8 22995

Street Railway Journal

Vol XXVII. NEW YORK, SATURDAY, APRIL 7, 1906. No. 14.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues).............................$3.00 per annum

Single copies .... 10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)........................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8500 *copies are printed. Total circulation for* 1906 *to date,* 114,800 *copies, an average of* 8200 *copies per week.*

The Election in Chicago

At the election held April 3 the citizens of Chicago declared themselves in favor of municipal ownership, but not of the municipal operation of the street railway systems of the city. The election was a close one, and the decision in favor of municipal ownership was carried by only 1½ per cent of the total vote cast. This decision required only a majority in its favor. That upon municipal operation required an affirmative vote of 60 per cent, and was lost by a little over 7½ per cent of the total vote. The election was conducted in accordance with the terms of the Mueller law, passed by the Illinois legislature and approved by the citizens of Chicago at the city election held April 5, 1904.

At the election just held, therefore, the citizens have virtually declared themselves in favor of the acquisition by the city of the street railway systems and their lease to the present or other companies, the purchase to be made by the issue of $75,000,000 worth of Mueller certificates. There is some doubt as to whether the Mueller law itself is constitutional, and this question will have to be determined by a test case before the supreme court. Again, the certificates themselves are not a lien against the city and may not be against the city's interest in the railway system. In fact, uncertainty as to just what constitutes the collateral or guarantee of these certificates may prevent purchasers for them being found.

The results of the election seem to be to leave the situation about where it was before the vote was taken. Before the city can acquire the railways as provided in the vote, the legal status of both the law and the certificates must be settled, and this will mean tedious delay. In the meantime, Mayor Dunne is reported as wanting to submit the operation proposition to another vote, which he hopes will be more favorable to his pet plan. The situation is certainly not very encouraging to those longing for better street railway service in Chicago.

Interchangeable Coupon Books in New York State

By the appointment of a committee, with powers to investigate and report at its next annual convention in June, the New York State Street Railway Association, at its Elmira meeting, held March 29, took definite action looking to the joint adoption by all the member companies of an interchangeable coupon ticket book good for passage over the lines of all the companies. The plan as proposed is based very largely upon the agreement now in force among certain members of the Central Electric Railway Association, frequent references to which have been made in these columns. The idea at first was to devise some form of interchangeable mileage book that could be sold at a stated cost per mile, but it soon developed that the lack of uniformity in the rates of fare charged by the interurban companies would prevent the adoption of a straight mileage book, inasmuch as on a few of the roads the regular rates of fare were less than that at which other roads, having higher fares, would be willing to accept mileage tickets. This matter of interchangeable tickets has been brought sharply to a head in New York State by reason of the important work now in progress, both through the central portion of the State and also in the southern tier of counties, whereby many of the gaps between important interurban centers are rapidly being closed, making through electric train service between New York and Buffalo, and between many important cities in the southern and western sections of the State, a matter of the very near future. In the form in which the matter was brought before the Elmira meeting of the New York State Association, the proposition is to sell the interchangeable-coupon books, each book containing 240 5-cent coupons, at the rate of $10 per book. This gives the purchaser $12 worth of transportation for $10, and operates as a reduction in fare equivalent to 16 2-3 per cent. J. H. Pardee, general manager of the Rochester & Eastern Rapid Railway, who presented the proposition as a paper before the association, has made a careful analysis of the rate sheets of the important interurban lines in New York State and finds that this reduction of 16 2-3 per cent nets approximately the rate of round-trip tickets. That is to say, if the proposition goes through, the holder of a coupon book will be able to get on a car of any interurban road that is a party to the agreement and make a single trip for virtually the round-trip fare.

There can be no doubt that an agreement between the important electric roads of the Empire State, looking to the issuance of interchangeable-coupon books, would be appreciated by the traveling public generally, and it would be of especial convenience and value to commercial travelers. In the opinion of those present at the Elmira convention the latter form a class of sufficient importance to be entitled to the fullest consideration. Having in mind the longer trolley routes and through service that will be available throughout the Empire State within the year, we venture to predict that if the managers of the important roads in the New York Association will adopt a joint coupon book, that can be carried conveniently in the vest pocket, and will be good for passage over the electric railways in all sections of the State, they will have the satisfaction of increasing their receipts as well as of seeing many a "knight of the grip," who is still prompted to travel in the old-fashioned way, by steam road, enjoying his cigar in the smoking compartment of their interurban electric cars.

Lighting of Interurban Cars

There is one point in street and interurban railway practice in which it might be said that for the last ten years absolutely no progress has been made. We refer to the lighting of cars. Better lighting is needed on both city and interurban cars, but on the latter the lighting is most assuredly inadequate.

Interurban lines have developed to a point where they cater to the same class of patrons as do steam lines. Many of these passengers are traveling men who, when on steam cars where lighting facilities will permit them to do so, utilize the time on the train to write up their notes and reports. It is safe to say, however, that comparatively few interurban lines have their cars so lighted that reports and notes may be written with any degree of satisfaction. In fact, in many it is almost impossible to read a newspaper at night. It is reasonable to presume that when steam and interurban roads are run parallel the inferior lighting on the electric car is the cause of much loss in traffic and if interurban lines are to compete with steam roads certainly this handicap must be removed.

Attempts to better the lighting by increasing the number of lamps, while helping conditions somewhat, has not proven a satisfactory method. The variations in the intensity of light remain about as great as before. Of course at a low line voltage the car with the greater number of lamps gives more illumination. On the other hand, after the eye has adjusted itself to the intense light when the line voltage is high, it is able to read print very little better on low voltage when the car has a large number of lights than when it has a fewer number. At present it does not seem possible to secure proper lighting of electric cars without the installation of a gas system, a storage battery together with a regulator, or some other expensive apparatus. Managers are naturally unwilling to install such apparatus, however, because of its cost and the additional complications in the car equipment. But it is a serious question and one to which inventors might properly devote some attention. One Western road to our knowledge is having several cars equipped with storage batteries and a regulator.

Advertising on Large Urban Systems

Progressive, energetic advertising has been one of the most potent factors in the success of many small interurban and even city roads. The importance of calling the public's attention to the facilities offered is being realized to-day as perhaps never before in most of the fields of public service work. The telephone industry bears striking evidence of the influence of advertising upon growth of business, and central stations all over the country are vigorously pushing their output into new territory. Perhaps the most notable advertising campaigns in the street railway field have been carried on by roads situated in regions especially favorable to the development of summer resort traffic. The larger city systems have not always realized the powers of advertising, however, for the traffic of every great metropolitan center is to a large extent compulsory.

The problem of stimulating traffic should certainly be looked into, however, in any case where the earnings have fallen over noticeably in their rate of increase, during the past few years. The company's cars are always available for such uses, and the judicious if sparing use of daily newspaper space may prove to be quite as effective as the "carrying of ads." in the weeklies of adjacent towns. There is certainly room for a broader co-operation between connecting systems in the matter of advertising. It is almost as much to the advantage of a large city road to stimulate traffic over its lines to points outside the limits of its own system as it is to develop local business within its own borders. In other words, the attractions of points reached by foreign cars which traverse a given city system in going and returning, should not be neglected by the urban street railway advertiser.

On every large city system which serves suburban or residential districts beyond walking distance from the business center, a large number of extra cars are necessarily held idle at other periods than the rush hours. The utilization of some of these cars is a point worth attaining, in its influence upon the statement of gross and net earnings at the end of the year. It will not be many weeks before the open car will be in operation once more, and we believe that it will pay to stimulate pleasure riding as the summer season comes on, by a little extra advertising on the part of some of the larger systems. Whether a city is adjacent to a park resort or not, every system is capable of providing comfortable transportation on its open cars during the warm evenings of the late spring and summer. There are many methods of attracting traffic. A number of these were discussed at the Elmira meeting, reported elsehere in this issue. We certainly believe that even the larger systems can do something to increase their profits by giving more thought to the subject than they have always done in the past.

Electric Railroading Abroad

Mr. Dawson's paper, which we are exceedingly glad to present to our readers in the current issue, is upon the whole by far the most complete discussion of the larger work of electric railroading which we have yet seen. It indicates very clearly that in the electrification of the larger railways our foreign confrères are well to the front, and are less hampered by conservatism than we are. In the growth of electric traction the same great problems have appeared both here and abroad. The coming of electric traction was welcomed by the tramway and, in so far as possible, repressed by the main line railroads. Everywhere the result has been the same. The tramways have been converted with great rapidity, and with almost universal success and the pressure of competition thereby brought to bear upon the main and suburban lines has been very keenly felt. The effect of real rapid transit upon the habits of the public, always a marked phenomenon, has been no less striking abroad than here. Just how it takes place and what are the various factors that produce it, is difficult to tell, but the facts are startling. As an example, study Mr. Dawson's figures for London, which we Americans are wont to look upon as a city less enterprising than a community of the first rank here. In 1895 it had just passed the 6,000,000 mark in population for the greater metropolis and the annual journeys per head amounted then to just over a hundred. To-day it is nearing 7,000,000, an increase of only 12 per cent to 15 per cent, but if we judge Mr. Dawson's figures aright, the journeys per head, by railway, tramway and bus, must be close to 150.

How much of redistribution of population and amelioration of general conditions this increase implies it is hard to reckon, but the aggregate effect is certainly imposing, and may be taken as the indubitable effect of rapid transit introduced by electric traction. And London, like every large city, is even now hard pressed for more facilities. It has not piled city upon city skyward like New York, but the very hugeness of the place has compelled the growth of outlying districts, and forced the construction of at least partially adequate facilities for travel. And, as in American cities, the main railway lines centering in the metropolis have not kept up with the march of progress. With the competition of the tubes and tramways the railroad business has fallen off relatively, and at present the possession of termini far within the city has become almost a disadvantage, since the congestion at these points is terrific. It is to the betterment of these conditions that Mr. Dawson especially addresses himself. Only modern methods employed, not conservatively, but radically, seem able to cope with the situation. The report of the Royal Commission favoring electric traction has carried weight and it now looks as if electrification on a large scale was to be the order of the day. There is not the slightest doubt that the daily capacity of a terminal can be doubled by the complete adoption of electric service with its greater working speed and larger facility for running on short headway. But for the greatest gain the change must be complete, and the steam locomotive put definitely out of service for urban work.

From Mr. Dawson's account the sooner this is done the better, and the main question is not the necessity for the change, but the best method of making it. In reviewing the available methods it must not be forgotten that the drastic Board of Trade regulations on rail return make the third rail system relatively less desirable in England than here, yet we believe that Mr. Dawson's condemnation of a low voltage third rail on the ground of economy is fully justified in London or anywhere. It is interesting to note, too, that the consensus of opinion among European engineers is distinctly against this method of distribution. Of the alternating-current methods Mr. Dawson strongly favors the single phase, laying aside the three phase on the well-known grounds of complication of overhead wiring and inefficiency of speed control, noting incidentally that the recuperation of energy claimed often as an advantage of the system cannot be taken very seriously. We would go further, and express a grave doubt whether on ordinary roads the recuperation game with any motor is worth the candle. It inevitably leads to some, usually considerable, extra complication and unless there are specially favorable opportunities for it, seems of very dubious value. Certainly it is not important enough to justify the use of a motor system otherwise uneconomical. Of the single-phase motors Mr. Dawson has an evident liking for the Winter-Eichberg, or modified repulsion type, as against the plain series compensated type in increasing use here. Certainly the curves of the Winter-Eichberg motor which he gives are very encouraging and the facility with which it can be wound for high trolley voltage, so far as the stator is concerned, is most striking. In the general case, however, we are not inclined to attach great importance to this feature, since on long lines the trolley voltage is pretty certain to be carried to a point above that for which one would care to wind even a stator, and given a transformer, the secondary voltage is unimportant. On certain lines where moderate trolley voltage is required the Winter-Eichberg type might be advantageous. However, this case, like capacity for working on d. c. circuits, is not general, but only of limited, importance. The final type of a. c. motor for railway work will be determined by its properties as a motor rather than by accidental advantages. It is interesting to note that the a. c. motor in question makes a specially neat work of the acceleration, and shows substantially the same efficiency as the corresponding d. c. motor, with a very moderate increase in weight, considerably less than the 20 per cent put forth in the usual d. c. manifesto. The mean power factor in the test cited was 85 per cent, which is certainly not a bad showing. The acceleration question is, however, largely a matter of adaptation rather than capability and probably the result just noted merely indicated more skill in planning than anything else. It is certain that in the last resort, the new a. c. motor must suffer a little in weight, efficiency, or cost, the inherent difficulties being to a large extent transferable from one account to another at the will of the designer. Certainly Mr. Dawson makes out a very strong case for the immediate introduction of electric traction on main lines, and we hope that the work now in progress on this side of the water will be full of encouragement

ELECTRIC TRACTION ON MAIN LINE RAILWAYS IN EUROPE.

BY PHILIP DAWSON, M. Inst. C. E., Etc.

The subject of electric traction on main line railways has frequently been dealt with in these columns, and attention has been particularly called to it recently by the series of papers read at the International Railway Congress at Washington last summer.

The present position of main line railways is very similar to that of tramways some twenty years ago, with the only difference that in the case of tramways electricity was still in its infancy and its value had still to be proved; whereas, in the present instance no one can doubt that electricity is quite capable of hauling main line trains.

The principal cause of the electrification of tramways was the desire to increase their earning capacity, and it was the financial success of the wholesale electrification of American tramway lines which led to its general introduction in Europe some years later. Generally speaking, the favorable results which accompanied the transformation in America were experienced in Europe, although possibly on a somewhat smaller scale.

Electric tramways have been referred to, because as far as Great Britain is concerned it is the results of their electrification which, to a large extent, is forcing the railway companies to seriously consider the necessity of taking action to stop the loss of traffic resulting from tramway competition. The results of electrification of tramways in Great Britain are shown in Table 1, which is taken from the last Board of Trade returns.

TABLE I.—SHOWING RESULTS OBTAINED BY THE INTRODUCTION OF ELECTRICITY ON TRAMWAYS IN GREAT BRITAIN

	1878	1904-1905
Length of route	269	2,117
Capital expended	£4,207,350	£52,675,152
Number passengers carried	146,000,000	2,069,000,000
Ratio of operating expenses to receipts	83.81%	66.19%
Net receipts	£230,956	£3,351,977

Some years ago, in an article contributed by the author to the STREET RAILWAY JOURNAL, the opinions expressed by representative officials of a number of British steam railway companies were quoted, showing the extent to which they considered the railway receipts had been affected by the electric tramways. The first step on the part of these railway companies, so far, has always been to oppose in Parliament and elsewhere every effort that was made either to electrify existing tramway lines or to build new ones, but the public demand for increased facilities of transportation prevented such retrograde policy being effective. The result is that so-called tramway competition has become much more serious, and has again been suggested this year by many railway companies as the cause for the decrease in their receipts from local passenger traffic.

In all countries large railway companies are probably among the most conservative bodies to be found, but particularly is this the case in Great Britain, and electric traction in their case will, in many instances, only be adopted when absolutely forced upon them. As a matter of fact, the same thing would appear to be the case in the United States, where the electrification of main line railways has generally only taken place because steam was inadmissible, and there is little doubt that railway men, if it had been possible, would have preferred to use steam instead of electricity.

Before dealing any further with the causes which are at work, and which will eventually result in the electrification of railways on a large scale on this side of the Atlantic, or with results which may be expected therefrom and the reasons which lead to anticipating such results, it may be advisable to consider the types of railway service for which electric traction is suitable and to explain the particular meaning which it attached in this article to "Electric Traction on Main Line Railways."

TRAMWAYS AND LIGHT RAILWAYS

Electric traction is applicable to either tramways and light railways or to railroads. A tramway and light railway in Europe may be defined as a system of which a large portion of the track is laid on the public thoroughfares and not on a private-owned right of way, or where, if the company has its own right of way, it is not required by Government regulation to protect level crossings or to be operated under the "block" system of signaling.

On such lines or public high roads the maximum speed permitted by Government regulations rarely exceeds 12 m. p. h. to 16 m. p. h., although in practice, even in Great Britain, this speed is greatly exceeded, as is shown by actual speeds which were taken by expert time-keepers of the Automobile Club of Great Britain and Ireland quite recently, and which indicate that on the London United Tramways, in Acton and Hanwell, the speed was generally considerably over 12 m. p. h., and frequently reached over 17 m. p. h. In Newport (Wales) the same results in timing were obtained, and in Leeds even higher speeds were found to exist. Notwithstanding these isolated cases, the congested condition of the streets of our large towns makes it impossible for light railways even on long routes to acquire a speed, including stoppages, which will give an average of 10 m. p. h. or more.

TABLE II.—INCREASE OF PASSENGER TRAFFIC IN GREATER LONDON

	Number of Passengers Carried by:					
Year	Railway (Local Companies)	Tramway	Omnibus (Two Principal Companies)	Total	Estimated Population of Greater London	Number of Journeys per Head
1880...	133,877,485	64,817,361	57,722,231	256,417,077	4,670,243	54.8
1890...	167,299,200	191,041,904	148,531,099	506,872,203	5,540,430	91.5
1895...	184,411,600	249,996,979	191,076,010	625,484,589	6,021,433	103.9
1900...	214,537,095	340,203,066	264,503,868	819,244,029	6,484,516	126.3
1901...	236,506,162	340,772,414	269,933,759	847,212,335	6,581,402	128.7
1904...	242,170,120	401,108,033	288,965,214	931,243,367	......	——

Note.—The railway companies included in the above table are the Metropolitan, Metropolitan District, North London, East London, City & South London, Waterloo & City, Great Northern & City and the Central London. The omnibus companies included are the London General and the London Road Car. The tramway column includes all tramway traffic.

METROPOLITAN OR RAPID TRANSIT RAILWAYS

For the purpose of this article, railways can be classed broadly as Metropolitan railways and as main line railways. Metropolitan lines generally either have no termini, or if they have, it is not necessarily the station where most passengers get out on arriving in town or get in when coming home at night. Such a railway does not usually have main line long distance steam trains running over its lines, nor is there usually much freight traffic handled over it. Such Metropolitan lines were till recently mostly worked by steam, although as the result of the enterprise of Mr. Yerkes and Sir Charles Maclaren, this is no longer the case in London.

Under the heading of Metropolitan lines which, in many instances, may be run through shallow subways, may also be included the tube, or deep level lines. In the latter case, electricity has been adopted from the commencement, but here again steam was inadmissible for reasons of ventilation, and electricity was necessarily adopted in the case of the City South London Railway, the first deep level line ever constructed.

The adoption of electric traction on Metropolitan lines inevitably means the suppression of all steam-hauled trains.

MAIN-LINE RAILWAYS

Main line railways are taken as being lines having termini in big towns, and over which a large number of different services are operated, such as long distance trains connecting up big towns which are far apart and which may be trains running long distances without a stop, or slow trains with frequent stops. Freight or goods traffic is generally one of the most important and remunerative branches, and is necessarily operated over the same system, and can, in its turn, be divided into slow and fast. The mere fact of long distance lines having termini in the big towns necessarily results in their lines being utilized to a varying extent, largely depending on the requirements of, and the facilities given to, the large crowds whose business requires them daily to go in and out of town to and from business.

TABLE III.

Passengers Carried In and Out of London in 1903 on Locomotive Lines	
Great Eastern Railway....	65,300,000
London & So. West'n Ry.	33,200,000
North London	26,700,000
Great Eastern & London & Tilbury Railway......	24,000,000
London, Brighton & S. Coast Railway	42,300,000
South Eastern & Chatham Railway	59,900,000
Great Northern Railway...	15,340,000
Midland Railway	9,767,000
Great Western Railway...	9,174,000
London & North Western Railway	4,470,000
West London Railway....	4,100,000
Total	294,151,000

Passengers carried in London on Metropolitan Lines in 1904	
Metropolitan	74,482,689
District	50,697,936
North London	34,988,493
East London	6,621,190
North & South	447,792
Central London	44,875,547
City & South London.....	17,631,275
Great Northern & City....	7,939,488
Waterloo & City	4,485,713
Total	242,170,120

1904—Passengers Carried Into and Out of London by Various Means of Conveyance	
Main line and Metropolitan Railways	542,000,000
Tramways	401,000,000
Busses	289,000,000

Although in many Continental towns the termini of the main railways are situated at some distance from the business centers, in most large towns in England the railway terminis are in or near the heart of the city. The result of this arrangement is most satisfactory from the point of view of the suburbanite who wishes to go to town, but the result as far as railway companies are concerned is not so satisfactory. Most of our railways were built over half a century ago, and the spare amount of land owned by them is often so small that quite apart from the question of short distance traffic, they lack sufficient space to deal with the rapidly increasing long distance and goods traffic. Also any increased station accommodation, particularly that required for properly handling the ever increasing local services, entails a vast expenditure of money, which, although amounting to millions of pounds, is frequently insufficient to give the desired accommodation for handling short distance as well as long distance traffic. Matters are further complicated in the case of most railways by the fact that the greater part of local travelers get out and in at the termini, thus greatly increasing the congestion and the number of passengers to be handled in a given time.

Under the heading of suburban traffic for main lines may also be included interurban traffic, in which also termini are generally encountered, such as that which exists in England between Manchester and Liverpool, or Bradford and Leeds.

CAUSES TENDING TO THE ELECTRIFICATION OF MAIN-LINE RAILWAYS

Having broadly considered the main conditions and generally classified the different system of railways, the reasons will be investigated which make it probable that electric traction may shortly be introduced on a very considerable scale on the main line railways of Great Britain, at the same time considering what portion ot their system is likely to be electrified and the reasons which for the present militate against such a change of motive power.

Among the principal causes which may eventually force electrification to be adopted by railways is, as has been already mentioned, the very serious competition which they are suffering at the hands of electric tramways. The railway companies are slowly discovering that although costly opposition may, for a time, put off the evil day, they cannot stop the progress and prevent electric tramways and light railways being built. They appear to be at last realizing that the only way to compensate for losses caused by paralleling electric tramways is to improve the local service of their own lines, and this, as long as steam is the motive power, is practically impossible.

As has already been pointed out, the accommodation at the stations and the number of tracks available, are scarcely sufficient to cope with the present services. The great improvement in long distance services increases the demand on the resources of the railway companies and it thus becomes impossible to increase the number or speed of the trains which are purely serving suburban districts as long as these are operated by steam. Furthermore, the requirements of suburban districts are constantly increasing, owing to the very rapid growth of the population in the large manufacturing centers of Europe. This is clearly shown by Tables II to V, which show the increase in traffic population in London, Berlin and Liverpool. The existing methods of rapid transit, as far as Berlin and London are concerned, are shown in the two maps accompanying this article, and which have been specially prepared for it.

TABLE IV.—INCREASE OF POPULATION AND TRAFFIC IN BERLIN

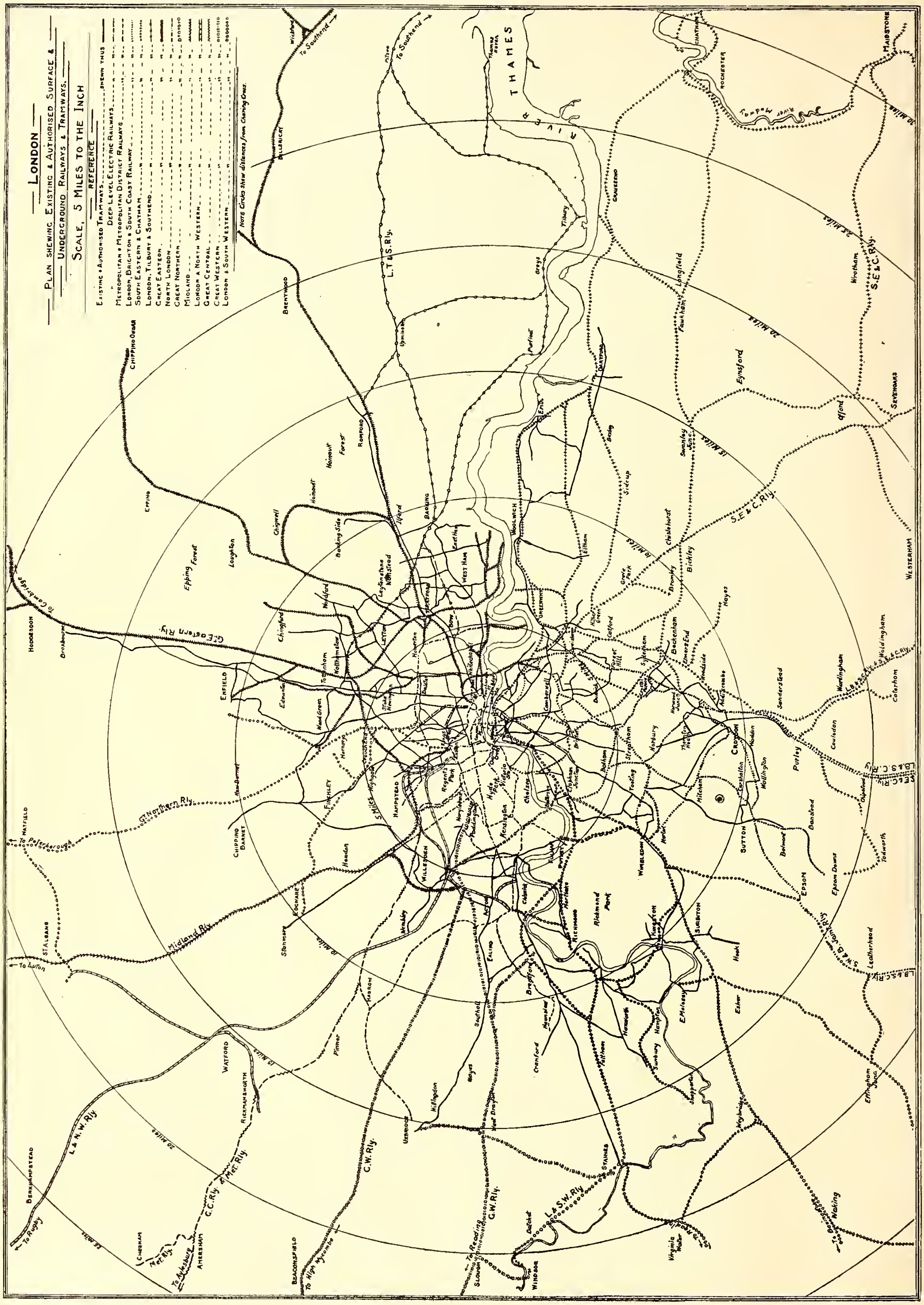
Year	Population of Greater Berlin	Passengers Carried, Tramways	Passengers Carried, Met. Rys.	Electric Railways	Passengers Carried, Omnibus	Total Passengers Carried	Times Pop. Carried Per Annum
1885	1,458,000	87,000,000	15,000,000	......	16,000,000	119,000,000	82
1890	1,827,000	143,000,000	29,000,000	......	29,000,000	209,000,000	114
1895	2,089,000	168,000,000	75,000,000	......	44,000,000	287,000,000	137
1900	2,404,000	280,000,000	98,000,000	......	80,000,000	458,000,000	191
1901	2,443,000	332,000,000	87,000,000	......	80,000,000	499,000,000	204
1902	2,505,000	345,000,000	92,000,000	19,000,000	79,000,000	533,000,000	225
1903	2,585,000	368,000,000	86,000,000	30,000,000	86,000,000	581,000,000	225
1904	2,650,000	394,000,000	111,000,000	32,000,000	93,000,000	631,000,000	238

TABLE V.—LIVERPOOL TRAMWAYS

Passengers:	1897	1898	1899	1900	1901	1902	1903
Electric cars	......	785,064	15,853,160	58,068,531	100,076,789	108,906,472	113,015,728
Horse cars	30,596,229	31,985,158	39,321,946	19,051,875	218,166	74,685	41,506
Omnibuses	7,812,855	9,001,812	8,596,344	5,247,552	813,825	354,428	......
Totals	38,409,084	41,772,034	63,771,450	82,367,958	101,108,780	109,335,585	113,057,234

The congestion of local traffic services is further increased by the practice of making short spur or branch lines from existing railways to those districts needing further accommodation. This method is advantageous from many points of view, but the result of such a policy is greatly to overcrowd the approach on the final section to the London terminus.

It is undoubtedly a fact that a great deal of the overcrowd-



MAP OF LONDON, SHOWING EXISTING AND AUTHORIZED UNDERGROUND RAILWAYS AND TRAMWAYS ing which exists in the large cities is due to the want of adequate rapid transit facilities and the Royal Commission on London Traffic rightly states that:

We look for the relief of overcrowding to the future adoption of electric traction for suburban trains, and to the increase in the number of trains run, which would probably follow the change in motive power. Trains of uniform, but not excessive size, run at very short intervals, afford the best way of meeting the evil of overcrowding.

The Royal Commission is greatly impressed by the possibilities of electric traction on railways, and clearly states this view as follows:—

So long as trains are hauled by steam engines we do not think that much improvement in the speed of suburban train service can be looked for. When electric traction is adopted the advantage of quicker acceleration will be secured, and the readier adaptability of electric trains to all requirements will, we hope, enable suburban train services to be greatly improved, and the journey time of trains to be reduced substantially.

It is, we think, evident that the introduction of electric traction will lead to a great improvement of suburban and urban railway facilities in London; the speed of all trains worked by electricity, especially those which stop at many stations, will show substantial increases over the speed of steam trains. It will, we believe, also be found that electric traction, apart from its other advantages, will enable railways companies to increase the number of trains working in and out of the terminal stations, and thereby add largely to the facilities afforded for suburban traffic.

We hope, therefore, that there may be no great delay before the railway companies serving London adopt electric traction for the working of their suburban train service.

MAIN-LINE RAILWAYS IN LONDON

In considering the problem of electric traction on railways and in order to show the necessity for action on the part of the railway companies as to the electrification of their suburban services, no better example can perhaps be taken than that of London, and in this connection attention is directed to its map already referred to.

Looking at this map of London the first broad feature which is apparent is the existence of 10 main lines of approach, each belonging to a separate and independent railway company. Seven of these main line systems are on the north of the Thames, two having their terminal on the east side of the central area within half a mile of each other and conveniently situated for access to the City of London. The remaining five have their termini almost in a straight line, extending from East to West for a distance of about 2½ miles from Kings Cross (G. N. R.) to Paddington (G. W. R.) Three of the main lines have their principal termini on the south of the central area.

These main routes along which long distance traffic is brought to London also afford the principal avenues of railway approach to London for the trains from all suburban branches, except those connected with the North London and the Metropolitan and Metropolitan District Railways. Hence again, subject to the same exceptions, the vast suburban traffic, although also served by many subsidary stations, is chiefly concentrated at the same terminal stations which serve the long distance passengers, who, thought large in the aggregate, form only a small fraction of the total number of passengers dealt with at the main termini.

It may be convenient here to set out a tabular statement of the main lines of railway into London and their principal terminal stations. (See Table VI.)

An examination of Table II will show that the traffic on these railways has not been seriously affected by the enormous increase in the number of passengers carried by tramways and which is due entirely to electrification. That is, the results obtained in London are very similar, if not perhaps quite as striking as those which were obtained by the electrification of the New York street railways. But notwithstanding the enormous increase in passengers carried by street railways in New York, the electrification of elevated lines resulted in a similar increase in their case, and the construction of the underground lines in New York has not, apparently, seriously damaged any of the above mentioned systems, in spite of the very large number of people carried by it. All of which shows that the increase of travelling facilities increases the demands on the part of the public, and that the increase in rapid transit facilities, once a public has been educated for travelling, has, up to date, never kept up with the demands.

TABLE VI.—SHOWING THE MAIN-LINE RAILWAYS HAVING TERMINI IN LONDON

Railway	Main Termini in London	Route, Miles in Greater London	Number of Stations in Greater London
Great Eastern	Fenchurch Street	86.1	88
London, Tilbury & Southend		16.3	8
Great Eastern	Liverpool Street	....	..
Great Northern	King's Cross	32.7	28
Midland	St. Pancras	20.3	14
Lon. & North Western	Euston	24.2	19
Great Central	Marylebone	2.2	1
Great Western	Paddington	28.7	16
Lon., Brighton & South Coast	London Bridge and Victoria.	71.7	56
S. East'n & Chatham	Victoria, Charing Cross, Holborn Viaduct, Cannon Street, St. Paul's.	124.7	101
Lon. & South Western	Waterloo	75.7	50
Total		482.6	..
Joint lines owned and authorized by the above companies:			
Total mileage		50.6	..
Total number of stations		....	50

Length of single road used by passenger trains in Greater London, 1604 miles. This figure includes Metropolitan and tube lines at present being operated.

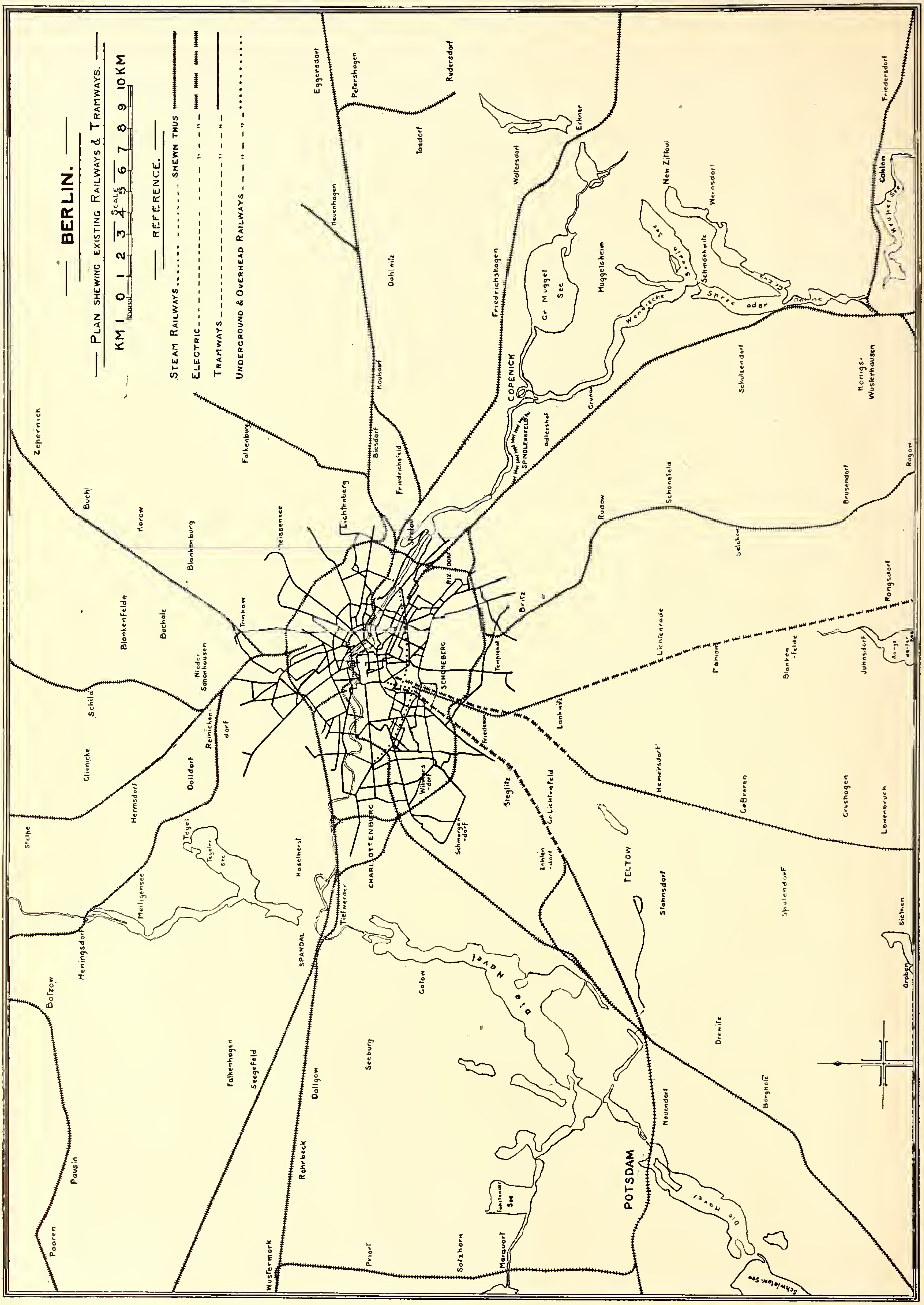
Applied to London, this means that the habit of travelling, which has been cultivated by the electrification of tramways, will, in the end, be beneficial to the railways, provided the latter amend their service and give the public rapid and frequent trains. At present only those people travel by railways, as far as suburban traffic is concerned, who are absolutely obliged to do so. If better facilities are granted the general public will avail themselves of the increased facilities as they get the chance. That the railways may do something in this direction is apparent from the fact that although the total annual traffic is constantly on the increase and, if anything, has been greater than in past years; the same cannot be said as regards the ratio of net receipts to capital expended, as is seen from Table VII.:

TABLE VII.—SHOWING NET PROFIT, IN PER CENT, OF CAPITAL EXPENDED ON MAIN RAILWAYS

	Per Cent
Average for five years from 1881 to 1885	4.22
Average from 1901 to 1905	3.80
Average for 1902	3.42
Average for 1903	3.4
Average for 1904	3.36

CONDITION OF ENGLISH MAIN-LINE RAILWAYS

Owing to the increase in population and consequent increase in the municipal and national expenditure, rates and taxes are constantly increasing, as will be seen from the fact that in 1904, the rates and taxes per train mile amounted to 3.1 pence, as against 2.9 pence in 1895. The total operating cost per train mile, including maintenance, locomotive power, traffic and general charges, compensation, legal and miscellaneous, has risen from 33.26 pence per train mile in 1895 to 41.27 pence per train mile in 1904. During the same period the total receipts from all sources per train mile has practi-



PLAN OF BERLIN, SHOWING EXISTING RAILWAYS AND TRAMWAYS cally remained stationary, having been 49.47 pence per train mile in 1895 and 49.19 pence in 1904.

The chairman of the North London Railway Company, at the last annual meeting this February, reported a further decrease in receipts from passengers, due mainly to the competition of electric tramways and railways, and stated that it was practically impossible to attempt to meet the competition until the electrification of suburban lines could be carried out.

Contrary to this result are the statements made at the meetings of the Lancashire & Yorkshire and North Eastern Railway companies, where reference is made to the results obtained by the electrification of the Liverpool & Southport and Newcastle & Tyneside lines, respectively.

The chairman of the Lancashire & Yorkshire Railway Company—Sir George Armitage—expressed satisfaction at the results of the electrification, which has enabled them to do a much greater amount of work and give a much greater service to the public, which would have been absolutely impossible under old conditions, and he stated that they were contemplating further extensions.

The chairman of the North Eastern Railway Company—The Right Hon. John Lloyd Walton—stated that the further experience of electric traction of the suburban lines of the Newcastle district have been entirely favorable, both practically and financially. In the last half year of steam they had had 2,844,000 bookings, but with electric traction for the last half year of 1905 they had carried 3,000,548 passengers, an increase in round figures of 25 per cent. The gross earnings for the year of 1903, when operated by steam, were £129,000 and for the corresponding year, 1905, when run electrically, £151,000. The chairman further stated, that while the running costs in 1903 for the half year were £42,761, although their mileage had been doubled with electrification, the working costs for the corresponding half year, 1905, were only £47,779.

Sufficient has already been said to demonstrate the necessity of decisive action on the part of the railway companies. No simple alteration of type of rolling stock or locomotives, or length of trains, or even reduction in fares will be sufficient to meet the case.

Those who are thoroughly acquainted with the results of electrification, obtained not only on tramways but also on railways, are frequently of the opinion that all that is necessary, is to convince the railway authorities of the results which can be achieved by the substitution of electricity for steam on their railways, and to quote the decision of other companies as regards electrification and the results obtained by them.

It may, therefore, be not without interest to investigate shortly the reasons which have led to electrification and how far electrification has been adopted by main line railways, and then to see whether the conditions which have caused electrification in other cases, may be expected to produce the same result, say, in London, or other towns or districts in which similar conditions obtain.

It is recognized that, as regards main line traction, electricity has not as yet been largely adopted, and that America is no exception to this rule. Indeed, until such times as the services of the New York Central, New York, New Haven & Hartford and Pennsylvania are electrified, America will be behind Europe in this particular branch.

EXISTING MAIN-LINE ELECTRIFIED ROADS

In England, there are two railway companies, namely, the Lancashire & Yorkshire, and the North Eastern, which have electrified portions of their systems. In both these cases, the electrified lines are branches which are used for local traffic only, and over which there are few or no main line trains and very few goods trains. Both these cases are therefore very different from the conditions which would have to be met in the case of any main line London railway desiring to electrify a portion or the whole of its suburban system. The principal reasons which led to the electrification in the two cases mentioned were, probably, tramway competition, and the desire on the part of these companies to increase their traffic.

If we look to France, we again find only one case in which what we may call a main line has been electrified, namely, the Orleans line. Electrification in this case was brought about by the building of the new station at the Quay d' Orsay, which enabled the railway company to come nearer the center of Paris, and which is connected with older stations in the outskirts, by means of a practically continuous tunnel. Here electric traction had to be installed, as steam trains could not have been run, and so all trains on their approach to Paris are hitched to an electric locomotive, which brings them into the terminus; it is only recently that the lines have been prolonged so that suburban electric service can be operated over it. The only other line in Paris which has been electrified is a suburban branch line of the Western Railway of France going to Versailles. It has very little traffic.

As regards Berlin the case is different, as here the railways are owned by the Government, which has long been investigating the problem of haulage, not only in connection with suburban lines but also with main lines. All readers of the Street Railway Journal know of the very progressive series of tests of high-speed railways carried out between Berlin and Zossen.

If we look to Italy we have the two comparatively long lines between Milan and Varese over a portion of which main line services have to run, but the majority of which is practically purely suburban system with no main line traffic. The well-known Valtelina line is a line entirely operated by water power and is a mountain railway, and in both these cases electrification was the result of the Italian Government engineers deciding to investigate electric traction.

If we go to America, the reasons of the electrification of the New York Central are too well known to need much explanation. Here again, the company was practically forced to electrify in consequence of the long tunnel leading to the terminus. The same applies to the New York, New Haven & Hartford and to the Pennsylvania lines into New York. In other words, in all the chief cases of electrification of main line railways, it will be found that the railways were either forced to electrify because of special local conditions, or that electrification was due to Government initiative and carried out at Government expense. It will be easily realized that Governments are far more likely to enter into large expenditure for experimental purposes than private companies who have to earn a dividend and to satisfy their shareholders, but besides this there is the fact that railway companies are, as already stated, probably the most conservative bodies in the world and that it takes a great deal to convince and to prove to general managers, locomotive superintendents, or railway engineers who have not been educated in electricity, that electricity is capable of doing the work required of it.

The reasons which have hitherto been the main cause for, and in many cases compelled, the adoption of electric traction on railways will probably not be those which will chiefly weigh in the future with railway companies when considering the electrification of their suburban services. Our main line railways are not under any obligation to use electricity on their suburban systems, and the disadvantages, whether real or imaginary, possessed by any one system of electric traction, may seriously militate against its introduction on railways. It is therefore of interest to compare the three systems which are at present available for operating railways electrically, and the peculiar features which may render each suitable or objectionable from the railway manager's or railway engineer's point of view.

DIRECT CURRENT

As regards the direct current system, very little need be said, as it is well known to all readers of the STREET RAILWAY JOURNAL. There can be no doubt as to its reliability and suitability for all purposes, no matter what the maximum speed to be obtained, or how high the desired rate of acceleration, or how heavy the weight of train to be hauled may be. But from a financial, and from the ordinary railway man's point of view, it possesses serious disadvantages when compared to the two other systems. It necessitates, in order to comply with the Board of Trade's regulations, not only a third rail, but in most cases a fourth rail as well, and if it is to be used on an extended system, all current has to be generated in the shape of high-tension polyphase currents, which have then to be transformed first to low-tension alternating currents, then to direct currents and finally distributed by means of low-tension conductors.

The capital cost of a complete direct current third rail system with high-tension three-phase transmission and rotary converter sub-stations is much greater than that of an equivalent single phase system and the operating costs are larger than in the case of a three-phase one. Some of the main items of the former are the cost of the additional current which has to be generated in the station, owing to the loss in transformation, as well as additional costs involved in operating and maintaining rotary sub-stations and interest on the greater capital involved.

It has been held by some that the cost of overhead construction used with single-phase high-tension railways is greater than the cost of installing the third and fourth rail, but such statements do not bear careful examination and, as far as Great Britain is concerned, where a fourth, as well as a third rail, is in most cases practically a necessity. It will be found that the cost involved by such a construction and by the necessary inter-connection between the different rails which must be effected, is, if anything, larger than the very best and most solidly designed overhead construction.

Even if the expense of construction and operation were of little importance there is another reason which militates seriously against the adoption of direct current and third rail by the main line railways of Europe for long distance service. The bulk of European railway engineers are opposed to the introduction of the third rail and, without going into the merits of this opposition, it will suffice to state that if a third rail were essential to the use of electricity on the majority of British railways, it is very problematical whether electricity would ever be introduced on a serious scale by most of our railways.

As long as there is a system which, while obviating the use of a third rail, possesses the following principal characteristics, it will be adopted by the railways in preference to the direct current one necessitating a third or fourth rail. The characteristics are:

Rapid acceleration from starting to maximum speed.

Reserve power and speed for making up lost time.

Simplicity and efficiency of equipment and economy in power consumption.

Ease of extension and adaptability to run over existing systems.

THE THREE-PHASE SYSTEM

The use of the three-phase system necessitates at least two overhead conductors which have to be insulated from each other, and which considerably increases the complications and cost of overhead work at crossings and turnovers. This disadvantage is comparatively unimportant on such a line as the Valtelina railway, which has no complicated junctions, but in cases such as would be met in some of the London stations, and on some of the London suburban lines, the disadvantages of such complications will at once become apparent. On account of the wires having to be insulated at crossings, it is not wise to exceed the pressure of 3000 volts, whereas, there are single-phase lines running to-day with a pressure on the trolley wire of 15,000 volts and no trouble has been caused thereby. It is quite possible that had no efficient and really satisfactory single-phase motor been evolved, railway companies in England might have been led seriously to consider, is not to adopt, the Ganz system instead of the direct current one. It is true that at the arbitration which was held to decide whether the Ganz three-phase concatenated system was to be adopted by the Metropolitan and District, or whether direct current and third rail were preferable, the decision was given in favor of the latter, but it is not to be forgotten that in this case all of the lines were practically in tunnel, which is not the case with the majority of suburban lines now considering electrification.

It is not proposed in this article to go into the technical merits or demerits of the three-phase system, the system itself being already sufficiently well known to the readers of the STREET RAILWAY JOURNAL. Those, however, who wish to get further details and a more scientific comparison of the various systems of traction, should refer to the London "Engineering," of May 26, 1905, page 663 and 664. It may be mentioned in passing that one of the great claims made in favor of the concatenated three-phase system is based on the recuperation of energy, but, on careful examination of actual figures obtained, the claim does not seem to warrant very serious importance being attached to it. Furthermore, it may be mentioned that recuperation can be obtained quite as well with direct current motors, and that certain forms of single-phase motors also lend themselves to recuperation, should such be desired and found in practice to be satisfactory or advantageous.

In connection with this point it should not be forgotten that recuperation is essential to the Ganz system as, owing to the properties of the three-phase motors, their rheostatic losses at starting are so very great that, unless recuperation of energy were effected, the energy consumption per ton mile with this system would be so heavy as practically to put it out of consideration, as far as suburban traffic is concerned. This point leads us to another classification of alternating current motors as follows:—

(1). Motors which can recuperate during braking or when going down hill, but which are economical without recuperation.

(2). Motors which cannot recuperate except by the introduction of very considerable complications.

(3). Motors which must recuperate if they are to be operated economically.

The first of the above three types is represented by a compensated repulsion motor of the Winter-Eichberg type, as manufactured by the Allgemeine Elektricitäts Gesellschaft and Messrs. Lahmeyer. The second type is represented by what may be called, a "plain" series motor, as manufactured by the Westinghouse Company, Siemens-Schuckert, Dr. Finzi, the Oerlikon Company and the General Electric Company of America. The third type is represented by three-phase motors, and the arrangement adopted by Ganz & Company in the concatenated or cascade system of control.

It is not intended in this article to refer to the theory of the different types of motors mentioned above; those who are interested in this particular branch should refer to the " Elektrotechnische Zeitschrift," No. 22, June 2, 1904, to a paper read by Mr. Karl Pichelmayer, of Berlin, and to an article by Dr. Eichberg in the same paper of Jan. 28, 1904, page 75, and to the many other theoretical papers on the same subject, which have appeared from time to time in the technical press, or to the papers read before the scientific societies. The two particular articles are only referred to as they treat particularly, clearly and completely the mathematical side of single-phase motors. Suffice it here to say, that as regards watt-hour consumption per ton mile under equal conditions of acceleration and load, such as are met with on ordinary suburban service on heavy railways, the single-phase motor, whether recuperating or not recuperating, compares more than favorable with the three-phase motor.

In this connection it must be distinctly understood that the whole discussion is one as regards the most advantageous motor to be used for handling suburban traffic, that is to say traffic which requires rapid acceleration and where running distances are short and stoppages numerous. In long distance traffic which, for the present at least, as far as Great Britain is concerned, does not seem likely soon to be operated electrically, different as well as additional factors will have to be taken into consideration, and the remarks which have been made as regards the three-phase system should in no way detract from the great credit due to the enterprising firm of Ganz & Company in installing the Valtelina line, and to the success which has crowned this enterprise.

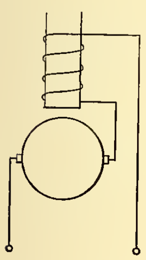


FIG. 1.—SIMPLE SERIES MOTOR

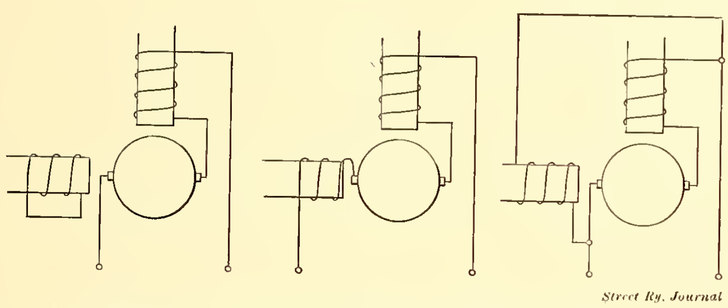


FIG. 2.—THREE FORMS OF COMPENSATED SERIES MOTOR

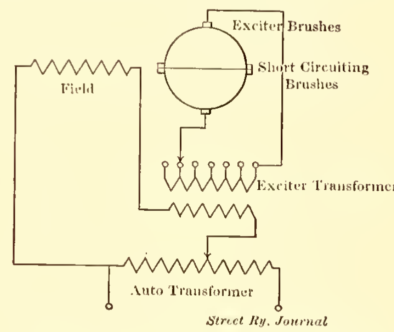


FIG. 3.—WINTER-EICHBERG COMPENSATED REPULSION MOTOR

SINGLE-PHASE MOTORS

Broadly speaking, there are at the present moment on the market, two definite types of single-phase motors, one designed, built and advocated by the Westinghouse, Siemens-Schuckert and General Electric companies, which may be called for the sake of briefness, the " plain series motor." This motor has been brought to a great state of perfection by the Westinghouse Company, and the general results obtained by its use seem to be excellent and appear to be in every way satisfactory.

The other type of single-phase motor may be broadly called the compensated repulsion type. The most satisfactory example of this type, up to the present, is the Winter-Eichberg motor, manufactured by the Allgemeine Elektricitäts Gesellschaft, the rights for which, in Great Britain, are owned by the British Thomson-Houston Company, who are the joint contractors with the A. E. G. for the electrification of the first portion of London, Brighton & South Coast Railway. A motor, much on the same lines, has also been put on the market recently by Messrs. Lahmeyer.

THE PLAIN SERIES MOTOR

This motor, as its name implies, is an alteration of the direct-current series motor, the alterations and additions being of a nature to reduce sparking at the commutator. As is well known, any ordinary series motor can be operated with single-phase current, and it is on this principle that Messrs. Deri and Lamme and Dr. Finzi started, having been followed by the General Electric Company of America and by Messrs. Siemens-Schuckert. The various devices which have been adopted for decreasing the sparking may be roughly divided into two categories, namely, the compensated coils method and the use of resistance in the armature circuit between the armature coils and the commutator.

The compensated coils may consist of short circuited windings on the stator, which was the arrangement first adopted by Deri some seven years ago, or an additional shunt coil on the stator, which in combination with the resistances between the armature windings and the commutator bars, is that which has been successfully adopted by Siemens-Schuckert. The Westinghouse Company improved the resistances by dividing them in such a way that each resistance only remains in circuit during the time that the commutator bar to which it is attached is covered by the brush. The Westinghouse Company has further introduced a compensated or neutralizing winding, which is in series with the armature and is reversed when the armature is reversed. In the case of the compensating shunt winding mentioned, it would appear that to make it in any way satisfactory, some regulation of this winding is necessary so as to insure the compensating field remaining always at right angles to the main field at all loads and speeds. Diagrammatically these arrangements as regards compensating are shown in Fig. 2.

THE COMPENSATED REPULSION MOTOR

Having briefly examined the connection and construction of the series motor, we will now as briefly investigate the compensated repulsion motor ; a diagram of the connections are shown in Fig. 3.

It will be seen from this diagram that the construction and connections of this motor are totally different from the plain series motor. The field winding can be entirely separated from the armature winding, and it is, therefore, possible, if it is wished, to wind the field in such a way that high-tension currents can be directly employed to excite it. The only low-tension current required to be taken from the line would then be that supplied to the exciting brushes on the armature.

In many cases it is preferable to use low-tension motors, in which case all the current required by the motors has to be transformed from the high pressure to the maximum low pressure usable just as in the case of the plain series motor. If high-pressure windings to the stator or field are adopted, only a comparatively small portion of the current, namely, that required for the exciter brushes, has to be transformed. In the case of low-tension motors series parallel controllers are used, the rotors being generally kept permanently in series, while the stators are first started in series and later on are put in parallel. The connections as proposed to be used

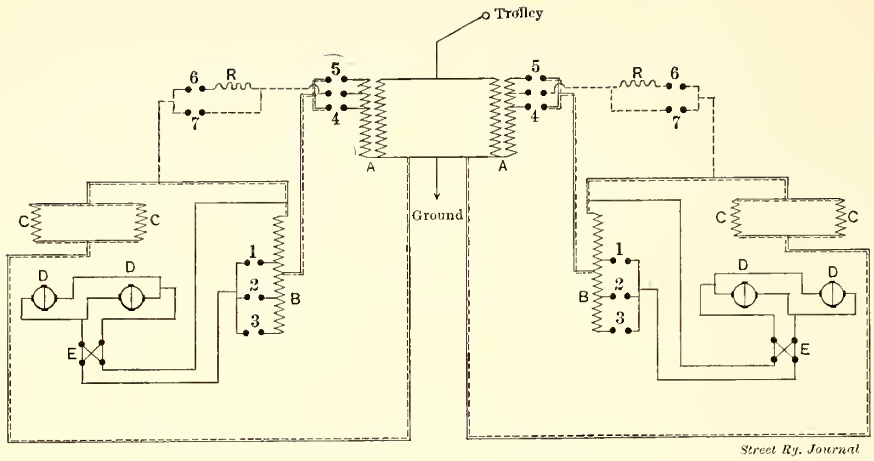


FIG. 4.—CONNECTIONS OF WINTER-EICHBERG EQUIPMENT FOR BRIGHTON & SOUTH COAST RAILWAY

A—Main transformer.
B—Exciting transformer.
C—Stator winding.
D—Rotor winding.
E—Reversing switch
1, 2, 3, 4, 5—Contactors.
R—Resistance.

Position of Controller	Contactors Closed
I.	4—2
II.	4—3
III.	5—1
IV.	5—2
V.	5—3

Motor equipment with regeneration shown thus —.—.—.
First braking position 6 is closed.
Second braking position 7 is closed.

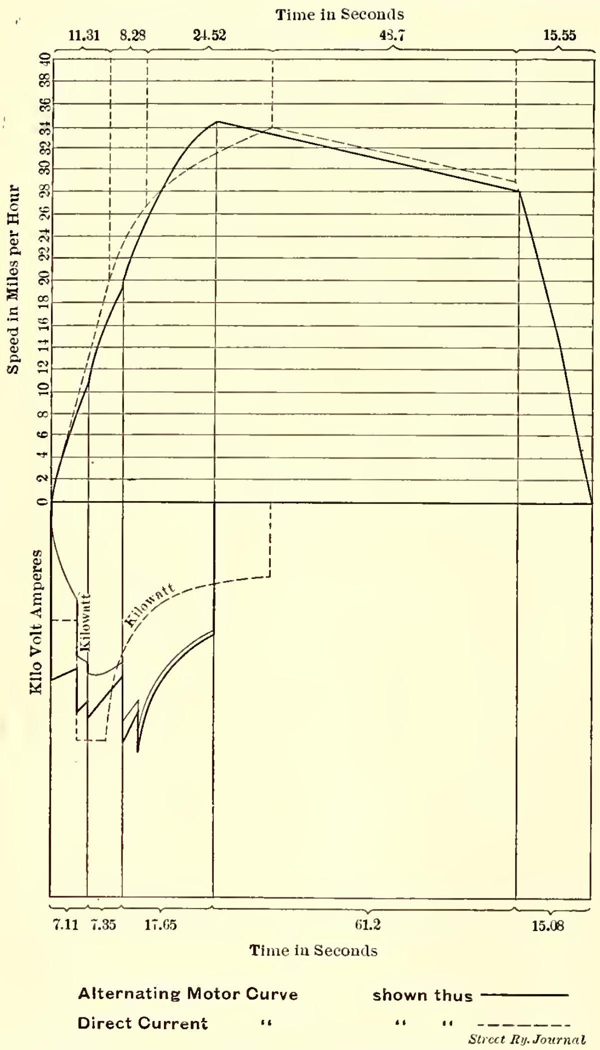


FIG. 5.—COMPARATIVE SPEED-TIME CURVES OF ALTERNATING AND DIRECT-CURRENT EQUIPMENTS

on the London, Brighton & South Coast Railway are shown in Fig. 4.*

* For diagram of the connections of the Winter-Eichberg equipment for the Swedish Railways, see STREET RAILWAY JOURNAL for March 31, page 488.

CHARACTERISTICS OF THE SINGLE-PHASE EQUIPMENT

Before describing some of the single-phase motors which have been made on this side of the Atlantic, it may not be out of place to see how far the single-phase motor is suitable for operating suburban trains, as there still appear to be many engineers who are of the opinion that, while single-phase traction may with advantage be used for long interurban roads and over those lines where rapid acceleration is not of primary importance, it is not suitable for handling suburban traffic where rapid acceleration is of vital importance. In this connection the decision of the officers and directors of the Brighton Railway Company to adopt the single-phase system of haulage, after the most careful investigation, is of great importance, especially as the conditions which the railway company required to be fulfilled were probably among the most stringent that have ever been issued, and the guarantees which are required from the tenders were of the most far reaching character, and

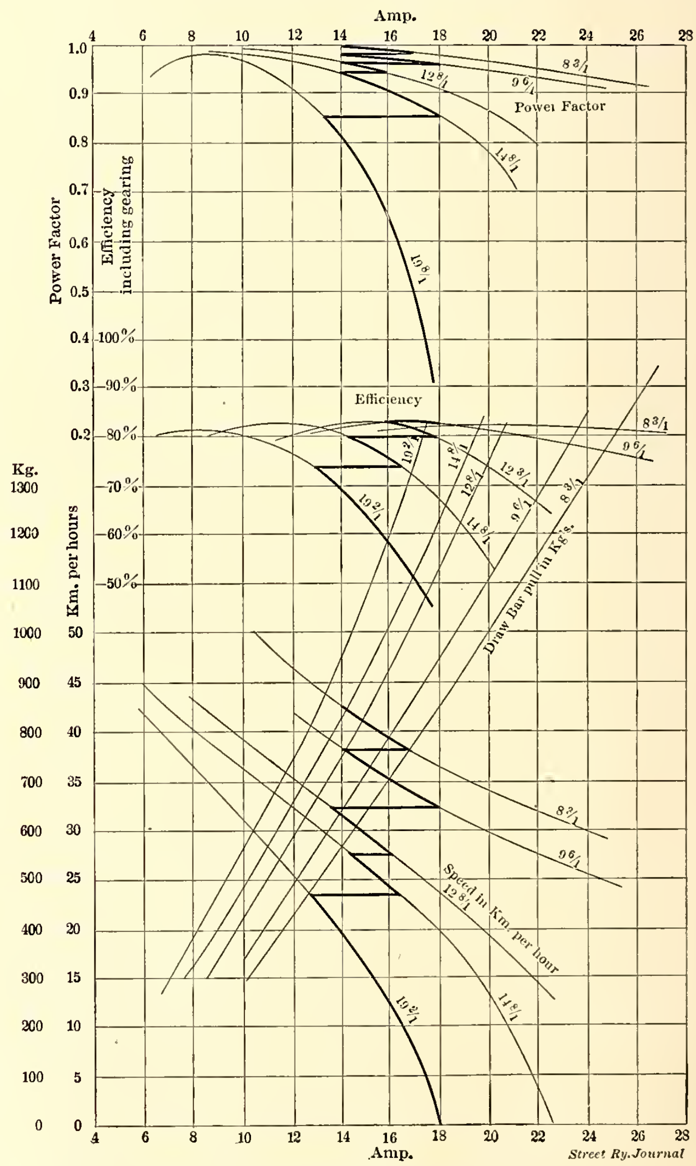


FIG. 6.—CURVES OF WINTER-EICHBERG 6000-VOLT, 25-CYCLE MOTOR

every guarantee given had to be based upon actual experimental results.

Figs. 5 and 6 show two diagrams which have been compiled from experimental data; both show the running of a three-car train through a distance of 1225 meters on a level and straight track. Each train was composed of two motor cars and one trailer car, and was propelled by eight motors. The only difference was that one train was operated by direct current and the other by single-phase current. The comparative weight and the result obtained are given below:

	Direct Current	Single-Phase
Weight of three-car train including 220 passengers	110 tons	117 tons.
Add for revolving motors	9 per cent.	11 per cent.
Gear ratio	1 to 3.5	1 to 3.7
Average power factor		0.85
Watt hours per ton kilometer	44.6	45.2 (41.3) if regenerating
Efficiency	72.8 per cent.	72 per cent.

But the curves of the performance of the two trains show far more than would be apparent from the above table, and clearly demonstrate the advantage of the use of a properly designed single-phase motor as regards acceleration. From them it will be seen that whereas with a direct-current motor it took 44.11 seconds to reach a speed of 34 m. p. h., with a single-phase motor equipment 34½ m. p. h. were reached in 32.11 seconds. The curves also show that in the case of a direct-current motor the acceleration is only fairly constant for about half the total period of acceleration, after which it rapidy falls off, whereas, in the case of the single-phase motor the acceleration is practically constant throughout the whole period of acceleration. Fig 6 gives efficiency, speed and power factor curves of the W. E. I. single-phase motor used in this test. The dark lines indicate the different transformer ratios employed to obtain the different speeds. The diagram given for the direct-current train were calculated for

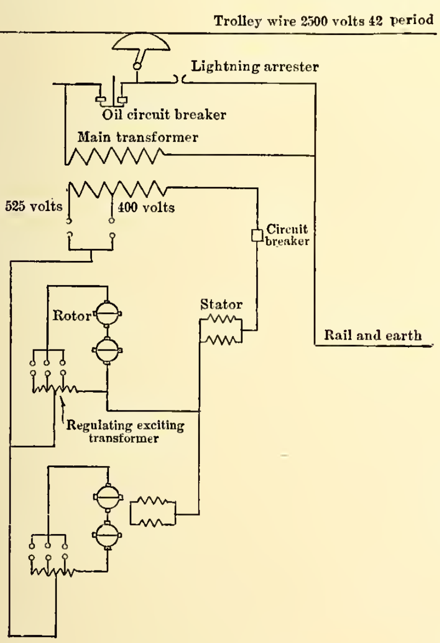


FIG. 7.—DIAGRAM OF WINTER-EICHBERG MOTOR CONNECTIONS ON STUBAITHAL BAHN

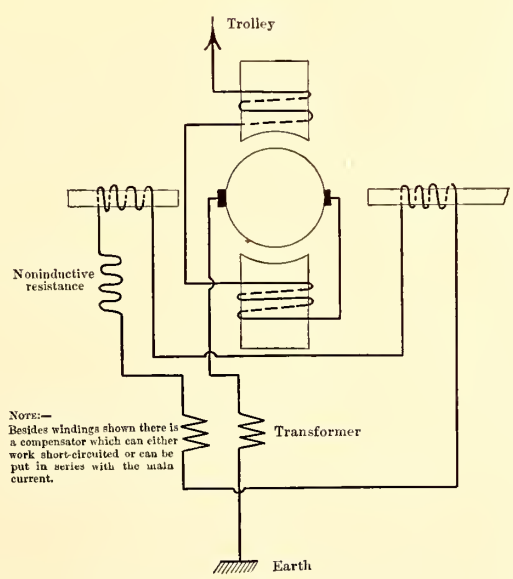


FIG. 8.—DIAGRAM OF CONNECTIONS, OERLIKON SINGLE-PHASE MOTOR

eight GE 66 motors, manufactured by the Allgemeine Elektricitäts Gesellschaft. The single-phase diagram includes eight W. E. I. Winter-Eichberg motors.

It will be seen that the maximum kw is somewhat greater in the case of a single phase than in direct current, but it will be observed that this maximum comes at a later stage than in the case of the direct current and that the result of it is a higher rate of acceleration during the final period of acceleration. The diagram clearly proves that the single-phase motor is eminently suitable for heavy traffic and rapid acceleration, or, in other words, for handling suburban trains.

Having considered both the general question of electric traction on railways, and also what particular type of motor, at any rate as far as Great Britain is concerned, may be ex-

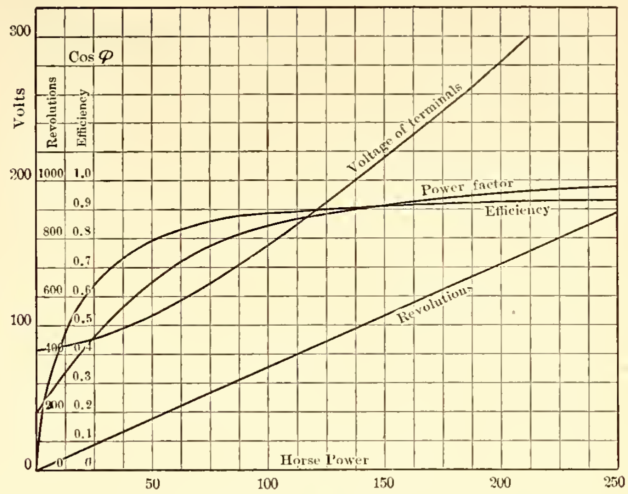


FIG. 9.—CHARACTERISTIC CURVES, OERLIKON 200-HP SINGLE-PHASE MOTOR

pected to be the one which will be most generally adopted, a summary of the heavy traction work which has so far been carried out in Europe may not be out of place.

Apparently, with the exception of Mr. Westinghouse and the New York, New Haven & Hartford Railway, the majority of American engineers seem still to be greatly in favor of continuous current for traction work on suburban railway lines, and considering the results this motor has yielded in America, it is, perhaps, not to be wondered at. Single-phase traction in America has certainly advanced, as the length of the lines carried out on this system by the Westinghouse and the General Electric Company show, but, unfortunately, most of these lines would appear to be long distance or interurban lines, or light railways, and, therefore, do not attract the attention of many of the well-known engineers. The case of the New York, New Haven & Hartford Railway is also different, as this railway company has decided upon the use of locomotives, and, as far as the writer can gather, is thus quite different from the electrification of heavy suburban lines running motor car trains at frequent intervals on this side of the water. No doubt American engineers and railway men will now watch the results which will be obtained in London and Hamburg with as keen an interest as European engineers have, in the past, anxiously awaited results of the electrification of lines, such as the Manhattan Elevated and others.

LIST OF EUROPEAN ELECTRIFIED MAIN LINES

The following is a list of practically all of the main railways in Europe which have been electrified. This list gives the subway lines in London but does not include mountain railways, the London tube railways, or the elevated and underground railways of Paris, Berlin or Budapest.

ENGLAND

Lancashire & Yorkshire, Liverpool & Southport division; length of route, 23.5 miles.[1]

SINGLE-PHASE CAR OF MURNAU-OBERAMMERGAU RAILWAY

Northeastern Railway, Newcastle branch; length of route, 82 miles.[2]

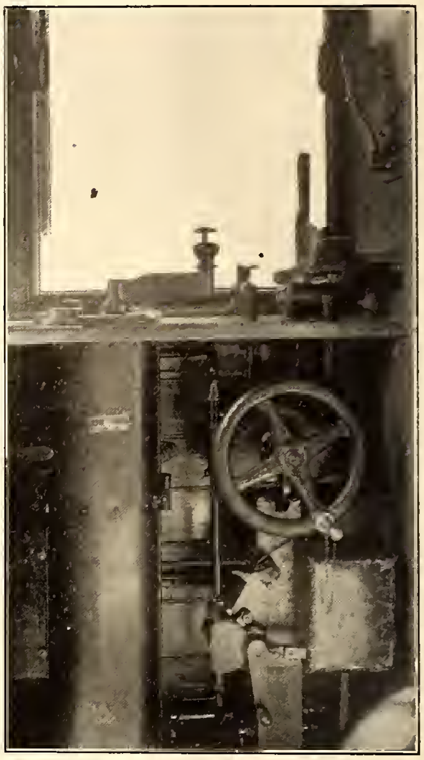
Mersey Tunnel, length of route, 4.6 miles.[3]

Metropolitan District of London, length of route, 24 miles.[4]

Metropolitan Railway of London, length of route, 79 miles.[4]

ITALY

Italian Government Railway, Milan-Gallarate-Varese, length of route, 45 miles.[9]



SINGLE-PHASE MASTER CONTROLLER IN CAB OF HAMBURG CAR

Italian Government Railway, Lecco-Colico-Chiavenna, length of route, 67 miles.[10]

Of the above the last is equipped with three-phase apparatus and the Hamburg railway with single-phase apparatus. The others are all direct-current roads.

SPINDLERSFELD EXPERIMENTAL SINGLE-PHASE MOTOR CAR

FRANCE

Western Railway of France, Paris-Versailles, length of route, 11 miles.[5]

Orleans Railway, Paris-Juvisy, length of route, 12 miles.[6]

GERMANY

Berlin-Grosslichterfelde, length of route, 5¾ miles.[7]

Prussian State Railway, Hamburg, length of route, 15 miles.[8]

The following is a list of the principal single-phase roads in Europe, in operation or course of construction:

[1] See STREET RAILWAY JOURNAL for Jan. 30 and April 2, 1904

[2] See STREET RAILWAY JOURNAL for June 20, 1903.

[3] See STREET RAILWAY JOURNAL for April 4, 1903.

[4] See STREET RAILWAY JOURNAL for March 4, 1905.

[5] See STREET RAILWAY JOURNAL for Nov. 15, 1902, and May 20, 1905.

[6] See STREET RAILWAY JOURNAL for Nov. 15, 1902; Feb. 28, 1903; Aug. 6, 1904, and May 20, 1905.

[7] See STREET RAILWAY JOURNAL for Sept. 7, 1901, and June 7, 1902.

[8] See STREET RAILWAY JOURNAL for March 17, 1906.

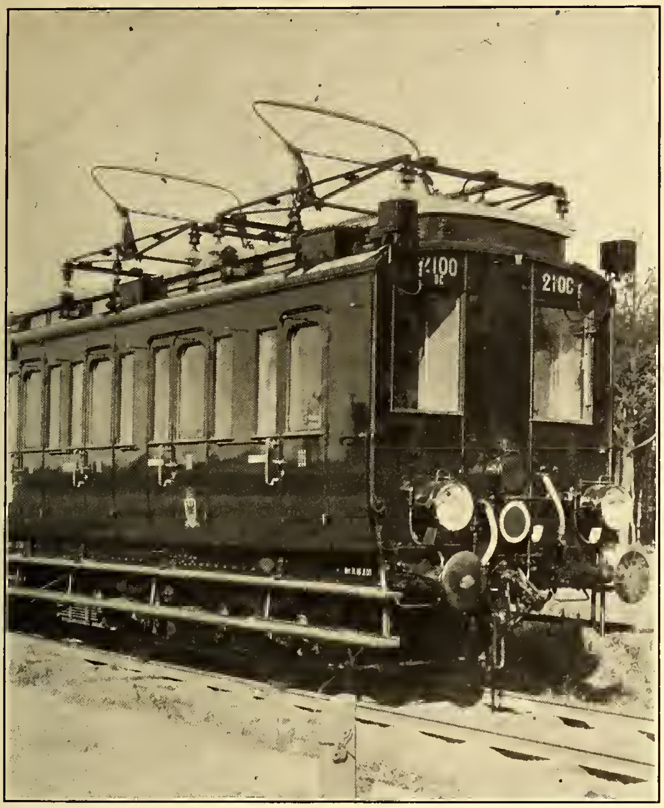
[9] See STREET RAILWAY JOURNAL for Nov. 24, 1900; Aug. 3, 1901; Dec. 6, 1902, and May 13, 1905.

[10] See STREET RAILWAY JOURNAL for May 2, 1903; April 1, Aug. 5, and Aug. 26, 1905.

Belgium.—Société Nationale des Chemins de Fer Vicinaux, Borinage division.[11]

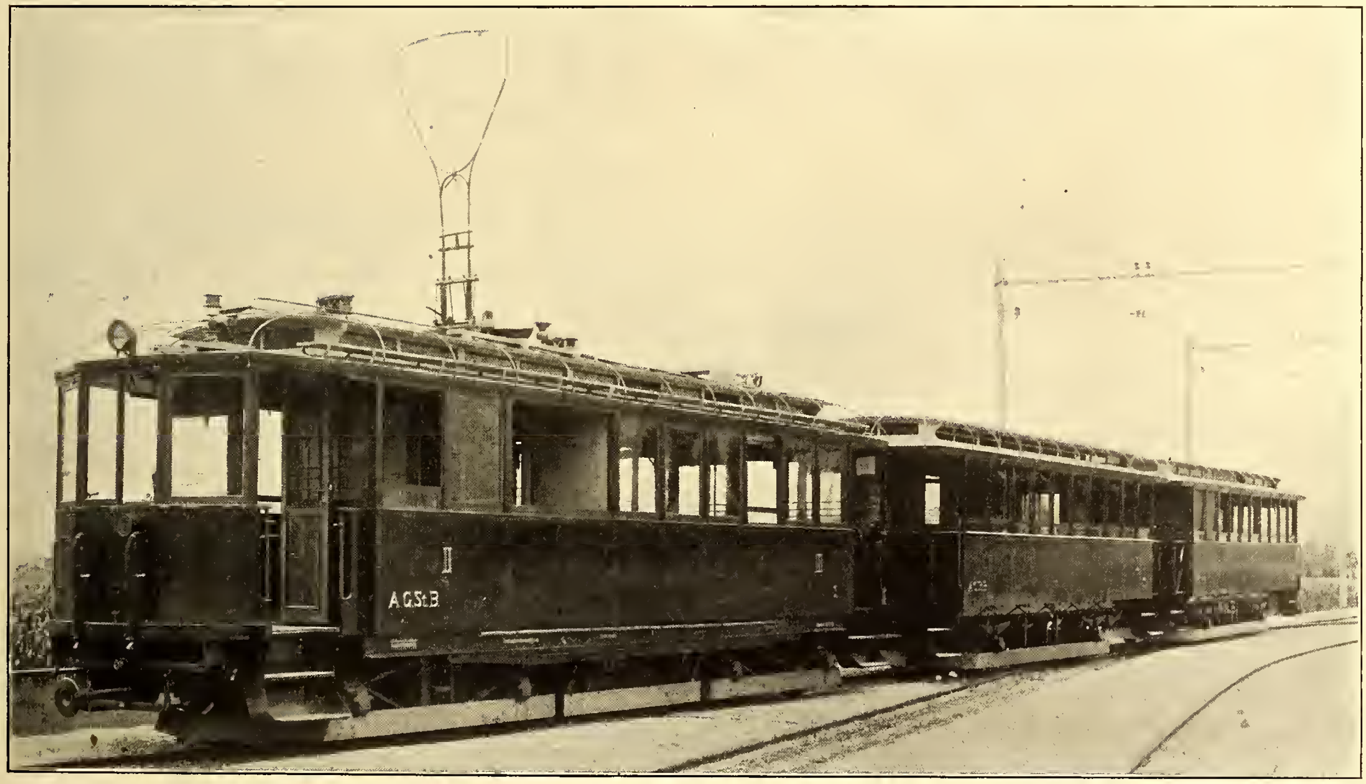
Germany. — Spindlersfeld - Oberschoenweide.[2] Oberammergau.[13] Hamburg.[8]

Italy. — Bergama-Valle Brembana. Rome-Civita Castellana.



END VIEW OF HAMBURG SINGLE-PHASE CAR, SHOWING ARRANGEMENT OF CURRENT COLLECTORS

CHEAP FORM OF BRIDGE OVERHEAD CONSTRUCTION, STATION OF STUBAITHAL SINGLE-PHASE RAILWAY



SINGLE-PHASE TRAIN ON STUBAITHAL BAHN, SHOWING PROTECTIVE STRIPS ON ROOF

Switzerland. — Seebach-Wettingen.[14] Simplon tunnel.[15]

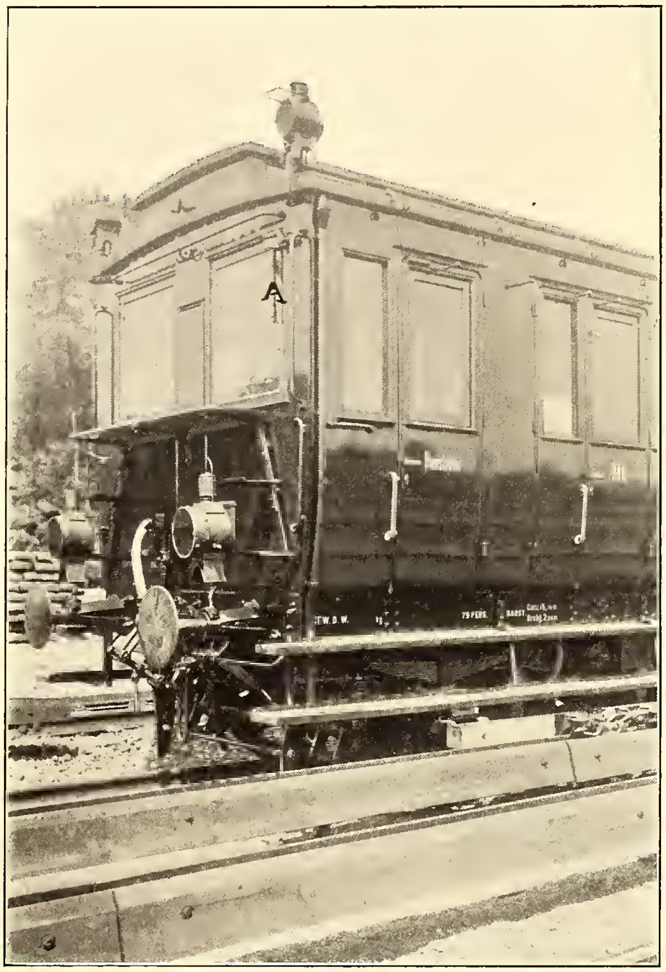
Austria.—Stubaithal.[12]

Sweden.—Government Railways.[16]

[11] See STREET RAILWAY JOURNAL for Sept. 16, 1905.
[12] See STREET RAILWAY JOURNAL for Nov. 26, 1904.
[13] See STREET RAILWAY JOURNAL for April 1, 1905.
[14] See STREET RAILWAY JOURNAL for Nov. 26, 1904; April 8, 1905, and Feb. 24, 1906.
[15] See STREET RAILWAY JOURNAL for Jan. 6 and Feb. 24, 1906.
[16] See STREET RAILWAY JOURNAL for March 31, 1906.

DETAILS OF EQUIPMENT

Views of several of these recent installations are presented herewith. Attention might be called to one or two features in connection with these cars, which has, perhaps, escaped mention in the descriptions which have been published of



FRONT END OF GROSS LICHTERFELDE CAR, SHOWING WINDOW CLEANER AT *A*

their electrical equipment. One is the metallic hoops and guards on the top of the cars, all properly earthed, to provide against any possibility of the wiring coming down and injuring the passengers. This is particularly noticeable in the Stubaithal, Oberammergau and Spindlersfeld cars. Another illustration shows the motorman's compartment in the Hamburg-Blankenese car. This compartment is fitted with a seat accommodating three passengers, and when this compartment is not being used for driving purposes, the controller is shut off by means of a door. Electric head lights are fitted to the car and a very neat arrangement is used for keeping the window clean in case of wet weather. This is an arrangement which is used in Germany and it is more clearly seen on the photograph of the Lichterfelde car, which is operated by direct current and which was equipped by the Union Company some time ago. The letter "A" indicates the squegee, which is a lever operated from within the cab and which cleans off any moisture which may have accumulated on the sash.

MOTORMAN'S CAB ON GROSS LICHTERFELDE CAR, SHOWING WINDOW CLEANER AT *A*

CAR DESIGN

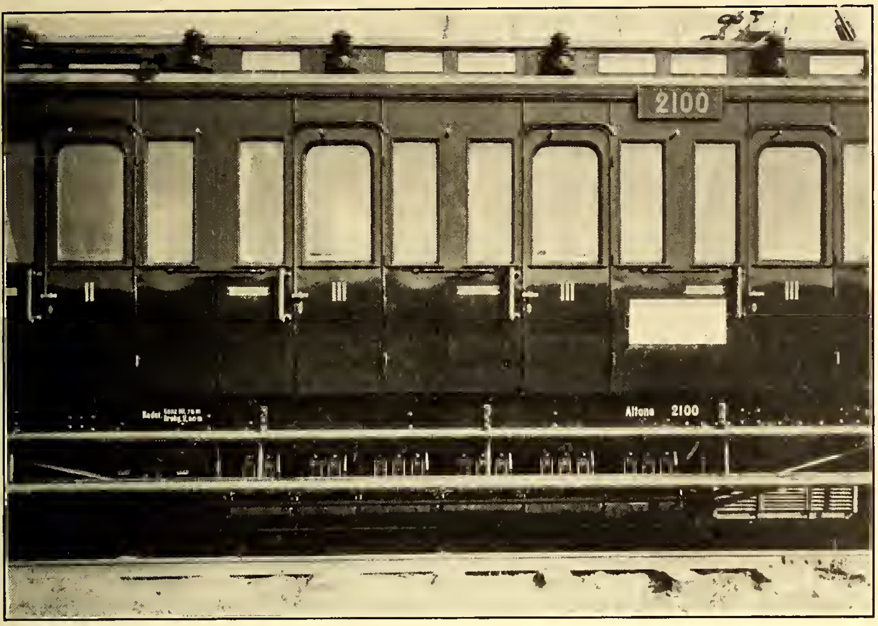
Having now considered the general condition in connection with the introduction of electric traction on main line railways, and also considered what the conditions are which will effect the use of electricity under different conditions of railway traffic, a brief consideration may perhaps be given as to what type of carriage, at least as far as Great Britain is concerned, will probably be found to be the most useful for handling the suburban traffic of our main line railways. The following classification may be of assistance in considering this question:

MAIN CLASSIFICATION	SUB-CLASSIFICATION
(1) Carriages with end doors only, being originally American and Swiss Standard practice.	(a) Side seats only, with large space between seats for standing room.
	(b) Transverse seats with passages down center.
	(c) Combination of the two types, side seats at end of car, allowing standing room at either end. Transverse seats in middle of car with narrow passage between them.
(2) Side doors along the whole of the coach.	(a) Transverse seats with passage through middle.
	(b) Transverse seats in the middle of the carriage with passage at either side.
	(c) Transverse seats at one side of the carriage with narrow passage at other side.
(3) Combination of above two, with end doors and center doors.	(a) Side seats with big standing room between seats as well as standing room at end doors and central doors.
	(b) Transverse seats or combination transverse and side seats with standing room in middle.

The diagram, Figs. 10 and 11, gives a good idea of the above-named arrangements.

The first class is that which so far has been generally adopted in America, and which has also been employed on a great many of the London tube lines. The second class is one which is known in America as the "Illinois Central," and which also finds favor on the Continent of Europe. The third class has been adopted by both countries.

In ascertaining what type of car is most suitable for suburban lines, the conditions which obtain must not be lost sight of. The principal one is that the main stations in London are practically all terminal stations, and that during the rush hours of the day at these termini, the train has to be practically completely emptied and filled in the shortest possible time. These conditions are totally different from those

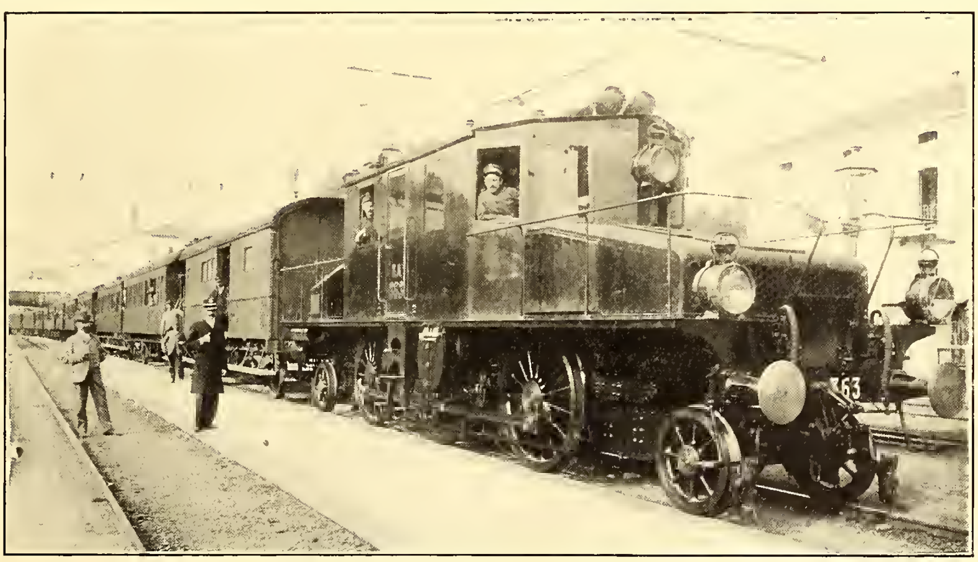


SIDE VIEW OF HAMBURG SINGLE-PHASE CAR, SHOWING CONTACTORS

met on the London tube lines and elevated roads in New York, where there are several stations at which passengers get in and out. The addition of a central sliding door has been made to assist the rapid unloading, the arrangement generally adopted being that passengers get out at the central side door and new passengers enter the car by the end doors. This is the system adopted by the Metropolitan District Railway in London, but it does not appear to be very favorably viewed by the English traveling public. Undoubtedly, in the conditions mentioned above, which exist with suburban traffic on main lines, side doors the whole length of the coach, as in the Illinois Central, are desirable. This system, however, presents certain disadvantages, in that side doors are more difficult to keep air tight and cause draught, also that in order to be satisfactory they should be worked by compressed air, which calls for a considerable amount of extra capacity of the compressors. It has been found in practice that the amount of air to work the side doors in some cases has to be even greater than the amount required for braking purposes.

The necessity of using sliding doors instead of swinging doors is in consequence of the very rapid acceleration which is rendered possible by the adoption of electric traction, otherwise the ordinary swinging doors would certainly appear to be preferable. In this connection there is a great advantage resulting from the use of single-phase motors, as by this system the acceleration can be so graduated that for the first few hundred feet it can be kept low enough to allow the doors to be closed by a person standing on the platform. The rate is then rapidly increased and kept practically constant until the end of the period of acceleration. Experiments which the writer has recently been able to conduct on d. c. and single-phase railways shows this very clearly. Thus, while the average acceleration for single phase during the whole period of acceleration is 1 mile per hour per second, the acceleration for the first couple of hundred feet or so, is under 1 ft. per second per second, rising rapidly after that till it reaches the neighborhood of 2 ft. per second per second. This latter rate is kept up till the end of the period of acceleration. On the other hand, with d. c. motors acceleration at the commencement is between 2 ft. and 3 ft. per second per second, rapidly falling afterward to under 1 ft. per second per second. The use of the single-phase motor, therefore, enables railway managers simply to consider the convenience of their passengers and to utilize that acceleration which, from the passengers' point of view, is the most suitable.

Under these circumstances there seems little doubt but that the type of suburban carriage finally adopted by the Prussian State railways will best meet the requirements. This type is shown in one of the plans accompanying this article, from which it will be seen that the train will consist of two classes, each class being again sub-divided into smokers and non-smokers. The carriages are arranged similarly to the ordinary type of English carriage, with side seats a narrow passage being provided at one end, so that any passenger getting into the compartment and finding it full can pass through this narrow passage and find a seat in another compartment.

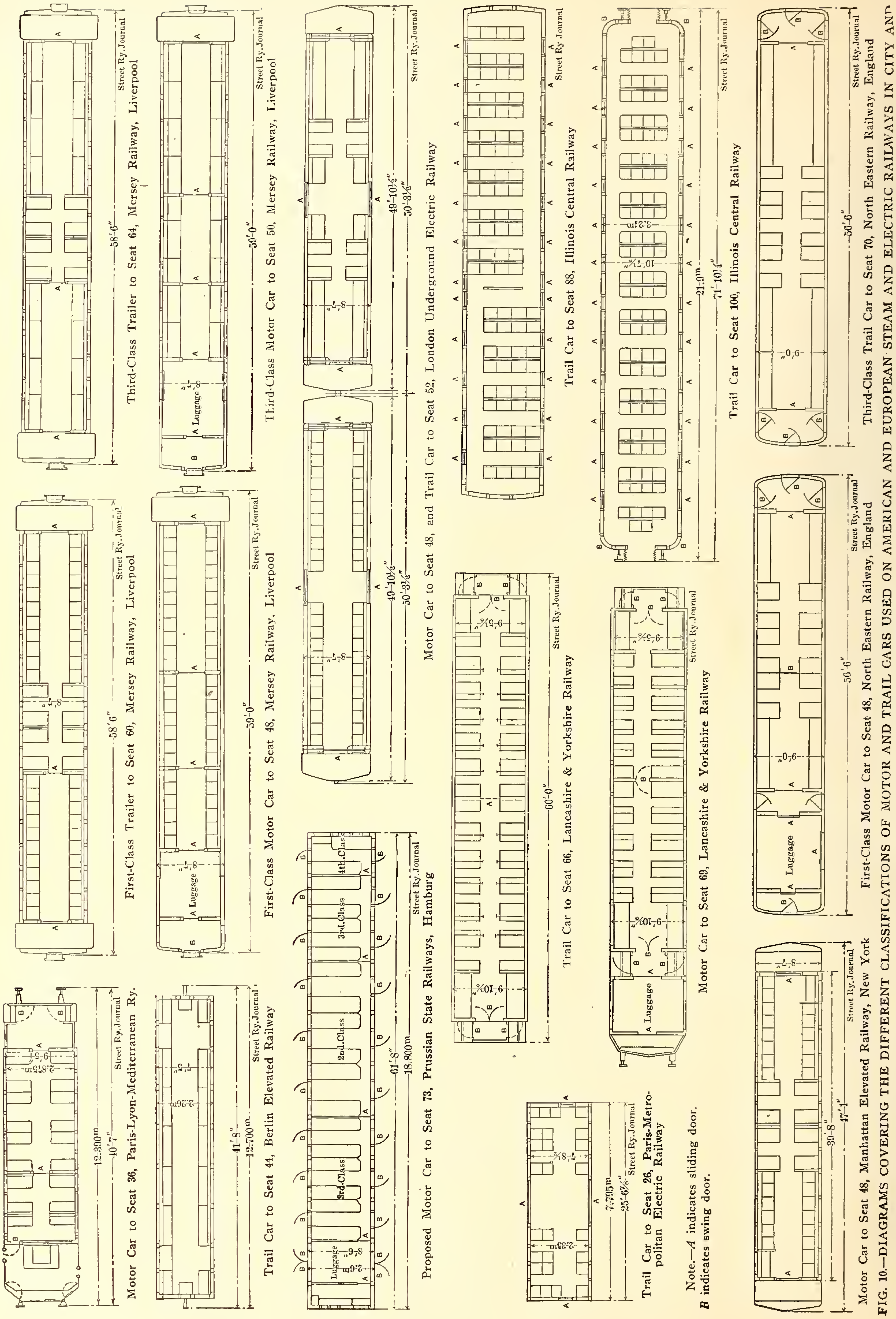


EXPRESS PASSENGER TRAIN ON VALTELLINA RAILWAY, WITH NEW LOCOMOTIVE

It may be contended by some that this takes away from the carrying capacity of the car, owing to the fact that one seat is taken away, but, as a matter of fact, the real carrying capacity is increased because three passengers are able to stand in the room which would otherwise be occupied by two seats.

CONCLUSIONS

A careful survey of the present traffic conditions existing



Third-Class Trailer to Seat 64, Mersey Railway, Liverpool

First-Class Trailer to Seat 60, Mersey Railway, Liverpool

Motor Car to Seat 36, Paris-Lyon-Mediterranean Ry.

Third-Class Motor Car to Seat 50, Mersey Railway, Liverpool

First-Class Motor Car to Seat 48, Mersey Railway, Liverpool

Trail Car to Seat 44, Berlin Elevated Railway

Motor Car to Seat 48, and Trail Car to Seat 52, London Underground Electric Railway

Proposed Motor Car to Seat 73, Prussian State Railways, Hamburg

Trail Car to Seat 88, Illinois Central Railway

Trail Car to Seat 66, Lancashire & Yorkshire Railway

Trail Car to Seat 26, Paris-Metropolitan Electric Railway

Trail Car to Seat 100, Illinois Central Railway

Motor Car to Seat 69, Lancashire & Yorkshire Railway

Note.—*A* indicates sliding door. *B* indicates swing door.

Third-Class Trail Car to Seat 70, North Eastern Railway, England

First-Class Motor Car to Seat 48, North Eastern Railway, England

Motor Car to Seat 48, Manhattan Elevated Railway, New York

FIG. 10.—DIAGRAMS COVERING THE DIFFERENT CLASSIFICATIONS OF MOTOR AND TRAIL CARS USED ON AMERICAN AND EUROPEAN STEAM AND ELECTRIC RAILWAYS IN CITY AND SUBURBAN SERVICE

in and round our large towns clearly shows that the suburban railway systems must be operated electrically within the next few years and the fact that one of the principal English railways, having termini in London, after most careful consideration, has finally decided to electrify its suburban system, upholds this view.

Besides the disadvantages of the third rail and the greater

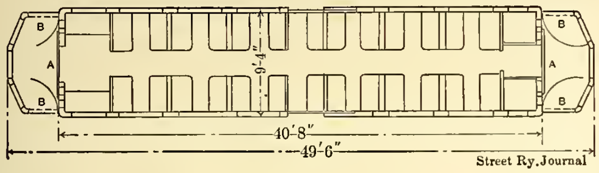
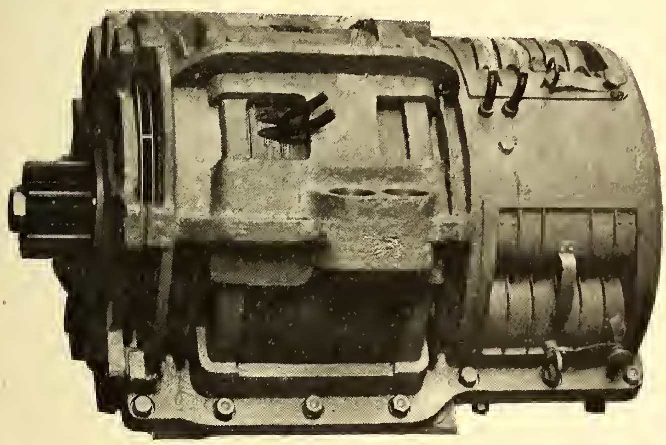


FIG. 11.—MOTOR CAR TO SEAT 58, GREAT NORTHERN & CITY RAILWAY, LONDON

costliness of direct current, as compared to single-phase current, this latter presents so many advantages that it would appear to be the only system which with our present knowledge will fill nearly all the requirements of railway men, and



HAMBURG SINGLE-PHASE MOTOR

is, therefore, the most suitable for handling the suburban traffic of our main line railways.

Electrification of main lines, as far as long distance and goods traffic is concerned, may be made under special circumstances but does not appear to be likely to be adopted in the near future, as far as Great Britain is concerned.

THE FIRST ELECTRIC RAILWAY IN BOLIVIA

A few months ago there was inaugurated by the Bolivian Government, at La Paz, Bolivia, the Bajada Extension of the Ferro-Carril de Guaqui á La Paz (Guaqui-La Paz Railroad), a meter-gage road operating between these two towns. This road is the first electric railway in Bolivia, and probably is the highest in the world. The extension completes the chain of communication by railroad and steamship between La Paz and the port of Mollendo on the Pacific Coast, and has already proved itself to be an important link in this chain. Almost all of the Bolivian importations enter at Mollendo and are shipped over the Southern Railway of Peru to Puno, on the Peruvian side of Lake Titicaca, the highest lake in the world, (12,500 ft. elevation). Transhipment is made across the lake to Guaqui, Bolivia, and from here over the Guaqui-La Paz Railroad to the "altos" (13,400 ft. elevation) overlooking the city of La Paz, the central plaza of which is 1500 ft. below. The only approach to the city is from above, and formerly all goods were carried from the railway terminus to the city by mule teams, and passengers traveled by coach, a distance of some eight kilometers, over a bad road.

The lower terminus of the Bajada Extension is located about one kilometer from the center of the city, and the power house and car house about 1½ kilometers along the road. The present equipment consists of two 150-kw General Electric railway generators, belted to Premier gas engines furnished by the Power Gas Corporation, of England. The mond gas producer is used. The generators are provided with collector rings to give a three-wire 250-volt distribution for lighting purposes during the night.

The rolling stock consists of two Brill cars for first-class passengers, two Brill cars for second-class passengers, each of which is mounted on Brill 21-E trucks and fitted with double motor GE-53 equipments; and one Brill 25-ft. vestibule baggage and express car, mounted on Brill 27-G trucks and fitted with four-motor GE-53 equipments.

The service required of the cars, when not carrying passengers or baggage, is that of taking up and down the "bajada" the freight cars of the steam road. For this purpose the platforms and bumpers were made stronger than usual. As practically all the goods traffic of La Paz is inward, the work resolves itself into holding back loaded cars on the down grade and drawing empty cars on the up grade. Each passenger car can draw one trailer up the hill and the baggage car two trailers. The downward journey is a question of brakes, and to hold back the trailers, the electric cars are equipped with Stirling power brakes, and air compressors, the latter operating Westinghouse air brakes on the freight cars. It was also desired to have track brakes, but the crowded condition of the bottom of the car, due to the narrow gage, made this difficult.

The road itself, throughout the entire length, is a series of curves. In fact, the longest piece of straight track is only about 1000 ft. Added to this, there is an almost continuous grade of 6 per cent from the lower end of the line to the railroad station on the "alto." The road is single track, overhead trolley construction, and although the station on the "alto" is only about 2 kms from the lower station, the 1500 feet difference in level necessitates a tortuous route almost 9 kms in length.

The entire full load capacity of one generator is taken in sending the baggage car with two empty trailers up the hill. The line is divided into two sections, a 300,000-C. M. feeder from the power station being tapped in the middle of the upper section.

The successful culmination of the Bajada Extension is due to the initiative and untiring efforts of T. Clive Sheppard, who, as Director General of Public Works, gave much of his personal attention to the matter. The electrical equipment and cars were furnished through W. R. Grace & Company, Lima, Peru, agents for the General Electric Company, on the West Coast of South America. The plant was installed by N. Coe Stewart.

Conspicuous signs in St. Louis cars will soon inform all passengers that the city ordinances provide "Ten Dollars Fine for Spitting on the Floor of This Car." The politely worded signs now displayed, stating that "The Ordinances and Decency Prohibit Spitting on the Floor of This Car," have not had the desired effect and the Board of Health has decided to lay down the law in more direct and vigorous fashion. A letter to the board from the Suburban Railroad Company, signed by Julius S. Walsh, president, says the company will do anything asked to aid in carrying out the order. This, it is expected, will take the form of an order to conductors to cause the arrest of passengers who violate the rule.

THE PENNSYLVANIA RAILROAD'S EXTENSION TO NEW YORK AND LONG ISLAND—THE LONG ISLAND CITY POWER STATION

A short account was published in the STREET RAILWAY JOURNAL for Nov. 4, 1905, of the electrified section of the Long Island Railroad. Current for the operation of this line is obtained from a large power station now being erected by the Pennsylvania Railroad Company. This station will also supply part of the power for the New York terminal, and will have capacity for emergency operation of the entire tunnel system and the electrified system of the Long Island Railroad.

Two companies have been incorporated through which the Pennsylvania Railroad Company is carrying on its New York extension work. One of these, the Pennsylvania, New Jersey & New York Railroad Company, will build all of that portion of the tunnel and approaches in the State of New Jersey and extending under the Hudson River to the boundary line of the States of New Jersey and New York; from this boundary the other, the Pennsylvania, New York & Long Island Railroad Company, will construct the tunnels, terminal station and yards on Manhattan Island, under the East River and in Long Island City. The officers of these companies are the officers of the Pennsylvania Railroad Company, the president being A. J. Cassatt. The engineering and architectural features are sub-divided in accordance with the character of the work, the whole project being under the general direction of the management of the Pennsylvania Railroad Company.

The tunnel work proper is divided into two parts; the East River Division being under the direct charge of Alfred Noble, chief engineer, and the North River Division under the direct charge of Charles M. Jacobs, chief engineer; the general railroad facilities and the electrical and mechanical features of the railroad and terminal are under the charge of George Gibbs, chief engineer of electric traction. These three officials, together with Brigadier General Charles W. Raymond, chairman, constitute a board of engineers to whom the general engineering features of the whole plan are confided.

Westinghouse, Church, Kerr & Company have been selected as engineers and contractors for the electrical and mechanical engineering, acting under the supervision of the chief engineer of electrical traction.

LOCATION AND CAPACITY

The Long Island City power station, already mentioned, adjoins the Long Island Railroad passenger and freight stations and is close to the East River. It contains at present three 5500-kw steam turbines and generators, a size which has been adopted as standard for future work. The station is designed so that it can accommodate within its present walls six generating units of this size and two of 2500 kw for lighting the tunnels. The ultimate capacity when extended will be about 105,000 kw in electrical machinery.

FOUNDATIONS

The site was formerly under water and had only been filled in to an extent that brought the surface about 1½ ft. above the extreme high water. A series of borings showed that the soil consisted of from 10 ft. to 15 ft. of loose fill and river mud overlying successive strata of clay, sand and gravel, with rock being struck at a depth of 35 ft. to 60 ft. below the level of the street. In the design of the foundation due consideration was given to several different methods and it was finally decided to use a comparatively uniform spacing of piles overlaid by a monolithic concrete mass of a thickness which should take up the distance between the point at which the piles could be safely cut off and extreme high water. Test piles indicated a safe carrying capacity for piles from 30 ft. to 35 ft. long, of 13 tons to 20 tons, varying on different parts of the site. The foundation was designed to carry a load of 12 tons per pile, and the spacing of the piles is on an average, 2 ft. 4 ins. between centers over the entire area. The total number of piles required for the foundation was 9115. Underneath the stacks the concrete cap is 8 ft. 6 ins. deep, the piles being cut off 2 ft. lower down. The stack

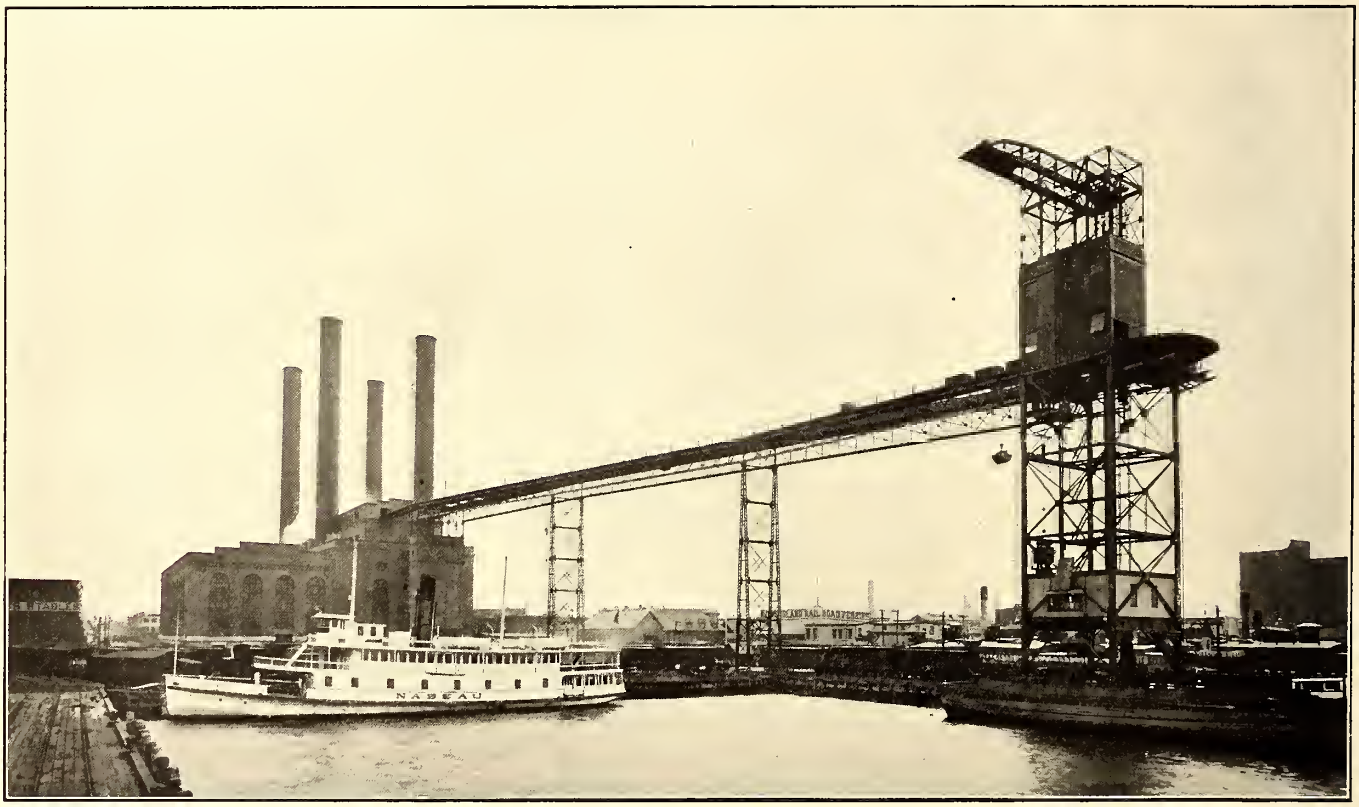


FIG. 1.—POWER STATION FROM RIVER, SHOWING COAL TOWER IN OPERATION

anchor bolts pass through a grillage of steel T-rails, embedded in the bottom of the concrete.

INTAKE FLUME

The flume for the condenser intake, and the overflow flume directly above it, traverse the building foundations completely from west to east, and are integral with it, as is shown by the cross section given in Fig. 4. Both the intake and the overflow flumes are nominally 10 ft. in diameter, this large sectional area being required to provide sufficient condensing water with a low velocity of flow when the power station is extended to its maximum future length of 500 ft. and filled with generating machinery. The elevation of the intake flume is such that it is always submerged.

At the bulkhead line, the intake is provided with an ice fender, extending to a point below the extreme low water, to prevent a boat that may be lying against the face of the timber rack from packing ice against it and stopping the water supply. This timber rack extends from the bottom to the top of the intake opening, and it is built of 3-in. x 10-in. yellow pine timbers spaced 4 ins. apart in the clear. The face of the rack is inclined, so that floating objects drawn in by the current can be easily removed. Behind the rack is a screen chamber or well, with two sets of screens fitted in vertical cast iron guides. Each set of screens is built in three parts, placed one above the other in the same groove, made up of oak frames and brass fittings, and on the front of the bottom rail of each section is a catch basket to retain falling objects when the screen is drawn up for cleaning or inspection. The outside screen is of iron wire, 1 in. mesh, and the inside screen is of No. 10 gage copper wire, ½-in. mesh. A trolley beam and chain block are provided over the screen well to facilitate lifting out the screens and removing debris from the baskets. It was also decided to place a 30-in. connection from the overflow into the screen chamber, so that under severest winter conditions warm water might be run through on to the screen to prevent an accumulation of ice within the intake chambers. It is not probable that it will be necessary to use this connection a great deal, but it is so placed that, even with a moderate load on the power plant, there will be sufficient warm water to cut out this ice. The valve controlling this by-pass is placed in a watertight compartment accessible from the top.

PILING

Spruce piles were used, varying in length from 25 ft. to 40 ft. They were driven practically to refusal with a 2000 lb. hammer, falling 18 ft. to 20 ft. The first pile was driven on Nov. 16, 1903, and the last one on March 5, 1904. There were at one time eight pile drivers on the ground, four of which were generally used for driving foundation piles, and the other four being used for sheet piling and for the piling needed for the temporary concrete plant. The greatest number of piles driven in one day was 232, using four pile drivers, and the greatest number of piles driven by one driver in one day was eighty-three.

CONCRETING

The concrete was mixed by machine, and a special plant was installed for this purpose, with a view to securing the most economical and rapid production of concrete. The plant had a capacity for storing about 2000 cubic yards each of stone and sand, and 2500 barrels of cement.

The concrete was mixed in proportions of 1, 2½ and 5, very wet, and required very little ramming. Although the work was done during an unusually cold winter, the precautions taken sufficed to prevent trouble from freezing. The entire block of concrete required for the monolithic cap and the flumes was about 18,000 cubic yards. The first concrete was placed on Jan. 24, 1904. Under favorable conditions the mixing capacity of the plant was as high as 100 cubic yards of concrete per hour. On one occasion fifty-seven men, working eight hours, placed 716 cubic yards of concrete, or about 90 yards per hour for a whole day.

FIG. 2.—GENERAL VIEW OF POWER STATION AND ASH TOWER

DIMENSIONS

The over-all dimensions of the present building are: 200 ft. x 262 ft., outside measurement. The boiler house is 103 ft. wide inside, the engine room 66 ft., and the electrical galleries 25 ft. wide. The boiler house proper is 82 ft. high to the top of the parapet. The coal pocket enclosure, superimposed on the boiler house, is 60 ft. wide, and its parapet is 118 ft. high. The engine room is 70 ft. high, to the top of the parapet.

The first floor of the boiler house is 16 ft. above the basement, and the second floor of the boiler room is 35 ft. above the first floor. In the engine house, the engine room floor is 23 ft. 6 ins. above the basement, and thence to the roof trusses the height is about 40 ft. in the clear. This is a much lower engine room than is commonly met with in power stations of this size, the saving in head room being due to the adoption of the horizontal type of steam turbine, which enables economy in vertical space required as well as in the floor area.

STEEL CONSTRUCTION

Like all large power stations of modern construction, the superstructure of the building consists of steel framework which carries the weight of the room and the entire contents of the building, excepting such portions of the machinery as may be more conveniently carried on separate foundations. The south wall of the boiler house supports the outer ends of the boiler room roof trusses on that side of the building, but in other respects the steel superstructure is independent of the building walls.

The steel framing of the boiler house and engine room are necessarily different in type, as the former has to carry a double tier of boilers with flues, economizers, etc., and a coal pocket of 5200 tons capacity on top of everything, while the engine room consists of simply a large open space which makes the roof truss construction the most conspicuous feature, but aside from this does not involve difficult construction. Conditions in the boiler house, are, however, more complex, chiefly by reason of the imposition of the coal pocket, which runs the entire length of the building.

The steel stacks are independent of the boiler house, excepting where they pass through the lower fire room floor, at which point the floor is built against the stacks. At other points they pass through circular openings in the floors and roofs, so that there is no stress induced upon the structure by deflection of the stacks under stress of wind.

A cross section of the coal pocket closely resembles the letter "W," this form being the necessary consequent of having a double line of boilers with an alley between them, requiring a down flow of coal by gravity at points directly over the boiler fronts. Every portion of the bottom of the bunker is so arranged as to induce constant movement of coal in the bunker to the fire rooms, thus tending to prevent fires in the bunkers. No fire has yet been detected within the bunker.

COAL-HANDLING PLANT

The location of the power station is such that it can receive coal either by water or by rail, but as some water transportation is necessary in order to reach the power station site from the New Jersey terminals of coal carrying railroad lines, it becomes cheaper to carry it in barges to the power station site. The plant was, therefore, designed more particularly to deal with water coal, though certain provisions were made in the design of the tower that will admit of the development of the power station for handling railroad coal directly from the cars should it ever be required in the future.

The complete coal and ash conveying plant, which is shown in one of the half-tone engravings, may be said to consist of three parts, the coal hoisting tower, the cable railroad, which carries the coal from the tower to the coal pocket and its supporting bridge, and the ash bin structure, which is so arranged that it forms a part of one of the piers of the cable railway bridge. This level bridge is 107 ft. above the dock, and is at about two-thirds the entire height of the tower, whose top is 170 ft. above the dock.

FIG. 3.—COAL BRIDGE, VIEWED FROM TOWER

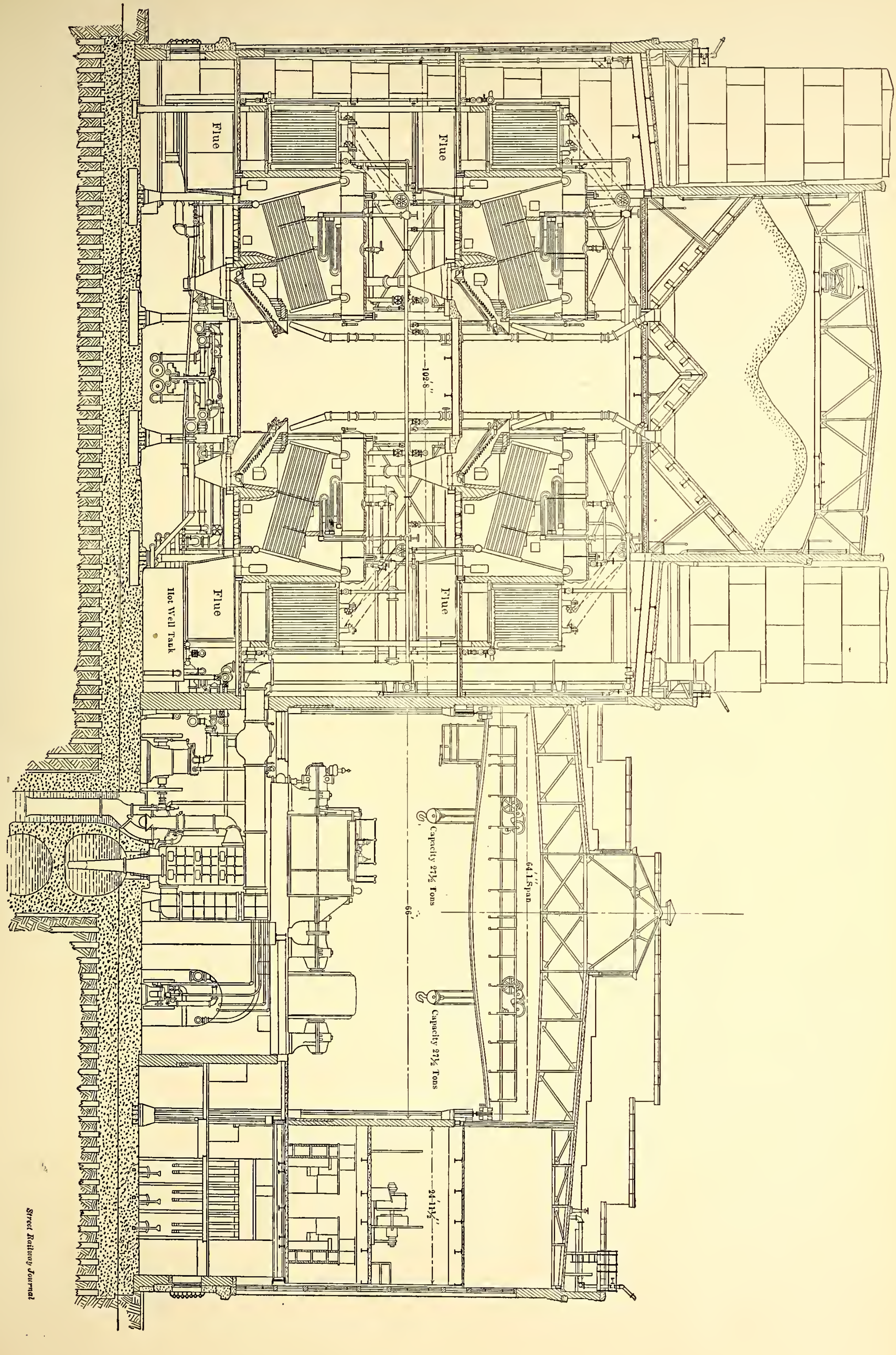


FIG. 4.—SECTIONAL ELEVATION THROUGH STATION

Street Railway Journal

The hoisting engine and apparatus is located within the four-corner columns of the hoisting tower in an enclosure 25 ft. above the dock and having a height of 14 ft. The tower is of the "one man" type, and has a capacity for 400 long tons of run-of-mine bituminous coal in five working hours. Hitherto, the single operator of a one-man tower has generally been stationed directly under the trolley boom, which, at the height adopted in this case, would necessitate shutting down during foggy weather. To avoid this contingency the mechanism controlling the operation of the bucket was designed to stand the operator at an elevation only a short distance above the barge then being unloaded. Another new element in the design partly introduced to facilitate this, is a third hoisting engine for opening and closing the bucket, in addition to the two engines ordinarily used, one for hoisting it, and the other for trolleying it along the boom.

The coal is hoisted in a 2-ton Haywood bucket of the "clam-shell" type, which is raised and lowered by a 2-cylinder 15 ins. x 24 ins. Lidgerwood type of hoisting engine, with a Stephenson link motion. The bucket is so counterweighted that when lowered its speed cannot exceed 1000 ft. per minute. It is suspended from a substantial trolley, carried on a rigid boom built of steel trusses in parabolic form, and projecting 43½ ft. beyond the tower, at a height of about 163 ft. above the dock. The opening and closing of the bucket is done by a "biter" engine, which is of the 8-in. x 10-in. Lidgerwood type. This engine can also be used to drive the winch head for warping barges along the dock, at which time it is disconnected from the biter mechanism. The trolley motion for running the bucket in or out along the boom is operated by a 6-in. x 8-in. Lidgerwood engine. All of these engines work at 160-lbs. steam pressure supplied from the main boiler house and are located in the engine room in the base of the tower. The bucket can complete a round trip, i. e., load, hoist, trolley it over the hopper, dump, trolley out, and descend again to the barge, in 45 seconds. The machinery for hoisting and trolleying the operation of the bucket was designed and built by the Robins Conveying Belt Company.

For about 34 ft. above the level of the cable railway, the upper third of the hoisting tower is completely enclosed with corrugated copper sheathing, forming a house with two stories, the lower one of which contains the weighing mechanism, and the engines driving the crushing machinery, and the cable railway, and the upper story containing the crusher. The roof of the crusher room is formed by the receiving hopper.

Between the coal tower proper and the boiler house structure, a distance of about 500 ft., there are four spans of bridge construction supporting the cable railway. The two outermost spans of this bridge are 140 ft. 6 ins. in length, the third about 149 ft., and the span from the ash tower to the boiler house is 70 ft. The long spans were justified, both on account of the height of the foundations and because they offered the minimum amount of obstruction in the freight yard. The combination of the high level cable railway bridge and the hoisting tower of corresponding height, enables all the hoisting to be done at one operation, without the pulverizing of the fuel incident to passage through a succession of conveyors or elevator devices.

The cable railway itself is designed for a capacity in excess of the other portions of the mechanism above described. That is, it is capable of handling 150 tons per hour, when operating twenty-nine 2-ton cars at a speed of 180 ft. per minute around a track loop approximately 2500 ft. long. There are at present installed ten cars, each of about 2 tons capacity. The cable is ¾-in. six strand wire rope, laid on hemp centers. It is driven by 7½-in. x 7-in. Westinghouse standard engine, and is kept taut by a heavy counterweight. The track is laid with 16-lb. T-rails, and the gage is 24 ins. A single guard rail is provided at curves. The minimum radius of curvature is 14 ft. 6 ins. The coal cars are of the side dump type, whose sides are designed to swing outward and whose bottoms are inclined outward so that the coal, when released by the swinging out of the sides, drops out of the car. The car dumps its load without letting go of the cable, proceeds around the loop and returns to the loading hopper automatically.

It is estimated that the actual cost, including labor, supplies, and fixed charges, per ton of coal, from the time it leaves the barge until it arrives in the bin, on the basis of 480 tons per day, is 9 1-3 cents per ton, which is believed to represent the greatest economy yet obtained by any plant intended to accomplish the same purpose under similar general conditions.

The striking feature of the installation is the unusual height, both of the lift and of the conveying cable railway for carrying coal into the pocket.

The ash bin is directly across Front Street from the boiler room, and ashes are delivered to it through a bridge, at an elevation of 69 ft. above the street, by means of a telpherage system which hoists and transports the ash cars from the boiler room basement up to the level of this bridge, and thence over into the tower where the contents are dumped into the bin. The bottom of the bin is 20 ft. above a railroad track that runs through the base of the tower, and the ashes are handled through dumping gates into gondola cars standing on this track. The capacity of the bin untrimmed is 300 tons.

WATER SUPPLY SYSTEM

Water is taken from the mains of the Montauk Water Company, two of whose service mains are connected to an 18-in. main supplying the power house. To be sure of having a reserve on this supply, there was built adjacent to the Long Island Railroad yard, at a distance of about 2700 ft. from the power station, the nearest available site, a standpipe 40 ft. in diameter, 80 ft. high, which is connected into this 18-in. main and under ordinary circumstances kept full. From the 18-in. main which runs along Front Street, parallel to the south wall of the building, two 14-in. branches are carried into the building, each branch having two 10-in. meters in multiple, with suitable by-pass connections. A third water connection of the same size is provided from the same main at the southeast corner of the power station. There are also two independent cross connections between this 18-in. supply line and the city water system, for use in case of accident to the Montauk Water Company's pipe line. Under normal conditions this water is only used as needed for "make-up" water to be added to the water of condensation which is returned from the surface condensers.

Owing to the employment of surface condensers the major part of the boiler supply is, of course, derived from the hot wells receiving the discharge from the surface condensers. For each generator unit two hot wells are provided in the form of steel tanks, 18 ft. 4 ins. x 18 ft. 5 ins., and 6 ft. 6 ins. deep, to which the water of condensation is pumped. Although each unit has its own pair of hot wells, they may all be connected together. The pipe connections are so arranged that the make-up water from the outside supply mains may first be used, if desired, for cooling purposes around the building, such as in jacketed bearings, whence it passes to the open heater. Otherwise, it goes directly from the mains to the open heater, which is a cylindrical Cochrane feed-water heater and purifier, made by the Harrison Safety Boiler Works. This heater is 8 ft. in diameter and 15 ft. long, and utilizes exhaust steam from the double-acting auxiliary engines and reciprocating pumps in various parts of the building. It has sufficient capacity to heat feed water for 15,000 hp of boilers from 40 degs. to 205 degs. F.

It was made purposely large in order to insure a comparatively slow circulation of the make-up water through it, so that it would have ample time to throw off the carbon dioxide and other injurious substances in solution, which would attack the valve seats and the tubes in economizers and condensers. The make-up water is likely to run from 10 per cent to 15 per cent of the entire water consumption of the plant. The heater is really more of a purifier than a heater. The arrangement was designed with this particular object in view. The Westinghouse single-acting engines driving auxiliary machinery do not send their exhaust steam to this heater on account of particles of crank case oil that may work into the exhaust, but the ordinary cylinder oil in the exhaust of the pumps and double-acting engines is extracted by allowing the steam to run at a very low velocity through a comparatively large pipe before reaching the heater, and thence into a 26-inch Cochrane oil separator, by which means it is effectually extracted.

By the course of treatment above outlined, the purity of the water in the steam in all parts of the system is insured, resulting in a marked decrease in corrosion and leakage in all parts of the plant with a corresponding reduction in operating expense and depreciation. For instance, the wear and tear on both water and vacuum pumps is appreciably reduced by reason of the lower speed made possible by the absence of leakage. The seats of the high pressure steam valves, being integral with the bodies, the corrosion of them would be a serious matter. But it is believed that corrosion can be absolutely prevented by eliminating from the feed water the gaseous as well as the solid impurities in the above manner.

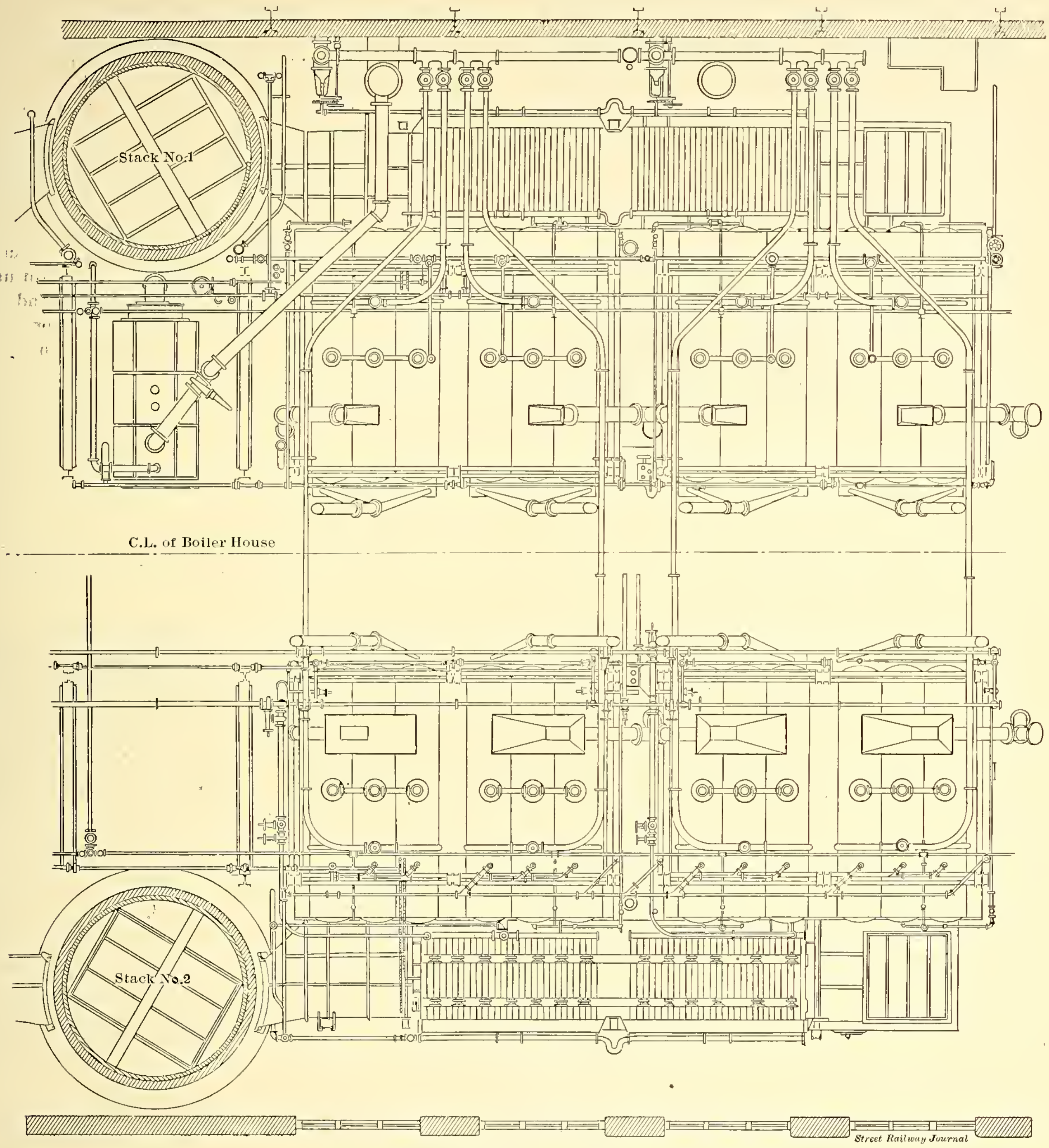


FIG. 5.—PLAN OF ONE UNIT GROUP IN BOILER ROOM

BOILERS

The boiler plant for the Long Island City power station consists of thirty-two Babcock & Wilcox water-tube boilers set in batteries of two boilers each, eight batteries on the first floor and eight on the second floor immediately over the former; these batteries are equally distributed on each side of

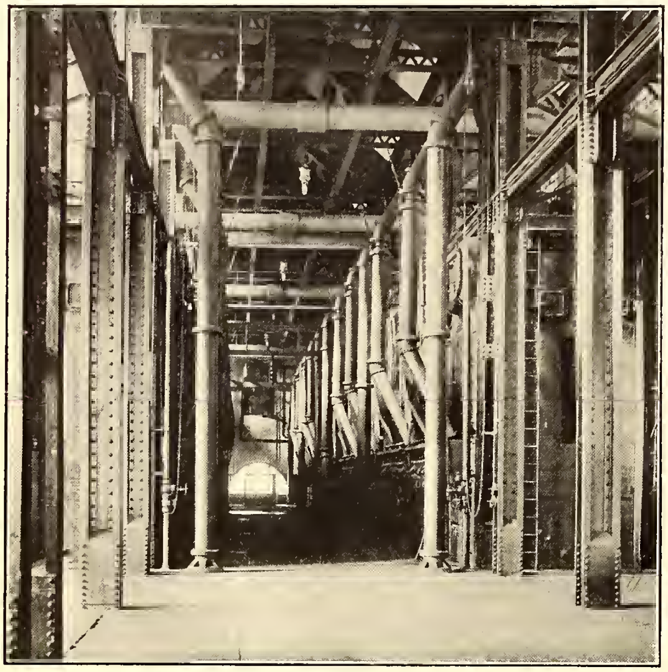


FIG. 6.—BOILER ROOM, SECOND FLOOR

the boiler plant, with a firing space between boiler fronts of about 18 ft. in width.

The boilers are designed for a working pressure of 200 lbs. per sq. in., and each boiler has a total effective water heating surface of 5243 sq. ft., comprised in three steam drums, 42 ins. in diameter and 23 ft. 10⅝ ins. long, and twenty-one sections of 4-in. tubes 18 ft. long, with twelve tubes in each section. Each boiler is supplied with a superheater capable of superheating the output of the boiler 200 degs. F. when operating at 200-lbs. pressure, and comprises about 1116 sq. ft. of superheating surface. Each boiler has two steam openings, the main nozzle receiving steam from the superheater, and the auxiliary nozzle taking its saturated steam directly out of the tops of the boiler drums for use in the auxiliary mains that supply the small engines in various parts of the house

The thirty-two boilers now installed are arranged in four groups with eight boilers in each group, the eight boilers being those on the first and second floors directly over one another. The group nearest the west end of the plant is intended ultimately to take care of the two 2500-kw lighting units there to be installed. The other three groups are each capable of supplying one 5500-kw turbine unit. The ultimate capacity of the boiler house, when finally extended, will be 96 boilers of the type now installed.

Each boiler is fitted with a Roney stoker. Each stoker is 150 ins. wide and has twenty-four grate bars, with a dumping grate at the bottom to drop the ashes into the ash pit. The bars are rocked by a small Westinghouse engine, there being one engine to eight stokers.

The contents of the ash pit are disposed of by gravity down a chute terminating over the narrow gage railway track in the basement. At the bottom of each chute is a dumping gate for loading the cars provided for the removal of the ashes.

FLUES AND ECONOMIZERS

The arrangement of flues, economizers, and dampers has been made so as to permit the operation of the plant on the unit system (that is, by working each set of eight boilers on one turbine) but the flues and economizers can be interchanged and cross connected to insure the greatest capacity and highest efficiency under all conditions of operation, even though some portions of the boiler and economizer plant may be out of service. One economizer utilizes the waste heat from two batteries of boilers.

Under normal conditions the gases from the four boilers discharge into their respective sections of the main flue, then pass through the economizer directly above, and into the stack, but dampers on the first and second floor permit inequalities of quantity and pressure to divide under the different economizers irrespective of the boilers in service. In case it is found necessary to isolate any economizer for cleaning and repairs, the gases can be by-passed directly into the stack or divided up through the other economizers.

Each economizer consists of fifty-six sections of ten tubes each, designed for 250-lbs. pressure. The rear wall of the economizer chamber is made of vitrified asbestos air cell board, laid on in sections, so that in the event of a broken economizer tube it is not necessary to tear down any of the brick work in order to replace the section. By the use of these economizers the hot gases are so reduced in temperature that they enter the base of the stack at about 350 degs.

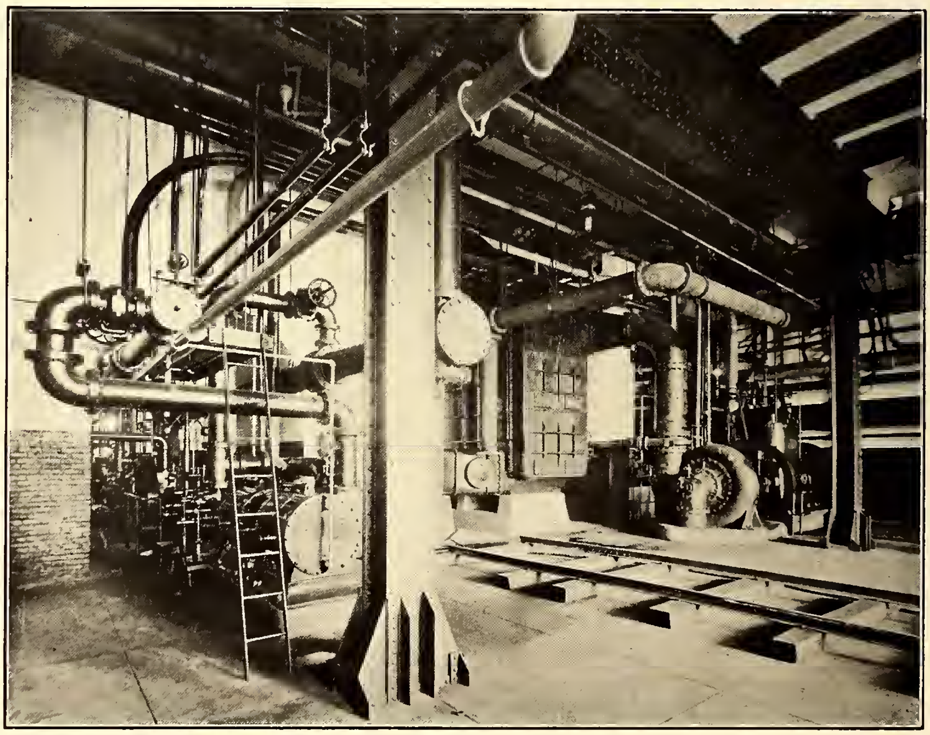


FIG. 7.—CONDENSER, CIRCULATING AND DRY VACUUM PUMPS

STACKS

There are four stacks in the power station, of which, however, only two are required for the operation of the present installed apparatus, but it was deemed advantageous to erect all four. When the station is extended, the number of stacks will ultimately be six. They are of steel, are entirely self-supporting, and are 275 ft. in height above the base. The inside diameter of the straight portion is 17 ft. 10 ins. at the bottom and 16 ft. at the top. The bottom courses are flared out to a diameter of 23 ft. They are lined throughout with brick, which is supported at intervals of 20 ft. with Z bar rings riveted around the interior of the stack. Each stack has six openings, two in the basement for the main flues, two for the boiler flues on the first floor and two for those on the second floor. These openings are all heavily reinforced with plate and angles. The concrete base of the stack is formed solid with the monolithic building foundation, and is run up 3 ft. above the basement floor, which gives an average height of 245 ft. above the furnaces. The plates composing the stack are of open hearth steel, and are larger than usual, to reduce the number of joints. Above the second opening, no ring is composed of more than four plates, the largest of which are about 6½ ft. x 15 ft. The time consumed in the erection of the four stacks was about three and one-half months.

STEAM TURBINES

For the initial equipment three main-generating units have been installed, consisting of steam turbines direct connected to three-phase, 11,000-volt generators of the revolving-field type. The turbines are of the Westinghouse-Parsons single-flow type, rated to develop 5500 kw at 175-lbs. steam pressure, and 27½ ins. vacuum, running at 750 r. p. m. The bearings of the turbine are supplied with a forced circulation of oil and are also water jacketed. At each end of the cylinder where the shaft passes through, a water-seal gland is provided which effectively prevents leakage of steam along the shaft. There is a large air space surrounding the cylinder for its entire length. It is lagged with asbestos, and fitted with an outside jacket of sheet steel, giving a smooth cylindrical exterior. The entire structure of the turbine and generator rests on a heavy rectangular bedplate, which in turn rests on the foundation, but it is not fastened with anchor bolts.

The length of the turbo-generator unit is 47 ft., width 13 ft., and height 14 ft. to the top of gallery railing. By way of contrast it may be stated that a four-cylinder piston engine of equal capacity, with its generator, occupies a floor space about 55 ft. long, by about 35 ft. wide, and 39 ft. in height.

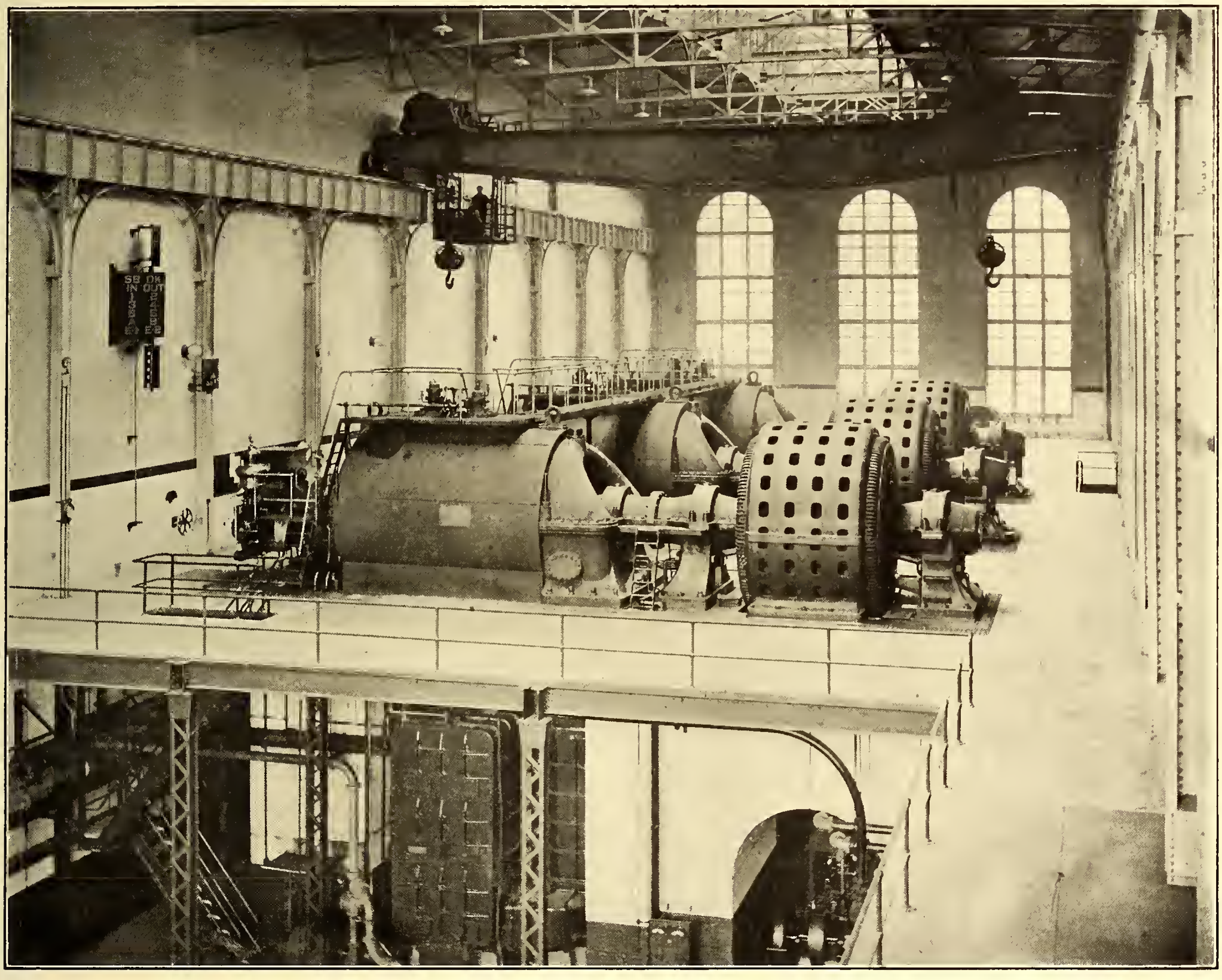


FIG. 8.—INTERIOR OF ENGINE ROOM

The steam consumption of the turbine is guaranteed by the builders not to exceed the following rates when operating at 750 r. p. m., with dry saturated steam at the throttle of 175-lbs. gage pressure, with a vacuum of 27½ ins. mercury (referred to a 30-in. barometer) in the exhaust pipe:

Rated load, 5500 kw, 15.3 lbs. steam per ehp-hour.
Three-quarter load, 4126-kw, 16.1 lbs. steam per ehp-hour.
One-half load, 2750 kw, 18.1 lbs. steam per ehp-hour.

These results will be improved by the following percentages, by the use of superheated steam, temperature being measured at the throttle:

100 degs. superheat, 10 per cent.

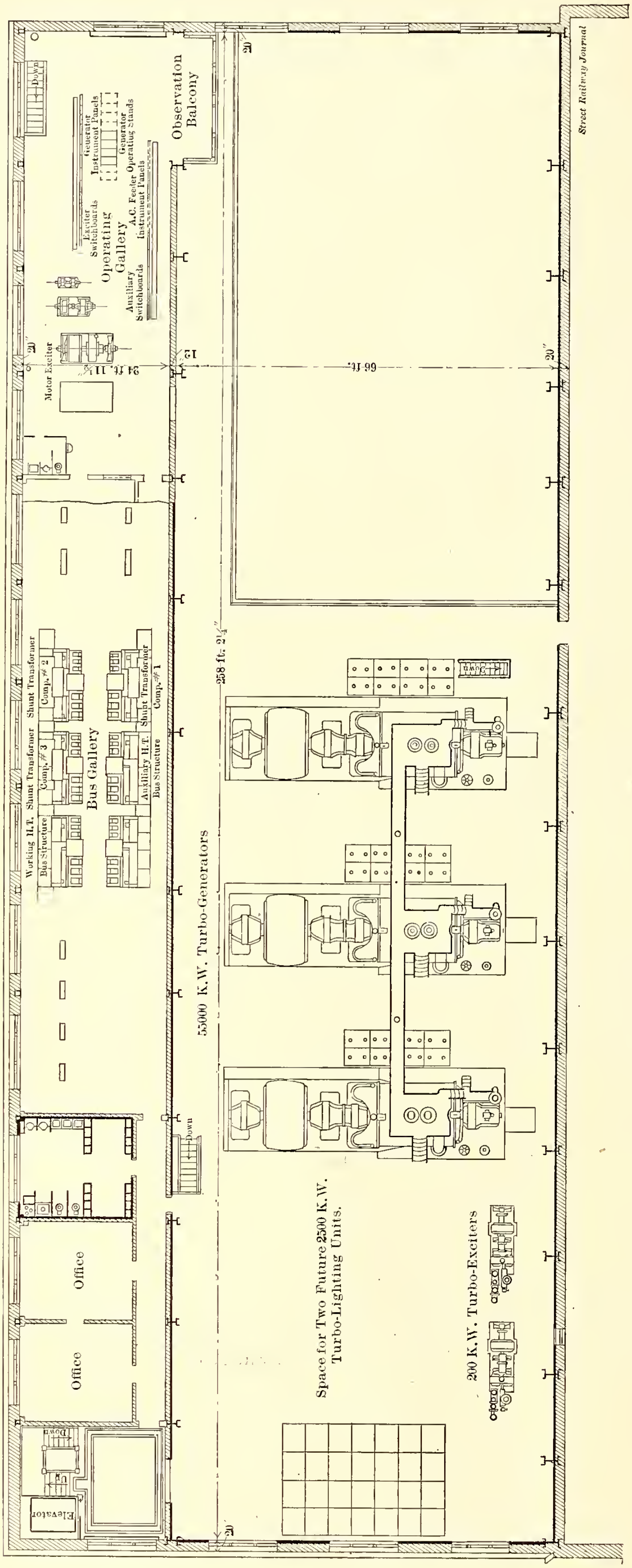


FIG. 9.—PLAN OF ENGINE ROOM AND SWITCHBOARD GALLERIES

150 degs. superheat, 12½ per cent.
175 degs. superheat, 13¼ per cent.

The turbine is also fitted with an automatic safety stop arrangement which shuts off the steam supply automatically in case the speed exceeds the predetermined limit. A device is also provided for controlling the action of the relief valve in the outboard exhaust connection.

To maintain perfect alignment of the revolving part of the turbine, there is provided a special bearing, resembling a thrust bearing in construction, but much lighter because of the absence of thrust. This is capable of very close adjustment.

Convenient to each turbine there is a bracket on the boiler room wall carrying a stop valve by which steam supply to each turbine unit can be cut off in the boiler room without leaving the engine room floor. An iron gallery, fitted with the usual iron ladders and polished hand rails, extends across the tops of the three turbine units, affording ready access to the admission and by-pass valve.

The turbines were built at the East Pittsburg works of the Westinghouse Machine Company.

CONDENSERS

A separate condenser is provided for each turbine. It is of the counter-current surface type, built by the Alberger Condenser Company, and has 20,000 sq. ft. of cooling surface, consisting of seamless drawn brass tubes of No. 18 S. W. G., and 1-in. outside diameter. The condenser is placed in a large arched opening made in the turbine foundation. In fact, the entire condensing plant, consisting of condenser, circulating pump, dry air pump and hot well pump, is compactly grouped within and about the base of the foundation.

The exhaust trunk is of cast iron, rectangular in section, well ribbed up on the outside. The outboard exhaust passes over the top of the condenser, through a 36-in. relief valve, to an independent vertical 36-in. exhaust pipe passing up through the roof behind the boilers. The exhaust steam enters the condenser at the bottom. The dry air pump exhausts the vapor from the top and the water of condensation is collected from the bottom by the hot well pump. The circulating water enters the tubes at the top, making three passes, and is discharged from the bottom of the condenser into the overflow flume directly underneath.

The intake flume is underneath the overflow, and access to its contents is made possible by a well extending past the outflow flume down to the intake flume, this being shown in sectional elevator in Fig. 4. Condensing water is lifted from this well by a 24-in. double suction centrifugal pump made by the Morris Machine Works, capable of pumping 20,000 gals. of salt water per minute against a head of 20 ft. Each pump is driven by a 12 x 24 x 12 Westinghouse compound engine direct connected to it. The engines are able to develop 175 hp at 175-lbs. steam pressure at 225 r. p. m., running non-condensing.

The condensed steam is drawn from the bottom of each condenser and discharged to the hot well tanks in the boiler-room basement by a 4-in. centrifugal pump direct connected to a 15-hp, 220-volt, direct-current motor, running at 560 r. p. m. A by-pass arrangement to the overflow flume is provided for discharging the condensed steam directly into the flume if desired. The wet pump and its motor, together with the condenser and exhaust trunk above described, is shown in Fig. 13. The relation of the hot well tanks to the boiler feeding system has already been outlined.

Vacuum is maintained in each surface condenser by means of a horizontal steam-driven two-stage dry vacuum pump, with Corliss valves and automatic governor on the steam end, and positive valve motion on the vacuum end. The vacuum cylinders and heads are water jacketed. The steam cylinders are 10 ins. and 24 ins. in diameter, and the pump cylinders 24 ins. in diameter, with a 24-in. stroke, and its normal speed is 100 r. p. m. They are built by the Alberger Condenser Company. Fig. 7 is a view of the centrifugal circulating pump and its engine, and also of the dry air pump, which, like the condenser, is placed in an arched opening in the engine foundation.

CONDENSER TUBE PROTECTION

A somewhat unusual feature has been introduced into this station to prevent the serious deterioration usually occurring where salt water is used for circulation of surface condensers. It is the universal experience that more or less galvanic action takes place in any event at the expense of condenser tubes, but this is often aggravated in large and important plants by the fact that the water and the body of the condenser have formed a convenient path for stray electric railway return currents getting back to their own power station some distance away, through the condenser intake and the water of the harbor.

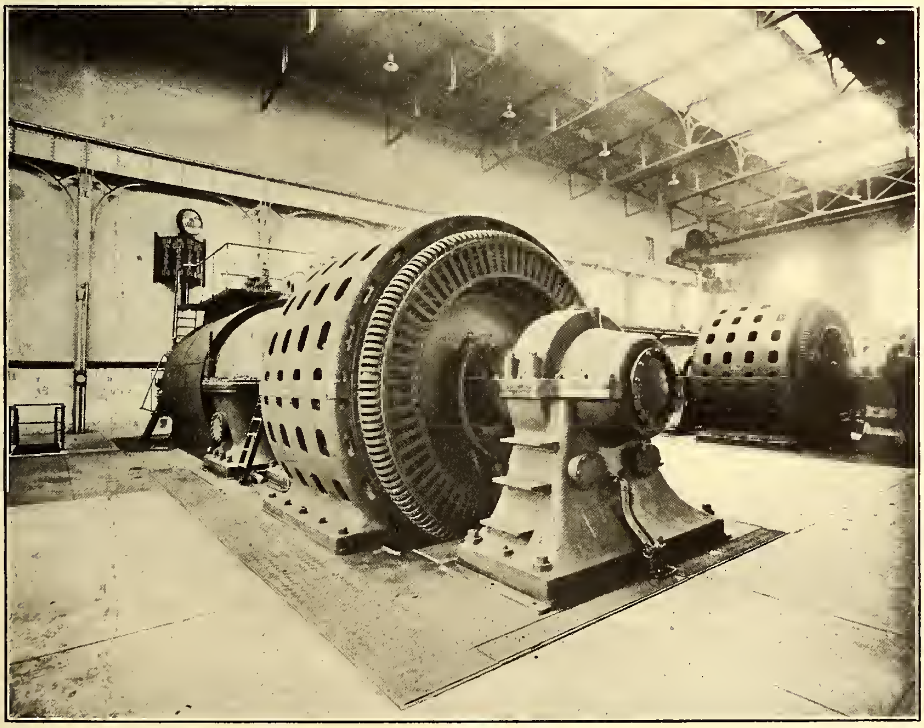


FIG. 10.—GENERATOR END OF 5500-KW TURBO-GENERATOR

A sufficient number of voltmeter readings were taken between the river, the flume, and various parts of the piping about the building and in the streets, to indicate that there was at all times a difference of potential enough to make trouble, although its polarity was not always the same.

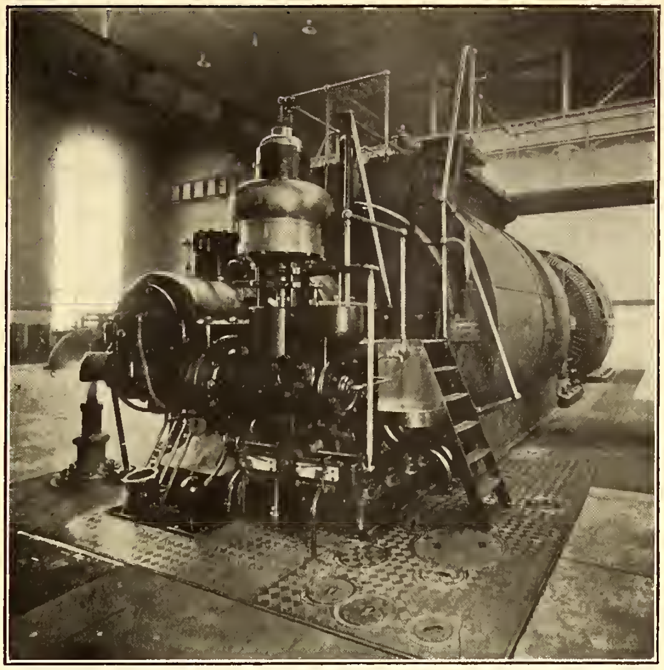


FIG. 11.—STEAM END OF 5500-KW TURBO-GENERATOR

The metallic connections of the power station equipment to the city piping station are through two 14-in. connections to the water mains and on account of the proximity of water mains to the trolley tracks all over the city, there is a tendency for stray currents to flow into the piping of the building, and then to the condenser intake, returning through the river to the negative bus-bars of some neighboring street railway power plant. Currents flowing in this direction are certain to cause electrolytic corrosion in the condenser tubes.

The method adopted to prevent this corrosion consists first in providing a shunt circuit between the incoming water pipes and the condenser flume, in order to divert as large a proportion as possible of the current from the condensers. This was done by the insertion in each water main connection of a short piece of pipe with an insulating joint on each end of it. These short pieces of pipe were then connected to a 750,000 circ. mil cable, which was carried to the outer end of the condenser intake. Such current as may leak from the pipes to the water contained in them thus has an opportunity to get back into the harbor without going through the piping system and the condensers. To neutralize the effect of such current as might still leak past the insulating joints, a small booster generator was provided, driven by a 220-volt motor. The positive pole of the booster was connected to the heavy grounded shunt cable above mentioned and the negative pole was connected to seven different points on each condenser, and there was an adjustable rheostat in each of these branches of the negative circuit. This superimposed voltage can be adjusted by means of the rheostats exactly to counterbalance the natural galvanic electromotive forces due to the brass tubes, the iron shell and the circulating water, together with the stray electromotive forces from outside. With the destructive potentials so counterbalanced, the condenser is in a

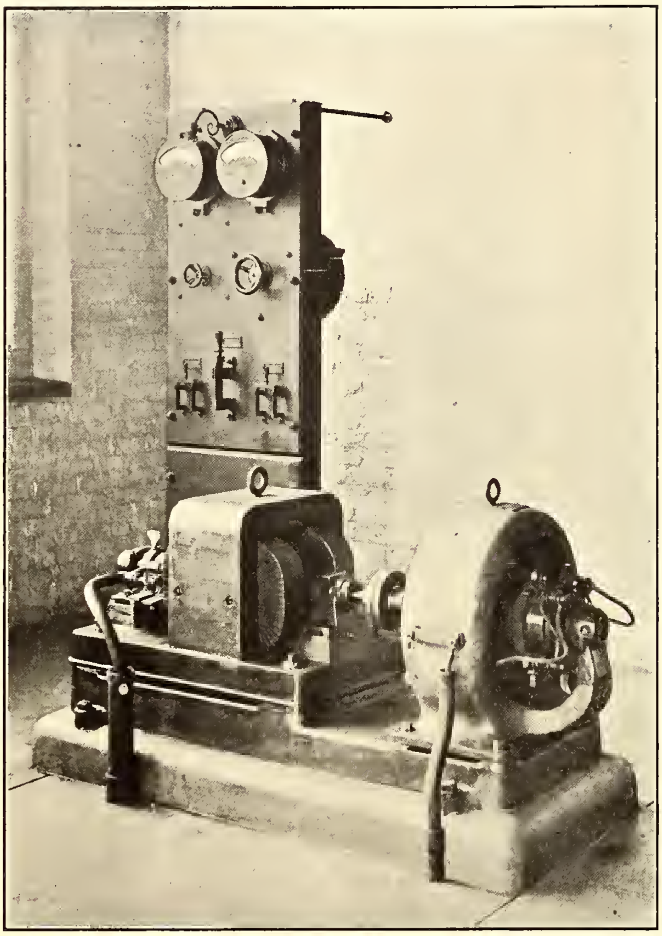


FIG. 12.—BOOSTER FOR PREVENTING CONDENSER ELECTROLYSIS

neutral electric state, which effectively prevents the corrosion and pitting of condenser tubes and sheets, and secures a far longer life than has hitherto been possible for this very important and highly vulnerable section of the steam equipment. A little switchboard panel is provided for each condenser, with seven rheostats mounted on it, each of which is connected by a separate negative lead to a different section of each of the three condensers.

A differential voltmeter is provided which can be plugged to each of these sections of the negative circuit, there being a separate rheostat in each circuit. By adjusting the rheostats for each section it is possible to keep the potential at zero in all of them. The booster apparatus shown in Fig. 12 is conveniently situated in the electrical bus gallery directly under the operating gallery. The rheostat panel for each condenser is situated conveniently to it in the engine room basement, and observations at suitable intervals enable the operating force to maintain the condensers absolutely neutral.

SYSTEM OF PIPING

In general, the piping for the main power units in the plant was laid out to conform with the general design of the station on the lines of the unit system already referred to. In other words, the piping was so arranged that under normal conditions a given group of boilers and auxiliaries serves a single main-power unit, which is provided with suitable cross and equalizing connections between itself and the similar system of piping of the adjacent power units.

MAIN OR SUPERHEATED STEAM

The general arrangement of the main steam piping is shown diagrammatically in Fig. 5 (drawn for a completed quarter of the station), and is such that four boilers on each floor, or eight altogether, feed directly to a separate main steam header, located back of the first floor boilers, joining these separate feeders, and fitted with suitable stop valves. It is then carried down to the point where it passes through the engine room wall under the turbine operating floor, having on the way a connection from a similar manifold with the corresponding group of boilers on the first floor. The two boilers on the south side of the boiler room are run into the same manifold as the two boilers directly opposite them on the north side, and the same arrangement is carried out on the lower tier of boilers.

As it is planned to use steam up to 200-lbs. pressure, with 200 degs. superheat, special care had to be taken to design the steam piping so as to allow ample flexibility for the excessive expansions due to these high temperatures. Long radius pipe bends were used throughout, and this arrangement has been found to furnish ample flexibility under the most exacting conditions. Full weight steam pipe, with extra heavy welded steel flanges, was used throughout on the main steam piping. The fittings are of special design and made of open hearth cast steel. The valves are constructed of semi-steel throughout, with integral seats and specially designed stuffing boxes. Gate valves were used throughout except at the boiler nozzles, where automatic reverse current stop and check valves were provided.

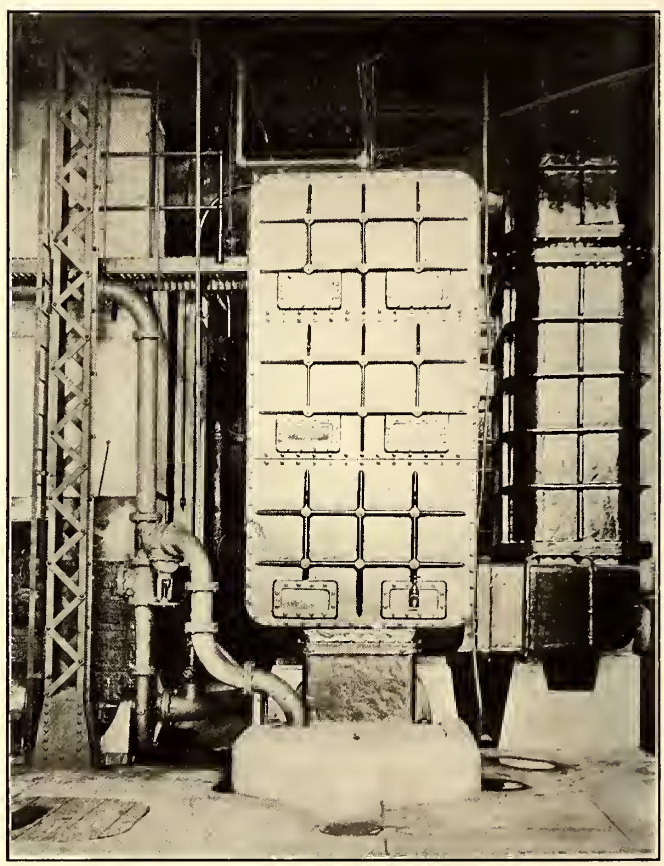


FIG. 13.—CONDENSER, EXHAUST TRUNK AND WET PUMP

The joints were made up with particular care, steel bolts and corrugated copper gaskets being used throughout. The faces of the flanges on the piping, valves and fittings inside of the bolt holes, and the raised faces given a smooth machine finish so as to insure perfection in obtaining tight joints.

The supports for the main steam piping as it crosses the boiler house to the large mains that lead to the engine room, consist simply of turnbuckle rods suspended from steel work of the roof, the arrangement being such as to afford opportunity of expansion in any direction. The large vertical feeders that lead to the engine room are supported by special bracket elbow fittings at the point where they turn from the boiler room into the engine room basement, the turbines being fed from below. The heavy manifolds above mentioned are supported from the roof beams, the springs being introduced to insure support from the pipe when it expands upward, these large risers being supported from the bottom. By these means the pipes are firmly supported, and at the same time given all needed opportunity for expansion without setting up an unnecessary strain.

BOILER-FEEDING SYSTEM

The normal feed water supply to the boilers comes from the "hot well" or storage tanks which receive their water from the main surface condensers. The water is taken from the tanks by four boiler feed pumps, installed in a pump room in the center of the basement. These pumps are of the outside packed plunger, pressure type, of Epping-Carpenter make, with compound steam ends, steam cylinders 14 ins. and 22 ins. in diameter, water cylinder 12 ins. in diameter, and 24-in. stroke. In case of emergency, the pumps suck directly from the water supply mains. They discharge into a 12-in. pipe, running around the ceiling of the pump room, making a loop which carries the discharge of the closed heaters. Each pump can discharge into either side of the loop, thus enabling the other side to be temporarily cut out for repairs if necessary.

There are two vertical coil pipe feed water heaters, each containing 1000 sq. ft. of seamless copper tube heating surface, having 5-16-in. steel shells 60 ins. in diameter by 12 ft. long, and designed for 300-lbs. working pressure. These heaters are supplied with exhaust steam from the auxiliary Westinghouse engines. The exhaust from the reciprocating pumps at various parts of the basement goes to the open heater above mentioned. The heaters are situated at the west end of the pump room and are so connected to the pumps and main feed lines that they can readily be by-passed. The discharge pipes through the heaters are 12 ins. in diameter.

From the closed heaters the feed water passes through risers to a loop over the first floor boilers, thence to the economizers, which have been described in connection with the boilers behind which they are located. From the economizers

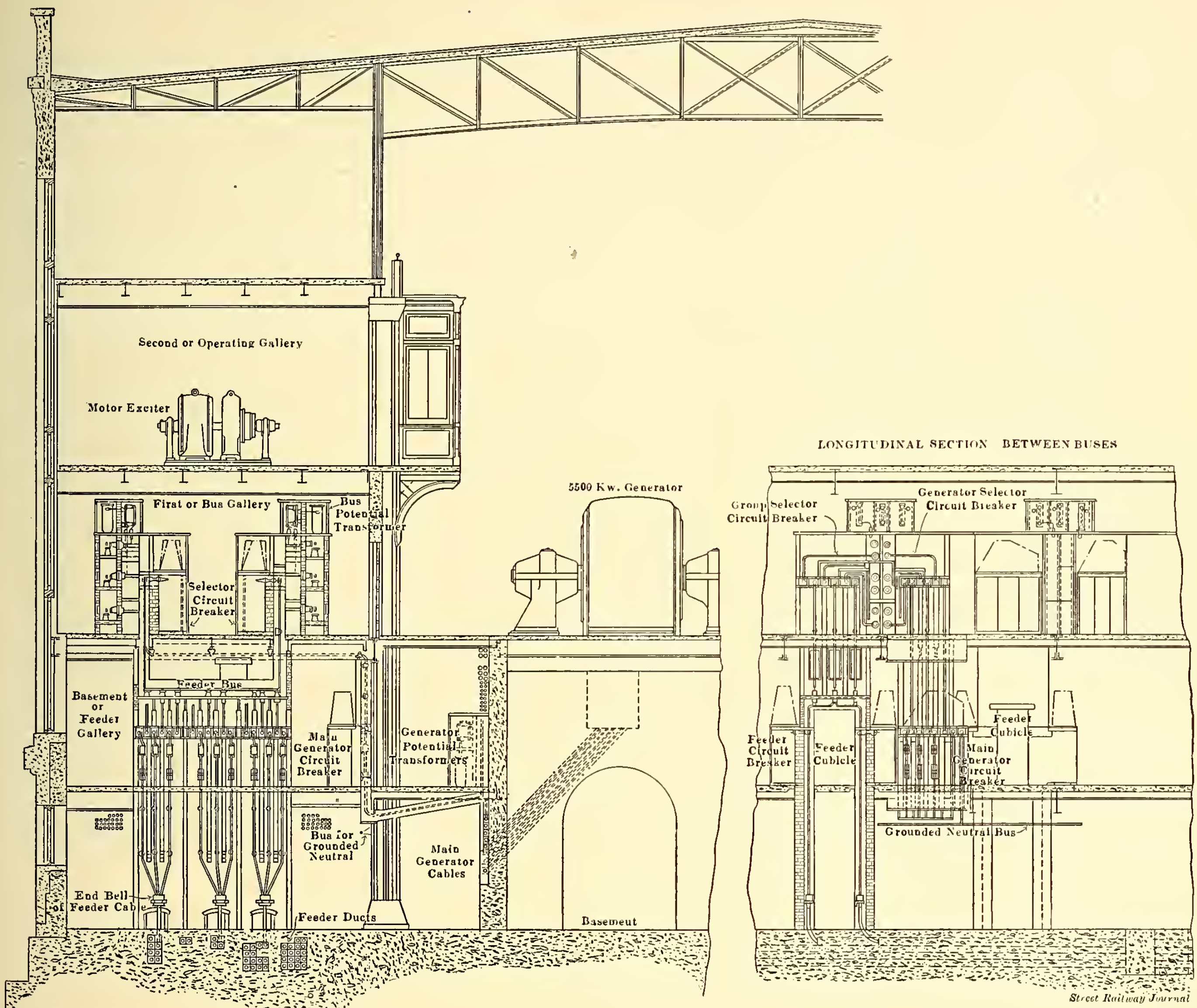


FIG. 14.—SECTIONAL ELEVATION OF SWITCHBOARD GALLERIES

the feed water passes into another loop, above the first floor boilers, whence it is distributed to the individual boilers.

LUBRICATING OIL CIRCULATION

There are three systems of distribution of lubricating oil. First of all, is that which distributes the oil to the turbine bearings and includes a storage tank 8 ft. in diameter by 14 ft.

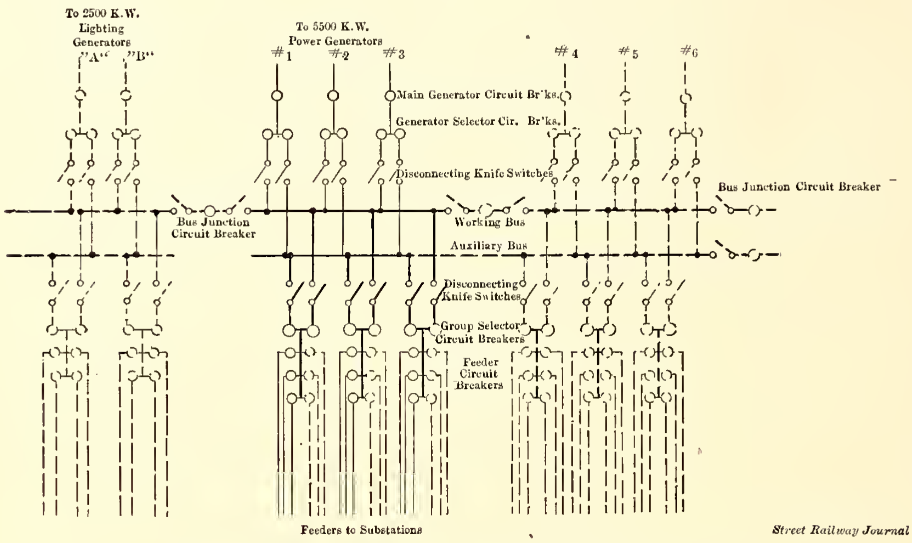


FIG. 15.—DIAGRAM SHOWING HIGH-TENSION WIRING

8 ins. deep, situated in the boiler house at about the level of the coal bunker, from which oil is distributed by gravity to the turbine bearings. From the bearings it is carried to a filter tank from which it is pumped automatically to the storage tank again by two 6-in. x 10-in. x 8½-in. x 12-in. compound duplex piston pumps, each having a capacity of 200 gallons per minute under 60-lbs. pressure. The filtering plant is located in a two-story closed chamber. The upper story of this chamber contains several tiers of filter pans which carry the bags through which the oil runs. The lower story contains the tank and pipe discharge connections to the oil pumps, which are situated on the top of the structure. There are about 5000 gallons of oil in this system and about 90 gallons per minute is circulated through each turbine when in operation. About 20 gallons per day are drawn off for various purposes, this including a very small loss by evaporation. Separate oiling systems are provided for the crank cases and for the cylinders of the reciprocating engines used for the auxiliaries.

COMPRESSED-AIR CLEANING SYSTEM

The station is equipped with a compressed air system for cleaning and other purposes. Air is supplied to this system by two motor-driven compressors of the Westinghouse Traction Brake Company's D-4 type of water-cooled compressors, operating from the 220-volt supply circuit. Each compressor has a capacity of 50 cu. ft. of free air per minute, at 100-lbs. pressure, and is controlled automatically by a pump governor.

PIPE COVERING

The non-conducting covering applied to the pipes and other heated surfaces throughout the building was furnished and put on by Keasbey & Mattison, in accordance with specifica-steam pipes consists of a layer of 1-in. asbestos cement and then a layer of 1-in. 85 per cent magnesia blocks, covered again with ¾-in. cement enclosed in a heavy canvas jacket. The saturated steam pipes are covered with 1½-in. 85 per cent magnesia jacketed with heavy canvas. Boiler feed lines and high pressure drips and all other auxiliary piping and heaters are also covered with 85 per cent magnesia in varying thicknesses. The smoke flues are jacketed first by 1-in. air space and then with 1-in. 40 per cent magnesia overlaid with ½-in. coat of hard finishing asbestos cement. These non-conducting coverings are held by galvanized iron netting and tie wires underneath the canvas.

The covering of the flanges and fittings on the superheated steam lines was of the special sectional design so as to be readily removable. Canvas covering on pipes and other surfaces were given two coats of paint, and a general color scheme, in which the different classes of pipes have different colors, was devised for the purpose of indicating at a glance the various systems of piping. As may well be imagined, it has been found of great convenience to the operating force.

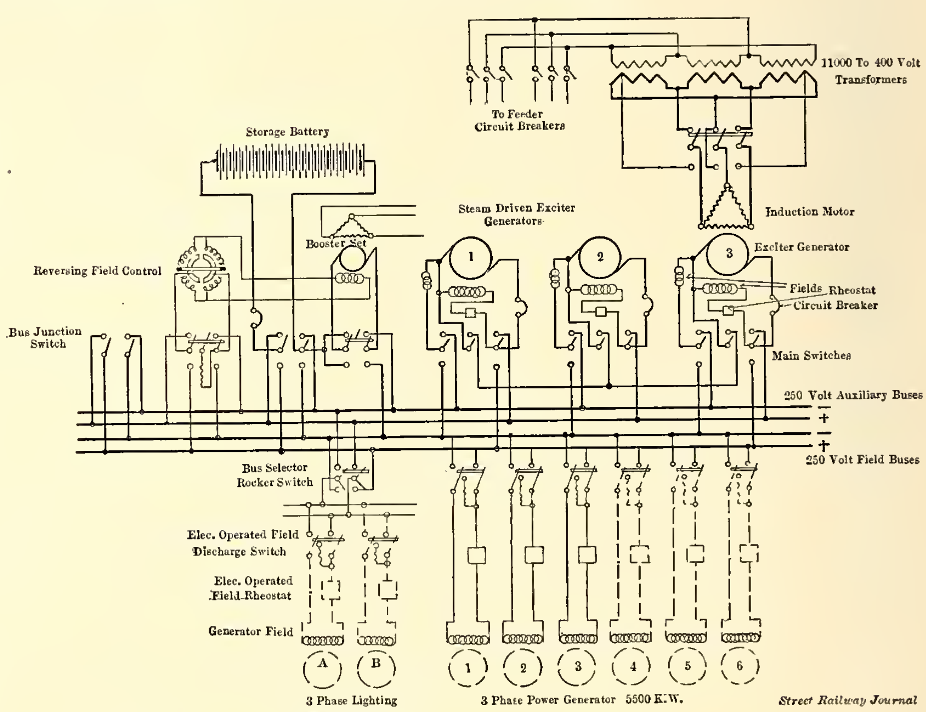


FIG. 16.—DIAGRAM SHOWING LOW-TENSION WIRING

GENERATORS

The main turbo generators, as stated, are of 5500 kw each and run at 750 r. p. m. The stator coils are wound with copper wire, and as is usual with very large generators, were built into slots after the armature frames and cores were permanently in position on the bedplates. They are "star-wound," i. e., the three sets of armature coils, needed for the generation of three-phase alternating current, are all connected to one point, called the "neutral," and the neutral points of the three machines are connected to one neutral bus, which is permanently grounded through a resistance.

The revolving field consists of a four-pole structure formed out of solid steel disks, milled to receive the winding. It is 6 ft. 8¼ ins. in diameter, and about 6 ft. long. The field coils are wound with heavy copper straps embedded in slots and retained by heavy bronze wedges. Ventilating ducts are provided in the core, which enables the revolving field to draw an abundant supply of air through its interior by a sort of fanning motion, which also aids in reducing the temperature of the stationary armature. The core is pressed on and keyed to a shaft of nickel-steel, 19¾ ins. in diameter, which runs in bearings 15 ins. in diameter, through which there is a forced circulation of oil. The field is separately excited at 220 volts, the exciting current being delivered to the winding through a two-ring collector by means of sliding carbon brushes.

These generators are each guaranteed to deliver 289 amps. per terminal at 11,000 volts, and 80 per cent to 100 per cent power factor for a space of 24 hours continuously, with a rise in temperature not to exceed 35 degs. C., and a 50 per cent greater current for two hours with a rise not to exceed 55 degs. C.

EXCITERS

Three separate sources are provided for exciting the fields of the main generators, viz., the two steam-driven exciters, one motor-driven exciter, and a storage battery. These are designed to give direct current at from 180 volts to 220 volts. The steam-driven units each consist of a Westinghouse-Parsons steam turbine directly coupled to a 200-kw direct-current turbo-generator, designed to run at 1800 r. p. m. These turbines are designed to run either condensing or non-condensing with 175-lbs. steam pressure and superheat up to 200 degs. These exciters are located near the southwest corner of the main floor. The motor-driven exciter, also of 200-kw capacity, is driven by a 290-hp, three-phase, 440-volt induction motor, both motor and generator being mounted on the same shaft, bearings and bedplate. This motor-driven exciter is located in the operating gallery. The three-phase motor derives its current from three 175-kw oil-insulated self-cooling transformers located in the basement of the electrical gallery.

STORAGE BATTERY

The storage battery is intended mainly as an absolutely reliable source of supply of the exciter-bus system and the other more important auxiliaries. It is installed in a specially arranged room in the engine room basement, and consists of 110 cells, each containing seven plates of the type "R" chloride accumulator, manufactured by the Electric Storage Battery Company. The tanks are built large enough to ultimately contain eleven plates. This battery has a discharge rate of 366 amps. for one hour, and is controlled from the operating gallery. It is normally kept floating across the excitation bus. In order to charge the battery a 12.5-kw booster, driven by a 15-hp induction motor, is located in the operating gallery next to the motor-driven exciter above mentioned.

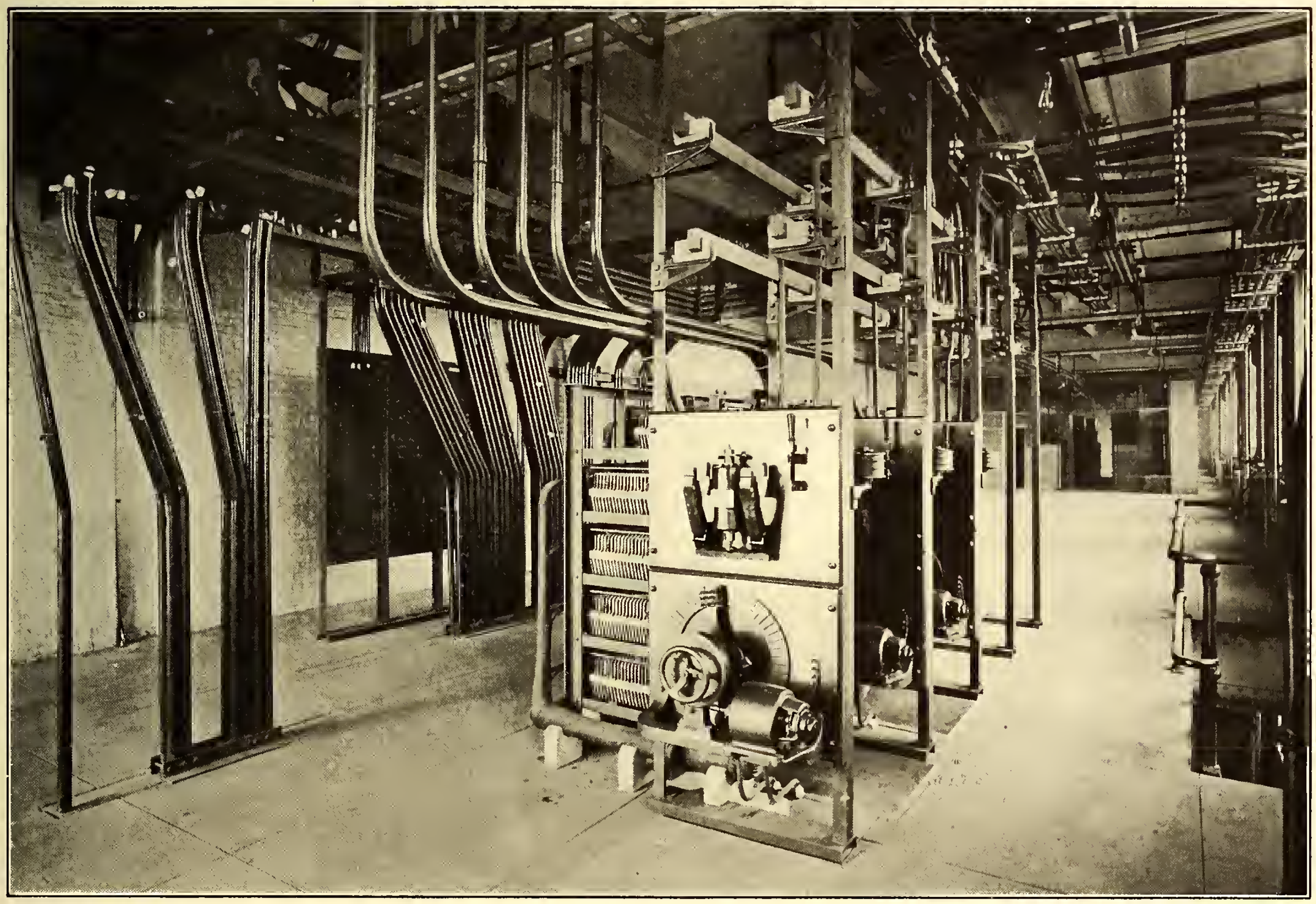


FIG. 17.—GENERAL VIEW OF BUS GALLERY, SHOWING MAIN GENERATOR, RHEOSTAT AND AUXILIARY WIRING

SWITCHBOARD APPARATUS

The generators are designed to run in parallel on either of two sets of main bus-bars, called the "working" and the "auxiliary" bus, only one set of which is generally in use. The general plan of the main wiring is quite simple and is shown in Fig. 15. For the sake of simplicity, the three conductors forming a three-phase circuit or connection are shown in the diagram as one conductor.

The switches for the outgoing feeders are arranged in groups of six (three only of each group being installed at present), these feeders being tapped from an intermediate or "group" bus. To distribute current to the feeders, therefore, it is first necessary to connect a group bus to either the working or the auxiliary bus, and this is done by providing each group with two selector circuit breakers, one for each of the two sets of main bus bars. Thus, any generator, or any group of feeders, can be connected at will to either set of main bus bars.

The course of the current from the generators through various switches and bus bars to the outgoing feeders can be readily traced from Figs. 14 and 19, which show a sectional elevation of the four electrical galleries. The cables are run through the turbine foundations into the basement (where taps are taken off for the generator potential transformers, whence small wire leads run in conduits to the instrument board in the operating gallery), then to main generator circuit-breakers which are placed on the feeder gallery next the generator-selector switches, thus enabling any generator to be thrown in on either set of bus-bars by closing the proper selector switch. The feeders are tapped from the group bus joining two opposite feeder-selector switches, six feeders being tapped on to each auxiliary group bus, and each feeder having its separate circuit breaker. The feeder circuit breakers are, therefore, installed in groups of six, three of each group being now installed, the remaining three being omitted until future completion of the equipment. The middle section of Figs. 14 and 19 is a cross section through the switchboard galleries at the feeder cubicle, and shows how the feeder selector circuit breakers, attached to either the main or the auxiliary bus, can connect either bus to the feeder bus directly underneath. To the latter are attached the feed switches, from which the outgoing cables are seen descending through the basement to the three-conductor cables entering the conduits. In the same sectional view may be traced the main generator

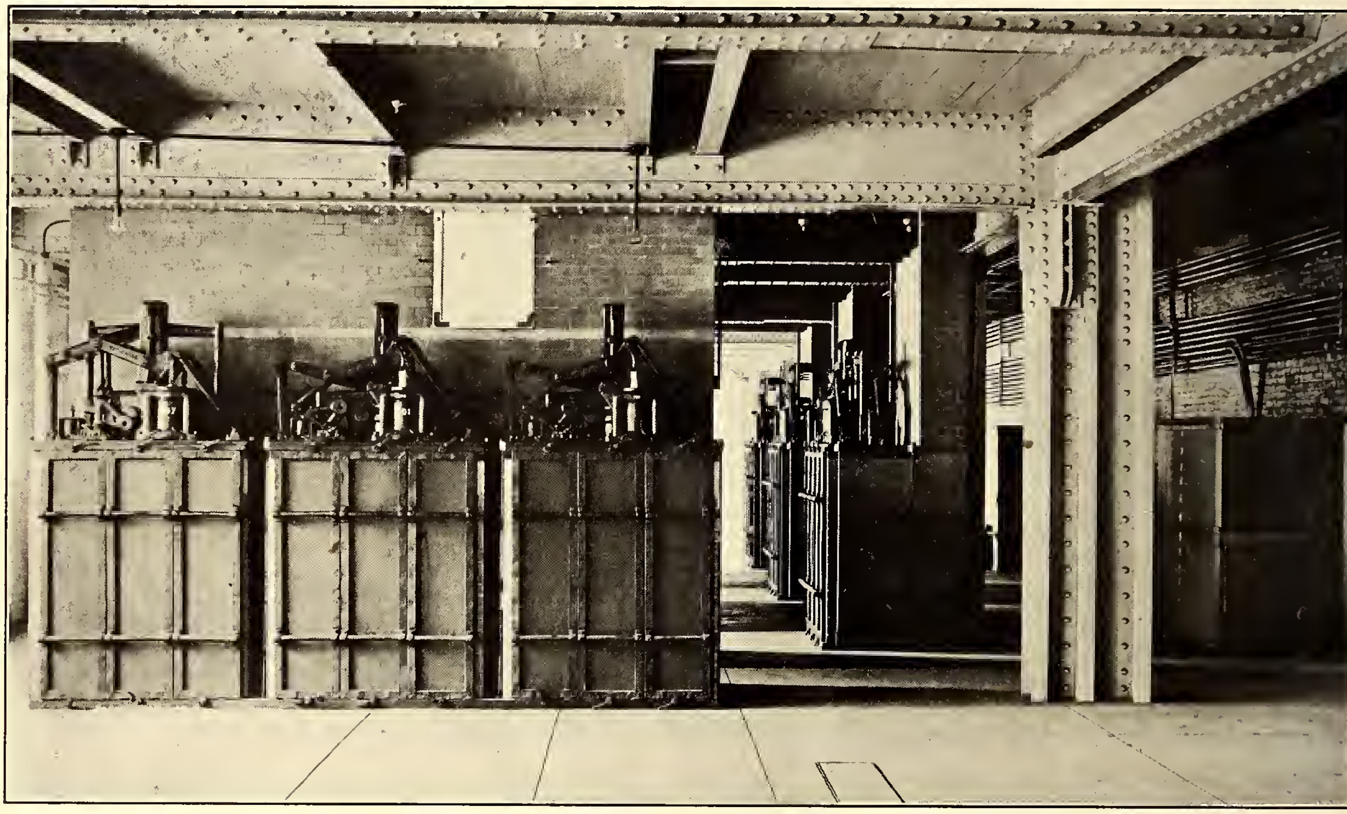


FIG. 18.—FEEDER GALLERY, SHOWING TYPE COIL CIRCUIT-BREAKERS FOR FEEDERS AND GENERATORS

above the basement, with their backs to the engine room columns. The main generator circuit-breakers are shown on the right hand side of Fig. 18, which also shows the potential transformers directly in the rear of them along the engine room wall.

The three bus-bars of the working bus are disposed in the three-story bus structure of brick and alberene stone along the north side of the gallery, the auxiliary bus being disposed in a similar structure along the south side and directly opposite the main bus. Ranged along the inner sides of these bus structures, and facing each other, are two lines of type "C" oil circuit breakers. The two smaller breakers on either line directly opposite to each other are the generator selector circuit breakers, and the two larger ones are the feeder group selector breakers. These successive pairs of feeder selector switches are joined underneath the floor by group bus-bars, and there being a selector switch at each end of this group bus-bar, the group bus can be joined to either the main or auxiliary station bus. The main generator switches are connected to similar sets of cross-connecting bus-bars joining cables which, on leaving the main breakers, run in septums directly under the bus gallery floor with connections reaching up to the generator selector switches by means of which the generator can be thrown at will on either set of bus bars.

All of the circuit breakers have remote electrical control and are worked from the main operating gallery on the upper floor. The main generator circuit breakers are of 600 amps. each, the generator selector breakers of 600 amps. capacity, the feeder-group selectors of 1200 amps. capacity, and the feeder switches of 600 amps. capacity. The generator switches are four-pole, to accommodate an extra connection to the neutral point of the generator winding and a neutral bus which is grounded. All the other oil switches are three-pole.

Each pole of the circuit breaker is enclosed in a separate fireproof chamber of brick, capped with a slab of alberene stone upon which the operating gear is mounted. The contact piece is carried upon a substantial wooden rod, and the contacts are located near the surface of the oil instead of near the bottom of the receptacle, thus insuring freedom of deposits of carbonized particles at the points of contact. The oil tanks are of sheet metal, and are insulated from the circuit. As is usual in this type of switch, the compartments are closed at the rear by the brick structure, while the front of each compartment is enclosed by a cover of asbestos lumber, held in place by eccentric clamps, thus facilitating quick and easy access to the parts. These switches are all electrically operated through solenoids actuated by current received from the auxiliary bus through controllers on the switchboard panels, as will be described later. The brick work of the oil switch structures is uniform with that of the bus structure, all being built of pressed yellow brick with caps of alberene stone.

Besides the oil switches there are also installed disconnect-

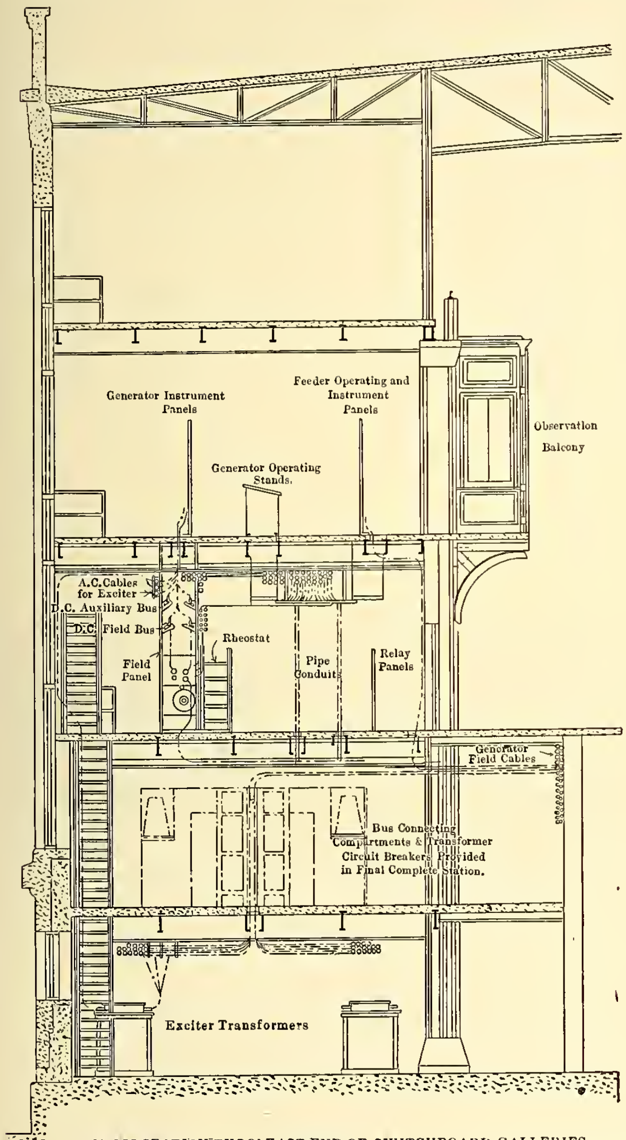


FIG. 19.—CROSS SECTION OF EAST END OF SWITCHBOARD GALLERY

ing hook type switches, to be opened and closed by hand, for isolating various parts of the system of connections when not in use, or while being inspected. These are mounted on heavy porcelain pillars placed in small compartments built into the brick bus structure. To get indications of the voltage across the main bus-bars, bus potential transformers are mounted in brick and alberene stone compartments on top of the bus structure. Leads from these transformers are carried to the instrument switch board.

The buses themselves are composed of copper bars, 3 ins. x ¼ in., resting on heavy porcelain pillars, each in its own compartment of the bus structure, and entirely isolated from the other two. The main connections between the bus-bars and all the main, generator, selector, and feeder switches are of heavy copper rods carried on porcelain insulators within brick compartments or "septums," to secure complete isolation of each conductor from all the others. These septums

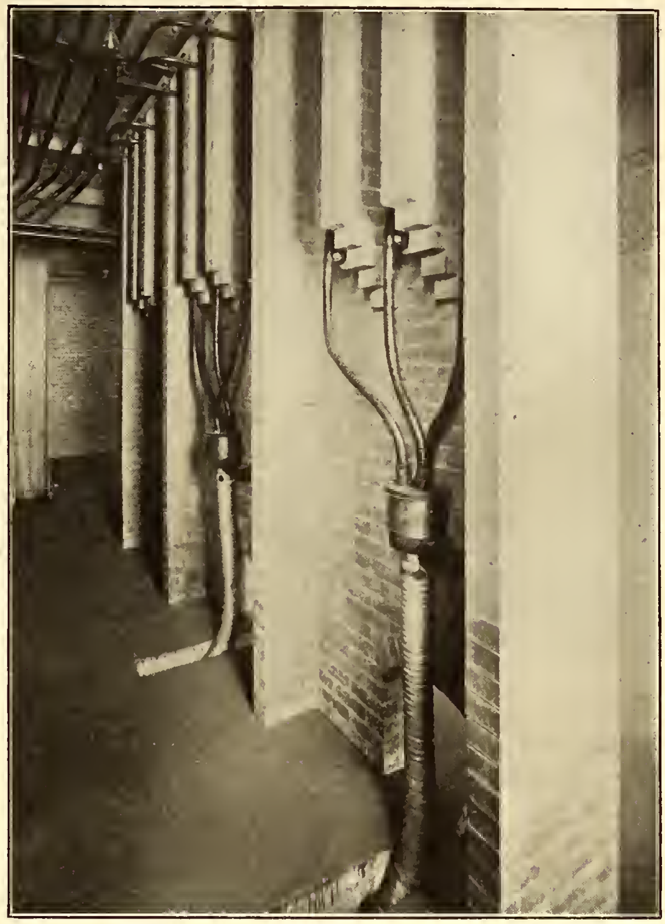


FIG. 20.—HIGH-TENSION FEEDER CABLES IN BASEMENT, ENTERING CONDUITS

are at the back of each of the feeder and generator switch structures.

From the feeder circuit breakers on the feeder gallery, the separate cables pass down through the floor, still in brick septums, to a few feet below the basement floor level, where they are spliced to the conductors of the three-phase cables, which are properly insulated and lead covered, and pass into the outgoing ducts which are laid in the floor of the basement gallery. Thence they are conducted to the distributing manhole at the commencement of the conduit line leading toward the sub-stations.

The connections between the main generator switches, the bus-bars and selector switches and feeder circuit breakers, are all of heavy copper bars or rods, mounted upon porcelain pillars. Bars and connectors of opposite polarity are separated by barriers or partitions of alberene stone, insuring absolute freedom from short circuit in this extremely important part of the installation. The enormous amounts of energy developed in the power house of this size are such as to make an absolute isolation of all main and bus connections a matter of paramount importance. The main conductors, separated as they are by partitions and carried on heavy porcelain insulators, need no other insulating covering.

ELECTRICAL CONTROL APPARATUS

The above described system of switches, bus-bars, and regulating or other auxiliary appliances is all controlled from the operating room at the east end of the third or operating gallery. This location at the east end of the present engine room will be opposite the center of the completed engine room when the building is extended to accommodate the final installation. This gallery is about 13 ft. above the main engine room floor, and projecting from the generating room is an overhanging observation balcony that gives a good view of the whole engine room. Mutual intelligence for the proper operation of the turbines and the controlling switches is commonly interchanged between the engine room floor and the operating gallery by means of a system of visual signals.

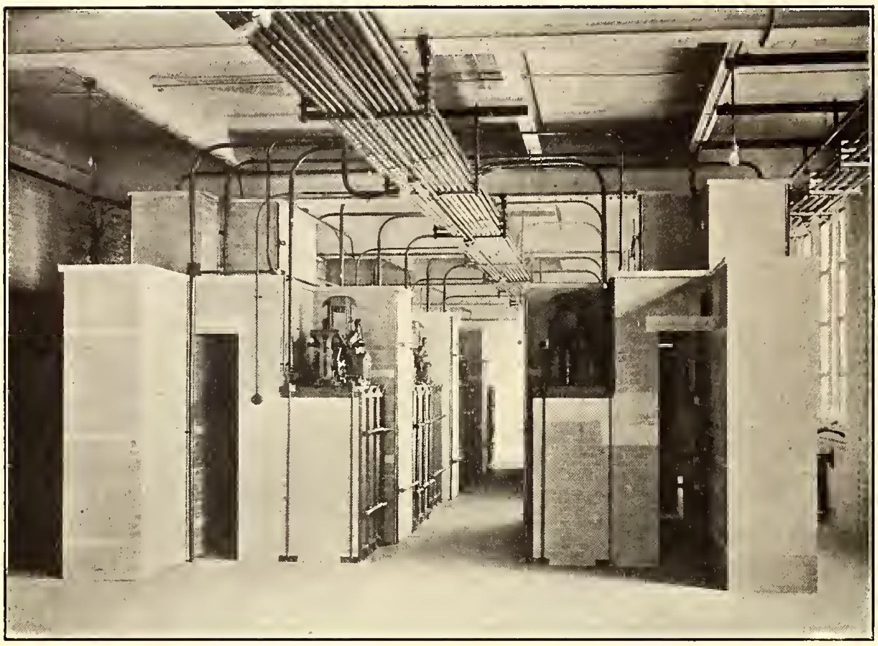


FIG. 21.—BUS STRUCTURES AND SELECTOR SWITCHES

The control apparatus consists of the following:

(a) Generator control bench.

(b) Greater instrument board, directly in front of the bench.

(c) Feeder control board.

(d) Exciter switchboard.

(e) Auxiliary switchboard.

The panels of these boards are of marble, and all panels and the metal fittings, switches and instrument cases have a dead black finish. The generator control bench resembles a low desk with an inclined top, and accommodates three sets of operating handles for the generator main switches, one set for each unit, and two sets for bus junction switches, which divide the main bus into sections. Directly opposite each generator panel on the desk is a vertical panel in the generator instrument board. The instruments on this panel are all operated from current derived from shunt potential transformers and series transformers, suitably located in the leads from each machine. On the narrow panel, to the left of the three-generator instrument panels now installed, are mounted three a. c. voltmeters, giving bus potential on each leg of the circuit, and a frequency meter. There are also two synchronizing lamps on this panel, one for each bus. On the bus junction panel at the right hand end of the instrument board, are mounted a differential a. c. voltmeter, two synchroscopes with plug receptacles, two synchronizing lamps, and an a. c. ammeter to indicate the current in the grounded neutral bus from the generators.

The feeder switchboard consists of three vertical panels, each containing apparatus for the control of six feeders and two feeder group selector switches, one of the latter running to each bus, end enabling the group of feeders on that panel to be put on either bus at will. Each of the three panels is at present equipped, however, with only three sets of feeder control apparatus, space being left for the remaining three when the installation is completed. The exciter switchboard is placed to the left of the generator instrument board with several blank panels intervening. A separate auxiliary switchboard controls the supply to all the various direct-current motors and the lighting system thrughout the station, and from it is also supplied the current required for electrically operating the generator selector and feeder oil switches, whether automatic or not.

All the outgoing feeder and main generator switches are fitted with both kinds of control, but all the selector switches have manual control only.

CABLES AND WIRES

The main generator cables are of the single conductor type, with four leads to each machine, each of 600,000 circ. mil, insulated with varnished cambric, 10-32 in. thick, protected on the outside with double braiding. Between the group selector switches and the outgoing feeder buses, each lead is of 1,318,000 circ. mil cable. Between the feeder switches and the end bells of the three-conductor cables that lead to the outgoing circuits, the cables are of 250,000 circ. mils. Between the feeder switches and the transformers that supply the

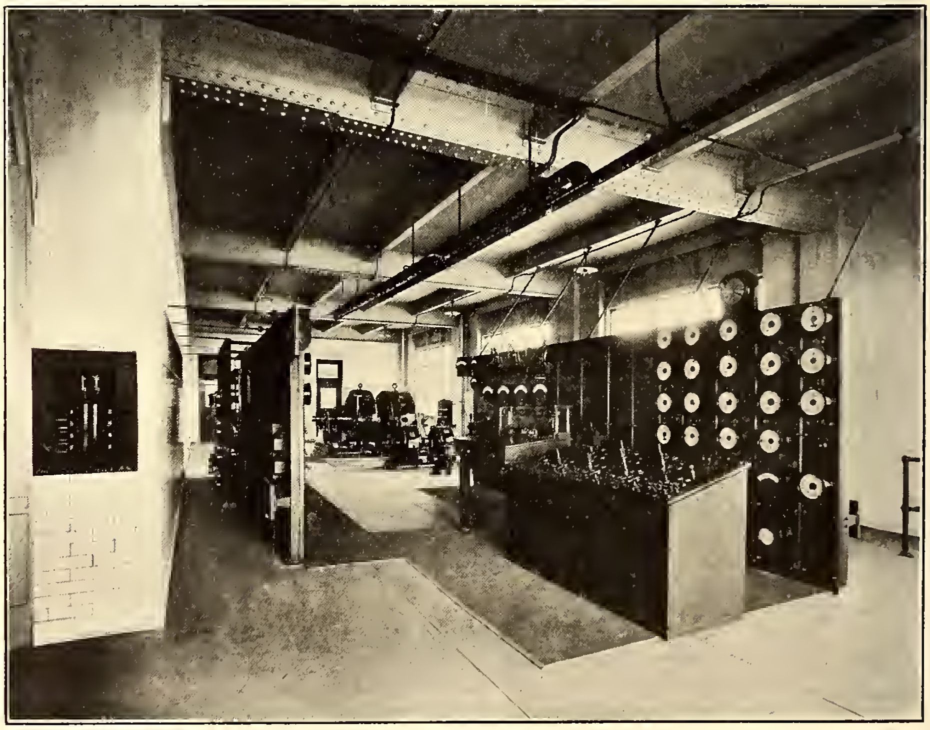


FIG. 22.—ELECTRICAL OPERATING GALLERY

motor generator exciter set, leads are 73,000 circ. mils. The main ground neutral lead connecting all the generators to the neutral resistance is of 600,000 circ. mils. All these cables are provided with 10-32 in. of varnished cambric insulation with a double protective braiding.

None of the power house cables, either high or low tension, is lead covered. The varnished cambric insulation of the cables, which was manufactured by the General Electric Company, is guaranteed to be sufficient for the working pressure adopted without the necessity of sheathing it with a continuous waterproof covering of lead, under the conditions that prevail in this power station, the ducts being so constructed that there is no possibility of moisture collecting in any point of the duct system.

The feeder cables leading to the high-tension transmission system are of the three-conductor type. Each conductor is of 250,000 circ. mils, and is wrapped with a layer of paper insulation, 7-32 in. thick. The three insulating strands when twisted into one cable are then surrounded with an additional insulating wrapping, 7-32 in. thick, and the interstices filled with jute. The whole is enclosed in lead sheath, 9-64 in. thick. These cables leave the power station through ducts laid in the floor of the basement gallery, which lead to a manhole directly outside of the building .

Each high-tension cable is provided with end balls of spun brass, 7¾ ins. in diameter and about 5 ins. deep, sweated to the end of the lead sheath of the cable and filled with insulating compound.

ENGINE-ROOM SIGNALS

A very complete system of signals for intercommunication between engine man and electrical operator has, therefore, been installed, which consists of a number of illuminated signals grouped together and located at a point visible from all parts of the engine room. These are worked from the operating gallery after the engine man's attention has been obtained by means of a whistle signal. A system of returning signals operated from the engine room floor, and showing in the operating gallery, enables the engine man to show the electrical operator that his signals have been understood, and the two systems together supply all necessary communication between the two operating floors. A large synchroscope visible from all parts of the engine room has been installed, so that by watching it the engine man is informed as the generator approaches synchronism and is switched into service. Figs. 8 and 10 show the signal board mounted conspicuously on the south wall of the engine room with the synchroscope on top of it. The large letters and figures are illuminated from behind by incandescent lamps, which are lighted when the proper contact keys are pressed by the electrical operator. A corresponding set of keys at each turbine enable the engine man to light the answering signals on the instrument panel in the operating gallery.

Suspended from the large signal board is a load indicator, by means of which the engine room forces are notified regarding the condition and tendency of the station load. This is actuated by an electric circuit manually operated by the main switchboard attendant. Other load indicators of the same type are also located in the upper and lower boiler rooms for the same purpose.

LIGHTING AND HEATING

The lighting for the station is done by arc lamps for general illumination, and incandescents for detail illumination. The arc lamps are run from a 110-volt d. c. circuit. The incandescent lamps are 220 volt and of 16 candle power.

The heating of the electrical galleries and offices is accomplished by means of a direct system of low-pressure direct steam pipe coils, amounting altogether to aobut 3300 sq. ft. of radiating surface. It is supplied by live steam, working through a reducing valve.

HOISTING MACHINERY

The traveling crane spanning the engine room has a capacity of 55 tons, and a span of 64 ft. It is of the double-trolley type, with a hoisting and a trolley motor on each trolley, besides the main motor which propels the entire crane. These motors are all operated from the 220-volt circuit. The crane was built by the Morgan Engineering Company. The hoisting trolleys are geared for both slow and rapid hoisting. Steel wire hoisting ropes are used throughout.

Two elevators have been installed, one a passenger elevator for serving the offices and electrical galleries, and the other a combination freight and passenger elevator in the boiler house, running from the basement to the top of the coal bin. These elevators were made by the Marine Engine & Machine Company, and all are of the electrically-controlled type operated from a 220-volt circuit. They are driven by motors capable of handling live load of 1800 lbs. at 200 ft. per minute and are fully equipped with safety devices. The elevator in the boiler house is arranged for automatic button control.

CONCLUSION

The first work of clearing the site began on Sept. 15, 1903, and the excavation on Oct. 20. The first turbine was started Jan. 16, 1905; high-tension current first turned into the transmission lines April 27, 1905. Current was furnished for testing cars on May 13, and on July 26, 1905, the line between Flatbush Terminal and Rockaway Park, the first section of the Long Island Railroad to use the new motive power, was permanently changed from steam to electrical operation.

The station was planned and built by Westinghouse, Church, Kerr & Company, engineers, for the Pennsylvania, New York & Long Island Railroad Company, which is the organization through which the Pennsylvania Railroad is carrying on its New York extension work. The design and construction were under the charge of George Gibbs, chief engineer of electric traction of the road, and under the general supervision of the Mechanical & Electrical Advisory Committee, New York Extension; a committee composed of officers of the Pennsylvania Railroad Company.

GETTING A NEW NAME FOR A NEW PARK

Big Island Park is the name the Twin City Rapid Transit Company has selected for its new amusement park on Big Island, at Lake Minnetonka, out of more than 2000 names suggested. In response to the company's invitation for a name, replies came from all over the United States. Suggestions even came by wire. A deluge of poetry was offered and the dictionaries seem to have been ransacked for words denoting pleasure. The name selected commends itself because it is historic, the island having been known as Big Island for 25 years or more, and is known prominently as part of Minnetonka. It also conveys the meaning of an island park. The keen interest which was manifested indicates how the Twin City's new amusement island at the lake has aroused the public, and with all the suggestions came pleasant words of good luck and well wishing for the island. Dana Todd, of Minneapolis, was awarded the prize of a chartered car party to the lake and island, as the guest of the company, on some day in the early summer, when the island is ready to be seen in all its beauty.

BAKER STREET & WATERLOO RAILWAY OF LONDON

The first of the underground tube railways in London, which belong to what is commonly known as the "Yerkes Group," was put in operation March 10, and is now in daily use. So much has already been published regarding the complete scheme of work which the late Mr. Yerkes laid out that it is hardly necessary to refer to it at this point. As has been frequently stated in these columns, the first of the processes of electrification which took place was the electrification of the Metropolitan District Railway, which is now a completed fact. In addition to this scheme, there have been under construction for the past few years three entirely separate tube or deep underground schemes, and the first of these to be completed, the Baker Street & Waterloo Railway, is the one now shown in the accompanying illustrations. To anyone studying the map of London, it will be seen that the east and west has been fairly well provided for with means of transportation. The north and south has had, however, little done to enable one to be transported comfortably from the northern limits of the city to the southern portions. The City and South London tube was the first to make some effort in that direction, but as it is confined to the "City" and has no connection with the West End, it could only do a portion of the work. The Baker Street & Waterloo Railway will undoubtedly fill a long felt want, as hitherto there have been almost no methods of communication between Charing Cross and the West End of London and the north-western suburbs. This railway will now connect Waterloo Station, the great terminus of the London & South Western Railway, with the West End at Trafalgar Square, Piccadilly Circus, Oxford Circus, and so on to Baker Street, where it will connect with the Metropolitan Railway system running further into the north-westerly suburbs. Later on when the scheme is completed it will also touch the Great Central Railway and the Great Western Railway at Paddington. The engineers for the construction of the line are Sir Benjamin Baker, Galbraith & Church and Dalrymple Hay, while the whole of the electrical equipment has been ably superintended by J. R. Chapman, chief engineer of the Underground Electric Railways Company of London.

The tube has been constructed practically in the same manner as other London tubes, and has been bored by means of the well-known Greathead cutting shields into the London clay, at an average depth of 60 ft. to 70 ft. below the surface. Previous articles in this paper have described this method of construction, so that it is not necessary to refer to it here, but the view on this page will give an idea of the shape of the cast-iron sections which are put in to make the tube after the clay has been cut away by means of the workmen in the shield. One of the interesting features of this tube has been that a large portion of the work has been conducted from a temporary staging in the river Thames, by means of which all of the clay dug out was taken away by means of scows and all of the necessary material for the tube was brought in the same manner, two vertical shafts being sunk into the bed of the river for that purpose.

TRAFALGAR SQUARE STATION OF THE BAKER STREET & WATERLOO SUBWAY

It will be remembered that the opening of the Central London Railway, popularly known as the "Twopenny Tube," was the commencement of a series of complaints from house-holders on the route of great annoyance from vibration, and so considerable sums of money in the way of compensation had to be paid. This railway, it will be remembered also, was operated by locomotives, but these were ultimately dispensed with and the multiple-unit system adopted, which eliminated to a very large extent the troubles of vibration. The subject of vibration, however, was considered a very important one, and every endeavor has been made in the Baker Street & Waterloo tube to prevent any trouble of this kind. Cross ties of non-inflammable Jarrah wood have been embedded in a bed of concrete, and the rail is of the regular British railway type, 90 lbs. bull-headed. Suspended joints are used and ballast is used between the tracks. The contact rails are rectangular in section and notched at the sides, so as to allow them to be clamped in chairs. The chemical composition is as follows:

	Per cent
Carbon	.05
Manganese	.19
Sulphur	.05
Phosphorus	.05
Silica	.03

The insulators are of vitrified earthen ware, made by Doulton & Company.

Everything has been done to make the risk of fire a practically negligible quantity. The station platforms are constructed of concrete and iron, and the ties, as stated, are non-inflammable. The rolling stock, referred to later, is built almost entirely of steel, and the small quantity of wood used for decorative purposes inside the cars is rendered non-inflammable. The whole tube also has been fitted with a system of electric lighting, electric lamps being placed at intervals of 40 ft., these lamps being supplied by an entirely different source of current from the cables which supply the power for operating the trains.

The signalling system is that known as the Westinghouse electro-pneumatic automatic, and is similar to that which is installed on the Metropolitan District Railway, which was described on page 417 of the Street Railway Journal for March 4, 1905. The system differs from that used in Boston and New York, in that besides the two running rails there is a fourth or return rail and a negative signal main. One of the running rails is continuous throughout the entire length of the road and constitutes the positive feeder to, or pole of, the signal system. The other running rail is divided into block sections by insulated joints and is connected to the negative main through a resistance at one end of the section, and a pressure of from 2 volts to 4 volts is maintained between the two running rails. Power is supplied from the motor generator sets installed in each sub-station at 60 volts pressure. The negative terminals of these machines are connected to the insulated conductor or negative signal main, running the entire length of the system.

At each end of the block section a polarized relay is connected by one terminal to the block rail, and by the other terminal to the continuously bonded running rail. The local signal circuit is controlled by both relays, and unless they are both suitably energized by a current in the normal direction, the signal cannot drop to clear. The entrance of a vehicle into the block section short circuits one or both of the relays,

THE YARD AT KENNINGTON FOR STORAGE OF CARS, REPAIR SHOPS, ETC.

and the signal is placed at danger and remains so as long as the vehicle is in the section. The main feature of this installation is that currents extraneous to the signal system cannot affect the apparatus so as to cause a false indication of safety. When a train is in the section, one or other of the relays is always reversely energized or shunted, thus opening the local signal circuit at one or two points. Each train works the signals automatically, the signal of the section of the train which has just left being automatically set to "danger" by the passage of the train. When the train reaches the end of the block, this signal is released and is set at "clear." There is also an automatic stop, which consists of an iron arm outside the track rail, so that should a motorman at any time take his train past the danger signal, the current will be automatically shut off by means of this iron arm actuating on the mechanism of the car itself, which engages with the air brake system on the train.

STANDARD CAR FOR BAKER STREET & WATERLOO RAILWAY

An emergency telephone system has also been provided for the use of motormen which can be made use of at any time, a pair of bare copper wires being installed in the tunnel which are within the reach of the motorman's cab at all times.

A great deal of thought has also been given to the subject of ventilation. Six exhaust fans have been installed at intervals, capable of withdrawing 18,500 cu. ft. of air per minute from the tunnels, which is sufficient to change the whole atmosphere of the tunnels about once every hour, allowing for the fact that some fresh air must of necessity be also extracted.

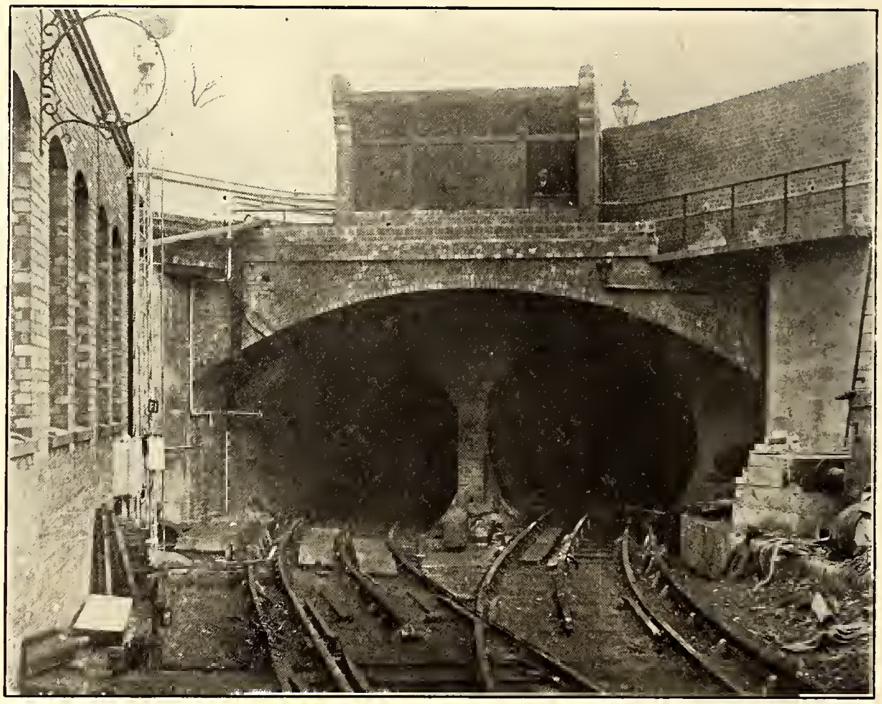
The stations themselves on this tube railway are the most attractive of any of the stations on the London railways. Each of the stations, as in the New York Subway, has a distinctive coloring or design. Each station is lined with glazed tile. The names of the stations appear in bold letters on the tiles and are permanently fired on.

Electric elevators are, of course, provided at every station. These elevators have an area of 150 sq. ft. The winding apparatus is above, and is operated by electric motors. In addition to the standard "Otis" safety device the motors are so wound that they will become self-exciting and act as powerful brakes themselves. Two powerful electro mechanical brakes are also fitted on each worm-shaft. The motors are connected to the drum shaft by worm wheel and spur gears. Each motor is of 35 hp, with a speed of 625 r. p. m.

The total length of the line (double track) is about 5 miles. There are eleven passenger stations and the average schedule speed is 14 m. p. h. The motors were supplied by the British Thomson-Houston Company, Ltd., of Rugby, and consist of GE-69s, 200 hp, with Sprague Thomson-Houston control. There are thirty-six motor cars, each equipped with two motors, and seventy-two trailer cars. The trains will be made up of six cars, a motor car at either end and four trailers in the middle.

All the control apparatus, as well as the air compressors, is carried in a steel cab at the driving end of the car. Here the contactors and circuit breakers are hung from horizontal slate panels supported by rigid steel framework. This form of construction was adopted because the small diameter of the tunnel does not allow sufficient room for the apparatus to be carried under the car, as in the case of the District Railway. It is also considered safer on the "tube" lines to have the apparatus enclosed in a steel cab in case of any fault developing in the equipment while a train is running in the tunnel.

Current for the Baker Street & Waterloo Railway is, of course, derived from the large station at Lots Road, Chelsea, which has been described in this paper, and the road will have physical connections with the Metropolitan District Railway and the Charing Cross, Euston & Hampstead Railway at Charing Cross station, and the Great Northern, Brompton & Picadilly tube at Picadilly Circus.



ENTRANCE TO TUBE FROM KENNINGTON YARDS

There are two sub-stations which feed the Baker Street & Waterloo Railway exclusively, both of which were completely equipped by the British Westinghouse Electric & Manufacturing Company., Ltd. They are situated at Baker Street and London Road, respectively, and their design, and that of the electrical machinery installed in them, are identical with those of the Charing Cross sub-station of the Metropolitan District Railway, a description of which was published in the STREET RAILWAY JOURNAL of March 4, 1905. The only difference is in the number and capacity of the rotaries, transformers, feeders, etc., which are as follows:—

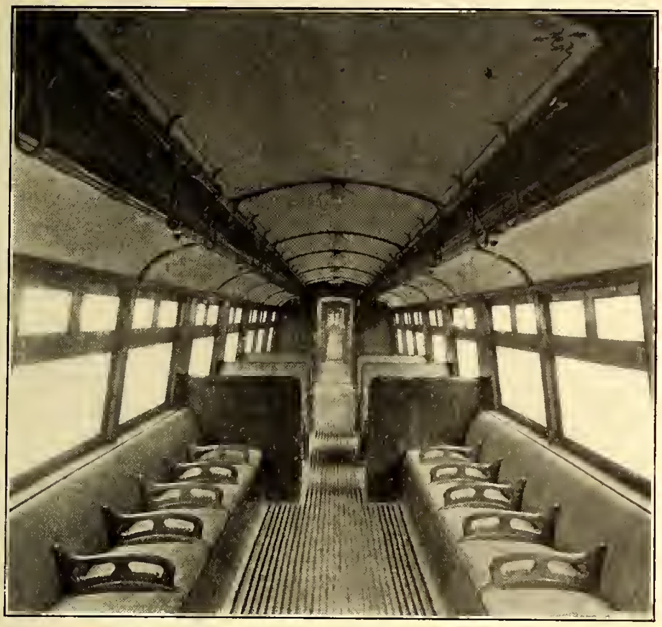
Two 800-kw rotary converters. (Space provided for one extra.)

Six 300-kw air-blast transformers supplying current to the rotaries.

Two lightning transformers supplying current for lighting the stations and tunnels.

Two motor generator sets for signaling apparatus.

There are two in-coming, high-tension, three-phase feeders at each sub-station, and five out-going feeders to the conductor rails at Baker Street and six at the London Road substation. All other details are covered by the Charing Cross description.



INTERIOR OF SUBWAY CAR FOR BAKER STREET & WATERLOO RAILWAY

The rolling stock, which is illustrated in this connection, was manufactured by the American Car & Foundry Company in America and put together at the company's Trafford Park works at Manchester. The cars are built almost entirely of steel, and the few internal fittings of wood have been treated so as to render them non-combustible; 108 cars have been ordered and 95 are completed. Six cars makes a standard train, of which the two end cars only are motor cars. All the cars are 50 ft. over all, 33 ft. between truck centers, 8 ft. 8 ins. in width and 9 ft. 5⅜ ins. high from rail level. The trailer car seats 52 passengers. The motor car has seats for 46 passengers, the remainder of the space being taken up by the motorman's cab and electric control apparatus. The motor trucks have wheels 36 ins. in diameter; all other wheels are 30 ins. in diameter. The floor of the car, except in the motorman's cab, is only 22 ins. above the rails.

The fare for any distance is 2d. and books of 25 tickets can be bought for 4s. In addition, workmen's return trip tickets, good on week days up to 7:58 a. m., can be bought for 2d.

INSTRUCTIONS TO INSURANCE INSPECTORS IN CLEVELAND

During the past two years the Cleveland Electric Railway Company has devoted considerable study to the subject of the insurance of its property against loss by fire, and especially to the subject of protecting its buildings and rolling stock against damage by fire. Among the precautions it has adopted has been the appointment of an employee of intelligence and ability at each shop and car-house to make daily inspections of the property, with a view to the prevention of fires. To assist these men in the performance of their duties the company has issued a series of printed instructions. These instructions are reproduced below.

INSTRUCTIONS TO INSPECTORS OF BUILDINGS

An ounce of prevention is worth a pound of insurance. This company cannot afford to have a fire in any of its power stations or car houses, or elsewhere. An extensive fire would not only destroy property of great value, but would cripple the company's business and cause a large loss in earnings. More than this, it would result in seriously inconveniencing its patrons, who are all the people of Cleveland and vicinity. The company has recently expended more than $100,000 for equipping its car houses with automatic sprinklers, and other large sums for fire-hydrants, for bricking up windows in car houses and for other purposes, in order to protect its property and business against loss or damage by fire. It is willing to spend more, if necessary, to make its buildings as nearly fire-proof as practicable, and it desires the co-operation of every employee in its efforts to prevent fires.

Observe carefully, therefore, the following instructions:

AS TO SPRINKLER EQUIPMENTS

See that all sprinkler lines are rigid and unobstructed at all times, and that proper water and air pressure are maintained.

See that no electric wire is in contact with the piping or hangers.

See that the gravity tanks are full of water.

See that all valves are sealed in proper position, either open or closed.

See that all indicator-posts register "Open."

See that tank risers and valve houses are properly heated, so that water in them will not freeze.

See that all drain valves are in working order.

See that all water connections and air pumps are operative.

See that alarms are in working order.

See that at least six sprinkler heads are on hand in each building.

Report, on the blank furnished for that purpose (form 150), the air and water pressures, in pounds, at valves, each day, and send the report, at the end of each week, to the master mechanic.

Study the sprinkler system, and suggest any modification that will, in your judgment, increase its efficiency.

AS TO GENERAL CARE AND CLEANLINESS

Inspections should be made daily of all buildings.

If any building is out of repair, report what repairs are needed.

Floors should be swept once a day, and all dirt and refuse placed in proper receptacles.

Smoking is not permitted in any building (except in club rooms, motormen's and conductors' waiting rooms, and other places designated for that purpose).

All buildings and cars should be kept constantly clean and free from litter.

Oil should be kept in the oil-storage houses.

If a fire is started in a car stove while the car is in any building, or if kindling is saturated with oil in any building, or within 20 ft. of any building, or if ashes are taken from any car stove while the car is in a building, report the fact.

If a car stove or chimney is broken or in bad condition, report it at once for repair.

See that the apparatus for heating the building is safely arranged.

See that all chemical fire extinguishers are charged, free from frost, and in good order.

See that fire pails are full of water in summer or sand in winter.

See that fire-hose is in place and in good condition, and that employees know where to find it and how to use it.

See that hydrant houses are in good order, with lanterns, axes, spanners, wrenches and hose ready for use.

See that all pits, closets, floors, benches, shelves and corners are free from dirt and grease.

See that oily waste not in immediate use is placed in standard waste cans, with self-closing lids, and that all waste cans are in order.

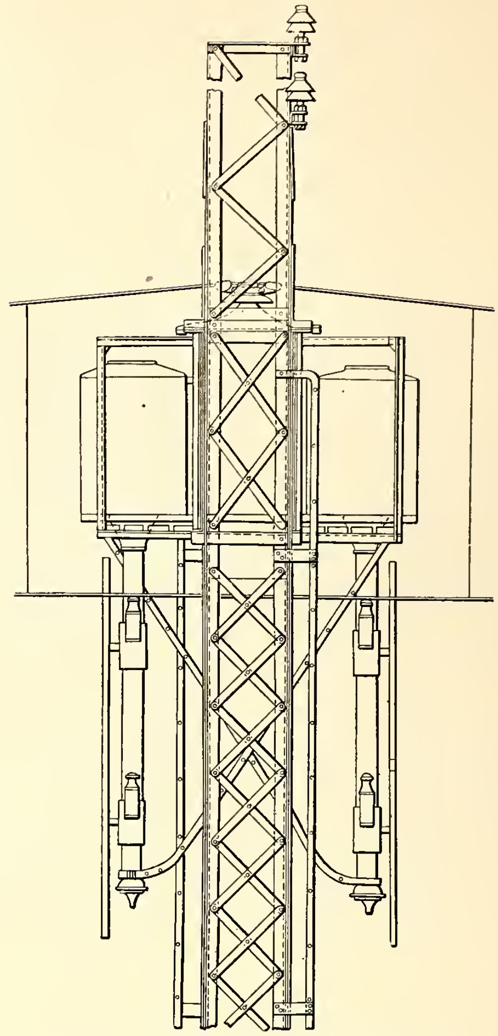
Suggest any improvement or change in construction or operation that will, in your opinion, lessen the hazard of fire.

All reports and suggestions should be sent to the master mechanic.

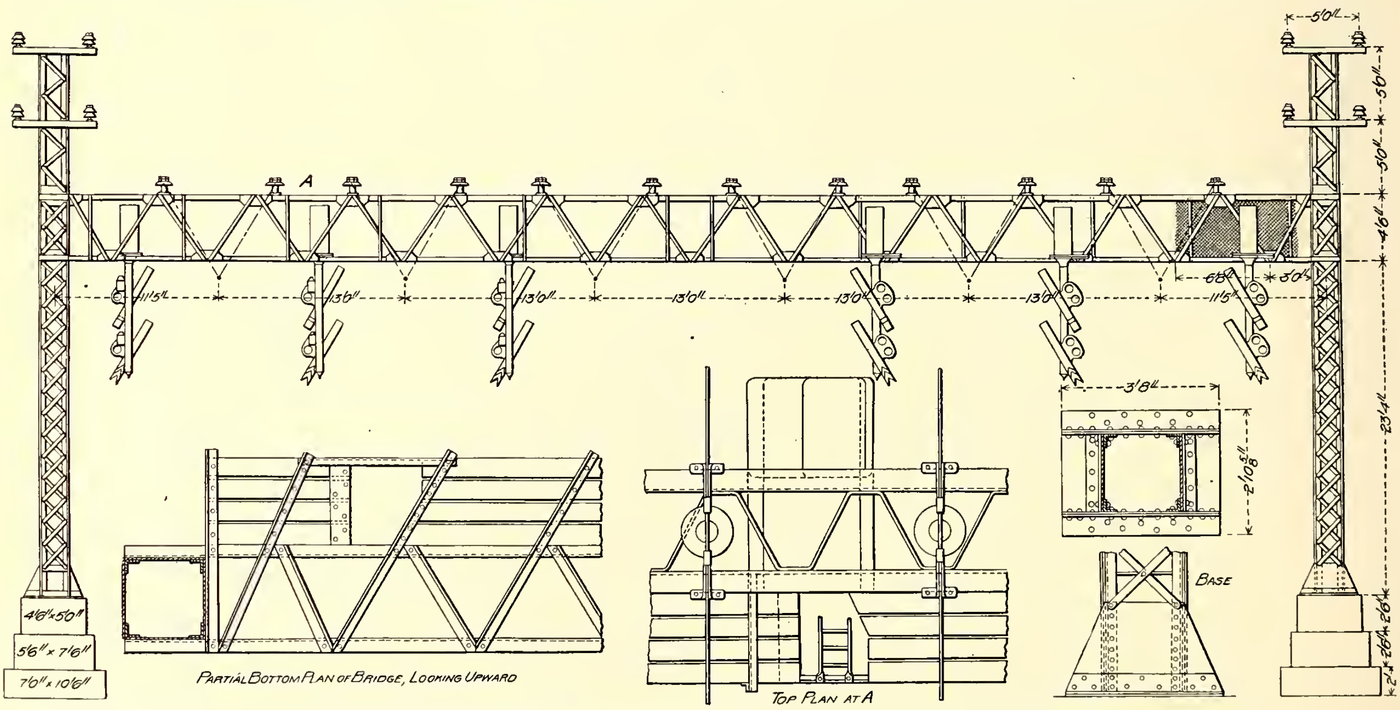
OVERHEAD CATENARY CONSTRUCTION FOR THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

An account was published in the STREET RAILWAY JOURNAL of Feb. 17 and March 24 of the overhead catenary construction proposed by the New York, New Haven & Hartford Railroad on its electrified section from Woodlawn to Stamford. As will be remembered, each trolley wire will be carried on two ⅝-in. steel catenary cables and that these catenary cables are carried on steel structural bridges which span four, and in some cases six, tracks. These bridges will be located every 300 ft. The trolley wires will be divided into sections, about 2 miles in length, by oil circuit breakers, which will be carried at these points on a bridge of heavier construction, known as an anchor bridge.

The accompanying engravings illustrate one of the intermediate bridges of the company, designed by the Westinghouse Electric & Manufacturing Company, and intended for spanning six tracks. As will be seen, the posts are 87 ft. 10 ins. apart on centers, 22⅝ ins. square, and are made up of four 4-in. x 4-in. x 9-16-in. angles with 2¼-in. x 7-16-in. double lattice bars on each side. The angles of the column are riveted at the bottom to a built-up base of plates and angles, which has a bearing surface 3 ft. 3 in. long and 2 ft. 10⅝ ins. wide on the concrete pedestal, to which it is attached by four anchor bolts per column. The pedestal is 4½ ft. x 5 ft. at the top, 7 ft. x 10½ ft. at the bottom, and 7 ft. deep. The anchor bolts are carried through the entire mass of concrete to 15-in. anchor plates on its bottom surface. The columns are connected by a pair of light Warren trusses, each having a 6-in. x 4-in x ¾-in. angle for a top chord, and a 4-in. x 3½-in. x 11-16-in. angle for a bottom chord, with angle-bar diagonals ranging in size from 3½ in. x 2½ in. x 3-8 in. at the ends to 2½ in. x 2 in. x 5-16 in. at the center. These chord and diagonal angles are connected by gusset plates with six rivets each. The top chords of the two trusses are connected by 2¼-in. x ⅝-in. diagonal straps, which are riveted to the vertical faces of the angles instead of being arranged like ordinary lattice bars. The lower chords are connected by a single system of latticing, consisting of 2¼-in. x 2-in. x 5-16-in. angles.



END ELEVATION OF INTERMEDIATE BRIDGE, NEW YORK, NEW HAVEN & HARTFORD RAILROAD



SIDE ELEVATION AND DETAILS OF INTERMEDIATE SIX-TRACK BRIDGE TO BE USED BY THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD FOR SUPPORTING TROLLEY WIRES & SEMAPHORES

Each alternate angle projects beyond the lower chord of the truss so as to carry a plank platform about 2 ft. 10 ins. wide. This platform is on the opposite side of the bridge from the signals and, as the latter are on the side of the bridge facing the trains, it follows that the platform is on one side of the bridge for half the length of the latter and on the other side for the remaining distance. This platform is covered with expanded metal to protect the inspector from the high-tension lines while handling the signals. Protection against accidental contact with the catenary cables overhead is provided by a covering also of expanded metal on planking, which is carried on 2½-in. x 2-in. x 5-16-in. angles, spaced every 7 ft., and riveted to the top chord of the truss. These angles are supported by the outer ends by uprights, which are of the same size, and 4 ft. 8 ins. long, and which are riveted at their base to the platform angles.

The triangular hangers, which support the No. 0000 trolley wire from the catenaries, are spaced 10 ft. apart. They are sections of pipe and consequently hold the trolley wire rigidly to the supporting cables, but the whole structure has a spring motion on account of the flexibility of the stranded cables. All the pipe hangers are in a vertical plane at right angles to the track. The weight of the intermediate bridge is approximately 13,000 lbs.; that of the anchor bridge, approximately 23,000 lbs.

THE SECOND QUARTERLY MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK

The second quarterly meeting of the Street Railway Association of the State of New York was held on March 29, in the Rathbun Hotel, Elmira, N. Y. The morning session convened at 10:30 o'clock, with about thirty-five members present and President R. E. Danforth in the chair.

MORNING SESSION

President Danforth opened the morning session by introducing to the members B. V. Swenson, secretary of the American Street & Interurban Railway Association, and asked him to outline the plans of the reorganized associations.

Mr. Swenson first referred to the advantages secured in association work, and a discussion of engineering, managing and auditing methods. He believed that a frank, open discussion and interchange of ideas, such as occurred at the last quarterly meeting of the New York association could not but be mutually beneficial. The American Street Railway Association was formed at a time when all of the smaller systems were operated by horses. Between 1884 and 1888 attention began to be directed to electricity and in 1895 the interurban railway made its appearance. The national association has thus kept in touch with the entire development of the street railway industry. In 1897 the Accountants' Association was formed, and the Mechanical and Electrical Association in 1902. Probably the most important subject upon which the latter association is now working is the standardization of equipment. The present committee is engaged upon the standardization of such items as journal boxes, wheel treads, brake shoes, and of track between city and interurban railways. This is of great importance when it is considered that it will not be long (and, in some cases, it is already being done) before cars will be interchanged between roads. The Claim Agents' Association was organized at St. Louis in 1904, and has already accomplished a great deal of good in compiling statistical information relating to fradulent accident claims. Attention has also been given to the knocking-down of fares by men who make a practice of going from one road to another.

After outlining the system of dues adopted by the new association, Mr. Swenson referred to the work now being done by several of the standing committees. The insurance committee, of which Henry J. Davies, secretary of the Cleveland Electric Railway Company, is chairman, has conducted a series of investigations and negotiations, as a result of which it is expected that the companies will be able to secure an average rate of 25 cents per $100 on protected property and 75 cents for unprotected property. The committee on compensation for carrying mail has secured information on rates paid for carrying mail from between 150 companies and 200 companies. The postal authorities at Washington do not seem inclined to afford very much assistance, but the committee's work has been presented to the postal authorities and to the members of the congressional committee. At present the rates are 3 cents for pouch mail and 15 cents per car mile. It is hoped that this will be advanced in a short time to 5 cents or 6 cents for pouch mail and 25 cents per car mile for mail cars.

There are additional committees on promotion of traffic, heavy electric railroads, municipal ownership, welfare work, public relations, etc. The committee on topics and papers is also at work on papers for the next convention, which will be held at Columbus, Ohio, from Oct. 15 to Oct. 19.

The president then announced that the first topic for discussion would be methods of increasing traffic by advertising, and in the absence of the author requested the secretary to read the paper on "Advertising" prepared by H. E. Smith, general passenger agent of the Hudson Valley Railway Company, of Glens Falls, N. Y. This paper was as follows:

ADVERTISING

The conditions under which urban and interurban roads throughout the country operate vary so much and the diversity of business served in different localities is so great, that it is almost impossible to give any one or more ways which will best bring what a road has to offer before the public in an attractive way, and gain the best results from the publicity department. Each manager should make a careful study of the interests which his road serves. He must study the people and ascertain what induced riding can be created. The people in some communities can and will afford to take advantage of frequent attractions, while in other places the people cannot spend their money quite so freely. The careful and conservative management will take these things into consideration and not endeavor to force attraction riding where there can be no results.

There is hardly a trolley road of any importance to-day but has its park or parks and on whose park lines riding must be stimulated by some means. It should be the aim of every manager before the opening of the park season to cast about his territory and ascertain what chartered car business can be worked up for his park, not only because there is good money in business of this kind, but because the chances are that a large number of people who make the trip in this way will enjoy themselves so much that they will want to go often, either individually or in small parties. Get the people to talking about your resort and others will follow. In order to interest Sunday schools, lodges, societies, etc., in your road or park, a complete list of such organizations with the names of officers should be at all times available, and to the names on this list the literature of the road and park should be sent early in the season, together with a short personal letter. The letter should be brief, but enough can be said to attract the attention of the person to whom it is sent so that it will not be thrown aside. Get the attention of the people in charge of these organizations and set them to thinking of the varied amusements to be had at your resort. After a short time, if nothing is heard from the letter, a personal call should be made, and the trip explained more in detail in such a way as to leave no doubt in their minds as to the advisability of running an excursion to your park. Personal interviews will go farther than the best advertising. On excursions of this kind it is well to have a representative of the company accompany the party, to look after details.

In order to get your park before the public generally a number of methods can be adopted, all of which have been found more or less beneficial. Cars can be equipped with announcement boards to be hung on the dash on open cars and on the side or front vestibule of the closed cars. These boards should be about 22 ins. x 28 ins., in order to take a fair-sized sheet and give a good display. Care should be taken not to get too much matter on a sheet, as this kind of advertising must necessarily be read hastily and in some cases from considerable distances. Therefore, the main features only should be brought out with the best type obtainable. These same boards may be used during the winter to advertise skating rinks, theaters, etc., along the line. Our experience has been that theaters are only too glad to furnish paper and labor for this kind of publicity. In connection with this outside display it is well to follow it up with hangers inside the cars or permanent cards placed in either the side or end spaces, so that whatever fact you are trying to bring out is not lost sight of at any time. Hangers for the inside work make a very effective display and can be used at your different stations or hotels and stores, but unless a great deal of attention is given this method it is not permanent.

In the matter of literature each manager will have to govern himself according to the conditions. As far as possible, a standard size should be adopted and followed. The most important form to have at all times is a good supply of detail time tables adapted to the needs of the public. If it seems desirable, pages may be added with descriptive matter, but so far as possible the two should be kept separate. In placing time tables especially, or literature in general, before the public, great care should always be used to make the matter as simple as possible. Get the literature up in such a way as to make it easily understood, for the majority of people do not fully understand how to get at anything but the simplest kind of a time card. Some roads solicit advertising enough for their literature to offset the cost of printing, but for anything outside of time table literature this does not pay in the end for it cheapens descriptive literature so much that it is less effective.

If your roads run through a historic country a study of the historical points can be made and literature pertaining to them can be put out. Or if you are obliged to depend upon picturesque scenery, manufacturing towns or mining regions, a little study will soon bring out points that will be interesting if put before the public in the proper way. Summer or winter resorts along your line should receive attention and oftentimes one resort will call for a whole booklet telling of the best way to reach it, the beauties of the place or the trips to be taken by your line after people have arrived. In getting out booklets describing special trips from resorts it should always be your aim to bring out your points in the simplest manner possible. Try to make the public see on paper just what you yourself have seen a thousand times with the eye in a clear, concise way, and the chances are the people will make the trip your literature suggests. Only the largest roads would probably be able to issue a weekly or monthly paper for distribution, though even the smaller roads might be in a position to run during the summer months a small pamphlet weekly which, with the proper distribution, would get into the hands of a large number of trolley riders. Enough advertising can generally be solicited to defray a large part of the expense. Special articles can be called for from the public to be used in the pamphlet for which prizes can be offered, which will create interest in the publication. There are innumerable prize schemes which can be worked out not only in a literary way but for park features as well.

In the matter of distribution of literature, we find that small tin racks placed in one end of the cars for time tables and literature prove one of the best ways to get this matter into the hands of the public. These same style of racks may also be used for hotels, stores and other public places. Nearly every one will gladly allow the racks to be put in their places of business. Of course, all stations along the line should be kept supplied with these racks and time tables. We also send literature to all bureaus of information, such as those established by the larger metropolitan papers. At the resorts along our line we put our advertising in the hotels and boarding houses, and then follow it up with a man of good address who is something of a reader of human nature. When he sees people reading or looking over literature, he can step up and introduce himself and explain details of some of the trips, and he usually secures the party for a trip.

In announcing special excursions or features which are only for a day or evening, we find that it is not wise to advertise too far in advance. Excursions advertised by steam roads are generally of longer duration than those on the trolley, and for this reason the public must have a longer time to think and plan over the trip. People usually take a trolley excursion on the impulse of the moment and, therefore, it is well to get out bills, dodgers and newspaper display only a few hours before your attraction. Spring it on the public in the best and most complete way possible under the existing conditions.

With the exception of the time table advertising, the foregoing has been along the lines of forced pleasure riding, and the writer now desires to say a word relative to what will be called, for want of a better name, the real or permanent business of a railroad. It is granted that we must strive in every way possible to build up the pleasure riding, but business that is going on each day, rain or shine, throughout the year is what, in the writer's opinion, should be gone after strong, for that shows permanent returns. Take for example the drummer trade, which is a large item to any road. To bring your service before this trade, comprehensive maps and time tables, showing all possible connections, should be in hotels and stores. Small pamphlets relating to towns or cities through which you operate can always be used. Merchants are glad to use them on their show cases or enclose them in all their correspondence. Such things keep your name before the people and bring business. Hangers and window cards announcing the convenient service, low rates and baggage regulations should be displayed where they will do the most good. Get on friendly terms with hotel employees and hackmen, giving them information which they can use to your advantage, and you will soon see many a knight of the grip enjoying his cigar in your smoking compartment rather than in the coaches of your rival, the steam road. Go after the permanent business by making close connections and operating clean cars, with polite and well-uniformed men who show as high a degree of intelligence as it is possible to get.

Now, as to bringing the freight and express service before the people, providing your road operates that branch. First of all a personal canvass should be made, giving rates, explaining the service and the benefits derived from the "electric way." Ask people to make a trial shipment, and if they agree, give it personal attention. Follow it up with an inquiry as to whether the trial was satisfactory or not, though you may know it could not have been otherwise. Make yourself a good fellow with your customers—it pays. Let your canvasser call frequently on shippers, as now and then slight dissatisfaction may arise which may be easily explained by personal interviews. Let your shippers and customers see that you have their interests in mind. Don't be afraid to let them understand that their business is important, no matter how small. It may grow or they may have friends.

A "sticker" with some attractive design may be adopted, and then give instructions to the whole office force to place one on every letter sent out. Give all merchants along your line a supply and ask them to use them when sending in orders to the wholesaler. It may be that you have only a half enthusiastic customer, and he will not state how he wants his goods shipped; the poster will be a reminder to the wholesale house. Hangers announcing special cars for perishable goods, schedules, etc., may be placed in stores, shops and public places. Cards with the same information can be placed in the advertising spaces of passenger cars.

The president then called upon B. E. Wilson, general passenger agent of the Rochester Railway Company, to open the discussion. Mr. Wilson said that although advertising by a traction company is a very important factor, and if handled properly has a surprising influence in increasing the company's revenues, still if the cars are not available and the crews are not courteous, no amount of advertising will get the business. The duties of the advertising man do not consist entirely in preparing press notices and attractive signs to place before the public but he must also learn how, by a little "boosting," to get people to ride. It is often necessary to originate and create attractions and not depend entirely upon the regular run of entertainments. The Rochester Railway two years ago arranged for a Masonic fair and carnival at Grand Haven along the latter part of the season, when the park travel had begun to fall off to some extent. The company gave the resort for two weeks without charge and the lodge furnished the attractions and did the advertising. The event was mutually successful, as the Masons cleared between $5000 to $6000, and the company carried a very heavy traffic. The Rochester company has also worked out several original schemes for city parks. The event known as "Toy Day" has been particularly effective. In the latter case the company gets out a lot of numbered tickets, which are hidden in out-of-the-way places in the park. It is then advertised that the children finding the tickets with certain numbers will be given toys or other prizes. Such an event creates considerable interest. The Rochester company is now working up a proposition to run a military carnival at Grand Haven for the last two weeks of the coming season, the military companies of the city to run the affair as did the Masons. Sham battles, drills, etc., will be put on, and a good business is expected. Two years ago a sham battle was given at the park for which the company carried 15,000 to 17,000 people between the hours of 5:30 o'clock and 7 o'clock p. m. The cost of that entertainment to the company was about $140. The same idea can be extended to interesting the Sunday schools and churches in the parks, as places for holding excursions and picnics.

All companies have about the same number of mediums with which to advertise, such as dash signs, cards, folders, billboards, the press, etc. Rochester is getting excellent returns from dash signs. The best results are obtained, however, from the company's own publication, which is a weekly folder known as "Trolley Topics." The booklet contains 32 pages, and the front and back covers are the same. Half of the pages in the book are bound in upside down, so that, in picking up the book, the passenger's attention is attracted by the arrangement, and almost before he knows it he is reading the notices and the advertisements. This is used as an argument in soliciting advertising. Last year the company secured about $1000 in advertising, and the expense of issuing the folders was $1200, which covered also the cost of two different cuts each week. The only other expense was that of distribution to hotels and other places. This year the publication will be issued by private parties, who will deliver the edition to the company free of cost for the advertising they can obtain in the books. These same parties are working up a proposition to get a number of electric railways interested in this, the private parties to get up the books at very little cost to the different companies and the companies to prepare their own local matter.

Mr. Danforth, in further explanation concerning the resort business in Rochester, said that the Rochester Railway Company operates four lines to resorts on Lake Ontario, which is eight miles from the city. There are also two popular city parks, so that for a place of 180,000 the city has almost too many places of amusement. Each resort on the lake has its own peculiar characteristics and the intention in all the advertising is to promote the peculiar advantages of each park without interfering with the others. One is a modern amusement park like Dreamland or Luna Park, Coney Island; another is a park of the old-fashioned picnic kind; Ontario Beach is more of a cottage resort, having in connection with it what is known as the "White City," where at times there are 3000 people to 5000 people living under tents. The only amusement in the last named park is dancing. There are two dancing pavilions, which last year were open almost every night from April to October. The business did not cost the railway company anything, as those who run the pavilions induce dancing clubs and classes from the towns to hire the dancing pavilions for certain nights.

W. W. Cole, of Elmira, believed that the value of advertising literature was greatly increased by having the reading matter illustrated with good cuts. A plain dodger without illustrations will either go unnoticed or be thrown away, while an illustrated pamphlet attracts attention and is read and kept. He referred to the scheme introduced by Mr. Wheatly in the City of Mexico, whereby the street railway tickets are numbered and cash prizes are given to the holders of tickets bearing certain numbers. Some of the delegates, however, thought this scheme would not be feasible in New York State, as it might conflict with the anti-lottery laws.

E. S. Fassett, of Albany, stated that his company has no advertising at all, except that done by the advertising company in the cars. So far as his company is concerned, it has no parks, and no special place of amusement to advertise. The company makes a contract for the car advertising, which relieves it entirely of all the responsibility of advertising anything. So far as folders and hangers are concerned the city ordinances both of Albany and Troy prohibit anything of the kind. The railway company is prevented by its contract with the advertising company from putting in the cars anything more than announcements regarding car movements. The United Traction Company of Albany believes this arrangement is to its advantage.

Mr. Wilson, of Rochester, said he had a scheme to provide a resort which could be reached for a 15-cent half-fare and a 25-cent adult fare. For this proposition he would go to the school principals of the city or town and offer a free ticket to the park or resort to every child in the school, with the understanding that the principal would sell an adult ticket for some one to accompany every child. There would be no question that in a city with 20,000 school children at least 10,000 would take advantage of this occasion, and the parents would be more than willing to spend 25 cents to go along with them.

Mr. Fassett wanted to know what would be done in cases where there were several children in charge of one adult.

Mr. Wilson, of Rochester, replied that it was understood there would be only one child for each adult fare.

Mr. Fassett remarked that he had a case where twenty-two children got on for one five-cent fare, and the conductor had to ask for instructions.

Mr. Beardsley, of Elmira, thought Mr. Wilson would find some difficulty, because the rules of various boards of education forbid the selling of tickets to school children through the school officials, but Mr. Wilson said he had spoken to several principals who expressed themselves as very much in favor of the idea and willing to aid in carrying it out.

Mr. Cole thought well of efforts tending to promote afternoon riding. With the exception of one or two afternoons throughout the week, the afternoon travel is fairly light unless the company can arrange a number of excursions. Every effort should be made to promote general party and excursion riding on lines where the income would go up by encouraging park business. Elmira has one park in the city where vaudeville attractions for the masses are given and another park of higher order where operas are given. The instant the performance is over the entire crowd wants to get on the cars at once and go home. The speaker wanted to know what attractions will tend to spread out the traffic, instead of having all the passengers leave at once.

Mr. Wilson, of Rochester, mentioned his experience last year in Glen Haven. They had an open-air theater or "circus maximus," with electric tower effects, and tried the scheme of continuing the entertainments over a longer period. They put on various acts for 15 minutes with intervals between, but the other concessions at the resort did not do very well, as the people were afraid of not getting close to the stage and, therefore, would spend the intervals between the acts waiting in the theater instead of walking around the park. This year the entertainment will be run off continuously without long intervals between the acts.

Mr. Cole remarked that he had found it a great advantage to have the sale of seats in the theater begin three days in advance, so that on rainy nights a larger crowd is carried to the park than would otherwise be the case, because those who have purchased tickets in advance go in spite of the rain. Seats in the theater cost 10 cents, 15 cents and 25 cents, and there are 600 free seats. The theater is enclosed and protected from the weather. Last year this park more than paid for the entertainment, and the company had a net profit of several thousand dollars.

A delegate remarked that he knew of a prominent manager who had been studying some of the statistics on his park travel, and was beginning to feel that the excursion business had to be examined from two standpoints. The great risk of accidents enters very materially on a number of lines he was operating in handling large excursions. For instance, his passenger agent would advertise some special attraction and every effort be made to get a big crowd out for an evening. The result was that the cars came and went jammed more than full and, in fact, it was almost impossible to keep the passengers off the roof. He kept some records and found that, while the receipts for the day showed up heavier, when he got his report from the accident department, the accident account had run up alarmingly. In fact, he decided that one or two of the special excursions had been run at a loss because what had been taken in as extra fares had to be paid out through the accident department. The delegate asked if it had been the experience of others that excursions materially increase the chance of accident.

Mr. Cole said that taking care of crowds is largely a matter of schedule. The fact whether or not liquor is sold also makes a difference, as there are less accidents in bringing down a quiet crowd, but, in any event, if the people cannot get away soon without considerable crowding the accident account is materially increased.

C. Loomis Allen, of Utica, referred to the question of temperance and non-temperance parks. His company has two parks whose history has been about as follows: In 1902, one park, located about three miles from the business center of Utica, ran with a license and produced a net revenue of about $9800; the other park, located about seven miles from the business center and reached on a 10-cent fare, was run as a temperance park and produced a net deficit of $15,000. The year following that the company leased the parks to two different parties at a nominal rental. The park where liquor is sold is making money and the other, which is still run as a temperance park, is barely making expenses. From his own experience and observation of results elsewhere, the majority of railway companies in providing attractions are putting in one dollar and taking out ninety cents, if all the items of expense that go into the operation of a park system are considered. To his mind the railway company has not much excuse to be in the park business. He said that he was a firm believer in advertising and had peculiar notions, perhaps, along that line. In the territory served by the Utica & Mohawk Valley Railway are some twenty-one papers, of which five are dailies and the rest semi-weekly or weekly. The company's advertising is confined wholly to the publication in these papers of time tables and "readers," consisting of slight references to whatever attractions may be offered at either of the two parks, but more especially to the different points of interest outside of the two parks. His reason for choosing this kind of advertising was, first of all, to secure the advantage of all the circulation possible without any effort on the company's part. The circulation of the daily papers used is upwards of 30,000, and as it is estimated that there are four persons per family he assumed that practically everybody served by this road reads one of these papers some time each day. In this way, he thought, prospective passengers were reached better than by any other system the company might adopt. The cost of this advertising is made up as follows:

The company issues to each daily paper published in its territory six local pass books, each containing fifty five-cent coupons, and to each of the owners of the semi-weekly and weekly country papers is issued one city book of fifty tickets, renewable when used up, and one interurban pass book, also renewable when exhausted. An accurate record is kept of the value of the coupons turned in; the total last year proving to be about $4000. This complimentary traffic is treated as a thing of no value except as a matter of information, and, therefore, is not passed into the company's accounts. He was sure that the custom of issuing complimentary transportation is a good thing and is productive of good feeling on the part of the press. No restriction is placed on the amount of transportation the newspapers have, but its use is confined to the persons to whom it is given. He had considered at different times the issuing of a trolley folder in his territory, but found that to get out 10,000 trolley folders, free from advertising except that referring to the company's business, would cost upward of $1500, and after getting the folders he would not have known where, nor how to distribute them.

Mr. Fairchild asked Mr. Allen if, after issuing the pass books, he paid cash for advertising and how the newspapers regulated the space allowed. Mr. Allen said he paid no cash whatever. The only restrictions that are made are made by three of the dailies, which restrict the space occupied by the time tables to 4 ins., but do not restrict the space given to "readers." His company does not try to take up too much space in writing a description of the subject to which it desires to attract attention, averaging not more than 1½ ins. to each notice. Sometimes in writing up some important event of local interest, as a reference to a battle field nearby, 3½ ins. to 4 ins. might be taken.

In reply to a question from Mr. Cole, as to keeping parks open on Sunday, Mr. Allen said that the two parks already mentioned are opened on Decoration Day and are kept open every Sunday until the Monday before the Fourth of July, and then are open every day of the week until Labor Day. The season runs practically from the first of July to Labor Day. The man who operates the licensed park has an orchestra for dancing every afternoon, and this orchestra is augmented on Saturday afternoons and Sundays.

C. F. Seixas, of St. Catharines, Ont., asked whether the operating department received any credit for transportation issued to newspapers. His company had an advertising account, but treated such transportation in the same way as other complimentary tickets, except that press tickets are printed on a different color, so that the cashier can distinguish press tickets from other tickets. He credits the operating department and charges to the advertising department the amount of this newspaper transportation.

Mr. Allen thought it unwise to put a restriction or a cash value upon the advertising given to the papers, or upon the transportation issued to the newspapers.

Mr. Seixas realized the force of Mr. Allen's argument, but said that every ticket issued by his company is charged to the account of some department. For instance, some free transportation is given when getting freight business, but that transportation is charged against the freight department and credited to the operating department.

J. H. Pardee, of Canandaigua, said that he had an arrangement with the Rochester papers to give them two annual passes, besides giving them mileage books for unlimited use by one or more people. These mileage books are charged to newspapers at face value and whatever advertising his company uses is charged back. The papers use all the transportation they want and credit the railway with the mileage books against the charge for advertising. If the balance is in their favor, they get more transportation and if in the railway's favor the latter does more advertising.

In connection with this question, Mr. Allen made a comparison between the value of the dead-head business issued to the account of advertising contracts to that of the total dead-head business. The latter averages $30 a day, including employees' tickets and other complimentary transportation, making a yearly total of about $12,000, while the advertising transportation is only $4000 a year.

F. W. Bacon, of Fort Lee, N. J., said that his company issued a monthly card in the form of a handsomely gotten up calendar, which has been found a valuable source of advertising. People who do not get this card month after month will call for it at the office or write in large numbers. In addition to this feature, as his line is an interurban road, large schedule boards are placed at prominent traffic points in the different towns. The company has also bill-posting boards, about 30 ins. x 30 ins., on which it advertises its business during the summer and in the winter leases the boards to the New York theaters.

Referring to the question of sale of liquors at parks, Mr. Fairchild said the matter depended very largely on the class of people served. One large company has solved the question nicely. Its park is probably one of the most elaborate and best conducted pleasure resorts of its kind in the country, and a strong point is made of the fact that no liquors are sold, so that women and children are free to go there at any time. However, private parties have put up, outside the limits of the park, a well-conducted hotel where a full line of liquors are sold, so that any visitor to the park who wants something stronger than the park water can very easily get what he wants. This keeps liquor out of the park. Mr. Danforth said that this solution of the question seemed to him like beating the devil around a stump.

Mr. Fassett agreed with Mr. Allen on parks, saying he did not believe that the park business is a healthy one for street railways. In the five cities reached by his company it was the policy to rather discourage picnics and excursions and try to turn them over to the steam roads, which can handle them by putting on longer trains, but as far as concentrating many trolley cars at one point and interfering with regular travel is concerned, he did not believe that to be good railway business. It seems to him to be very much better to get a factory established at some outlying point or promote a building boom, which would result in constant business. So far as passes are concerned, his company has none except for employees. He saw no reason why passes should be given to city officials or policemen and firemen. The latter are better paid than many other citizens, but while his company would have no particular objection to policemen and firemen riding while on duty, it refused this privilege for fear of its being abused.

Mr. Wilcoxen asked Mr. Fairchild whether the accidents he referred to occured at the terminals or between them, and was told that they usually occur at the loading and unloading points, both at the park and in the center of the city, where the crowds make a rush when getting on or off, especially on open cars with running board.

Mr. Pardee opened the discussion on interchangeable coupon books by reading the following paper on "Interchangeable Coupon Books." Mr. Pardee had a number of sample books used in the Central West which he passed around for inspection.

INTERCHANGEABLE COUPON BOOKS

During the past few years many of the principal cities and villages in New York State have been connected by interurban electric railroads, and in a few years more the present gaps will be closed, and through electric train service will be possible from New York to Buffalo, as well as along the through lines of travel in the southern part of the State. Commercial travelers find electric roads quicker and more convenient than steam roads, and as the electric lines are extended they will be patronized by commercial men more and more. Each electric railroad has its own basis and system of fares, and while the basis and system are not the same on all roads, yet there is a considerable uniformity and practically all of the electric lines are approximately on the same basis and system. A few of the electric lines are issuing and selling to their patrons books which correspond in theory to the mileage books of the steam roads. Some of the lines are issuing straight mileage books which are identical with the steam mileage books, and others are selling coupon books which contain certain numbers of five-cent coupons entitling the holder to five cents' worth of transportation for each coupon contained in the book. It would seem that if an interchangeable coupon book, good on all of the interurban lines of the State could be issued, such a book would be appreciated by the traveling public generally and particularly by commercial travelers, and that increased business would naturally result.

Several of the interurban lines of Illinois last year formed an association called the Interstate Electric Railway Association for the express purpose of issuing interchangeable coupon books good on all of the roads joining the association. The roads joining signed a contract covering all of the details of the issuance and use of a book which contains 120 five-cent coupons and which is sold at a price of $5. The settlement of the revenue derived from the sale of the coupon book tickets is taken care of as follows:

All foreign coupons collected by companies parties to the contract shall be mailed to the company issuing same, not later than the fifth day of the calendar month following the month in which they are honored. A statement shall be rendered for the coupons so sent on a basis of 83 1-3 per cent. of their face value, duplicate of which statement shall be forwarded by the same mail to the chairman of the association, and a remittance for said statement, if correct, shall be made by the issuing company not later than the 10th of the same month. Provided, however, that the settlement between two companies, each of which has mailed a statement to the other for the same month, shall be made by a payment of the balance.

The conditions attached to the coupon books and made a part of the contract for selling provides substantially as follows:

First—The holder of the book is entitled to receive an aggregate of $6 worth of transportation.

Second—The company acts only as agent for the sale of such transportation as may be used over the lines of any other company.

Third—Coupons must be detached by conductor.

Fourth—Sufficient coupons at their face value shall be detached to cover the local cash fare and not less than two coupons shall be accepted for any distance.

Fifth—Baggage can be checked only under the rules of the company over which the ticket is used.

Sixth—The book expires one year from date of purchase.

Seventh—The ticket is a bearer ticket, and is good for the use of any one person, and the person presenting the book shall be considered as the owner thereof.

Other usual conditions are attached, but are not important.

Fifteen of the interurban lines of Ohio and Indiana formed a similar association, called the Ohio-Indiana Railway Association, for the issuance and sale of interchangeable coupon tickets. The books issued by this association and sold by the subscribing companies are on the same plan as the Interstate Electric Railway Association, except that the books contain 240 coupons, or $12 worth of transportation, and are sold for $10. The conditions attached to these books are more severe than those attached to the books of the Interstate Electric Railway Association in the particulars that the book is good only for the transportation of the purchaser and that the purchaser must identify himself or herself by writing his or her name on the back of the coupon strip detached. The roads comprising the Ohio-Indiana Railway Association, as I am informed, make monthly settlements for tickets sold and redeemed through the equivalent of a clearing house.

It will be noticed that the reduction of the rate of transportation is equivalent to 16 2-3 per cent, and the writer has had the rate sheets of several of the New York State interurban lines analyzed and finds that this reduced rate nets approximately the rate of round trip tickets. In other words, the holder of one of these books will be enabled to receive one-way transportation at approximately the same rate as the round trip transportation. The recommendations of the writer are that the interurban lines of the State of New York join in the issuance and selling of an interchangeable coupon-ticket book which will contain 240 five-cent coupons at the rate of $10, subject to the following conditions:

First—That the book is good for one year.

Second—That the book is good in the hands of any person and for any number of persons.

Third—That there shall be detached sufficient coupons at their face value to equal the one-way ticket rate.

Fourth—That not less than two coupons shall be detached for any distance, however short.

Fifth—That tickets shall not be good for the transportation of baggage unless permitted by the regulations of the company over whose lines it may be used.

Sixth—That expired or unused coupons may be redeemed only by the company issuing same is presented within eighteen months from the date of issue but only on the following basis:

Full fare or face value shall be computed on all of the coupons which shall have been used. The balance of the original purchase cost shall be the value of the redemption.

The writer would recommend that the system of monthly settlement by the different companies be the same as pursued by the Interstate Electric Railway Association, that is, that each road receives or remits balances with every other road. These coupon-ticket books, as issued by the associations named, are in the same general form as the steam road mileage books, and cost to manufacture from six cents to seven cents, in lots of one thousand.

Mr. Shannahan expressed his appreciation of Mr. Pardee's paper and said it seemed to him that the interurban lines are bound to meet in the future and adopt some common form of mileage transportation. He wanted to ask Mr. Pardee what he meant by the tickets being good for only one year. Would that be held constitutional? For instance, his company sells a ticket which is good until used and why should this not apply to a book of coupons?

Mr. Pardee thought that because a coupon book is sold at a reduced rate some limitation can be placed on it. Personally, he was not especially in favor of the one-year limitation. On his road straight mileage tickets are sold at the rate of 1000 miles for $12, without any limitation as to the number of persons, except that not less than four coupons (5 cents) be taken as a minimum fare, and that if a book is redeemed the part used is figured at the rate of 1½ cents a mile, the holder getting the balance. He believed that the fewer restrictions placed on a coupon book the more successful it will be.

Mr. Shannahan thought that the use of round trip tickets and other forms of transportation for which the cash goes through the ticket office will be a very decided advantage.

Mr. Sheehan, of the Buffalo & Lockport division of the International Railway Company, said his company had a commutation book good only for the holder, but found that two or more persons tried to use one book, and that transportation would be sold at reduced rates by cigar dealers and other storekeepers who bought the books and sold them to their customers. It was, therefore, necessary to put in force very severe restrictions to confine the use of these books to the parties to whom they were issued.

Mr. Pardee said that a distinction should be made between commutation and mileage books, as they are not supposed to be the same. His company has commutation books and the rate of fare decreases with the distance. On a 28-mile ride a fifty-four trip book averages 23 cents. He had learned from J. H. Merrill, secretary of the Central Electric Railway Association, that the mileage book used by members of that association had worked out for the great benefit of the companies. He knew that on his own road a great deal of travel is obtained through the mileage books, which are good for any number of persons. If an interchangeable coupon book can be put into the hands of commercial travelers which they need not sign and can use on any convenient electric railway, they will not ride on the steam roads when they can go by trolley.

As an example of steam railroad practice, Mr. Shannahan mentioned the New York Central. The latter issues a mileage book which it sells for the straight rate of two cents, and good for any number of persons. It also gives commutation rates very much below the mileage rate. Tne rate of less than one cent a mile is based on one person riding every working day or school day of each month, but the theory of the mileage book is entirely different.

Mr. Stevens, of the Albany & Syracuse Railroad, said that his company has been using some form of mileage book for some time. It has been so successful that it is thinking of adopting a book with different kinds of tickets. The company issues a $10 book for $8, and is thinking now of issuing a $5 book for $4.50, in order that the people who do not live near the ticket stations may have the advantage of the mileage rate, and that the ticket sales may make up the greatest portion of the receipts. There was only one thing in Mr. Pardee's recommendations to which he took exception, namely, in regard to using the book for any number of people.

Mr. Allen expressed himself as a firm believer in a form of joint coupon book which will accomplish what Mr. Pardee had outlined in his valuable paper. He did not think it should be confounded with commutation rates. He did not believe in commutation rates on trolley roads, thinking that if the whole public is offered the lowest fare possible, and with as few restrictions as possible, the company will be giving the public the most it can for its money and the public will purchase the most transportation it can use. The book coupon should have such a value that it would meet the rates of fare that are practically uniform in New York State. There should be no restrictions as to when, where or by whom used, or on what class of trains the book will be accepted. With a mileage or round-trip ticket, the operation of fare collection is comparatively simple and certainly is a great convenience to the passenger, conductor and railway. He hoped that not only the interurban roads, but the city roads of New York State, would join in issuing a joint interchangeable coupon book.

C. L. Wilson, of Toronto, said that on the interurban roads out of Toronto his company sells a family commutation book and has found that the conductors have a way of accommodating their friends with these tickets. He has recommended to the management that they be done away with; that the regular fare could be reduced somewhat and a 10-fare ticket sold in lieu of commutation books. He liked the coupon book idea and believed many interurban roads could use it to advantage. His company is seriously considering doing away with commutation books on account of their abuse.

Mr. Shannahan then moved that a committee of three be appointed to take up with all the companies in New York State the question of adopting an interchangeable coupon book; to draft a form of contract; and to report at the annual convention in June. The motion was carried.

The meeting then adjourned for luncheon.

It is stated that a syndicate of Chicago capitalists, represented by R. H. Springer, are having a survey made for an electric railway from the Cuernavaca line of the Mexican Central to the city of Chilpancingo. The syndicate has options on more than two million acres in the valley of the Rio Balsas. If these lands are purchased, they will be colonized with American farmers. The electric power for operating the railway will be furnished from waterfalls.

CORRESPONDENCE

THE WARD LEONARD SINGLE-PHASE SYSTEM

Bronxville, N. Y., March 30, 1906.

Editors Street Railway Journal:

In your issue of March 24, you published an abstract of the paper by Mr. Lamme on "Alternating Current Electric Systems for Heavy Railway Service," with discussion. In his paper, Mr. Lamme first took up my system and with great particularity of figures has given the weight, losses, etc., of the motor generator required for a locomotive on my system which would be equivalent to the Westinghouse-New Haven locomotive. It will probably be unnecessary to say that Mr. Lamme has presented my system in the most unfavorable light possible, and as my silence under the circumstances might be misinterpreted as an admission that his presentation of my system was a fair one, I request the opportunity of using your columns to direct attention to a few pertinent facts.

Any fair comparison between my system and the commutated single-phase alternating system demands not merely exaggerated figures as to the weight, cost and efficiency of my motor generator, but complete data as to both systems, including figures showing the weight, cost and inefficiency of the alternating-current motor. Upon this subject Mr. Lamme is significantly silent, although it is the vital part of the Westinghouse locomotive, and one upon which he is no doubt able to give exact information. My present belief is that at the same speed, ventilation, horse power and other determining conditions, the losses would be 100 per cent greater in the commutated single-phase motor than in the direct-current series motor and that its weight would be about 50 per cent greater. As to the equivalent propelling motors in my type of locomotive, these motors are more efficient than even the best forms of direct-current series motors.

Had Mr. Lamme directed attention to the light weight, high efficiency and small size of his motors, upon which he had exact information, it would have been more convincing as to the superiority of the Westinghouse locomotive, than to magnify the alleged defects of a certain portion of my system, while leaving its best points unnoticed.

The figures Mr. Lamme gave as to my system might have applied to it about 16 years ago, when I invented it, but they are completely out of date to-day. It seems evident that progress is possible during 16 years along the lines of my system, as well as along the lines of commutating series alternating motors. On account of unpublished inventions which are involved, I cannot give full details on this subject. For the present, it may suffice for me to say that instead of 54,000 lbs. 25,000 lbs. would be a fairer figure at which, at present, to estimate the weight of the apparatus needed to convert the alternating current into direct current, and that there is a corresponding reduction in the losses stated by him.

Having recently received full and accurate engineering data regarding the Ward Leonard-Oerlikon locomotive, which has been in successful operation for more than a year, I can confidently say that even basing the figures on this locomotive and its performances, it will compare favorably with the Westinghouse locomotive, as far as the published facts enables one to judge. This Ward Leonard-Oerlikon locomotive was designed for freight haulage, a type much more difficult to design and somewhat heavier per horse-power than the passenger locomotive type, on account of the gear reduction.

A Ward Leonard-Oerlikon locomotive capable of exerting 800-hp maximum output, measured at the rails, has a total weight of 97,000 lbs., all on drivers. There are 121 lbs. on drivers per horse-power at the rails, based upon the maximum output, which compares favorably with the best modern freight locomotive practice, in which there are about 125 lbs. on drivers per indicated maximum horse-power in the cylinders. The present selling price of a Ward Leonard-Oerlikon locomotive F. O. B. works is about 20 cents per pound, if only one is ordered.

I estimate that if locomotives of the Ward Leonard type should be manufactured in large enough quantities to make comparisons with steam locomotives fair, the price per pound would be 9½ cents, which I arrive at as follows:

	Cents Per Pound
Motor generator	10.0
Propelling motors	12.0
Average of total electric equipment	11.6
Mechanical equipment, including trucks, driving axles, etc.	7.0
Average price of total locomotive when manufactured in large quantities	9½

The importance of the multiple control of several locomotives acting on one train can hardly be overestimated. Mr. Lamme's silence as to the multiple control of locomotives of the Westinghouse type is certainly significant. My system of multiple locomotive control, which I described and patented some five years ago, consists essentially of four small wires along the train and a field rheostat on each locomotive. Here is an advantage in weight, reliability, simplicity, first cost and efficiency in my system for heavy traction which more than compensates for all objections that can be raised against the motor generator.

In speaking of the great importance of increasing the train power by multiple locomotive control, Mr. Townley said, in discussing Mr. Lamme's paper, "The result is to secure an increase of track capacity, which is of even more importance in congested districts than the question of train or engine mile costs." For evident reasons Mr. Lamme does not compare my system of multiple locomotive control with that of the Westinghouse Company.

As to frequency, it is possible to use any frequency with my system up to 50 cycles with perfect results. This may be of great importance when electric lighting is to be supplied from the same source, which will certainly be desirable. As to the propelling motors, which of necessity are subjected to the worst treatment and must operate with the minimum of attention, my motors are better in this respect than any other form of commutator motors, as the type is the best possible for sparkless commutation and the voltage can be selected at any desired amount to suit the best design, and since the armatures and field circuits are never necessarily opened there is a complete absence of the destructive sparking which is met with in larger motors, and which is due to the usual barbarous opening of these circuits in the use of the usual series parallel control.

The perfect division of the load between all of the motors, especially during starting and acceleration, is also a matter of great importance, and in this feature my system has great superiority over any system employing series motors, especially when such motors are in series with each other. This latter arrangement is the worst engineering possible for locomotive practice, and leads inevitably to the power-equalizing parallel rod and the rigid wheel base, which is one of the most objectionable features of the steam locomotive, and should be, and can be, eliminated from the electric locomotive.

The importance of being able to restore energy at any and all speeds while upon down grades and for braking, is now no longer questioned. As to such energy restoration, Mr. Lamme, speaking of the Westinghouse locomotive system, says: "A number of ways of doing this in a more or less successful manner have been tried."

This feature is inherently and automatically present in my system without any additional apparatus and by the simplest methods. This feature increases the efficiency, reduces the cost of the generating and transmitting plant, increases the load factor of the generating plant and effects an important saving of brake shoes, tires and rails. My single-phase system is the only one which has this important advantage. In other words, that feature is essentially mine, as the patent records show.

A matter of great importance in all locomotives, and especially freight locomotives, is the ability to secure the maximum tractive effort for starting the load with a certain weight on drivers. That is, it is of great importance to secure the highest possible coefficient of traction. The torque should be absolutely smooth and under perfect control by the most gradual increase and decrease and the torque and speed should be practically independent of each other. By my system, with the train at rest, the torque can be gradually and smoothly raised until the load starts, or the wheels slip. If a certain pair of wheels slip they do not run away in speed, and they have no effect in reducing the torque of others, as in the case with two motors in series. The slipping pair of wheels grind slowly around, exerting their maximum torque and a slight adjustment of the controller reduces the torque to a static pull once more. No series motor can have this important property and two series motors in series with each other make the worst combination imaginable, for maximum traction.

Notwithstanding Mr. Lamme's statement that there is no essential difference between the single-phase and the continuous current as to maximum traction for a certain weight on drivers, this still remains unproven and apparently unreasonable.

Mr. Lamme states that the employment of my system necessitates a complete and separate complement of d. c. controlling apparatus. I grant that the Westinghouse locomotive requires this, but I deny that my locomotive does, but as unpublished inventions of mine are involved in my denial, I cannot explain my position fully at present.

Recalling the high speed of the single-phase motors and the air blast needed to carry away the unusually large amount of energy wasted in heat, it seems appropriate to point out that the weight per horse-power of continuous current motors can be reduced in the same way, and to the same degree, and that, therefore, speeds and ventilation must be equalized before fair comparisons can be drawn.

I presume that the two static transformers, which the Westinghouse locomotive has and which mine has not, can fairly be assumed to weigh something and cost something at 25 cycles, and I do not suppose that any one will contend that "six operative voltages" are as good for locomotive practice as a practically unlimited number.

I trust that I have made it clear that a comprehensive electric railway system cannot be fairly judged merely from exaggerated figures as to the weight, cost and inefficiency of one element, such as my motor generator, and that especially is it unfair to attack one element of a competing system by specific hypothetical figures and withhold all information of real importance as to the system advocated by the writer. Mr. Lamme is no doubt able to give convincing figures on the weight, cost and efficiency of the single-phase motors he has designed and tested, but he is discreetly silent on this subject. But he gives with exact definiteness such figures as to my system, which he has never designed, built or tested

During the past fifteen years, this system of mine has been struggling for existence in the survival of the fittest. About 1893 three of the leading engineers of the General Electric Company reported upon it in writing. The first said that no generator could be made for use on the system, although a large number of Edison generators were in fact then operating perfectly on the system. The second engineer said it would be impossible to restore energy from full speed to rest, or to reverse, by reversing the field of the generator. The third said that the conversion of energy on the train in order to secure voltage control of the speed was undersirable, unnecessary and uncommercial. A few years later my system was completely exterminated on the floor of the A. I. E. E. by exactly such figures as Mr. Lamme now presents. But after being apparently successfully killed in this country, it was born again in England, Switzerland and Sweden, where leading engineers, about 1902, pronounced the Ward Leonard system the best then available for comprehensive railway electrification.

For many years past the Ward Leonard system, which consists essentially in the conversion of the high-tension energy on the locomotive instead of in sub-stations, and voltage-speed control instead of series-parallel and rheostatic control, has been ignorantly ignored by those who have so successfully obstructed progress in electric railway matters by forcing the sale exclusively of their standard, obsolete, patented, series parallel, low-tension system. I merely direct attention to this, but can not complain of it, for I very much appreciate the open field I have enjoyed in the patent office and expect to profit from it in many ways.

Fortunately there are at present unmistakable signs of the dawn of a brilliant day in electric railway engineering, for the steam railways are beginning to employ electrical engineers, who owe nothing to, and care nothing for, the electrical engineering and patent trust.

Mere manufacturers will not, much longer, control the electric railway engineering in this country, for trunk line electric traction involves interests so large and so varied as to insure, in the immediate future, competent engineers who will tell manufacturers what they shall make for them and will not say "what have you in stock?"

The United States Navy electrical engineers have thus far been the only ones in this country who have intelligently specified their wants, and insisted upon the best, and wherever they have operated they have raised the standard to the highest in the world. It is significant in this connection that, notwithstanding the cost, weight and inefficiency of the motor generator, the Ward Leonard system was specified some ten years ago by the Navy officials against the strenuous efforts of the manufacturers and after annual assaults by unsuccessful experiments, the turrets, some of which weigh 600 tons, are still operated by my system.

In conclusion, in order to test Mr. Lamme's willingness that a fair comparison should be made, I now offer to supply to your paper, for immediate publication, complete data and curves showing the actual performance, efficiency, etc., of the Ward Leonard-Oerlikon locomotive if he will publish equivalent data in the same issue as to the Westinghouse-New Haven locomotive, which has been tested.

H. Ward Leonard.

TESTING ARMATURES IN THE WINDING ROOM

March 23, 1906.

Editors Street Railway Journal:

I was amused at an article headed: "Testing Armatures in the Winding Room," in your issue of Feb. 10. The incident quoted was the result of gross carlessness or incompetency of the armature winder; no one can deny that. The company by whom I am employed has on its system about 1600 armatures. Two men, who are competent, rewind these armatures, and are assisted by two apprentices. We have no need for any testing apparatus other than a lamp bank of 1 amp. at 550 volts, and never have had any such trouble as that quoted.

The writer has wound armatures of all descriptions for the last ten years and has never tested out the coils of single coil armatures, but when there are two or three coils in a slot, those in each slot are tested for shorts.

The practice of some railway companies and manufacturers of giving their machines a ground test of from 2800 volts to 3500 volts a. c. is injurious in my opinion. In several cases factory armatures have grounded with us before they turned a wheel, having probably been weakened by the factory test.

A joke was recently played in this shop on a car house foreman, who returned an armature to the winding-room because he said it would only run one way. We disconnected a few leads on opposite sides of commutator and tested them for proper connection and found them to be O. K. We then resoldered the leads which we had removed, and returned the armature to the car house. The next day it was returned and the foreman reported the same trouble, although the armature was tried in another car. We then defaced the number on the end of the armature shaft and stamped on another number. The armature was then put in a car, and has done service for the last six months. The foreman, knowing the number, which was 1009, inquired what we had done with it. He does not know yet.

Armature Winder.

PILOTS OR FENDERS FOR INTERURBAN CARS

Boston, March 26, 1906.

Editors Street Railway Journal:

In regard to the question as to whether or not pilots are desirable on interurban cars, as discussed by Mr. Boynton in your issue of March 3, the writer wonders why some one has not mentioned fenders as possible alternatives. The fender is usually considered applicable only to city cars, but many interurbans in the Central West, particularly those radiating from Toledo, Ohio, use them almost exclusively. There is, of course, considerable difference between the horizontal, flat fender, largely used in the East, and the modern interurban fender. The latter is capable of picking up a horse or cow from the track when the car is going at full speed, and carrying it until the car can be brought to a stop, thus proving a better "cow-cather" than a pilot.

As far as appearance is concerned, the pilot has the advantage. It is also of more use than a fender in pushing inanimate objects from the track, thus preventing derailment. Its first cost is also less, though, when one considers damage claims likely to arise, the fender should prove more satisfactory in the end, for when a pilot would injure or kill a man, a fender would pick him up uninjured. A pilot requires none of the attention which must be bestowed on a fender, but many objections to pilots, such as snow piling up under the rear pilot of a double-end car, do not apply to a fender.

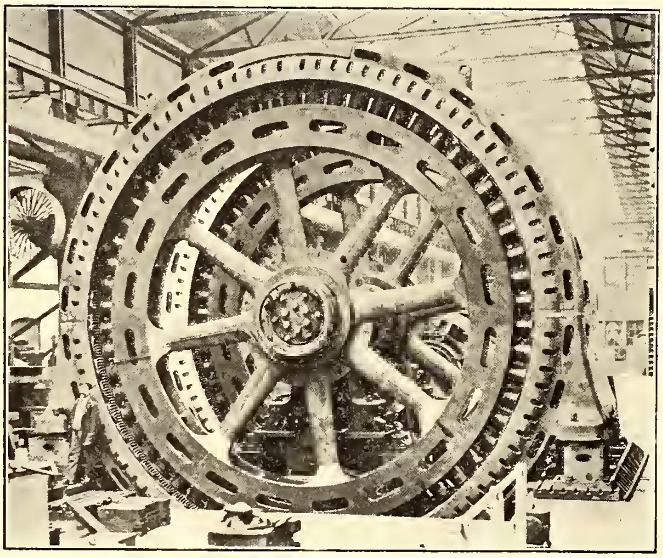
The writer does not know of any laws requiring pilots on interurban cars. If any exist, they probably specify fenders; in fact, there are several Ohio towns which have forced, or are trying to force, interurbans to exchange pilots for fenders. An interurban road of heavy enough construction to use multiple-unit trains, ought to leave fenders alone and use pilots, if anything. But, for light railways running partly upon highways, and with numerous grade crossings,—such as are still quite numerous in spite of the remarkable advance in heavy construction and reconstruction in the last few years,—the fender is the best suited, as a protection to the public, and a means of avoiding unnecessary damage suits.

K. P. Armstrong.

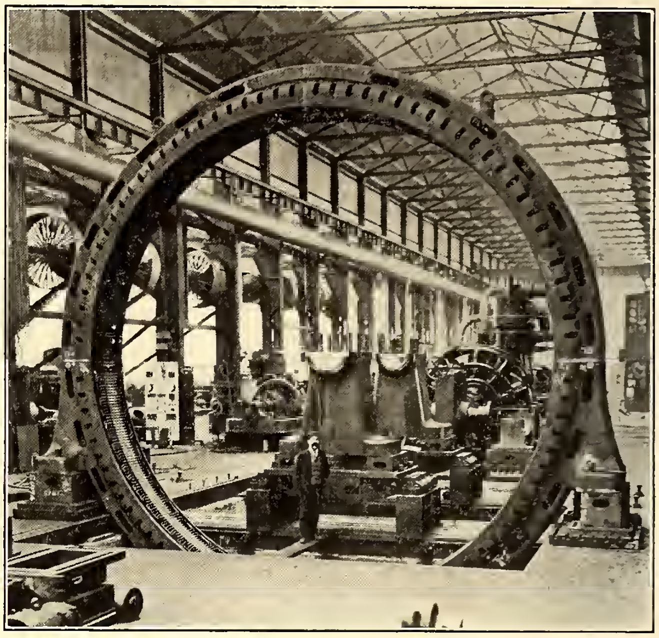
LARGE ALTERNATORS FOR JOHANNESBURG

Siemens Bros., Ltd., of Stafford, England, have just completed four two-phase 50-cycle alternators for the Johannesburg municipality. Two of these are for 1350 kw 3300 volts, and run at 100 r. p. m., and two are for 675 kw 3300 volts, and run at 125 r. p. m. The company recently invited a number of technical journalists to inspect the new machines at the company's works at Stafford, and during the visit the accompanying notes were obtained:

These alternators are designed for direct coupling to gas engines, to the specification of Messrs. Mordey & Dawbarn, and had to fulfill the most stringent guarantees. The temperature rise was guaranteed not to exceed 50 degrees F. in any part, after running for 12 hours at full load, and this temperature rise was not exceeded on test. The size of the machines was determined principally by the low excitation loss and the small rise of voltage on throwing off the load required by the specification. The 675-kw sets, which are not shown, have an excitation loss of only 1.1 per cent of the output. When running at full load on a .75 power factor the rise of voltage on throwing off the full non-inductive load is only 4½ per cent. Similar results have been obtained on the 1350-kw sets.



1350-KW TWO-PHASE ALTERNATOR FOR JOHANNESBURG, SOUTH AFRICA



STATOR FOR 1350-KW TWO-PHASE ALTERNATOR FOR JOHANNESBURG, SOUTH AFRICA

The stator frame is of cast iron and combines great stiffness with minimum weight. It is efficiently cooled by the current of air set up by the rotor, which escapes through the holes in the side protecting flanges and the shell of the frame. The frame is cast in four pieces, which are held together by concealed bolts. The stator plates are firmly clamped by means of insulated bolts between two cast steel angle plates, which are fixed to the stator frame by means of bolts and adjustable sleeve nuts, making it unnecessary to machine the inside of the stator frame. The core is built up of laminated stampings, insulated on both sides; the slots are open with grooves to receive wooden keys to hold the former wound stator coils firmly in place. This construction allows the coils to be thoroughly insulated before they are slipped into position, and also provides for repairs or renewals being easily made. The coils are insulated with mica moulded on to the straight part. This tube of mica, when the coil is in position projects a sufficient distance beyond the stator core to ensure a leakage distance sufficient for the voltage of the machine.

The ends of the coils are taped with special oiled tape, and, being very rigid, they are kept well away from all parts of the frame or core and thus have an ample air insulation. They are thoroughly protected by the shields on the frame without interfering with ventilation.

The rotor consists of poles attached to a cast steel wheel, the rim of which is of U section. The wheel is cast in four pieces. It is provided with spokes and is strongly ribbed inside. The divisions are made through the spokes in order to avoid the large bending moments due to unsupported lengths of rim and the segments are held together by shrunk keys inside the rim. Lateral movement is prevented by round keys fixed in the rim. The hub is held together by shrunk rings.

All poles are round and mounted on flat circular facings on the periphery of the fly wheel. They are held to the wheels by screws passing through the fly wheel from the inside, the screws being provided with lock washers to ensure their not working loose. The pole itself is prevented from turning by a steady pin. The pole shoes are of thin stampings, securely riveted together, and are attached to the pole by means of four countersunk screws which are locked into position after being tightened. The rotor coils are wound on metal formers which fit the poles, a flange on the pole itself holding them in position against centrifugal force. The construction is of great mechanical strength and suited to high peripheral speeds. Should a rotor coil be damaged, it can easily be replaced by taking off the pole, and the stator windings can also be easily removed.

From the stator coils, leads are taken to porcelain terminals mounted on the underside of the stator frame. They are readily accessible and yet out of all danger from casual or accidental contact. The stator coils are also so placed that should moisture collect on the machine from any cause, they are thoroughly protected. From the rotor coils, leads are taken to the slip-rings.

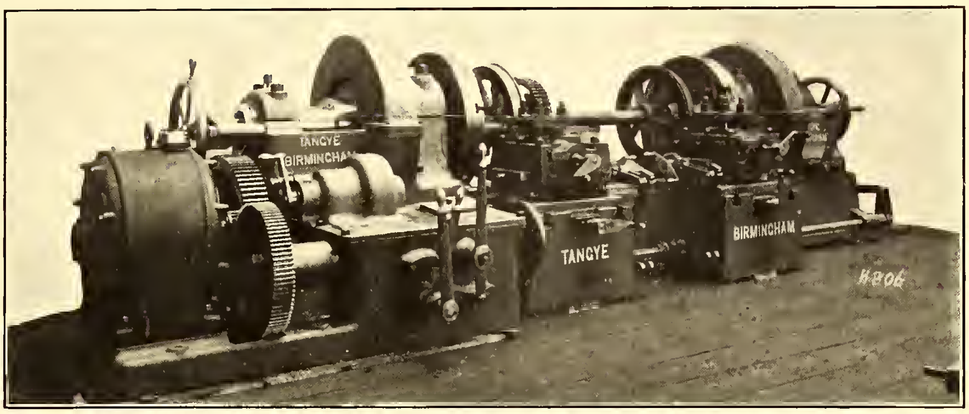
The slip-rings are of brass and are supported on insulated pins which are screwed into the boss of the rope wheel that drives the exciter. The current is collected from these by means of two carbon brushes on each ring, so that one can always be lifted off or replaced without in any way interfering with the operation of the machine. The current flowing through the carbons is kept at a low density, thus insuring small wear and absence of glowing and pitting.

WHEEL-TURNING LATHE FOR LONDON

The lathe shown in the accompanying cut is made by the Tangye Tool & Electric Co., of Birmingham, England, for turning worn tires of hard steel, and will take two cuts at the same time, one on each tire, $\frac{3}{8}$ ins. deep x $\frac{1}{8}$ in., traverse at speeds which vary from 15 ft. to 30 ft. per minute, depending upon the hardness of the tires.

The bed is 3 ft. 5 ins. wide x 20 ft. deep, and 15 ft. 4 ins. long, and has the pockets carrying the slide rests cast with it. The left-hand headstock is fixed, but the right-hand one is adjustable along the bed to suit the different lengths of axles.

The spindles are 14 ins. diameter x 14 ins. long in the front bearings, and $8\frac{1}{2}$ ins. diameter x 10 ins. long in the back bearings, and have the driving plates cast with them. The bearings are of special hard gun-metal, and adjustable. Steel tail pins are provided to take the end thrust. Each of the spindles is bored out and has sliding inside it a steel barrel 9 ins. in diameter, which is moved in or out by large hand wheel, and carries a special split cone for carrying the axle from the bearing seats, thus ensuring rigidity under heavy cuts, and avoiding the use of centers, which would not be suitable for the heavy cutting. The drivers are of cast steel with large pins, and the wheels are close to the face plate; in the small wheels, which have solid bodies, special holes and suitable drivers are provided to ensure steady driving, and in all parts great care has been taken to ensure the steady running and absence of all vibration.



WHEEL TURNING LATHE FOR LONDON TRAMWAYS

The driving of the lathe is from a 36-hp E. C. C. alternating-current motor by means of a rawhide pinion and spur wheel, to a variable speed gear box, which also carries the motor, so that they are self-contained. The gear box has all its gear wheels enclosed, and the changes of speed are made by levers in the front. From the gear box the drive is by spur gear to a 6-in. diameter forged steel shaft carried in adjustable gun-metal bearings in the bed, on which are forged steel pinions working into forged steel rings on the spindles. The whole of the gear is machine cut from the solid, all the pinions and most of the wheels being of steel, and suitable gear covers are provided. The maximum purchase of the gear is 720 to 1, and six changes of speed are provided, ranging in regular order from 1 to 6 r. p. m. of the spindle.

The slide rests are arranged to carry $1\frac{3}{4}$-in. square tools; they have large square slides throughout, the number of joints has been reduced to a minimum, and the rests can be adjusted by screw on the bed to support the tools close to the cutting edge even when turning small wheels. Each rest has an indexed swivel for turning the correct cone on the wheel treads. The feed motion gives traverses of 1-16 in., $\frac{1}{8}$ in. or 3-16 in. per revolution. The levers and connecting rods are of exceptional strength and each rest can be separately adjusted to give any of these traverses.

The illustration shows the lathe standing on the shop floor, but when in use it is sunk in a pit so that the top of the bed at the back is on a level with the ground, thus permitting the wheels to be rolled into the lathe, and raised to the center of the lathe by means of an elevator in the bed.

When tested on the shop floor, without any foundation, the lathe took cuts on hard steel tires of 7-16 in. deep x $\frac{1}{8}$ in. traverse at 25 ft. per minute, and on the wheels shown in the view of the lathe, which were 28 ins. in diameter on tread, it reduced the thread to $27\frac{1}{4}$ ins. diameter, and rounded the flange on both wheels in about 15 minutes, which is an exceptional result on such hard material.

The lathe weighs nearly 18 tons, and was supplied to the tramway department of the London County Council for use in the repair shop at New Cross Tramway Depot.

A NEW ONE-FARE RECORDING REGISTER

The Ohmer Fare Register Company, of Dayton, Ohio, complying with the request of a number of managers of street railways in the larger cities, is now manufacturing a recording register for one fare. It is operated with the ordinary rod or cord, prints the number of fares by the trip, the day, the month, the direction, the number of the machine and the conductor's number. This invention is being built under the original Ohmer patents for recording machines, and along the lines of the several larger types of registers, for recording a plurality of fares, which the company has been building with so much success during the past ten years. The record sheets in this new machine are clearly printed and easily removed. It is a strong and complete register for recording one fare.

It resembles, somewhat, the new two-fare recording register built by the Ohmer Company and which was described in the Street Railway Journal of March 3, 1906.

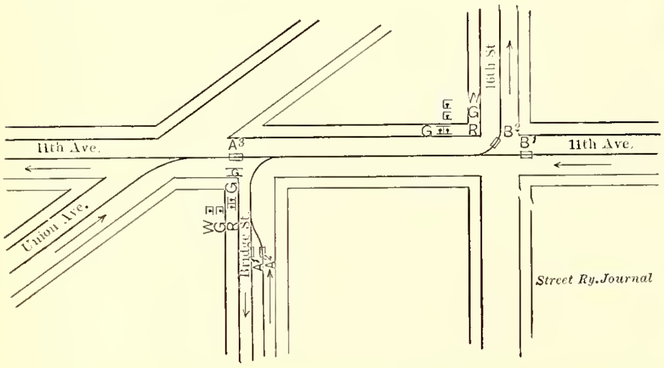
BLOCK-SIGNAL AT COMPLICATED CROSSING

A very interesting installation of the Eureka automatic electric signals has been in operation for some time at a complicated wiring on the Altoona & Logan Valley Electric Railway, at Altoona, Pa. This particular set is located on Eleventh Avenue, between Sixteenth Street and Bridge Street, Altoona, at a point where service is complicated and very frequent, and where buildings shut off the entire view around the corners, as shown by the accompanying diagram.

The Broad Avenue cars and the Hollidaysburg cars, on eight and fifteen-minute schedule, respectively, come in Union Avenue, up Sixteenth Street, and after passing around a loop, go back over Eleventh Avenue. The Seventh Avenue cars, on eight-minute schedule, come in on Bridge Street at the end of the double track, pass up Sixteenth Street and similarly return down Eleventh Avenue and out Bridge Street. The Eighth Avenue and Juniata cars, each on eight-minute schedule, also pass over this section in opposite directions on a belt line; the former coming in on Bridge Street and up Sixteenth Street, while the latter go out Eleventh Avenue and Bridge Street. Besides this regular service, three or four extra cars may pass over this block at various times during the day. Under such service three or four cars are often in the block at the same time, while as many may be waiting to pass in the opposite direction.

The circuit makers are located as shown in the diagram. At the end of the double track on Bridge Street, and on the corner of Sixteenth Street and Eleventh Avenue are the governing colored lights, white, green, and red, facing outward from the block, and on the corner of Eleventh Avenue and Bridge Street is an intermediate green light that can be seen from each direction on Eleventh Avenue.

A car, for instance, entering the block at either Bridge Street or Union Avenue, gets a white light at the Bridge Street end as it crosses A2 or A3. In series with this white light, are four others, the intermediate light, a green light facing inward at Sixteenth Street, and red and green lights facing outward against cars going out Eleventh Avenue. Successive cars entering in the same direction simply alternate



COMPLICATED LAYOUT OF INTERSECTIONS AT ALTOONA, PA., PROTECTED BY AUTOMATIC SIGNALS

the white and green lights at the entering end, while all the other lights remain burning, and remain so until the last car has passed out under B2, or out of the block under any of the circuit makers.

Similarly, cars entering at Eleventh Avenue and Sixteenth Street under B1 get white or green at that end, the intermediate light, the green facing inward, and the red and green facing outward against cars coming in Bridge Street. A car coming in Union Avenue cannot see the red at this end of the block but sees the intermediate light burning. It can cautiously proceed to the corner far enough to see along Eleventh Avenue and Bridge Street before touching A3 and cars in the block can be located. In a like manner the lights remain burning until all cars have passed out under A1 or A3, or any other circuit maker.

This set was installed nearly a year ago and has given invaluable service ever since. Previously it was necessary for conductors to leave their cars and flag their motormen around the corner. As the service is very frequent here and street traffic heavy, much time and annoyance has been saved.

The Altoona & Logan Valley Electric Railway Company has sixteen other similar sets distributed throughout the system between turnouts on single track, all having the capacity of recording twenty-four cars in the block. This system of signaling is controlled by the Eureka Automatic Electric Signal Company, of Lansford, Pa.

Reports from Schenectady state that the gasoline electric car which was built by the General Electric Company for the Delaware & Hudson Railroad recently, gave excellent service in a heavy snowstorm.

TOP-SEAT CARS FOR SANTIAGO, CHILI

Ten top-seat cars like the one illustrated were recently shipped to the Chilian Electric Tramway & Light Company, Ltd., of Santiago, Chili, by the J. G. Brill Company, of Philadelphia. When these cars are placed on the lines, the company will have nearly 200 motor cars and 150 trail cars in commission. The new cars measure 17 ft. 6⅝ ins. over the bodies, 29 ft. 4 ins. over the platform crown pieces and 30 ft. 11¾ ins. over the buffers; width over the side posts, 7 ft. 10 ins. The interiors are finished in cherry of natural color with stationary transverse vis-a-vis seats composed of cherry and ash slats. The seats are 34¼ ins. long and the aisle 18 ins. wide. Curtains at each side of the windows slide on rods at top and bottom. The window sashes are double with the upper stationary and the lower arranged to drop into pockets in the side walls. The ceilings are of carline finish with steel rafters sandwiched between each pair of wooden rafters. The deck seats are the full length of the car body and are removable. Over the portion of the platform occupied by the motorman

DOUBLE-DECK CAR FOR THE CHILIAN ELECTRIC TRAMWAY & LIGHT COMPANY, LTD.

INTERIOR OF CHILIAN CAR

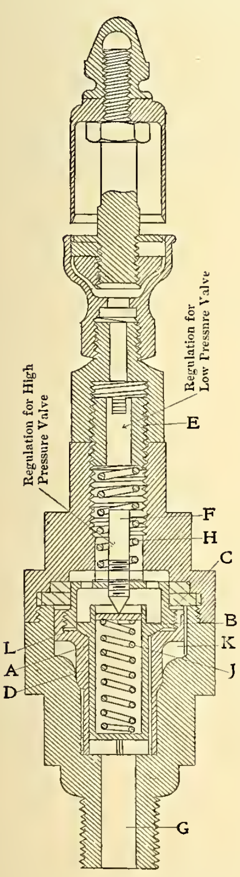
the hood is extended to form a protection for the motorman and for passengers entering and leaving the car, and is also used to support the electric headlight. Entrances are provided at both sides of the platforms. The platform step facing the deck stairs is twice the width of that on the opposite side. The sand boxes, angle iron buffers, radial draw bars, ratchet brake handles, alarm gongs and other specialties are of the builder's manufacture. The trucks have a wheel base of 6 ft. and 33-in. steel-tired wheels. Two motors of 37 hp each are used per car.

Santiago, the capital of Chili, is the third largest city in

South America, and is noted for its picturesque and healthful situation. It lies on a level highly cultivated plain, 1700 ft. above the sea, with the curving line of the Andes ten miles distant, showing a succession of magnificent snow covered peaks. The city covers an area of about eight square miles and the streets and avenues are wide and mostly paved with Belgian blocks and lighted by gas, which is supplied by the tramway company. The principal avenue is two miles long and 350 ft. wide. Besides the two driveways, each 100 ft. wide, there are promenades for pedestrians, and the space between the driveways is used by tramway tracks. Facing this avenue are some of the finest private residences in the city. Santiago is well provided with parks and squares, the number being twenty-five, and the largest having an area of over 200 acres. The public and business buildings are handsome structures, and the homes of the lower as well as the better classes are well built. There is telephone and telegraph communication with the nearby cities and towns. A belt railway surrounds Santiago and railways connect the city with the port of Valpairiso, 114 miles distant, and other cities in every direction. The Transandine Railway gives direct communication between Santiago and Buenos Aires, Argentine Republic. The population of over 300,000 is exceeded in South America only by that of Buenos Aires and Rio de Janeiro.

AN AUTOMATIC LOW-PRESSURE SIGNAL

While such accidents are not of very frequent occurrence, it must be admitted that on electric railway lines many are due to the air pressure in the air reservoir of the brake system falling below that at which the car can be stopped in a reasonable short distance. Very few of the cars now in operation are provided with any device that will warn the motorman when the reservoir pressure falls below that required for an emergency stop. If pump governors and pumps were infallible there would, of course, be no necessity for such a device. But as they are not absolutely infallible a device to indicate a falling of the pressure would at times add considerably to the safety of all those aboard the car equipped with it.



SECTION OF PRESSURE ANNUNCIATOR

A device which not only indicates low pressure but in addition acts as a high-pressure indicator and a safety valve, has been recently invented by Bert Aikman, of Chicago. It is now being put on the market by the Ohio Brass Company and several have been installed on cars throughout the country. The contrivance is largely of brass, measuring 7 ins. in length and 2 ins. in diameter. The working of its valves may be understood by reference to the accompanying cross section. Reservoir pressure is admitted through passage G. The outer of the two concentric valves, A, is held to its ground seat, D, by the coil spring, H. The inner valve, B, is held against seat, L, by the lower coil spring, J. With no pressure in the reservoir both valves are seated. When air is pumped up to that at which the low pressure alarm is to be given both valves are raised until the outer one seats on a rubber gasket at C. The outer valve has about 1/8-in. travel and while it is moving upward, there is a slight passage of air past the seats D and C and to the atmosphere through the whistle at the top. This passage of air is only momentary, for when the valve raises enough to let reservoir pressure into cavity K, the area upon which the pressure acts is increased and the valve moves upward suddenly. When the high pressure limit is reached, valve B is raised from its seat, L, and air escaping over the seat passes upwards through the middle of the stem and sounds the whistle. As long as the pump continues in operation the whistle will blow. On stopping the pump, however, the pressure drops, due to the escaping air and valve B seats itself. If for any reason the pressure falls below that at which the low-pressure spring is set valve A drops slightly and is unseated at C and air passing over seats D and C blows the alarm whistle. The whistle continues to sound until the pressure falls sufficiently to seat valve A on seat D. When the valve does come to a seat the pressure in cavity D is relieved and reservoir pressure considerably above that at which it seats is required to raise the valve. The low-pressure limit is regulated by means of screw E, which acts on spring H. Adjustment of high-pressure valve B is made by applying a screw driver to screw F. The use of the device tends to break careless motormen of the habit of allowing the pump to continue to run after the safety valve begins to blow off. The piercing tone of the whistle is so annoying that the motorman is forcibly reminded of the necessity of cutting the pump out. When the ordinary safety valve is employed, the motorman must keep close watch on the gage after the pump is cut out, to see that the pressure does not fall too low. The use of the annunciator described, however, obviates the necessity of doirg so, as the motorman is forcibly reminded of low pressure by the alarm. For this reason the annunciator should be placed in the cab near the controller. It is better, however, to make the connection with the reservoir through a separate pipe leading from the reservoir, for if the connection is made direct with the pipes leading to the brake valve or whistle false variations of pressure are likely to cause annoyance.

FIRE DEPARTMENT AND TRANSIT COMPANIES CO-OPERATE IN BROOKLYN

The Brooklyn Rapid Transit Company is making preparations to install at once signal red lights in front of each fire apparatus house which faces upon its surface tracks. There are twenty such houses, and the contrivance is to be so rigged that the trap lever which drops at the first tap of the alarm in the house, will light a cluster of red lamps suspended out over the trolley wires. This will serve as a warning to motormen to halt their cars and give the apparatus an opportunity to make a quick start. Similar action has been taken by the Coney Island & Brooklyn Road, which is also installing the same sort of warning lights.

The Interurban "Enterprise," dated Winterset, Iowa, a four-page paper published by the Des Moines, Winterset & Creston Electric Railway Company, was gotten out under peculiar circumstances. The company applied for a franchise at Winterset and asked for only such a franchise as was necessary. The application was bitterly opposed by various interests which believed that the road would not be to their advantage. The result of such opposition was to secure the assistance of all the newspapers in Winterset against the franchise. The hostile attitude of the newspapers compelled the company to edit and publish the "Enterprise," which was used to set forth the company's side of the application.

SOME NEW DIRECT-CURRENT SWITCHBOARD INSTRUMENTS

Movable coil permanent magnet type instruments have been in general use for years, and the principle employed in their construction is universally considered to be the most satisfactory for measurements on direct-current circuits. It is, however, generally known that these instruments do not remain equally reliable on switchboards as when used in laboratory work. This is due to the fact that the instruments have been constructed too delicately and fragilely to withstand handling by inexperienced men and the trying working conditions existing in stations.

The large majority of cases in which instruments fail to indicate properly is caused by friction, due either to damaged pivots or jewels or to an accumulation of dust or other small particles between the movable and stationary parts of the instruments. It seems to be self-evident that the cases protecting the instruments proper should be dust-proof, but a close inspection shows that very few of the so-called dust-proof cases really deserve this name.

The peculiar form of pivots and jewels generally employed in electrical measuring instruments cannot withstand the jarring in transportation or the vibrations found in central stations. Instruments with conical pivots will seldom show any friction under the first laboratory tests, and the manufacturer seems to be satisfied that this way of pivoting the movable coil is the easiest, and has, therefore, adhered to it. The mechanical difficulties to be overcome in producing instruments with cylindrical pivots and journaled in watch jewels are undoubtedly greater, but when once accomplished an instrument of this kind will remain practically frictionless forever. There is no possibility of the pivots or jewels becoming damaged under ordinary conditions. Another defect found in instruments is the insufficient insulation of the current-carrying parts. Connections are often made by thin wires not properly supported, which can easily come in contact with each other or the case, causing not only inaccurate indications but frequently the complete burning out of the instruments.

The American Instrument Company, of Newark, N. J., in bringing out its new line of direct-current switchboard instruments, has taken special care to insulate all parts of the instruments from their enclosing cases, to make these cases absolutely dust-proof by providing large contact surfaces where detachable parts are joined, and to employ highly polished cylindrical steel pivots and perforated jewels. Besides these vital points other minor ones have been carefully considered. By the selection of a proper winding for the movable coils the instruments have a somewhat larger torque, which permits the use of stronger controlling springs. Zero errors so often noticeable in other instruments, are completely avoided. All voltmeters are adjusted to the same resistance per volt and, therefore, multipliers can be interchanged. The same plan has been adopted for the shunts of ammeters. The scale opening in the front of the case is somewhat larger than usual, thus more light is admitted to the scale and it can be read more clearly.

Scales for the different ranges are divided in such a manner that the indications of the instruments are easily read without any mental calculations. The instruments are regularly provided with back connections, but can be converted into instruments with front connections if preferred. All instruments can be mounted flush with the switchboard by the mere addition of a special guard ring.

OPEN CARS FOR PERU

The John Stephenson Company, of Elizabeth, N. J., has recently shipped to the Lima City Tramways, of which W. R. Grace & Company, of New York, are the managers, forty open cars. Lima is the chief city of Peru, with a population of 113,000. So very fine and costly are the buildings, so picturesque the dwellings and beautiful the parks, that the city has earned for itself the name of the "Paris of America." It is also a great industrial and manufacturing center, and has an extensive local street car service connected with neighboring towns by interurban roads, among them being the Lima-Callao; this line connects Lima with Callao, the chief port of Peru, about 9 miles distant from the capital.

The new cars are of the standard open character. The economy in their length is at once apparent, this being accomplished by the omission of the two seats outside of the bulkheads, permitting of shorter platforms. The absence should be noted of any space between the side sill and the tow piece (as is usual in standard open cars). The length of the body is 20 ft., and over the vestibules 26 ft. 3 ins.; width over the sills and panels, 6 ft. 6¼ ins., and over the posts at the belt, 7 ft. 5¼ ins.; distance between the centers of the side posts, 2 ft. 6 ins.; distance between the center of the post to the corner post at bulkhead, 3 ft. 7⅜ ins.; height from floor to the ceiling, 7 ft. 10¾ ins.; height from the rail to the side sills, 2 ft.; height from the sills over the trolley board, 8 ft. 10¼ ins.; the platform steps are 1 ft. 3 ins. from the rails. The interiors are finished in white ash, with ceilings of bird's eye maple, three-ply. The transverse seats are made of ash slats. The three sash at each end of the car drop into pockets in the ordinary manner, this portion of the car being well protected with window-guards. The Brill folding gate is used in the platforms. The car is equipped with two motors of 25 hp each.

PERUVIAN OPEN CAR, WITH BULKHEAD SEATS OMITTED

The passenger officials of Ohio steam roads have decided to put into effect the 2-cents-a-mile passenger tariff to the exclusion of all other rates within that State. The 1000 mile books of the Central Passenger Association will be accepted on Ohio roads but will not be sold. The reduction of all fares to a 2-cent basis will do away with convention rates, excursion rates, commuters' rates, charity tickets, clergymen's permits, etc., on Ohio steam roads.

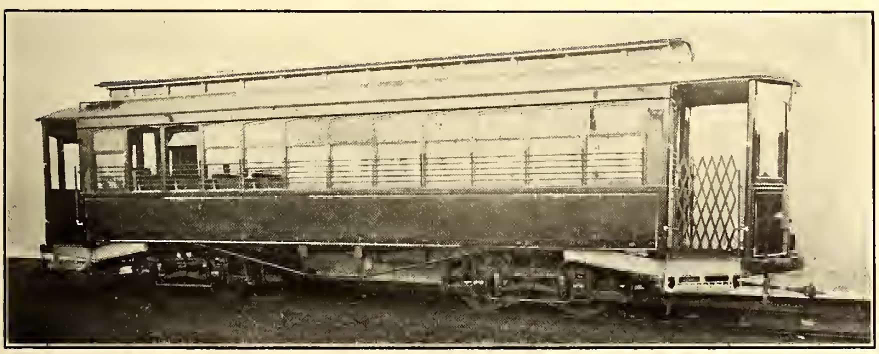
SEMI-CONVERTIBLE CARS FOR MOBILE

An article in the STREET RAILWAY JOURNAL of Feb. 4th, 1905, described four semi-convertible cars built by the American Car Company for the Mobile Light & Railroad Company. These cars have given such satisfaction that the company has ordered fourteen cars of the same dimensions and details, with the exception that the new grooveless post feature is included. These cars measure 18 ft. 10 ins. over the bodies, and 27 ft. 10 ins. over the vestibules; and in addition there are six cars of the grooveless post semi-convertible type, 30 ft. 10 ins. long over the bodies and 39 ft. 10 ins. over the vestibules. The short cars are mounted on Brill No. 21-E trucks and the long cars on No. 27-G-1 trucks of the same manufacture. The new cars have just been placed on the company's lines at Mobile which, with the cars in service, brings the equipment up to nearly 100 motor cars and 25 trailers.

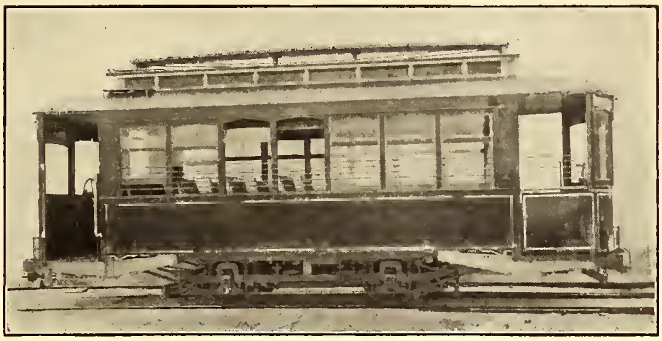
The dimensions of the smaller cars are as follows: Length over the end panels, 18 ft. 10 ins., and over the vestibules, 27 ft. 10 ins.; width over the sills and side sheathing, 8 ft. 2 ins.; centers of posts, 2 ft. 5 ins.; height from the floor to the ceiling, 8 ft. ¼ in.; from the track to the under side of the sills, 2 ft. 6⅜ ins., and from the under side of the sills over the trolley-board, 10 ft. 7 ins.; from the track to the platform step, 15¼ ins., and from the step to the platform, 12 ins. The side sills are 4½ ins. x 7¾ ins., and the end sills, 4½ ins. x 6⅞ ins.; inside sill plates, 12 ins. x ⅜ ins.; wheel base of the No. 21-E trucks, 7 ft. 6 ins., wheel diameter, 33 ins., and axle diameter, 4 ins. Two motors are used per car of 400 hp each. The weight of a car and truck without the motors is 13,000 lbs., and weight with motors and complete equipment, 19,400 lbs.

These cars have several unusual features. The trolley-board, as will be seen in the illustration, is of a long truss type, which brings the weight of the trolley stand and pole upon the car ends instead of upon the roof at the center. These are the only single-truck cars of this type ever built to have inside truss rods in addition to the regular 12-in. x ⅜-in. steel sill plates. The vestibules it will be seen are enclosed at one side and five-bar window guards are continued to the vestibule corner posts.

The double-truck cars measure 30 ft. 10 ins. over the end panels, and 39 ft. 10 ins. over the vestibules; width over the sills, including the sheathing, 8 ft. 2 ins.; centers of the posts, 2 ft. 5 ins.; height from the floor to the ceiling, 8 ft. ¼ in.; from the track to the under side of the sills, 2 ft. 10 ins., and from the under side of the sills over the trolley-board, 9 ft. ½ in.; from the track to the platform step, 16¾ ins., and from the step to the platform, 14 ins.; length of the seats, 36 ins., and width of the aisle, 22 ins. The side sills are 4¾ ins. x 7¾ ins.; intermediate sills, 4 ins. x 6 ins.; end sills, 5¼ ins. x 6 ¾ ins., and 12-in x ⅜-in. sill plates. Inside and under trusses are also used. The wheel base of the No. 27-G truck is 4 ft. 6 ins., wheel diameter, 33 ins., axle diameter, 4 ins., and four 40-hp motors are used per car. The weight of a car and trucks without the motors is 26,500 lbs., and with the motors and complete equipment, 38,200 lbs. These cars have entrances at both sides of the platforms with folding gates. Both the small and large cars are finished in cherry with bird's-eye maple ceilings. The seats are of Brill manufacture and composed of cherry slats with spindle backs. The backs are of the pushover type and the seats tilt.



DOUBLE-TRUCK CAR FOR MOBILE



SINGLE-TRUCK CAR FOR MOBILE

The tracks throughout the business part of the city and on the principal residence streets, are laid with 90-lb semi-grooved rails, placed on concrete stringers. The company owns Monroe Park on Mobile Bay, where summer opera is given for a season of four months, which is said to be the longest consecutive engagement of any opera company in the United States. The Park is very popular and is unsurpassed in its equipment and the fine views which may be had from all points. The Mardi Gras, which is held each year in Mobile, is second only to that of New Orleans.

SCHEDULES ON THE NEW YORK SUBWAY

George S. Rice, chief engineer of the Rapid Transit Railroad Commission, has just rendered a report to President Orr submitting the results of an investigation made by him and his assistants into the subject of headways and efficiency of service in the subway. This investigation was conducted March 3 to March 7, on which days the total ticket sales at all stations were as follows:

Saturday, March 3	446,884
Sunday, March 4	280,081
Monday, March 5	539,248
Tuesday, March 6	478,605

Those on Monday were among the largest day's sales since the operation of the road.

A subway car seats 52 passengers, and records were taken as to the number of sitting and standing passengers, on both local and express trains, during the 24 hours of each day. It was found that passengers distribute themselves through the trains very irregularly and that the end cars were less crowded than those in the center. In many cases the central cars are crowded with standing passengers, while there are seats vacant in the end cars. As a result of the investigation the engineers recommended that seven-car or eight-car express trains should be run during the entire Sunday schedule instead of five cars for part of the day as at present, and that the Sunday express schedule should be begun earlier.

In respect to the week-day express service, the engineers found that trains are run between 7 a. m. and 9 a. m., and 5 p. m. and 7 p. m. at the smallest interval practicable, and although these trains are very crowded it does not seem possible to increase the service. The present express train headway at other hours is 6 minutes between 6 a. m. and 7 a. m. and betewen 7 a. m. and 8 p. m., three minutes between 9 a. m. and 10 a. m. and between 4 p. m. and 5 p. m. for eight-car trains. After 8 p. m. approximately all express trains are reduced to five cars. The engineers recommend that eight-car trains should be maintained from 6 a. m. to 9 p. m. and that more express trains should be run throughout the day until 1 a. m. than the schedule now provides. They also think that more local trains should be run during the rush hours; at other hours the service seems adequate. They also recommend that notices should be posted at the stations at night regarding the hour at which the express service is discontinued.

CIRCLE TIME-LIMIT TRANSFERS

The Globe Ticket Company, of Philadelphia, has added to its extensive line of tickets a new form of transfer invented by W. C. Pope, vice-president of the company, and named the "circle time-limit transfer." Owing to its clearness and the ease of indicating the time limit with one punch this type has created a good impression on the traction men who have already seen it. The accompanying illustrations are reproductions of four specimen tickets.

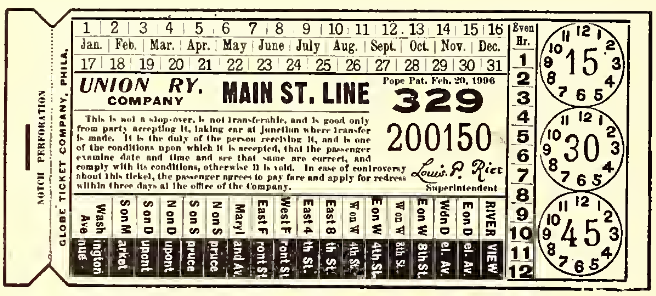


FIG. 1.—TICKET WITH TRANSFER POINTS SHADED TO DENOTE A. M. AND P. M.

Fig. 1 shows a transfer on which the month and days are punched in the regulation way and the transfer points are shaded to denote a. m. or p. m. For the time-limit one column is shown for even hours, and for fractions a series of even hours arranged in a circle around each fraction needed, according to the time-limit required. In this case a 15-minute time-limit is indicated.

Fig. 2 shows a transfer to be issued for a. m. use only, therefore the transfer points are not shaded.

Fig. 3 shows a transfer for p. m. use only, the time-limit being shaded. In this way an a. m. transfer can be told at a glance from one good only for p. m. use. This, it is believed, will prevent many of the present abuses which are a source of loss and annoyance to street railway management, and there is absolutely no more waste, or trouble in issuing. It can only mean at most that a few conductors on their noon trip must carry two pads of transfers.

Fig. 4 shows a dated transfer with the day of the week, month and date of month printed on it in a contrasting colored ink, and the time-limit is the same general arrangement, except it shows at one punch not only the hour and fraction but as well whether that hour and fraction are a. m. or p. m., there being two series of hour figures arranged in a circle

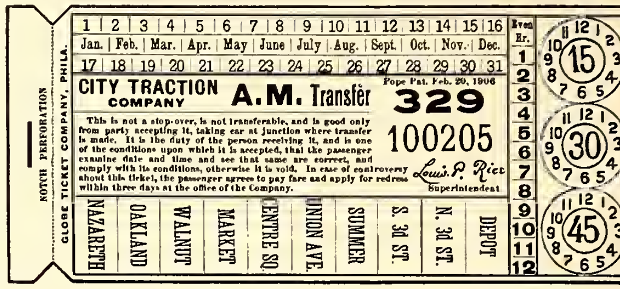


FIG. 2.—TRANSFER DEVISED FOR A. M. USE ONLY

around each fraction, one dark and one light. The even hour column is shaded half light and half dark.

IMPROVEMENTS IN TACOMA

On his return to Tacoma from the East, W. S. Dimmock, general manager of the Tacoma Railway & Power Company, announced in detail the plans for improving the company's property, which he outlined in general for the STREET RAILWAY JOURNAL when in New York en route to the coast. Part of the interurban line to Seattle is to be double-tracked, the Sixth Avenue line is to be double-tracked, 4 miles of the Jefferson line are to be relaid with heavier rails, a sub-station is to be built at Puyallup, a car house is to be erected on Puyallup Avenue, a branch is to be built to Bismarck, and street pavingexpenditures are to be made that will aggregate $75,000. In addition, twenty-six new cars are to be placed in service on the local lines in Tacoma, and four new coaches on the interurban line. Included in the new rolling stock equipment will also be a freight locomotive and flat, box and gondola freight cars. The new track to be laid on the Tacoma-Seattle line will aggregate 10 miles. It will of course increase the safety of operation and permit the cutting down of the running time between centers. The new cars are mostly single enders and are being constructed by the St. Louis Car Company.

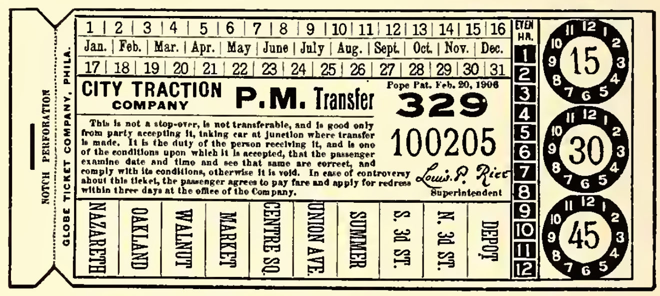


FIG. 3—TRANSFER FOR P. M. USE ONLY

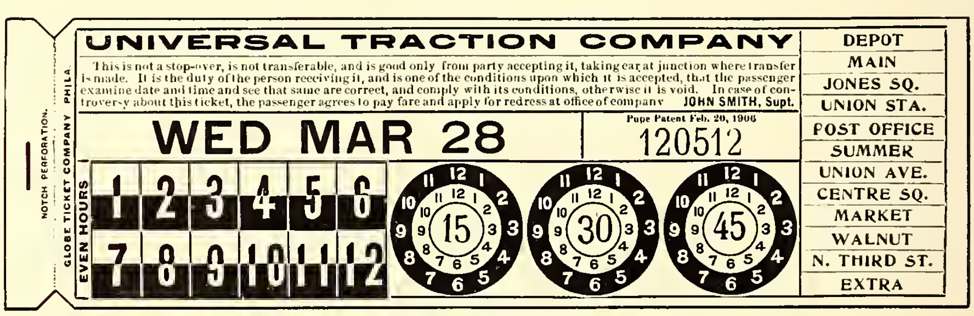


FIG. 4.—A. M. AND P. M. TRANSFER, WITH DAY, WEEK AND MONTH PRINTED ON IT

AUTOMATIC TRACK SWITCH

The St. Louis & Suburban Railway Company has been using successfully for two years an automatic track switch made by the Woolley Electric Company, of Clayton, Mo.

This device may be said to consist of three distinct parts—the trolley contacts, the relay magnets and contacts, in a box usually mounted on a pole near the switch, and the magnets and lever mechanism, housed in a heavy cast-iron box, between the rails near the switch tongue to be operated.

The overhead contact is illustrated in Fig. 2. It consists of a piece of galvanized sheet iron bolted around the trolley and insulated from it. The two contacts are placed on the wire, 20 ft. or 30 ft. apart. The box containing the relay magnets is of such a shape that these magnets, with their respective contacts and blow out coils, are carried one above another, so that the box is but a few inches wide.

Inside the cast-iron box placed in the street is a second box containing two magnet coils. A common plunger for the two coils is so connected to the switch tongue that current through one of the coils throws the switch one way, while current through the other throws it in the opposite direction.

The instructions to motormen regarding the operation of the switch are very brief. To throw the switch for the curve track, the first of the two overhead contacts is run over with the power on, and the car is allowed to coast over the second. If the switch is to be thrown for the straight track the first contact is run over with power off, while power is applied in passing the second one. Should the switch tongue be in the desired position, the car is allowed to coast until beyond both of the contacts.

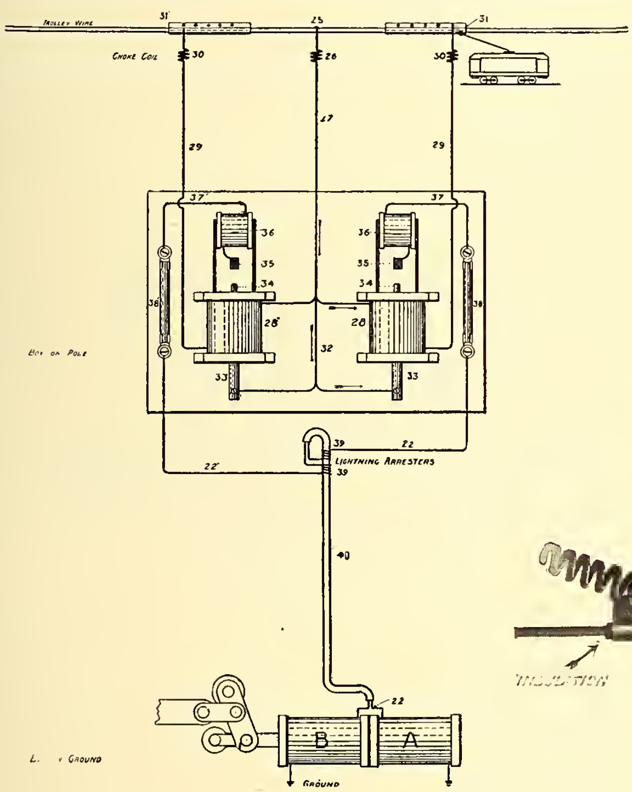


FIG. 1.—DIAGRAM OF CONNECTIONS

All of the parts of the automatic device, as well as the electrical connections between them, are shown in Fig. 1. A tap from the trolley at 25 leads through a choke coil, 26, and wire, 27, to two relay magnets, 28^1 and 28, and to the plungers of these magnets as well. The paths through the relay magnets continue by way of wires 29^1 and 29 to the two sleeves or contacts on the trolley wire. It is evident that while the trolley wheel of a car rests on one of the overhead sleeves, as is indicated in the drawing, any current used by the car must pass through one or the other of the relay magnets. Assume that the controller is turned on when the trolley wheel is bearing on contact 31. Current through magnet 28 lifts plunger 33, causing its upper end, 34, to make contact with lug 35. When this contact is made, current from the trolley flows successively through wire 32, and plunger 33, blow-out coil 36, wire 37, fuse 38, choke coil 39, and through a rubber-covered wire into an iron pipe, extending between the box on the pole and the cast-iron box placed between the rails near the switch tongue. Wire 29 entering the pipe emerges in the box previously referred to, and as wire 22 continues through the winding of coil A and to ground on the magnet frame. When magnet A is excited the switch tongue, if not already thrown in the desired position, is pulled over. The path from the trolley to magnet B is closed in a manner similar to that already described for magnet A.

The employment of two separate circuits eliminates many serious objections. The circuit through the relay magnets is of very heavy wire and is intended to carry several hundred amps., which amount of current would flow through it were a heavy car started when the trolley was on one of the overhead contacts. The circuits through the blow-out coils and the operating coils are of small wire and high resistance.

The fact that the circuits through the relay magnets are of large wire, and consequently of low resistance, eliminates any tendency for the trolley to draw an arc in passing from the trolley wire to one of the contacts. The drop in the circuit is only about two volts, and it is readily seen that no destructive arcing can take place at this difference in pressure.

When the armature of a relay magnet drops, current at the full line voltage is broken at contacts 34 and 35. To prevent arcing at this terminal the choke coil, 36, is placed in the circuit. This causes the arc to snap at about a 1-16-in. opening between the terminals. Any danger of arcing at this point is further removed by the fact that the armature drops 1 inch.

No danger can result if a car is stopped with the trolley on a contact, as in such an instance current ceases to flow through all the circuits as soon as the power is thrown off the car. The relay magnets are constructed to operate at any set current desired, but usually are adjusted to work at about 35 amps.,

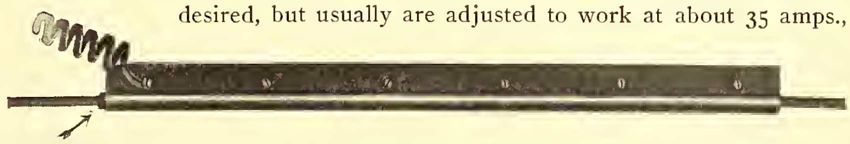


FIG. 2.—OVERHEAD CONTACT

as this avoids any danger of them being operated by the heater or auxiliary circuits of the car. Where heaters are employed it is customary to adjust the relay magnets, so that they will operate on the first notch of the controller when the heaters are on and on the second notch when the heaters are off.

The box containing the operating magnets has a cast-iron cover made in two parts to facilitate inspection and cleaning. Since such a box is impervious to mud and water, the mechanical parts inside are so constructed that the presence of water will not affect their operation. As it is highly essential that the magnets be protected from all moisture, they are housed in a second cast-iron box having cast-iron heads, which are screwed in position. A combination of right-hand and left-hand threads, on the heads of the box and on the ends of the brass tubing around which the coils are placed, make it possible to screw the heads and the tubing in place as tight as may be desired, and make the box waterproof. After the magnets are placed in position in the inner box, this is filled with paraffin, to guard further against the entrance of water.

IMPROVED STORAGE AIR BRAKE SYSTEM

One of the main advantages of the storage air brake system over other air brake systems is that instead of using compressors for each car the air is compressed at stations suitably located over the city, and stored for transmission from time to time to the receivers on the cars. In the system devised by the Magann Air Brake Company, Ltd., of Detroit, Mich., the air is stored at a pressure of 300 lbs. On the cars are air reservoirs into which the air is passed from the station storage tanks and held at the same pressure. From these reservoirs the air passes by a pipe through a reducing valve into a small receiving tank at a pressure of 50 lbs., more or less, according to the size of the car and the consequent power required for operating the brake. In some cases a pressure of 25 lbs. is amply sufficient. From this receiver the air passes through piping to the motorman's valve, where it is under the control of the motorman and can be used to put the brake in operation and to release the brake to its normal position.

From the motorman's valve the air passes into piping which connects with the brake cylinder. To operate the brake the motorman, by a slight turn of the valve handle, allows the air to pass into the brake cylinder between two piston heads, which are thus forced apart, driving the pistons out on either end of the cylinder. By means of levers attached to these pistons the brake is put into operation.

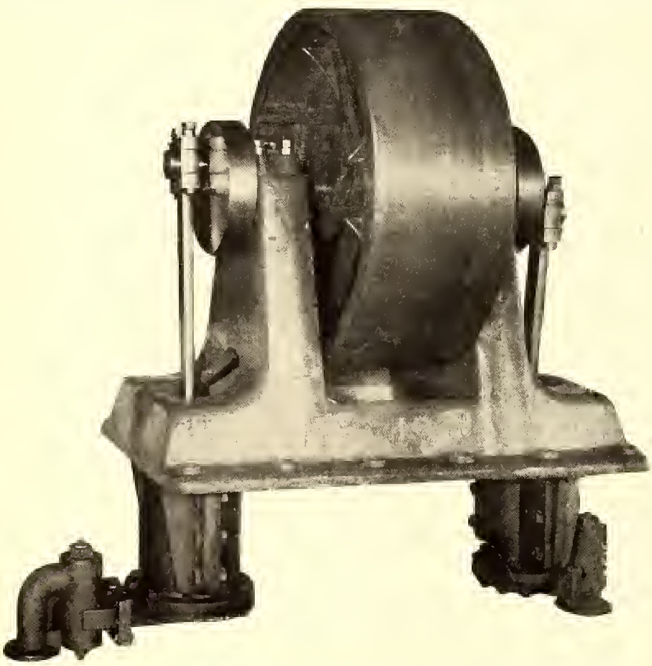


FIG. 1.—NEW COMPRESSOR FOR AIR-STORAGE SYSTEM

In ordinary circumstances the motorman allows sufficient air to enter into the cylinders to check the speed of the car and gradually allows more and more air in till the car is brought to a complete standstill. In case of emergency, by allowing the whole pressure of air into the cylinder more rapidly than in ordinary cases, the car can be brought to a standstill practically as speedily as circumstances require.

To release the brake another slight turn of the valve handle is required; this allows the air, which was driven in between the piston heads when applying the brake, to pass out into the atmosphere, thus permitting springs inside the brake cylinder to return the piston heads to their normal position and release the brake.

The reservoirs used are of such strength as to avoid all possibility of accident from explosion; each reservoir being thoroughly tested before use. The ultimate rupture point of these reservoirs is five times the working pressure.

The installation of the Magann air brake does not in any way interfere with the operation, in case of need, of the ordinary hand brake, and the cars can still be equipped with a hand brake, though experience shows that there is practically no necessity for this, owing to the simplicity of the apparatus used, which reduces to a minimum the likelihood of its getting out of order. A duplex gage, placed in front of the motorman, shows the pressure of air, both in the reservoir and the receiver, so that he is fully advised as to the amount of air still available for use on his car before the reservoirs require recharging.

Of the accompanying illustrations, Fig. 1 shows the new compressor designed and built by the company, and Fig. 2 a specially large cylinder made for use on the Toronto & York Radial Railway for the new 60 ft. combined passenger and freight cars running on its Mimico Divisions. These are specially heavy cars and an unusually large cylinder was required to operate them. The body of the car weighs 18 tons, and the total weight, with load, is 35 tons. The motors aggregate 220 hp.

Among the recent improvements made in this system are the following. A special check valve which it attached to the charging tanks on the cars and automatically admits air from the charging station, but does not let air out when the tank has been charged; a special form of coupler designed for compressed air, which greatly facilitates the charging of the tanks on the cars and reduces the charging time to a very few seconds; and an automatic charging valve. Under the present system the charging hose between the charging box and the car tank has to be emptied of air before it can be uncoupled, so as to prevent damage by the escape of the compressed air. This requires a special valve in addition to the valve which lets the air into the hose, and the turning on and off of these two valves requires four different motions. The new charging valve mentioned does the work of both valves, is opened by a single foot pressure and immediately closed on the foot pressure being taken off.

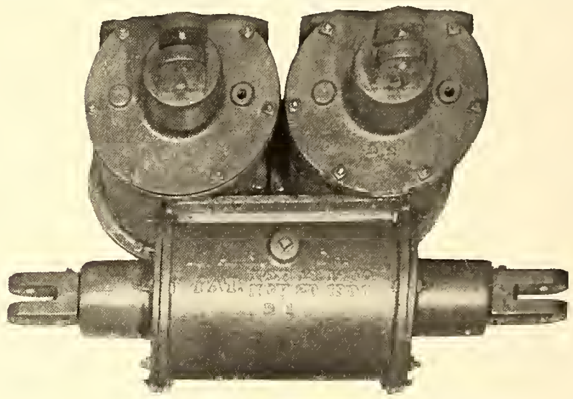


FIG. 2.—DOUBLE-ACTING JAM CYLINDERS FOR 60-FT. CARS

All of the double truck cars of the Toronto Railway in service have now been equipped with air brakes, and a large number of new cars in course of construction will be equipped this year. There are at present five compressor stations in Toronto, with from one to three large 15-ft. x 3-ft. tanks for storing air. This installation was described on page 236 of the STREET RAILWAY JOURNAL of Feb. 10.

General Superintendent Dicke of the Fort Wayne, Van Wert & Lima Traction Company recently ran a special theater car from Lima to Fort Wayne, 65 miles, to enable Lima people to witness a production of "Ben Hur." The car made the run each way in less than two hours. A special low rate was made and the theater seats were sold through the Lima office of the company.

LONDON LETTER

(*From Our Regular Correspondent.*)

We have frequently referred in these columns to the great enterprise which the late Mr. Yerkes inaugurated in London some six or seven years ago, and we are pleased to be able to record this month the opening to traffic of the Baker Street & Waterloo Railway, which is the first of the tube railways with which he was connected and which is under the control of the Underground Electric Railways Company of London. This railway was not, however, inaugurated by Mr. Yerkes, as the work had already been commenced before his connection with London, but had been brought to a standstill for lack of funds and imperfect organization. It is just about eight years since the work was commenced by the erection of a huge staging in the river Thames, close to the Hungerford Bridge, which is the bridge from Charing Cross Railway Station. From this staging two shafts led down into the London blue clay underneath the bed of the river, and chiefly from this point the boring operations for the tube were commenced southwards and northwards. In another column will be found a fuller description of the tube, and it will suffice to say here that the press were afforded an excellent opportunity to inspect the tube, various railway stations and sub-stations, the terminus at the Kennington Road end, where a branch from the underground tube comes to the surface, and where there is a large area for the storage of the necessary rolling stock, large repair shops, offices, etc., etc. The formal opening took place a day or two afterwards, Sir Edwin Cornwall, M. P., chairman of the London County Council, performing the necessary function. At the luncheon which followed the opening ceremony, Mr. Edgar Speyer, chairman of the Underground Electric Railways Company, presided. After reading a letter from Mr. George Lloyd, the president of the Board of Trade, wishing success to such an important enterprise, Mr. Speyer stated that he considered it an especially happy augury for the success of the line that it should have been opened that day by Sir Edwin Cornwall, who was himself intensely interested in the transportation problem of London, by means of his connection with the London County Council's vast system of tramways. Sir George Gibb, the general manager of the company, made special reference to the fact that the various tube systems which were now under construction would, when completed, be all connected together at various points, so that the question of transportation from one point of the metropolis to another would be made much more easy than at present. The new tube is naturally the best of the tube railways in London, as many lessons had been learned from the experience of the other tubes. One very striking feature of the tube is that it is lighted by incandescent lamps from end to end, and it is intended, at least for some time, to keep the tube lighted, as it is expected it will give considerable confidence to the traveling public.

We have referred in these columns previously to the opening of the new tramway from the Strand to Islington by means of the subway which starts at the bottom of Kingsway and continues along the whole of the length of that new thoroughfare underneath Holborn, coming to the surface at the corner of Southampton Row and Theobalds Road. The opening was, unfortunately, delayed, but the opening ceremony has now taken place, and the new route has been in use by the public for the past few weeks and has proved most popular. It has, of course, long been known that there is an immense population around the Strand district which wants to get to the north, the only method of transportation having hitherto been the slow horse omnibuses. This is the first electrification of tramways in the north portion of London by the London County Council, and the fact that this first northern section made use of the new thoroughfare and was in a subway added interest to it, and has perhaps made the lines even more popular than they would have been on the surface. The subway under Kingsway is a shallow subway, constructed much in the same manner as that in Boston; the chief difference is that the cars are operated on the conduit system instead of on the overhead wire system. Under Holborn, however, the subway takes a sudden dip, so as to escape all sewers and pipes under that thoroughfare. The construction at this point changes from the ordinary subway construction to that of cast-iron tube so familiar to the Londoner in connection with the tube railways. This tube construction is only used under Holborn, however, where the tramway has to dip some 30 ft. This is a little unfortunate, as it makes a very severe grade from the lowest point of Holborn up to the corner of Theobalds Road, where the tramways emerge from the approach to the subway. At present the subway terminates, so far as traffic is concerned, at the corner of Aldwych and Kingsway, though the subway itself is actually constructed down the western branch of Aldwych as far as the Strand. It is intended later on to cross the Strand in much the same way as Holborn has been crossed, and the tube will then continue underneath Wellington Street south to the Embankment, where the exit will be made on to this thoroughfare at road level. The present width of the tramway subway is 20 ft. and the height 13 ft. 6 ins., so that a different type of car to those with which Londoners are familiar has had to be used. All of the cars are of the single-deck pattern, and are constructed of steel and other non-inflammable material. They are the first tramway cars of this type constructed in this country, and were supplied by Messrs. Dick, Kerr & Company, who made them to the design of Mr. A. L. C. Fell, the chief officer of the tramways. Sixteen cars have been supplied for the present, though when the northern system of tramways is electrified a much larger number will be used. As has been said, this route has attained instant popularity, and augurs well for the success of the electrification of the northern tramways when they become electrified. This work is now being put in hand, both Dick, Kerr & Company and J. G. White & Company having recently received very large contracts for electrifying the trams from Bloomsburg to Poplar, and from Shoreditch and Stamford Hill.

The Folkstone Town Council has decided to hand over its powers for the introduction of trams to the National Electric Construction Company, on the payment of £15,000, after the Royal assent is given to the bill now being promoted in Parliament. It has been arranged that the trams will not run on Sundays between 11 and 1 o'clock. The cars are to be worked on the Dolter surface contact system.

Mr. D. Boyle, who has been chairman of the Manchester Corporation Tramways committee since it was first formed on the municipalization of the tramways, has resigned his position both as chairman and also as a member of the committee. He has accepted the managing directorship of the Manchester District Omnibus Company, Ltd., just formed, with the object of providing a service of motor omnibuses on the south and west suburbs of the city, and other districts beyond, not now provided with a tram service, or, where a tram service exists, to act as a feeder thereto and receive traffic therefrom. The new company has declared its intention not to enter into competition with the Manchester tramways, and it was after receiving definite assurances on that point that he agreed to accept a position on the directorate.

Mr. R. Stuart Pilcher, traffic manager of Corporation Tramways, Burton-Upon-Trent, was appointed general manager of the Aberdeen Corporation Electric Tramways. The salary is £300 per annum. The new manager will not have control of the electrical equipment of the tramways, his duties being practically confined to the management of the traffic. Mr. Pilcher is a naticc of Liverpool, and has been in Burton for two years.

The Mayor of Kingston recently opened an important Surrey extension of the London United Electric Tramways. The lines have been carried across Kingston Bridge from the former terminus at Hampton Wick, and extended through Kingston to Talworth in one direction and to Long Ditton in another. The lines now opened link up Kingston, Surbiton, Malden and Long Ditton, but they are only an installment of the ring of electric trams which will soon encircle the metropolis. A little later the line will be continued from Raynes Park through Wimbledon to Tooting, where it will join with the County Council system, and it will then be possible to reach almost any part of the Surrey shore of the Thames by tram from the center of London. In the other direction, the Long Ditton line will be continued through Thames Ditton and Molesey to Hampton Court, across the river to join the Middlesex system of the same company there, as well as across Kingston Bridge, while the Surbiton line will be carried on to Hook.

THE NORFOLK SITUATION

R. Lancaster Williams, who, with the Middendorf interests of Baltimore, dominates the street railway and lighting business of Norfolk, is quoted as stating that he and his associates will not part with the control of the Norfolk Railway & Light Company, but that at the stockholders' meeting April 19, additional capital will be accepted from new interests who wish to join with those now in control. Mr. Williams said that $2,000,000 will be added to the capital stock to build a new power house, to cost $1,000,000, and to buy rolling stock in order to handle the passenger traffic during the Jamestown Exposition.

NEW HAVEN TO BE ELECTRIFIED BETWEEN BOSTON AND PROVIDENCE

Another important announcement has been made regarding the plans of the New York, New Haven & Hartford Railroad. This is to the effect that electric trains will be run on the Providence division, which is to be four-tracked for its entire length between Boston and Providence. This plan of the company was made public in an address delivered by President Mellen before the Art Club, of Boston, Saturday evening, March 24. In his speech Mr. Mellen reviewed the general situation confronting the company, and then detailed briefly the plans made for meeting existing conditions. In addition to this he expressed himself freely on the rate question. Much that he said about the general situation in railroad circles in New England necessarily was foreign to his reference to electrification. Still his remarks along these lines are valuable as throwing light upon the general situation that confronted him when he assumed the management of the road, and are particularly pertinent as showing the aggressive campaign in hand for bettering conditions. He said the mistake had been made of not standardizing the equipment as acquisition had been made of new lines, with the result that in many cases serious consequences followed. In locomotive equipment and bridges he said conditions were very bad. The gist of his remarks in this respect are contained in the following statement:

"The lack of equipment is remedied so far as numbers is concerned, but the character is yet far from satisfactory, and will continue to be until the bridges are rebuilt to carry the heavier class for which they are designed. The past winter has been the first in many years where there was power in reserve for emergencies which fortunately did not arise, but before another winter the present increase in business will absorb all of that reserve even, without additional provision is made.

"In this vicinity at the present time we are building additional shops at Hyde Park and Readville at an aggregate expense of about $1,500,000, which, with the facilities already there, will make one of the most complete plants for its purposes that exists east of Altoona, Pa., a plant of greater capacity than all the scattered, obsolete and uneconomical ones inherited from the various lines of road now making up the New Haven system, and with a similar plant to be erected at or near New Haven we shall then be able for the first time in the history of the property to maintain the equipment as it should be, instead of witnessing that constant deterioration of which complaint has so justly been made.

"The four tracks upon the Providence line will be extended from Readville to East Junction, with revision of alignment and grades, and with the elimination of all crossings, there meeting a double-track line to Providence by way of Pawtucket, and another double-track line by way of the new tunnel now building in Providence, the two connecting at the Union station, completing by the two routes a four-track line between the two cities, one of them without crossings at grade, and so constructed to be a high-speed line, than which there can be no faster or better, completed with a view of using electric traction, which we anticipate the results of the work upon our New York end will demonstrate to be economical and practical."

STREET RAILWAY SITUATION IN SAN FRANCISCO

The advocates of an electric conduit railway system in San Francisco were considerably encouraged recently by a compromise said to have been reached by President Calhoun of the United Railroads and representatives of the Society for the Adornment of San Francisco and the Sutter Street Improvement Club whereby Calhoun agreed to provide an underground electric conduit system on Market Street as far as Valencia Street, and on Sutter Street as far as Polk Street, and would be permitted to replace the cable system with the overhead trolley in other portions of the city without opposition on the part of the associations named.

This announcement drew forth considerable discussion and elicited a further statement from President Calhoun in which he declared that the United Railroads was not moved by motives of economy in favoring the overhead trolley as against the conduit system, and that the company would donate to the city, for the improvement of the Golden Gate Park Panhandle the difference in cost of the two systems should the people decide in favor of poles and wires on Market Street. He figured that the difference in cost would be somewhere in the neighborhood of $200,000. He has agreed to supplant the cable system on Market Street with an up-to-date conduit system, provided the people of San Francisco do not rise up and object to the improvement. He maintained, however, that what the city needs, and what he believed the people will favor, is a uniform system of overhead trolley lines.

The next development was threatened litigation against the United Railroads by the city for the annulment of its franchise, on the ground that the merger of the eighteen companies and their absorption by the present corporation was an illegal act. In answer to several inquiries President Calhoun finally sent a letter addressed to Jas. D. Phelan and others, in which he said: "In view of the development of the last few days, the threatened litigation against my company, and the action of the Sutter Street Improvement Club, I desire to inform you that the United Railroads will proceed to prepare a plan for the improvement of the transportation of San Francisco, the essential feature of which plan will be a modern up-to-date, efficient and uniform system of electric propulsion, through the introduction of the overhead trolley system wherever the grades of the streets of the city will permit. When this plan is perfected it will be presented to the proper authorities of the city for their consideration. We will be very glad to go over it with you. Under the circumstances, it will be useless for me now to furnish the preliminary plan of which we spoke."

The apparent abandonment of the conduit system by the United Railroads drew forth an emphatic statement from Claus Spreckles, who says if he can do anything to prevent it there will be no overhead trolley system in San Francisco. He is said to be ready to organize a company to give San Francisco an up-to-date conduit system and already has engineers working on the plans. He proposes to make use of the tracks of the United Railroads wherever advantageous under the law which allows one road to run for a distance not exceeding ten blocks over the tracks of another one on the payment of a sum fixed by law. Mr. Spreckels states that his attorney informs him that the new road can use the tracks of the existing company by paying interest on half of the original cost of the tracks and maintenance charges.

The final development is the announcement by the city administration that it has formulated a plan for a municipal street railroad system so attractive that private capital will readily take hold of it and construct the road under conditions that will permit the city to assume ownership after a stated period. The details of this plan for interesting capital are not made public, but the administration states that it will be eagerly taken up and that there will be no difficulty in getting all the capital necessary. New tracks are to be laid on Market Street, but in the main, franchises will be awarded on streets not now occupied. The conduit system will be used throughout.

FRANCHISE AWARDS IN LOS ANGELES

The reported sale of the Los Angeles-Pacific Company's electric railway system to E. H. Harriman for $6,000,000 has brought forth many stories concerning the preparations that are being made by Henry E. Huntington to meet the competition promised by the new interests. Whatever Mr. Huntington's plans are, however, he has kept them to himself. Still, an interesting development came to light on March 27, when E. W. Gilmore, acting presumably for Mr. Huntington, was granted by the City Council of Los Angeles a twenty-one-year franchise for a steam or electric railway to be used as "a part and extension of a railroad to be constructed and maintained between the city of Los Angeles and other cities and towns," to be single or double track, at the option of the grantee, over a certain strip of land having a uniform width of 40 ft., and paralleling the Los Angeles River for a distance of more than 3 miles. This franchise would give Mr. Huntington a new line through Los Angeles that would connect the vast country north of the city directly with the mile-long mole he is now building into deep water at San Pedro. The franchise begins just where the old San Gabriel Rapid Transit Railway ends, on the east bank of the Los Angeles River at Aliso Street. This old line Mr. Huntington owns from the city to Sherb, and its roadbed is now being regraded with the intention of putting an electric road upon it, and extending it to Pasadena. The route lies entirely over a private right of way from Aliso Street south along the river bed. Mr. Huntington can build an electric railway which will afford all of his lines to the north a short-cut to San Pedro and other seaside points. This route does not comprise a public thoroughfare, and for that reason would be especially desirable for fast freight and passenger traffic. Moreover, it would provide a through line that would avoid the restricted speed required on city streets.

THE TRI-CITY CONSOLIDATION

In connection with the plan to consolidate the public service utilities of Davenport, Ia., and Rock Island, Moline and East Moline, Ill., to which reference has been made before in the Street Railway Journal, it is announced that it is proposed to organize the Tri-City Railway & Light Company under the laws of Connecticut, in which will be vested the ownership of substantially all of the outstanding stocks and all except $464,000 of the bonds of the following companies:

(a) People's Power Company (gas and electric lighting, Moline & Rock Island).

(b) People's Light Company (gas and electric lighting, Davenport).

(c) Davenport Gas & Electric Company (gas and electric lighting, Davenport).

(d) Tri-City Railway Company (electric transportation, Davenport, Rock Island and Moline).

(e) Davenport Suburban Railway Company (electric transportation, Davenport and vicinity.)

(f) Moline, East Moline & Watertown Railway Company (electric transportation, Moline to East Moline and Watertown).

Of the 34,080 outstanding shares of the capital stocks of above companies 33,530 shares, or 98 4-10 per cent, and in no case less than 96 per cent have already been acquired. It is confidently expected that all of the stock will soon be secured. Of a total of $2,913,000 bonds outstanding, all but $464,000 have been or will be acquired.

The capitalization of the new company is to be as follows:

Five per cent collateral trust first lien sinking fund gold bonds, dated April 1, 1906, due April 1, 1923, but subject to redemption at option of company on any interest date at 105 and interest; with a sinking fund sufficient to retire $2,250,000 of the bonds by maturity; total authorized issue		$9,000,000
To be presently issued		6.000,000
Reserved to refund at maturity $464,000 6 per cent bonds, due $33,000 annually, and balance in 1911..................	$464,000	
Reserved for additions and improvements.	1,500,000	
Reserved for additions and improvements at 85 per cent of cost..................	1,036,000	3,000,000
Common stock, total authorized, all to be issued forthwith		$9,000,000
Preferred stock, 6 per cent cumulative total authorized		3,000,000
To be issued forthwith		2,600,000
Reserved		400,000

The engineering firm of J. G. White & Company is associated with the banking houses of Mackay & Company and Halsey & Company in plans involving the institution of a thoroughly modern service in connection with the consolidation. The report of the physical condition of the properties of these companies was made for the bankers by J. G. White & Company, and it is probable that the operating department of the same company will be charged with the work of operating the consolidated system in accordance with the best modern practice, one of the foremost operating experts of the country being made general manager of the holding company. In the traction system there are 100 miles of track, and one phase of the general improvement contemplated is the renovation of the service of the street railways, involving more frequent and regular service and an increase of speed. Another step in the direction of increased efficiency will be the manufacture of a single variety of gas in one plant instead of the manufacture of six varieties in three different plants as now obtains. Finally, the water-power rights of the Moline Water-Power Company will be made the most of, and so developed as to permit the abandonment of a large percentage of power generation by steam.

INSURANCE COMPANY TO START MAY 1.

The American Railways Insurance Company, of Cleveland, will commence writing policies on street railway risks on May 1. This company is allied with the Traction Mutual Insurance Company, which is being formed to carry out a plan whereby traction companies may carry their own insurance. This company will not become operative until $20,000,000 of protected risks have been secured. The American Railways Insurance Company has been formed to furnish immediate protection for those companies that desire to become associated with this movement. It is a stock company with $200,000 capital stock and $300,000 reserve, and while it will be operated as a stock company and will enter into active competition with the old-line companies, taking unprotected as well as protected risks, it will be a mutual company in that the profits, after paying losses, operating expenses, and a small percentage for a reserve fund, will be divided among the companies insured. The company will limit its operations to $25,000 on any one risk. It is estimated that on sprinkled risks the net cost will not exceed ½ per cent. Henry N. Staats, manager of the various companies, states that more than fifty leading city and interburban companies have agreed to give part of their insurance to the new company this year.

It is stated that since these mutual companies commenced their activities about a year ago the old-line insurance companies have reduced rates on both protected and unprotected risks. Within the past few weeks old-line insurance companies are said to have rewritten insurance with reductions in rates as follows: Cincinnati Traction Company, from $1.55 to $1.25; Rochester Railways & Light Company, $1.05 to $0.75; Utica & Mohawk Valley, $1.20 to $0.75; Chicago City Railway, $1.85 to $1.00; Eastern Ohio Traction Company, Cleveland, $1.45 to $1.12. The Cleveland & Southwestern Traction Company, the Kansas City Railway & Light Company and the Twin City Rapid Transit Company are also said to have secured large reductions in rates.

MUNICIPAL OWNERSHIP, BUT NOT OPERATION, DECLARES CHICAGO

Chicago has declared for municipal ownership of street railways, but not for municipal operation. The decision was made at the election held April 3, at which a majority of 3837 was recorded for municipal ownership. The vote for municipal operation was defeated by 10,651. The vote on the proposition, "Shall the city of Chicago proceed to operate street railways?" was: For the proposition, 120,911. Against, 110,260.

On the question of public policy submitted to the people, which was: "Shall the City Council proceed without delay to secure municipal ownership of all street railways in Chicago under the Mueller law, instead of passing the pending franchise ordinances or any other ordinances granting franchises to private companies?" the vote was 111,662 for, to 108,025 against, a majority of 3837 for the proposition. The question of issuing $75,000,000 worth of Mueller law certificates was also answered in the affirmative, the majority being 3339. The vote in detail was: For, 110,008; against, 106,669.

The Mueller law, which lacks the authority of the Supreme Court and the validity of which is open to some doubt, is a legislative act passed several years ago, authorizing the issuance of "certificates," a sort of bonds to be used for the purchase of public utilities by any city wishing to go into the business. This is the first time any municipality has had a chance to vote on the subject, and Mayor Dunne and his immediate municipal ownership friends are deeply disappointed at the people's declaration against the idea of the city operating the street car lines. After the return had been received, Mayor Dunne said:

"The election, so far as municipal ownership is concerned, leaves us practically nowhere. It would have been all plain sailing if the operation clause had carried. Now it is up to the street car companies to say on what terms they will sell out to the city. Then we will have to test the Mueller law in the courts.

"If they decide in our favor, and I think they will, I propose that we go to the people again. We will have possession of the street car lines, and our possession will have been confirmed by the courts. I propose then to submit the operation proposition to another vote. I don't believe that we could get the full approval of the people to operate unless we had possession. When we have that I am assured that the vote will be overwhelmingly for operation."

The "I. M. O." movement was fought vigorously in every journal published in Chicago. The Republican party was dead against it, and ex-Mayor Harrison and a large body of conservative Democrats also deprecated it. The Council opposed it, and Mayor Dunne had been blocked in every move he made in its favor. The corporations, and this means not only the street railway companies, but every corporation and firm of any description in the city, was strongly against it.

STRIKE AT WINNIPEG

Winnipeg is in the throes of a strike that has assumed a very serious aspect. The trouble culminated March 29, when the conductors and motormen in the employ of the Winnipeg Street Railway Company quit work in an effort to enforce their demands for higher wages. Violence attended the situation almost immediately. Wires were cut and switches opened, and finally the attempt was abandoned that had been made to run cars. A proclamation was issued at once by Mayor Sharpe asking the co-operation of all citizens in maintaining order. The following day a detachment of Royal Canadian Mounted Rifles was placed on duty in Main Street, and the regulars were called into service to preserve order. Regulars, drawn up at Higgins and Main Streets, with fixed bayonets, did not awe the crowd, which attached a car and attempted to drag away the crew. Mayor Sharpe then read the riot act, and was greeted with hoots and jeers. The soldiers then loaded with ball cartridge. The mob still failed to disperse, and a charge with fixed bayonets was ordered. This drove back the excited men. Six cars were operated, but none was sent out after dark.

BROOKLYN EMPLOYEES' ISSUE THEIR MAGAZINE

The Brooklyn Rapid Transit Employees' Benefit Association last week issued the first number of their new magazine "The Third Rail." They have secured the consent of the company to publish this in the interests of their association and to further advance the objects for which the association was organized. The paper has thirty-six pages, and cover, of which twenty-four are devoted to reading matter. The contents includes fiction and feature articles with illustrations. Any profits that may be derived from the publication will be devoted to furthering the educational work of the members of the Employees' Benefit Association. The committee from the Benefit Association will have the immediate work of editing and publishing the new monthly. The general plan for distributing the paper and placing it on sale was referred to in the STREET RAILWAY JOURNAL of Jan. 26, 1906.

FREIGHT SERVICE BEGUN ON THE OLD COLONY

A beginning was made April 2 in the operation of freight cars by the Old Colony Street Railway Company, of Boston, under the Brockton-Taunton-Providence permit, granted several weeks ago by the Massachusetts Railroad Commission. The first cars were started from Taunton, through the towns of Rehoboth and Seekonk to the State line, whence they were taken into Providence over the tracks of the Rhode Island Company. This development is practically the first move in the freight business by the large companies operating into Boston.

The Old Colony trackage gives access direct to a new freight station just established in Taunton, and within a few days the route for this car will be extended toward Boston as far as Brockton. It was expected that the Brockton arrangements would be all completed this week; but two stores which are to serve as a temporary freight station and for offices of the division freight agents have yet to be remodeled to fit them for their new uses, and a short section of tracks connecting this station with the company's existing tracks in Brockton has yet to be put down. When that is done service will be established between Taunton and Fall River.

So far as the Brockton-Boston link of this contemplated system is concerned, the company has not yet finished with the town of Milton with reference to securing the necessary franchise from the local authorities. It will be some time yet before the petition for approval of this northerly link can be placed before the Railroad Commissioners. The Fall River branch was petitioned for some time ago, but the Fall River Aldermen imposed so many unusual restrictions that the Railroad Commission sent the matter back to the local authorities. The Commission has stated that it will grant its approval to the proposition when the local authorities give their permission without imposing conditions foreign to the business of carrying freight. The Commission holds that the only conditions pertinent are those which relate to the manner in which freight business shall be conducted, and not conditions carrying provisions for snow removal, waiting rooms, and other items associated wholly with passenger service.

NEW ELGIN, AURORA & SOUTHERN COMPANY ORGANIZES—MOOTED PLANS FOR EXTENDING THE INFLUENCE OF THE COMPANY

At a meeting of the stockholders of the newly organized Aurora, Elgin & Chicago Railroad Company, the consolidation of the Aurora, Elgin & Chicago Company, the Elgin, Aurora & Southern Traction Company and the Cook County & Southern Railraod Company, officers and directors for the ensuing year were chosen as follows:

L. J. Wolf, president; D. J. Peffers, vice-president; H. C. Lang, secretary and treasurer. L. J. Wolf, D. J. Peffers, H. C. Lang, F. E. Meyers, James Hopkins, Harry Greenebaum, E. C. Faber, directors. Later, Mr. Faber's appointment to the position of manager of the company was announced.

On March 31, a call was issued from the offices of the Mandelbaum Syndicate in Cleveland for a meeting of the shareholders of the company at Chicago, June 30 next, to vote on a proposition to issue bonds to the amount of $25,000,000. Coupled with the notice is another calling upon shareholders to pass upon a proposition to enlarge the scope of the present charter so as to enable the company to acquire a network of lines covering practically all of Northern Illinois and Southern Wisconsin. Among the lines it is proposed to include in the merger, aside from the three embraced in the reorganized Aurora, Elgin & Chicago Company, are: Elgin & Belvidere, Belvidere, Rockford & Freeport, Rockford, Beloit & Janesville, Janesville & Madison, Geneva & Freeport, Aurora & DeKalb, Aurora, Plainfield & Joliet, Yorkville & Plano, Carpentersville & Crystal Lake, Freeport & Dubuque.

THE PUBLIC SERVICE CORPORATION'S MEETING

United States Senator John F. Dryden's resignation as a director of Public Service Corporation of New Jersey was announced to stockholders at the annual meeting held April 2. His letter stated that his Senatorial duties prevented him from giving attention to the business of the corporation. At the election James P. Dusenberry was elected in his stead, and A. B. Carleton, Thomas Dolan George R. Gray, A. R. Kuzer, T. N. McCarty, R. Morgan and J. I. Waterbury, the retiring members, were reelected. At the close of the meeting Secretary Frederick Evans said no action had been taken on the merger plan with J. P. Morgan and United Gas interests. Considerable interest attached to the meeting because of the statements to the effect that new interests would be admitted to the management of the company.

THE ELSBERG BILL IN NEW YORK

The Elsberg Rapid Transit bill has passed the State Senate. Its essential object is to give the New York Rapid Transit Commission greater freedom of action. Now it can let contracts for constructing rapid transit lines only on condition that the contracting party be bound to equip and operate them. The original Elsberg bill precluded the further use of that plan and required separate contracts for construction, and for equipment and operation. As passed by the Senate, it leaves the option of either plan to the Commission. Franchises are limited by the bill to twenty years, with renewals not to exceed the same period.

THE MONTGOMERY SITUATION ADJUSTED

The City Council of Montgomery, Ala., and the Montgomery Traction Company have at last reached an agreement under which the Traction Company will immediately begin the work of connecting its tracks with those of the recently acquired Montgomery Street Railway. An ordinance has been passed granting the franchise, and the representatives of the Traction Company have signified the intention of that company to accept the terms. With one exception, the ordinance is identical with the one passed by the Council and approved by Mayor Teague several weeks ago. This exception was in reference to the provision as to the issuing of books of twenty-four tickets to be sold for $1. The ordinance has been before the City Council since December. The controversy has been referred to from time to time in the STREET RAILWAY JOURNAL, and recently was the subject of an editorial, in which were set forth the peculiar conditions sought to be imposed upon the company for the simple privileges it desired looking to the improvement of property.

THE DEATH OF G. MARTIN BRILL

George Martin Brill, president of the J. G. Brill Company, died suddenly of apoplexy on March 31, at his home in Marion, a suburb of Philadelphia. The stroke came without warning, for he was apparently in his usual good health and had only returned the previous evening from New York, and intended to go to St. Louis the following day. The funeral was held on the afternoon of April 4, at his home, and the pall bearers were the heads of the different departments of the Brill Company.

The story of Mr. Brill's life is easily read by what he has left—a happy home, an honored name, and a successful business. He was born in Hesse Cassel, Germany, in 1846, and was the eldest son of John George Brill. The father came to this country in 1847 and settled in Philadelphia, where he was employed in the car building concern of Murphy & Allison. After his graduation from the public school, G. Martin Brill obtained a position with Murphy & Allison and was foreman of the woodworking department for several years. In 1868 the plant was destroyed by fire, and as the firm decided to discontinue street car building, Mr. Brill and his father took up this branch of the business. A small shop was rented at Thirty-First and Chestnut Streets, and the new firm of J. G. Brill & Son commenced in a very modest manner. The quality of workmanship of the productions was quickly recognized, and year after year it was necessary to purchase additional ground and erect buildings, until all the available land in the vicinity (four and a half acres in extent) was covered. In 1890 the present plant—comprising eighteen and a half acres, covered with modern buildings, was occupied. Since the death of his father in 1888, Mr. Brill has been the president of the company, and until recently was also its general manager. The company's first foreign order was obtained in 1872 for a large number of cars for the City of Mexico, and after that the foreign business grew rapidly and to-day constitutes a large percentage of the output. Highest awards have been received by the company for its cars and trucks at nearly all the principal expositions at home and abroad, the last being the Lewis and Clark Exposition of 1905. Finding it necessary to take care of an increasing volume of business, the Brill Company has purchased within the last few years the American Car Company, of St. Louis, the Kuhlman Car Company, of Cleveland, and the John Stephenson Company, of Elizabeth, although each of these plants is operated separately. The Philadelphia plant has received important additions nearly each year of its history, and another large erecting shop is about to be built.

G. MARTIN BRILL

As an inventor Mr. Brill has issued to him nearly one hundred patents, for the most part on cars, trucks and parts of their equipment. As a manufacturer his work is well known to readers of this paper, but it might also be said that the management of the Brill works was directly in his charge. He possessed a marvelous faculty for detecting faulty work of any kind, whether of material, design or workmanship, and he trained his men to exercise the same degree of watchfulness. In the business world he was regarded as an unusually able organizer and director of affairs. His business associates knew the man they were dealing with, for he spoke plainly, and his methods were always governed by high principles.

Besides being president of the J. G. Brill Company, Mr. Brill was a director in the American Car Company, the G. C. Kuhlman Car Company, the John Stephenson Company, the Merchants' National Bank, of Philadelphia, and the Inter-State Railway Company. He was a member of the Manufacturers' Club, in Philadelphia, the New York Club, the Union Club, of Cleveland, and the St. Louis Club.

IMPROVEMENTS IN HELENA

A contract has been made between J. G. White & Company and the Helena Light & Railway Company, of Helena, Mont., whereby the former company will undertake the reconstruction of properties of the latter for $140,000.

On Sept. 11, 1905, the public service utilities of Helena were bought, reorganized and consolidated under the holding corporation known as the Helena Electric Light & Railway Company. The amount of the transaction was $2,350,000, which covered electric railway, electric light and gas lighting properties. Responsibility for operation was delegated by the corporation to the operating department of J. G. White & Company. During the month of February, 1906, the traffic on the railway was nearly quadruple that of the corresponding month of 1905, and the proceeds from the lighting service were also very materially augmented.

Electric power is supplied the Helena Light & Railway Company by the Missouri River Power Company, and the organizations are united in the ownership of the central sub-station, from which power is distributed for the public service. The agreement for power supply calls for a rate at maximum of utilization of $25.00 per horse-power-year. Owing to the fact that the maximum is not at present utilized, there is a large margin for increase of consumption by the light and railway company without increase of operating expense.

There are about 18 miles of track in the railway system, a great deal of which will be reconstructed under the provisions of the contract just signed. Before the reorganization the annual income from the railway property was about $62,000, and from the lighting property, both gas and electric, about $151,000. The combined operating expenses were about $143,000, making the ratio of operating expenses to gross receipts 67 per cent. A careful estimate of operating conditions after the contemplated improvement places the gross receipts at $255,000, and the operating expenses at $147,000, thus reducing the ratio to 57 per cent. The estimate for improvement includes $115,000, to be devoted to reconstruction and extension in general, and $25,000 for the relaying of tracks and replacement of overhead construction on Main Street in Helena.

THE STANDARDIZATION COMMITTEES

It will be recalled that shortly after the plans for reorganizing the various national street railway associations had been consummated, announcement was made that an important function of the new parent association and its allied bodies would be the instituting of active work looking to the securing of more uniform standards and practice along certain lines. To this end two committees on standards have been appointed, one representing the American Street & Interurban Railway Association, and one representing the American Street & Interurban Railway Engineering Association. The plan is for the committee of the engineering association to make the active investigations and prepare the reports. The reports will then be reviewed by the committee of the parent body, and the latter committee will make the recommendations to the main association, based upon the reports. The office of the secretary of the parent association will be placed at the disposal of the engineering standardization committee, and the general notices and information blanks will be sent out from that office. By co-operating in this way it is expected that the two committees and the association headquarters will keep thoroughly in touch one with the other on this work. A considerable amount of preliminary work has been done and it has been decided to take up first, investigations looking to the standardizing of tread of wheels, brake shoes, journals, journal-boxes, and tanks for street and interurban railways. Data blanks requesting information on these items will be sent out in the near future to all electric roads in America, and the committee bespeak the co-operation and assistance of everyone interested in this important work.

Secretary Swenson announces the appointment of the two standardization committees as follows:

For the American Street & Interurban Railway Association:

Chairman, H. C. Page, general manager, Springfield Street Railway Company, Springfield, Mass.; John Murphy, general manager, Pittsburg Railways Company, Pittsburg, Pa.; H. A. Nicholl, general manager, Indiana Union Traction Company, Anderson, Ind.; T. W. Wilson, general manager, International Railway Company, Buffalo, N. Y.; H. Wallerstedt, engineer car equipment, Interborough Rapid Transit Company, New York, N. Y.

In the American Street & Interurban Railway Engineering Association:

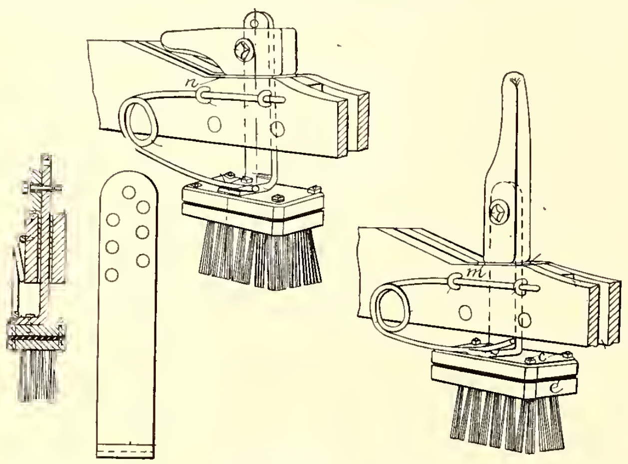
Chairman, H. Wallerstedt, engineer car equipment, Interborough Rapid Transit Company, New York; Herschel A. Benedict, mechanical and electrical engineer, United Traction Company, Albany, N. Y.; F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Company, Philadelphia, Pa.; Paul Winsor, chief engineer of motive power and rolling stock, Boston Elevated Railway Company, Boston, Mass.; W. H. Evans, master mechanic, Indianapolis Traction & Terminal Company, Indianapolis, Ind.; H. B. Fleming, superintendent of maintenance of way and structure, Chicago City Railway Company, Chicago, Ill.; J. M. Larned, engineer, maintenance of way, Pittsburg Railway Company, Pittsburg, Pa.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MARCH 27, 1906

815,986. Pleasure Railway; William P. Taylor and James L. Hoard, of McKeesport, Pa. App. filed Dec. 28, 1905. A gravity railway comprising a main track on which cars are adapted to travel in forward direction, a track section on which the cars are

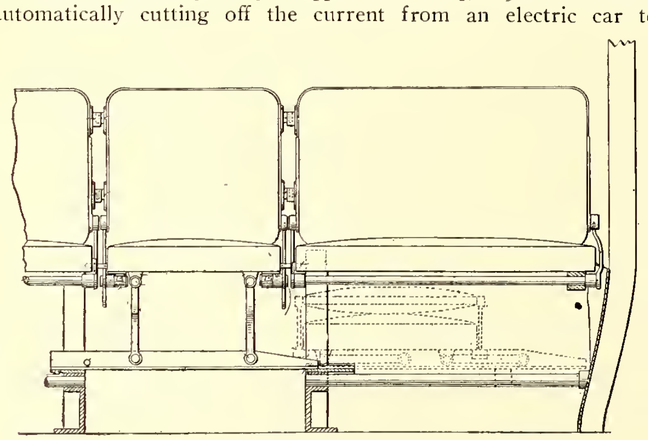


PATENT NO. 816,485

adapted to travel in a rearward direction, movable track sections for switching the cars, and braking means carried by the first mentioned track section to prevent passage of the cars thereon during the operation of the switch sections, said braking means being automatically operated in the movement of the switch sections.

815,991. Trolley Pole; Andrus S. Weaver, Sodus, N. Y. App. filed Jan. 7, 1905. The upper end of the trolley pole is hinged to the body thereof and the relative movement causes the pole to drop when the wheel leaves the conductor.

816,014. Safety System for Electric Road Crossings; Arthur H. Johnson, Rahway, N. J. App. filed Dec. 5, 1892. Means for automatically cutting off the current from an electric car to



PATENT NO. 816,537

thereby prevent its approach to a track on which a steam or other train is approaching.

816,148. Trolley Shield; John W. Brown and Charles W. Jenkins, Washington, D. C. App. filed April 29, 1905. The lower half of the trolley wheel runs in a curved guard which prevents the wheel from catching over the wire when it slips off and is being repositioned by the retriever or other means.

816,239. Trolley Harp; Isaac H. Lunt, Barre, Va. App. filed Sept. 6, 1905. The trolley is hinged at the upper end of the pole to have an independent transverse movement, the purpose of which is to facilitate rounding curves.

816,293. Brake Hanger; George M. Brill, Philadelphia, Pa. App. filed June 27, 1905. An adjustable and universal joint for each end of the hanger consisting of bearing blocks adapted to turn in pockets and hangers free to turn in said blocks.

816,294. Car Truck; John A. Brill and Samuel M. Curwen, Philadelphia, Pa. App. filed March 31, 1904. Details of construction.

816,308. Switch; Matthew S. Farmer, Washington, D. C. App. filed July 21, 1905. Levers in the tread of the rails are depressed by the wheel flange thereby elevating a switch-throwing pin adapted to be engaged by suitable means on the car.

816,373. Brake Shoe; James F. Powers, Elkton, Md. App. filled Dec. 16, 1905. Comprises a cast-metal body portion having a hard metal strengthening member applied to the rear face thereof, said member being provided with a plurality of dovetailed openings, and with an intermediate bearing head, having a dovetailed recess formed therein, said recess and openings being designed to receive material of the body for uniting the strengthening member thereto and the body having enlargements in which the member is terminally embedded.

816,377. Switch; Hugh Richardson, Atlanta, Ga. App. filed Aug. 16, 1905. Switch operating mechanism involving two springs of different strength, one of which controls the other.

816,415. Trolley; Henry Zancer and Gustav Hahn, Wilmerding, Pa. App. filed Sept. 25, 1905. A pair of guard arms adapted to normally close over the wheel and hinged upon the sides of the harp, for preventing the escape of the wire. The arms can be separated when desired by a cord connection.

816,467. System of Trolley Wire Suspension; Paul E. Herkner, Berlin, Germany. App. filed Sept. 10, 1904. A trolley system for high-speed trains in which the hangers at the curves have short arms or rods connected with the trolley wire which permit a slight upward yielding thereof when the train passes.

816,485. Rail Cleaning Apparatus; John Lindall, Boston, and Paul Winsor, Weston, Mass. App. filed Jan. 23, 1904. Spring-pressed wire brushes attached to the truck frame.

816,537. Disappearing Seat; Samuel M. Curwen, Haverfort, Pa. App. filed Feb. 9, 1905. An aisle seat adapted to be folded and stored under one of the adjacent seats.

PERSONAL MENTION

MR. CHARLES R. VAN ETTEN, general freight agent of the Brooklyn Rapid Transit Company, has resigned, effective April 1. Mr. James B. McQueeney is appointed acting general freight agent.

MR. F. H. RAPLEY, who held the position of assistant to the president of the Pressed Steel Car Company, has resigned and returned to England to accept a position with a manufacturing company.

MR. ALBERT SPIES, who, in addition to his duties as editor of "Cassier's Magazine," has had charge of the editorial management of the "Electrical Age," of New York, since it has been in the possession of its present owners, has resigned from the editorship of this latter property.

MR. JOHN N. SPELLMAN has been appointed master mechanic of the Indianapolis, Columbus & Southern Traction Company, with headquarters at Greenwood, Ind. Mr. Spellman came from the Indiana Union Traction Company, with which he was connected for six years.

MR. C. N. WILCOXSON, general superintendent of the Cleveland & Southwestern Traction Company, of Cleveland, has been appointed general manager of the company, President F. T. Pomeroy having relinquished the active management. Mr. Wilcoxson was formerly general superintendent of the Western Ohio Railway.

MR. WILLIAM E. ROLSTON, for several years superintendent and chief engineer of the Dayton & Troy Electric Railway, of Dayton, Ohio, has resigned to accept a similar position with the Canton-Akron system, of Canton, Ohio. Mr. Rolston was responsible for many of the innovations which gave the Dayton & Troy the reputation of being one of the best constructed and best operated interurban lines in the Central West.

MR. AXEL H. ENGSTROM, of Philadelphia, consulting engineer in electric railway work, is dead. Mr. Engstrom was born in Sweden and was forty-nine years old. He has lived in America twenty-five years. Mr. Engstrom resigned as chief engineer of the Electric Traction Company, of Philadelphia, in December, 1895, and started in business as consulting engineer. Since then he has been retained as consulting engineer for a number of electric railways and electric power plants, and has also had charge of the complete construction of a number of electric railways, besides the construction of machine shops. Among properties built by Mr. Engstrom are the Fairmount Park Transportation Company's line in Fairmount Park, Philadelphia, and the Philadelphia, Morton & Swarthmore Street Railway Company's lines, adjacent to Philadelphia. Mr. Engstrom's estate will complete the unfinished work that he had on hand under charge of Mr. Chas. R. Peddle, who for a number of years has been associated with Mr. Engstrom.

MR. EDWARD G. WATERS has just been appointed assistant to the first vice-president of the General Electric Company, with headquarters at Schenectady, N. Y. Mr. Waters has been connected with the General Electric interests for a long time, and for the past three years has made his headquarters at Rugby, where he has been associated with the British Thomson-Houston Company, in a managerial capacity. Previous to going to England he was private secretary to Vice-President General Griffin, in the New York office of the company, and before that time represented the General Electric Company at Pittsburg.

MR. B. A. CONOLLY, for the past four years auditor of the Lima Electric Railway & Light Company, of Lima, Ohio, has resigned to become associated with Mr. Joseph B. Mayer, of Buffalo, who recently organized the Traction, Gas & Electric Finance Company, and has acquired a number of properties between Buffalo and Erie. Mr. Conolly will be auditor of the street railway lines of Erie, the Jamestown & Chautauqua Lake Railway, the Chautauqua Lake Steamship Company, the Buffalo, Dunkirk & Western Railway, the Dunkirk & Fredonia, and the Hamburg Railway, which are included in the deal. Mr. Conolly was given a farewell banquet by his associates at Lima a few evenings ago.

MR. WALLACE D. LOVELL, of Newton, Mass., well known as a business man and a street railway promoter, is dead. Mr. Lovell was born in Weymouth, Feb. 3, 1854, and received his education in the public schools, and later engaged in the banking business in Boston. Eventually he became a partner in the firm of Potter, Lovell & Company, bankers and brokers. After the firm retired from business Mr. Lovell passed some time in Mexico. On returning to Massachusetts he became interested in street railways. Foreseeing their development Mr. Lovell planned a system which would connect Boston with Manchester and Concord, N. H. The start in this plan was made with the electric railway running from Exeter, N. H., to Hampton Beach. Later the latter resort was connected with Amesbury. After the construction of the lines running to the beach, to Exeter and Amesbury they were continued to Haverhill, and the purchase of the franchise that had been obtained for a road between Haverhill and Salem, N. H., was the nucleus for the construction of the lines in Southern New Hampshire that have connected Nashua, N. H., with Haverhill, Lowell and Lawrence. Haverhill thus became the center of this system of street railways, and Canobie Lake Park one of the most important pleasure resorts. It was after this that Mr. Lovell secured franchises for the road between Haverhill and Manchester, N. H. The proposed new line to Boston from Haverhill was next planned, the object being to secure a through line from Boston to Manchester, N. H.

MR. W. BOARDMAN REED, whose resignation as engineer of maintenance of way and buildings of the New York City Railway Company was announced in the March 24 issue of this paper, was tendered a farewell dinner March 31 by his late associates. The banquet was held at the Hotel Astor, and was attended by about seventy-five gentlemen, including the officers and heads of departments of the New York City Railway Company, with the members of Mr. Reed's immediate staff and a few of his outside personal friends. The principal address of the evening was that of Mr. Vreeland, who spoke of the deep regret which he and the other representatives of the company present felt at the resignation of Mr. Reed. He also referred in the highest terms to the work carried on by Mr. Reed while with the company, to his engineering ability and skill and to his personal popularity with all with whom he was brought in contact. In conclusion, Mr. Vreeland, in behalf of the members of Mr. Reed's staff, presented him a diamond ring and a series of resolutions which are published below. Mr. H. A. Robinson, of the company's legal staff, in behalf of the heads of departments of the company, also presented Mr. Reed a gold watch. In replying to these speeches and gifts, Mr. Reed referred to the loyalty, harmony and esprit de corps which are characteristic in a marked degree of the organization of the New York City Railway, and which had been an important factor in the success and daily work of the maintenance of the way department. The toastmaster at the dinner was A. E. Aeby, New York agent of the Pennsylvania Steel Company, and addresses were also made by a number of others present. The resolutions to Mr. Reed follow: "Whereas, William Boardman Reed has for twelve years acted in the capacity of engineer of maintenance of way and buildings of this company; and, Whereas, during that period he has, by his uniform courtesy and eminent fairness toward the employees of this department, won their esteem and sincere good will; therefore, be it Resolved, that we adopt this method of conveying to him our grateful appreciation of those qualities which have endeared him to us. Committee, W. T. Dougan, M. H. Lynch, T. H. Gorey, F. Cooley, H. W. Webb, H. Bendfeldt."

AS STATED in the Street Railway Journal of March 31, Mr. J. V. E. Titus, whose energetic methods have made Garton-Daniels products known to electric railways far and wide, has been elected second vice-president of the new Electric Service Supplies Company. Mr. Titus was born in Lambertville, N. J., April 15, 1874, moved to Grenada, Miss., in 1885, but a year later wandered north to Keokuk, Ia., where he received a public school education. In 1892 the Garton-Daniels Electric Company was formed in that city, and Mr. Titus entered its employ as stenographer and bookkeeper. Within another year he was on the road selling lightning arresters with such success that 1894 saw him elected secretary of the company. He was the active manager of the business until 1899, when the present Garton-Daniels Company was formed with Mr. Titus as vice-president and treasurer. Upon the death of President John C. Daniels, in 1903, he was elected president and treasurer.

J. V. E. TITUS

MR. W. T. DOUGAN, assistant engineer of maintenance of way of the New York City Railway Company, has been appointed engineer of maintenance of way of the company, to succeed Mr. W. Boardman Reed, whose resignation from the company, to take an active interest in the management of the Bishop Gutta Percha Company, was noted in the Street Railway Journal of March 24, and to whom, as noted elsewhere in this issue, a farewell banquet was tendered at the Hotel Astor (New York) Saturday evening, March 31, by his associates in the New York City Company. Mr. Dougan accepts the added responsibilities of the new position well fitted by previous experience to perform them, for he has been with the company two years as assistant to Mr. Reed, and six years as engineer of construction in changing from horses to underground conduit. In addition to this he has as an asset engineering experience dating from his graduation from Union College in 1892, which has extended to many branches of railroad work. For two years Mr. Dougan was assistant engineer of construction of the electric railway from Fonda to Gloversville, N. Y. Later he had charge of the construction of the electric railway from Herkimer to Frankfort, through Mohawk and Ilion, N. Y. This work included the building of the power house at Mohawk. For a year he was assistant engineer at the iron ore mines owned by Witherbee, Sherman & Company in Essex County. He also made the preliminary surveys and located the Mountain Lake Railway, which extends from Gloversville to Mountain Lake, a summer resort in the Adirondacks. Mr. Dougan also had charge of the preliminary surveys for the New York & Ottawa Railway from Moira, N. Y., to Ottawa, Canada, across the St. Lawrence River. Following this began his connection with the New York City Railway Company.

W. T. DOUGAN

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Feb. '06	66,420	37,839	28,581	22,667	5,914
	1 " " '05	60,312	35,462	24,850	22,917	1,934
	2 " " '06	139,655	79,458	60,197	45,334	14,863
	2 " " '05	125,777	72,554	53,223	45,834	7,390
AURORA, ILL. Elgin, Aurora & Southern Tr. Co	1 m. Jan. '06	40,714	23,790	16,924	9,333	7,591
	1 " '05	33,906	22,297	11,609	9,333	2,276
	7 " " '06	307,741	164,735	143,006	65,173	77,833
	7 " " '05	273,996	153,064	120,932	65,173	55,760
BINGHAMTON, N. Y. Binghamton Ry. Co	1 m., Feb. '06	19,364	11,881	7,483	7,372	111
	1 " " '05	17,134	10,696	6,438	7,844	†1,406
	8 " " '06	193,371	100,090	93,281	58,137	35,144
	8 " " '05	173,001	91,905	81,096	56 866	24,229
CHAMPAIGN, ILL. Illinois Traction Co	1 m., Feb. '06	209,064	*115,313	93,751	------	------
	1 " " '05	170,380	*94,366	76,014	------	------
	2 " " '06	442,816	*240,755	202,061	------	------
	2 " " '05	361,740	*197,345	164,395	------	------
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Jan. '06	39,545	27,480	12,065	------	------
	1 " " '05	26,259	19,831	6,428	------	------
	7 " " '06	404,711	211,326	193,384	------	------
	7 " " '05	293,799	156,326	137,473	------	------
Chicago & Milwaukee Elec. R. R. Co	1 m., Feb. '06	36,593	21,050	15,543	------	------
	1 " " '05	23,599	14 888	8,710	------	------
	2 " " '06	80,0?7	43,744	36,293	------	------
	2 " " 05	48,425	29,542	18,883	------	------
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co	1 m., Feb. '06	13,930	*8 599	5,331	6,678	†1,347
	1 " " '05	11,209	*8,971	2,238	6,673	†4,435
	2 " " '06	29.788	*17,717	12,072	13,357	†1,285
	2 " " '05	24,555	*18,708	5,846	13,337	†7,490
Cleveland & Southwestern Traction Co.	1 m., Feb. '06	39,718	26,981	12,737	------	------
	1 " " '05	30,406	22,923	7,483	------	------
	2 " " '06	86,285	54,531	31,754	------	------
	2 " " '05	65,166	45,700	19,466	------	------
Lake Shore Electric	1 m., Feb. '06	52,128	*31,714	20,414	20,404	10
	1 " " '05	41,043	*28,463	12,580	20,404	†7,824
	2 " " '06	111,756	*70,370	41,386	40.808	578
	2 " " '05	88,877	*60,321	28,556	40,808	†12,252
DETROIT, MICH. Detroit United Ry	1 m., Feb. '06	379,334	*234,319	145,015	92,296	52,719
	1 " " '05	321,177	*211,070	110,107	92,970	17.137
	2 " " '06	797,167	*484,554	312,613	184,538	128,075
	2 " " '05	677,373	*440.275	237,098	186,407	50,691
DULUTH, MINN. Duluth St. Ry. Co	1 m., Jan. '06	54,424	33,722	20,702	17,536	3,166
	1 " " '05	47,593	27,908	19,685	16,729	2,956
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co	1 m., Feb. '06	107,655	56,592	51,063	------	------
	1 " " 05	95,425	45,914	49,511	------	------
	2 " " '06	221,870	112,593	109,277	------	------
	2 " " '05	201,252	93,899	107,353	------	------
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co	1 m., Jan. '06	80,145	47,531	32,614	------	------
	1 " " '05	68,5?6	43,107	25,459	------	------
	12 " Dec. '05	949,498	580,832	363,665	------	------
	12 " " '04	83 ,231	533,295	301,937	------	------
FT. WORTH, TEX, Northern Texas Tr. Co	1 m., Dec. '05	57,296	35,758	21,538	9,938	11.601
	1 " " '04	55,165	30,972	24,193	9,182	15,011
	12 " " '05	661.037	391,863	269,174	118,127	151,047
	12 " " '04	564,711	328,813	235,898	108,760	127,138
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Jan. '06	14,832	13,347	1,485	3,899	†2,414
	1 " " '05	15,675	14,854	821	3,408	†2,587
	12 " " '06	166,224	167,136	912	44,149	†45,060
	12 " " '05	200,758	137,347	63,411	40,772	22,639
HOUSTON, TEX. Houston Electric Co.	1 m., Jan. '06	43,077	30,137	12,940	8,174	4,766
	1 " " '05	34,572	22,123	12 449	8,389	4.061
	12 " " '06	525,820	321,539	204,281	105,289	98,992
	12 " " '05	364,318	316,042	48,277	97,571	†49,294
HUDSON, N. Y. Albany & Hudson R. R. Co	1 m., Feb. '06	19,863	*17,880	1,983	5,000	†3.017
	1 " " '05	19,537	*18,051	1,486	5.000	†3,514
	8 " " '06	236,460	*178,585	57,875	40,000	17,875
	8 " " '05	207,758	*159,826	47,932	40,000	7,932
MANILA, P. I. Manila Elec. Ry.& Lt. Co.	1 m., Feb. '0?	70,600	34,845	35,755	------	------

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co	1 m., Feb. '06	257,206	126,301	130,905	86,095	44,811
	1 " " '05	236,025	128,378	107.647	71,193	36,455
	2 " " '06	535,358	265,918	269,440	170,311	99,128
	2 " " '05	492.483	258,606	233,877	145,543	88,334
Milwaukee Lt., Ht. & Tr. Co	1 m., Feb. '06	40,872	17,807	23,066	21,953	1,113
	1 " " '05	33,856	19,287	14,568	18,373	†3,804
	2 " " '06	85.787	37,648	48,139	43,691	4,448
	2 " " '05	72,379	39,069	33,310	37,316	†4,005
MINNEAPOLIS, MINN. Twin City R. T. Co	1 m., Feb. '06	380,385	188,843	191,542	109,708	81,834
	1 " " '05	321,451	170,281	151,170	97,325	53,84?
	2 " " '06	788,251	394,362	393,888	219,417	174,472
	2 " " 05	672,571	345,595	326,976	194,650	132,326
MONTREAL, CAN. Montreal St. Ry. Co	1 m., Feb. '06	213,416	156,039	57,377	36,124	21,253
	1 " " '05	185,864	147,896	37,968	20,478	17,491
	5 " " '06	1,171,016	772,173	398,843	138,962	259,881
	5 " " '05	1,027,214	701,878	325,336	95,805	229,530
OAKLAND, CAL. Oakland Traction Consolidated	1 m., Jan. '06	121,623	68,524	53,099	35,679	17,420
	1 " " '05	104,673	61,521	43,152	30,485	12,668
	12 " Dec. '05	1,441,471	740,367	701,103	392,955	308,149
	12 " " '04	1,258,136	659,261	598,875	318,550	280,335
San Francisco, Oakland & San Jose Ry. Co	1 m., Jan. '06	48,309	22,801	25,508	16,497	9,011
	1 " " '05	40,381	16,405	23,976	12 578	11,398
	12 " Dec. '05	535,134	234,998	300,136	159,840	140,295
	12 " " '04	419,350	180,409	238,940	111,000	127,940
OLEAN, N. Y. Olean St. Ry. Co	1 m., Jan. '06	8,939	4,531	4.408	2,744	1,664
	1 " " '05	8,788	3,890	4,898	2,693	2,205
	7 " " '06	77,727	38,671	34,057	18,576	20,481
	7 " " '05	69,166	33,509	35,657	18,513	17,144
PEEKSKILL, N. Y. Peekskill Lighting & R R. Co	1 m., Jan. '06	10,210	*5,844	4,366	------	------
	1 " " '05	9.116	*5,987	3,129	------	------
	7 " " '06	78,772	*40,912	37,861	------	------
	7 " " '05	71,804	*40,188	31,616	------	------
PHILADELPHIA, PA. American Rys. Co	1 m., Feb. '06	177,037	------	------	------	------
	1 " " '05	153,347	------	------	------	------
	8 " " '06	1,225,696	------	------	------	------
	8 " " '05	1,006,770	------	------	------	------
ROCHESTER, N. Y. Rochester Ry. Co	1 m., Feb. '06	147,409	82,908	64,501	27,776	36,725
	1 " " '05	124,452	74,442	50,010	26,776	23,234
	2 " " 06	305,170	175,333	129,837	55,761	74,076
	2 " " '05	259,403	152,032	107,371	53,762	53,609
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Feb. '06	638,076	*401,457	236,619	198,609	38,010
	1 " " '05	553,337	*398,043	155,294	199,657	†44,363
	2 " " '06	1,336,003	*825,748	510,255	397,218	113,037
	2 " " '05	1,159,833	*840,539	319,294	399,344	†80,050
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Jan. '06	600,210	------	------	------	------
	1 " " '05	543,371	------	------	------	------
	12 " Dec. '05	7,061,352	------	------	------	------
	12 " " '04	6,647,612	------	------	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Jan. '06	49,618	31,863	17,755	10,904	6 851
	1 " " '05	41,340	25,607	15,733	10,553	5,180
	12 " " '06	594,514	354,283	240,231	128,045	112,185
	12 " " '05	545,750	317,445	228,306	126,111	102,195
SEATTLE, WASH. Seattle Electric Co	1 m., Jan. '06	235,396	155.893	79,503	23,230	56,273
	1 " " '05	201,760	142,636	59,124	25,135	33,989
	12 " " '06	2,599,550	1,687,269	912,281	289,744	622,537
	12 " " '05	2,333,181	1,614,395	718,786	297,420	421,366
SYRACUSE, N. Y. Syracuse R. T. Co	1 m., Jan. '06	86,061	49,591	36,470	21,759	14,711
	1 " " '05	74,254	44,251	30,003	20,334	9,669
	1 " Feb. '06	79,351	44,349	35,002	22,092	12,910
	1 " " '05	68 479	41,246	27,233	20,312	6,921
	2 " " '06	165,412	93,940	71,472	43,851	27,621
	2 " " '05	142,733	85,497	57,236	40,646	16,590
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Jan. '06	59,831	39,150	20,681	10,417	10,264
	1 " " '05	46,248	30,187	16,060	8,962	7,093
	12 " " '06	643,344	423,480	219,863	123,873	95,990
	12 " " '05	574,489	369,326	205,163	113,306	91,857
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Jan. '06	159,053	*83,148	75,905	42,290	33,615
	1 " " '05	150,944	*76,090	74,854	42,701	32,153
	12 " Dec. '05	1,913,456	*972,994	940,462	510,307	430,155
	12 " " '04	1,752,833	*923,208	829,625	499,874	329,751

Street Railway Journal

VOL. XXVII. NEW YORK, SATURDAY, APRIL 14, 1906. No. 15.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:

NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....$3.00 per annum

Single copies .... 10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.... $6.00

25 shillings. 25 marks. 31 francs.

Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 122,800 copies, an average of 8187 copies per week.

Painting Car Floors

In most places it is the prevailing idea that the car floor needs painting only at times when the car receives its yearly general overhauling. Some roads, however, are adopting the practice of applying a coat of paint to the floor at intervals as frequent as twice a month. It must be admitted that there is much to recommend this practice. Nothing in a car probably is more noticeable than the floor, and it is certain that there is no part more difficult to keep clean. A coat of paint applied to the floor every few weeks facilitates the cleaning wonderfully. It tends to make the floor waterproof and, therefore, does not allow the dirt to adhere, as it does to a rough worn-out floor. The additional cost of painting is to a great extent counterbalanced by the less cost of cleaning. But above all the appearance of the floor is improved wonderfully and the car is made more sanitary, due to the fact that sputa cannot soak into the floor and dry.

Keeping Brake-Shoe Data

An attempt recently made by us to obtain definite figures regarding the wear of brake-shoes, discloses the fact that close records of this important feature are not kept in a great many car shops. In a large number of cases, neither the original weight of the shoe nor its weight when discarded, is known. The average mileage can usually be calculated in a general way by dividing the car mileage by the number of shoes put on in a given period, and in some cases figures are kept of the length of time elapsing between the replacement of individual shoes. But the cost per 1000 miles run and the percentage in weight of the shoes scrapped, are frequently unknown quantities. It may be argued that there is no need of such figures. On the other hand, it is reasonable to presume that the more definite the information that can be secured in street railway shop practice about such a considerable item of expense as brake-shoes, the greater is the probability of reducing expenses. Suppose, for instance, that the cars of an interurban system are cared for at several division shops under the direction of foremen who do not see each other once a month. One foreman may discard his shoes at a thickness such that the discarded shoes will have a weight of 20 lbs. Another foreman may have found by experience that the shoes can be worn to a thickness which gives them a weight of but 16 lbs. This little difference of opinion between foremen would in a year's time result in quite an expenditure for brake-shoes. Were all foremen on the line given instructions to discard shoes, say, at 16 lbs., and then be provided with a balance of some sort with which to weigh the shoes, quite a saving would often result. It is extremely satisfactory that the Committee on Standards has announced that one of the first subjects which will engage its attention is that of brake-shoes. We doubt whether there is any other portion of the car equipment which needs standardization more, and in which a set of standards could be generally adopted with so little inconvenience, than with the brake-shoe.

But to return to the subject which we were discussing, that of weights. An incident, which shows one instance where a knowledge of the weights of brake-shoes came into play, may be cited. A study of the weights of the shoes when put on and when discarded and the percentage of the original weight worn away, gave the superintendent the idea that he might be able to increase this percentage. An examination of the shoe itself showed that quite a little metal could be removed from the flange of the shoe. As the shoes were cast in a local foundry, it was necessary only to cut down the patterns a proper amount, and the desired results were obtained. Of course, a close examination of the shoe might have lead to the same conclusion, but, nevertheless, in this instance a record of the weights of the shoes was primarily responsible for a good move.

Pyrometer Records in Power Plants

The notable progress which has been made of late in the measurement of high temperatures, suggests the use of the electric pyrometer as a valuable power-plant auxiliary. Very little has thus far been done by operating companies in the way of regularly keeping watch upon the performance of boiler furnaces, flues, economizers, chimneys and superheaters, and the quantitative information gathered along these lines has been almost entirely obtained in the course of occasional economy tests, rather than in the ordinary course of power-house operation. In the campaign for improved efficiency, which is now being pushed energetically in so many quarters, no department of power-station work needs more attention than the boiler room and its ramifications, and the pyrometer, as now commercially developed, offers a means of analysis which ought not to be overlooked.

The proposal to add any new complications to the modern power plants seldom receives a warm welcome from the overburdened designer, but in behalf of the electric pyrometer, it must be appreciated that the addition of such an instrument to the plant is almost as simple a matter as the purchase of a steam-engine indicator, while its operation is as easy as the reading of a voltmeter, once the installation has been made.

Indicating and recording pyrometers are now available for the measurement of temperatures, both below and above the range of the power-plant service. In comparison with the temperatures found in the manufacture of pottery, operation of blast and electric furnaces, the temperature of flue gases and superheaters in street railway plants are so moderate that little trouble ought to be experienced on the score of thermometer depreciation. In the modern power plant, the flue and superheater temperatures do not often exceed 700 degs. F.; if they do, the matter ought to be investigated. The temperature of the furnaces runs much higher, but there is no trouble in measuring them with commercial apparatus.

Probably, the portable pyrometer is the simplest apparatus for general power-plant service. Usually, the thermo-couple principle is employed, and the readings are recorded either upon a special galvanometer, or upon a calibrated indicator reading directly in degrees. It may be carried about as a portable instrument or mounted upon the power-plant switchboard, for the resistance of the lead wires is almost always negligible. If desired, recording pyrometers can be installed in the flues, economizer, and superheated steam mains, and connected to a common recorder tablet at any part of the plant where it is desired to take readings. The analysis of such records ought to throw a great deal of light upon the efficiency of combustion, the fitness of mechanical stokers for the work in hand, the value of various methods of hand firing, steam power of different fuels, quality of chimney draft, best methods of operating mechanical draft apparatus, the maintenance of superheat in high-pressure steam mains, influence of the weather upon the boiler performance and the presence of defective conditions in the flues and furnaces. At the present time, it is a very difficult problem to compare the performance of steam boilers of different makes, and there is need of much more definite information upon the question of best heating surface, grate area and furnace form for different kinds of service. Temperature measurements do not, of course, indicate the quantity of heat which is being effectively utilized, or wasted, but they are certainly an index of the general condition of things, and for that reason there is little doubt that at no distant date pyrometer records will be widely employed in the scientific operation of boilers and heat engines in power plants.

Inadequate Service in Chicago

In another column of this issue W. A. Blanck contributes an article outlining a method pursued by him to determine whether the downtown surface loops of Chicago are being operated at their maximum capacity. Mr. Blanck was retained by the Chicago City Railway Company to show in a comprehensive manner the traffic condition of these loops in anticipation of a jury trial of cases against the companies, in violation of an ordinance prohibiting the crowding of cars. For the present, however, the cases against the company have been halted by an injunction obtained by the railway companies. The suits in question were brought under the public comfort act, which forbids the overcrowding of cars and which also compels the railway companies to keep thermometers in them. In all about 500 suits had been filed in a justice court to recover $200 for each offense. Judge Mack, who granted the injunction, declared that it was nonsense to bring such a multiplicity of suits when the intent of the law was to impose a fine of $200 for a violation, and further fines if violations were continued.

It cannot be denied that the cars are overcrowded, but blame for the condition of things rests upon the city administration for not providing means by which the company can operate more cars in the downtown district. The companies have proved by actual attempts that they cannot do so. Experiments, both in Chicago and other cities, have shown that there is a certain headway in congested districts at which the greatest number of passengers can be carried. When attempts are made to run more cars, the cars interfere with each other and the schedule is decreased to such an extent that the number of cars passing a point in a given time is decreased rather than increased. During the World's Fair at St. Louis, the St. Louis Transit Company found that a 25-second headway was about the smallest that could be maintained to advantage on Olive Street, and this street is comparatively free from obstructions by traffic and crossing lines. To one who has not studied the problem and who has not had actual experience in running cars in crowded streets, it naturally appears that whenever an additional car is put on the line the hauling capacity will be increased. This fact no doubt accounts for the recent attempts of one of Mayor Dunne's "traction experts" to put into effect a plan to do what the companies themselves have found an impossibility. He said he would show by practical demonstration that more cars could be operated around one of the cable loops. The companies were undoubtedly very glad to afford the opportunity, because they would be the greatest gainers from an increase in the track capacity. The results, however, were not very satisfactory. The first attempt resulted in the tying up for half an hour during the evening rush of a line on which the experiment was tried, and the interference of the general manager of the railway was all that prevented a complete demoralization of the traffic. A second attempt was attended with the same result.

The difficulty encountered by the average person in understanding why more cars on a line do not increase the carrying capacity in proportion, was, no doubt, the reason for Mr. Blanck's investigations. The companies knew by actual trial that additional cars on the loop would not increase the number passing a given point, so that Mr. Blanck's investigations were principally to show the reasons for this condition in a manner that would be readily comprehended by the average juryman. The city authorities have evidently accepted the fact that no more cars can be operated in the downtown districts under existing conditions, yet suits continued to be filed against the railway companies for crowding of cars. What the city should do is to give the railway companies the opportunity to avoid violations of the law. If the companies were allowed to equip their cable lines with the overhead system and make other improvements in downtown terminals, which they are most willing to do, it would be possible to operate a sufficient number of cars so that everybody could usually obtain a seat. Then and not until then would the city be justified in bringing suits of the character that have been filed.

The New York, New Haven & Hartford Locomotive

We are glad to be able to give our readers some details regarding the electric equipment of this very important machine. It is so obvious that the task involved in this novel equipment demands extreme skill in design that one is prepared for almost any sort of innovation. Looking over the machine, however, the thing which most impresses one is not any sensational deviation from well accepted good practice, so much as the skill and tact with which every resource of the electrical and mechanical engineer has been brought to bear upon the task. The conditions to be met were severe in an extraordinary degree. Not only was it necessary to build a single-phase commutating motor of hitherto undetermined dimensions, but it must be able to shift over at will to d. c. supply derived either from an overhead trolley or a third rail, must run efficiently and with complete speed regulation from both sources, and all this without serious complication that might lessen reliability.

The general type of the motor is the compensated series winding already tried on smaller equipments. For this heavy work at high speeds, the geared motor, which does well enough in less severe service, had to be given up, and the most striking electrical feature of the New York, New Haven & Hartford motors is that they are made boldly upon an extreme multipolar design, so as to drive directly the 62-in. wheels of the locomotive. The ordinary designer would be rather staggered at a twelve-pole design for railway service, but here is a twelve-pole motor not only for direct current but for alternating current in particular. To fit it for alternate-current working, the armature is furnished with the high resistance leads, or, as the inventor more properly terms them, preventive leads, which are a feature of the Lamme design of commutating series single-phase motor, and which have been thoroughly described. This device makes it easy to keep down the short-circuit current produced by the alternating flux when the segment is under a brush, and with it the principal source of destructive sparking. Of course, there is very perceptible loss of energy in these leads, less, however, than if the current were allowed free play in the coils.

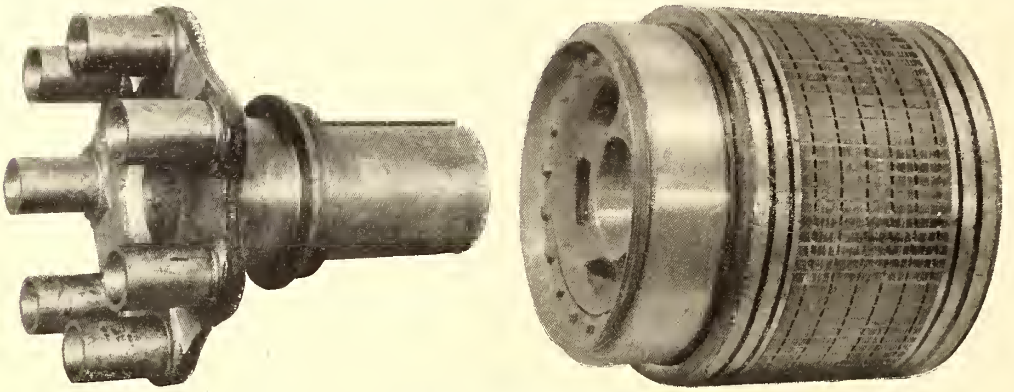
Another important feature of the motor is the artificial ventilation which is applied in this locomotive to transformers, rheostats and motors. The importance of forced cooling in transformers is well known, and the few experiments in cooling railway motors have been very encouraging. In this instance the need of a motor for slow speed, and hence inherently heavy, and also for alternating current, with its allied hysteresis and eddy currents, has given artificial cooling added importance. The increased output in this locomotive is very useful in improving the weight efficiency and in successful working on severe overloads. Since in an a. c. motor, in which one has to work the iron rather gently, the burden naturally falls heavily upon the copper, the extra cooling is highly important.

Incidentally, the fact that one is working the iron at low density enables one to make a virtue of necessity and regulate on the d. c. circuits with the potent aid of a shunted field. On the whole, therefore, the d. c. regulation is found to be rather smoother and more efficient than usual.

In a motor such as here considered, the torque is essentially a matter of importance, and the fact that the motor is also direct coupled has enabled the designer to kill two birds with one stone. By means of a highly ingenious arrangement of springs, the flexible connection between motor and axle also furnishes the cushioning necessary to steady the torque. The general character of the drive from the armature on its quill to the axle is familiar, but the details are most ingeniously worked out. The connection of the armature with the driving wheel is secured by concentric spiral springs to take up the transverse movement, or end thrust, of the armature, and by eccentrically wound springs surrounding the pins on the armature shaft which cushion the movements of the armature in the plane at right angles to the axle. At the same time the fields are carried independently of the truck by a frame supported on the truck journals. The control is, of course, electro-pneumatic from master controllers, so that the essential wiring is at 14 volts from a small storage battery. This allows all the high-voltage wiring to be kept well out of the way of the operator. The current collectors, on account of the three sources with which they must connect, high-voltage a. c. and low-voltage d. c. trolley wires and third rail, are a bit intricate, but they are, so far as the trolleys are concerned, of the sliding form, well tried out on the Continent, and quite certain to give good service. Altogether the details of this locomotive seem to have been worked out in a masterly manner, and while they are probably not yet perfect, they certainly give promise of results well worthy the ingenuity here displayed.

SINGLE-PHASE DIRECT-CURRENT LOCOMOTIVE FOR THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

The plans of the New York, New Haven & Hartford Railroad for the electrification of portions of its main line have been referred to frequently in these columns, and a short description of the locomotive and motors to be used was published in the issue of March 24. Further particulars of these locomotives, of which thirty-five have now been ordered from the Westinghouse Electric & Manufacturing Company, have just become available. As the New Haven locomotive at the Pittsburg works is the largest which has yet been constructed for single-phase operation, an account will first be published of the motor and its construction.



FIGS. 1 AND 2.—ARMATURE AND DRIVING QUILL

ARMATURE

The active armature winding is one of the well-known direct-current types. However, the winding is closed on itself and is not directly connected to the commutator, but is indirectly connected to it through the preventive leads which are a feature of the Westinghouse design of single-phase motor. These leads serve the same function as the well-known preventive coils used in alternating-current work when passing from one tap to another of a transformer. In fact, the armature, in one sense, may be considered as a transformer with a lead brought out from each coil to a contact piece, the various contact pieces being assembled together to form a commutator. The brush, in passing from one contact to another, short circuits an intermediate coil, just as in the case of a transformer under similar conditions. The size and capacity of the preventive coils or leads in a motor are such that under continuous operation they will attain the same temperature as the active winding.

The function of the preventive coils or leads is to reduce to a rather low value the short-circuit current caused when the brush passes from one commutator bar to the next. For reducing the loss, due to this source, to the lowest possible value, the preventive action in the leads should be as high as possible. But, as the working current supplied to the motor must pass through the same leads, it is evident that a high resistance would produce a high I^2R loss from the working current. It is, therefore, evident that there is some intermediate condition which gives the most efficient results, both as regards economy of power and commutation of the current. The preventive leads on these motors have been proportioned for this condition. Thus the losses are actually less when the preventive leads are used than when they are omitted, and the commutation is correspondingly better, especially at low speed and at start. Without these leads excessive current will be found, especially at start, and would be indicated by glowing and spitting at the tips of the brushes. This action appears to be practically absent in the New Haven motors.

The active armature winding consists of several coils per slot, with one turn per coil. The coils are made of form wound strap, and are inserted in the slots from the top. Fibre wedges are used for holding the coils in place in the body of the armature, while binding wires serve for supporting the ends of the winding.

There are several brushes per holder, and both the brushes and holders resemble closely those used in direct-current work. The brushes have a thickness of ½ in. and are pressed against the commutator by means of a coiled spring. The total locomotive mileage is not yet sufficient to determine the life of the brushes, except by approximation from the present rate of wear, and this has been so small that an accurate estimate cannot yet be made. A flexible copper jumper or shunt is used for carrying the current to the brush. The major insulation, between the holder and the framework of the motor, is mica in the form of tubes, which fit snugly over studs, which are riveted to the body of the holder. Over each mica tube is placed a short porcelain sleeve and a long metallic cartridge. A clamp serves for squeezing the cartridge tightly against the mica tube and for retaining the brush holder in place on the framework of the motor. The porcelain sleeve furnishes a certain amount of mechanical protection to the mica tube, and it aids in insulating the holder from the frame, but its mechanical strength is not utilized in connecting the holder to the frame.

FIELD

The field winding, which is of the conductively compensated type, is arranged in two circuits, namely, the main field coils which are placed around projecting poles on the field core and produce the active field flux, and the compensating field coils, which are placed in slots in the projecting pole faces and serve for opposing the armature magnetomotive force, and thus of neutralizing the reactance of the armature. Each pole is provided a number of slots for containing the neutralizing coils which remain at all times electrically in series in the armature circuit, whether the machine is operated by direct current or alternating current. The neutralizing coils are mechanically so arranged on the core that the active field coils can be removed without disturbing the other coils.

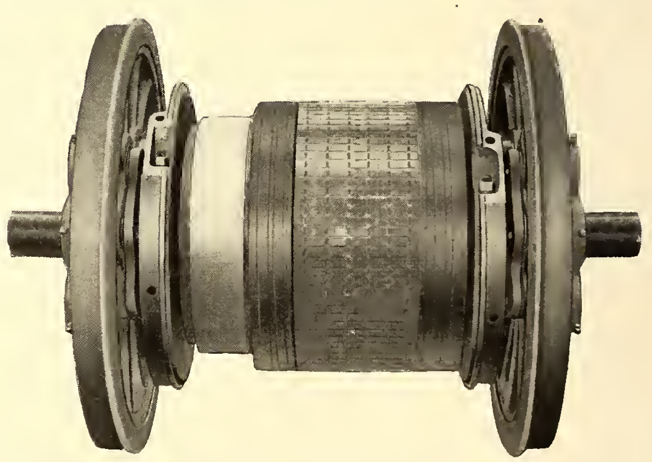


FIG. 3.—A PAIR OF DRIVING WHEELS, WITH ARMATURE AND BEARING HOUSINGS FOR SUPPORTING FIELD FRAME

Although during normal direct-current operation the field coils receive twice as much current per armature ampere as during alternating-current, and, therefore, in effect the coils of each motor are arranged in two groups, which are placed in series for direct current and in parallel for alternating current, the active field coils of each motor are in reality joined permanently in series and only two leads pass from the field frame for this purpose. Two motors are operated as a unit, and the separate field circuits of these motors are placed in series or in parallel, as desired, according to the current used. These facts are discussed more fully elsewhere.

THE FRAME

The frame, truck and cab of the locomotive were built by the Baldwin Locomotive Company, according to designs developed with the coöperation of the New Haven Railroad and the Westinghouse Electric & Manufacturing Company. The frame is of the rigid type, with side pieces made of steel channels, to which are bolted and riveted other steel channels placed traversely, two over each truck, forming transoms for the transmission of the weight to the center-pins. These channels are placed outside the wheels and as close together and as low down as the wheels and draw-head will permit, and are braced and squared by substantial steel flooring plates which are riveted and bolted to the top flanges. The transoms are further braced by gusset plates, which are riveted and bolted to the bottom flanges of both sets of channels, and which transmit the tractive power from the center-pin to the side channels. The frame is still further strengthened and secured by diagonal plate braces.

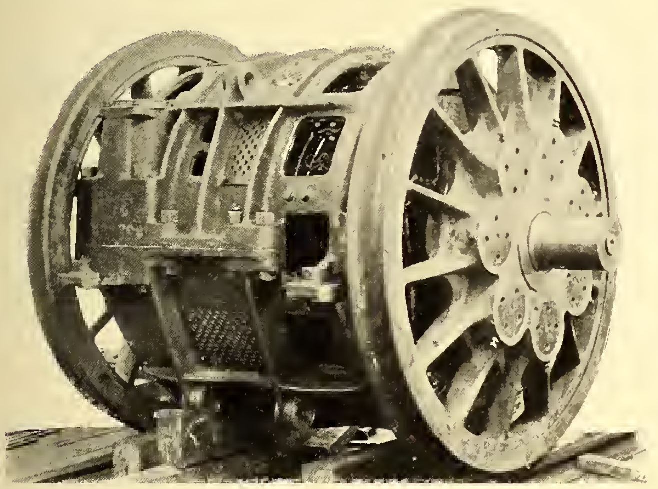


FIG. 4.—A PAIR OF WHEELS WITH MOTORS MOUNTED IN PLACE

THE TRUCKS

The running gear consists of two trucks, each mounted on four 62-in. driving wheels. The trucks have side frames of forged steel, to which are bolted and riveted pressed steel bolsters which carry the center plates. The weight on the journal boxes is carried by small semi-elliptic springs under the ends of the equalizer bars, to assist in restoring equilibrium. A very strong construction is secured without excessive weight, by the use of bolsters 30 ins. wide at the center plate and extended to nearly double that width at the ends which are bolted to the side frames. Center pins, 18 ins. in diameter, transmit the tractive effort to the frame. They are well lubricated, to permit free motion on curves. The truck pedestals are provided with wedge and gib adjustments to take up wear, and the bearing brasses are easily removable by hand. The distance between truck centers is 14 ft. 6 ins.

CAB

The cab is formed of sheet steel, mounted on a framework of Z bars, which supports the walls and roof. Windows are provided at each end, giving an outlook on both sides and in front of the locomotive; and the driver is so close to the front that he can see the track a very few feet ahead. This advantage is not possessed by any type of steam locomotive now in service. The master controllers, auto-transformers, instruments, grid resistances, air operating valves, compressors, and other auxiliary apparatus are mounted inside the cab upon an angle-iron framework, which is built into the cab and securely anchored to floor and roof. A clear passage-way is left through the center. Trap doors in the floor furnish easy access to the motors for inspection or repair.

MOUNTING OF MOTOR

Mechanically considered, the motors are of the gearless type, and interest in the equipment is naturally centered in the methods employed for suspending the motors and for transmitting the torque to the drivers. Special precautions are taken to insure that both the gravitational force of the motor on the axle and the torsional force of the armature on the drivers should be transmitted through elastic mediums, on account of the effect which the great weight of the motor equipment would produce at high speeds. The problem of suspension, as exemplified in these motors, was much more difficult than that encountered in gearless motors intended solely for direct-current work, by reason of the fact that one of the prime essentials in the construction of single-phase series motors is that the air gap must remain constant, while with certain direct-connected motors of the bipolar type it has been found possible to allow the mechanical position of the armature in the field structure to vary between wide limits.

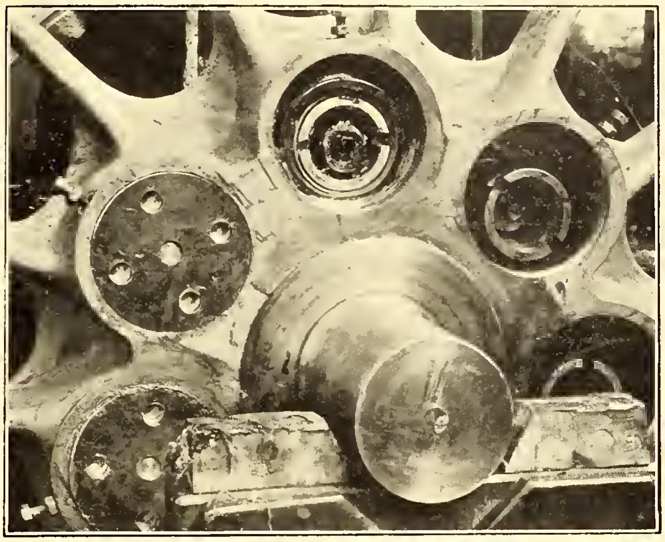
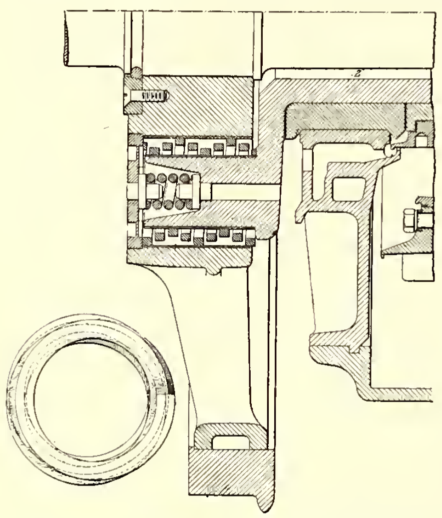


FIG. 5.—DETAIL OF DRIVING WHEEL, SHOWING POCKETS

The hollow shaft of the armature is constructed in two halves, one of which is shown in Fig. 1. These two halves are alike and each is provided with an end disk from which project seven hollow pins. Each half is forced, by hydraulic pressure, into the ends of the hollow armature spider (Fig. 2) and is securely keyed in place. Fig. 1 shows the key way and also a collar which forms the side of a bearing upon which the field frame is journaled. The mounting of the armature and quills on the locomotive axle is indicated in Fig. 3. The split disks, shown at each ends of the armature in this illustration, rest upon the bearings on the armature shaft to which attention has just been directed, and to them is rigidly clamped the outer field frame of the motor, as represented in Fig. 4.

The field structure of each motor is thus mechanically connected to its armature structure through two bearings, which insure that the armature will remain at all times concentric to the field poles. The central portions of these two bearings, as explained, are formed on the hollow cast-steel shaft of the armature, and the external portions are composed of split bronze bearings, which fit snugly into the field housing. The weight of the entire motor, therefore, may be carried by the armature shaft or by the field structure, according to the relative values of the upward pressures exerted on these members.



FIGS. 6 AND 7.—END VIEW OF ECCENTRIC SPRING AND SECTION THROUGH DRIVING WHEEL AND MOTOR, SHOWING HELICAL AND ECCENTRIC SPRINGS IN PLACE

The axle of the locomotive passes through the armature quill, and when actually concentric with it, there is a clearance of about $\frac{5}{8}$ in. on all sides between the axle and the inside of the shaft. This allows a slight movement of the armature, in respect to the axle, required by the flexible suspension of the motor which is about to be described.

On each end of the locomotive axle is mounted a 62-in. driving wheel, in the hub of which are formed seven circular pockets which contain helical springs for assisting in carrying the weight of the motor and for transmitting the torque from the armature. Into each of these pockets there projects one of the hollow pins on the end of the armature shaft, and illustrated in Fig. 1. Each pin is surrounded by a spring placed between the outer circumference of the pin and the inner circumference of the pocket, as shown in Fig. 5. This spring is arranged so as to tend to hold the pin concentric with the pocket, and it resists yieldingly to any gravitational or torsional force for a total movement of $\frac{3}{4}$ in. The spring is of unusual form; its turns are progressively eccentric. Thus an end view of the spring would show an inner radius and an outer radius differing from each other by $\frac{3}{8}$ in. greater than the thickness of the stock from which the spring is built. The convolution of the spring first touches the outer circumference, then passes inwardly and gradually approaches the inner circumference, which is reached by the end of the second turn; it then gradually passes from the inner to the outer circumference, which latter is reached at the end of the fourth turn, and so on to the end of the spring. Between the outer circumference of the spring and the inner circumference of the pocket is fitted a sheet-iron tube, and a similar tube is placed between the spring and the pin. These tubes and the spring form a unit which may be taken intact from the pocket when the outer end cap is removed. On account of their mechanical form and their position in the pockets, these springs cannot be stretched beyond their elastic limit, and, since each pocket is provided with adequate lubrication, it is expected that they will withstand the most severe wear and will last indefinitely. They are capable of sustaining the whole weight of the motor, but they will normally be used solely for transmitting the torque to the drivers. Each pin contains a hollow space, in which is placed an additional pocket, which serves for receiving the end thrust of the motor against the drivers. To illustrate the general plan of this construction, Fig. 6 and 7 are reproduced from drawings contained in two patents issued April 3 to R. Siegfried, and by him assigned to the Westinghouse Company. An end view of the eccentric spring is shown in Fig. 6, while Fig. 7 is a section through the locomotive wheel, hollow armature shaft, pin and motor. The clearance between the armature shaft and locomotive axle is shown at 2. As these are patent drawings, and not working drawings, they do not necessarily show exactly the construction adopted, but are presented to give the reader a general idea of this novel and ingenious form of gearless armature drive.

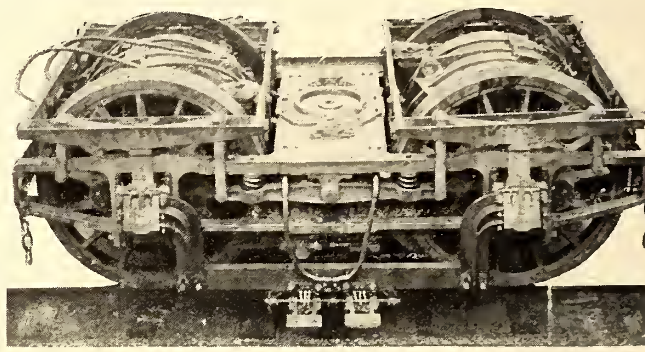


FIG. 8.—SIDE VIEW OF TRUCK

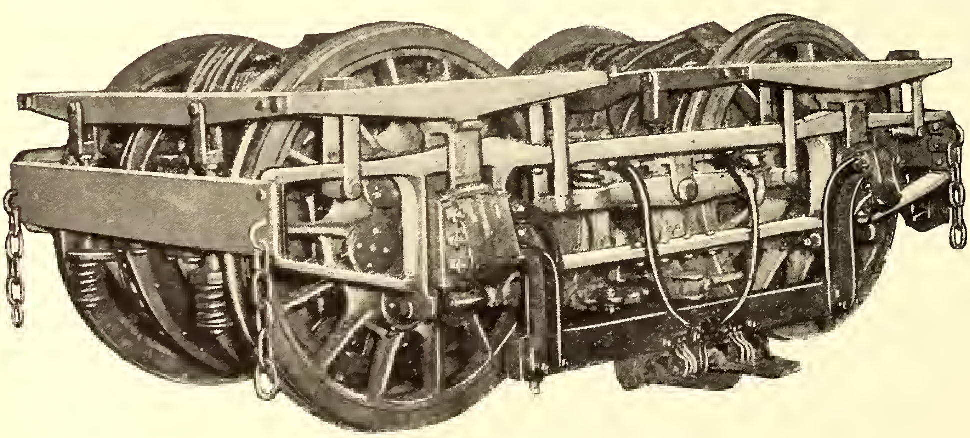


FIG. 9.—END VIEW OF TRUCK

FIELD SUSPENSION

Having now fully discussed the method of attaching the motor to the driving wheels, it will be in order to consider the method of carrying the weight of the motor from the truck and of resisting the backward torque of the field structure. This is accomplished by providing a steel frame entirely distinct from the truck and pivoted from the journal boxes of each locomotive axle. From this frame the weight of the motor is carried by springs, on which rest lugs of the field structure. The adjustment of the tension on these springs determines what proportion of the weight of the motor is carried by them and just how much weight is carried through the pins on the armature quill. The general construction of this frame is shown in Figs. 8 and 9. Since the frame from which the motor is suspended is distinct from the truck, the swinging of the locomotive can have no effect on the motor, and it would seem that it is not possible for the motor to deliver other than a cushioned blow to the rails. Recent observations show that, even when traveling at a speed of 40 m. p. h. over an exceedingly rough track, the motor was not subjected to excessive vibrations, and the locomotive rode smoothly. The backward torque of the field structure is transmitted to the truck through rods which permit a certain amount of vertical or horizontal motion.

PULSATING TORQUE

In connection with the pulsating torque of the single-phase series motor it is especially noteworthy that, although the torque of the machine pulsates at twice the circuit frequency and the electrical torque varies from its maximum value to zero, and even assumed a reversed value if the field flux is not in time-phase with the armature current, such condition does not exist with reference to the mechanical torque which reaches the drivers. The pulsation in the value of this latter torque depends upon the inertia of the matter, which may be moved by the electrical torque before the mechanical torque produces motion, and upon the elasticity of the medium which permits the movement. Thus with the locomotive in question, when the drivers are stationary, each mechanical position which the field and armature structures of the motor assume causes to be transmitted through the springs to the drivers a certain definite value of mechanical torque. In order for the mechanical torque to reach zero fifty times per second, it would be necessary for the field and armature structures to be returned by the springs to the zero torque an equal number of times in this period. The final result is that, unless the inertia of the moving mass and the elasticity of the springs happen to be adjusted for vibrational resonance at the circuit frequency, the armature and field structures will vibrate through very narrow limits, and the torque, which reaches the drivers, and which fluctuates in unison with the electrical torque, will be almost constant at a value equal to about one-half of the maximum electrical torque.

Observations have shown that the mechanical torque exerted by the locomotive drivers varies only slightly, although the torque of the motors as found under brake tests fluctuates through a considerable range. A fluctuating mechanical torque would be undesirable under conditions where the motors are required to exert at starting a torque sufficient to slip the drivers. In this case the torque available for acceleration would bear to that which could be obtained with direct-current motors the ratio of the average to the maximum torque, viz.: 50 per cent for rigid suspension, and values up almost to 100 per cent for spring suspensions. In the New Haven locomotive the necessary and unavoidable weight of the equipment is so much larger than that corresponding to the product of the required draw-bar pull and the co-efficient of tractional friction that the slipping of the drivers is almost impossible.

CONTROL

As has been intimated above, the two armatures on each truck with their corresponding compensating field coils are joined permanently in series, and are operated at all times as a unit. For direct-current work, the two motor units of each locomotive are connected in series at starting and in parallel at full speed, while for alternating-current work the two units are operated separately from the secondaries of the step-down transformers at variable voltage, so that they are practically joined in parallel at all times. Although during direct-current operation, the familiar series-parallel method of control is employed, several unusual features have been introduced so that the losses during acceleration are equally as small as, and perhaps smaller than, would be the case if there were complete series-paralleling of the four motors by the method used ordinarily with four-motor equipments. The motors, being of the compensated type, will run sparklessly with the fields weakened to any desired extent, and this condition is taken advantage of during the acceleration period before passing from the series to the parallel position. Thus there is eliminated a large portion of the loss which would take place in the resistances if the motors were changed directly from the normal series position without resistance to the parallel position with the full resistance in circuit; much of the lower part of the normal speed range in the parallel position is covered by the motors connected in series with shunted field coils.

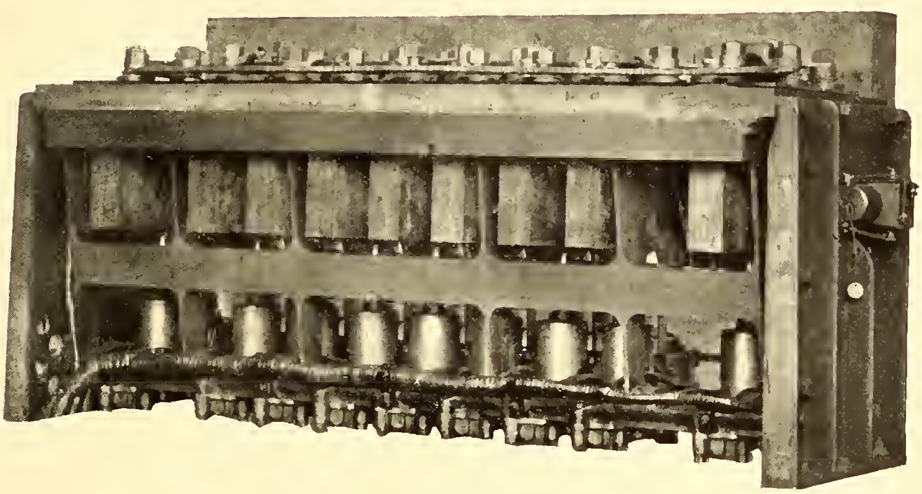
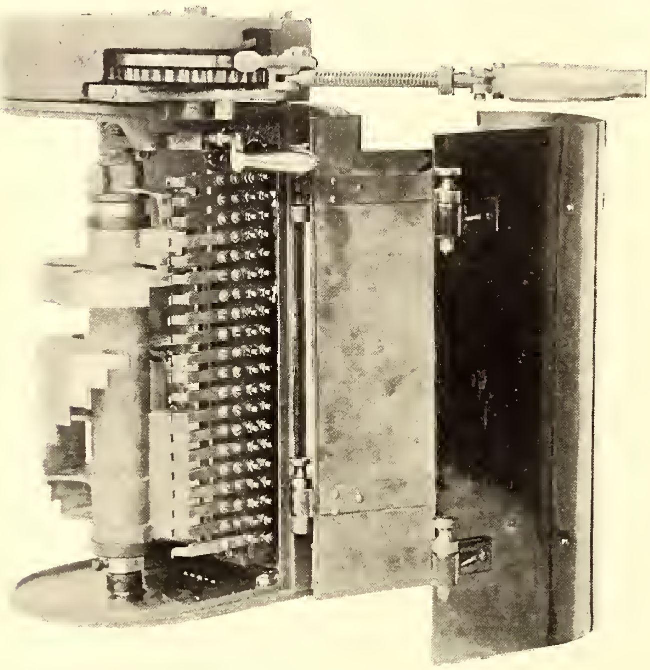


FIG. 10.—GROUP OF A. C. UNIT SWITCHES

The acceleration is extremely smooth, which condition is to be attributed partly to the facts just stated and partly to the fact that in passing from the series to the parallel connection the circuit to neither motor is opened, nor is either motor short-circuited. In the initial series position at starting, one motor unit is connected on the ground side, and the other on the trolley side, with the resistance in series between them. In the final series position the resistance is out of circuit, and the two units are in series across the line. If now there be connected in parallel with each motor unit a resistance of a value such that one-half of the line voltage will cause to flow through it a current equal in value to that passing through each motor, the two motor units will in effect be connected in parallel across the line, each unit having in series with it a resistance which absorbs one-half of the line voltage. Under this condition, no current will flow directly through the middle-voltage connection between the two motor units, and this connection may be broken without changing the performance of the motors, after which the resistance in series with each motor unit may be decreased until the two units are directly in parallel across the line. In the middle-voltage connection between the motors is placed a limit switch, the tripping coil of which is so adjusted that the change from the series to the parallel position cannot take place until the current in this connection decreases to a certain predetermined safe value.

During alternating-current operation each motor unit is fed at variable voltage from the secondary of a step-down transformer, there being two separate and distinct transformers on each locomotive. There were three objects in using two rather than one main transformer; one was on account of the convenient disposal of the weight of the transformers on the locomotive; the second related to the increased reliability of service in case a transformer circuit should be disabled, while the third had reference to the convenient arrangement and employment of the same unit switches for either direct-current or alternating-current work. The same master controllers are used for alternating current as for direct current. At each running point the motor circuits are joined directly to a certain tap on the transformer winding and no extra resistance is in circuit. In passing from a tap to one next higher in voltage, the usual method is followed of first inserting a resistance between the taps, then the connection to the lower-voltage tap is broken, thereby placing the resistance in series with the motor at the higher voltage; then the resistance is short-circuited, leaving the motor joined directly to the higher voltage tap. The "preventive resistance" used between the taps is exactly the same resistance unit which is used at a certain step in the direct-current control, while the same short-circuiting switch is employed in each case.



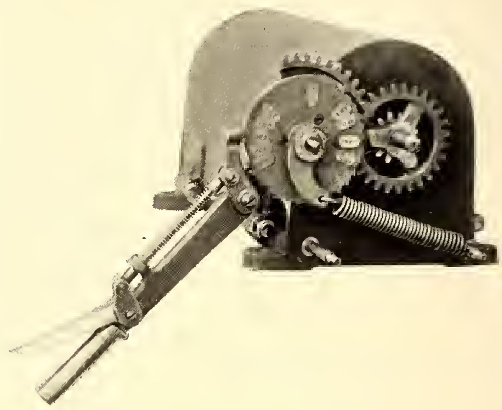


FIG. 11.—SIDE AND END VIEWS OF MASTER CONTROLLER, WITH COVER REMOVED

UNIT SWITCHES

Each switch used in the motor circuits is of the Westinghouse "unit" type, operated by air under 80 lbs. pressure, and controlled by an electromagnet which receives current from a 14-volt storage battery. There are, therefore, on the locomotive three systems of wiring: the 11,000-volt primary circuits to the step-down transformers; the lower-voltage motor circuits (corresponding to the secondary circuits from the transformers and the equivalent 600-volt direct-current circuits), and the battery electromagnetic circuits. The high-potential circuits pass directly from the trolleys through the manually-operated oil switch to one terminal of the primary of each of the step-down transformers, the other terminals of which are effectively grounded to the locomotive frame. The lead from the trolleys to the oil switch is protected by a grounded covering, and, as only the 14-volt battery runs to the master controller, it would seem as though the danger-to-life element had been practically eliminated. The motor circuits pass either from the direct-current trolley, third-rail shoe or the taps on the secondaries of the transformers to the unit switches and through the motors to the ground.

The unit switches differ inappreciably from those used in ordinary direct-current work. They are arranged in groups for convenience, as shown in Fig. 10, and the switches of each group have their magnetic blow-out coils placed mechanically in the same line so that they assist one another in producing the blow-out flux. Each blow-out coil consists of two complete turns built up of copper sheets insulated by japan for the purpose of decreasing the losses from eddy currents. Precautions are also taken to minimize the eddy currents in the iron cores of the magnets. The pole faces are not laminated, but slots are cut across them in such direction as to prevent the production of excessive eddy currents. It is worthy of note in this connection that if a current of a certain value is to produce a given flux, the reactance is less when a magnetic core is used than when air alone is depended upon to convey the flux. For a certain frequency, the reactance is proportional to the product of the flux and the turns, and the less the number of turns required for the production of a certain flux, the less will be the reactance. It will be seen, therefore, that the magnetic core which is more or less desirable for direct current is practically essential for alternating current.

MULTIPLE OPERATION

The locomotive may be controlled from either end by means of a master controller which is of the usual type, except that its handle is somewhat different from those heretofore used. As indicated in Fig. 11, the handle resembles somewhat the throttle lever of a steam locomotive, and is provided with a gear mechanism which allows the drum to be revolved through about twice the arc covered by the lever. The reverse lever is mounted immediately below the operating lever of the controller. The circuits which run to one master controller are directly in multiple with those to the other controller. A continuation of these circuits through flexible leads from one locomotive to another allows any number of locomotives to be operated simultaneously from one master controller. When the master controller is in the off position, connections are so established that all circuit-breaker trips which may be open are closed by the simple closing of a small switch conveniently located in the locomotive cab. Current is supplied to the control circuits by two sets of 7-cell storage batteries, each of which has a capacity of 40 amp.-hours and weighs 150 lbs. In connection with the switch groups, cut-out switches are provided so that either pair of motors may be cut out by simply rendering certain switches inoperative. It is thus possible to cut out the motors without manipulating the main circuit.

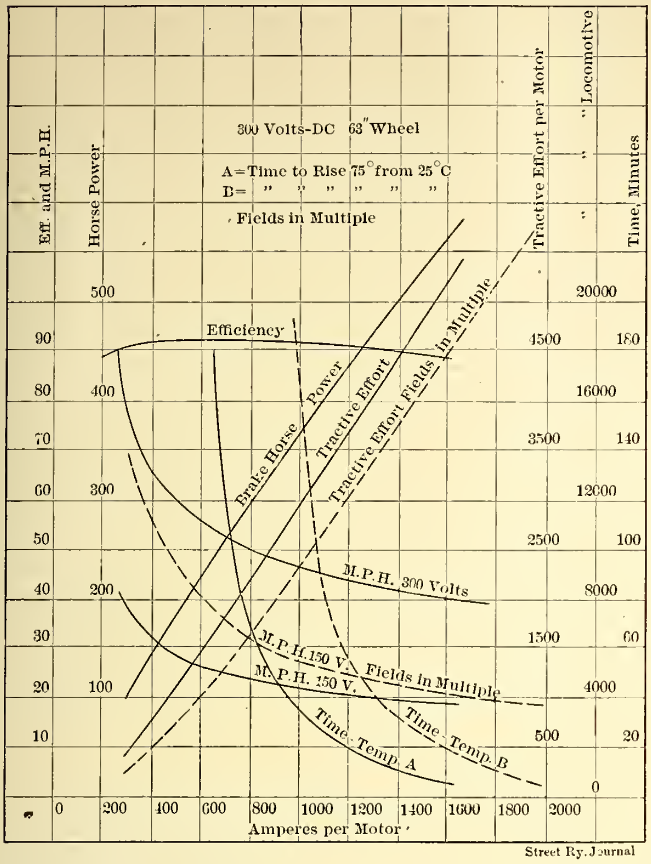


FIG. 11.—CHARACTERISTIC CURVES OF 250-HP GEARLESS MOTOR OPERATING ON 300 VOLTS, DIRECT CURRENT

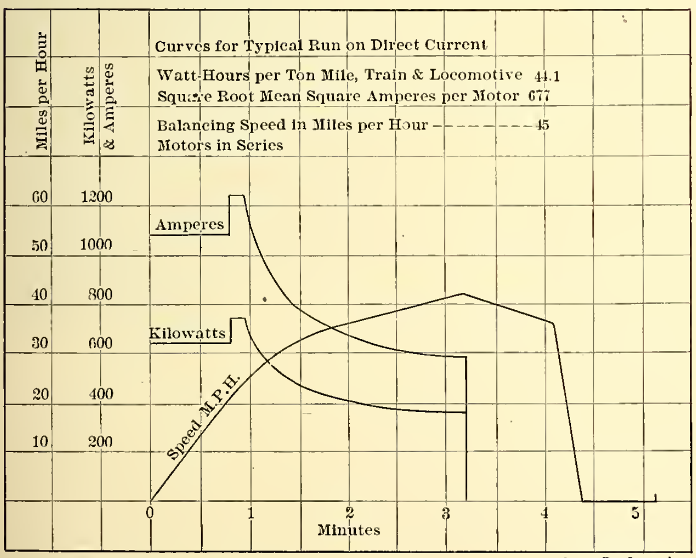


FIG. 13.—TYPICAL RUN OF LOCOMOTIVE ON DIRECT CURRENT WITH MOTOR-GROUPS IN SERIES

CURRENT COLLECTORS

There are two pantagraph bow trolleys for collecting the current from the 11,000-volt overhead conductor system. The upward pressure against the wire is supplied by springs in the base of the pantagraph equipment. Compressed air is admitted to a cylinder when it is desired to lower the collector. When the collector is in its lowest position, a catch engages the mechanism and holds it in place. The catch can be released by means of an electropneumatically operated lever when compressed air is on hand, or it can be released manually if desired. The framework of the pantagraph mechanism is built up of steel "bicycle" tubing and the col-

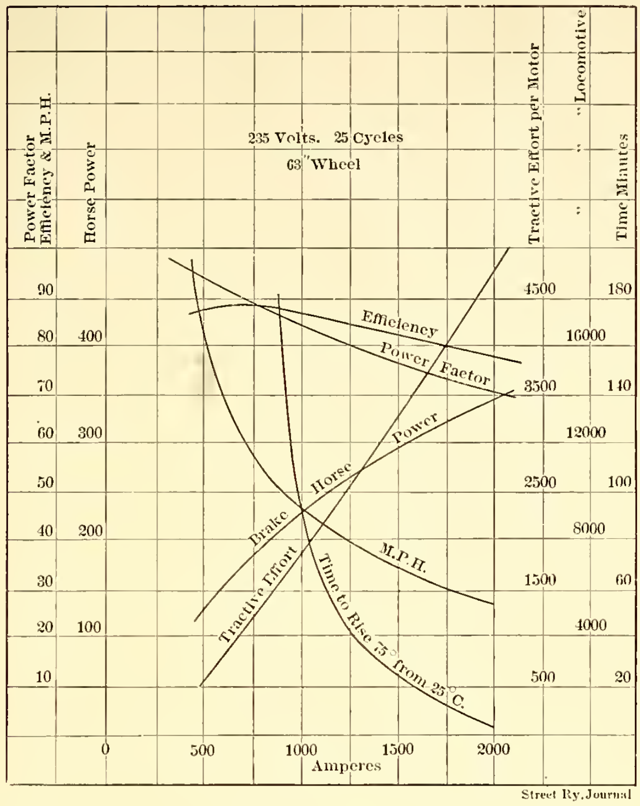


FIG. 12.—CHARACTERISTIC CURVES OF 250-HP GEARLESS MOTOR OPERATING ON 235 VOLTS, ALTERNATING CURRENT

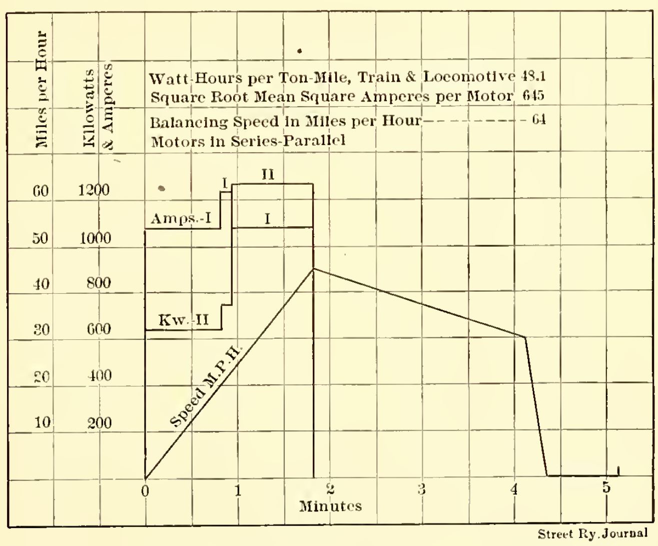


FIG. 14.—TYPICAL RUN OF LOCOMOTIVE ON DIRECT CURRENT WITH MOTOR-GROUPS IN PARALLEL

lector bow is a broad strip of soft copper. It is proposed to "zig-zag" the overhead wire so that the wear may be uniform over the bow. The collector mechanism is mounted on massive porcelain insulators bolted to the roof of the locomotive.

For use over the New York Central portion of the route, there have been provided both a second and lower overhead direct-current pantagraph trolley and a system of third-rail contact shoes. The direct-current trolley is of the same general type as that used for the high-potential collectors, and it is mounted immediately over the center of the locomotive. There are two mechanically separate but electrically interconnected contact shoes on each side of each truck, making a total of eight shoes per locomotive. These shoes are designed for use with either an over-running or an under-running rail, and the mechanical pressure in each case is supplied by springs. On account of the fact that no third

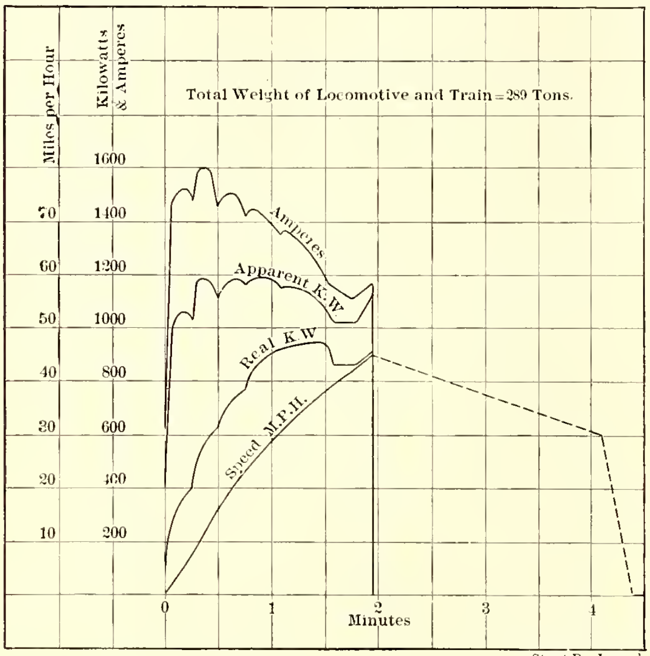


FIG. 15.—TYPICAL RUN OF LOCOMOTIVE ON ALTERNATING CURRENT

rail will be used over the high-potential portion of the route, and the projecting shoes in their normal position would be liable to strike any small obstruction along the side paths, a device will be used for lifting the contact shoes out of the way when the locomotive is using alternating current. This device will be operated electropneumatically, and will be automatic so that when the alternating-current circuit is completed the shoes will be lifted from the rails.

AUXILIARY APPARATUS

All of the controlling mechanism of the locomotive is placed within the cab, and no parts are carried below the floor except the electric cables and the air pipes. In addition to the various switch groups and the two main transformers referred to above, the cab contains an air compressor driven by a compensated motor of the same general type as the main driving motors. The circuits to this motor are controlled automatically by the pressure of the air in the receiver, which is also placed within the cab. The four main traction motors, the high-potential transformers and the main circuit rheostats are cooled by air furnished at low pressure by means of a motor-driven centrifugal blower, which obtains air from the inside of the cab itself. The low-pressure air has two paths. One path passes first through the transformer and then to the rheostat. The other path goes directly to the motors. It enters the armature near the shaft, passes around and between the armature laminations, flows outward through the ventilating ducts in the field cores and reaches the outer air through perforated caps on the frame of the motor. Since a considerable volume of air is required for each motor, and it is undesirable to cause the air to assume a high velocity, it was necessary to provide a large flexible conduit between the air passages on the cab and those on the motors proper. The flexible conduit is made up of heavy canvas tubing, which is reinforced with wire and given an accordion pleating. It is stated that by the use of the air blast the temperature of the motors under load has been so decreased that the continuous rating is almost equal to the one-hour rating.

DIMENSIONS AND PERFORMANCE

The New Haven locomotive measures 36 ft. 4 ins. over the bumpers and weighs approximately 85 tons. It is capable of handling a 200-ton train in local service on a schedule speed of 26 m. p. h., with stops averaging about 2 miles apart—making, in such service, a maximum speed of about 45 m. p. h. It can also handle a 250-ton train on through service with a maximum speed of about 60 m. p. h. With heavier trains it is planned to couple two or more locomotives together and operate them in multiple. The tests which have been made on the first locomotive equipped show that it will, without difficulty, meet all the requirements for which it has been designed.

Figs. 11, 12, 13, 14 and 15 show the performance of the motors considered separately and of the locomotive as a whole. Fig. 11 gives the calculated performance curves of the motors on direct current at 300 volts per motor, while Fig. 12 gives the performance curves of the machines on 25-cycle current at 235 volts per motor. A study of these two curves indicates that the motors are excellent direct-current machines and that they operate on alternating current at a good power factor and a satisfactory efficiency. The curves of Fig. 13 show a typical run of the locomotive on direct current, the motors remaining always in series, while Fig. 14 shows a typical direct-current run with the motors operated in series-parallel. The effect of shunting the field coils with the motors in series will be noted from the sudden increase in the amperes taken by the motors just before they begin to decrease in acceleration while operating without resistance. With the shunted field coils the series connection of the motors would allow a maximum speed of 45 miles per hour under the assumed load, while with the motors in parallel without shunted field coils the maximum speed attained on a level track would be 64 miles per hour, as indicated in Fig. 14. The curves of Fig. 15 were obtained during an acceleration test of the locomotive on alternating current.

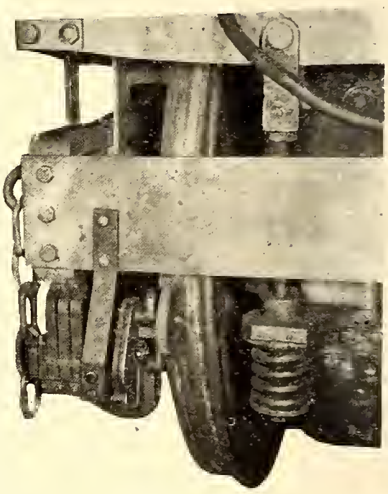
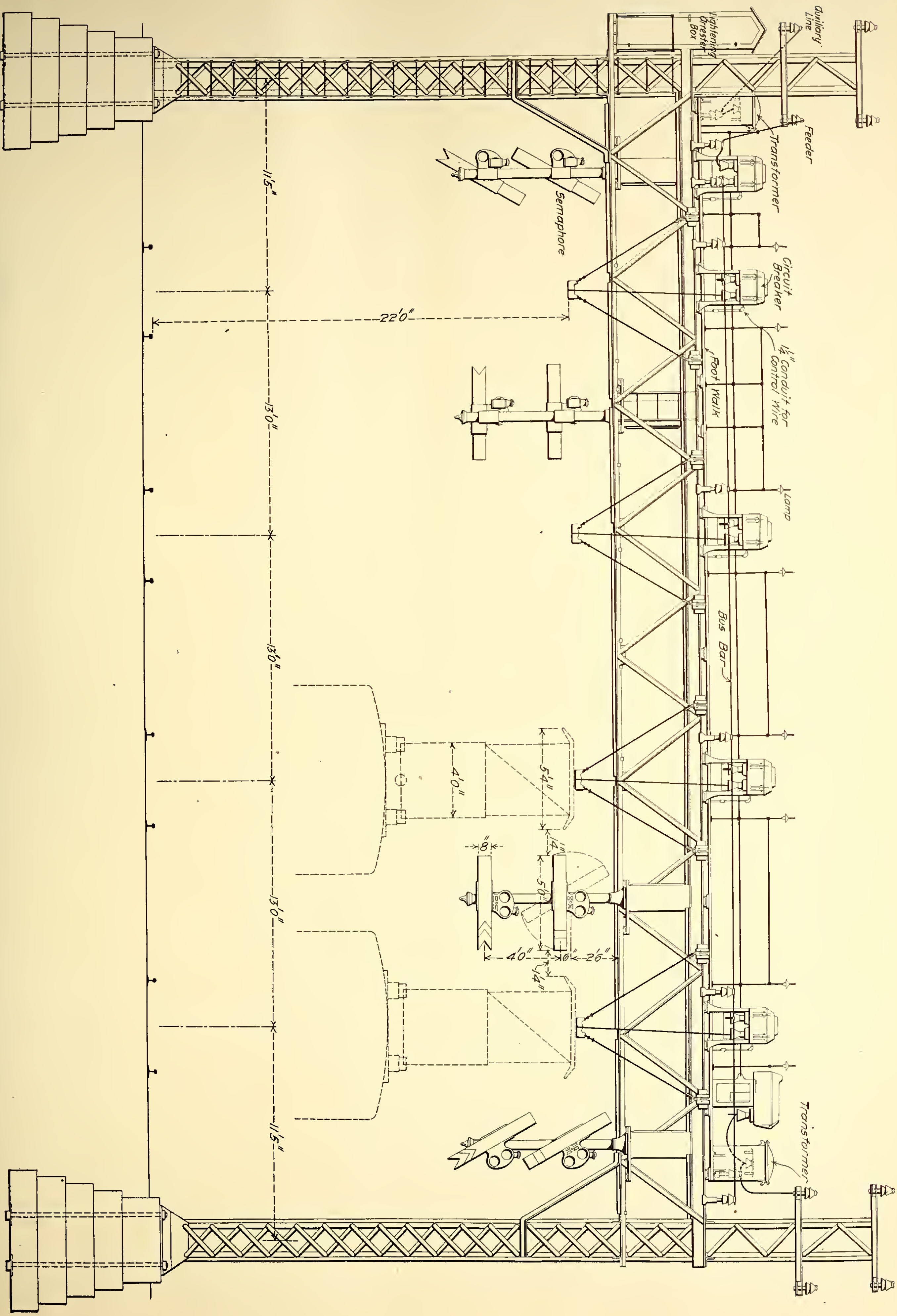


FIG. 16.—ELECTRIC SPEED RECORDER

The current and power consumption correspond very closely to the predetermined values. The line upon which the locomotive has been tested is not well adapted to high-speed work on account of the numerous sharp curves which exist, but, in spite of these adverse conditions, the locomotive has been operated at speeds above 60 miles per hour without difficulty.

Fig. 16 shows an ingenious electrical speed recorder used during the tests on this locomotive at the Pittsburg works. It consists of a magneto whose driving wheel is pressed against the locomotive driver.



SIDE ELEVATION OF ANCHOR BRIDGE ON NEW HAVEN ROAD, SHOWING POSITION OF CIRCUIT BREAKERS AND SEMAPHORES

ANCHOR BRIDGE FOR NEW HAVEN ELECTRIFICATION

A view of the intermediate bridge used by the New York, New Haven & Hartford Railroad and particulars of its overhead catenary construction were presented in the issue of last week. The engraving on page 595 gives a side elevation of one of the company's anchor bridges, designed for four tracks. These bridges, it will be remembered, are located about every 2 miles on straight track and carry the circuit-breakers by which the trolley wires are divided into sections. As will be seen, the posts are 61 ft. 10 ins. apart on centers. The base is built up of plates and angles which rest on a concrete pedestal, to which they are attached by anchor bolts. The pedestal is 8 ft. deep, 4 ft. 6 ins. wide at the top and 7 ft. 2 ins. at the base. The lower chord of the connecting truss is 24 ft. above the head of the rail, and as the conductor is carried 2 ft. below the lower chord, there is a clear space of 22 ft. between the lower surface of the conductor and the head of the rail. An outline of the cars and collectors is given in dotted lines in the sketch.

The bridge carries semaphores for each track, and also, on the top chord, the oil circuit-breakers for 11,000 volts. A footwalk with railing is provided on the top of the truss, which is also furnished with a number of incandescent lamps. The bus-bar is carried on insulators outside the railing. The lightning arresters are located on a projection of the lower chord of the truss and outside one of the posts.

NEW YORK CITY TRAFFIC STATISTICS

An interesting pamphlet of statistics for 1904 and 1905, showing the operation of the surface, subway and elevated lines in New York City for that period, has recently been published by the Board of Railroad Commissioners of New York. Besides the annual figures, the pamphlet gives for all the systems, except the subway, the statistics by months for the last two years of the paid fares, transfers, greatest number of passengers carried in one day, car mileage and transfer points, also for each year the number of cars owned, cars in service, employees in operating department, power capacity and maximum power used. The subway traffic statistics are not given by months, as the subway is not under the control of the Railroad Commissioners, but under that of the Rapid Transit Commissioners.

TABLE I.—SHOWING TOTAL NUMBER OF PASSENGERS CARRIED AND CAR MILES RUN BY SURFACE, ELEVATED AND SUBWAY LINES IN NEW YORK CITY.

Boroughs.	Passengers Carried.						Car Miles.		
	Paid Fares.			Transfers.					
	1904.	1905.	Increase.	1904.	1905.	Increase.	1904.	1905.	Increase.
Manhattan	689,638,134	745,896,116	56,257,982	173,751,290	166,125,312	*7,625,978	126,186,232	149,334,212	23,147,980
Bronx	24,650,755	25,002,165	351,410	16,257,546	15,356,061	*901,485	7,492,269	6,403,478	*1,088,791
Brooklyn	338,963,835	372,584,004	33,620,169	69,547,584	85,225,129	15,677,545	61,742,825	67,943,149	6,200,324
Queens	16,800,353	19,493,173	2,692,820	3,029,120	3,695,954	666,834	3,900,025	4,244,982	344,957
Richmond	7,607,170	8,176,240	569,070	793,622	792,968	*654	2,263,561	2,323,634	60,073
Total	1,077,660,247	1,171,151,698	93,491,451	263,379,162	271,195,424	7,816,262	201,584,912	230,249,455	28,664,543

* Decrease.

The total figures of passengers carried on paid fares and transfers and the car miles run for the five boroughs for the two years are shown in Table I., which is taken from the report. The largest number of passengers carried in any one day is shown in Table II. Table III. shows for five of the companies given in Table II. the percentage which the traffic on the busiest day bore to the average day, also the two busiest consecutive months, and the percentage which the traffic during those two months is to the total.

An analysis of the traffic figures published by the Railroad Commissioners is interesting. Such an analysis to determine the average rate of fare, including transfers, the average rides per capita and the average receipts per capita, is given in Table IV. In this table the average rate of fare is determined by dividing the product of the paid-fare passengers and 5 cents by the total number of passengers carried, including transfers. In this table the subway and elevated divisions of the Interborough Rapid Transit Company are credited with fares of 5 cents each. This is not exactly correct, as the subway and elevated lines transferred to each other during the last part of the year at one point in the Bronx. The elevated lines also issued transfers throughout the year to a few of the surface lines in Manhattan and the Bronx for an extra fare of three cents. As no record of the number of these transfers which were issued appears in the report, they have been ignored. The number of transfers issued for this extra fare of 3 cents by the surface lines in the Bronx to the Manhattan elevated lines are given in the report. As stated in the foot note, they amounted to only a little over 4,900,000, so that they are not an important factor in the transportation system, and as statistics of the division of fare are not published, they have also been omitted from Table IV.

TABLE II.—SHOWING GREATEST NUMBER OF PASSENGERS CARRIED IN ANY ONE DAY.

	1904.	1905.
N. Y. City Ry	1,800,873 in Oct.	1,911,065 in Mar.
Manhattan Elevated	1,065,762 in Apr.	948,901 in Jan.
Union Ry	99,051 in June	115,588 in May
Southern Boulevard	8,788 in June	7,458 in Sept.
Brooklyn Rapid Transit	1,666,684 in Dec.	1,818,133 in July
Brooklyn & Coney Island	189,755 in July	199,263 in June
N. Y. & Queens County	124,069 in June	137,603 in May
Long Island Electric	27,467 in July	29,320 in July
Richmond Lt. & Ry	30,607 in July	32,236 in July
S. I. Midland	190,275 in July	40,387 in July

TABLE III.—SHOWING PERCENTAGE OF TRAFFIC IN BUSIEST DAY OVER AVERAGE FOR YEAR, ALSO TWO HEAVIEST MONTHS AND PERCENTAGE THEY BEAR TO TOTAL FOR YEAR FOR FIVE COMPANIES FOR 1905.

NAME OF COMPANY.	Per Cent BusiestDay Over Average Day.	Two Busiest Months.	Percentage of Year.
New York City Ry	23	Sept. and Oct.	18
Manhattan Ry	37	March and April	18
Brooklyn Rapid Transit	59	June and July	19
Coney Island & Brooklyn	85	July and Aug.	23
Richmond Lt. & Ry	134	July and Aug.	23

As will be seen from the column of average rate of fare, the Bronx surface lines issued the greatest number of transfers in proportion to the number of cash fares, so that the average fare is only slightly over 3 cents. The Manhattan surface lines, i. e., the Metropolitan system, come next, with 3.47 cents. The Brooklyn lines are over 4 cents, and the lines in Queens and Richmond considerably higher. The final two columns in Table IV. are extremely interesting as showing averages rides per capita of 431 for the Borough of Manhattan, and 359 for the entire city. The latter figure is more than 2½ times as large as that shown for London in the article by Mr. Dawson in the last issue of the Street Railway Journal, and over 50 per cent larger than that shown for Berlin. As Table IV. is made up of the total number of passengers carried, and not of the fare passengers carried, the column "per cent of increase over 1904" is deceptive as far as it re-

TABLE IV.—SHOWING TOTAL PASSENGERS CARRIED IN 1905, PER CENT INCREASE OVER 1904, AVERAGE RATE OF FARE, POPULATION AND AVERAGE RECEIPTS AND RIDES PER CAPITA IN 1905.

Borough.	Passengers Carried in 1905, Including Transfers.	Per Cent Increase over 1904.	Average Rate of Fare, Including Transfers.	Population, 1905.	Average Rides per Capita.	Average Receipts per Capita.
Manhattan surface lines	545,846,949	d1.6	3.47	2,112,697	258	$8.99
" elevated "	249,965,166	d14.5	5.		118	5.91
" subway "	116,209,313	a	5.		55	2.75
Total	912,021,428	7.3	4.09	....	431	17.65
Bronx	b 40,358,226	d1.3	3.09	271,629	149	4.60
Brooklyn	457,809,133	12.7	4.07	1,358,891	337	13.71
Queens	23,189,127	16.9	4.29	198,241	117	4.92
Richmond	8,969,208	6.8	4.56	72,846	123	5.61
Total for city	1,442,347,122	7.5	4.06	4,014,304	359	14.57

a The subway was put in operation Oct. 29, 1904, and carried only 16,241,869 people during 1904. The total increase of both subway and elevated travel in 1905 was 13.5 per cent. *b* Not including transfers from elevated for which an extra fare of 3 cents is charged. The transfers from these lines to the elevated in 1905 numbered 4,930,346. *d* decrease.

lates to receipts, for on many of the lines the transfers have not followed the same ratio of increase or decrease as the paid fares. For this reason Table V. is presented.

An analysis of the paid fares of several of the systems, given in Table V., is particularly interesting. It shows, for instance, that although the total number of passengers carried on the Metropolitan system (or Manhattan surface lines) shows a decrease in 1905 over 1904 of 1.6 per cent, the paid fares show a decrease of only about ¼ of 1 per cent. If, instead of comparing the total paid fares for each year, we compared the average paid fares per day for each year there would be a still further slight difference, as 1904 contained 366 days and 1905 365 days. Upon this basis the Metropolitan system, for instance, would show an increase of about 32 fares per day, or approximately 0.003 per cent, in spite of the fact that in 1904 the subway was in partial operation for only two months, whereas in 1905 it was in operation for twelve months, and a number of extensions were made to the subway system during that year.

An analysis of the traffic by months is also interesting, and this is shown on the accompanying diagram. In this diagram the traffic is plotted by average paid passengers per day for each month, instead of the total passengers during the month, to eliminate differences caused by the different number of days in each month, and different number of days in each

TABLE V.—SHOWING NUMBER OF FARES PAID ON PRINCIPAL SURFACE LINES IN NEW YORK CITY IN 1905.

	For the Year.	
	Paid Fares.	Increase in Per Cent over 1904.
Manhattan surface lines	379,721,637	0.27*d*
Brooklyn Rapid Transit *a*	337,679,930	11.1
Coney Island & Brooklyn	33,123,716	0.6*d*
New York & Queens County	15,945,796	13.1
Union & Southern Boulevard	25,002,165	1.4

a Includes elevated lines in Brooklyn. *d* Decrease.

year. These traffic curves are also worthy of considerable study. Taking the Metropolitan curve, for instance, it will be seen that the highest peaks in both 1904 and 1905 are during the spring and fall months. The cause of this is undoubtedly the fact that the company has no special summer business, and its winter business has been seriously interfered with during the last two years by the severe weather. This was particularly the case in the winter of 1904-05, when the traffic during January and February, 1905, dropped to abnormal proportions. If these two months should be omitted from the comparison of the two years, the increase in paid fares between 1904 and 1905 rises from practically zero to 1.9 per cent. This increase in paid fares, with a decrease in passengers car-

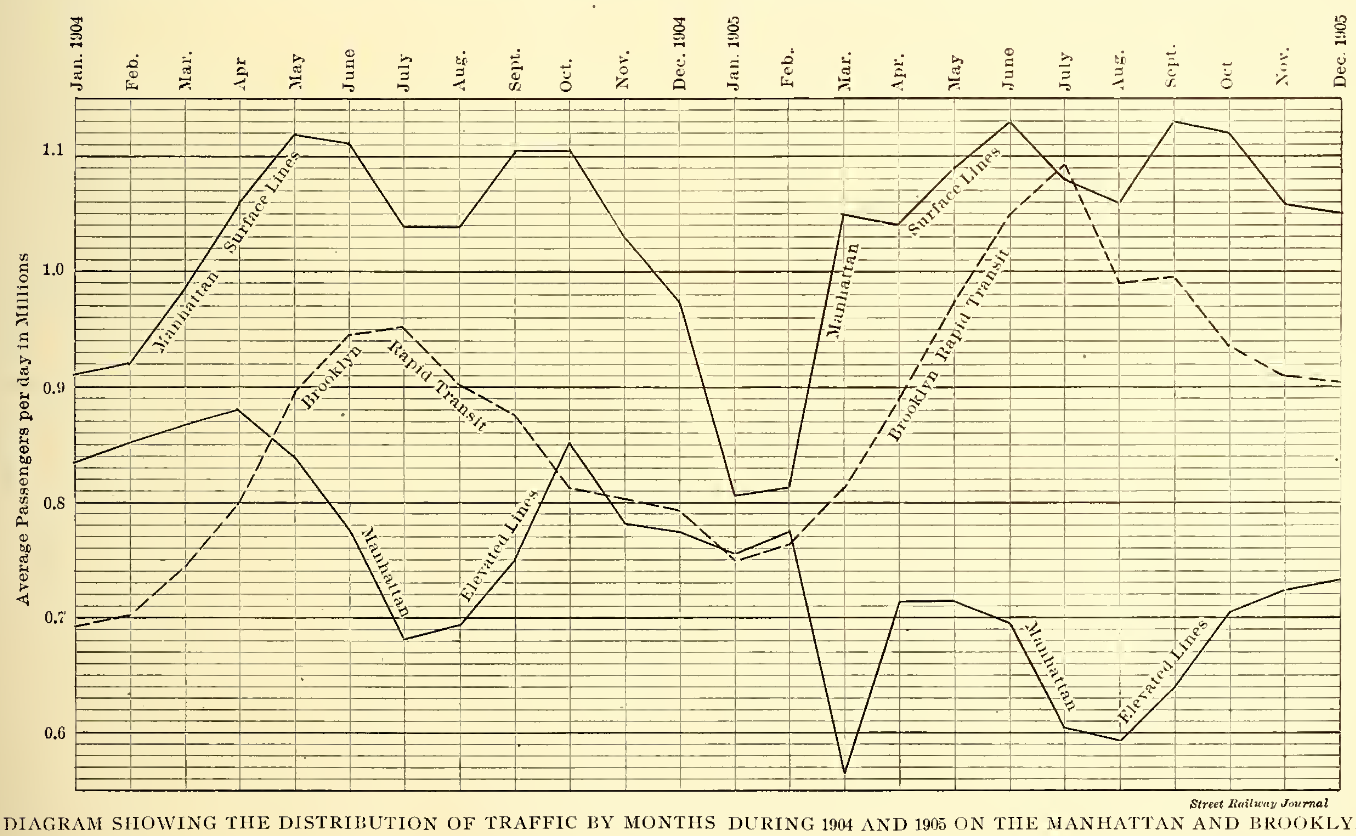


DIAGRAM SHOWING THE DISTRIBUTION OF TRAFFIC BY MONTHS DURING 1904 AND 1905 ON THE MANHATTAN AND BROOKLYN ELEVATED AND SURFACE LINES ried, accompanies an increase in transfer stations, as shown in Table VI. It is undoubtedly due to the establishment of a number of through routes, and also to the fact that since the opening of the subway, the surface lines are doing more of a short-haul business, for which, of course, they are particularly adapted. Table VI. gives, therefore, a clue to the redistribution of traffic which has occurred from the opening of the

TABLE VI.—SHOWING NUMBER OF TRANSFER STATIONS (IN JULY) OF EACH YEAR AND PERCENTAGE OF TRANSFERS ISSUED TO PAID FARES.

	Number of Transfer Stations.		Percentage of Transfers Issued to Cash Fares.	
	1904.	1905.	1904.	1905.
Metropolitan System	463	514	45	43
Brooklyn Rapid Transit	342	448	21	23
Coney Island & Brooklyn	5	5	17	18
Van Brunt St. & Erie Basin	1	1	10	9
New York & Queens County	10	11	21	23
Union Ry Co	...	...	7	7
Southern Boulevard	...	...	6	8
Richmond Light & Railroad	...	...	10	9
Staten Island Midland	...	...	11	9

subway, as the Metropolitan system, which is the only one of the larger systems which has been affected by the subway, is the only one which shows a decrease in the ratio of transfer passengers to cash passengers.

Another interesting table, indicative of the character of traffic carried by the different companies, is Table VII., which shows the number of cars owned and employees per million car miles, as well as the average number of passengers per car mile. Statistics are not given in the Commissioners' report for all the companies as to the number of cars in service, and this would of course be a better figure than the number of cars owned. The large number of cars required by the companies which do a summer business is very strikingly shown. The figures for cars and employees are taken as the average between the highest and the lowest reported during the

TABLE VII.—SHOWING CARS AND EMPLOYEES PER 1,000,000 CAR MILES AND CARRIED PER 1,000,000 PASSENGERS AND PASSENGERS PER CAR MILE FOR 1905.

	Per 1,000,000 Car Miles.		Per 1,000,000 Passengers Carried.		Passengers Per Car Mile. (c)
	Cars.	Employees.	Cars.	Employees.	
New York City Ry*a*	35	169	6.6	18	81
Manhattan Elevated *b*	26	104	6.2	22	41 (*d*)
Brooklyn Rapid Tran. *b*	60	200	8.7	29	68
Coney Island & B'klyn *a*	74	122	13	21	59
N. Y. & Queens Co. *b*	70	119	13	21	58
Union Railway & Southern Boulevard *a*	99	...	15	..	63
Richmond Lt. & Ry. *a*	94	159	22	39	44

a Cars and employees are those for January 1, 1906. *b* Average for highest and lowest months. *c* Average for year. (*d*) Average for subway division is 39.

year, where such figures are given in the report, otherwise they are taken as those of Jan. 1, 1906. The final column, that of passengers per car mile, is particularly interesting as showing the low ratio for the elevated and subway lines as compared with the surface lines. The elevated and subway cars are longer than those used on the surface, but the longer haul more than makes up for this difference in seating capacity.

It is understood that the Commission plans to continue the publication of similar statistical information at intervals.

General Manager F. L. Mowry, of the Stark Electric Railway, has adopted a watch inspection system for the road. Each motorman and conductor must have a watch that will keep accurate time and be up to a certain standard, and the watch must be inspected at frequent intervals by the company's inspector.

THE CAPACITY OF SURFACE LOOPS FOR TRAFFIC AS INFLUENCED BY INTERSECTING LINES IN THE DOWNTOWN DISTRICT OF CHICAGO

BY W. A. BLANCK

Innumerable complaints of overcrowding and of an insufficient number of cars during the rush hours in the morning and evening hours, gave the city of Chicago cause recently to file suits in the circuit court against the Chicago Union Traction Company for $1,500,000, and against the Chicago City Railway for $500,000, for violation of the good service ordinance.

The traction companies commissioned the writer to make an independent investigation on the surface lines entering the downtown district of Chicago, so as to file a sworn statement setting forth the possible traffic on the existing lines under existing conditions. As a jury trial was imminent, the writer endeavored to put all statements in a very comprehensive form, and to make use of only the simplest and most direct methods in the analysis of the problem. An abstract of one of the cases, that relating to the Blue Island Avenue loop of

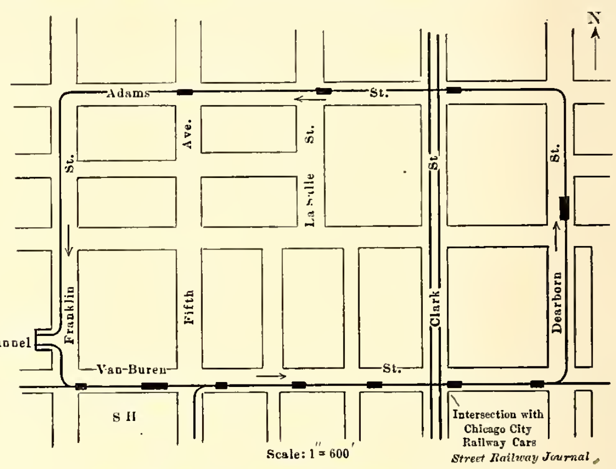


FIG. 1.—PLAN OF BLUE ISLAND AVENUE LOOP, CHICAGO

the Chicago Union Traction Company, might be of interest to the readers of the STREET RAILWAY JOURNAL.

Since the overcrowding of cars is only the natural sequence of not running a sufficient number of cars, the following investigation is limited to the determination of the smallest distance between two consecutive cars on the Blue Island Avenue loop contingent on the severe demands of the rush hour service. The Blue Island Avenue line is at present a cable line, connecting the west side of Chicago with the business district. Before entering the loop district (see Fig. 1) the line passes through a tunnel under the Chicago River. Although the service on the Blue Island Avenue line proper cannot be called very heavy, local conditions in the downtown district necessitates the passage of numerous electric and horse cars over part of the loop, so that the service for the rush hours under consideration would be the following:

Street	Car Line	Headway
Franklin St....	Blue Island Ave. (cable)	4.5 minutes.
Van Buren St..	Blue Island Ave. (cable)	4.5 minutes.
	Van Buren St. (electric)	1.5 minutes.
	Twelfth St. (electric)	1.5 minutes.
Dearborn St...	Blue Island Ave. (cable)	4.5 minutes.
	Sedgwick St. (horse)	9.0 minutes.
Adams St......	Blue Island Ave. (cable)	4.5 minutes.
	Harrison St. (electric)	2.0 minutes.
	Fulton St. (electric)	10.0 minutes.

To show the above service in a comprehensive and graphical way, accurate observations were made as to the time required for a cable train to traverse the loop, and it was found that 13 minutes elapsed from the time the cable train leaves the tunnel at Franklin Street to the time it returns to the tunnel. As the length of the loop is 5078 ft., this corresponds to a schedule speed of 4.4 m. p. h.

As a basis for the graphical schedule it was taken as a fair assumption that the schedule speed of the cable cars is the

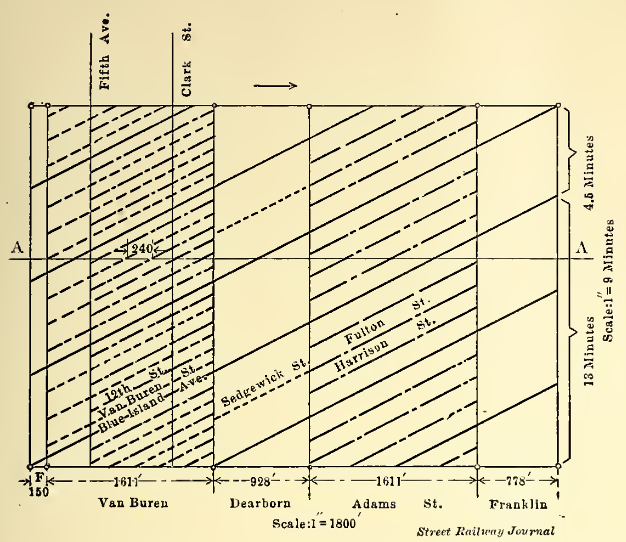


FIG. 2.—RUN SHEET FOR CARS ON BLUE ISLAND AVE. LOOP

limiting factor for all electric or horse cars interspaced between two cable trains, because the latter are dependent on the maximum rope speed (given by a city ordinance) and on the reduced rate of acceleration, due to the large inertia of the cable train and the limitations of the grip device. The run sheet is given in Fig. 2. The entrance of a Blue Island cable train into the loop is shown by points at the left of this diagram. The progress of the trains around the loop is assumed to be uniform, and is shown by lines which cut the right of the diagram at points higher than those at which they originate at the left of the diagram, by an amount representing 13 minutes, or the time required for the trip around the loop. In this particular case, as the speed of all cars shown is assumed to be uniform, all lines are parallel and inclined at an equal angle to the base of the diagram.

In glancing over the car service as given above, it will be self evident that the greatest congestion on the loop is on Van Buren Street, between Franklin Street and Dearborn Street, and since a congestion of traffic on one point of the loop system limits the amount of traffic on the entire loop, all further investigations will be confined to the Van Buren Street traffic.

To determine the distance between two cars on the most congested part of Van Buren Street, the time elapsing between the passage of two cars by one fixed point must be known. This is best derived by considering the number of cars for each line operated on Van Buren Street passing a point between the limits named in one minute. It is as follows:

Van Buren Street................	1/1.5	= 0.66 cars per minute.
Twelfth Street	1/1.5	= 0.66 cars per minute.
Blue Island Avenue	1/4.5	= 0.22 cars per minute.
A total of........................		1.54 cars per minute.
Or time between cars.............	1/1.54	= 0.65 min. = 39 sec.

In distributing the cars on the graphical schedule with the above time interval, it will be seen that six electric trains are interspaced between two cable trains of the Blue Island Avenue line, and as a section A-A, parallel to the horizontal axis of the run sheet, represents to scale the distance around the loop, it will readily be seen that the space between two intersections of the line A-A represents the center headway of two consecutive cars, which amounts in this case to about 240 ft.

Moreover, it is to be remembered that the car service on Van Buren Street encounters a large obstruction in crossing Clark Street, on which the Chicago City Railway maintains, during rush hours, a 20-sec. service on the north bound as well as on the south bound track. The distance between two consecutive cars will then be determined by two quantities, namely, A, space allowed for braking and, B, space allowed for cars on crossing lines.

A. Since the safe braking distance is proportional to the speed of the car, the maximum space allowed between the cable trains will be required when the latter run at rope speed or 6.6 m. p. h. Assuming a braking effort equal to a retardation of 0.75 m. p. h. per second, a space of approximately 45 ft., would be required to bring the cable train from maximum speed to rest. As, however, this maximum is very seldom obtained, and as the cars are generally well under control, the writer did not think it necessary to make allowance for this in determining the distances which it is practicable to maintain between trains. Although not definitely considered, this limitation still exists, and whatever value it may have will tend to increase the distance which may be permitted between trains.

B. The space allowance of the Union Traction car crossing the Clark Street service of the Chicago City Railway, or in other words, the distance travelled by a loop car during the interval the Chicago City Railway car obstructs the loop track, is found as follows:

Average distance of car centers, as taken from the run sheet, 240 ft.
Average length of train (one cable and six electric trains), 50 ft.
Average distance between trains, 190 ft.
Average time for Chicago City Railway cars crossing Van Buren Street, as determined by frequent stopwatch observations, 12 seconds.
Average speed of loop car as mentioned before, 4.4 m. p. h., or 6.45 ft. per second.
Average space allowance for the passing of one Chicago City Railway car, 12 x 6.45, 77 ft.
Average space allowance for the passing of two Chicago City Railway cars interspaced between two consecutive cars of Chicago Union Traction Company's loop, 2 x 77, 154 ft.
Distance of front end of next loop train from crossing as second Chicago City Railway car passes, 190-154, 36 ft.

In other words, the influence of the intersecting line has reduced the center headway of the loop cars, amounting to 240 ft., to a clearance of 36 ft., between the front end of a loop car and the rear end of a Chicago City Railway car passing the crossing.

This condition may also be considered on the time basis in the following way:

Average time between trains as given before, 39 seconds.
Average length of train, 50 ft.
Average time required for the train to pass a given point or move its own length, 50/6.45, 7.8 seconds.
Average time elapsing from moment, when the rear end of one train passes a given point to the moment, when the front end of the next train arrives at this point, 39-7.8, 31.2 seconds.
Average time for Chicago City Railway cars passing Van Buren Street, 12 seconds; as two such crossings must be made between two consecutive loop cars the total time taken up by Chicago City Railway cars will be 24 seconds.
Time interval between the front end of a loop car and the rear end of Chicago City Railway car passing the crossing, 31.2-24, 7.2 seconds.

These results are obtained under the best conditions, assuming that north bound and south bound Chicago City Railway cars are crossing Van Buren Street simultaneously. But, considering the usual interference by passengers and freight wagons on the street, this condition is not generally attained, with the result that a clearance of 36 ft. is seldom found to exist.

From the above, not taking in account the space required for braking, it is evident that it is impossible to operate more cars on the loop under consideration as long as the present schedule speed is maintained. An increase of the latter is, in the writer's opinion, entirely impracticable, as the interference due to the congested drayage conditions in this particular location makes it difficult to maintain even the present schedule speed during the rush hours in the evening.

REPORT OF CLEVELAND CHAMBER OF COMMERCE COMMITTEE AS TO BASIS FOR FRANCHISE RENEWAL IN CLEVELAND

The special committee of the Cleveland Chamber of Commerce, which was appointed, with the sanction of the Cleveland Electric Railway and the city administration, to investigate the street railway franchise question in Cleveland, and if possible to determine an equitable basis of settlement, has returned its report with recommendations, after some four months of investigation, during which more than forty sessions were held. The committee was composed of W. R. Warner, J. G. W. Cowles, W. H. Canniff, S. P. Fenn, J. G. Jennings, George T. McIntosh, and M. A. Marks, all men of highest standing in the Cleveland business world. While the contending parties are in no way bound to abide by the findings of the committee, its report will unquestionably prove of great value in helping to settle the questions at issue in Cleveland and be of great interest and value as a basis for settlements of similar situations in other cities. On presentation to the Chamber of Commerce the report was adopted almost unanimously, the only negatives votes being cast by Mayor Johnson and his associates.

In brief, the report condemned the plans for municipal ownership and of a holding company, as suggested by Mayor Johnson, and suggested a reduction of fares with shorter hauls. It advised the sale of three tickets for 10 cents, fifteen tickets for 50 cents, and thirty tickets for $1, for straight fares without transfers; 5 cents for cash fare for a ride with a transfer, and the shortening of the length of haul as follows: The fare limit to be West Ninth Street for passengers from points east and southeast, and East Ninth Street for passengers from points west and southwest. This would allow passengers from the limits of the city to ride to the public square and a short distance beyond, in other words, cutting the longest possible hauls practically in two on the low-fare tickets, but allowing the long hauls and transfer on payment of 5 cents. Paving, cleaning and sprinkling ordinances are to stand, but the bridge taxes and car licenses are to be removed. In return for these concessions, the committee recommends the granting of a new twenty-five-year franchise for the entire system.

On the subject of municipal ownership, the committee said that, in the first place, the city is not legally authorized to operate street railway lines, and, if it were legally possible, the committee would hesitate to advocate such a step, as municipal ownership is untried in this country. In Europe there are many such systems, but investigation shows that the demands in the way of service and other conditions are different. In view of the unfavorable report made to Mayor Dunne, of Chicago, by Mr. Dalrymple, manager of the Glasgow system, the committee felt warranted in recommending that the experiment should not be tried in Cleveland.

On the second suggestion, the lease of the present property to a holding company, to be controlled by a committee as outlined by Mayor Johnson, it seemed evident that there would be no reduction of fare to the rider for several years to come. The main argument urged for this plan seemed to be that it would lead the way to municipal ownership and operation.

In outlining its reasons for suggesting a reduction of fare on the plan mentioned, the committee said that the situation in Cleveland was unique in many respects, and that the experiences in other cities could not be taken as a basis for Cleveland. After careful investigation it believed that the cost of carrying passengers on an average for the past thirteen years was 2.91 cents, not including interest on bonded or floating debt, and nothing for dividends. The committee was surprised to learn that the cost of carrying passengers was greater per passenger in 1905, when 110,000,000 passengers were carried, than in 1895, when only 53,000,000 passengers were carried. This was due, it believed, to the greater average length of ride, an increase of about 17 per cent on cost of wages, increased cost of supplies, fuel, etc.

About 33 per cent as many transfers as fares were collected in 1905. Nearly all testimony taken was in favor of something additional for a transfer, and the conclusion of the committee was to this effect. It was of the opinion that the unit of ticket purchase should be as low as possible, so as to benefit the poorer classes.

The committee endeavored to ascertain the actual investment of the company, and although afforded every facility, it was unable to arrive at satisfactory conclusions. During thirteen years the company expended in betterments and renewals more than $10,000,000, of which $4,500,000 were taken from surplus and the remainder from new capital. In 1905 the net, after paying interest, was $1,600,000. It paid $994,500 in dividends, and the surplus, $624,000, went into betterments. If the company should continue to operate with the same rate of fare and, allowing for a 5 per cent annual increase, its net earnings in 1916 would be $2,500,000. If, however, on the same basis of increase, the average fare be reduced from 4.7 cents to 3.76 cents, the saving to the public in 25 years would be $54,000,000. Therefore, the plan mentioned above was suggested. The committee was of the opinion that this rate was as low as the company could successfully operate under and it admitted that it was not likely to produce unduly large returns in the future.

Attorney Johnson, who assisted the committee in preparing its statement, attempted to show what the company would get out of the terms. He took the company's report for 1905 for his basis. He said that the average fare was 4.7 cents, the operating cost 2.82 cents, and the actual cost, including interest, 3.27 cents. Various experts testified as to how many people who now take transfers would continue to do so under the new plan. One said 12 per cent of the 33 per cent now using them, and another said 15 per cent. It was estimated that probably 5 per cent of the passengers would pay cash 5-cent fare. Figuring that only 10 per cent would ask for transfers and 5 per cent pay a nickel, thus leaving 85 per cent who would buy tickets, it was figured that there would be $287,000 left after paying interest. If 15 per cent asked for transfers the balance for dividends would be $380,000. Allowing for growth of traffic from 5 per cent to 8 per cent, compounded annually, it was estimated that 200,000,000 would be carried in 1916. The net earnings would be $1,466,000. Deducting interest paid by the company in 1905 this would leave a balance of $1,020,000. This, however, would not be exactly fair, because the bonded indebtedness would increase.

Officials of the Cleveland Electric Railway Company decline to discuss the report of the committee. It will be considered by the Board of Directors of the company this week.

SECOND QUARTERLY MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK—II

In the last issue of the Street Railway Journal was given an abstract of the proceedings at the morning session of the second quarterly meeting of the Street Railway Association of the State of New York, which was held at Elmira, March 29, for the discussion of transportation subjects. An abstract of the papers and discussions at the afternoon session is here given.

AFTERNOON SESSION

After the luncheon recess, President Danforth introduced J. M. Connelly, president of the Elmira Chamber of Commerce, who outlined some of the methods by which the business men of Elmira are building up their community. Mr. Connelly stated that Elmira had been somewhat quiet for the last four years, but lately, with the assistance of such men as W. W. Cole, general manager of the Elmira Water, Light & Railroad Company, and other go-ahead business men of the city, the community has had an awakening. The Chamber of Commerce was organized, and by active efforts a fund of $150,000 was collected from the business men of Elmira—a remarkable record for a city of this size. Mr. Connelly stated that Elmira had an excellent electric railway service, and went on to outline the important and useful part that an electric railway company plays in the building up and development of any community. He pointed out that recent development in transportation matters, such as improvements in the electric railway motor, progress in alternating-current work and in gasoline motor cars, would have an important bearing on the future growth and prosperity of the Empire State. He stated that Elmira had found it advantageous and to her own interests not to hamper the public service corporations, but to encourage them in their work; and he expressed the opinion that if the communities of the State would only lend the proper encouragement to their public service corporations, the interests of the public and of the communities would be far better served than by the adopting of a narrow-minded "dog-in-the-manger" policy. In Elmira the motto is "Everybody—together." Everybody pulls the same way, and then everybody participates in the general progress and prosperity that comes as the result of these united efforts.

President Danforth replied and said he believed the members would agree that Elmira had a progressive and liberal Chamber of Commerce, which was a credit to the community. He believed this city had struck the keynote of the situation. If the common good of the community is to be served best, co-operation and not petty restrictions must be the keynote, and Elmira offers indisputable evidence of what can be accomplished for the good of the community when this spirit of co-operation exists between the municipality and the public service companies.

President Danforth then called on E. J. Wilcoxen, superintendent of the Rochester & Sodus Bay Railway Company, to open the discussion on "Collection and Registration of Interurban Fares."

FARE COLLECTION ON INTERURBAN CARS

Mr. Wilcoxen first explained the system now in force on the Sodus Bay division of the Rochester Railway Company. The line extends 40 miles, from Rochester to Sodus Point, and there are twelve distinct fare limits which do not overlap, and the Ohmer register is used. For purposes of fare collection the line is divided into two parts, namely, at the sixth-fare point, or half-way. Passengers leaving Rochester and going beyond that point, if they present a ticket, receive from the conductor a hat check, which has the station printed beyond the half-way limit point; if a passenger pays cash and is going beyond the sixth point the conductor collects the cash through to destination and gives the passenger a hat check with the amount of money paid indicated by punch marks. When the car arrives at the sixth point the conductor collects from everybody on the car. If a cash check is presented going to stations beyond this limit, the conductor rings up 10 cents on the register for the amount punched on the hat check; for tickets he rings the same way. The company sells single and round-trip tickets, and has card passes and ticket-book passes. The passes are checked in the same way as the paid tickets. The dials on the Ohmer register are so arranged that the checking is made very easily, and an impression of the register record is taken at each 5-cent limit. His company has used the Ohmer register for about four years, and is fairly well satisfied with the results obtained.

C. Loomis Allen, of Utica, asked if with the Ohmer register it is possible for the company to ascertain what the amount of the business is between given points; that is, how many people ride through and how many ride between the different fare divisions.

D. A. Byrne, cashier of the Rochester Railway Company, replied that on the Sodus Bay line the printed slips made at each fare limit, showing the actual records as taken from the Ohmer register, are numbered 1, 2, 3, 4, 5, etc. Thus 1 to 2 is for the city division, 2 to 3 for the next division, and so on. From these it is possible to determine the number of people carried, the amount of cash taken in and the total number of fares between every limit. The day's receipts can be divided for every limit by the index system on the sheet taken from the register.

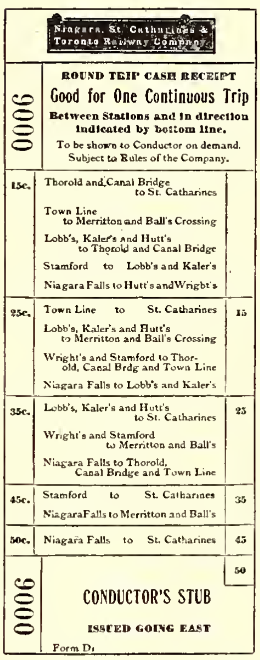
President Danforth said that the simplest proposition, of course, would be to collect the fare in each limit, as is done now in the East on some lines, and was done years ago on the Sodus Bay line. On the latter a through passenger's fare was registered thirteen times from the center of the city to Sodus Point. That method is annoying to the passengers and takes a good deal of the conductor's time. Where a road is carrying a large number of through passengers or long-distance riders, the steam railroad method seems to be the most practical. The trouble with that method is that no register is used. The steam railroad depends absolutely upon the conductor's report. There is nothing to check him in any way at the end of a half or full trip to see that he has the proper number of tickets and cash on hand. With the Ohmer register the company is able to account for varying rates of fare. It lessens the work of the conductor in some degree, but not as greatly as the use of cash duplicates. His objections to the system are, first, that the railway company cannot buy the registers, but has to pay an expensive rental; and second, it requires a considerable amount of office work to obtain the kind of information Mr. Allen inquired about, namely, the number of passengers riding between different points.

Mr. Pardee, of the Rochester & Eastern, said he was using practically the steam railroad system. The cash fares are based on 2 cents a mile, and all other fares are based on mileage instead of zones. Of the receipts, 87 per cent comes through the sale of tickets at ticket offices. The conductors register 5-cent cash fares on the plain register and cut duplicates for everything above that. With this method it is a very simple matter to obtain in the office all the information Mr. Allen desired. He determines very quickly the amount of business between any two points. Something must be turned in by the conductor for every passenger—for instance, a slip being given for passes. On the whole, he finds that this system works very satisfactorily.

Mr. Shannahan, of the Fonda, Johnstown & Gloversville, thought Mr. Pardee's statement that 87 per cent of his gross income is turned in by his ticket agents is a very gratifying and surprising showing. If it is assumed that conductors are short a certain percentage, say 10 per cent or 15 per cent of the 13 per cent transportation sold by them, the shortage, which must inevitably exist on all lines, is reduced to an absolute minimum.

Mr. Allen, in reply to a question, stated that on the Utica & Mohawk, 54 per cent of the receipts are in the form of tickets sold through conductors.

Mr. Ryon, of the Schenectady Railway, said that every conductor on the Schenectady system is a traveling ticket agent, and a very small proportion of the cash received on the system is turned in through the ticket offices. The local conductors sell interurban tickets, carrying at one time five kinds to seven kinds of tickets, averaging about $35 worth. Of course, they replenish their stock, so that while the ticket offices take in considerable money, most of the receipts come from the conductors' sales of tickets. The system is not altogether satisfactory. The speaker recommended about a year ago that the selling of tickets be taken out of the conductors' hands. He has found in his experience that the greater part of the troubles come either through errors of the conductors in handling the tickets, or through the fraudulent manipulation of tickets. Up to last year it was practically impossible to check the interurban divisions. The method of registration was changed, and the company is now using altogether the New Haven recording fare register. It is impossible on this road to use the zone system. The checking on the lines at the present time is remarkably satisfactory. It is found that with double registration it is possible for the men to collect all fares and check to a cent.


Niagara, St. Catharines & Toronto Railway Company.

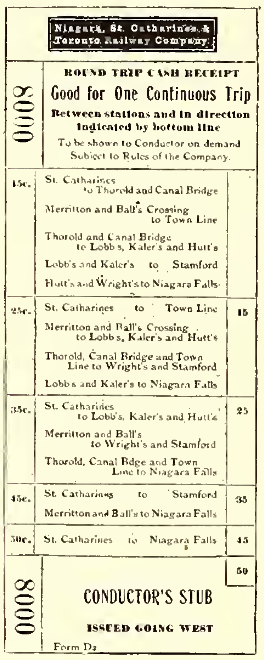
0006

ROUND TRIP CASH RECEIPT
Good for One Continuous Trip
Between Stations and in direction indicated by bottom line.
To be shown to Conductor on demand. Subject to Rules of the Company.

15c.	Thorold and Canal Bridge to St. Catharines Town Line to Merritton and Ball's Crossing Lobb's, Kaler's and Hutt's to Thorold and Canal Bridge Stamford to Lobb's and Kaler's Niagara Falls to Hutt's and Wright's	
25c.	Town Line to St. Catharines Lobb's, Kaler's and Hutt's to Merritton and Ball's Crossing Wright's and Stamford to Thorold, Canal Brdg and Town Line Niagara Falls to Lobb's and Kaler's	15
35c.	Lobb's, Kaler's and Hutt's to St. Catharines Wright's and Stamford to Merritton and Ball's Niagara Falls to Thorold, Canal Bridge and Town Line	25
45c.	Stamford to St. Catharines NiagaraFalls to Merritton and Ball's	35
50c.	Niagara Falls to St. Catharines	45
		50

0006
CONDUCTOR'S STUB
ISSUED GOING EAST
Form D1

RETURN-TRIP RECEIPT PRINTED ON BLUE PAPER--SOLD ON CARS GOING EAST


Niagara, St. Catharines & Toronto Railway Company.

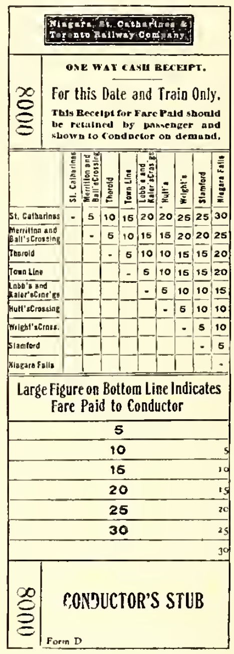
0008

ROUND TRIP CASH RECEIPT
Good for One Continuous Trip
Between stations and in direction indicated by bottom line
To be shown to Conductor on demand Subject to Rules of the Company.

15c.	St. Catharines to Thorold and Canal Bridge Merritton and Ball's Crossing to Town Line Thorold and Canal Bridge to Lobb's, Kaler's and Hutt's Lobb's and Kaler's to Stamford Hutt's and Wright's to Niagara Falls	
25c.	St. Catharines to Town Line Merritton and Ball's Crossing to Lobb's, Kaler's and Hutt's Thorold, Canal Bridge and Town Line to Wright's and Stamford Lobb's and Kaler's to Niagara Falls	15
35c.	St. Catharines to Lobb's, Kaler's and Hutt's Merritton and Ball's to Wright's and Stamford Thorold, Canal Bdge and Town Line to Niagara Falls	25
45c.	St. Catharines to Stamford Merritton and Ball's to Niagara Falls	35
50c.	St. Catharines to Niagara Falls	45
		50

0008
CONDUCTOR'S STUB
ISSUED GOING WEST
Form D2

RETURN-TRIP RECEIPT PRINTED ON RED PAPER—SOLD ON CARS GOING WEST


Niagara, St. Catharines & Toronto Railway Company.

0008

ONE WAY CASH RECEIPT.
For this Date and Train Only.
This Receipt for Fare Paid should be retained by passenger and shown to Conductor on demand.

	St. Catharines	Merritton and Ball's Crossing	Thorold	Town Line	Lobb's and Kaler's Cros'gs	Hutt's	Wright's	Stamford	Niagara Falls
St. Catharines	-	5	10	15	20	20	25	25	30
Merritton and Ball's Crossing		-	5	10	15	15	20	20	25
Thorold			-	5	10	10	15	15	20
Town Line				-	5	10	15	15	20
Lobb's and Kaler's Cros'gs					-	5	10	10	15
Hutt's Crossing						-	5	10	10
Wright's Cross.							-	5	10
Stamford								-	5
Niagara Falls									-

Large Figure on Bottom Line Indicates Fare Paid to Conductor

5	
10	5
15	10
20	15
25	20
30	25
	30

0008
CONDUCTOR'S STUB
Form D

SINGLE - FARE RECEIPT PRINTED ON GREEN PAPER—SOLD ON CARS GOING IN EITHER DIRECTION

Mr. Stevens, of the Auburn & Syracuse, said that last May his ticket sales were 24 per cent of the receipts. By increasing the cash fare rate over the ticket rate, the percentage of ticket sales went up to 68 per cent of the gross receipts. He is planning to put into effect a form of ticket which he used on the Pacific Coast. With this all conductors sell round-trip tickets. The ticket is divided into two halves. One part has printed in black face type the words "not good for passage." This half is detached and turned in by the conductor, and the other half is given to the passenger for the return trip. In this way it is possible to overcome the possibility of the conductor selling this half over again for the return trip, which may be done with the ordinary duplex ticket. By having the conductors sell tickets he expects to make the proportion between tickets and cash about 80 per cent. His company uses the Ohmer register, as it cannot get along with duplicates. For handling the matter of shortages, the speaker introduced a system of arriving at percentages of efficiency of the individual men by taking the number of daily mistakes, counting one for every 5 cents over or short, dividing the total for the month by the number of days and subtracting this from 100, to get the relative percentage of the employees. The percentages averaged as high as 98 per cent, and in one case as high as 99 per cent for one month.

President Danforth believed the form of ticket suggested by Mr. Stevens is a great improvement on the regulation duplex ticket, as it does away with the possibility of the conductor selling the going portion of the ticket to a passenger traveling in the opposite direction. It also has the advantage that it furnishes a round-trip rate to passengers boarding the car in any fare limit. On interurban lines there are many fare limits in towns where ticket agencies are not maintained. It would appear that the only other method is the use of a coupon book, as discussed at the morning session. The selling of these books will do away with a great deal of work on the part of the conductor, and in a measure will do away with the necessity of constantly checking the two portions of the ticket turned in to see that both parts are cut alike.

Mr. Allen asked how many forms of ticket must be carried by the conductor.

Mr. Stevens replied that only one form was necessary. One part is good for passage in the direction punched and the other has printed in black-face type "Not good for passage," and is detached and turned in by the conductor at the time the fare is paid. Only three punches are necessary. The conductor rings on the register the amount of the fare at the time he issues the ticket, and he must account for the money indicated by the punch marks on the "not-good-for-passage" portion.

Mr. Fassett said he had been waiting very patiently to hear of something better than what he had. His company still retains the old bell punch system, the conductor registering the different kinds of fare by punching different colored slips. On his system they have 3 cents for a transfer, three different overlapping 5-cent fare limits, and 6-cent, 10-cent, 11-cent and 15-cent fares. While this is pretty complicated, the old punch does the business still.

Mr. Seixas, of St. Catharines, said he had used on a comparatively short line—15 miles—the regular duplex system. He discarded it for two reasons: First, the number of times the conductor had to punch, causing liability of mistake; and second, the difficulties of accounting after the tickets reached the counting department. His company devised a system consisting of a duplex book, each ticket lined up in 5-cent spaces, running from 5 cents to 50 cents. The conductor, on receiving fare, simply tears off at the line representing the fare collected. He hands in the stub of his book, and must turn in cash according to the torn off stubs. On the portion given to the passenger are shown the different stations, the rates of fare between two points and the cost of round trip. The cost of these tickets is only one-half that of the old duplex system, the ticket requires only one tearing-off, and it is a simple matter to determine from the stubs the amount the conductor should turn in.

The tickets are put up in books of 100, and are printed in three colors. The green one is issued as a receipt for single fare. The red one is issued on car going west and is redeemable on car going east, and the blue ticket is issued on car going east and is redeemable on car going west. Therefore the conductor has two books in use going in either direction. For tearing off the tickets the conductor uses a little silver plated slide, the width of the ticket, with about ⅛-in. bevel on each side, so as to enable it to cling to the book. (Samples of these tickets are shown on page 602.)

President Danforth next asked Mr. Wilson, of Buffalo, to give the results of his investigation of the "Pay-as-you-enter" car, used in Montreal. (For description of the new Montreal car see Street Railway Journal for Jan. 27, 1906.)

FARE COLLECTION ON CITY CARS

Mr. Wilson stated he had spent a day in Montreal and was most forcibly impressed with the operation of this type of car. The car is equipped with one entrance and two exits. The back platform is 7 ft. long, holding about 15 people. On the new cars this platform will be 9 ft. long. They have the "coffee-pot" system of collecting fares, and the people seem to be educated into having their fare ready before going on the car. The speaker made at least one hundred observations during his stay in Montreal, and found that it took about one second for a passenger to get on or off the car. In his judgment the idea is the best he knows of, but whether it can be adapted to American conditions and the American people is a question. His company, the International Railway Company, is building a sample "Pay-as-you-enter" car, which will be given a thorough trial in Buffalo. This is a double-end car and has a 32-ft. body with 7-ft. platforms. The successful operation of this type of car seems to depend on the size of the platform, and the number of passengers that can be accomodated on the rear platform, as the idea is to have the passengers all get on by the rear step when the car stops. As soon as all the passengers are aboard the car starts and the passengers pay their fare and pass into the car while it is moving. The platform should accommodate 25 people. The car that is being built for trial in Buffalo is designed so that the motorman's and conductor's ends can be interchanged. The idea is not at first to introduce the "coffee-pot" system, but to station the conductor in the place he is to occupy on the rear platform and have him collect the fares until the public becomes familiar with the operation of the system. If that works, the fare box can be introduced later. The theory of the "Pay-as-you-enter" car is a most attractive one and is worth a trial. The idea is to advertise thoroughly, giving the reasons for introducing the car. From the standpoint of the traveling public, there are a number of very important advantages to be gained, among which are the fact that the conductor does not have to push through a crowd to the inconvenience of passengers, and the conductor is in the proper position at the rear end to eliminate the jumping on and falling off the car—a class of accidents continually occurring at the rear platform. There will be an arrangement whereby the front door can be operated by the motorman to let people off that way, but they will not be allowed to enter by the front platform. Mr. MacDonald, general manager of the Montreal Street Railway, told the speaker that the new system had increased their earnings on the line they put it on 10 per cent, and had decreased their accidents 25 per cent. If those results are possible it is certainly worth a trial, because the present method of collecting fares in this country is all wrong. The speaker believed the idea of having two thousand fiscal agents all over the system, composed of men not always of the best type, is entirely wrong. In Canada when they progressed beyond the horse car with its fare box, they retained the fare box and simply made it movable instead of fixed. One argument against this car is the possible reduction in speed that will be made, and the speaker rather thinks that the car will cut down the schedule, especially during the rush hours. However, it is worth a trial. In reply to a question about making change on this car, Mr. Wilson said that in Montreal they do not have any trouble about making change. The conductor carries $20 in change in envelopes already made up.

Mr. Fassett asked what arrangement would be made for smokers standing on the rear platform.

Mr. Wilson, of Buffalo, replied that his idea was not to allow anyone to stand on the rear platform.

Mr. Wilson, traffic manager of the Toronto & York Radial Railway, outlined the fare-box system in Toronto. In that city it is almost compulsory for the company to use the fare box. As the earnings increased, the proportion of tickets increased from 30 to 70 per cent. The company does not object to the growth of the ticket system, but it would be impossible for the conductor to collect tickets without the fare box. There is very little trouble with bad coins in the accounting department. The fare box has a little window on each side which enables the conductor to inspect each fare that is deposited. A sheet is kept showing what spurious coins are coming in from each conductor, and if a man continues to turn in too many bad coins he is disciplined. The "Pay-as-you-enter" car with a straight 5-cent fare simplifies matters wonderfully. Where tickets are used, those tickets must be sold, and that takes time somewhere. In Montreal it is well understood that it is the selling of tickets which causes delay. Mr. MacDonald is well satisfied with the invention. The claim of 20 per cent is a very conservative estimate of the saving. In Toronto it is almost impossible to do without fare boxes. Instead of having the conductors handle the fares they each carry $15 worth of tickets and $10 in change, purchased from the car house or office at the end of the route. Except at certain rush hours, when they must provide tickets in advance, $15 will carry them over for four or five trips. It has been found that it is hard for the conductors to do accounting work in keeping track of the different kinds of tickets. The Toronto companies tried doing without the box for awhile, but soon returned to it. A full account of the Toronto system of handling fares was published in the Street Railway Journal for Jan. 27, 1906.

Mr. Fairchild said he had the pleasure of going over the Montreal system and watching the "pay-as-you-enter" car. Whatever the drawbacks of their method may be, they are getting all the fares. As Mr. Wilson has said, there is enough in the idea to warrant very serious consideration. As he has pointed out, the American roads, when they gave up the old fare box, went backward instead of forward. The Canadians kept the fare box, but gave it to the conductor to pass around. In this connection it had occurred to the speaker that one of the objections to this car, as in rainy or cold weather, would be that some of the passengers who had neglected to get their fares ready must stand around on the platform until they got at their money. This is particularly noticeable with a certain class of ladies who have a set of pocketbooks, one inside the other. The idea occurred to the speaker that it might be advisable to allow the passengers to enter the car at either end, letting them pay their fare as they leave the car. The whole thing hinges on the design of the cars. If the rear platform is divided into three aisles, so the passengers coming in and leaving do not conflict, one of the serious delays at crowded points will be overcome. One objection to having passengers pay their fare as they leave the car would be the congestion at busy points. It might be necessary to hold the car until all the passengers had paid, but it would be possible to save the delay most roads now have due to incoming and outgoing passengers blocking the doorway, as the car would be loading at the same time it was unloading.

In reply to a question by Mr. Wilcoxen, Mr. Fairchild said in Montreal they issue transfers when the passenger pays his fare. The conductor has the transfers ready, and the person drops the fare in the box and calls for a transfer. The transfer could be given to passengers when they leave the car unless a road had a complex transfer system, but with simple transfers it would be easy to hand them to passengers when they leave the car.

Mr. Cole, of Elmira, thought in the collection of fares one of the most important points in the discussion of this car would be how much it would reduce the speed that could be maintained. In three cities he found that in increasing the speed of cars the earnings increased in proportion. In the collection of fares under this system it would seem that the cars could not make the same speed, as there would be delays at crowded points. Therefore, in studying the actual gains it is necessary to study the decrease in car operation, decrease in car miles run, and the extra number of cars required to do the same amount of work.

Mr. Seixas called attention to the fact that to anybody who has not operated in Canada it seems almost unbelievable, but the Canadian method of getting about is entirely different from that in the United States, and it is just as much different in England as in Canada. In England the people let the man in front stay in front and the man behind stays behind. Also, as Mr. Wilson said of the Canadians, they have an absolute respect for the law—the law of etiquette. In Canada that condition exists to a greater or less extent. The man in front stays in front, except when the Yankees go over there and "boost" him out of the way. On the success in educating the people in this country depends the success of the "pay-as-you-enter" system. It is a question whether the American people can be educated to allow the man in front to keep his place.

Mr. Wilson, of Buffalo, said as to the point about speed mentioned by Mr. Cole, he was surprised that the new cars in Montreal made better schedules than the old-type cars. The latter unload only at the rear entrance, while the former can unload at two places and take on passengers at the same time. So the new type really catches up with the old-time cars where they are operated on the same lines. It is not so long ago since the Buffalo company permitted passengers to leave by the front door. For years passengers have been loading and unloading from the same entrance. The company was accustomed to that method and it has been making money—and losing $500 per day in knocked-down fares.

CITY SCHEDULES

President Danforth, in taking up the subject of "City Schedules," said that the subject is a particularly broad one, and a matter in which those having charge of city operation are vitally interested, covering not only the making of the schedule but the data upon which that schedule is based; and after the schedule is made, the method of checking its results and providing for its proper revision. In most cities the time table good to-day is of no value to-morrow. It is hard to realize that conditions are varying in one's own city from day to day so rapidly, but careful analysis of the traffic will show that a city schedule must often be changed if the lines are to be operated to the best advantage.

Mr. Fassett said the conditions in Albany have changed comparatively recently. Up to last year the Albany system operated without transfers, operating instead by a system of inter-communicating lines. Albany is divided into practically two divisions. Some few people desired transfers, and in the end the transfer problem was thrust upon the company. By the system of inter-communicating lines the company had been distributing the traffic, but by introducing transfers it was concentrating the traffic all the while. It went through the hard experience of carrying many more passengers and taking in less money. New time tables are now being planned. The concentration in the center of the city became so bad that he has planned to avoid congestion by taking the cars a little to the north and south of the central points, and making the transfer points at the ends of the lines and not in the center of the city, that is, for the regular cars. This will have the advantages of separating the transfer passengers from the cash passengers in the rush hours, and it will take people away from the center of the city and limit the use of the stop-over privileges; and also by using during the rush hours short cars from the center of the system to the outskirts for short riders only, passengers can get on without being interfered with by transfer passengers later. By routeing the cars to take passengers from the center of the city, trouble is avoided with the transfer privilege.

Mr. Ryon asked what the conductor does when a transfer is presented at a wrong transfer point.

Mr. Fassett replied that the passenger either pays his fare or is put off. There can be no question about that point, in view of the recent rulings that a company can make its own transfer points. Where a person has a mispunched transfer, it is another matter.

Mr. Ryon said in Schenectady the situation is this: There is a waiting room in the heart of the business district. The local riders will walk to that waiting room from two to three blocks around, thus congesting traffic. In working out transfer points the company prefers to keep passengers away from the downtown district. Recently he has been working on definite instructions to conductors on proper transfer points, and he attempted to lay out a plan to keep the passengers away from the waiting room. But the question of stormy weather comes up, as it recently did, when passengers cannot be expected to stand in the rain or snow four or five blocks from the waiting room. The only way of getting rid of that is to get rid of the waiting room. The idea is to get the station off the business street and stop the congestion and, of course, do away with the possibility of riding downtown and back on a transfer, which is sometimes done. The lines all come to a central point, and there are a couple of belt lines, so that a passenger can get on one line, get off at a neighboring transfer point, take a car at waiting room and go back.

Mr. Carver, general superintendent of the Rochester Railway, said his company believes the matter of city schedule is strictly a financial proposition. In the handling of traffic on steam roads, both freight and passenger, the theory is to charge all the traffic will bear, so that a ton of first-class goods, for instance, will bring in more than a ton of lumber. That can be reversed for city railways. It is possible to fix the amount of money that can be taken in on a certain line on a certain day of the month by keeping a daily check on what such line is doing. On one line it was necessary to show a certain percentage of increase. In comparing with March of last year on the same line, the earnings were $9800 and last year was taken on a basis of $1.95 per car-hour. This year they tried for and secured an increase of 13½ per cent, but this was on the basis of $1.92 per car hour. This is 3 cents per car hour less than last year, but they obtained the volume of money they wished that line to bring in from day to day. Considering the money taken in for a given day, the company knows how the receipts are divided and where the money comes from. They can check the receipts each day in less than a day, and after the money is taken in they can tell what it is costing to get it, what they are getting per car hour, and if they are not getting the increase they want they can change the schedules. On another line on Feb. 28, they had to change and run 550 car hours per month more. The first ten days or twelve days that this schedule ran it did not show up well as a business proposition, but it is now becoming a paying one. Should the tabulation show it was falling behind they would change the schedule right away. That is done on the principle that the prime object of a city schedule is to get the greatest number of conductors in the way of the greatest number of nickels at the smallest cost possible.

President Danforth said the keynote in the making of city schedule is to get all the passengers possible—keep the sidewalks empty.

Mr. Cole thought that in checking up city schedule work there are four essential conditions: First, the earnings per car mile; second, the earnings per car hour; third, non-revenue mileage, and fourth, the percentage of transfers to gross receipts. These four conditions are the ones that must be considered. In many cities where consolidation has taken place, it will be found that many lines still operate over their old routes. Lines will be found where ten passengers are transferred and only five or six go on for the rest of the trip. This should be reversed, and yet such conditions actually exist in many cities. The condition of non-revenue mileage exists, especially on the longer city lines. Up to the city limits a certain revenue per car mile is obtained. Beyond that this revenue increases until a non-revenue mileage is reached, so that instead of having every car go through, it is better to send only every other car through to the end of the line. The same conditions exist largely in most cities, that is, the cars are carried beyond the revenue point. Longer-riding passengers should be required to take the through cars.

President Danforth said there is one thing to be considered in the line of Mr. Cole's remarks, and that is the local condition. Each line must be considered separately and according to its own needs. As he said before, a company wants all the people to ride from whom it can obtain a profitable revenue. For that reason it is desirable to go a step beyond the actual needs of the service, and give a certain amount of extra accommodation as a matter of advertising. It pays to do this up to a certain point. As Mr. Cole says, the routeing of cars must be carefully laid out and cars must not be run beyond a reasonable point. It very often pays to route trippers over parts of two lines to avoid excessive transfers. There is another phase of this subject, and that is in the methods used by various companies in making up their time tables, the division of the time tables into runs, and the assignment of such runs to the train crews. There is quite a diversity of methods. In Rochester it is the practice not to run a large number of trippers, as compared with Buffalo and other systems. This makes a great difference in the division of the work. The conditions in Rochester are more like those in smaller cities. The average rider does not go over 1½ miles from the center, but a great many ride through the center of the city. The cars carry practically two loads each trip, in spite of the large number riding through the center.

Mr. Carver, in further explanation of the Rochester system, said every car carries a train number and runs according to schedule. They do not run many extras. When trippers go out, the office knows pretty nearly what they are going to do. Personally, he thought it is better to have the tripper on time. As an instance, recently they had quite a storm and there were many extras out without being on time. There was one case where a tripper should have gone out at 5:50 p. m., but did not go until 6. This tripper would have had too large a load and the next car would have been underloaded. Most extras should run on schedule and carry regular train numbers. After a schedule is made up and the proper amount of car mileage figured to produce the result desired, then the run is divided up and the run number is different from the train number. The Rochester Company has a system of seniority. The oldest man on the line has the pick of any run, the next oldest the second choice, etc.

Mr. Duffy, general superintendent of the Syracuse Rapid Transit Railway, believes that local conditions must govern in making up a schedule. In his city, on the main line, there are three divisions which must be taken into consideration in making up the schedule. He runs a tripper service in the direction of greatest travel. Most of the tripper service is on that particular line, and from a point where two or three large factories are situated. From these lines the passengers go to the center of the city and transfer. But he has found that with one factory employing 2000 people it is more economical to run direct to the southern part of the city without transferring at the center. In making up the schedules the men are satisfied with ten hours a day, so he subdivides the schedules accordingly. He has also a seniority rule, but that does not give the oldest man the right to select his run. For instance, such a man might pick out a run which the superintendent does not believe him to be capable of handling and, therefore, the superintendent reserves the right to change the men. He finds that he can get men on the extra list 7½ hours or eight hours six days in the week and take chances for Sunday. If less, it means new men on the run every night.

President Danforth then announced that a letter had been received from W. Caryl Ely, president of the American Street & Interurban Railway Association, expressing his regret that he could not be present at the meeting.

J. DuBois, division superintendent of the Fonda, Johnstown & Gloversville Railroad, then read the following paper on "Methods of Discipline:"

METHODS OF DISCIPLINE

In order properly to take up this subject, it might be well to follow the case of any transportation employee from the time of his entering the service, and note the general policy of his training. We will find, on any street railway system, a number of regular conductors and motormen and a greater or less number of "extra" men. Each of these men have been carefully selected. He has been recommended by his previous employers, his habits and moral character have been vouched for as good, and he has passed the necessary physical examination. He has practiced for a sufficient length of time under the supervision of a competent instructor, and has been "turned in" as thoroughly posted. A book of instructions and the current time tables have been issued to him, and he has been examined as to his familiarity with the rules and schedules. If the applicant is a motorman, he has spent a specified time in the shops and has been instructed in the details of the equipment and the best methods of making slight repairs on the road.

The main idea of the training of these men is instruction, and the method of discipline should correspond with and bear out this idea. The province of discipline begins when an employee enters the service, and its object is to keep the service at the highest point of efficiency. It should encourage all employees to use care and good judgment, and discourage them from being careless and slovenly in their work. Discipline may consist of commendation, reprimand, suspension or discharge. Commendations or reprimands may be verbal or by letter. Suspension may be for one day, two days, fifteen days, thirty days or more. Discharge is final.

The method of discipline by suspension is gradually losing in favor. The objections to it are well founded. The suspended employee, being deprived of his usual employment, finds that time hangs heavily on his hands and is apt to spend too much of it in saloons. The temptation is to drink too much, to spend too much money and to tell all his friends how it happened, and how badly he has been used by the railway company. By the time he is to resume work, his earnings have been cut into and his frame of mind is apt to be decidedly disloyal. The persons who suffer most by the suspension are the wife and children of the suspended employee. The household expenses, such as rent, coal, grocer's bill, etc., go on, while there is no wage coming in from the bread winner.

The practice of the Fonda, Johnstown & Gloversville Railroad has been to follow the Brown system of discipline by record, modified somewhat to meet our local conditions. The method is comparatively simple. A record blank is kept for each employee. This blank gives his name, badge number, date of entering service, date of assignment to a regular run, and all information regarding the man in question. From time to time entries are made on this blank, such as commendations, reprimands, accidents, promotions, missed runs, flattened wheels, etc.

Each employee is free to inspect his own record blank on application to the office, and is informed of each entry made upon it. In case of the investigation of an accident a man's record is taken into consideration, and should largely influence the decision. With a man's record are filed all papers concerning him, such as his application blank, physical examination, etc. By looking at the record blank, one can tell at a glance whether the man is an efficient employee or not. When it becomes evident that any man is a detriment to the service, he is dismissed. One of the chief merits of this system is that it enables the superintendent of transportation to differentiate the men, and helps him to know the men whose violations of the rules are due to carelessness, and those whose offenses are wilful. After the superintendent has called the attention of the former to their irregularities, they become more careful and pay stricter attention to their work. In the case of the latter, whose repeated violations of the rules show that they are not accepting the reprimands and adverse criticism of their chief in the proper spirit, it is made sufficiently plain to the official in charge that they are not the sort of men whom it is desired to keep in the service of the company.

Mr. Duffy believed that the efficiency of any method of discipline lies largely in the executive ability of the man placed in charge of such matters. Discipline should begin when the man first commences work with the company. It is largely a work of education to discipline properly any class of men. The Syracuse company requires an application to be signed by two reputable citizens and the prospective employee is required to pass a physical examination. In the case of a conductor, he is given a book of rules and is placed on the car and kept with the first conductor about six days. He then spends one or two days with different conductors. He is then turned over to the foreman or chief despatcher and is examined as to his knowledge of the rules. He is then sent to the superintendent and receives his badge and punch. In the case of a motorman, he is put on a car to learn. After six days, if thought competent, he is turned in. Each instructor signs a blank, saying that he believes the applicant capable of performing his duties. The motorman takes a little longer to learn, that is, fourteen days for the conductor and twenty-one days for the motorman. The last three days are spent in the shop learning about the electric appliances on the cars. After getting through the shop the applicant becomes a motorman. A printed form for questions and answers is given each man when he enters the shop, and he is instructed by the master mechanic or his clerk as to the meaning of these instructions. The applicant is given a written examination and then goes to the superintendent and gets the rules. No set system of discipline, like the Brown or other system, is followed out. If a man is reported for infracion of rules, which seems due to carelessness, he is sent to the superintendent for conference. It has been the speaker's experience that a personal talk between an employee and the superintendent does a great deal more good than when the disciplining is left to a subordinate officer. On his system he is able to see the larger number of the men, but on larger systems that would not be possible. There are three or four things that require and should merit instant dismissal, drink, entering saloons, dishonesty and disobedience to the orders of a superior officer. In almost all cases the latter has meant dismissal, although at times the officer placed in charge of men does not use the proper methods in handling them. While it is hard for the superintendent when a man has had a difference with his superior, to bring them both to the superintendent's office to decide which is right, the speaker believes that the employee of any company should have the right to appeal to the managing superintendent. He thinks that fact should be made known to the employees at all times, and if they have a real or alleged grievance they should have this right of going before the highest authority.

Mr. Ryon explained the method he is using in Schenectady in training motormen. Recently he has made a change which he thinks is bringing about very desirable results. He has a general barn foreman, a part of whose duties is to lecture the motorman. The railway company has a skeleton car which the General Electric Company originally exhibited at St. Louis. This car has been set up in one of the houses. Formerly his company put the motorman on the car for practice before putting him through the mechanical features of his training in the car house. About one and a half years ago, it was decided to pay a man while going through the shop $1 a day, not to exceed seven days. It was thought by doing that the men could be induced to take more interest in this part of their instruction. This scheme of payment was discontinued because it was decided to be a mechanical charge against the master mechanic. The question came up again recently, and it was decided to start that plan again, but instead of putting the motorman upon a car to practice first, he is sent to the barn foreman, who stays with him a full half day on the instruction car, after which the applicant goes into the barn. He is really turned in by the barn foreman before he practices on the cars. It is believed the instruction the men are getting and the experience in the barn is helping them on the road, because they know the equipment better. About the time this plan was started the superintendent also selected one of the most competent motormen to act as instructor. As the new men finish their course in the shop the instructor takes them in hand, watches them and reports to the transportation department as to their familiarity with the equipment and ability to handle the car. These records are filed and kept, with the idea that if something happens with the man on the line he cannot plead ignorance. He has been turned in as competent, and if he abuses the equipment the superintendent feels that he has wilfully violated the rules, and that he is a dangerous man to continue in the service.

Mr. Wilson, of Toronto, said in his city they have a system of roadmasters. (This system was described in the Street Railway Journal for Dec. 30, 1905. The company selects a motorman who has shown good service, and has the ability to handle men to a certain extent, and gives him a roadmaster's cap. His duties are particularly those of an inspector. The company was able to cut the force of inspectors' staff in half when it put on the roadmasters. There are two shifts, one for regular and one for relief. The roadmasters are scheduled for runs, and act as motormen, receiving a little additional to the regular motorman's salary. The roadmaster is permitted to change from car to car. If a roadmaster meets on a run a man who is not doing well, he exchanges cars to see what is the matter. If anything is wrong with the car he sends it to the shop, unless he can fix it, and thus keep the car on the road. New men are trained by these roadmasters. All of these roadmasters are non-union men and so new men are not installed with union ideas when being trained. Another feature is that this system keeps the company in touch with the conditions on the different lines. If the roadmaster thinks changes are beneficial, he makes suggestions to the superintendent. He is the first man to finish work at night and the last man on in the morning, so he is able to check men coming and going into the houses. The mechanical department feels that the roadmaster system has been a great help to it in reducing shop repairs.

Mr. Fairchild said the main point of the Toronto roadmasters' system is that while serving as inspectors these inspectors are also acting as regular motormen. He asked Mr. Wilson, of Toronto, if they do not find sometimes, in case of trouble, that the roadmaster happens to be at the other end of the line and it is necessary to wait until he comes around?

Mr. Wilson replied that they have two or three lines duplicating parts of the same trip, and they have very little trouble in that way, for if one roadmaster is not near another one is.

Mr. Fassett asked if the roadmasters make a daily report.

Mr. Wilson replied that they do. The roadmasters are continually changing cars, and this tends to make the other employees do right for fear that a roadmaster may show up on the next car.

Mr. Allen asked how many roadmasters were maintained.

Mr. Wilson said they had 34 roadmasters for 350 cars on an 18-hour basis. They also have six inspectors, who do not ride on cars, but confine themselves during the rush hours to intersections at busy points.

Mr. Fassett said the United Traction Company, of Albany, spends considerable money in maintaining on its system thirty-eight inspectors on eighty miles of track for 175 cars. The inspectors are perfectly competent to make light repairs, carrying rubber gloves, tools, etc. They look out for the maintenance of schedules and see that the rules of the road are obeyed. The idea that they are simply checkers is erroneous. Another duty covered is in accidents. The inspector immediately goes to the place of the accident and endeavors to get the names of witnesses, and he telephones headquarters about the accident. The chief inspector, if the accident is serious, or if necessary to close the matter up at once, gets in touch with other inspectors, gives the names and addresses of the witnesses, and the inspectors go to the persons and get their statements of the accident. So that by 9 o'clock next morning, when the reports are made, all the statements of witnesses are in the possession of the superintendent, to be turned over to the claim department for proper action. The speaker is satisfied that this inspection system pays. He has discouraged the idea of motormen tinkering with the car at all, except perhaps to cut out a damaged motor. The instructions are to report to the inspector and have him decide. Another thing in the case of blockades, which sometimes occur in cities, the motormen and conductors do not seem to care to get back to their own schedules, unless it is relieving time or off for the night. They would rather run in groups than any other way. The inspector is more particular and knows where each car should be at a given time. In case of a stoppage or blockade the cars are sent out by the nearest inspector, who gives the motormen instructions as to what to do to maintain the service. This, of course, also tends to keep down the number of accidents.

Mr. Cole thought that one of the chief troubles is that some conductors are apt to remember all the things that help them, but not the company. The motorman, too, has had his course of instruction, but he has much more to learn. It is a good thing to have a staff of inspectors to keep motormen and conductors in touch with the latest developments in order to maintain the highest efficiency of the service.

Mr. Ryon said his company had a rather peculiar situation at Schenectady in that the heaviest travel is away out on the outskirts of the town, as it must take a great many people to and from the General Electric Works, and it has to move the entire population of the city in one direction at one time. In the morning he puts out sixty-four cars, which go to the General Electric Works before 7 o'clock. If a man is late a minute he loses an hour. The inspectors are stationed throughout the congested part of the system and at junction points to the main line, to take care of troubles that might arise from cars running on close headway. If a train was delayed a few minutes it might mean an hour each to 5000 men—a very serious matter. In the evening the conditions are just reversed. There are a string of cars from the General Electric Works all the way uptown until they begin to divide at the different routes. The inspectors are always on the spot to break blockades. If a car breaks down it is taken off the main line as soon as possible.

President Danforth, in taking up the question of station rules, said it seemed to him that if the companies adopt a standard system of rules covering employees' operation of cars, they should also adopt a system of rules covering employees when entering and leaving car houses.

Mr. Ryan said he had found, upon the examination of rule books, that many roads place power station rules under what he would call station rules. In the old rule book of his road the station rules were included in the general rules.

Mr. Ryon then read the following paper:

STATION RULES

This subject, while secondary to rules for the safe running and proper conduct of cars in operation, is, in the writer's opinion, of much more importance to a perfect organization of train service employees, than may appear without giving the subject careful study. Discipline is the fundamental principle of organization, in the absence of which there can be no system. While system is synonymous with method or rule, as coördinate with organization, we will assume that it is rather a plan of organization. Discipline is the result of a rule, and hence rules are necessary for the maintenance of discipline; discipline is necessary to perfect organization; and system or method is the result of organization, all of which are essentail to the successful manipulation of large properties and the handling of a large body of men.

The child is first taught punctuality and to obey the unwritten laws of instinct for self-preservation, before venturing beyond the threshold. Why then should not our employees be taught that punctuality and observance of written laws or rules governing their conduct before leaving our threshold is essential and necessary before giving to them the responsibility of human lives and the collection of our revenues. Discipline begins at the station, and we must therefore have rules, for without rules we have no discipline.

Station rules are, therefore, necessary. Assuming that this conclusion is undisputed, we have then to treat of the subjects to be covered by such rules; the method of placing them before the train men, and the method of enforcing them.

The term "station rules" does not appear to be understood by some companies. "Car house" seems to be a more definite term as a distinction from a "power station," which is generally called a "station." In view of this fact, if it is the sense of this association that "car houses" should be termed "stations" the writer is of the opinion that this association should go on record as to the definition of the term "station," in order that it may be generally understood that "station rules" are "car house rules." After receiving a request to prepare a paper on this subject for discussion at this meeting, the author wrote to a dozen or more of the large street railway systems in neighboring states, requesting a copy of their station rules. With one exception, all replies indicated that the railroads replying did not know just what was wanted. A second letter, explaining fully, did not bring any results. One road sent a printed copy of rules governing power stations, and others, who had the impression that power station rules was wanted, said they did not have any set rules.

Until Jan. 1, of this year, the station rules of the Schenectady Railway Company were embodied in the book of rules under the title of general rules. The present book of rules was worked out last year, and closely followed the street railway standard, except that we followed the steam road standard to a large extent on the interurban rules. Station rules were eliminated from this rule book.

The author found on examination of rule books of some large systems that some rules of a general nature which might properly come under the head of station rules are classified under general rules.

As station rules have been divorced from rules governing trainmen, and the subject does not appear to have received the attention which it merits, the author does not hesitate in expressing his opinion that the executive committee of the New York State Association displayed excellent judgment in bringing the matter to the attention of this association. In the adoption of the standard rules, there seems to have been a desire on the part of the committee to simplify and adopt only such rules as are proper and necessary. This was commendable, and the same course should be pursued in promulgating a set of station rules which will receive the approval of this association. In the writer's opinion, all rules applicable to trainmen, whether in the stations or on the road, should be under one cover. However, the station rules should be properly classified under that title.

The author would recommend the standardizing of station rules, for the information and enlightment of street car men.

As conditions are not identical on all roads, modifications of discipline could be arranged to suit the conditions of labor or other exigencies. The subjects to be covered by station rules are particularly those which concern the report of behavior and discipline of trainmen at the stations and the care of rolling stock in the car house.

A copy of these regulations should be placed in the hands of every trainman, and a copy should be placed in a conspicuous place in the station. The moral effect of the law staring the men in the face is a constant admonition to "saw wood," and the penalty of missing out may ever be a constant reminder that the "early bird catches the worm." As the Schenectady Railway is the market for station rules of approved form, the author is not prepared to place before this meeting any originality on this subject for discussion. The station rules of our old rule book are still in force, and are similar to those in effect on such roads as have a system or method in their work. The writer is quite well satisfied with the station rules of the International Railway and the Rochester Railway, which are practically identical, and for the purpose of opening the discussion on this subject, the author has prepared a copy of these rules, making such changes as are necessary to meet the requirements in Schenectady.

These rules are submitted for the consideration of the association:

SCHENECTADY RAILWAY COMPANY STATION RULES FOR TRAINMEN

1, Appointment.—All trainmen, after having been appointed, will practice as students until their instructor has certified as to their competency to perform the work, after which they will be examined by assistant superintendent.

At this examination they must be familiar with the running time, streets along the route, and all other rules and regulations pertaining to the running of a car.

After this examination has been passed satisfactorily the employee's name will then be placed on the extra list for work.

Extra trainmen will be rated and be assigned to work in the order of dates of appointment.

2. Addresses.—Trainmen must keep the station master at their respective stations advised of their correct addresses, promptly reporting any change in same.

3. Obey Those in Authority.—Trainmen will hold themselves in readiness at all times to promptly and cheerfully obey all orders of those in authority. Disrespect to officials, either in manner, speech or otherwise, will not be tolerated.

4. Temporary Assignment of Runs.—When a regular run becomes vacant it will be assigned to the first extra, to be retained by him until the next general listing. When regular man is off on sick leave and does not report for duty by the first of the following month, his run will be assigned to the first extra on the list, who will hold such run until regular man reports for duty. All runs, except those designated on time card by "EX," will be considered regular runs. Extra men securing runs do not lose their standing for work on the following day unless there is a relief in such run, in which case it will be considered a day's work.

5. Listing Up.—When occasion requires, all regular runs will be listed up and given to regular trainmen by order of seniority, except when the best interests of the company require assignments to be made otherwise.

6. Wages.—Wages are allowed for "platform time," services rendered while actually employed on the company's cars, except for "watch duty," as shown in Rule No. 14.

(Assignment of Wages).—Employees must not make any assignment of wages due or to become due.

7. Suspension.—Trainmen will receive no compensation for time lost while under suspension.

8. Promotion.—To obtain promotion, capacity must be shown for greater responsibility.

9. Daily Bulletin Book.—A book known as "Daily Bulletin Book" will be posted in a conspicuous place in each station, not later than 5 P. M., which will show the names of all extra men assigned to duty for the following day; also the names of all regular men or extras on absentee or sick list. In addition to the bulletin book an "extra car service" sheet will be posted, showing the names of all men assigned to extra cars for morning service, and again in the afternoon for evening service.

Extra men and regular men serving on the extra list must frequently examine the "bulletin book" and also the "extra car-service" sheet, as one man's name may appear several times on either sheet.

In assigning crews for extras, station clerk will call men from the bottom of the extra list, working upwards.

10. Report for Duty.—Regular trainmen, or extra trainmen, assigned to regular runs, also extra trainmen bulletined for extra cars, will report at the station at least 10 minutes before such car is due to leave the station or relief point, will go to station

clerk's window and announce their name and run number and will not leave window until station clerk has acknowledged receipt of their report by checking their names off on train book.

Extra men bulletined to report at "regular show up" will be in the assembly room in advance of specified time, and remain there until after roll call; failure to answer a roll call will be considered a miss, for which no excuse will be accepted. Extra men desiring to lay off for the day must make their request known to station clerk at close of roll call, who may, at his discretion, grant such permission; it being understood that extra men so excused will be last for work on reporting for duty. Extra men on duty until 12 o'clock midnight, or later, may, on application to station master or station clerk, be excused until second "show up" on the following day, providing they can be spared.

11. Standard Time.—Standard clocks are provided at all stations. Trainmen are required to provide themselves with a standard watch and keep it correct, comparing time with station clock daily before going on duty.

12. Order Board.—After reporting for duty, and before taking car out, trainmen must examine "order board" and sign the receipt book for such orders as may appear thereon. Failure to do so will be a sufficient reason for removal from car and service on extra list for the day.

13. Relieving at Points Away from Station.—When assigned to take car at a point away from the station, trainmen must be at such point ready to take car at its schedule time. In case of relief, trainmen failing to be at relief point on time, crew operating car will continue run until relieved, but must report the failure to be relieved from first company's 'phone.

14. Watch Duty.—The first crew for work after all vacancies have been filled will remain on watch at the station, receiving half time therefor until ordered out or excused. Men on watch will be expected to keep the assembly room neat and clean, and will do such errands as inspector or station master may request.

15. Leave of Absence.—Station master will, at his discretion, grant leave of absence for any period not to exceed five days. Absentee cards for a longer period than five days must be approved by the superintendent. Trainmen must secure an absentee card whenever excused from duty for more than one day. Trainmen will, under no circumstances, be granted leave of absence for more than thirty days at any one time. Requests for permission to be absent must be made in person or in writing. Telephone requests will not be considered. No employee will be excused from duty to engage in any other occupation or business, nor will his position be held for him while so engaged.

16. Sickness.—After requesting to be relieved from duty on account of sickness, trainmen will, when able to resume work, report at the station in full uniform by 4 P. M., so as to be marked for work on the following day. Should the station master request men to perform extra work, by running trippers, they will be obliged to do so.

Trainmen who are excused from duty on account of sickness must report at the expiration of thirty days, either in person or in writing, and failure to do so will result in dismissal.

Trainmen when on sick leave must not leave the city without first notifying the station master, and turning over to him badge, etc., for safe keeping.

17. Sick Notice.—Should trainmen be unable to report, written notice, signed by trainmen or attending physician, will be accepted, providing it is received by the station master or clerk 10 minutes previous to the time trainman takes his run, unless assigned to duty at a point away from the station, in which event written notice must be received at least 30 minutes before time due to take car.

18. Absent Without Leave.—Failure to report at proper time, as provided for in station rules Nos. 10 and 13, unless written sick notice has been received, will subject men to discipline as follows: Regular trainmen failing to report 10 minutes before car is due to leave station or failing to be at relief point in time to take car on its schedule time, will be subjected to discipline as follows: For the first offense, five days at the foot of the extra list; for the second offense within six months, ten days at the foot of the extra list; for the third offense within six months, station master will suspend trainman, instruct him to report to superintendent transportation, forwarding a written report giving the dates of previous misses and stating what disciplinary action was taken.

Extra trainmen failing to answer roll call, or failing to be at relief point on time, unless written sick notice has been received, as provided for in station rules Nos. 16 and 17, will be dropped to the foot of the extra list; all other extra men being advanced in turn. Extra men missing too frequently will, in addition to being dropped to the foot of the extra list, be reported to superintendent of transportation, who will take such action as the findings warrant.

Regular or extra trainmen who absent themselves from duty for five days or more without leave will be considered dismissed from the service.

19. Trainmen's Duty Before Taking Car.—Conductor, after reporting for duty, will provide himself with lost article slips; day sheets, envelopes and a supply of transfer tickets, also such change and tickets as may be allowed. He will then see that the commencing number of transfer pad is correctly noted on front of day sheet, and that they are the proper transfers for the line to which he is assigned. He will then take register readings on the car which he is to operate; will go to the station clerk's window and compare register readings with the station clerk's record of same, except at stations where there is a register clerk with whom register readings must be compared. In addition to this he will see that car is clean and fit for service; that it is provided with broom and proper signs, and that a crippled car card, detention slips and witness slips are in the box provided for that purpose.

Motorman will, after reporting for duty, provide himself with a switch-iron and three extra fuses; will examine car and see that fuse-box contains regular ampere fuse provided by the company; that car is provided with darw-bar and pin; that sand-boxes are filled and in working order, and will test brakes and controllers. If any part of the car is found to be defective it must not be run out of the station, but report of its condition must at once be made to the station master or his representative.

Motormen must never move a car until certain that no one is working over, under or about it.

20. How Cars Are to Be Left in Station.—Before turning car into station conductor will set registers at zero, sweep car out thoroughly, and, if box-car, will raise all windows; in case it is a summer car he will, in wet weather, lower curtains, that they may dry during the night. He will remove trolley from wire and also change trolley when required.

Motorman will set up hand-brake, throw switch to "off," and remove controller handles, placing them on top of controller.

21. Going Off Duty.—Before going off duty, conductor will note closing number of transfer pad, take register readings, totalize day sheet so as to give number of passengers carried and make full settlement for the day.

An accounting of all fares collected, transfers and cash-fare receipts issued or spoiled, as well as those remaining unused, must be made at the station daily, at hours specified by the station master. Cripple car report, detention report and a complete report of any accident or altercation which may have occurred on the car during the day must be made out on the proper blanks, signed by both the conductor and motorman, and delivered by conductor to station master or clerk before leaving station.

Motorman and conductor are forbidden to leave the station until such reports have been approved by inspector, station master or clerk.

Motormen, before going off duty, will report condition of their cars on the sheet provided for that purpose at the station.

22. Removing Parts of Car.—Trainmen are forbidden to enter any car in the station other than the one to which they have been assigned, or to remove switch-iron, controller-handles, sand or bell punches, broom, or any part of the car equipment.

23. Uniforms, Neatness, Etc.—Trainmen must be provided with uniform cap, badge and complete working outfit before taking charge of car. When on duty, trainmen must wear the prescribed uniform, which must be kept neat and clean. The official badge must be worn in plain sight on the cap, and cap must be worn squarely on the head. Uniform buttons will be furnished by the company, which, together with badge, book of rules and all other property of the company must be surrendered when trainmen leave the service.

Exchanging badges, punches, or duties, is positively forbidden. Under no circumstances must an employee loan his badge or his punch to any person, and when excused for sickness, or when on leave of absence for seven or more consecutive days, badges must be surrendered. The loss of a badge or punch must be reported immediately to station master.

Trainmen must always keep themselves neat and clean, clothes brushed and shoes shined, and also assist in keeping the assembly room and other parts of the station neat and tidy.

24. Deportment While in or Around Station.—Trainmen, while in or around station, must not use profane or obscene language, or spit on the floor. Conversation must be carried on in a moderate tone of voice. Boisterous conduct will not be tolerated.

25. Contributions.—Soliciting contributions or selling tickets on behalf of any employee or employees of this company is prohibited, except on account of the benefit association.

26. Employees Leaving the Service.—Trainmen will be required to give at least three days' notice of their intention to leave the service before final settlement is made, and must, upon request, make affidavit containing a full and true statement of any accident, delay, blockade, mishap or altercation of which they have knowledge, and will turn in all the company's property with which they have been intrusted, if a clear record card is desired.

27. Refusing Work.—Trainmen will be required to perform such duties as may be required of them by inspector, station master or station clerk, and failure so to do, or refusing work of any kind, will be followed by forfeiture of badge and other company property, it being understood that when a trainman refuses work he severs his connection with the company.

28. Snowstorm.—All regular men who are laying off and all extra men who have been excused are required to report at stations immediately in case of snow or sleet storm.

Trainmen failing to comply with the above will be subject to discipline.

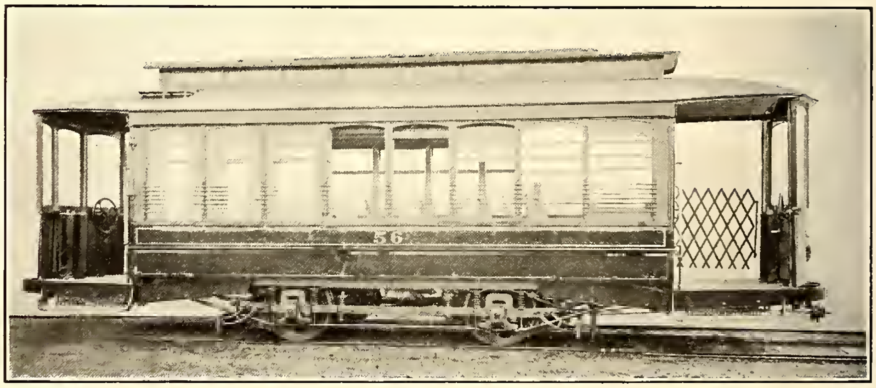
Mr. Ryon added to his paper the remark that on his cars a suggestion box is placed, in which the crew can drop suggestions regarding car defects noticed by them.

After an informal discussion on station rules, the meeting adjourned.

NEW ROLLING STOCK FOR JACKSON

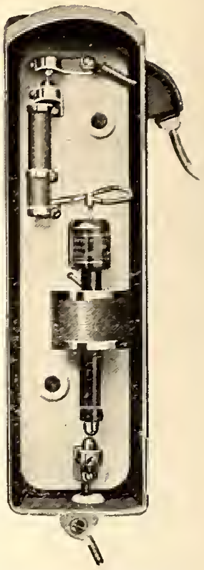
The Jackson Electric Railway, Light & Power Company, of Jackson, Miss., has recently received eight new cars from the American Car Company, of St. Louis, Mo. Jackson is the capital of Mississippi, famous for its great cotton industry, and is an important railway and manufacturing center. Its street car system operates principally within the city and has an extension to an amusement park. The same car company was also the builders of the very handsome and unique car shipped to this same company about a year ago, which was originally intended for special service to be mounted on double trucks; ultimately the car was equipped with the Brill single No. 21-E truck and put into regular service. The eight new cars shipped are of the Brill semi-convertible type, this construction being so well known as to need little comment here, the characteristic feature being that both upper and lower sash automatically slide into the roof, affording greater aisle space and longer seats, due to the omission of the usual pockets framed between the posts. The sub-tropical climate of Jackson demands a well-ventilated car in the summer season, and the cars now shipped admirably meet this condition, affording as they do the maximum window space for the free ventilation of air.

The length of the car body is 20 ft. 8 ins., and over the vestibules, 30 ft. 8 ins.; width over the sills and panels, 7 ft. 9½ ins., and over the posts at the belt 9 ft.; distance between the center of the side posts, 2 ft. 5 ins.; height from the floor to the ceiling, 8 ft. 4⅛ ins.; height from the rail to the side sills, 2 ft. 6⅞ ins.; height from the sills over the trolley board, 9 ft. 1½ ins. The platform steps are 1 ft. 3 7-16 ins. from the rails; length of the seats, 35 ins.; width of the aisle, 22 ins. The inside finish is of ash and the ceilings of plain birch. The car is finished with transverse seats of spring rattan, with corner grab handles; sand boxes, "Dedenda" gong, angle iron bumpers, "Retriever" signal bell. The portable vestibules are fitted with folding gates. The trucks are of the No. 21-E pattern and carry 25-hp. motors.



SINGLE-TRUCK, DOUBLE-VESTIBULE CAR FOR JACKSON, MISS.

POLE ARRESTER FOR ALTERNATING-CURRENT CIRCUITS



POLE ARRESTER FOR ALTERNATING-CURRENT CIRCUITS

In the accompanying illustration is shown one of the new arresters for alternating-current service brought out by the Garton-Daniels Company, of Keokuk, Iowa. This is a pole arrester designed for potentials from 1200 volts to 2500 volts. It is placed in either iron or wooden waterproof covers, and has a dipped metal finish; in other respects it is the same as the station type of this arrester, which was described in the Street Railway Journal for Feb. 3, on page 205. The cover is fitted with insulating bushings for the leading-in wires and the arrester is carefully insulated from the cover. The total air-gap distance in this arrester is 3-32 in. The series resistance averages 250 ohms. If an iron-covered arrester is employed, the net weight is 21 lbs., and the dimensions are 16⅞ ins. x 6 ins. x 5 ins., while the respective data for the wooden-covered style are 72½ lbs., and 19 ins. x 7½ ins. x 7¼ ins.

NEW STEEL CAR DEPARTMENT OF THE ST. LOUIS CAR COMPANY

The St. Louis Car Company has added a new department to its organization. It is known as the steel car department and will occupy two new buildings, one of which has already been constructed, and another now being erected. One of the buildings will be equipped with punches, shears, and other necessary machinery, while the newer one will be used exclusively as an erecting shop. The steel cars, after being erected, will be painted and finished in the department where similar work is done on cars of semi-steel and wood construction. The all-steel-bottom framing of the St. Louis Car Company, which might be said to have been the first step towards the construction of steel cars by the company, is now generally used on all the company's cars of wood body construction. After proving the merits of this steel-bottom framing, the company began the manufacture of cars of semi-steel construction, and the creation of the new steel car department is the result of a determined effort on the part of the St. Louis Car Company to lead in the construction of all-steel cars for both electric and steam service. In view of the favorable experience gained thus far with steel cars built for subway service, it is likely that they will soon find a wider field.

FINANCIAL INTELLIGENCE

The Money Market

There has been no improvement in the monetary situation during the week. On the contrary, the market has worked firmer, if anything, despite the liquidation in the stock market, and heavy offerings of funds by foreign bankers against exchange transactions. Money on call in the open market has ranged between 6 and 30 per cent, while the interest charges for loans for all fixed periods have ruled higher than those for any like period for several years. Sixty-day loans commanded 8 per cent, and was paid, while for sixty and ninety days 6 per cent was freely bid, with little offered under 7 per cent; four to six months' accommodations were obtainable at 6 per cent. The high rate prevailing in the local market was reflected in a sharp break in the rates for sterling exchanges, prime demand bills declining to 4.8295, a net loss for the week of nearly 2½ cents on the pound sterling, and the lowest rate recorded since November, 1903. Under ordinary conditions such a sharp break in exchange would have resulted in heavy importation of gold from Europe, but up to this time our bankers have not been able to secure any substantial amount of the yellow metal in the European market for shipment to the United States, owing to the tactics employed by foreign bankers to keep their gold supply intact. Just now there exists a heavy demand for gold in Europe, in anticipation of the flotation of a new Russian and other Government loans, so that local bankers must depend entirely upon the supply of bar gold in the open market, which has not been very large of late. However, it is considered only a question of a short time when the Bank of England will have to part with some of her gold. Rates of exchange are at a point where it is possible to import English sovereigns, and sooner than to lose a round amount of coin the authorities of that institution are likely to remove the restrictions recently placed upon the market for gold bars. At the close cable advices are to the effect that $6,100,000, gold, has been engaged for shipment to New York, and other similar engagements are expected. France is also in the market for gold, and is competing with the United States for a round amount of gold bars expected to arrive in London from South Africa early next week. It is probable, however, that the gold will be secured for New York bankers. A new Russian loan has been practically decided upon, and according to present plans the loan will be for £92,000,000 ($460,000,000), and will bear 5 per cent interest, and will be issued at 85. At the close, there was a sharp break in call money to 2 per cent.

The bank statement, published last Saturday, was decidedly unfavorable. Cash decreased $7,904,200, and as the reserve required was only $212,300 less than last week, the surplus reserve was entirely wiped out, and a deficit of $2,560,625 created instead.

The Stock Market

Speculation in the stock market has been dominated by conditions in the money market. A period in which call money rules at from 20 to 30 per cent cannot fail to be a strong argument in favor of conservatism in speculative operations, and this has been demonstrated by the decrease in the volume of business on the Stock Exchange during the past week. The coal labor situation has ceased to be a factor, and all other general conditions are practically ignored in the consideration which is given to the money market. The sharp break in sterling exchange to the lowest point of the year would ordinarily have acted as an offset to the high money rates, but in this instance it failed in this respect owing to the absence of any gold engagement of importance. It had been expected that a substantial amount of gold would have been obtained for shipment to this side, but the bringing out of the Russian and other Government loans influenced the foreign banks to place obstacles in the way of gold exports to the United States, although these cannot long continue under existing conditions. The stock market held remarkably well under unfavorable influences until the publication of the bank statement, which had a depressing effect upon sentiment and influenced considerable selling. In the closing days of the week the market was under considerable pressure. The liquidation in the active stocks, and especially in the shares in which the pools have recently been active, has been beneficial, and as a result of the week's operation the technical position of the market is much improved. Stocks have passed from weak to strong hands, and with an improvement in monetary conditions, which is expected after the middle of the month, there should also be a rather decided improvement in the stock market. It was expected that the Government crop report on winter wheat would have a favorable influence, but it failed to influence any buying. Interest centered in Union Pacific, which has shown pronounced weakness, and in the anthracite coal shares, which have acted much better than other stocks. The steel stocks have not suffered to any great extent, and conditions in the trade would appear to justify confidence in these shares. Amalgamated Copper showed pronounced strength early in the week, but later the stock declined with the rest of the list, notwithstanding the strong position of the copper metal trade and the talk of an increased dividend at the directors meeting next week.

About the only interest in the traction stocks was in Brooklyn Rapid Transit, and while this stock displayed a fair amount of strength the greater part of the week, it broke sharply at the close, and it looked as if a big line of speculative stock came upon the market. Everything in connection with the property is favorable, and the earnings for the second half of the fiscal year promise to make a new high record. Metropolitan has been practically neglected. Metropolitan securities declined rather sharply, quite a little of the stock coming out on the decline.

Philadelphia

Less interest was manifested in the local traction shares during the past week. Trading was considerably less animated than in the previous week, and although prices reflected the weakness prevailing in the general securities market, the net changes were, in most instances, confined to the fractions. An exceptionally strong feature was American Railways, which scored a net gain of a point on transactions amounting to about 700 shares. Philadelphia Rapid Transit was about the only issue to develop activity, upwards of 6500 shares being dealt in during the week. At the beginning there was some pressure to sell on rumors of increased competition, the price declining from 29 to 28¼. At the low figure there was some good buying, which resulted in a recovery to within ⅛ of the high, but at the close there was another reaction to 27½. Philadelphia Companys issues were comparatively dull and slightly lower. The free common sold to the extent of about 700 shares, at from 50½ to 50, while the receipts, representing about 1700 shares of deposited stock, sold at from 54 to 55 and back to 54¼. The free preferred brought 49¾ and 58 for small amounts. Philadelphia Traction ran off from 99¾ to 99, on the exchange of about 200 shares. Other transactions included Consolidated Traction of New Jersey, at 80¾, Union Traction at 62, Fairmount Park Transportation at 17¾ and 18, Fort Worth & Wabash Traction at 28, and Railways General at 6⅞.

Chicago

Trading in the street railway issues in the Chicago market was less active and price fluctuations were comparatively narrow. Chicago Union Traction was the feature, both as regards activity and weakness, about 1200 shares of the common selling from 7 to 5⅞, in sympathy with the decline in the stock in the New York market. The preferred sold at 21 for 300 shares. Chicago City Railway brought 155 for a lot of twenty-five shares, and 130 shares of North Chicago sold at 35. West Chicago made a new low record at 23. Other transactions included Metropolitan Elevated, at 26 and 26½, the preferred at 68; Chicago & Oak Park at 6⅞, South Side Elevated at 93 and 94, and Northwest Elevated at 25½ and 26.

Other Traction Securities

Trading at Baltimore was extremely dull. United Railway 4s sold at 92½ and 92⅜ for about $35,000, while about $80,000 of the free incomes brought prices ranging from 74⅞ to 73¾, the final transaction taking place at 74. The pooled incomes declined from 74 to 73, but later recovered to 73¼, on dealings aggregating about $60,000 bonds. About 300 shares of the pooled stock sold at 18⅝ to 18¼. Norfolk Railway & Light 5s were fairly active and firm, upwards of $40,000 changing hands at 100¼ and 100½. Other sales were: Lexington Street Railway 5s at 104½, Virginia Railway & Development 5s at 100, Baltimore City Passenger 5s at 106, North Baltimore 5s at 120, and Macon Railway & Light 5s at 100. The feature of the Boston market was the pronounced strength in Boston Elevated, which rose from 155½ to 157½ on the purchase of about 350 shares. Boston & Worcester issues also displayed considerable activity and strength, the common advancing from 36½ to 39, on transactions aggregating 1000 shares, while the preferred moved up from 86 to 90, on the purchase of 700 shares. Boston & Suburban sold at 22¼ and 22 for small lots. Massachusetts Electric common and preferred ruled quiet, the common moving between 19½ and 19, and the preferred between 68½ and 67½, the final transactions taking place at 67⅞. West End common 99⅝ and 100, and the preferred sold at 116 and 116½. West End 4s of 1915 brought 102 for $5,000 bonds. The New York curb market was unusually dull, trading being confined almost exclusively to the Interborough-Metropolitan issues. About 10,000 shares of the common changed hands at from 54⅝ to 52¼, while upwards of 5000 shares of the preferred sold at prices ranging from 90¼ to 89⅛. The new 4½ per cent bonds sold at from 92¼ to 90½, and closed at 91¼, about $500,000 changing hands. Interborough Rapid Transit receipts sold at 233 for 200, and 100 New Orleans Railway common brought 34½. Public Service 5 per cent notes sold at 95½ and interest for a block of $25,000.

Cincinnati, Newport & Covington common was the most active issue in Cincinnati last week, and it made a fractional advance from 52⅜ to 53. The preferred declined from 98 to 96⅞ during the week. Cincinnati Street Railway sold at 145⅞ to 146 for a few small lots. Aurora, Elgin & Chicago preferred sold at 92¼. Toledo Railways & Light at 35, and Detroit United at par. Reports of greatly improved earnings for Toledo & Western caused an advance from 16½ to 18¾ in the stock of that company. The supply was all cleaned up at these prices. Cleveland Electric was very active in Cleveland. It opened the week at 79, and advanced a point during the week, owing to the adjournment of the Legislature. Aurora, Elgin & Chicago common declined from 34 to 33⅛, and the preferred from 93½ to 92½. Northern Ohio Traction & Light sold at from 31⅝ to 31½, Lake Shore Electric, old preferred, sold at 70½, Western Ohio bonds sold at 85¼, and Muncie, Hartford & Ft. Wayne bonds at 95.

Security Quotations

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

	April 4	April 11
American Railways	52	52¾
Boston Elevated	155½	156¾
Brooklyn Rapid Transit	87½	84½
Chicago City	150	150
Chicago Union Traction (common)	6½	5⅞
Chicago Union Traction (preferred)	21½	21½
Cleveland Electric	81	—
Consolidated Traction of New Jersey	80	80
Detroit United	99	98¾
Interborough Rapid Transit	232	225
Interborough-Metropolitan Co. (common), W. I.	54¼	52¼
Interborough-Metropolitan Co. (preferred), W. I.	90⅛	88⅛
Interborough-Metropolitan Co. 4½s, W. I.	91½	90¼
International Traction (common)	—	38
International Traction (preferred), 4s	—	71
Manhattan Railway	156	155
Massachusetts Elec. Cos. (common)	19½	19
Massachusetts Elec. Cos. (preferred)	67½	67
Metropolitan Elevated, Chicago (common)	26½	26½
Metropolitan Elevated, Chicago (preferred)	68	68
Metropolitan Street	116½	113
Metropolitan Securities	74¼	72
New Orleans Railways (common)	34½	34
New Orleans Railways (preferred)	81½	81
New Orleans Railways, 4½s	—	—
North American	100¾	98½
North Jersey Street Railway	27	27
Philadelphia Company (common)	50¼	50¼
Philadelphia Rapid Transit	28½	27
Philadelphia Traction	99¼	98¾
Public Service Corporation 5 per cent notes	94½	94
Public Service Corporation certificates	73¼	72½
South Side Elevated (Chicago)	94	—
Third Avenue	135	132
Twin City, Minneapolis (common)	119½	118⅛
Union Traction (Philadelphia)	61¾	62
West End (common)	99	99
West End (preferred)	114½	114½

W. I., when issued.

Metals

The production of pig iron during the month of March exceeded all previous records. Figures compiled by the "Iron Age" show that the output was 2,165,632 tons, exclusive of charcoal iron. The production of charcoal pig iron for March was 35,000 tons, bringing the total production up to 2,200,000 tons. The stocks of pig iron of the United States Steel Corporation at the end of March amounted to 110,000 tons, the lowest figure in the history of the company. The shipment of material by the company for March was 998,000 tons, the largest on record. Copper metal continues strong and prices are unchanged, as follows: Lake, spot, 18½ and 18¾c.; electrolytic, 18¼ and 18½c.; castings, 18 and 18¼c.

THE CHATTANOOGA CONSOLIDATION

Graham & Company, of Philadelphia, have purchased all the street railways of Chattanooga, Tenn., including the Chattannoga Electric Railway and the Chattanooga Rapid Transit Company, and will merge them under the title of the Chattanooga Railway Company. A considerable sum has been provided for extensions and improvements. The capitalization of the consolidated companies comprises a slight reduction in fixed charges, and is based on conservative lines, details of which will be announced later.

YORK, PA., SYSTEMS SOLD

The franchises and property of the York Street Railway Company have been sold to Brown Brothers, bankers, of Philadelphia. It is said that there is little York capital in the new ownership of the road, as only two of the directors—Ex-Judge W. F. Bay Stewart and Grier Hersh—are interested financially in the new company. It is rumored that the road will be operated by a syndicate. Under the new ownership the electric railway system will be extended throughout York County, connecting all the towns, boroughs and villages of any importance. Previous to the sale of the road the York County Traction Company owned and controlled all the lines of street railway in this city, together with the suburban lines to Dallastown, Red Line and Windsor, a distance of about 11 miles; the York & Dover Electric Railway, which passes through Brookside Park, which is owned by the company; the York Haven Street Railway Company, running to the town of New Haven, a distance of 11 miles, and the York & Wrightsville Street Railway Company, connecting Wrightsville, on the Susquehanna River, with York, a distance of 12 miles.

NEW COMPANY AT NORFOLK

An announcement has been made regarding the Norfolk situation, to which reference was made in the STREET RAILWAY JOURNAL of April 7. It is that the name of the merger of the electrical, traction and lighting properties in the vicinity of Norfolk. is to be the Norfolk & Portsmouth Traction Company. The capitalization is $6,000,000 stock and $8,000,000 bonds. There will be an immediate issue of $3,500,000 of bonds and $5,000,000 of stock. R. Lancaster Williams, now president of the Norfolk Railway & Lighting Company, which owns the largest properties absorbed, is to be the president of the new company, and E. C. Hathaway, general manager of the Norfolk Company, is to be general manager. The new company will build an interurban line from Portsmouth to Suffolk and Smithfield, Va., and will control new lines to be extended to the Jamestown Exposition grounds. Interests identified with the United Gas & Improvement Company, of Philadelphia, are connected with the project.

AFFAIRS IN CHICAGO

There is nothing of very great import to record of Chicago during the week just ended. True, the text of the Supreme Court decision in the 99-year case was made available; but the ruling, as given in abstract, was so complete as to make the original, as the "Economist" put it, only worthy of the study of lawyers and laymen as a document showing clear statement, close reasoning and logical conclusion. In this connection another decision of the Supreme Court, just made, is of interest. In it are directly concerned the West Chicago Street Railway and the city, and the finding is in favor of the city. The question involved was that of bearing the expense of lowering the tunnel under the Chicago River. Still another legal case remains to be mentioned. This is the answer of the Union Traction Company filed in the Federal Court April 6, to the bill of its underlying companies attacking the Consolidated Traction Company. The complaint was mainly that the Consolidated Company was built by the credit and with the cash of the North and West Chicago companies at the time Mr. Yerkes had control of them, and the property, instead of being taken by him, should have been turned over to them. The answer in effect says that so far as the Union Traction Company knows the financial methods of Charles T. Yerkes were correct. The Union Traction admits that it gave Mr. Yerkes bonds of the Consolidated in exchange for his stock in the latter company at the rate of $45 in bonds to $100 in stock, but says it was necessary for it to get control of the property, and it was protecting the stockholders in the underlying companies when it did it. It denies that it entered into the trade with Mr. Yerkes whereby he got control of the underlying and formed the Union Traction Company. The claim is made that the matter was investigated thoroughly, and Mr. Yerkes was forced to make good doubtful securities amounting to $1,563,200 before the bargain finally was struck.

Affecting the elevated companies came a decision to demand a general increase in wages for every employee of the elevated railways. The wage scale per hour that will be presented to the officials of the various roads follows:

Motormen, now getting 25 and 28½ cents an hour, 27½ and 30 cents an hour.

Conductors, now getting 21 cents an hour, 25 cents an hour.

Gatemen, now getting 18¼ cents an hour, 20 cents an hour.

Platform men, now getting $1.70 a day (twelve hours), $2.40 a day.

Ticket agents, now getting $1.50 to $1.70 a day (twelve hours), same pay for eight hours.

The agreements on all roads except the Metropolitan and the loop expire May 1; on these May 31. The platform men, who work twelve hours for $1.70 a day, say that theirs is the hardest work of the service. The scale committee for the South Side street railway employees met Superintendent Mason B. Starring, of the Chicago City Railway, during the week, and set forth the reason why the men who operate the street cars believe that they should have higher wages.

The following table shows the daily average number of passengers carried by the elevated roads in March, with comparisons:

	1906	1905	Inc.	P. C.
METROPOLITAN				
January	129,720	116,013	13,707	11.81
February	135,570	121,177	14,393	11.09
March	138,169	124,853	13,316	10.70
SOUTH SIDE				
January	92,406	84,569	7,837	9.15
February	95,077	88,173	6,900	7.83
March	95,466	91,384	4,082	4.47
NORTHWESTERN				
January	81,191	73,728	7,463	10.12
February	83,572	78,773	4,799	6.09
March	85,154	80,500	4,654	5.78
CHICAGO & OAK PARK				
January	47,921	44,668	3,253	7.28
February	48,920	47,149	1,771	3.75
March	49,542	48,167	1,375	2.85

Elsewhere in this issue will be found the report of the Metropolitan West Side Elevated for the year ended March 28, which was formally made public last Wednesday.

REPORTED SALE OF MEXICO PROPERTIES

It is stated that arrangements have been made for the sale of the Mexico City Tramways Company, Ltd., to McKenzie & Mann, of Montreal, who are largely interested in street railway and power development in Mexico. Wernher, Beit & Company, of London, England, are the owners of the system in Mexico, and it is understood that the deal was concluded in London by representatives of the syndicate in Europe at this time.

CITY BLAMED FOR FAILURE TO CARRY OUT RECOMMENDATION OF RAILROAD COMMISSION FOR BROOKLYN

In a report on the transportation conditions in Brooklyn, issued by the State Railroad Commission, the city authorities are sharply blamed for neglecting to make municipal improvements recommended. The Commission confesses the congestion during the rush hours on the Brooklyn lines, and admits that there is some overcrowding during other hours, but says that the condition of the surface and elevated travel during the non-rush hours is better than it has been for a number of years. The report contains some new figures on Brooklyn traffic, showing that the number of passengers on both elevated and surface systems in January, 1906, was 34,377,752, an increase of 6,121,547 over January, 1905, or 21.63 per cent. The report says that the company has complied with eight specific recommendations for increasing the service on its elevated lines, resulting in an increase of 7184 car miles daily, and has complied with nineteen recommendations for improving the service on its surface lines, increasing its schedules so that 1320 cars were operated on the surface lines in January, 1906, against 1220 in January, 1905. It says that 201 double-truck cars, each seating forty-eight, were put in service in place of 101 single-truck cars, seating only thirty, and 92 cars were added to the elevated equipment. In dealing with the city's responsibility for the congestion of the rush hours, the Commission cites its recommendations of a year ago, and says:

"No contracts have as yet been executed for any additional tunnels under the East River.

"No action has been taken by the local authorities to bring about the construction of an elevated structure connecting the Brooklyn and Williamsburg Bridges.

"No work on erecting the Manhattan Bridge has been done.

"No change in the Manhattan terminal of the Brooklyn Bridge which would relieve present conditions has been made.

"The city has not constructed loops and shelter stations at the Manhattan terminal of the Williamsburg Bridge.

"The city has not extended Flatbush Avenue to provide an additional artery through the business portion of Brooklyn to the Brooklyn Bridge.

"The police force for regulating vehicle traffic and expediting cars has not been increased, but has been reduced."

The Commission's recommendations of a year ago for the improvement of Brooklyn's elevated system are recited with these comments:

"The Brooklyn Heights Railroad has not complied with this board's recommendation that an additional track be constructed on all its elevated lines.

"It has complied with the recommendation to lengthen its platforms, except on the Broadway line from the ferry to East New York, and on the Ridgewood line from Vanderbilt and Knickbocker Avenues.

"It has not complied with the recommendation that ash cars be operated only at night."

The company has ordered 100 additional elevated cars and 150 more surface cars, which are to be delivered this month, and will order 150 more surface cars for delivery in the fall, which will give the company all the cars that it can operate with its present track facilities. The board finds that the maximum number of surface cars run over the Brooklyn Bridge in the rush hours varies from 280, the limit set by the Bridge Department, to 316 an hour. On the Williamsburg Bridge the number varies from 145 to 166 an hour. As regards the additional track on the elevated lines, this improvement could only be carried out after the structure had been greatly strengthened and many of the island stations displaced. On one line, the Lexington Avenue division, a considerable portion of the property would have to be entirely reconstructed, as the structure is erected on pillars in the center of the street, the devil strip being very narrow. The repairs now being made to the elevated structure were referred to in an illustrated article published in this paper for Dec. 24, 1904.

NEW JERSEY FREIGHT BILL SIGNED

Governor Stokes, of New Jersey, has affixed his signature to Senator Wakelee's freight bill. It authorizes electric railway companies to carry freight through such municipalities as, by ordinance, grant them permission, subject to such restrictions and limitations as the traversed cities, towns, boroughs and other municipalities may require. Several years have elapsed since this question was raised in New Jersey. The first bill to allow trolley companies to carry freight was fought and defeated by the railroad corporations, notwithstanding the pleas of the Monmouth County farmers, who were greatly interested in it.

REPORT OF THE METROPOLITAN WEST SIDE OF CHICAGO

The report of the Metropolitan West Side Elevated, of Chicago, for the fiscal year ended Feb. 28, 1906, was formally made public Wednesday, April 5. Net earnings were $241,425, being equal to 2.77 per cent on the outstanding preferred capital stock. This result, however, was reached after charging to income $65,115 interest, which previously had been charged to capital account. Gross business from passenger earnings increased 11.8 per cent over the previous year. In the fiscal year the company reduced its floating debt carried in the balance sheet "as collateral trust notes," $300,000. On April 1 the company paid an additional $200,000, reducing this indebtedness to $600,000. It is evidently the policy of the new management to liquidate its floating obligations and take care of new expenditures before concerning itself with any material distribution on the preferred stock. The annual report, as submitted by President H. G. Hetzler, indicates that the company is in the best position it has ever enjoyed, although not paying dividends. The comparative statement of earnings, expenses and income makes the following exhibit:

EARNINGS	1906	1905
Total passenger earnings	$2,360,256	$2,080,937
Advertising earnings	60,955	40,854
Rent earnings	14,419	11,580
Miscellaneous earnings	16,695	20,225
Gross earnings	$2,452,327	$2,153,597
EXPENSES		
Maintenance of way and structure	$114,963	$98,725
Maintenance of equipment	202,220	163,528
Conducting transporation	692,316	638,507
General expenses	76,690	92,002
Loop expenses	86,239	64,551
Total operating expenses	$1,172,430	$1,057,316
Net earnings from operation	1,279,896	1,096,281
Proportion of operating expenses to gross earnings, loop expenses excluded	44.29	46.09
Proportion of total operating expenses to gross earnings	47.81	49.04
Proportion of total operating expenses and taxes to gross earnings	54.12	54.98
INCOME		
Net earnings from operation as above	$1,279,896	$1,096,281
Interest and exchange	4,998	4,566
Rental of outside property	3,108	987
Other income	4,530	....
Gross income	$1,292,533	$1,101,834
Interest on first mortgage bonds	392,150	392,320
Interest extension mortgage bonds	120,000	98,349
Interest on collateral loan	43,635	....
Rental, Illinois Trust & Savings Bank, trustee	4,797	1,998
Rental, Pennsylvania Company	11,900	11,900
Rental, Union Consolidated Elevated Railroad	20,351	20,351
Rental, Union Elevated Railroad (loop)	222,277	208,846
Taxes, car licenses and special assessments	154,790	126,643
Total charges	$969,901	$860,409
Surplus	322,631	241,425

COMPARATIVE BALANCE SHEET

ASSETS	1906	1905
Cost of road, equipment and property	$29,845,258	$30,029,607
Construction advances	831,709	432,915
Capital stock in treasury, preferred	292,000	291,900
Capital stock in treasury, common	35,800	....
First mortgage bonds in treasury	164,000	192,000
Extension mortgage bonds in treasury	1,500,000	1,500,000
Cash on hand and in banks	213,340	222,044
Northern Trust Company, trustee	....	135,331
Material and supplies	48,221	49,794
Accounts receivable	18,667	24,250
Prepaid insurance	19,639	25,604
Advances, Union Consolidated Elevated Railroad	43,559	43,559
Unadjusted accounts	12,730	26,609
Totals	$33,024,937	$32,973,616
LIABILITIES		
Capital stock, preferred	$9,000,000	$9,000,000
Capital stock, common	7,500,000	7,500,000
First mortgage bonds, 4 per cent	10,000,000	10,000,000
Extension mortgage bonds, 4 per cent	4,500,000	4,500,000
Collateral trust notes	800,000	1,100,000
Unpaid vouchers, pay rolls and accounts	107,959	97,733
Interest coupons due and not presented	26,820	84,300
Interest accrued, not due	67,783	52,693
Rentals accrued, not due	8,308	7,775
Taxes accrued, not due	130,638	105,501
Depreciation reserve	92,413	57,230
Balance surplus	791,013	468,382
Totals	$33,024,937	$32,973,616

President Hetzler, in his report, notes that the location of a number of large establishments, such as Sears, Roebuck & Company, Winslow Bros. Company, and the Western Electric Company, at points near the Metropolitan "L's" lines, has given increased traffic in a direction opposite to that of the company's heavy morning and evening business. There has been a considerable increase in traffic from the Aurora, Elgin & Chicago also. The company was compelled to elevate its tracks over the Chicago & Northwestern at Kinzie Street, and there must be a similar elevation over the Chicago, Burlington & Quincy tracks on the Douglas Park branch. A number of improvements were made, after noting which Mr. Hetzler says that in order to provide for the increase in traffic orders have been placed for fifty-two new motors of 160-hp capacity and fifty new motor cars. The report continues:

"The total assessed value of the railroad property, including capital stock, for taxation for the year 1905 is $1,874,915, as compared with $1,656,567 for 1904, an increase in assessed valuation of $218,348.

The tax rates are also higher, the rate for the west town for 1905 being 6.983, as against 6.591 for 1904, and for the south town 6.796 for 1905, as against 6,391 for 1904.

"The total tax for 1905, exclusive of car licenses and special assessments, amounts to $130,638, as compared with $107,837 for the year 1904, an increase in general taxes of $22,801. The total taxes for the fiscal year, including car licenses and special assessments, in the sum of $154,790, compared with $126,643 for the previous fiscal year.

"The income account was charged this year for interest, $65,115. A similar charge of $2,798 was made for rental paid to Illinois Trust & Savings Bank, trustee. These amounts, if added to our surplus for the year to place same on a parity of last year, would make $390,545, or an increase of $140,120.

"In order to maintain your structure and equipment in good condition, it was necessary to expend for maintenance of way and structure, and for maintenance of equipment, $54,928 more than the year previous.

"In the expenditure for maintenance, etc., is included a monthly allowance for depreciation and renewal, which account now shows a balance of $92,413, or an increase of $35,182 since the last annual report."

In the election of directors, Nathan Allan and Moses J. Wentworth were chosen to succeed John P. Wilson and George Higginson, Jr. The other two retiring directors were re-elected.

NEW YORK, NEW HAVEN & HARTFORD AFTER RHODE ISLAND CORPORATION

The report is current that the New York, New Haven & Hartford Railroad is now seeking to secure control of the Rhode Island Securities Company, controlling the street railway lines in Providence and those throughout the State. While the Providence "Journal" quotes Marsden J. Perry, president of the Rhode Island Company, to the effect that he does not believe arrangements are being made for disposing of the property, it said on April 8: "It is estimated that fully 7500 shares of Rhode Island Securities stock have changed hands in the Providence market during the past week or two, out of a total of about 20,000 shares held here. Several important brokerage houses have been identified with the buying and selling of this stock, but, ultimately, the greater part of the shares traded in have, it is understood, reached the office of Richardson & Clark. The low price of the week on Securities was 31½, and the high price was 50, so far as has been positively learned. Since the sale at 50 there have been sales at 39½ and also at varying prices up to 44½, transactions made on the same days showing rather wide variations. The later demand has been less urgent. Whatever the actual source of the local buying of Securities shares, the total amount involved, even at 40 a share, would be $300,000 for 7500 shares, but the recent average price would exceed 40. What the present week will reflect as to the price fluctuations in this stock, which is the key to the Rhode Island Company's entire traction system, is difficult to forecast. But there is great interest in the community, and the popular theory still is that New Haven buying of the minority stock put up the price in this market."

PROGRAMME OF THE IOWA ASSOCIATION

The programme has been announced in detail of the third annual meeting of the Iowa Street and Interurban Railway Association, to be held at the Kirkwood House, Des Moines, Thursday and Friday, April 19 and 20. The meeting will convene at 10 a. m. Thursday, with an address of welcome by H. H. Polk. Following this will come the address of President Hippee, of the association, which will be followed by such general business as the reading of the minutes and the presentation of the report of the secretary and treasurer. The morning session will close with a paper by John F. Ohmer, of Dayton, entitled "Transfers—Their Use and Abuse." In the afternoon delegates will attend in a body the session of the Iowa Electrical Association in Elks' Hall, at which Hon. L. Y. Sherman, Lieutenant-Governor of Illinois, will read a paper entitled "Limits of Governmental Activity." On the return of the party to the Kirkwood, Roger W. Conant, of Cambridge, Mass., will present the paper, "Rail-Bond—Field and Armature Testing." At the session on Friday morning the papers, "The Adoption of Gasoline Motors for Street and Interurban Service," by F. W. Hild, of Chicago, and "The Standard Car Body and Truck for Both City and Interurban Service," by George H. Tontrup, of St. Louis, Mo., will be read. The closing session will be held Friday afternoon. Two papers are to be read, "Discipline of Car Service Employees," by J. G. Huntoon, of Davenport, and "Mutuality of Interests of the Operator and the Supply Man," by W. R. Garton, of Chicago. The executive session will then be held and the officers elected. The officers of the association are: George B. Hippee, of Des Moines, president; James F. Lardner, of Davenport, vice-president; L. D. Mathes, Dubuque, secretary and treasurer.

SUPREME COURT DECISION IN FAVOR OF CLEVELAND COMPANY

The Cleveland Electric Railway Company gained an important victory over the city in a decision rendered last Monday by the United States Supreme Court. The case involved the right of the city to grant a charter to a new street railway company to operate a line in Woodland Avenue in the face of the contention of the old company that its charter had not expired. The case presented a phase of the effort to force three-cent fares on the street railways in Cleveland by the city administration. The city claimed that the franchise of the company on this street expired last year, and called for bids and granted a franchise to the Forest City Street Railway Company, the so-called three-cent fare company supposed to be backed by Mayor Johnson. The Cleveland Electric brought suit to annul this grant on the ground that its franchise had been extended at the time the road was equipped with electricity, and that its grant on that street would not expire until 1908. The Circuit Court rendered a verdict in favor of the company, and by mutual consent the case was carried to the Supreme Court.

It is the general opinion that the same arguments apply to the Central Avenue franchise, the city having made a similar grant on this street to the Forest City Company. This being true, the operations of the low-fare company, for the present, at least, will be limited to the West Side streets, upon which it obtained franchises in open bidding. The decision also makes the position of the old company much stronger as to the value of its unexpired franchises in case Mayor Johnson's leasing plan should be seriously considered by the company.

PUBLIC SERVICE OFFICERS RE-ELECTED—FINANCIAL PLAN ANNOUNCED

At the annual meeting of the directors of the Public Service Corporation of New Jersey, held Tuesday, April 10, the officers were re-elected and the plan approved for floating additional stock. In substitution for the plan of financing as proposed by Morgan & Co., it is now planned to offer to the shareholders the 5 per cent gold notes of the company to the amount of $6,250,000, falling due Nov. 1, 1909, convertible May 1, 1909, at the option of the holder into the stock of the company at par. Robert Winthrop & Company, bankers, of New York City, and the United Gas & Improvement Company have agreed to underwrite upon exactly the same terms offered to the stockholders so much of the issue of the convertible notes as may not be subscribed for by stockholders. The plan provides for all financing for the years 1906 and 1907. The notes will be issued from time to time during the next two years, as the needs of the company require. President McCarter concludes his report by saying that the increases in the business of the company are so large that the officers feel that it will be consistent with business prudence for the company to commence the payment of dividends in the near future.

Thomas N. McCarter was re-elected president; A. B. Carlton, John J. Burleigh and Charles A. Sterling, vice-presidents; James P. Dusenbery, treasurer; R. D. Miller, assistant treasurer; Frederick Evans, secretary; E. W. Hine, assistant secretary, and P. S. Young, controller. In the last issue of the Street Railway Journal mention was made of the election of J. P. Dusenbury to succeed United States Senator J. F. Dryden as a director, and the names were published of the seven directors re-elected. The directorate now is composed of Samuel T. Bodine, Thomas C. Barr, David Baird, J. J. Burleigh, A. B. Carlton, Walton Clark, Mark T. Cox, J. P. Dusenbury, Thomas Dolan, George R. Gray, Hugh H. Hamill, William C. Heppenheimer, A. R. Kuser, Louis Lillie, Randall Morgan, Thomas N. McCarter, Uzal H. McCarter, F. W. Roebling, John F. Shanley, Charles A. Sterling, Leslie D. Ward, P. F. Wanser, John I. Waterbury and E. F. C. Young.

MR. MELLEN QUOTED AS REGARDS NEW YORK—BOSTON ELECTRIC SERVICE - WORCESTER DEAL ANNOUNCEMENT

In speaking of the work now being done on the New York, New Haven & Hartford Railroad, between New Haven and Willimantic and Willimantic and Boston, on Tuesday, April 10, President Mellen, of the company, is quoted as having said:

"The revision of the Boston & New York Air Line between New Haven and Willimantic and the New England Railroad between Willimantic and Boston, will make a line approximately 200 miles in length between New York and Boston, upon which trains can be easily run in 4 hours by steam and in less time by electricity, and at as low a fare as upon any other road in existence, or proposed, or even theorized about.

"Such a line the New Haven management has in contemplation, the engineers are now at work upon it, the financing of the same has been provided for, and the line itself will be available for use before a charter even can be obtained for such a line as has been petitioned for before the Massachusetts Legislature."

In this connection the announcement is of interest that Mackay & Company have purchased more than a majority of the shares of the Worcester Railways & Investment Company, which stock has been transferred to their names. What will be done with the stock is not yet disclosed. It will be recalled that several weeks ago mention was made in the Street Railway Journal of the rumor to the effect that the stock was being sought by the New York, New Haven & Hartford Company.

LEGISLATION IN IOWA

The Thirty-First General Assembly, of Iowa, adjourned sine die April 6. The body passed two measures of importance to the railroads of the State. One provides that one railroad company may charge the same passenger and freight rates between two points in the State as a competitor, although the competing line or lines may be many miles shorter. The bill is known as the long and short haul measure. The Governor recommended the passage of such a measure as applying to passenger rates alone, and it was thought at the time that it was intended to give the steam railroads of the State an opportunity to compete with the interurban lines. One of the first amendments adopted was one specifying that the act should not apply to interurban lines; in other words, the competition must be confined to steam roads alone. The author of the act included freight rates as well as passenger rates, and it is believed now that this provision was incorporated with the idea of undermining the freight rates of Iowa, and practically nullifying the work of the Railroad Commissioners of this State. It is also generally understood that the Governor will now veto the act, on the ground that the act as passed would give the railroads absolute control of the freight rate situation in Iowa, which is now somewhat controlled by the Railroad Commissioners. The other act passed is known as the anti-pass law, and applies to steam and interurban railways alike. It prohibits the issuance of free transportation to State, county and city officials, with certain qualifications.

THE PURPOSE OF THE NEW AURORA, ELGIN & CHICAGO ISSUE

The seemingly authoritative report to the effect that the contemplated increase of the bonded indebtedness of the Aurora, Elgin & Chicago Railroad to $25,000,000, noted in the STREET RAILWAY JOURNAL last week, was for the purpose of acquiring a network of lines covering Northern Illinois and Southern Wisconsin is declared to be untrue by H. C. Lang, of Cleveland, secretary of the company. Mr. Lang states that this will simply be the authorized bond issue, and the amount actually issued will be $5,050,000 to retire an equal amount of underlying bonds of the companies recently consolidated. Mr. Lang says that under the laws of Illinois it is necessary to name a specific amount as the maximum for the mortgage. The directors therefore thought it would be better to be a figure that would take care of all possible needs of the company during its lifetime. Under this arrangement it will probably never be necessary to issue second mortgages and the interests of the stockholders will be safeguarded all the better in consequence. One of the terms of the new mortgage will be that no additional bonds can be sold until the net earnings of the company have borne a certain relation to the outstanding, and the proposed issue; in other words, until the net earnings are more than capable of taking care of the interest on that portion of the authorized issue which it was proposed to sell.

TRANSFERS ON TRANSFERS IN BROOKLYN—AN EXPLANATION

The Brooklyn Rapid Transit Company has recently returned to the practice of issuing a transfer on a transfer, and in explanation says this recession of the rule whereby a transfer was issued only for a cash fare, is intended to increase, and, so far as possible, equalize transportation facilities in all sections of the boroughs of Brooklyn and Queens.

The application of this rule in December, 1903, that a transfer should only be issued for a cash fare, was an effort to correct the abuses of the transfer privilege. In 1902, the year before this order was issued, 57,000,000 transfers were issued, and a total of 340,000,000 passengers carried. In other words, every sixth passenger who paid a cash fare left the car on which that fare was paid and completed his journey on another car, or cars, by the aid of transfers. But the rule of 1903, while doubtless reducing the abuse of the transfer privilege, did not, as might have been expected, materially lessen the proportionate number of transfers to passengers carried. On the contrary, the record for that year shows that one-sixth of the 365,000,000 passengers carried asked for and received transfers.

In 1905, the proportion of cash fares to transfers still remained at six to one. In January of the present year the number of transfer passengers had increased so that one in every five passengers carried availed himself of the privilege. With the recent increase of transfer facilities in effect, or about to be made effective, the proportion of transfers to passengers carried will doubtless greatly increase and the cash return for each passenger's ride will be reduced.

In 1904 a comparison of the number of passengers carried, and the total receipts received in cash fares, showed the actual value to the companies for a single ride for each paying passenger to be $.0409. Last year by the same means, the actual value of a single cash fare was found to be $.0399 plus. This reduction resulted, despite the enormous increase of traffic, from the fact that the increase in transfers more than kept pace with the growth of traffic. A comparison of the figures for January this year shows the actual cash value of a fare for that month, owing to the still greater increase in the proportion of transfers, to be $.0393 plus.

When the transfer arrangements recently determined upon have been perfected, there will be in effect transfer privileges at over 600 intersections of lines comprising companies included in the Brooklyn Rapid Transit system.

THE FALL RIVER FREIGHT DECISION

The Massachusetts Railroad Commissioners have decided relative to the order of the Board of Aldermen of Fall River, giving the Old Colony Street Railway Company the right to carry baggage and freight over certain lines of its railway in that city. The order in question appeared objectionable to the Commissioners on the ground that it made the privilege subject to several unwise conditions.

"One of these," the decision says, "is the provision that the sale or lease of the railway shall work an immediate forfeiture of the right to carry freight. It is unsafe to prejudge a question of the future in this way, for a change in the control of a railway need not necessarily be inimical to the public interests."

As regards the right to revoke the privilege the decision says: "We only suggest that the right to revoke cannot be left to the independent action of the local board."

In regard to the clearing of the streets the Commissioners hold that: "The paragraph in these orders which relates to the removal of snow presents no plan for doing the work, and if literally obeyed is rather a hindrance than an aid to any practical arrangement between the parties.

"To the claim of the company that the limitation of the freight privilege to a term of years is contrary to the policy of the law, it is enough to say that during the experimental period in this class of service the limitation seems wise.

"The petition will be approved whenever action shall have been taken by the Board of Aldermen to meet the suggestions above made and the regular schedule shall have been filed."

MINNESOTA RAILROAD COMMISSION HAS NO JURISDICTION OVER ELECTRICS

Attorney-General E. T. Young, of Minnesota, has reaffirmed the opinion given two years ago by former Attorney-General W. B. Douglas, that street railway lines, even if built outside the limits of any city, do not come under the jurisdiction of the State Railway Commission, and that it has no power to receive complaints or make orders regarding service and charges. He bases his opinion on the law creating the Commission, which in the new code reads that "the general supervision of railroads and express companies doing business as common carriers," shall be vested in the board. Whether the street railway running between two cities is a common carrier does not enter into the question, according to the Attorney-General, but it depends upon whether they are "railroads and express companies." The Attorney-General holds that they are not, and therefore the Commission has no jurisdiction over them.

The question was put up to the Attorney-General two years ago in connection with the St. Paul and Stillwater line. It was argued that because the line runs across the country and enters into competition with the steam railroads it ought to come under the jurisdiction of the Railroad Commission, but Attorney-General Douglas held that it did not. The question came up again in regard to the new Excelsior line from Minneapolis. The City Councils of Minneapolis and Excelsior found they had no jurisdiction over the service and charges on the line, because part of the line was outside the limits of both cities. The matter was referred to the Commission, and they asked the Attorney-General for a ruling on the point.

FRANCHISE VALUATIONS INCREASED IN NEW YORK

The final valuation for the current year of special franchises operated in this city, as announced by the State Board of Tax Commissioners, shows an increase of $59,301,250, equal to approximately 20 per cent over the valuation of the year previous. The total valuation is placed at $361,479,300, against $302,178,050 for 1905.

The valuations of the franchises of the companies entering into the Interborough-Metropolitan Company, as placed by the board, as compared with 1905, are as follows:

	1906	1905
New York City Railway system......	$79,470,000	$79,233,000
Manhattan Railway Company........	62,700,000	59,700,000
Interborough Rapid Transit system...	18,000,000	9,000,000
Total	$160,170,000	$147,933,000

The total percentage of increase is 8.26 per cent.

The valuations of franchises of other of the large corporations compare as follows:

	1906	1905
Brooklyn Rapid Transit system......	$38,479,000	$29,560,000
Consolidated Gas Company..........	82,921,000	69,710,000
Brooklyn United Gas Company......	16,495,000	13,194,500
New York Telephone Company......	17,078,000	6,610,000

NEW TRANSFER SYSTEM FOR NEW YORK

Announcement was made Monday, April 9, by the Interborough Company, of a new transfer system for Manhattan and the Bronx on the subway, elevated and surface lines. Three-cent tranfers may be purchased between Bronx surface lines and eight subway stations on the Broadway and Lenox Avenue branches above 145th Street and West Farms. One of these lines, to which a franchise must be granted, will after May 1 connect the subway station at 181st Street with the Bronx Zoological Garden, the Southern Boulevard, and Third Avenue. Free transfers to and from the subway and Manhattan elevated roads will be given at seven points on the Aqueduct Avenue, Fordham Road and Third Avenue lines of the Union Railway.

ELECTRIC RAILWAY ENGINEERING AT THE WORCESTER POLYTECHNIC INSTITUTE

Brief mention was recently made in these columns of the decision of the trustees of the Worcester Polytechnic Institute to erect a new building for the use of the department of electrical engineering. As the plans for the building are nearing completion it may be well to mention some of the features connected with the railway engineering department. A notable one will be the electric railway engineering laboratory, a part of the equipment for which will be a 25-ton, double-truck, four-motor electric car. The exterior will closely resemble an ordinary interurban car, but instead of seats the interior will be occupied by automatic recording instruments, for the purpose of indicating not only the performance of the car in operation, but also the electrical and physical conditions of the track and electrical circuits over which it is operated. Double doors at one end of the building and two tracks connecting with the local electric railway system will afford an entrance for this or other cars into the laboratory. Inside the building, one of these tracks will be over a pit for inspection and repair purposes, while the other will terminate in a testing stand, arranged for the reception of the institute car or any other car. While on the testing stand, the car will rest on supporting wheels, which, as they revolve, will give the effect of a moving track, the car being held in a stationary position. Suitable arrangements have been designed for applying a load to the supporting wheels in such a way as perfectly to imitate the losses in rolling friction, wind resistance, etc., as well as the acceleration and retardation momentum of the equipment under test. The power consumed by the car during any given run will be measured by the power input, and by the power absorbed in the loading apparatus, as well as by a traction dynamometer, all of the instruments being autographic. A complete equipment of the various forms of controlling, braking, heating, signalling and other accessory electric railway appartus will be installed, as well as both alternating and direct-current railway motors for "stand tests."

NEW LINE OUT OF SCRANTON

Work is now under way in Scranton on an electric railway that is to be built jointly by the Northern Electric Street Railway Company and the Dalton Street Railway Company to connect Scranton and Lake Winola, extending through Clark's Summit, Glentown, Dalton, La Plume and Factoryville. From Providence Square to the city line of Scranton, along West Market Street, or the old Abington turnpike, the franchise is held by the Northern Electric Street Railway Company, and from that point the remainder of the road will be built by the Dalton Street Railway Company. The Northern Electric Street Railway Company now owns the Abington turnpike and will have full control over the highway. From Providence Square to the city line, the road will pass along the highway, and from the city line it will be built on a private right of way. About 13 miles of private right of way has been secured. The plans have been definitely arranged for the construction of the road as far as Dalton, but it is stated that the directors are seriously considering the advisability of changing the route to Lake Winola by building a branch from Clark's Summit, by way of the Hillside Home and Gravel pond. The power house will probably be at Dalton. The officers of the Northern Electric Street Railway Company are: Dr. A. J. Connell, president; Colonel E. H. Ripple, secretary and treasury; R. W. Day, general manager. The entire route has been surveyed by Messrs. Stevenson and Knight, while the construction work is in charge of Sherman A. Dilley, the chief engineer and superintendent of construction.

SAN FRANCISCO RAILWAY SITUATION

President Calhoun of the United Railroads, of San Francisco, states that he has no intention of building a subway under Market Street. With a good electric service, he says, he can take care of the traffic for fifteen years to come, and he expects San Francisco to have a million population within twenty years, at that. Ford, Bacon & Davis, who have prepared the plan, declare that the company will spend nearer $10,000,000 than $8,000,000 in carrying them out. While these plans have not yet been made public, they include tracks, car houses, necessary extensions to districts not now served and shops. The company bought a tract about a year ago for these shops. Thornwell Mullally, assistant to President Calhoun, and Chief Engineer W. C. Lane recently visited the site, preparatory to the final adoption of the car house plans. Meantime, there is an order in the St. Louis shops for 100 modern cars to cost $7,000 each. They will be especially designed for local needs. The shops will give employment to 400 men, and will cost $360,000. Seneca Avenue, which crosses the site, has been closed by the Supervisors, a spur track has been built and part of the sewer in Ocean avenue provided for in the bond issue has been ordered built. The loop at the foot of Market Street, for which application has been made to the Harbor Commission, will cost $100,000. New cars figured on will cost $1,000,000. About 600 men are engaged on paving work and about 550 on track laying.

Rudolph Spreckels has announced that the street railway system which was planned by himself and his father, Claus Spreckels, to force the United Railroads to grant concessions in the way of bettering the service, will be constructed whether or not the United Railroads decides to give Sutter Street a conduit line. The articles of incorporation have been drawn up, but, pending a decision regarding the probable length of the road and the approximate amount of capital required, they will not be filed. These and other details will be determined on in the course of a few days. Most of the work of preparing the engineering plans will be done in the Sheldon building, at 421 Market Street, where Rudolph Spreckels has his office, and notice has been given to all other tenants on his floor to vacate. According to Rudolph Spreckels, offers have been made to substitute for the bonds of the new road, and the entire amount of capital required is in sight. One of the propositions that has been under consideration by the promoters of the opposition street railway system involves the acquisition of the California Street railroad.

A Havana despatch says that a general strike in support of the striking employees of the Havana Electric Railway has been called, but it is doubtful whether the call will be heartily responded to. The electric cars are being run fairly regularly by new hands.

A NEW ENGINEERING COMPANY

The American Engineering & Construction Company has just been incorporated, with headquarters in the Eagle Building, Brooklyn, N. Y., by R. C. Taylor, Edward Taylor and J. J. Sides. Realizing the importance to the managers of electrical railways of having qualified experts in the various departments ready to handle any technical or practical propositions that may be causing them annoyance or expense in the economical operation of their roads, or problems continually arising which may be beyond the scope of their regular organization, the new company has included in its regular staff of engineers men of wide experience in the operation of electric railways, and is prepared to handle any class of mechanical, electrical and construction work.

The company will also act as consulting engineers in drawing up or reviewing designs and specifications of complete plants, or apparatus to fulfil standard or special requirements. Through a corps of engineers it will undertake the testing of complete power plants, distribution and transmission lines, rail returns and bonding, characteristics of motors, economy and efficiency of braking systems and all other electrical and mechanical devices or constructions used in passenger or freight traction systems. Expert testimony in accident litigation will also be taken up.

The three members of the firm have been identified with the largest operating companies in this country, and are well known in electric railway and engineering circles. R. C. Taylor, the president of the new company, served his apprenticeship as a machinist in Scotland, and is a graduate of the South Kensington Science and Art School, London, England. Among the more important positions he has held were those of master mechanic and chief engineer of the West Superior Iron & Steel Company; mechanical engineer for Robinson & Cary Company, of St. Paul, Minn.; master mechanic and chief engineer of the Twin City Rapid Transit Company, Minneapolis, Minn.; mechanical engineer of the Brooklyn Rapid Transit Company. J. J. Sides, who is the secretary and treasurer, started as chief clerk for the West End Street Railway Company, of Boston, during the installation of the first electric equipment, and later was superintendent of construction on underground trolley systems for the Metropolitan Street Railway Company, of New York; superintendent of construction of the Central Power Station, Boston, and the Ninety-Sixth Street Power Station, New York City, also the Rockingham Light & Power Company's Station at Portsmouth, N. H., and recently with the engineering department of the New York Edison Company. Edward Taylor was in the electrical engineering department of the Twin City Rapid Transit Company, and the Fort Wayne Electric Company. Later he became chief electrician of the American Tin Plate Company, Pittsburg, assistant to the master mechanic of the Buffalo Street Railway, and has recently been engineer of experimental work, testing equipment on the Brooklyn Rapid Transit system.

The company has already secured a number of contracts, among them being the installation of two 500-hp boilers for the East River tunnel, and six boilers for the South Jersey division of the Public Service Corporation of New Jersey.

PROGRAMME OF FIFTY-THIRD MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The programme for the fifty-third meeting of the American Society of Mechanical engineers, to be held at Chattanooga, Tenn., May 1 to 4, has been announced. The headquarters throughout the entire meeting will be at the Read House, and will be opened Tuesday, May 1, at 12 m. The professional sessions on Tuesday and Wednesday evenings, and Wednesday and Thursday mornings, will be held in the Assembly Hall of the Read House. Tuesday afternoon, May 1, has been left free for assembly of members and for visits to points of interest throughout the city. The opening session will be held Tuesday evening, May 1, at 9 o'clock, in the Assembly Hall of the Read House. The address of welcome will be delivered by Mayor W. L. Frierson, to whom Fred W. Taylor, president of the society, will respond. This session will give an opportunity for members to meet each other, to renew old acquaintances and to form new ones. It will be an informal gathering, at which the ladies will be welcome. The second session will be held Wednesday morning, May 2, in the Assembly Hall. This will be a business session for the report of tellers, and committees and general business. Until the hour of adjournment after the executive business has been concluded, the following papers will be presented: No. 085. "Report of Committee on Standard Proportions for Machine Screws." No. 092. "Report of Committee Co-operating on Pennsylvania Railroad Locomotive Tests." No. 096. A. W. Mosley and J. L. Bacon, "Effect of a Blow."

At 1 o'clock Wednesday afternoon, May 2, members and ladies will take trolley cars at the corner of Market and Ninth Streets for the Chickamauga-Chattanooga National Military Park on Chickamauga battlefield and United States army post. A carriage drive will be taken over the battlefield and park, where hundreds of monuments and historic tablets will be seen. Afterward the Twelfth United States Cavalry will give a regimental drill in honor of the visitors. At the third session, on Wednesday evening, May 2, professional papers will be presented as follows: No. 090. William H. Bristol, "Low Resistance Thermo-Electric Pyrometer and Compensator." No. 089. Henry D. Hibbard, "Manganese Steel." No. 094. James M. Dodge, "A History of the Introduction of a System of Shop Management." No. 091. R. T. Stewart, "Collapsing Pressure of Bessemer Steel Lap-Welded Tubes." No. 093. George B. Willcox, "New Liquid Measuring Apparatus." The closing session will be held Thursday morning, May 3. "Water-Wheel Governing" is the subject which will be the principal matter of discussion at this session, and a number of short papers will be presented, to be followed by general discussion. Among those who will present papers on this subject are: Messrs. Mark A. Replogle, George A. Buvinger, John Sturgess, George J. Henry, Jr. A number of others have also signified their intention of discussing this subject orally. The following professional papers will then be presented: No. 088. William O. Webber, "Efficiency Tests of Turbine Water-Wheels." No. 097. Thomas E. Murray, "The Improvement of the Tennessee River and Power Installation of the Chattanooga and Tennessee River Power Company," at Hale's Bar, Tenn.

On Thursday afternoon, May 3, at 2 o'clock, there will be an excursion to Lookout Mountain by trolley and incline, from which will be viewed the city of Chattanooga, the windings of the Tennessee River, the Cumberland Mountains, the Blue Ridge Mountains, the battlefields, and the whole historic panorama. The local members of the American Engineering Societies, together with other citizens of Chattanooga, will tender a reception to the officers, members and ladies of the society, at the Read House, Thursday evening, May 3. Friday morning will also be devoted to social features, several excursions being planned.

The annual meeting of the society will be held in New York, N. Y., Dec. 4 to 7, 1906.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED APRIL 3, 1906

816,571. Flexible Connection and Suspension Means for Gearless Motors; Karl F. Elers, Pittsburg, Pa. App. filed April 3, 1905. A truck axle and a wheel having an annular series of chambers in one side and coil springs in the chambers, an electric motor, a sleeve or quill for the motor armature having substantially radial arms, each of which has rigidly supported heads that project into adjacent wheel chambers and have seats for the ends of the springs.

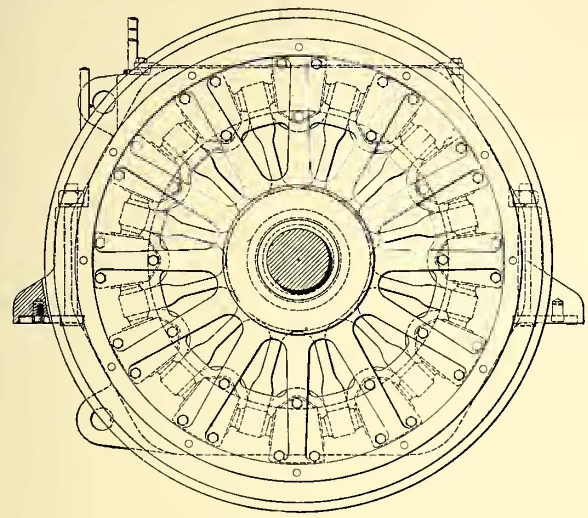
816,600. Suspension Means for Electric Railway Motors; Charles A. Psilander, Pittsburg, Pa. App. filed April 3, 1905. An electric motor having its armature loosely sleeved upon one of the axles and leaf springs connected at their middle points to the middle points of the sides of the motor field magnets and at their ends to the truck frame.

816,610. Flexible Connection for Gearless Motors; Robert Siegfried, Pittsburg, Pa. App. filed May 22, 1905. A truck wheel having a cylindrical chamber or opening and a set of yielding, resilient rings arranged side by side in the opening, an electric motor and a sleeve or quill for the motor armature having a boss that projects through the set of rings in the wheel chamber.

816,611. Flexible Connection and Suspension Device for Gearless Motors; Robert Siegfried, Pittsburg, Pa. App. filed May 22, 1905. Consists of a truck axle and a wheel therefor provided with a cylindrical chamber, the axis of which is substantially parallel to the axis of the wheel, a motor armature having a quill or sleeve provided with a boss that projects into the wheel chamber, and compressible, resilient means interposed between the bosses and the circumferential wall of its chamber.

816,612. Flexible Connection for Gearless Motors; Robert Siegfried, Pittsburg, Pa. App. filed Dec. 18, 1905. Comprises an axle having a wheel provided with a set of chambers, a quill or sleeve surrounding the axle and provided with bosses that project into the chamber, resilient cushioning means that surround the bosses within the chambers and resilient cushioning means between the ends of the bosses and the wheel. See illustration on page 590 of this issue.

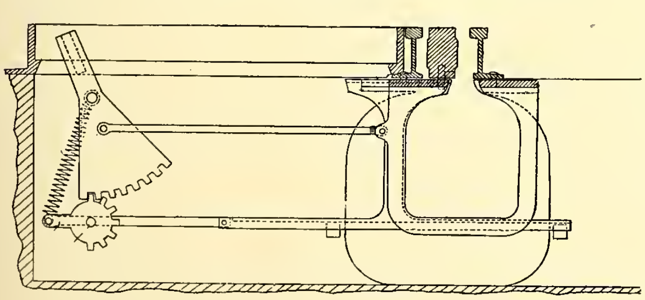
816,617. Beamless Car Brake; George W. Swisher, Clifton Forge, Va. App. filed Aug. 17, 1905. A beamless brake employing oppositely sliding plungers and a lever working between said plungers for spreading the same, longitudinal sliding bearings for the plungers and a transverse slot in the plane of the plunger bearings to admit a controlling lever, and a vertical elongated pin opening intersecting both the longitudinal slideway and the transverse slot.



PATENT NO. 816,571

816,646. Point or Switch for Electric Tramways Working Upon the Slot Conduit System; Albert N. Connett, London, England. App. filed Aug. 24, 1905. Two tongues are provided, arranged one above the other, the lower tongue being broader than the upper tongue at its free end, means for supporting the lower tongue at both sides of the point, means connecting the lower tongue to the upper, such that when the lower tongue is moved across the slot in either direction, the upper tongue is moved across the slot through a lesser distance.

816,647. Point or Switch for Electric Tramways Working Upon the Slot Conduit System; Albert N. Connett, London, England. App. filed Aug. 24, 1905. For supporting an upper tongue in both of its positions, two lower tongues are provided, and means whereby the lower tongues are moved in the opposite direction to the upper tongues in reversing the point.



PATENT NO. 816,647

816,762. Apparatus for Controlling the Passage of Cars or Vehicles Along a Railway; Louis H. Thullen, Edgewood, Pa. App. filed Jan. 18, 1905. The switch point is connected to a continuously rotating motor through a magnetic clutch, which is normally inoperative, but which can be energized by the signal or pilot circuit. Interlocking means provided for ensuring a proper setting of the signals determined by the movement of the switch point.

816,774. Iron-Framed Wood Pad for Track Rails; Giuseppe Borini, Reggio Emilia, Italy. App. filed Oct. 26, 1905. A metallic frame for wood pads.

816,812. Switch Mechanism; William C. Mortensen and George M. Themm, Salt Lake City, Utah. App. filed Oct. 2, 1905. A vertical lever on the car is depressed by the motorman to engage the switch point.

816,875. Trolley Harp; Barney Murphy, New Haven, Conn. App. filed Aug. 24, 1905. The trolley harp is swivelled to the pole in such manner as to provide a vertical axis. A projecting bail engages a hook on the pole to limit the movement.

816,913. Switch-Throwing Device; Georg W. Hercules and Thomas J. Martin, Berver, Pa. App. filed July 13, 1905. A shoe on the car engages a lever in the roadbed, which has suitable connection with the switch point.

817,031. Controller; Thorsten von Zweigbergk, Preston, England. App. filed May 15, 1903. A motor starting device having a rheostat arm moved over contacts by a Geneva stop-motion, which is driven by an electric motor, differentially wound with shunt and series coils.

817,036. Automatic Block-Signal System; Abram L. Bower, Boyertown, Pa. App. filed Jan. 31, 1903. Disks at the various stations have spaced contacts therein and are stepped around by pawl and ratchet devices so as to alternately illuminate and extinguish certain signal circuits.

817,131. Automatic Railway Signal; John Neumaier, Milwaukee, Wis. App. filed July 8, 1905. A metallic box in the roadbed had an upwardly projecting finger in the path of the wheel flanges of the train. The finger completes special alarm circuits, and is adapted to be reset after depression by a train by means of an electromagnet within the box.

PERSONAL MENTION

GENERAL EUGENE GRIFFIN, first vice-president of the General Electric Company, sailed for Europe on April 10.

MR. JAMES RAWLE, of Bryn Mawr, Pa., has been elected president of the J. G. Brill Company to succeed the late Mr. G. Martin Brill.

MR. AUGUSTUS SPIES, president of the Menominee & Marinette Light & Traction Company, of Menominee, Mich., has been elected Mayor of Menominee.

MR. PETER LINDEMAN has resigned from the Interborough Rapid Transit Company, of New York, after four years' service, to become connected with the Indiana Union Traction Company in charge of the rolling stock and equipment. Mr. Lindeman formerly was with the New York City Railway Company.

MR. T. J. NICHOLL has been elected general manager of the Hudson Valley Railway, of Glens Falls, N. Y., and assumes his new duties at once. He has been general manager and engineer in charge of several large roads in the West, and for seven years was vice-president, general manager and chief engineer of the Rochester Railway Company.

MR. F. D. NORVEIL has been appointed by Mr. D. G. Edwards, chief traffic manager of the merged Dolan-McGowan lines, to the position of assistant traffic and freight manager of the merger lines in Indiana, including the Ft. Wayne, Van Wert & Lima Traction Company. All passenger and freight agents will report to him and receive instructions and tariffs from his office in the Terminal Building, Indianapolis.

MR. EDWARD T. WALSH, who has for five years past been connected with the Interborough Rapid Transit Company, of New York, in the general design of the Fifty-Ninth Street power plant of the subway division, has resigned to accept the position of assistant engineer of construction of the National Cash Register Company, Dayton, Ohio. Mr. Walsh has had an extensive experience in power plant and structural steel design. His early experience consisted of a number of years upon the cable railway system of the Brooklyn Bridge, during which he secured his education at Pratt Institute. Subsequently he was employed three years by the Atlas Portland Cement Company in power plant and building design, from which position he came to the Rapid Transit Subway Construction Company.

MR. J. C. BRACKENRIDGE has been appointed consulting engineer by the New York Central Railroad, to serve in connection with the electrification of that company's lines within what is known as the "electric zone." This area includes all of that part of the New York Central lines extending from the Forty-Second Street terminal to Yonkers. Mr. Brackenridge worked out and installed electricity on the Brooklyn Union Elevated line, which, up to that time, covered the heaviest electric traction installation attempted. At the same time, Mr. Brackenridge's general railroad knowledge gives him a command of practical traction requirements that are of inestimable value in the successful working out of the problems that will inevitably be met in connection with the work in which he has been retained. Mr. Brackenridge will continue as president of the Rossiter-MacGovern Company, of New York, which office he assumed last January.

MR. ALSON H. POMEROY, of Berea, Ohio, formerly president of the Cleveland & Southwestern Traction Company and prominent in the operations of the Pomeroy-Mandelbaum syndicate of Cleveland, died at his home last week. Three years ago Mr. Pomeroy was stricken with apoplexy, and at that time he retired from active business, and was succeeded as president of the Cleveland & Southwestern by his son, Mr. F. T. Pomeroy. Mr. Pomeroy was one of the pioneer street railway men of Ohio, and is credited by many with having built the first suburban road in the State. He entered the business in the 70's, when he built a horse car line in Berea, his home town. Later he built horse car lines at Mt. Clemens, Mich., and at Sandusky, Ohio. In 1893 he conceived the idea of building a suburban line to connect Berea with Cleveland. For a time this was operated with the storage battery system then being tested by Washburn, in Cleveland. This proved a failure and the line was equipped with the trolley, being the first suburban line to enter Cleveland. Two years later the line was extended to Elyria, and the system has since been extended until it now embraces about 150 miles. Mr. Pomeroy was interested in all the so-called Pomeroy-Mandelbaum properties, which include about 600 miles of roads. The burial was at Lake View Cemetery, Cleveland.

A. H. POMEROY

AT A MEETING of the board of directors of the Westinghouse Electric & Manufacturing Company, held Tuesday, April 10, Mr. L. A. Osborne, formerly third vice-president of the company, was elected second vice-president to succeed Mr. Frank H. Taylor, resigned. Mr. Taylor, who is also a director of the company, will retain his seat on the board. Mr. Osborne's duties as third vice-president comprise the direction of the engineering and manufacturing activities of the company. As second vice-president he will assume the direction of the commercial branch while retaining those of the engineering department. The new second vice-president is a graduate of Cornell University, and entered the employ of the Westinghouse Electric & Manufacturing Company in 1891. He has successively held the positions of assistant superintendent, assistant to the vice-president, manager of works, fourth vice-president and third vice-president.

THE RESIGNATION of Mr. R. D. Schindler, for two years general manager of the Pacific Electric Railway Company, of Los Angeles, and the Los Angeles Interurban Railway Company, who sometime ago announced his determination to leave the service of the Huntington-Harriman syndicate, became effective April 1. With his retirement a circular was issued announcing that the office of general manager would be abolished. Within forty-eight hours of this announcement there went forth a circular from the president, effective April 2, announcing that Mr. J. McMillan had been appointed acting superintendent of transportation of both companies. He will perform the duties of this office in connection with his duties as traffic manager. Superintendents and other transportation officials are ordered to report to him. Thus Mr. McMillan practically becomes general manager of these corporations without carrying the title. Mr. McMillan came to Los Angeles from Texas several years ago at the solicitation of Mr. Epes Randolph, who is now the personal representative of Mr. E. H. Harriman in Southwestern America and Mexico. At first he was assistant to Mr. Randolph, when the latter was general manager of the Pacific Electric Railway Company. Afterward he was made traffic manager and has held that position for about two years.

MR. JOSEPH L. BREEN, general manager of the People's Railway Company, of Dayton, met with a shocking death while in the performance of his duties a few days ago. The recent high waters in that district had caused Mr. Breen considerable anxiety over the safety of a temporary bridge over the Miami River, crossed by his line, and he had been riding back and forth on the rear platform of a car watching the driftwood which lodged against the piles of the structure. Leaning out to take a last look, he was struck in the head by a pole placed on the bridge by a telephone company and was knocked into the river. Although his head appeared to have been badly cut, he made a desperate effort to swim to the shore. For several hundred feet he was seen to fight for his life, and then he disappeared after a boat had put out for him. A peculiar circumstance was that he had just ordered posted in car houses and on cars, a warning, indicating the danger of leaning from a car while crossing this bridge. Mr. Breen was forty-one years of age, married, and had eight children, the oldest fifteen. He entered the street railway business in 1892 with the Union Traction Company, of Philadelphia, remaining with that company seven years. He then entered the service of the American Railways Company and superintended the construction of the Chicago & Joliet Railway. On his completion of this task, he was appointed general manager of the People's Company, which is owned by the American Railways Company.

IN VIEW of the recent formation of the Electric Service Supplies Company, it may be interesting to give some facts regarding Messrs. Porter and Berg, who enter the new firm. Mr. J. W. Porter first entered electrical work in the construction department of the Edison General Electric Company. While with that company, in 1889-90, he was engaged in the construction and operation of the electric road which was then being built in Fort Scott, Kan. He later served in the same capacity in the electrifying of the Grand Rapids Street Railway, and also in the building of the Norfolk (Neb.) Street Railway. Upon the consolidation of the Edison General Electric Company with the Thomson-Houston Electric Company he resigned his position to accept one in the sales department of the Ansonia Electric Company, of Chicago, where he remained until 1893. Mr. Porter later engaged in the electric lighting business, building and operating the Dearborn Lighting Company, a central station furnishing current for lighting and power in the downtown district in Chicago. Mr. Porter was manager of this company's business until 1899, when he engaged in the supply business which has become so well known under the firm name of Porter & Berg. Mr. Porter will be first vice-president as well as one of the directors of the Electric Service Supplies Company. Mr. Porter's old associate, Mr. Max A. Berg, entered the electrical field in 1889, at which time he accepted a position with the Electrical Supply Company, Chicago, which later changed its name to that of the Ansonia Electric Company. In 1892, the Ansonia Electric Company organized a railway department, and entered into the manufacture of overhead material, Mr. Berg taking charge of that department. This was at a time when the Chicago roads began electrifying preparatory to handling the large number of people expected to visit the World's Fair the following year. Mr. Berg later became the secretary of the Wallace Electric Company, Chicago, and after having resigned his position with them was appointed the Chicago representative for the Ohio Brass Company, of Mansfield, Ohio. After a period of four years in Mansfield with the Ohio Brass Company he came to Chicago, and became a member of the firm of McGill, Porter & Berg, which company in 1900 was incorporated under the name of Porter & Berg, the present offices occupying the entire second floor of the Plymouth Building, Nos. 303-305 Dearborn Street. Mr. Berg will be the secretary as well as a director of the Electric Service Supplies Company, whose organization was mentioned in the STREET RAILWAY JOURNAL of March 31.

J. W. PORTER

MAX A. BERG

Street Railway Journal

VOL. XXVII. NEW YORK, SATURDAY, APRIL 21, 1906. No. 16.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)............................$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy).......................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid..................... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 130,800 copies, an average of 8175 copies per week.

The Summer Road

It is nearly time for our annual diatribe concerning the management of summer traffic on the long list of electric roads that reach summer resorts along shore and in the hills. And the burden of our remarks will be, as usual, the missed opportunities for excursion and long-distance riding. There are literally dozens of roads so situated that, with a little coöperation and attention to details, they could very materially increase their summer earnings. It is not only the ball park and the amusement park that can pile up fares, but the regular riding for pleasure. Thousands of town dwellers depend very largely on the electrics for their outings, but in spite of this, summer traffic has not been by any means worked to its legitimate conclusions. The main point, as it seems to us, is to increase the facilities for long-distance riding by a proper arrangement of through cars. We could mention not a few roads that are so situated as naturally to get a great deal of this business, but which, by failing to make proper connections, or neglecting to run through cars, forfeit a considerable amount of it. No one likes to make a trolley trip to a distant beach, however attractive, if the journey involves several changes of cars at local points, with many doubts about getting a seat, and with a strong probability of long delays. Through cars are important at all times of the year in bringing out traffic, as many of the interurban systems have already learned, but in summer they are doubly important.

Take, for example, a continuous track that runs for twenty miles or thirty miles along the coast. If operated as a continuous line and judiciously advertised it is likely to draw very large traffic, not alone on Sundays and holidays, but every day in the week for three months. If run in the way that is too common, it is shunned by a very large number of people who would otherwise gladly use it, merely because the trip is likely to be made uncomfortable by changes and waits. There is a possibility, now beginning to be realized, of working up quite a business in special daily excursions, with seats reserved for a small extra fare, which would add materially to the income of the system for at least a couple of months in the year. But apart from this line of operations, which should be encouraged, there is always the opportunity for the continuous trip, even if it has to be constructed by traffic arrangements with connecting roads, just as in the case of steam roads. What would be the business on these if they were as much split up into disconnected units, as are electric roads at the present time? Even the consolidation of electric lines as to ownership does not always imply physical coöperation to the extent that is desirable. It is an old lesson that should have been learned long ago. A judicious planning of summer through travel will not only make profits, but friends. Everyone who enjoys a successful excursion, with quick and comfortable service, is an active, though unpaid, advertising agent of the line, just as every long-waiting and exasperated strap-hanger is an abusive enemy. How often have we heard the tale, "I went down to Sculpin Beach by trolley yesterday—don't try it while there is a roof garden in business—four hours and three changes of cars—stood up the last half of the way." This theme, with variations, can be suppressed by good management—and it should be.

Tools in Repair Shops

Prompted by economy, a few electricians limit their tool kits to a pair of pliers and a screw driver. For the same reason, probably, some railway repair shops are almost as meagerly supplied with tools. In some a few monkey wrenches, sledge hammers and crowbars are all that can be found with which to do the great variety of work usually encountered in a repair shop. In almost every case it is certainly false economy to fail to supply proper tools to carry out the repairs. To be sure the work can be performed in a way with a limited supply of tools, but the manner in which it is done is often very discouraging to the workman who takes pride in his work, and the time required to do it frequently shows the reason why it costs so much more to get out the same work in one shop than in another. On the other hand it is undeniable that a good equipment of tools is an education of itself, as well as the best incentive to do his best with the proper kind of workman.

But to return to the most common defects in equipment. An insufficient supply of wrenches is very often noticeable. The fact that a monkey wrench can be made to turn almost every nut encountered, seemingly gives to some superintendents the idea that no others are needed. But many nuts are placed in angles, where only one-twelfth of a turn can be secured with each application of a flat, or monkey wrench. By perseverance, the workman may manage to get them tight. Usually, however, the nut wears round, and the workman's hand is well skinned by repeated slipping of the wrench before it is screwed up sufficiently. A cold chisel is often resorted to before a satisfactory job can be done. The appearance of the nuts, however, after the work is done, bears very little resemblance to the originals. A liberal supply of socket wrenches should always be at hand to use on nuts in otherwise inaccessible places. Such wrenches may cost, in labor and material, one or two dollars. But when 5 minutes or 10 minutes are lost by attempting to use a monkey wrench on each nut, it will be seen that a proper wrench will usually pay a pretty good return on the money invested.

But wrenches are not the only tools lacking in some shops. A pair of bolt cutters for cutting copper cables is frequently absent. To be sure, it is possible to conduct a shop without bolt cutters. Cables can be sawn in two with a hack saw, or a cold chisel may be employed to cut them, but the time required and the attending inconvenience makes a pair of bolt cutters preferable from every standpoint. Proper cold chisels, files, blow torches or pots, and similar tools are often not to be had. Yet the men in the shop are expected to make a good showing.

The absence of a pinion puller has often been noticed in shops. Instead of applying a puller and removing the pinion without injury, it is driven off by repeated blows from a sledge. The fact that a pinion puller is not in the shop can usually be discovered by observing the battered condition of the pinions. Any good blacksmith can make a pinion puller with a few hours' work, yet in some shops, for some unaccountable reason, pinions continue to be pounded off the armature shaft.

Nothing probably demoralizes a shop force more than the absence of proper tools, and the use of makeshift methods to get along without the tools. After a workman has pounded his hands up or skinned his knuckles through trying to work with improper tools, when he knows the management is at fault, he is not likely to care much whether or not the job is done properly. An atmosphere of looseness in doing work will usually prevail sooner or later, and the slipshod, careless manner in which the work is turned out will begin to show itself in frequent breakdowns and increased cost of maintainence.

The Ethics of Headlights in City Streets

There is just now considerable discussion in regard to the use of powerful headlights on railways. There is no question that they are very desirable from the operating standpoint, and form one of the most powerful protections against accident which can be devised. It is equally certain that such a light may at times produce a glare that is a source of great annoyance to users of a contiguous highway. That it may be serious is evident enough, for the eye cannot readily see beyond a brilliant light and sees only with difficulty dimly lighted objects in its own vicinity. So long as a road is upon its own isolated right of way nobody is likely to be adversely affected—it is only in the common case of using the highway that the trouble begins.

But the blinding effect to which we have referred is by no means confined to the headlights of electric cars. The acetylene search lights in use on many automobiles are almost equally serious in their effects, the more so as the vehicles bearing them are actually running in a highway at a rate of speed generally greater than that of an electric car, and frequently very much greater. Just why the car should be criticised more than the automobile it is difficult to discover. So far as the public using the highways is concerned, it is desirable that all vehicles should carry lights, not for illumination of long stretches of road, but as markers to show plainly their locations. Anything more than such lights are rather disadvantageous save to the occupants of the vehicle, and the only advantage of very powerful lights is to show obstacles before they come within the dangerous space pertaining to that vehicle and speed. For the usual interurban cars this space is fairly long, and a correspondingly powerful light is needed for the purpose mentioned. It has generally been claimed for automobiles that the space required for stopping is very short, but this claim is somewhat belied by the huge searchlights that have come into use, unless one supposes that they are carried purely for amusement. At all events, in this headlight matter, electric cars and automobiles are certainly tarred with the same brush, and if one is a nuisance so is the other. In either case there is available the very simple remedy of dropping an opaque or translucent shutter over the offending light whenever it becomes necessary, and at present this is insisted upon in certain cities. In some localities the people rather like the bright headlight announcing the coming of the car from afar. When, however, the kicks begin to come, and show a strong sentiment in the other direction, a screen is worth considering.

The only unfortunate feature about the screen is that frequented roads are the very place where the headlight can be most useful, and in these places a serious reduction of light is objectionable unless the speed is considerably lower. But the plan has the advantage that the unscreened headlight can then be more freely used as the community gets used to the idea, and its advantages in reducing accidents become more generally recognized. Kicking thrives on opposition and generally does not long survive a sympathetic hearing.

Car Lighting

As we have frequently remarked, there is ample room for improvement in car lighting, but the subject is such a live one we hope we shall be pardoned if we refer again to some of the more salient features in the problem. The proper method of car lighting is a case in which the technical side of the question has not yet been properly studied, not, to be sure, from any lack of interest, but because the subject of illumination is, as a rule, far "off the beat," so to speak, of the average railway man. The result is that, while there is an ample, in fact, lavish expenditure of current for car lighting, the illumination is quite often bad. As we have pointed out, a car is a particularly troublesome space to light, because of its dimensions. It is often filled with people, many of whom stand in the aisle, and the lights ought to be so distributed as to give everyone ample light without thrusting a bulb fairly under his nose. Aside from this, the voltage upon electric lines, particularly interurban lines, is of necessity variable, and is subject to the worst variation during the crowded hours, when light is often most needed. There ought to be reform, but to secure it requires the active coöperation of the railway man and the lamp maker. The former must dispose his lights so skilfully that they may produce the best possible results for the energy used, while the latter must stand ready to furnish the kind of lights best adapted to give good light under the strenuous conditions found upon a trolley road.

As to the first part of the problem, the main thing is to give a well-distributed light without needless glare. On the whole, we believe that the distribution requirement can be best met by using two series of lights at the edges of the monitor roof, or higher, if the shape of the car permits. These should be either provided with ground bulbs or should be enclosed in mild diffusing globes, and could best be arranged by providing for them in building the car roof, instead of sticking them on afterward. They certainly need not be of high candle-power, and, if furnished with proper diffusers, will give a fairly even and pleasant illumination, ample in amount without exceeding the energy now generally devoted to lighting. But even the most judiciously placed lamp will not do good work if it flickers badly with every shift or voltage. Here is where the skill of the lamp maker can come in. An ordinary carbon filament 16-cp lamp varies in light to the extent of almost a candle-power per volt, and hence of necessity the light flickers on very small provocation. But there are now lamps available, or soon to be available, in which the resistance of the filament increases with the temperature, instead of decreasing, as in the case of ordinary carbon. Hence there is a certain tendency toward self regulation which ought to be valuable in working at varying voltage, particularly if the lamps are not pushed to higher efficiency than is now usual. Both the tantalum and the "metallized" filament lamps, when worked at moderate efficiency, have something of this quality, and since the latter can be varied in temperature coefficient by its treatment, there should be opportunity to produce a lamp relatively steadier under varying voltage than the common forms. There is at least a chance for a useful improvement of this kind, and we commend the subject to the lamp makers for earnest consideration. Given a lamp of such character, and the whole matter of proper car illumination would be much simplified.

The Selection of Incandescent Lamps

While upon this subject of lamps, it might be well to refer to the subject of their scientific selection and purchase. This is a matter which until quite recently has received comparatively little attention from street railways. To a certain extent, this statement also applies to various other small supplies, such as oil, grease, paint and fittings. The tendency in many cases is to buy material of this character largely on the basis of price. To test this class of equipment costs quite a little money and time, considering the value of a given consignment, and there is no doubt that, in a good many instances, it hardly pays to follow up the matter further than to secure data bearing upon the life of the material in actual service. On a large system, however, the cost of supplies runs well up into the tens of thousands of dollars each year, and some companies find it highly profitable to maintain a laboratory where commercial, physical and chemical tests can be made to supply information to the purchasing and operating departments. There is no reason why small companies could not club together in this kind of work and share the expense of any researches which from time to time seem necessary, or else utilize the services of some established laboratory.

In buying incandescent lamps, however, service tests can be made with the greatest satisfaction only upon the particular system which is to use them, for only in this way can a correct idea be obtained of the life under the conditions of vibration prevailing on any given set of routes. It is also easily possible to make comparative life tests under specified voltage or current conditions without putting the trial lamps upon the cars, and this method gives excellent relative results when lamp specifications are drawn, to inform bidders in detail just what tests are to be imposed. Long life is a fundamental necessity in a railway lamp. A life of from 600 hours to 800 hours may satisfy the requirements of a central station on account of the gain in efficiency, but in street railway car service a life of from 1000 hours to 1500 hours, or even 1800 hours, is generally regarded as more acceptable, even though it may mean specifying 4 watts per candle power for lamp efficiency instead of 3.5 watts, or possibly 3.1 watts. With the advent of the new high-efficiency lighting units for large service, a stimulus has been imparted toward the production of lamps of about 20 cp, and when these appear on the market at efficiencies of 2.5 watts, or possibly 2.4 watts, per candle-power, it will be well worth while for the street railway manager to investigate the cost of using an improved lamp, bearing in mind first cost, life and energy consumption.

Aside from the question of life, the percentage of burnouts, maintenance of candle-power within the specified limits, self regulation with varying voltage, as discussed in the previous editorial, and rate of increase of energy consumption with life should receive attention in the selection of lamps. Tests of this kind can be pretty well tried out at the power station or shop. An impression prevails in some localities that lamps cannot well be studied with reference to their life in actual car service, but it ought to be a simple matter to mark the bases and keep a single burnout record through the coöperation of the car house foreman. The question is worth looking into at all events. The reliable maker has no cause to fear a thoroughly scientific test, and it is a matter of some consequence to an operating road to know just what it is getting.

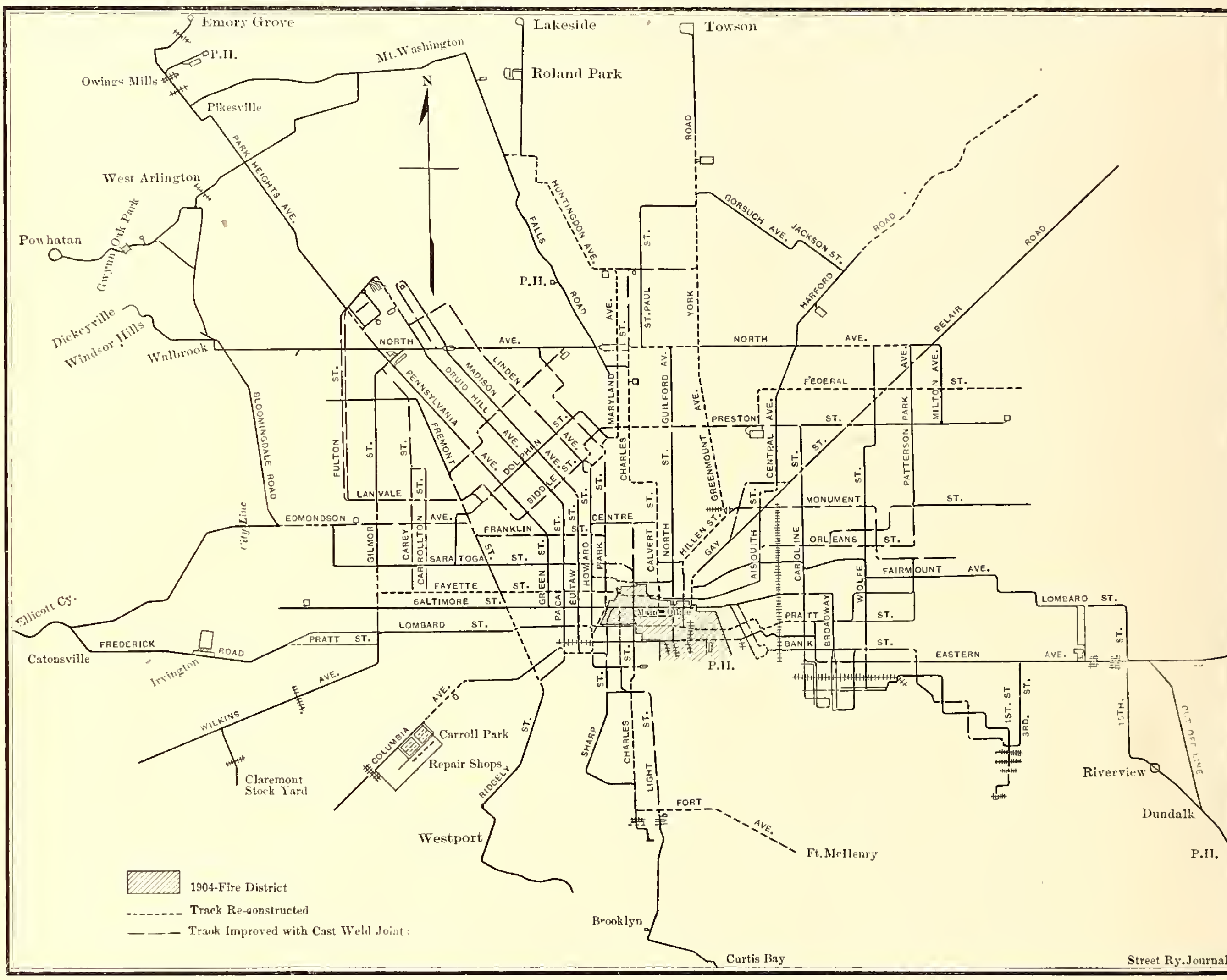
THE RECONSTRUCTED BALTIMORE SYSTEM

The United Railways & Electric Company, of Baltimore, was in February, 1904, called upon to pass through an ordeal without a parallel in electric railway experience. The great conflagration, which for two days, Feb. 7 and 8, raged through the business section of the city, embracing an area of several square miles, was so overwhelming in its magnitude as to completely paralyze for a time the company's operations. The burnt district occupied a tract of ground in the business section between the harbor and a steep hill, this section forming virtually a narrow throat through which passes the concentrated traffic between the eastern and western sections of the city. The closing of this throat left the railway company with virtually two isolated systems, with all connections between the two temporarily severed. That in so short a time the company was able to clear its tracks of the tons of debris, restore its entire system of poles and overhead work in the burnt district, rehabilitate its power generating and transmitting facilities, which had been badly crippled by the fire, and withal, that it could pass through the remainder of the year with operating financial results only slightly less favorable than those of the previous year, and enter the succeeding year free of floating debt, with improved motive power, tracks and car equipment is a fact that bears forcible testimony to the vigor, energy and skill of the management.

Although the fire has now passed into history, a statement of the havoc wrought in the operations and property of the railway company, together with the work accomplished during the past two years in bringing the property to a higher state of efficiency than it enjoyed before the destruction, will prove both interesting and instructive.

The fire started about 10:05 a. m., Feb. 7, in the wholesale dry goods establishment of John E. Hurst & Co., but did not reach the offices of the railway company in the Continental Trust Building until 10 p. m., and the Pratt Street power house of the company until about 4:50 a. m., Feb. 8.

The company's offices occupied the ninth and tenth floors of the Continental Trust Building, a thoroughly modern, supposedly fireproof office structure, located on the principal business street. It may be added, that when attacked by the flames this building proved utterly unable to resist the high temperature, the fire quickly breaking the plate glass windows on the various floors, and finding sufficient inflammable material in the wooden wainscottings and linings to completely destroyed the interior of the structure. As it became apparent for an hour or two before the offices were burnt that the fire would reach them, provision was made for protecting the records and valuable papers of the various offices, either by storing them in the supposed fireproof vaults, or by sending them by car to the Park terminus on Druid Hill Avenue. While the papers of the president's office were saved, many of the important papers and books of the general manager's, treasurer's, auditor's and claim department offices were destroyed, due to failure of the vaults.



MAP SHOWING COMPLETE SYSTEM OF THE UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE

The original portion of the main Pratt Street power house, fronting on Pratt Street and Dugan's wharf, with the exception of the boiler room, was entirely destroyed. This portion of the power station contained all of the direct-current generating units, and the machinery destroyed included three 500-kw engines and generators, two 800-kw units, one 750-hp engine without generator, one exciter engine and three boosters. The section destroyed also included three 2500-hp vertical engines, direct connected to 1800-kw railway generators, but these units were not so badly damaged as to prevent their repair. One of these was patched up sufficiently to be put into service on March 7, the second one was ready for use on March 19, and the third on April 2. The partial saving of this machinery was due to the large traveling crane having been placed immediately over it to catch the falling roof, and to the main parts of the engines being of such magnitude as to resist warping or other serious damage by fire. The generators suffered much more severely than the engines.

The boiler room, which is upon the west side of the building, extending its entire length, and which is separated from the engine room by a brick partition wall, escaped with very slight injury, such as damage to doors and windows and to the coal hoisting apparatus on the wharf. The main contents of the building consisted of ten boilers, none of which were injured. In addition to the damage to this building and contents, the remnant of an old sugar refinery, at the corner of Dugan's wharf and Wood Street, south of the new engine house, which was partially occupied by the company as a storeroom, was completely burnt out with the exception of the brick walls, which remained in fair condition, and were soon afterward roofed in to serve as a temporary sub-station.

The contents of boiler house No. 2 were practically uninjured with the exception of the elevator and machinery appurtenant to it, and to the coal hoist. The contents of the new engine house, which house proved to be entirely fireproof, escaped without injury.

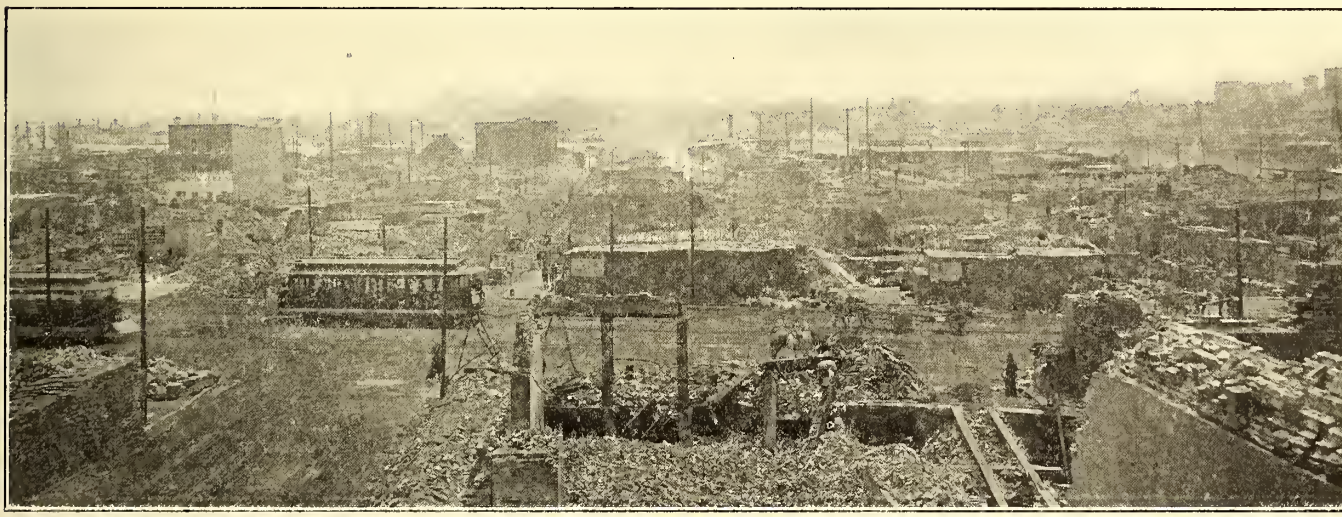
As the burnt district was almost coincident with the district in which all wires were carried in subways, the fire damage to transmission lines was largely confined to trolley wires and poles, the feeders and cables themselves, including the main cables connecting the power house with the sub-stations, entirely escaping injury on account of their being in the subways, although many of the cables were put out of commission owing to the flooding of the cable pits at the power house, and the burning off of the cable connections. Of course, many of the poles and trolley wires were destroyed by fire and falling walls, many of the wires being cut down ahead of the fire to facilitate the operations of the fire department.

As the car service was being operated upon many of the lines when their connections with the power house were broken, such cars were left stalled upon the streets until such time as temporary connections could be made, and on Feb. 8 fourteen of the company's lines outside the fire district were in operation.

The United Railways & Electric Company was one of the first institutions in the city to rally from the despondency of Blue Monday, the day following the fire, and many hours before the smoke had lifted from the stricken city, temporary offices for the various departments had been established wherever room could be obtained, and plans were under way for clearing the tracks of debris, restoring the overhead construction and repairing the damage to the power system.

Of prime importance in this connection are the lessons that were learned as a result of the conflagration. First and foremost, it was found that any wood was fatal in any structure intended to be fireproof. Not only was this demonstrated in the instance of many of the tall office buildings, several of which were gutted owing to the burning of the wooden floors and linings, but it was also shown in the destruction of a portion of the Pratt Street power house. This station was built of brick and steel, but it had a wooden roof. The brick walls withstood the attack remarkably well, but as soon as the roof caught from the outside, all efforts to save the building had to be abandoned. Incidentally, the heavy crane spanning the engine room in this station did excellent service not only in strengthening the walls and keeping them from total collapse, but also in catching a considerable portion of the roof and roof girders when they fell, thus protecting much of the machinery underneath from being completely buried in debris.

The two materials that, almost without exception, passed through the fire ordeal unscathed, were reinforced concrete and wire glass. The latter material in particular demonstrated its fire-resisting qualities, and in many places in the burnt district, plates of wire glass were left intact although subjected to direct contact with flames, as shown by their



GENERAL VIEW OF THE BALTIMORE BURNT DISTRICT, TAKEN SHORTLY AFTER THE DISASTER, IN FEBRUARY, 1904, SHOWING QUICK WORK ACCOMPLISHED BY THE UNITED RAILWAYS & ELECTRIC COMPANY IN RESTORING ITS SERVICE WHILE THE DISTRICT WAS STILL IN RUINS blackened surfaces. Brick walls, where there were no wooden window frames and trimmings, also made an excellent showing, and it would appear from the Baltimore disaster that brick construction with metal doors, metal sills and trimmings, and wire glass in all the ventilators and windows will give a construction that will resist fire from the outside almost as well as concrete, providing the roof be of re-inforced concrete, terra cotta tiling or other non-inflammable material. A lighting sub-station located in the heart of the burnt district in Baltimore, and which was built with brick walls, re-inforced concrete roof and wire glass windows, although subjected to the direct attack of the flames was practically uninjured, and the machinery it contained was placed in service a few hours after the fire had past, or virtually as soon as the water had been pumped from the basement. In line with the lessons learned as a result of the fire, the Druid Hill Avenue sub-station, which owing to its immediate surroundings was much exposed, has been remodeled to reduce the fire risk by covering the south gable with corrugated iron and reconstructing the monitor roof with steel and wire glass. In the same direction, the wooden floor system of the extensive steel viaduct across the valley of Stony Run, has been renewed in steel so that the only perishable portions of that important structure now remaining are the guard rails and foot-walks.

The fire proved the efficiency of underground conduits for protecting transmission wires from direct injury in widespread conflagrations. Practically all of the feeder cables and transmission lines of the United Railways & Electric Company within the burnt district were carried in underground conduits and subways, and the main portion of the distribution system escaped injury, although, of course, the terminal connections at the power house were destroyed. However, as soon as these connections were restored, the distribution system was found to be in good working order.

RECONSTRUCTION WORK

As soon as the fire had spent itself after raging uncontrolled for two days, the first concern of the company was to start the work of freeing its tracks of debris and restoring the poles and overhead lines. This was naturally a difficult and lengthy undertaking, due to the great number of tottering walls and ruins, and the inevitable delays occasioned by the restrictions imposed by the city officials, both for general safety and in order to protect the interests of all concerned. For several months, service upon all tracks between Baltimore Street and the harbor, in a considerable portion of the burnt district, was rendered impossible by the construction and operation of steam railroad tracks on top of the electric railway tracks, in order to facilitate the removal of debris. In connection with the restoring of the burnt district, the city authorities elaborated a comprehensive scheme for widening the streets and changing the grades in the business section, and the perfecting of these plans also delayed the company in the work of restoring its service. In spite of all delays and obstacles, however, the first car was run through the burnt district Feb. 21, and a fairly satisfactory service throughout practically the entire district was restored within one month.

TRACK AND LINE STANDARDS

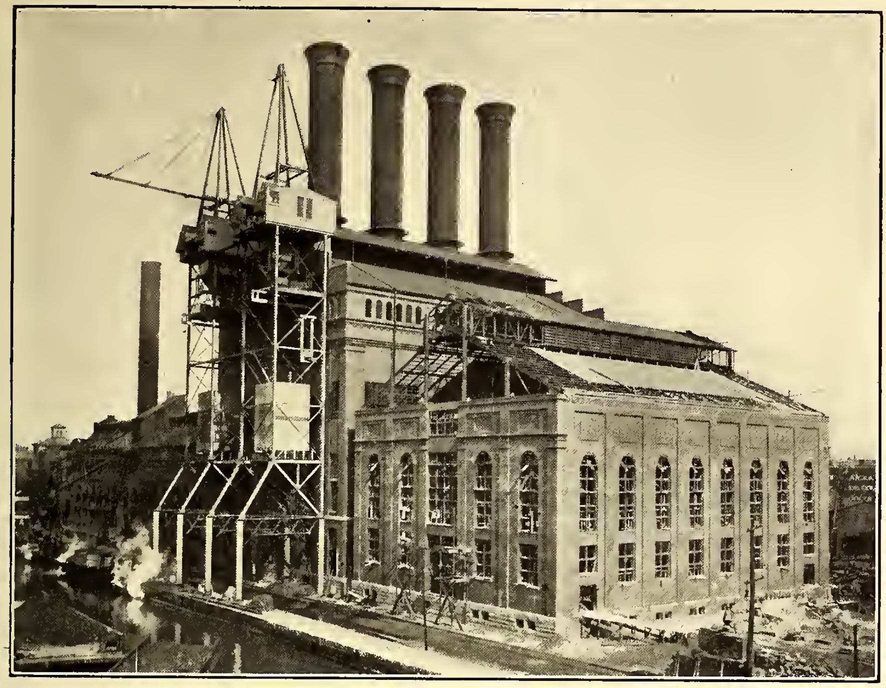
In reconstructing the overhead work occasion was taken to put in modern and first-class construction. The standards adopted include span wire, iron poles, cap and cone insulators for city lines; and span wires, wood poles, cap and cone insulators for suburban lines. The company still has considerable center pole mast arm construction, both on city and suburban work, but only where such suspension is made necessary by local conditions.

VIEWS SHOWING TYPICAL SITUATIONS CONFRONTING THE UNITED RAILWAYS & ELECTRIC COMPANY AFTER THE BALTIMORE FIRE, IN FEBRUARY, 1904

Summarizing the work accomplished by the overhead department during 1904, 4 miles of lines were rebuilt with iron poles and 8 miles with wood poles; during 1905, 6 miles were rebuilt with iron poles and 8 miles with wood poles; or a total of 26 miles of overhead construction entirely rebuilt since the conflagration.

The tracks in the burnt district, except for being covered with great piles of debris, were not injured, practically none of the rails showing any signs of warping. However, as a result of the alteration in street grades and alignments, decided upon by the city, many of the lines were re-constructed with heavier rails, and during the two years that have elapsed since the fire, this work of renewing and reconstructing track has been extended to other pars of the system. The standard track construction adopted for all new work is a 9-in. Trilby rail, Pennsylvania Steel Company, section No. 276, weight 113 lbs. per yard, with 12-hole plates. The rail is laid on wooden ties with 10-in. cable plug terminal bond and Cox joints. In repairing old tracks, the rails are being cast welded at the joints by the Falk method. During the past two years 35.6 miles of track have been cast welded.

Summarized, the track department since the fire has reconstructed 5 miles of track with T rail; 36 miles with girder rail, and has built 4.6 miles in new extensions with girder construction.



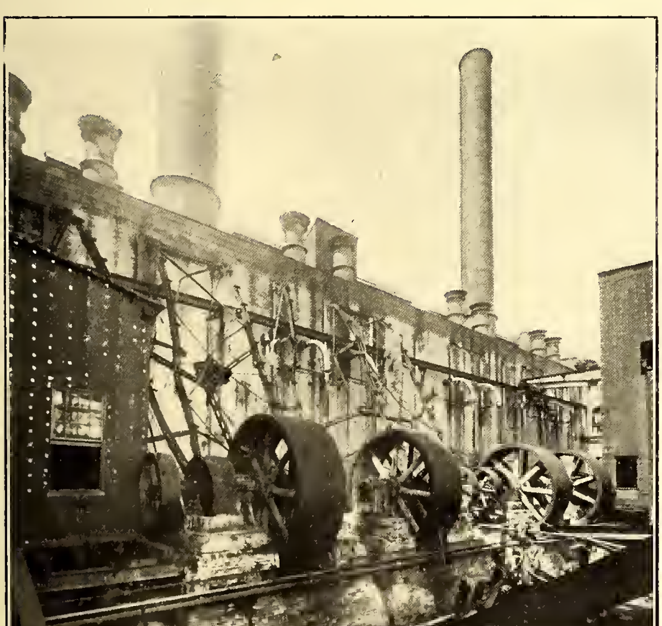
PRATT STREET POWER HOUSE OF THE UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE, BEFORE THE FIRE DISASTER IN FEBRUARY, 1904

POWER SUPPLY

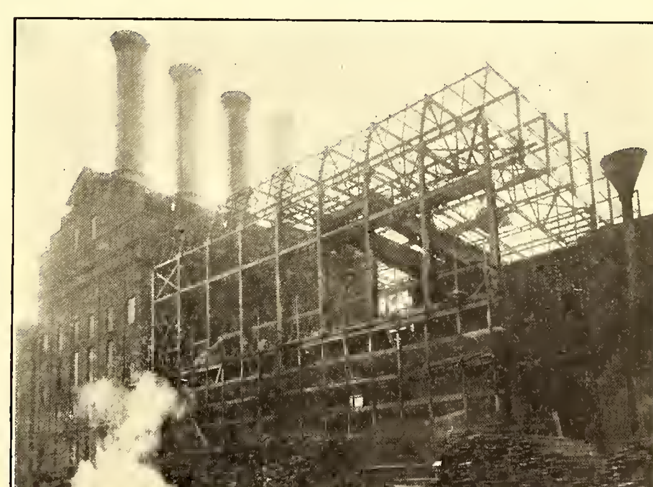
Coincident with the renewing of tracks and overhead work, the engineering department of the company has been busily engaged in restoring and improving the power supply. As previously stated, the main generating station is located on Pratt Street on tide water. Previous to the fire, this plant consisted of two engine rooms with a double-deck boiler room between. One of the engine rooms contained the direct-current generating machinery, and the other the alternating-current apparatus. The section of the building in which was housed the direct-current machinery, was totally destroyed, but the alternating-current side remained practically uninjured. This put all of the direct-current machinery out of commission, and although the company had a sufficient supply of alternating current, it could not operate any of its lines in the direct-current zone, which included the burnt district, for lack of converting and transforming facilities. The first work of the company's engineers, therefore, was to make arrangements for sub-station apparatus. The remaining walls of an old sugar refinery building on the power station site were hastily roofed over, and in this improvised building were installed transformers and converters supplied by the Westinghouse Company upon rush orders. The apparatus included three 1000-kw rotaries and one 350-kw and two 100-kw motor-driven boosters. The sub-station was ready for business in about a month after the fire, and the company was able to resume regular operation on such of its lines throughout the city as were not blocked by debris. In the meantime, the work of reconstructing the burnt portion of the building was commenced, and three of the direct-current units that had passed through the fire were repaired and placed in service. Each of these units consists of a 2500-hp vertical cross-compound McIntosh & Seymour engine, direct connected to a 1800-kw General Electric Railway generator.

The alternating-current units at the Pratt Street station at the time of the fire comprised four 3000-hp McIntosh & Seymour vertical cross-compound engines direct connected to 2000-kw Westinghouse alternators. As stated, none of this machinery was injured. In December, 1904, a fifth unit of the same size was placed in operation, and there is now being installed a sixth unit comprising a 7500-hp McIntosh & Seymour vertical-horizontal cross-compound engine direct connected to a 5000-kw Westinghouse alternator.

These units comprise all of the generating machinery now at Pratt Street, and give a rated capacity of 30,000 hp and an overload capacity in the aggregate of 40,000 hp in power-generating apparatus.



PORTION OF THE PRATT STREET STATION, DESTROYED BY THE FIRE



RECONSTRUCTING THE PORTION OF THE PRATT STREET POWER HOUSE THAT WAS DESTROYED BY THE FIRE

To supply steam to the new units in course of installation, the boiler-room equipment is being increased by four batteries of B. & W. boilers, aggregating 4000 hp.

The original method of distribution was with direct current from a number of power houses located in different sections of the city. The new power scheme is to distribute from one central alternating-current station to rotary sub-stations located in outlying sections of the city, and destribute direct current from these points. All lines within an area of approximately one mile from the main generating station are fed direct with direct current generated at the main station.

At the main station, alternating current is generated at 13,000 volts, 60 cycles, and is transmitted at the initial voltage to sub-stations, of which, when the present plans are consummated, there will be five, as follows: Druid Hill Avenue, with 4500-kw capacity; Nunnery Lane, with 1500-kw capacity; Pratt Street, with 3000-kw capacity; Eastern, with 3000-kw capacity, and Northern, with 4000-kw capacity, giving a total of 16,000-kw capacity in converting apparatus. Three of the sub-stations are now in operation, and the fourth is under way and will be in operation in about six months. The sub-stations are connected with the main generator station by 3-conductor 13,000-volt cables laid in underground conduits.

To help out during the re-construction period, three old direct-current stations, that had previously been out of commission, have been temporarily restored and placed in operation, but these will be discontinued as soon as the improvements at the Pratt Street power house have been completed.

The company was fortunate in losing no cars as a result of the conflagration, and none of its car houses or shops were damaged. The natural increase in traffic, however, has necessitated new car operating and storage facilities, and the company is at present making plans for extensive additions to its present car house capacities. The rolling stock has also been recently increased by the purchase of 200 new cars of the Brill semi-convertible type.

GENERAL

As showing the remarkable progress that has been made by the citizens of Baltimore, in recovering from the effects of the disaster, it may be said that the area covered by the burned buildings was 2,300,000 sq. ft. Of this space, 335,000 sq. ft. has been taken for widening streets. Of the available space left for building purposes, about 1,500,000 sq. ft., or nearly 72 per cent, has now been rebuilt. The total floor space in the burned district was a little over 8,500,000, exclusive of the property for public purposes. Of this 6,613,000 sq. ft., or 79 per cent, has now been reconstructed. The value of the new buildings is estimated at about $20,000,000, and over half of them are occupied or are ready for use.

VENTILATION IN THE SUBWAY

George S. Rice, chief engineer of the Board of Rapid Transit Commissioners, has just submitted a report containing his recommendations for ventilating the New York Subway. The investigations of Dr. Soper, as given in the Street Railway Journal for March 31, show that the air in the subway is not very different from that outside, and that proper sanitation in the subway can be secured by ordinary means. The present difficulties arise because the heat generated in the operation of trains is not dissipated in a sufficiently rapid manner. To improve the conditions in summer the air must be renewed more frequently, and it must also be cooled. No definite plan is recommended for cooling, although Mr. Rice suggests three ways in which it may be accomplished, viz., by evaporation of water, by refrigeration, and by absorbing the heat by disposing relatively cool water throughout the subway in some manner to be determined upon.

To renew the air, Mr. Rice recommends the use of exhaust fans and also of automatic louvres or ventilators. The latter should be so constructed that they will only open outward, and the covers balanced so that they will remain closed, except when the interior air pressure is greater that that outside. They should be located midway between stations, and the air pressure produced by a train as it approaches them forces the louvres open. After the train has passed, the louvres will automatically close and the air necessary to replace that removed is drawn in through the station openings. Observations made upon louvres of this kind, which have been installed between the Columbus Circle and Ninety-Sixth Street station, show that approximately 20,000 cu. ft. per minute were discharged through 100 sq ft. of louvres during the hours of maximum train movement. From 1 a. m. to 5 a. m., when very few trains were moving, only about 5000 cu. ft. were discharged through the same area. Mr. Rice recommends that these ventilators should be located between stations, so that the freshest air will be at the stations, and also so that such iron dust as may be liberated by the operation of the trains will be drawn into the interior of the tunnel and out through the exhaust openings there provided. He recommends that between Brooklyn Bridge and Columbus Circle station, fourteen outlet chambers of this kind be constructed; that they consist of both louvres and exhaust fans; that the fans should be used only during the three summer months, and for the twelve hours at night out of the twenty-four, excepting in emergencies, but that the automatic louvres be in constant operation. These ventilators will discharge their air through gratings in the sidewalks, but the rate of discharge will not be over 5 miles per hour and it will be deflected toward the center of the street. If this discharge should prove objectionable, ornamental chimneys, 10 ft. high, can be constructed. The cost for these fourteen ventilators is estimated at $170,000.

Between Columbus Circle and Ninety-Sixth Street the subway is much cooler than south of Columbus Circle. Here fourteen sets of louvres and six fan outfits are recommended at a cost of $40,000. In addition, it is proposed to cut out the vault light work in several stations, to provide larger inlets for fresh air. The cost of this work would be $30,000. This apparatus would have the capacity of renewing the air in the subway once every thirty minutes.

It is stated that by July 1 the last of the old steam railroad elevated coaches of the Brooklyn Rapid Transit Company will have been rebuilt and equipped with motors, according to the plans set forth in the Street Railway Journal of Aug. 13 and 20, 1904. This work has all been carried out at the Thirty-Ninth Street shops, which were fitted especially for the purpose. Upon the completion of the work, the building will be remodeled somewhat and converted into a paint shop for the surface and elevated cars of the entire system. A cut has been roofed and transformed into a tunnel 1200 ft. long, adding much valuable acreage to South Brooklyn, and yet affording a ready means of access to the shop. Within a few months an absolutely fireproof building has been erected for oil and paint storage. Into this building have been brought tanks for the storage of lubricating and illuminating oils, and still greater tanks for varnishes and paint ingredients. A portion of the present shop is to be used for a paint and drying room. Two hundred surface and elevated cars can be housed in it at once. The surface cars, in particular, require a great deal of work.

GOOD WIRING PRACTICE ON CARS AT WASHINGTON, D. C.

Gordon Campbell, master mechanic of the Washington Railway & Electric Company, of Washington, D. C., has worked out a simple and practical system of wiring cars intended to meet the underwriters' approval and to afford maximum protection against damage to cars and injury to passengers through failure or defect in any portion of the wiring, or from electrical causes in general.

For the purpose of explaining the scheme the protection as applied to a 25-ft. 6-in. vestibule car will be described.

In the first place protection in general against damage from electrical causes is secured by covering the under side of the car floor over motors, rheostats, plows, and arresters with transite or asbestos lumber. For this purpose fireproof material ⅛ in. thick is used on the less exposed portions, and material ¼ in. thick over the sections where the chance of trouble is greater, as over the rehostats and motors. (See Fig. 1.)

All the wiring on the car is treated as divided into three classes, i. e., wiring for power, wiring for heaters, and wiring for lights.

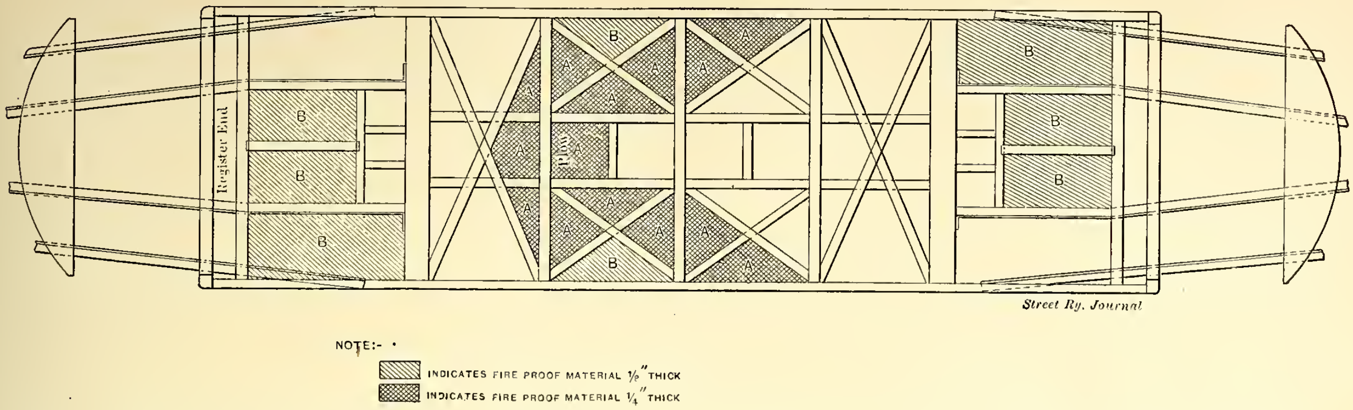


FIG. 1.—TIMBER PLAN OF WASHINGTON VESTIBULE CAR, SHOWING SPACES IN WHICH UNDERSIDE OF FLOOR IS PROTECTED WITH FIREPROOF MATERIAL

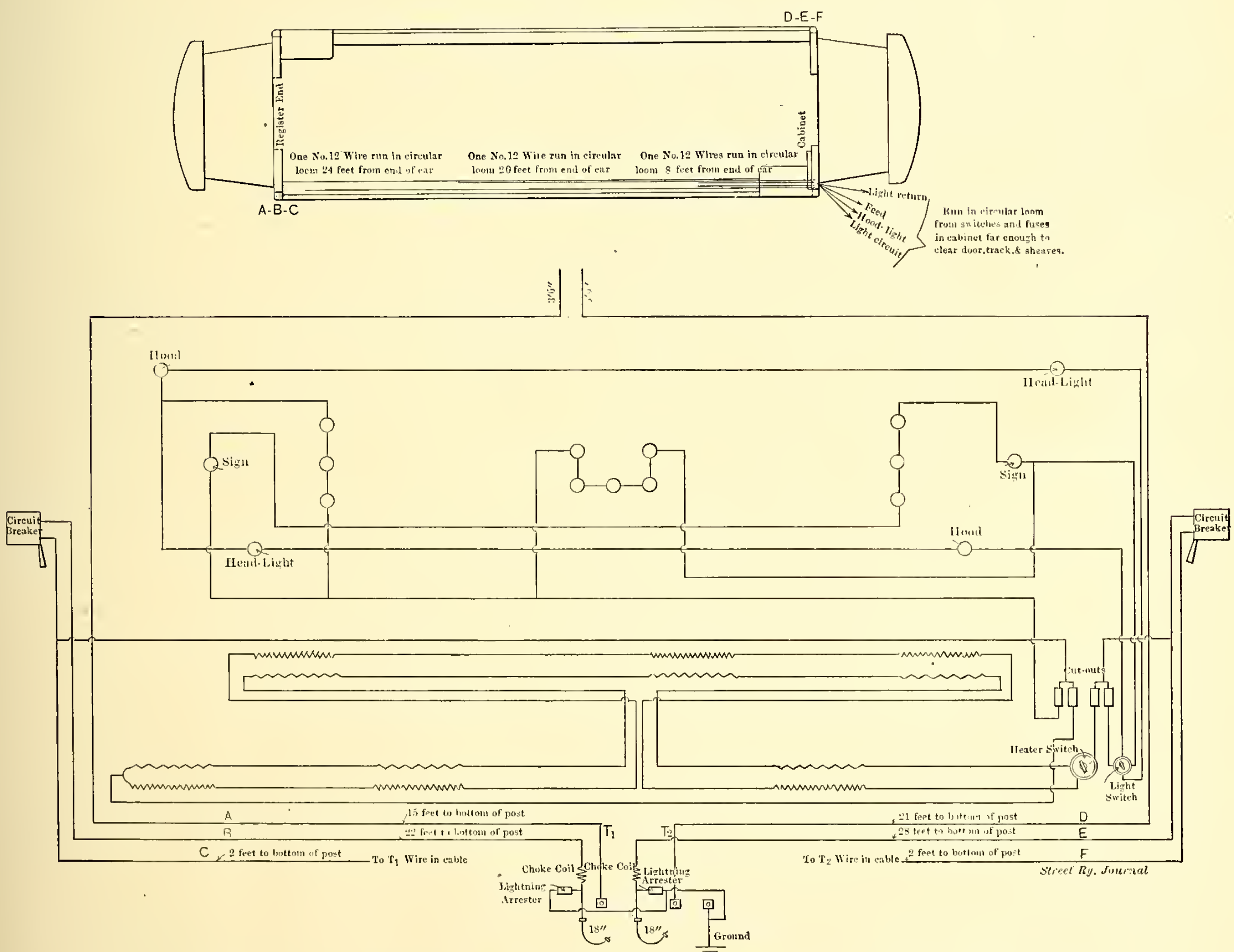


FIG. 2.—STANDARD WIRING DIAGRAM FOR TROLLEY, LIGHTS AND HEATERS, WASHINGTON CAR

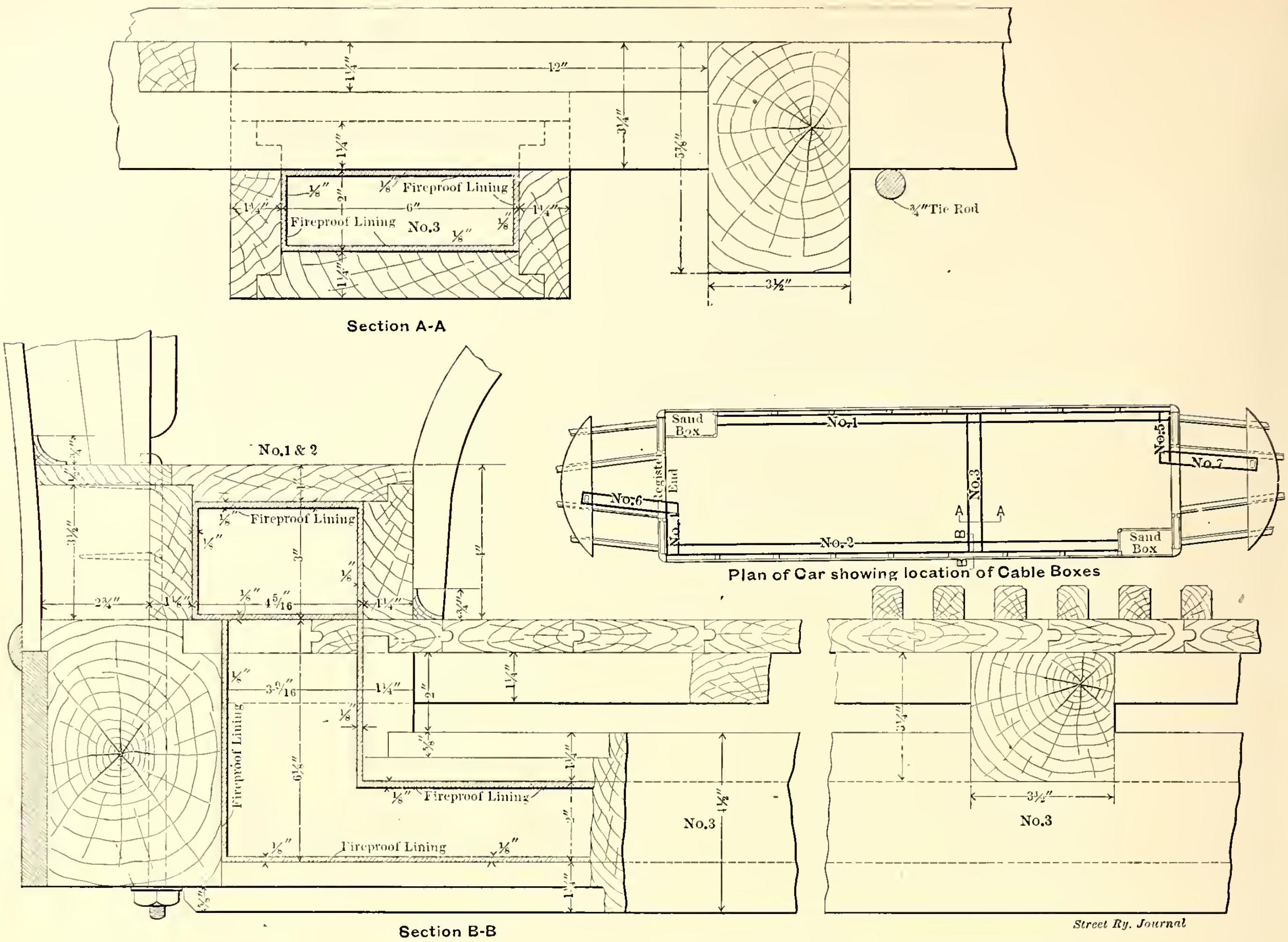


FIG. 3.—PLAN OF CAR AND DETAIL SECTIONS OF CABLE BOXES NOS. 1, 2 AND 3, WIRING SCHEME FOR WASHINGTON CAR

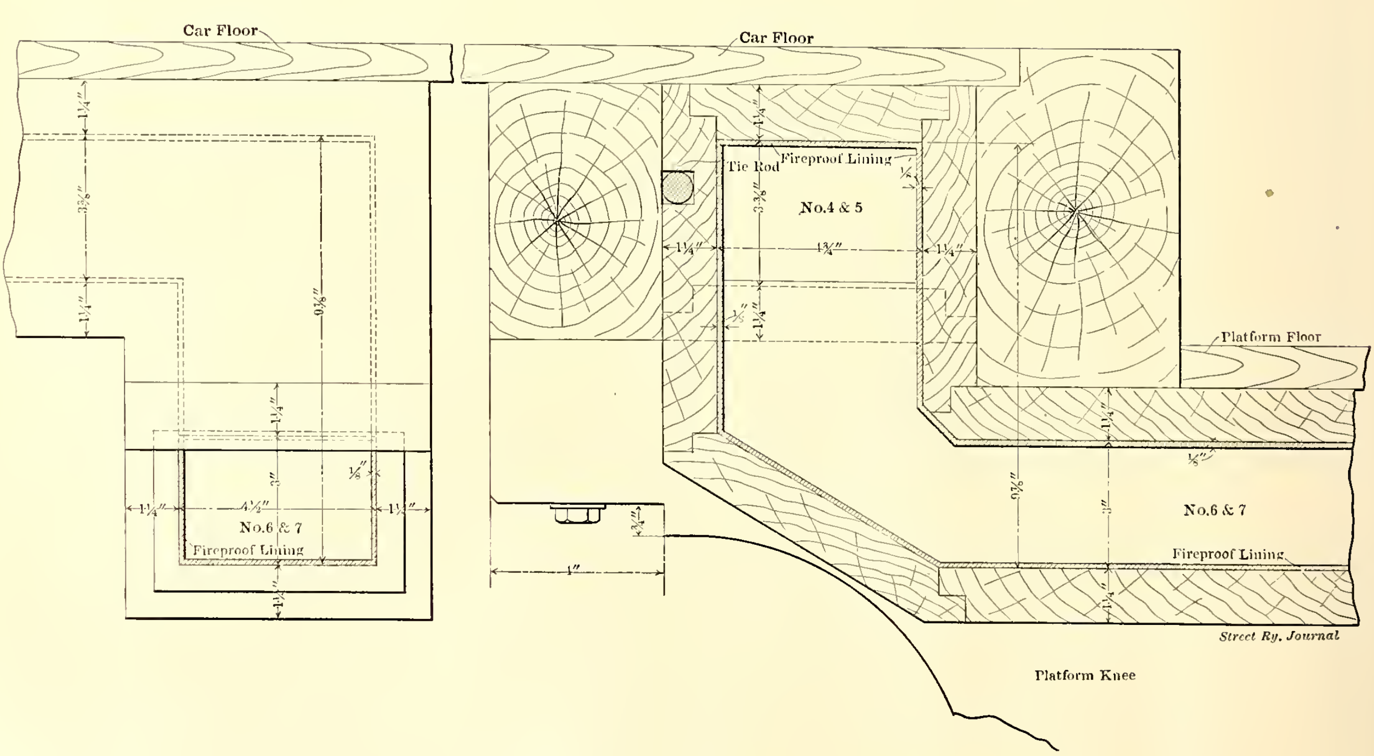


FIG. 4.—DETAIL SECTIONS OF CABLE BOXES NOS. 4, 5, 6 AND 7, WIRING SCHEME FOR WASHINGTON CAR

The power circuit includes cables from controller to controller, connections to rehostats, connections to motors and mains to trolley and to plow.

The power cables are entirely enclosed from controller to

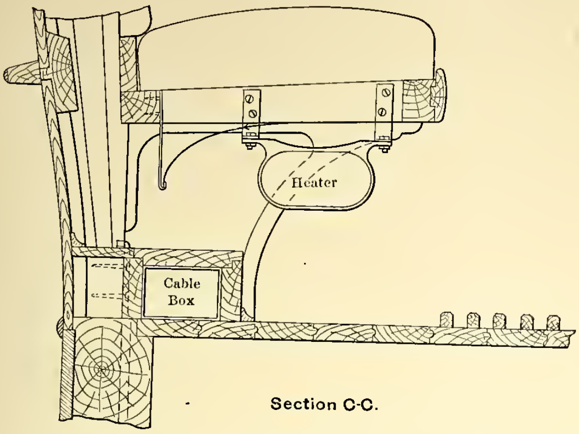


FIG. 6.—DETAIL OF SEAT, HEATER AND CABLE BOX, WASHINGTON CAR

controller in a wooden box with fireproof lining. The box runs under the platforms to the end sill, crosses behind the end to the side sill, enters the car, and runs the full length of the car under the seat. Near the center of the car the two longitudinal boxes are connected by a box running across the

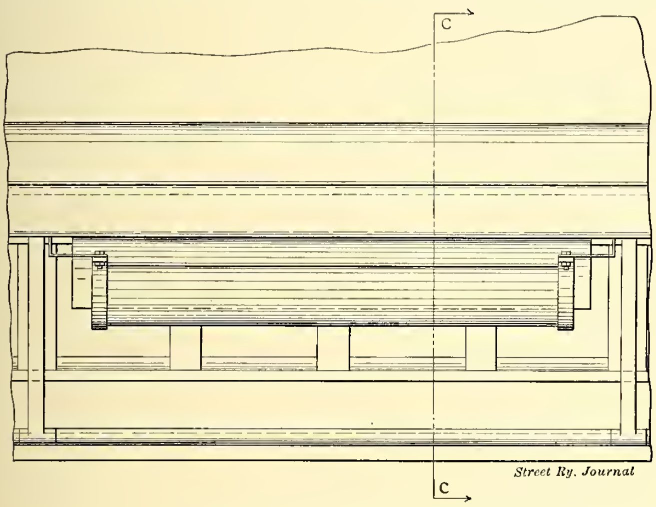


FIG. 7.—ELEVATION OF SEAT, SHOWING ARRANGEMENT OF HEATER, WASHINGTON CAR

car underneath. The cables cross through this box. They are thus well protected from fire, and from water and from mechanical injury, and are easily accessible. The connections to motors are covered with a flame-proof braid, and are enclosed in circular loom. This loom starts inside the cable

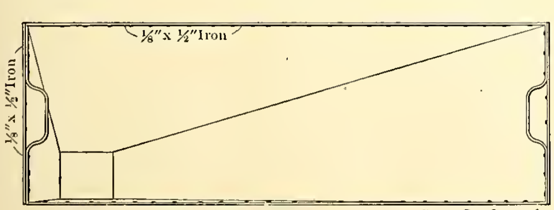


FIG. 10.—PLAN OF SAND-BOX, WASHINGTON CAR

box. For the motor connections there is provided a junction box (see Fig. 5), which consists of a wooden box lined with fireproof material. There are no exposed connections. Motors are drilled on the side nearest the center pin to reduce the "swing" to a minimum,

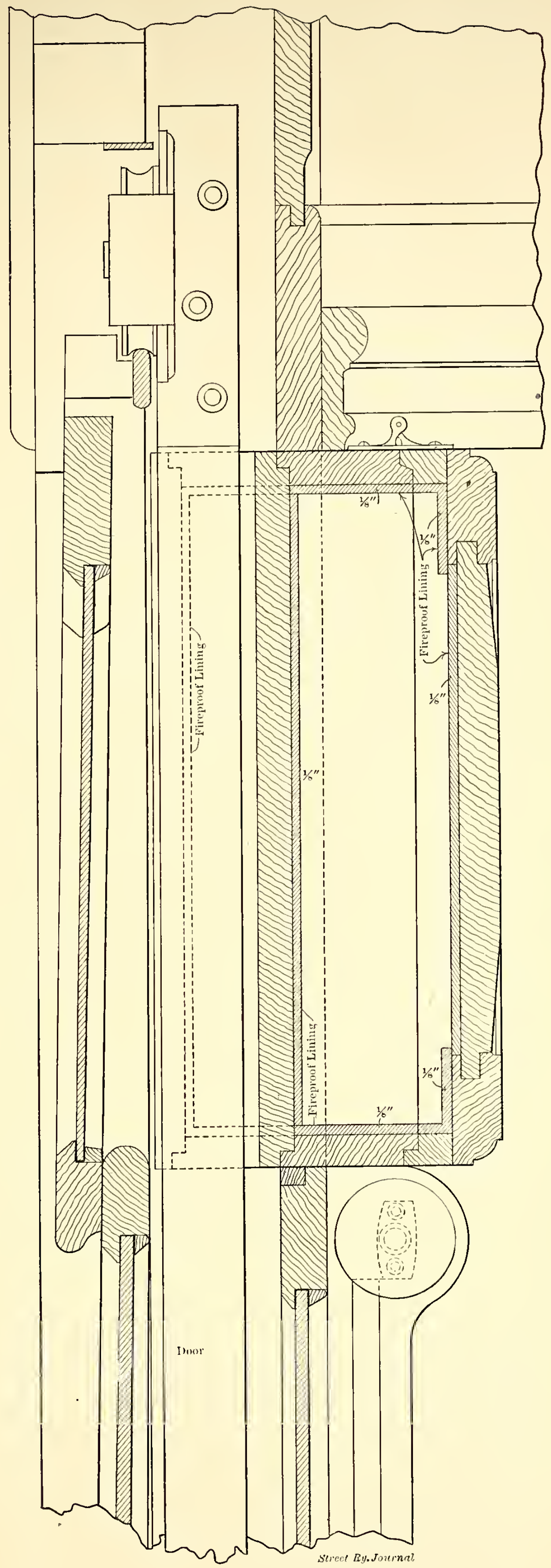
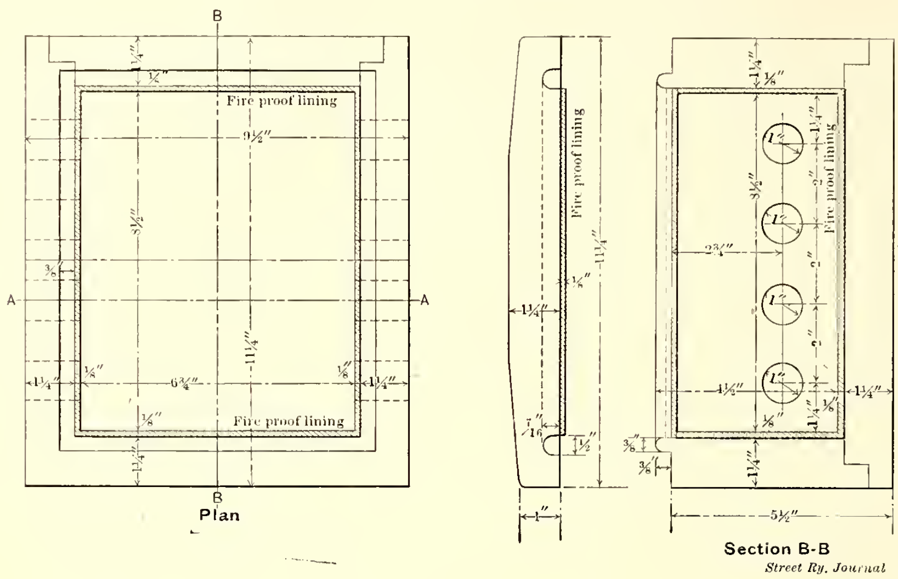


FIG. 9.—SECTION SHOWING LOCATION OF SWITCH CABINET, WIRING SCHEME FOR WASHINGTON CAR

The mains to the trolleys are brought down through the corner posts to the cable box. For metallic circuits, the circuit breakers are placed on each side of the line. The mains to the plow are carried in circular loom to the cable box. All wires not in the fire-proof box are covered with flame-proof braid. Plan of the car showing the arrangement of cable boxes is shown in Fig. 3, and sections of the boxes at different points are shown in Figs. 3 and 4.



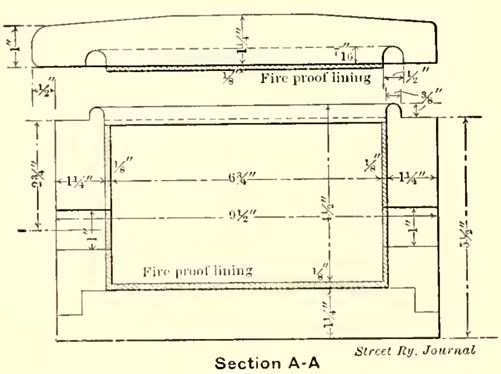


FIG. 5.—JUNCTION BOX FOR MOTOR LEADS, WASHINGTON CAR

The car seats are carried on malleable iron brackets and are open underneath. This eliminates the accumulation of dirt, which is unsanitary and is liable to cause fire.

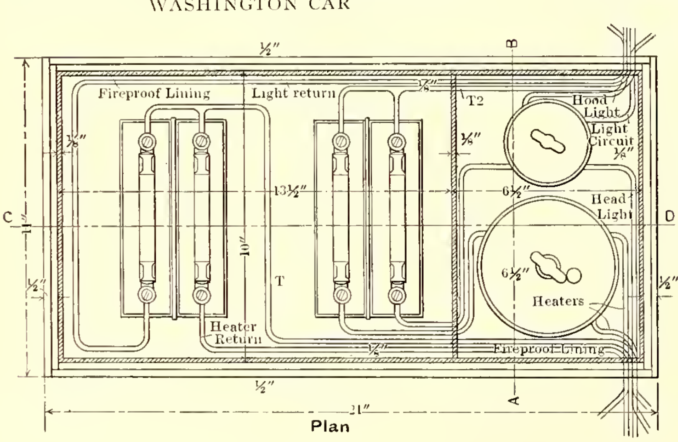
The heaters are hung under the seats, which are protected by a curved sheet of tin with proper air space, which also promotes the circulation of heat. The heater wires are run in the cable boxes, and in circular loom, and the connections to the heaters are completely covered with circular loom. For short spans between the heaters, the wires are run in fireproof moulding. The arrangement of seats and heaters is indicated in Figs. 6 and 7.

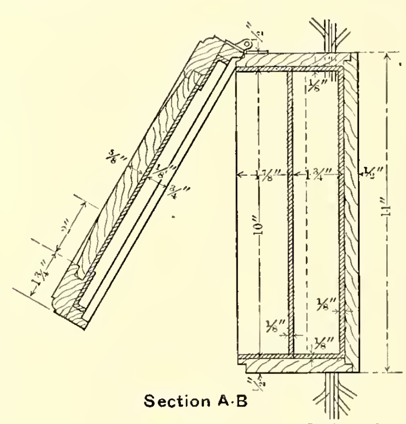
In one corner of the car a switch cabinet is provided, containing the heater switch, the light switch (two circuits), and the positive and negative fuses for both the heaters and the lights. This cabinet is lined with fireproof material, and wired in circular loom, and the wires running up from this cabinet above the door sheaves are covered with circular loom, as are also the wires running down from the cabinet to the cable box. The switch cabinet is illustrated in Figs. 8 and 9.

The light and heat wires throughout the cars are flame-proof. For the lights wireless clusters are used.

For lining the cable boxes and for fireproofing in general, transite or asbestos building lumber is used. The rehostats are supported on iron insulated from the floor by fireproof material. Rubber bushings are used where wires pass through floors, partitions and the sides of cable boxes. The trap doors are lined with transite board, bound at the edges with iron straps.

The ground wires are attached to the body center bearings and when necessary, the truck center bearings are grounded to the truck in a substantial manner.





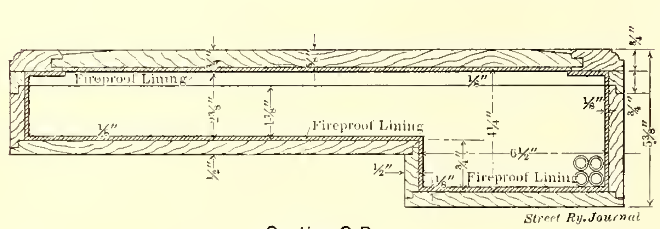


FIG. 8.—DETAILS OF SWITCH CABINET, WIRING SCHEME FOR WASHINGTON CAR

The scheme of fire protection is extended to the sand box, which is of special shape to give room for the inside cable box. The sand box (see Fig. 10) is made of galvanized iron and around the top has a binding strap of iron which at the ends is bent to form handles by which the box can be lifted out. The box and casing is painted with weather-proof paint. It will thus be seen the protection of cars against fires includes the covering of exposed parts of the under-framing with fireproof material, the housing of straight runs of cables in fireproof lined boxes and in circular loom at entering and leaving points, and the prevention of accumulations of dirt, dirt being considered one of the most frequent causes of fires on cars.

The Western Ohio Railway Company, of Lima, Ohio, in connection with the Dayton & Troy and the Toledo, Bowling Green & Southern, will place through cars in service between Dayton and Toledo on or about May 1.

THE ADVANTAGES OF THE INTER-POLE DESIGN IN RAILWAY MOTORS

BY G. HERBERT CONDICT

The Electro-Dynamic Company, of Bayonne, N. J., has made such a great success of the inter-pole type of motor for stationary purposes, it has been decided to enter the electric railway field with a railway motor embodying the inter-pole features. A number of tests have recently been made by the company of motors designed for this work, and most encouraging results have been secured. It has been demonstrated beyond all question that the inter-pole type of railway motor is far in advance of anything that had heretofore been brought out in a direct-current practice. The motor excels particularly in the following features:

1. The motor is absolutely sparkless under all conditions of operation up to voltages as high as 2000. There is no doubt that the voltage can be raised to a much higher figure even than 2000 volts; the only limit is the question of insulation.

2. A much greater flexibility in speed regulation can be secured. This is owing to the fact that the motor will operate satisfactorily with its fields weakened to almost any extent. In the tests mentioned, motors of 40-hp capacity have been run with only 8 per cent of their normal fields at 200 per cent overload, with absolutely no sign of a spark.

3. In the inter-pole railway motor, a much greater torque per ampere can be obtained for a given amount of material, owing to the fact that more conductors may be placed upon the armature than in the ordinary type of railway motor for a given field strength.

4. For a given service, the inter-pole motor may be made much smaller than a motor of any other type, or conversely, a much larger output can be secured from a given size of motor. To cite a specific example, in the design of a 200-hp railway motor, for high-speed trunk line service with high voltages, it has been possible to increase the track clearances to about three times what they would be with an ordinary railway motor of equal capacity.

5. As high voltages can be used, much lower cost of installation results, as less copper is used in the transmission circuits. This also allows of the use of a multiple-voltage system on electric railways. Low voltages can be used in towns and cities, and other places where low speed is desirable, and high voltages in suburban districts where high speeds are allowable. This advantage is secured with a single controlling equipment.

To illustrate in a graphical way some of the advantages secured from the use of the inter-pole railway motor, several diagrams are presented herewith, and illustrate the following features:

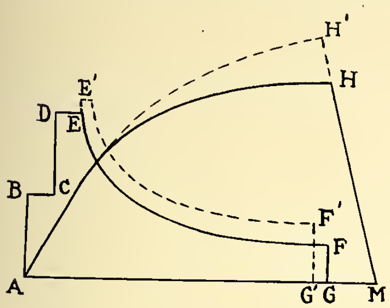


FIG. 1

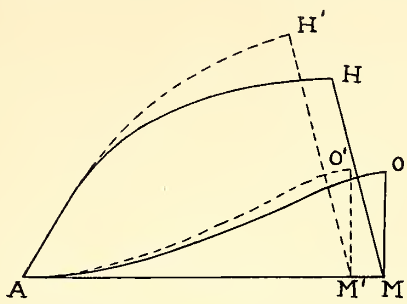


FIG. 2

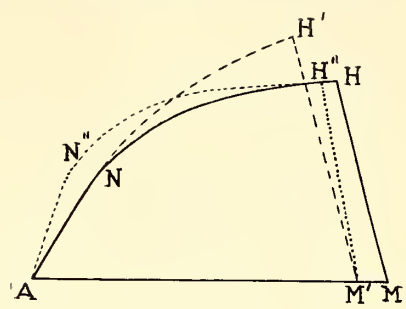


FIG. 3

Fig. 1 is a speed-time curve of the usual form, and shows that higher average speeds can be made without increasing the starting currents and breaking pressures. It will be noted in this curve that the full line, AH represents the speed secured from an ordinary railway equipment, while the line AH′ shows the speed curves with the inter-pole motor. As will be seen, higher average speeds may be secured with the inter-pole motor with the same rates of acceleration and retardation, that is, a greater distance may be traveled in a given time.

Fig. 2 is a diagram which shows that, with a given acceleration and a fixed rate of braking, a given distance can be covered in a shorter time. The distance MO is covered in the time AM by the ordinary equipment, and in the shorter time AM′ by the inter-pole equipment. When it is desired to make up time with the ordinary equipments, it is necessary to increase the rate of acceleration and also the rate of retardation.

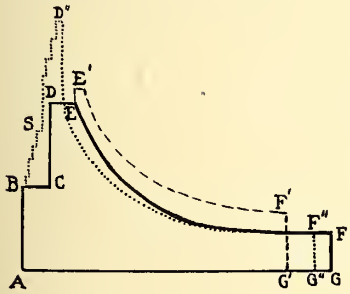


FIG. 4

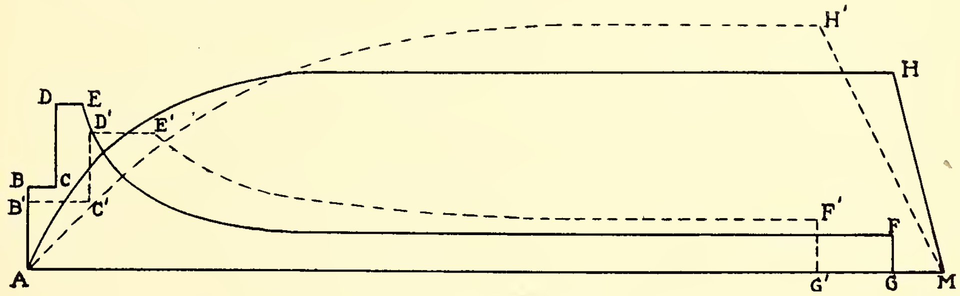


FIG. 5

In Fig. 3 it will be noted that the inter-pole equipment, with the same rates of acceleration and retardation as in ordinary running, will make up time without causing discomfort to the passengers or subjecting the apparatus to the great strains due to increased acceleration and retardation which would occur in the operation of the ordinary equipment. In this figure AN″ H″ M′ represents the make-up time conditions with this latter type of equipment, while A N H′ M′ represents the conditions with the inter-pole equipment.

Fig. 4 shows the power required to make up time in runs where the accelerating and braking periods form the larger part of the running time. The extra power required is furnished at more efficient positions of control with the inter-pole type of equipment.

An interesting diagram is shown in Fig. 5, where it will be noted that the same schedule speeds may be made with smaller starting currents and lower brake pressures with the same amount of energy consumption. From this diagram, it will also be noted that the maximum load, as well as the variation of load on the power house, will be less for a given schedule speed if inter-pole equipments are used.

The advantages cited above are more apparent the longer the run. In a specific case for which calculations have been made for a double equipment of 40 hp, inter-pole motors on a 17-ton car, a saving of 25 per cent in energy was found to be possible in a one-mile run, retaining the same schedule made with ordinary motors. The possibility of operating the motors with weakened fields allows a saving in energy, from the fact that very much less resistance in the parallel positions will be used in getting the motors up to full parallel running position. This is an advantage which will show more particularly in short runs, or where the controller is thrown on and off frequently.

The Electro-Dynamic Company will soon give out for publication its designs of high-speed railway motors, fitted with inter-poles and especially designed for trunk-line service, as well as curves, data, figures and weights, all of which will prove of great interest, and will show what a revolution is being produced by the use of the inter-pole design in this class of railway service.

COMPARISON OF EARNINGS OF PROMINENT STEAM AND ELECTRIC RAILWAYS IN OHIO

An interesting comparison has just been made between the passenger earnings of steam and electric roads by a Cleveland financial expert. The figures taken were the passenger earnings of the Lake Shore & Michigan Southwestern Railroad, one of the most prosperous steam roads in the country, as compared with the Lake Shore Electric Railway, which closely parallels the steam road and which, while it is a comparatively old electric line, has not by any means reached a maximum earning capacity and is making tremendous gains. Of the $38,000,000 gross earnings for the steam road last year, $7,676,000 was derived from passenger earnings. The road operated 1520 miles of track, so that its passenger earnings were $5,050 per mile of track. The Lake Shore Electric is operating about 170 miles of track, and its earnings this year will reach $1,000,000. The earnings are practically all from passengers, or about $5,500 per mile of track for the passenger service. The comparison, of course, is not exactly a fair one to the steam road, because, based on the earnings, a greater portion of the trackage should be charged to the freight department. But by making the necessary mental allowance, the parallel is a significant one.

To go farther into the comparison, the Lake Shore Electric, Cleveland & Southwestern and Cleveland, Painesville & Eastern roads, embracing about 340 miles of track, are all in the territory of the steam roads mentioned, and are earning in excess of $5,000 per mile from passenger earnings, or almost equal to that of the steam road, with its high-speed trains and magnificent equipment. This suggests that, when the chain of trolley lines between Buffalo and Chicago is fully completed and the various lines become as well developed as the three roads mentioned, the aggregate of earnings will almost equal the passenger earnings of the Lake Shore & Michigan Southern. With the building of numerous feeder lines to these more important interurban lines, they will within a few years exceed the parallel traffic of the steam road.

CORRESPONDENCE

OIL SEPARATORS IN THE LONG ISLAND CITY POWER STATION

Philadelphia, Pa., April 14, 1906.

EDITORS STREET RAILWAY JOURNAL:

Upon reading the article in your issue of April 7, descriptive of the Pennsylvania Railroad Company's Long Island City power station, we find a point to which we would take serious exception. We quote from the last few lines of the first column on page 541: "The Westinghouse single-acting engines driving auxiliary machinery do not send their exhaust steam to this heater on account of particles of crank case oil that may work into the exhaust."

While the engineers of this plant may not believe that the crank case oil can be removed from the exhaust steam by an oil separator, and while it may be true that many makes of oil separators are not efficient enough to remove this oil, it is a positive fact that the Cochrane oil separators, when installed to meet these conditions, will remove this oil. The exhaust steam from the Westinghouse single-acting engine in our own plant has for years been passed through a Cochrane oil separator into a Cochrane feed-water heater, from which our boilers are fed, and we have absolutely no trouble from oil in the boilers. We could give you the names of a number of other plants in which our Cochrane oil separators give thoroughly successful and satisfactory service in taking the oil out of exhaust steam from Westinghouse engines.

HARRISON SAFETY BOILER WORKS,
R. H. Ramsey.

ASH-DUMPING DEVICE FOR HOT-WATER HEATERS

Springfield, Ohio, April 10, 1906.

EDITORS STREET RAILWAY JOURNAL:

The writer has noted upon many occasion the utter disregard for cleanliness during the cleaning of ash pans of car heaters. In a great many instances no pan is used, and when the ash pit is full to overflowing, the ashes are carried to the door on a small-sized street car shovel, and then thrown away. This plan not only produces a great deal of dust, but also leaves a trail of clinkers upon the floor of the car.

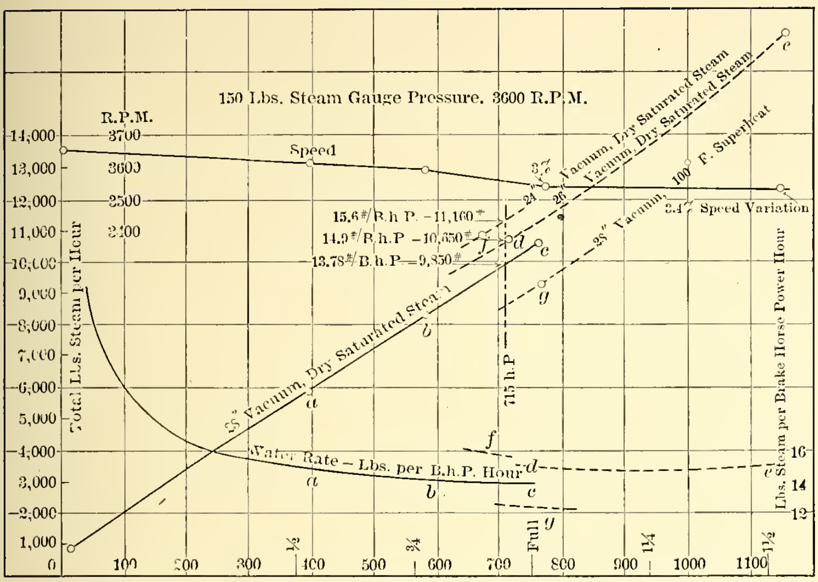
Instead of providing an ash pan beneath the grate, the bottom of the ash pit or box should be fitted with a door or grate, sliding forward. This grate, when open, should communicate with a hopper, which in turn could protrude through the car floor. This would allow the ashes to fall through to the ground beneath whenever the hopper was to be dumped. The whole outfit, as described, could be constructed from thin steel plate. Such a proposition is well worth consideration of every operator, for time and again the writer has been incommoded by the crude method of dumping ashes just described.

C. B. ROSS.

The Toledo, Fostoria & Findlay Railway Company has contracted for an automobile bus with a capacity of 12 passengers, which will operate between Prairie Deport and Billmans, a distance of two miles, giving the first mentioned town connection with all cars.

EFFICIENCY TESTS OF A 500-KW. TURBINE

Ludwig & Co., consulting and supervising engineers, of Atlanta, Ga., recently conducted an efficiency test on a 500-kw Westinghouse-Parsons turbine for mill work in Atlanta. The turbine was designed to develop normally 750 B. H. P., with a steam pressure of 175 lbs. at the turbine throttle, 150 degs. F. superheat, 28 ins. vacuum absolute, i. e. (reduced to 30-in. barometer) and when running at a speed of 3600 r. p. m. The tests were made to determine the fulfillment of the build-



PERFORMANCE CURVES OF A 500-KW TURBINE

er's guarantees and the general running qualities of the turbine under ultimate conditions of service.

Although the turbine will eventually drive a 500-kw polyphase generator of the revolving-field type, it was particularly desired to obtain results at the turbine shaft. Consequently, brake tests were performed, separate electrical tests being made upon the generators in the shops of the builders. The turbine was subjected to different loads by means of a water absorption brake, operating upon the same principal as the Prony brake. The results were computed in like manner.

The main results are presented in the accompanying diagram.

ADVANTAGES OF T-RAIL IN CITY STREETS

The development of interurban roads has called renewed attention to the desirability of the use of T-rails in paved streets. In response to a recent request for information, B. V. Swenson, secretary of the American Street & Interurban Railway Association, prepared a short report on this subject. Some of the reasons why T-rails are superior to girder rails in paved street are given in the report as follows: (1) The paving can be maintained in far better condition with T-rail than with girder rail. (2) The wear on the paving is reduced, owing to the fact that the vehicular traffic will distribute itself over a larger surface of the street instead of attempting to make use of the area adjoining the electric railway tracks. (3) As vehicles will not make so general use of tracks laid with T-rail, the number of accidents due to collision of cars and other vehicles is materially reduced. (4) With T-rails there will be a material reduction of broken wheels and axles on wagons and other vehicles, due to the wrenching of wheels by reason of the groove in grooved girder rails. (5) T-rails have all the advantages of grooved rails, with none of their disadvantages. (6) The T sections give a stronger structure with less metal than the girder sections. This is an important feature in eliminating, in so far as possible, a foreign element in the make-up or construction of the pavement. (7) The joint troubles are materially reduced by reason of the physical construction and form of T-rail as compared with girder rails. Hence T-rail gives an easier riding track and insures greater comfort to the passengers than when the cars are run upon girder rails. (8) Actual experiments have demonstrated that cars passing over T-rails do not make nearly as much noise as when passing over girder rails, and T-rail construction will, therefore, reduce the noise incident to electric railway operation. (9) The T-rail entirely eliminates the delays and annoyances caused by snow, ice and dirt filling the grooves of girder rails. T-rail construction will, therefore, facilitate car movements and permit a more regular service. (10) It is the recognized law of economics that that which accomplishes the same result for less capital, outlay or investment reacts to the general good, weal and welfare of the people or public as a whole.

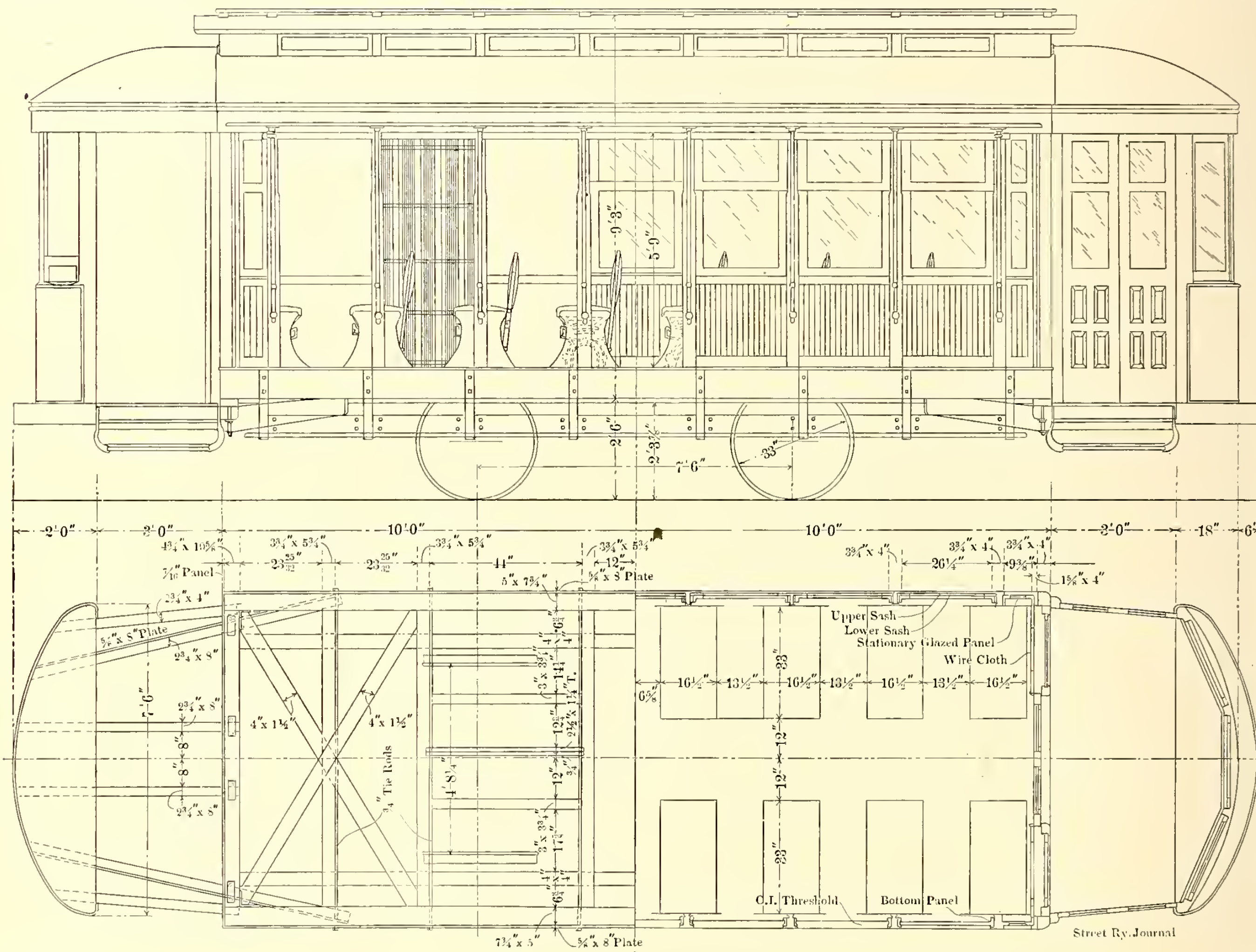
After stating that these arguments had been suggested by W. E. Harrington, of J. G. White & Company, the report refers to the benefits to villages and cities afforded by modern electric interurban railways, and the necessity of providing a rail on which they can enter the terminal cities. In the present stage of the art, nothing will accommodate satisfactorily the wide tread and deeper flange of wheel required by these cars except a T-rail section. A refusal to permit T-rail to be laid in city streets, therefore, will act as a direct obstacle to electric railway development and consequently as a serious check to the progress and welfare of the community. Examples of communities, among many in which T-rail has been laid, and is now in use with the entire sanction and approval and to the satisfaction of municipal authorities, the public and the railway companies, are the following: Milwaukee, Minneapolis, Denver, Indianapolis, Cincinnati, Dubuque, Ia., Battle Creek, Kalamazoo, New Haven and Montreal, Can. As indicating the general trend of opinion in this direction, it may be stated that a considerable stretch of T-rail for electric railway operation is now being laid on Boylston Street in Boston.

The Indiana lines operated by C. C. Reynolds, of Indianapolis, which include the Indianapolis & Northwestern, the Indianapolis & Eastern, the Richmond Street & Interurban and the Indianapolis & Martinsville, will be actively represented in the baseball field this season. W. R. McKowan, heretofore general passenger agent of the Indianapolis & Eastern, who in the past has given considerable attention to the baseball business on his line, will devote his time almost exclusively to the business of the Indiana Interurban League, which will be the title of the association. The cities of Richmond, Greenfield, Lebanon, Frankfort, Martinsville, Lafayette and Crawsfordville will be represented by teams, and in the majority of these places the games will be played in parks operated by the traction companies. The companies will help to maintain the teams, will offer prizes to the winning organizations and provide transportation. Mr. McKowan will be in charge of schedules and arrangements and will act as referee in matters of dispute. He is an ex-professional ball player and has had long experience in baseball management.

A NEW LINE OF CONVERTIBLE AND SEMI-CONVERTIBLE CARS

The new full and semi-convertible cars now being built by the St. Louis Car Company embody several interesting features. Both designs are radical departures from others that have been employed. As they involve the same principles, the description of the full-convertible type, with a few changes, will apply equally well to the semi-convertible car. The sides of the car are constructed of posts, 3¾ ins. thick, and are grooved to receive three movable sections that close the opening between the posts. The sections consist of the top and bottom sash and a lower section of wood, which closes the space below the lower sash. When the car is converted to an open one, the three sections between each set of posts are pushed upwards and rest in a pocket between the lower deck roof and the lower deck headlining. The car has been designed to eliminate the usual objection to convertible cars, the sticking of the sash when the posts become slightly out of square, and this is accomplished by making each section slightly narrower than the one above it and arranging each of the two lower ones to slide into guides or channels attached to the section above. On either side of the lower sash, at a distance of ⅜ in. from the edge, a brass channel is screwed, extending the full height of the sash. When the lower section is raised, by means of handles screwed to it, it slides up into these guides until it strikes the closed ends of the channels at the top. A further effort to raise the lower panel carries the lower sash with it, and into similar channels screwed to the top sash, and when the lower section is raised still higher all three sections are carried into the pocket previously referred to, and an angle iron rest or seat fastened to the inside of the letter board holds them in place. When the car is converted from an open to a closed one it is necessary simply to grasp the handle on the lower section and pull forward until the sections are free from the angle iron support, and then one after another they fall into their proper places. About 10 minutes is required by the motorman and conductor to open up a car with a 20-ft. body, and the car can be closed in a much shorter time.

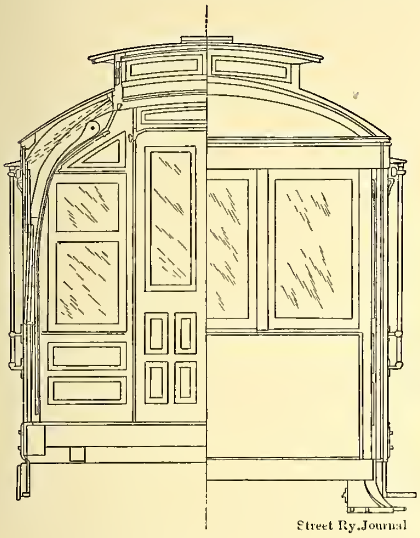
Sticking of the sash when the posts are slightly out of true is avoided, as has been said, by making each section narrower than the one above it. The two lower sections are in contact with the posts only when in their lowered positions, for when they are raised they withdraw from the posts to slide into the channels attached to the section above. The top section is so short that the posts would have to be out of square an unusual amount before it would bind. The sash can be raised independent of each other, and this permits the car to be arranged as a semi-convertible one, by allowing the lower section to remain in position and raising only the two upper sash. If desired, the upper one alone can be raised for ventilation. The lower sash can, of course, be raised as in the ordinary type of closed car. When the three sections are all in their lowered positions they fit snugly into place, and all rattling is avoided. They are also arranged to overlap an amount equal to the width of the sash rail and are fitted into the pockets in such a manner that they press against each other, making all the joints practically air tight.



SIDE ELEVATION AND PLAN OF CONVERTIBLE CAR, ALSO SHOWING FLOOR AND PLATFORM FRAMING

The curtain is placed in the upper portion of the pocket above the headlining, and grooves permit it to be pulled down to the floor. The pocket is provided with a hinged door, just under the deck sill, to give access to the curtain. The convertible type of car is provided with grab handles on the posts, arm rails and running boards, and cast-iron panels at the base of the posts.

The semi-convertible type differs from that of the convertible car in that the two sash only are designed to raise. Guides are placed only on the upper sash. The pockets into which the sash are raised are practically the same as in the open car. The running boards and the grab handles on the posts are, of course, absent. The semi-convertible cars now being completed have side sills consisting of a ⅜-in. x 15-in. steel plate sandwiched between wooden members. The plate extends above the floor of the car and serves to secure in place the side posts, which are screwed to it, as well as to brace the car and eliminate the necessity of an inside truss.



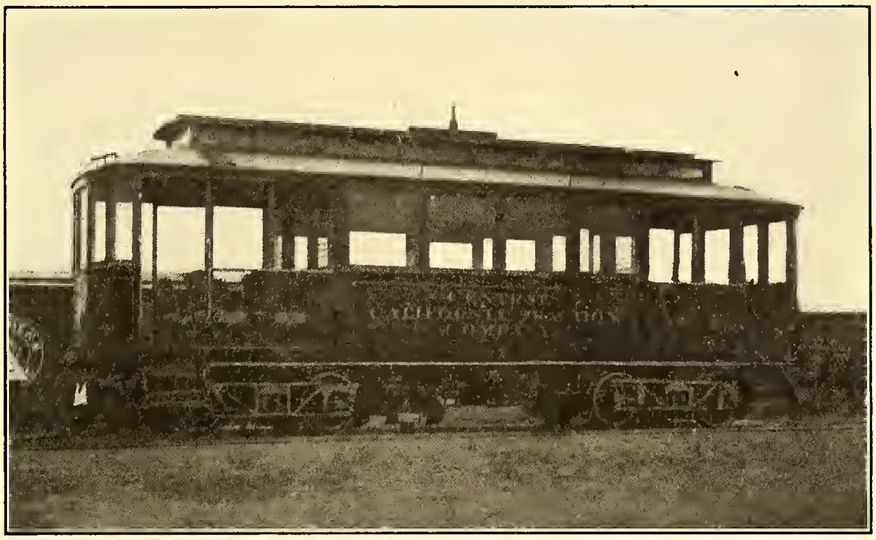
END ELEVATION OF CONVERTIBLE CAR

FLEET OF STEAMERS BUILT BY THE TWIN CITY RAPID TRANSIT COMPANY TO HANDLE EXCURSION TRAFFIC ON LAKE MINNETONKA

The Twin City Rapid Transit has just built a fleet of nine steamers for use on Lake Minnetonka in connection with its two new electric lines to that resort. There are three double-end, double-deck ferries, each 100 ft. long, and with a capacity of 1000 passengers, to ply between the company's terminal at Excelsior and Big Island Park, the Twin City's new amusement resort in midlake, and six empress steamers, each 70 ft. long, and having a capacity of 150 passengers and a speed of 15 m. p. h. These will trail the lake's shores and pick up cottagers for the electric lines. The Twin City has also purchased three other fast excursion steamers, so that the fleet of 12 steamers has a total carrying capacity of nearly 5000 persons. Three lines of sightseeing cars will be put in service shortly by the Twin City Company, ranging in time from 3 hours to 5 hours each, and in cost from 50 cents to one dollar. "The Twin City Sightseer" will include St. Paul and Minneapolis, "The Wildwood Sightseer" both cities and Wildwood, on White Bear Lake, and "The Minnetonka Sightseer" both cities and Lake Minnetonka, a tour of which, on a special boat, will be included.

NEW CARS FOR STOCKTON, CAL.

Stockton, Cal., is a city of 20,000 inhabitants, situated in central California, and is served with a very efficient street car service by the Stockton Electric Railway and the Central California Traction Company. The latter company has lately increased its equipment by an additional five cars, built by the John Hammond & Company car works, of San Francisco, Cal. These cars, as may be seen in the accompanying illustration, are of the California double-end type, which has become the style of car almost universally used on the Pacific Coast, where climatic conditions and its general popularity have made this type of semi-closed car practically a necessity. It has a length over all of 32 ft. with a width of 8 ft. 3 ins. on bodies. The closed compartment in the center is 14 ft. 1 in. long, and fitted with upholstered seats running longitudinally, while the open sections at each end have a length of 8 ft. 3 ins. each. Standard walk-over seats are used in these outside compartments, which have a seating capacity of 16 persons. The interior finish is in cherry with nickel trimmings. The eight windows, four to each side, drop into sockets covered with flats, and plate glass is used exclusively for lighting, except for the sky lights, which are of plain glass. The sides of the car are straight and covered with sheet steel, as are also the ends. The exterior is painted with Sherwin-Williams mohawk red, with letters and striping in gold, presenting a particularly pleasing appearance.



ONE OF THE NEW DOUBLE-TRUCK CARS FOR THE CENTRAL CALIFORNIA TRACTION COMPANY

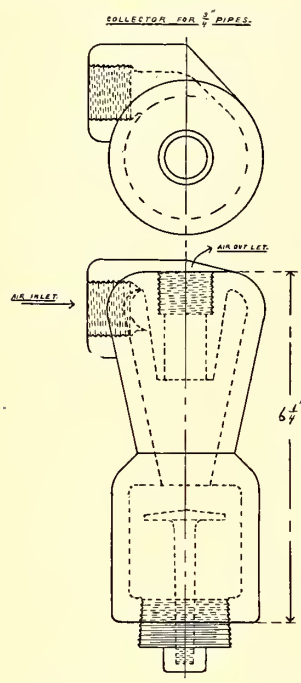
The cars are mounted on standard gage double trucks, also designed and manufactured by this company, and have a wheel base of 5 ft. 3 ins., 4½-in. axles, with wheels 30 ins. in diameter and 3½-in. tread. The frame is made entirely of steel, with inside-hung type 92A Westinghouse motors of 35-hp capacity. All the cars were delivered in Stockton completely equipped and ready for operation.

The Lake Shore Electric Railway has announced that, beginning May 1, it will increase the number of Cleveland-Toledo limited trains from three to five each way daily, and that it will begin the operation of two-car and three-car trains on these runs. The new cars, which will be delivered about that time, will be among the finest interurban cars in service. The line between Cleveland and Lorain is now being double tracked, and it is announced that the double-tracking will be eventually extended to include the entire main line.

AN AIR PURIFIER

A troublesome feature in the operation of air brakes, and, in fact, all pneumatic devices, is the presence of dirt and moisture in the air. Dirt proves most troublesome around triple valves on automatic air brake systems, where it may prevent the operation of the brakes. Moisture is a common cause of trouble during freezing weather around valves and moving parts in all kinds of compressed air apparatus. Large drums are sometimes used in the pipe lines, so that the moisture and dust will have time to settle. Drums for this purpose are valuable only when the velocity of the air through them is very low. Screens in the pipes strain the air and catch all the particles that cannot get through the mesh of the screen, in time clogging up the screen, yet letting small particles through.

A device which has been remarkably successful in keeping dirt out of triple valves on automatic air brake equipments on steam railways has recently been specified for use in connection with the electro-pneumatic multiple-unit control system on the new cars now being built for the Metropolitan West Side Elevated Railway, Chicago. A sectional drawing of this device is shown herewith. It consists of two chambers, an upper or separating chamber, and a lower or settling chamber. The air inlet which is at the top of the separating chamber is so designed that the entering air takes up a whirling motion around the walls of the chamber. The solid matter, such as dirt and moisture, is then thrown by centrifugal force against the outer walls of the chamber, while purified air passes up through the opening in the center. The impurities fall into the settling chamber below. The outlet for the air is in the axis of the vortex of air in the chamber, consequently nothing but pure air is drawn into the outlet. The principle is one which has been employed successfully for many years in dust and shavings collectors in planing mills. To prevent the impurities in the lower chamber being drawn up by the vortex after they have settled, the pedestal or cap shown in the drawing is used. The accumulation of dirt in the collecting chamber is removed without difficulty by unscrewing the plug at the bottom. Where there is much moisture a pet cock can be placed at this point.



OUTLINE AND TOP PLAN OF AIR PURIFIER

An efficiency of 100 per cent is claimed for the device, based on tests in which a known weight of water and dust was introduced in the supply pipe and the amount accumulated in the collecting chamber weighed after passing through the separator. This test shows that practically all the foreign matter is removed from the air. The device should preferably be inserted in piping systems as near to the apparatus to be protected as possible. On automatic air-brake systems it is located at the inlet to the triple valve. Previous devices to free the air of impurities have employed screens or packing, which partially obstruct the passage, and as dirt and moisture accumulate, the passage is obstructed still more, until finally the supply may be completely shut off. The device under description depends upon centrifugal force for its action, and does not in any way obstruct the passage. The accumulation of dirt and moisture in the triple valve of automatic air-brake systems requires them to be cleaned on passenger cars every three months on some roads, and at least every six months, to comply with M. C. B. requirements. Double that period is allowed on freight equipments. The length of time that a triple valve will operate is dependent upon the accumulated dirt. By keeping out the dirt, the length of time it will operate without attention will depend upon the lubrication, and the fitting of the parts. This collector is being put on the market by the Derby Manufacturing Company, of Burlington, Iowa.

SEMI-CONVERTIBLE CARS FOR MERIDIAN, MISS.

The Meridian Railway & Light Company has recently added new equipment to its road to the extent of five new cars, embodying the Brill grooveless post semi-convertible feature, the order being entrusted to the American Car Company, of St. Louis. The cars are 18-ft. long over the bodies. This length, which is considerably shorter than present practice, was adopted because of unusually heavy grades, one of which is 7 per cent for quite a distance. Although last year the city of Meridian was visited by the yellow fever, and the quarantine necessary effected its commercial interests severely, the city is in a flourishing condition, its outlook for the future is bright and the conditions sufficiently favorable to

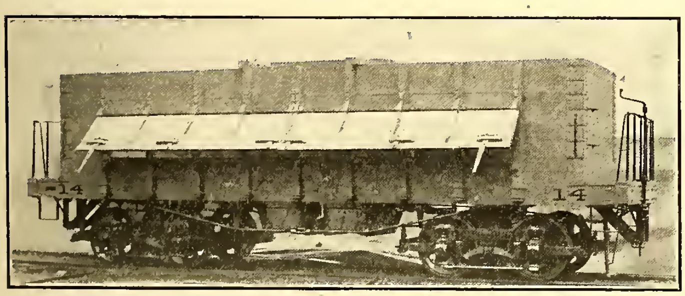
SINGLE-TRUCK, SEMI-CONVERTIBLE CAR FOR THE MERIDIAN LIGHT & RAILWAY COMPANY

warrant the increase in the number of cars. The catastrophe of a few weeks ago, in the form of a tornado, which devastated the central portion of the city, but which happily resulted in little loss to the railway company, proved another temporary stumbling block in the city's progress. Another reason to that already given regarding the short length of the new cars, is that at present it is deemed wise not to make too heavy a demand upon the power equipment, but to increase the frequency of cars at the least possible outlay. The type of car which the company has successfully used for the past two years, besides its suitability to traffic and climatic conditions, was also chosen on account of its serviceableness during the entire year. Full convertible cars, also of the grooveless post system, constitute part of the equipment, and were furnished by the American Car Company. The company furnishes its own light and power, and also owns North Park, and this summer will see some of the new cars used on the tracks leading to this popular place of amusement. This branch of the system has been rapidly built up and fine residences now line the road. There are three other branches, one of which runs from the center of the town to the railway shop district, where will be found the homes of the hands employed there. Meridian is a railroad center of considerable importance, besides being the leading city of the State in the value of manufactured products.

The general dimensions of the new cars are as follows: Length over the end panels, 18 ft. 10 ins.; length over the dashers, 27 ft. 10 ins.; width over the sills, 7 ft. 9½ ins.; width over the posts at the belt, 8 ft. 2 ins.; sweep of the posts, 2¾ ins.; distance between the centers of the posts, 2 ft. 5 ins.; height from the floor to the ceiling, 8 ft. 4½ ins.; height from the track to the under side of the sill, 2 ft. 6⅞ ins.; height from the under side of the sills over the trolley board, 9 ft. 1½ ins.; height from the track to the platform step, 15 ft. 7-16 ins.; height of the risers, 12 ins.; size of the side sills, 5 ins. x 3⅜ ins.; size of the center crossings, 3¼ ins. x 4¾ ins.; size of the end sills, 3½ ins. x 7⅝ ins.; thickness of the corner posts, 3¾ ins.; thickness of the side posts, 3¾ ins.; width of the aisle, 24 ins. The cars are finished in cherry and have decorated birch ceilings, and slat seats of cherry with spindle backs. Portable vestibules are used, which are well adapted to the climate of this section of the country, as they form a sufficient protection to the motorman and to passengers, add little to the weight of the car, may be readily removed during the summer, and take up little storage room. Folding gates of the builder's type are used at the platform entrances. The cars are mounted on the 21-E truck, having a wheel base of 7 ft. 6 ins., with 33-in. wheels. There are two 40-hp motors per car.

NOVEL TYPE OF COAL CAR FOR THE CONEY ISLAND & BROOKLYN RAILROAD

The interesting type of hopper-bottom coal car, shown in the illustration, was designed and built by the J. G. Brill Company, and lately shipped to the Coney Island & Brooklyn Railroad Company. As will be seen, it is arranged to empty the coal either into a pit or deliver it through the side doors alongside the track. The sills for the side doors are not low enough to enable all the coal to be delivered through the sides, but the arrangement greatly facilitates rapid handling, as most of the coal may be discharged in this way, and what remains can be quickly shovelled out through the same openings, thus obviating the necessity for the longer operation of



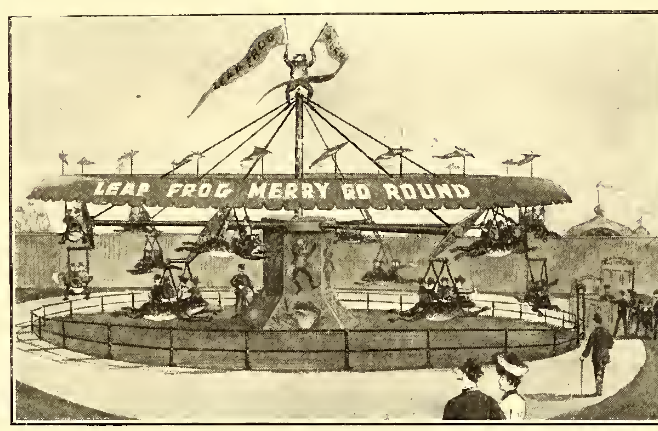
COAL CAR FOR THE CONEY ISLAND & BROOKLYN RAILROAD

throwing the coal over the high sides. The side doors are in pairs, and each door is opened by a lever, which releases three strong catches at the same time. The hoppers at the bottom are opened or closed by ratchet mechanism of the usual type. The trolley boards are placed on cross members resting directly on the high sides. The capacity of the car is twenty tons.

The sides of the car are braced with 4-in. x 4½-in. posts set in metal sockets, and the corners are clamped with forged brackets. The side sills are 5 ins. x 10 ins. thick, and the stringers 4¾ ins. x 10 ins., with end sills also 10 ins. thick. A pair of angle irons at each end of the car are bent in triangular form, and carry the pull irons to which the draw bars are attached. The botom of the car is inclined at the ends and sides and covered with 3-16-in. sheet iron. The length of the car over the corner posts is 25 ft., and over the crown pieces 29 ft. 4 ins. The width over the side doors is 8 ft. 11 ins.; the height from the track to the under side of the sills, 3 ft. 2⅝ ins., and from the under side of the sills over the top of the sides, 5 ft. 11¾ ins. The distance between the centers of the side posts is 2 ft. 6 ins. The car is mounted on 27-G trucks, which have a wheel base of 4 ft. and 33-in. wheels. The weight of the car body and trucks is 29,800 lbs.

THE LEAP-FROG MERRY-GO-ROUND

The leap-frog merry-go-round is the name of a novel and amusing variation of the merry-go-round which has retained its popularity for so long a period. The device is now being built for summer parks by the American Novel Machine Company, of Boston, Mass. The plan of construction admits of one motor revolving the whole machine as a merry-go-round if desired, with the frogs in a horizontal line, or in the same



THE LEAP-FROG MERRY-GO-ROUND

relative position to each other at any other angle outside a horizontal plane. While thus revolving the "leaps" may be thrown in and out at will. Thus, it will be appreciated that the company is really producing two money-making machines in one, without increasing the cost price or operating expenses over an ordinary merry-go-round.

The center pole is 25 ft. high, made of extra heavy iron pipe, 12 ins. in diameter, from the top of which the entire weight of the machine is suspended. All the arms, yokes and supports are of iron or steel. The gears and operating parts are of cast steel, except the frogs or coaches, so that a machine of great durability is secured.

The machine is 45 ft. in diameter from outside to outside of the frogs. These are regular carrousel coaches seating four people each, carved and decorated in imitation and color of a genuine frog. There are six revolving shafts, each terminating in a yoke from which are suspended two frogs, or twelve in all, giving a seating capacity of forty-eight people. The main framework revolves twice each minute, while the frog arms make 6 r. p. m., that is, the frogs leap six times to every two revolutions of the main framework. The revolving arms which leap the frogs are about 16 ft. above the ground. The length of the yoke from which the frogs are suspended is 10 ft. In its lowest position, a frog is within 1 ft. of the ground. When a frog is at the highest point in the leap, the bottom of the car is about 12 ft. from the ground, that is, the rise and fall of the frogs is between 11 ft. and 12 ft. All exposed parts are decorated with two or three coats of paint and varnished in regular up-to-date carrousel colors.

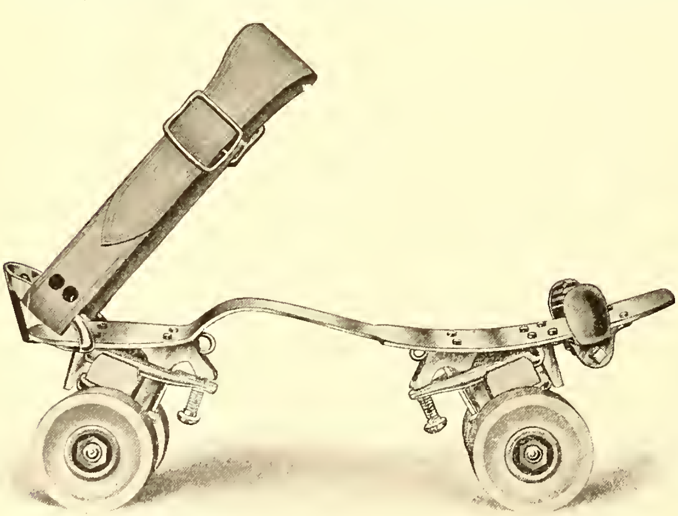
As the frogs load from the ground, or a low platform on the outside, the land space selected should not be less than

60 ft. x 60 ft. The motive power furnished with the machine is of 25 hp, electric or gasoline, at purchaser's option. It is not absolutely necessary to house in the machine, although most amusement venders believe that it pays to do so in order to protect their patrons and maintain business during wet or rainy weather. Competent amusement men have decided that this is a ten-cent proposition, with children under twelve at half fare. If the machine is run as a five-cent ride, the revenue per trip (when loaded to capacity) is \$2.40. Allowing one minute to load, three minutes to ride, and one minute to unload, which is the usual rule, twelve trips per hour would give \$28.80. The running expenses, including ground-rent, power, lights, and attendants, cannot exceed \$25 per day, and under favorable conditions will not reach \$20. Thus it will be seen that if the machine runs to capacity for only one hour per day during the entire season, it would prove a paying proposition.

The foregoing figures are mentioned merely as an illustration of its minimum capabilities, and not to convey an impression of what the real net earnings for the season would amount to. The total weight of the machine will come within seventeen tons, and it can be loaded into an ordinary furniture car for transportation.

IMPROVED ROLLER SKATE

M. C. Henley, of Richmond, Ind., whose roller skates have been on the market for twenty-seven years, reports that the great revival in this business has again compelled him to relinquish all other lines for the production of roller skates only. This factory has a capacity of 2000 pairs per day. The accompanying illustration of the improved Henley ball bearing rink skate shows that its manufacturer has kept pace with the times, bringing out an up-to-date, practical constructions in keeping with modern rink requirements. One of the principal points of superiority claimed is its light weight. This is made possible by the use of a fine quality steel in the foot-plate (shaped to conform to the foot), hardened and drawn to



ROLLER SKATE FOR RINK SERVICE

a spring temper, possessing great strength, but which springs sufficiently with the weight of the skate to make it much more desirable than a straight rigid plate. This spring-steel foot-plate is said to be much less liable to break or bend.

Rubber cushions are used in connection with pressure plates, and all the latest models, as in the one illustrated, embrace this construction to give them the requisite tilting or lateral motion so essential to easy and graceful skating. The largest skate of this type will easily turn a 2-ft. circle, all of the wheels resting squarely on the floor at the time.

Attention is called to the special and simple construction of this skate, by which the trucks and frame can be instantly separated by drawing back the coupling pin, which is held in position by a wire spring. The tension can be instantly adjusted to suit the skater, thus adapting it for all kinds of skating.

These skates are furnished with different kinds of ball-bearing wheels. The manufacturer claims superiority for his new steel band combination wheels over all other metal wheels. They are construeted on the same principles as the wheels filled with paper used for Pullman palace cars. The steel bands are said to be as thick as any, and thicker than most wheels of all metal combination. The bands are filled with a regular box-wood wheel, forced and clinched on same under heavy pressure, making the wheel one solid body, the wood forming a complete support for the steel band, even when worn down to thickness of paper. In fact, when the band is completely worn off, it still leaves a perfect box-wood wheel which can be used as any new wheel, or recovered with a new steel band at small cost.

Among the prominent places now using these skates may be named: Wayne Rink, Detroit; Louisville, Ky.; Lynchburg and Petersburg, Va.; Milwaukee, Wis.; Memphis, Tenn.; Johnstown, Pa.; San Francisco, Cal.; Hamilton, Newark, Uhrichsville, Toledo, Massillon and Youngstown, Ohio; besides many hundred of rinks in other parts of the eountry. These skates are especially adapted for summer park rinks, and large quantities have been sold for his purpose.

A NEW LINE OF GEARED FARE REGISTERS IN FOUR STYLES

The new fare registers brought out last fall by the Sterling-Meaker Company, of Newark, N. J., are of sufficient originality and mechanical excellence to invite attention. These registers naturally refer back to the Sterling No. 5, introdueed nearly four years ago. That machine was a very pronounced departure. In its construction the familiar elements whieh had characterized register making for so long were thrown aside, and a new start was taken. Numeral discs gave way to numeral wheels, and the uncertain ratchet and friction were replaced by pinion and gear. Simplicity, directness and strength were sought, and a machine was created to stand the hardest shocks and to defy the ingenuity of dishonesty. All the wearing parts were of hard metal and the wearing surfaces large. The results justified the invention. Nearly 4000 of No. 5 have been sold, and, so far as its maker knows, with entire satisfaction to the purchasers.

But it was not feasible to develop the No. 5 as a double register or a printing register, on account of its form. A new structure has, therefore, been made. The principles eharacterizing the No. 5 have been adhered to in simplicity, positiveness, strength and directness. The new structure is likewise geared throughout. The machine cannot be made to falsify itself. It will not work except as it is meant to work and should work. Its power of endurance has been "partially" tested, that is, after it had been rung up at 300 strokes a minute to over 3,000,000 fares, it was still in good working order, without a break or failure in any part, or any indication that it would not run off 3,000,000 more.

This new structure is sold in four forms: No. 15 is a straight single register, such as No. 5; No. 12 is the printing register for city use, No. 14 is the printing register for interurban use, and No. 16 is the double register. All are geared throughout.

A NEW TYPE OF RAIL JOINT

For about a year the Delaware, Lackawanna & Western Railroad has been experimenting on one of its lines with an unusual form of rail joint, devised by D. P. Springer, of Waverly, N. Y. The primary object of this invention is to provide for the effects of expansion and contraction, and to keep the overlapping ends of the rails in their fixed relative positions without resorting to rail chairs, angle plates, or similar accessories. It is also claimed that the construction adopted will prevent lateral spreading of the rails, as well as keep up the joints.

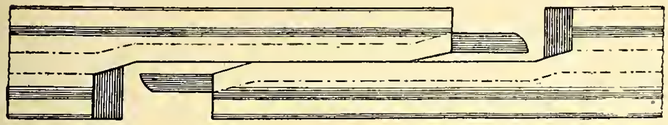


FIG. 1.—JOINT BEFORE BUTTING

The appearance of the rail ends before they are butted is clearly shown in Fig. 1. It should be noted that the web of the rail, for some distance back from the end, is offset a distance equal to one-half of its thickness, and that near the end of the rail the web is given another offset of an equal amount. The heads and bases of the rails are then slotted out, so that the opposing ends will interlock with one another. When the ends are assembled they form an elongated joint, the greater part of which is longitudinal at the rail heads, and all of which is supported by two webs. Owing to this construction the tread of the wheel tends to bear equally on both sides of the jointed rail-ends, thereby materially reducing vibration and the usual wear and tear of the rolling stock.

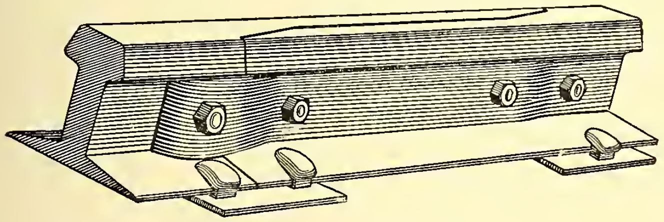


FIG. 2.—COMPLETE JOINT

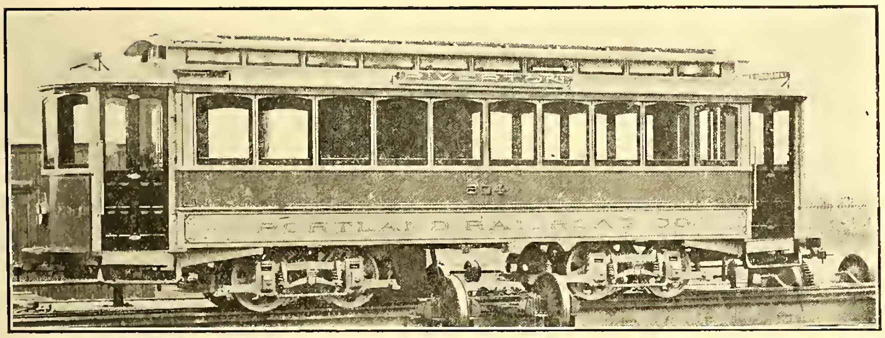
The extreme projections of the rail heads are beveled, to rest upon seats in the opposite head, as shown in Fig. 1. In addition, the lower side of the base of each rail is provided, at the beginning of the joint, with a slotted enlargement, not shown in the diagrams. This enlargement is similar in appearance and purpose to a base plate, and receives the extending projection of the base of the other rail. These interlocking projections remove the possibility of the rail ends sagging or being depressed at such points. The ordinary base plate is also used, as shown in Fig. 2. After the rail ends have been assembled, bolts are applied, as illustrated.

OHIO FARMERS ASK ELECTRIC RAILWAYS TO RUN REFRIGERATOR CARS

The Medina County (Ohio) Milk Producers' Association has asked the interurban roads entering Cleveland to equip their cars with some sort of refrigerator facilities, in order that the milk producers in the surrounding country may deliver milk in Cleveland in such a state that it will not conflict with the rules of the Cleveland Board of Health, which recently declared that milk must be delivered into the city at a temperature not in excess of 50 degs. Fahrenheit. Milk warmer than this cannot be sold in Cleveland. The producers said that they could deliver to the transportation company at this temperature, but they could not be responsible for it in transit unless refrigeration facilities were provided. Most of the milk used in Cleveland is handled by the traction lines.

DOUBLE-TRUCK CLOSED CARS FOR SUBURBAN SERVICE INSTALLED BY PORTLAND RAILROAD COMPANY

The Portland Railroad Company has placed on its Riverton division four new double-truck closed cars, built by the John Stephenson Company, and mounted on trucks of the Brill 27-G short-base equalized type. Riverton is a suburb, about five miles from the business center of Portland, and contains the finest of the system of parks owned and operated by the railway company; in fact, this park is one of the most picturesque and best equipped amusement resorts of the kind in the country, having a large rustic theater, casino, boat house and other buildings for its numerous attractions. The Presumpscot River flows through the park, and constitutes one of its chief charms. Large crowds attend the band concerts which are given throughout the entire season, and as the attendance is drawn from all portions of the city and suburbs, nearly every branch of the railway system is benefited. Cape Cottage Park and Underwood Park also receive large patronage. A division of the company's lines extends to Old Orchard Beach, one of the most attractive bathing beaches on the coast. The cars operated on this section are of the 14-bench open "Narragansett" type. Semi-convertible cars are also considerably used on the various branches. The entire system comprises about a hundred miles of track and nearly 250 cars, of different types, are operated.



DOUBLE-TRUCK VESTIBULED CAR FOR PORTLAND, MAINE

The new cars measure 28 ft. over the bodies and 37 ft. 5 ins. over the vestibules; width over the sills, 7 ft. 5 ins., and over the posts at the belt, 7 ft. 7½ ins.; sweep of the posts, 1¾ ins.; centers of the posts, 2 ft. 8 ins.; height from the floor to ceiling, 8 ft. 1⅝ in.; from the track to the under side of the sills, 2 ft. 8¼ ins.; from the under side of the sills over the trolley board, 9 ft. 1½ in. The window sash drop into pockets, and the seats are placed longitudinally. Mahogany constitutes the interior finish and the ceilings are of quartered oak. Automatic vestibule folding door controllers and other specialties of Brill manufacture, such as bumpers, drawbars, gongs, signal bells, etc., are included. The substantial bottom framing consists of 4¾-in. x 7¾-in. side sills, with 6-in. x ½-in. sill plates on the insides; the sub sills are 1¾ in. x 6 ins., center sills 3½ ins. x 4⅛ ins., and end sills 5¼ ins. x 6⅞ ins. The truck wheel base is 4 ft., and wheel diameter 33 ins.; axle diameter 4¼ ins. Four 40-hp motors are used per car.

LEGAL DEPARTMENT*

OPINIONS OF PHYSICIANS AS TO CAUSE OF PHYSICAL CONDITION

In the trial of an action for personal injuries it is proper to ask a medical expert whether, in his opinion, the actual physical condition of a person might have been caused by a certain previous injury, and as to the probable permanence of such physical condition. The law on this subject is well stated in the following language from the New York Court of Appeals in Turner v. City of Newburgh (109 N. Y., 301-309):

We think that, for the proper application of that rule, it is perfectly competent to furnish the jury with evidence of the present physical condition and bodily sufferings, and with the opinions of competent physicians as to whether such could have resulted from the accident, and as to their permanence.

The rule established by the cases of Strohm vs. N. Y., L. E. & W. R. R. Co. (96 N. Y. 305), and of Tozer vs. N. Y. C. & H. R. R. R. Co. (105 id. 617), referred to by counsel, simply precludes the giving of evidence of future consequences which are contingent, speculative and merely possible, as the basis of ascertaining damages. Those authorities in no wise conflict with the rule allowing evidence of physicians as to a plaintiff's present condition of bodily suffering or injuries, of their permanence and as to their cause. We conceive such to be the best mode and manner of furnishing information for the guidance of the jury in awarding damages. It is for the jury to say, upon the evidence, whether they believe the plaintiff's then condition to be the direct and proximate result of her accident, for which the defendant should be made answerable in damages, if caused by its misconduct, and not contributed to by any default of plaintiff in the exercise of ordinary care and prudence.

Practical and just limitations upon the rules above stated were given in two recent decisions by the First Appellate Division of the New York Supreme Court in Raynor v. Metropolitan Street Railway and Newton v. N. Y., N. H., etc., R. R. (106 App. Div., 449; id., 415). In the Raynor case a physician on the stand expressly admitted that he could not say with reasonable certainty whether or not the wound which had been received caused the particular injuries. This in itself was sufficient to exclude any opinion he might offer. An opinion expressed under such circumstances could not properly be classed as "expert evidence." It would be merely a vague speculation with the effect of giving the jury a pretext for indulging sympathy. It was accordingly held that it was not competent to ask the doctor whether in his opinion the accident was sufficient to cause the alleged weakness and abnormal condition of the plaintiff; that evidence that the plaintiff's condition might have been caused by the injury or that the injury was sufficient to cause such a condition was not competent evidence to show that the injury did cause the condition.

In the Newton case it appeared that the plaintiff was playing cards in the car of a railroad train at the time of a collision. He was thrown over on the seat by the crash but was not physically injured so far as he knew. Indeed, he testified, "I felt no pain or anything that day. I did nothing that day at all * * * I did not think much about it at the time." Physicians who examined him several weeks later testified that he was suffering from a disease of the heart. They expressed the opinion that such diseased condition could have been produced by a nervous shock, but they did not testify that a nervous shock did in fact result from the collision or from any physical injury which was the result of the collision. It was held, quite properly as we think, that the evidence did not establish that the plaintiff had suffered any physical injury from the accident. Here, as in the Raynor case, the effect of permitting a recovery would have been to offer the jury bald speculation as to what might possibly have produced a diseased condition without fixing a definite injury as a starting point. The decision in the Newton case is in harmony with the doctrine prevailing almost everywhere in this country which precludes the allowance of damages resulting from mental shock or mental suffering without tangible physical injury. In the course of its reasoning the Court said:

If no one had been seriously injured as the result of this collision, and the sole effect had been to throw the plaintiff's testator forward, as he has testified, and the car had then proceeded to the depot, there is no reason to suppose from this evidence that the plaintiff's testator would have suffered any serious effect from the accident. But the testimony of a physician that nervous or mental shock could have caused the condition in which the plaintiff's testator was found at the time of the trial was not competent to show that the physical effect of this accident did cause the plaintiff's testator's condition at the time of the trial.

CHARTERS, ORDINANCES, FRANCHISES.

INDIANA.—Eminent Domain—Condemnation Proceedings—Award—Exceptions—Increased Verdict—Damages—Instructions—Deduction for Benefits—Trial—Credibility of Witnesses—Evidence—Admissions—Offer Preceding Condemnation.

1. Though defendants in condemnation proceedings file no exceptions to the award of appraisers, but, on the amount thereof being paid into court, receive it, yet, plaintiff having excepted to the award and had a trial on the issues so raised, it must pay the additional amount of damages then found, or lose all rights in the land.

2. In view of the instruction given at plaintiff's request, in proceedings to condemn a right of way, that in assessing the damages the jury could not take into consideration remote or fanciful injuries, resting wholly in conjecture and not admitting of an estimate in damages, certain particular things being specified which they could not consider, the part of an instruction that in estimating damages the jury could, in addition to certain things, consider "any other things either annoying or hurtful and necessarily incident to the permanent location and operation of a traction line across a farmer's premises," will be considered harmless.

3. Burns' Ann. St. 1901, Sec. 922, providing that in estimating damages no deduction shall be made for any benefit that may be supposed to result to the owner from the contemplated work, applies to condemnation proceedings for a railroad right of way.

4. An instruction, in a proceeding to condemn a right of way through a farm, that in weighing the testimony of different witnesses as to the effect of taking the strip on defendant's remaining lands for farming purposes they may consider whether the witness is a practical farmer of experience, or a mere owner of real estate, with little, if any, experience in the actual work and management of a farm, "bearing in mind, however, that you alone are to determine whether these facts have been shown, and what weight, if any, is to be given to these facts," is proper; the jury not being told that the testimony of one class of witnesses is entitled to greater weight than that of another class.

5. An offer made by the land owner for the purpose of agreeing on the compensation to be paid for a railroad right of way is not evidence against him as an admission; there having been a failure to agree, resulting in condemnation proceedings.—(Indianapolis Northern Traction Co. vs. Dunn et al., 76 N. E. Rep., 269.)

NEW JERSEY.—Street Railways—Leases—Ultra Vires Act—Injunction—Trespass—Remedy at Law—Inadequacy—Appeal—Suspension of Injunction.

1. Plaintiff street railway company, desiring to extend its tunnel under the North River, still underground, leased from defendant connecting street railway company the right to use certain of its land for that purpose for 999 years. The land so leased was vacant, except for an old storehouse, and it appeared that the use of the land for the extension of such tunnel would not interfere in any way with the exercise of the franchises of the lessor. Held, that such lease was not beyond the lessor's power to grant.

2. Where plaintiff under a lease from defendant was entitled to enter certain land for the extension of plaintiff's tunnel which had been constructed under the North River, but defendant intervened and with a strong hand refused to permit plaintiff to do the work contemplated, plaintiff's damages being uncertain, it had no adequate remedy at law, and was entitled to an injunction restraining such acts.

*Conducted by Wilbur Larremore, of the New York Bar, 32 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

3. Where an injunction was granted restraining defendant from interfering with a strong hand to prevent plaintiff from constructing certain improvements under a lease, the injunction would not be suspended pending appeal under a statute declaring that no appeal from an order granting an injunction shall suspend or modify its operation without an order of the chancellor, and that a suspension or modification thereof shall extend only so far as may be necessary to preserve the subject of the appeal, and shall not in any case be allowed to destroy the right established or protected by the decree appealed from.—(Hoboken & M. R. Co. et al. vs. Jersey City, H. & P. Ry. Co. et al., 62 Atl. Rep., 539.)

OHIO.—Street Railroads—Grant of Franchise—Consent of Property Owners—Rates of Fares.

The requirements of Sec. 30 of the new Municipal Code (Sec. 1536-185, Rev. St. 1903) that the council of a city shall not grant a franchise for the construction of a street railroad excepting "to the corporation, individual or individuals, that will agree to carry passengers upon such proposed railroad at the lowest rates of fare, and shall have previously obtained the written consent of a majority of the property holders upon each street or part thereof, on the line of the proposed street railroad, represented by the feet front of the property abutting on the several streets along which such road is proposed to be constructed," confers upon such property holder the privilege of giving or withholding his consent to the construction of such road, but it does not give him the privilege of limiting his consent to a particular corporation or individual. His consent, so limited, is inconsistent with the requirement that the franchise be given to the corporation or individual that will carry passengers at the lowest rates of fare and would tend to defeat the purpose of the statute. The limitation, therefore, is void, and the consent good as a consent to the construction of the road by the lowest bidder.—(Forest City Ry. Co. et al. vs. Day, 76 N. E. Rep., 396.)

WEST VIRGINIA.—Street Railways—Grant by Municipal Authorities—Effect—Forfeiture of Right—Conditions—Nonperformance—Equity—Relief Against Forfeiture—Enforcement of Forfeiture—Oppressive Conduct—Appeal—Review—Discretion of Court—Municipal Corporations—Privileges in Highways—Police Power—Certiorari—Actions Reviewable—Construction—Consent of Municipal Authorities.

1. An ordinance, passed by the council of a town, granting to a street railway company the right to lay its track and operate its railway in the streets of the town, and accepted by the railway company, constitutes a contract between the town and such company, vesting title to such right or easement in it, unless the ordinance contains conditions precedent compliance with which is requisite to the vesting of title.

2. Such right may be forfeited and lost by failure to comply with subsequent conditions, and, if the ordinance expressly provides for forfeiture as the penalty of non-compliance with conditions specified in it, substantial performance of the contract as a whole constitutes no answer to a proceeding to forfeit for failure to comply with such conditions, however slight their relative importance may be. The question of materiality is, in such case, withdrawn from the courts by the stipulations of the contract.

3. A street railway license or privilege in a street may be forfeited for failure to lay planks of prescribed dimensions along the rails of its track in front of improved property, if the ordinance expressly gives the right to forfeit it for such cause.

4. Equity will relieve from forfeitures for non-performance of covenants other than those for the payment of money, arising out of accident, mistake, or surprise, and in the absence of willful and deliberate refusal to perform, when no pecuniary injury has resulted to the covenantee and the wrong done is easily remediable; but such power of relief is discretionary, and will not be exercised unless the delinquent covenantor is able and willing to immediately perform the covenant.

5. Equity will not permit the enforcement of a forfeiture in an inequitable and oppressive manner, nor a perversion thereof to purposes other than those for which the power of forfeiture has been reserved.

6. In the exercise of such power, under an ordinance of a municipal corporation prescribing notice and specification of cause as a necessary preliminary step, the officers of such corporation must deal fairly, openly, and frankly with the party whose rights they attempt to take away, and abstain from such conduct as will work a surprise upon him. Their conduct is governed by substantially the same rules and principles as apply to proceedings by private persons under similar circumstances. In order to be inequitable and oppressive, their conduct need not be actually fraudulent. If in equity and conscience it is oppressive or lacking in fairness, equity will relieve, however honest and sincere the parties attempting to forfeit may have been.

7. The discretion of the court in such case is a sound legal discretion, subject to review, and the appellate court will reverse the action of the trial court when, in its opinion, relief has been improperly denied.

8. A declaration of forfeiture of a street railway privilege in a street by the council of a town, effected by repeal of the ordinance by which the privilege was granted, pursuant to a reservation of power so to do, for cause and after notice, has not the force and effect of a judicial determination of the existence of cause for forfeiture, and does not preclude a resort to the courts by the railway company for vindication of its rights. After such repeal, pursuant to notice, the railway company may, by injunction, prevent the town authorities from removing or disturbing its track, if no cause of forfeiture existed, or the circumstances shown are such as to call for the exercise of equity jurisdiction to relieve from forfeiture. In so far as the decision in town of Davis vs. Davis, 21 S. E. 906, 40 W. Va. 464, imports the contrary of the foregoing proposition, it is re-examined and disapproved.

9. The action of municipal authorities in granting and revoking privileges and licenses in highways is the exercise of delegated police power, and is not judicial in character.

10. Only judicial action is reviewable by the writ of certiorari under Secs. 2 and 3 of Chapter 110 of the Code of 1899. The scope of the writ is not altered by the statute in respect to the nature of the proceedings for the review of which it may be had. In this respect it remains as it was by the common law.

11. Consent of the board of commissioners of Ohio County to the operation of a street railway on and over the Cumberland Road in said county of Ohio does not confer authority upon the railway company holding such permit to construct and operate its railway on and over such portion of said road as lies within the limits of the town of Triadelphia, in said county, without the consent of the authorities of said town.—(Wheeling & E. G. R. Co. vs. Town of Triadelphia et el., 52 S. E. Rep., 499.)

WISCONSIN.—Street Railroads—Franchises—Construction.

A city ordinance granting a street railway the right to build and maintain a single or double-track railway, with all necessary switches or turnouts, upon certain streets of the city, provided that the entire line shall be completed and in operation before a certain date, gives the railway an option to build either a single or a double-track line within the specified time, and its exercise of that option, by building and putting in operation a single-track line, exhausts its rights under the ordinance, and it cannot, after the expiration of the time limited, lay additional tracks, and thus convert its line wholly or partially into a double-track line.—(Eastern Wisconsin Ry. & Light Co. vs. Winnebago Traction Co., 105 N. W. Rep., 572.)

LIABILITY FOR NEGLIGENCE

ALABAMA.—Carriers — Injuries to Passenger — Complaint—Sufficiency—Contributory Negligence.

1. A complaint in an action against a street railway company for injuries received by a passenger while alighting from a car, in consequence of the sudden starting of the car, which alleged that the car stopped at the intersection of designated streets, which was plaintiff's point of destination; that she attempted to alight there; that before she had fully got off the car was put in motion, and as a proximate consequence thereof she was thrown to the ground; that the starting of the car caused the injuries complained of; and that the car was negligently operated—states a cause of action against the objections that it fails to sufficiently state defendant's negligence, that it fails to allege that defendant put the car in motion while she was alighting, that it fails to allege that the car stopped for the purpose of allowing passengers to alight, that it fails to show that the place where the car stopped was a regular stopping place for passengers to alight, and that it fails to show that defendant's servants had notice of her attempt to alight.

2. A passenger, alighting from a car which had stopped, is not negligent as a matter of law because she attempts to alight with her back in the direction in which the car was going; she having the right to assume that the car would remain stationary until she had alighted.—(Birmingham Ry., Light & Power Co. vs. Handy, 39 S. Rep., 917.)

ALABAMA.—Pleading—Disjunctive Allegations—Street Railroads—Defect in Streets—Negligence—City Ordinances—Effect—Master and Servant—Independent Contractor—Action—Evidence—Street Railroads—Repair—City Ordinance—Construction—Taking Possession of Street—Duty to Public—Negligence—Liability of Employer—Excavation in Street—Injuries—Action—Instructions—Trial—Province of Court—Obstruction in Street—Liability—Confused or Misleading Charge—Abstract Charge—Municipal Corporations—Duty of Traveler — Damages — Expenses Incurred—Husband and Wife—Credit—Presumptions—Municipal Corporations.

1. In an action against a street railway for injuries received by plaintiff through falling into an excavation made by defendant in a public street, the first count of the complaint alleged that defendant excavated its track or dug a ditch in the street, etc., and that plaintiff fell into such excavation and was injured in consequence of defendant's negligence in leaving the excavation without barricades or without such other means as are usual to guard the public at night from falling into it, etc. The second count alleged the character of the injury received and the manner in which it was received, and averred that defendant's negligence consisted in leaving the excavation open without a light or other thing to give warning thereof. The third count alleged the duty of defendant as operator of a street railway to keep the part of the street occupied by its track in a reasonably safe state of repair for the safe passage of travelers over it, and alleged a negligent disregard of such duty by permitting an excavation to remain in the same unguarded, without lights or other things to give warning thereof. The fourth count alleged defendant's duty to keep that part of the street over which its track ran in safe repair for the passage of travelers and a disregard of the duty by excavating the same and negligently failing to put up signals or lights on the excavation. The fifth count set out that it was defendant's duty to keep the street occupied by its tracks in reasonable repair for the safe passage of travelers, and that a contractor, constructing or repairing said track for defendant, made an excavation and negligently left it open at night without proper lights or safeguards. The sixth count set forth a city ordinance requiring any street railway company operating its line within the city to keep in good repair all that part of the street occupied by its tracks, and averred the operation by defendant of a street railway company, etc., its duty to keep the street so occupied, etc., in reasonable repair, and that the tracks and the street were out of repair by reason of a hole negligently left open by defendant without proper guards, etc., and that plaintiff fell in and was injured. The seventh count set out an ordinance granting to defendant the right to operate and maintain an additional track on the street in which the injury occurred, and also another city ordinance requiring defendant to keep that part of the street whereon its track was laid in good repair, and alleged a breach of duty in respect thereto and negligence, etc. Held, that the several counts were not remurrable as charging disjunctively two causes of action.

2. The fact that a street railway is by city ordinance required to keep that part of the street over which its track passes in good repair does not make it any the less liable for negligence in leaving an excavation made by it in such street without the usual safeguards.

3. Where, in an action against a street railway for injuries received by plaintiff through falling into an excavation made by defendant in a street over which its track passed, defendant set up that the excavation was being made by an independent contractor for whose negligence it was not liable, and, further, that the work was done under the supervision and direction of the city engineer, plaintiff was properly permitted to prove by such city engineer that the permit to do the work was secured by one stated to be defendant's general manager.

4. A city ordinance requiring any street railway company operating a line within the corporate limits to keep in good repair all that part of the street occupied by its tracks, includes additional tracks to be laid, as well as those already laid and under operation.

5. Irrespective of ordinance, when a street railway company takes possession of a portion of a public street for the purpose of building and operating a railway under its franchise, it necessarily assumes a duty to the public to keep that part of the street occupied by it free from pitfalls and in a safe condition.

6. A principal is liable for the acts of an independent contractor employed by him where the work to be done is intrinsically dangerous, however skillfully performed.

7. Where an employer owes certain duties to third persons or the public, he cannot relieve himself from liability by committing the work to a contractor.

8. In an action against a street railway for injuries sustained by plaintiff through falling into an excavation made by defendant in a street, an instruction that if plaintiff "on approaching the place where she sustained her injury, if there was anything, such as dèbris, lumber, timber, piles of dirt, etc., such as was reasonably calculated to give warning that the earth had been excavated at that point, it was then her duty to be on the lookout to detect and avoid any such excavation, and if she failed to do this, and thereby contributed to her injury, she cannot recover," was properly refused as confusing.

9. In an action against a street railway for injuries sustained by plaintiff through falling into an excavation made by defendant in the street, a charge that there was no evidence in the case that plaintiff suffered any permanent injury on account of the fall testified about was properly refused, as the court cannot be required to declare to the jury that there was no evidence of a particular fact.

10. The fact that the city engineer is overlooking work done by a street railway in a public street in the course of repairing its tracks does not relieve the railway from the duty resting on it to keep such part of the street in a safe condition.

11. In an action against a street railway for injuries sustained by plaintiff through falling into an excavation made by defendant in a public street, a charge reading: "When I charge you that the plaintiff did or failed to do anything which contributed to her injury, I do not mean that what she might have done or failed to do was the sole cause of her injury. It would be sufficient if such conduct on her part merely contributed to her injury to prevent a recovery in her case"—was properly refused, as confusing and liable to the construction that the court had charged that plaintiff had done or failed to do something which contributed to her injury.

12. Where, in an action against a street railway for injuries sustained by plaintiff through falling into an excavation made by defendant in a public street, the evidence was uncontradicted that plaintiff was crossing the street at a regular crossing when the accident occurred, a charge that "while a foot traveler on the sidewalks or on crosswalks provided for them, if they go off the sidewalks or crosswalks for foot travelers, it is their duty to use reasonable care to see that the way is clear," was properly refused as abstract.

13. In an action against a street railway for injuries sustained by plaintiff through falling at night into an unlighted excavation made in a public street by defendant, where there was no evidence tending to show that any light had been placed at the excavation or that anyone had extinguished such light, a charge that if lights were placed at the excavation, and they were thereafter extinguished by some person unknown to defendant before the injury occurred, defendant was not liable, was properly refused as abstract.

14. In an action against a street railway for injuries sustained by plaintiff through falling into an excavation made by defendant in a street, a charge that plaintiff, while walking along the sidewalk on the street, had the right to assume that the sidewalk was safe, but when she stepped off the same and into the street it became her duty to use ordinary care to look and see that the street was clear and safe, was properly refused, as calculated to mislead the jury by giving the impression that greater care was required when off the sidewalk than when on it.

15. It is not the duty of a traveler in a public street to ascertain whether or not the way is clear, though it is his duty, after ascertaining that there is an obstruction, to exercise ordinary care to avoid injury.

16. In an action against a street railway for injuries to a married woman, where there was no evidence as to whether credit was given plaintiff or her husband for medical services, the presumption was that the credit was given to the husband.

17. A traveler on a public street, knowing of a dangerous excavation therein, or having reason to believe that the same exists, must, on approaching the place, look for and avoid it if possible.—(Montgomery St. Ry. Co. vs. Smith, 39 S. Rep., 757.)

ALABAMA.—Carriers—Injuries to Passengers—Contributory Negligence — Trial — Instructions — General Affirmative Charge—Injuries to Passengers—Actions—Alighting from Moving Train.

1. The slowing up of a train for a station is not an invitation to the passenger to alight while the train is in operation or moving, or for the passenger to place himself in a position of peril.

2. In an action for injuries to a passenger, where the evidence

entirely failed to show any wantonness on the part of the trainmen, the general affirmative charge with hypothesis for defendant was properly given as to counts of the complaint alleging wantonness on the part of defendant, its agents, or servants, in inflicting the injury.

3. In an action for injuries to a passenger, a charge that, unless the jury believe from the evidence that defendant's servant or agent was guilty of negligence, they must find for defendant was proper.

4. In an action for injuries to a passenger, a charge that, if plaintiff was guilty of negligence which contributed approximately in the slightest degree to her injury, the jury must find for defendant was proper.

5. A passenger is guilty of contributory negligence in attempting to get off a moving car at a time when a reasonably prudent person similarly situated would not attempt to alight.

6. In an action for injuries to a passenger, instructions stating in effect that defendant was guilty of negligence if it slowed up its train to receive a passenger, and after so slowing up moved off more rapidly without seeing that plaintiff, who was wishing to get off, was not in a position of peril, were bad, in that they took from the jury the question of defendant's negligence.

7. In an action for injuries to a passenger, a charge that plaintiff was entitled to recover if defendant negligently moved the train more rapidly after slowing down at the station at which plaintiff wished to alight, provided plaintiff acted on the slower motion of the train and attempted to get off, and such slower motion was such as to make plaintiff believe that it was safe to act upon it, and the injury was occasioned by the increased speed, was bad, in that it hypothesized defendant's negligence on plaintiff's belief under the circumstances, and not on the belief of a reasonably prudent person.—(Sweet vs. Birmingham Ry. & Electric Co., 39 S Rep., 768.)

CALIFORNIA.—New Trial—Discretion of Trial Court—Verdict Against Evidence—Street Railways—Negligent Operation—Sufficiency of Evidence—Death—Actions—Measure of Damages.

1. It is the duty of the trial judge, on a motion for a new trial, to exercise his judgment and discretion in reviewing the evidence, and even though it is conflicting, to grant a new trial if he does not believe that the verdict is the correct conclusion from all the evidence; and his action in so doing will not be interf red with on appeal, except in case of an abuse of discretion.

2. In an action against a street railway for the death of the driver of a wagon, caused by collision with a street car, an order of the trial court granting a new trial, on the ground that the evidence did not support the verdict, which was for defendant, but showed negligence on defendant's part, held, in view of the evidence, not an abuse of discretion.

3. Under Code Civ. Proc. Sec. 377, providing that, when the death of a person is caused by the wrongful act or neglect of another, his heirs or personal representatives may maintain an action for damages against the person causing the death, and such damages may be given as under all the circumstances of the case may be just, the amount of recovery in actions for wrongful death is limited to the value of the pecuniary interest of the persons entitled to such recovery in the life of the person killed; but such pecuniary interest need not be measured and demonstrated by the evidence as a precise sum of money, and the fact that it is not shown that a husband, on account of whose death damages are claimed by his widow, was in sound bodily health, and in receipt of monthly wages or salary, is not fatal to a recovery of more than nominal damages.—(Ruppel vs. United Railroads of San Francisco, 82 Pac. Rep., 1073.)

CALIFORNIA.— Appeal— Findings of Court — Construction — Trial—Damages for Personal Injury—Carriers—Injury to Passenger—Contributory Negligence—Negligence of Carrier—Presumptions—Duty as to Transportation of Passengers.

1. Findings of a trial court are to be so construed as to uphold the judgment, and when, from the facts found, other facts may be inferred which will support the judgment, the inference will be presumed to have been made by the court below.

2. A finding that a specified sum will compensate one for a personal injury negligently inflicted means the amount necessary to compensate him as fixed by Civ. Code, Sec. 3333, providing that the measure of damages is the amount which will compensate for the detriment proximately caused by another's breach of obligation not arising from contract.

3. Where a passenger on a street car notified the servants in charge of the car to stop at a crossing, and the car as it approached the crossing slackened its speed as if to stop, the passenger, in leaving his seat and proceeding to the door for the purpose of alighting when the car came to a stop, was not guilty of contributory negligence as a matter of law, precluding a recovery for injuries received by reason of the sudden jerking of the car occasioned by the sudden turning on of the electric current.

4. Where a street car was so operated as to violently throw therefrom a passenger who had notified the servants in charge of the car to stop at a crossing, and who, on the car slackening its speed as if to stop at the crossing, had left his seat and proceeded to the door for the purpose of alighting when the car came to a stop, a presumption that the servants were not exercising the utmost diligence for the safety of the passengers as required by law, but were negligent, arose.

5. The care which a carrier must exercise towards its passengers is the utmost care, involving such constant supervision over and observation of the passengers as will insure to the employees information as to the condition and position of the passengers; and, when the means of knowledge in relation to the position of a passenger is in the carrier, the same rule applies as when actual knowledge exists.—(Griffin vs. Pacific Electric Ry. Co., 82 Pac. Rep., 1084.)

MASSACHUSETTS.—Street Railroads—Injuries to Person on Track — Contributory Negligence — Evidence — Burden of Proof.

Evidence in an action against a street railway company for the death of a person who was struck by a street car examined, and held not to prove decedent's freedom from contributory negligence, notwithstanding the motorman's negligence just before the accident.

In an action against a street railway company for the death of a person who was struck by a car, plaintiff has the burden of proving that decedent was in the exercise of ordinary care, though the motorman was negligent just before the accident.—(Gorham vs. Milford, A. & W. St. Ry. Co., 75 N. E. Rep., 634.)

MINNESOTA.—Street Railroads—Collision with Traveler—Evidence—Instructions—Contributory Negligence.

Action to recover for personal injuries sustained by a collision between the defendant's street car and the sleigh of the plaintiff's husband, in which she was riding and which was drawn by a horse owned and driven by him. Held:

1. The evidence justified the trial court in submitting to the jury the question of the willful negligence of the defendant, and the court's charge to the jury as to such question, considered as a whole, was free from error.

2. The court did not err in its charge as to the alleged failure of the defendant to sound its gong.

3. The evidence does not show that the plaintiff was guilty of contributory negligence as a matter of law.—(Teal vs. St. Paul City Ry. Co., 104 N. W. Rep., 945.)

MINNESOTA.—Pleading—Amendment—Conforming Complaint to Evidence—New Trial—Excessive Damages—Assignment of Error—Appeal—Review.

In an action to recover damages for personal injuries alleged to have been caused by the negligence of the defendant, the complaint alleged that the defendant so carelessly and negligently operated and controlled the car as to cause the car to collide violently with an iron gate extending across the tracks, thereby with great force throwing the plaintiff against the seats and other parts of the car. At the trial, evidence was received from which it might reasonably be inferred that the plaintiff's injuries were caused by the manner in which the car was handled by the motorman in attempting to make a sudden stop, and not solely by the shock of the collision. Held, that the trial court did not abuse its discretion in allowing the plaintiff to amend the complaint in o. der to make the allegations conform to the evidence.

2. Where it is claimed that the damages awarded by a jury in an action to recover unliquidated damages, such as an action for personal injuries, are excessive or inadequate, and were given under the influence of passion or prejudice, the motion must be made in the trial court, under the fourth subdivision of Sec. 5398, Gen. St. 1894.

3. The granting or refusal of a new trial upon the ground of excessive or inadequate damages appearing to have been given under the influence of passion or prejudice rests in the sound judicial discretion of the trial court, subject to review in this court under the rules applicable to other discretionary orders. It cannot be raised for the first time in this court.—(English vs. Minneapolis & St. P. Suburban Ry. Co., 104 N. W. Rep., 886.)

MISSOURI.—Street Railroads—Injury to Traveler in Collision —Contributory Negligence—Discovered Peril—Instructions— Inconsistent Instructions.

1. A traveler on a street, injured in a collision with a street car, may recover, though guilty of negligence contributing to the injury, where the motorman not only could have seen the traveler's peril in time by proper care to have averted the danger, but did actually see him in peril a sufficient length of time to have done so.

2. Where, in an action against a street railway company for injuries to a traveler received in a collision with a street car, a witness testified that the car was run as fast as it could go, and it was shown that the force with which it struck was sufficient to kill one of the plaintiff's horses and carry the weight of the wagon and load—2000 lbs.—50 ft., there was evidence that the company ran its car at a rapid rate or speed, sufficient to predicate an instruction thereon.

3. An instruction, in an action against a street railway company for injuries to a traveler received in a collision with a street car that before plaintiff can recover it must be found that the company's negligence was the direct cause of the injury, and that then he cannot recover if his negligence contributed to the injury, being based on the concurring negligence of plaintiff and the company, is not in conflict with an instruction based on the separate negligence of the company as the direct cause of the injury.—(Jager vs. Metropolitan St. Ry. Co., 89 S. W. Rep., 62.)

MISSOURI.—Street Railways—Injuries to Pedestrian—Trespasser—Discovered Peril—Contributory Negligence—Appeal—Harmless Error—Instructions—Variance—Rule Prohibiting Use of Track.

1. Where plaintiff was walking upon the tracks of defendant street railway company at a point which was not a street, but which was in a populous city and was generally used by pedestrians, the company was liable for an injury caused by plaintiff being struck by a car, if the persons in charge thereof could by proper care have discovered the plaintiff's peril in time to have avoided the injury.

2. Where plaintiff was walking upon the tracks of defendant street railway company at a point which was not a public street, and there got his foot caught in a safety device and was injured by a car, he was guilty of contributory negligence, preventing a recovery unless defendant's servants could, by proper care after discovering the danger, have avoided the accident without endangering its passengers and employees.

3. Where, in an action against a street railway company for personal injuries, the petition alleged that plaintiff was injured while passing along a place "used as a part of a certain street, which place was one where the public was accustomed to walk upon defendant's tracks," an instruction permitting a recovery if plaintiff was injured "at a place on defendant's track where the public was accustomed to walk" was not such a variation as to be available on appeal, in the absence of any affidavit made at trial as provided by statute.

4. In an action against a street railway company for injuries sustained by a pedestrian walking on the tracks at a place where the public was accustomed to walk, the fact that defendant had forbidden such use of its tracks was not material.—(Williams vs. Metropolitan St. Ry Co., 89 S. W. Rep., 59.)

MISSOURI.—Damages—Measure — Personal Injury — Future Loss—Instructions—Appeal—Review—Questions not Raised Below.

1. Where, in a personal injury action, the evidence authorizes the jury to assess present damages for future loss as a result of the injury, an instruction that the damages must be confined to the loss reasonably certain to result is proper.

2. Where, in a personal injury case, the evidence shows that plaintiff will be wholly disabled from performing the work in the business in which he was engaged at the time of the accident, an instruction that plaintiff, if entitled to recover, is entitled to compensation for loss of time in his business which "he may hereafter lose, if any, by reason of" the injuries, is proper, for the word "may" means "shall."

3. In a personal injury action, the question whether plaintiff could recover for loss of earnings could not be reviewed in the appellate court, if not raised below, under the express provisions of Rev. St. 1899, Sec. 64.—(Caplin vs. St. Louis Transit Co., 89 S. W. Rep., 338.)

MISSOURI.—Carriers—Duty Towards Passengers—Negligence —Presumptions — Actions for Injuries — Pleading — Allegations of Negligence—Necessity of Proof—Railroads—Accidents at Crossings—Pleading—Issues—Sufficiency of Evidence—Instructions—Enlargement of Pleadings—Trial—Instructions—Cure by Conflicting Instructions.

1. A common carrier, though not an insurer of the safety of its passengers, is held to the exercise of the highest degree of care in protecting them from injury.

2. The right of action which accrues to a passenger injured while being served by the carrier, is founded in negligence, but from the character of the relation a presumption of negligence arises from the fact of injury, and throws the burden upon the carrier to establish the exercise of requisite care on its part.

3. A petition against a carrier for injuries to a passenger need not specify the negligent acts which caused the injury, but it is sufficient that it charge in general terms that plaintiff was injured while being carried as a passenger as the result of the negligence of the carrier.

4. Where a petition against a carrier for injuries to a passenger unnecessarily alleges the specific acts of negligence complained of, plaintiff assumes the burden of proving the acts alleged, and must recover, if at all, on the negligence pleaded.

5. A petition against a street railway and a railroad for injury sustained by a passenger on a street car as the result of a collision between the street car and a railroad car, which alleged that defendants failed to keep a reasonable and necessary lookout and to observe the approach of the railroad car, authorized proof of the negligence of a watchman employed to warn street cars of the approach of railroad cars, as well as that of the servants in charge of the street car in failing to take proper precautions to apprise themselves of danger before sending the car across the railroad tracks.

6. In an action against a street railway and railroad for injuries sustained by a passenger on a street car as the result of a collision between the street car and a railroad car, there was evidence that the watchman employed by both the street railway and railroad had had an altercation with a switchman employed by the railroad as to their respective duties in the matter of giving crossing signals, and that on the occasion of the accident the watchman refused to heed signals of the switchman, and the switchman refused to notify the watchman of the approach of the railroad car and gave signals direct to the motorman. Held, that there was sufficient evidence of negligence to take the case to the jury as against both defendants.

7. A petition against a street railway and railroad for injuries to a passenger in a street car, resulting from a collision between the street car and a railroad car, alleged that defendants were guilty of negligence in failing to keep a necessary lookout and observe the approach of the railroad car. The court charged generally to find for plaintiff, if the defendant street railway failed to use the highest degree of care toward plaintiff, or if the defendant railroad failed to observe ordinary care, and such failure resulted in or contributed to plaintiff's injury. Held, that the charge was erroneous, in that it failed to condition the right of recovery on the establishment of the negligence charged in the petition.

8. In an action against a carrier for injuries to a passenger, a charge erroneously permitting a recovery on the establishment of negligence of any kind on defendant's part, regardless of the issues raised by the pleadings, was not cured by another charge requiring a finding for defendant unless it was negligent in some manner charged in the petition.—(Hamilton vs. Metropolitan St. Ry. Co. et al., 89 S. W. Rep., 893.)

MISSOURI.—Electricity—Personal Injuries—Care as to Licensees—Proximate Cause—Probable Consequences—Death —Contributory Negligence—Presumptions—Electricity—Evidence—Action—Instructions.

1. Where a contract between an electric company and another required the latter's servants to work in the electric company's power house, the company was bound to keep wires near which such servants were required to work so insulated and protected as to be safe.

2. Where a servant of one who had contracted to do certain work in an electric power house, was killed by a shock of electricity, caused by an iron pipe, which he was fitting, or by his wrench, coming in contact with an insufficiently insulated wire, the want of proper insulation was the proximate cause of the death.

3. In an action for death, owing to the alleged negligence of defendant, in the absence of evidence it is to be presumed that deceased was in the exercise of due care.

4. Where the servant of one who had contracted to do certain work in the power house of an electric company was killed, by an iron pipe he was fitting, or by his wrench, coming in con-

tact with an insufficiently insulated wire, it appearing that there was sufficient light at the place to enable him to do his work, but not sufficient for him to make an examination of the insulation, he had a right to assume that the insulation was sufficient, and was not guilty of contributory negligence.

5. The servant of one who had contracted to do work in an electric power house was killed, owing to an iron pipe that he was fitting coming in contact with on insufficiently insulated wire; and in an action for the death the court charged that defendant was not required to use the most perfect form of insulation, and that if that which was used was reasonably safe there could be no recovery, but that if the insulation was in an imperfect and dangerous condition, which was known or could have been made known to defendant by reasonable care and inspection, and if deceased received an electric shock by reason of such imperfect condition, plaintiff was entitled to recover. Held, that the instruction was sufficiently favorable to defendant.

6. The court instructed that, if the accident was the result of deceased's own negligence and carelessness in working in a place which a reasonable person in his position would know to be dangerous, or of his negligence as to the manner in which he performed his work, which negligence directly contributed to the injury, there could be no recovery; that a workman has no right to work in a place obviously dangerous, and that if he does so he takes the naturally incident risks; but that the mere fact that deceased might have known that the place was dangerous would not of itself deprive plaintiff of the right to recover, if in point of fact the accident resulted from defendant's negligence, and if deceased exercised such care and caution as a man of ordinary care and prudence in his calling would exercise under like circumstances. Held, that the instruction was a fair one on the doctrine of contributory negligence.—(Ryan vs. St. Louis Transit Co., 89 S. W. Rep., 865,)

MISSOURI.—Street Railroads—Crossing Accident—Negligence—Observance of Ordinance—Presumptions—Look and Listen—Presumptions—Contributory Negligence—Question for Jury—Trial—Request to Charge—Other Instructions—Crossing Accident—Speed Ordinance—Evidence.

1. Where the car by which deceased was killed as he was passing over a street crossing approached at a speed of from 20 to 25 miles an hour, in violation of a city speed ordinance limiting the speed of cars to 10 miles an hour at the place of the accident, passing a car going in the opposite direction, and deceased was struck just as he was leaving the track, so that it was inferable that, if the car had been running at a proper rate of speed, deceased would have succeeded in crossing ahead of the car, the question of defendant's negligence is for the jury.

2. Deceased, who was killed by a street car at a crossing, had a right to presume, in attempting to cross ahead of the car, that it would be run in obedience to a city speed ordinance.

3. In an action for death in a collision between deceased and a street car at a crossing, it would be presumed, in the absence of evidence to the contrary, that deceased looked and listened before attempting to cross in front of the car, and that he was in the exercise of proper care.

4. In an action for death of a pedestrian in collision with a street car at a crossing, evidence held to require submission of the question of deceased's contributory negligence to the jury.

5. A motorman, while operating a street car over a crossing, though entitled to presume that a person approaching the track will stop before undertaking to cross, so long as there is nothing in the conduct and actions of the person to indicate the contrary to a man of ordinary prudence, on the observance of conduct and actions justifying such contrary conclusion, is bound to pursue such course in the operation of the car as he would if he was in fact aware that the person was going to get on the track.

6. It is not error for the court to refuse a request to charge which was covered by the instructions given.

7. It is not error for the court to refuse a request to charge directing the jury to consider certain particular facts in reaching a conclusion on an ultimate fact in issue.

8. In an action for death in a collision at a street railroad crossing, alleged to have been caused by the operation of the car at an excessive rate of speed, a city ordinance prohibiting the operation of cars at a greater speed than 10 miles an hour at the point in question was admissible.—(Eckhard vs. St. Louis Transit Co., 89 S. W. Rep., 602.

NEBRASKA.—Carriers—Injury to Passenger—Evidence.

In an action for damages by a passenger against a street railway company, where the defendant's liability rests upon the question whether or not a street car was suddenly and carelessly started as the plaintiff was about to alight therefrom, which is denied, the defendant is only required to furnish sufficient proof to rebut that produced by the plaintiff upon this point, and is not required to establish its freedom from negligence by a preponderance of the evidence.—(Lincoln Traction Co. vs. Shepherd, 104 N. W. Rep., 882.)

NEW HAMPSHIRE.—Death—Damages—Capacity to Earn Money—Evidence.

1. Under Pub. St. 1891, c. 191, Sec. 12, providing that, in an action for the wrongful killing of a human being, his capacity to earn money may be considered as an element of damage, evidence tending to show such capacity is competent.

2. Evidence in an action for the wrongful killing of plaintiff's wife, brought under Pub. St. 1891, c. 191, Sec. 12 of which makes capacity to earn money an element of damage, that deceased never had earned money, and from her station in life probably never would render services calling for pay, though competent on the question of capacity to earn, would not prevent the jury from finding from other evidence that such capacity existed.

3. In an action for the wrongful killing of plaintiff's wife, brought under Pub. St. 1891, c. 191, Sec. 12 of which makes earning capacity of the deceased an element of damage, evidence as to the value of the wife's services as housekeeper in plaintiff's family was competent as tending to show such earning capacity.—(Dillon vs. Hudson, Pelham & Salem Electric Ry. Co., 62 Atlantic Reporter, 93.)

NEW YORK.—Carriers—Passengers—Termination of Relation—Obstruction of Streets—Standing Cars—Persons Crossing Tracks—Personal Injuries—Negligence.

1. A street railroad's duty to a passenger as such ceases, where the passenger has alighted from the car at the terminus of its route, and has proceeded along the car to its front, and has started to cross the track.

2. A street railway has the right, without being charged with a breach of duty or an unlawful obstruction of the highway, to allow its cars to stand upon its tracks for a reasonable length of time.

3. A street car had reached the terminus of its route, and had stopped on a downgrade for the passengers to alight. A rule of the railroad required the motorman to stand at his post until the conductor had finished seeing to the alighting of the passengers, and had come to the front of the car, after which it was the motorman's duty to alight, lift the fender, and strap it to the dashboard. Plaintiff was the last of a number of passengers to leave the car, and proceeded along the side of the car to its front, and started to cross the track, where she tumbled upon the fender and was injured. But a very short time had elapsed between the accident and the stopping of the car, and there was no necessity for plaintiff's turning immediately in front of the car. The accident occurred in the nighttime, but it was not absolutely dark. Held, that defendant was not negligent in permitting the fender to remain down as long as it did, although the motorman might have immediately lifted it with a hook when the car came to a stop.—(Poland vs. United Traction Co., 95 N. Y. Supplement, 498.)

NEW YORK.—Street Railroads—Collision with Traveler—Paramount Rights in Street—Crossing Cul-De-Sac—Instructions—Appeal—Harmless Error—Refusal of Request to Charge.

1. In an action against a street railroad for injury to a traveler in a collision with a street car at a point where the track passes an intersecting street, which is at that place a cul-de-sac, a request to charge that the car had a paramount right on the track, and that the place was not a street crossing, should have been granted, leaving it to plaintiff's counsel to request a proper instruction defining the manner in which the right must be exercised.

2. In an action against a street railroad for injuries to a traveler in a collision with a car, error in refusing to charge that a street railroad has a paramount right of way in a street when its track passes an intersecting street which is at that point a cul-de-sac, is not cured by an instruction that the motorman, though seeing the traveler at the distance of half a block from the track, was not bound to bring his car to a stop, but had a right to believe that the traveler would not attempt to drive across in front of the car.—(Rutz vs. New York City Ry. Co., 95 N. Y. Supplement, 345.)

NEW YORK.—Master and Servant—Death of Employee—Assumption of Risk.

An employee was killed while attempting to move a street car into a car house. The car came to a stop on the curve leading into the house, and the employee directed that leaders should be attached to the car platform, and gave instructions to go ahead. The car did not move. He then walked into the space between the car and the wall of the barn, when the car moved and crushed him. He knew the situation and acted in view of that knowledge. Held, that he assumed the risk as a matter of law, precluding a recovery for his death.—(Laffan vs. Metropolitan St. Ry. Co., 95 N. Y. Supplement, 705.)

NEW YORK.—Street Railroads—Vehicles—Drivers—Injuries—Contributory Negligence.

Where, the street car which struck plaintiff's truck was compelled to cover a distance of over 200 feet, embracing two street crossings, while plaintiff's truck was traveling a distance of not more than 50 to 70 ft. in crossing obliquely over the tracks in the daytime, and plaintiff testified that the speed of the car increased while he was on the easterly track, and that he used his whip to get clear, and succeeded in getting all but the hind wheel of his truck off the rack when the collision occurred, he was not guilty of contributory negligence as a matter of law.—(Mattes vs. New York City Ry. Co., 95 N. Y. Supplement, 596.)

NEW YORK.—Carriers—Injury to Passenger—Negligence—Evidence.

Evidence, in an action for injury received by a passenger, that as he walked toward the door the train came to a sudden stop and he was thrown down, showed no actionable negligence on the carrier's part.—(Needham vs. Interborough Rapid Transit Co., 95 N. Y. Sup., 561.)

NEW YORK.—Street Railways—Collision with Team—Contributory Negligence—Instructions—Damages—Cause of Injury—Evidence.

1. In an action for collision of a street car with a wagon, the driver having turned to cross in front of the car while it was standing 25 ft. away, and there being evidence that the heads of the horses had not got on the track before the car started, it was error to refuse an instruction that if it was apparent to the driver, or would have been apparent to a person of ordinary prudence, exercising ordinary care, that the car would overtake him unless its speed was slackened, it was not a prudent act for him to assert his rights and proceed, though it was the motorman's duty to slow down or stop to enable him to cross.

2. That the injuries received by horses were caused by collision of a street car with the wagon to which they were attached is not proved by testimony of the owner and driver that after the accident the horses limped; their condition prior to and at the time of the accident not being shown.—(Goodman vs. New York City Ry. Co., 95 N. Y. Sup., 544.)

NEW YORK.—Carriers—Injuries to Passengers—Negligence—Station Platform—Duty to Remove Obstructions.

1. The existence of an obstruction over which a passenger falls upon a station platform is not, in the absence of evidence or of something about the obstruction itself to indicate the length of time during which it was on the platform, or the cause of its presence there, sufficient to charge the railroad with negligence.

2. A railroad's duty toward passengers with respect to obstructions on a station platform is to use reasonable care not to permit the station to become dangerous through the presence of such obstructions after a reasonable opportunity to discover and remove them has elapsed.—(Scholtz vs. Interborough Rapid Transit Co., 95 N. Y. Sup., 557.)

NEW YORK.—Street Railroads—Collision with Vehicles.

Evidence that plaintiff's servant was driving along a street in the same direction in which a street car was traveling, and, without looking or taking any precaution, drove on the track in front of the car, did not show freedom from contributory negligence.—(Kueski vs. New York & Queens Co. Ry. Co., 95 N. Y. Sup., 650.)

NEW YORK.—Master and Servant—Injuries to Servant—Street Railroads—Proper Appliances—Assumed Risk—Evidence—Experts—Hypothetical Questions.

1. Where plaintiff, who was employed to work on an elevated railroad structure, was directed to clear snow from the ties with an iron shovel, which did not necessitate contact with nor dangerous proximity to the electrically charged third rail, defendant company was not guilty of negligence in providing plaintiff with an iron shovel, instead of a wooden one.

2. Plaintiff, having been previously employed for six months to work on the third rail as one of the electrical repair gang, and having knowledge or means of knowledge of the danger incident to contact therewith, assumed the risk.

3. Where, in an action for injuries, plaintiff testified that particles of molten lead had gone into his eye, but the only other evidence thereof was that of plaintiff's physician, who testified that he took some particles out of the eye, but could not say whether they were lead, or iron, or dirt, it was error to permit hypothetical questions to be asked, including as their most important element the assumption that particles of molten lead had gone into plaintiff's eye.—(Smith vs. Manhattan Ry. Co., 95 N. Y. Sup., 529.)

PENNSYLVANIA.—Carriers—Passenger on Street Car—Injuries—Presumptions—Contributory Negligence—Death by Wrongful Act—Action by Wife—Defenses—Evidence—Carriers—Injury to Passenger—Evidence.

1. Where a person is unable to find room on a summer car other than on the running board, and is killed in collision with another car while riding thereon, a presumption of negligence arises against the company, and the burden is on it to rebut it.

2. In an action against a street railway company to recover for the death of a passenger killed while riding on the running board of a summer car, the court could not say as a matter of law that plaintiff's intestate was guilty of contributory negligence, though there was evidence at the time of the collision he was standing on the track by the side of the car.

3. The fact that a wife, suing for the death of her husband, had prior thereto consulted counsel as to the matter of divorce, is no defense.

4. Where, in an action for the death of plaintiff's husband, there was evidence that his earning capacity was small, it was not error to admit evidence that his father had been in the habit of assisting the wife.

5. In an action for the death of a passenger by collision between two street cars, evidence as to the effect of the collision on the other passengers is immaterial.—(Abel vs. Northampton Traction Co., 61 Atlantic Rep., 915.)

TENNESSEE.—Street Railroads—Injury to Person on Track—Question for Jury—Contributory Negligence—Question for Jury—Trial—Material Issue—Conflicting Evidence—Submission to Jury—Municipal Corporations—Ordinances—Evidence—Instructions.

1. Evidence in an action against a street railway company for injuries received by a pedestrian in a collision with a street car, held, to require the submission to the jury of the question of the company's negligence.

2. Evidence in an action against a street railway company for injuries received by a pedestrian in a collision with a street car, held, to require the submission to the jury of the question of the pedestrian's contributory negligence.

3. Where the evidence is conflicting on an issue which must necessarily enter into consideration of the controversy, and by itself or in connection with other evidence be determinative of the case, the issue must be submitted to the jury.

4. In an action against a street railway company for injuries received by a pedestrian in a collision with a car, plaintiff without objection introduced a copy of an ordinance. The ordinance was an amended ordinance and regulated the speed of cars within the city. Held that, although it would have been more formal to have introduced the original ordinance, there was no reversible error in admitting the amended ordinance only.

5. Where, in an action against a street railway company for injuries received by a pedestrian in a collision with a car, the evidence showed that plaintiff was attempting to cross a street, that she looked in both directions and saw cars coming on both tracks, that she started diagonally across the street, that before reaching one of the tracks she was intercepted by a wagon, and that as she passed behind it and was about to enter on the other track a car struck her before she could cross the track, the refusal to charge that it was the plaintiff's duty to not only look before attempting to cross the track, but also after she had been intercepted by the wagon, and that if her failure to so look was the direct cause of the injury there could be no recovery, though the company was negligent, was reversible error, though the court charged that, if plaintiff failed to exercise ordinary care, and her negligence was the proximate cause of injury, there could be no recovery.—(Knoxville Traction Co. vs. Brown, et ux., 89 S. W. Rep., 319.)

TEXAS.—Railroads—Accidents to Trains—Collision with Street Car—Statutory Signals—Lookout—Negligence Per Se—Concurring Negligence—Joint Liability—Proximate Cause—Appeal—Assignments of Error—Sufficiency—Trial — Instructions—Assumption of Facts—Railroads—Accidents to Trains —Collision with Street Car—Statutory Signals—Failure to Give—Appeal—Invited Error—Crossing Railroad Tracks—City Ordinance—Construction—Injury to Passenger—Pleading—Instructions—Issues—Trial — Instructions—Assumption of Facts—Burden of Proof—Instructions—Excessiveness.

1. In an action for injuries to a street car passenger in jumping from the car to escape an imminent collision with a railroad train, the failure of the railroad company to ring a bell while approaching the crossing, as required by Sayles' Ann. Civ. St. 1897, art. 4507, and to keep a proper lookout at the crossing as required by a city ordinance, constituted negligence per se.

2. Where, in an action for injuries to a passenger of a street car in jumping therefrom to escape a threatened collision with a railroad train, there was evidence that, if the railroad company had kept a proper lookout, the street car would have been seen and the train would not have rapidly approached the crossing in the manner it did, and that, if it had given a proper statutory signal of its approach, the car would not have gone on the crossing, and also that, if the street car had stopped as required by a city ordinance before attempting to cross the railroad, the approach of the train would not have alarmed plaintiff, the railroad and street car companies were each guilty of concurring negligence which caused the accident, and were each, therefore, liable.

3. Where an accident occurred from two causes, both due to negligence of different defendants, but together an efficient cause, such concurring cause was a proximate cause, and the negligence of one furnished no excuse for the negligence of the other.

4. Assignments of error submitted as propositions that instructions objected to were "erroneous and misleading"; "that such charge * * * was further erroneous, misleading, and confusing to the jury, when considered in connection" with other specified paragraphs of the main charge; "that the court erred in a specified paragraph of its main charge, in that said charge was erroneous, misleading, and confusing"; and "that the charge permitted a double recovery"—were fatally defective for failure to allege the specific error in the charge of which complaint was made.

5. In an action for injuries to a street car passenger while jumping from the car to escape a threatened collision with a railroad train, an instruction that it was the duty of the railroad company to use ordinary care to prevent injury to plaintiff, and defining ordinary care, was not objectionable as assuming that the railroad company injured plaintiff and that it was guilty of negligence.

6. Where plaintiff was injured in jumping from a street car to escape a threatened collision with a railroad train, and the railroad company failed to ring the bell as the train approached the crossing, as required by Sayles' Ann. Civ. St. 1897, art. 4507, such company was not relieved from liability because the train was actually stopped before collision after causing the injury.

7. A party cannot allege error in an instruction given which was substantially the same as an instruction requested by it.

8. A city ordinance providing that no street car shall stop on any street crossing or on any railroad track, but shall come to a full stop before crossing any railroad track, is sufficiently comprehensive to include a railroad track, whether main line or spur.

9. Where, in an action for injuries to a passenger in jumping from a street car to escape a threatened collision with a railroad train, the petition charged that the street car company failed to take any precaution whatever to indicate the presence or coming of the railroad train, the court was justified under such allegation in presenting the issue as to whether the street car company failed to keep a reasonably sufficient lookout for the train.

10. The court in such action did not assume that plaintiff had reasonable ground for leaving the car while on the track by submitting the question whether there was reasonable ground for leaving the car after it had moved off the railroad track.

11. The court did not place the burden of showing that the failure to stop the car was not the proximate cause of the disaster by instructing that, if the jury found that the failure to stop the car was not the proximate cause of the injury, then the street car company would not be liable.

12. In an action for injuries to a passenger, an instruction that the jury should allow plaintiff such damages as would fairly compensate her for her injuries was proper.

13. Where plaintiff prior to the injury was 34 years of age, strong, healthy, and robust, weighing 175 lbs., and after the injury caused by defendants' negligence was a nervous wreck, suffering from insomnia, pleurisy, neuralgia, and irregular menstruation, a verdict for $16,000, reduced to $14,000, was not so excessive as to require reversal.—(Galveston, H. & S. A. Ry. Co. et al. vs. Vollrath, 89 S. W. Rep., 279.)

TEXAS.—Carriers—Street Railroads—Injuries to Passengers Alighting—Warning—Question for Jury—Costs—Preparation of Transcript.

1. Where, in an action for injuries to a female passenger while alighting from a street car, negligence was charged in that the car platform and steps were wet, muddy, and slippery, rendering them dangerous for ladies unassisted to alight, whether the carrier owed plaintiff a duty either to warn or assist her was for the jury.

2. Where a statement of facts prepared by plaintiff was claimed to be so defective in many particulars that defendant could not agree to it, and defendant thereupon obtained an order directing the official stenographer to prepare and file a transcript of the testimony, as authorized by Gen. Laws 1903, p. 85, the expense thereof was payable by defendant, and was not taxable as costs in the case.—(Flory vs. San Antonio Traction Co., 89 S. W. Rep., 278.)

TEXAS.—Damages—Personal Injuries—Fright Resulting in Injury—Railroads—Injury to Trespassers—Discovered Peril.

1. Where fright is caused to one by the wrongful act or omission of another, and physical injury results therefrom, and such injury is the proximate consequence of the act or omission, and should have been foreseen under the circumstances, a cause of action exists therefor.

2. A railroad is liable for physical injury resulting from fright, caused by the wrongful act or omission of its servants in failing to stop a train while crossing a bridge on which the injured person was walking, and from which she had barely time to escape before the train reached her, where such servants saw and knew the dangerous situation of the injured person, and knew or should have known her fright and the injury which might result therefrom.—(Hendrix vs. Texas & P. Ry. Co., 89 S. W. Rep., 461.)

TEXAS.—Carriers—Who are Passengers—Obligation of Carrier —Negligence—Personal Injury—Plaintiff's Prior Physical Condition—Damages—Personal Injuries—Evidence—Aggravation of Existing Physical Condition.

1. A person in the act of getting on a street car, and before he has got entirely in the car, is a passenger, imposing on the servants in charge of the car the duty of exercising such a degree of foresight as to possible dangers and such a degree of prudence in guarding against them as would be used by very prudent and competent persons under similar circumstances.

2. Though plaintiff, in an action for personal injury negligently inflicted, alleged in her petition that she was, prior to the injury, sound and healthy, she was not required, in order to recover for the injury sustained, to prove the allegation.

3. The evidence, in an action for personal injury negligently inflicted, that plaintiff's general physical condition at the time of the trial was no worse than it had been for several years previous to the injury, and that, instead of having been, previous to the injury, a healthy person, as alleged, plaintiff had been sickly and incapable of physical labor, does not preclude recovery for such physical and mental suffering, incapacity to attend to her affairs, etc., as alleged, as were immediately consequent on the injury, and the direct result thereof, together with expenses incurred for medical attendance on account thereof.

4. In an action for personal injury negligently inflicted by another, the petition alleged that before the injury plaintiff was healthy, capable of attending to her domestic affairs, and that because of the injury she was unable to do so. The evidence showed that she was, in fact, physically unsound before the accident. Held, that she was entitled to damages for such injury as aggravated a previously diseased physical condition.—(Green vs. Houston Electric Co., 89 S. W. Rep., 442.)

WEST VIRGINIA.—Carriers—Injury to Passenger Alighting from Street Car—Instructions.

In an action for injuries sustained by a passenger while attempting to alight from a street car, it is error to give to the jury an instruction, in which, after telling them that, under the law, the defendant is held liable for the slightest negligence, they are instructed that the defendant must "repel by satisfactory proof every imputation of such negligence," when the facts are not such as to create a presumption of negligence against the defendant and cast the burden upon it to disprove negligence of the plaintiff is involved.—(Blake vs. Camden InterState Ry. Co., 50 S. E. Rep., 408.)

FINANCIAL INTELLIGENCE

WALL STREET, April 18, 1906.

The Money Market

There has been a decided change for the better in the monetary situation during the past week, rates for all classes of accommodations working down to a normal level. The improvement was due largely to the relief measures adopted by the Secretary of the Treasury, which not only places at the immediate disposal of the national banks the gold engaged by them abroad for importation, but also places the institutions in a better position to obtain gold in the foreign markets for shipment to this side. Heretofore the importers of the precious metal had to figure the loss of interest while the gold was in transit, but under the new plan this important item is eliminated from the cost of importation. The amount of gold engaged during the past week is estimated at about $15,000,000, including the $6,100,000 announced at the close of last week, and further substantial engagements are looked for. Up to the present time a very small portion of the gold has been received, but the treasury department has already paid out about $13,100,000 on account of these engagements. Another important factor has been the heavy gain in cash by the local institutions. During the week ending April 13, the receipts of currency from the interior were about $4,500,000 greater than in the preceding week, while the shipments by the New York City banks were about $5,500,000 smaller. This substantial gain in cash was reflected in the bank statement published last Saturday, which showed a surplus of $4,772,500 against a deficit in the previous week of $2,560,625. The surplus in the corresponding week of 1905 was $9,352,400, as compared with $27,304,600 in 1904, $6,007,650 in 1903, $6,578,650 in 1902, $14,922,100 in 1901, and $10,950,275 in 1900. Foreign exchange has been irregular. Following the easier tendency in money rates, sterling advanced sharply, but at the close the market again yielded to heavy offerings of finance and other classes of bills. European markets have been quiet and practically unchanged. Official announcement of the new Russian loan will be made shortly. Money on call has loaned at 12 per cent and at 3 per cent, the average rate for the week being about 6 per cent. Time money has ruled decidedly easier; thirty-day accommodations, which commanded about 8 per cent a week ago, were obtainable at 5½ per cent, while sixty and ninety-day funds, which were in demand last week at 6½ and 7 per cent, practically went begging at 5 per cent. For the longer periods money was freely offered at 5 per cent.

The Stock Market

The developments in the financial markets during the past week were of a revolutionary character, and resulted in a radical change in the tone and character of both the money and stock markets. At the close of last week, money was scarce and rates were high, with sterling exchange weak, and all hope of an improvement dependent upon gold imports. The announcement that the Secretary of the Treasury had agreed to lend to national banks the full amount of the gold engaged by them for import, such loans to be secured by the deposit of approved securities, and to be repaid upon the arrival of the gold in this country, was followed by liberal offerings of funds by the banks and private bankers, and resulted in a break in the call-loan rate from 25 per cent to 3 per cent, time money also working down to a normal level. The relaxation in money rates alarmed the shorts in the stock markets into covering, and prices advanced rapidly under rather aggressive buying. The leading feature of the upward movement was Amalgamated Copper, which made a gain of about 8 points, on reports that the directors at their meeting this week will place the stock on a 7 per cent dividend basis. The steel stocks made good gains, and the shares of the anthracite coal roads advanced sharply, with heavy buying of Pennsylvania, although the coal labor situation was not encouraging. The stock market has been and is expected to be influenced largely by the money market, and the latter is not in a sufficiently strong position to warrant a revival of bullish activity upon a broad scale. Nevertheless, the outlook is bright, and all indications point to higher prices.

The local traction shares have acted remarkably well. Following the break in Brooklyn Rapid Transit to below 85, there was aggressive buying of the stock, which lifted the price up to 89, and while part of the buying was attributed to the pool, not a little of it was influenced by the favorable position of the company, its continued large earnings and the assurance of the largest summer's business in the history of the company. The Metropolitan issues have been firm, as the business of the company will improve with the milder weather.

Philadelphia

Decided strength characterized the market for the local traction shares during the past week, prices in nearly every instance ruling somewhat above those prevailing at the close of last week. The volume of business, however, was not large, owing to the observance of the Easter holidays. Philadelphia Rapid Transit was about the only issue to display any degree of activity, upwards of 5000 shares changing hands at from 27½ to 28¾, a net gain for the week of 1¾ points. Union Traction developed pronounced strength, the price rising 1¼ points to 63½ on the purchase of about 600 shares. Philadelphia Company's issues were extremely quiet, but prices for both the free stock and the receipts held firm. Of the first named less than 500 shares sold at 50, while upwards of 2000 shares of the deposited stock changed hands at from 53¾ to 54¼. Sales of the preferred stock were made at 49½. Philadelphia Traction was fractionally higher, a few odd lots changing hands at 99 and 99½. Other transactions included American Railways at 53 and 53¼, Fort Worth & Wabash Valley Traction at 28, Consolidated Traction of New Jersey at 80½ and 80¼, United Traction of Pittsburg preferred at 50, Fairmount Park Transportation at 17¾, and United Companies of New Jersey at 262.

Chicago

Less interest was manifest in the street railway issues at Chicago. Not a single transaction was reported in Chicago City Railway, while in the stocks of the other surface roads trading was confined largely to odd lots. West Chicago, which closed at 23 last week, advanced to 26, while the consolidated bonds rose to 64½. Union Traction preferred was firmer at 18, and North Chicago brought 31. Chicago & Oak Park Elevated brought 6¾, and the preferred sold at 22. South Side Elevated lost a point to 93. Other transactions included Northwestern Elevated common at 25⅜ and 25½, the preferred at 60¼, Metropolitan Elevated common at 26½, and the preferred at 68 and 68⅛.

Baltimore

Trading in the tractions at Baltimore was very quiet and without noteworthy feature. United Railway 4 per cent bonds ruled practically unchanged, with transactions at 92½ and 92⅜. The free incomes sold to the extent of about $60,000, at from 73¾ to 73, and back again to 73½, while one $1,000 certificate sold at 73. Norfolk Railway & Light 5s sold at 102 for $14,000, and $1,000 North Baltimore Railway 5 per cent bond brought 120. The Boston market was dull and irregular. Boston Elevated, after declining from 156¾ to 155, recovered to 156. Boston & Worcester common sold at 39½ to 39, and back to 39¼, while the preferred changed hands at 89 for small amounts. Massachusetts Electric common was steady, with transactions at 19¼ and 19, but the preferred dropped to 67½ to 66¼, on sales of about 600 shares. West End common changed hands at from 99 to 100, and the preferred at 115¾ and 116. In the New York curb market, Interborough-Metropolitan issues ruled fairly active and firm. Upwards of 11,000 shares of the common changed hands at prices ranging from 52⅛ to 54, while about 4000 shares of the preferred brought prices ranging from 89 to 90⅜, and closing at 90. The 4½ per cent bonds advanced from 89⅞ to 91⅛, but subsequently reacted, and closed at 90¼. About $475,000 changed hands. New Orleans Railway common was weak, several hundred shares selling at 34½ to 34⅛. The 4½ per cent bonds were steady, $10,000 selling at 90.

Cincinnati, Newport & Covington issues had a very active week in Cincinnati. The common had an unprecedented upward move due doubtless to dividend reports. It opened the week at 53⅛ and advanced steadily to 62½, the highest price on record. The preferred opened the week at 97, and sold up to 97½. Cincinnati Street Railway sold at 146½ and 147. Cincinnati, Dayton & Toledo also had an upward movement, advancing from 26¾ to 28. A small lot of Detroit United sold at 99. Cleveland Electric made a gain from 79 to 80, and then declined fractionally. Aurora, Elgin & Chicago common sold at 33⅛ to 34, and the preferred sold at 93½. Cleveland & Southwestern sold at 15, and the 5 per cent bonds at 96⅛. Lake Shore Electric made a fractional advance to 16½.

Security Quotations

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

	April 11	April 18
American Railways	52¾	54
Boston Elevated	156¾	158
Brooklyn Rapid Transit	84½	87½
Chicago City	150	150
Chicago Union Traction (common)	5⅞	6
Chicago Union Traction (preferred)	21½	21½
Cleveland Electric	—	81
Consolidated Traction of New Jersey	80	80
Detroit United	98¾	97
Interborough Rapid Transit receipts	225	—
Interborough-Metropolitan Co. (common), W. I.	52¼	53¼
Interborough-Metropolitan Co. (preferred), W. I.	88⅛	89
Interborough-Metropolitan Co. 4½s, W. I.	90¼	90¼
International Traction (common)	38	37½
International Traction (preferred), 4s	71	72
Manhattan Railway	155	155½
Massachusetts Elec. Cos. (common)	19	19¼
Massachusetts Elec. Cos. (preferred)	67	67
Metropolitan Elevated, Chicago (common)	26½	26
Metropolitan Elevated, Chicago (preferred)	68	67
Metropolitan Street	113	116⅝
Metropolitan Securities	72	73¾
New Orleans Railways (common)	34	32⅞
New Orleans Railways (preferred)	81	80
New Orleans Railways, 4½s	—	88½
North American	98½	100⅝
North Jersey Street Railway	27	27
Philadelphia Company (common)	50¼	49¾
Philadelphia Rapid Transit	27	28¼
Philadelphia Traction	98¾	99
Public Service Corporation 5 per cent notes	94	94
Public Service Corporation certificates	72½	72½
South Side Elevated (Chicago)	—	93
Third Avenue	132	133½
Twin City, Minneapolis (common)	118⅛	119
Union Traction (Philadelphia)	62	63
West End (common)	99	99½
West End (preferred)	114½	115½

W. I., when issued.

Metals

According to the "Iron Age," reports from the leading interests indicate that there has been a more general resumption of buying of pig iron, the orders booked during the past two weeks having increased considerably and extending over the whole field. The congestion of the rail mills is growing more serious, and is likely to have its effect on the general steel market, and indirectly upon the output of the rolling mills. The Tennessee Company has opened its books for 1907 at $29, and has taken orders for 67,000 tons. Structural trade is quieter. The inquiries from foreign markets are heavy and pressing.

Copper continues strong at 18½ to 18¾c. for lake, and 18 to 18¼ for castings. It is stated that some heavy contracts have been made at current prices.

ELECTRICITY FOR A TEXAS STEAM LINE

J. H. Hill, general manager of the Galveston, Houston & Henderson Railroad, has been directed by the board of directors of that road to investigate the substitution of electricity for steam as motive power on the line. The road runs between Galveston and Houston, a distance of 51 miles, and does a heavy passenger business. Preliminary investigation, looking to installing electric traction upon the road, has already been made, and when Mr. Hill has made his report definite action will be taken in the matter.

FRENCH STATISTICS

Official statistics, published by the French Government on Feb. 27, give the following data for the tramways and light railways in France:

LIGHT RAILWAYS	
Length on Dec. 31, 1904	6418 km, or 4011 miles
Length on Dec. 31, 1905	6880 " 4300 "
Concessions granted in 1905	340 " 212 "
TRAMWAYS FOR PASSENGERS AND MERCHANDISE	
Length on Dec. 31, 1904	4500 km, or 2812 miles
Length on Dec. 31, 1905	4808 " 3005 "
Concessions granted in 1905	588 " 367 "
TRAMWAYS FOR PASSENGERS ONLY	
Length in service at end of 1904	2006 km, or 1254 miles
Conceded in 1905	
Length conceded to end of 1905	2321 " 1450 "

NEW ROAD OUT OF KALAMAZOO

The Grand Rapids & Kalamazoo Valley Traction Company, of Kalamazoo, Mich., the names of whose officers were mentioned in the STREET RAILWAY JOURNAL of March 31, reports that of the 50 miles of road laid out, 15 miles have already been graded, and that the work of the construction is only awaiting the purchase of the necessary materials. The negotiations are under way at the present time for securing the rails, and it is expected that the construction work will be begun in the course of the next few days. The financial arrangements are in the hands of S. A. Phillips, Betz Building, Philadelphia, Pa.

EARNINGS OF THE ILLINOIS VALLEY RAILWAY

The gross earnings of the Illinois Valley Railway for the year 1905 were about $5,000 per mile of track. This is an excellent showing when the location of the road and the population along the route are considered. The Illinois Valley Railway operates through several small towns, the largest of which, La Salle, according to the census of 1900, had a population of only 10,588. The total population of the several towns along the line, according to the same census, was slightly above 39,000. As the road is 36.6 miles long, the population per mile of track is about 1000, and the gross earnings per capita were about $5. This is unusually large for an outlying district, but it is partly accounted for by the fact that the western end of the road traverses a coal mining region, while other portions pass through a district where cement factories and zinc smelters are located.

REPORT OF THE GENERAL OMNIBUS COMPANY OF PARIS

The Cie Générale des Omnibus of Paris is the largest tramway and omnibus company in that city, and one of the largest street railway companies in the world. For a long time it had a monopoly of the interior transportation in the city, but there are now several smaller companies. The report for 1905 shows 250,121,235 passengers carried, a decrease of 6,248,413 as compared with the previous year. This decrease is due principally to competition of the Metropolitan Subway. The operating expenses of the different motive powers were as follows:

	Francs Per Car-km	Cents Per Car-Mile
Omnibuses	0.5621	17.99
Horse cars	0.5529	17.69
Compressed-air cars	0.4092	13.09
Serpollet steam cars	0.4912	15.72
Purrey steam cars	0.3685	11.79
Rowan steam cars	0.4824	15.46
Accumulator cars	0.5072	16.23

Other statistics for 1905 follow:

	Omnibuses	Horse Cars	Mechanical Traction
Kilometers run, total	22,925,999,120	4,123,186,831	17,639,406,910
Kilometers run per car per day	93.847	98.098	109.483
Passengers carried, total	114,557,809	24,241,733	111,321,693
Passengers per car per day	469	576	691
Passengers per trip	30	36	45
Passengers on upper deck	65,095,708	12,236,197	51,150,905
Passengers on lower deck	49,462,101	12,005,536	60,170,788
Av. r'c'ts in frs. per passenger	0.1873	0.1749	0.1634
Av. r'c'ts in frs. per car km.	0.9359	1.0283	1.0311

UNIVERSAL TRANSFER BILL IN NEW YORK

At this time, when the readjustment and unification of the subway, elevated and surface railway lines in New York is about to be perfected, through the consolidation of the New York City Railway Company and the Interborough Rapid Transit Company, the bill introduced in the Legislature which provides for universal transfers, naturally is attracting attention. The officials of both companies affected are opposed to the measure, because of the trouble that would result from any attempt on their part to meet its requirements at this time. President Vreeland, of the New York City Company, and Vice-President E. P. Bryan, of the Interborough, say that the result of giving transfers at every point would seriously cripple the service and make the conditions of travel many times as bad as they are now. President Vreeland has expressed himself as follows on the subject:

There is no doubt that the law making it compulsory to give free transfers at all points from and to the elevated, subway and surface-car systems would lead to the most serious discomforts to passengers. The operating officials of the various systems should have control of the regulation of traffic so as to afford the public a great many more advantages than are possible under the present system.

By reason of the operation of the law on rigid lines, rightly interpreted, there are thousands of passengers every day who crowd the Broadway and other main lines who could be more comfortably transported and brought with greater speed to their destinations by the use of lines less crowded. The traveling public and the truckmen crowd Broadway while other lines of travel north and south, such as Second Avenue, Eighth Avenue and Ninth Avenue, would be much more convenient.

Before it was made impossible to travel in opposite directions on the same transfer, more than 100,000 passengers a day rode from the East Side over to Broadway, then up Broadway, and then back again to the East Side. They could have gone direct by way of Second or Third Avenue. They blocked travel and brought discomfort to thousands of persons besides themselves.

The question of transfers is one of operation, and if the operating officials of the various roads were authorized to regulate the flow of traffic, the result in added comfort and quickness would, I am sure, be appreciated by the general public.

Vice-President Bryan, of the Interborough, said:

For many years the citizens of this city have been fighting for a rapid transit system which would carry passengers from the downtown district to Harlem or the Bronx quickly. If universal transfers were put into effect now the subway would be so jammed that the movement of trains would be impeded, the public would be subjected to much discomfort, and traffic in general would be seriously delayed.

The subway is now operated, in the morning and evening "rush" hours, at its full capacity, and no matter what law is passed compelling free and universal transfers, we cannot carry more passengers on the trains at those times.

In the subway the question of stairways, of platform space, and of train capacity, must be carefully considered. To crowd the platforms more than they are now would result in conditions every day such as now occur if, for any reason, an express train is delayed for ten or fifteen minutes. No matter how many persons crowded to the platform, we couldn't carry any more passengers than we carry in the "rush" hours now.

DOES IT MEAN NEW YORK CENTRAL CONTROL?

The Pennsylvania & Ohio Electric Railway, a 24-mile road, lying partially in the main route from Buffalo to Chicago, has been sold to L. A. Robinson, general passenger agent of the Pittsburg & Lake Erie Railroad, one of the New York Central lines. The daily papers of the district say the sale is the opening of a campaign on the part of the New York Central to acquire parallel electric lines across Northern Indiana and Ohio from Buffalo to Chicago, the same as has been done in New York State. While it is generally conceded by well-informed traction men in Cleveland, where the traction properties are largely owned, that the great steam system is likely to acquire these properties in time, it is not believed that this particular sale has that significance, as it is pointed out that Mr. Robinson owns Woodland Beach Park on the lake front near Ashtabula, together with the Ashtabula & Lake Shore Electric Railway, operating an electric railway from the park to Ashtabula, and he has announced that these properties are to be consolidated with the Pennsylvania & Ohio, with a view to reducing expenses; that the Pennsylvania & Ohio power station is to be enlarged and the service improved. It is hardly thought that the first mentioned improvement would be made if all the lines in the main East and West route were to be merged. On the other hand, there is considerable significance in the recent purchase of all the lines between Buffalo and Erie by Ex-Lieutenant-Governor Sheehan, of New York, who is said to be attorney for the New York Central. Horace Andrews, of Cleveland, who has been associated with the New York Central in all its New York State traction operations, has been abroad for several months, and his associates at Cleveland say they know nothing about these latest developments in Ohio.

IMPROVEMENTS AT WILMINGTON

The Wilmington City Railway Company, of Wilmington, Del., has placed contracts for new equipment calling for an expenditure of $400,000. The improvements to be made extend to all departments of the system. There will be an addition to the power house, on the north side of the Brandywine, at the foot of Buena Vista Street, making it two-thirds larger than at present. This work will be done by J. & T. Oliver, who are rebuilding the Southwestern line for the Interstate Railway Company. A battery of four 400-hp boilers has been ordered from the Heine Boiler Company, of Phœnixville, Pa., and two additional generators, one 800 and the other 600-kw capacity, from the General Electric Company. These generators will be direct connected to two engines, to be built by Robert Wetherill & Company, of Chester, Pa. Twenty new cars, fully equipped—ten summer cars and ten winter cars—ten to be built by the American Car & Foundry Company, at the local plant, and ten by the J. G. Brill Company, of Philadelphia, have also been ordered.

In addition to awarding the above contracts it has been decided to proceed to build, as soon as permission is given by the Street and Sewer Department, two local extensions of considerable importance.

GRATUITOUS LIFE INSURANCE TO EMPLOYEES AT COLUMBIA, S. C.

The Columbia Electric Street Railway, Light & Power Company, of Columbia, S. C., has voluntarily instituted an insurance department for its employees. The plan of insurance as announced is that the company insures each employee who has been in its service for over twelve months for $250, payable at his death to his wife, if she is living at his death, and in case of her death, to his children, share and share alike, or in case he has no wife or children, to his estate. When employees shall have been in the service of the company for two years they will be insured for $500, three years $750, and four years $1,000. "Employees" shall not include any of the following officers: President, vice-president, general manager, secretary, treasurer, auditor, clerks, bookkeepers, chief engineer, stenographer, porter or track greasers, but shall be construed to mean superintendent, car starters, motor tenders, linemen, motormen, conductors, employees of sub-station, except porter, employees of car houses, except day laborers and porters, employees of power plant, canal and steam plant, except porter and laborers; lamp trimmers, trouble man, meter readers, machinists, mechanics and the foremen of the above enumerated divisions. The term of the service shall begin with the date of the signing of this plan by the president, and the insurance shall be put in effect in accordance with the time already served by employees. Service with the Columbia Water Power Company shall be construed as service with this company. The company's records of beginning of service shall be conclusive proof of beginning of service. Suspension shall not be construed as a termination of service.

This plan may be amended at any time by the company and may be withdrawn and cancelled in the discretion of the board of directors.

In case the employee is discharged and afterwards again takes up employment with the company, or in case the employee leaves the service of the company, and is again employed, the insurance shall begin from the second date of employment and not from the first. In case an employee is discharged or voluntarily leaves the service of the company, the insurance shall cease absolutely. The insurance is a gratuity, and is not to be construed or regarded as a contract, and may be discontinued at any time.

In case of death by accident in connection with the work of the company, the insurance shall be paid only upon a full and complete release of the company by those authorized to give it for all damages, but nothing shall be paid by the company where a suit is entered for damages by the representatives of the employee.

The plan has been worked out by Edwin W. Robertson, the president, and William Elliott, Jr., vice-president and general manager of the company.

THE CANADIAN PACIFIC AND ELECTRICITY

A report from Ottawa says it is understood that the Canadian Pacific Company has decided to await the outcome of experiments by the New York Central and New York, New Haven & Hartford Railway Companies before taking steps for the electrification of any part of its system. The line from Montreal to Quebec will in all probability witness the first installation. All the electric power necessary can be obtained from Shawinigan Falls.

REPORT OF UNITED RAILWAYS COMPANY OF ST. LOUIS FOR YEAR

The annual report of the United Railways Company for the year ended Dec. 31, 1905, has just been issued. Besides the statements covering the earnings of last year, which have been published, it contains comparative tables of business and traffic for each year since 1900. The earnings from operation and other income increased from $4,469,207 in 1900 to $8,460,016, the operating expenses, taxes and depreciation from $3,646,487 in 1900 to $5,318,368 in 1905, and the surplus from $822,719 in 1900 to $3,141,647 in 1905. There was a deficit of $1,694,393.02 in 1900, and a surplus of $104,571.74 in 1905. The number of revenue passengers increased from 90,617,379 in 1900 to 170,009,691 in 1905. The number of transfers and passes increased from 36,195,654 in 1900 to 74,231,470 in 1905. The total number of passengers increased from 126,813,633 in 1900 to 244,241,161 in 1905. The general statement follows:

CONDENSED STATEMENT

SUMMARY OF BUSINESS

	1905	†1904
Earnings from operation and other income	$8,460,016.01	$9,977,564.17
*Operating expenses, taxes and depreciation	5,318,368.80	5,751,066.65
Surplus over operating expenses, taxes and depreciation	$3,141,647.21	$4,226,497.52
Deductions: Interest on funded debt, miscellaneous interest and organization expenses	2,387,915.47	2,446,292.36
Net income	$753,731.74	$1,780,205.16
Dividends on preferred stock	649,160.00	598,022.50
Surplus	$104,571.74	$1,182,182.66

TRAFFIC STATISTICS

	1905	†1904
Revenue Passengers	170,009,691	201,316,532
Transfers and passes	74,231,470	83,974,502
Total passengers	244,241,161	285,291,034
Percentage of passengers using transfers	41.48	39.64
Average Passenger Earnings:		
Per revenue passengers	4.90	4.89
Per total passengers	3.41	3.46
Mileage	30,453,085	37,910,484

GENERAL BALANCE SHEET (CONDENSED)

Dec. 31, 1905

ASSETS

Property and plant			$89,701,083.23
Securities in Treasury:			
Preferred capital stock of the United Railway Company of St. Louis (70,000 shares), held in trust, for the use and benefit of this company	$7,000,000.00		
General first-mortgage 4 per cent gold bonds of United Railways Co., of St. Louis	277,000.00		
			$7,277,000.00
Louisiana Purchase Exposition stock (par value, $210,000.00)			$2,100.00
Current Assets:			
Cash in bank, trust companies and depositories	$886,100.24		
Cash on deposit to pay bond coupons	582,000.00		
Cash on deposit to pay matured underlying liens	8,500.00		
Cash on deposit for employees' savings	8,195.00		
Bills receivable	71,506.48		
United States—Post Office Department	8,246.30		
City of St. Louis	2,557.33		
Bond and stock scrip	958.95		
Open accounts	708,528.49		
Insurance premiums and water license prepaid	39,676.76		
Material and supplies	268,155.80		
			$2,584,425.35
Total			$99,564,608.58

* Depreciation for 1905, $421,752.39—none charged in former years.
† World's Fair year.

LIABILITIES

Capital Stock:			
Preferred shares	$20,000,000.00		
Less—Reserved for acquisition of capital stock of constituent companies not purchased	16,800.00		
		$19,983,200.00	
Common shares	$25,000,000.00		
Less—Reserved for acquisition of capital stock of constituent companies not purchased	86,200.00		
		24,913,800.00	
Total capital stock issued			$44,897,000.00
Total funded debt outstanding			51,980,000.00
Current Liabilities:			
Audited vouchers and pay roll payable in Jan.		$270,794.69	
Bond coupons matured—not presented		751,350.00	
Underlying liens matured—not presented		8,500.00	
Bills payable		505,000.00	
Employees' savings deposits		8,195.00	
Outstanding tickets		22,093.97	
Unclaimed wages		3,792.50	
Employees' badge deposits		2,786.65	
Accrued Liabilities:			
Taxes (not due)	$37,291.65		
Interest on funded debt (not due)	210,816.66		
Dividend on preferred stock, payable Jan. 10, 1906	162,290.00		
Miscellaneous	3,609.22		
		414,007.53	
			1,986,520.34
Reserve Funds:			
Depreciation reserve		$214,560.05	
Injury and damage reserve		196,877.97	
Fire insurance reserve		19,796.68	
Legal expense reserve		20,262.33	
			451,497.03
Profit and Loss:			
Surplus, Dec. 31, 1904	$138,620.04		
Adjustments	6,399.43		
		145,019.47	
Profit from year's operation		104,571.74	
Surplus			249,591.21
Total			$99,564,608.58

President John I. Beggs, of the company, said in presenting the report:

"There was expended during the year 1905, for betterments and additions to the property of the company (not properly chargeable to operation or current repairs and renewals), the net amount of $335,494.61, as shown by the statement embodied in this report. This amount will have to be provided for at some time in the future by a sale of some of the preferred stock of the company, $7,000,000 of which is in its treasury available for betterments or the acquisition of additional property.

"During the year a reserve account was created, which it is intended steadily to increase, to provide for expenditures on account of injuries and damages, 6 per cent of the gross earnings being carried to this account, out of which all payments and expenses on account of injuries and damages are paid. This fund at the end of the year (as will be seen by the balance sheet) amounted to $196,877.97, and in order that it may be more than a bookkeeping account, there was placed to the credit of this fund $250,000 of the 4 per cent gold bonds of the company received from the trustee under the mortgage upon the retirement of the Jefferson Avenue underlying bonds. The interest received from these bonds will be added to the fund.

"There was likewise created during the year a fire insurance reserve account, which it is intended gradually to increase to such an amount as will ultimately justify the company in carrying its own insurance, a certain percentage of the gross earnings being carried to the credit of fire insurance reserve, to which is charged all fire insurance premiums and losses paid. The balance to the credit of this account at the end of the year amounted to $19,796.68. There was placed to the credit of this fund $27,000 of the first general mortgage 4 per cent bonds (part of those received upon the retirement of the Jefferson Avenue bonds), the interest on which, together with the interest on any other investments for the fund, to be added to it from time to time as received.

"During the year the policy was established of carrying to a depreciation reserve account 5 per cent of the gross earnings of the company, to provide for extraordinary and uncurrent repairs and renewals, not properly chargeable to betterments. The amount carried to the credit of this account for the year was $421,752.39, of which $206,192.34 was expended, leaving a balance of $214,560.05 at the end of the year to the credit of the account.

"The company has heretofore labored under the disadvantage of having its woodworking repair shop located at a distance of about 3 miles from the machine and paint shops; therefore, plans have been perfected and contracts entered into for the construction of a commodious and comprehensive woodworking and paint shop adjacent to our machine shop on the east, the cost of which, including grading, construction and equipment will be about $160,000.

"It is expected that these shops will be ready for occupancy about the middle of the coming year, and that considerable saving will be effected, and the work of the company facilitated by having the principal shops of the company grouped together at Park and Vandeventer Avenues.

"The company is lacking in buildings in which properly to house and care for its rolling stock, but before constructing additional car houses, we deem it advisable to consider carefully the advisability of obtaining locations for car houses much farther removed from the center of the city, in order to save the large amount of dead mileage now necessary in getting cars back and forth from the ends of their runs to their housing quarters. This matter should be given careful consideration during the ensuing year.

"No new passenger equipment has been purchased during the past year, and it is not likely that any will be added during the ensuing year, the 450 cars purchased to take care of the abnormal World's Fair business, together with the equipment previously owned by the company, being deemed sufficient to take care of the business during the years 1905 and 1906. All of the company's equipment has been put in better and more sightly condition than ever before.

"It is the purpose of the present management, when the new shops are completed, to undertake the building of our own cars, the new shops having been designed with that end in view, the intention being to turn out about two new cars per week to take care of the equipment as it wears out and becomes obsolete, and likewise to provide for the growth of the business. It is our belief that we can save money in the cost of equipment and at the same time have our standard better maintained and better construction and finish assured at all times.

"During the year the company has taken steps to establish a hospital for the care of our sick or injured employees, and we likewise intend to establish a recreation hall in the large dwelling house acquired with the land purchased on Grand Avenue, between Park and Vista Avenues. We are likewise rendering some assistance to worthy employees who are overtaken with misfortune to save them from the clutches of "loan sharks."

STANDING COMMITTEES OF THE AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION

As already announced, the American Street and Interurban Railway Association has drawn up an extensive scheme of committees for handling the work of the association. The committees on membership, standardization and car wiring have already been mentioned in these columns. The following committees are also announced by the secretary:

Committee on Papers and Topics.—Richard McCulloch, chairman, United Railways Company of St. Louis, St. Louis, Mo.; Theodore Stebbins, expert, National Civic Federation, Columbus, Ohio; E. G. Connette, Worcester Consolidated Street Railway Company, Worcester, Mass.; W. B. Brockway, Nashville Railway & Light Company, New York, N. Y.; J. S. Doyle, Interborough Rapid Transit Company, New York, N. Y.; S. L. Rhoades, Philadelphia Rapid Transit Company, Philadelphia, Pa.

Committee on Insurance.—H. J. Davis, chairman, Cleveland Electric Railway Company, Cleveland Ohio; R. B. Stearns, Northwestern Elevated Railroad Company, Chicago, Ill.; T. C. Penington, 4012 Drexel Boulevard, Chicago, Ill.

Committee on Compensation for Carrying Mail.—John I. Beggs, chairman, Milwaukee Electric Railway & Light Company, Milwaukee, Wis.; G. T. Rogers, Binghamton Railway Company, Binghamton, N. Y.; P. F. Sullivan, Boston & Northern Street Railway Company, Boston, Mass.

Committee on Promotion of Traffic.—W. E. Harrington, chairman, J. G. White & Company, New York City; Howard F. Grant, Seattle Electric Company, Seattle, Wash.; H. E. Reynolds, Boston & Northern Street Railway Company, Boston, Mass.

Committee on Public Relations.—John B. Parsons, chairman, Philadelphia Rapid Transit Company, Philadelphia, Pa.; H. A. Robinson, New York City Railway Company, New York City; W. Kesley Schoepf, Cincinnati Traction Company, Cincinnati, Ohio; F. H. Dewey, Worcester Consolidated Street Railway Company, Worcester, Mass.

Committee on Municipal Ownership.—C. D. Wyman, chairman, Stone & Webster, Boston, Mass.; John A. Beeler, Denver City Tramway Company, Denver, Col.; George F. Chapman, United Railways of San Francisco, San Francisco, Cal.; H. M. Sloan, manager, Calumet Electric Street Railway Company, Chicago, Ill.; J. J. Stanley, Cleveland Electric Railway Company, Cleveland, Ohio.

Committee on Standard Rules.—E. G. Connette, chairman, Worcester Consolidated Street Railway Company, Worcester, Mass.; Richard McCulloch, United Railways Company of St. Louis, Mo.; E. C. Faber, general manager, Aurora, Elgin & Chicago Railway Company, Wheaton, Ill.

STANDING COMMITTEES OF THE AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION

The names of the gentlemen composing the committee on standardization of the American Street and Interurban Railway Engineering Association were published in the Street Railway Journal for April 7. Since that date President Adams has announced the composition of other standing committees, as follows:

CONTROLLING APPARATUS

J. S. Doyle, superintendent of car equipment, Interborough Rapid Transit Company, New York.

Hugh Hazelton, electrical engineer, the Hudson Companies, New York.

John Lindall, superintendent of motive power and machinery, Boston Elevated Railway Company, Boston.

MAINTENANCE AND INSPECTION OF ELECTRICAL EQUIPMENT

William Pestell, general manager, Worcester Steel Foundry Company, Worcester, Mass.

J. S. Doyle, superintendent of car equipment, Interborough Rapid Transit Company, New York.

W. D. Wright, superintendent of equipment, the Rhode Island Company, Providence, R. I.

MAINTENANCE OF WAY

F. G. Simmons, superintendent of construction and maintenance of way, the Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

W. B. Reed, formerly engineer of way and buildings, New York City Railway Company, New York.

R. L. Crump, engineer, Ford, Bacon & Davis, Memphis, Tenn.

In addition to these committees the association has a standing committee on shop records and accounts. This is a joint committee, two members of which are appointed by the Accountants' Association and two members by the Engineering Association. No work has been done by this committee since the St. Louis convention, in 1904, at which time an excellent report was presented with splendid results. As both associations have so much other work on hand for this year, no report will be presented at Columbus. The chairman for the representatives of the Engineering Association is H. H. Adams, superintendent of shops, the United Railways & Electric Company, Baltimore, Md.

Besides the committees mentioned above the Engineering Association is represented on three committees of the American Street and Interurban Railway Association as follows:

President Adams, ex-officio, is a member of the executive committee.

R. B. Stearns, superintendent of the Northwestern Elevated Railways Company, of Chicago, is the representative appointed by the Engineering Association to serve on the insurance committee.

J. S. Doyle, superintendent of car equipment of the Interborough Rapid Transit Company, of New York, is the representative of the Engineering Association on the committee on papers and topics.

ANNUAL REPORT OF THE NEW ORLEANS RAILWAY & LIGHT COMPANY FOR 1905

At the annual meeting of the stockholders of the New Orleans Railway & Light Company, held Monday, April 9, the following directors were elected: E. C. Foster, R. M. Walmsley, Jos. H. DeGrange, W. R. Stauffer, Maurice Stern, T. H. McCarthy, Albert Baldwin, Hugh McCloskey, Geo. A. Hero, A. Brittin, Frank B. Hayne, Wm. Adler, Pearl Wright, of New Orleans; John W. Barr, Jr., Louisville, Ky.; A. M. Young, New York. The report gives the figures of earnings and expenses, etc., for the year, from Jan. 1 to Dec. 31, but that period from Jan. 1 to June 30, for the underlying companies, covers the period when the company was in the hands of the receiver, the figures being given for a year for comparative purposes. President Foster reports:

INCOME

	1905	1904
Passenger earnings	$3,291,960	$3,071,929
Electric light and gas earnings	1,705,807	1,541,575
Miscellaneous	95,941	60,839
Total earnings	$5,093,709	$4,674,344
EXPENSES		
Operating expenses, railroad department	$1,901,084	$1,753,720
Operating expenses, electric light and gas departments	770,357	744,802
Total operating all departments	$2,671,460	$2,498,522
Net earnings from operation	2,422,249	2,175,821
Interest on funded debt, taxes and miscellaneous	1,784,226	2,149,840
Surplus available for dividends	$638,023	$25,980
Dividend on preferred stock	125,000	....
Surplus	$513,023	$25,980
Percentage total operating to total earnings	52.2	53.4

STATISTICAL STATEMENT

RAILROAD DEPARTMENT

Total miles single track	52.35
Total miles double track	63.33
Total miles special track	11.91
Total miles all track reduced to single	190.92
Total miles of street and right of way occupied by tracks, not including 11.91 miles of sidings	115.78
Gross passenger earnings per mile of single track	$17,242.62
Gross passenger earnings	$3,291,960.00

	1905	1904
Revenue passengers carried	65,021,214	60,696,927
Transfers redeemed	6,641,193	5,832,572
Revenue mileage	16,753,874	16,354,145
Eighteen horse cars	102,156	99,897

In presenting the report President E. C. Foster, of the company, said:

"The New Orleans Railway & Light Company was organized under the laws of Louisiana, June 12, 1905, with a capital stock fixed at thirty million ($30,000,000) dollars, divided into two (2) classes of issue, of which $10,000,000 is non-cumulative 5 per cent preferred stock, $20,000,000 is common stock.

"The company has a bonded indebtedness of $30,000,000—of general 4½ per cent gold mortgage bonds, out of which there is held in escrow an amount equivalent to the outstanding bonds of the underlying companies amounting to $12,806,000—at this writing.

"On July 16, 1905, the company acquired by purchase at receivers' sale, the properties owned, leased and controlled by the New Orleans Railways Company.

"The fiscal year covers the period from Jan. 1 to Dec. 31. The company therefore had a corporate existence of but five (5) months and sixteen (16) days; say, from July 16 to Dec. 31, 1905, and the New Orleans Railways Company from Jan. 1 to July 16, 1905, a period of six (6) months and fifteen (15) days. The operations of the following acquired companies by the New Orleans Railway & Light Company, therefore, cover a period of six (6) months from July 1 to Dec. 31, 1905:

"New Orleans & Carrollton Railroad, Light & Power Company.

"St. Charles Street Railroad Company.

"Orleans Railroad Company.

"New Orleans & Pontchartrain Railroad Company.

"New Orleans Lighting Company, lessee

"For comparative purposes only, we give the earnings of these properties from Jan. 1 to Dec. 31, also the operating expenses, fixed charges and taxes and the net earnings, as compared with the corresponding period of one year ago, it being fully understood that the period from Jan. 1 to June 30, for these underlying companies enumerated above, covers the period during which the New Orleans Railways Company was in the hands of receivers. The figures are given for comparative purposes only:

	1905	1904
The gross earnings for that period were	$5,093,709	$4,674,344
The operating expenses	2,671,460	2,498,522
The fixed charges and taxes	1,784,226	2,149,840
Leaving a surplus for that period of	$638,023	$25,980

"During the past three (3) years there has been expended on the property for betterments and improvements the sum of $3,653,302.05. These improvements consist of:

New Orleans & Pontchartrain Railroad Company	$85,679
Real estate and other additions to railroad property	188,957
Electric cars	390,967
New power houses	1,603,252
Betterment and reconstruction of tracks	431,008
Reconstruction of overhead lines	16,491
New tracks	45,978
Additions to electric light properties	255,042
Arc lamps, meters, transformers and appliances	147,475
New municipal lighting system	108,244
Addition to gas properties	179,990
New mains and services	200,212
Total	$3,653,302

"The construction and betterment work in prospect is: The completion of the main power station, the completion of the addition to the Claiborne power station, the completion of the distributing system for the electric light and power department, the extension of tracks on St. Claude Street, the Levee & Barracks line, rehabilitating of tracks, the carrying on of the work of the extension of lines in the electric light department, the carrying on of the work of the extension of the mains and enlarging of the plant of the gas department, and new cars to be installed which have been purchased.

"The business for the past year has been very gratifying, considering the fact that we were afflicted during the summer season of 1905 by an unfortunate health condition; but, notwithstanding that fact, you will observe the gross earnings increased $419,365.71.

"The business since Jan. 1, 1906, has been very gratifying.

The gross earnings for the month of January were	$498,578
Operating expenses, fixed charges, taxes, etc	401,370
Surplus	$97,207
The gross earnings for the month of February were	$506,507
Operating expenses, fixed charges, taxes, etc	392,873
Surplus	$113,634

"So that the dividend declared on the preferred stock for the past three (3) months, payable on April 14, was more than earned during the first two (2) months of the year, and if the earnings continue the balance of the twelve months on the same ratio, as we have every reason to expect, there will be a substantial surplus in excess of the dividend on the prefered stock.

"The expenditures on the property in the way of maintenance we believe to be sufficient to maintain the property in its present serviceable condition.

"The accounts of the company were audited to June 30, 1905, and the accounts of the receivers to the close of the receivership, July 16, 1905."

ANNUAL MEETING OF THE BALTIMORE COMPANY

The stockholders of the United Railways & Electric Company, of Baltimore, held their annual meeting, Wednesday, April 11. This meeting was largely attended, owing to a belief that the stockholders would be acquainted in part with the details for raising additional capital with which to acquire land and erect modern car houses thereon. This question, however, was only incidentally touched upon in the annual report. The earnings were very gratifying, showing some $900,000 over fixed charges, or considerably more than is required to pay interest on the income bonds. This sum was applied to extraordinary improvements, such as the company is not called upon every year to make. Contrary to expectation, there was no change among the directors. A decision made was to issue quarterly reports hereafter. The cause of the delay in announcing the new financial plan is the decision of the management to have the advice of experts in connection with the cost of building the new car houses, so it may be guided in determining the capitalization of the Maryland Electric Railway Company, through which the new funds will be provided.

An amendment to the by-laws was adopted providing for the creation of the office of general counsel of the company, to which Joseph C. France has already been elected. The annual report, which was submitted, showed earnings and expenses as follows:

Gross earnings of owned and leased lines	$6,023,698.26
Operating expenses, maintenance, insurance, payments on account of principal of car trust certificates and $58,258.73 placed to credit of accident reserve account	3,765,291.80
Earnings in excess of operating expenses, etc.	$2,258,406.46
Income from other sources	2,725.00
Income applicable to fixed charges, taxes, etc.	$2,261,131.46
Fixed charges, park and other taxes and interest on car trust certificates, etc. (but not interest on income bonds)	2,230,066.54
Surplus for fiscal year carried to credit of profit and loss	$31,064.92

Compared with 1905, gross earnings showed an increase of $575,224.89, or 10.55 per cent; operating expenses and maintenance increased $888,752.95; decrease in fixed charges, $14,512.45; decrease in net results of 1905, due to heavy expenditures for reconstruction of track, purchase of new cars, etc., as compared with 1904, $298,997.61. For the same reason, the operating and maintenance expenses amounted to 62.58 per cent of the gross earnings, as compared with 52.87 per cent for 1904, an increase of 9.71 per cent. The total number of revenue passengers carried was 122,318,438, an increase of 12,791,530. The number of transfers used was 49,292,821, an increase of 5,360,602; that is, over 40 per cent of the paying passengers availed of the transfer privilege, making the whole number carried 171,611,259. Continuing, the report says:

"Had it not been necessary to incur the heavy extraordinary expenses referred to, amounting to $929,761.96, then the ratio of operating expenses to gross earnings would have been 47.05 per cent instead of 62.58 per cent.

"The total taxes paid by the company during the year, including cost of street paving, amounted to about $550,000. The park tax paid for the last quarter was $99,440.85, which was $9,042.68 in excess of that for the corresponding quarter of 1904, and $1,232.93 more than paid for the previous quarter, which latter can only be accounted for as above, that is, by the favorable weather during the last quarter and the rainy weather during the summer, and by the further fact that, during the summer months the travel upon suburban lines is especially heavy, while during the fall and winter months city travel, which is subject to the park tax, increases.

"The Mayor and City Council of Baltimore being desirous of converting the city sections of the four turnpikes controlled by this company into regularly paved streets, is, agreeably to understanding with this and the turnpike companies, proceeding to acquire title by condemnation, with the understanding that the perpetual rights of way enjoyed by this company will be re-ceded to it upon the condition that the 9 per cent park tax on passenger earnings, which the Court of Appeals decided did not apply to these rights of way, will be gradually assumed after three years, say 1 per cent the fourth year, 2 per cent the fifth, and so on increasing 1 per cent per year until the full tax will be payable for the twelfth year.

"Referring to the recently published communication from the executive committee of this company to the Senate committee on corporations as to amendments then pending to the charter of the Maryland Electric Railway Company, which have since been enacted, it may be reiterated that it is proposed that the Maryland Electric Railway Company shall aid the management in its plans for the conservative development of the United's system. Immediately after the fire of 1904 the policy of reconstructing tracks out of income and acquiring new equipment on the car trust plan was adopted. It is proposed that the Maryland Electric Railway Company, which is controlled by friendly interests, shall finance the acquisition of the real estate, the erection of new car houses and buildings for the use of the United and the purchasing or building of such extensions to the United's system as may be deemed advisable. It was also set forth in the statement that the heavy cost of the new car house system and the building of suburban lines and extension should not, in the opinion of the board, be paid for out of income if other means could be devised, as it was not the intention of the management to defer payment of interest on income bonds any longer than was actually necessary."

BIDS FOR GEARY STREET RAILROAD

At a meeting of the Board of Supervisors of San Francisco, on April 9, four bids were submitted for the construction of the Geary Street Railway. Only one of these was within the appropriation of $350,000, made by the last Board of Supervisors. The bids were:

Healy-Tibbitts Contracting Company	$420,000
Deneen Building Company	359,500
Atlantic, Gulf & Pacific Company	369,000
C. E. Loss Company	347,000

The bids were referred to the public utilities committee, to report as soon as possible. The C. E. Loss Company is the contractor for the Ocean Shore Railway.

SUBWAY CHARTER GRANTED FOR PITTSBURG

The charter of the Fording-Morse syndicate, of Pittsburg, for the construction of a subway in the down-town section of Pittsburg has been approved by Governor Samuel W. Pennypacker. The application for the charter was filed on Dec. 29, 1905, under the name of the Pittsburg Subway Company. The route is as follows: Beginning at Smithfield Street and Oliver Avenue, running along Oliver Avenue to Liberty Street, along Liberty to Ferry, along Ferry to Third Avenue, along Third Avenue to Smithfield, along Smithfield to the place of beginning at Oliver Avenue, or 1 mile in all. The capital is $50,000. The officers are: Horace F. Baker, Pittsburg, president; Horace F. Baker, Coleman E. Andel, Edwin K. Morse, Pittsburg; Hugh H. Lyon, Avalon; Harrison M. Williamson, Allegheny, directors.

ANNUAL MEETING OF TECHNICAL PUBLICITY ASSOCIATION

At the second annual meeting and banquet of the Technical Publicity Association, held Thursday, April 5, at the Aldine Association, New York, the following officers were elected: President, F. H. Gale, General Electric Company; first vice president, H. M. Cleaver, Niles-Bement-Pond Company; second vice-president, C. B. Morse, Insersoll-Rand Company; secretary, Rodman Gilder, Crocker-Wheeler Company; treasurer, H. M. Davis, Sprague Electric Company; members of executive committee, Robert L. Winkley, Pope Manufacturing Company, and G. M. Basford, American Locomotive Works; members election committee, C. W. Beaver, Yale & Towne Manufacturing Company; Chas. N. Manfred, Johns-Manville Company, and H. H. Kress, A. S. Cameron Steam Pump Works.

P. F. Kobbé, former president of the association and now an advertising specialist, was the guest of the evening, and gave an address on the general subject of advertising. An informal discussion followed, in which members and guests took part.

The membership of the association shows a steady increase, and its finances are in good condition. The following resolution was unanimously passed:

Resolved, That the association shall take active steps to secure definite information regarding the circulation of mediums in which the members of the association are interested.

AFFAIRS IN CHICAGO

At a special meeting of the Chicago City Council, held Saturday, April 14, the committee on local transportation was directed to frame ordinances providing for the "immediate unification, improvement and rehabilitation of the street railway service." Alderman Foreman, an opponent of Mayor Dunne's plan for municipal ownership, introduced the resolution, which was voiced by three-fourths of the Aldermen. The text of the resolution is:

Whereas, The paramount present need of the people of the city of Chicago is an immediate and radical improvement of the transportation facilities; and

Whereas, It is the duty and function of the City Council of the city of Chicago to make plans and provisions for the accomplishment of this purpose.

Resolved, By the Council of the city of Chicago, that the committee on local transportation be and it is hereby directed forthwith to take up for consideration the best method of securing immediate unification, improvement and rehabilitation of the street railway service of the city of Chicago.

Resolved, That the committee be and it is hereby directed to report to this Council its conclusions as early as practicable, in the form of an ordinance or ordinances providing for such unification, improvement and rehabilitation.

Alderman Foreman, in commenting on the resolution, said the resolution simply directed the committee to report the best means of remedying the present condition, and he did not know what kind of ordinances would be framed. Mayor Dunne knew nothing of the resolution until it was introduced. He added that he was desirious of getting as good service and as many improvements as was possible without militating against the municipalization of the lines. He could not, he said, give any permits for trolleyization until the claims of the ninety-nine-year act were settled beyond doubt.

Walter L. Fisher, formerly president of the Municipal Voters' League of Chicago, has been appointed special counsel in traction matters by Mayor Dunne. Mr. Fisher succeeds to the position held by Clarence S. Darrow, until his resignation last winter. The first work taken up by Mr. Fisher will probably be that of arranging for a test of the validity of the $75,000,000 Mueller ordinance. He will also direct his attention to the question of lowering the tunnels.

A. B. du Pont, the special adviser of Mayor Dunne in traction matters, has recommended to the Mayor that the tops of the Washington Street and La Salle Street tunnels be knocked off and a flat roof be constructed in each tunnel, only high enough for the passage of cars. The flat roof would be of steel and concrete and could be constructed, according to Mr. du Pont, for $60,000 for the two tunnels. It is figured that such construction would admit of the passage over the tunnels of vessels drawing 21 ft. of water, in accordance with the Secretary of War's order. This matter engaged the attention of the Mayor when in the East, and at Washington the Mayor, accompanied by Walter Fisher, special counsel for the city of Chicago, consulted with Secretary Taft concerning the removal or lowering of the tunnels under the Chicago River. By an act of Congress the tunnels, being considered an obstruction to navigation, were ordered either removed or lowered, and the Secretary of War was directed to see that this was done within a certain time. Secretary Taft heard both Mr. Dunne and W. W. Curley, for the Union Company, on the case, but will not make a decision for several days.

NEW PUBLICATIONS

Electric Railway Track Construction. By Max Diedrich, Berlin. Berliner Union Verlagsgesellschaft. 51 pages, paper covers. Price 3.50 marks.

The author is street railway engineer of the Berlin municipality, and his essay was written as a thesis for the degree of Dr. Ing. at the Königlicher Technischer Hochschule. He first takes up the subject of track location. This is followed by chapters on subconstruction, joints, special work, rails, bonding, etc. The historical side of the subject is touched upon, and the author illustrates by a series of sections, the gradual evolution of the present girder rail. A comparison is also given of methods of laying track in pavements of different kinds. No prices are given.

Adjuster's Manual for the Settlement of Accident and Health Claims. By C. H. Harbaugh, M. D. The Spectator Company, New York. 304 pages; leather covers. Price $2.00.

This book is written to assist insurance companies, transportation companies and others in the adjustments of claims resulting from accident and sickness. The author has classified under appropriate heads all conditions which can be met in dealing with this class of business, gives the causes and symptoms for each trouble, average period of total and partial disability under different conditions, hints as to whether fraudulent claims can easily be brought, and if so the customary way of simulating or exaggerating the injury, points on adjustment and the permanent effects. The book is divided into three parts, viz.: accidents, diseases and poisoning. It has been prepared throughout with the idea of its use by adjusters in mind, and should, in consequence, be of great value to those who have this work in charge.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED APRIL 10, 1906

817,156. Amusement Apparatus; Charles A. Carlson and Daniel H. Haywood, New York, N. Y. App. filed Jan. 6, 1906. Self-driven cars of the automobile type, run on an endless trackway. The walls of the building, inclosing the trackway, have scenery painted thereon, and revolve to give the illusion of a higher rate of speed.

817,169. Railroad Tie; Joseph Preund, Neaver, Pa. App. filed Aug. 12, 1904. A railroad tie having a reinforcing bar embedded in the tie and extending under the rail-base and having the up-turn outside said base, the tie and up-turn being arranged to extend up to the upper part of the rail.

817,256. Electric Signaling for Trolley Railroads; Edward W. Lee, South Atlanta, Ga. App. filed Jan. 31, 1905. A trolley contact device, consisting of two copper-covered strips of wood fiber or other good insulation, forming a circuit maker and breaker, fastened to the underside of a short plank or block of insulation, which acts as a water-shed.

817,264. Electric Controlling Device for Cars; James H. K. McCullum, Toronto, Can. App. filed March 1, 1905. Provides a magnetic brake and control circuits by which the various combinations are automatically effected.

817,281. Automatic Intercommunicating Train Reporting System: Elmer E. Steiner, Knightstown, Ind. App. filed July 14, 1905. An auxiliary wheel carried by the trolley pole contacts with a special wire.

817,290. Electric Railway Switching Mechanism; Harry L. Young, Pueblo, Col. App. filed Oct. 5, 1905. A railroad switch system employing magnets at the switches which directly actuate the switch point and are energized by a special trolley connection, which is provided at a proper point along the track.

817,293. Automatic Railroad Signal; Jas. S. Anderson, Ames, Neb. App. filed Dec. 26, 1905. A number of contact-shoes mounted on top of the locomotive and adapted to engage with contact rollers supported adjacent to the track, in order to complete the necessary signal circuits.

817,299. Safety Car Fender; Frederick Cushman, Cleveland, Ohio. App. filed Jan. 31, 1906. Consists of a carrier and guard therefor, adapted to rise across its front, and fixed fulcrums for the carrier at about its middle and sides, on which the carrier is adapted to be shifted back and forth.

817,320. Street Car Fender; Denis Houlahan, Toronto, Can. App. filed April 21, 1905. Comprises two platform sections, one located above the other, and so attached to the car structure that under normal conditions they will be carried parallel with and slightly above the pavement of roadbed, and so arranged that under abnormal conditions the forward end of the lower section will move into contact with the pavement.

817,348. Track Instrument for Automatic Railway Block Signaling; Alfred J. Stecker, Detroit, Mich. App. filed March 27, 1905. A circuit-making tappet comprising a pair of hinged blades, adapted to be deflected by the car wheel to close one signal circuit when the train passes in one direction, and a second signal circuit when the train passes in the opposite direction.

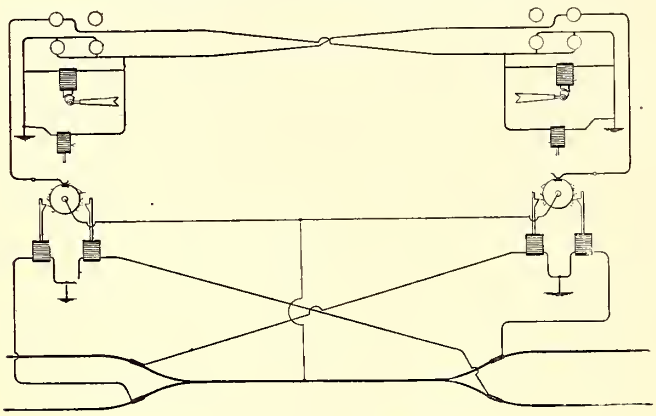
817,366. Electric Switch for Electric Railroad Cars; Otto Frank and Peter J. McCaffrey, Brooklyn, N. Y. App. filed April 1, 1905. A pair of magnetic valves control the respective inlets at the two ends of a pneumatic cylinder, which moves the switch arm, and a pair of springs are disposed to normally hold the arm in central relation.

817,368. Overhead Trolley Support and Switch; Byron E. Green, Ilion, N. Y. App. filed Sept. 28. 1904. A metallic box or casting for incorporation in the conductor at turn-outs, and having grooves to guide the wheel on to the proper wire.

817,454. Car Wheel; John Taylor, Troy, N. Y. App. filed

Sept. 7, 1905. A malleable-iron wheel center, having a hub, felly and spokes formed integral, the spokes being approximately H-shaped in cross-section.

817,463. Railroad Signal System; Rollin A. Baldwin and Geo. D. Foote, New Haven, Conn. A recording appliance at each entrance to the block section, which is adapted to make a record of each car which enters the section and to complete a signal circuit until all of such cars have again left the section. The device also records the number of cars which enter the section, so that a clear signal is not given until they have all left the same.



PATENT NO. 817,463

817,558. Car-Rail Hose Bridge; John S. Heator, Shelbyville, Ky. App. filed Oct. 24, 1905. An arched rail, provided with corrugated shoes at right angles thereto, adapted to rest upon the pavement.

817,562. Storm Curtain for Open Cars; Maria E. Holden, Yonkers, N. Y. App. filed Dec. 26, 1905. A curtain composed of waterproof slats, arranged to be wound upon winding posts in suitable castings at the ends of the car, whereby the curtains can be quickly adjusted by the conductor or motorman.

817,606. Electric Brake; George R. Yancey, Louisville, Ky. App. filed Aug. 7, 1905. A chain or rod is connected to extend throughout the entire train, and may be tightened to apply the brakes on all the cars by a motor-driven drum on the forward car.

817,699. Inclined Suspended Railway; Rollie B. Fageol, Des Moines, Ia. App. filed Sept. 21, 1905. Details of a suspended pleasure railway.

PERSONAL MENTION

MR. C. E. NEWCOMER has resigned as superintendent of the Albuquerque Traction Company, of Albuquerque, N. M.

MR. J. E. STARR has been retained by the New York Rapid Transit Commission as special expert to study the question of ventilation in the New York subway.

MR. V. RAY RONK, auditor of the Detroit, Monroe & Toledo Short Line, has resigned to become manager of the electric lighting and heating plant at Bowling Green, Ohio. Mr. Ronk's change is the result of the recent sale of the Monroe line to the Detroit United.

MR. JAMES F. LARDNER, manager of the Tri-City Railway Company, has been appointed general manager of the Tri-City Railway & Light Company, which has recently secured control of the public utility companies of Moline and Rock Island, Ill., and Davenport, Ia.

MR. FRANK S. GANNON, vice-president of the New York City Railway, has resigned to take up the duties of the presidency of the Atlantic & North Carolina, the Virginia & Carolina Coast and the Norfolk & Southern Railways. This system, now having 400 miles of track and three steamboat lines, will be extended by 200 miles of track within a year.

MR. LEMUEL BANNISTER, the founder of the English branch of the Westinghouse Electric Company, died at the Imperial Hotel, New York, April 13, after an illness of three years, with an affection of the throat. Up to three years ago Mr. Bannister was vice-president of the English Westinghouse Company. He lived in London, but when his health failed, he retired from business. Mr. Bannister was about 67 years old.

MR. CHARLES A. MUDGE, formerly chief engineer of the railway department of the Allgemeine Elektricitäts-Gesellschaft, of Berlin, has been appointed consulting engineer of the Electro-Dynamic Company, of Bayonne, N. J. Mr. Mudge is engaged upon the design of a line of high-voltage, interpole, direct-current motors which the company will soon place on the market, as outlined in an article by Mr. G. Herbert Condict elsewhere in this issue.

MR. HARRY HARTWELL has recently been appointed assistant chief engineer, in charge of the maintenance of way department of the United Railroads, of San Francisco, Cal. Mr. Hartwell comes to the Pacific Coast from Nashville, Tenn., where he held a similar position with the Nashville Railway & Light Company. His experience in street railway engineering has been varied and thorough, comprising experience in New York City, London, England, and Brazil.

MR. A. W. JORDAN has been appointed general passenger agent of the Dayton, Springfield & Urbana, the Columbus, London & Springfield, the Columbus, Grove City & Southwestern and the Urbana, Bellefontaine & Northern lines, formerly known as the Appleyard lines and now a part of the Schoepf syndicate system. Mr. J. T. Horton has been appointed general freight agent of these lines, succeeding Mr. C. C. Collins, who recently went with the Western Ohio Railway in a similar capacity.

MR. W. B. BROCKWAY has resigned as auditor of the operating department of Ford, Bacon & Davis, and is now connected directly with Ford, Bacon & Davis, consulting engineers. In recognition of the cordial relations which have existed between Mr. Brockway and the auditors of the Newman and Ford, Bacon & Davis system of electric railways, the auditors of these companies recently presented Mr. Brockway a beautiful cut-glass water set. The presentation occurred at Nashville, Tenn., on March 19.

MR. FRED S. BORTON, of Cleveland, has entered the brokerage business in that city in partnership with his brother, Mr. T. E. Borton. Mr. Borton was formerly prominent with the Everett-Moore syndicate, and was secretary of the Cleveland Electric Railway, the Cleveland, Painesville & Eastern Railway and the Northern Ohio Traction Company. For the last two years he has been prominently identified with the Pennsylvania & Mahoning Valley Railway, representing Herrick, Parmelee & Crawford, of Cleveland, who control the property.

ON ACCOUNT of the rapid expansion of the business of the Westinghouse Machine Company, the board of directors has decided to enlarge the executive organization by increasing the number of vice-presidents from two to four, and has elected Mr. E. H. Sniffin and Mr. Arthur West to fill the new offices of third and fourth vice-presidents, respectively. Mr. Sniffin will be in charge of the sales department as heretofore, as his field of work has not been altered in assuming the new title. Mr. West, who has been chief engineer of the company, still retains that title and position.

MR. HENRY E. HUNTINGTON, president of the Los Angeles Railway Company, was waited upon by about 250 of the conductors on his lines a few evenings ago, and through a spokesman was presented with an engrossed and illuminated memorial, expressive of the appreciation by his employees of the unasked advance in wages given them Dec. 6. The presentation was made by Messrs. P. C. McNaughton, Frank R. Nye, John Collins, William Schultz and George F. Weber. Mr. Huntington acknowledged the token in a brief speech. The resolution is headed "An expression of thanks to Mr. Henry E. Huntington, president of the Los Angeles Railway Company," and follows: "We, the conductors and motormen of the Los Angeles Railway Company, in special meeting assembled this eighteenth day of December, nineteen hundred and five, desire to express to you, and to those associated with you, our hearty appreciation and gratitude for your good-will and liberality, manifested toward us hitherto on many occasions during the period of our service with the Los Angeles Railway Company and made especially evident to us on December the sixth by an unsolicited increase in our wage schedule. We take this occasion, at the beginning of the new year, to assure you, in recognition of your generous treatment of us and your kindly consideration for our welfare, that we shall make even greater effort to perform our duties in such manner as well befits trusted employees and public servants, doing faithfully and cheerfully our part in the way of aiding you to maintain a railway service that shall be efficient, comfortable and safe. Signed for the conductors and motormen by Frank R. Nye, William Schultz, John Collins, P. C. McNaughton, George F. Weber, committee."

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, APRIL 28, 1906. No. 17.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....................$3.00 per annum

Single copies .... 10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)......................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

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

Running Cars on Schedule Time

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

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

Schedule Time and Through Cars

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

On many of the interurban lines in the Middle West, the limited service shows an excellent profit, but even if this was not the case, the reputation which a road gets in the way of well handled connections is far from valueless. Progressive managers are looking at this question of foreign cars in a very broad-minded manner, for they realize that every person who can be induced to come to their cities is a source of possible revenue. The street railway company which does not receive with open arms every passenger delivered to its lines, regardless of whether he arrives by a through car, afoot, or on a beast of burden, deserves to lose fares. It seems trite to urge the importance of operating through cars on time and over the shortest feasible route, but many companies fail to do this. Most managers, having an expert knowledge of how to handle the passenger traffic of electric railways, will agree that a through interurban car is about the last piece of rolling stock which should be permitted to meander about town before it reaches its destination and run the risk of blockades, in the hope of picking up a few chance local fares. A steam road, or an interurban with a private right of way, can afford to deviate more or less from a straight line in entering a city, but the aimless wandering through crooked streets, which characterises the last two or three miles of some other interurban routes, is absolutely fatal to the enjoyment of fast time, as well as correct schedules, between terminals.

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

Official Inspection Trips

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

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

The Electric Locomotive in Increasing Train Loads

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

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

The Electric Locomotive Question

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

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

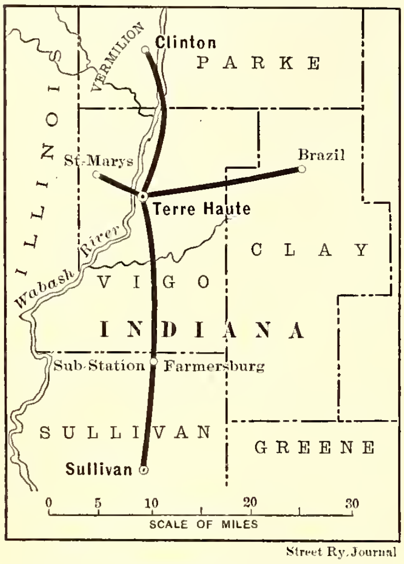
Mr. De Muralt's spirited defense of polyphase traction raises an entirely different set of questions from those offered by either Mr. Sprague of Mr. McClellan. There is no doubt that both the single-phase and d. c. locomotives meet more readily the requirements of those who are used to operating steam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

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

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

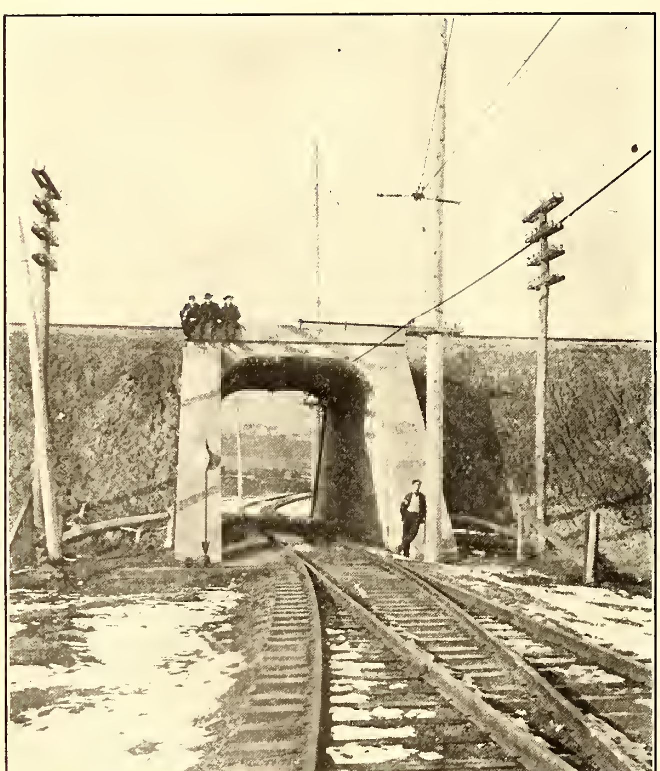
EXTENSIONS AND IMPROVEMENTS OF THE TERRE HAUTE TRACTION & LIGHT COMPANY

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



MAP OF TERRE HAUTE SYSTEM

TRESTLE BRIDGE ON ST. MARY'S LINE

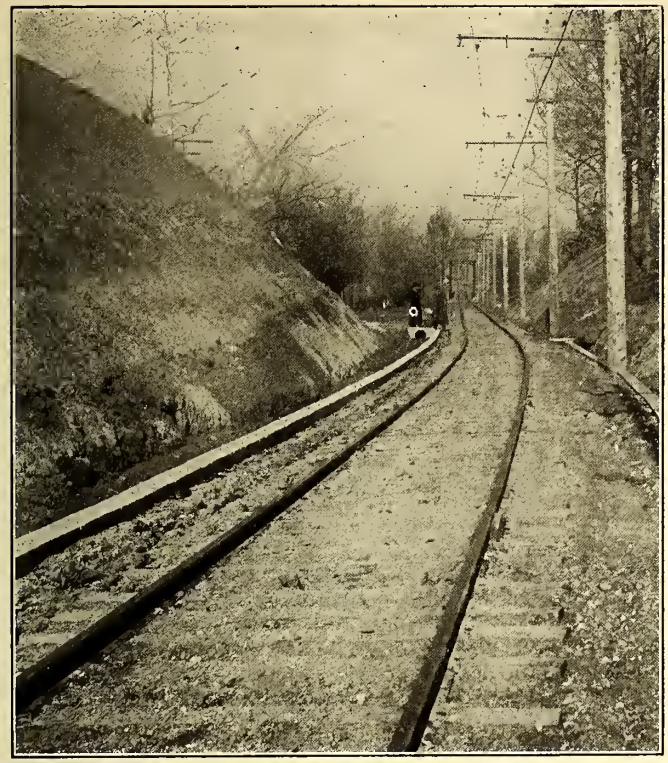


VIADUCT UNDER VANDALIA RAILWAY, ST. MARY'S LINE

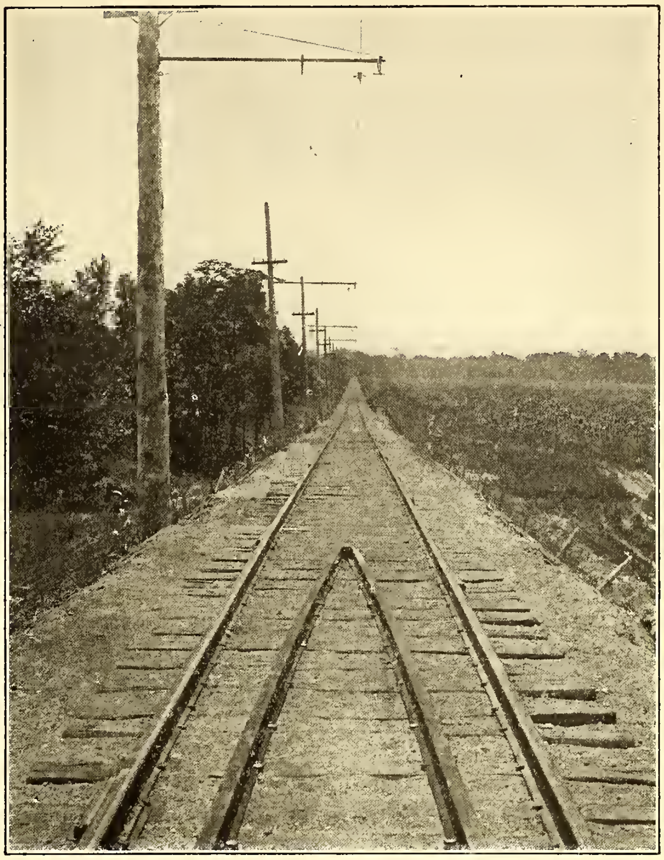
CUT ON SULLIVAN LINE, WITH CONCRETE PROTECTION

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

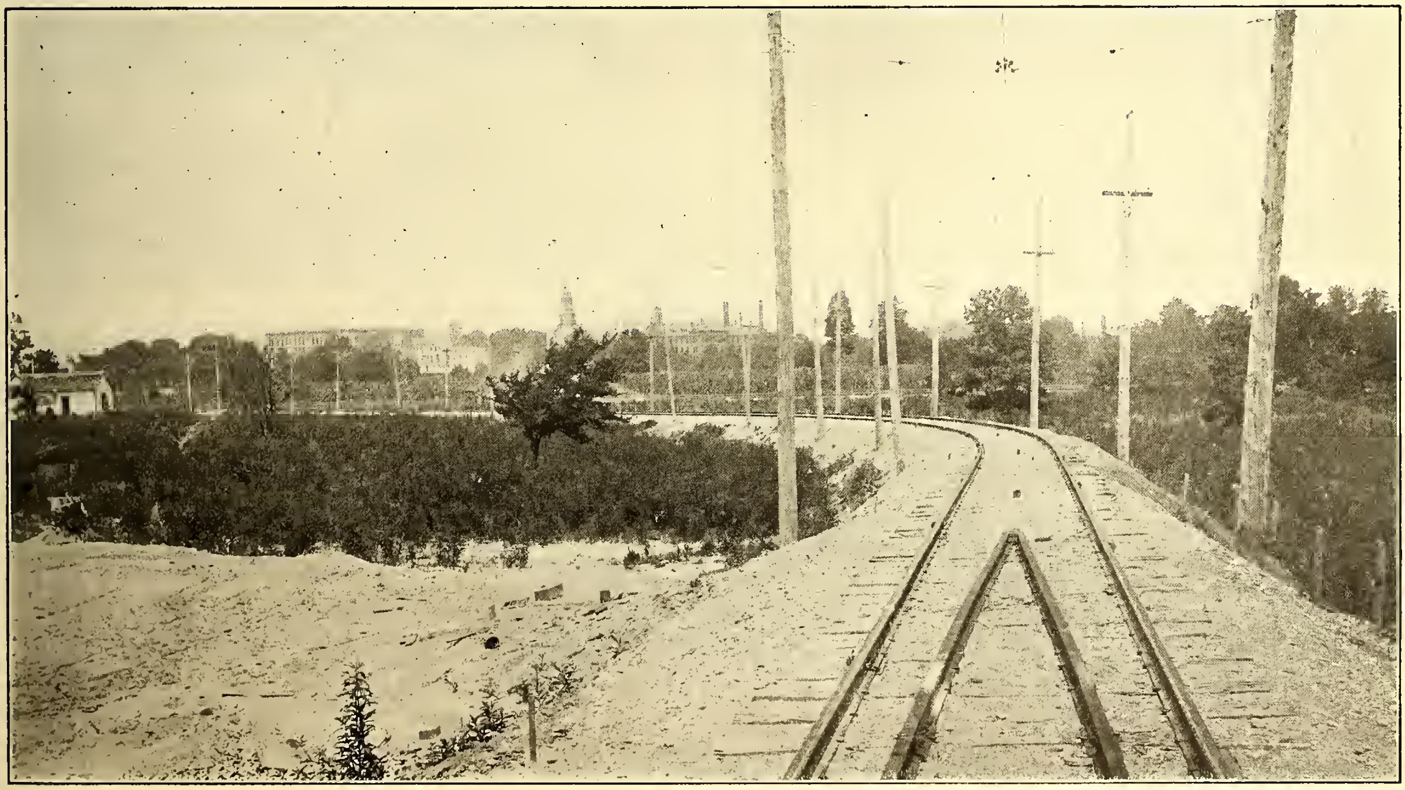
The track of the electric line is laid with 70-lb. rails 30-ft. long, fastened together with Weber rail joints. The ties are of chestnut, and the road is well ballasted with gravel. With the exception of one grade of 2 per cent, there are no grades of consequence on the line. The curves are of long radii, and there are very few that will not permit the cars to be operated around them at full speed. Other than at one place near the city limits of Terre Haute, no excessive grading was encountered. One of the illustrations shows a view of the cut at this point, and the concrete work alongside the track to prevent washing. There were, however, several places where, in order to cross ravines and waterways, special construction was necessary. At one point a steel



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



APPROACH TO BIG FOUR CROSSING



CURVE JUST BEFORE REACHING BIG FOUR CROSSING

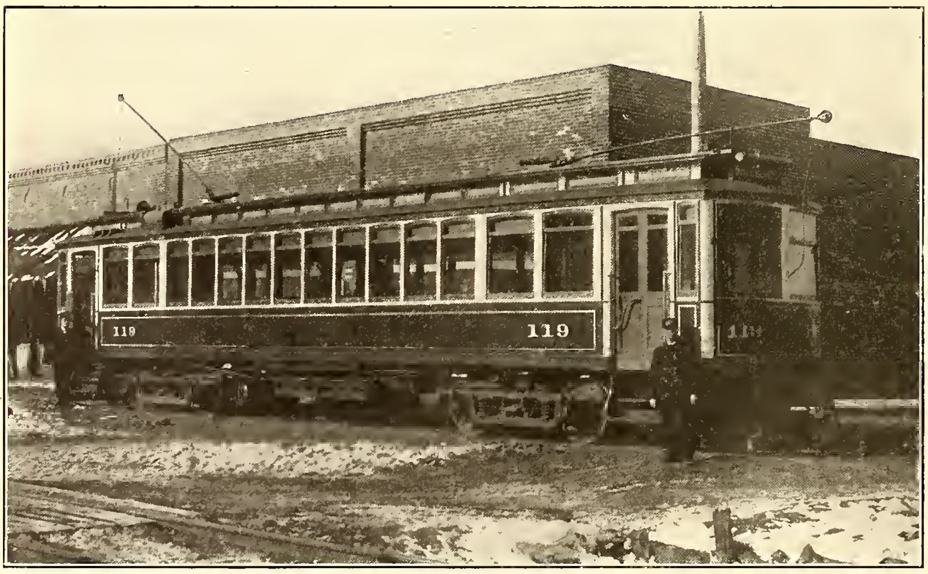
structure 120 ft. long was built, and at four other points steel girders each 15 ft. in length were erected. For all of these, abutments of concrete were provided. In addition to these structures, there are on the line, four wooden trestles having a total length of 320 ft. The largest is about one mile north of Farmersburg, where the road crosses a ravine of considerable depth.

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

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

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

Some unusual features are encountered in the high-tension feeder system supplying the sub-station at Farmersburg. Two-phase current is obtained from the buses tieing the



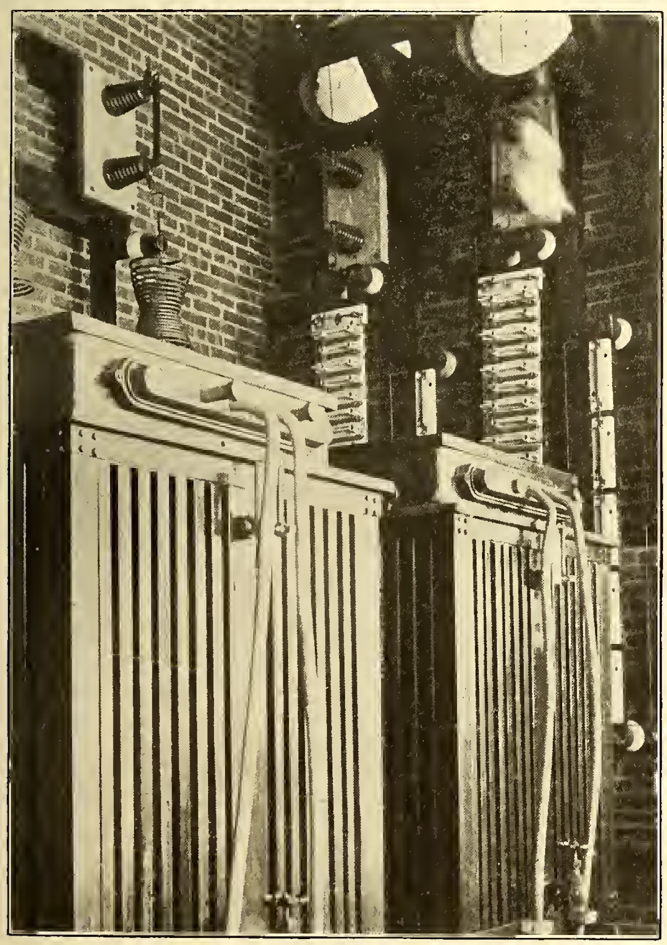
STANDARD CAR ON SULLIVAN LINE AT SHELBURN TERMINUS

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

TYPE OF WAITING STATION ON SULLIVAN LINE

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

The Farmersburg sub-station equipment is housed in a brick building measuring 22 ft. x 56 ft, half of which is used as a freight station for Farmersburg. This arrangement results in considerable economy, as it permits the station operator to serve as station agent as well. The sub-station is of 300-kw capacity, one Westinghouse two-phase rotary converter being installed. All the apparatus is contained in one room. The high-tension lines are brought into the building through vitrified tiles, in a manner already described in connection with the transformer house. The arresters of the GE-type are located on a wood frame below the entering wires, while the choke-coils are on the wall immediately above the two transformers. These latter are of the oil-cooled type, each of 165-kw capacity. The secondaries are carried under the floor to the rotary converter as are the d. c. leads from the converter to the switchboard. This board consists of a machine panel carrying a two-phase synchroscope, power-factor meter, and the necessary starting switches for the induction-starting motor on the rotary converter shaft, and a feeder panel upon which are mounted the usual volt and ammeters, and a 600-amp. Thomson recording wattmeter. A 500,000 circ. mil feeder is carried from the Ninth Street power house in Terre Haute to a point some distance south of the Farmersburg sub-station. This one cable feeds the whole line, it being supplied



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

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

THE ST. MARYS LINE

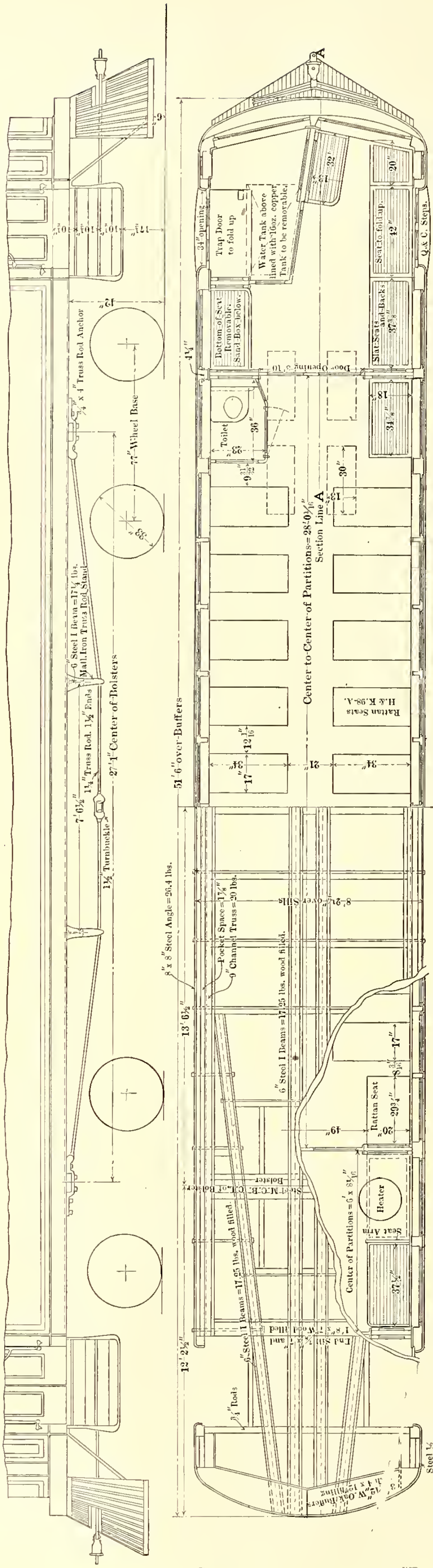
About 5 miles northwest of Terre Haute, is located a Catholic school for girls known as St. Marys-of-the-Woods. The school was founded more than fifty years ago, and during its existence the town of St. Marys has grown up near it. This village is the terminus of the interurban line west out of Terre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

TRANSFORMER HOUSE LOCATED IN THE OUTSKIRTS OF TERRE HAUTE

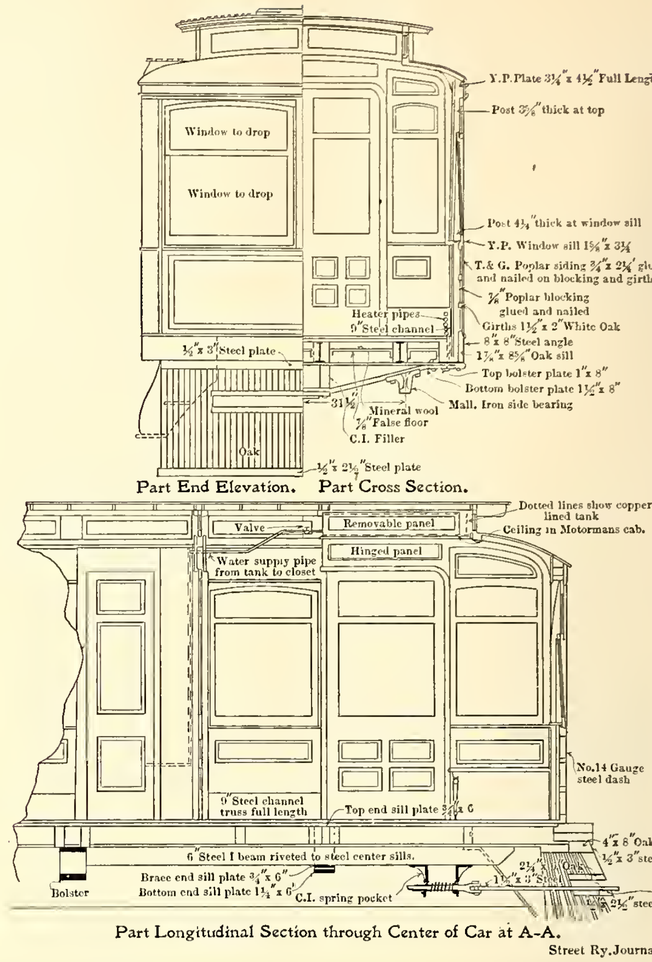
the line is on a private right of way. Grade crossings of steam roads have been avoided altogether. The tracks of the Vandalia railroad are carried over the line on a concrete viaduct, while a steel girder 120 ft. long carries the line over the Big Four tracks. In addition to these structures, there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

TRAIN OPERATION ON THE NEW LINES

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



PLAN OF CAR AND FLOORING—TERRE HAUTE



FRONT AND SIDE ELEVATIONS OF CAR

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

NEW CARS FOR THE SULLIVAN DIVISION

Three new cars have been obtained and a fourth recently ordered for the Sullivan division, and these have an interior arrangement of compartments and motorman's cab somewhat out of the ordinary. The car is, in fact, of the same type as used on the interurban lines out of Milwaukee, Wis., and was described in detail in the STREET RAILWAY JOURNAL for Sept. 5, 1903. The body of the car might be said to be continuous to the bumpers, as there are no vestibules. Of the three compartments into which the interior is divided, the passenger compartment in the middle of the car is the largest. On one end is a smoking room, while on the other is a combination baggage and passenger compartment. The cabs, one in each end of the car, occupy the left corner of the compartment at the front of the car, and are separated from the compartment by sliding doors. When at the rear end, the cab is converted into an entrance or vestibule by sliding these doors back and lifting a trap door. The toilet room is located in one corner of the main compartment, and is provided with a Hart sanitary closet, the supply of water being obtained from a copper tank overhead in the motorman's cab nearest the toilet room. A Franklin hot water heater is placed in the baggage compartment. The car, although but 51 ft. 6 ins. over bumpers, seats sixty-four people. This comparatively large capacity is obtained by reason of the fact that no room is lost by giving up space to vestibules of the customary type. The body of the car is mounted on Baldwin trucks, upon each of which is hung two GE-73 motors each of 75 hp. Sprague-General Electric type M control and Westinghouse automatic air brakes, fitted with graduated release connections, are employed.

ADDITIONS TO POWER HOUSES

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

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

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

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

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

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

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

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

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

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

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

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

TRANSFERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

THURSDAY AFTERNOON SESSION

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

BOND AND MOTOR TESTING

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

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

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

Mr. Conant then considered the difficulties to be overcome in making perfect bonding, as disclosed by tests on the various styles installed under different conditions and length of service. Assuming that the bond has been selected of sufficient cross section, he stated the most important point is to install it so as to make good electrical contact with the rail. This is where most bonds fail, for if the slightest crevice is left between copper and iron, the moisture will rust the iron surface in contact with the copper and prove fatal to the bond. It is no exaggeration to say that there might as well be no bond at all as to have one installed so that a layer of rust intervenes between copper and iron at the surface of contact, If it is a pin-driven bond in which the terminal is a copper sleeve expanded by a steel pin, then the pin must be of the right size as well as the terminal. If either the pin or the terminal is too small, the copper will not be forced outwards with sufficient force to properly fill the hole in the rail. If the pin is too large, the copper terminal is likely to be crowded out of its proper shape in various ways, and not expand uniformly into the hole. A common defect in installation is to neglect to drive the pin at all. This, of course, is fatal to the efficiency of the bond, and the bond may as well have been omitted altogether. In a compressed bond similar carelessness will have like results. In all protected forms that go between fish plate and web of rail, sufficient room must be given so that no amount of drawing up of fish-plate bolts will jam the bond, otherwise loosening and breaking will result. If there is much movement to the rail, the bond must be long and flexible, while for rails that are solidly embedded in pavement, a shorter bond will be sufficient.

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

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

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

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

The author next passed to the subject of motor testing, and after reviewing the history of railway motor designing and outlining some of the more common motor troubles, took up the matter of making armature tests. In his opinion, the only test that is really of much value for an armature is to put it in a motor frame and run it as near as possible under service conditions. Experience has shown that a high voltage test, while it locates some of the armature faults, does not locate all, and that many times an armature will come in burned out but a few hours after passing this test. The running test in motor frame shows up so many more of the armature defects than can be discovered by any of the simpler instrument tests, that it hardly pays to make these latter at all. This should be taken as applying to the average medium-size road. There are, of course, exceptional cases where this statement is not true.

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

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

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

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

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

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

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

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

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

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

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

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

DISCIPLINE OF CAR SERVICE EMPLOYEES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CONDUCTORS

Immediate Discharge

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

Demerits

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

Conductors' Merits

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

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

MOTORMEN

Immediate Discharge

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

Demerits

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

Motormen Merits

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

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

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

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

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

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

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

SOME PRACTICAL EXPERIENCES WITH STEAM TURBINES*

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

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

STEP-BEARING PUMPS, BAFFLERS, STRAINERS, ETC.

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

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

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

STEP BEARINGS

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

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

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

STEADY BEARING

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

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

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

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

TURBINE PILOT AND MAIN NOZZLE VALVES, ETC.

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

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

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

MIDDLE AND TOP BEARINGS

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

LUBRICATION

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

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

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

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

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

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

ENTERTAINMENT OF THE IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION

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

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

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

CORRESPONDENCE

NEW YORK CENTRAL AND NEW HAVEN LOCOMOTIVES

New York, April 23, 1906.

EDITORS STREET RAILWAY JOURNAL:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Frank J. Sprague

THE STREET RAILWAY SITUATION IN SAN FRANCISCO

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

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

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

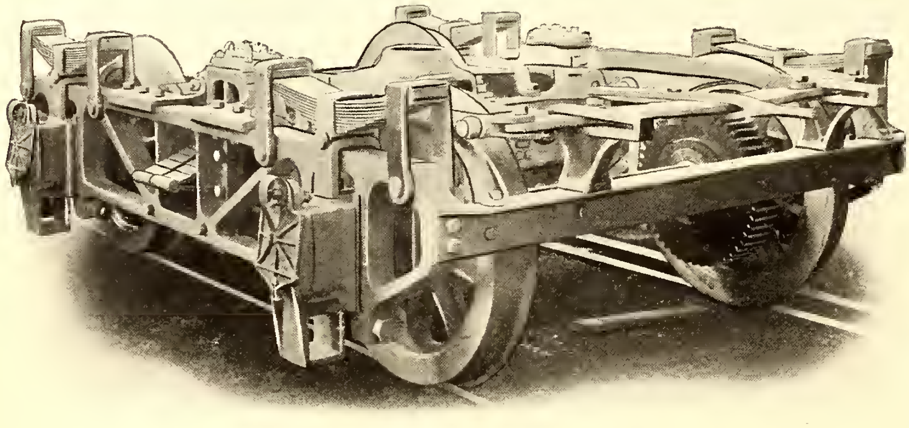
In preparation for the rebuilding of the city, Ford, Bacon & Davis, of New York, have already commenced drawing up plans for the extension of certain of the company's lines. It is expected that in the rebuilding of the city the filled-in ground, which was the part of the city most affected by the earthquake,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

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

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

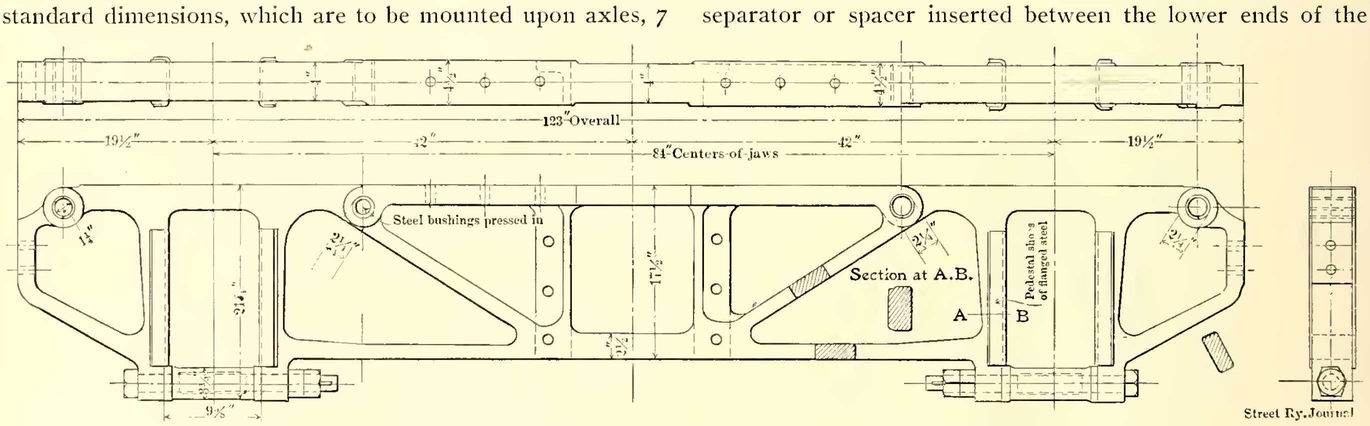
MOTOR TRUCKS FOR THE NEW YORK CENTRAL ELECTRIC SERVICE

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



SIDE VIEW OF NEW YORK CENTRAL TRUCK

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



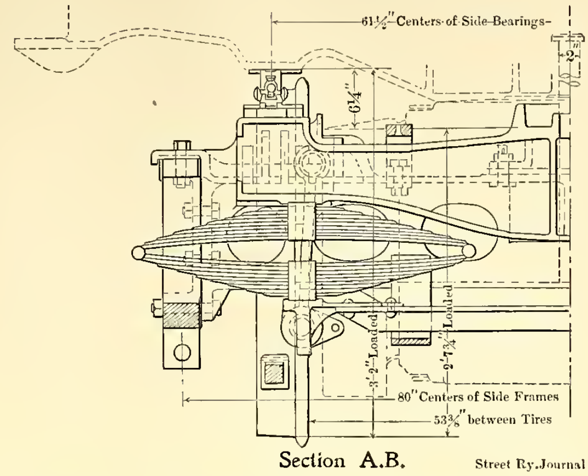
THE SINGLE-PIECE, CAST-STEEL TRUCK SIDE FRAME

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

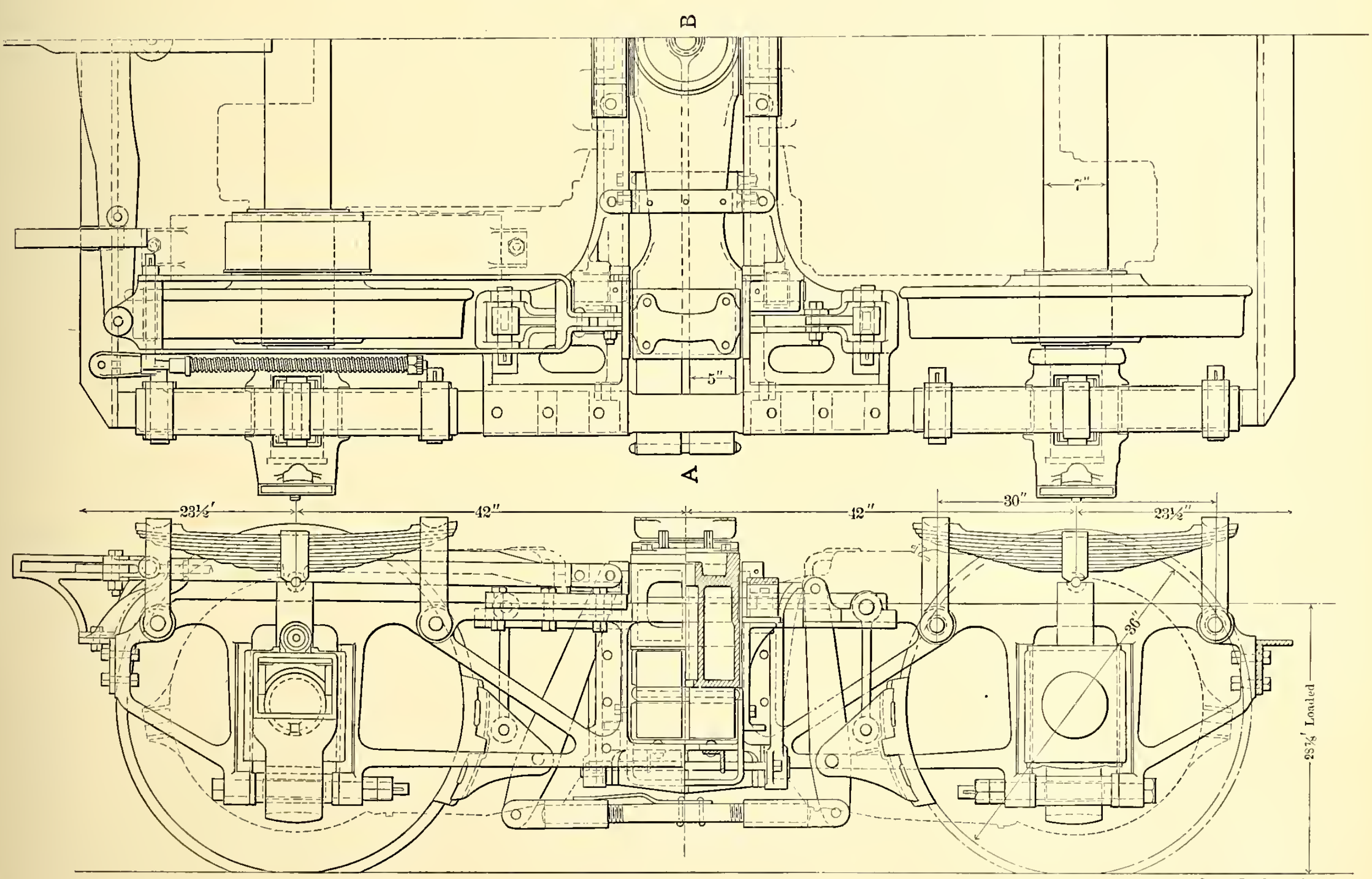
U-shaped pedestals of 1 x 4-in. steel bar, straddling the side frame. Flexibility at the point of support is provided by a 1-in. rocker pin lying in the milled slots upon the top of the U-shaped pedestal and lower face of the spring band. The truck frame is suspended from the ends of the elliptic spring by forged loops of ⅝ x 3-in. iron, which are pinned to the upper member of the side frame by 1¾-in. pins keyed into place. The holes in the side frame for these pins are in all cases bushed with 2¼-in. steel bushings, which may thus be renewed when worn. The springs are ten-leaf half-elliptic, 5 ins. in width and 30 ins. in length between bearing sockets.

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

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

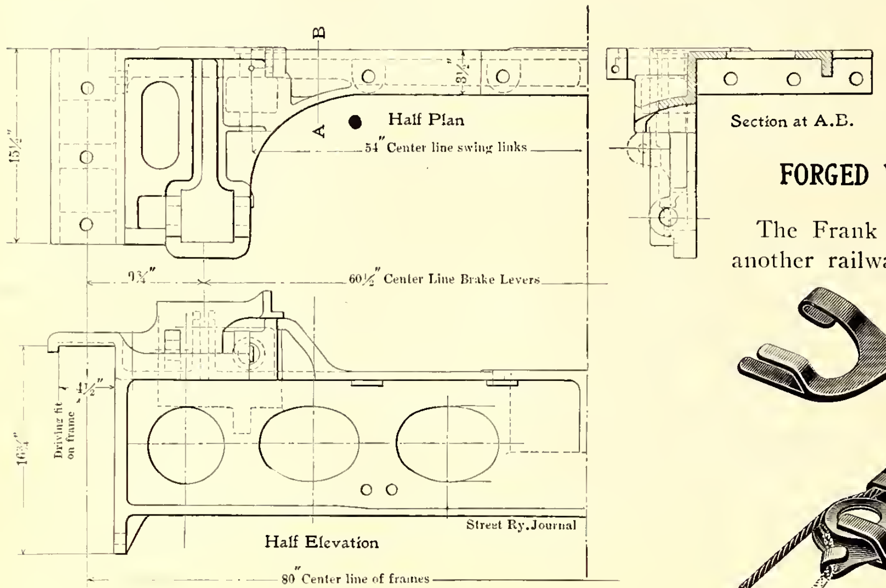


SECTION THROUGH BOLSTER AND SPRING PLANK



SIDE ELEVATION AND HALF PLAN OF TRUCK

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



TRUCK TRANSOM

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

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

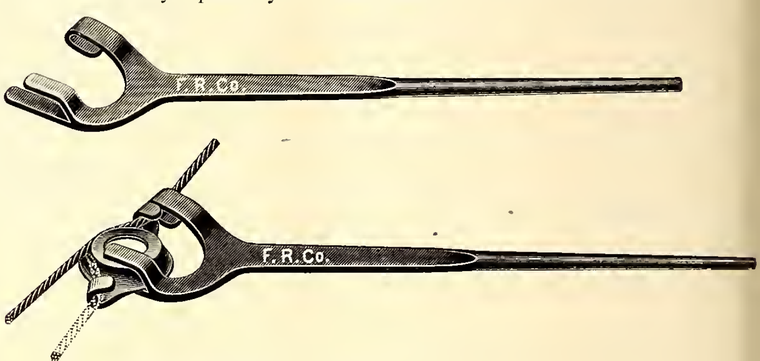
The truck is designed for the nose suspension system of mounting the motors, for which there are case-hardened wearing plates upon the upper flanges of the transoms to carry the motor lug. These wearing plates are held in place by the loop bars passing over the motor lugs, the bolts of which fasten both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

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

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

FORGED WRENCH FOR CAP AND CONE HANGERS

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



HANGER WRENCH AND ITS APPLICATION

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

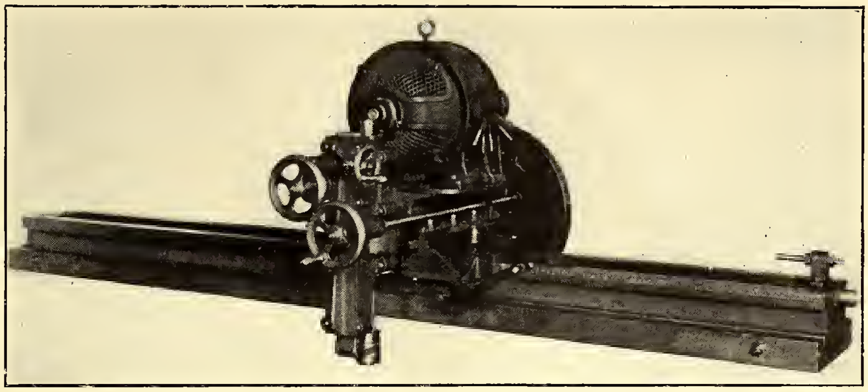
RESULTS OF A TRACKLESS TROLLEY TRIAL IN GERMANY

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

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

PORTABLE MILLING MACHINE

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



PORTABLE MILLING MACHINE IN ACTION

THE TERRITORY AND EQUIPMENT OF THE WALLKILL TRANSIT COMPANY

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

COMBINATION CAR FOR THE WALLKILL TRANSIT COMPANY

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

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

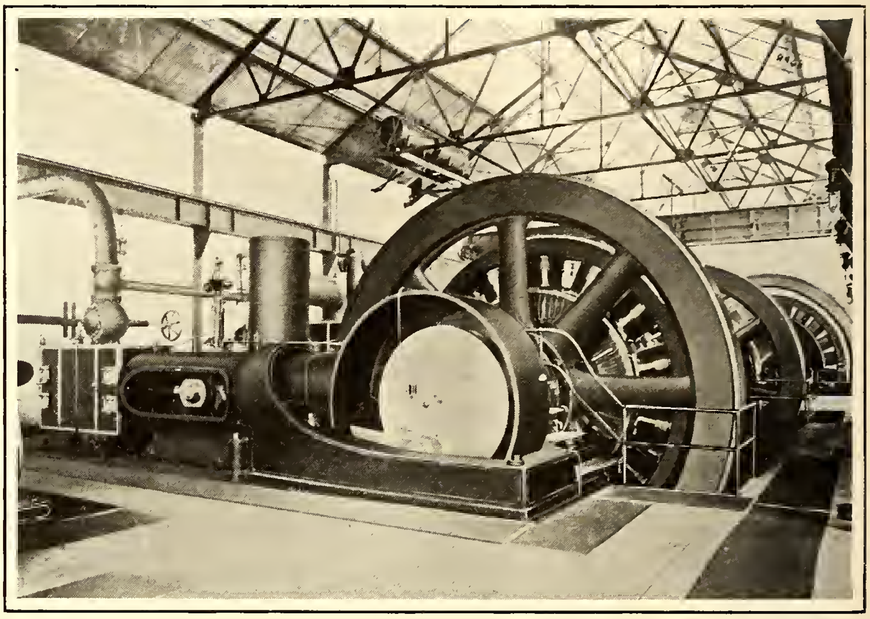
INTERIOR OF COMBINATION CAR

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

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

NEW TRACTION FACILITIES FOR HARRISBURG, PA.

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



HORIZONTAL CROSS-COMPOUND ENGINES IN HARRISBURG POWER STATION

elevator. The boiler plant will be equipped with the usual feed-water heaters and economizers, which will occupy one-half of the floor space of the building only, ample room being provided for the installation of additional boilers and engines, as the growth of the system warrants, so that the plant will have an ultimate capacity of 9000 hp, or 10,000 hp. The stack, 10 ft. inside diameter and 210 ft. high above foundations, will be built of reinforced concrete, resting on the solid rock, 20 feet below the ground level. A railroad siding, connecting with both the Pennsylvania and Reading railroads, will run between the boiler room and the stack.

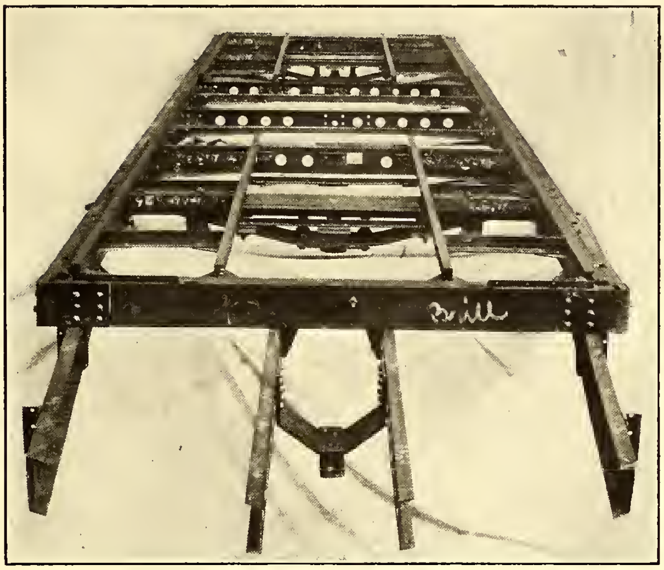
An interesting engineering feature of the new plant will be the water-supply tunnel. Plans have been drawn and the work will shortly be started on the boring of a 5-ft. tunnel in the solid rock, 30 ft. below the surface of the ground, extending from the plant in a direct line under the yards of the Central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

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

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

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

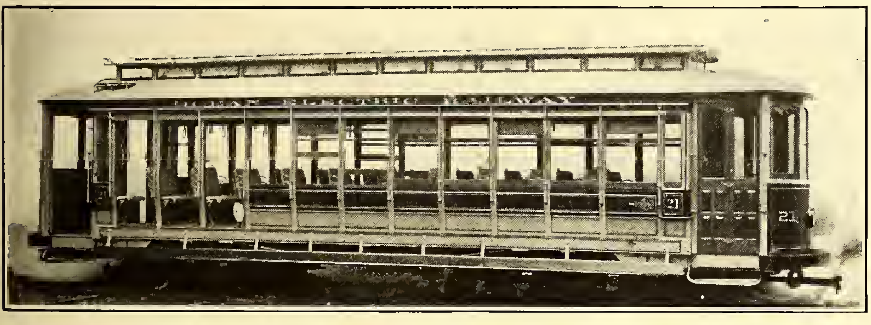
Another novel feature in connection with this car lies in the continuous cross-seats which are used when summer weather becomes settled. These are arranged by substituting wooden slat backs, which extend across the car for the spring rattan backs of the double seats. The spring rattan cushions are allowed to remain and the aisle space is filled with a rattan cushion which is clamped into place. By this arrangement larger seating capacity is afforded during the warm weather, which at this resort results in a large number of passengers being carried. As soon as the weather becomes variable in



STEEL BOTTOM OF CONVERTIBLE CAR

the autumn, the cane backs for the double seats are replaced, so that the panels and sashes may be drawn down whenever desired, instead of relying upon the curtains, which do well enought for protection against slight summer showers, and which are arranged to be drawn entirely to the floor.

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



CONVERTIBLE CAR FOR THE OCEAN ELECTRIC RAILWAY COMPANY

NORFOLK ELECTRIC MERGER

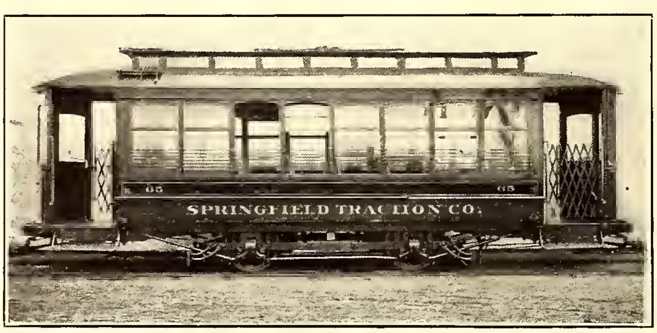
The merger of all the electric traction, light and gas properties in Norfolk, Portsmouth, Berkerley and Suffolk, with the exception of the Bay Shore Terminal and Norfolk & Atlantic Terminal properties, into the $14,000,000 holding corporation known as the Norfolk & Portsmouth Traction Company, has been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

CARS FOR DOUGLAS, ARIZONA

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

NEW EQUIPMENT FOR SPRINGFIELD, MO.

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



SEMI-CONVERTIBLE CAR FOR THE SPRINGFIELD TRACTION

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

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

ELEVATED ELECTRIC RAILWAY FOR MILAN EXPOSITION

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

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

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

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

FINANCIAL INTELLIGENCE

Wall Street, April 28, 1906.

The Money Market

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

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

The Stock Market

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

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

Philadelphia

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

Chicago

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

Other Traction Securities

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

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

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

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

Security Quotations

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

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

W. I., when issued.

Metals

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

CLEVELAND ELECTRIC ASKED TO MAKE PROPOSITION

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

WASHINGTON, BALTIMORE & ANNAPOLIS COMPANY SECURES BALTIMORE TERMINAL

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

EFFECT OF LOW FARES IN OHIO

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

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

McKINLEY SYNDICATE SEEKS TO ENTER ST. LOUIS

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

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

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

THE BRIDGE PROBLEM IN NEW YORK

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

IN MEXICO

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

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

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

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

THE NEWARK-NEW YORK HIGH-SPEED LINE ARRANGEMENTS

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

NEW OHIO LAWS

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

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

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

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

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

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

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

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

THE BROOKLYN COMPANY'S TUNNEL PLANS

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

NEW HOME FOR STREET RAILWAY JOURNAL

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

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

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

CHICAGO TRACTION MATTERS

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

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

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

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

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

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

BROOKLYN RAPID TRANSIT EMPLOYEES' ASSOCIATION DOINGS

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

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

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

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

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

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

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

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED APRIL 24, 1906

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

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

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

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

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

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

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

817,858. Automatically Tripping Trolley Pole; Thomas H. Mars, Chicago, Ill. App. filed July 12, 1905. The trolley pole has an extensible link connection with a spring which normally holds the wheel against the wire, but the spring is tripped out of operative relation by any sudden upward movement of the trolley pole. The extensible link serves to reposition the parts in normal relation when the pole is drawn downward.

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

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

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

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

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

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

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

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

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

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

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

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

PERSONAL MENTION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Street Railway Journal

VOL XXVII. NEW YORK, SATURDAY, MAY 5, 1906. No. 18.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid.... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8500 *copies are printed. Total circulation for* 1906 *to date,* 147,300 *copies, an average of* 8183 *copies per week.*

Conducting Pleasure Parks

In conducting street railway parks, the mistake is often made of installing and maintaining those attractions that appeal to the lower class of patrons. We refer to cheap shows, the sale of intoxicating liquors, nickel gambling machines and similar devices. It may be stated with certainty that when such attractions are maintained in a park in a small city or town, and the class to which such a park appeals begins to frequent it, disorder will prevail, and sooner or later both the park and the company backing it will acquire a bad reputation. The better class of people will avoid the place thereafter, and soon the park will be abandoned as a failure.

This remark applies especially to parks in smaller localities. In cities with a population large enough to support two parks it is probably best to have them of such a nature that they attract different classes of people. The cheaper amusements may be provided in one resort, while the better class of entertainments, band concerts and other features that appeal to the higher grade of patrons may be maintained in an entirely separate place. This plan is pursued by two or three companies which we call to mind. There is nothing in the higher grade parks to attract the undesirable element, and they increase from year to year in popularity with the better class. For the less refined element, which always exists in any large city, other parks are conducted, several miles distant from the former. Here cheap shows and other attractions demanded by the class of people for whom these parks are intended to appeal are maintained.

In general, we do not believe it wise to attempt to make people of widely different types, socially and intellectually, mix in amusement resorts. An attempt to do so will almost invariably end in failure, and especially will this be the case in a comparatively small town.

The Functions of Limited Service on Traction Lines

It is interesting to note that the high-speed lines of the great traction belt in Ohio and Indiana are getting down to a standard of policy as to the best methods of handling the so-called limited service. This subject has occasioned a great deal of controversy during the past two or three years. The first roads to put on limited service did so with an idea of accommodating the traveler who was going a considerable distance, that is, from one large town to another. A slight excess fare was instituted to discourage the use of these cars by those who desired to ride locally for short distances. Later, when a number of lines were connected up, there came the interline limiteds with chair seats, and, in two or three instances, buffet service. The idea of these ventures was that they would capture from the steam roads the highest class of through service. One road in this district even installed sleeping cars, although its route was not long enough to permit the passenger to go to bed. By this time the majority of the experimenters with these innovations have become pretty thoroughly disillusionized. It is becoming generally admitted that there is little demand among the class of people who patronize the traction lines for the extreme luxuries of the long-distance limited steam trains. While the electric lines are making through connections and quickening their schedules over long distances, the great mass of revenue will probably continue, as it has in the past, to come from the poorer class of people who desire to save money, the commercial traveler who wants to make quick jumps from town to town, and a very small proportion from the sightseer who is viewing the country and takes this method of seeing the villages and towns.

The latest form of limited service adopted by the majority of the roads in the district mentioned provides for the conveniences of these people, without attempting to cater to the small proportion who travel in parlor cars. The chair-seat idea has been given up by the great majority of roads, because chairs greatly reduce the seating capacity of a car. The limiteds, in the majority of cases, are proving the most popular cars, and on many roads they have been crowded much of the time. And to offer a man a ride in a beautiful car without furnishing him a seat is the worst kind of a farce. A number of roads increased the seating capacity of their chair cars by leaving out the baggage compartment, but this plan is now generally acknowledged to have been a mistake. The limiteds are supposed to cater to the convenience of the traveling man, but if the traveling man cannot carry his sample trunks with him he has no use for the speedier car. While there are now several roads with runs of from 100 miles to 150 miles, it is found that comparatively few of the patrons of these cars travel the entire distance; in other words, the way passengers still greatly predominate. If the seats are made comfortable and have high-roll backs, the patrons do not care especially for the chair seats, especially as many of the chairs used by interurban roads are not designed for fleshy people. Moreover, the seats, as a rule, are not adaptable for a reclining position, due, of course, to the desire to secure a maximum seating capacity and the necessarily narrow width of the car. Some of the roads are building limited cars with ordinary seats in the passenger compartments and chair seats in the smokers, which is a good arrangement, although it has the objection of limiting the seating capacity of the smoking compartment, which is usually the popular portion of the car on long trips.

The matter of excess fares on limiteds seems to have settled itself, due largely to the passage of a two-cent fare law in Ohio. This law has brought down the rates of the steam roads to a point where the electrics have had to shave off the extras to keep below them. Indiana roads have followed the same plan as the Ohio roads in this matter, because the excess fare has been found to drive away a good many passengers who could otherwise be secured. The question of the advisability of running limiteds only a few times a day or every other car has also been quite thoroughly threshed out. As intimated, there has been more and more of a demand for the faster car, and practically all the roads operating this service have found it desirable to make every other car a limited. The opinion is also growing that a car once in two hours is often enough for the farmers and denizens of small hamlets, which is a further argument in favor of more frequent fast cars.

In brief, it has been found that the limited service, which accommodates the greatest number of people, calls for ordinary seats of comfortable design, a large seating capacity, service every two hours, no excess fares, baggage on all limiteds, stops in towns of 1500 or more, and speed as fast as consistant with safe operation. When electric roads are built entirely on private right of way, through cities and towns, as well as through country districts, and when there is business enough to warrant the operation of several cars in a train, it will be time enough to cater to the wants of the elite among the traveling public.

The Situation at San Francisco

Sufficient time has elapsed since the disaster at San Francisco so that a general idea can be obtained of at least the street railway situation in that city. The accounts first published indicated that the loss to the physical property of the company had been large. Fortunately, however, later reports, such as published in our issue of last week, and confirmed this week, show a much more favorable condition of affairs. Extensive changes and improvements had been planned, but most of them had not been undertaken as yet. This condition, combined with the fact that the center of the city, where the fire started, was still equipped with cable apparatus and the early hour of the earthquake, which was at a time when most of the cars were in the car houses in the outskirts of the city, explained the comparatively small loss. Incidentally, the earthquake has demonstrated in a very effective way the relative capacities for resisting the effect of seismic shocks of buildings of different characters and on different foundations. The safest locations were in the hilly districts, where bed rock exists at or near the surface, and here very little damage was done. The modern "sky scrapers" were also practically uninjured structurally by the shock, and most of the damage was confined to the buildings on made land. Masonry walls, when well braced, stood the shock remarkably well. A considerable amount of brick masonry of poor quality was thrown down. Several brick stacks were injured, indicating that these structures, unless well braced, are susceptible to injury. There was comparatively little damage to the trolley tracks, except through the destruction of the overhead wires from falling buildings, but greater injury to the underground cable conduits, which seemed impotent to resist the ravages of fire and earthquake, as both alike tend to close the slot. With commendable enterprise, the street railway management has undertaken the immediate reconstruction of its disabled lines and has completed the equipment of the most important ones so rapidly that they have been of incalculable service in removing the debris, and otherwise assisting in the rehabilitation of the city.

Besides the effect on the condition of the company's property, the question naturally rises as to the influence of the disaster upon the future earnings of the San Francisco system. Upon this point it is possible to reason only by analogy. Precedents of a certain kind can be found in the results following the great fires at Baltimore and Patterson. These disasters, it is true, are not quite comparable in their effects, because of the large exodus from San Francisco, and the fact that on account of the earthquake many persons, not required to live in the city for business reasons, may have objections to it as a place of residence. We hardly believe, however, that these conditions will have a permanently serious effect upon the developments of the city. The experience of the past two weeks indicates that buildings can be erected which will not be injured from earthquake shocks, while the influx of workmen and artisans to undertake the reconstruction required in San Francisco will, undoubtedly, largely counterbalance in number the loss of those former residents who have moved away from the city since the fire, and who have no intention of returning. The harbor at San Francisco possesses so many advantages that if practical immunity can be secured from another such disaster by the erection of a different class of buildings, as now seems probable, there will always be an important commercial city on the Golden Gate.

Allowing, however, for the difference already mentioned between the San Francisco disaster and those already referred to, the experience of the street railways in Baltimore after the fire of February, 1904, and of those of Paterson after the fire and flood two years previously, is of interest.

According to statistics the recovery of the Baltimore railway system from the effects of the fire in that city was very rapid. The conflagration occurred on Feb. 7. The day before the fire the United Railways Company of Baltimore operated 621 cars over 34 lines, and its receipts amounted to $15,298. The service on the day after the fire included only fifteen lines and only eighty-two cars were run. The receipts on that day were $2,015. The receipts on the day after the fire, therefore, were only about 14 per cent of those on the day before the fire, and there was a reduction of 88 per cent in car mileage. By the end of February the comparison with the previous year showed a reduction of only 35.1 per cent in car mileage and of 22.8 per cent in passenger receipts. The decreases for the month of March, the month after the fire, were 22.43 per cent in mileage and 6.65 per cent in receipts; for April, 10.15 in mileage and 1.17 per cent in receipts. In May the receipts showed an increase of $7,364, equal to 1.5 per cent. For the full year, 1904, the receipts of the company amounted to $5,451,180, a decrease of only $29,449 compared with the receipts of 1903.

In the case of Paterson, the effects of the fire of Feb. 9 and the flood of Feb. 16, 1902, on the earnings of the street railway lines of that town were almost negligible. The earnings of the Paterson lines of the Public Service Corporation for the month of February, 1902, amounted to $25,939, compared with $26,029 in February, 1901. For the year 1902 the receipts were $417,112, an actual increase of $12,642 over those of the previous year.

The Gasoline Car

Mr. Hild's paper on this topic, published in this issue, is altogether the best summary of the situation which we have yet seen. It is a peculiarly difficult one to treat, by reason of the scarcity of data on the performance of gasoline cars, and yet in these days of high-powered automobiles one can get a pretty close line on engine performance, which, after all, is the vital factor, so far as the motive power is concerned. We certainly agree, to begin with, that of the self-propelled cars only those driven by internal combustion engines can be seriously considered. No refinement is likely to bring the steam dummy into popular favor, while it is conceivable that the gasoline street car might readily make friends, since it is reasonably quiet and free from smoke or smell. Reliability, however, is quite another matter, and one which it is very difficult fairly to judge. Obviously far more complicated than an electric-motor car, the gasoline or gasoline-electric car certainly has the burden of the proof in reliability. On the other hand, it is hardly fair to judge this by the data derived from automobiles, which necessarily operate under far less favorable conditions, are much more lightly built, and are altogether of a character to indicate a relatively high repair bill. Then, too, the engines of the car are larger, more powerful, and operated under better conditions for efficiency than those of an automobile, and hence should give a better economic result.

Coming down to particulars and basing his judgment on the best data attainable, Mr. Hild figures out the operating cost of a gasoline car of size commensurate with an interurban electric car at nearly 15 cents per car mile, as against about 6 cents for the trolley car. The power items are here taken at 7 and 1.91 cents respectively. This is not unduly high for the gasoline car, considering its relatively great weight, and the large engines necessary for anything like high acceleration. A special mechanic is assumed as part of the car crew, which brings the labor item up to 3 cents per car mile for the gasoline outfit. This is according to present custom, but we must own that it is an item which eventually should be dispensed with. It ought to be possible, and probably is possible, to build a gasoline equipment for such service which can be effectively handled by the driver alone. The requirements of the service are less severe than in the working of a high-power touring car, and one good man should be able to handle the car. The maintenance charge against the gasoline car is taken at 4 cents per car mile, including the car and all its equipment. Such a value is subject to some uncertainty, but the same item for the electric car is 1.5 cents, and the difference does not look excessive in view of the comparative complication. Perhaps it could be cut down when the gasoline car got fairly on a commercial basis, but even so, we should hesitate to reduce it more than a cent. Looking the estimate all over, one can hardly see an opportunity for cutting down the cost with the self-propelled car more than a couple of cents, unless by a change of fuel. Cheap alcohol, which we hope Congress will soon give us, or the production of an engine utilizing kerosene successfully, would reduce the fuel bill somewhat.

Look at the question any way you may, however, there is a considerable margin in favor of the straight-electric car when in anything like active service. We have as yet said nothing of the so-called gasoline-electric car, since there is no reason to expect it to show much better economic results than the straight gasoline car, however much more facile the control may be. Broadly, the economy of both types should be nearly the same, differing in items, but not greatly in amount. With this general showing, the necessary limitations of the gasoline car are apparent. It can only compete with a trolley car on favorable terms when the latter would show abnormally high cost per car mile. This could happen through a very considerable increase in cost of power over Mr. Hild's figures, or by so infrequent service as to exaggerate the fixed charges or by a combination of these unfavorable conditions. With costly fuel and infrequent service a point can be reached, as Mr. Hild points out, at which the self-propelled car would have the advantage. On some rural lines we can easily see where a gasoline car could be used with real advantage, such as a line which would operate say two cars on one hour headway, and the trolley system has to endure large fixed charges and an abnormal cost of power, at times perhaps as high as that which Mr. Hild estimates for the gasoline car. Bearing this in mind, one may fairly predict a real field of usefulness for the self-propelled car, although not a very large one. In certain cases, it may prove a convenience temporarily on roads ultimately best worked on the ordinary trolley system, or as auxiliary equipment for use in emergencies. Meanwhile, we hope that it will be carefully worked out for these very purposes, and in so doing improvements will be made that may very possibly extend its sphere. There is much to hope from the internal combustion engine in many directions, and the more it is investigated and improved the better.

CAR HOUSE, SHOPS AND SHOP PRACTICES AT BIRMINGHAM, ALA.

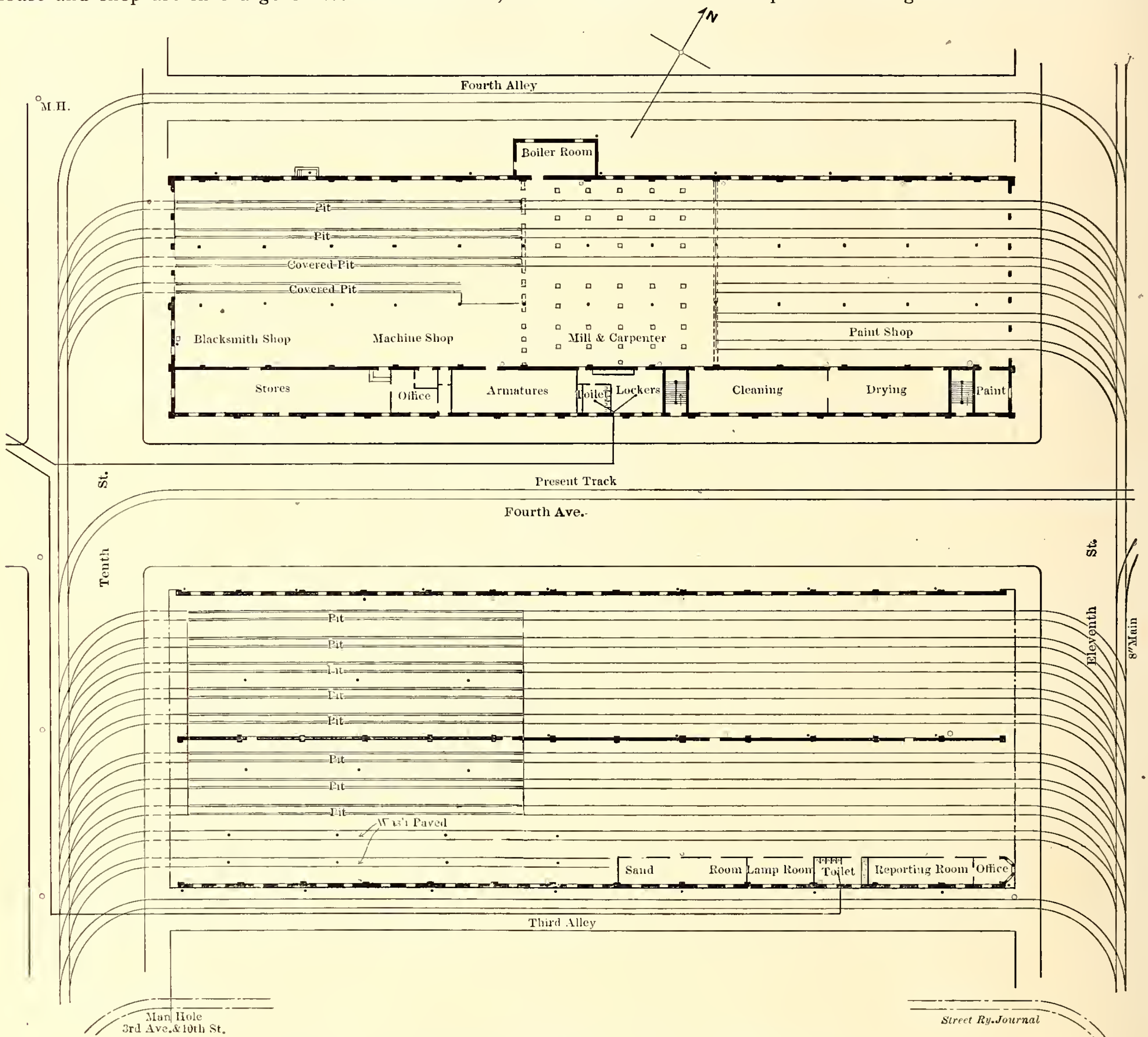
The car-housing and repair plant for taking care of all the cars of the Birmingham Railway, Light & Power Company was erected about three years ago, and took the place of several car houses and shops scattered throughout the Birmingham district, which were formerly owned by the independent companies prior to the consolidation. The house and shop are in charge of W. A. McWhorter, master mechanic and assistant superintendent. J. L. Mason is assistant master mechanic. The plant consists of two independent buildings, separated by an 80-ft. street.

CAR-HOUSE DESIGN

The car house is 400 ft. long by 140 ft. wide, and contains ten tracks. The layout is what may be termed a "straight through" arrangement, that is, the building is open at both ends and all the tracks, with the exception of a short track for washing purposes, extend straight through the building, and there are track connections to the street at both front and rear.

At one end of the house, eight of the tracks pass over a concrete pit which is 160 ft. long, and serves as an inspection and working pit for cars as they come in off the line. The method of carrying the tracks across this pit area is unique, and will be described in detail in connection with the description of the repair shops. The building is divided longitudinally by a fire wall into two bays, each approximately 68 ft. wide. The accompanying plan will serve to make clear other details of the interior arrangement.

As to the structual features of the building itself, the walls are of red pressed brick and the roof is carried on two sets of truss-spans extending in each case from the center fire wall to the outer walls. The roof is flat, and is covered with composition fire and weather proofing. In addition to the numerous windows along the sides, light is secured through a system of roof monitors, which are placed crosswise in order to throw the light lengthwise of the house.



LAYOUT OF CAR HOUSE AND REPAIR PLANT AT BIRMINGHAM, ALA.

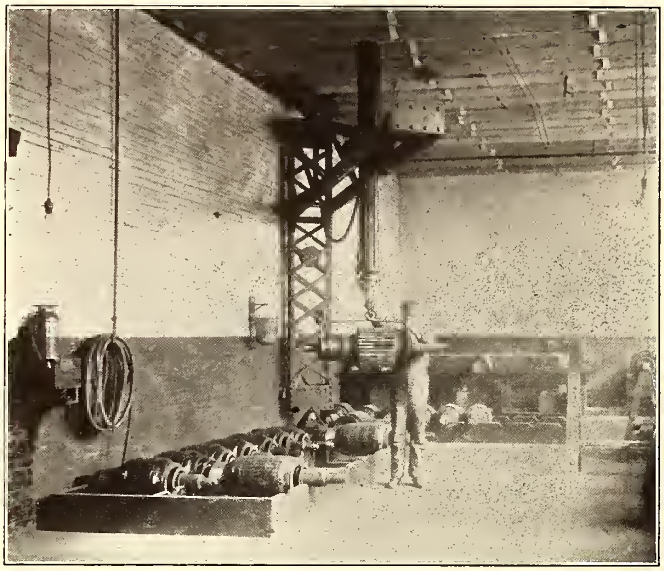
REPAIR-SHOP DESIGN

The repair shop building is similar in general construction to the car house. The roof spans, however, are supported on I-beams, which are carried by the outside walls and two rows of latticed columns through the center. This arrangement, in conjunction with the cross monitors in the roof, gives a particularly well-lighted shop.

Along one side of the shop building is a narrow two-story

REAR VIEW OF CAR HOUSE AND REPAIR SHOP AT BIRMINGHAM

CAR HOUSE AND REPAIR SHOP AT BIRMINGHAM. THE BUILDING IN THE FOREGROUND IS THE CAR HOUSE, AND THE REPAIR SHOPS ARE SHOWN IN THE BACKGROUND annex, separated from the main shop by a fire wall and utilized on the ground floor for store-room, offices, arma-



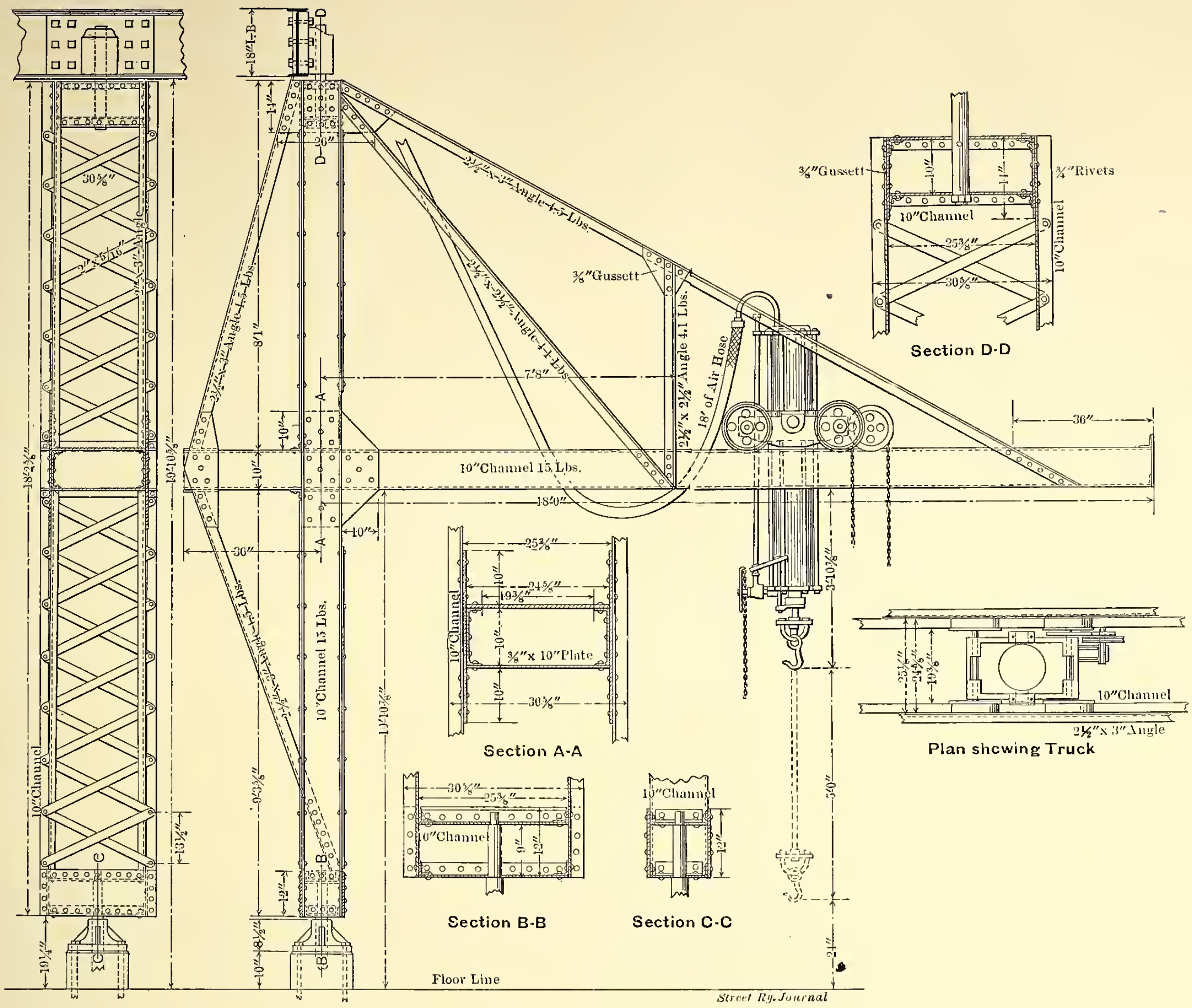
VIEW IN ARMATURE ROOM AT BIRMINGHAM SHOPS, SHOWING JIB CRANE FOR HANDLING ARMATURES

ture room, and for cleaning, drying and paint-storage in connection with the paint-shop work.

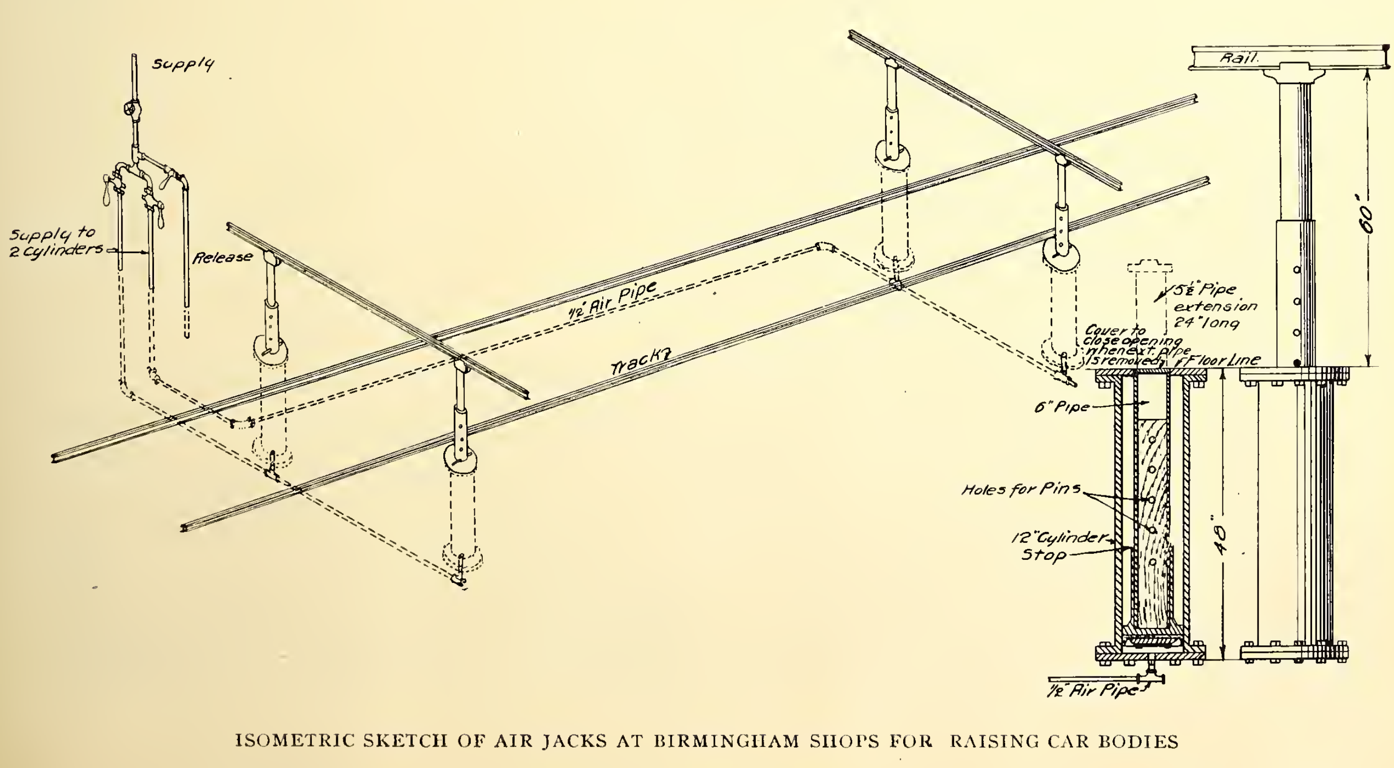
As in the case of the car house, the shop building is open at both ends and the arrangement of the tracks is on the "straight through" idea, that is, beginning at one end the shop is apportioned off to the various classes of the work in the order in which a car would naturally receive attention. First comes the blacksmith shop, then the machine shop, then the mill and carpenter shop, and at the far end the paint shop. The tools and machines for carrying on the work in each of these departments occupy floor space equal in width, approximately, to about one-half the width of the shop building, and the remaining space to the outer wall is occupied by the tracks, three of which extend straight through the building from end to end, with one extra stub track for the blacksmith and machine shops, and three extra stub tracks for the paint shop. Thus, cars can be brought directly opposite the particular department that is doing the work on them.

From this, it will be understood that the movement of cars through the shops is from one end of the building toward the other, as the work of repairs to trucks, motors, car bodies and painting progresses, but the movement of material and parts, while the work is in progress, is across the building, back and forth between tools and tracks, the layout offering every facility for handling all classes of car repair and maintenance work systematically and with maximum convenience and despatch.

A PORTION OF THE REPAIR SHOPS AT BIRMINGHAM, SHOWING METHOD OF SUPPORTING RAILS OVER PITS, AND CONVENIENT ARRANGEMENT OF JIB CRANE AND JACKS FOR EXPEDITING TRUCK AND MOTOR REPAIR WORK



DETAILS OF TYPE OF JIB CRANE USED IN REPAIR SHOPS AT BIRMINGHAM FOR VARIOUS PURPOSES



ISOMETRIC SKETCH OF AIR JACKS AT BIRMINGHAM SHOPS FOR RAISING CAR BODIES

At the machine-shop end of the building, that is to say, the section devoted to truck and motor repairs, the four tracks pass over a concrete pit, which is 170 ft. long and four tracks wide. The opening under the two tracks nearest the shop tools is planked over with removable flooring, to better accommodate certain classes of repairs, leaving the other two tracks with open pits for the removal of motors and motor parts, wheels, axles, etc.

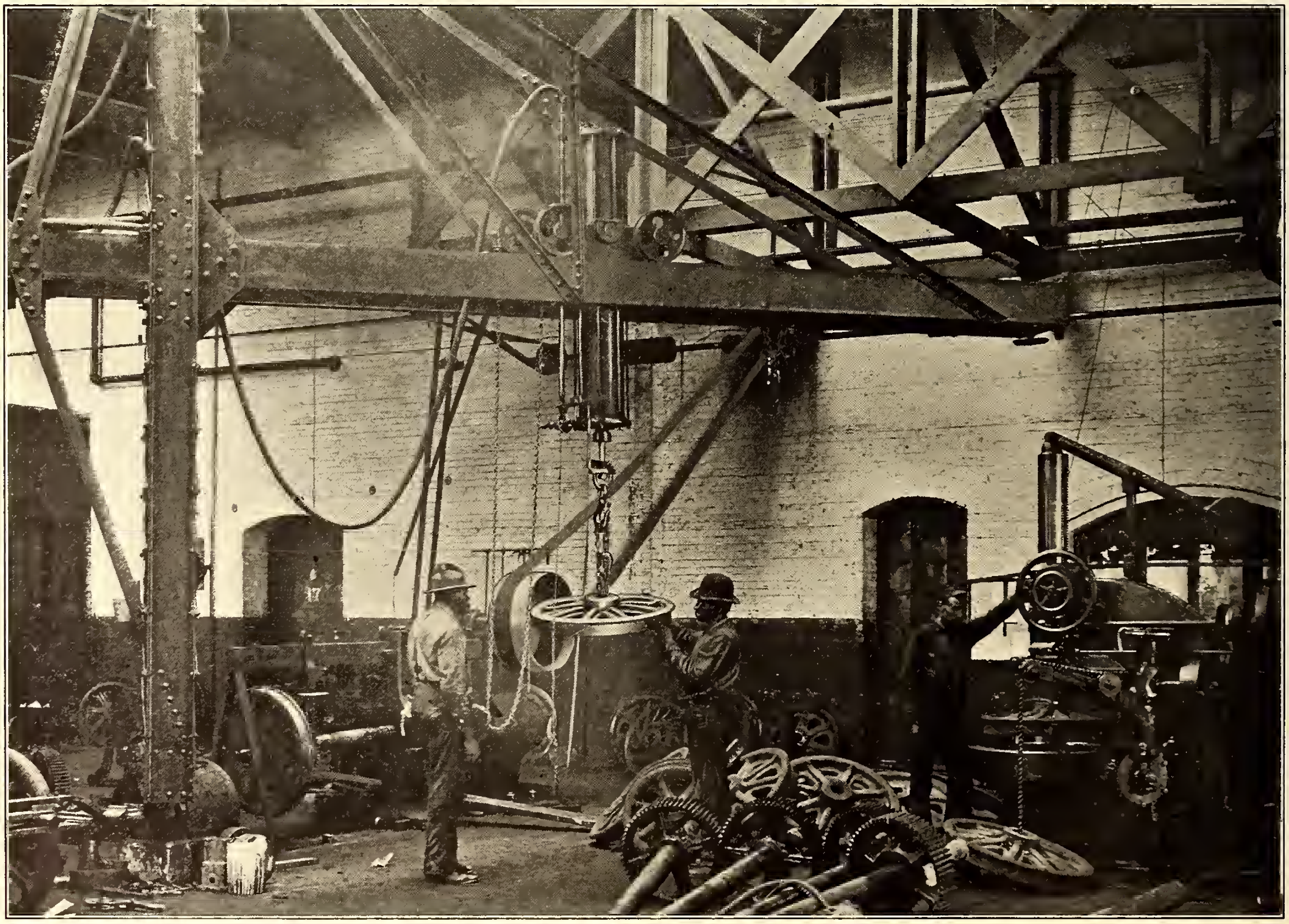
PIT DESIGN

The method of carrying the tracks over the pit area, as already referred to, is unusual, and merits particular attention. The track rails are supported on 6-in. wrought-iron pipe stanchions, which at the bottom are screwed into cast-iron base plates resting on concrete foundations, and spaced longitudinally 7½ ft. apart. At the top, each of the stanchions has a special casting in the shape of a deep collar clamped around the pipe, the tops of the collars forming bearing plates to which are directly bolted the flanges of the track rails, which are 7-in. 80-lb. T-rails. The construction gives well-lighted, well-ventilated and unobstructed pits, there being no walls, partitions or cross-bracing to interfere with free access underneath all the tracks. The floors of the pits are concrete. The accompanying half-tone illustrations show clearly the details of the arrangement, and are commended to the attention of anyone interested in pit designing.

PIT CONVENIENCES

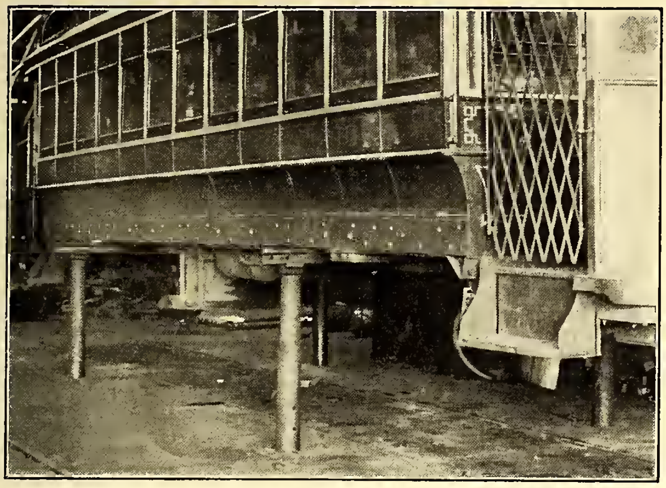
The two pit tracks that are not floored over with the removable planking, are provided with one hydraulic jack for removing armatures, two air jacks for the same purpose, and one hydraulic jack for removing wheels and axles. The hydraulic lifts are operated with hand pumps. Between the two tracks are two swinging jib cranes fitted with air hoists for picking up motor and truck parts and wheels from the floor of the pits, and swinging them across to the floor of the general shop on the higher level. This arrangement has been found exceedingly convenient, and has helped in large measure in keeping down cost of motor and truck repairs, as there is no unnecessary labor in handling material and parts. In connection with the subject of pit jacks, it may be said that the jacks designed for use with compressed air cost about $16 each, while the jacks that are operated hydraulically cost two or three times that amount. It has been the experience at Birmingham that for this particular class of work air is more easily handled than the hydraulic pumps, and if the installation was to be made over again it is probable that air lifts in the pits would be used exclusively.

Each of the two tracks that are planked over is provided with an air lift for raising car bodies free from the trucks. Each lift comprises four vertical cylinders, resting on concrete foundations. These cylinders are 4 ft. high and 10 ins. in diameter, and they are set with their tops flush with the floor. In each cylinder is a piston formed of a 6-in. cast-iron pipe. If it is desired to lift a car body higher than the total travel of the pistons, extension pieces consisting of 5-in. pipe, 2 ft. long, are adjusted to the tops of the pistons, thus giving a total lift of 5 ft. above the floor. One of the drawings shows plainly the details of this arrangement for raising cars. The object of the removable extension pieces in the top of the pistons, is to leave the car floor unobstructed when the jacks are in the lowest po-



VIEW IN REPAIR SHOPS AT BIRMINGHAM, SHOWING JIB CRANE FOR SERVING WHEELS AND AXLES TO BORING MACHINE AND WHEEL PRESS sitions, as the extensions can then be taken off and there will be no projections above the floor level. The car body is held in the raised position by means of pins inserted in holes in the 6-in. pistons in the manner shown in the diagram.

The cylinders are connected two in series, as indicated

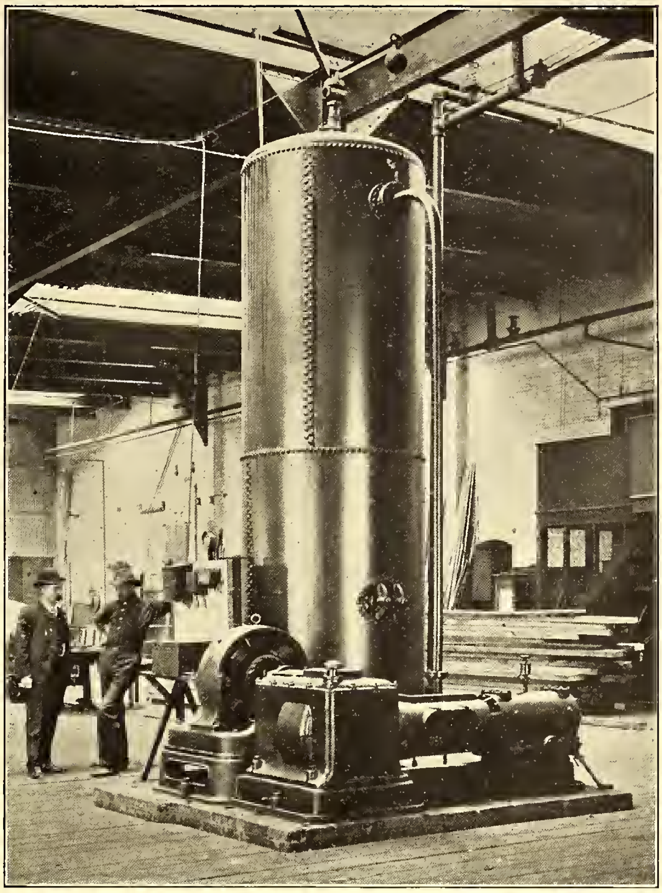


CAR-BODY ON AIR JACKS AT BIRMINGHAM SHOPS

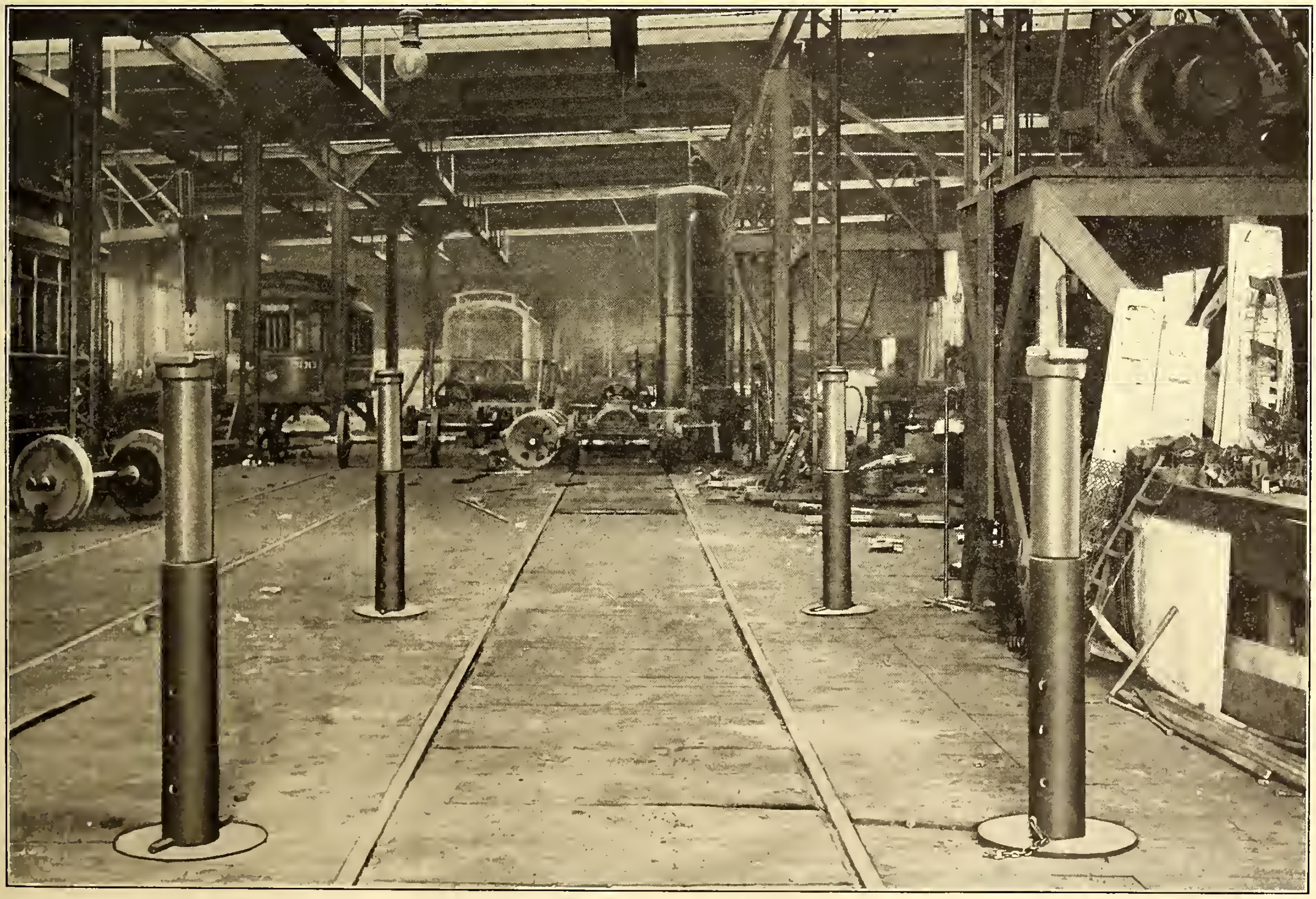
in the diagram. Air is supplied to each pair through a ¾-in. pipe, and the same pipe is used to exhaust the air when the car body is being lowered, by means of a simple arrangement of valves, which is also plainly indicated on the diagram.

COMPRESSED AIR

An important feature of these shops is the many applications to which compressed air is put throughout the plant. Air is used in pneumatic tools for riveting, drilling, boring

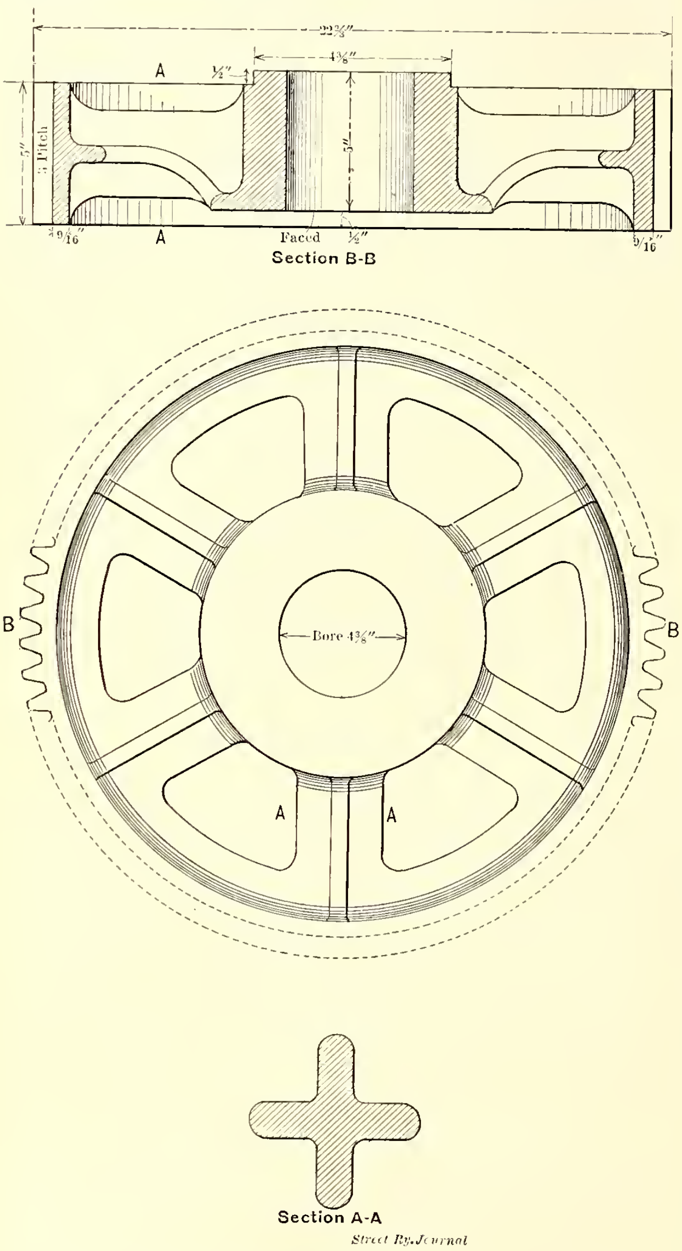


AIR-COMPRESSING PLANT AT BIRMINGHAM SHOPS



PORTION OF REPAIR SHOPS AT BIRMINGHAM, SHOWING AIR JACKS FOR RAISING CAR BODIES and other purposes in the machine and carpenter shops; in the pits, for operating numerous cranes, car hoists, and jacks; for blowing gas furnaces and blacksmith forges, and for blowing out motors and controllers and cleaning cars.

The air is obtained from a compressing outfit, located in the center of the general shop. The plant consists of a Christensen compressor, driven by a 35-hp 500-volt motor taking current from the trolley circuit. The storage tank,



SPECIAL 66-TOOTH SOLID GEAR, USED BY BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY

as will be seen from one of the engravings, consists of a vertical reservoir made of boiler plate riveted at the seams. The reservoir is 17 ft. 6 ins. high and 5 ft. 2 ins. in diameter. A safety valve at the top protects the tank against excessive pressure. The motor is started and stopped by an automatic switch, which cuts in and out at predetermined pressures. The plant has a capacity of about 200 cu. ft. of free air per minute.

The air is utilized at about 100-lbs. pressure. The air pipes are carried underneath the flooring, and extend to all parts of the plant, along the sides of the pits, along the shop benches, into the armature room and wherever the air can be utilized. Branches from the air mains are brought up at the building columns at frequent intervals, and take-offs are provided from the pit and bench-supply pipes, so that the men by means of flexible-hose connections can obtain air at any point for any purpose. The air supply is also carried through an underground pipe to the car house, located across an intervening street, where it is available for hoisting and cleaning purposes. As a detail of experience, it may be said that no trouble has been found in transmitting air for distances up to 500 ft., and air is available at the distant ends of the supply pipes at pressure sufficient to serve all purposes.

JIB CRANES

For handling parts and material, extensive use is made in these shops of a novel pattern of jib crane designed by Ford, Bacon & Davis. There are two of these cranes for serving the repair pits, one for handling wheels to and from the boring machine and for carrying wheels and axles to the wheel press; one for serving wheels and axles to the turning lathe, and one for handling armatures in the armature room. The cranes are of different sizes suited to the particular work they are to perform, but the details of construction are the same in each case. The general design will be understood from the working drawing reproduced on page 699, which shows a crane of 5630-lbs. capacity, with 10-in. air hoist, used for handling wheels and axles.

The upright standard of the crane is a 10-in. lattice-channel girder, pivoted at the top and bottom in cast-iron bearings. The jib arm, upon which the air hoist travels, is 18 ft. long, and the crane will therefore serve the area included in a circle 36 ft. in diameter. The master mechanic is of the opinion that cranes of this kind offer the ideal way of handling material in the pits, and of carrying work to and from stationary tools.

GEARS

The Birmingham company has discarded split gears, and has adopted exclusively a solid gear designed by the master mechanic, and made by the E. W. Bliss Company, of Brooklyn, N. Y. The features of the design are the extra heavy ribbed spokes between the hub and the rim, and the shape of the hub, which has been modified to suit the special form of motor bearings used on the Birmingham cars. The gear is shown in one of the drawings herewith. It is the practice to press gears on to the axles with about 20-tons pressure.

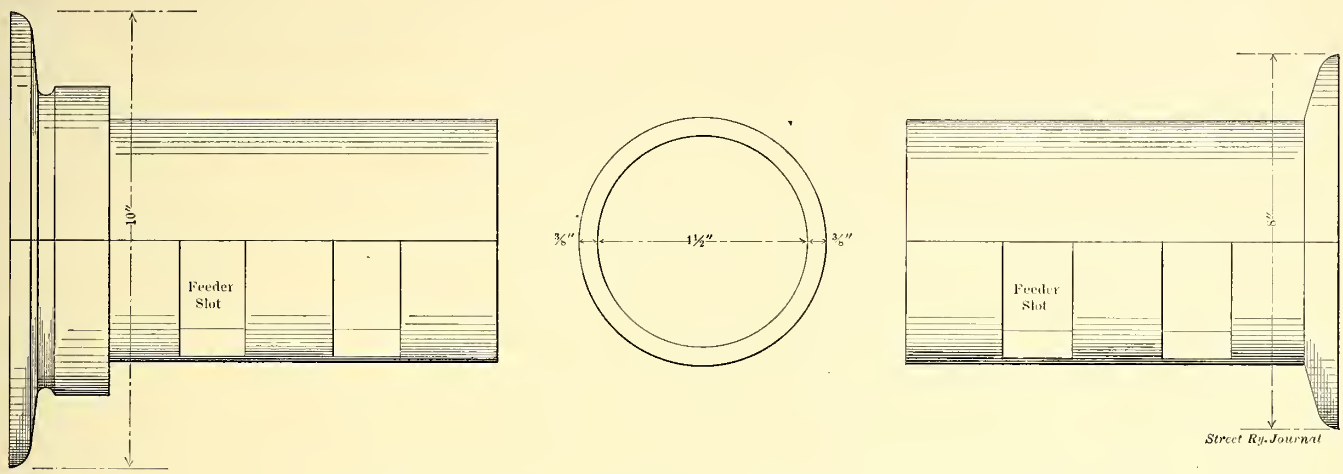
MOTOR BEARINGS

For motor bearings, the company has adopted an extra long brass bearing the feature of which is a heavy collar, which is primarily intended to prevent grit from working into the bearings. On the gear side this collar is inside the gear case and forms a 10-in. bearing plate against the gear, the entire inner side of the gear, as will be noticed from the drawing, being faced off to a machine finish to give a good bearing surface for the face of the collar. On the wheel side, the collar on the bearing is let into the hub of the wheel sufficiently to give a tight-bearing fit, so there is no chance for dirt or grit to work into the bearing, either from the gear side or the wheel side. Moreover, the addition of the collar to the bearings has increased the life of motor bearings 20 per cent, inasmuch as the ordinary style of bearing usually wears fastest at the end that bears against the gear, and has to be discarded for this reason before the bearing itself is worn out. The collar gives a larger wearing surface at the ends, and therefore increases the life.

It will be noticed also that the bearing is 10⅝ ins. long, which gives 1½ ins. more of wearing surface in the length. The material used is a good bronze gun metal. Oil is employed for lubrication and is fed through an oil cup, which is a modification of the Galena cup. The bearings, as described, cost about $5.50 each, and from the shop records it appears that several sets have been in constant service for 10 months, and have made 50,000 miles without showing signs of excessive wear. It is expected that they will run at least 100,000 miles before they have to be replaced.

WHEEL PRACTICE

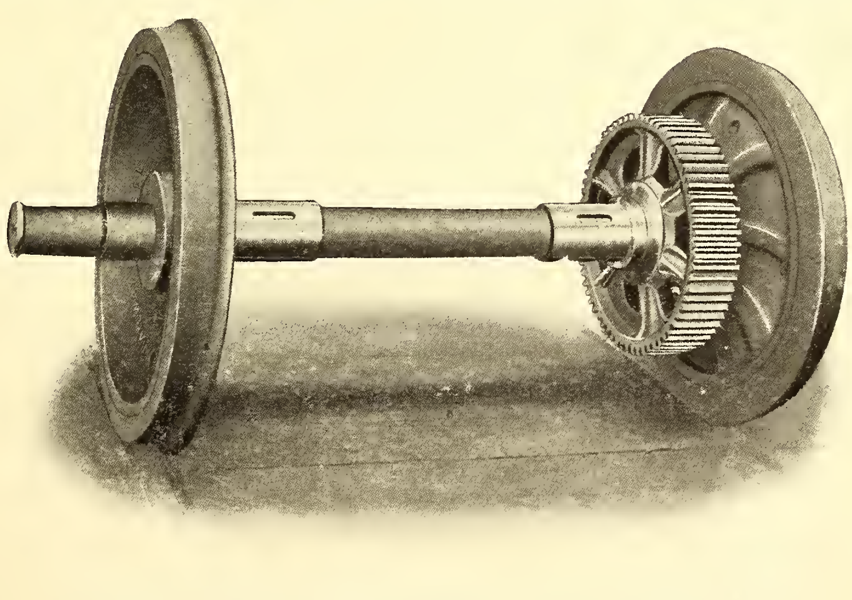
The company is using cast-iron wheels for city service, but in an experimental way is trying steel wheels on interurban cars. At present, 40 pairs of Taylor wheels are in use. These have been running a little less than a year, and thus far have averaged something over 30,000 miles. The wheels at this writing are just beginning to come in for their first turnings, and the indication is that the lot will average 50,000 miles before the first turning will be necessary.



SPECIAL MOTOR BEARING USED BY BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY

No special provision has yet been made for doing the turning work, but such of the wheels as have required it have been turned in an ordinary 40-in. lathe at a cost of approximately $2 per pair for the actual machine work. This cost can be reduced when better facilities for doing the work have been provided. The figure given does not include the cost of removing and replacing wheels under cars, and the master mechanic points out that the cost of doing this work should not be charged as an additional cost against the steel wheels, providing they make the same or greater mileage between turnings as cast-iron wheels, for the cost of replacing either would be the same.

Both cast-iron and steel wheels are pressed on and off axles in a hydraulic press, at about 35 or 40 tons pressure. To avoid breaking wheels when they are being pressed on and off, it is the practice to use a heavy steel ring of sufficient diameter to pass over the gear. This ring presses upon the wheel just inside the rim, and distributes the pressure equally to all the spokes or, in case of a plate wheel, distributes the pressure evenly over a considerable area. The use of this ring has entirely eliminated the breaking of wheels in the pressing off process, and is believed to be an improvement over the more common method of inserting steel bars through the spokes of the gear, as the bars concentrate the whole load at two points on the wheel and, if a wheel happens to fit a little tighter than usual on the axle, it is almost impossible to drive it off without breaking.

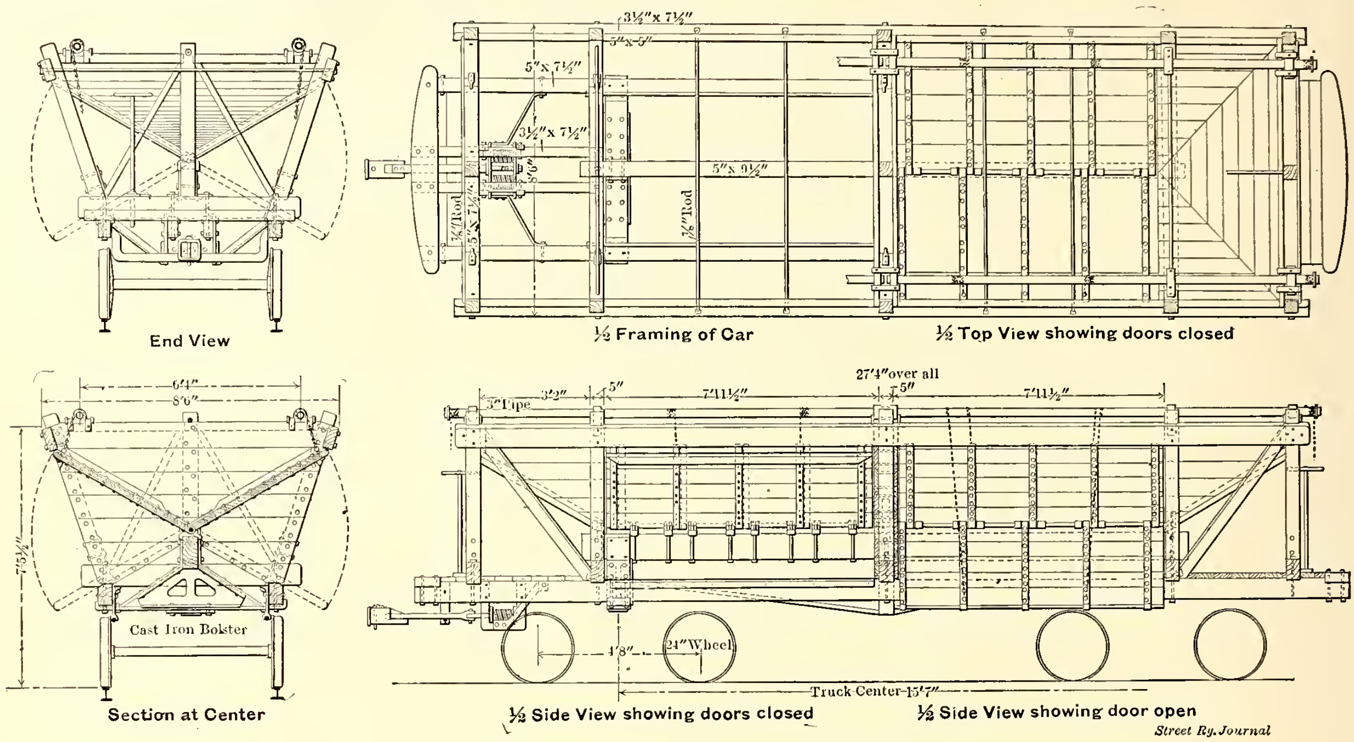

STANDARD WHEEL, AXLE, AND GEAR, AND SPECIAL MOTOR AXLE BEARING WITH COLLAR USED AT BIRMINGHAM

COST OF ARMATURE COILS

All the armature and field coils required on the system, are made at these shops. The master mechanic states as his opinion that a railway company can make its own coils at less cost than it can buy them, provided it has sufficient work to warrant a well-equipped coil department, and a well-organized winding force. At these shops, for instance, a set of coils for GE-57 motor that formerly cost $27, is now produced for $24. The coil room has taping machines, pneumatic presses for pressing coils, electrically heated oven and other modern labor-saving devices for doing this work at minimum cost.

BALLAST DUMP CAR

There has recently been built at these shops a dump car for hauling sand, slag-ballast, and similar material. As will be understood from the accompanying half-tone engraving and drawing, the car is 27 ft. 4 ins. over all, and is built with two separate compartments, thereby giving facilities for dumping either one-half the load or the entire load at any one place. Each compartment or hopper is V-shape, the two sides consisting of wooden doors lined with steel plate. The two doors are hinged at the bottom to a common horizontal rod, and are normally held in the raised position by chains which are wound upon shafts formed of 3-in. double-strength wrought-iron pipe. The doors are let down or raised by rotating these shafts by means of hand cranks at the ends. Each compartment has capacity for 6 cu. yds. of material.

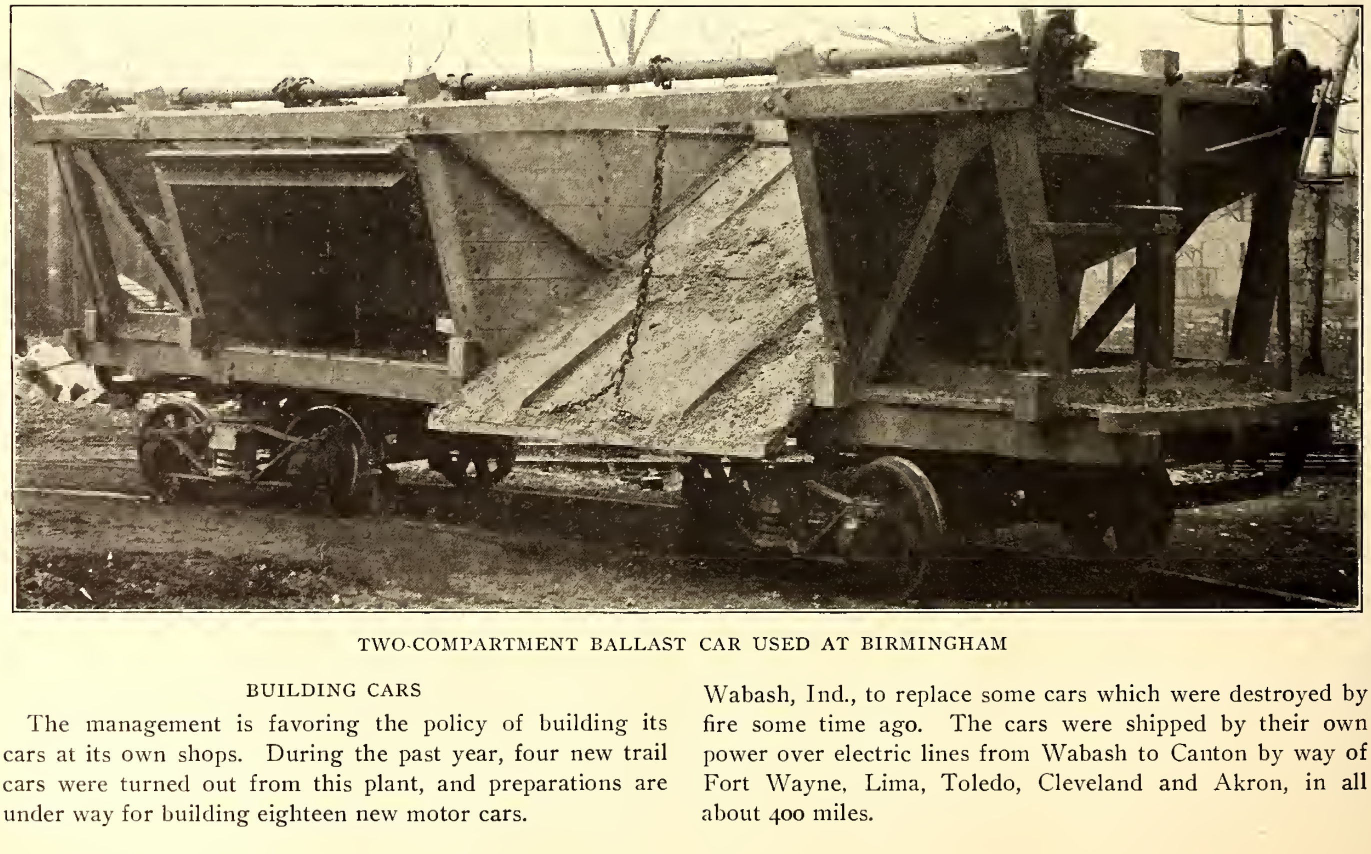


BALLAST CAR BUILT AT SHOPS OF BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY

CAR EQUIPMENT

The company owns 214 cars, including motor cars and trailers. The electrical equipment includes a total of 430 motors, of which 100 are of the GE 1000 type, 60 are the GE 67 type and 270 are GE 57's. The standards in rolling stock adopted by the company were described in the STREET RAILWAY JOURNAL for March 24, 1906.

The longest continuous trip in one direction over electric roads, was made several weeks ago by two cars which were purchased by the Canton-Akron Company from a road at Wabash, Ind., to replace some cars which were destroyed by fire some time ago. The cars were shipped by their own power over electric lines from Wabash to Canton by way of Fort Wayne, Lima, Toledo, Cleveland and Akron, in all about 400 miles.



TWO-COMPARTMENT BALLAST CAR USED AT BIRMINGHAM

BUILDING CARS

The management is favoring the policy of building its cars at its own shops. During the past year, four new trail cars were turned out from this plant, and preparations are under way for building eighteen new motor cars.

INTEGRATING WATTMETERS ON THE CARS OF THE CLINTON STREET RAILWAY

It is usually conceded that integrating wattmeters, if placed on cars and read at frequent intervals, would be the means of detecting undue consumption of current by individual motormen, defective apparatus, tight brakes and other irregularities which cause increased current consumption. However, lack of actual data from systems where meters have been installed on the original cost and the maintenance of the meters has done much to retard their general adoption.

General Manager R. M. Howard, of the Clinton Street Railway, Clinton, Ia., has all of his cars, with the exception of a line car, equipped with meters, and the general results obtained are very interesting. In short, the consumption of power has been reduced 20 per cent. Trouble with the electrical equipment and its maintenance has also been reduced. Very little difficulty has been experienced in keeping the meters in order. The latter are of the Thomson type, and are placed overhead in the vestibules of the cars. The motormen take all the readings, which are obtained when the men begin their run and when the car is turned in or given to another motorman. To facilitate reading, each motorman is supplied with a small pad of blanks of the form illustrated. The motorman enters the actual readings of the dial and makes the subtraction. He also enters the length of his run in hours. These slips are turned in each day and the readings are transferred to two books, one a "car power record," the other a "motorman's power" record. After entering the readings the constant of the meter is taken into consideration, and the total consumption in watts is computed.

MOTORMEN'S POWER RECORD. 411

NAME.

DATE		FROM	TO	METER READING From	To	CONSTANT	TOTAL HOURS	TOTAL CURRENT USED	REMARKS
		M	M						
		M	M						
		M	M						
		M	M						
		M	M						
		M	M						

MOTORMEN'S RECORD OF METER READINGS

The power records contain space for remarks, and under this heading is usually entered the condition of the weather, as this has quite a bearing on the current consumption. The use of two books enables any excess of current by either a motorman or a car, to be caught at once.

At the end of each week the total consumption of each motorman for the week is divided by the total hours of operation of the cars by the motorman, and the result, which is in watts per car hour, is posted on a bulletin board in the trainmen's room.

Merits are given for the least consumption, and, besides, there has arisen a spirit of rivalry among the men—with the result that each tries to keep his record the lowest. Attempts to keep the record lowest causes each man to accelerate slowly and to coast as much as the schedule will permit. As all the cars on the same run consume about the same amount of current, the motormen know what the consumption should be, and any excess is at once reported, and the car is examined.

On the main line, with a single-truck car, weighing 12 tons, driven by two GE-67 motors, and operated on a schedule of 8.56 miles per hour, the average consumption is 10 kw-hours per car-hour. At the present time, under ordinary conditions, the readings of the different men on this line vary in amount from 9.5 kwh to 11 kwh per car-hour. The economy from the use of meters is well shown by the reduction in consumption by the different motormen since the meter system was put into operation. When the meters were first installed the consumption of different men varied from 10 kwh to 15 kwh per car-hour. Had the meters never been installed the inefficient men would, no doubt, have continued to use 50 per cent more current than was necessary. However, the excessive consumption of these directed attention to their methods of operating the car, with the result that, in a few weeks, they were enabled to reduce the current used.

The system is also of value in training new men. When first put on a car these men used about 14 kwh per car-hour. After a period of two weeks the consumption drops to 12 kwh, and remains at this figure for about three weeks, when it drops down to about 10 kwh, which is the average amount. Tight brakes and defective electrical apparatus are shown at once by high readings of the meter. Tight brakes will frequently cause a 50 per cent increase in the readings of the meter. As it is to the motorman's interest to keep the consumption down, he returns his car to the car house for inspection at the first opportunity after discovering any increase in current consumption. The meter readings are also utilized to obtain the line and track losses. At intervals of one or two months, the total of the readings of the meters on all of the cars is compared with the readings of the station wattmeter, and the line losses are at once apparent.

As a consequence of the better handling of the cars, induced by the use of the meters, the maintenance expenses of

MOTORMAN'S DAILY POWER STATEMENT. CAR NO. 27

NAME J. Wilson DATE 4/15 1906

TIME 5½ hrs. Meter Reading Constant 2

FROM A. M.	FROM P. M.	TO A. M.	TO P. M.	Meter Reading FROM	Meter Reading TO	AMOUNT USED.
5.50		11.50		0436	0726	290

STATEMENT OF POWER CONSUMPTION

the electrical equipment of the cars is much lower than it was before the installation of the meters. A grounded or defective armature is of rare occurence. The life of brake-shoes has been increased considerably. At the present time a shoe lasts about six months. Dupont shoes, with an original weight of 28 lbs., are employed, and they are worn down to about 10 lbs. before being discarded.

Since installation the maintenance cost of the meters has been approximately $3 per year per car. Practically the only attention given them is that of renewing jewels and of polishing the commutators. In the last two years but one meter has been injured by lightning.

Mr. Howard believes the use of wattmeters has a good effect on the discipline of the employees in general. They feel that in the operation of the road every little detail is being given attention, that the operation of the road is better systematized, and that their own conduct and actions are being watched closely.

The Swedish Government has introduced a bill in Parliament authorizing a grant for the purchase of waterfalls belonging to private persons with a view to utilizing them for supplying power for the proposed electric State railways. It is further proposed to expend a sum not exceeding 5,000,000 kroner ($1,350,000) to purchase waterfalls which may be considered necessary for working the railways in the immediate future and the purchase of which cannot be delayed without detriment to the State.

THE FREMANTLE (AUSTRALIA) MUNICIPAL TRAMWAYS

Fremantle is one of the most important ports of Australia, and is situated in the southwestern part of the State of West Australia. It is here that the mail boats from England or the Continent of Europe first call on their way to the main eastern commonwealth ports.

POWER HOUSE OF THE FREMANTLE MUNICIPAL TRAMWAYS

The road is owned by the municipality and is controlled by a board of five members, called the Fremantle Municipal Tramways & Electric Lighting Board. The members are elected on a separate franchise, as follows: One each in Fremantle and East Fremantle by freehold property owners, and one each in both municipalities by occupiers of property, making four in number. The Mayor of Fremantle is, ex-officio, the fifth member. The control of the trams and lighting is, therefore, taken away from the councils, and handed to a board constituted for the management alone. This is the first and only municipal tramway in Australia, the others being either State owned, as in New South Wales, or privately owned, as in the remainder of the States. Municipal lighting, on the other hand, is quite customary in Australia.

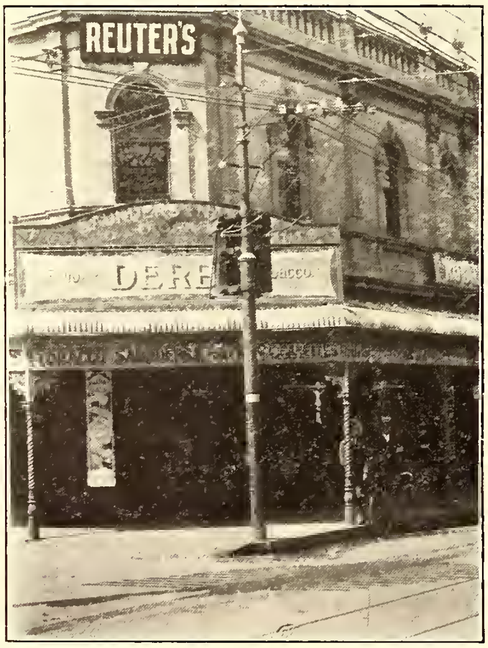
The tramways and lighting system not only serves Fremantle proper, which has a population of about 23,000, but also the suburb East Fremantle, with a population of 4000. The latter furnished one-seventh of the capital, while Fremantle proper furnished the remainder. The road was opened Oct. 30 of last year. Previous to this time cabs were the only means of transit and gas the only method of lighting.

The contract for the construction of the entire system was secured by the firm of Noyes Brothers on a commission basis, for which they were to find the capital, design, buy the necessary material, supervise and control the construction on behalf of the Tramway Board. The necessary powers for borrowing up to £100,000 by the municipalities on debenture stock was incorporated in the act incorporating the Board. The work is now successfully completed, and although the contract time does not elapse for two months more, some sections have been working since October last.

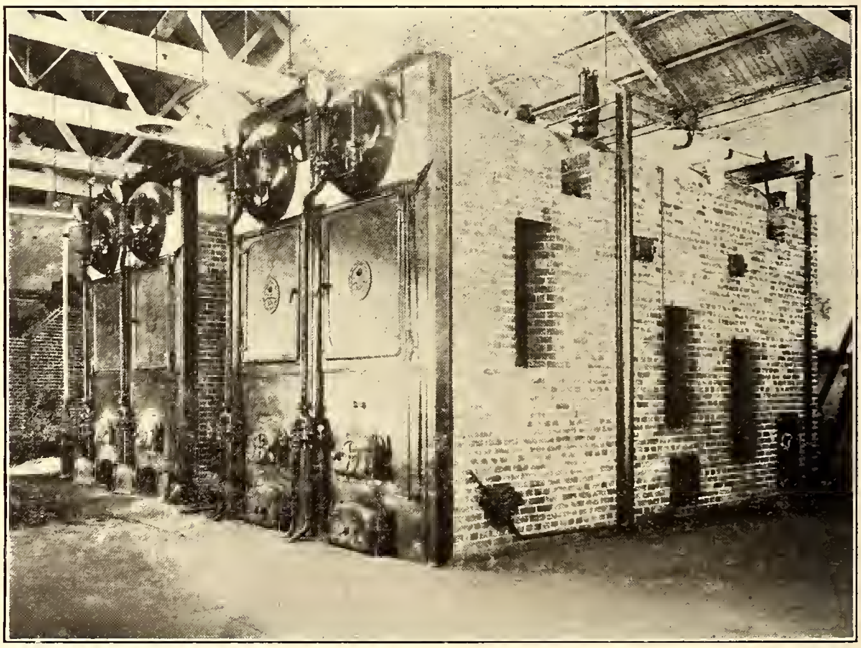
POWER HOUSE

The power house is a substantial brick building, located at the South Mole, on the edge of the harbor, and alongside the railway. At one end of the building is located a small iron building, in which the battery is housed. The main building is divided by a brick wall into an engine room, 87 ft. long by 34 ft. wide, and a boiler room, 87 ft. long by 45 ft. wide; the engine room floor is some 6 ft. higher than the boiler room, which allows for the carrying of exhaust pipes, and also connecting cables underneath the main floor.

The boiler room has installed in it at present four boilers, in two batteries of two boilers each, and additional room for two more boilers of the same capacity. The boilers are of the Babcock & Wilcox manufacture, each having a heating surface of 1426 sq. ft., and grate area of 28 sq. ft. They are designed for 160-lbs. working pressure, and up to 150 degs. superheat. Each boiler has a water drum, 3 ft. 6 ins. in diameter, and 24 ft. long, and nine rows of 4-in. Mannessmann cold drawn steel tubes, the superheater of mild steel tubes is located underneath the rear part of the water drums, as is the usual practice with this type of boiler. The two feed pumps are Worthington duplex, having steam cylinder, 6 ins.



50-KW TRANSFORMER PLACED ON A TRAMWAY POLE IN FREMANTLE



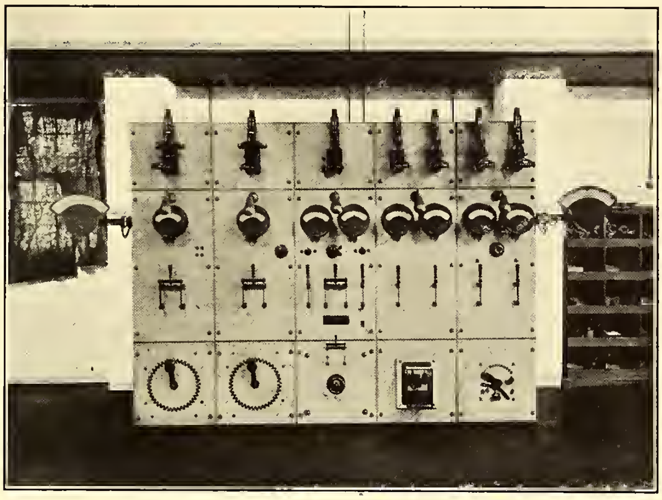
BOILER ROOM IN FREMANTLE MUNICIPAL TRAMWAYS POWER HOUSE in diameter, water cylinder 3½ ins. in diameter, with 6-in. stroke; they are of the usual standard brass-fitted pattern of this maker.

A Guttmann water softener, having a capacity of 300 gallons per hour, is located in the boiler room. Exhaust steam from the feed pump is utilized to heat the water in the water softener for precipitating the impurities, soda ash being used as the reducing agent; this was essential on account of the very hard nature of the local water. In the main flue is located a Green economizer, divided in two sections of 96 tubes each, arranged in eight rows of 12 tubes, each being 9 ft. long by 4½ ins. in diameter. The scrapers are driven by a 2-hp motor geared down, and located on top of the economizer chamber.

The condenser system consists of a Worthington surface condenser, 12 ft. long by 2 ft. 7 ins. wide, by 4 ft. 8 ins. high. The area of the cooling surface is 1400 sq. ft. The air pump, by the same maker, is vertical, three-throw, single acting, and is driven by a 500-volt Westinghouse shunt-wound variable-speed motor. The circulating pump in this case is of the centrifugal type, driven likewise by a 500-volt shunt-wound variable-speed motor. The piping for the inlet and discharge of the circulating pump is carried in a brick tunnel under the buildings directly to the sea. This latter construction permits of the suction pipes being readily inspected, and also eliminated a long discharge pipe, besides allowing for a handy drain from the boiler room.

The generators are four in number, two being d. c. machines for the tramways, and two a. c. machines for lighting, each being direct connected to English high-speed engines. The d. c. generators are each 150 kw, 550 volts, 430 r. p. m., compound wound; while the a. c. generators are each 150 kw, 2200 volts, two-phase, 50 cycles, 428 r. p. m. The exciters are mounted directly on an extension of the main bed plate with their armatures mounted on the main shaft. These generators have revolving fields and stationary armatures, and were manufactured by the British Westinghouse Electrical & Manufacturing Company. The four engines driving these generators are all similar, with the exception of the slight difference of speed. They are of the Belliss & Morcom high-speed vertical compound type, taking steam at 150 lbs. pressure, with 100 degs F. superheat, and running with a 24-in. vacuum. They are guaranteed to give 265 bhp, with a consumption not exceeding 22 lbs. steam per kw at full load; and at half load 23.4 lbs. They have a central valve, are entirely enclosed, having forced lubrication; an enclosed governor on the end of the engine shaft, which works directly by a series of levers on the inlet valve, provides close and sufficient regulation. The engines have given splendid satisfaction during their operation, and are very economical in all-day service.

The d. c. switchboard consists altogether of five panels of the best Italian marble, arranged as follows: Two generator panels, on each of which is mounted one two-pole circuit breaker, one ammeter, one lamp, one main two-pole switch and rheostat on the bottom panel, one battery panel, having circuit breaker, one differential ammeter, and one differential voltmeter, also the necessary main switches for putting the battery either to the feeders or cutting it out entirely. The two feeder panels have been arranged for supplying two feeders on each panel with the usual meters and switches. The board is also fitted with a main voltmeter, ammeter, and Thomson recording wattmeter.

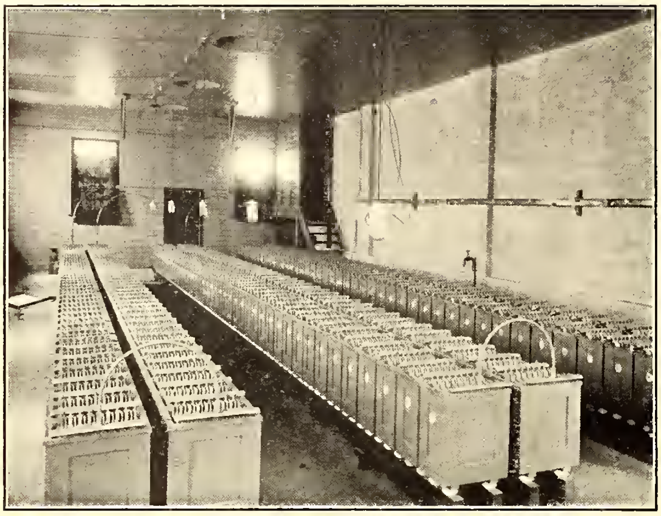


THE DIRECT-CURRENT SWITCHBOARD

The a. c. switchboard is entirely separate from the d. c. board, and consists of six panels of the best Italian marble. There are two generator panels, with oil-break switches. Each panel has two ammeters, and recording and integrating wattmeters, with the usual ground detector. In front of each panel are pedestals on which are mounted the field switches and the handles which control the resistances in the fields of the exciter and main generators. Three of the feeder panels are the same, with the exception of the Stillwell regulators; each feeder panel is arranged with two single-phase, double-throw oil-break switches and an ammeter in each phase. There are four Stillwell regulators on the board for controlling the same number of single-phase feeder circuits. The arc panel is fitted up for one series a. c. arc circuit with a double-throw oil switch and ammeter; there are also three plug switches for short circuiting or opening the secondary of the balanced regulating arc transformer, which is located in the basement. Both the boards have a very neat appearance, and add materially to the beauty of the engine room. This switchboard was made by the generator builder.

ENGINE ROOM IN POWER HOUSE OF THE FREMANTLE MUNICIPAL TRAMWAYS

An automatic reversible booster set has been installed for charging the battery of 265 Tudor cells. The booster consists of a 500-volt shunt-wound motor, with its armature pressed on the same shaft as that which carries the armatures of the booster and exciter. The booster is of the differential multipolar type, with a capacity of 150 amps. at 150 volts. The exciter furnishes the current for the shunt fields of the booster and carries the main current in its series-field winding, while its shunt is separately excited. The battery consists of 265 cells of the German Tudor type, as manufactured by the Accumulatorenfabrik Aktiengesellschaft. The battery has a capacity of 296 amps. at the one-hour rating, and a charging



BATTERY ROOM OF THE FREMANTLE TRAMWAYS SYSTEM

rate of 144 amps. Each cell has eight positive and nine negative plates. The battery is laid out in six rows of cells, two rows being placed back to back.

THE PERMANENT WAY

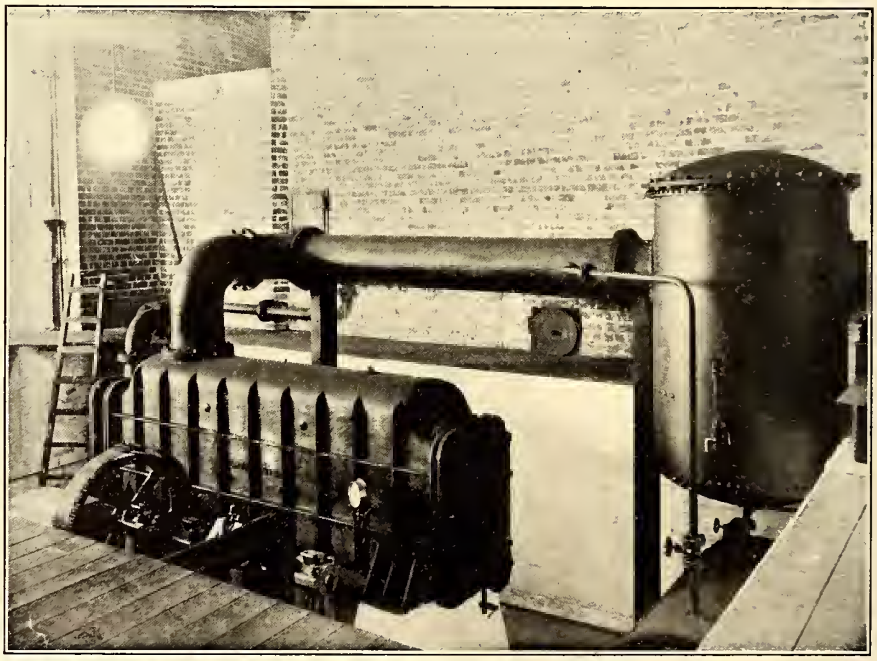
The total length of permanent way laid consists of 7.1875 miles of single-track lines, that is, running track in macadamized road 6.1 miles; running track in wood blocking, .37 mile; and sidings, passing stations, car house, etc., .71 mile. The gage is 3 ft. 6 ins., this being exclusively the practice in this State, both for the State Railways, and also with the tramways at Perth and Kalgoorlie. There are four different routes, with a loop in the central part of the city. The construction is single track throughout, with passing stations suitably placed. The lengths of the routes, from the center of the city, are as follows: East Fremantle, 1.80 miles; South Fremantle, 1.48 miles; Marmion Street, 1.24 miles; Beaconsfield, 1.61 miles. This latter route runs .41 mile over the Marion Street route; central portion of city, .78 mile. On all these routes the tracks are placed on one side of the roadway in such a manner that when duplicated, if required, the track will be central, with the exception of High Street and Market Street, which are too narrow for double track. The rails are 92 lbs. per yard, 6½ ins. deep, of the grooved-girder type, with 6½-in. base for the straight track, and 95 lbs. per yard, of the same type, for curves.

The type of construction of the permanent way of the macadamized roads was carried out on the usual lines. The street was excavated to a depth of 15 ins., and Jarrah (Westralian hardwood) ties, 6 ft. 6 ins. long x 9 ins. wide, by 4½ ins. deep, were spaced 2 ft. 6 ins. apart on a 4-in. bed of 2-in. ballast. This ballast is what is called locally "Capstone," or weather hardened surface sand stone. It is very hard and has proved to make a splendid road bed. Blue stone would have cost double the amount, without bettering the class of construction to any marked extent.

Each rail joint is bonded with two No. 0000 B. & S. Chicago bonds, 3 ft. long, and every other rail is cross bonded with No. 00 B. & S. tinned cross bonds, applied to the rails by the Brown plastic alloy method, with bolted heads. All special work is well bonded, and special long bonds carried around the work. The fish plates are 2 ft. 7 ins. long, of mild steel, and secured by six 1-in. bolts, with spring washers, the five tie rods for each 40-ft. rail of the macadamized road are of mild steel, ¾ in. in diameter, and threaded for 5 ins. on each end. The tie rods in the wood-block construction are flat, with the exception of the ends.

After the rails, sleepers, bonds, etc., had been placed in position and the capstone ballast filled in to a couple of inches above the rails, the whole was rolled by an 18-ton roller, and is afterward packed under the head and guard of rails. This top was then sprinkled with tar and covered with 2 ins. to 2½ ins. of tarred ¾-in. ironite, which is broken slag that has been slowly cooled. On top of this was placed a small amount of tarred screenings, then dusted and again rolled with the steam roller. The result has been a remarkably good road, at a minimum amount of cost for this country.

Part of High and Cliff Streets was paved with wood blocks previous to the putting down of the tram tracks, and the wood blocks were but 6 ins. deep, resting on a concrete bed, 8 ins. thick. The rails being 6½ ins. deep, it was necessary on removing the blocks for putting down the rails to chip a groove in the concrete, from 1 in. to 1½ ins. deep, for laying the rails and allowing for a fresh bedding of concrete. These were anchored at every joint by an inverted piece of



CONDENSER PIT, SHOWING SURFACE CONDENSER, AND ECONOMIZER IN THE BACKGROUND

old tram rail, being bolted to each rail and buried in the concrete. On curves and special work the anchors took the form of ties of the standard type, being buried in the bed with the rail secured to them by screws. The special work was also made by the Lorain Steel Company, and was fitted up and marked at the works before being sent out.

OVERHEAD CONSTRUCTION

For the central part of the city about a mile of Mannessmann steel span and anchor poles was put in. The poles are 28 ft. long, 7 ins. external diameter at base, and 3 ins. at the top for the former, and 29 ft. long, 8 ins. external diameter at base, and 3¾ ins. at the top for the latter. These poles are of weldless tubular steel, and have three different reductions in diameter for each pole, with ornamental collars, caps, etc. Some of the tramway poles also carry wires and arc lamps for the lighting, and where this occurs the poles are slightly larger, with the necessary arms for carrying the cables and lamps. The wooden span and anchor poles are Jarrah wood, 29 ft. long, and 10 ins. base, by 7 ins. top for the span poles, and for the anchor, 29 ft. long, by 12 ins. in diameter at base, and 9 ins. diameter at top. They were all adzed and trimmed up, and an ornamental cast-iron cap placed on top, which not only improves their appearance but also protects the pole from splitting, an inherent defect of Jarrah when exposed to weather. All the poles are put in the ground to a depth of 6 ft., concrete being used with the steel and wooden anchor poles.

The trolley wire is No. 000 B. & S. gage hard drawn circular copper wire. The span wire is galvanized steel, composed of seven strands No. 11 B. W. G. wire. The trolley wire is put up in duplicate throughout, the distance between the two wires being 6 ins. It is required by the local post office officials that guard wires shall be placed over all trolley wires where there are any telephone or telegraph wires. These merely consist of two No. 10 B. & S. galvanized wires, carried about 18 ins. above the trolley wire, and separated from each other by about 2 ft. They are insulated from ground by small button insulators, being interposed between main guard wires and the poles. The feeders are four in number

CAR HOUSE AND GENERAL OFFICES OF THE FREMANTLE MUNICIPAL TRAMWAYS

and are carried underground from the power house to the car house, where they are brought up the poles and to their various feeding points by aerial cables.

CAR HOUSE AND ROLLING STOCK

The car house, which is located on High Street, is a substantial two-story brick building, having a frontage on the street of 70 ft. and a depth of 151 ft. The ground floor is entirely used for the storage of cars, rooms for motormen and conductors, store, receiving office, and machine shop. There are five tracks carried into the shed, one only runs a third of the length of the building, the others being extended practically the full length of the building. The floors are made of

HALF-CLOSED, HALF-OPEN TYPE CAR USED IN FREMANTLE

granolithic, and suitable brick pits for inspecting and repairs have been constructed. The first floor contains the board's, manager's, and general offices.

The rolling stock consists of fourteen Brill combination type cars, which differ from the standard California type, inasmuch as a partition between the motorman's platform and the open compartment is placed so that there is no passenger seat on the motorman's platform. This has proved most convenient, as it keeps the passengers away from the motorman. The closed compartment of the car is 11 ft. 6 ins. over the end panels, and is attractively finished in cherry, stained mahogany, and highly polished. The ceilings are of decorated bird's-eye maple. The cars are 28 ft. 4 ins. over the crown pieces, and 8 ft. 5 ins. from end panels of closed compartment over crown pieces. The width over sills is 7 ft. 9½ ins. in the closed compartment, and 6 ft. 11¾ ins. in the open compartment. The width over the posts is 8 ft. 4 ins. in the closed and 7 ft. 10 ins. in the open sections. Thirty-six passengers may be comfortably seated. The long dropped platforms are supported without strain to the body by angle irons, with the upper flange under the sills of the body and offset prolonged to carry the platform, a cantilever arrangement, which adds greatly to the strength of the car. A detailed description of this type was published on page 844 of the May 6, 1905, issue of the Street Railway Journal.

Each car is equipped with two British Westinghouse No. 80 motors, having a continuous capacity of 34 amps. at 300 volts, temperature not to exceed under these conditions 75 degrees C. The controllers are by the same maker, type No. 210. They are also arranged for the control of the magnetic brakes, which have been installed on each car. The controller is large and has ample capacity for the work. The magnetic brakes are of the Newell track type, taking current from the motors when braking, and the solenoids also control the wheel brakes by a series of levers. They have been so successful that the State Public Works Department has not required the Tramway Board to place fenders on their cars, as the other two companies in this State have to do. These cars are without doubt the finest in Australia, as the design is extremely suitable for the Australian climate. The weather, even in the winter, is not cold, and in the summer the cars should be as open as possible, but protection from the dust is also required. The side curtains of these cars, however, quite meet the case, and the general public opinion is that they could not be better for the local conditions. Smoking is allowed in either end of the open compartment, but not in the closed compartment of any car.

The sprinkler car is the standard Brill type, with double-head sprinklers at both ends. The capacity is 2500 gallons.

TRAMWAY FARES AND TICKETS

The fares on the tramways are as follows: 3d. (6 cents) cash is charged from any part of the city to the termini of any line, but twelve tickets for the same journey are sold for 2½ shillings (60 cents), and can be obtained from any conductor; workman's tickets are sold for 3d. cash each, and are good for return, but may be used only during certain hours; school children, between the ages of 12 years and 20 years, 3d. cash with return, good only during certain hours; children between the ages of 3 years and 12 years, on any line, 1d. cash; on what is called the city loop, from the Town Hall on High Street, and the City Markets on South Terrace, to termini in the business part of the city, 1d. cash. Specimens of several tickets are reproduced in the accompanying cuts. Transfers are issued at all connecting lines.

GROUPS OF DIFFERENT FORMS OF FARE TICKETS AND TRANSFER USED ON THE FREMANTLE TRAMWAYS

The method of collecting fares is based on the check-ticket system. Every passenger has a check given him in exchange for his fare. These are different in color and marking for each different fare collected, and the checks are supposed to be destroyed by the passenger on leaving the car. With good inspection and checking the method works most satisfactorily, and seems the most approved scheme of collecting fares in Australia.

The check for transfer is issued by the conductor on receipt of duly punched transfer from some other line. The transfer itself is somewhat different from the ordinary transfer, inasmuch as the date is not stamped, but a place allowed for punching the same. The transfer points being very few, and the number transferred not being very large, it was a saving in time and labor not to have them dated.

For motormen and conductors, the "On Service" ticket shown is issued to them weekly, the number being the number of trips they will have to make into the car house to take shift. On making trips with these tickets they are given a check on the car called an "On Service" check. This latter method is followed for the reason that every passenger in the car must have a check ticket when the inspector goes through for the purpose of inspecting the different tickets.

With the exception of the adult tickets, the samples of tickets reproduced are only temporary ones. The workman's and school tickets will be blocked similar to the adult ticket.

The tramways and lighting systems have now been in operation for some months, and the engineers, Noyes Brothers, are about to turn the undertaking over to the Tramway Board, after having demonstrated the entire success of the whole scheme. The engineer at present in charge of the construction and operation is F. A. McCarty, of the contracting firm.

The report of the Anglo-Argentine Tramways Company for 1905 shows a heavy increase in earnings, but this is mainly due to the fact of the inclusion for the first time of the system of the City of Buenos Ayres Company. A comparison with the report for 1904 would, therefore, be illusory and even a comparison of the results of the City of Buenos Ayres Company a year ago would be unsatisfactory, as the lines of that undertaking are now in process of being converted to electric traction. The gross earnings of £720,500 are, however, a very gratifying achievement, though on the mileage run receipts are a trifle less and expenses a trifle more. The number of passengers carried was nearly 82,500,000. The net revenue amounts to £255,600, and as the annual income payable to the City of Buenos Ayres Company represents its share of the distributable earnings of the lines, the surplus remaining for the Anglo-Argentine proprietors admits of the holders of the common stock receiving a dividend of 8 per cent, as heretofore. The amount carried to reserve is £20,000, as against £10,000, but whereas last time £25,000 was placed to the renewals fund, nothing is transferred in this report. The balance forward, however, is increased from £5,900 to £10,200.

NEW ENGLAND STREET RAILWAY CLUB

The April meeting of the New England Street Railway Club was held in Boston, at the American House, on the evening of April 26, President Winsor being in the chair. The speaker of the occasion was John S. Schumaker, of the Farrell Foundry Company, Ansonia, Conn., his subject being "Fuel and Boiler Furnaces." An abstract follows:

The handling of fuel and the design of boiler furnaces have a marked influence upon the economy of a plant. The important consideration in the choice of fuels is not so much a question of the number of heat units which are contained in a given quantity of fuel as the number which can be utilized per dollar paid. This is true of the boiler furnaces in general use to-day. In an internally-fired tubular, a return tubular, or a vertical-tubular boiler, or some of the water-tube boilers as ordinarily set, great concessions have been made in the design in order to maintain a furnace temperature of 3000 degs. F. In such a furnace, when a shovelful of soft coal is thrown upon a bed of hot fuel, the volatile matter is quickly distilled, some of it before the coal lands, and if the atoms of hydrogen and carbon thus distilled do not immediately find their quota of oxygen, there is small chance that they will while within the sphere of our influence.

Flaming should cease before any abstraction of heat by the boiler proper takes place. Much may be effected in this respect by reducing the velocity of the gases through the boiler. Flame in the last pass of the gases in a water-tube boiler is the result of burning soft coal with too much draft, and it is in no sense beneficial. Any attempt to use the tubes of a fire tube or the tube spaces of a water-tube boiler for a combustion chamber results in inefficiency. Combustion and the transmission of heat cannot go on at the same time and the same place with economy. The 100 or 150 per cent excess of air over that theoretically required to effect the combustion of the fuel will not compensate for the lack of even distribution of the oxygen in the furnace, but will act as a heat insulation in the fire tubes and tube spaces, to permit combustion to go on. Something must come between the unconsumed gases and the cold tubes, or the combustion will never be completed. This is why a soft coal, with 20 per cent of volatile matter, or so, is not the best fuel for many boilers. When the time and place for combustion are a minimum, hard coal is the more desirable, from the standpoint of heat-unit economy. No large quantities of combustible gases are quickly distilled with each firing of the hard coal to be swept into the heating space before a sufficient time has elapsed for combusiton.

The percentage of moisture in coal seldom receives proper attention. The percentage of ash is often considered of grave importance, but in a recent case, in a change from coal containing 6.15 per cent ash to one containing 5.23 per cent ash, the moisture increased from 1.28 per cent to 3.62 per cent. The ash is inert, but the moisture takes away the heat units necessary to evaporate it and is discharged into the uptake as a gas with over twice the specific heat of nitrogen. Moisture also makes it necessary to increase the velocity of the gases through the furnace and boiler, which is objectionable. A furnace should be something other than a place into which coal is poked. Down-draft furnaces have helped in some cases, but often the furnace is inadequate and the air is excessive in quantity. The velocity of the gases is determined by the draft, which overcomes a fixed resistance, except for the variations in the thickness of the fuel on the grates. The draft is made strong enough to pass 200 per cent of the air necessary for the combustion of the fuel through the boiler and furnace, overcoming the combined resistances.

With induced draft, either by fan or chimney, this means that just above the fuel with a bed 12 ins. to 14 ins. thick, we have a vacuum equal to from .75 in. to 1 in. of water, with a total draft of from 1 in. to 1.5 in. of water. As soon as the fire doors are opened to add fuel there is a strong inrush of air, so that natural draft, with a hand-fired grate, does not help in reducing the velocity of the gases.

Forced draft by steam jet has very little in its favor. The steam can in no case give up more heat by association than it has taken for its dissociation, and although association may follow dissociation, making a closed cycle, netting 100 per cent in itself, there is still a net loss through the furnace. An additional weight of gases has to be added to the gases normally voided by the chimney in order to move the steam vapor, amounting in weight from 3½ per cent to 12 per cent of the steam output. Another ill effect of the steam jet is the abrupt and local change of temperature in the furnace, which allows no graduated range. Ideal draft conditions can be produced with forced fan draft.

The higher the temperature the more quickly does combustion take place, and the more nearly the chemical proportions approached the best, the more rapid will be the burning of the fuel. A perfect chemical mixture of carbonic oxide and air will require from .04 sec. to .07 sec. to become carbonic acid upon ignition per cubic foot of gas. This is too short a time for the boiler furnace, through which the gases pass at a rate of from 20 ft. to 50 ft. per second. It is very important to reduce the amount of air close to that theoretically required for the combustion of the fuel, for the excess of air frequently takes away 15 per cent of the total heat value.

With a proper arrangement of forced draft the fan can be gaged so as to deliver just about enough air for combustion, and at a pressure capable of penetrating the bed of the fuel, leaving the balance of the draft sufficient to carry the product of the furnace through the boiler and flues. The latter draft should show less than .05 in. just above the bed of fuel. The firing doors can then be opened as frequently as necessary for the addition of fuel, or for attending a fire. As far as possible fuel must be added in such a manner that the percentage of volatile matter is kept as low and as uniform as possible. This will give an air rate practically uniform and will best be accomplished by adding small quantities of coal frequently, spread uniformly over the fire. The best gas mixing is accomplished just above the fire, and as one goes higher up in the furnace there is the greater tendency for the gases to stratify. With the furnace and draft conditions as outlined it is probable that 95 per cent of the plants operated can increase their efficiency from 10 per cent to 15 per cent, while doing from 80 per cent to 125 per cent of their rating. The chief difficulty of the mechanical stoker is its inability to meet the demands upon it, by reason of the erratic burning of fuel, and it is not, in practice, the automatic machine it is expected to be.

To sum up, the three prime factors bearing upon the economical burning of fuel are: First, a boiler furnace that is a furnace; second, the proper maintenance of the fuel burning; third, the proper air through the furnace for the particular conditions of the individual plant. The greatest of these factors is the air rate. It is well worth while to attempt to operate the boilers with due regard to the plant's load factor.

Mr. Schumaker concluded by forecasting the characteristics of the boiler furnace of the not distant future, basing his opinion upon a comprehensive consideration of all the factors entering into the generation of power from fuel, including extensive experiments conducted by himself, with the assistance of L. M. Glodell, under the auspices of Franklin Farrel. In the light of these experiments the chimney will be eliminated, and the entire furnace will be placed within the boiler proper, subjecting the whole to boiler pressure. Mr. Schumaker has already operated such a boiler and furnace at 80 lbs. pressure.

SOME FEATURES OF SHOP PRACTICE AT ST. JOSEPH, MO.

The shop practice of a company maintaining its cars in an up-to-date manner usually contains many features of universal interest in the street railway field and the practice in the shops of the St. Joseph Railway, Light, Heat & Power Company is no exception. Through the courtesy of General Manager J. H. Van Brunt and the assistance of F. A. Dillman, master mechanic of the system, it is possible to present here several of the features of the practice in these shops.

A storage car house occupies the southeast corner of the rectangular space taken up by the shops at Highland and St. Joseph avenues. The machine and repair shop are on the west side of the storage car house, the paint shop to the north, while the carpenter and wood working shop is at the northwest corner and between the paint and machine shops. Tracks entering the repair shop continue on through the wood-working room and then by a right angle turn into the paint shop. This arrangement permits cars brought in for repair to be carried successively through the repair shop, the carpenter shop and finally through the paint shop with the least amount of movement. In the design of the shops special attention was given the lighting arrangements. Skylights in all portions of the roof admit light to every part of the shop.

Very little trouble is experienced with the electrical and mechanical equipment of the cars, and this is largely due to the frequent and rigid inspections to which they are subjected. One armature winder rewinds and repairs all the armatures and fields of all the cars on the system, there being a total of 177 cars. This number, however, includes summer bodies as well as winter. There are required 77 cars, however, to operate the schedule. The repair work moreover is not sufficient to keep the armature winder busy and he is compelled to spend much of his time at other work.

Every ninety days cars are given a general inspection of electrical apparatus, including circuit breakers, lightning arresters and other parts often neglected. The motors are opened and the armatures are dropped and blown out. Twice each year the insides of the shells are painted with an elastic insulating paint. This inspection is most rigid, and after a car has been gone over everything is in first class order. At the time the electrical inspection is made the trucks and the car body are gone over thoroughly and all nuts and bolts are tried. Controllers are gone over once a week. One man spends all of his time on these alone.

A record of all the work done on cars is kept in the office. Cards, one for each car, are inserted in a rack and upon these are written the date of the changing of bearings, date of overhauling, and on the front of the card, where it is visible when the cards are in the rack, is written the date at which the car is to come into the shop for overhauling and inspection. The system is comparatively simple, yet it serves its purpose.

CLEANING CARS

The clean appearance of the cars is due to the thorough washing given them each week. Two men are engaged in this work continually. The cars are placed over a section of a track provided with a drain, and the outside of the body, the trucks and the vestibules are washed with a hose. Afterwards they are scrubbed with a brush and are finally wiped off with a chamois. The interior of the car also receives a good cleaning at the same time. The floors are scrubbed, the windows cleaned and all the woodwork is rubbed off with a chamois. Two men are able to clean cars in this manner at the rate of about ten a day.

The fact that the cars are kept well painted and varnished makes the cleaning process easier. Cars are invariably put through the paint shop once each year, which is a rather frequent interval when it is considered that the bodies are in service but half a year. They are first taken in the wash room and scrubbed thoroughly. After being inspected, the bodies are put through the carpenter shop, where needed repairs are made and are then taken into the paint shop. This shop contains four tracks and has a capacity for twelve cars. One mistake often made in the painting of cars is that proper time is not allowed. The process is rushed and all coats are not allowed to dry thoroughly before others are applied. In this particular Mr. Dillman is most insistent. The ample capacity of the shops, together with the fact that the cars are painted during those periods of the year when the type of body is out of service, offers no excuse for rushing the work. In their yearly trip through the paint shop usually the exteriors of the cars are simply touched up and varnished, the iron work

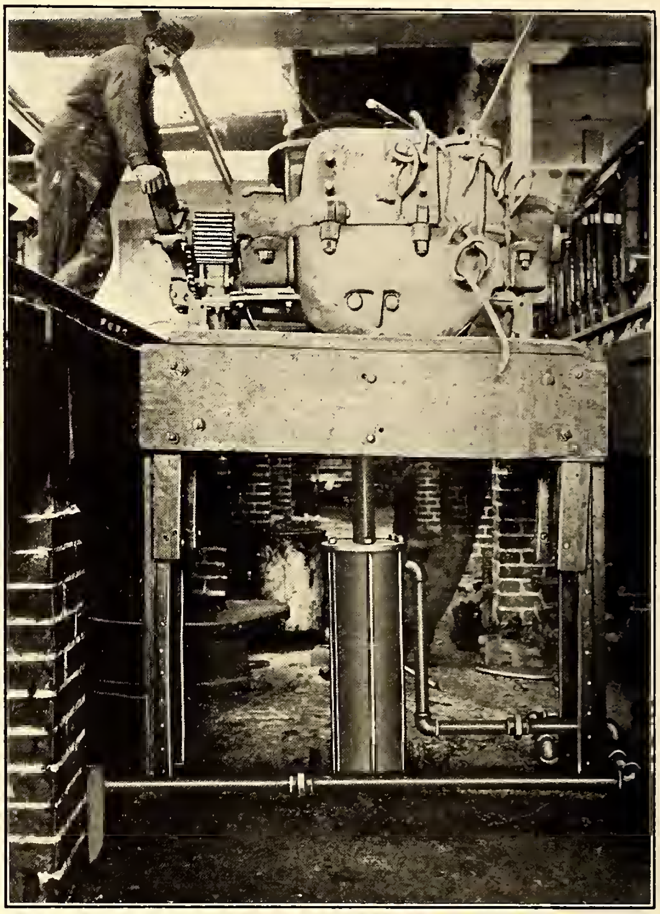


FIG. 1.—HYDRAULIC HOIST IN PIT

blacked off, the roofs and floors painted and the interior finish varnished. On about one-third, however, the trucks are painted in addition. It is also the custom to burn off and repaint completely about fifteen cars per year. The facilities offered for doing the work in the paint shop, together with the fact that the work is carried out in a systematic manner, makes the labor cost comparatively small. The average cost of labor for overhauling one lot of sixty-nine cars was $10.44 per car. Of these forty-nine were scrubbed, touched up, varnished, blacked off, had their roofs and floors painted and were oiled inside. The remainder had their trucks painted in addition.

The truck repair shop contains several devices for facilitating work that are of special interest. In Fig. 1 is shown a hydraulic jack installed in the pit, which is of great convenience in changing motors from one truck to another and in raising car bodies. Two of these are installed in the shop.

The cylinder of each of them is an 8-in. wrought iron pipe upon which top and bottom heads are bolted by six rods extending the full length of the pipe along the outside. A leather-packed piston head is fitted to a 2½-in. piston rod. The upper end of the rod terminates in a flat head. In the illustration a wood platform is shown fitted over the head for handling motors. Four guides, at the sides of the pit, keep the top to the platform level. The piston is raised by admitting water from the city mains underneath it. Both the inlet and discharge are controlled by ordinary globe valves. An additional pipe leading from the cylinder near the top carries away the water leaking past the piston. When car bodies are hoisted the wood table is removed and the piston is made to lift directly against the sill.

Some of the later motors are fitted with bearings adapted to oil lubrication. All of the older ones provided with grease boxes are now lubricated with oil by means of the box shown in Fig. 2. The illustration shows an oil box fitted in the grease box of a GE 800 motor. Another oil box is shown resting on the motor. The lug at the bottom fits into the oblong hole in the bearing shell and thereby assists the dowel pin to hold the shell in position. Through the center of the box a 17-64-in. hole is drilled. A rod ¼ in. in diameter is inserted in this. When the box is in position the lowed end of this rod extends through the box and rests lightly on the shaft or axle. The upper end extends through the center of the box almost to the top. The box is filled two-thirds full with tightly packed wool waste, and on top of this Galena car oil is poured. The feeding takes place through the 1-64-in. clearance between the rod and the hole through the bottom. The slight scraping or chattering movement of the rod, due to its resting on the shaft, no doubt assists in the feeding, and because of the absence of this movement the feeding is practically stopped when the car is not in motion. All the armature bearings are fitted with this box, the motor axle as well as the armature bearings. The oil boxes are filled every third day, and other than this they require practically no attention. On a test, a car fitted with this oil box ran 1246 miles on three pints of oil. This included all the oil used on four armature and four motor axle bearings.

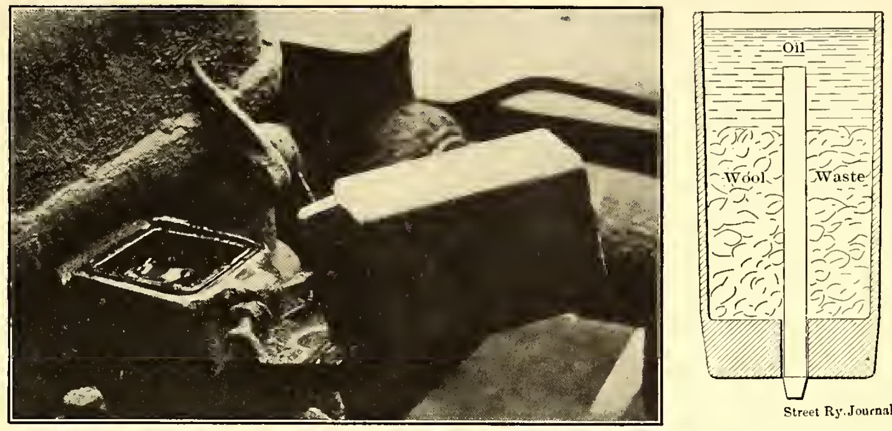


FIG. 2.—GREASE BOX WITH OIL CUP INSIDE; ALSO SECTION OF OIL CUP

A pressure far beyond the rated capacity of the hydraulic wheel press is often required to remove wheels from axles. On one occasion the wheel press was damaged. To prevent further injury to the press, it is now the practice to bore the hubs and crack them by a blow with a sledge hammer. Fig. 3 shows a device for drilling the hubs, which consists simply of a shaft carrying a drill chuck and supported in a wood frame. Power is obtained from a bolt machine near by. The pulley is keyed to the shaft and the feed screw on the end moves forward the pulley as well as the shaft and drill chuck. The face of the pulley is sufficiently broad to allow considerable movement. Hinged arms with hooks to catch behind the flanges of the wheel are bolted to each side of the wood frame and these hold the wheel in position when pressure is applied on the drill. After a 15-16-in. hole is drilled, a sharp blow with a sledge cracks the hub and the wheel is easily removed.

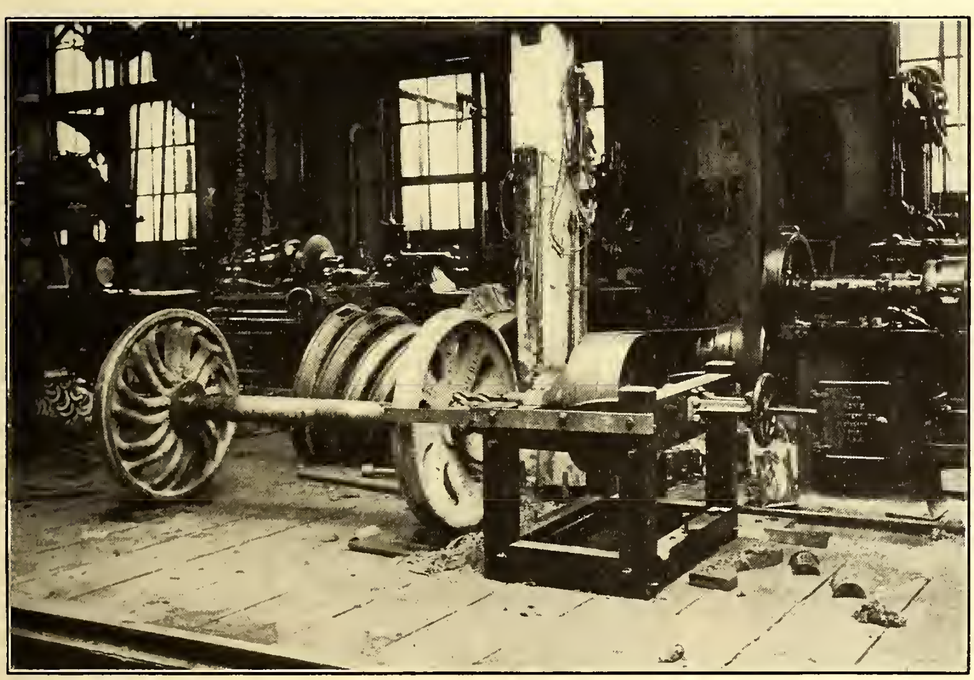


FIG. 3.—MACHINE FOR DRILLING THE HUBS OF CAST-IRON WHEELS

A great deal of trouble has been experienced by the burning of the controller cylinders under some of the segments and this burning is often so severe that a new segment cannot be attached to the old base. Fig. 4 shows a burned controller. It may be seen that quite a portion of the segment base is burned away. The illustration also shows a controller repaired by means of a brass base casting similar to the one shown resting on the star wheels of the controllers. When a cylinder is to be repaired the burned segment base is turned down flush with the barrel of the cylinder and the brass casting is finished to fit. By means of screws the casting is clamped over the cylinder and the copper segments are then attached in the usual manner. This method of repairing controllers has been the means of putting in good condition many cylinders which would otherwise be useless.

A convenient platform for working on the eaves and roofs of cars is used in the carpenter shop. This is shown in Fig. 5. It is suspended to the roof high enough above the floor so that it does not cause inconvenience to those working beneath. In the same illustration is shown a summer body which is being fitted with a new floor framing. Trouble has been experienced by cars drooping down at the ends. To prevent this the sill plates of the cars being repaired are given a 4-in. camber, bowing down at the middle point. This curvature is given them by swedging them while cold. After the plates are drawn down on the sills and the car set on the trucks, this amount of camber causes the cars to be slightly bowed down in the middle, which permits the platforms to droop slightly before the car is perfectly straight.

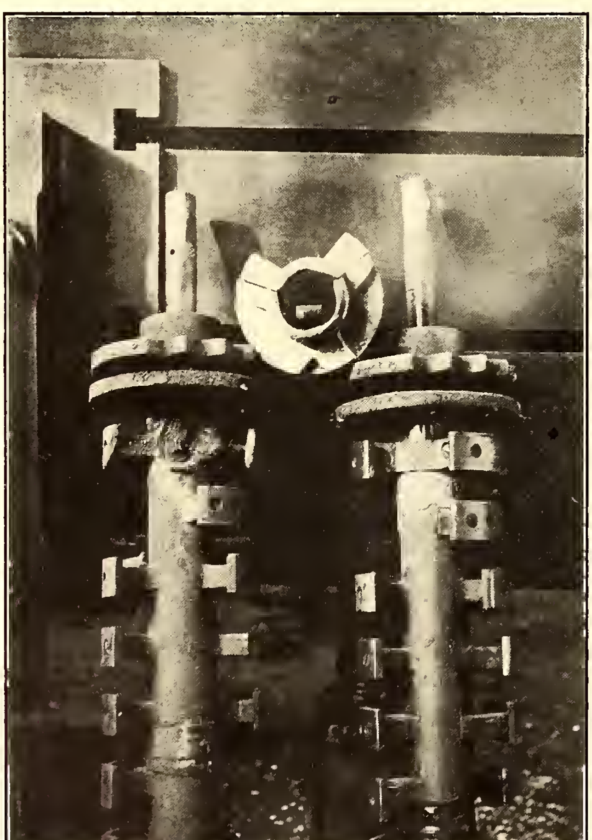


FIG. 4.—A BURNED CONTROLLER AND A REPAIRED ONE, WITH REPAIR CASTING

Mayor Weaver approved plans for the Philadelphia Rapid Transit Company's Market Street subway east of City Hall. Building of the underground electric railway will be pushed, and the company anticipates its operation within two years.

THE NEW CLOSED CAR ADOPTED BY THE SCHENECTADY RAILWAY COMPANY

The Schenectady Railway Company sometime ago placed in service twelve closed cars, which in their design are believed to embody the most advanced practice for city and suburban operation. They were built at the Kuhlman works of the J. G. Brill Company, according to design and specifications prepared by J. G. Baukat, formerly engineer of the Schenectady Railway Company. A most interesting feature of these cars is the novel brake-rigging arrangement devised by Mr. Baukat, which permits the maximum number of braking combinations possible on double-truck cars using power and hand-brakes. This rigging will be described hereafter in detail.

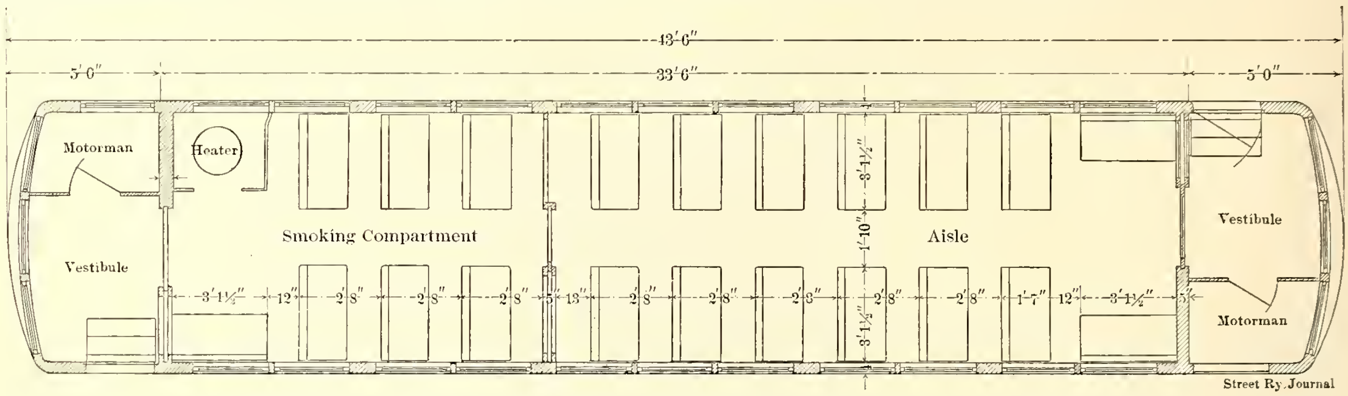


FIG. 1.—PLAN OF SCHENECTADY CAR, SHOWING SEATING ARRANGEMENT, LOCATION OF HEATER, VESTIBULE AND MOTOR COMPARTMENTS

FIG. 5.—ELEVATED PLATFORMS IN CARPENTER SHOP, ST. JOSEPH, MO.

The body of each of these cars is 33 ft. 6 ins. long, divided into a passenger compartment 20 ft. 1½ ins. long and a smoking compartment 12 ft. 1½ ins. long. The length over the bumper sills is 42 ft. 8 ins.; and the length over the bonnets, 42 ft. 11½ ins. The width of the bottom of the car over the panels and over the posts is 8 ft. 5½ ins.; the width over the drip rails, 8 ft. 8 ins.; height from the floor to the ceiling, 8 ft. 6 ins.; height of the doorways, approximately, 6 ft. and 6 ft. 6 ins.; height from the bottom of the sills to the top of the trolley board, 9 ft. 7 ins. The seats, which were furnished by the Hale & Kilburn Manufacturing Company, are made up of eighteen cross-seats, and three longitudinal ones near the motorman's cabs, giving a total seating capacity of forty-two.

Each side sill is built up of one 7-in. channel, one 7-in. x 3½-in. angle, one ⅜-in. x 24-in. steel truss plate with Georgia pine filling strips. The center sill, eye-beams and all cross sills and braces for the entire bottom framing, are also of steel as shown on the plan. The flooring is of Georgia pitch pine, 3¼ ins. wide by ⅞ ins. thick, is secured to the sills with flat-head screws, and has four trap doors for securing access to the motors. There are two steel bolsters and four chafing irons per car in addition to steel bumpers, consisting of 6 in. channel beams. The doors and side posts are of white ash tenoned, leaded and secured by strap bolts. The body framing, such as center rib rails, window rails and belts, side and corner posts, drip and guard rails, letter boards, side and end ribs are of white oak secured with pins and with all tenons or inter-locks leaded.

The roof frame is of white ash, and the roof is strengthened with concealed ⅝-in. steel rafters. The latter are so placed as to receive the strain of the trolley apparatus to the best adtage, and are forged to the shape of the roof in a solid piece with the foot at each end bolted to the top rail. The roof is painted with thick white lead, and all the nail holes, screw holes and joints are puttied and covered with No. 8 cotton duck laid in white lead and covered with three coats.

The dasher steel is of No. 12 B. & S. gage, one piece on the side and one piece on the front. The step openings are enclosed with doors of the standard steam road type. The step openings are closed by a trap door furnished by the O. M. Edwards Company, of Syracuse, N. Y. The treads are of second-growth white ash 1¼-in. thick, faced with 1 in. of half-round iron, secured to malleable iron hangers, and provided with a back fender or riser which prevents the passenger's foot from slipping through. The treads are covered with strips of non-slipping metal. A motorman's step is placed in the right hand diagonal corner of the guard rail, and another on the corner posts and suitable step on landing on the deck.

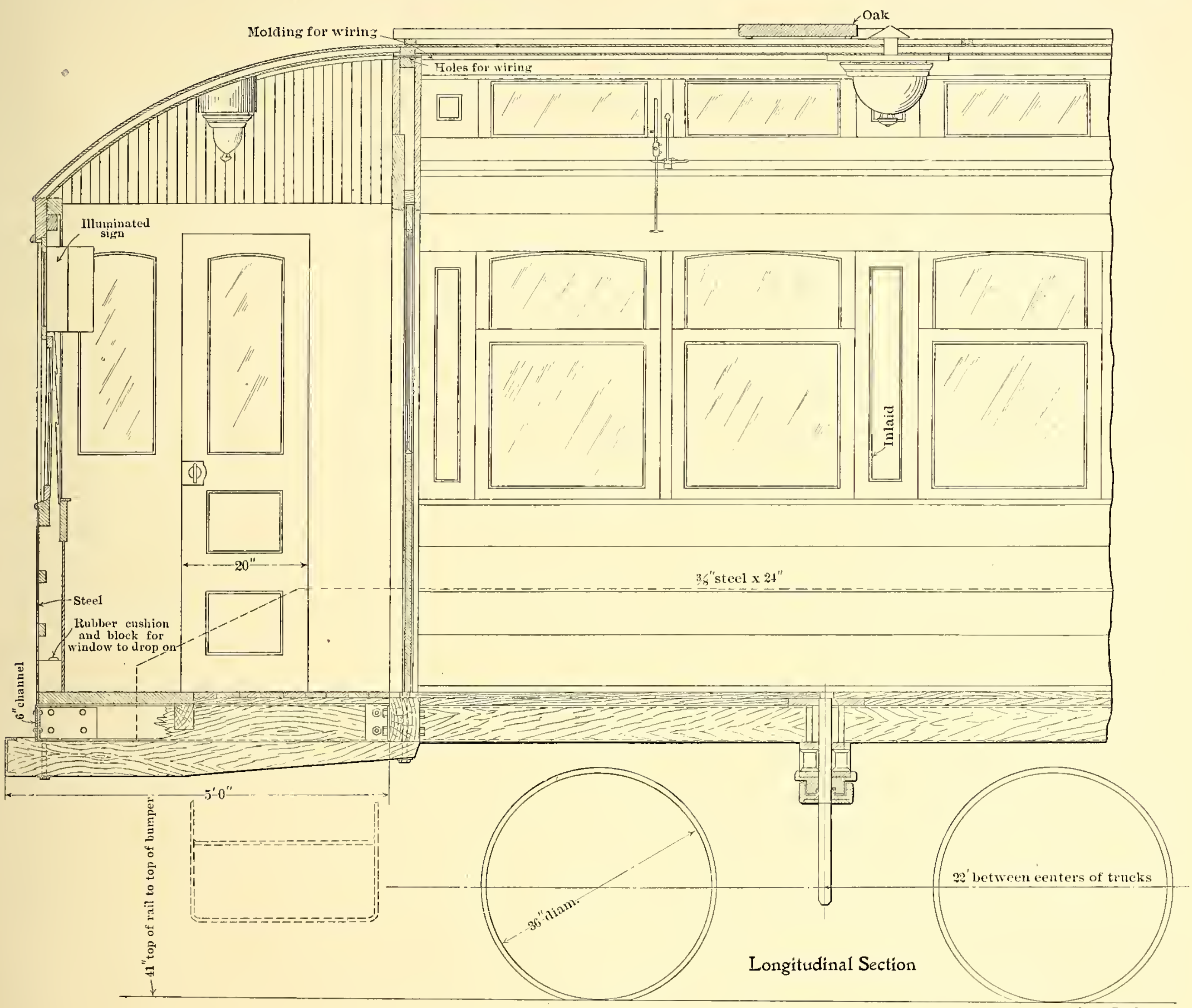


FIG. 2.—PART HORIZONTAL SECTION OF THE SCHENECTADY CAR

The car interior is of a dull mahogany or wax finish in natural wood, and inlaid. All fancy carving and panel work has been omitted, and no stain is used. In applying this finish, there were used one coat of range shellac, two coats of rubbing varnish, and one coat of finishing varnish rubbed to a dull polish. Each car is heated by a Franklin hot water heater, which is enclosed by a removable partition provided with a door and lock. This partition is finished to correspond with the interior of the rest of the car. It is bolted to the main car body with brass angles on to brass plates, the latter being screwed on to the side of the car.

The two vestibules are furnished with three lights each, while there are eleven windows on each side of the car fitted with double thickness American plate glass—all side sashes are fitted with the O. M. Edwards balance sash. The upper sash are stationary. All of the side windows are provided with curtains, and those in the motorman's cab (including the glass door) are arranged to enable the motorman to shut off all light from the passenger compartment. All curtains are of double-coated Pantasote, mounted on 1-in. rollers and fitted with the No. 86 Forsyth fixtures, made by the Curtain Supply Company, of Chicago, Ill.

The ventilator sash is pivoted in the center, and is arranged to have two ventilators manipulated by one ventilator opener. There are eight ventilators in the smoking compartment, and twelve in the other section. Over each of the Holophane globes there are ventilator openings, as in steam railroad cars. This arrangement is shown in Fig. 2.

Illumination is provided through five 12-in. Holophane globes in the car proper, and one 6-in. globe in each vestibule. The bottom of every one of these globes has a hole for ventilation, and is suspended by a brass ring, which is properly hinged and held to a frame mounted on a wooden block, and designed to correspond in finish to the wire moldings. All of the car wiring, which is laid out for Type-M control, consists of asbestos-covered cable, and each wire is separately concealed in iron-pipe under the car, using special design fittings for bends and bell mouth with rubber bushings in same where wire leaves iron pipe. Wherever a wire is carried through a partition of the floor, it is protected with a circular loom or soft rubber bushing.

Special attention was given to the subject of car painting, and the following represents the order in which each coat was applied at intervals of 48 hours; (1) one coat of oil and lead priming; (2) application of white lead putty; (3) three coats of lead; (4) three coats of rough stuff; (5) scoured to a surface; (6) one coat of ground color; (7) two coats of color; (8) two coats of wearing body varnish. The underside of the car bottom frame has two coats of lead paint mixed with oil, and the underside of the roof-board received one coat of boiled oil before the head lining was put up.

Each car is mounted on two Brill 27-E-1 trucks, somewhat modified by Mr. Baukat, using a steel bolster, Taylor brake hanger, truss plates against the bolster, and a special designed adjusting bar for adjusting brake-shoes, instead of turn buckle. They are equipped with 36-in. diameter Taylor fused steel-tired wheels, and carrying GE-74 motors geared for a speed of 40 miles an hour. The air brake equipment is of the Christensen straight air type, as made by the National Electric Company, of Milwaukee, Wis.

The brake-rigging of these cars possesses some very interesting features, and, therefore, its construction will be discussed in detail. The first feature to be noted in the accompanying Fig. 3, is, that should the inside pull-rods G or H, which form a part of the power-braking arrangement, break, it is still possible to use the brake-rods belonging to the hand-brake system. Thus, the air and hand-brakes operate independently. Assuming that it is desired to set the brakes from the No. 1 end of the car, the brake wheel in the corresponding vestibule is applied until it has taken up the 8 ft. of chain, which in turn pulls the floating lever A. The latter then pulls over the rod E in the direction indicated by the arrow, and since this rod E is attached to a pair of brake-shoe levers, the brake-shoes on truck No. 1 are set up. After the first set of shoes have been applied, the lever A will pull the longer rod D, which in turn will act on fixed lever B until the pulling over of rod F causes its corresponding brake-shoe levers to set the shoes on truck No. 2. Of course, the same thing could be accomplished with the hand-brake from the other end of the car as the mechanism at both ends is exactly alike. It should also be noted that if the long or through pull-rod D breaks, it is still possible to set the breakers on No. 1 truck because lever A will pull up against the strap shown on drawing, and then continue to pull rod E over as before. Should the broken rod happen to be the through lever C, it would still be possible to set the brakes on truck No. 2. Even if both through levers and the small pull-rod at one end of the car were broken, it would still be possible to brake the second truck by signaling to the conductor at the rear of the car, and the same thing is true should lever E or F break. It is apparent from the foregoing that without any complex or expensive construction, there has been secured by this design a great degree of safety in a double-truck car using both power and hand-brakes.

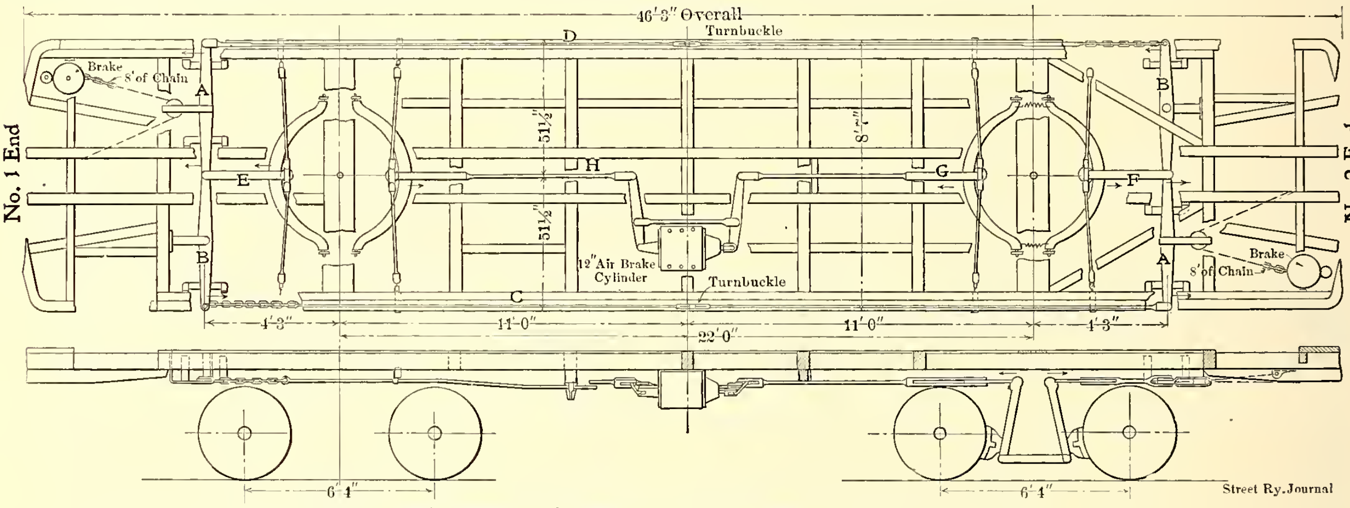


FIG. 3.—DIAGRAM SHOWING ARRANGEMENT OF BRAKE RIGGING

In honor of the annual Mardi Gras celebration at New Orleans, the New Orleans Railway & Electric Light Company has recently published a handsome booklet, containing views of some of the finest electric lighting decorations used during the festival, and operated by power furnished by the company.

THIRD ANNUAL CONVENTION OF THE IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION—II

In the last issue of the STREET RAILWAY JOURNAL was published an abstract of the first day's proceedings of the third annual convention of the Iowa Street and Interurban Railway Association, held at Des Moines, Ia., April 19 and 20. The proceedings of the first day covered a paper on transfers by John F. Ohmer, of Dayton, Ohio, one on bond and motor testing by R. W. Conant, of Cambridge, Mass., and another on the discipline of car service employees, by J. G. Huntoon, of Davenport, Ia. Herewith is given an abstract of the papers and discussion during the second day, Friday, April 20.

FRIDAY MORNING SESSION

The session Friday morning was opened by F. W. Hild, who presented a paper on "The Adoption of Gasoline Motors for Street and Interurban Service," of which the following is an abstract:

THE GASOLINE CAR FOR INTERURBAN SERVICE

In view of the present widespread interest in steam railroad circles in the self-contained power car as a means of meeting the increasingly severe competition of the electric roads, it may not be amiss to consider this type of car from the view point of the electric railway engineer. That the large steam roads have keenly felt the electric railway competition, has long been known, and it is now particularly evidenced by the various methods under consideration for meeting it. Thus the Union Pacific has built at its Omaha shops a straight gasoline car, wherein the power output of a gasoline engine is mechanically transmitted to the car wheels. The Burlington, some months ago, built at its Aurora shops, and for a short time experimentally operated, a gasoline-electric car, wherein the power output of the gasoline engine was transmitted electrically to the wheels. The Delaware & Hudson[1] has placed in operation a gasoline-electric car. The Lake Shore is also trying such a type of car. The Ohio River & Columbus Railway, according to the technical press, is experimenting with a steam-propelled car, which is to be a modern edition of the old-time steam dummy. The press has described the F. M. Hicks gasoline-electric car[2] for the St. Joseph Valley Traction Company and, very recently, the Strang car[3], a gasoline-electric car which ran with its own power from Philadelphia, where it was built, to Kansas City, where it is to go into service on an interurban road in that vicinity.

The writer has seen experimental outfits utilizing the automobile principle of carrying the motive power on the truck frame. In one case, it was a high-pressure superheated steam engine, with direct-chain transmission and with flash boiler, kerosene or gasoline pan burner, radiating condenser, etc., all very much like the equipment of the well-known "White" steam automobile. In another case, it was a four-cylinder gasoline engine, with friction disc transmission, etc., similar to automobile equipment.

The independent motor car idea had its inception abroad and much more work has been done in this direction in France, Germany, and Great Britain than in this country. The most conspicuous application of the idea is the steam motor cars of the Great Western Railway, of Great Britain.[4] This railway has in use a number of modernized steam dummy cars using coal as fuel for steam generation. The preference on the continent seems to be for the internal combustion engine, and several experimental gasoline-engine cars being tried. The Wurtemburg State Railway[5] is one of the most aggressive of foreign roads in trying the independent motor car. This railway has experimented with electric storage-battery cars, with steam-motor cars of the Serpollet type and gasoline cars of the Daimler-motor type. It is interesting to note that the Wurtemburg State Railway put an independent gasoline-motor car into service in December, 1893, something over twelve years ago.

There can be no doubt that most of the several types of self-power-contained cars will find useful fields of application and will become valuable auxiliaries to the standard forms of rail transportation; but also, in the judgment of the writer, there should be no doubt that these fields of application will be relatively restricted and do not include such as are now served by the usual electric system. The factors which have made electric traction so successful in city, urban and interurban service are many and varied, but those which enter into a discussion involving a consideration of other types of motor cars, are:—

(a) Reliability and simplicity.
(b) High-schedule speeds and high-train frequency.
(c) Cleanly and noiseless operation.
(d) Low cost of operation and of maintenance.

On the other hand, the self-powered cars enjoy two advantages which are the sole reasons for the present interest in this type of car. They are:—

(e) Absence of external power transmission circuits.
(f) Less initial investments.

It is the purpose of this paper briefly to investigate and compare these several factors.

Apparently the greatest difficulty encountered by the designers of the gasoline cars, is the transmission of power from the engine to the driving wheel. This is not surprising in view of the fact that the internal combustion engine is essentially a constant-speed motor, and that railway work demands wide ranges of variable speeds. At the present time, the favorite means appears to be the use of electricity, indicating that the difficulties of direct mechanical transmission and variable-speed operation are so great as to warrant the rather roundabout transmission involved by the addition of generators, with or without batteries, and the standard railway type motors and control. Indeed, it is claimed by the promoters, that the efficiency of the gasoline-electric outfits compares very favorably with any type of mechanical transmission and, moreover, has the greater advantages of large variations of speed, flexible driving, ease of control, and lesser wear and tear. The acceleration and change of speed are smooth, and without the jar or shock which is ever present with any mechanical change-speed gear. This situation suggests to electrical engineers the early discussions of series vs. shunt motors for railway work. The designers of the gasoline-electric cars, while fully agreed as to the method of power application, nevertheless differ among themselves on the important question of power supply. Some insist that a storage battery is an indispensable adjunct, for the reason that gasoline engines have low efficiencies at fractional loads, and, furthermore, have practically no overload margin. The battery, therefore, is needed to take care of the recurring inevitable overloads. Others, however, prefer to use a much larger generating unit, largely because of the saving in weight and space, and the avoidance of acids and fumes.

The Union Pacific gasoline motor car No. 1 is the best known of the straight gasoline cars, and while not much of detail has been allowed to come to the public, the general

[1]See STREET RAILWAY JOURNAL for Feb. 10, 1906.
[2]See STREET RAILWAY JOURNAL for Apr. 8, 1905.
[3]See STREET RAILWAY JOURNAL for Mar. 3, 1906.
[4]See STREET RAILWAY JOURNAL for Nov. 5, 1904.
[5]See STREET RAILWAY JOURNAL for Nov. 5, 1904.

features of the car are, according to published reports: Car body 56 ft. over all; weight, 26 tons to 29 tons; seating capacity, approximately 50; motive power, 100 hp (rated) gasoline engine.

Gasoline motor car No. 2, of the Union Pacific Railway, is considerably larger than car No. 1, and has several improvements which were suggested by the tests made with car No. 1. It is 55 ft. long, has two 4-wheel trucks, and seats 57 passengers. It is of the same general design as car No. 1, and is of steel construction throughout. The car weighs 56,000 lbs., although it is expected that additional cars which are to be built will not exceed 50,000 lbs., as it was very difficult to obtain proper material, and heavier parts were used than were necessary. The car is driven by a 100-hp, 6-cylinder gasoline engine, designed especially for this purpose. It has a "make and break" spark ignition, with a primary battery for starting and a magneto for regular running service. The lever which controls the metal clutch is operated by air, which is controlled by a specially designed operating valve, by means of which the car may be started at a slow speed and the engine disconnected or thrown into high speed at will. The driving wheels are 43 ins. in diameter; the other wheels are 34 ins. All wheels are of rolled steel.

The car is ventilated by means of Cottier suction ventilators. The circulating coils for cooling the gasoline engine are so arranged that during cold weather the fresh air supply for the passenger end of the car may be warmed by passing over them. The car is lighted by acetylene gas, and the 25 panel lights are so arranged that while the lighting is very brilliant, it is of a mild and diffused character, and not wearisome to the eye. The interior of the car is finished in antique mahogany with a cream white ceiling and decorated in gold and sepia. The car has been in use since Sept. 14, and is giving very satisfactory results. It accelerates rapidly and is capable of developing a high speed. It was built at the Omaha shops of the Union Pacific Railroad, under the supervision of W. R. McKeen, Jr., superintendent of motive power, who has invented and patented the important features of construction.

RELIABILITY

It probably needs no argument to show that the straight electric car considered alone is far less complicated, and hence far more reliable than any other form of motor car. The straight electric has the minimum of moving parts, all of which (excepting the brake mechanism, which are common to all cars) are non-reciprocating, while all other types of self-propelled cars have reciprocating mechanism, which include a great number of moving parts, more or less complicated in adjustment. The greater simplicity and reliability of the standard electric car is perfectly obvious in the fact that, aside from the conductor or fare collector, but one attendant, the motorman, is necessary for the car operation, whereas, every type of independent railway motor car, so far as the writer knows, requires an additional skilled mechanic to look after the portable power plant. Of course, efforts are and will be made to render the equipment so thoroughly automatic as to permit the dispensation of this skilled mechanic. Far be it from the writer's wish to infer that American inventive ingenuity may not accomplish this, but a few healthy doubts as to its early attainment are permissible when one remembers the automobile enthusiast who stated that he owned a car for three years, of which he spent one year on it and the other two under it. The annoyances which may attend the use of a private vehicle may be tolerated by the owner, but such annoyances would be prohibitive in a public utility like a transportation system, therefore, the need of mimimizing interruptions and delays will undoubtedly compel the retention of the extra attendant.

But the question of reliability of the straight electric goes beyond the car itself, and involves a consideration of power generation and transmission. Power-generating machinery, both steam and electric, has been brought to a very high order of development, and in the hands of thoroughly competent operators, the probability of interruption of power service through failure of this machinery is extremely remote, particularly if the plant be provided with a judicious, yet reasonable, reserve. There are plants in this country which have operated for years without failing to deliver power, and it has come to be understood that the engineer who fails to "keep the busses hot" must have an exceptionally good excuse in order to retain his job. The modern transmission circuit, whether for alternating current or direct current, is of sturdy construction, mechanically strong and reliable, so that the percentage of failures due to all causes except the elements is no greater and usually less than experienced with other parts of the roadway.

SCHEDULE SPEEDS AND TRAIN-FREQUENCY

It is a peculiar fact that no other form of machinery, whether used for power generation, power translation, or power utilization, has such high efficiency, such capacity for overload and such flexibility of control as has electrical apparatus. The remarkable speed and torque characteristic of the series-wound motor permit of a smooth and rapid rate of acceleration, absolutely under the control of the operator. This rate of acceleration may be practically anything desired, and is accomplished without resorting to excessive power demand or abnormally large motors. The maximum acceleration is usually determined by the comfort of the passengers, and by the slipping of the wheels, and is not limited by energy consumption. Indeed, it has been shown that for a given schedule the equipment having the highest rate of acceleration will perform the service with the least energy consumption.

The facility for maximum acceleration, the great capacity for overload, and the high ratio of power to weight, enable the straight electric car to handle successfully and economically higher schedule speeds than any other type of car, no matter how equipped. The steam-engine operated car, because of the overload power of the steam engine, would probably come next, while the gasoline car, with direct mechanical transmission would, because of the absence of starting torque and of overload capacity of the gasoline engine, fall well below them all. High accelerating power becomes more important as the number of stops in a given distance increase, and it is this fact, as well as the difficulty of mechanically transmitting power from the gasoline engine to the drivers, which renders combination gasoline-electric cars at present the most promising of the self-contained cars. Moreover, with the straight electric system practically no power is wasted. The motorman, by the simple manipulation of his controller, utilizes the power only as it is needed. Any system of transportation employing self-contained motive power units must be obviously at a disadvantage in this respect, since fuel consumption must go on all the time the train is in service, whether it is coasting or standing at a station.

CLEANLY AND NOISELESS OPERATION

The great importance of cleanly and noiseless operation of trains is best evidenced by the action of the New York Central, the New York, New Haven & Hartford, the Pennsylvania, the Long Island Railroad, and the Baltimore & Ohio in electrifying their largest terminals. It is well known that this action was largely brought about by public sentiment. That the builders of self-contained cars appreciate the importance at least of cleanliness is indicated by the fact that nearly all are using oil for fuel, and practically none of them would consider the smoke, cinder and soot-producing fuels, such as coal, etc. The advantages, if any, are in favor of the standard electric system, for there must always be present some vibration and some exhaust fumes from the engine of the self-powered car.

OPERATING AND MAINTENANCE COST

The absence of actual operating data of self-contained cars does not permit at the present time of a comparison of actual maintenance and operating charges between such cars and the straight electric. It is perfectly logical, however, to expect, in view of the complicated mechanism of the former and extreme simplicity of the latter, that the maintenance charges for the self-contained car system will be greater than for the straight electric. The maintenance cost may reasonably be expected to be about midway between the electric car and the steam locomotive. The operating cost of the several types of self-contained cars will naturally vary among themselves, but in all instances such costs, exclusive of interest on the investments, will be materially higher than the straight electric, and in most cases, the costs, including interest charges, will favor the straight electric.

This reasonably follows, in view of the high efficiency of the modern power station and transmission systems of electric traction, and also because of the high weight efficiency of electric cars. The independent motor car must not only drag along its own power plant, but it must sacrifice valuable remunerative space in order to carry it. For the same remunerative capacity, the self-contained car will weigh from 50 per cent to 100 per cent more than the standard electric car. Under the same conditions of track, speed and distance the energy consumption required to move cars of any sort will vary as their weight, hence it follows that the energy consumption of the self-contained car, will be from 50 per cent to 100 per cent greater than the electric car. The labor expense of practically all types of self-contained cars will be 50 per cent and upward greater than the straight electric, for the reason that, in addition to motorman and the conductor, a skilled mechanic is necessary for the operation of the power generating apparatus in each of the self-contained cars. This attendant is usually paid 30 cents to 40 cents per hour, or from 50 per cent to 100 per cent higher wages than the ordinary platform men receive.

All self-contained cars, excepting those equipped with storage batteries, must have prime movers of sufficient capacity to accelerate the cars suitably, and since the power required for accelerating is from two times to four times that for full-speed running, and also because of the intermittent power demand in railway service, it follows that the average load on the prime mover will be but a fraction of its rated power, hence the efficiency of engine operation, whether steam or gasoline, must be low. This condition is worse with gasoline engines which have no overload margin, and in such cases the average load will probably not exceed 40 per cent. Where a floating storage battery is carried on the car, it is, of course, possible to use a smaller engine and to work it at close to its rating most of the time, and the fuel cost per ton mile of such a car would be somewhat less than of one without battery.

The St. Joseph Valley locomotives, with single trailer, during the early days of its operation, averaging 66 miles per day, consumed 50 gals. of gasoline per day. This worked out per train mile as follows:

	Cents
Fuel at 16 cents per gal.	12
Labor, 75 cents per hour	3.4
Acid, water, waste, sundries	.6
	16.0

H. M. Beardsley published in the STREET RAILWAY JOURNAL, July 15, 1905, a very complete table of operating statistics of electric roads in New York State. A study of this shows that straight-electric operation per car mile is much less than the above figures, and if the comparison be made on the basis of cost per car seat or unit of remunerative space, the showing will be still more in favor of the straight-electric cars. The average of ten roads in the table, work out as follows:

	Cents
Power	2.629
Wages of conductor and motorman	4.146
Car service supplies	.109
Miscellaneous	.16
	7.044

Comparison between a single concrete case and an average of a lot of widely varying cases, while giving an indication, is not convincing. Therefore, it may be of more interest to compare briefly the requirements and performance of a gasoline-electric car, and a straight car for transporting a given number of passengers, under the same conditions of distance, time, stops and road-way. Assume a line 25 miles long, standard steam railroad construction, stops of 15 seconds duration each, to average one every three miles. It is desired to operate a car seating 48 passengers, making the run one way in one hour.

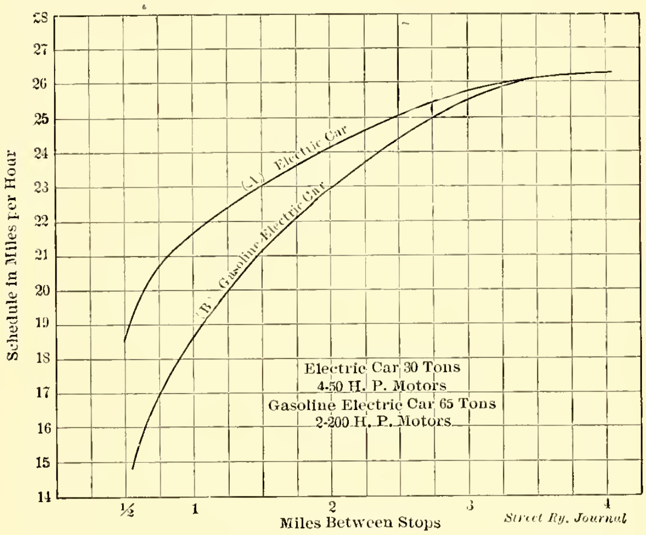


FIG. 1.—CURVES SHOWING COMPARATIVE SCHEDULE PERFORMANCE OF ELECTRIC AND GASOLINE CARS

Let us take the D. & H. car previously mentioned. It has been recently described in the technical press, but no hint of its detailed performance published, so we must rely upon calculated performance. This car weighs about 125,000 lbs., and the car body measuring 65 ft. over all, is of the combination type, that is with passenger and smoker compartments, seating a total of 40 passengers, and with baggage express compartment. A standard interurban car, about 45 ft. long, will seat comfortably 48 passengers, and will weigh, fully equipped, 24 tons to 28 tons. With four 50-hp motors, geared to about 35 miles to 38 miles per hour maximum speed, and with normal trolley voltage, such a car will perform very satisfactorily the service outlined.

In Fig. 1 are two curves, showing the schedule performance, which might be expected of the two cars, B referring to the gasoline-electric car and A to the standard-interurban car. Incidentally, it is interesting to observe that as the frequency of stops increases, the self-contained car falls much more rapidly away from the schedule than the straight electric. Thus, at one stop per mile, it can do 18¾-m. p. h. schedule, while the straight electric can do 21¾ m. p. h.

Under the conditions assumed, the rate of energy consumption of the straight-electric car will be about 60 watt-hours per ton mile at the motors, and this value will be used as applying to the combination-self-powered car, although, as a matter of fact, the input to the latter will be somewhat higher owing to its slow rate of acceleration, and would more than offset the elimination of rheostatic losses in the motor control.

Manufacturers of gasoline engines of the size under consideration generally claim 10 hp-hours' output per gallon of gasoline at full load, but will guarantee only 8 hp-hours per gallon of this fuel. In the calculations which follow, no account will be taken of the rapid falling off in fuel economy at fractional loads, so, in using the 8 hp-hour per gallon value, the error, if any, is in favor of the gasoline outfit.

Electric power station performance is well known from numerous published or otherwise available records. The following is typical of 4000-kw turbine, water-tube boiler plant with coal at $1.60 to $1.80 per ton.

Coal	$ .0034
Labor	.0016
Maintenance	.0007
Supplies	.0003
Cost per kw-hour at switchboard	$ .006

A well operated plant with fairly good load factor should encounter little difficulty in producing power at this figure; indeed, many show much better results. For the purposes of this discussion, however, a higher figure, $.0085, will be taken. This value is easily attained by most of the interurban power plants in the middle west.

Transmission efficiencies to the motors will be taken to average as follows:—

	A. C. System, Per cent	D. C. System, Per cent
Step-up transformers	96	96
Line	97	97
Step-down transformers	96	96
Rotary	—	88
Car transformer	96	—
Feeder and trolley network	93½	89
Net efficiency	80	70

Gasoline Electric, Car 62½ tons	Straight Electric Car, 30 tons
62½ × 60 = 3.75 kw-hrs. p. c. m.	30 × 60 = 1.80 kw-hrs. p. c m.
3.75 × 25 = 94 kw. av. per trip.	1.80 × 25 = 45 kw av. per trip
94 kw, 78% of 120 kw, the rating of the generator, and at this average load generator efficiency equals 90% approximately.	
Then $\frac{3.75}{.746 \times .90} = 5.6$ hp-hrs. p. c. m.	
The engine will develop at full load about 8 hp-hrs. per gal. of gasoline.	Power at interurban generating station costs $.0085 per kw-hr at the busses; taking transmission efficiency to the motors at 80% (A. C. system).
With fuel at 10 cents per gal. Power $\frac{10. \times 5.6}{8}$ = 7c. p. c. m.	Then $\frac{1.80 \times .0085}{80} = 1.91$ p. c. m.
Car Crew	Car Crew
Motorman, .21 per hour.	Motorman, .21 per hour.
Conductor, .21 per hour.	Conductor, .21 per hour.
Mechanic, .33 per hour.	
.75	.42
$\frac{75}{25} = 3$ cts. per car-mile	$\frac{42}{25} = 1.68$
	Allow for sub-station attendance, .01, 1.69 p. c. m.
Waste, oil, small supplies, .60	Waste, oil, small supplies, .55

Summary

7.00	Power	1.91
3	Labor	1.69
.6	Supplies	.55
10.60	Per car-mile	4.15

These are comparative costs per car mile, exclusive of maintenance and of general expense, and are subject to considerable variation under varying conditions. The Union Pacific car, which weighs about 29 tons, has unofficially been stated to consume one-half gallon gasoline per car mile in service involving much fewer stops. The Strang gasoline storage-battery car, weighing approximately 37 tons, consumes, according to official statements of the builders, 0.45 gallon of gasoline per car mile. No statement of service conditions is given, but is inferentially taken from the run from Philadelphia to Kansas City, where the stops were very infrequent, probably less than one in 20 miles.

As a check on the above calculations the gasoline consumption per ton mile works out about as follows:—

	Gallon
Delaware & Hudson car	.0112
Union Pacific car	.0168
Strang car	.0118

It is not intended to compare these three types of independent motor cars, for such comparison would be manifestly unfair, unless one took into account all the factors entering into construction and operation of each of the cars. It is intended to show, however, that the calculated performance of the D. & H. car includes a margin favoring the independent motor car, as compared with the standard electric.

INITIAL INVESTMENTS

To get down to the gist of the whole problem, and to see the influence of the initial investments on a given proposition, we will investigate two cases; the first between the gasoline electric and the standard electric, and the second between these and steam railway service.

The first proposition contemplates the average interurban condition and may represent the competition between two paralleling roads for the local passenger and light traffic business, which is assumed to demand cars at one hour headway from 6 a. m. until 12 p. m., or 18 hours' service. The item of cost and maintenance common to both roads will not enter into the present consideration, and we will assume that the general expense of administration, engineering, taxes, insurance, etc., will be the same in both. We will take the same service conditions as before, i. e., 25 miles of road, stops every three miles, and one hour for the run.

The single-phase system is well adapted to such service, and will be considered first. It would be entirely feasible to operate with a generating plant in the center of the line feeding 6600 volts directly into the trolley, eliminating high-tension transmission and sub-station, and thereby effect a saving in the assumed case of approximately $16,000. But it might be necessary, because of water supply, coal, etc., to build the power house at one end of the line, and thus necessitate a sub-station. In order to be entirely fair to the gasoline car, let us assume this extreme condition.

Two cars will normally handle the service, but for special day requiring half hour headway and for reserve four motor cars and two trailers will be purchased. The normal daily mileage will be 900.

ESTIMATED COST OF STRAIGHT ELECTRIC SYSTEM

Power plant	$45,000
One sub-station	2,000
Distribution system	48,000
Four motor cars and 2 trailers	36,000
Rail bonding	6,250
	$137,250

Interest and depreciation at 10 per cent, $13,725, or $37.60 per day.

ESTIMATED COST OF GASOLINE ELECTRIC SYSTEM

Four motor cars at $17,000	$68,000
Two trailers at $3,000	6,000
	$74,000

Interest and depreciation at 10 per cent, $7,400, or $20.30 per day.

The maintenance of electric cars and plants per car mile can be gotten fairly well from the many published records, but that of the self-powered cars is at present a matter of guess. It will be taken at four cents per car mile, which is roughly one-half the average maintenance charges of steam locomotives per mile.

	Gasoline Electric	Standard Electric
Power	7.	1.91
Car crews	3.	1.68
Supplies	.6	.55
Maintenance, equipment and cars	4.	1.5
Maintenance of plant and distribution system	—	.5
Operating cost per car-mile in cents	14.6	6.05

DAILY COST, 900 CAR-MILE A DAY

Operation	$131.40	$54.45
Interest and depreciation	20.30	37.60
	$151.70	$92.05

Thus, the difference in favor of the straight electric under the conditions assumed would be $59.65 per day, or approximately $22,000 per year.

Consider now, an existing branch of steam road where the passenger traffic is light. Service must be given, even if without profit. Indeed, many such branch lines are now operated at a loss, so far as the passenger and light traffic is concerned. The problem then is to find the cheapest means of handling the business.

Let us take the same length of line, frequency of stops, etc., as before, but assume that four trains each way per day will handle the business. We will assume that the train crews, when not on the passenger runs, are kept employed elsewhere on the system. The steam service would call for two light locomotives and four passenger combination cars. The self-powered and the straight electric would each require two motor cars and two trailers. The trailers would not be used during the normal service, but would have to be purchased and kept to meet the demands of Sundays and special days.

It is assumed that the roundhouse, repair shop and water tanks would about balance the cost of electric car house and repair shop. Omitting then, as before, all factors of cost and operation common to all three systems, we will have—

ESTIMATED INVESTMENT FOR STEAM SERVICE

Two 45-ton locomotives with tenders	$16,000
Four passenger coaches	16,000
	$32,000

Interest and depreciation at 10 per cent, $3,000, or $8.78 per day.

ESTIMATED INVESTMENT FOR STRAIGHT ELECTRIC SERVICE

Power plant	$27,000
Sub-stations	1,500
Distribution system	48,000
Two motor cars and 2 trailers	21,000
Rail bonding	6,250
	$103,750

Interest and depreciation at 10 per cent, $10,375, or $28.50 per day.

A plant of this size would not produce power so cheaply as the larger ones previously considered. The cost per kw-hour is taken at 1½ cents per kw-hour, hence we have—

	Cents
Power	3.38
Labor (as before)	1.69
Supplies (as before)	.55
Maintenance (as before)	2.
Per car-mile	7.62

ESTIMATED INVESTMENT GASOLINE ELECTRIC SERVICE

Two gasoline electric cars	$34 000
Two trailers	6,000
	$40,000

Interest and depreciation at 10 per cent, $4,000, or $10.90 per day.

The steam train will consist of the locomotive, tender and two cars, giving a train weight of approximately 110 tons. Under the assumed conditions of schedule, stops, weight, etc., such trains will require about 55 watt-hours per ton mile, i. e., .0735 hp per ton mile. In such service, the locomotive would burn about 7 lbs. of coal per hp-hour, and if this coal cost $2.25 per ton, the train mile cost would be approximately—

TRAIN CREW

Engineer	.35	per hour
Fireman	.21	"
Conductor	.30	"
Brakeman	.175	"
	$1.035	

COST OF STEAM OPERATION

	Cents
Power	6.35
Maintenance of locomotive and cars	8.
Supplies	2.
Round-house expenses	1.
Train crew	4.15
Per train-mile	21.5

The daily operating costs, exclusive of those items which are common to all the systems, would then be:—

	Steam	Electric	Gasoline
Operation	$43.00	$15.34	$29.20
Interest and depreciation	8.78	28.50	10.90
Total	$51.78	$43.74	$40.10

As the same equipment and, therefore, the same investment would be needed for a few trips more or less, and applying the same unit operating costs per car mile and the same fixed charges, we get the following:—

Daily Round trips	Mileage	Steam	Electric	Gasoline
Six	300	$73.29	$51.36	$54.70
Five	250	62.53	47.55	47.40
Four	200	51.78	43.74	40.10
Three	150	41.03	39.93	32.80
Two	100	30.28	36.12	25.50
One	50	19.53	32.31	18.20

This brings out clearly, that in the assumed case, the gasoline car is cheapest under six-round trips per day, while the electric system is the cheapest at six trips or more per day. (See Fig. 2 on next page).

Generally speaking, the gasoline car will show a saving over the steam train in light, infrequent service, but when the frequency begins to approximate 2½-hour headway between trains, the electric car is undoubtedly the cheapest and becomes increasingly so with increase of traffic frequency.

EXTERNAL TRANSMISSION CIRCUITS

We come now to what, probably more than any other factor, including even higher initial investment, has been the greatest stumbling block to the electrification of steam railroads. All other details of electric railroading have easily surmounted the objection of the steam railroad men. It is not the purpose to discuss the important subject of external transmission circuits within the limits of this paper, but it is well to point out that the progressive men in heavy railroad work no longer look upon the electric power conductor with the doubt and misgiving, not to say scorn, with which they regarded it a few years ago. The overhead trolley has demonstrated its reliability and sturdiness on thousands of miles of electric roads from Maine to California, from the Lakes to the Gulfs, in all conditions of weather and seasons. But until very recently, low trolley voltage limited its use to light interurban service. The writer is quite in sympathy with the railroad men's objections to the third rail, which, while it has splendidly performed its functions of showing the possibilities of heavy traction, is for many reasons inadvisable for surface work, although well adapted for subway or elevated roads. The advent of the single-phase system permitting the use of high-trolley voltages, and hence moderate power conductors and bow trolleys, has brought the overhead-trolley conductor into the field of heavy railroading and, with the large eastern roads setting the pace, the early electrification of the present steam lines will inevitably come on.

CONCLUSIONS

Managers of steam railroads entrusted with the direction of large vested interests, are naturally very conservative, and, therefore, slow to make what would appear to be radical changes in their equipment. Therefore, while they realize the limitations of the steam locomotive in suburban and interurban service they will, before stringing the trolley wire over their tracks, try out pretty thoroughly the independent motor car, which holds out alluringly the suggestion of interurban service without power house, without the track bonding and without the external transmission circuit. This try-out will definitely establish the true field of the self-contained car, and, in the writer's judgment, this field will be the very short spurs of existing steam railroads, serving sparse population, making infrequent trips, principally to connect with main-line trains. Take one road, the Burlington for example. The Galena Junction shuttle train, operating on a 5-mile spur, and meeting the more important trains of the main line; and the Dubuque shuttle train, which operates on the 1¼-mile spur from East Dubuque over the Mississippi River bridge, could well use such independent motor cars, unless, indeed, electric power at satisfactory rates can be purchased of the neighboring electric companies.

There is another field, not very wide it is true, but a profitable field which the independent motor car may enjoy with freedom from competition. The writer expects to see the present private cars of our millionaires displaced by the independent-motor car, which can be made as comfortable and luxurious as any of the Pullmans now in service. Its owner may go anywhere that standard gage tracks lead to, regardless of limitations to locomotives or to electric cars.

As to prospective interurban roads which are promoted with the view to using the gasoline or other type of independent motor, it is highly desirable to go slow and investigate. Broadly speaking, if a prospective road is to depend for revenue only on its passenger and light express traffic, and the business only warrants one-half or more hours' headway between cars, it becomes very much of a question whether or not the road will pay or ought to be built at all.

But this brings us into the realm of interurban railway economics, concerning which, much less even than railway engineering, it is not well to generalize. Each individual proposition should be independently examined and passed upon by a competent engineer, who should determine the equipment best fitted for it.

In city service, the independent gasoline car will find only the remotest application. Under certain conditions of power plant arrangement and operation, there may be isolated instances where the independent car might be called upon to handle the "Owl" service in the small hours of the morning. It may also be used on such streets on which the municipality prohibits the laying of tracks. Indeed, such cars are already in operation on Fifth Avenue, New York. In such service, the independent car will probably displace the so-called "trackless" trolley cars, which are in use in some European cities.

In conclusion, the writer believes that the independent-motor car will prove a useful transportation medium. Its field will be distinct from that served by the standard electric system. The likelihood of the independent car is quite remote. Reduction in operating cost of the independent car must come about through cheaper fuel and smaller labor. As we all know, the price of gasoline is constantly increasing—due to the diminishing supply of the crude oil from which it is made. Kerosene engines and alcohol engines are

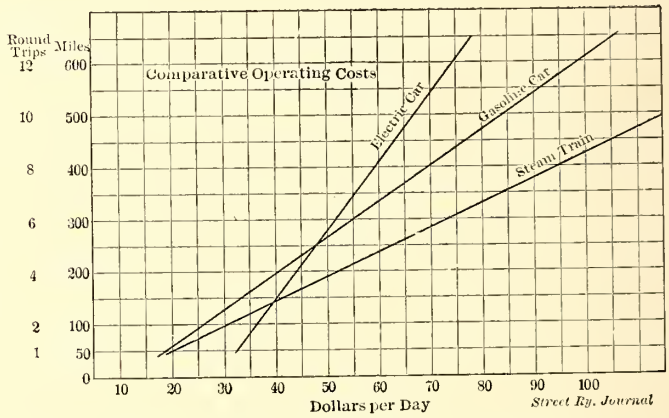


FIG. 2.—CURVES SHOWING COMPARATIVE OPERATING COST OF THREE SYSTEMS OF TRACTION, RUNNING STATED NUMBER OF TRIPS PER DAY

frequently spoken of, but as yet can not compete with the gasoline engines. The reduction in labor expense is not very promising. Advances and improvement in the art of independent-motor car will undoubtedly be made, but at the same time, it must be borne in mind that the electric system will by no means stand still, and if its future progress be judged by that of the past, it will undoubtedly become the preeminent, if not the universal, transportation medium.

In commenting upon Mr. Hild's paper, President Hippee said he did not think three men would be required on a car. He thought the motorman ought to be able to run the engine. A gasoline car, he thought, was no more unreliable than the first electric cars, and these, he said, did not require a third man.

A. P. Jenks, of Chicago, did not think the third man could be dispensed with. The Delaware & Hudson Railroad, he said, was compelled to go abroad for an engine, and it was a rather complicated one. The Delaware & Hudson car weighed 62½ tons, of which weight one-half was in the car body and trucks. The engine was of the high-speed type, running at 425 r. p. m., and developed 160 hp. All the figures he had seen concerning the cost of operation of gasoline cars, he said, were very close to 14.6 cents per car mile.

Mr. Conant thought that a field for the gasoline-motor car, not mentioned by Mr. Hild, was in the development of roads. On a new road frequently it was desired to know what amount of traffic could be depended upon before heavy expenditures were made in electrical equipment. He thought the use of a gasoline-motor car on the road at first would be the cheapest method of determining whether the road would be a financial success.

Mr. Hild stated he had investigated the gasoline-electric motor car problem with a view of using such cars on a road in Illinois and Wisconsin, and had found that there was a difference of $40,000 per year in favor of electrical operation.

Mr. Craft said he had seen some large gasoline engines and that he failed to see how a motorman could take care of the engine in addition to his other duties.

Mr. H. W. Kitto, of Des Moines, did not think Mr. Hild's figures fair. He said the Great Western Railway, of England, had found that motor cars could be run on ordinary roads at very low cost; and if this was so, why could they not be operated on rails to the same advantage. He attacked Mr. Hild's figures as regards the original cost of gasoline-motor cars, saying he failed to see where the money could be put. He thought the weight of such cars could be reduced 50 per cent. With regard to a third man on the car, he thought this could be avoided by using a two-cycle engine, which is very simple in construction, rather than the more complicated four-cycle engine.

Following the discussion of Mr. Hild's paper, W. R. Garton presented a paper entitled "The Mutuality of Interests of the Operator and the Supply Man," of which the following is an abstract:

MUTUALITY OF INTERESTS OF THE OPERATOR AND THE SUPPLY MAN.

In the introduction of his paper, Mr. Garton explained that he would use the term "supply man" to include the manufacturer as well as the supply man, and also the traveling salesman. The author then paid a glowing tribute to electric railway men as a class, pointing out that of necessity the electric street railway man has made for himself a hustling environment, and he not only keeps pace but is generally in the lead. To-day he is usually the liveliest and most wide-awake individual in the community. He has become so filled with the result of his own achievement and the impetus he has gained that those coming into contact with him are compelled to assume much the same attitude. The writer entered a plea for a greater unity of interest between the buyer and the seller, for although the operator is, in a large measure, responsible for the growth of the general field of this industry, yet it is equally true that the supply man is to be thanked for the development of new labor and time-saving productions, directly influencing the earning capacity of electric railway properties, which to-day represent investments of millions of dollars. It is the province of a wide-awake manufacturer, supply man or salesman to bring to the operator's attention the most potent issues, and if the operator will coöperate, by proper selection, he must surely be the gainer. The supply man represents the most active and energetic class of business men dealing with important problems. To-day the average salesman representing this branch of the industry is not only a gentleman of tireless activity, habitual diligence and intelligence, but is possessed of a keen desire to apprise himself of a thorough knowledge and keep pace with the constant changes for the betterment of the art. Therefore he can in many instances be looked upon as in quite a degree an expert in matters of this character. He is constantly schooling himself, gathering information at every turn. This may sound like a conclusion assumed for the sake of argument, but when it is known that he goes from one property to another in quest of knowledge it certainly is fair to assume that he can, if he will, become well versed, and he does. The supply man grasps the situation, applies himself and brings forward a means of accomplishing the carrying out of principles incorporating advanced ideas for the success of his plans, which contemplate improved methods for overcoming weaknesses and simplifying the means of gaining greater proficiency in the operation of the railway, and efficiency in the apparatus, much and always to the interest of the operator and his property.

The salesman who bores the life out of an operator for an order, while he is suffering with a toothache or bothered with some intricate problem which he is to solve, would certainly be most indiscreet, and it is reasonable to suppose that the next time that salesman called he would be turned down and refused an audience, and justly too. There is also need for discretion on the part of the operator. It is not necessary to bore a possible purchaser or freeze a salesman as a rule in order to accomplish the desired purpose. There should be a stronger bond of harmony and a greater community of interest than is general. Such cannot but work for the betterment of all concerned. There must be some give and take on both sides, as we all have our bitter pills to swallow. Every one will probably admit that the supply man and the exhibits have come to be prime factors in the conventions of the electric railway associations. This same contingent, the author believes, forms the financial basis and backbone of the splendid electrical journals published in the interests of electric traction, progress and success. Here the author thinks is one of the sequels and further proofs of the real necessity of one for the other. The operator needs the magazine to aid him in keeping abreast of the times, and the supply man needs it to keep in touch with the operator and to keep the operator in touch with him. The reasonable conclusion must be that coöperation of these two interests through the medium of the electrical journal is truly essential. If all these interests can be drawn into closer harmony with fixed ideas of accomplishing the greatest possible good for all concerned, opportunities of vast import that are in many instances given little or no attention can be taken advantage of, and as a natural sequence beneficial results will often be secured. If the operator has the heart and good will of the supply man, and the supply man the high regard and kindly feeling for the operator that is hoped for, each can constantly render to the other almost invaluable service, which money cannot buy. It should be firmly fixed in the minds of all that electric traction is the biggest, most gigantic and far-reaching question confronting the world to-day. And those active in bringing about a condition of higher standards are true sculptors in the art gallery of life, moulding with each day's efforts and successes, a greater and grander condition for the ennobling of mankind and the betterment of the people.

After the reading of Mr. Garton's paper the convention adjourned until 2 o'clock in the afternoon.

FRIDAY AFTERNOON SESSION

The afternoon session was taken up by the reading and discussion of a paper on "The Standard Car Body and Truck for City and Interurban Service," presented by George H. Tontrup, of St. Louis.

STANDARD CAR BODY AND TRUCK FOR CITY AND INTERURBAN SERVICE

In this paper Mr. Tontrup offered a few suggestions as to the design and construction of car bodies and trucks, and although he realized he was speaking from the standpoint of the car builder, he felt that possibly he might offer a few helpful hints based upon his interviews with many electric railway men. Inasmuch as most managers have an ideal car of their own, and these ideas on many points reveal a wide diversion of views, the ideal car must of necessity be based upon a compromise, like most other questions pertaining to mechanics and engineering. The present electric car is the connecting link between the old horse car and the modern steam coach. The horse car has almost entirely disappeared, and at the present time the interurban electric car is making fast inroads into the territory of the steam coach. It would be a difficult task to build a car that would accommodate itself to the two extremes, that is, the short city line on the one hand, and conditions approaching steam railroad operation on the other. Hence it is necessary to discuss car design under at least two divisions, namely, city and interurban service. The cardinal requirements for the ideal city car may be divided into the following heads: The handling of passengers, the comfort of passengers, and the maintenance of equipment. Each of these heads can be divided and subdivided, and each division taken as an individual subject for a separate paper, but in a paper under this general heading all must be considered to a certain extent.

As to handling passengers, the principal objection to the double-truck car for dense city service has been the difficulty of loading and unloading passengers quickly, but this objection is fast disappearing. The argument advanced by some of the advocates of the single-truck car was that less time was consumed by the passengers in walking the length of the shorter car to the rear platform. This is perhaps true and might remain a strong objection to the double-truck car if the same oscillation, tetering and unsteady motion when running existed with the double-truck as with the single-truck car. However, the comparative steadiness of motion with the double-truck car enables passengers to leave their seats and walk to the rear platform before the car reaches the destination, and thus passengers will usually be at the rear door ready to alight as soon as the car comes to a stop. In like manner, the conductor can give the signal to start as soon as the passengers are safely on the platform, and the passengers can, with perfect comfort, take their seats after the car has started. As regards the platform, the writer is of the opinion that there should be put one single step, and as low as height of motor, diameter of wheel and curve conditions will permit. The steps should be at diagonally opposite corners only, so that passengers will never attempt to board or leave the car except at the step near the conductor's position. The platform, to further facilitate the handling of passengers, should be as long as possible, consistent with strength and the prevention of sagging. The length of platform may range from 4 ft. 8½ ins. to 6 ft., but experience has shown that for city service the platform should not exceed 6 ft., because a longer platform can be adopted only at the expense of rigidity. The platforms should be provided with a railing running from the step to within, say, 24 ins. of the opposite side, and should also have what is commonly known as a three-quarter vestibule, with folding doors or gates. The entrance from the platform to the body of the car should be a single door and of the accelerator type. By the use of this door, at least three-quarters of the rear platform is available for standing passengers, and passengers can get off and on at one and the same time without serious confusion, thus reducing the time necessary for stops.

The next question that should receive attention is the aisle. The width of aisle not only has a bearing on the handling of passengers, but it is also closely related with the comfort of passengers. When cross seats are used the aisle should be as wide as a comfortable seat will allow. The width of aisle and length of seat are, of course, dependent upon the width of the car, and this is influenced by the distance between tracks, radius of curves and width of street. If these governing conditions are such as to restrict or reduce the width of car, it follows that the only space that can be economized in order to give the greatest width of aisle is at the side walls of the car. To accomplish this the sash should be designed to be raised, thus giving a large part of the sash pocket for increasing the aisle width. In the writer's opinion, a sash that raises has other advantages over one that lowers, in that it is more sanitary, as the sash pocket does not offer a convenient receptacle for refuse and dirt. The city car should have cross seats, except at the end of the car, which should have at the narrow side of the door a longitudinal seat and at the wide side of the door a stationary end seat, which will give seating capacity for three passengers. This arrangement will give a greater standing space in the end of the car, where it is most needed. The cross seats should have corner-grab handles. The ventilators should be arranged in pairs so that one-half or less may be opened in the opposite direction to that in which the car is moving. This method creates a suction from the inside of the car, and at the same time excludes the dust. The question of heating the car is also an important consideration in connection with the comfort of passengers. The manufacturers have succeeded in producing many good types of stoves, hot-water heaters, hot-air heaters and electric heaters, and any of the accepted forms will produce all the heat necessary to maintain a comfortable warmth if the heat is not wasted. In the writer's opinion, the main question is not so much what type of heater to use as it is how to utilize and retain the heat generated. This is a matter governed very largely by climatic conditions, but it is also dependent upon the judgment of the conductor and partly upon the construction of the car. The lighting of the car is largely a question of securing equal distribution and placing the lamps in a vertical position. If the lamps are placed on the walls of the car or in a horizontal position, they not only produce a quivering light, but the lamp films are very much impaired by the vibration of the car.

As to the maintainence of equipment the necessary work that will have to be done in properly maintaining the car body will be largely dependent upon the design of the trucks. An electric car is subjected, when running, to a continuous jarring, and it is essential, from the standpoint of maintenance, that this jarring or shaking should be reduced to the minimum by the use of good trucks. In the matter of trucks it is true, paradoxical as it may seem, that the least one buys for the money, the more he gets; in other words, the fewer the number of pieces comprised in the truck the easier it will be to keep both truck and car body in repair, and only those parts are necessary that will keep the frame true and square, take care of the brake rigging, and make the truck resilient. In the writer's judgment, the use of hot rivets in making trucks is not good practice. Not only are rivets troublesome when repairs are needed, but they cause the parts of the structure to work or grind upon each other when long pieces of dissimilar metals are riveted together, owing to the difference in contraction and expansion of the metals. In regard to resilience, that truck is best that will dissipate the shock or jar caused by depressions in the rails before the shock reaches the body center plate. This calls for a sufficient number of nests of springs and proper distribution of these springs throughout the structure. While the different truck manufacturers have tried nearly every possible combination of springs, it has been proven beyond question that the springs which carry the equalizer should be brought as close as possible to the journal, which is the first place in which the impact is felt. By placing the springs close to the journal box there will be a tendency to absorb the shock and reduce its effect on the car body.

Mr. Tontrup is of the opinion that the concave and convex side panels have outlived their usefulness and should be discarded. The straight-sided car is stronger and easier to maintain. Furthermore, in case of damage, it requires but the replacement of a few pieces of sheathing instead of a long panel, as formerly was the case with the panel side. A few companies have adopted a sheet steel for the sides of cars. The writer makes a point in connection with the maintenance of cars, by emphasizing the necessity for regularly tightening up bolts and nuts. Cars are frequently operated for months without any one ever thinking to take up the slack on nuts. It is a well-known fact that in tightening up a nut on a bolt after it has been turned as tight as possible with the wrench, if the head of the bolt is given a sharp tap with the hammer the nut will frequently stand another turn or half-turn. This is precisely what takes place when a car is kept in service for any length of time; that is, the bolts all tend to shake loose and, if they are not tightened up frequently, the whole structure will begin to work and grind in all its parts, and will soon need a general overhauling.

The interurban car has much in common with the city service car, and may properly be considered under the three headings of accommodation, speed and comfort to passengers. As to the structure of this car it, like all other structures, depends on the use or purpose intended. The interurban road has reached its present development because of its ability to give a system of single units with frequent schedules and numerous stops. In the writer's opinion, the interurban car has reached abnormal length, and in this respect has exceeded the desirable limit. While it is true that a majestic looking car makes an agreeable impression on the people adjacent to the road, and gives them a feeling of part ownership, still this matter has been overdone Electric cars have been built for ordinary interurban service that measured 60 ft. over all, and the present average is probably 52 ft. over all. This extreme length is inconsistent with the fact that small units and frequent service are what have made the interurban car popular. The writer believes that it is better to have shorter cars and a more frequent schedule. According to his experience the ideal interurban car would be, say, 34 ft. over corner posts and 43 ft. over all, with saloon and smoking compartments. This car should have platforms level with the floor of the body and fitted with double steps. This platform construction is in keeping with the idea of a high-speed car. It gives ample room for the high-speed truck with 6-ft. wheel base and sufficient clearance for motors. It also permits building the center sill of I-beams extending from bumper to bumper. It is believed a car of this type would have sufficient weight to give entire safety when running at high rates of speed. The trucks under an interurban car are, of course, an important part of the equipment. These trucks should be of heavy type with wheel base 6 ft. or 6 ft. 6 ins., which would permit of inside-hung motors. The wheels should be heavy and should have treads and flanges as near the M. C. B. specifications as possible. The interurban car preferably should be operated the same end on going in either direction, but should have a double end brake and electric equipment, the brake and controller on the rear end to be used in case of emergency. The front end should be partitioned off to give a motorman's cab as a precaution against anything that would distract the motorman from his duties. The importance of this cannot be over-rated on a high-speed car where the safety and lives of passengers are largely in the hands of the motorman. The cars should have the steam coach type of roof, as this pattern offers less air resistance than a monitor with bonnet. The sides of the car should be constructed with "W" bracing or double sheating straight sides. As the comfort of the passengers depends greatly upon a wide seat, a good, comfortable, wide seat should be provided, and this can usually be done because there are seldom the same restrictions as to width of interurban cars as there are on city cars. The seats should have high backs with a head rest. All that has been said of the city service cars in regard to heating and ventilation applies equally well to the interurban car.

President Hippee wanted to know why every car builder put in veneered ceilings, or head lining. He said this ceiling was objectionable because a leak in the roof would cause a blister in the ceiling which could not be removed. Mr. Tontrup stated that this ceiling was used because of its good appearance, but that now steel ceilings were being used to some extent as a substitute.

After the discussion of Mr. Tontrup's paper, Mr. Crafts took the occasion to call to the attention of the convention the past work of President Hippee in connection with the formation and development of the association. Two years before, he said, President Hippee had conceived the idea of such an organization, and under his care the association had developed to such a point that the meetings rivaled in interest those of the national convention. All was due to Mr. Hippee, who was retiring from the presidency, and he moved that the association extend a vote of thanks and appreciation to Mr. Hippee. This motion was seconded by F. J. Hanlon, of Mason City, who added that no other man in the State could have done what Mr. Hippee had accomplished. After the motion had been passed, Mr. Hippee responded, thanking the association for its kind expressions, and stating that all his work in connection with the association had been a pleasure.

The nominating committee reported the following nominations: President, F. J. Hanlon, of Mason City; vice-president, P. P. Crafts, of Clinton; secretary, L. D. Mathes, of Dubuque. These nominations were accepted unanimously. Mr. Hanlon, in assuming his new duties, said he would do all he could to follow the example set by Mr. Hippee.

Mr. Garton, in speaking for the supply men present, stated that they had thoroughly appreciated the occasion, and wanted to know if the supply men would not be allowed to assist the association financially or otherwise. In reply to Mr. Garton, President Hanlon said the association appreciated the good intention and good will of the supply men, but that the supply men were under other expenses. Secretary Mathes said he considered the supply men as very much responsible for the success of the association, and that they were welcome to attend all the meetings, but that the association was well able to take care of itself financially. Mr. Hippee said the offer to help the association financially had been made by several other representatives of the trade. He considered that they had much to do with the success of the association, and were moreover under heavy expenses in making their exhibits. On motion, by Mr. Hippee, the convention adjourned to accept the invitation of the Inter-Urban Railway Company to an excursion over the lines of the company and supper en-route in the new private car "Iowa." It was decided to hold the next meeting of the association at Clinton, Ia.

The work of connecting the line of the Syracuse Rapid Transit Company with the West Shore Railroad was commenced last week. This improvement is in anticipation of the electrification of the West Shore road, as the cars to and from Utica will pass through Robbers Row on leaving and entering the city.

THE STREET RAILWAY SITUATION IN SAN FRANCISCO

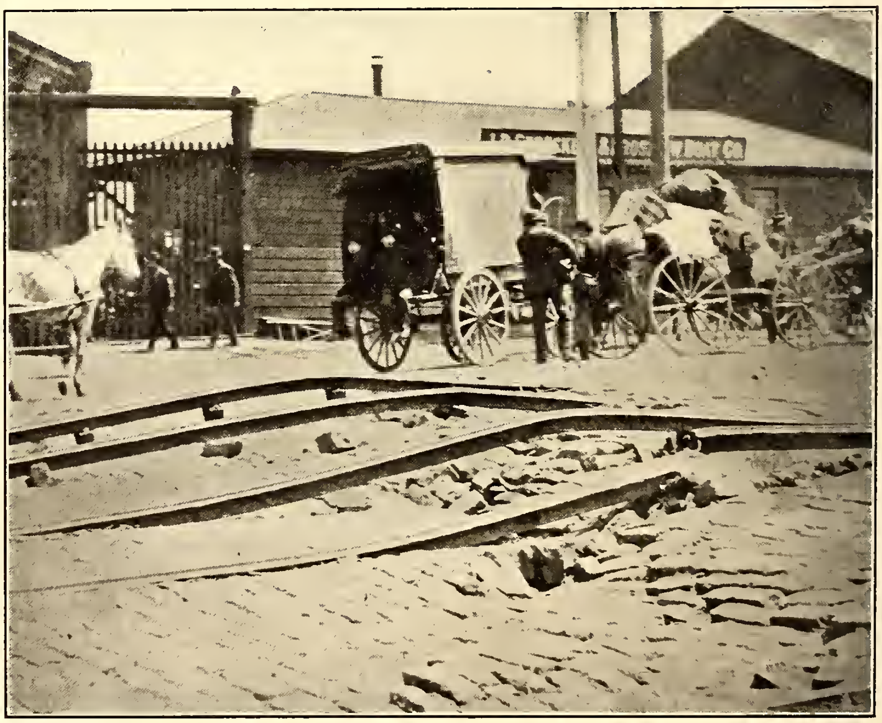
The earthquake that visited San Francisco on the morning of April 18, followed by the most disastrous fire in the history of the United States and lasting over three days, of course, did a great deal of damage to the street railways of the city, although, as outlined in the last issue of the Street Railway Journal, the damage was not so great as the first reports indicated. As a matter of fact, the loss to the company will not be nearly as heavy as might have been expected, considering the magnitude and extent of the disaster. The officials of the United Railroads of San Francisco now place the loss in physical property at $1,250,000, most of which is covered by insurance.

WHAT THE EARTHQUAKE DID TO THE TRACK AND ROADBED OF THE CABLE SYSTEM IN FRONT OF THE SAN FRANCISCO POST OFFICE

The tremors of the quake have passed, the fire has burned itself out and now, with the rising of a new San Francisco, more beautiful and artistic than ever before, steps are being taken as rapidly as possible to place the city in a normal condition.

The burned district includes about 2500 acres, or approximately 5 square miles of the city's area, including the entire business, commercial, hotel, and shopping districts, and a large portion of the residential section. The earthquake district, or that section in which the shock did the greatest damage, is for the most part coincident with the heart of the burned district. Within the earthquake and fire area the United Railroads of San Francisco has about 100 miles of track, laid for the most part as double track in 50 miles of streets. Of this mileage, 60 miles was operated by the overhead trolley and 40 miles was operated by cable. The cable lines suffered the most from the effect of the earthquake and fire, as the concrete foundations were badly twisted and broken by the force of the shock. In many cases also the slot rail closed up, either on account of the twisting of the foundations or warping by the heat. Of the electrical lines within the fire area, of course, all the feeder and overhead work was destroyed, although the poles in many cases can be straightened and utilized. So far as can be learned, the electric railway tracks did not suffer materially from warping of rails, although, in a few isolated cases, the tracks heaved as a result of the earthquake and threw the rails out of alignment, but it is believed that all of the electric railway mileage can be very quickly repaired as soon as the danger from tottering walls has been removed and the debris cleared away. Repairs to the cable conduits, however, will be a more serious matter, and it is doubtful if either the city authorities or the railway company will think it feasible to attempt to renew the cable tracks or use the underground conduit. The mayor has already issued a temporary permit for stringing trolley wires on Market Street, which was formerly a cable line, and cars are now run on this line by electric traction.

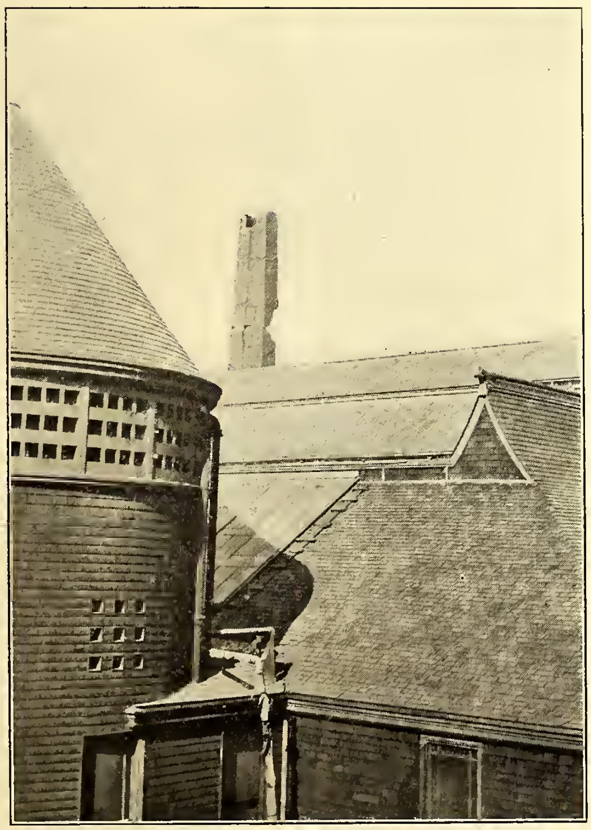
The cable service was also seriously injured by the destruction of the two cable power houses, which were located well within the burned area. At one of these cable plants were the main repair shops for the system, which were also destroyed. By a curious, and at the same time most fortunate, freak, the two main electric railway power houses escaped serious injury. One of these stations was located across the street from the fire limit, and although the building was discolored by smoke the flames did not reach the structure, and the plant was ready for operation



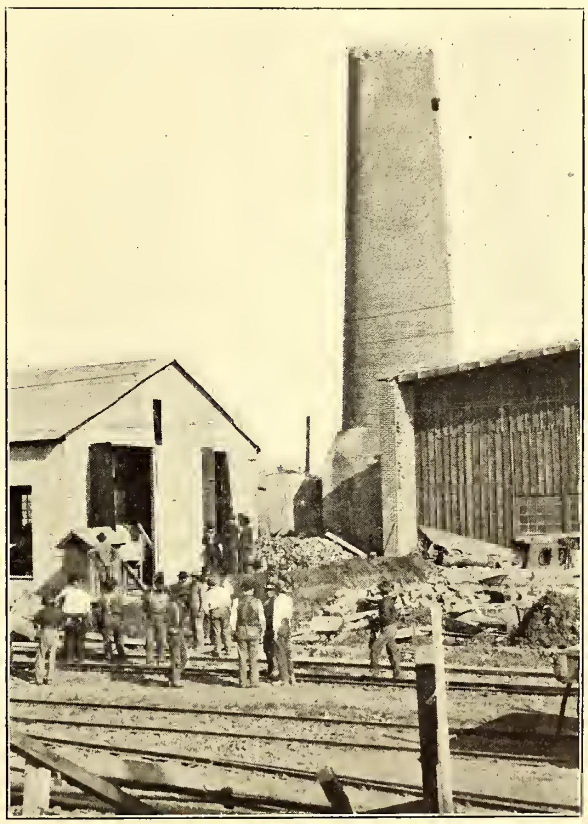
ANOTHER VIEW, SHOWING TRACKS TWISTED AND BROKEN BY THE EARTHQUAKE, AND WAGONS LOADED WITH REFUGEES, FURNITURE AND MERCHANDISE immediately after the disaster. Most of the company's car houses were located outside the fire limits and were not injured in any way. This accounts for the small loss in electric rolling stock, as most of the cars were in the car houses. So far as can be learned, only seven electric cars were destroyed.

As in the case of the Baltimore fire, the street railway company was one of the first institutions in the city to rise from the despondency and confusion caused by the double disaster, and after the staff had helped in fighting the fire step by step, the entire organization rallied around the executive officers, and in many cases, while the ruins were still smouldering, the temporary reconstruction work was well started. The financial interests associated with the United Railroads, both in San Francisco and in the East, were among the first to start a relief fund, and the day after the disaster the sum of $75,000 was subscribed jointly to the general relief work by the United Railways Investment Company, Ladenburg, Thalman & Company, Patrick Calhoun, C. Sidney Shepherd and Ford, Bacon & Davis. The company aided further in the relief work by opening four of its car houses and housing and lodging the homeless. By almost superhuman efforts two of the main lines through the very heart of the destroyed district were opened up, and a remarkably good service given. This electric service was of the utmost convenience and help to the citizens and the relief force, as this service for some time

TWO SCENES ALONG THE LINES OF THE OAKLAND CONSOLIDATED TRACTION COMPANY, SHOWING THE UPHEAVAL OF THE ROADBED AND TWISTING AND BREAKING OF THE RAILS



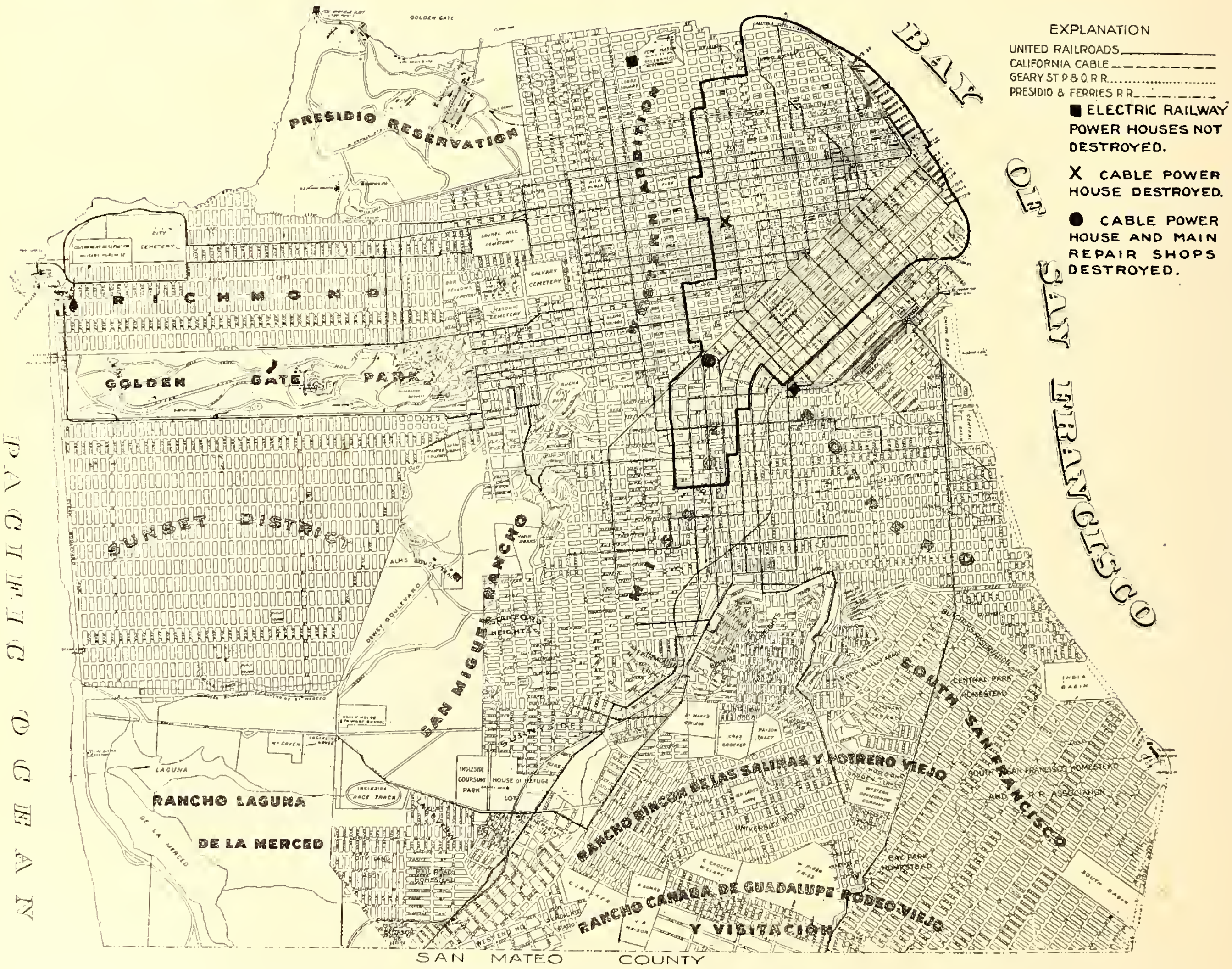
STACK OF PIEDMONT POWER STATION, OAKLAND



STACK OF YERBA BUENA POWER STATION OF THE KEY ROUTE, OAKLAND offered practically the only means of transportation through this section of the city. All passengers were carried on the cars free of charge, and it is the intention to give this free service until conditions become more normal. The company will run cars on Market Street by overhead trolley as soon as dangerous walls are removed, namely in a day or two. The day after the fire cars were operated successfully from Broadway down Fillmore Street, through Sixteenth Street to Bryant Street, which is now the crowded district. On April 30 cars were also operated from Sixteenth Street down Mission Street to Market Street. Mayor Schmitz operated the first car as motorman, and Judge Morrow and a distinguished party of citizens were on board. The sight of the cars aroused the greatest enthusiasm among the people, as the operation of these cars provided extremely useful service. On April 30 the company reported that it was ready to operate also on Twenty-Sixth Street to San Bruno Avenue and Dwight Street; Fifth Street and Market Street to Mission Street and Canandage Street; Sixteenth Street and Bryant Street to Kentucky Street and Twenty-Third Street; Fillmore Street to Haight Street and Stanyan Street; Fillmore Street to Sixth Avenue and Calf Street, via. Sacramento Street. This gives service on the present lines of the system over practically the entire city. It is the intention to lay temporary tracks on Market Street, each side of the present tracks, for removing debris.

TRACK TWISTED IN OAKLAND BY THE EARTHQUAKE

The revised general boundaries of the burned district are as follows: Water front from Brannon Street on the east to Jones Street on the north, Jones Street to Chestnut Street, to Hyde Street, to Polk Street, to Filbert Street, to Van Ness Avenue, to Clay Street, to Franklin Street, to Sutter Street, to Van Ness Avenue, to Golden Gate Avenue, to Octavia Street, to Page Street, to Cough Street, to Market Street, to Dolores Street, to Twentieth Street, to Mission Street, to Eighteenth Street, to Howard Street, to Fifteenth Street, to Folsom Street to Eleventh Street, to Bry-



A REVISED MAP OF SAN FRANCISCO, THE HEAVY ENCLOSING LINE SHOWING THE AREA AND LOCATION OF THE DESTROYED DISTRICT ant Street, to Water front. This district is outlined on the accompanying map.

The only electric power plant injured by the earthquake or fire was that at North Beach, where the roof was broken in and the machinery slightly damaged. The Millbrae and Turk and Fillmore sub-station roofs and sidewalks were damaged by the earthquake, but the machinery is uninjured. The telegram states that the employees fought every inch against fire, day and night, without eating or sleeping.

That the damage to electric railway property was not confined to San Francisco is evident from the reproductions on pages 727 and 728 of scenes in Oakland after the earthquake.

The shock was doubtless as severe on the east side of the bay as in San Francisco. The damage to some buildings was severe, but the total loss was surprisingly light. Nearly all electric railway lines could have been operated continuously had not the management prudently ordered the current kept off the wires until all had been thoroughly inspected. This was done, and all electric roads operated within twenty-four hours.

Three of the accompanying views are of the electric railway tracks of the Oakland Consolidated Railway Company on Webster Street, Alameda. This street is a causeway filled across a tidal marsh—the worst possible formation with respect to stability. The land on both sides has never been filled, so that the roadway has had no lateral support. Here one of the tracks sank 3 ft. or 4 ft. The kinking of the track is due to end pressure buckling the 70-lb. rails. There were several other spots about the same as the one shown.

Another view shows the brick stack of the Piedmont power station, Oakland. This chimney was 136 ft. high; the hole in the side is about mid-height. All above the hole has since been pulled down. This building stands on filled-in salt marsh.

Another view shows the brick stack of the Yerba Buena power station. It was 1[illegible]6 ft. high; about one-third is gone from the top. Some cracks exist in the remaining portion, but the chimney is in a serviceable condition. It stands on swampy ground near the shore of the bay, but has a very substantial pile foundation. The appearance of confusion in the foreground is due to an extension of the engine and boiler rooms, which has been under way for some time.

15,000-KW POWER PLANT FOR LOS ANGELES, CAL.

The Pacific Light & Power Company, of Los Angeles, Cal., has just contracted with Charles C. Moore & Company, engineers, of San Francisco, for a complete steam power plant to be delivered and installed at Redondo, Cal., a suburb of Los Angeles. This plant will be used for supplying power to the entire street railway system of Los Angeles and the various surrounding towns, in connection with the various other power plants and water transmission systems. This plant will have a nominal capacity of 15,000 kw, consisting of three 5000-kw units; the overload capacity of the plant will be about 30,000 ihp. The generating units consist of three McIntosh & Seymour combined double horizontal and vertical compound condensing engines, with grid-iron valves, each direct connected to a 5000-kw fly-wheel type General Electric 50-cycle 18,000-volt alternator. Engines will operate under 175-lbs. pressure, 100 degs. F. superheat at throttle, and 27½-in. vacuum. The engines are fitted with a special equipment of electrical speed-changing devices, and McIntosh patented time-delayed dash pots, to facilitate the synchronizing of alternators and the operation of alternators in parallel under variable load. The division of load between the engine and the speed of each engine will be controlled by the switchboard operator. Each engine has two horizontal high-pressure cylinders and two vertical low-pressure cylinders, as well as two sets of condensing apparatus, one for each low-pressure cylinder, so that in case of breakdown of either side of any main engine, the other side may be operated under an overload.

Wheeler Admiralty surface condensers are to be used throughout. Connected to each condenser there will be one motor-driven Wheeler centrifugal circulating pump, also one Edwards triplex vertical single-acting suction, valveless air pump, motor driven. The air-pump and circulating-pump motors are supplied with power from an auxiliary generator, or may be operated from the main generator. Each main generator has its independent engine-driven exciter. The auxiliary engine and exciter engines are tandem compound non-condensing, supplied by the Harrisburg Foundry and Machine Works. The exhaust steam from the auxiliary engines, together with the various drips and the exhaust steam from the feed pumps, will be used for feed water heating purposes. Steam is supplied by means of eighteen 600-hp Babcock & Wilcox water-tube boilers of forged steel construction, each boiler having an integral superheater to give 125 degs. superheat at the boiler nozzle when operating between 190 and 200 lbs. gage pressure. Each boiler is equipped with fuel oil furnaces and oil burners. Weber steel concrete chimneys will be used. All high-pressure steam piping will be specially designed with rolled-steel flanges and lap joints.

Chapman gate valves will be used throughout, specially constructed for use with superheated steam. Electrically controlled valves will be used at critical points. On the outlet from each boiler there will be one Pearson automatic angle steam stop and check valve. Oil is supplied to the boiler by means of Snow specially constructed oil pumps, and will be heated by means of Goubert multiflow oil heaters. The feed pumps are horizontal duplex compound, outside center packed. The feed water is heated by Goubert vertical multiflow feed-water heaters.

The entire plant is designed on the panel system, and in effect consists of three independent plants of 5000 kw each. It is of particular interest as being the largest power plant ever contracted for as a whole on the Pacific Coast, and one of the largest so placed in the United States. Heretofore, the large steam plants on the Pacific Coast have been used in connection with water-power transmission purposes, merely for purposes of reserve. In this instance it is the intention of the owners to operate the plant continuously on account of the low cost of the production of power. The plant is situated near the oil wells, and oil will be secured at an exceedingly low rate. The economy of the plant is such that power may be produced at a rate and sold in competition with water-power transmitting companies.

One of the novel features of this contract is the provision for the contractors to operate the plant for a period long enough to insure all parts being in proper working order, and then to submit the plant to a ninety-day test under actual working conditions, to determine the compliance with the guaranteed economy of the complete plant. During this test the entire operation of the plant will be under control of the contractors and sufficient data will be obtained to determine individual performance of the various apparatus. The object of this test is not only to determine the amount of bonus or forfeit due, depending upon the economy of the plant, but also to establish a record for the economy of the station, which the company's regular operators are subsequently expected to maintain.

HIGH-TENSION DIRECT-CURRENT RAILWAY BETWEEN COLOGNE AND BONN, GERMANY

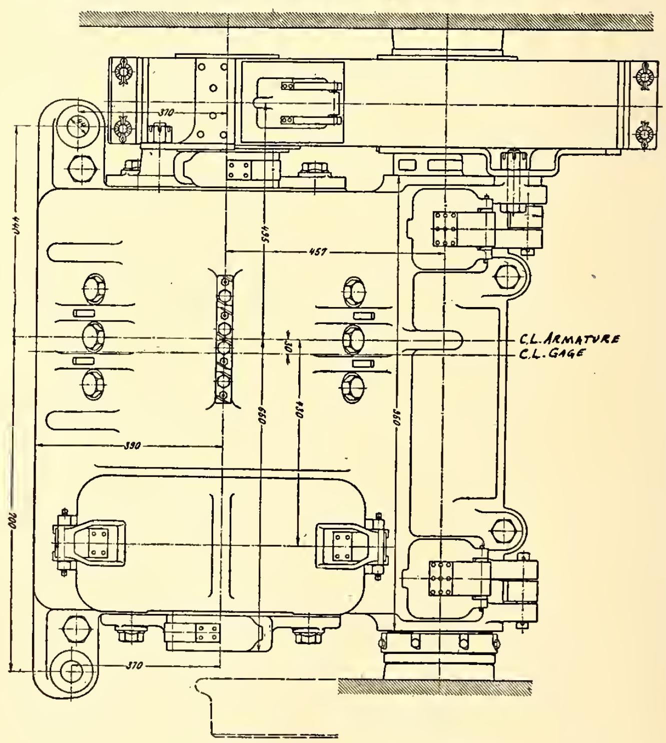
A 990-volt direct-current electric railway has just been completed for operation between the cities of Cologne and Bonn, Germany. The line is 28.3 km (17.6 miles) in length and passes through a number of villages near the Rhine River and through a coal mining territory. Freight is handled in addition to the passenger traffic. At present the line is double track only for a short distance, but the typographical conditions along the right of way are such that there will be no difficulty in double tracking the line all the way whenever necessary. The track is very substantially built, being calculated for wheel weights of 7000 kg (15,420 lbs.) It is proposed to operate the passenger trains up to a speed of 80 km (50 miles) per hour, running two trains each way hourly, carrying up to four cars, with a seating capacity of 250.

A TRAIN OF TWO MOTOR CARS AND TWO TRAILERS ON THE 990-VOLT DIRECT-CURRENT LINE BETWEEN COLOGNE AND BONN

A special difficulty arose in connection with the operation of this line, as the only power which was convenient was the 550-volt direct-current used by the railway systems in Cologne and Bonn. A number of large electrical manufacturers were asked to make bids for the power equipment. One plan of the Allgemeine-Elektricitäts-Gesellschaft contemplated the use of 6000-volt single-phase current for the line running in the open country and 550-volt direct current in the cities. Another plan by the same company involved the use of 800-volt direct current on the interurban section and 550 volts in the cities. A third plan was submitted by the Siemens-Schuckert Company, calling for 990 volts on the open line and 550 for the city. After a careful study of these three proposals, the third was chosen and it was determined to build at Wesseling, midway along the line, a power station capable of generating a transmission potential for 990-volt operation. The reasons for adopting this plan are given as follows:

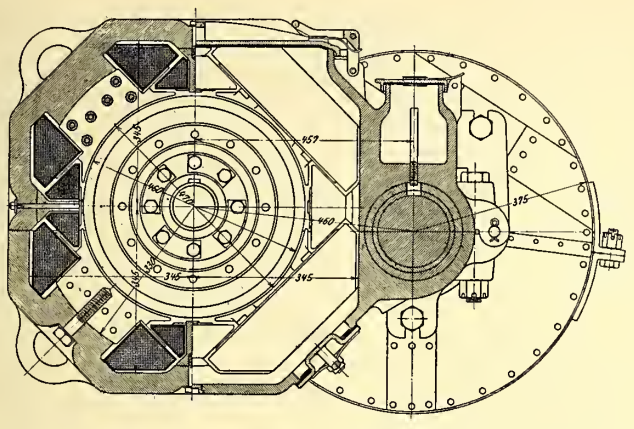
The use of high-tension single-phase current required the conversion to 200 volts on the car, as well as the fact that the same motor would have to be capable of using direct current on the city sections. Even though the motor should be capable of operating satisfactorily on both a. c. and d. c., it was found that the additional controlling and other apparatus would increase the weight so much above that of the direct-current equipment, that the use of single-phase current would be uneconomical, as compared with straight direct current. Again, the saving in overhead work in transmission, due to the high-voltage single-phase current, was overbalanced by the more expensive car equipment required with single phase. Besides this the use of single-phase current would make it impossible to use storage batteries to prevent possible interruption of traffic. Finally it appeared that the part of the line running in the country, comprising 22 km (13.6 miles), was too short to take full advantage of the benefits of the single-phase transmission, while the use of a high-tension direct current, with the power house located at the center of the system, would prove the most economical and reliable. This road is not the first high-tension d. c. line built by the manufacturers, as the Berlin Elevated Railway has been using 800-volt d. c. motors for some time.

The power-transmission system is divided as follows: In the cities of Cologne and Bonn, current is taken at 500 volts from the terminal power stations, and for the interurban section 990-volt current is taken from the new station at Wesseling. This portion of the line is divided into three feeder sections. The central section receives current directly from the power station at 990 volts, and also from a storage battery. The end sections are supplied with current from the station



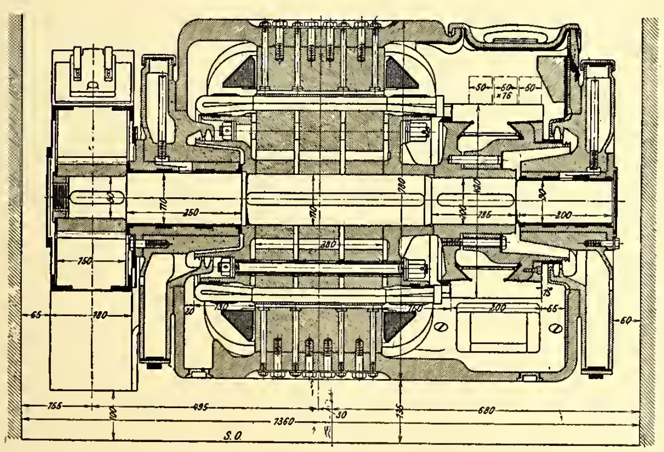
VIEW OF 990-VOLT INTER-POLE MOTOR FROM ABOVE through a 150-volt booster, and are also provided with storage battery auxiliaries. These batteries are each of 330 amp-hours capacity, and float across the line.

Each track is equipped with two trolley wires of 80 sq. mm cross section (160,000 circ. mils), and catenary construction is used. The catenary is supported by steel poles at intervals of 15 m (50 ft.) At the Marienburg and Bonn terminals special section insulators are used to prevent any possibility of the 990-volt current entering the lower-potential line of the city railways. The rails are bonded by two copper bonds of 75 sq. mm section (150,000 circ. mils), and are cross bonded every 100 m (328 ft.) The lighting current for the stations is taken directly from the trolley wire. All auxiliary transmissions, such as telephones, block signaling, etc., are laid in cables, to avoid all interference with the trolley currents.



CROSS SECTION OF INTER-POLE RAILWAY MOTOR

For the freight traffic the railway has five steam locomotives of the type used on the government railroads, and for the passenger service there are at present ten motor cars and ten trailers. The motor cars have special compartments for the motorman, room for twenty-eight passengers in the second-class compartments and twenty-nine in the third-class compartment. The trailers are usually made up of second and third-class compartments, but, if exclusively third class, seat seventy-two passengers. They also have special compartments for mail and express material. The longest allowable train, namely of four cars, is capable of carrying a maximum of 258 seated passengers. The entrances are placed in the center of the sides of the cars. The central compartment is fitted with longitudinal seats and is for smokers. The end compartments have cross seats on one side of the aisle and a longitudinal seat on the other, and are for non-smokers. The doors at the ends of the cars are intended only for the train men, but, in emergencies, may also be used by passengers. All the cars are equipped with Westinghouse air brakes, in addition to the hand brakes. The electrical equipment of each motor car consists of two 130-hp, 990-volt motors, which permits a motor car and trailer weighing 54 tons to attain a speed of 70 km (44.1 miles) an hour. As the multiple-unit system is used, two or more motor cars can be operated with trailers in the usual way.



LONGITUDINAL SECTION OF INTER-POLE RAILWAY MOTOR

The motor is of the interpole type, and has four main poles and four interpoles. The arrangement is shown in the accompanying cuts in which the dimensions are in millimeters. The windings of the interpoles, as well as those on the main poles, are in series with the armature. The armature coils are of flat copper ribbon. Two sets of brushes are used, and the operation of the motors is said to be sparkless. The armature core has four ventilation slots, which make it possible to cool the windings effectively. The hourly rating of the motor at 990 volts is 130 hp at 700 r. p. m. The gear ratio is 1:3.1, and standard gage is used. The control system is operated by a special low-voltage current taken from a storage battery. Current is taken from the trolley wires through two bows on each motor car. The motor compressors for the air-brake system are carried on the trail cars. The heating and lighting of all of the cars is electrical.

This paper is indebted to the manufacturers and to the "Electrotechnische Zeitschrift" for the foregoing particulars and illustrations.

A CONVENIENT FORM FOR INSPECTORS OF MULTIPLE-UNIT EQUIPMENTS

In inspecting the controllers of multiple-unit systems, it is necessary to know what contactors or unit switches should close on each point of the master controller. E. R. Cunningham, electrical engineer of the Inter-Urban Railway Company of Des Moines, Ia., has gotten out the form illustrated to facilitate inspectors in their work. The form shows in a graphical and in a very effective manner what contactors should close on each point. Blue prints of the diagram are supplied to those working with the control system. As multiple-unit control systems are connected in several different ways, the diagram presented is not, of course, correct for all systems.

POINTS	CONTACTORS.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	●	●		●						●				
2	●	●		●						●	●			
3	●	●		●		●				●	●	●		
4	●	●		●		●	●			●	●	●	●	
5	●	●				●	●	●	●	●	●	●	●	●
6	○	○	○		○					○	○			
7	○	○	○		○	○				○	○	○		
8	○	○	○		○	○	○			○	○	○	○	
9	○	○	○		○	○	○	○		○	○	○	○	○

Street Ry. Journal

GRAPHIC ARRANGEMENT, SHOWING THE CONTACTORS CORRESPONDING TO THE PROGRESSIVE CONTROLLER NOTCHES

INTERESTING TRACK WORK IN SAN FRANCISCO

An interesting piece of track work was being undertaken on the Sutter Street cable line in San Francisco by the United Railroads of that city just previous to the recent earthquake and fire, and an account of it was prepared for this paper just before the recent disaster. Although later occurrences will undoubtedly change the policy of equipment in that city, the engineering features of the change are so novel that an account of them is presented.

The Sutter Street line is one over which there was a great deal of discussion on the part of the property owners, who, in their demands for an improved service, requested that an underground conduit system be installed. As an underground system was shown to be not practical at the present time, and as an overhead trolley was objected to, the question was settled for the time being by the railway company agreeing to improve the present cable service.

The first step toward this improvement concerned the track and the new work consisted in making three distinct changes; first, the old light cable rails were replaced by heavy 7-in. steel girder rails in 60-ft. lengths; second, the distance between centers of tracks was widened, and, third, it was proposed to change both tracks from the present 4-ft. 12½- in. to standard gage.

The first operation—that of relaying the track with heavier rails—involved no unusual difficulties. The concrete bed was broken away from around each rail, the iron-plate cross ties were sawed off a few inches, and the new rails were bolted to double angle-iron chains, whose upright connecting plates were bolted to the ends of the cross ties. The form of support may be noted in the accompanying illustration. No change was made in the cable slot.

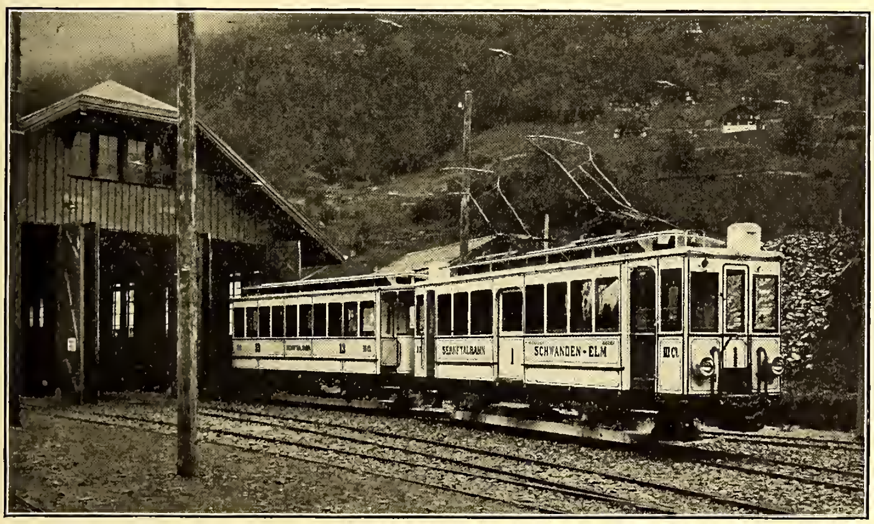
The matter of widening the distance between track centers, however, was a more difficult operation. The tracks were originally 9 ft. 6 ins., center to center, and while the new rails were being laid it was deemed advisable to widen this distance to 10 ft. This latter is the width between track centers on Post, O'Farrell, Ellis and most of the other streets in the city on which the United Railroads operates, with the notable exception of Market Street, where the distance between track centers is 12 ft.

TRACK WORK ON THE SUTTER STREET LINE, SAN FRANCISCO, BEFORE THE FIRE. THE JACKS ARE IN POSITION FOR MOVING OVER THE BED OF THE TRACK

The work consisted in moving the entire massive roadbed, including the cable slot, of the south track, a distance of 6 ins. away from the other tracks. The earth was first removed from between the tracks to a depth of 4 ft., which is the depth of the concrete bed of the track. A similar excavation about 2 ft. wide was made on the outside of the roadbed, to allow space for the moving of the structure. Then, by means of hydraulic and ordinary jacks, braced against the concrete structure of the north track, the solid masonary roadbed of the south track was moved over the required 6 ins. The accompanying illustration shows a block of the Sutter Street line between Kearny and Montgomery streets, where the roadbed was thus moved. In the foreground may be noted the bend in the track which marks the point up to which the work had proceeded. In setting the jacks they were placed about 5 ft. apart, and the 50 ft. thus covered was worked over at one time, and so on until a whole block was moved over, when the excavations were filled in again. An entire block was thus moved in a forenoon. An interesting fact in connection with the work is that the entire mass of concrete was twisted out of alignment without cracking or damaging the structure in the slightest. The sand foundation under the concrete, of course, made it possible to move the mass in this way where, with a clay or rocky soil, it might not be possible.

So far as known, this is the first place in the United States where such a piece of work has been done. The United Railroads first accomplished the same task recently on Larkin Street in the three blocks fronting on the City Hall, the fact being mentioned in the STREET RAILWAY JOURNAL at the time. The only serious difficulties arise when large sewer or water mains pass through the concrete road bed, but so far the trouble has been successfully met. At crossings, sections of rails were sawed out of the crossing tracks, south of Sutter Street, and afterwards inserted between the two Sutter Street tracks.

It was the plan of the company to reduce the gage of the Sutter Street road to standard gage at night, by shifting the rails at once. With this object in view, the new angle-iron chairs had an inner row of bolt holes, 1½ ins. inside the others, to which the rail bolts were to be be fitted. The pavement blocks were also placed in position alongside the rails temporarily at first, so that they could be easily removed when



PASSENGER MOTOR CAR AND TRAILER, SERN VALLEY

the time came. These precautions and improvements will undoubtedly be found to be most convenient when the reconstruction of the system, now under way, is farther advanced.

The Toledo, Fostoria & Findlay Railway Company has contracted for an automobile bus with a capacity of 12 passengers, which will operate between Prairie Deport and Billmans, a distance of two miles.

ELECTRIC RAILWAY IN THE SERN VALLEY

One of the results of the exploitation of the rich water powers in the Alps has been to encourage the building of electric railways between towns whose small population could not afford this convenience if the cost of power were high. The latest of these lines has just been opened for service in the Serntal or Sern Valley, of the Upper Rhine district. This railway is of the standard direct-current type, is 13.9 km long

FREIGHT MOTOR CAR AND TRAILER, SERN VALLEY

and connects the towns of Elm and Schwanden. The line follows a rather tortuous public road, so narrow and abrupt that a large number of retaining walls had to be constructed besides widening the road in many places. About 8800 cu. meters were blasted out, 19,000 cu. meters of material (two-thirds rock) used for the retaining walls, and eleven metal or stone bridges constructed.

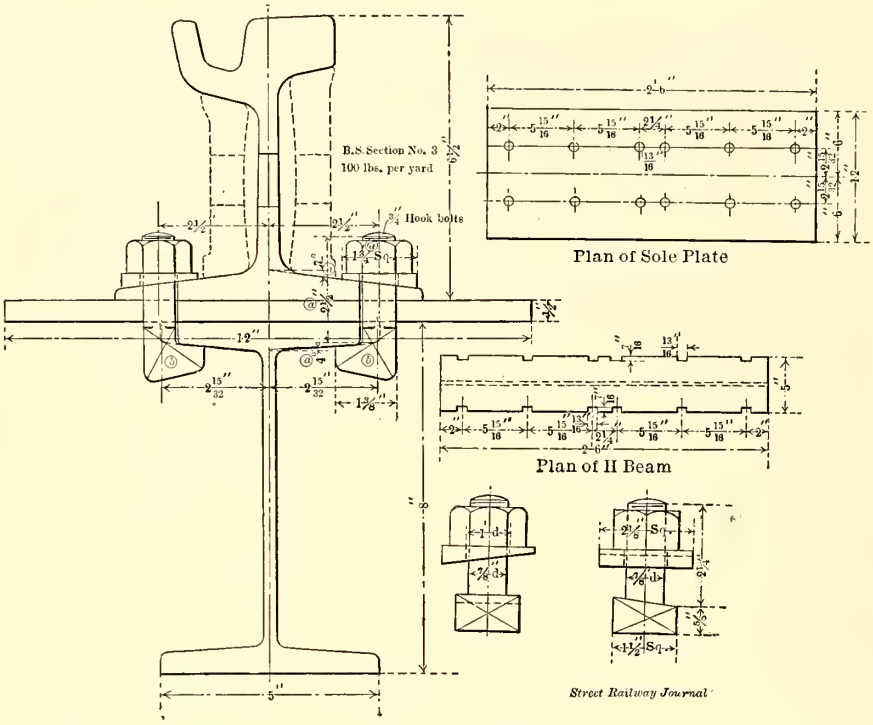
Grooved rails, weighing 32 kg per meter (about 64 lbs. per yard), are used in the villages and at crossings, but T-rail, weighing 25 kg per meter (about 50 lbs. per yard), is laid in 12-meter sections on the rest of the line. A novel feature is the use of metal ties. The type of rolling stock is well shown in the accompanying illustrations. The passenger motor cars consist of three single-truck vehicles, having a car body 9.6 meters long. They are divided into a baggage section and second-class and third-class compartments, seating twelve passengers and six passengers respectively, and having standing room for twelve passengers more. There are also three trailers, each seating forty passengers; a single-truck motor freight car, five covered freight trailers and four open freight trailers. All of the electrical equipment for these cars was furnished by the Maschinenfabrik Oerlikon. The motor cars carry two 65-hp series-parallel motors, each of which is geared for a speed of 25 km an hour on the level. Provision is made for air and electric braking. Current is taken from the line through double bows, as shown.

The hydro-electric power station, which furnishes the power for this line, is near Engi-Vorderdorf. It is equipped with two Bell horizontal spiral turbines of 200 hp, each running at 680 r. p. m., and direct connected to Oerlikon 135-kw, 800-volt, direct-current generators.

RECENT TRACK WORK IN LONDON

Some interesting track construction in which old rails are used for ties has recently been completed in London by the London United Tramway Company.

The rails were laid in 45 ft. lengths, were of the British standard sections No. 3 and 3C. Tie rods, screwed at both ends, were placed 6 ft. 6 ins. apart, except at joints where the spacing was to 6 ft. 9 ins. The accompanying section shows the joint adopted. A steel channel, 30 ins. long x 5 ins. wide and 6 ins. deep, weighing 30 lbs. per ft., and a steel plate, 30 ins. long x 12 ins. wide x ½ in. thick, are fastened to the rail by 2½-in. x ¾-in. hook bolts. The attachment is made by the hooks of the bolts fitting into slots made in the top flange of the channel, and fastened through holes in the plate and bottom flange of the rail, and the nuts screwed down on to a bevel washer. The bolts are made of mild steel, and are threaded for a length of 1½ ins. from the nut. The rails were then bonded with two No. 0000 Crown bands, 32 ins. in length.



DETAILS OF LONDON TRACK WORK, REINFORCED JOINT USED IN NEW WORK BY THE LONDON UNITED TRAMWAY COMPANY

Another interesting feature connected with the track construction relates to the ties, which were spaced 9 ft. apart, and consisted of 6 ft. lengths of old tramway girder rails, with a depth of 6 ins. and a flange of the same dimension. These rails were embeded in the concrete foundation with the flange uppermost, and were firmly fastened to each rail by means of two ⅞-in. bolts with bevelled washers.

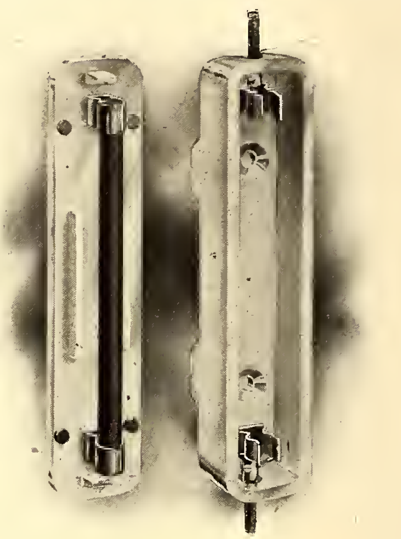
After the track laying and bonding had been completed, the track was concreted in. When this had set, it was covered by a floating 1⅛ ins. thick, and surfaced so as to provide the proper camber for the paving. The blocks were then thoroughly grouted with cement grout (2-1).

The contractors for the work were J. G. White & Company.

The Detroit United Railways will receive from the Cincinnati Car Company in a short time ten interurban cars for limited service on the Rapid Railway, Flint Division, and later on the Detroit, Monroe & Toledo Shore Line. Each car is 57 ft. long, and will be driven by four 100-hp motors.

A NON-GAP LIGHTNING ARRESTER

The usual type of lightning arrester is made with some form of air gap, the idea being that the high-potential lightning discharge will easily leap across the gap to ground, but that the line potential is not powerful enough to follow it. A distinct departure from this style of lightning arrester is the one now made by the Woolley Electric Company, of Clayton, Mo. The essential part of this new arrester consists of a rod of very high ohmic but non-inductive resistance cut in directly between the line and the ground without any intervening air gap whatever, so that it allows a constant flow of part of the line current through it to the ground. It is claimed that the construction of the rod is such that, while it limits the flow of the line current to a decidedly negligible quantity, for instance, 1-60 of an amp. on 550 volts, it does not in any way impede the lightning discharge, offering to it, as a matter of fact, a dead short-circuit to ground. The rods are of like composition throughout, and will neither heat nor fuse



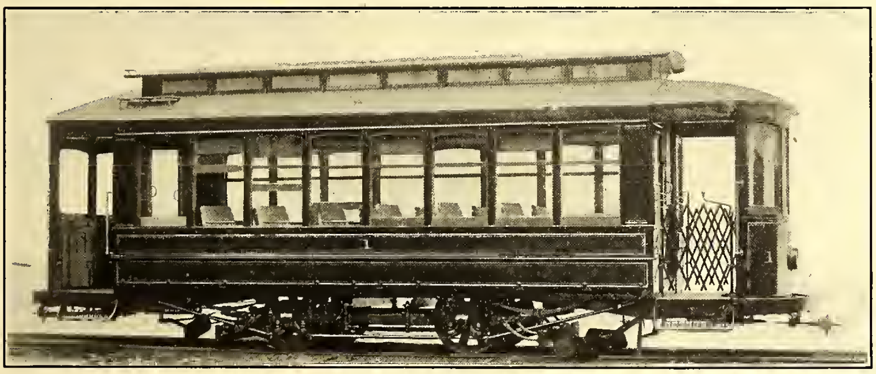
GAPLESS LIGHTNING ARRESTER

JUNCTION OF KINGSTON ROAD AND LONDON ROAD. SHOWING METHOD OF LAYING STEEL TIES on account of the small line current or the severe lightning discharge. It is stated that the resistance will remain constant under any conditions of operation. One reason why this arrester is claimed to be superior to the air-gap type is the fact that in the latter the lightning change must build up to a potential high enough to discharge itself over the gap, and, of course, until this discharge takes place the high potential is liable to go down the line and injure the electrical apparatus in connection with it.

The discharge rod is mounted in a porcelain box, so arranged that the removal of the cover will also remove the rod for inspection, the cover being held in place by spring clips. The outside dimensions of this box are 2⅜ ins. x 2¾ ins. x 10⅜ ins., and for car-line use is enclosed in a wooden box. The indestructibility of the rod, the fact that it is non-arcing and its absence of moving parts naturally make the maintenance and replacement costs almost nothing. This arrester, which its manufacturer calls "Type C. C.," or constant current, has been in continual service during the last two seasons on a number of electric railway lines. Among the companies using it may be mentioned the St. Louis & Suburban Railway Company, which, in a recent letter to the manufacturer, states that the twenty-five which it installed on its switchboard at the main power station and at points along the line had given very satisfactory service, and that recently it had purchased 125 more to install at other points.

NEW EQUIPMENT FOR POUGHKEEPSIE

Poughkeepsie lies on the east bank of the Hudson River, 73 miles north of New York. It is on the New York Central & Hudson River Railroad, and communicates with the New York, West Shore & Buffalo Railway by ferry from Highland, and with the Hartford & Connecticut Western Railroad by the Poughkeepsie, Hudson & Boston Railroad (37 miles). Well laid out, with regular and shaded trees and abundantly supplied with water, Poughkeepsie is a pleasant place of residence, and it enjoys a special reputation for its educational



ONE OF THE NEW GROOVELESS POST, SEMI-CONVERTIBLE CARS USED BY THE POUGHKEEPSIE CITY & WAPPINGERS FALLS RAILWAY

institutions, Vassar College, the earliest and one of the greatest women's colleges in the world, being within a short distance from the city. Two miles north of the city, on an eminence above the Hudson, stands the Hudson River State Hospital for the Insane. In the summer the river front presents an especially busy appearance, with its numerous excursion boats and other pleasure craft. The steamers of the New York & Albany line touch at Poughkeepsie and the rowing course, where the intercollegiate contests are held each year, starts at the Poughkeepsie Bridge. From the river one can board a car on the main line of the Poughkeepsie City & Wappingers Falls Railway and be taken direct to Vassar College, if desired, which lies 2½ miles east of the city, and is the terminus of this branch of the railway system. Two other lines extend through the city, and a suburban line runs to the village of Wappingers Falls, which is situated on the river, about 8 miles south of Poughkeepsie. The entire railway system comprises about 18 miles of track.

At the time of the fire, which occurred at 12:30 a. m. on Feb. 11, the equipment of the road consisted of thirteen

POUGHKEEPSIE OPEN CAR

single-truck closed cars, eight single-truck open cars, one 40-ft. double-truck closed, and one 42-ft. open car. The entire plant, consisting of car houses, power and lighting station, which were adjoining, was destroyed by this fire, and, with the exception of one car, which had not yet come into the car house, the entire rolling stock of the railway company suffered in a like manner. To tide them over in their misfortune cars were borrowed from the United Traction Company, of Albany, and a rotary converter was ordered, shipped by express and erected, so that use could be made of the alternating current generated by the local lighting company, and by Monday, Feb. 9, eight days after the fire, the energetic efforts of the company were rewarded by seeing the operation of the road once more resumed.

Cars of the groveless post, semi-convertibe type, built by the J. G. Brill Company, are to compose the major portion of the new rolling stock, and the six cars which have recently been put in operation are of this type, and their measurements are as follows: Length over the end panels, 28 ft. 4 ins.; length over the vestibules, 30 ft. 4 ins.; width over the sills, including the plates, 7 ft. 10½ ins.; width over the posts at the belt, 8 ft. 2 ins.; sweep of the posts, 1¾ ins.; distance between the centers of the posts, 2 ft. 5 ins.; height from the rail over the trolley board, 11 ft. 9¼ ins.; side of the side sills, 5 ins. x 8 ins; size of the end sills, 4½ ins. x 8 ins.; thickness of the corner posts, 3⅝ ins.; thickness of the side posts, 3¼ ins.; length of the seats, 36 ins.; width of the aisle, 22 ins. The cars are finished in cherry; ceilings of decorated birch; spring cane seats, and other Brill specialties, such as sand boxes, gongs, etc.

Trucks of the 21-E type are used under the car bodies, and have a wheel base of 7 ft.; diameter of the wheels, 33 ins. The car builder now has in the course of construction for this road seven additional semi-convertible cars, six measuring 18 ft. 3 ins. over the bodies, and one 28 ft. Open cars, built by the American Car Company, of St. Louis, have also been placed on these lines, the dimensions being as follows: Length of the car body over the crown pieces, 28 ft. 8⅜ ins.; width of the car body over the sills, 6 ft. 3 ins.; width of the car body over the posts at the seat ends, 7 ft. ½ in.; side sills, 3¾ ins. x 7 ins.; sweep of the posts, 5 ins. Type 21-E trucks are also used under these open cars, with wheel base of 7 ft.

SOME RECENT INSTALLATIONS OF DIESEL ENGINES IN ENGLAND

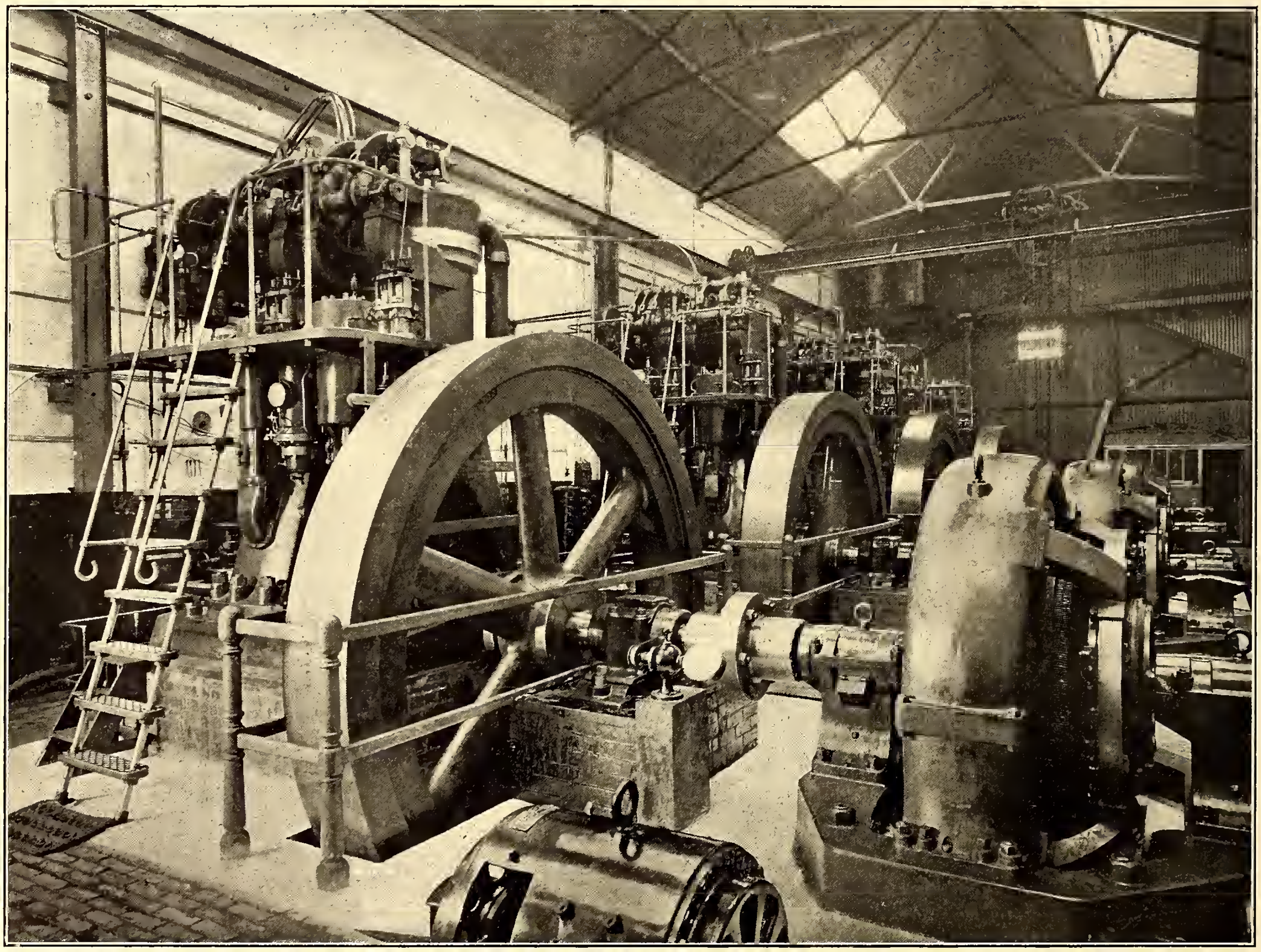
The Diesel engine, of which a great deal has been heard in this country, has been installed in several electric traction stations in England, notably at Rothesay, in the Island of Bute, in the Lye sub-station of the Dudley & Stourbridge Tramways and at the Yardley station of the Birmingham Tramways Company. An interior view of the latter station is shown in the accompanying engraving. This station contains four Diesel engines of 100 kw each, each directly connected to a generator.

Figures for three months show the load factor of this station to be 31.5 per cent, and the amount of Texas crude oil used per kw-hour is 0.66 lbs., which at 52s. 6d. (14.60) per ton, equals 0.1836d. (0.3672 cents) per kw-hour. The total operating expense during the same period amounted to 0.437d. (0.874 cents) per kw-hour. During February, 1906, the load factor increased to 50 per cent, and during that month the total operating expenses amounted to 0.362d. (0.724 cents) per kw-hour.

The total cost of the plant, with switchboard, cables, pump, water-cooling tower, tank and building, amounted to £10,539, (or $126.50, per kw). Owing to reduced manufacturing expense, it is stated that the present cost, inclusive of buildings, would be £800, or $9.60 per kw less. At 10 per cent on the investment, the interest, with the present output, would be 0.388 cents per kw-hour. The tenders on a steam plant, exclusive of buildings, for the same station was £9,195.

The total cost for a 28-day period in June, 1905, and output of 68,920 kw-hours, was as follows:

Fuel	0.185d., or	0.370 cents per kw-hour
Oil, waste, stores	0.044d., or	0.088 cents per kw-hour
Repairs and Maintenance,	0.038d., or	0.076 cents per kw-hour
Wages	0.161d., or	0.322 cents per kw-hour
Salaries	0.014d., or	0.028 cents per kw-hour
Total,	0.442d.	0.884



POWER STATION AT MANCHESTER, USING DIESEL ENGINES

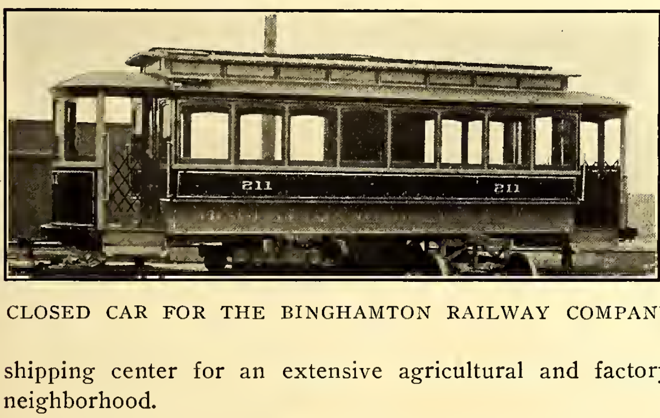
STREET RAILWAY MEN CONTRIBUTE TO SAN FRANCISCO FUND

A number of employees of the Washington & Canonsburg Railway Company, of Washington, Pa., recognizing that there must be many cases of suffering and want among the street railway employees of San Francisco, have contributed the sum of $41.50, through the United Railroads of San Francisco, with the stipulation that this money is to be sent direct to the families of the street railway men of San Francisco. Robert R. Reed, general manager of the Washington & Canonsburg Railway Company, in forwarding this money on behalf of the men, requested that, if opportunity arose, it should be applied to some specific case of hardship which might arise. The Washington & Canonsburg Railway Company is part of the Pittsburg Railways Company, of which James D. Callery is president, and which is controlled by the Philadelphia Company, of which Judge J. H. Reed is president.

The following is the list of subscribers to the fund: James Kent, superintendent; C. R. Lacock; C. Z. Brownlee; J. P. Summers; J. J. Stephens, M. Watson; W. B. McBride; I. J. Duvall; E. S. Mitchell; John Stollar; Thomas Dacey; W. W. Mitchell; J. V. Patterson; Ray Crosland; R. N. Markley; O. I. Gilbert; J. O. Parker; C. M. Carson; D. L. Gray; R. V. Noble; Joseph Thompson; E. C. Vankirk; J. B. Horne; H. H. Dille; J. H. Lightner; H. R. Hewitt; John Loughman; S. B. Anderson; A. Martin; F. V. Hill and George T. Hallam.

CLOSED CARS FOR BINGHAMTON RAILWAY COMPANY

The first electric railway in the State of New York was installed by the Washington Street & State Asylum Railroad Company, of Binghamton, which now forms a part of the Binghamton Railway Company. This latter company is energetic and enterprising, and its present railway system has been well planned. The tracks of the company cover about 45 miles, and the roadbed is of a heavy and substantial standard. About 80 cars are in service, and it was only within the recent past that the road increased its rolling stock to the extent of eight new ten-bench open cars, built by the J. G. Brill Company, and also two very handsome semi-convertible passenger and smoking-car bodies, also constructed by the Brill Company. Binghamton has a population of 40,000, and, together with Port Dickinson, Lestershire, Endicott and Union, four neighboring towns reached by the lines of the company, the district directly served has a population of about 10,000, in addition to the city. The city is most favorably situated for street railway business, being at the junction of the Chenango and Susquehanna rivers, and branches out in four directions. The officials of the Binghamton Railway Company have paid particular attention to developing the terminals of the different lines, Ross Park, operated by the railway company, and which is the pleasure resort of the city, being the most important terminus. This beautiful park, which is about 1½ miles from the center of the city, comprises 100 acres of natural wooded country, and thousands of visitors from Binghamton and nearby towns are attracted during the season. Another park that is well patronized is Casino Park, owned by the railway company. Binghamton is a manufacturing city of some note, and a commercial and shipping center for an extensive agricultural and factory neighborhood.

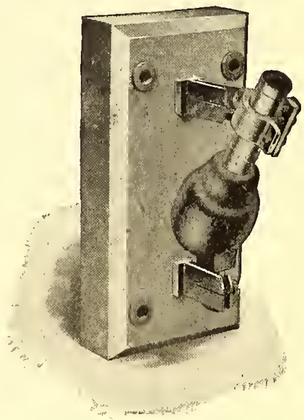


CLOSED CAR FOR THE BINGHAMTON RAILWAY COMPANY

The accompanying illustration shows one of the new cars which have recently been put in operation on the lines of the Binghamton Railway Company. The details of the cars are as follows: Length over the end panels, 22 ft.; length over the crown pieces, 31 ft. 5 ins.; width over the sills, including the plates, 6 ft. 3 ins.; width over the posts at the belt, 7 ft. 6 ins.; sweep of the posts, 8 ins.; distance between the centers of the posts, 2 ft. 9¼ ins.; height from the floor to the ceiling, 7 ft. 10 ins.; height from the track to the under side of the sills, 2 ft. 5 ins.; height from the under side of the sills over the trolley board, 8 ft. 9⅜ ins.; height from the track to the platform step, 1 ft. 4¾ ins.; size of the side sills, 3¾ ins. x 5¾ ins.; size of the end sills, 4½ ins. x 6¾ ins.; size of the sill plates, ½ in. x 7 ins.; thickness of the corner posts, 3¾ ins.; thickness of the side posts, 1¾ ins.; length of the seats, 21 ft. 6 ins.; width of the aisle, 3 ft. 2 ins. The cars are finished in cherry, and have ceilings of three-ply birch.

HIGH-POTENTIAL FUSE HOLDERS

The General Electric Company has perfected a new device in the shape of a high-potential fuse holder. These fuse holders are designed to protect 2300 and 6600 volt systems, but can be made to suit special requirements for higher voltage. They supersede the "expulsion" type, and will be used in the future on all General Electric switchboards requiring high-potential fuses. The device is of small size, and is said to be capable of rupturing more energy under short-circuit conditions than any other similar device heretofore placed on the market. The body of the holder consists of an insulated metallic chamber, into the upper end of which is screwed a fibre tube. That part of the fuse located in the chamber is of smaller cross section than the remainder, to insure rupturing at that point. The expansion of the gases formed by the area in the chamber expels the fused metal and effectually opens the circuit. New fuses can be readily inserted in the holder by removing a screw plug located in the bottom of the bulb.



HIGH POTENTIAL FUSE HOLDER

The holder is connected in circuit by means of blades fastened to either end, which fit into clips mounted on a base or switchboard panel. The advantages of this method of support will be readily understood. Spare fuse holders can be kept on hand ready for the instant replacement of ruptured fuses. The complete device is compact, substantial, easy to handle, and may be located in any convenient place. The holder can be supplied in groups of two, three or four, mounted on bases or in single elements without bases for switchboard mounting.

It is recommended that 2300-volt holders be spaced on 12-in. centers and 6600-volt holders on 18-in. centers; unless barriers are use between them, in which case these distances can be made 5 ins. and 8 ins., respectively. The ampere rating corresponds to the continuous current-carrying capacity, and the rupturing point is approximately 60 per cent greater. Fuses for operating on small overloads can be made to order. The 2300-volt and 6600-volt fuse holders are made to carry 100 amp. fuses, or smaller sizes. Holders of both voltages are furnished back connected for switchboard use without base, and either back or front connected on base singly or in groups with barriers.

The Long Island Railroad Company is laying an extra track across the Flushing Meadows, so that its Port Washington Branch will be double tracked from Long Island City to Main Street, Flushing. The company has plans for electrifying that part of its system, and has been widening its right of way.

PORTABLE RECORDING GAGES

The value of recording pressure gages as a powerful factor in promoting safety and economy has long been recognized. Many users have, however, felt the need of a light, compact, portable recording pressure gage, and particularly an instrument which is so well made and free from delicate mechanism that an ordinary workman can manipulate it successfully with

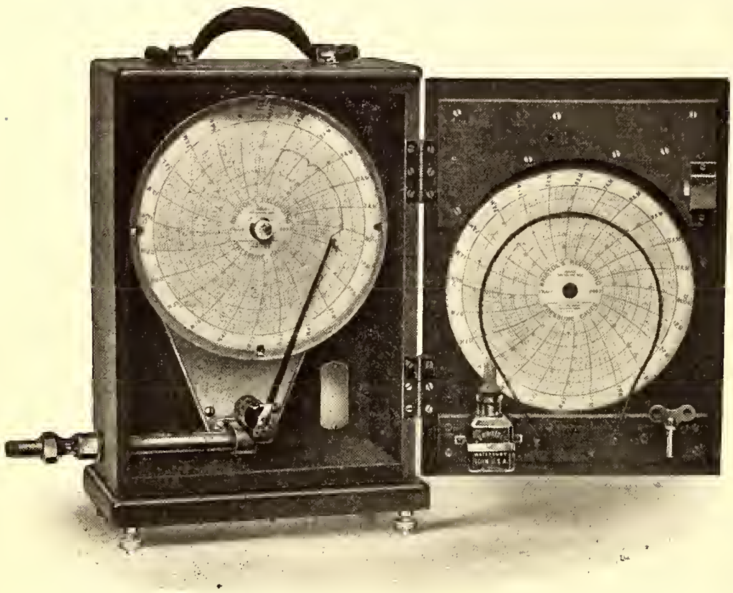


FIG. 1.—PORTABLE GAGE FOR PRESSURES EXCEEDING 5 LBS. PER SQUARE INCH

reasonable care. To cover these requirements, the Bristol Company, of Waterbury, Conn., has placed upon the market a modification of its well-known recording gage.

In these portable gages, the metal case has been omitted the pressure tube and clock for driving the chart being mounted on a light aluminum back, which is in turn mounted in a handsome wooden carrying-case designed with special reference to ease in handling and making connections to the source of pressure.

For recording pressures which may exceed five lbs. per sq. in., the type illustrated by Fig. 1 is employed. A special flexible connection with unions, is supplied to facilitate connecting to piping at various angles. When a permanent installation is unnecessary, this instrument could be used to advantage, as, for example, on boiler tests, water mains or fire protective systems where a few accurate and continuous records would settle disputes or lead to better service.

For gas pressure, draft or light vacuum, the gage illustrated by Fig. 2 is adapted, since it is capable of recording pressures as low as 1-20 in. head of water. Connection is readily made by means of a rubber hose to nipple, which projects through the side of case. A simple clamping device is employed to hold the pressure tube rigidly, when the gage is being transported.

The portable gages above described weigh about one-third as much as the standard form gages mounted in a carrying-case, which has been used heretofore as a substitute. Both forms are furnished with leveling screws to facilitate adjustment of the instrument. Provision is also made for carrying a supply of charts and ink with each gage.

Members of the mechanical engineering department of the Ohio State University have arranged to make an efficiency test of the power station, sub-stations, lines and cars of the Columbus, Buckeye Lake & Newark Traction Company.

MEETING OF THE AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION

A meeting of the American Street & Interurban Railway Manufacturers' Association was held in New York, April 27, to elect permanent officers of the association, make arrangements for the Columbus convention next October, and adopt a permanent constitution and by-laws. Upon invitation, Messrs. Ely and Swenson, of the American Street & Interurban Railway Association, were present. The former, upon request, outlined the work which the American Association and its different committees were doing, and referred particularly to the municipal ownership committee and the committee on standardization of equipment. The work of the latter committee was of particular interest to the manufacturers present, and it was the general sentiment that this work was most timely and important. The secretary then described the work which was being undertaken by the insurance committee. The fields of the other committees were also described in detail, and the president was congratulated upon having secured such representative and well-known men to serve. The association then took up the subject of its revised constitution and by-laws and adopted the articles presented by the committee on this subject. The following officers were then elected: President, James H. McGraw, president McGraw Publishing Company, New York; vice-president, Charles C. Pierce, General Electric Company, Boston; treasurer, E. H. Baker, Galena Signal Oil Company, New York; secretary, George Keegan, Interborough Rapid Transit Company, New York. The adoption of Columbus as

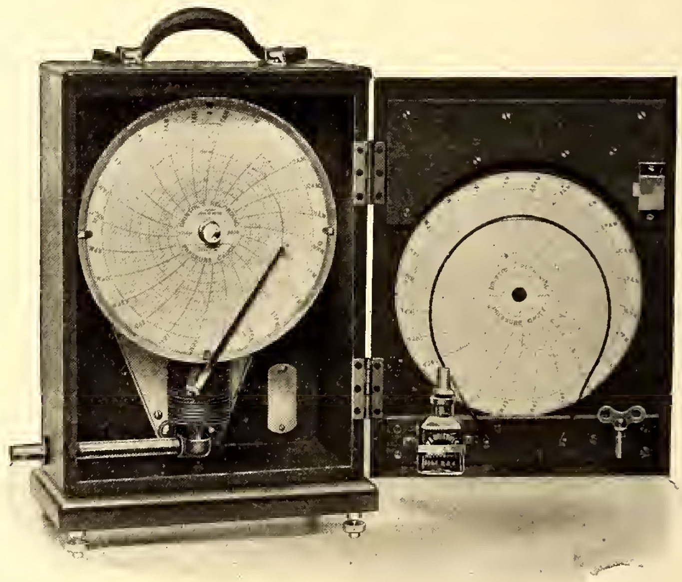


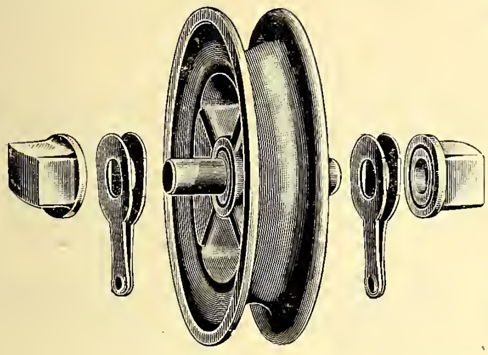
FIG. 2.—GAS PRESSURE OR LIGHT VACUUM GAGE

a convention city by the American Association was enthusiastically received. A committee was appointed by the president to take up the preliminary work of the association's work in connection with the convention. This committee will meet in Columbus soon, with one from the American Association.

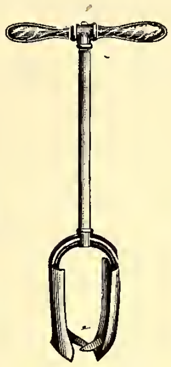
In the evening the members of the executive committee, with Messrs. Ely and Swenson, of the American Association, Frank Hedley, general manager of the Interborough Rapid Transit Company, and J. F. Calderwood, vice-president and general manager of the Brooklyn Rapid Transit Company, were entertained at dinner at the city club house of the New York Yacht Club.

IMPROVED TROLLEY WHEEL AND HARP

The Liberty Bell Company, of Bristol, Conn., maker of the well-known Liberty trolley harp, described in the Street Railway Journal of June 4, 1904, is now manufacturing for the 4-in. and 6-in. sizes of this harp a special trolley wheel. The harp is so constructed that it does not revolve on a through pin or axle, but is held in place on a shaft between spring-connected bearing blocks. The result is that the wheel is prevented from moving sideways when rounding a curve, thereby avoiding arcing and the usual grinding contact which tends to shorten the life of the wheel and wire. In general, it is claimed for this company's wheel that it will prove more durable and economical, because it has no bushing, has wider bearings, runs steadier and has better contact than others. For high-speed electric railways or other lines, where the conditions are unusually severe, the company offers its special Liberty cushion harp No. 12, with 6-in. wheels, of the type mentioned above.



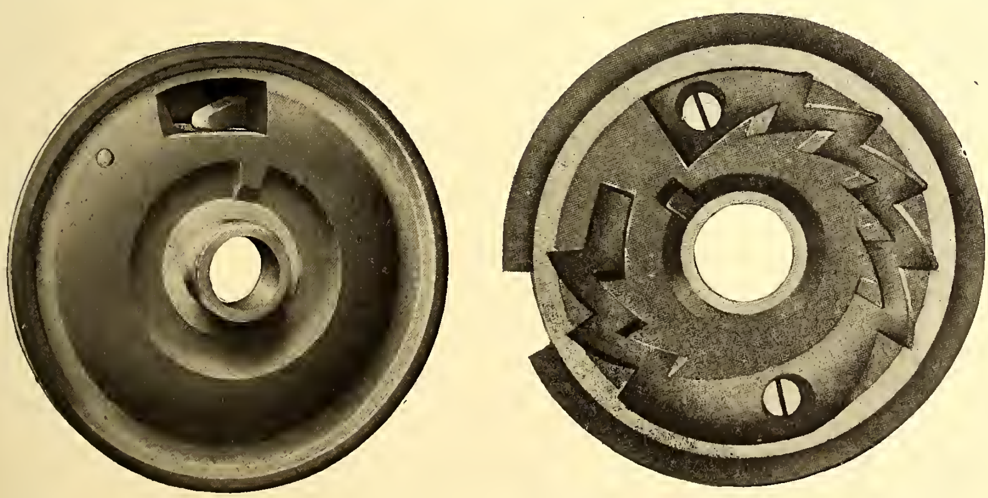
TROLLEY WHEEL AND BEARING BLOCKS



POST-HOLE AUGER

A SIMPLE CONTROLLER REGULATOR

The necessity for some automatic means for checking the extravagant consumption of current by careless motormen has been often admitted by railway managers, but most of the corrective devices offered have not fulfilled their promises of saving power without introducing other evils, such as complicated mechanism and lack of flexibility to comply with schedule requirements, particularly on crowded city lines.



TWO INSIDE VIEWS OF CONTROLLER REGULATOR, SHOWING THE SIMPLICITY OF THE CONSTRUCTION

To meet the needs of electric railways and others using electrical machinery, the Equipment Protection Company, of New York, has placed on the market the Barrett controller regulator. It consists of a stationary, malleable-iron plate which is attached to the controller cap, and provided with camming and arresting teeth; a malleable-iron cover which, when placed in position, locks to the stationary plate; and a heavy tool-steel pawl which is actuated by gravity and adapted to engage the teeth of the stationary member for a brief interval at each "point" as the controller handle is advanced in applying the current. The simplicity of this regulator is well shown in the illustrations of the interior. There are but three parts, and no springs, dash-pots, cogs, rollers, exposed pawls or experimental features of any kind. There is nothing to get out of order and lubrication is unnecessary. The company is not making any extraordinary claims as to the exact saving insured by this regulator, but it is, nevertheless, confident that it will save its initial cost many times a year.

AN ECONOMICAL POST-HOLE AUGER

For several years past Iwan Brothers, of Streator, Ill., have manufactured a simple post-hole auger which has been found a convenient tool whenever a considerable number of holes must be dug for poles, posts, etc. As will be noted from the accompanying illustration, this auger is very simply constructed, the bowl being formed by two blades of crucible steel riveted to a strong malleable arch. The two blades have notched edges for interlocking, and, therefore, can hold each other firmly in place. The total length of the sizes from 3 ins. to 10 ins. is 4 ft.; 12 ins. and 14 ins., 6 ft. These lengths will answer for all ordinary purposes, but where deeper holes are required longer pipe can be attached. The 12-in. and 14-in. augers are fitted with 1-in. pipe and all the other sizes with ¾-in. Their weight varies from 9 lbs. to 24 lbs. each.

Little pressure is needed to operate this auger, except in very hard ground, as the two sets of cutting blades grip very quickly. It is made to bore in all kinds of ground, aside from solid rock, and will also take up gravel and small stones.

The Brooklyn Rapid Transit Company is making plans for building one of the most important new lines that it has constructed for several years. The new route is to extend from Brooklyn to Jamaica, and will be established by the extension of the Myrtle Avenue elevated line to Lutheran Cemetery at Middle Village, where free transfers will be given to the Metropolitan Avenue cars for Jamaica. Practically, all the necessary consents of property owners have been secured, and it remains only to get the authorization of the Queens County authorities. The proposed route will consist of an extension of the Metropolitan Avenue line along the Williamsburgh and Jamaica turnpike from Middle Village to Jamaica, connecting at the Lutheran Cemetery with the extension of the Myrtle Avenue elevated line, and will terminate there. With the free transfer from the elevated to the surface line, it will be possible for patrons to ride all the way to Jamaica for a single fare. In effect, there will be a direct route by trolley from the Eastern District of Brooklyn to Jamaica, with a transfer connection.

ELECTRIC INDICATING LANTERN

About one year ago the Eureka Automatic Electric Signal Company, of Tamaqua, Pa., installed for the Tamaqua & Lansford Street Railway Company two Eureka indicating lanterns at the railway company's Manila Grove Pavilion.

ELECTRIC INDICATING LANTERNS USED AT PARK PAVILION

These lanterns, which show in both directions, have been found to be a great accommodation to passengers. Persons wishing to leave the grove on the east bound or west bound cars need not go to the depot to wait, but can remain on the pavilion or in the grove until the proper indicating lantern is illuminated by the approaching car they are awaiting. These lanterns are connected in series with blocks of Eureka automatic electric signals, and are so arranged that they are aglow only when cars are approaching the grove. Thus persons wishing to take cars in either direction are given ample notice and may walk leisurely to the depot, boarding the car with little delay.

Persons about to leave the grove often asked, "How soon will the next car leave for east and west?" This question is no longer asked, as any one, by means of the lanterns, can know with positive certainty the approach of east or west bound cars. When cars leave the Grove, the lanterns are automatically cut out. Indicating lanterns of this type would also be a great accommodation in large stores, hotels or places of amusement, where people could remain until the last minute before taking cars. The only cost of maintenance is that required for the renewal of incandescent lamps, possibly once or twice a season.

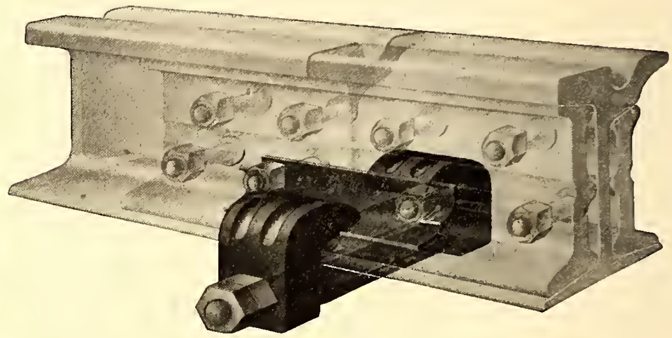
A document has been filed in the Hudson County Court House, Jersey City, recording the leasing of the land owned by the Public Service Corporation at Hudson Street and Hudson Place, Hoboken, desired for the terminal of the Hoboken branch of the tunnel that has been constructed between Morton Street, Manhattan, and Fifteenth Street, Jersey City.

REDUCED RATES IN OHIO

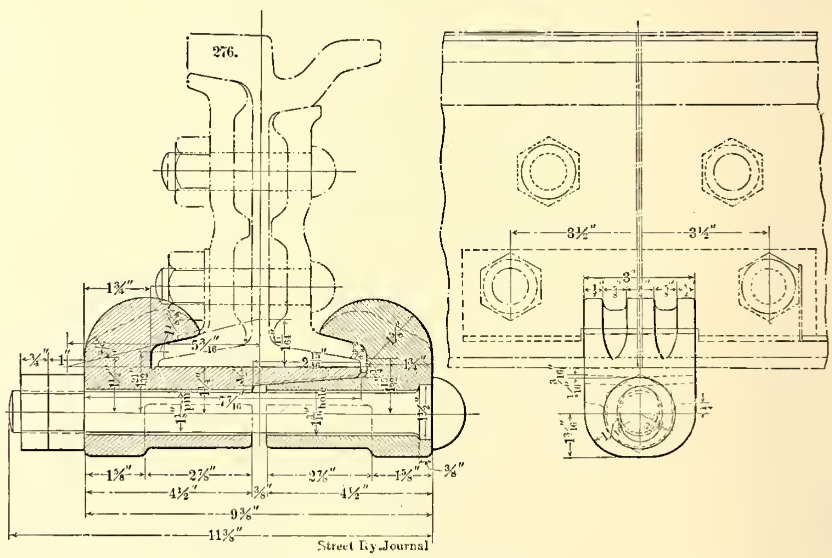
The Schoepf syndicate, which has recently acquired the Appleyard properties, has announced a considerable reduction in rates on the lines between Columbus and Dayton, the reduction being especially marked on round-trip tickets. This is to meet the competition of the Big Four road between these points. The steam road has reduced its rates as a result of the recent 2-cent fare bill in Ohio, and it makes no extra reduction on round-trip rates.

A SIMPLE RAIL-JOINT

The McConway & Torley Company, of Pittsburg, which manufactures malleable and steel castings, as well as several standard railroad couplers, is now actively pushing a rail joint for street railway use which can be applied to the regular patterns of splice bars used with the A. S. C. E. rail sections. The object of this device is to hold the jointed parts level, so that the ends of the rails will not be battered, as in the case with the unsupported joint. This joint is very simple in construction, as it consists of only two complementary parts, which when bolted together can be made to clamp the rail base and splice-bars in a very efficient manner. It is not by any means an untried contrivance, but is said to have been in satisfactory service for a long period on several lines whose operators are now using it in large quantities. One of the accompanying cuts has been prepared to exhibit this joint in plan and elevation, while the other shows its appearance when applied in service.



JOINT APPLIED TO RAIL



DETAILS OF RAIL JOINT

APPREHENDING WIRE THIEVES

The loss of wire and bonds by copper thieves is an annoyance which periodically strikes nearly every city and interurban company in the country; especially the latter class of roads. In many districts it is apparent that there are bands of thieves who make a business of stripping wires from poles or removing bonds from fish plates, and either melting it and then disposing of it or selling it in bulk to junk dealers. The daring of some of this class of thieves is something astonishing. Frequently there have been cases where a gang of men with a wagon and ladders and equipped with all the appliances of legitimate repairmen, have taken down thousands of feet of wire in broad daylight and escaped with it unquestioned by people who saw them and supposed they were employees of a company. In a great many cases men of this character are ex-wiremen who know their business, who have carefully planned arrangements for getting away with and disposing of their booty, and whose skill and sang-froid makes them difficult to apprehend. Probably a larger percentage of losses, however, comes from men and boys who are hard up and occasionally venture forth at night with a cold chisel or a pair of pliers and carry away a few soldered or unprotected bonds or a few hundred feet of wire in some isolated place. At 12 cents to 15 cents a pound for scrap copper, a few hours' work at night yields a comparatively good income, even though carried on only occasionally. Losses of this kind are less annoying to traction companies by reason of the intrinsic value of the material carried away than they are by reason of the loss of current due to grounds, the disruption of traffic through insufficient voltage and the loss of time and expense in finding the break and repairing it.

The majority of roads when they suffer from losses of this kind, either get the local police to take up the matter or hire a detective agency to follow it up. In either case the percentage of recoveries of property and conviction of thieves is usually very low, because it is difficult to identify the property, wire being all alike, and because, as stated, the thieves usually operate only periodically in a certain neighborhood. Some few large systems employ detectives exclusively in this work, but with the great majority of roads losses are so infrequent, or so small, that it would not pay to follow this course.

While the growing tendency of interurban lines to consolidate or to co-operate and work together in matters of traffic and operation, it would seem that a great many losses of the kind described could be avoided by several companies in a district clubbing together and hiring a man to make a business of discouraging wire thieving. If the plan was followed up in a number of districts these men could co-operate and render each other great assistance by exchanging information as to the operation of gangs of thieves or of individuals, and by securing evidence and making arrests. Steam roads employ such men and their methods of co-operation annually save thousands of dollars. The great importance of good current conditions to electric roads makes it especially important that some such plan be put in force.

Some valuable and interesting suggestions along this line are furnished by Charles H. Kelso, of Cleveland, who is employed by the Everett-Moore syndicate almost exclusively in the work of apprehending wire thieves who annoy those properties. Incidentally he attends to other matters of a private nature, such as securing evidence in accident cases, following up thefts of freight, etc., and he is withal a very important cog in the organizations of these properties. He has been remarkably successful in securing convictions, breaking up gangs of thieves and in recovering property. In the six years he has been employed in this work he has secured the conviction of twenty-seven wire thieves, with sentences of from one year to seven years, and has recovered thousands of dollars worth of property. Unquestionably the chief reason for his success is that he has made a study of the methods of this class of criminals, has a wide acquaintance among men likely to engage in such work and among junk dealers likely to buy such material; in a word, has devoted his attention exclusively to such work. His jurisdiction extends over the Cleveland, Painesville & Eastern, the Northern Ohio Traction & Light Company, the Lake Shore Electric Railway, Toledo Railways & Light Company, and a number of telephone companies controlled by this syndicate. Frequently he does work for other companies in this district. He has devised a system of private marks for each of these companies. Rail bonds and other copper and brass parts are stamped with this mark in a manner which is scarcely noticeable, while wire is also privately marked. A simple device is attached to each reel, so that as the wire is unreeled it is given a slight nick at intervals; the distance between nicks varying for different roads. These marks are hard to detect but they afford almost indisputable evidence in identifying property and in securing convictions against dealers who buy such property. A wide acquaintance with police and court officials also aids in the work. He has a large collection of descriptions and photographs of men who have been engaged in such work, and when a robbery takes place he is frequently enabled to find that a certain well-known crook has been seen in that district and he gets after him. On occasions he has followed men from place to place all over the country, and finally apprehended them. Men who engage in such work frequently have distinctive methods of operating, and Mr. Kelso's familiarity with these methods has enabled him to locate the criminal where an ordinary detective would be at a loss to find a clue. Mr. Kelso prides himself upon being the watchdog of the properties of the Everett-Moore syndicate. He says that the thieves are afraid of him and that of late they are confining their depredations to roads not protected by his watchful eye. As evidence of this, he points to the fact that one summer a year or two ago he took a vacation, and in an unguarded moment mentioned an intended trip to a newspaper man who gave him a personal item. He says he had just got comfortably settled down to a good quiet rest at an obscure resort when he received a flood of telegrams from a number of managers to come home quickly and get after a flock of wire thieves that had descended upon all parts of the system. Since then he has taken no vacation.

TRAFFIC CIRCULARS IN BOSTON

For the convenience and instruction of the rapidly growing body of people who appreciate the delights of trolleying through eastern and southern Massachusetts, southern New Hampshire and northern Rhode Island, the passenger department of the Boston & Northern and Old Colony Street Railway Companies has now in the process of publication three descriptive folders, one of thirty-six pages for the lines and connections of the Boston & Northern system, one of twenty-four pages for the lines and connections of the Old Colony system, and one embodying brief facts concerning the parks, groves, seashore resorts and other places of outdoor recreation along the lines and connections of both companies. The folders will have striking cover designs, will be illustrated and artistically arranged on a fine quality of paper, so that they will be of value as souvenirs, as well as for the interesting and helpful matter that they will contain.

LONDON LETTER

(From Our Own Correspondent.)

The report of the National Electric Construction Company, Ltd., which is closely associated with the Dolter Electric Traction, Ltd., is interesting because it shows that a good deal of surface contact work is at present being carried out in England—a fact which is well enough known, but is interesting when seen in the annual report of a company. It appears that the equipment of the tramways between Rotherham and Mexborough and the tramways at Torquay are both making excellent progress. Both of these installations are being equipped on the Dolter system. Within the last few weeks, also, the Dolter Electric Traction, Ltd., has received a contract for laying the surface contact system on the Front at Hastings, but this contract is unfortunately subject to the consent of the Hastings Council, which is extremely slow to move in the matter.

The scheme for linking up the Bournemouth and Poole district with Canford Cliffs and the Havens and connecting Studland and Swanage more closely with the district of Bournemouth, has had to be abandoned on account of the opposition to the necessary conveyor bridge over the Channel which divides the North and South Havens. No one disputes the fact that electric tramways in this direction would be a great benefit to everyone in the vicinity, and would have opened up a beautiful country for pleasure purposes as well as giving facilities to the residents in the country portions for reaching the town of Bournemouth. The town of Poole is, after all, a harbor, and the custodians of that harbor naturally object to anything that can possibly interfere with the free coming and going of ships. The Light Railway Commissioners have therefore rejected the scheme for the present.

The electrification of the tramways in the city of Birmingham is rapidly proceeding, as some of the old steam routes will at an early date become the property of the Corporation. The new tramways are also well in hand, and the contractors who are at present engaged in the work are pushing forward as rapidly as possible. Many new contracts have recently been let, so that by the end of 1906 most of the work of conversion and most of the new work will be completed. It is expected that on Jan. 1 next the remaining steam cars in the city of Birmingham will be replaced by electric cars all over the city. The tramways committee expects to make the change during the night of the last day of 1906, and the first day of 1907 should see something like 200 new electric cars in service.

The city of Leeds, under the able management of J. B. Hamilton, has made another record in the conduct of its tramway affairs. Not only has it taken in a larger amount and carried a larger number of passengers, but has been able to do this with a considerably reduced car mileage. During the past year the tramway cars have carried over 69,000,000 passengers and have run about 7,000,000 miles, the receipts amounting to about £309,000. This means an increase of £14,676 over the previous year's receipts, and an increase of about 9,000,000 in the number of passengers carried. It will thus be easy to pay over the £52,000 which has been promised for the relief of rates for the past year.

The new system of electric tramways for the Corporation of South Shields has just been put into operation. The work was commenced about June of last year, the contractors being Underwood Brothers for the permanent way and Dick, Kerr & Company for the overhead equipment. The overhead equipment consists chiefly of side bracket poles supporting grooved trolley wire. Forest City bonds have been used entirely on the track construction. The cars have all been built by Hurst, Nelson & Company, Ltd., with British Westinghouse equipments and Brill trucks. The electric current for the operation of the system is supplied from the Corporation's electricity works, where two 500-kw Dick-Kerr generators have been installed.

It seems likely that the tramway dispute in Manchester between the tramways committee and the tramway men will be settled without a strike. The chief cause of the trouble has been the application of the men for payment of time and a half for Sunday labor. A number of meetings and conferences have been held, and it would now appear that arbitration will settle the question, though it looked for a time as if it would be impossible to arrive at this conclusion. The Manchester tramways committee has had under consideration the election of a chairman in succession to Councillor D. Boyle, who recently resigned the position in consequence of having become managing director of a company which proposes to run a motor omnibus service in the Manchester suburbs beyond the electric tramways area. The committee's choice has fallen unanimously on Mr. Wainwright, who has been for many years deputy chairman, and Alderman Bowes has been elected deputy chairman. Mr. Wainwright has been a member of the City Council for nearly sixteen years, and has been on the waterworks, tramways and finance committees, though most of his particular work has been devoted to the interests of the tramways.

Perhaps the most striking fact that would appear to a stranger visiting London at present, would be the number of motor omnibuses which are now plying in almost every thoroughfare. It is not much more than a year since really practical motor omnibuses began to ply in London thoroughfares, although for several years previous to that experimental motor omnibuses were in operation, chiefly for the purpose of getting statistics of operation. It would appear that the horse omnibus is doomed, a fact which will not be regretted by many, although it must be confessed that one's nerves will have to get more accustomed to the motor omnibuses before they are absolutely popular with everyone. There are perhaps plying in London now some four or five hundred motor omnibuses, and it is estimated that over a thousand more are on order for delivery as soon as they can be manufactured. The motor omnibuses are all doing good business in London, though whether they will eventually pay is a question open to some doubt, and it seems evident that they will not pay to the extremely large extent that was expected of them at first, as repairs and maintenance, especially of the rubber tires, have been heavier than was expected. Their popularity steadily increases, however, as they have the happy faculty of getting over the ground quickly, and can outdistance horse omnibuses so completely that there is almost no comparison. Even the tube railways will have to use all their endeavors to encourage traffic, as even they cannot accomplish a journey in many minutes less time than the motor omnibuses, when one takes into consideration the getting to and from a particular station and the necessary descent to and ascent from the platform.

The Hon. Arthur Stanley, M. P., has been made chairman of the Lancashire United Tramways, Ltd., and is devoting his energies to the completion of this extensive system of tramways stretching between Liverpool and Manchester. As will be remembered, this system has not been successful financially, but has been practically reorganized recently with fresh capital, and when the connecting links are completed it is hoped with new enterprise and new management to make a success. The lines at present commence at the boundary of Liverpool and pass by way of Prescot, St. Helens, Hindley and Atherton to Bolton. Another line connects by way of Boothstown, and from there a line via Worsley is being made to connect with the Salford Tramways, which in turn connect with the Manchester system. The Farnworth Urban District Council has, in the meantime, entered into an arrangement with the South Lancashire Tramways Company whereby its system of electric trams will be operated by the company, it forming one of the most important connecting links in the new system between Liverpool and Manchester. The work of making the actual connecting links is rapidly progressing, and it is hoped that in August the whole system will practically be completed.

The service of tramcars between St. Leonards and Bexhill has now been commenced, this line forming part of the Hastings Tramways. It will undoubtedly prove a popular line and form a new method of transportation between the two watering places. When a decision has been arrived at, however, for the electrification of Hastings Front, the system will undoubtedly be very much more effective, but so far no actual desicion has been arrived at by the Hastings Council, although the Hastings Tramways Company has made a definite contract to equip the Front with the Dolter surface contact system, as announced elsewhere in this letter.

The London County Council has not given up its pet proposal to secure powers from Parliament to run tramway cars over the Thames bridges, and this bill has now been read for a second time in the House of Commons without very much opposition. This, of course, does not mean that the field is won, but it is a considerable step in the right direction. Captain Hemphill, the new chairman of the highways committee, stated that the Royal Commission had advised a large increase in the direction of the tramway sections, and stated that there were only about 30 miles of electrified tramways in the County of London at present, and that as there were only 115 miles of tramway in the vicinity of London where there ought to be at least 300 miles, it was obvious that the work of electrification would have to be expedited. It is interesting to note that the tramways north of the Thames leased to the Metropolitan Tramways Company for the past few years, have now been retransferred to the London County Council, under the terms of the new arrangement whereby the agreement is terminated now instead of four years hence. There will be as little change as possible in the traffic organization, but the work of electrification will be commenced immediately, the first stage of about 22 miles of single track having already been put in hand. It is expected that the electrification of the whole of this northern system of tramways will involve an expenditure of about £5,000,000, but the Council is entering upon the work without the slightest hesitation, believing that the increased traffic will make this expenditure a good paying proposition. The lines affected are about 50 street miles in length. The London County Council is to be congratulated in its action about the tramways. It had to pay £80,000 for good will on the business for four years, but as the system was getting to be absolutely intolerable under the old slow horse-car condition, something drastic had to be accomplished. The County Council is also endeavoring to get permission to construct a new tramway, which will, of course, be electric, from Cricklewood through Edgware Road to the Marble Arch, as has been frequently stated in these columns. Much opposition has been encountered, but the standing orders committee of the House of Lords has now allowed the bill to proceed. It is also interesting to note that the immense generating station which the London County Council has been building at Greenwich for the past two years is now rapidly approaching completion, and it is expected that early in May it will be ready for furnishing power for London County Council purposes. When the station is completed, it will be a huge one, containing about 40,000 hp, although at present only a portion of the power will be available. It is situated at Greenwich, opposite the Isle of Dogs, and extensive pier accommodations have been provided, so as to allow the discharge of coal. Cranes have been installed to discharge 20,000 tons of coal in a day. The engines are by Musgrave, of Bolton, while the Electric Construction Company, of London and Wolverhampton, has furnished the generators. The boiler house is equipped with Stirling boilers.

Again the most interesting question is that of furnishing electric power in bulk to London. It will be remembered that last year a most comprehensive bill, called the Administrative and County bill, was put forward by a party of Newcastle financiers, of which C. H. Merz was the electrical engineer, but which failed to get through before Parliament rose. The London County Council has awakened this session, on account of the fact that this administrative and county bill very nearly passed, and has this year promoted a very similar bill in Parliament for the furnishing of electrical power to the whole county of London. The recent change in the government has undoubtedly helped it, and there seems little doubt but that this bill will actually go through unless stopped in the House of Lords. It has already passed the second reading in the House of Commons, whereas the administrative and county bill and the additional Electric Power Supply Company's bill (St. Neot's scheme) have not gone so far as their promoters would have liked. During the discussions these two bills, however, have been given a *locus standi* before a hybrid committee, so that they will be discussed incidentally along with the London County Council bill. There will be other bills considered by the same committee, so that practically the whole subject of furnishing electric power in bulk to London will be discussed. The discussion on the second reading was an interesting one. McKinnon Wood stated that the London County Council was not anxious to kill private enterprise, but it did want to oppose private monopoly; that he considered the bills in Parliament at present were just as strongly opposed by the already existing private companies as by the London County Council. It was simply a question to be decided as to whether the necessary supply of electricity in bulk at a low rate should be entrusted to the central municipal authority rather than to private enterprise. He claimed that the bill was not a new one, but that for certain reasons it had not been brought forward in such a strong way as it was presented now. He fully thought that the existing electrical enterprises would be protected in any scheme which the London County Council would promote. The Council was in a particularly good position to furnish current in bulk, as it would shortly by using 37,000,000 of units for tramway supply, and its existing station at Greenwich would soon be in a position to turn this out. If private enterprises were to secure a valuable monopoly of this kind, in some future year such monopoly would have to be purchased in the same way as £50,000,000 had to be paid to the water companies, and examples had already been made in the electric lighting business when Marylebone had to buy out a company for the sum of £1,200,000. Lloyd George, president of the Board of Trade, also made some interesting remarks, chiefly reassuring in character, and stated that all power bills would receive careful consideration in the hybrid committee. He insisted, however, that the government did not accept the view that municipalities were not capable of managing electrical enterprises, and considered that most of the borough Councils who were furnishing electric current in London at present were doing so profitably.

The eleventh annual convention of the Incorporated Municipal Electrical Association, of which J. E. Edgcome, of Kingston-on-Thames, is president, this year will take place during the week commencing June 18, in London. There will be papers on the commercial development of electricity undertakings, boiler-house plant, steam turbines, depreciation of machinery and other interesting subjects, though the titles of the papers of the contributors have not yet been communicated.

At the last smoking concert of the season of the Electro-Harmonic Society, held at the Holborn Restaurant, an interesting presentation took place, when two massive silver bowls were presented to Messrs. Alabaster and Gatehouse, and a handsome silver inkstand to Mr. Izard, as an acknowledgment of the services which these gentlemen had rendered to the society, and to mark the end of the twentieth session. The presentation was made by Colonel Crompton, who read a letter from Sir William Preece, regretting that he could not be with his friends that evening on account of doctor's orders. Colonel Crompton alluded in a happy manner to the great success which had followed this social gathering for so many years, and for the excellent work which Messrs. Alabaster, Gatehouse and Izard had done for the society. Each of the recipients replied, Mr. Alabaster giving a brief sketch about the formation of the society, and Mr. Gatehouse stating that he had commenced his musical career at the age of sixteen, and that although he had played at over a thousand concerts in a purely amateur way, this was the first acknowledgment of his services that he had ever received. The concert was then resumed and a pleasant evening was spent, terminating a successful session. A. C. S.

AFFAIRS IN CHICAGO

Mayor Dunne has suggested plans for improving the transportation service and rehabilitating the traction system that may bring about harmonious action between his followers in the City Council and the Aldermen who have opposed municipal ownership. The suggestions were made in a letter to Chairman Werno, of the local transportation committee, and are supposed to embody the ideas of Special Counsel Fisher as well as the Mayor. The Mayor admitted that immediate municipal ownership is impossible until the legality of the Mueller law and the ordinance providing for the issue of $75,000,000 of street railway certificates have been tested. While this is being done he proposed that steps be taken to improve the service, consolidate the traction systems, and rehabilitate their properties.

The Mayor's suggestions to Chairman Werno contain the following propositions:

That the traction companies shall agree upon a price for their properties at once.

That the city shall agree to pay the price agreed upon and pay back all the money put into improvements, with a fair return on the investment, when it takes over the properties.

That the companies shall be given indeterminate licenses to operate their cars, terminable on reasonable notice whenever the city desires to purchase, this right to be exercised at any time.

That the companies shall consolidate all their systems into one, if possible, and the consolidated company deal with the city.

That a definite term bond may be allowed to be issued if the companies find it impossible to borrow money for rehabilitation under an indeterminate license.

That if the companies refuse to agree to the terms proposed, then arrangements shall be made with some other company to operate cars on the streets to which the city is entitled to possession by reason of expired franchises.

That immediate steps be taken to test the validity of the Mueller law and of the ordinance authorizing the issue of $75,000,000 of street railway certificates.

The South Side street car men have ratified an agreement with the Chicago City Railway whereby an increase of 1 cent an hour for all men who have been in service for a year is secured. This means 25 cents an hour instead of 24 cents, and will affect between 2000 and 2500 men. In return for this concession by the company the men have waived a demand for a 10 per cent increase for car house employees. Working conditions are to remain the same as those of last year.

No attempt will be made before July 1 by the United States Government to enforce the law providing a fine of $10,000 a month for failure to lower the tunnel structure to 22 feet below the water level. This is the gist of the decision announced by Secretary Taft. The Secretary's conclusion is based on the desire of the War Department to give Chicago sufficient time to arrange for future use of the tunnels by the street railway companies, after the decision of the United States Supreme Court on the petition for rehearing in the ninety-nine-year franchise case shall be known. It is assumed by the Secretary that this decision will be given by June 1, so that a month after that date will be available for beginning the actual lowering of the tunnels or for making new arrangements with the street railway companies. A virtual promise further to extend the time for completing the work, if a beginning is made by July 1, is contained in the Secretary's statement.

Reasons for asking a rehearing of the Chicago ninety-nine-year franchise case were presented to the United States Supreme Court Thursday, April 26, in petitions by the Chicago Union Traction Company and the Chicago City Railway Company. Oral arguments are not allowed before the court on such motions, and the hope of the petitioners therefore rests in their written statements. The Union Traction Company outlines eleven reasons why the rehearing should be granted. The Chicago City Railway Company filed a separate petition for rehearing through its attorney, John P. Wilson, of Chicago. This petition contains seven chief points in support of its argument for a rehearing.

THE MEXICO SALE

F. S. Pearson, of New York, has been electe president of the Mexican Tramways Company, and is the heau of the syndicate referred to in the STREET RAILWAY JOURNAL of April 14, as having purchased the street railway system of Mexico City from the former owners, Wehrner, Beit & Company. Those associated with Mr. Pearson in this purchase are a number of English, French and American bankers who differ from the principal holders of the Mexican Light & Power Company, the owners of the Necaxa power plant, although some of the same European interests are represented in both companies.

The sale is said to have been effected for $11,250,000 gold, but the actual cash paid for the property is $6,250,000 gold, the purchasers assuming the payment of about $2,000,000 gold, of debentures, as well as the mortage bonds of $6,000,000 Mexican money, of the company that preceded the present one. Mr. Pearson was to leave for Mexico City, May 5.

It has not been stated when the new company will take actual charge of the street railway property, but it is believed that the payments will be soon be made, and that the transfer may take place within the next couple of months.

At the time W. W. Wheatley, president and general manager of the Tramway Company, was in New York last year, a statement was published from him giving in outline the plans of the company for securing power from the Mexico Light & Power Company, and reviewing briefly the situation in Mexico City at that time. Dec. 2 was the date of publication of the issue in which this interview was contained.

THE SPOKANE-PEND D'OREILLE COMPANY ARRANGING TO BUILD

The Spokane-Pend d'Oreille Rapid Transit Company, of Spokane, Wash., is rapidly arranging the preliminaries preparatory to constructing its proposed line. Surveys have been completed, right of way secured and terminals bought at a cost of $90,000.

The line, which will be operated by the single-phase system, will run for 30 miles through the center of the irrigated valley of the Spokane River, which is largely sub-divided into 5 and 10-acre tracts, and will pass through the irrigated districts and towns of Opportunity, Greenacres, Otis Orchards, Sucker Lake and East Greenacres. At Moab it will secure the large business of the Newman and Sucker Lake districts. At Rathdrum the business of Fish and Spirit Lakes and the Spirit Valley will be secured. The eastern 15 miles of the road will run through a fine tract of cedar, larch, fir and pine timber, as yet almost untouched. Between Spokane and this point the road will connect with the Oregon Railway & Navigation Company of the Union Pacific system, the Spokane International branch of the Canadian Pacific Railroad system and the Coeur d'Alene branch of the Northern Pacific system, thus giving three transcontinental connections for the large timber areas around Lake Pend d'Oreille. At the terminus is the large lime, cooperage and saw-mill plants of the Washington Brick, Lime & Manufacturing Company, with a capacity of 500 barrels of lime per day. Around the lake are a number of promising mining districts of silver, copper and gold, among them "Lakeview," "Granite Creek" and "Blacktail." Sandpoint, Hope, Ellisport, Clarks Fork and Idlewild, a beautiful summer resort, are all near the lake. As to power, the company has arranged to purchase 1000 hp from the Washington Water Power Company, to be taken from its new power station at Post Falls, Idaho, and at Rathdrum, the county seat of Kootenai County, about midway of the Rapid Transit Company's line. The officers of the company are: C. H. Reeves, president; J. J. Browne, first vice-president; D. K. McDonald, second vice-president; J. Grier Long, treasurer; R. A. Hutchinson, general manager; Mark F. Mendenhall, secretary; Jas. C. Cunningham, W. S. McCrea, Harry A. Rhodes, trustees.

ANOTHER RULING BY MASSACHUSETTS COMMISSION JUSTIFYING INCREASE OF FARE ON INTERURBANS

In an order issued by the Railroad Commissioners of Massachusetts last week, by which the petition of Melrose against an increase of fares on the Boston & Northern Street Railway is disposed of, the Commission clearly sets forth the fact that interurban street railways cannot be maintained on a fare that yields less than 1 cent per mile, and adds that the rate of 5 cents, between Melrose and Boston, a distance of about 9 miles, is lower than that charged by any interurban line in the country, taking the service into consideration. The full text of the Commission's order, summarizing briefly the whole situation, follows:

Several months ago the Boston & Northern Street Railway Company increased the cash fare between Melrose Highlands and Boston from 5 to 10 cents, at the same time placing on sale at certain places 10-trip tickets at 75 cents.

The question is whether the increased fare is excessive.

An examination of the figures presented and of the returns of this and of other companies and an investigation of street railway conditions without as well as within this commonwealth conclusively shows that no company can carry passengers 9 miles for 5 cents over an interurban railway constructed, maintained and operated like this, and at the same time out of earnings pay anything in the way of a fair return upon investment.

In populous centers where a large and frequently changing patronage fills and refills the same car, low fares yield a profit that cannot be realized upon railways which for the most part carry passengers long distances through smaller communities.

The average cost of transporting passengers upon the ordinary interurban railway, with its long-distance riding, is necessarily greater than upon the city railway with its heavy traffic for short distances. When, as in some instances, a railway is both urban and interurban in character, it is the great volume of constantly changing traffic within the city limits which makes possible the 5-cent fare upon the long-distance lines.

Again, in comparing railways, whether urban or interurban, in different sections of the country, the expense of roadbed and equipment, rate of wages, cost of heating and climatic conditions all have an important bearing upon fares. In Massachusetts the required standard of roadbed and equipment is expensive and costs of operation are high.

The fare between Melrose Highlands and Boston was formerly 10 cents, but some years ago was reduced to 5 cents in the expectation that the cities of Chelsea, Everett, Malden and Melrose would furnish in the riding for short distances a patronage similar to that of a large municipality. The company now faces the fact that this expectation has not been realized.

In our belief there is nowhere to be found an instance where a service like that upon this railway between the points named is being successfully performed under like conditions for a 5-cent fare. Upon interurban railways in the West, where fares are almost wholly governed by mileage, the average rate is higher than upon our railways, the common rate being not less than 1¼ cents a mile, often 1½ cents a mile.

We know of no ground upon which we could declare that the fares under consideration between Melrose and Boston are excessive or unreasonable. Any such finding would be against the evidence and indefensible.

This is not the case of an experiment with a fare upon the promise of which a location has been granted and which presents the question as to how long an experiment with it should be continued. The original increase proposed by the company was from 5 to 10 cents. Upon the suggestion of the board in a former order the 10-trip ticket at the rate of 7½ cents a trip was introduced.

In our opinion, however, these tickets have not been brought within the convenient reach of patrons. To place them on sale at a few fixed points is not enough. The only way in which the tickets can be always available is apparently through placing them in the hands of conductors for sale upon the cars, and we recommend that this course be taken.

HALF BILLION FOR NEW SUBWAYS IN NEW YORK

Important facts concerning the cost of construction, equipment and operation of New York City's future subways were brought out last week in the testimony of George S. Rice, chief engineer of the Rapid Transit Commission, at a hearing before a special commission recently appointed by the Supreme Court to determine whether or not certain projected lines are needed, and if the city has available funds for building and equipping these lines.

Particular attention was given to the Third Avenue subway, and other projected lines were taken up after Mr. Rice had given all the figures asked for concerning Third Avenue. Mr. Rice stated that the cost of building and equipping the Third Avenue subway would be $39,000,000, the construction costing $26,000,000 and the equipment $13,000,000. It was estimated, he said, that the line would carry 600,000 passengers daily, and that if operated by the city the cost would be 60 per cent of the gross receipts, based upon 600,000 passengers daily. That would amount to about $11,000,000 a year. If operated by a private corporation the cost would be only 50 per cent of the gross receipts. He said the present subway was being run on that basis, and it was practically certain that municipal operation would cost more than private operation.

As to the total cost of construction and equipment of the nineteen subway routes now approved by the Rapid Transit Commission, Mr. Rice said it would be $450,000,000, construction costing $300,000,000 and equipment $150,000,000. Equipment, he said, would cost slightly less than $1,000,000 a mile. He gave the following estimates of the cost and equipment of the several principal projected lines: Third Avenue, $39,000,000; Seventh and Eighth Avenues, $40,000,000; Lexington Avenue, $44,000,000; First Avenue, $28,000,000.

Mr. Boardman, speaking for the Rapid Transit Commission, said: What this city needs is a comprehensive scheme of transit, another route on the East and West Sides, a connecting line between the two, and a route to Brooklyn that will utilize the two bridges. It would be nonsense for the city to undertake anything but a comprehensive scheme of improvement.

SUMMER SCHOOL FOR ARTISANS AT THE UNIVERSITY OF WISCONSIN

The sixth annual session of the Summer School for Artisans, held under the direction of the College of Engineering of the University of Wisconsin, begins June 25, and continues for a period of six weeks. Courses of study are offered in the following subjects:

1. Engines and Boilers.—Lectures and laboratory courses covering the theory, construction, management and testing of steam engines, boilers, gas engines and gas producers, refrigerating machines, etc.

2. Applied Electricity.—Lectures and laboratory courses covering the theory of direct and alternating-current dynamos and motors, the operation and method of testing electrical machinery, batteries, transformers and other apparatus, photometry and calibration of instruments.

3. Mechanical Drawing and Machine Design.—Elements of applied mathematics, courses in mechanical drawing and machine design adapted to the preparation of the students.

4. Materials of Construction, Fuels and Lubricants.—Lectures on the properties of materials accompanied by laboratory tests; lectures on fuels and lubricants with laboratory tests on the heating value of coals and efficiency of lubricants.

5. Shop Work.—Practice with hand tools, wood and metal working machinery, and in blacksmithing and pattern making.

6. Manual Training.—Lectures and laboratory courses adapted to the requirements of manual training teachers.

The instructional force is taken from the regular faculty of the College of Engineering, and the entire laboratory and shop equipment belonging to the college is used by the students in the summer school. The requirements for admission do not extend beyond a working knowledge of English and arithmetic, but the policy is to allow a large amount of individual work, so that the student may take advantage of all the preparation he has obtained. The school offers to those unable to take a regular four years course an opportunity of obtaining a working knowledge of the methods of testing and in the use of instruments, together with such theoretical principles in each case as the nature of the subject and the preparation of the student may permit. Correspondence students have found the school of value in giving an opportunity for laboratory practice along the lines in which they have had theoretical instruction. A bulletin describing the work of the School for Artisans in detail will be sent on application to Frederick E. Turneaure, dean, College of Engineering, Madison, Wis.

NEW YORK ALDERMEN CAN NOT GIVE FRANCHISES

The Court of Appeals has sustained the act of the last Legislature taking from the Board of Aldermen of New York City the power to grant public franchises and reposing it in the Board of Estimate and Apportionment. The bill passed on by the court was enacted because the Aldermen would do nothing with the application of the New York Connecting Railroad for a franchise. This company is dominated by the Pennsylvania Railroad, which laid out a route over a private right of way for a railroad from the Bushwick section in Brooklyn across Queens to Ward's and Randall's Islands, and thence over a bridge to a junction with the New Haven road at Mott Haven. The franchise application came before the Rapid Transit Commission, and is still there, as the Mayor thinks that the proposed terms are not fair to the city. One objection to the road's franchise is that it involves the building of an embankment for a long distance crossing city streets, and that in the course of time the city may have to remove the tracks. As soon as the Legislature passed the law last spring companies desiring franchises made haste to get their applications before the Board of Estimate and Apportionment. The merits of these applications were duly considered by the board, and then referred to committee pending the final disposition of the suit brought by the Aldermen to test the constitutionality of the act. Some of these franchises are as follows:

Southern Boulevard Railway Company, four extensions.

New York City Interborough Company (Belmont), thirteen extensions and five alterations in routes.

New York & Portchester Railway Company.

Nineteen routes laid down by the Rapid Transit Commission.

New York Connecting Railroad Company.

Union Railway Company, twenty-two routes in the Bronx.

Nassau Railway Company in Brooklyn.

SALE OF PORTLAND (ORE.) RAILWAY SYSTEM

The statement is confirmed that E. W. Clark & Company, of Philadelphia; J. W. Seligman & Company, of New York, and the Portland General Electric Company, have purchased, in the interest of the Portland Railway Company and the Portland General Electric Company, the controlling interest of the Oregon Water Power & Railway Company.

The Oregon Water Power & Railway Company has in operation about 72 miles of railway, consisting of a line running from First and Couch to Canemah, above Oregon City, about 18 miles; a line running from East Oak and East Water Streets along the river front to Sellwood, and thence through Powell's Valley to the power plant at Cazadero on the Clackamas River, about 40 miles; a line running from Second and Madison Streets to the Mt. Tabor reservoir, about 6 miles; and a line running from the city to Lents Junction, about 8 miles. An extension to Fairview and Troutdale and the Columbia River, of about 10 miles, is under construction.

The Portland Railway Company owns and is operating about 118 miles of road, and with the 72 miles of constructed lines and the 10 miles of the Troutdale extension of the Oregon Water Power & Railway Company operated in connection with them, will make a system of nearly 200 miles of railway.

It can be stated authoritatively that a number of important suburban extensions are already contemplated, and that the entire electrical output, which is estimated at 50,000 hp, will be under the direct control of the Portland General Electric Company. The water power properties, electric plants, sub-stations, transmission lines, etc., of the Oregon Water Power & Railway Company will be operated in connection with the electric generating and distributing systems of the Portland General Electric Company. The completion of the power plant on the Clackamas River, at Cazadero, will be pushed as rapidly as possible. It is expected that by Sept. 1 of this year 15,000 hp will be delivered in Portland from the Clackamas plant.

The Portland General Electric Company is now furnishing all of the electric current for the operation of all lines of the Portland Railway Company, and will hereafter supply such additional power as may be necessary to operate the present lines of the Oregon Water Power & Railway Company and all extensions of the same.

THE 1906 CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION

Announcement is made by Elmer M. White, secretary, that the tenth regular annual convention of the American Street and Interurban Railway Accountants' Association will be held in the city of Columbus, Ohio, during the week beginning Oct. 15, 1906. At this early date, of course, only the bare outlines of the programme can be given.

As the "Question Box" has been of much help to many of the members during the past two years, it will be continued, and a special blank for questions is being sent to all of the members.

There will be a paper read treating the use of curves or the graphic method of showing results, by C. F. Bryant, auditor of the Connecticut Railway & Lighting Company, Bridgeport, Conn. Another paper will consider the routine of construction accounts, by S. P. Young, comptroller of the Public Service Corporation of New Jersey, Newark. The supject of depreciation and appreciation as applied to electric railways will be led by Robert N. Wallis, treasurer of the Fitchburg & LeominsterStreet Railway Company, Fitchburg, Mass. This subject has been ready for discussion for many years, and it is planned to make this effort the most comprehensive possible along certain lines. The meeting at which this question is to be considered will be open only to those representatives of members presenting proper credentials.

HOLDING COMPANY FOR NEWMAN PROPERTIES IN THE SOUTH

It is reported in financial circles that it is proposed to form a holding company with $20,000,000 common stock and same amount preferred to take over the street railway and light properties controlled by Isadore Newman & Son, of New Orleans and New York, embracing systems in Memphis, Nashville, Birmingham, Knoxville, Little Rock and Houston. The stock issues of the properties amount to $8,745,000 common and $13,000,000 preferred. A schedule is submitted to the stockholders giving a basis of exchange.

MAYOR McCLELLAN ACCEPTS ELSBERG BILL

Mayor McClellan, of New York, announced last Thursday that he had signed the Elsberg Rapid Transit bill, and had returned it to Albany, with a memorandum of his approval. The bill now goes to Governor Higgins for final action. In his memorandum of approval the Mayor said:

"By the enactment of this bill many radical changes will be made in the existing rapid transit law. As the bill now stands, there is but one clause to which any serious objection has been offered. This relates to the section limiting the length of future leases to twenty years with the privilege of one renewal for twenty years in addition. It has been urged that such a term is too short to prove attractive to responsible bidders, and that the investment of private capital in an enterprise of this kind under such conditions would be impossible. I fail to see, however, any substantial reason for believing that this limitation will have such an effect.

"It cannot be said that a forty years' lease of an underground road in the city of New York would prove wholly uninviting to private capital. I say forty years' lease advisedly, for I regard a twenty years' lease, with the privilege of a renewal of twenty years thereafter, as amounting to nothing more than a naked lease for twenty years. If it should prove that private capital will not be offered under these conditions, and that the city by itself cannot construct and equip these new roads, it will be perfectly feasible to apply to the next Legislature for a satisfactory amendment to this law."

The New York State Board of Railroad Commissioners has removed its New York offices from Whitehall Building, 17 Battery Place, to rooms 5094-7 Metropolitan Life Insurance Building, 1 Madison Avenue. The offices will be open during business hours each day.

LOUISVILLE SYNDICATE BUYS JACKSON PROPERTY

A Louisville syndicate, composed of Attilla Cox, John L. Helm, George Gaulbert, J. W. Gaulbert, William Jarvis, Henning Chambers, Oscar Fenley, C. E. Claggett, Harry Weissinger and S. S. Bush, have purchased the electric railway and lighting properties at Jackson, Tenn., a rapidly growing town of 23,000. The new company, which will be called the Jackson Electric Company, will at once add 7 miles of track to the 3½ miles acquired, and abandon the present power plant and rebuild on up-to-date lines at a new location. Particular attention will be given to lighting and power. A suburban line will be built to Bemis, 3 miles distant, which is a model manufacturing town patterned after Pullman. S. S. Bush, who built and is general manager of the Pascagoula Street Railway & Power Company, of Scranton, Miss., is also general manager of the Jackson Electric Company, and will build and manage it, with his general offices for both companies at Louisville, Ky. The same syndicate owns both properties.

PEEKSKILL SYSTEM SOLD

The Peekskill Lighting & Railroad Company, capitalized at $1,400,000, which furnishes gas and electricity to Peekskill and the adjacent territory and operates 10 miles of electric railway, has been acquired by the interests controlled by F. A. Stratton, of Mount Vernon, and it is rumored that it will be merged into the Northern Westchester Lighting Company, of which Mr. Stratton is president, and which is capitalized for $2,00,000.

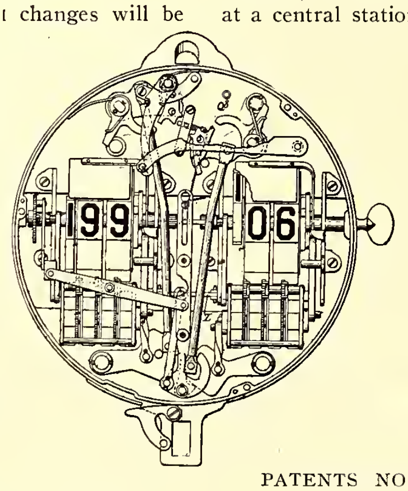
After closing a deal a new board of directors were elected, with Mr. Stratton as president, and they took immediate steps to contract for a new plant and several other improvements and additional machinery. The Peekskill electric railway system will be extended to Ossining, for a connection with the proposed lines of the Hudson River & Eastern Traction Company. This will give the people of Peekskill an almost direct connection with the county seat at White Plains and the eastern side of Westchester County.

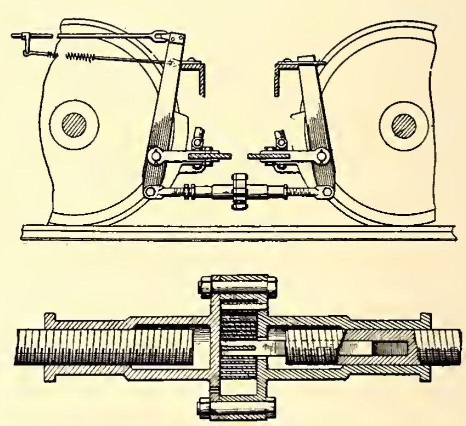
STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED APRIL 24, 1906

818,495. System of Operating Railroad Switches; Aldred K. Warren, New York, N. Y. App. filed June 24, 1905. Apparatus at a central station for operating track switches, consisting of a plurality of keys which directly work the switch levers in an oil bath. At the same time certain magnets move switches on miniature tracks in front of the operator so as to show the condition of the actual track.





PATENTS NOS. 818,508 AND 818,639

818,508. Fare Register; Arthur H. Woodward, Chicago, Ill. App. filed Sept. 27, 1901. Details of a fare register for recording both cash fares and transfers.

818,509. Hundred Indicator; Arthur H. Woodward, Chicago, Ill. App. filed Oct. 10, 1903. See patent 818,508.

818,515. Electric Signal System; Victor W. Bergenthal, Chicago, Ill. App. filed July 21, 1904. A block system in which lamps are cut in by the engagement of the trolley wheel with suitable contacts adjacent the trolley wire.

818,561. Switch; Edward P. Robbins, Mansfield, Ohio. App. filed Oct. 20, 1905. A pair of contact-shoes arranged one on each side of the trolley wheel, and adapted to be engaged by contacts adjacent the trolley wire in circuit with a pair of solenoid coils which move an armature directly connected to the switch point. At the same time signal lights are displayed to indicate the position of the switch point.

818,631. Trolley Wire Support; James H. Lane and Uriah Culnick, Newark, N. J. App. filed May 4, 1905. Comprises a member having horizontally projecting flanges and arms depending from the central portion thereof and adapted to be bent inward to embrace the usual trolley wire.

818,639. Brake; William G. Price, Kingston, N. Y. App. filed Dec. 23, 1903. Means for reducing the amount of movement necessary for applying the brake-shoes to the wheels, consisting of a turnbuckle and spring for actuating the same.

818,640. Car Truck; William G. Price, Pittsburg, Pa. App. filed Nov. 12, 1904. A movably mounted bolster having transoms arranged at the sides thereof, and spring arms interposed between the transoms and bolster for frictionally resisting movement of the bolster.

818,641. Slack Adjuster; William G. Price, Pittsburg, Pa. App. filed Feb. 11, 1905. Means for automatically taking up slack produced by the wear of brake-shoes, comprising a movably-mounted rod, a casing inclosing the same, and means for supplying balls between the rod and the end of the casing.

818,744. Signal Apparatus; Clarence W. Coleman, Westfield, N. J. App. filed Feb. 6, 1906. Mechanism for operating a three-position semaphore arm consisting of an electric motor and gear connections therefrom to the main rod of the semaphore arm. A special lever and switch arrangement is used so as to insure the required movement of the semaphore arm under different conditions.

818,773. Switch-Throwing Device; John H. Mayer, New Kensington, Pa. App. filed Dec. 21, 1905. The movements of the switch point is accomplished by levers on the car, which engage tappets in the roadbed, which are mechanically connected to the switch point. The movement of the switch closed different lamp circuits.

818,795. Railway Signaling Device; Charles H. Smith, Lebanon, Pa. App. filed March 30, 1905. A signal system for single-track trolley roads, consisting of a semaphore and switch-box at each turn-out, with a lever which is moved by the car contactor into one of two extreme positions. At each turn-out there is a solenoid magnet with two armatures, which establish certain lamp circuits according to the position of the operating arms.

818,797. Fender; John Stawartz, Homestead, Pa. App. filed Aug. 16, 1905. Comprises a pair of cushioned jaws which close over and retain any object encountered by the fender.

818,824. Device for Actuating Switches; Anderson Fuller, Amsterdam, N. Y. App. filed Jan. 30, 1906. A depending treadle on the car engages a lever in the roadbed which is mechanically connected to the switch point.

818,855. Railway Signal System; Alfred L. Ruthven, Topeka, Kan. App. filed Sept. 1, 1905. Designed to notify the engineer or motorman of the presence of another car or train on the same track, and whether the train is moving in the same or in the opposite direction. Special trolley circuits are provided which include alarm devices in each train, and circuits along the roadbed are also operative to indicate the direction of the respective trains.

818,873. Guard Rail for Street Cars; Edward P. Danbridge, Philadelphia, Pa. App. filed Dec. 7, 1905. The guard rail is suspended in vertical slots by cables adapted to be wound and unwound on a drum to raise and lower the guard rail.

818,900. Car Wheel; Aaron Mast, Annapolis, Mo. App. filed Jan. 5, 1906. The tread of the wheel is wound with wire.

818,935. Combination Strap Hanger; Samuel S. Brooks, Brooklyn, N. Y. App. filed June 3, 1905. A combined strap hanger, signal bell and register ringer.

818,947. Shoe Contact; George H. Fretts, Springfield, Mass. App. filed May 13, 1905. An insulated shoe for trolley wires suitable for purposes of track switches and the like and consisting of metallic plates bolted to the trolley wire and holes beneath the bolts, so that the latter may drop to the ground in case they become loosened and not interfere with the passage of the trolley wheels.

819,012. Compound, Which Forms an Emulsion with Water to be Applied to the Surfaces of Roads or Other Places; Edward Hardcastle, Stockport, England. App. filed Jan. 2, 1906. Consists of coal-tar creosote and resinate of soda holding pitch or asphaltum in solution, which forms an emulsion with water, for the purpose of preventing the formation of dust and allaying it.

819,032. Fluid Pressure Brake; William P. A. Macfarlane, Chicago, Ill. App. filed Nov. 4, 1905. Reduction of auxiliary-reservoir pressure in the operation of restoring the train-pipe pressure for the purpose of releasing the brake is accomplished by venting some of the auxiliary-reservoir pressure into the train pipe, with the result that the train-pipe pressure is augmented and the main air-drum on the locomotive thereby assisted, and at the same time the degree of pressure necessary for the release of the brakes is reduced.

PERSONAL MENTION

MR. G. E. BENDER, who for a number of years has been assistant secretary of the Cleveland, Painesville & Eastern Railroad Company, with headquarters at Willoughby, Ohio, has resigned, and will be associated with the new banking and brokerage firm of Borton & Borton, with offices in Cleveland.

MR. RAY RONK has been appointed auditor of the Lake Erie, Bowling Green & Napoleon Traction Company. Mr. Ronk entered business as a bookkeeper with the Detroit & Toledo Shore Line, and later became auditor of the Detroit, Monroe & Toledo Short Line, which was recently acquired by the Detroit United Railway.

MR. JOHN H. MILLER, general manager of the Springfield Railway Company, of Springfield, Ohio, has assumed charge, temporarily, of the People's Railway Company, of Dayton, which is without any operating head, due to the recent deaths of both General Manager Breen and Superintendent Kelley. Both of the properties mentioned are controlled by the American Railways Company, of Philadelphia.

MR. EDWARD BRILL has been elected treasurer and Mr. M. Herman Brill secretary of the J. G. Brill Company, to succeed Mr. James Rawle, whose election to the presidency of the company was announced in a recent issue of this paper. Mr. Edward P. Rawle has been elected assistant treasurer of the company. The following offices of the company are without change: Mr. John A. Brill, vice-president; Mr. Samuel M. Curwen, general manager, and Mr. William H. Heulings, Jr., assistant secretary.

MR. A. STAVENOW, chief traffic manager of the Grosser Berliner Strassenbahn and the Western & Southern Berlin Suburban Railway, has just arrived from Germany to make a study of traffic handling in the large American cities. He expects to visit Buffalo, Boston, Philadelphia and several other Eastern cities. He is particularly interested in the subjects of schedules, fare collection and accounting, car storage and employees' benefit associations. Mr. Stavenow has brought with him an ingenious street railway map of Berlin in relief, all of the lines being shown by layers whose thickness varies in accordance with the traffic density.

MR. R. W. BAILEY, of East St. Louis, has been appointed superintendent of properties for the new East Side Corporation, which has consolidated the East St. Louis & Suburban with the Alton, Granite & St. Louis lines, to succeed Mr. J. F. Porter, in charge of the Alton lines. Mr. Bailey has been given charge of the Alton electric lighting and gas system and the street railway, the interurban lines operated by the Alton, Granite & St. Louis and the Edwardsville, Alton & St. Louis Companies. He will have his office at Alton. Mr. Porter will complete the work of reorganizing the Alton Water-Works Company and then go elsewhere to look after the interests of J. G. White & Company.

MR. FRANK A. POLHAMUS, formerly superintendent of the New York & Long Island Traction Company, has been appointed assistant trainmaster of the Long Island Railroad, in charge of operations of the company's trolley lines, comprising the Ocean Electric Railway at Far Rockaway, Glen Cove Railroad at Glen Cove, Huntington Railroad at Huntington, Northport Traction Company at Northport, and the Nassau County Railway at Sea Cliff. Mr. Polhamus entered electric railroading some eight years ago as a conductor on the Lake Shore Electric Railway, at Cleveland, Ohio. After serving four years in that capacity he was appointed superintendent of transportation of the New York & Long Island Traction Company. This position he held three years, subsequently being appointed general superintendent of the same company. Mr. Polhamus will have his headquarters at Long Island City, in the offices of Mr. F. Hartenstien, superintendent of transportation.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Mar. '06	71,580	41,287	30,293	22,667	7,627
	1 " " '05	67,113	38,166	28,948	22,917	6,031
	3 " " '06	211,235	120,745	90,490	68,001	22,490
	3 " " '05	192,890	110,720	82,171	68,751	13,421
ALBANY, N. Y. United Traction Co	3 m., Mar. '06	415,431	250,317	165,114	86,581	78,533
	3 " " '05	402,737	234,813	167,924	86,241	81,683
	9 " " '06	1,314,156	847,755	466,401	259,744	206,657
	9 " " '05	1,292,987	756,715	536,272	259,558	276,714
AURORA, ILL. Elgin, Aurora & Southern Tr. Co	1 m., Feb. '06	37,062	21,513	15,549	8,989	6,560
	1 " " '05	31,390	20,825	10,566	9,133	1,432
	8 " " '06	344,803	186,248	158,555	74,162	84,394
	8 " " '05	305,387	173,889	131,498	74,306	57,192
BINGHAMTON, N. Y. Binghamton Ry. Co	1 m., Mar. '06	21,567	11,570	9,816	7,437	2,380
	1 " " '05	18,989	10,686	8,303	6,048	2,254
	9 " " '06	214,938	111,851	103,087	65,573	37,514
	9 " " '05	191,989	102,591	89,398	62,915	26,484
CHAMPAIGN, ILL. Illinois Traction Co	1 m., Mar. '06	215,751	*124,258	91,492	------	------
	1 " " '05	178,265	*98,047	80,218	------	------
	3 " " '06	658,567	*365,014	293,553	------	------
	3 " " '05	540,006	*295,392	244,614	------	------
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Feb. '06	38,549	25,733	12,816	------	------
	1 " " '05	23,099	18,898	4,201	------	------
	8 " " '06	443,259	237,059	206,200	------	------
	8 " " '05	316,899	175,224	141,674	------	------
Chicago & Milwaukee Elec. R. R. Co	1 m., Mar. '06	40,453	22,219	18,234	------	------
	1 " " '05	30,290	15,144	15,146	------	------
	3 " " '06	120,490	65,963	54,527	------	------
	3 " " 05	78,716	44,686	34,029	------	------
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co	1 m., Mar. '06	15,450	*9,869	5,581	6,843	†1,261
	1 " " '05	14,134	*9,135	4,999	6,679	†1,680
	3 " " '06	45,239	*27,585	17,653	20,200	†2,546
	3 " " '05	38,689	*27,843	10,846	20,016	†9,170
Cleveland & Southwestern Traction Co.	1 m., Mar. '06	42,321	27,311	15,010	------	------
	1 " " '05	37,219	24,635	12,585	------	------
	3 " " '06	128,606	81,841	46,765	------	------
	3 " " '05	102,385	70,335	32,050	------	------
Lake Shore Electric	1 m., Mar. '06	53,459	*30,321	23,138	20,404	2,733
	1 " " '05	56,973	*35,450	21,523	20,404	1,119
	3 " " '06	165,215	*100,691	64,524	61,212	3,311
	3 " " '05	145,850	*95,771	50,079	61,212	†11,133
DETROIT, MICH. Detroit United Ry	1 m., Mar. '06	427,521	*262,720	164,801	93,634	71,167
	1 " " '05	382,722	*236,178	146,544	90,285	56,259
	3 " " '06	1,224,686	*747,273	477,413	278,173	199,240
	3 " " '05	1,060,095	*676,453	383,642	276,693	106,949
DULUTH, MINN. Duluth St. Ry. Co	1 m., Feb. '06	50,348	29,722	20,626	17,450	3,176
	1 " " '05	43,451	25,334	18,116	16,711	1,405
	2 " " '06	104,772	63,444	41,328	34,986	6,342
	2 " " '05	91,044	53,243	37,801	33,441	4,361
FINDLAY, O. Toledo, Bowling Green & Southern Tr. Co	1 m., Mar. '06	26,083	*14,581	11,502	9,715	1,787
	3 " " '06	78,063	*44,648	33,415	29,896	3,519
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., Feb. '06	71,951	44,529	27,423	------	------
	1 " " '05	62,020	38,891	23,130	------	------
	2 " " '05	152,097	92,260	59,837	------	------
	2 " " '04	130,586	81,998	48,589	------	------
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., Feb. '06	49,566	35,124	14,441	9,942	4,499
	1 " " '05	36,423	25,571	10,852	8,482	2,371
	12 " " '06	683,605	410,457	273,148	120,425	152,723
	12 " " '05	572,279	331,452	240,827	109,679	131,148
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Feb. '06	12,676	13,676	1,001	3,824	†2,824
	1 " " '05	12,144	12,223	†79	3,402	†3,482
	12 " " '06	167,757	167,588	168	44,571	†44,402
	12 " " '05	201,735	137,478	64,257	40,988	23,270
HOUSTON, TEX. Houston Electric Co.	1 m., Feb. '06	39,269	27,811	11,458	7,729	3,729
	1 " " '05	30,918	20,204	10,715	8,496	2,218
	12 " " '06	534,170	329,146	205,025	104,522	100,503
	12 " " '05	368,769	315,969	52,800	98,317	†45,516
HUDSON, N. Y. Albany & Hudson R. R. Co	1 m., Mar. '06	21,181	*15,512	5,669	8,796	†3,127
	1 " " '05	20,381	*15,461	4,920	7,021	†2,101
	9 " " '06	257,641	*194,097	63,544	48,796	14,748
	9 " " '05	228,139	*175,287	52,852	47,021	5,831
MANILA, P. I. Manila Elec. R. R. & Lt. Co., Railway Dept	1 m., Mar. '06	42,500	22,500	20,000	------	------
	2 " " '06	82,750	42,000	40,750	------	------
	12 m., Dec. '05	347,317	165,235	182,182	------	------
Total, all depts	1 m., Mar. '06	72,500	38,648	33,852	------	------
	2 " " '06	143,100	73,493	69,607	------	------
	12 m., Dec., '05	724,649	369,979	354,670	195,109	159,561
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Mar. '06	277,476	140,030	137,446	89,017	48,429
	1 " " '05	254,131	131,285	122,847	74,101	48,745
	3 " " '06	812,834	405,948	406,886	259,328	147,558
	3 " " '05	746,614	389,890	356,724	219,644	137,079
Milwaukee Lt., Ht. & Tr. Co	1 m., Mar. '06	44,854	19,561	25,292	24,503	790
	1 " " '05	39,310	19,786	19,525	19,051	473
	3 " " '06	130,641	57,309	73,332	68,193	5,138
	3 " " '05	111,689	58,854	52,835	56,367	†3,532
MINNEAPOLIS, MINN. Twin City R. T. Co	1 m., Mar. '06	418,250	198,056	220,194	109,708	110,486
	1 " " '05	361,732	172,766	188,966	97,325	91,641
	3 " " '06	1,206,501	592,418	614,082	329,125	284,957
	3 " " '05	1,034,303	518,361	515,942	291,975	223,967
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Mar. '06	235,307	156,458	78,848	39,663	39,185
	1 " " '05	209,231	159,004	50,227	22,646	27,581
	6 " " '06	1,406,322	928,632	477,691	178,625	299,066
	6 " " '05	1,236,445	860,883	375,563	118,451	257,112
OAKLAND, CAL. Oakland Traction Consolidated	1 m., Feb. '06	118,997	62,938	56,059	35,678	20,380
	1 " " '05	100,354	56,576	43,778	30,818	12,960
	2 " " '06	240,620	131,462	109,158	71,357	37,800
	2 " " '05	205,027	118,097	86,930	61,303	25,628
San Francisco, Oakland & San Jose Ry. Co.	1 m., Feb. '06	48,084	19,828	28,256	17,746	10,510
	1 " " '05	41,170	15,429	25,741	13,009	12,732
	2 " " '06	96,393	42,629	53,764	34,243	19,521
	2 " " '05	81,551	31,834	49,717	25,587	24,130
OLEAN, N. Y. Olean St. Ry. Co	1 m., Feb. '06	8,173	3,971	4,202	2,726	1,476
	1 " " '05	6,616	3,908	2,708	2,693	14
	8 " " '06	85,900	42,641	43,259	21,302	21,957
	8 " " '05	75,782	37,417	38,364	21,206	17,158
PEEKSKILL, N. Y. Peekskill Lighting & R.R. Co	1 m., Feb. '06	9,133	*5,610	3,524	------	------
	1 " " '05	7,767	*5,323	2,444	------	------
	8 " " '06	87,905	*46,521	41,385	------	------
	8 " " '05	79,571	*45,511	34,060	------	------
PHILADELPHIA, PA. American Rys. Co	1 m., Mar. '06	195,856	------	------	------	------
	1 " " '05	176,801	------	------	------	------
	9 " " '06	1,423,047	------	------	------	------
	9 " " '05	1,252,342	------	------	------	------
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Mar. '06	707,482	*456,559	250,923	198,026	52,897
	1 " " '05	683,190	*458,164	225,026	199,129	25,897
	3 " " '06	2,043,485	*1282307	761,178	595,244	165,934
	3 " " '05	1,843,022	*1298702	544,320	598,472	†54,152
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Feb. '06	563,906	------	------	------	------
	1 " " '05	516,966	------	------	------	------
	2 " " '06	1,164,116	------	------	------	------
	2 " " '05	1,060,337	------	------	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Feb. '06	45,821	29,247	16,574	10,904	5,670
	1 " " '05	39,491	23,677	15,814	10,554	5,260
	12 " " '06	600,844	359,854	240,991	128,395	112,595
	12 " " '05	546,634	317,728	228,906	126,479	102,427
SEATTLE, WASH. Seattle Electric Co	1 m., Feb. '06	216,944	143,435	73,508	27,266	46,243
	1 " " '05	179,925	121,573	58,352	24,880	33,472
	12 " " '06	2,636,568	1,709,131	927,437	292,130	635,308
	12 " " '05	2,341,363	1,615,222	726,141	298,812	427,329
SYRACUSE, N. Y. Syracuse R. T. Co	1 m., Mar. '06	88,221	50,365	37,856	22,386	15,470
	1 " " '05	77,153	44,913	32,240	20,471	11,769
	3 " " '06	253,632	144,304	109,328	66,237	43,091
	3 " " '05	219,935	130,410	89,525	61,117	28,408
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Feb. '06	54,902	36,196	18,706	12,632	6,074
	1 " " '05	40,746	30,698	10,048	9,098	950
	12 " " '06	657,500	428,978	228,522	127,408	101,114
	12 " " '05	574,927	369,628	205,300	113,002	92,297
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Feb. '06	142,811	*75,165	67,646	42,304	25,342
	1 " " '05	133,405	*69,231	64,174	42,819	21,355
	2 " " '06	301,865	*158,313	143,552	84,594	58,958
	2 " " '05	284,349	*145,321	139,028	85,520	53,508
UTICA, N. Y. Utica & Mohawk Valley Ry. Co	3 m., Mar. '06	199,844	123,901	75,943	44,964	30,979
	3 " " '05	173,625	126,775	46,850	44,104	2,746
	9 " " 06	662,772	378,651	284,121	134,728	149,393
	9 " " '05	588,040	392,007	196,033	132,983	63,050

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, MAY 12, 1906. No. 19.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....................$3.00 per annum
Single copies ....10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS.

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 155,300 copies, an average of 8174 copies per week.

Ventilation in Moderate Weather

We have had a good deal to say about car ventilation, and the importance of looking after windows and ventilators as a regular part of the operation of a road, but the conditions on many roads are so open to improvement in this matter that we cannot refrain from again entering an emphatic protest against the carelessness in car ventilation which so frequently exists, and which cannot but have an influence on the traffic in these days of moderate weather between winter and summer. While it is still cool enough so that walking is pleasant, yet is not so cold nor so warm that it is uncomfortable, is the very time when the street railway manager, especially in the smaller city, must make his cars thoroughly attractive to the riding public if he is to get the nickels. If the cars have a stale, never-ventilated odor when the passenger steps into them, he is likely to notice it, and to avoid riding whenever he can. The reason why a superintendent should be especially careful to secure good ventilation in the spring is that the weather is just cold enough so that the cars are shut up at night and in the early morning for warmth, and the difference between the inside and outside temperature of a car is not such as to give much natural ventilation when the rear door is open. In crisp, winter weather, when the heaters are going in the cars, there is always considerable change of air when a door is opened. In moderate weather the case is quite different. Then there is almost nothing to cause a change of air inside of a car unless the ventilators, and perhaps the sash as well, are open. There are thousands of cars in operation that never have the ventilators open from one year's end to another. It is not by any means true that a car, after a few years of operation, must necessarily acquire an unpleasant odor. If it does so, it is largely due to continued operation without ventilation, either on the road or in the yard or car house.

As we have previously pointed out, many complaints from lack of ventilation and stale odors in cars are due to the fact that they are shut up entirely from midnight until morning in a car house, thus giving all the odors of the day before a chance to "soak in." It is just as important to clean the bad air out of a car as it is to clean the dirt that accumulates during the day. There was once an idea that a hotel building which has been occupied a great many years acquires a "hotel odor" that can never be got rid of. The fact of the matter is, the hotel odor, or any odors acquired by old buildings, are due simply and solely to lack of ventilation from day to day, and can be gotten rid of in a very short time by proper ventilation, plus cleaning of carpets, etc. We have in mind a hotel which is not by any means new or elegant in its furnishings, but which is as free from stale odors as the newest and most modern hostelry. The reason simply is that the management takes pains to see that all opportunities for ventilation are not as religiously closed as is usual in buildings of this character.

Inspection and Care of Lightning Arresters

There is hardly an electric railway system, operating cars in the suburbs or in the open country, that does not experience considerable damage to equipment from lightning. The damage resulting on some systems is so severe that motormen are instructed to shut off the current during severe storms. The inefficiency of the prevailing types of lightning arresters is usually blamed for all damage that is done. But the blame in many cases, we believe, could more correctly be laid to lack of inspection and care of arresters, and to improper methods of wiring.

No matter what type of arrester is employed, there is a possibility of it geting out of order. The arrester is usually installed under the car in some dark place, and frequently no thought is given to it after installation until the car comes in with an armature or field grounded by lightning. Often even this does not cause an examination of the arrester. A new armature is placed in the motor, the car is again put in operation, and the apparatus is again injured by the first thunderstorm that occurs. The fact that lightning goes through a car should immediately raise a question as to whether there is not something wrong with the arrester or the wiring, and the fault should be located and remedied before the car is permitted to leave the shop. Some types of arresters are supplied with short flexible leads, equivalent probably to a No. 14 wire. When attempting to locate a fault with such an arrester it is well to examine this lead closely, to see that it is not burned off. The writer has encountered several instances where the wire has been burned out of the insulation completely, yet the insulation held together, and gave every appearance of a good connection. This fault is of such frequent occurrence that it is a cause of wonder why leads of such small carrying capacity are employed. Probably they have been used to prevent a heavy short-circuit should the arrester itself break down. At any rate, it is well to be certain that connections are still intact before a car damaged by lightning is permitted to leave the shop.

Some of the arresters used on railway cars have an adjustable spark gap. Often this type of arrester has been installed without regard to the width of this gap, and we venture to say that many of them are put on cars by shop men who do not know what the length of the gap should be, its purpose, or even the general principle of the arrester. After being installed, the arresters often are never opened and examined. Lightning arresters should be inspected with as much care as any other part of the equipment. Of course, it is not necessary to make a thorough examination of them every day or two, but they should be given some attention at all times, and during the stormy periods of the year a very close watch should be kept on them.

The wiring of the arrester lead is often to blame for burnouts from lightning. It is of paramount importance that the lead from the trolley to the arrester, and the ground for the arrester should be run as straight as possible. Where bends are necessary they should have a very large radius. The wireman who prides himself on doing a neat job may object. Wires strung under a car look better when right-angle turns are made, and many wiremen, unless cautioned, will wire an arrester lead in this manner.

Of course, car lightning arresters alone should not be depended on for protection. In fact, they should be regarded simply as additional safeguards to the line arresters, which are not subject to jolt and jar, and can, consequently be kept in proper condition more easily than those on the cars. We feel that were lightning arresters given a proper amount of care and attention, thunderstorms would not be regarded with such dread by many superintendents, as they are at the present time, and the force in the winding room would not be compelled to work overtime after every storm.

The Incandescent Lamp Item in the Store Room Account

The reduction of operating expenses on a street railway system is a never-ending problem on account of the changing conditions which constantly confront the management. In these days there is a far wider appreciation than ever before that the small items, which seem insignificant in themselves, amount to surprising totals at the end of the year, so that economy is to be sought quite as much in the improvement of details as in the conduct of general policies.

The incandescent lamp itself is a case in point. We referred recently to possible improvements in lamps from the standpoint of their illuminating properties, but it seems also worth while to touch upon this item from the side of the store room account. Every large street railway is a wholesale user of incandescent lamps, yet, so variable are the conditions which determine the consumption of lamps, few companies really obtain the full value of the money expended annually for bulbs. On a large system, the incandescent lamp item may run as high as five or ten thousand dollars per year, or even higher, representing the total revenue of from one to two hundred thousand paying passengers. Any traffic manager will jump at the chance to add from ten to twenty thousand fares to the gross receipts of his system in a year's time, and certainly a saving of 10 per cent or 20 per cent in the lamp consumption is worth striving for, although the conditions must be pretty bad if there is room for attaining the latter figure.

Every street railway company operating in a large city uses immense quantities of supplies, and of these multitudinous items the incandescent lamp is, of course, but one. But the importance of keeping stock room records and receipts is more and more realized in these days, and the plan of requiring detailed statements of breakages, losses, and defective or worn out equipment is as desirable in the use of incandescent lamps as in other supply parts. In a good many cases lamps are stored at car houses in bins, where conductors and motormen have simply to help themselves in order to supply their cars, and no receipts are required. A better plan is to require the base of the old lamp to be given in exchange for the new one, or a definite report in case the lamps are stolen. It is a well-known fact that in some parts of the country an incandescent lamp is good for a drink at the nearest saloon, and as a result companies suffer numerous depredations from bibulously inclined passengers. Headlights are often vulnerable points of attack, and the plan of so locking the headlight case that it can only be opened by tools is a possible remedy in the tougher districts.

The gist of the whole matter lies in more complete records of the life of lamps. The condition of the trucks and track, amount of special work traversed, percentage of car mileage at night, constancy of the line voltage, candle-powers and number of lamps used per car, all have an influence upon the commercial life. The cost of lighting an ordinary car is a very small part of its operating expense, but the multiplication of even a minute item all over a large system is by no means negligible. Sporadic tests are doubtless useful in determining the relative usefulness of different kinds of lamps, but, in the long run, nothing can take the place of simple but regular stock room records. After all, the incandescent lamp is relatively expensive as a supply part, and probably two or three trips per year of each car are required as a fair average to pay for lamp renewals.

A Lesson in Construction

Terrible as were the results of the San Francisco earthquake it has given the world invaluable lessons in the construction of buildings and of permanent ways for transportation which it would be well to heed. There has been no other great earthquake which has given important information regarding the real usefulness of modern methods and materials. In fact, never before has an earthquake of destructive character visited a city typical of present conditions. In regions known to be exposed to severe seismic risks, buildings have been in recent years constructed with this possibility in view and high structures have been sedulously avoided, the usual plans being either to build low houses of extra heavy masonry, or very light buildings, as in Japan, capable of being considerably racked without giving way. But San Francisco, although in some cases, as in the destroyed City Hall, special ties were included in the masonry, was, as a whole, built much like the large cities of the East. Central California has long been known to be an earthquake region, in which perceptible shocks to the number of many hundred have been recorded in the last century. But of these less than 1 per cent have been severe enough to do any material damage whatever, and in only a single recorded instance was the force at all comparable with that indicated in the present catastrophe. It was a case of familiarity breeding contempt. Now, whenever small shocks are frequent, a big one may occur, and without in the least posing as alarmists, it may be pertinent for us to remark that a shock of considerable magnitude was reported from Central Connecticut during this week, that some five hundred shocks perceptible without instruments have been recorded in different parts of New England and the Middle States in the last century and a half or so, and that a few of them have been heavy enough to do some little damage. The number stated above is probably far below the whole truth, on account of scanty records, and it is not too much to say that symptoms of seismic activity are more numerous and consistent along the northern Atlantic coast than anywhere else in the country east of the Rocky Mountains.

Bearing this in mind, it will be instructive to look over the evidence from San Francisco as bearing on general problems of construction. It is too early yet to grasp the relations between the forces at work and the destruction wrought, but, as has been over and over noted in the papers, and is further evinced by the illustrations in this issue, the modern steel building came out of the shock pretty well, though injured by the fire. The same was true of certain low masonry and concrete buildings, while ordinary brick and frame buildings, the former especially, suffered severely from the earthquake. These facts are a capital illustration of the soundness of the judgments long since formed by the seismologists in Japan, Italy, and elsewhere. It has been consistently found by them that two classes of structures escape serious damage in earthquakes; first, those massive and rigid enough to move only as a whole; second, those light and flexible enough to stand considerable racking without going to pieces. Thus the standard Italian construction called for in dangerous districts is either extra heavy and well-bonded masonry on a rock or concrete platform foundation, limited in height and with light roof, or on the other hand, a construction of heavily-braced timber framing, merely filled in with light, hollow brick. The former is a forerunner of the reinforced concrete that did admirably in California, the latter of the modern steel building that did equally well. It should not be understood that steel buildings necessarily meet all the requirements. The aim should be, so far as resistence to racking goes, to make the filling of the walls as near to a weightless wind-break as possible. A heavy earthquake in New York, for instance, would be accompanied by enormous destruction of life, merely from the filling shaken out of the framing and bombarding the streets. The aim should be to load the stiff steel frame as lightly as possible, for the less the inertia of the filling the less likely it is to be thrown violently out.

To apply these principles to such construction as railway men have to deal with, power houses and car houses can be cheaply and safely built of steel or reinforced concrete. The roofs, being of rather wide span, are danger points, and the evidence now at hand indicates that a light, steel-truss roof with only moderately long spans is the best form available. Chimneys of every usual sort have proved to be sources of danger. The wreck of them on all sorts of buildings in the stricken region of California was no inconsiderable factor in the general destruction. Tall brick stacks may be counted on as pretty certain to go in a severe earthquake. Here again steel and reinforced concrete come into play. The former, of course, requires very careful bracing, and the latter should be, as far as practicable, lightened in the upper sections. In any case, there is considerable to be said for short stacks and induced draft. Most of the power stations around San Francisco came through in pretty fair shape, save for stacks, thanks to the fact that most of them were fairly well built and did not carry their weights too high. Some recent stations with heavy upper works would have had a bad time of it we fear, especially if built on made ground, which is particularly likely to yield in an earthquake.

An interesting feature of the San Francisco situation is the value of the overhead trolley system in an emergency. It does not take much shaking or heat to put a slotted conduit out of business, while the old reliable trolley can stand almost anything, and if the wires come down they can be quickly replaced. As after-shocks are likely to follow up the San Francisco earthquake for some years to come in decreasing frequency and intensity, the city would do well to go very slow in the slotted conduit line for a long time to come. Indeed, it would be quite as well never to go back to it at all. Tracks suffered severely in certain localities, as is inevitably the case when there are considerable earth displacements. There seems, however, to have been nothing so severe in this line as was experienced in Japan when, after the great shock of fifteen years ago, it became necessary to resurvey certain districts for purposes of taxation. All in all, the San Francisco railways pulled through better than would have been expected, and have displayed splendid energy in getting into action again. The new San Francisco will rise in far better and more permanent construction than is to be found in any other American city. The lesson for the rest of us is to remember that Washington, Baltimore, Philadelphia, New York and Boston are in a little better shape to resist an earthquake, or to fight the resulting fire, than was San Francisco, and that it is the part of wisdom to bear such a contingency in mind. Charleston, up to the fatal 31st of Aug., 1886, had less reason to anticipate a disastrous shock than any of the cities just mentioned has to-day.

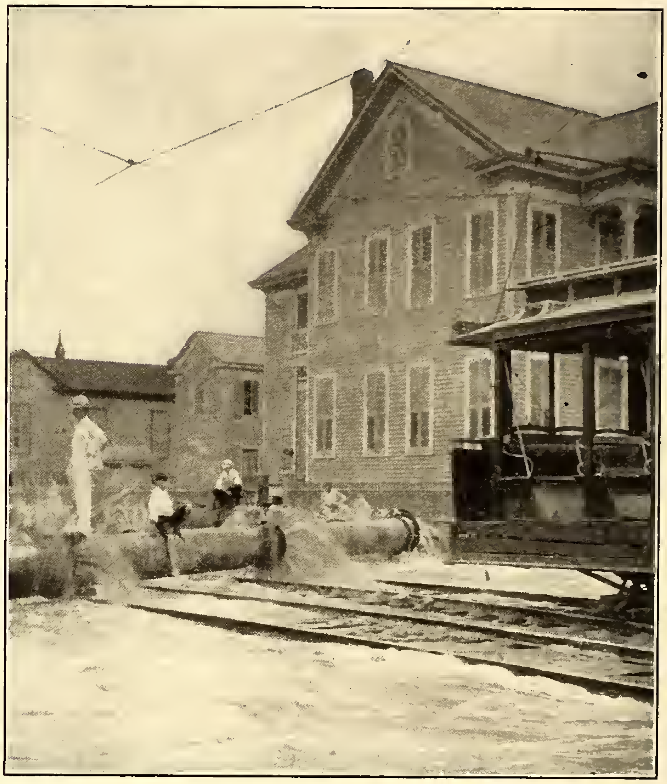
THE STORY OF THE GALVESTON GRADE RAISING—FROM THE STREET RAILWAY POINT OF VIEW

BY H. S. COOPER,
Manager Galveston Electric Company

To raise street-car tracks is not usually a serious undertaking, even if the raise is a heavy one, provided it can be done in long sections and with ample time, plenty of good ballast or filling, by daylight, with weather conditions favorable and not too much interruption from traffic. Lacking any of these favoring conditions the job becomes more difficult, and lacking all of them, and with absolutely unprecedented adverse conditions, it becomes a very difficult undertaking, especially when traffic is heavy and rush schedules have to be strictly maintained. This is the problem that confronted the Galveston Electric Company on about 12 miles of its tracks two years ago, when the city of Galveston proposed to raise the grade of more than half of the city anywhere from a few inches to 9 and 10 ft. In addition to this—in fact, in advance of it—the Electric Company had to face the preliminary adverse condition of having five of its ten lines cut in two by the digging across them of a canal reaching to the center of the city, up which canal the dredges would bring the sand filling dredged up in Galveston Bay. These lines cut by the canal were loop lines, comprising every north and south line running to the Beach—the place of popular resort in Galveston for seven months in the year. They were the lines of heaviest traffic during those months, and the cutting of the canal reduced them to stub-end lines, broke all inter-communication between them, rendered temporarily useless their downtown termini and transfer points, necessitated new, hurried and constantly changing schedules as the lines were cut, one by one, as the canal advanced. All this had to be done—not as a permanency—but with the knowledge that in two or three years, when the city had been raised and the canal refilled, all these lines would very probably be put back to their old routes and locations and termini, and with the further knowledge, that within those two or three years every one of those lines would, at unknown times, be unavoidably put out of service by the grade-raising operations for minutes, hours, days, weeks or even months.

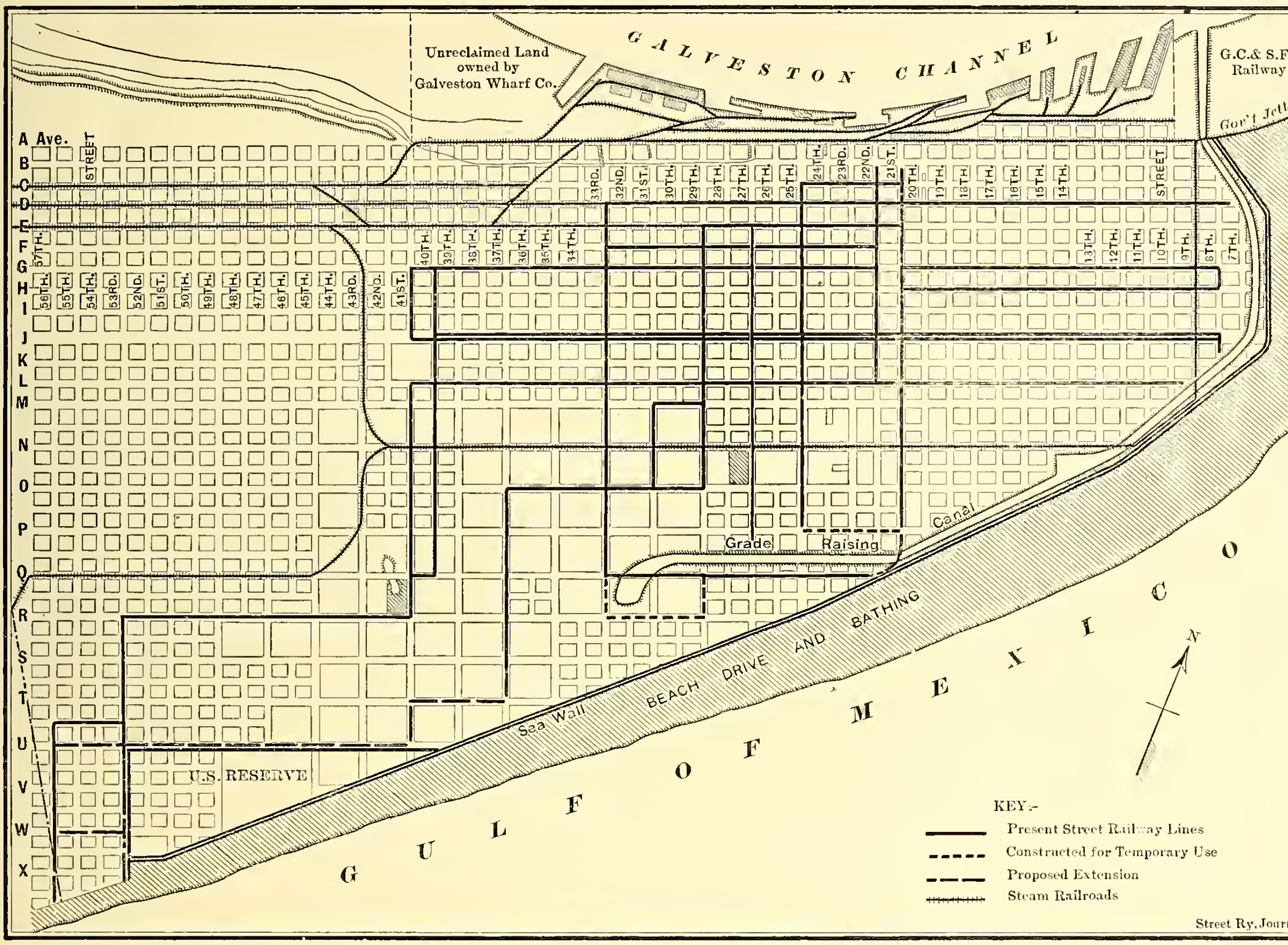
Those were the traffic conditions—to have an uncrossable canal cut through the heart of the system; to have loop lines turned into stub-end lines which ended nowhere; to have fixed special work connections in the paved streets of the downtown loops and termini, which special work was wrong in all sorts of directions for the new routeing and might be worse when the foreseen holding up of traffic occurred on some of the lines, and still worse when unforeseen conditions arose. Had it been a permanency it would have been a comparatively simple—although superlatively costly—matter to have changed the special work and its connections and rebuilt and rerouted all lines. But to do that for only two or three years, to virtually scrap thousands of dollars' worth of costly special work, to buy and lay down in costly pavement more thousands of dollars' worth of new special work and—at the end of three years or less—repeat the process, was something which, from a financial standpoint, was not to be thought of—and it wasn't! When the grade-raising of the city was finally determined on, when the conditions were fixed for the next three or four years, the Galveston Electric Company took on itself its second heavy burden, the heaviest ever laid on a small street railway, and looking the future cheerfully in the face, said: "We'll do the best we can for the next three or four years with what we have. We'll keep up our schedule and our service despite canals and grade-raising, and sand and water and pipes and any other old thing that may be shoved on us. In fact, just to show what we are, and to join in with the spirit of our indomitable little city, we'll improve our track and our cars, and our service and our schedule, so there!" and it has done all it said it would.

Track, poles and lines were hustled up just as they were about to cave into the advancing canal, and, if possible, were promptly temporarily rebuilt and relaid where they would be



OPERATING UNDER DIFFICULTIES. THE VIEWS SHOW 42-IN. PIPES ACROSS THE TRACKS OF THE GALVESTON ELECTRIC COMPANY DURING THE GRADE-RAISING OPERATIONS of the most aid to the badly crippled lines; special work was changed, twisted and turned, and put in locations for which it was never intended, and which hurt its feelings. Day after day, as line after line was cut and changed, new routeing and schedules had to be figured out, checked up and the patrons informed of the changes, until the transportation department just "dreamed schedules." For it was the season of beach traffic, when all Galveston turned out of an evening to its beautiful salt-water pleasure ground, and when thousands of excursionists, not only from Texas, but from far-away Colorado and the Territories, came in train loads to the "finest beach on the Gulf." Consequently any line as yet untouched by the canal was used almost until the scoop of the advancing tide, with a base of 16 ft. width, anchored by piles to the clay bed 40 ft. below. Its base is protected by a rip-rap of granite blocks weighing tons apiece. That made the city safe from the gulf for all time, but it also made some new and unpleasant conditions. The city is on an island, and that island is a sand island, nothing but clear, pure, beach sand, and its highest point—its "ridge"—was only 8 ft. or 10 ft. above high tide. Consequently, to build a wall half way around it and 16 ft. high, rather hemmend it in and cut off its beautiful view, and its lovely soft south breezes and raised up all sorts of questions as to sewerage and drainage, etc.

Now, running through the center of the city, parallel with the gulf and the bay, is Broadway, a beautiful 150-ft. street,



MAP OF GALVESTON, TEX., SHOWING THE SYSTEM OF THE GALVESTON ELECTRIC COMPANY, THE NEW SEA WALL AND THE GRADE-RAISING CANAL

dredge commenced to gnaw into the roadbed and then—a hurried taking up and new routeing and new schedules. And all this was merely preliminary to the actual grade-raising.

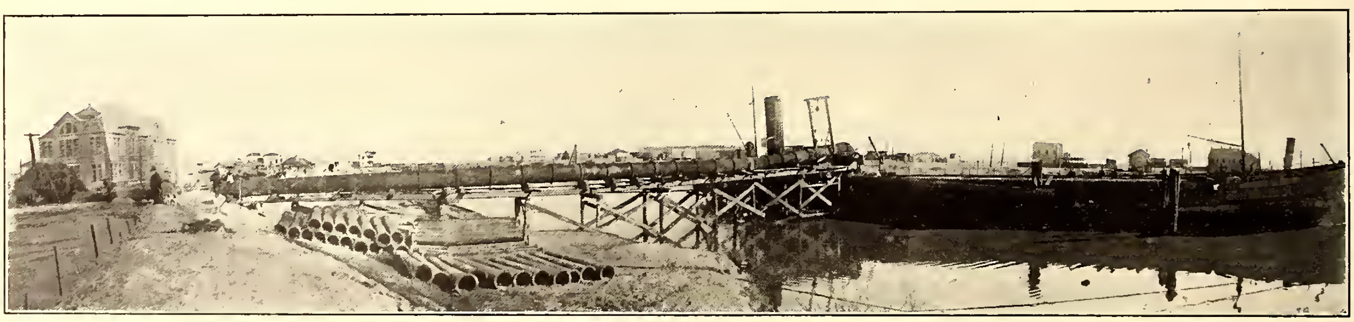
Now, to understand the conditions of the grade-raising, we must go back a little. Galveston Island is a low sand island, 35 miles long, and from 3/4 miles to 1 1/2 miles wide. It lies east and west, paralleling the Texas mainland coast, and separated from that mainland by Galveston Bay, a salt-water estuary from 2 miles to 5 miles wide between the island and the mainland. The south coast of the island is bathed by the waters of the Gulf of Mexico and, if one could have the proper power of vision, he could stand on its broad and beautiful beach and look southward straight across the Gulf of Mexico to Yucatan. Warned by the storm of 1900, the city built around its gulf shore the most stupendous protective work of modern times—the great "Sea Wall." This is a solid mass of granite concrete 5 miles long, 16 ft. above high esplanaded through its entire center with magnificent palms and blooming leanders and, before the grade-raising, one of the loveliest streets in the world. The city called in the best engineering and contracting talent in the world. They considered and said: "We will fill in Broadway in all its dips and hollows until it is absolutely level and 10 ft. above high tide. Then we will take a slope from the top of that 10 ft. to nearly the top of the sea wall and we'll fill that in. Then you will have a city 16 ft. above the highest tide at the gulf, and sloping down to 8 ft. or 10 ft. at the bay!" "But how about the houses?" "Oh, the people will raise them up on timbers and we'll put the filling under them." "And the fences and the trees, and the gardens and the curbing, and the paving and the sidewalks?" "Oh, we'll lift them all up as we fill in." "But what about the street railway and its tracks, and its poles and lines?" "Oh, we guess they'll find a way out of it." So it was settled so far, but another thought arose. "Where can we get the stuff to fill with? It will take millions of cubic yards, and if there was a solid train of cars coming in every day, and all day, it would take ten years to fill, and cost twenty millions of dollars." Then arose a genius and said, "We will put dredges into the bay and we will cut a canal two miles long into the center of the city—just a safe distance away from the Sea Wall. We will temporarily move all the houses off where the canal will be. The street railway company will move its tracks and poles and lines away temporarily, and the stuff we dig out of the canal we will throw out on the sides against the Sea Wall. After the canal is dug, we will build big hopper dredges, which will go out into the bay and dig up the nice clean sand off the sand bars and fill their hoppers, and then will steam up the canal and pump that sand, mixed with water, out through big pipes over the area to be filled. The nice clean salt water will run off, and leave the nice clean sand filling distributed evenly on a nice clean sandy slope, from the Sea Wall to Broadway. When the grade-raising area is filled, we will commence to fill the canal the same way, backing out as we go, until we have filled it to its beginning. We will do it for a quarter of what it would cost you any other way." And the city said: "My! How nice and simple! We'll do it!" And they are doing it, but it is not as simple as it looks—especially to the street railway company.

VIEW SHOWING END OF 42-IN. PIPE DISCHARGING SAND AND WATER IN THE GRADE-RAISING OPERATIONS AT GALVESTON

Ordinarily it would seem simple enough—just raise the track a moderate height in long stretches ahead of the grade raising, using the dirt alongside as sub-fill and, when the grade reached the track, raise it again the same way, and so on ad finitum, but that is not the way it is done. First of all the grade is not raised gradually as a whole, but instead, sections of two blocks and three blocks wide, reaching from the canal to Broadway, are filled completely before the next section is touched at all. Levees, or banks of dirt, from 2 ft. to 10 ft. high, are thrown up all around the section to be filled, a drainage ditch is left open on the lower side for the filling water to run away and drain back into the canal or off down the island into a bayou and thence into the bay. Then the big pipes—21 ins., 33 ins., or 42 ins. in diameter—are stretched out from the dredge pumping stations in the canal and the dredges attached thereto, and pour out from their hoppers into these pipes a flood of water and sand, until the hoppers are empty. Then back they go into the bay, fill up hoppers, steam up the canal and empty, and so it goes on night and day, and holidays and parts of Sundays, an almost never-ending stream of water and sand flowing into the section, the sand settling and the water running off until the section is level with the top of the levee and up to grade.

These dredges force the water and sand mixture out of the pipes at a pressure of from 18 lbs. to 20 lbs. at the dredge. The idea is to keep the pressure at the discharge end at approximately zero, so that a full stream of the mixture will flow from the end of the pipe with as little washing effect as possible. The mixture contains from 20 per cent to 33 per cent of sand—averaging 25 per cent. With one or the other—and sometimes two and three of the pipes flowing streams at the same time, the amount delivered is enormous. Often in a day of 24 hours, from 12,500 to 15,000 cubic yards of sand, or the equivalent of 1000 railroad carloads, or a train seven miles long loaded full of sand, have been unloaded and placed in location.

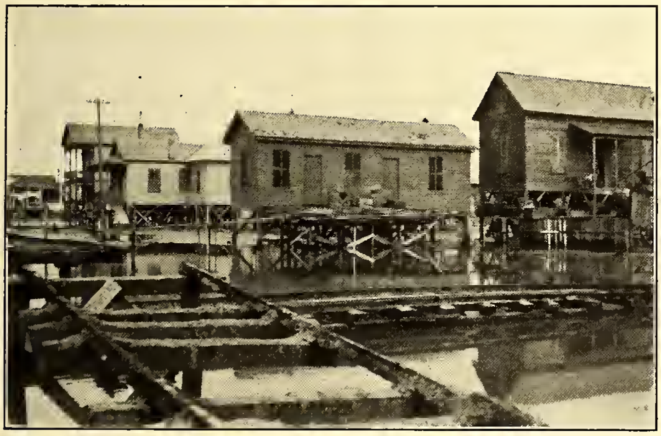
And down in the big basin formed by the levee is the poor street car track. It has been humped up in spots, to allow gas and water and sewer pipes to be raised up to the surface—waiting to be again covered to a normal depth. It has had to be raised up over the levee from 2 ft. to 6 ft., so that that levee may be intact all around, and with that and the little bumps over the water pipes, it looks like a drunken roller-coaster. It has had to cross drainage drains on quick-built trestles of old ties; it has been robbed of dirt alongside of it to form the levees until, in places, it stands up as if on an embankment. Robbed of its filling it is open to every change of temperature, and consequently "kinks" in all directions, until a rail fence is a straight line to it. Every joint is racked, bonds are broken, and it is a most disreputable looking affair,



THE GRADE RAISING AT GALVESTON. SAND IS BROUGHT IN ON SELF-PROPELLED SCOWS, AND IS PUMPED OUT THROUGH 42-IN. PIPES AND DISCHARGED OVER THE AREA TO BE RAISED

Still the cars run over it, serenely climbing up and down the bumps and weaving their way along the sinuous rails, while sand and salt water are flowing from 2 ins. to 6 ins. over the top of the track. For block after block the street car track is the only way available, sidewalks and streets, and yards and gardens are submerged under an almost never ceasing flood of salt water and sand, and to reach that track and the cars on it, platforms are built from houses and the passengers are received and landed as if from a steamboat. Ordinary stopping points are neglected and forgotten, and the motorman has to be able to gage his stop to a nicety for the landing, while the conductor, in long rubber boots, gets off into the stream and aids the ladies and children to embark and disembark.

And the track. The track is the next to the last thing to be raised—the poles and lines are the very last. The track cannot be raised ahead of the filling, for the flood of water and sand from the big pipes would wash away the roadbed in a minute, neither can it be raised on cribbing for the same reason. "Then how is it done?" Simply by letting the sand fill up the track until it is nearly or quite over the rails and then, with men and jacks in plenty, "jacking it up" a few inches and allowing the sand to settle under the ties, then repeating the operation whenever the flood is let loose upon the track.



VIEW IN GALVESTON, SHOWING HOUSES AND TRACKS ON STILTS, READY FOR THE GRADE TO BE RAISED

Again, it seems simple, doesn't it? But there are one, or two, or three—or fifty—difficulties. When a dredge starts pumping into its pipe, the first few minutes' flow—until the sand and water in its hoppers is well mixed—is nearly pure water, and washes everything before it as it comes from the pipe. Again, when a dredge has finished pumping out its hoppers, it always pumps a lot of pure water through the pipe until all sand in it has been washed out, otherwise the sand in the pipe, under the diminishing flow at the end of the pumping, would settle in the pipe itself and fill it full and choke it. So, it may happen that, in the beginning of a dredge's pumping, the pure water will wash out the filling under the track, the track will sink, the sand-charged water will follow in a few minutes, and, lo, the track is submerged, inches or feet. It cannot be raised until the dredge ceases pumping, and then it must be laboriously dug out of the clinging suction of the wet sand, jacked up and hastily tamped up on quicksand. In the meantime the schedule is interrupted, and the poor beleaguered householder is marooned on a car in sight of home. Again, when the dredge stops pumping, the torrent of pure water will often wash out all the sand for rail-length after rail-length, and when the water subsides the track lies out of sight in a pool of salt water a half-block long and from 1 in. to 6 ins. deep. This does not daunt the motorman; he is an adept at navigation-on-wheels, and the whole section is dependent on him and his car, so he "puts her to three points" and, with hand on brake, "listens" his way along over the unseen track.

Now to jack-up tracks is not hard if you have anything to hold up your jack, but when the whole thing is a quicksand under the influence of the flowing water, when the men are knee-deep in that quicksand and have to pull their feet out one by one with their hands when they wish to move, then is the time that the jacks sink 6 ins. every time they raise the track 1 in., the time when two men shove shovels under the rail from each side, a third quickly places the jack in position under the rail and on the shovels, and two others pump away at the jack-handle. While the jack and shovels sink fast, the track rises slowly, or not at all, and in a minute or two the jack is nearly submerged and it takes all that three men and two shovels can do to get it quickly out from the suction of the sand. Then do it all over again until the pumping ceases or the flow changes location—for that is another of the difficulties. Nothing can be told as to the direction of the mixed stream. The sand settles so rapidly as often to dam its own flow, and the stream will change its direction in a minute or two. Then all hands must hustle-up with jack and to a new location, 20 ft., 50 ft., 100 ft. away.

VIEW AT GALVESTON, SHOWING AREA SHORTLY AFTER IT HAD BEEN RAISED TO THE NEW GRADE

And this not for 8 hours or 10 hours a day and in broad daylight and nice weather. The dredges know no hours, no days, no seasons. Weather is nothing to them, nor daylight nor darkness. It is a "continuous performance," and the street railway must perform whenever the dredges pump. So, day and night, light or dark, hot or cold, in fair weather or in the most blinding rain storm, the track force must be out and about, or there will be track washed out or buried and traffic suspended or interrupted, and none of these must occur, for they cost money—and fares. And when at last the level is reached on a section; when everything is "up to grade"—a dozen feet higher than it was a few weeks ago—an ordinary track foreman would weep at the sight. Every joint is loose and strained and wide open, bolts are rusted to a "jam-fit" by the salt water, nearly every bond is gone, spikes are all loose and ties are all askew—many of them have been left 12 ft. under ground, held there by the suction of the wet sand. All the old roadbed and good ballast are a dozen feet under ground, and nothing is left to line and surface on but fine, loose, white sand that will take months to settle to place, and will shift under rain or with wind just like so much flour. Do you wonder the track foreman weeps—for the schedule and service must be maintained.

Later comes the time for the line foreman to weep. All this time he has had to stand supine—or nearly so—and see the sand crawl up on the poles until they were 12 ft. to 18 ft. in the ground, for you cannot raise poles in a quicksand. He has raised the trolley wire when the rising track made the trolley base scrape the spans. He has put 2-in. x 4-in. scantling extensions on his poles and kept the live line wires from burning off the top of people's heads as they went under them, but that was all. He must wait one, perhaps two or three, months after the section is "up to grade" before he can start to raise the poles, for it takes that long for the sand under the surface to become stable, and when it is water soaked, as at first, it is a combination of consomme and mush, distinctly not good to work in.

When he has 2 ft. or 3 ft. of comparatively solid surface sand to work in, he gets two 30-ft. wooden levers, strongly braced with steel, a lot of 3-in. x 12-in. plank, an imposing array of guys and block-and-tackle, and from twelve to twenty men, and starts to pull poles—some of them 16 ft. to 18 ft. in the ground. He lays a foundation of plank on each side of the poles, piles up his "purchase" on them, drops heavy log chains as low on the base of the pole as he can, puts the hooks of his levers into a bight in the chain, and says, "Ready!" Then, with a "Ye-o!" twelve men leap on to the upraised end of the big levers, the plank and "purchase" sink down 2 ins. or 3 ins. in the soft sand and the pole comes up (sometimes) an inch. More plank, more "purchase-blocks," more "Ye-oing," and it comes up 3 ins.; next time it comes up 4-ins., and then 6 ins. "at a lift" until it is also "up to grade" and the broad, white ± grade mark on it, that was just peeping out of the ground when he started, is up in the air as many feet above grade as there have been feet of filling at that spot.

"A primitive and wasteful method!" you say? "Primitive" it is true, but "wasteful" it is not. Some time and money was lost in the beginning, because every one thought the same as you. Every sort of gin-pole and derrick and stump-puller idea was tried, and the ideas are now where the apparatus would have been—under the sand. Remember, that you are working on a crust of loose sand over a quicksand, a substance that when you dig down to it, flows and sticks like—or worse than—any semi-solid mass that you can think of, a substance that holds a pole down with 15 lbs. to the square inch plus the friction, a substance that yields like, warm molasses candy, to a steady weight or pressure. Dig down a couple of feet and you are at the limit of digging, for the stuff flows in as fast as you dig. Pull steadily on the top of the pole, beyond a certain strain, and the base of the pole will slowly move in an arc on the fulcrum of the 2 ft. of dry surface sand. So, when poles are "set with a rake," when they are corner-poles, or have any preponderating strain in one direction, they must be "guyed" and braced and stayed, and every time the pole is raised a few inches this guy must be slackened, that one tightened, a brace eased and a stay stiffened, for the pole must come up to the top in the same position and location and inclination in which it originally was, otherwise wires and cables are slackened or tightened too much, the poles will be all "out of line," the trolley wire a disgraceful "clothes line," and every frog and guy and crossing and bridle completely "out of whack."

But the line foreman has this consolation over the track foreman. When a pole is up to grade and a big "dead man" (an old cross tie) has been planted across it, a foot or two below the surface, to give it a bigger bearing surface against the loose surface sand; when guys have been run taut and the slack taken out of all slackened parts, then he knows that his grade-raising troubles on that section are pretty nearly over, for slowly but surely the water will drain away deeper and deeper, leaving good solid "dirt;" slowly each little particle of sand will "lock" into its neighbor's embrace, and his pole will finally stand better in the "filling" than it did in the old island sand.

But the track foreman and the line foreman are not the only weepers; the master mechanic has a few tears to shed also. The salt water pumped in by the dredges not only plays havoc with the insulation of the electric equipment, but it rusts everything iron and steel that it touches, and the fine sand gets into every crack and cranny, into the journals and bearings, into every working and wearing part, and also plays havoc with them. Wheels are content to live only four-fifths as long as they ought to under normal conditions; brake-shoes die in early youth; journals and bearings crave constant attention and perfect lubrication or they get hot in the collar, and every piece of steel and iron breaks out in a rash of rust if it is not constantly re-clothed in paint. As for insulation—salt water is a fair conductor, and when you run a car at a lively speed through some inches of it—it splashes and, being salt water, when it dries, it leaves the salt. When it gets damp this salt spreads and creeps into every tiny hole and crack, and when it gets near enough, the 500 waiting volts jump and "spit-crack-k-k"—a short circuit or a burn-out. "What is done to prevent?" Just make everything not only air proof and current proof, but salt-water proof, and keep it so. Do as is done in every department—invent things—and, if they fail, invent more things until you succeed. There is no precedent—make one, that's all! The cars must run and run on schedule, must run as regularly, as safely, as if conditions were normal, for in the grade-raising district the people rely on the cars. Without them they could hardly stay there.

"And do you keep up schedules and give good service?" Ask the people of Galveston, and to a person they will say "They not only do that, but on the track that the canal has left intact we have a better service than we ever had."

"And isn't your operating cost tremendous?" Not so very large, thank you! Quite some less than a good many other roads we could name that have not our abnormal conditions.

"And your earnings—haven't they fallen off greatly?" No indeed, they have steadily increased, not a big increase—just a nice steady little "move" that has pleased the company every month since the grade raising started.

"Well! How do you account for it?"

We don't. We simply know it's so and keep on working and trying, and inventing to make it all better.

"Well!!"

Yes. That's what everyone says when they come to Galveston—and our street railway visitors put it stronger!

DISPOSING OF ARTICLES LEFT ON INDIANAPOLIS INTERURBANS

The terminal station at Indianapolis is made the repository for articles left on the interurban cars by passengers, two rooms being set aside to receive the goods. The increase in the number of articles recently has been so great that a change of plan has been decided upon, and hereafter the articles will be disposed of after the expiration of a fixed period. Conductors will now turn in a description of the article left on their cars, and if it is not claimed by the owner it will be given to the conductor, if he desires the article. If not, it will be sold at auction to the benefit of the company.

THE NEW YORK CITY INTERBOROUGH RAILWAY

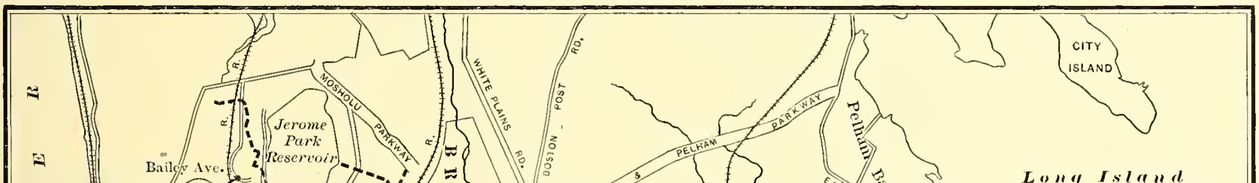
The operation of the complete overhead trolley lines of the New York City Interborough Railway Company will be commenced simultaneously with the opening of the subway passenger station at One Hundred and Eighty-First Street and St. Nicholas Avenue, on the upper West Side, in the Borough of Manhattan. Excellent transit facilities will then be given to sections of the Borough of the Bronx on the east, which have hitherto had inadequate service. Included in the routes to be operated are the Washington Bridge, Aqueduct Avenue line and across town to the Zoological Garden in Bronx Park, all of which have been difficult of access in the past.

Washington Bridge is regarded as one of the handsomest bridge structures in the world. Shortly after construction work was commenced, the mayor required that the company's plans for its overhead construction be submitted to the Art Commission. The members of the commission expressed their appreciation of the existing plan to erect poles and brackets which would be in harmony with the architecture of the bridge structure. In the preparation of the handsome designs for the brackets, which are constructed of T-iron and flats, the engineers had the assistance of George Nichols, architect. The poles and brackets were furnished by the Elmer P. Morris Company.

The track on the bridge is imbedded in 17 ins. of concrete, which rests on the buckle plate and which, with an asphalt covering, forms the roadway. Steel ties are used every 10 ft.

The rails used on all the other parts of the routes are 107-lb., 9-in. girder type, and are laid on yellow-pine ties at a distance of 30 ins. between center. The joints are bonded with soldered bonds under the splice bars. The Brill semi-convertible cars used have 28-ft. car bodies, and are 40 ft. in length over all. They are equipped with four 38-hp motors.

ARTISTIC OVERHEAD CONSTRUCTION ON WASHINGTON BRIDGE



MAP OF BRONX BOROUGH, NEW YORK, SHOWING THE LINES OF THE NEW YORK CITY INTERBOROUGH RAILWAY

A. E. Kalbach was the engineer in charge of the construction and equipment of the road, and was assisted by C. W. Wilder and J. H. Barnard. Power for operating the lines will be secured from the Interborough Rapid Transit Company.

PLANKING UNDER TRACK IN NEW ORLEANS

As is generally known, all the land in and around the City of New Orleans has been formed by accumulated deposits of mud and silt left by the Mississippi River during the time when the river flowed unconfined over the site before the construction of the New Orleans levees. This mud, or more properly speaking, clay, makes a fairly reliable foundation when it is dry, but when it is moist, which is its usual condition, due either to seepage water or rainfalls, it becomes a thick sticky material which has many of the characteristics of quicksand and gives a treacherous, unreliable foundation for construction work of any kind, necessitating special precautions and special treatment in all engineering operations.

TEARING OUT OLD TRACK WORK IN ASPHALT STREET, NEW ORLEANS

As can be readily imagined, the work of laying street railway tracks in the city and suburbs has been attended with considerable difficulty and has called for special engineering methods. It should be said, however, to the credit of the engineers who have been responsible for track construction in New Orleans that they have overcome these difficulties well, and the New Orleans Railways & Light Company is only now beginning to renew portions of its roadbed that have been down for eight or ten years and are still in fair condition. The difficulties have been increased by reason of the fact that in this portion of the country broken stone or gravel for ballast is very scarce and almost prohibitively expensive, and recourse has been had to clam and oyster shells as a substitute for stone or gravel for track ballasting purposes. Furnace slag has also been used to some extent.

PUTTING IN CONCRETE IN TRACK WORK, NEW ORLEANS

The chief factor in solving the problem of securing a permanent track has been found in putting a layer of planking underneath the roadbed. The purpose of this planking is not, as might be supposed, so much to keep out water as it is to distribute the load evenly over a large area and to some extent to bridge over short sections of quicksand material that under concentrated loads might develop a tendency to sink or sag. This same idea has been adopted in other Southern cities where the soil is impregnated with moisture.

The accompanying drawings give the details for the latest standards in track construction adopted in New Orleans for paved streets and unpaved streets. In both classes of work, as soon as the excavation for the roadbed has been made, there is laid in the bottom of the trench a flooring, consisting of planking in strips 9 ins. to 12 ins. wide and 1½ ins. thick. The strips run longitudinally with the direction of the track, and although they are not tongued and grooved they are laid with their edges as close together as possible and form practically a waterproof bottom to the trench. The layer of planking is 9 ft. wide under each track and extends about 6 ins. beyond the ends of the ties at each side.

In ordinary work the construction after the planking has been laid is as follows:

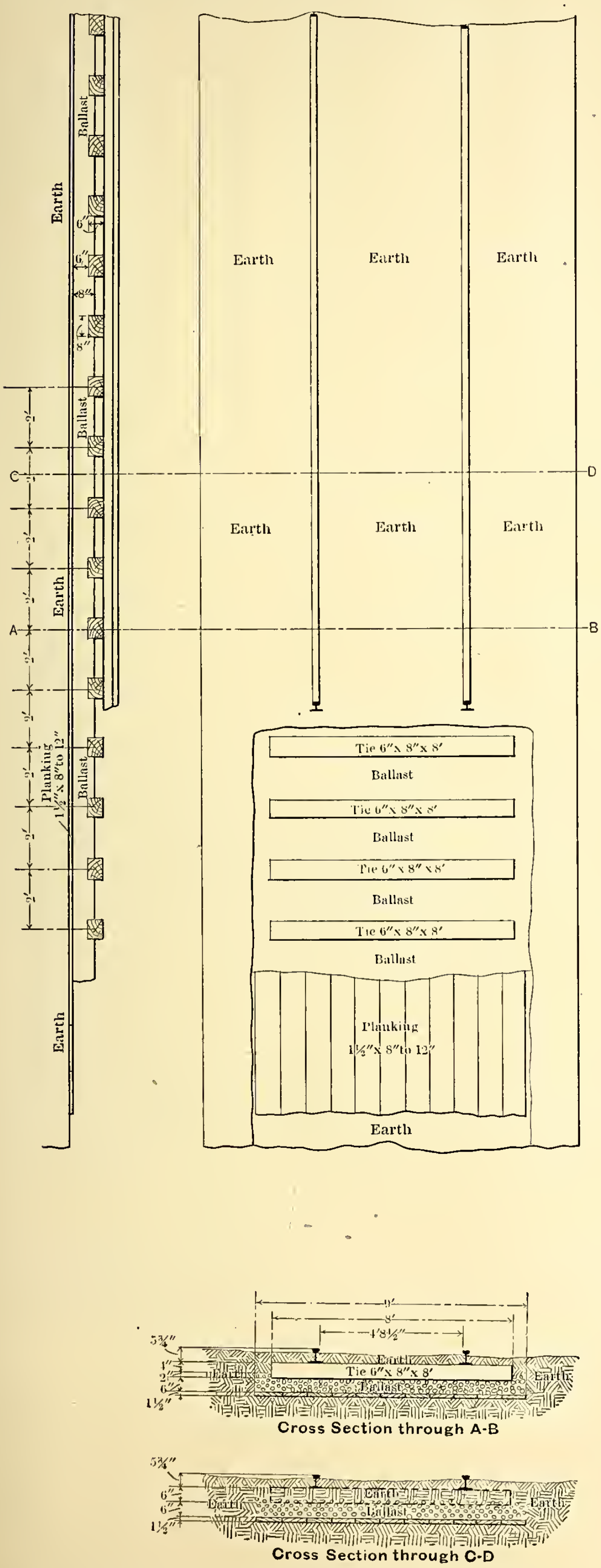
Directly on the planking is placed 6 ins. of ballast. The material used for this purpose, as stated, is usually clam or oyster shells, although on some of the latest work on heavy lines broken stone is being used to some extent. The ties, the standard size of which is 6 ins. x 8 ft., are laid on the ballast on 2-ft. centers and the spaces between ties and to within ¼ in. of the head of the rail is tampered with earth filling.

In the streets that are paved with asphalt the foundation is the same except that for the earth filling is substituted a bed of concrete which rests upon the ballast foundation and extends up to within 3½ ins. of the surface of the street, to form a foundation for the asphalt paving. In asphalt streets the tracks themselves are paved with belgian blocks, and it is the practice to place on either side of the web of the rail fillers consisting of creosoted timbers, the purpose of which is to prevent the belgian blocks from working in under the head of the rail. The concrete used in this work is a 1:2:4 mixture and the material is put into the roadbed quite dry. After it is in place the trench is flushed with water which flows down through the bed, completing the wetting process. The materials are then allowed to set. This procedure avoids the necessity for making the men work in the wet concrete mix-

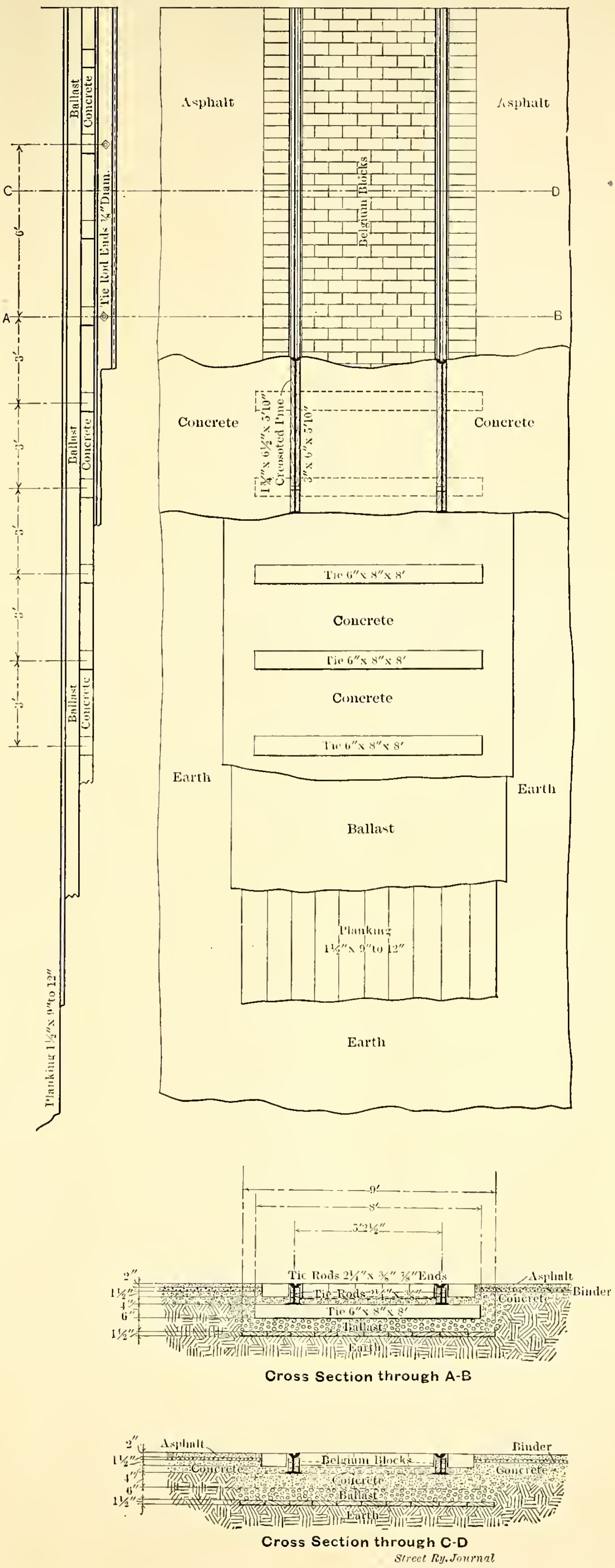
CONCRETED TRACK READY FOR PAVING, NEW ORLEANS ture. The present management has lately rebuilt six miles of track with concrete foundations in this way.

The foregoing describes the latest standards that have been adopted by the New Orleans Railways, Light & Power Company, but inasmuch as many of the lines were built by several independent companies, all of which have been consolidated at different times into the present company, some of the older lines present considerable variety in track work.

The present operating company owns approximately 180 miles of track. Of this mileage 10 miles or 12 miles are built with 100-lb. T-rail, laid on 6 ins. of broken stone, which in turn is laid upon a 1½-in. plank flooring.



DETAILS OF T-RAIL CONSTRUCTION, WITH LAYER OF PLANKING UNDER TRACK, NEW ORLEANS



DETAILS OF GIRDER CONSTRUCTION IN ASPHALT STREETS, WITH LAYER OF PLANKING UNDER TRACK, NEW ORLEANS

There are about 22 miles of the system, laid originally with 60-lb. T-rail on earth ballast, and which is now being re-ballasted with 9 ins. of clam shells under the ties and up to the top of the ties. This track for the most part is located either on private right of way or in neutral ground. The neutral ground is perhaps peculiar to New Orleans, and comprises a raised section running through the center of some of the widest streets and given over exclusively to electric railway operation.

Another predominating type of track construction, amounting to 9 miles or 10 miles, is built with 80-lb. T-rail, either on slag or shell ballast. Where slag was put in it was laid to a depth of 6 ins. on 1½-in. planking, but where shell ballast was utilized the bed of shells was carried to a depth of 12 ins. and the planking was omitted.

The remaining mileage consists of 6-in. and 9-in. girder rails on 6 ins. of gravel ballast, with plank flooring in the bottom of the trench.

In further explanation of the use of the planking it should be said that inasmuch as the primary object of putting in the plank flooring is to distribute the load evenly, the planking is omitted whenever good ballast, such as gravel or broken stone, is put in to a depth of at least 12 ins. below the ties. The theory is that the load under each tie is distributed through a section of the ballast that may be described as a truncated wedge, which at the top is the same width as the tie. With ties 8 ins. wide and spaced 2 ft. on centers the angles of load distribution under adjacent ties will intersect at a point about 8 ins. or 9 ins. below the base of the ties. The object sought is to unite these successive load areas in a common base or foundation, so as to give even distribution of weight over the whole area of the roadbed. This object can of course be secured by putting in sufficient depth of ballast, which would be not less than 10 ins. or 12 ins., but in view of the scarcity of ballasting material in this locality the same object is accomplished at less expense by putting in the planking and using only 6 ins. of ballast.

FOUNDATIONS FOR CROSSINGS

The lack of stability in the soil has been made evident with especial force at locations where the street railway tracks cross steam railroads. There are a number of such crossings on the New Orleans system and their maintenance, especially on the lines where the traffic on both the steam and street railway tracks is heavy, has been a very serious problem. The present engineering department has been giving particular attention to this subject, and has recently developed a construction that gives promise of materially reducing the cost of keeping up crossings. The latest practice is to put concrete under the entire area occupied by the crossing. The excavation is first made and in the bottom is built up a crib work of old T-rails laid log cabin fashion. This is then filled in with mass concrete to a depth of 18 ins. to 20 ins., smoothed level on top. This gives a solid granolithic foundation, the crib of rails acting both as binder and re-enforcement for the concrete. On this foundation is laid 6 ins. of broken stone in which are embedded the ties. The crossing is bolted direct to the ties. Instead of paving the intersections in the usual way special corrugated iron plates made to fit the spaces between rails are used. These plates rest on lugs on the intersection castings and on wooden strips supported on the ties. These wooden strips serve to reduce the noise. Wharton solid manganese crossings have been adopted for all heavy traffic locations.

A number of locations have been installed, as outlined in the foregoing, and the results seem to justify the somewhat expensive construction. The bed of concrete appears to absorb the entire shock of the blows when cars or trains are passing and there is practically no vibration perceptible at any point within the crossing area, even under the impact of heavily loaded freight trains.

The wheels on the steam trains have wider treads than the electric railway wheels, and considerable trouble has been experienced, due to the overhang of the steam wheels striking the paving at crossings and intersections. To prevent this it is now the practice to put a special iron angle plate along the sides of the steam tracks and the paving is brought up against these angles instead of directly against the rail. All track and line work on the New Orleans system is in charge of A. L. Black, electrical engineer.

TROLLEY CARS FOR HOUSE MOVING

Since the view of a car moving a house in Atlantic City, N. J., was published in the STREET RAILWAY JOURNAL of March 31, on page 501, E. R. McDowell, superintendent of the Ashtabula Rapid Transit Company, of Ashtabula, Ohio, has called attention to the like novel use of the rolling stock on his line, as shown in the accompanying illustration of a car moving a building. The company has been moving houses for the last six years, and even very large buildings have been taken quite a distance along the tracks. It might be added that the work is not done for the novelty or pleasure, but if it is found that the buildings to be moved are an obstruction, the company's purpose is to remove them as quickly as possible.

ONE OF THE ASHTABULA RAPID TRANSIT COMPANY'S CARS MOVING A HOUSE AT ASHTABULA, OHIO

STREET RAILWAY SITUATION IN SAN FRANCISCO

(*From Our Regular Correspondent.*)

It was an event of no small importance to San Francisco—the city devastated by the earthquake of April 18 and a five-days' fire—when car No. 1377 formally opened street railway traffic on the morning of April 27, the tenth day after the disaster. Mayor Schmitz operated the controller, and Superintendent David Young, Jr., the brakes, and the party included several prominent citizens, Vice-President and General Manager G. F. Chapman; assistant to the president, Thornwell Mullally, and other officials of the United Railroads. The car was operated from the car house at Turk and Fillmore Streets, out Fillmore to Broadway, then back over the entire length of Fillmore, and thence over Church and Sixteenth Streets, Mission Street and Fifth Street to Market, which was then the limit of operation.

This placed the system of the United Railroads in operation on a small scale, and the cars have since been run under as rapid a headway as possible. On April 28 the connecting curve from Fifth Street out Market was completed, and for the first time in the history of San Francisco an electric car was run down Market Street to the Ferry Building. The first car was manned by Thornwell Mullally, who was accompanied by several officials and citizens as guests. The Market Street line, from the ferry to Fifth Street, is now in regular operation, and is carrying large crowds. Other lines that have been placed in operation are the line from Mission and Sixteenth Streets to Onondaga Avenue, from Sixteenth and Bryant Streets to Kentucky and Twenty-Third, and some of the lines embraced in the Ellis and O'Farrell and the Turk and Eddy Street systems.

VIEW OF SUTTER STREET, SHOWING LINE OF RESCUED CARS WHICH WERE USED AS BED-ROOMS BY REFUGEES FOR SOME TIME AFTER THE FIRE

Up to Sunday, April 29, no fares were collected on the cars, but at a meeting of the general relief committee, Rudolph Spreckels suggested that, in spite of the magnanimous offer of the United Railroads to furnish free transportation on its cars, it ought to be allowed to collect fares. Mr. Mullally suggested that fares might be collected, but he offered to turn over all the company's receipts to the relief committee, to be used by it in relief work. This offer was greeted with enthusiastic applause and unanimously accepted.

The first day or two no fares were collected from women and children, but this order filled the cars with so many people, evidently sightseers and relic hunters, that the relief committee afterward decided regular fares should be collected from everyone. The receipts of the first day's collections amounted to $1,867, and this sum was turned over to the committee promptly. It was suggested that this donation of gross receipts should not continue indefinitely, as it would work an extreme hardship on the United Railroads. Mr. Mullally declared, however, that no request for a discontinuance of the arrangement would ever come from the United Railroads, and that it remained for the general committee to decide just how long it wanted the company to turn over its receipts.

Patrick Calhoun, president of the United Railroads, has announced the determination of his company and its officers and owners to do everything in their power to assist in the rebuilding of San Francisco on a larger, grander and more beautiful scale than ever. He declared that it was the general feeling throughout the East that the earthquake could not shake the confidence of the American people in the future of San Francisco, and that the energy and capacity displayed in the re-establishment of law and order would command the respect and admiration of mankind for all time to come. He states that he has placed large orders for cars and material, and that men and material are now on the way from the East. Mr. Calhoun's cheerful and courageous view of the situation and of the city's future has done much to raise the spirits and hopes of the people of San Francisco.

RUINS OF THE CITY HALL, SAN FRANCISCO

Officials of the United Railroads announce that they expect to enlarge the field of street railway operations throughout the burned and unburned sections of town almost immediately. The company's electric power plant at North Beach has been found to be practically uninjured, aside from the injury to the buildings, and fires were started under the boilers on April 30. The company hopes to have the power plant in full operation soon. This will greatly relieve the strain that has been placed on the Bryant Avenue power station, and will enable the company to operate electric cars quite generally throughout the city. All the lines now being operated, as well as the extension of the Ellis and Eddy Street lines to Market Street, will be given a better service than existed previous to the fire.

Although transportation facilities are now being furnished San Francisco quite generally through the unburned district by the trolley lines, as well as through the heart of the burned district, there seems to be no prospect of operating any of the cable roads inside of six months. In fact, it seems quite likely that some of the cable roads of the city will never again be operated as such, and that the earthquake and fire will have the effect of hastening the conversion of many miles of cable roads into electric properties.

So far as the Sutter Street line is concerned, it seems to be generally conceded that its operation as a cable road is a thing of the past. The United Railroads will probably resume, in the near future, the work of standardizing the line, which was in progress at the time of the catastrophe, and which was described and illustrated in the last issue of the STREET RAILWAY JOURNAL. This involves the spreading of the tracks so as to obtain greater clearance between the inner

RUINS OF PALACE HOTEL AND CROCKER BUILDING IN DISTANCE. THE VIEW GIVES AN IDEA OF THE DEBRIS IN THE STREETS

rails, as well as the narrowing of the gage from a width of 4 ft. 11¼ ins. to 4 ft. 8½ ins.

The Sutter Street cable power house, in spite of the vigorous fight made by the company's men to save it, was completely destroyed by fire, and all that remains of the cable system is the roadbed and a lot of antiquated cars that were hauled to places of safety.

The Geary Street line, it is generally accepted, will never be again operated as a cable road. This is the municipal railway, and a contract has already been let for converting it into an underground conduit system.

The Union Street line may never again be operated as a cable road. The company's franchise has but six years to run, and it is not thought that the company would rebuild and equip the road except under a renewal of the franchise, in which event it is regarded as more than likely that the line would be converted into a modern electric road. The Union Street power house was completely wrecked by the earthquake, and, after that, was destroyed by fire. The roadbed on this line was badly twisted out of shape in places. On Union Street, between Steiner and Pierce, the roadbed was moved out of alignment fully 6 ft., and in other places the slot is closed.

As for the other cable roads of the United Railroads, all are in bad shape. The Valencia Street cable station, which operated the main Market Street line, the Valencia, Castro and Haight Street lines, was destroyed. The power houses of the Hayes and McAllister Street lines were not burned, but suffered by the earthquake. At the same time, the cable slots were more or less damaged, and to put them in shape for operation would require considerable time and expense. The Powell Street system, together with the lines on Sacramento, Clay, Washington and Jackson Streets, are also in bad shape, and it is the view of the officials of the United Railroads that the lines could not be put in shape to be operated inside of six months. The power house at Mason and Washington Streets was badly crippled by the earthquake, the high brick chimney that towered over the building doing much damage when it crashed through the roof. Later the power house was burned and the driving machinery ruined. A number of cable cars was burned at the same time.

Speaking of the damage caused by the earthquake and fire, Secretary Geo. B. Wilcutt and General Manager S. F. Chapman stated that the company lost four power houses and two sub-stations. The Bryant Street electric power house was saved by a 30-in. salt-water main, from which was pumped water for the protection of the property at that point. The company saved some of its records from its office in the Realty Building, and also from the offices at Market and Valencia, both of which places were burned. So far as known, not more than two or three of the company's employees were killed by the earthquake. Several of the officers were burned out of house and home, Mr. Handlon, assistant to Mr. Chapman, having a narrow escape from losing his life. The damage to the overhead work in the burned district is, of course, great, the wires being only good for scrap in most localities. In some places the track dropped 15 ft.; in others, the rails are badly warped by the heat. The cable roadbeds were thought at first to have stood the shock fairly well, but when succeeding tremblers closed up the cable slots in various places, the faith of the officials in cable roads was shaken also, and, of course, what would be detrimental to a cable slot would similarly damage an electric conduit roadbed. At present, it looks as if San Francisco will see nothing but trolley systems for some time, and it may be that the cable and conduit systems will entirely disappear.

In electrifying the Market Street cable road under the temporary franchise granted by the Mayor, iron tubular poles were placed 100 ft. apart next the curb throughout almost the entire length of this thoroughfare. The rails of the cable

LOOKING DOWN MISSION STREET, SAN FRANCISCO

tracks were bonded some years ago, and the work of getting the line ready for electric operation after the fire was greatly simplified. At the junction of Fifth and Market Streets a curve has been installed, so as to allow the cars on Mission Street to run up Fifth Street to Market, and then down Market to the Ferry.

One of the views on page 761 gives a good idea of Sutter Street on April 29, showing the stoves and improvised cooking utensils on the street and the cars saved from the Polk and Sutter Street car houses. All the cars in this car house might have been saved had there been any means of lowering the cars stored in the upper story. The electric elevator used was rendered useless by the earthquake, and, as no other means could be devised in the short space of time before the place was swept by fire, these cars were left to their fate. Those on the ground floor, however, were hauled into the street, and, with assistance of several teams of horses, were pulled up the incline on Sutter Street as far as Octavia Street, where they were allowed to run down the other side of the hill to Filmore, as seen in the same view. This portion of the street presented a unique and somewhat ghostly appearance the night of Thursday, April 19, with the long line of cars, standing motionless and filled with people who had no other shelter, and sat huddled together on these cars getting what rest they could after the exertions of the eventful day.

The headquarters of the United Railroads, formerly in the Rialto Building, which, as mentioned, was gutted by the fire, are now in the car houses at Turk and Fillmore Streets. This location is now nearly in the business center of what remains of San Francisco, and Fillmore Street to-day presents as busy an appearance throughout its whole length as Kearney or Market Streets did before the fire.

Under date of May 6, President Calhoun, of the United Railroads, telegraphed New York as follows: "One hundred cars were in operation yesterday, and gross receipts for the day were $6,373. Water was extended to North Beach power station last night. Two hundred cars are in operation to-day, including line to San Mateo. All electric lines, except some of those in the burned district, will be in operation to-morrow. In addition, Market Street has been equipped throughout with the overhead trolley since the fire, and is

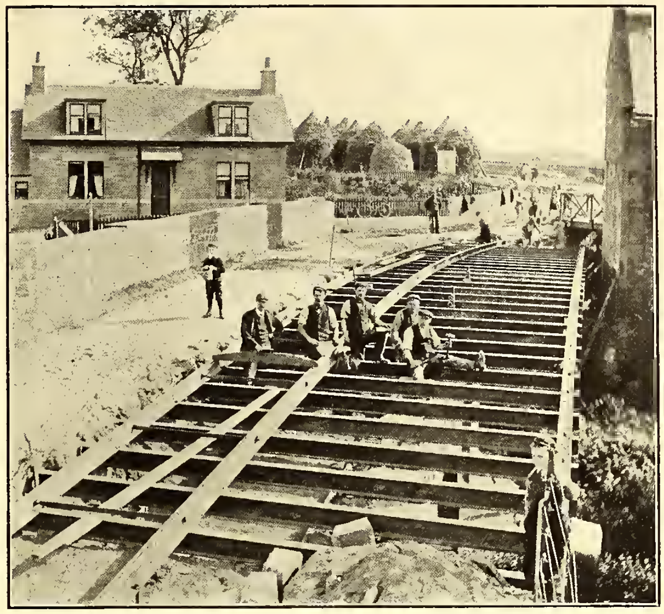
SECTION IN PRIVATE ROAD

now in full operation. We will start several additional electric lines in the burned district as soon as dangerous walls are removed. We will then give through electric service to all parts of the city. Normal conditions are being promptly restored, and the city will be rapidly rebuilt."

The Illinois Traction System has begun the distribution of about $100,000 under its profit-sharing plan, according to which each employee receives a cash present amounting to one-twentieth of his earnings for the year.

INTERURBAN LINE NEAR DUNDEE, SCOTLAND

The Dundee, Broughty Ferry & District Tramways, though short compared with many American systems, is interesting as being the latest British interurban railway. It connects Dundee, the third largest city in Scotland, with a population of 161,000, with Broughty Ferry, a residential town extending 3¼ miles along the seashore, and Monifieth. In 1901 the



WIDENING BRIDGE OVER DIGHTY WATER FOR ELECTRIC ROAD

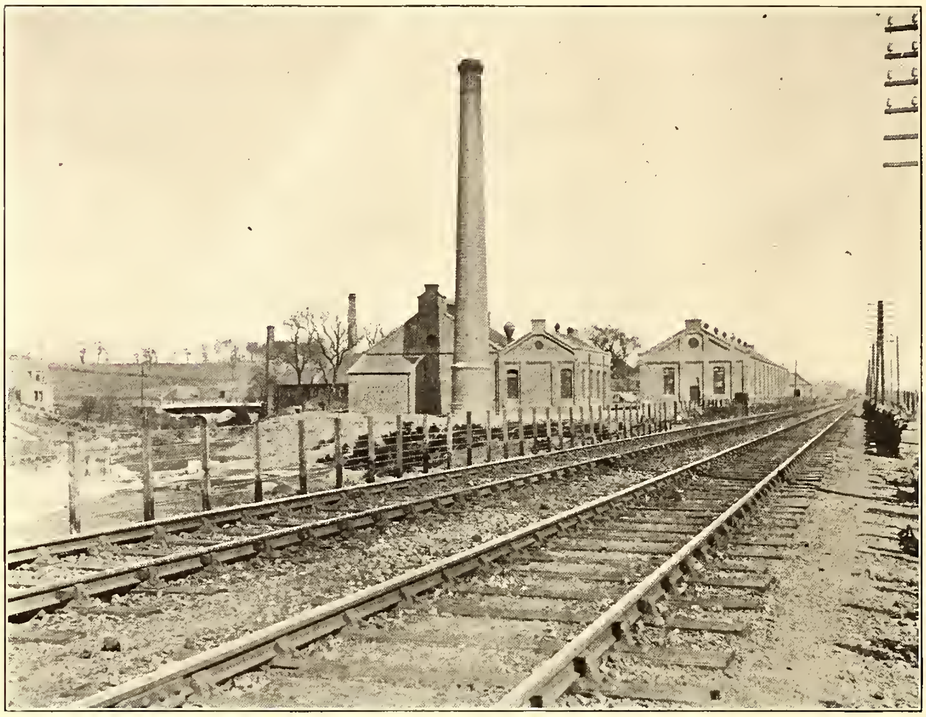
population of Broughty Ferry was 10,500, but this number is very largely increased during the summer months by the influx of visitors. Monifieth has a population of about 3000 and one of the finest golf courses to be found in Scotland, which during the summer draws large numbers of visitors.

Attempts have been made at joining up the above-mentioned places by means of tramways ever since 1872, and in 1899 Greenwood & Batley, Ltd., of Leeds, obtained an order under the light railways act to construct an electric railway over the route. The Board of Trade, however, refused to confirm the order, stating that it was convinced that a great deal of good would accrue from the building of the light railway, but it could not confirm the order on account of the material effect it would have on the existing railway companies, which were then serving the district in question. Finally, the existing bill, after favorable concessions had been obtained from the local authorities and land owners, was promoted in the spring of 1905 by George Balfour, and was duly passed and sanctioned in the same year.

The total length of route of the present system is about 5½ miles, 4¼ miles of which are double track, giving 9¾ miles of single track. It starts with a physical junction with the Dundee Corporation Tramways at the extreme eastern boundary of Dundee. For part of its length it runs along the country roads and highways, and for part over a private right of way to Monifieth. By an arrangement with the Dundee Corporation, the cars run over the Corporation lines to the center of the city.

The rails are of No. 1 British standard grooved section throughout, weighing 90 lbs. to the yard, with 96-lb. rails on curves of short radius. The sharpest curve has a radius of 30 ft. At the joints, continuous-rail joints were employed in lieu of the more usual fish-plate; the rails are anchored every 22 ft. The bonding is double, with concealed bonds of 4/0 section. The special work was supplied by Edgar Allen &

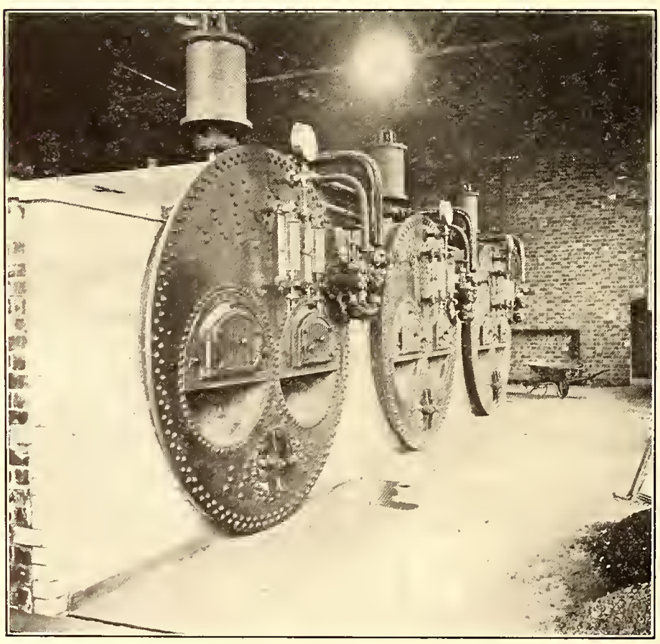
Company, Sheffield; the switches are 11 ft. long, of cast steel. with a radius turnout of 100 ft. The private right of way above mentioned was made 50 ft. wide. This road is fenced on both sides, and the cars are allowed by the Board of Trade



EXTERIOR OF POWER STATION AND CAR HOUSE, DUNDEE & MONIFIETH INTERURBAN RAILWAY

to run at a speed of 15 m. p. h. One bridge, where the road crosses the Dighty Water near Monifieth, was widened by passing steel girders under the track. These girders are embedded in concrete, and, acting as cantilevers, support the footpath on each side.

The overhead equipment is the standard side-running



BOILER ROOM

bracket-arm suspension, with double trolley wire and flexible suspension. The cables were supplied by Messrs. Henley, and are paper insulated, lead-covered, laid solid in wooden troughs.

The power house is situated on the banks of the Dighty Water, from which the supply of condensing water is obtained. The feed-water is taken from the Dundee water supply. The building is of brick, with a slated steel roof, and has two bays. The dimensions of the engine room are 53 ft. x 25 ft., and of the boiler house 53 ft. x 49 ft., the latter being built with a monitor roof. At the rear of the power house is a coal store 21 ft. x 12 ft. The chimney is 110 ft. high, with an interior diameter of 5 ft. The flooring in both engine and boiler rooms is of concrete. There are three Lancashire boilers, 28 ft. long and 7 ft. 6 ins. in diameter. The working pressure is 160 lbs. per square inch, and each boiler is capable of evaporating 4600 lbs. of water per hour at normal rating. At the back of each boiler is a Sugden superheater, provided with a by-pass to allow of it being cut out if necessary. Each superheater has 190 sq. ft. of heating surface, and is capable of superheating 5000 lbs. of steam per hour 150 degs. F., at the boiler pressure of 160 lbs. There are two Worthington steam-driven feed pumps, each capable of delivering 1400 gals. of water per hour to the boilers. The feed-water heater was supplied by the Wheeler Condenser Company; it has 150 sq. ft. of heating surface, and, with the exhaust steam from the auxiliary plant, will heat 2000 gals. per hour from 70 degs. to 200 degs. F. The condenser is a surface condenser of the Worthington make, and is operated by a Blake-Knowles combined air and circulating pump. The condenser condenses 9000 lbs. of steam per hour, and will maintain a vacuum of 26 ins. with the barometer at 30 ins. The pipework was supplied by Babcock & Wilcox, Ltd.

ENGINE ROOM

The generating plant comprises two Belliss-Bruce Peebles 200-kw traction sets, running at 400 r. p. m. The Ferranti switchboard used consists of two generators, one feeder and one Board of Trade panel. The lighting can be taken from the switchboard or be supplied by a separate Willans' unit.

The car house, which is situated at Milton, about one-half mile from Monifieth and about 100 yds. from the main road, is a brick building with a slated steel roof. The length is 221 ft., and width 36 ft. One end of the car house is occupied by repair shop, paint shop, storeroom and smithy. There are three pits, two of which are 135 ft. long, and one 170 ft. in length; the three doors are fitted with Kinnear steel rolling shutters, with special trolley-wire attachment.

The cars, twelve in number, were supplied by the British Thomson-Houston Company, of Rugby. They are fitted with that company's electrical equipments, the two motors being each capable of giving 1300 lbs. draw-bar pull at a car speed of 10 miles per hour. The bodies and trucks are of the Brush Company's manufacture. All the cars are fitted with hand, electric and track slipper-brakes.

TRACKLESS TROLLEY BETWEEN SPEZIA AND PORTOVERE, ITALY

The Società per la Trazione Elettrica, of Milan, has recently constructed a trackless trolley line between Spezia and Portovere, a distance of about 2.3 miles. The road follows all the sinuosities of the coast and has curves with a minimum radius of 25 ft. and grades up to 6.8 per cent. The cars take current from two overhead wires of the ordinary type, which are suspended at a height of 5.50 meters (18 ft.) from the ground, and 35 cm. (14 ins.) apart. Both span and bracket construction are used. One of the overhead wires is grounded and is connected with all the metallic parts of the car, to avoid any danger to passengers. The current is supplied from the power station of the Spezia tramway lines at 500 volts d. c.

The cars are built like 'buses and, therefore, are light, weighing empty only 1500 kg. (3300 lbs.) Each has a seating capacity of fourteen persons. Two 4-hp motors are used and are geared to the rear wheels. The controller is arranged for four forward and two backward speeds as well as for electric braking. There is also a mechanical brake operated by the foot or hand. The cars are fitted with electric heaters and lamps.

ITALIAN TRACKLESS TROLLEY OMNIBUS IN SERVICE

The trolley, known as the Cantono type, has given satisfaction and has held to the trolley wires even when turning curves at the speed of 20-25 km (12-14 miles) per hour.

Two cars are run from 6 a. m. to 8 p. m., so that each car makes twenty round trips daily, or about 140 km, or 88 miles. The average power consumption is about 200 watt-hours per car km. (320 watt-hours per car mile.) It is understood that the Società per la Trazione Electtrica is building two other similar line installations, one at Pavia, the other at Siena, and will construct a line at the Milan Exposition.

TRACKLESS TROLLEY TRUCK CARRYING FREIGHT

NEW SCHEDULES ON INTERCONNECTING OHIO INTERURBANS

The Dayton & Troy Electric Railway, the Western Ohio Railway, and the Toledo Urban & Interurban Railway have announced the schedules for their interline limited service between Dayton & Toledo, which will go into effect May 15. There will be through cars every two hours, alternating with the local cars, which will be confined to the separate roads. They will cover the 162 miles in 5 hours and 30 minutes, making stops only at Tippecanoe, Troy, Piqua, Sidney, Wapakoneta, Lima, Bluffton, Findlay, Mortimer, North Baltimore, Cygnet, Bowling Green and Maumee. The cars will carry baggage, and no excess fares will be charged except for local rides on any one of the roads. The chair-seat idea has been given up, and the cars will be the standard passenger coaches with high back seats to secure the maximum seating capacity.

THERMIT RAIL-WELDING IN NEW YORK CITY

BY R. F. KELKER

During the season of 1905 about thirty different companies —scattered from Massachusetts to California—made use of the Thermit process for welding from a few hundred to three or four thousand joints each. The advantages of the Thermit welding system lie chiefly in the simplicity and elasticity of its application.

A most striking instance of these advantages is shown by the work done last fall for the New York City Railway Company, on its Grand Street reconstruction. Local conditions would have made the use of other processes extremely difficult—if not absolutely impossible. Traffic congestion on such a narrow street as Grand Street would not have permitted the use of a portable cupola without closing the street. As power was not available until the last few days of the work, the welding could not have been done electrically. Another element which would have militated against the use of other processes was the inability of the contractor to have a sufficient number of joints ready to permit the welding gang to work continuously. It was necessary to lay off the men several times during the construction, and one lay-off lasted about three weeks. As the men in the welding gang were returned to other gangs, no loss was caused by the stoppage of the work, as would have been the case had other processes been used. These few points show clearly the simplicity of the process, and how easily it may be adapted to the various exigencies of field work.

The welding gang was made up of five men, including the working foreman, and this small gang made, as a maximum, twenty-seven joints in nine hours. The track was put in service a few days before the welding was completed, and it was necessary to finish by night work, with cars on 10 minutes to 12 minutes' headway. The number of men already mentioned made twelve welds between 1 a. m. and 4 a. m., with little interference to the traffic.

The laborers on the welding gang, four in number, were Italians. Owing to the irregularity of the work, the foreman seldom has the same men for more than four or five days. This brings out a salient feature of the Thermit process—the work can be done by inexperienced men.

The molds were made in the old horse car barn near Corlear's Hook, dried in a light sheet-iron oven, and stored in the car house until required. The materials for molding were clean, coarse Long Island sand and a low-grade flour. A batch of molding material was made up, in the proportion of one shovel-full of flour to ten or eleven of sand. These materials were well mixed by hand and tempered with water. The actual amount of water required can only be determined by practice. The molds, when dried, were very hard, and well withstood transportation across the city. The time required to dry the molds was about three hours. The molds and appliances sufficient for a day's work were loaded on a truck each morning and delivered at the desired point on the track. Empty mold boxes were returned each evening for refilling during the coming day.

A Buckeye torch with extension burners, of the type used for sweating out hard centers in special work, was employed to heat the rails at the joint, so as to drive out any moisture. A torch of this character is most efficient, on account of the time saved in waiting for the rail to become properly heated.

The welding was done after the track was paved. Several courses of dry paving were left at the joints, so that the rail should be as near the normal in temperature as possible, considering the season. After the joints were welded, a couple of laborers and pavers followed up the gang and immediately closed up the welding holes.

To hasten the execution of the welding, the actual work was divided among the men, and each had certain assigned duties. One laborer cleaned the rails with a wire brush, and in case there was a heavy coating of rust, it was removed by using a hammer and chisel. This man saw that the joint, if open, was properly closed by "Dutchmen," or shimmed. The gasoline torch was kept one joint ahead of the welding gang, and the cleaner was kept one or two joints ahead of the torch. The man engaged in cleaning joints also carried sand molds from the truck to the joint ahead of the welders, and saw that the molds were ready for use. While the men were carrying the torch ahead to the next joint, the foreman saw that the joint which had just been heated was in proper shape—that is, that it was in perfect line and surface, and properly shimmed. He then gave it a final cleaning with a wire brush, and painted the head of the rail with clay, to protect it. He next examined the molds and took a hand in placing them in position, assisted by his men. After the molds were placed, the mold boxes were carefully luted with moist clay, where they joined each other and where the rail passed through them. This was done to prevent a leakage of liquid steel, in case of any inequalities in the mold. Earth was then banked about the molds and rammed hard against them by the laborers, who completed this work of preparation. In the mean time the foreman examined the condition of the crucible, replaced the thimble if necessary, opened the welding portion and prepared the plugging material. The crucible was then set over the running gate in the mold. After this was done, the crucible was properly plugged and the Thermit welding portion was emptied into it. A half teaspoonful of ignition powder was placed on top of the Thermit, ignited, and the crucible was then immediately covered. Upon the completion of the reaction (twenty to thirty seconds) the foreman waited a little for the slag and steel to separate, then tapped the crucible. When the pour was completed, a laborer threw a shovel-full of dry sand over the slag in the mold. The crucible was then lifted to the side, cleaned with a small iron rod, and the rough slag was chipped away from the nozzle to provide the proper seating of the plugging washers for the next joint. In the meantime the laborers removed the clamp and molds. After a few moments more—required for the slag to solidify—the slag block was knocked free from the head of the rail by a bar or spike-maul, and the head of the rail was hammered lightly to a proper surface, if a slight upset showed or the shims needed trimming. This work completed the weld, and the welding hole was then filled with concrete and paved.

The rail welded was Lorain Steel Company's "Section 109, No. 340-a 9" Trilby girder. The track was built on what are known as Third Avenue and Metropolitan construction plans. The former, having suspended joints, was welded, and the latter, being of the support-joint type, was plated up and bolted. The construction work was done under a contract held by Naughton & Company, of New York City, and the Goldschmidt Thermit Company placed a working foreman on the track to care for the welding and its details.

The chief features of the work were the flexibility of the Thermit process in overcoming delays without loss of time, its fixed economy in relation to any number of welds, its simplicity, which admits the employment of unskilled labor; the small amount of light, and easily handled, equipment involved, and the fact that its use renders unnecessary either outside fuel or electric power.

THE FIRE PROTECTION OF CAR HOUSES

The Committee on Car Houses of the National Fire Protection Association has prepared its report, which will be presented at the annual meeting of the association, to be held at Chicago, May 22, 23 and 24, 1906. Through the courtesy of C. H. Patton, chairman of the committee, the STREET RAILWAY JOURNAL is permitted to make an advance publication of the report. This is done with the thought that some street railway companies might wish to offer suggestions for improving the specifications and requirements before the meeting of the association in Chicago. Any such suggestions should be sent during the week ending May 19, to C. H. Patton, Park Building, Cleveland, Ohio.

REPORT OF COMMITTEE ON CAR HOUSES

In submitting to this association for approval the accompanying requirements for construction, and automatic sprinkler protection, for railway car storage houses, your attention is respectfully invited first to a few general remarks touching on the subject.

Regarding automatic sprinkler protection in this class of property, one of the features considered is the probable loss to any one car or car body that would result from a fire, even under the best possible protection that may be provided. Even with aisle sprinklers at either side of car, placed as close to car as clearance may permit, the actual fire tests already given have demonstrated that a loss from $300 to $500 may be looked for. Taking the average sized car, 8 ft. by 40 ft., leaves two unprotected surfaces of 320 sq. ft., or in all 640 sq. ft. of surface of each car not directly protected, and without the closest possible distribution of water available at either side of car to reach this surface, the extent of a probable loss is increased. With the end in view of recommending protection in car houses that may reduce the probable loss in any one car to the lowest minimum, the accompanying requirements have been drawn up.

During the past year automatic sprinkler equipments of the aisle and ceiling system type have been installed in railway car storage houses at Albany, Cleveland, Pittsburg, one or two Eastern cities, and at several points in the West and Northwest. The Cleveland equipments were the first installations, were put in during the summer of 1905, and close observation of these equipments up to the present time does not show that operating practices have been interfered with or inconvenienced, or that the sprinkler lines have received any mechanical injury in any manner. All systems have been in apparent operative condition at all times: In one instance, however, condensation formed at drain valves of aisle lines, freezing up valves, which would indicate that where feasible, it would be well to supply aisle lines from underneath, rather than from overhead drop method, account of drainage.

The subject of recommending sprinkler protection for open-car storage yards came before your committee, but at this time no recommendations appear to be in order, due to lack of investigation. One experiment was recently made at Cleveland along the line of placing aisle sprinklers between car tracks, the heads being arranged pendantly, and without fuse, the systems being under hand-valve control at an unexposed location.

Information obtained by your committee from railway companies at twenty of our large cities relating to storing cars in the open, indicate a divided opinion as to such practice, the experience at most of these places being that cars stored in the open are susceptible to more rapid deterioration than when stored under cover, and that the plan is not economical. At other places, however, advices show that this practice is followed, and that the railway companies there favor the plan.

So-called non-combustible and semi-non-combustible cars appear to be receiving favor by railway companies for subway use, and in one or two instances are in use on elevated roads. Due to numerous reasons presented, indications at this time are to the effect that this type of cars will not, for some time at least, be generally adopted for surface-line use.

It is the opinion of some of your members that a car house of a standard non-combustible character would permit of at least a modified ceiling automatic sprinkler equipment, in connection with aisle sprinklers. This would lessen the cost of sprinkler equipment therein, and absolutely eliminate any building exposure to the cars, which would prove particularly desirable in the event of storage therein of cars of non-combustible construction.

Railway companies generally are giving closer attention than formerly to the importance attached to erecting car houses of non-combustible, and slow burning, construction; also to the limitation of car values in any one fire division. Noticeable among the properties erected of late, are several of reinforced concrete type throughout, and others of brick and reinforced concrete, and tile roof construction. This type of construction seems to permit of the practice of eliminating interior columns, the width of building being such as to accommodate not more than three parallel tracks, with roof girders having as support the side walls only, the span not exceeding, say, 35 ft.

Your committee respectfully requests that this association adopts a standard for reinforced concrete construction for buildings, at this present meeting. This class of construction is in general use in many cities, and a guide as to what may constitute proper construction is greatly needed. Your committee on cement for concrete construction has been requested by this committee, through your secretary, to present a standard to the association.

The past year shows a falling off of car house fires from previous experience, which is no doubt largely accountable owing to the betterment of hazards, improved maintenance, construction of buildings, and a safer system of electric wiring in cars. Quite a few extensive losses, however, occurred in railway properties during this period.

Your committee held a joint meeting with the automatic sprinkler committee on March 12 and 13 last, and the requirements herewith submitted are the outcome of that conference. Slight changes have been made, however, in these requirements by the chairman in revising the latest draft, and time did not permit of furnishing all members the latest revision. At the meeting in question there was present a very good attendance of members of these two committees, although not all members were there.

REQUIREMENTS FOR CONSTRUCTION OF STANDARD RAILWAY CAR STORAGE HOUSES

A standard railway car storage house should be one of non-combustible, or slow-burning character, throughout, and be so constructed and protected that it may not contribute in any manner toward the spread of fire therein, and contribute only, in case of fire, not to exceed sectional losses of the structure. One single division should not exceed dimensions to expose to any one fire a greater number of cars therein than would represent a valuation of $200,000 of combustible rolling stock, or a total interior trackage of not more than 1200 ft.

(NOTE:—The following are recommendations from the standpoint of fire protection only, and are in no way intended as a detailed guide to architects or mill engineers with reference to the strength which any building may require due to size or occupancy.)

SECTION 1. WALLS:—(Approved concrete construction is not covered under this specification.) Walls to be of good, hard-burned brick, laid in best of lime and cement mortar.

(a) Outside Walls:—When of pier construction, piers to be not less than 20 ins. thick, the face of pier to measure not less than one-fourth as much as the space between centers of piers, and the wall between piers to be not less than 12 ins. thick. When without piers, to be not less than 16 ins. thick.

Where exposed, to be carried full thickness of wall, at least 5 ft. above roof, to be provided with durable and non-combustible coping. Where roof is of fire-resistive construction, walls to extend to roof. If exposed, walls to be solid, or any openings therein to be protected in a standard manner.

(b) Cut-Off or Division Walls of Fire Sections:—To be not less than 16 ins. thick, and when walls are over 60 ft. in length, to be not less than 20 ins. thick, or to be strengthened by equivalent piers or pilasters, spaced not over 20 ft. center to center, the walls between piers being not less than 16 ins. thick.

To be not less than 5 ft. parapet, carried full thickness of wall, projecting through and beyond cornice 8 ins., with durable and non-combustible coping. Where roof is of fire-resistive construction, parapet may be modified.

To be no openings in division walls separating car-storage sections, except that for every 100 ft. of length there may be one opening in wall, of an area not exceeding 21 sq. ft., the same to be protected with a standard automatic closing fire-door on each side of opening. End walls to have no openings within 5 ft. of division walls.

SECTION 2. HEIGHT:—One story, without basement or space below, except at pits. Height of walls not to exceed 20 ft. at eaves line, or 25 ft. at peak of roof above the floor level, the slope being from 1 in. to 1 in. per foot.

SECTION 3. AREA:—Sections between standard cut-off or division walls to contain not over 16,000 sq. ft. of floor area. Distance between centers of adjacent tracks not to be greater than 12 ft. or less than 11 ft.

SECTION 4. ROOF AND ROOF SUPPORTS:—

(a) Post or Column Covering (when of Fire-Resistive Type):—All vertical metal supports to be insulated by not less than 4 ins. of concrete, or of terra cotta, or of such other insulating material as may be approved by the National Board of Fire Underwriters, independent of any air space next to the metal. Well-laid brick is strongly preferred for column covering.

(b) Girder Covering (when of Fire-Resistive Type):—All metal girders shall be insulated throughout by not less than 4 ins. of concrete, or of terra cotta, or of such other insulating material as may be approved by the National Board of Fire Underwriters.

NOTE:—No plaster of paris or lime mortar shall be used for the purpose of insulating material, nor shall any plaster, whether or not on metal lathing, be considered a part of the covering required.

No single block or unit of insulating material used for column covering shall have a greater vertical dimension than 6 ins. when placed in position, nor shall the shells and web of hollow tile or terra cotta blocks be less than 1 in. in thickness, and these blocks shall be laid up with Portland cement mortar, and the said blocks be suitably tied or anchored together.

(c) Roof (when of Fire-Resistive Type):—To be of an approved system of brick, concrete or terra cotta, or other non-combustible material which may be approved by the National Board of Fire Underwriters for such purpose, with satisfactory insulation of special supports or tie-rods. Roof covering to be of gravel or approved composition.

(d) Roof and Roof Supports (When of Slow-Burning Type):—Roof timbers to be not less than 3-in. splined plank. To have timbers (preferably single stick) not less than 6 in. x 12 in., spaced not less than 6, nor more than 10 ft. on centers, supported by wooden posts, not less than 10 in. x 10 in., and without trusses. Where roof timbers enter walls at opposite sides, there to be at least 8 ins. of brickwork between ends of beams, which shall be self-releasing. To be without monitors. Roof covering to be of gravel or approved composition.

SECTION 5. SKYLIGHTS AND VENTILATORS:—Skylights to be of flat type, wire glass and metal frames, constructed in accordance with National Fire Protection Association standard. Ventilators, if any, to be of metal.

SECTION 6. CORNICE:—Cornice, if any, to be of non-combustible material and plain finish.

SECTION 7. FINISH:—If any, to be non-combustible, and without concealed spaces.

SECTION 8. FLOORS:—To be of brick, concrete, stone or earth.

SECTION 9. PITS:—To be constructed of non-combustible material throughout, including floors, steps and walls, and to have not more than two track sections communicating.

SECTION 10. TRACKS:—To run clear from building, without break or transfer table. To be terminated by suitable bumpers, so that there will be a clear space of not less than 3 ft. between bumpers and wall of building. Special track-work in front of building to be provided with guard rails where necessary.

SECTION 11. TRACK DOORS:—Track doors to be in pairs, to be arranged so that whether open or closed, any door of one pair will not interfere with the operation of any other pair. When within 10 ft. of cut-off walls, to be covered and hung as for a swinging standard fire-door. Approved metal roller doors may also be used.

SECTION 12. HAZARDS:—All electrical, heating, power and occupancy hazards to be installed and maintained, and where necessary to be cut off, in accordance with the rules and requirements of the National Board of Fire Underwriters, as published in specific pamphlets.

RULES AND REQUIREMENTS FOR INSTALLATION OF AUTOMATIC SPRINKLER EQUIPMENTS IN RAILWAY CAR STORAGE HOUSES

The rules and requirements of the National Board of Fire Underwriters for sprinkler equipments, automatic and open systems, as recommended by this association, in published edition of 1905, are to be observed in protecting this class of property, and in addition thereto the special features as herein recommended are to apply.

Attention is also called to the necessity of sub-dividing the areas of street railway property, so that an excessive amount of value shall not be exposed to any one fire.

SECTION 1. CEILING CURTAINS:—

Permanent ceiling curtains are recommended in buildings having a height of over 23 ft., from floor to ceiling. These curtains may be constructed of non-combustible material, or of not less than 1-in. tongued and grooved boards, coated on both sides with non-inflammable paint; curtains to sub-divide ceiling into pocket areas not exceeding 5000 sq. ft, each, and be of a depth from ceiling to trolley wire. Inspection departments having jurisdiction should be consulted as regards the specific location of these curtains.

SECTION 2. AISLE SPRINKLERS:—

(a) In addition to the regular ceiling installation, sprinklers to be placed on both sides of each track, in an upright position, on horizontal pipe lines parallel with tracks, and to be so located that water will spray directly into cars through side windows of car bodies; the sprinklers to be at such a height that their deflectors will be from 2 to 4 ins. below the upper sash-rail of car windows.

(b) Distance between sprinklers on aisle lines not to exceed 8 ft.

(c) The standard pipe schedule to govern installation of aisle lines, except that no pipe smaller than 1 in. to be used.

(d) When the distance between sides of cars on adjacent tracks does not exceed 4 ft., one line of sprinklers to be placed in the center of each aisle between tracks.

(e) When the distance between sides of cars on adjacent tracks exceeds 4 ft., two lines of sprinklers to be installed. Sprinklers to be placed not less than 6 ins. nor more than 12 ins. from the sides of cars to be protected.

NOTE:—When the distance between the sides of cars in adjacent tracks is less than 12 ins., or where aisle lines in accordance with this section may not be practicable, as at curves, switches, transfer tables, car elevators, repair and paint shops, special instructions from inspection departments having jurisdiction, should be obtained as regards installing raised or altered lines.

(f) Sprinklers to be placed between cars and partitions, division, or outer walls, not less than 6 ins. nor more than 12 ins. from the sides of cars to be protected.

(g) Sprinklers on all aisle lines to be staggered spaced.

SECTION 3. SUPPLY MAINS TO AISLE SPRINKLERS:—

(a) Aisle sprinklers to be supplied through independent connection from main risers, taken from above and close to dry pipe valves; shut-off valves to be provided for ceiling and aisle systems, so arranged that either can be controlled independently.

(b) Aisle lines not to be supported by nor connected to ceiling sprinklers. Special hangers or supports to be provided that aisle lines may be rigidly secure.

(c) Ceiling sprinkler lines to be protected against short circuit from contact with trolley poles.

SECTION 4. PITS AND UNDERFLOOR SPACE:—

Underfloor space where communicating with pits, to be sprinklered.

SECTION 5. HAND FIRE APPLIANCES:—

Auxiliary hand fire appliances are deemed essential, as fires within car bodies must not be expected to be extinguished minutely by sprinklers, and a full equipment of approved chemical extinguishers or hand-hose service to be supplied. (See Section S, Rule 10, N. F. P. A. Sprinkler Rules.)

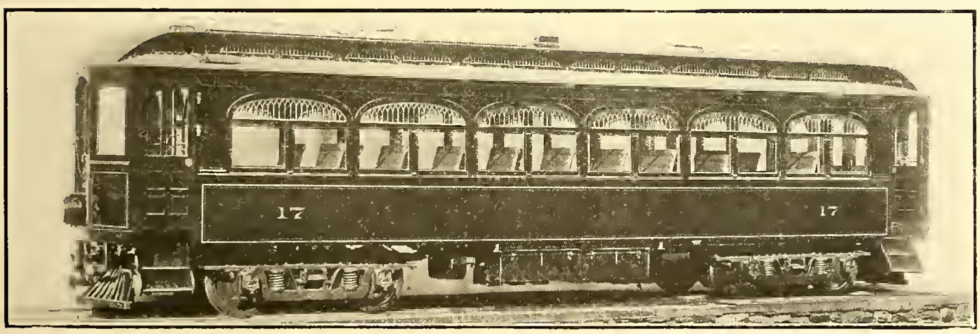
Motormen and conductors of the Stark Electric Railway, of Canton, Ohio, have been required to undergo an examination similar to that for employees of steam roads. A test for color blindness, hearing and sight and a physical examination were held. It was required that all employees, to retain their positions, must pass a satisfactory examination and secure a physician's certificate. With only one exception, all the crews passed the examination. This is one of the innovations instituted by General Manager F. L. Mowrey.

JOINT USE OF TRACK BY ELECTRIC AND STEAM ROADS IN ILLINOIS

The Warsaw Division, of the Keokuk & Western Illinois Electric Company, of Keokuk, Ia., is operated under rather unusual conditions. Warsaw lies across the Mississippi River and about five miles south of Keokuk, and in reaching it the electric line is operated over the tracks of three different companies, in addition to those of the operating company. The river is crossed on the railway bridge of the Keokuk & Hamilton Bridge Company. After leaving the bridge, the tracks of the Wabash Railroad are used for a distance of about 3000 ft. At this point a spur takes off a distance of about 1 mile to the city of Hamilton, but the main line continues down the river over the tracks of the Toledo, Peoria & Western Railway. When near Warsaw, a branch line constructed by the electric railway company leaves the steam road tracks and leads up the river banks into the town of Warsaw. The joint use of the tracks by the several companies necessitates particular attention being given that the electric cars are run on schedule time. All steam trains, when on schedule time, have the right of track over electric trains. When steam trains are late, however, conductors of the electric trains are instructed to obtain telegraphic train orders against the late trains from the despatcher's office at Peoria, Ill. Between Keokuk and Hamilton, the electric trains are governed by the rules of the Keokuk & Hamilton Bridge Company. A. D. Ayres, manager of the electric line, states that no difficulty whatever is experienced in the joint operation of electric and steam cars over the same track. An extension of the line of the Keokuk & Western Illinois Electric Company will be made to Carthage, Ill., during the coming year. The extension, which will be 12 miles long, will continue east from Hamilton and will pass through Elvaston, a town of about 500 inhabitants. Carthage has a population of 3500, and is the county seat of Hamilton County.

HANDSOME INTERURBAN CARS FOR PHILADELPHIA & WEST CHESTER TRACTION COMPANY

Seven fine interurban cars are now being placed on the lines of the Philadelphia & West Chester Traction Company, which connect the suburban towns of West Chester, Clifton, Garrettford, Llanerch and Ardmore with the surface, subway and elevated lines of the Philadelphia Rapid Transit system. The company has recently reconstructed its entire system to meet the demands of a rapidly increasing population to the west and northwest of the city.



A SIDE VIEW OF THE HANDSOME INTERURBAN CAR ADOPTED BY THE PHILADELPHIA & WEST CHESTER TRACTION COMPANY

The cars, which were built by the J. G. Brill Company, show very clearly that the policy of the railway is to provide its patrons with all the luxury, as well as comfort, possible to the most advanced forms of interurban equipment. As will be seen in the illustrations, graceful design is combined with powerful construction; but the cars themselves must be seen to have an adequate idea of their splendid appearance. The exteriors are painted a rich maroon with simple stripings in gold leaf. Below the windows the sides and vestibuled ends are sheated with steel. It is hard to conceive a more graceful arch than is embodied in the upper part of the twin windows

INTERIOR OF INTERURBAN CAR FOR THE PHILADELPHIA & WEST CHESTER TRACTION COMPANY

and the ventilator sashes. The effect is heightened by the arched row of green art glass in small diamond sections, set in the leaded glass of the window heads, and the same kind of glass is entirely used for the ventilators. In the interiors a light-green tinted dome of empire style, decorated with gold festoons of ribbon, contrasts pleasantly with the rich dark red of vermilion wood, which constitutes the interior finish. The woodwork is richly and simply carved and inlaid, and the bronze trim substantially and well designed. Clusters of lights, shaded by frosted glass globes, are set at intervals in the dome, and single lights are placed along the lower ventilator rails. The window sashes are arranged to be raised to their full height, and have balance weights, to make their operation easy. Between the larger compartment and the smoking compartment is a partition of vermilion wood, with sliding door, glazed in the upper part, and with windows on either side and leaded glass transom above. The partition is arranged to be readily removed from the car if desired. Single sliding doors, at either end, and the vestibule doors are also of vermilion wood. High back seats of generous dimensions are upholstered in green leather. Interlocking rubber tiling covers the floor, and, altogether, the interior presents a most attractive appearance. The bottom framing is entirely of steel, and consists of angle-iron side sills with extra wide sill plates; these sill plates take the place of inside and under trusses. The intermediate members and crossings are also of angle iron, with large gusset plates over the needle beams. The flooring is composed of cement, laid on galvanized corrugated iron and covered with interlocking rubber tiling.

The general dimensions of the car are as follows: Length over the body, 36 ft.; length over the vestibules, 44 ft.; width over the sills, including the side sheathing, 8 ft. 6 ins.; height from the rail over the trolley, 12 ft. 3/8 ins.; distance between the centers of the side posts, 2 ft. 10 ins.; thickness of the corner posts, 3 5/8 ins., and thickness of the side posts, 2 1/2 ins. and 4 3/4 ins.

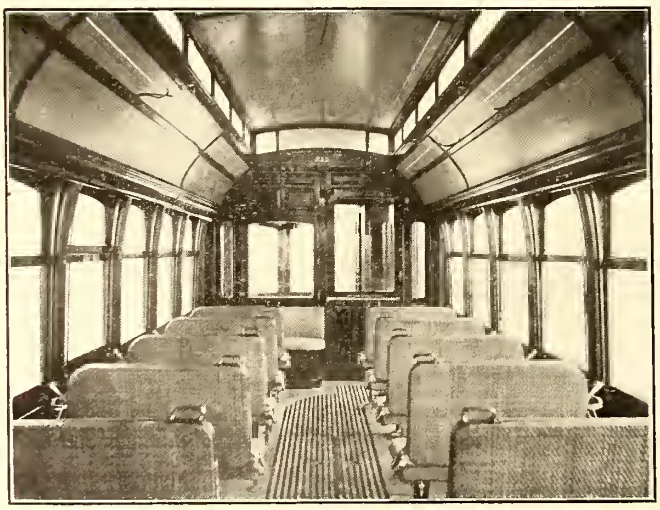
The cars are arranged for head-end train control, and have doors in the vestibule ends, to permit passing from one car to another. All of the cars are fitted with pilots at each end, as they are to be operated singly as well as in trains, and are to run in either direction.

CONVERTIBLE CARS FOR LINCOLN, NEB.

In 1891 the first electric cars were put in service in Lincoln, Neb., and the Lincoln Traction Company is now operating ninety cars over its 40 miles of tracks. In the paving of the roadbed the company has favored, to a large extent, the use of vitrified brick, which is manufactured near the city, and the manufacturing of this vitrified brick now forms one of the

CONVERTIBLE CAR, OPEN

city's chief industries. Lincoln is an important railroad city, on account of the presence of the State capitol, State institutions, several colleges and university, and the street railway company's tracks carry passengers direct from the Union Depot to these points of interest, which are mainly located in the suburbs, four or five miles distant. The stock yards and



SEATING ARRANGEMENT OF LINCOLN CAR

packing houses, located at West Lincoln, also create traffic on the lines which serve this district.

The latest addition to the rolling stock of the Lincoln Traction Company comprises four grooveless post convertible cars, built in St. Louis by the American Car Company, who also built four cars for this road of a similar character about a year ago; some of the first electric cars put in operation were the product of the John Stephenson Company. The new cars are particularly interesting on account of a motorman's compartment on the left side of the forward platform, having a diagonal partition, including a "semi-accelerator" swing door extending from vestibule corner post to inside post in body end. The rear platform is of the "Detroit" type, with a dividing railing extending three-quarters of the width of the platform. Another unusual feature consists of fixed panels between the double corner posts and side posts at the rear of the car, giving space for longitudinal seats at the rear corners, accommodating three passengers each, and at the same time increasing the standing space near the doors. These features were included in the cars furnished last year, and have successfully met the conditions in Lincoln. The cars seat twenty-eight passengers each and provide an unusually large amount of standing room. The interiors are handsomely finished in golden oak, with ceilings of birch veneer decorated. The sashes and panels are arranged to be raised into pockets in the side roofs. The seats are of Brill manufacture, having brackets between the posts and the backs, which not only strengthen the backs and enclose the space, but serve as grab handles. The flooring is double and the interspace filled with mineral wool.

The length of the cars over the end panels is 20 ft. 7 ins., and over the vestibules 30 ft. 7 ins.; width over the sills, including the sill plates, 7 ft. 6 1/2 ins.; over the posts at the belt, 8 ft. 4 1/2 ins.; sweep of the posts, 5 ins.; distance between the centers of the posts, 2 ft. 7 ins.; height from the floor to the ceiling, 8 ft. 7 7/8 ins.; from the track to the under side of the sill, 2 ft. 5 3/4 ins., and from the under side of the sills from the trolley board, 9 ft. 5 7/8 ins.; from the track to the platform step, 14 ins., and from the track to the running board, 18 ins.; length of the seats, 33 ins.; width of the aisle, 24 ins. The cars are mounted on 21-E single trucks, having 8-ft. wheel base, 33-in. wheels and 4-in. axles. Two motors are used per car of 27-hp capacity each. The weight of a car and truck without the motors is 15,300 lbs.

PROPOSED INTERURBAN RAILWAY BETWEEN NORWALK, OHIO, AND BLUFFTON, IND.

The Riggs & Sherman Company, of Toledo, has been engaged to make preliminary surveys and estimates for a construction line from Norwalk, Ohio, to Bluffton, Ind., the route being practically an air line. The road would pass through every county seat between these terminals, viz: Tiffin, Findlay, Ottawa, Van Wert and Decatur. At Norwalk connection would be made for two lines for Cleveland, and at Bluffton there are two lines for Indianapolis, thus giving excellent opportunity for through traffic between these centers. An electric line is now building through Ottawa to Toledo, thus giving an outlet to that city. It is claimed that the route from Toledo to Indianapolis and from Cleveland to Indianapolis would be shorter than any of the existing steam lines, and much shorter than any probable electric lines. At a meeting, held at Van Wert last week, J. W. Miller, of Kalida, was chosen president, and W. B. Jones, of Van Wert, secretary. I. R. Tudor, of Van Wert, N. E. Mathews, of Ottawa, and Harry R. Moltz, of Decatur, Ind., were chosen a committee to effect corporate organization. F. L. Webster, of Van Wert, was elected treasurer, and L. E. Gleason, of Van Wert, Dr. C. F. Douglas, of Kalida, and John B. Houlthouse, of Decatur, were chosen trustees, in whose name the right-of-way will be taken. This is one of the longest electric lines projected in this district.

TESTS OF 500-KW STEAM TURBINE

At the convention of the Iowa Electrical Association, held recently at Des Moines, a report was made by Messrs. Austin Burt and Niels Christensen of some tests made by the Citizens Gas & Electric Company on a 500-kw Curtis steam turbine, installed in its station at Waterloo, Ia.

The turbine was of the four-stage type. Steam at 150 lbs. without superheat was used. Water for the step-bearing and oil for the middle and top bearings were supplied by duplex pumps. The air pump of the surface condenser, which was of the Edwards type, was driven by a 12-hp motor, while a 30-hp motor drove the circulating water pump. Current for exciting the fields of the generator was furnished by a 25-kw horizontal Curtis turbo-exciter. All determinations were made by weighing the condensed water. Steam from each of the auxiliaries was condensed by coils immersed in cold water.

The results of the tests are given in the following table:

TABLE I.

	A Length of Test Hours	B Average Load Kw	C Per Cent. of Capacity	D Steam Pressure Lbs.	E Vacuum in Inches	F Total Steam Used Lbs.	G Steam per Kw Hour Lbs.	H Builder's Guarantee Lbs per Kw Hour
1. Turbine ½ load	1	253	50.6	150	27.87	5487	21.67	23.5
2. Turbine variable load	8	366	73.2	149	26.91	63955	21.82	23.0
3. Turbine ful load	2	518	103.6	147	27.81	20370	19.61	21.
4. Turbine 50% overload	1	750	160.	144	28.02	14635	19.52	21.5

The water consumption of each of the auxiliary units, as well as the total consumption for auxiliaries and generator, is shown in Table 2.

TABLE II.

	Average Kw	Step and Oil Pumps Lbs.	Circulating and Air Pumps Lbs	Exciter Lbs.	Total Auxiliaries Lbs.	Generator Lbs.	Total Generator and Auxiliaries Lbs.	Total Coal per Kw Hour Lbs.
Turbine, ½ load	253	.47	2.86	1.61	4.94	21.67	26.61	4.09
Turbine, variable load	366	.31	2.01	1.05	3.37	21.82	25.19	3.87
Turbine, full load	518	.24	1.28	.95	2.47	19.61	22.08	3.27
Turbine, 50% overload	750	.18	.88	.65	1.71	19.52	21.23	3.34

STARTING UP OF AN ALLIS-CHALMERS STEAM TURBINE

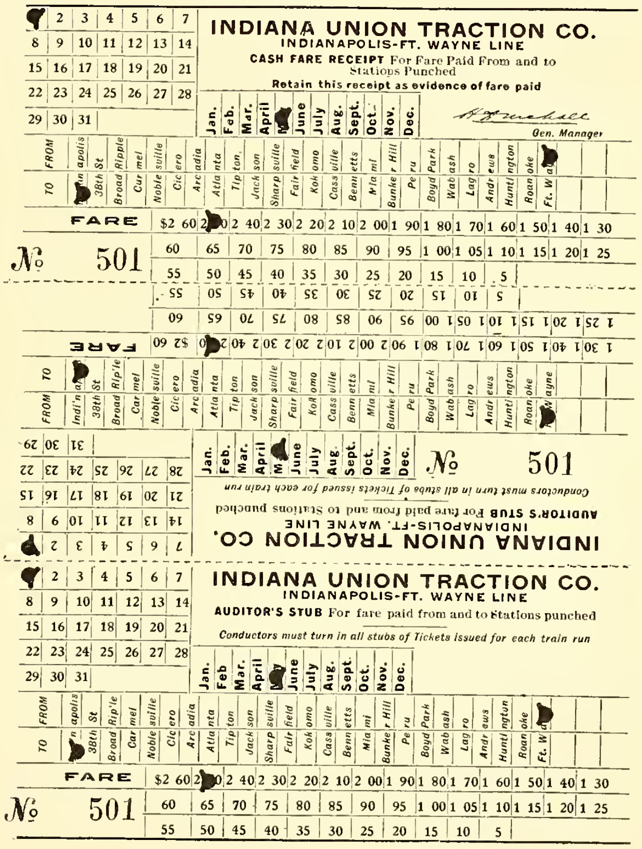
A large steam turbo-alternator built by the Allis-Chalmers Company has recently been started up under such circumstances as to deserve chronicling. The turbine referred to is one of 5500-kw rated capacity, installed in the Kent Avenue power house of the Brooklyn Rapid Transit Company. The turbine and its direct-connected alternator were ready for operation on Feb. 1, but the boilers, condensing apparatus, piping, etc., were not completed until late in March. While lying idle for nearly two months in an uncompleted station, the insulation of the generator windings naturally became damp, and therefore, as soon as steam was available for running the turbine, it was started up at part speed to dry out the generator. This drying-out process was going on when, on the morning of March 27 a mishap at another power house left the railway company short of power and it was decided to put the new turbine in operation. The turbine was run slowly until 12 o'clock to dry out the generator. Insulation tests were then conducted and the load was then gradually put on the turbine, until at 3:05 the turbine was carrying a little over 3000 kw, which was all that the railway company needed at that time. At 3:45 p. m. the unit was carrying over 4000 kw. On the following day the load ran up to over 5000 kw, and on the succeeding day it reached 7000 kw, the turbine taking heavy loads during the morning and afternoon peaks, and running until late each night.

On March 30, the other apparatus of the transit company being again in working order, an opportunity was given to lay off the turbine. It was started again, however, on April 1, and has been in continuous operation ever since.

TRIPLICATE FARE RECEIPT FOR INDIANA THROUGH INTERURBAN RIDING

For the through service between Fort Wayne and Indianapolis inaugurated on May 1 by the Indiana Union Traction Company and the Wabash Valley Traction Company, a new triplicate cash fare receipt has been devised by William H. Forse, Jr., auditor of the former company. It was realized that a passenger who overlooks buying a ticket does not wish to be bothered by several fare collections during his journey, and therefore a receipt had to be invented to meet the peculiar conditions arising from through service over the lines of two companies.

The receipts are made up in pads of fifty, and the three parts are so folded that the conductor can punch like sections simultaneously. The passenger's portion of the receipt



TRIPLICATE CASH FARE RECEIPT

is not only indicated by the different text in the upper right-hand corner, but by the red printing in addition. The two audit stubs, which are exactly alike, are turned over by the conductor to the auditor's office of the road upon which he ends his day's run. In this office the clerks separate the two stubs to send one to the auditor of the connecting line that he may calculate the number of passengers carried, earnings, etc. It will be noted that the conductor must make five perforations in all—two for the date, two for the starting and stopping points, and one for the amount paid.

FINANCIAL INTELLIGENCE

Wall Street, May 9, 1906.

The Money Market

There has been very pronounced relaxation in the money market during the week, and it now looks as if we had seen the end of any tight money. Call loans were made as low as 2½ per cent, and time money was offered at 5¼ per cent, with borrowers not disposed to pay over 5 per cent for any period. This change is the natural result of the cessation of shipments of money to the Pacific Coast. Since the movement began on April 18, the city banks have transferred a total of $34,468,000 through the Sub-Treasury and by mail and express. Some additional small amounts may be sent, but these will represent merely transfers of relief money. The ease in money is due to the large gold movement and the Treasury policy of advances against actual engagements. Since May 1 the engagements amount to $15,500,000, and the arrivals of gold to only $6,000,000. Since the beginning of the import movement on April 12 the engagements aggregate $48,370,000, the arrivals $19,362,600, and the amount due to come $29,007,400. It is expected that the Bank of England directors will advance the official discount rate on Thursday, but the Bank of France has adopted a liberal policy, and will release gold for New York. It is said that the French bank will release $5,000,000 each week until the American demand has been filled. There is nothing in the domestic situation other than trade activity, that would make for firm money, and the outlook is encouraging.

The sterling exchange market has developed a decidedly firmer tone, and rates are fully ½ cent higher, the advance having been due to purchases against gold imports, an inquiry for remittances and the inactivity of loan bills. Until grain and cotton moves out more freely the market will be governed by bankers' requirements.

The Stock Market

The past week has been an eventful one in Wall Street, and the developments having direct relation to the securities market have been of more than ordinary importance. The Garfield report on the Standard Oil Company, which President Roosevelt submitted to Congress on Friday, had been anticipated with some apprehension, but it contained some very favorable suggestions regarding the railroads, and really proved the influence which turned the stock market. From the date of the San Francisco disaster the market underwent liquidation on a large scale, and prices declined in a semi-panicky manner. Weak holders were shaken out, and several plungers were compelled to throw over a big line of stocks. Following the Garfield report came the news that the miners convention had decided to accept the terms of the 1903 agreement for a period of three years, thereby removing all labor troubles in the anthracite trade. The practical suspension of currency shipments to the Pacific Coast was another favorable influence, and the result was a sensational recovery in the whole market, under the lead of Reading, which advanced nearly 20 points from the low level of last week. The improvement was largely the result of short covering, assisted by some "bargain" buying, but the market was heavily oversold, and the recovery was only a natural one, although it has run further than expected. We have had all the liquidation possible, and with easier money, good crop prospects and activity in trade the outlook is more promising for a better market.

The local traction shares were strong, and Brooklyn Rapid Transit was prominent in the recovery, the improvement in it having been based on large earnings.

Philadelphia

Very little activity developed in the local traction shares during the past week, and although prices displayed some irregularity, the general tread of values was upward. At the beginning of the week the liquidation in the general securities market was reflected in lower prices for the street railway shares, but toward the close there was some good buying, which lifted prices for several issues substantially above those prevailing at the close of the previous week. Philadelphia Company common, after selling at 49¾ at the opening, advanced to 51, and closed within ⅛ of the highest, on transactions amounting to upward of 6000 shares. Sales of the preferred stock were made at 48¾ and 49, while the unstamped receipts, representing about 2500 shares of stock, sold at 34. Philadelphia Rapid Transit also recovered from the recent depression, about 4000 shares changing hands at from 25⅞ to 27. Philadelphia Traction was unusually active, upwards of 700 shares selling at 98¼ and 98½. Union Traction, after selling at 62, jumped to 63, on the purchase of about 700 shares. Consolidated Traction of New Jersey eased off from 79 to 78⅛, but later recovered to the opening figure. Second & Third Street Passenger stock sold at 29½ for a small lot, representing a loss of about 7 points. Other transactions included United Companies of New Jersey at 262½, American Railways at 51½ and 51¾, and Railways General at 6⅞.

Chicago

The market for tractions at Chicago has been very quiet, trading for the most part being limited to odd lots. Prices, however, ruled firm. North Chicago, after selling at 35, broke to 32, but subsequently recovered to the former figure, while West Chicago rose from 26 to 29 on the exchange of 25 shares. Chicago Union common sold at 5⅞ and 6 for 200 shares, and 100 preferred brought 17. Chicago & Oak Park Elevated sold at 6 for 300 shares, and South Side Elevated moved up to 90. A small lot of Metropolitan Elevated brought 26½, and 125 shares of Northwestern sold at 24.

Other Traction Securities

Trading in the Baltimore tractions was confined almost entirely to the United Railway issues, about all of which recovered part of the recent losses. The free stock sold from 15 to 15⅝ for about 600 shares, while the pooled advanced from 15½ to 16⅜, about 2500 shares changing hands. The free incomes rose from 68⅞ to 69¾, on the exchange of about $75,000 bonds, and the certificates representing bonds deposited brought prices ranging from 67½ to 68½. The 4 per cent bonds were quiet but steady, upwards of $50,000 changing hands at 92. Macon Railway & Light 5s sold at 100, and $10,000 Norfolk Railway & Light 5s brought 99¾. The Boston market was dull and irregular. At the beginning of the week Boston Elevated dropped a point to 153, but subsequently recovered all of the loss. Boston & Worcester common moved between 35 and 36½, and the preferred sold at 87½. Massachusetts Electric issues were heavy. The common, after selling at 18, ran off to 17½, on sales of a few hundred shares. While the preferred declined from 65½ to 64. West End common changed hands at 98 and 99, and the preferred sold at 115 and 114¾. Trading in the tractions in the New York curb market has been extremely light, owing largely to the transfer of the dealings in the Interborough-Metropolitan issues to the New York Stock Exchange. Interborough Rapid Transit receipts alone figured in the week's transactions on the curb, about 1500 changing hands at from 217¾ to 226. The majority of traction issues showed a decline on the Cleveland exchange last week. Northern Ohio Traction & Light common dropped from 30 to 28¾ on sales of about 800 shares. This in the face of the statement that the stock will be placed on a 2 per cent basis in July. About $20,000 worth of the Consolidated 5s sold at 100¼, a fractional decline. Lake Shore Electric Railway declined to 15¼, a fall of 1 point during the week. Cleveland & Southwestern Traction sold at 14, also a fractional decline. The new Aurora, Elgin & Chicago sold at 30½, a decline of 2 points from the price of the old common, which is supposed to have the same value. Cleveland Electric Railway sold at 78. Cincinnati, Newport & Covington common continues to advance on the Cincinnati exchange. The stock opened the week at 64, and sold at 66 the early part of this week. Cincinnati, Dayton & Toledo stock was active for the first time in some months, and it moved up to 27 on sales of about 600 shares. Cincinnati Street Railway sold at 144½. Toledo Railways & Light declined to 30, and Detroit United to 92, in sympathy with movement on the New York exchange. At Columbus, the Scioto Valley Traction common has been in strong demand at around 39. The property is making gains of 80 per cent gross over last year, and dividends on preferred stock will start July 1. Columbus Railway & Light common has been active at around 82, and the old Columbus Railway common was active at 103.

Security Quotations

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

	May 3	May 9
American Railways	51¼	51½
Boston Elevated	a154	153
Brooklyn Rapid Transit	75	82⅝
Chicago City	150	150
Chicago Union Traction (common)	6⅛	6⅛
Chicago Union Traction (preferred)	21½	21½
Cleveland Electric	80	78
Consolidated Traction of New Jersey	79½	79
Detroit United	92¾	94
Interborough Rapid Transit receipts	219	223
Interborough-Metropolitan Co. (common), W. I.	49¾	52
Interborough-Metropolitan Co. (preferred), W. I.	82½	85¼
Interborough-Metropolitan Co. 4½s, W. I.	—	87¾
International Traction (common)	37½	36½
International Traction (preferred), 4s	73	71
Manhattan Railway	148	152½
Massachusetts Elec. Cos. (common)	17	17¾
Massachusetts Elec. Cos. (preferred)	64½	65
Metropolitan Elevated, Chicago (common)	26	26½
Metropolitan Elevated, Chicago (preferred)	—	64½
Metropolitan Street	108	113
Metropolitan Securities	70⅝	70¼
New Orleans Railways (common)	30½	31
New Orleans Railways (preferred)	—	—
New Orleans Railways, 4½s	—	86
North American	93¾	96⅞
North Jersey Street Railway	27	27
Philadelphia Company (common)	49¾	50¾
Philadelphia Rapid Transit	25⅜	26¾
Philadelphia Traction	98¼	98½
Public Service Corporation 5 per cent notes	94	94
Public Service Corporation certificates	—	68
South Side Elevated (Chicago)	88	89
Third Avenue	126	127
Twin City, Minneapolis (common)	110¾	113½
Union Traction (Philadelphia)	62	62¾
West End (common)	98	98½
West End (preferred)	114½	114½

W. I., when issued. a Asked.

Metals

According to the "Iron Age," the production of anthracite and coke-iron in April amounts to 2,073,645 gross tons, compared with 2,165,632 tons in March. The furnaces are running at the rate of 484,000 tons a week. Foundry pig is rather quiet, with an easier tendency in some localities. Further activity is reported in steel-making irons. The cast-iron pipe foundries continue exceedingly busy. Pacific Coast orders for structural material have been very light. Further rail orders for 1907 are looking up. The Pennsylvania enquiry is for 180,000 tons, and two Western roads are in the Chicago market for 70,000 tons. Copper metal continues strong; heavy sales for near delivery being reported at 19 cents. Quotations are unchanged at 18½ to 18¾ cents for Lake; 18¼ to 18½ cents for electrolytic, and 18 to 18¼ cents for castings.

YOUNGSTOWN & OHIO COMPANY'S PLANS

The Youngstown & Ohio River Railway Company, which is being promoted by prominent Cleveland people to build a line from Youngstown to the Ohio River at East Liverpool, has secured a 99-year lease on 6 miles of the Pittsburg, Lisbon & Western Railroad (steam), extending from Salem to Washingtonville. This section will be electrified immediately and will be used as an entrance to Salem from the main line of the road. The Cleveland Construction Company, which is building the new line, has secured all the required right of way, has purchased rails and ties for 28 miles of road, and will commence construction work immediately from Washingtonville to East Liverpool, by way of Lisbon. Officials of the company state that there is no truth in the report that it has affected amicable arrangements with the Youngstown & Southern Railroad, which is operating a line from Youngstown to Columbiana, and which, it is reported, proposes to build a parallel line through Lisbon to East Liverpool

ANNUAL MEETING OF THE NEW YORK STATE ASSOCIATION

It is officially announced that the regular annual convention of the Street Railway Association, of the State of New York, will be held at the Grand Union Hotel, Saratoga, N. Y., on June 26 and 27. It is confidently believed this meeting will be one of the most successful ever held under the auspices of the association. Saratoga is conveniently reached from all parts of the State; the hotel proprietors promise to take the best of care of the convention; an excellent programme of papers, reports and discussions is in course of preparation and especial entertainment features will be provided for the ladies. Further particulars concerning the programme, and other features of the meeting will be published in a later issue.

CLASSIFIED ACCOUNT OF SUBWAY OPERATING COMPANY'S EXPENSES GETTING READY TO RUN

August Belmont, president of the Interborough Rapid Transit Company, has supplemented his former statement of the investment of the company in the operation of the subway with a moderately detailed account of the expenditures under the head of "Equipment." This item, as it was lumped in the first statement, made it appear that equipment was responsible for upwards of $22,000,000. It now appears that the $22,000,000 included all of the company's expenses up to the time that the company began running trains, expenditures for salaries, lighting, legal expenses and such matters while the enterprise was still in the constructive stage and was earning nothing, having been regarded as capital investment. In this matter the company followed the usual practice of accounting, even in charging interest on the investment during construction to capital account.

The detailed statement of capital expenditures follows:

Engineering	$444,461.09
Main power station building, engines, generators, boilers, tools, machinery, etc.	7,047,540.32
Sub-power station buildings, tools and machinery	2,145,468.16
Cables	1,940,686.82
Third rail and bonding running rail	405,349.41
Train inspection sheds and Lenox Avenue shops and yard	391,472.13
Telephone line	42,714.02
Cars	8,043,366.31
Tunnel and station lighting and equipment	364,209.42
Interest on various expenditures from date of purchase to Oct. 27, 1904	594,876.10
Office furniture and fixtures	17,128.76
Signal system	691,643.72
Legal expenses, including counsel fees and salaries of attorney and assistants, and all other law department expenses, including office rent, printing, etc., from May, 1902, to Oct. 31, 1905	101,027.19
Salaries of general officers and clerks from May, 1902, to Oct. 31, 1905	332,787.01
Directors' fees	20,525.00
Insurance	8,208.98
Stationery, printing, advertising, etc.	24,800.40
Miscellaneous office expenses, etc.	51,700.43
Shop and yard, Fifty-Fourth Street (since abandoned)	2,074.99
Structure and track tools	6,877.09
Total	$22,676,917.35

Comptroller Metz has detailed one of the city's accountants to go over the books of the subway company and verify the above statement. Assuming that he will find it correct, there still remains the matter of $12,100,000 cost of subway lease to be explained in equal detail. The declaration of Mr. Belmont's representatives that the apparent profit of $7,000,000, for which the present company had to pay the Rapid Transit Construction Company when the lease was transferred, had all gone into the property is likewise a matter for verification by the city authorities.

LONG ISLAND'S NEW TRAIN SCHEDULE—THE PART PLAYED BY ELECTRICITY

The spring time-table of the Long Island Railroad will go into effect on Thursday, May 17. A number of additional trains will be run on the several divisions of the road and the running time of numerous trains will be reduced, thus giving faster service than during the winter, and in some respects as good as the full summer schedule. The change which will be made in June, however, will introduce still more trains. The many new locomotives which are already in use will enable the operating department to keep to schedule time, and the additional equipment of coaches and parlor cars will help to overcome one of the chief difficulties of the past, when for lack of equipment there has repeatedly been vexation on the part of the officials as well as the traveling public.

The adoption of electricity on the Atlantic division, between Flatbush Avenue station, Brooklyn, and Jamaica, and to Rockaway makes a vast difference in the running time of trains, permits the running of a greater number of trains each way and thus adds materially to the betterment of the entire service of the road. On and after May 17, 194 of these electric trains will be operated daily. The electric service will be extended to Valley Stream, on the Montauk division, 15¾ miles from Flatbush Avenue by way of the old southern road, known as the Locust Avenue route, which is to be operated as a part of the Atlantic Avenue division. Ten trains each way will be run over this section between Jamaica and Valley Stream, and thirty each way between Flatbush Avenue and Belmont Park.

A study of the new schedule shows that there will be many small changes in the time of running trains, nearly all in the interest of better service by reason of shortening the time of trips. In some instances trains will start a few minutes later than at present from the island stations, and reach the western terminals at the usual time. In several instances trains which are now doing duty for many stations will be changed, so that there shall be an express to take care of the larger stations and a local to accommodate the rest.

STUDENTS OF POLYTECHNIC INSTITUTE OF BROOKLYN MAKE TRAIN TEST

On Monday evening, May 7, the students in the electric railway course at the Brooklyn Polytechnic Institute under their instructor, Sydney W. Ashe, made a train test on one of the Brooklyn Rapid Transit Company's "L" cars on the Fifth Avenue line. The car left the Thirty-Sixth Street yards at 9:30, equipped with a new train-testing set, the thesis of Messrs. Hewlett and McCarty, of the Polytechnic. The instrument contained a roll of paper 10 ins. wide, arranged to pass under pencils which recorded line voltage, motor current, time in half-seconds, wheel revolutions and instantaneous speeds. In addition, records were taken of the peaks of the total line current, and of the motor voltage while accelerating. The test was a great success, complete data being obtained over the line from Thirty-Sixth Street to New York and return to Sixty-Fifth Street, and then to the Thirty-Ninth Street yards.

This recording device was built in line with ideas of Mr. Ashe, who had had considerable trouble in obtaining satisfactory results with the testing sets hitherto made. An interesting feature was the use of a Weston magneto tachometer, which was mounted on the end sill of a car-truck on rubber cushions. This instrument was belted to the 5-in. axle of the trailer truck. Wires were then led up from the instrument to the recording device, which followed variations of the voltmeter needle. Prior to the test the car was moved over a small stretch of track, making a given number of wheel revolutions. This distance was taped and the circumference of car wheel accurately determined. One important result of the test, was the proof of the great superiority of the Westinghouse unit switch control, over the older forms of Westinghouse upright control, and various forms of hand-control. The test was made possible by the co-operation of various officials of the Brooklyn Rapid Transit Company, namely, Messrs. Calderwood, Roehl, Gove, Smith, and their assistants, Mr. Brown and Mr. Dempsey, and was very successful.

On Monday, May 14, a similar test will be made on the railway company's instruction car No. 999, which is equipped with upright control. The Monday following, a complete test will be made on a four-motor trolley car of the latest type.

THE REORGANIZATION OF THE HUDSON VALLEY COMPANY

The reorganization of the Hudson Valley Railway Company has been completed. E. Clarence Jones & Company and Charles W. Morse, jointly, are now in control of the company, and it is intended to operate in connection with the Hudson River lines of steamers from New York to Troy and Albany, which are controlled by Charles W. Morse through the Hudson Navigation Company, and make a direct route for passengers and freight between New York and all points on the Hudson Valley Railway Company and to Lake George. The reorganized company will have $3,000,000 capital stock and a total authorized issue of $4,000,000 first consolidated mortgage 5 per cent bonds. Of these bonds, which are now the same securities as were authorized before the readjustment of the company's finances, $2,228,000 have been issued, $1,290,000 are held in the treasury to secure an authorized issue of $645,000 collateral trust bonds, of which $500,000 are outstanding and $145,000 are in the treasury; $482,000 of the mortgage bonds are reserved to retire divisional bonds. The debenture "A" income 5s amount to $700,000, of which $227,000 are in the treasury, and the debentures "B" income 2s to $2,500,000. The consolidated bonds are a first mortgage on the entire system of about 127 miles, subject only to $482,000 divisional bonds on about 26 miles.

CHICAGO TRACTION MATTERS

Mayor Dunne's letter, sent last week to Chairman Werno of the local transportation committee, in which he urged the immediate betterment of the street railway service of the city and outlined a plan for securing improvements, has been received with commendation by both municipal ownership advocates and those opposing municipalization. The traction situation, however, is awaiting the outcome of the motion for a new trial in the ninety-nine-year case made by the traction companies. Mayor Dunne feels confident that the motion will be overruled. If it is, the Mayor expects the Council to work along the lines suggested in his letter. Regarding his attitude the Mayor is quoted as having said:

"I am in favor of better service. I want it just as soon as we can get it. I will champion any plan for getting it which will not jeopardize municipal ownership. I want it made plain that I have not tried and will not try to hinder the improvement of the transportation facilities in even the slightest way. My position is directly the opposite, and I believe the lines can be rehabilitated within two years. I don't mean to wait that long before we do something in this direction. The plans and specifications for improvements can be approved in short order. Just as soon as the companies make an agreement with the city, just that moment we will have municipal ownership in easy reach. Things ought to hum from this on."

Alderman Werno sent out invitations to traction officials to attend a meeting of the Council, at which it was proposed negotiations for settlement were to begin. Among those invited were T. E. Mitten and General Counsel E. R. Bliss, of the Chicago City Railway; John M. Roach and W. W. Gurley, of the Union Traction Company, and Henry A. Blair, of the North Chicago and West Chicago companies.

The City Council, not content to wait for the decision as to whether or not a new trial should be granted the traction companies in the ninety-nine-year case, has unanimously passed an order for equipping the Blue Island Avenue cars with electricity and rerouteing them. Mayor Dunne opposes this action, because of the fear of giving the traction company additional rights in case the rehearing of the ninety-nine-year case is granted, and he may veto the ordinance.

A petition of more than two hundred property holders and business men along Cottage Grove Avenue has been presented to the Council by Alderman Bennett. The petition asks that the Cottage Grove Avenue cable line, from Thirty-Ninth Street south, be equipped with the overhead trolley. The claims of the Chicago City Railway under the ninety-nine-year case do not apply to this part of Cottage Grove Avenue.

The case involving the relative rights of the Union Traction Company and its underlying companies has been postponed, because of the illness of Judge Grosscup. Julien T. Davies, Henry W. Taft and R. R. Govin, representing New York capitalists, who came to Chicago to appear before Judge Grosscup and induce the underlying companies to apply jointly for franchises and licenses, returned to New York without having accomplished anything definite towards bringing the companies together.

INDIANAPOLIS-FT. WAYNE LINE OPENED

Through limited service between Indianapolis and Ft. Wayne over the Indiana Union Traction and the Ft. Wayne-Wabash Valley Traction Companies' lines was begun Tuesday, May 1. The first car out of Indianapolis left at 7 a. m., and made the trip in 4½ hours, and the first car out of Ft. Wayne left at 5:20 a. m., and made the trip in a few minutes less than schedule time. There are four trains each way daily, which connect at Ft. Wayne with more than ten railroads, and complete traction service through to Toledo and Lima.

Six cars are used for this service, known as the "Kenilworth," "Ivanhoe," "Talisman," "Woodstock," "Kokomo" and "Peru." They are each 62½ ft. long, and divided into four compartments, including a buffet for light luncheon. The entrance to these cars is by side doors, opening into the observation platform at the rear. This platform is enclosed by heavy plate-glass, corresponding to the oval shape of the rear end of the car. Corner settees, upholstered in leather, and camp and rocking chairs have been furnished for the observation apartment. The interior is provided with rich, figured green plush upholstered high-back seats and lounges. The buffet separates the passenger compartment from the smoking-room. The latter is large and well furnished with chairs and lounges, upholstered in leather. The forward compartment for baggage has two sliding doors. This room is separated from the motorman by an open frame work. In this compartment are placed the hot-water heater, fire extinguishers, emergency tools and telephone equipment. The seating capacity of each car is fifty-five passengers.

The initial car, "Kenilworth," was brought to Indianapolis the day before the opening of service, and the public was invited to inspect it. Frank D. Norveil, general passenger agent, and other officials of the companies were present to welcome the visitors.

THAT PUBLIC SERVICE CORPORATION REPORT

The report of earnings of the Public Service Corporation, which gained circulation in the daily press recently, and was regarded as unfavorable, is unauthoritative. In explanation, Frederick Evans, secretary of the Public Service Corporation, declared that neither he nor anyone else connected with the company gave out the figures which were a part statement of Public Service earnings.

"At the annual meeting of the Public Service in April," Mr. Evans said, "no such report was made. Neither has it been made at any other time or place. If it was to be made, the annual meeting would be the place for it. Such a report has not been made to the State. What was published were figures pertaining to only three of our lines.

"We made to the State some time ago a report which was to be given at regular intervals. It was about the amounts of the stock and securities, and things of that sort of our different properties. I cannot say whether the published figures about two or three trolley lines were correct or where they came from. I was informed that something like them were published in a financial paper recently. If that is so I do not know where the latter obtained them.

"Nothing has been given out by the Public Service Corporation."

EARNINGS OF THE SAO PAULO COMPANY

The Sao Paulo Tramway, Light & Power Company's report for the year ended Dec. 31, 1905, from the point of view of earnings is the best in its history. Gross earnings show an increase of $489,067, or 34 per cent. Net increase 31 per cent over the preceding year. The company paid 8 per cent last year on its stock and still had a surplus after the application to contingent fund of $50,000 of $363,032. Aside from the contingent fund, which after the addition noted amounted to $79,350, there seems to be no conspicuous allowance for the maintenance of the properties. If considerable sums are applied to this purpose the company's accounts as presented do not make it clear. The operating expenses of 35.1 per cent of gross earnings do not appear to conceal any large expenditure for maintenance.

EASTERN OHIO PROPERTY TO BE FORECLOSED

The reorganization committee of the Eastern Ohio Traction Company have announced to stockholders that the reorganization plan for refinancing and extending the property to connect with the Mahoning & Shenango Valley Traction Company's lines, has failed, about 15 per cent of the stockholders having refused to take part in the reorganizaton which called for an assessment of about $38 per share, for which the holders were to receive securities in the reorganized company. The bondholders will ask the Cleveland Trust Company, trustee under the mortgage, to declare the principal due, in default of the payment of interest, which means the foreclosure of the property and the wiping out of the stock, which is owned entirely by Cleveland people. In all probability a committee of bondholders will be formed to buy in the property. The system consists of about 90 miles of road, extending east from Cleveland into sparsely settled farming country. The trouble with the system is that it is composed of two branches, originally independent roads, which were consolidated some years ago. One road through this district would have been an excellent proposition, as the freight business is very heavy. If an extension could be built to connect for Youngstown and Pittsburg, and the property improved, there is little doubt that it would still be a good proposition. Last year it lacked only $8,000 of paying fixed charges and is making fair gains. The difficulty is that the physical property is depreciating because there is not sufficient capital properly to maintain it.

INFORMAL DISCUSSION OF CLEVELAND LEASING PLAN

Seven of the fifteen directors of the Cleveland Electric Railway Company discussed the franchise situation for several hours last week. As there was not a quorum, no action could be taken, but it is stated that a number of directors expressed themselves as willing to consider a leasing proposition that might be made by Mayor Johnson, providing the conditions safeguarded the property so it could not be destroyed. They are unwilling, however, to consider the price of $85 per share for the stock, which Mayor Johnson desired to use as a basis for the leasing settlement. It is doubtful if the company will submit a new franchise proposition to the city. It has submitted one and been turned down, and there are few, if any, of the directors that do not feel that any proposition at this time would be used against the company and fail to aid in the solution of the problem.

FLY-WHEEL ACCIDENT AT MANSFIELD

The main power station of the Mansfield Railway, Light & Power Company, of Mansfield, Ohio, was badly wrecked and thrown entirely out of commission on Thursday, May 3, by the bursting of the fly-wheel of the 850-hp Corliss engine, which furnished power for the street railway system. The wheel was 20 ft. in diameter, with 50-in. face, and weighed twelve tons. The engine was entirely demolished, and a large portion of the roof of the building was carried away. Surrounding buildings were damaged somewhat, and one steel stack was knocked down, while another was shifted from its position. A 450-hp Cooper engine adjoining the machine that was wrecked was badly damaged, while a 350-hp Russell engine was slightly injured by falling debris. A 450-hp Allis engine was uninjured, although covered with wreckage. One wall of the building was thrown out of plumb and will have to be rebuilt. An engineer was slightly hurt, and a fireman was burned while attempting to shut off the steam. No one was seriously injured, however.

The accident affected the public utilities of the city to a considerable extent. The entire lighting and power systems were disrupted, the street railways were tied up, and the interurban lines radiating from the city were unable to get beyond the city limits. The Shelby-Mansfield line was entirely tied up. One engine was started within 24 hours, and a small amount of power was obtained from the Ohio Central Traction Company and the Ohio Brass Company, which enabled the company to move a few cars and start some of the power and lighting circuits. A new engine has been contracted for, and factory experts are repairing the damaged machines. The loss to the plant and business is estimated at between $75,000 and $100,000. B. B. Pierce, chief engineer of the company, and Otto E. Osthof, chief engineer of the H. M. Byllesby Company, of Chicago, which has a controlling interest in the Mansfield Company, are in charge of rehabilitating the plant.

THE BASIS OF THE SOUTHERN CONSOLIDATION

A statement has been submitted in New Orleans outlining the allotments which the holders of stocks in the street railroad companies, which make up what is known as the Newman group, are to receive in a new holding company which it is proposed to organize for the purpose of taking over the properties in Nashville, Little Rock, Birmingham, Knoxville, Memphis and Houston, as referred to in the STREET RAILWAY JOURNAL for May 5. The schedule is understood to be tentative. It proposes the following basis:

Birmingham Railway holders of 100 shares of preferred stock will receive 105 shares preferred in the new company; holders of 100 shares common will receive 150 shares new common and ten shares preferred. Memphis Railway holders of 100 shares preferred will receive 90 shares preferred; holders of 100 shares common will receive 108 shares new common. Nashville Railway holders of 100 shares preferred will receive 90 shares new preferred; holders of 100 shares common will receive 82 shares new common. Little Rock holders of 100 shares preferred will receive 105 shares new preferred; holders of 100 shares common will receive 125 shares now common. Knoxville Railway holders of 100 shares preferred will receive 100½ shares new preferred; holders of 100 shares common will receive 90 shares new common. Houston Light & Power Company holders of 100 shares preferred will receive 102½ shares of new preferred; holders of 100 shares common will receive 187½ shares new common.

CHANGE IN PLACE OF MEETING OF CENTRAL ASSOCIATION

The May meeting of the Central Electric Railway Association will be held at the Algonquin Hotel, Dayton, Ohio, Thursday, May 24, instead of at Columbus, as was reported at the last meeting. At a meeting of the executive committee of the association, held May 1, Robert W. Waite, vice-president and treasurer of the Louisville & Southern Indiana Traction Company, New Albany, Ind., was elected a member of the executive board, to fill the vacancy made by the resignation of G. F. Wells, who, as previously noted in the STREET RAILWAY JOURNAL, has resigned as general manager of the Terre Haute Traction & Light Company, to enter the home office of Stone & Webster in Boston.

CONVENTION OF THE SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION

Final arrangements have been completed for the annual convention of the Southwestern Electrical and Gas Association, which is to be held at Galveston, May 16, 17, 18. A very interesting and attractive programme has been prepared by the committee. Mr. Stichter, editor of the "Question Box," reports that although this the first year of the inauguration of this feature, widespread interest has been shown by the members of the Association and outside electrical, gas and telephone companies, and that he has received numerous questions concerning each branch of the association, the answers and discussion of which brought forth at the convention should prove both valuable and interesting.

A pleasing entertainment has also been provided for each day of the convention, including a tour of inspection of the grade raising work of the city, the sea wall, and the dredging apparatus used in connection therewith, the latter, through the courtesy of the engineers in charge of the work, having been retained so that its operation might be seen by those present at the convention. There will also be an excursion down the harbor and to the jetties.

The Galveston Business League's rooms in the Tremont Hotel have been selected as headquarters of the convention, and many applications for reservation of rooms have already been received. Special prices have been obtained, and those expecting to attend it are requested to make application for accommodations, stating number of rooms, whether with or without bath. These should be addressed to H. S. Cooper, chairman of the entertainment committee, care of the Galveston Electric Company, so that all may be provided for and avoid confusion and misunderstandings upon arrival. Arrangements are being made by the committee for special rates on all railroads.

TUNNEL BETWEEN CAMDEN AND PHILADELPHIA

James N. Vandegrift, of Syracuse, has been commissioned to prepare plans for the proposed double-track electric railway tunnel under the Delaware River, which will connect Camden, N. J., and Philadelphia, Pa. The work calls for 2700 ft. of tunnel under the river and a mile of subway approaches. The promoters of this undertaking are the Wolf Brothers, of Philadelphia and New York. Plans for the construction, so it is said, will be ready by September.

The tunnel under the Delaware River is an important connection between Philadelphia and the electric and steam lines in New Jersey which center in and around Camden, the present means of transportation across the river being the ferries.

CORNERSTONE OF UNITED ENGINEERING BUILDING LAID

Andrew Carnegie laid the cornerstone of the United Engineering Building, at 25 to 33 West Thirty-Ninth Street, New York, Tuesday afternoon, May 8. Mr. Carnegie gave $1,500,000 for the erection of the building, which will be used as the headquarters of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Institute of Mining Engineers. The ceremony was brief, and the only decoration was a large American flag, which draped the southeast corner of the building, where the stone was laid. It is expected that the building will be ready for occupancy by Jan. 1, 1907.

ANNUAL REPORT OF THE GENERAL ELECTRIC COMPANY

The annual report of the General Electric Company, made public May 4, shows profits of $3,458,098 (including $173,389.52 from securities sold, and $798,539.27 from royalties, dividends and other sundry profits. There was paid in dividends during the year $3,861,062, and $1,000,000 was written off the company's patent account. The surplus for the year was $2,458,098, making the total surplus $12,027,295. The total sales of the year amounted to $43,146,902, and the total orders received $50,044,272. The former was an increase of about $4,000,000, and the latter about $15,000,000 as compared with last year.

The portion of the report referring to the orders received during 1905 relates in most part to the company's railway work. The company received during the year orders for over 300,000 hp of heavy traction motors, viz.: of sizes from 125 hp to 200 hp. Its orders for all railway motors for the year were about 750,000-hp capacity. The Sprague-General Electric train control was used on Jan. 31, 1906, on 4026 cars, an increase of 1029 over last year. This control has now been adopted to single-phase working. Up to Feb. 1, 1906, the company had received orders for 535 steam turbines, and had shipped to customers 346. The turbine sales last year included orders for forty-four turbines from eleven of the principal foreign countries. These turbines are now made in units of 12,000-hp rating. The company's single-phase apparatus has been ordered by many roads, among them the Pontiac & Joliet Railway, Toledo & Chicago Interurban Railway, Milwaukee Electric Railway & Light Company, Central Illinois Construction Company, and Richmond (Va.) & Chesapeake Bay Railway Company. The New York Central locomotive on Jan. 31, 1906, had run 29,568 miles. The total maintenance cost, as reported by the New York Central Company, is only about one-fourth the average maintenance cost of a steam locomotive. The West Jersey & Sea Shore Railway is now being equipped, and has 64 miles of track.

In the department of long-distance transmission of electricity reference is made to the Kern River development, where the Edison Electric Company, of Los Angeles, Cal., is installing four 7000-hp General Electric Company generators, to transmit the electric power a distance of 115 miles to Los Angeles. Another interesting plant is that of the Jhelum River, in Kashmir, India, where 5500 hp of the company's generators will be used to transmit power about 60 miles for industrial purposes, and eventually for the operation of a 156-mile electric railway. This contract was largely due to the highly successful operation of the 11,000-hp 92-mile transmission plant in Mysore, India, for which the company supplied the electrical apparatus some three years ago.

THE CLEVELAND, ASHLAND & MANSFIELD TRACTION COMPANY

Bids for building the Cleveland, Ashland & Mansfield Traction Company's proposed line have been submitted, and are now being canvassed by the executive committee, and the contract for construction will soon be let. This road is promoted by Col. C. V. Hurd, of Cleveland, and is to run from Mansfield in a northeasterly direction to Seville, in Medina County, at which point it will connect with the Cleveland & Southwestern, making a continuous and direct line into Cleveland. The route has been carefully surveyed and located, and the rights of way have been nearly all contracted for, only a few being left to be adjusted by condemnation proceedings. The bonds to be issued have all been subscribed for at par, nearly half the amount by local investors along the line, the balance by Cleveland capitalists.

The Roberts & Abbott Engineering Company, of Cleveland, under whose supervision the contracts will be let, has done all the engineering work, and is interested in the promotion. Among those who are back of the enterprise are F. T. Pomeroy and A. E. Akins, president and vice-president of the Cleveland Southwestern; J. F. Harper, L. J. Wolf, H. C. Lang and Levi Meashem, of Cleveland, and F. E. Myers, of Ashland. The chief points touched are Mansfield, Ashland, West Salem, Lodi, Leroy and Seville.

ORGANIZATION OF THE NATIONAL BRAKE & ELECTRIC COMPANY

Announcement has just been made that the plant and other assets of the National Electric Company, which were sold recently under foreclosure, were formally transferred on May 1 to the National Brake & Electric Company, a corporation of Wisconsin, with a paid-up capital of $1,000,000. The new company, as successor of the Christensen Engineering Company and the National Electric Company, will continue to manufacture air brakes and electrical machinery with extended facilities and abundant working capital. In soliciting a continuance of the patronage with which its predecessors in the business were favored, the company assures customers of superior workmanship and reasonable prices, and that prompt attention will be given to orders.

As the pioneers in the manufacture of motor-driven air compressors and in the adaption of air brakes for electric traction service, the company proposes to maintain its high position by the development of improved devices to meet the new conditions due to the more exacting demands of the present day. The general sales office has been located at No. 519 First National Bank Building, Chicago, Ill., where all correspondence to the company should be addressed.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MAY 1, 1906

819,044. Car Fender; John Dobos, New York, N. Y. App. filed Jan. 23, 1906. Comprises a rotary brush obliquely mounted in the car frame, and having a gear connection with one of the car wheels, whereby the brush is caused to rotate in a direction contrary to the direction of movement of the car.

819,081. Concrete Roadbed for Railways; Julius W. Schaub, Chicago, Ill. App. filed Jan. 22, 1906. A roadbed for railways having longitudinal rail supports, a body of concrete having portions located between and beneath said rail supports, means for detachably anchoring said rail supports to each other as well as to that portion of the body lying between them, and means for laterally supporting the rail supports from the outside.

810,146. Trolley Wheel Guard; James H. Lane and Uriah Gulnick, Newark, N. J. App. filed May 8, 1905. Mounted on vertical axles on the harp are a pair of L-shaped guards, adapted to normally close over and retain the trolley conductor in place under the influence of tension springs connected to the arms for this purpose.

819,189. Radial Railway and Tramway Truck; James S. Warner, Forest Gate, England. The truck frame is connected to the axle-boxes by suspension links, so arranged that they connect the journals and the truck frame and control their relative movement.

819,203. Car Brake; William W. Broga, Springfield, Mass. App. filed Sept. 23, 1904. A combined momentum and hand-brake adapted to be operated by either or both actuating means.

819,215. Passenger Car Frame; George Gibbs, New York, N. Y. App. filed May 13, 1905. Details of construction of a car frame designed to attain maximum strength and seating capacity with minimum weight.

819,277. Braking Apparatus; William L. Holman, San Francisco, Cal. App. filed April 26, 1905. A brake handle capable of operation near a wall of the car through a partial arc and a brake stem or shaft in two parts clutched together at the floor of the car, engages automatically and is released by a foot treadle.

819,292. Car Wheel; Frank Latimer, High Bridge, N. J. App. filed Dec. 18, 1905. Comprises a tire and a center interlocked transversely by independent dove-tailed interlocking means.

819,293. Electric Railway; Mathias A. Lazareff, New York, N. Y. App. filed May 19, 1905. A protected third rail which is divided into sections along the roadway, the different sections of which are individually energized as the train approaches by means of mechanical connections moved by the train.

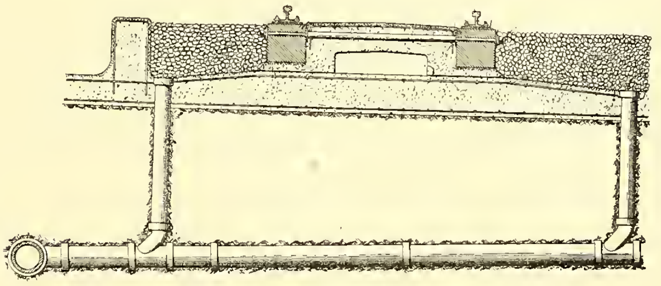
819,322. Electric Signaling; Jacob B. Struble, Wilkinsburg, Pa. App. filed Nov. 16, 1901. In order to avoid the actuation of signals by "wild" currents from the motors of passing trains, a special relay is provided in the signal circuit, which moves under the impulse of direct but not alternating currents, and which is effective to prevent actuation of the signals under "wild" currents.

819,323. Railway Signaling; Jacob B. Struble, Wilkinsburg, Pa. App. filed March 12, 1902. Relates to an alternative construction for accomplishing the same results as in the preceding patent. The transformers in this case are effected by alternating and not direct currents.

819,326. Control to Apparatus Governing the Passage of Cars or Vehicles Along a Railway; Matthias Van Asch Van Wyck, New York, N. Y. App. filed Oct. 26, 1905. Relates to means for maintaining a train-stop in operative position. The train stops are first depressed by the approach of a train and then again made operative after the train has passed.

819,327. Control of Apparatus Governing the Passage of Cars or Vehicles Along a Railway; Matthias Van Asch Van Wyck, New York, N. Y. App. filed Nov. 10, 1905. Relates to modifications of the above.

819,397. Railway Signal; Rollin A. Baldwin, South Norwalk, Conn. App. filed Feb. 6, 1904. A block signal system for single-track trolley roads, comprising a special circuit wire fed from the trolley by the passage of a car and magnets which alternately light or extinguish the signal lamps as required.



PATENT NO. 819,081

819,402. Self-Releasing Brake Handle for Tram Cars, etc. Marius Belmondo, Marseulle, France. App. filed Aug. 8, 1905. The brake ratchet is released by depressing a spring-controlled lever in the brake handle.

819,647. Switch-Operating Device; Alfred H. Gore, Shelbyville, Ind. App. filed Jan. 23, 1906. Details of construction of a lever on the car adapted to engage a lever in the roadbed which is suitably connected to the switch point.

819,677. Electric Block Signal System; Paul J. Simmen, Chico, Cal. App. filed July 31, 1905. A plurality of conductors disposed in overlapped relation along the length of the roadway, and a shoe on the train makes connection with one or two sections ahead, so as to determine the position of trains on the blocks ahead.

NEW PUBLICATIONS

Strassen-Eisenbahn-Gesellschaft, Hamburg. One of a series of Historical and Biographical Sketches About Hamburg. 19 ins. x 13 ins. Published by Julius Eckstein, Berlin.

In commemoration of the twenty-fifth anniversary of its corporate existence the Strassen-Eisenbahn-Gesellschaft (Street Railway Company), of Hamburg, Germany, has had published an elaborate souvenir brochure. In this publication an historical account is given of Hamburg traction methods from the early horse car and steam dummy days up to the present time. Following this there is an extended description of every department of the company's activities, including its great car-building plant, which supplies rolling stock to many other German companies. The text and illustrations have been prepared with characteristic German thoroughness, and reflect credit on the railway officials who were responsible for them.

Report of the Twenty-Fourth Annual Meeting of the American Street Railway Association, held at Philadelphia, Sept, 27-28, 1905. Published by the Secretary of the American Street and Interurban Railway Association, New York; 453 pages.

This is the last report of the American Street Railway Association, and not only contains the report of the Philadelphia convention, but also an account of the steps taken by the executive committee in the reorganization of the association upon its present basis. It therefore includes the interesting report of Professor Henry H. Norris, who was selected to study the most desirable form of organization, with analyses of the constitutions and methods of working of fourteen national and international technical associations. The proceedings at Philadelphia were devoted in large part to the reorganization of the parent body, and the contributions by Professor Norris, Mr. Doherty and others familiar with organization matters make the volume of special interest to those interested in association organization. Nevertheless, a great deal was accomplished in a technical way, and this is also reported in the usual complete manner. The volume also contains a list of those registering at the meeting, members of the association, the new constitution and by-laws, and excellent full-page engravings of President Ely and ex-Secretary and Treasurer Penington.

PERSONAL MENTION

MR. DAVID TODD, of Youngstown, Ohio, has been appointed secretary and treasurer of the Youngstown & Southern Railroad in place of Mr. F. D. Wilkerson, who has resigned to go in other business.

MR. THOMAS LOWRY, president of the Twin City Rapid Transit Company, and the Soo road, is back at his Minneapolis office, greatly benefited in health by a residence of five months in the Southwest.

MR. EDWIN F. FABER, superintendent of the Delaware city lines of the Columbus, Delaware & Marion Railway, of Columbus, Ohio, has resigned to become superintendent of the Elgin-Belvidede Interurban line at Elgin, Ill.

MR. E. J. DAVIS, for several years contracting agent for the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville Railway, of Newark, Ohio, has been promoted to be general passenger and freight agent of the two lines with headquarters at Columbus.

MR. HENRY F. VOGEL, vice-president and general manager of the St. Louis Car Company, has tendered his resignation to President Kobusch. Mr. Vogel will rest for several weeks, during which time he will consider several propositions which he has received.

MR. C. F. BAKER, superintendent of power of the Brooklyn Rapid Transit Company, has resigned, and Mr. C. E. Roehl, electrical engineer, will, in addition to his other duties, have charge of the operation of all power and sub-stations of the various companies comprising the Brooklyn Rapid Transit system.

MR. R. B. STEARNS, formerly superintendent of the Northwestern Elevated Railroad, Chicago, on May 1, assumed the duties of general manager of the Chicago & Milwaukee Electric Railroad, which position was made vacant by the resignation of Mr. A. L. Drum, whose resignation from the company to take up other work is noted elsewhere in this issue.

MR. J. H. CRAWFORD was on May 1 appointed master mechanic of the Wheeling Traction Company and subsidiary lines, of Wheeling, W. Va., to fill a vacancy caused by the resignation of Mr. J. F. Ford. Mr. Crawford was previously master mechanic of the South Jersey division of the Public Service Corporation of New Jersey, with headquarters in Camden.

MR. A. L. DRUM has resigned from the position of general manager of the Chicago & Milwaukee Electric Railroad, and as consulting engineer will devote his attention to the erection of the large power station of the Chicago & Milwaukee Power Company, which will be erected at Waukegan, Ill., to furnish power for operating the Chicago & Milwaukee Electric Railway, and for commercial uses.

MR. JOHN YOUNG, formerly general manager of the Glasgow Tramways, has resigned as general manager of the Metropolitan District Railway of London, but has been elected a director of the company. Mr. A. Collinson has been appointed general manager of the Metropolitan District Railway to succeed Mr. Young. Mr. Collinson was formerly connected with the engineering department of the Northeastern Railway of Great Britain.

MR. JULIUS S. JENSEN, of New Haven, Conn., has been appointed to the position of superintendent of the power stations of the Consolidated Railway Company. The office includes all the lines of the company in Connecticut, Massachusetts and Rhode Island. Mr. Jensen has been a mechanical engineer in the electrical department of the railroad for several years, before which he was in the motive department. He is a native of Copenhagen.

MR. J. A. BENDURE, for the past five years general manager of the Lima Railway & Light Company and the Lima & Toledo Traction Company, has resigned to become associated with Jos. B. Mayer, of Buffalo, N. Y., who is engaged in promoting an electric railway out of Buffalo. Mr. Bendure has been succeeded by Mr. F. T. Hepburn, who has been with the Cincinnati Traction Company. Mr. Hepburn will not only have charge of the properties mentioned, but also the Ohio portion of the Ft. Wayne, Van Wert & Lima Traction Company. All of these properties are now controlled by the Schoeff syndicate of Cincinnati.

MR. OREN ROOT, JR., general manager of the New York City Railway Company, has been appointed vice-president of the company to succeed Mr. Frank S. Gannon, who, as previously noted in the Street Railway Journal, resigned to take up the duties of the presidency of the Atlantic & North Carolina, the Virginia & Carolina Coast, and the Norfolk & Southern Railways. Hereafter Mr. Root will perform the duties of both offices. Mr. Root, who is only 33 years old, was graduated in 1894 with honors from Hamilton College, which is also the alma mater of his father, his grandfather and his uncle, Elihu Root. Soon thereafter he entered the service of the New York City Railway Company, then the Metropolitan Company, in the construction department. Subsequently he became assistant to Mr. H. H. Vreeland, then general manager. Shortly after the election of Mr. Vreeland to the presidency of the company, Mr. Root was elected as his successor as general manager. This was about three years ago.

MR. CHARLES L. SPIER, associate of Mr. Henry H. Rogers, of the Standard Oil Company, president of the Staten Island & Midland Beach Railway Company and an officer in a number of electric railway companies, was killed in his residence at New Brighton, S. I., early Monday morning, May 7, either by a burglar or through the accidental discharge of his own pistol; it is uncertain which. Death must have been instantaneous, for the bullet entered the left breast, cutting through the lower part of the heart. Mr. Spier was 38 years old, and was prominently identified with street railway interests near New York. Among the various offices held by Mr. Spier were: Secretary and treasurer of the Asbury Park & Sea Girt Railroad Company, director in the Commercial Newspaper Company, vice-president and director in the New Jersey & Staten Island Ferry Company, president and director in the New York Investment Company, director in the Rapid Transit Ferry Company, secretary, treasurer and director of the Richmond Borough Company, president and director of the Atlantic Coast Electric Railway Company, secretary, treasurer and director of the Seashore Railway Company and director of the Southfield Beach Railroad Company. He was also president and director of the Staten Island Midland Railway Company, vice-president and director of the West End & Long Branch Railway Company, president and director of the Yetman Transmitting Typewriting Company and vice-president and director of the Richmond Light & Railroad Company.

Street Railway Journal

VOL. XXVII. NEW YORK, SATURDAY, MAY 19, 1906. No. 20.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 163,300 copies, an average of 8165 copies per week.

Fire Protection at Passenger Stations

The importance of fire protection has been thoroughly brought home to electric railway managers by the experience of the last three or four years, and it is most gratifying to note the improved conditions now existing on many systems. Special attention has been paid to car house and repair shop protection, and of late power houses and sub-stations have been, in many cases, well provided with facilities for extinguishing fires. On progressive roads newly designed structures are carefully considered from the standpoint of fire risk, and both cars and stations are built with particular regard to the reduction of such hazards as the occurrence of even a slight blaze tends to create.

It sometimes happens that even if a structure is well designed, a fire hazard arises in the course of its use, and through alterations in equipment the possibility of trouble exists in considerable measure. Passenger stations well illustrate this point, particularly if they are so designed as to preclude the free movement of very large crowds from the platform to the street. A station at a large park, on an elevated structure, or in a tunnel, needs extra watchfulness in comparison with an ordinary surface platform or shelter. The walls of the station, its approaches and exits, or its platform, may not be composed of inflammable material, and yet a company finds itself obliged to look out for possible trouble in quite a number of directions. If the public could be relied upon to remain cool-headed in time of emergencies when no real danger exists, the matter would be very simple, but, unfortunately, the most trifling accident, such as the blowing of a fuse or the throwing of a lighted match into a waste barrel partly filled with waste paper, is frequently sufficient to start a panic among the timid passengers.

Bearing in mind these conditions, it is a good plan to install metal waste barrels at stations, with covers which can be closed tightly by the station attendants in case a smudge is started. In cases where wooden platforms are used, it is important to close every opening into the sub-platform spaces through which rubbish might fall and accummulate, thereby preventing the chance of a panic in case smoke should appear. There should, as far as possible, be no place about a station where lighted matches, cigar stubs, etc., can cause trouble, although, of course, the fire risk presented by heavily loaded news stands must in the main be watched by the attendants. In addition to the supply of sand pails, water pails and extinguishers, ordinarily provided in good practice, concrete flooring or cement and expanded metal platform surfaces, together with auxiliary sources of station lighting and a force of well disciplined employees, will do much to minimize any unusual occurrence in the way of short-circuits, motor flashing and carlessly thrown combustibles. The whole matter is simply an illustration of the "stitch in time" philosophy. With the opening of the park season it is well worth thinking about.

Commutator Maintenance

The electric equipment of an ordinary 600-volt direct-current power station has now become so thoroughly standardized, and, consequently, so reliable, that there is in some plants a tendency to slight the detailed care of the generators and motors necessary for the best maintenance. In a large power plant there is almost always something to do in the way of keeping the steam piping, valves and other auxiliary apparatus in repair, and in a small station the variety of work per employee is so great that it is easy to overlook any except the most necessary duties.

Under all usual conditions of operation the commutator is the only weak spot of a direct-current machine built by reliable makers, and the commutator is vulnerable inherently, no matter how well designed it may be electrically and mechanically. Aside from an occasional inspection of the bearings and a blowing out of the armature by compressed air once a week or thereabouts, practically no attention needs to be given to any part of a direct-current generator except the brushes and commutator. Once in awhile it is well to feel of the different field coils immediately after a shut-down, or to take their temperatures externally by thermometer while current is on, but as long as these points are not entirely overlooked from quarter to quarter, there is little real need of frequent attention to them.

To insure continuous service and to ward off trouble from sparking, it is well to keep a regular watch of the behavior of the brushes and commutator, taking care to clean off carbon dust frequently, and to make sure that oil or dirt does not collect. The practice of using waste or emery cloth on commutators is bad, on account of the tendency of the former to disintegrate and catch between segments, and the wearing effect of the latter is injurious. Ordinarily a commutator only requires to be wiped off with a piece of canvas and occasionally lubricated by a very small amount of oil applied with a cloth. The main point is to keep a smooth and true surface, looking out for looseness and flat spots. The latter are generally induced by excessive brush pressure or too great hardness in the brushes, by too much end play or by loose bars.

Sparking is common in machines which are operated without proper care, and the ordinary causes are so easily remedied that they are worth mentioning again. The brushes may not be set at the point of commutation, or fitted to the curvature of the commutator surface. Insufficient brush pressure or brushes burned at the ends frequently cause sparking. An open circuit, loose connection or rough bar is also provocative of trouble. These points are supposed to be kept constantly in mind in power plant operation, but, unfortunately, they are frequently neglected, for the reason that there is a widespread idea that electrical machinery can be left without attention for long periods without the least chance of disturbance. In comparison with steam equipment and intricate mechanical apparatus this is, of course, true, but unless the points mentioned above are looked after from time to time the best results cannot be secured from the machines.

Inducing Traffic on Interurban Lines

Occasionally managers of electric railway systems seem to regard it their duty simply to care for that traffic which comes to them, and they make very little effort to increase the travel over the line by advertising, or by soliciting business. Managers of electric light and power plants a few years ago were inclined to operate their systems on the same principles, but they have now discovered that by going after business vigorously they can increase the demand for current three or four fold. Many railway managements, it is true, do go after business in a systematic manner, but there are some who should take pointers from the electric light and power companies. There is just as much occasion for advertising an electric railway system as there is for advertising any other business concern.

In general, advertising should be intended to do two things; to acquaint traveling men and strangers of the existence of the road, and to keep in the minds of the local people the fact that the road is ready to be used at their convenience. For the benefit of the traveling men or strangers advertisements of some kind should be sent to hotels and other public places in neighboring towns. Time cards should also be available in these distant towns, as with them the traveling man can make out his route in advance before reaching a town through which the road is operated. For the benefit of local persons the advertising should be of a general character. The newspaper and the theater program should not be neglected. The newspaper advertising need not all be in the advertising columns. To be sure, a time table should be kept there, and these columns should be used freely to make special announcements of excursions or special occasions in neighboring towns. Usually, however, a great deal of prominence may be gained in the reading columns of the paper, if the management will furnish the editor with genuine news notes concerning the road or news in which the road is mentioned. Aside from returns through increased travel, newspaper advertising is often advantageous in another way. If the newspaper is given business it is most probable that the paper will be favorably disposed toward the management of the road. In view of the fact that new franchises may be required at a future date, or that special privileges may be desired at any time, it is desirable for the railway company to be as much in favor with the press as possible.

Some roads have aroused the interest of local people by offering prizes, either in money or free trips over the line, for the best name for new parks, new stations along the line, trade marks for the road, or for the best verse of poetry concerning the road. Such schemes as this tend to make the people in general feel that they have an interest in the road, and that it partly belongs to them. When this feeling can be aroused, increased receipts are certain to follow.

Some specific soliciting of business should also be done. Churches, lodges and other organizations, which have occasional conventions, picnics, or other large gatherings, should be repeatedly reminded of the fact that the road is ready at all times to run special cars and furnish special accommodations to care for unusually large gatherings. Such announcements may be made to all societies in the vicinity by means of printed circulars, but personal letters should be sent to those most likely to have assemblages in the near future. Often a personal representative of the road sent to the entertainment committee of a society will be able to suggest means of entertainment of guests by an excursion over the road.

A great deal of traffic may sometimes be induced by advertising interesting places along the line. An illustrated booklet describing such places may often be gotten out to advantage. There is hardly a road that does not have peculiarly attractive points near the line. If history attaches romance to any of the points, this should be dwelled upon in the descriptive booklet. A great deal of travel is always occasioned by base ball or other leagues, embracing several of the towns along the line. When interest is aroused in the local team, a game with the team of a neighboring town usually results in a crowd of supporters following the team. If a road is operating through a district where base ball enthusiasm does not exist, certainly the management should consider seriously the organization of a league.

When people can be induced to take up homes along the line, permanent and steady traffic is assured, and if rents are cheap enough in the outlying districts to warrant people paying fare into the cities, this fact should be well advertised. Occasionally managements of roads have been instrumental in organizing land or real estate companies to develop town sites or residential districts along the line. It is usually well to encourage companies who wish to do this, and concessions in fares or promise of more frequent schedules when the population of the proposed community reaches a certain amount will often assist.

No cut and dried rule can be formulated for inducing traffic on an interurban road. It is up to the management to exert itself to a point where the best means naturally suggest themselves, but certainly no management is doing its duty to the stockholders when it is content to take only that business which is forced upon the road.

Electrification of the West Shore Railroad Between Utica and Syracuse

In many respects there is no work in electric traction of greater interest and significance than that comprised in the electrification by the Oneida Railway Company of the West Shore Railroad between Utica and Syracuse, the plans for which are outlined elsewhere in this issue. The electrification of the trunk terminals in and around New York City has undoubtedly involved larger and more complex engineering problems, but all of these terminal propositions must be classified as special and unique. Although they are none the less interesting on that account, it is likely that nowhere else in this country, or at least not outside of half a dozen of the very largest population centers, will similar propositions be encountered. On the other hand, the work now in progress by the Oneida Railway Company on the West Shore Railroad, and by the Pennsylvania Railroad on its Camden & Atlantic City line, involves the application of electric traction to out-and-out steam railroad trunk service, where the choice between steam and electricity as motive powers was made upon their abilities as transportation agents rather than primarily upon the question of the production of smoke. These installations may, therefore, well be considered as the forerunners of a vast amount of similar work—just how vast, steam railroad engineers are not yet prepared to admit and electric railway engineers hardly dare to guess.

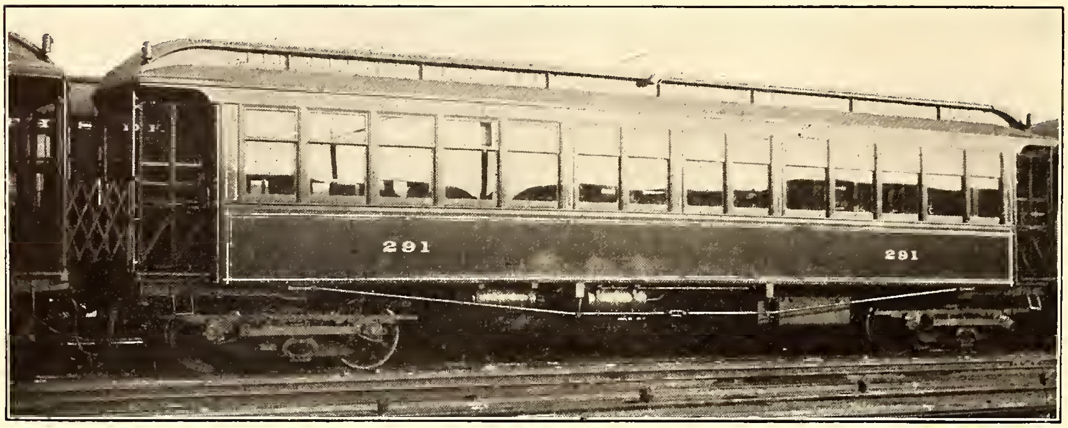
In the Oneida Railway work, so far as the plans have been announced, there is much that attracts attention. In the first place, perhaps the most important feature is the experiment of moving trains of varying velocities at high speeds and short headway with the trends of traffic in the same direction. Three classes of service will be conducted over this section. There will be limited single electric cars and trains traveling at a schedule speed of 40 miles per hour. Operating between these high-speed units will be electric cars and trains for local travel, moving at a schedule speed of 24 miles per hour. In addition, there will be on the same tracks fast freight trains drawn by steam locomotives scheduled to make 15 miles to 18 miles per hour. The problem which the engineers and managers of the Oneida Railway Company will undertake, therefore, will be to pass the higher grade units around the slower trains with safety and without delays to the units of any grade. As the present line has only two tracks, it is proposed to solve this problem by the use of a long third track on grades, and by the use of four tracks within certain yard limits. It so happens that the section between Clarks Mills and Vernon, a distance of 8½ miles, involves a grade, for a portion of the distance, of approximately 0.57 per cent. Throughout this section there will be built a middle track over the grade with Y-connections to both outside tracks at convenient locations. By means of properly placed interlocking switch towers, this middle track will be used for executing passing movements of both eastbound and westbound units. On the 5-mile section between Oneida and Canastota, where there are certain yard limits and water receiving stations which will be used by the steam locomotives, there will be installed two additional tracks, making this a four-track section, for the purpose of expediting traffic of all classes. With this lay-out, the handling of the different services becomes a matter of proper adjustment of schedules in conjunction with a few easily understood rules for the guidance of tower men, formulated upon principles now clearly defined by standard practice in handling train movements on single-track and double-track roads.

The second feature of interest in this electrification, and perhaps the most interesting from the electrical engineering standpoint, is the selection of the standard 600-volt, direct-current system. It may be that the ardent advocates of higher voltages will experience a qualm of regret that this, one of the first applications of electricity to trunk-line conditions, was not used as an opportunity for letting either the single-phase or the higher voltage direct-current motor demonstrate what it could do. We sympathize to a certain extent with this view. At the same time we do not take the decision as evidence of serious doubt in the minds of those who must stand sponsors for the work as to the future success of some higher voltage system, but merely that local reasons made tried and familiar practice preferable. It must be remembered that the transportation problem already described is a considerable innovation, and the introduction of electricity at all is another. The management of trunk-line railroads look upon any experiments in motive power, and properly, in a most conservative spirit and place the continuance of traffic and safety of operation above all other considerations. The condition is not unlike that of an important trunk-line electric railway, like Broadway in New York City, which cannot afford to adopt any new system until it has been thoroughly tested on a less important line. In one sense, the conditions between Utica and Syracuse were especially favorable to the adoption of direct current, from the fact that its employment practically does not debar the management from installing a higher voltage system at a later period, say in five years, if during that time such a change should be proven desirable. In such an event, the present rolling stock and the rest of the direct-current equipment could always be used upon some of the extensive d. c. systems with which the operating company is affiliated.

In conclusion, we wish to take this occasion of congratulating the Oneida Railway Company upon its enterprise in equipping this important section of the West Shore with electric power. The decision to use electricity and the satisfactory results which we anticipate as a result will do a great deal toward solving the wider applications of electricity to transportation problems, which are bound to come in the future. It is also satisfactory to know that the work has been intrusted to those who have had wide experience in handling electric transportation problems.

THE NEW CARS OF THE SOUTH SIDE ELEVATED RAILWAY, CHICAGO, AND THEIR EQUIPMENT

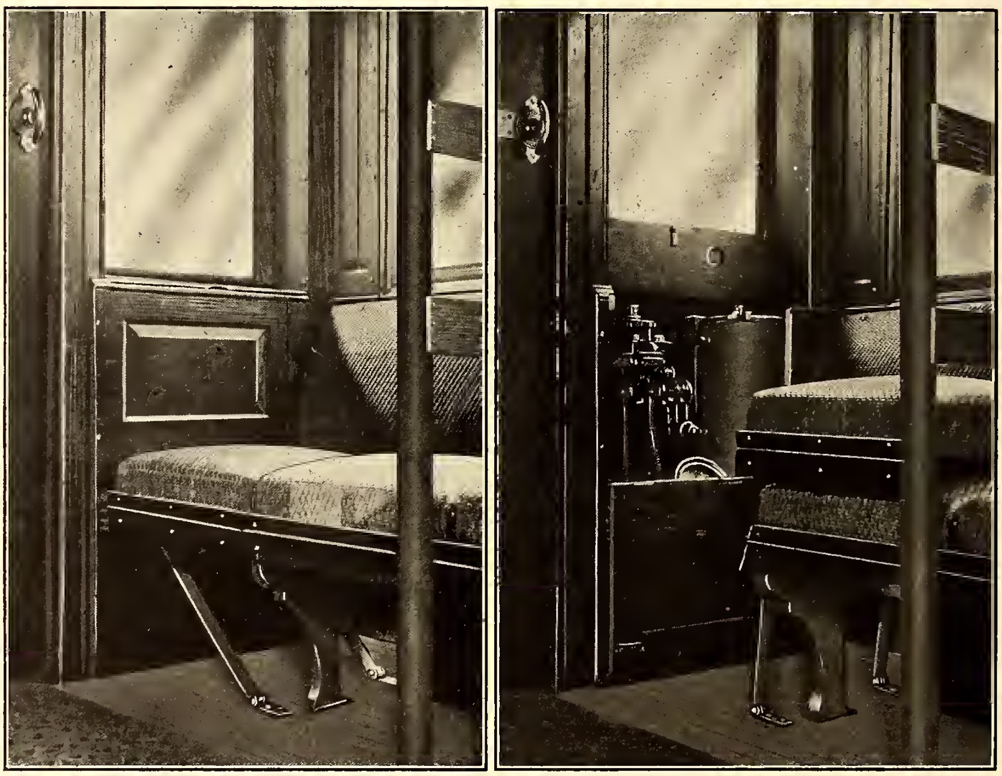
After steel cars were adopted for the New York Subway, there was a general movement towards the use of cars with steel-floor framings by interurban and elevated railroads. Steel cars have one feature which makes them almost a necessity for underground service. This is their fire-proof construction. For elevated service, however, this feature is of much less importance. Other considerations and the fact that no trouble whatever had been experienced with the cars of wood construction which have been in operation on the road in the past caused the managers of the South Side Elevated Railroad, Chicago, to decide in favor of the usual wood construction for their new cars. These cars, of which seventy have been built by the Jewett Car Company, and eighty additional ones are now being constructed by the American Car and Foundry Company, at Jeffersonville, Ind., were illustrated and described in a short article in the Street Railway Journal for Dec. 2, 1905. The article did not, however, enter into the details of the car. Very little was said concerning the new features embodied in the cab, and no reference at all was made to the electrical and brake equipment. All of these, as well as other features of the car, embody new ideas. Through the courtesy of the South Side Elevated Company it is possible now to give a detailed description of the car and its equipment.



SIDE VIEW OF THE SOUTH SIDE ELEVATED CAR

THE CAR-BODY

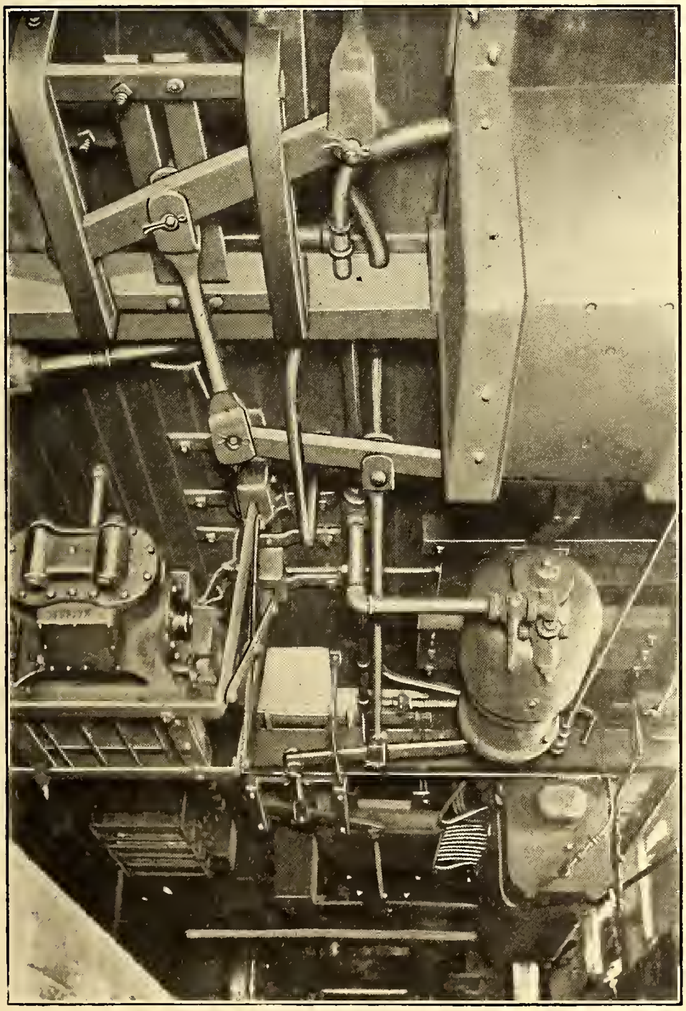
The arrangement of the cab is probably the most interesting feature of the car body and is well shown in the accompanying illustrations. When occupied by the motorman it has all the conveniences of other styles of cabs placed inside the car. When not at the front end of the train, however, the only evidence of it being a cab is iron post extending to the floor and a canopy overhead. All of the control apparatus is enclosed, and the doors covering it are securely locked by an automatically fastened latch, so that a passenger sitting inside the cab cannot tamper with the controller or brake valve. The change to a motorman's cab is very quickly effected. The forward seat is raised and drawn back to rest on the one immediately behind it. Hinged arms extending to the floor keep the seat in the proper position. When the forward seat is raised a lever automatically unlocks a hinged covering, forming the inside finish of the car, immediately below the arm rest of the front window. After this cover has been swung down, the arm rest, which is hinged, may be raised and all the control apparatus, consisting of master controller, brake valve, air gage, and whistle cord, is exposed. The motorman is isolated from the remainder of the car by drawing down two pantasote curtains, one at the rear, the other at the side of the cab. When arranged to be used by passengers, the cab seats two people, and these are in no way isolated from the remainder of the car. No seating room at all is lost in the car by reason of the presence of the cabs when the car is used in the middle of the rear end of a train.



MOTORMAN'S CAB WITH SEAT LOWERED FOR PASSENGERS AND RAISED FOR MOTORMAN

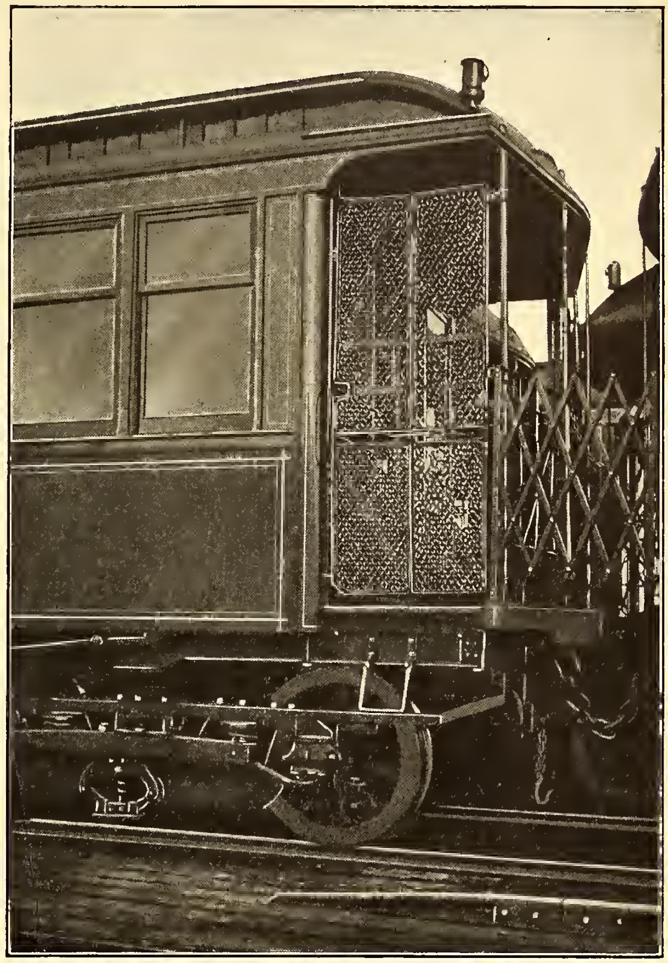
In all other respects than this cab feature, the interior of the car is much the same as with the cars that have been in service on the company's line for several years. The interior is finished in mahogany rubbed to a dull finish. The headlining is of quartered oak. Deep mouldings and flutings, which would have increased the difficulty of keeping the interior of the car clean, have been avoided. Shallow panels in the finish between the windows, above the truss plank and at the ends of the car prevent an unduly plain appearance. The lamps are well distributed throughout the car and the electric heaters are placed under the seats. On some of the old equipment the end doors are over at one side of the center line of the car, and by being so placed two seats are cut out at each end of the car. The additional seats gained by placing the end doors in the center of the new car, together with the seating room obtained in the cab, give the later cars a seating capacity of eight more than that of the old cars, which are the same length. In other words, since the new car seats 52 people and the old one 44, the increase in seating capacity is about 18 per cent, without changing the dimensions of the car.

One of the accompanying reproductions shows the steel platform used on the cars. The side arms are of 6-in., 17¼-lb. I-beams placed directly under the side sills, to which they are bolted. They extend back beyond the bolster and have a sufficient offset to allow them to pass under it. The two center I-beams under the platform extend back toward the middle of the car, a distance of 18 ft. from the bumper. The draw-bar rigging is bolted to these I-beams and the draw-bar strains are consequently transmitted direct to the center sills of the car. A 6-in. 15½-lb. channel bar, which forms the front of the steel platform framing, is secured to the longitudinal I-beams by means of angle plates.



VIEW OF APPARATUS UNDER THE CAR

The platforms were designed in the shops of the company and were built on several of the old cars to replace platforms of wood construction before the new cars were built. The bottom framing, as has been said, is of wood. In addition to the center and side sills, two sets of intermediate sills are employed. This gives a construction which, it has been computed, will stand a greater crushing strength in the event of collision than a steel floor framing of the design usually used under cars of the same dimensions. Over the rheostats, controller apparatus and cables, the underframing is lined with ¼-in. transite board, and above the trucks this transite is covered with galvanized iron.



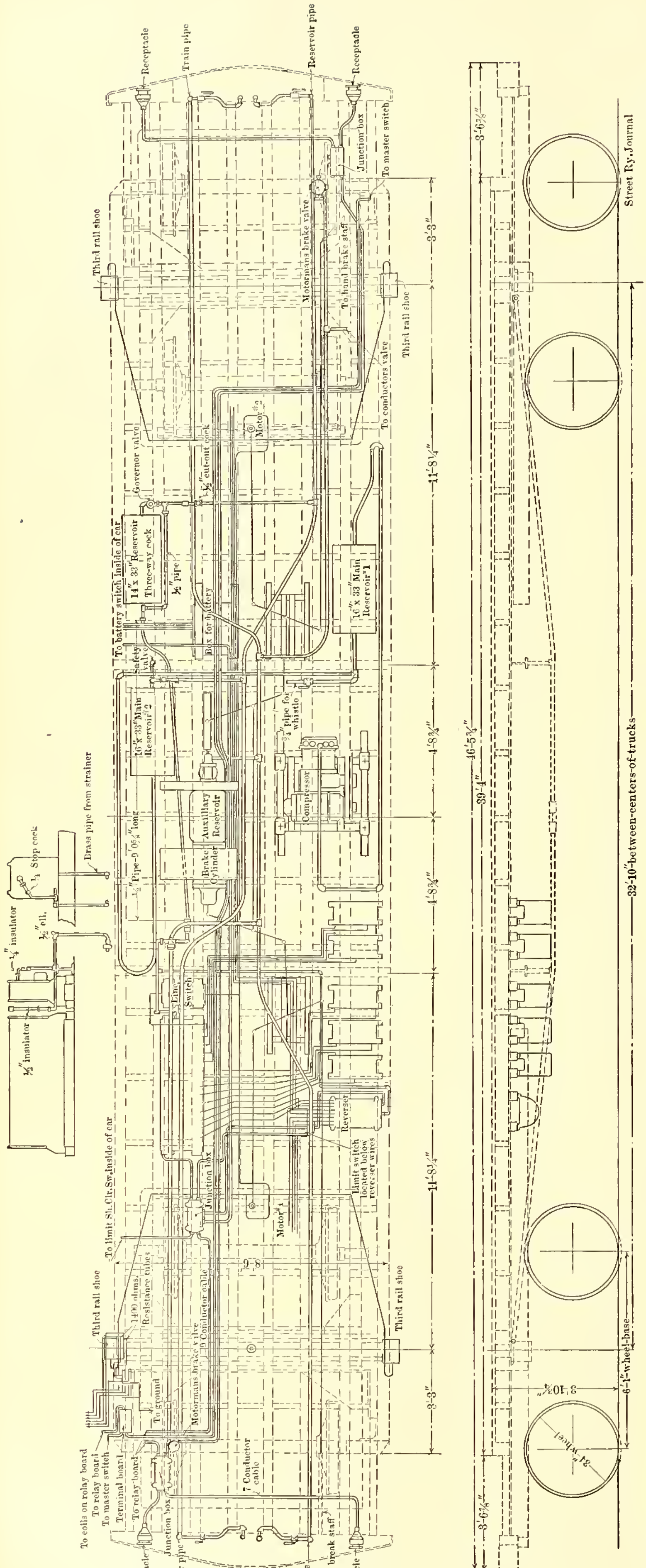
END OF CAR SHOWING I-BEAM CONSTRUCTION OF PLATFORM AND HIGH GATES

One of the illustrations shows the new folding gate used on the platforms. The gates are of wire mesh and extend to within a few inches of the hood over the platform. The object of these high gates is to prevent accident to passengers in a hurry who might attempt to jump over gates of ordinary height.

GENERAL WIRING PLAN

The motor wires and train line cables are carried in a box conduit, built between two of the sills and lined on all sides with ¼-in. transite. The cables are cleated firmly to the sides of the conduit in such a manner that they are held apart from each other notwithstanding the jarring and vibration of the car.

Where the cables pass over the transoms or other iron work they are protected with circular loom in addition to the transite board. Both resistance and motor cables are of No. 00 extra flexible flame-proof wire. This wire is considerably in excess of the required capacity, but the company has found the use of extra heavy wire very desirable, in that it insures against overheating of cables under almost all circumstances, and this reduces the fire risk to a minimum. The heater circuit is carried in Sprague flexible conduit. Flame proof wire is used on the light circuits. The general layout of controller



PLAN OF CAR ON SOUTH SIDE ELEVATED RAILWAY AND SIDE ELEVATION OF FLOORING, SHOWING ARRANGEMENT OF UNIT SWITCH CONTROL APPARATUS

and air brake equipment located beneath the car is shown in the accompanying plan.

THE MOTOR AND TRUCKS

The car is mounted on Baldwin trucks, having 34-in. steel tired wheels and equipped with inside-hung brakes. One motor, mounted on each truck, is placed on the inside axle. Westinghouse motors known as style No. 121 of 75 hp each are employed, and the general type to which they belong was described at some length in the Street Railway Journal for Sept. 23, 1905. The frame is split at an angle of 45 degs. The armature is usually changed by removing the top half of the motor casing, and this operation requires only about 30 minutes. If it is desired to change motors rather than armature, the motor may be lifted from the truck by simply removing the gear case and the axle caps.

The brush holder consists of two parts, that holding the terminal, which is bolted to the motor shell, and the carbon holder, which in turn is secured to the terminal holder and is so designed that as the commutator wears down it can be lowered, while the terminal holder remains in one position. This arrangement permits the part holding the brushes to be adjusted or removed from the motor without in any manner disturbing the leads. The armature shaft is much heavier than usual and was so made at the solicitation of the railroad company. A special grade of bronze without babbit lining is used for the axle bearings. Steam road practice is followed in fitting these bearings. They are fitted direct to the axle by repeated trial and scraping, and with the employment of black lead to indicate the close fitting surfaces. After being so fitted the cars are not given any lengthy preliminary test but are put in service at once. The success of the method of fitting the bearings may be judged from the fact that in the last three years but one car has been brought into the shop because of hot motor axle bearings, and this was caused by negligence in oiling.

THE CONTROLLER

The controller is a special design of the Westinghouse electro-pneumatic system. The chief point of interest about it is probably the fact that it operates in connection with the Sprague multiple-unit system of control. The greater number of the old cars on the company's lines are equipped with this latter type of control, in fact, the system was first installed and was developed largely on this road. At the present time, cars having both the Sprague and Westinghouse controllers are made up in trains indiscriminately, no attention whatever being paid to the type of control on the car. This harmonious operation was accomplished without any rearrangement or changes in the Sprague controller circuits. On the new cars the leads from the control or train line are connected to five relays, shown in the diagram of circuits herewith. These relays close the Westinghouse pneumatic control storage battery circuits and thereby operate the controller. The controller is a modification of the Westinghouse turret type, which was described in the Street Railway Journal, May 6, 1905, in connection with an article dealing with Brooklyn Rapid Transit cars. The unit switches, instead of being arranged on a circular frame, are installed in a long box in such a manner that hinged covers give access to the main contacts on one side and to the interlock fingers on the other. Although as previously mentioned, this control apparatus was specially designed to work jointly with the original Sprague multiple unit control, the Westinghouse pneumatic system sacrificed none of its automatic devices for the protection of the equipment.

The operation of the controller may be understood by following the wiring as shown in the diagram. On the first point of the controller, relay No. 2 and one of the reverser relays are gram of the motor and resistance circuits, it will be seen that the closing of the unit switches M1 and JR throws the motors in series with all the resistance in the circuit, and the controller is on the first notch or in the switching position. The closing of these switches also closes a return to B— for wire No. 8, which is supplied with battery current over relay No. 2. Wire 8 leads by way of the limit switch to L, and thence the path continues over M1 interlock (M1-unit switch being closed) to wire 16, over J interlock to 17, over JR interlock to 18, then through the S lifting magnet to 12, and to the line relay, which is located on the relay board with the five relays connected to the Sprague cable. After passing over the relay the path continues through wire 11 to 9 and over the circuit breaker trip to B—. When S closes, wire 20 is connected to

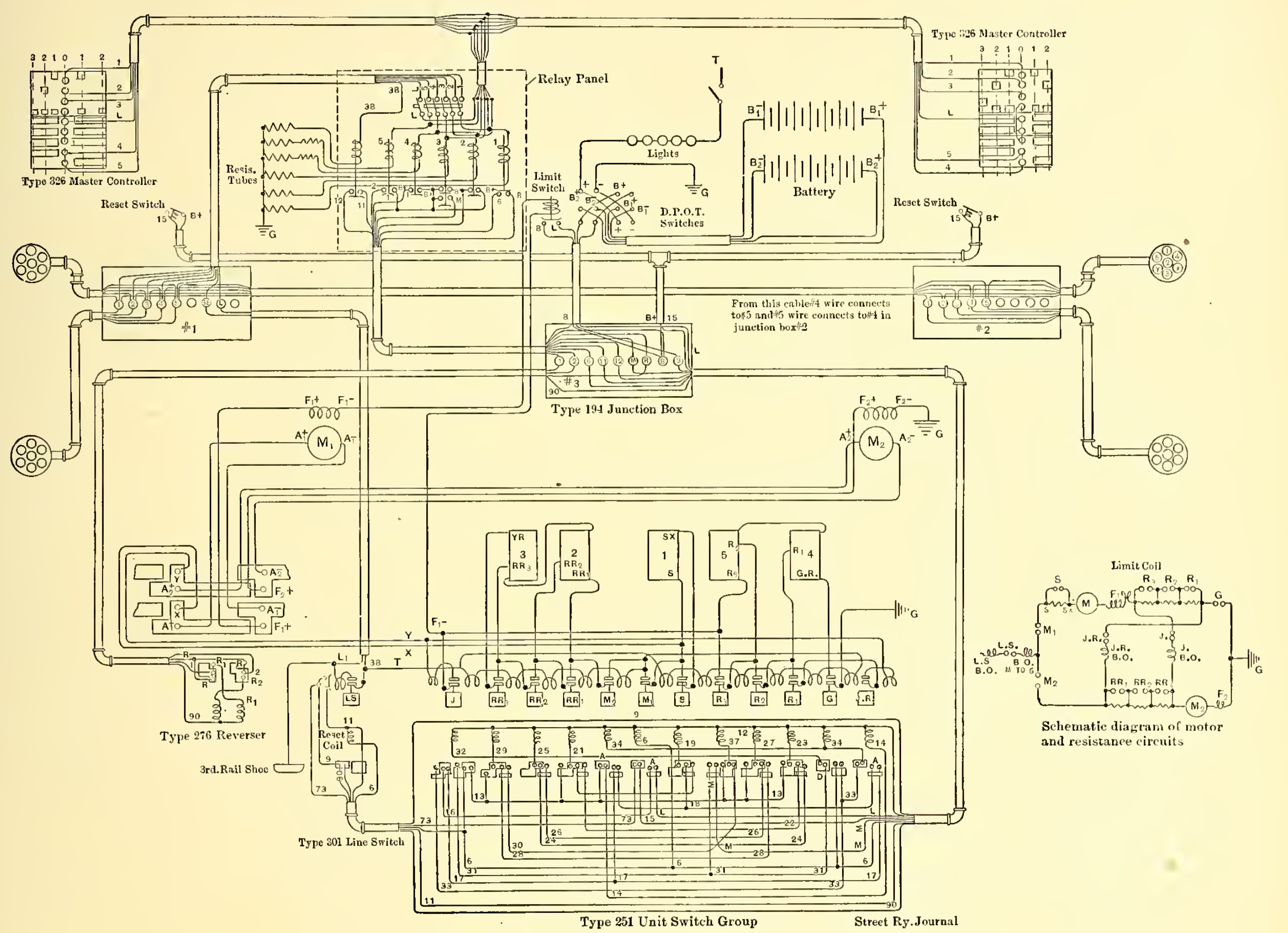
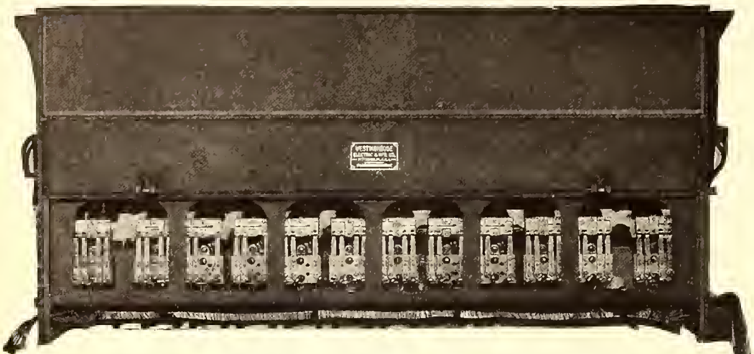


DIAGRAM OF CONNECTIONS, UNIT SWITCH SYSTEM, SOUTH SIDE ELEVATED CARS

lifted. Should number 4 be the reverser relay lifted, wire 1 of the control circuit is connected to B+. Current then flows through No. 1 wire and over the reverse interlock to R1, through one of the reverser coils to 90, through 90 to the line switch interlock, thence to No. 9 and to B—by means of one of the double point double-throw battery switches. The current energizes the reverser magnet, which admits compressed air to its cylinder and throws the reverser, and when the reverser operates, wire R is connected on the reverser interlock to wire 1. Part of the current is shunted through R over to No. 1 relay to wire 6. This wire leads to the interlocks of unit switches S and J. The branch to S passes on through the operating magnet of M1 unit switch, closing this switch, and to B— over 9. The path to the J interlock continues over wire 13 to the M2 interlock, thence to wire 14 and through the JR operating magnet. By reference to the schematic diawire 18 over the S interlock and this starts a progressive lifting of the resistance switches. Wire 20 supplies current to the magnet of RR1 switch and this is closed. Then R1 magnet obtains current over 22 and is closed. Switches RR2, R2, RR3, R3, are closed successively in the order given, and the motors are then connected in series with all the resistance cutout. After these switches have operated they are held closed by current over wire 13.

Throwing the master controller to the second point drops No. 2 relay and raises No. 1. This cuts the battery current off of every part of the controller, with the exception of the reverser and, consequently, all the unit switches are opened.

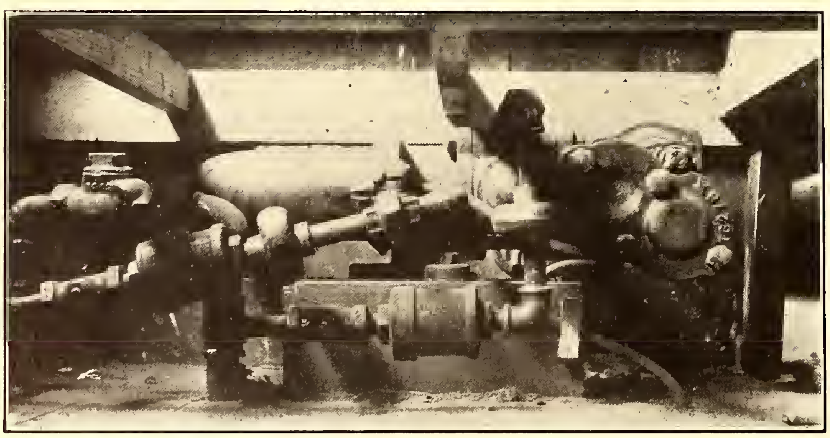
On the third point of the master controller, No. 1 relay drops and No. 3 picks up. The current over No. 1 relay to wire 6 lifts M1 and JR switches, as before. When these are raised current over wire 8 lifts the switches, cutting out the resistance and throwing the motors in full series as before. When R3, the last of the resistance switches to operate, closes,



GROUP OF UNIT SWITCHES

wire M from No. 3 relay supplies current over wires 31 and 32 to the magnet of the J unit switch. This switch closes and current is cut off from wire 13. Switch JR and all of the resistance switches, with the exception of S, are consequently opened. The closing of J also connects 33 with B+ through wires 16, L and 8. Current through 33 closes unit switches G and M2. When G closes, J drops as the connection between wires 31 and 32 is broken at the G interlock. The only switches closed now are M1, S, M2 and G. The motors are, therefore, connected in multiple with all the resistance in circuit. When J drops, however, current is supplied to the magnet of S unit switch through wire 18, M2 interlock, wire 17, J interlock, wire 16, M1 interlock, L and the limit switch. Current is also supplied to wire 13 by the dropping of J. All the resistance switches again close successively in their previous order and the motors are connected in full multiple.

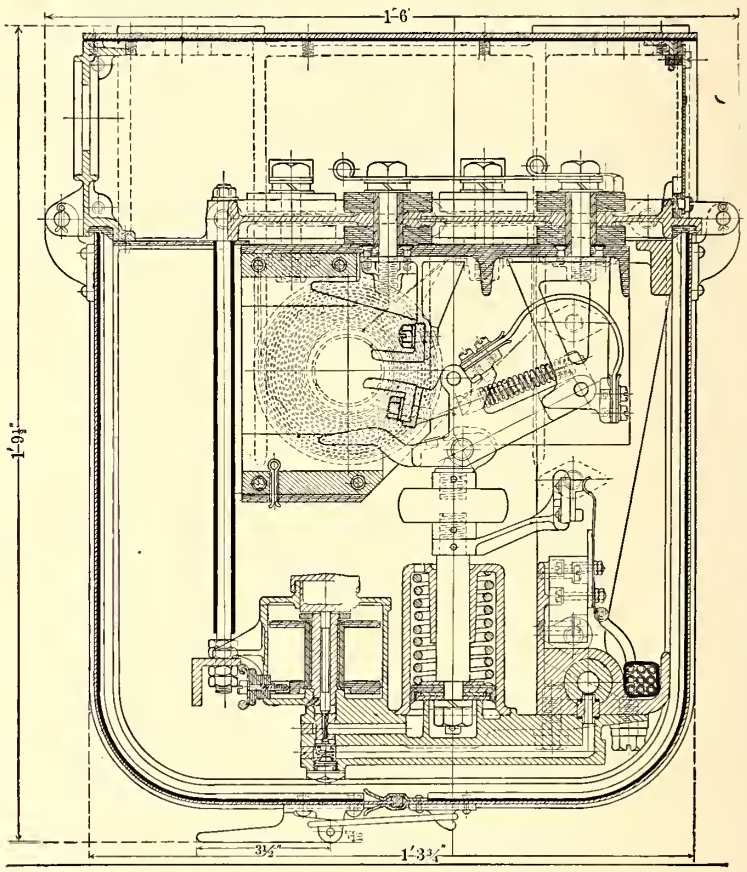
By reference to the diagram it will be seen that the return circuit of all the magnets, with the exception of M1, passes from 12 to 11 over the line relay and from 11 to 9 by way of the circuit breaker trip. The magnet of the line relay is connected between the third rail and the ground. The function of this relay is to drop the controller to the "off" position when the power is interrupted, because of gaps in the third rail or any other cause. When the power is restored the switches will automatically notch up again to the former position of the controller without the motorman moving his handle. This prevents the damage to the equipment that would result if power were suddenly resumed with the controller in the



PUMP GOVERNOR INSTALLED UNDER ONE OF THE CROSS SEATS

full multiple position. If by reason of a grounded armature or for any other cause an abnormal current flows through the circuit breaker, the circuit breaker trip is operated and the contact between wires 11 and 9 is broken and the current is cut off from the line switch operating coil and from all the switch magnets, with the exception of M1. Before the circuit breaker can be thrown in again, the circuit breaker trips must be reset by closing for an instant the reset switch located under a seat in the interior of the car. Closing this switch supplies battery current to wire 15 and over M1 interlock to 73, and to the reset coil, which throws the trip in and restores connection between wires 11 and 9. The circuit through the reset coil is broken at the M1 interlock when this unit switch is closed, and this prevents the circuit breaker being reset, except when the controller handle is in the "off" position.

The limit switch regulates the feeding of the controller. The motorman merely places his handle at switching, series, or parallel position, as the case may be. The lifting coil of the



SECTION OF PNEUMATIC UNIT SWITCH

limit switch is connected in the circuit of No. 1 motor and when the current through it exceeds a predetermined amount, contact between wires 8 and L is broken. As previously traced, current through L operates the unit switches, cutting out the resistance. When the circuit is broken the progressive lifting of these switches is stopped until the current decreases and the limit switch drops. Those resistance switches that have already lifted, however, do not drop, as they are retained by current through wire 13.

The batteries operating the controller are housed in a box under the car. Two sets of seven cells each are employed. The double-pole double-throw battery switches are mounted on a board under a seat in the interior of the car. When both switches are thrown in one direction, one set is connected to the control system, while the other set is being charged through the ground connection of the car lights. It is customary to change the position of the switches once each day.

It will be noted that the interlocking arrangement is thoroughly worked out. The switch group cannot operate unless the reverser switch is thrown in the proper direction and in the full position, otherwise the R wire will not make contact. Neither can the reverser be operated if the line switch is closed, as the circuit through wire 90 is open. The control equipment consists of the following parts, the line switch, upon which the circuit breaker is mounted; the unit switch group, the reverser switch, the limit switch, five resistance grids, two double-pole double-throw battery switches, two master controllers, the relay panel and three junction boxes.

A practice somewhat unusual was carried out in connection with the installation of the apparatus on these cars. When the cars were equipped they were not given trial runs, as is customary, but were put into regular service at once. They are moreover not brought into the shop for inspection until their regular turn, which comes at ten-day intervals. It is possible to follow such a method successfully only by exercising extreme care in the installation of the apparatus. The successful installation of the work is due to the efficiency of the shop corps, under the management of General Foreman George H. Hopkins.

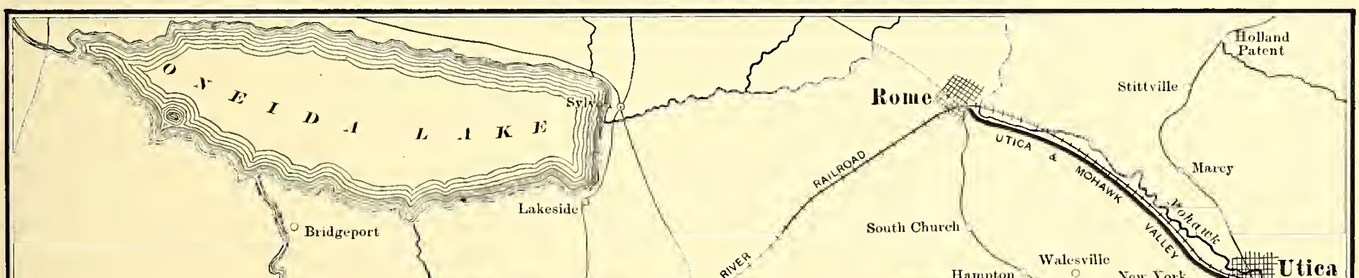
ELECTRIFICATION OF THE WEST SHORE RAILROAD BETWEEN UTICA AND SYRACUSE

About a year ago an agreement was closed between interests identified with the Utica & Mohawk Valley Railway Company, the Oneida Railway Company and the West Shore Railroad whereby, under certain restrictions and stipulations, the Utica & Mohawk Valley and the Oneida Railway interests agreed to lease the tracks of the West Shore between Utica and Syracuse, and to equip this section for electrical operation, the West Shore consenting to relinquish all its passenger business between these two points, but reserving the right to operate freight trains over the section by steam locomotives. Acting under this agreement most of the contracts have been let for work and materials involved in electrifying this division of the West Shore. For general convenience and for simplifying the keeping of accounts, all of the construction work will be carried on under the name of the Oneida Railway Company.

The section of the West Shore included in the agreement runs from the westerly city line of the city of Utica to the easterly limits of the city of Syracuse and comprises a double-track road throughout its length. The rails and roadbed of the steam road will not be disturbed but will be bonded at the joints and utilized for electric service. Track connections will be made in Utica with the system of the Utica & Mohawk Valley Railway Company and in Syracuse with the system of the Syracuse Rapid Transit Company, and it is the plan to give through service into the centers of the respective terminal cities, and also to other points on the respective systems. As is generally known, the Utica & Mohawk Valley Railway Company has for some time operated a high-speed, double-track interurban road through the Mohawk Valley from Rome to Little Falls, and the West Shore electrified section, in connection with the systems already in operation, will make possible continuous service from the city of Little Falls to the city of Syracuse and points reached by existing lines radiating from the latter city, thus closing one of the longest gaps in the much discussed continuous electric service from Albany to Buffalo. The distance from Little Falls to Syracuse is 76 miles, of which the section included in the West Shore division, from the city line of Utica to the city line of Syracuse, comprises 44 miles.

It is proposed to give three classes of service over the West Shore tracks between Utica and Syracuse. There will be fast limited cars or trains scheduled to make 40 miles per hour, and local cars or trains scheduled to make 24 miles per hour. These two classes of passenger service will be operated entirely by electricity. In addition, the West Shore will maintain fast freight service, the freight trains to be drawn by steam locomotives and scheduled to make from 15 miles to 18 miles per hour. In order to provide for passing the faster moving units around the slower trains, a third or middle track will be laid between the stations of Clarks Mills and Vernon, a distance of 8½ miles. This middle track will have Y-connections with both outside tracks, and will be used jointly by eastbound and westbound traffic, in order to expedite the movements of all trains. This section will be under the control of switchmen located in interlocking switch towers situated at points that will insure safety and dispatch in the handling of train movements under all conditions of traffic. On the section between Oneida and Canastota, a distance of 5 miles, two additional tracks will be laid, making four in all, as there are yard limits and watering stations in this section, and it will be necessary to provide the four tracks in order to pass the electric units around freight trains that may be held up in the yards or at water stations.

Power for the electric service will be furnished by the Hudson River Electric Power Company, which controls extensive



MAP SHOWING SECTION OF WEST SHORE RAILROAD BETWEEN SYRACUSE AND UTICA, NOW BEING ELECTRIFIED BY THE ONEIDA RAILWAY COMPANY water power developments on the Hudson River at Spier Falls, Trenton Falls and Mechanicsville. This company is now building transmission lines from its water power plants as far west as Rome, but, pending the completion of these lines, has built a temporary steam-generating station at Utica to supply the needs of the Utica & Mohawk Valley Railway Company and the Oneida Railway Company. For the electrified section of the West Shore the power company will deliver 60,000-volt, three-phase, 40-cycle current to the Oneida Railway at a sub-station located near Clarks Mills, a short distance west of the city of Utica. From this station west the Oneida Railway Company will build and maintain its own 60,000-volt transmission line and sub-stations. For serving the entire section between Utica and Syracuse there will be four sub-stations, as follows: Station No. 1, located at Clarks Mills; station No. 2, located 1½ miles west of Vernon; station No. 3, located 2 miles west of Canastota; station No. 4, located at Manlius Center. The distance between the sub-stations will average approximately 10 miles.

The operating company's 60,000-volt transmission line will start at sub-station No. 1, and, following in general the line of the West Shore, will run to sub-station No. 4, at Manilus Center. This line will be continuous, that is to say, it will pass into and through each sub-station, taps to the bus bars in each case being taken off within the building through disconnecting switches.

The equipment at all the sub-stations will be the same, and in each case will comprise two 300-kw rotaries, and one three-phase, oil-cooled transformer for each rotary. The design of the sub-stations and of the equipment follows standard practice, no attempt having been made to introduce exceptional features. The General Electric Company will furnish all of the apparatus. The sub-station buildings will be of brick with litholite trimmings, and provision will be made in each station for a lineman's room, store room, hot-water heaters for heating the buildings, lavatories, etc. The rotaries will deliver direct current to the line at 600 volts.

The operating company's high-tension transmission lines will be formed of a seven-strand copper cable for each phase, and the line will be carried on steel tower designed and erected by the Archbold-Brady Company, of Syracuse. These towers embody a number of new features, which will be described in a later article. They are of the square, or four leg, type and the average height of tower will be 39 ft. from the ground to the bottom pin. In special cases, however, taller towers will be installed. The standard spacing between towers will be 480 ft., but this will also be changed in special locations. The transmission cables will be carried on Thomas No. 4002 porcelain insulators. The line has purposely been designed with sufficient capacity to meet the future demands for some time to come.

Direct current will be distributed to cars and trains by means of a third rail of the protected under-running type, as adopted by the New York Central Railroad in its New York City electrical zone. This rail was described in the STREET RAILWAY JOURNAL for Sept. 2, 1905. It is of the bullhead, or double head, type, but on the West Shore it will be made of standard carbon steel, as the density of traffic will not require the unusual carrying capacity which impelled the New York Central management to adopt a rail of special composition having low resistivity. The details of the protection for the rail and the exact location on the ties have not yet been fully decided, but the rail will be thoroughly protected with some form of enclosing cover. The third rail weighs 70 lbs. to the yard, and contracts have been placed with the Lackawanna Steel Company for 6000 tons. The third rail will be carried on a bracket which is a modification of the pattern adopted by the New York Central.

For the initial equipment the Oneida Railway Company has placed contracts with the J. G. Brill Company for 15 cars which will measure 50 ft. over all. These will be of the regulation Brill semi-convertible type, and will be mounted on Brill 27-E-2 trucks. The electrical equipment will include four GE-73 motors to each car in connection with the General Electric-Sprague system of multiple-unit control. These cars will also be equipped with graduated release automatic air brakes of the new type recently brought out by the Westinghouse Traction Brake Company. This type of automatic brake is arranged to give perfect control when cars are operated either as single units or in trains, thereby offering all the advantages of straight air in single-car operation and automatic air in train operation.

Contracts have been let to the Roebling Company for all the bonds required for bonding the third-rail conductor. These bonds will be the regular Roebling soldered type, and they will be attached to the upper head of the protected third rail. Each joint will be single bonded, having a capacity of 1,000,000 circ. mils at each joint. The third rail will be supplied in 30-ft. sections and a two-bolt fish plate will be installed at each joint.

The track rails are to be bonded with the Ohio Brass Company's all-wire bonds throughout the entire section, with the exception that orders have also been placed for several sample installations of other types of bonds.

The work on the West Shore electrified section is being carried out by the Oneida Railway Company, of which the following are the officers: H. C. Andrews, president; J. J. Stanley and W. K. Vanderbilt, Jr., vice-presidents; Walter Kernan, counsel; Charles B. Rogers, treasurer; C. Loomis Allen, general manager; and W. J. Harvie, electrical engineer.

CAR TESTS ON BOSTON & WORCESTER STREET RAILWAY

A series of tests have been made, during the last month, on one of the passenger cars of the Boston & Worcester Street Railway Company's cars, as thesis work by L. S. Lord and W. C. Redding, post-graduate students at Worcester Polytechnic Institute, under the direction of A. S. Richey, formerly chief engineer of the Indiana Union Traction Company, now assistant professor of electric railway engineering at the institute. A special recording apparatus was built for these tests, semi-autographic in nature, recording speed, line volts, line current, motor volts, motor current, brake pressure, locations and time. These values were ploted on a sheet of paper, 30 ins. in width, which moved at a constant speed of 2 ins. per minute. Each of the six first values mentioned above were alloted a space 3½ ins. in width, and were represented by curves, while the locations and time were each represented by a straight line at one side of the paper. In addition to this recording apparatus, wattmeters were installed on the car, showing total power consumption, power used by air compressor, power used by type-M contral circuits, and I^2R losses in one motor's field. A General Electric recording ammeter served as a check on the total current curve of the larger recording apparatus. The car was run on regular schedule time, making all stops, and five round trips were made between Worcester and Boston. About 300 lineal ft. of record was made, from which the results are now being deduced.

The American Street & Interurban Railway Association has just printed in bulletin form the constitution and by-laws of its three affiliated associations: The Accountants' Association, the Engineering Association, and the Claim Agents' Association.

TABULATION OF TRAFFIC STATISTICS IN BERLIN

BY A. STAVENOV,
Traffic Manager, Grosse Berliner Strassenbahn.

It is of great importance for the traffic manager of a street railway company to analyze the conditions under which his individual lines are operated. He should not only know whether too many or too few cars are being run to satisfy the demand on each portion of each route, so that he can change the schedule if necessary, but should also be acquainted with the class and direction of passengers carried on each route and their average length of ride. The value of this latter information is particularly important in the case of suburban lines. If, for instance, a line extends through a high-class residential district to a manufacturing center; or vice versa, if it passes through a manufacturing district into a high-class suburb, it may be well to determine whether it would not be better to give each district a separate service. On the other hand, it may often be desirable to consolidate two services, voice their requests so loudly, are often more valuable to the railway company from a traffic standpoint. If a railway company knows exactly where its passengers come from and where they are going, and how many passengers are using each line, it is in the best position, not only to arrange its schedules in the most efficient way, but also to prove to the

REPORT FOR WEDNESDAY, FEB. 8, 1905.

Line No. 23/24.

Gesundbrunnen (Pankstrasse E. Badstrasse) — Nettelbeckplatz-Potsdamerstrasse. (E. Gross Gorschenstrasse)

Passenger Km	48,288	
Motor-Car Km	2,329.92	3,327.04
Trail Car Km	997.12	
Passengers on fare tickets	10,821	13,687
Passengers on commutation tickets (collected Feb. 9. 05.)	2,866	
Fare Ticket Receipts on Feb. 8, 1905		1,082.10 marks
Commutation Ticket Receipts for Feb. 8, 1905		153.66 marks
		1,235.76 marks
Average increase per passenger, km		2.55914 pf
Average ride of a passenger		3.53 km

FIG. 1.—TYPICAL REPORT, REPRODUCED FROM FRONT OF TRAFFIC CARD.

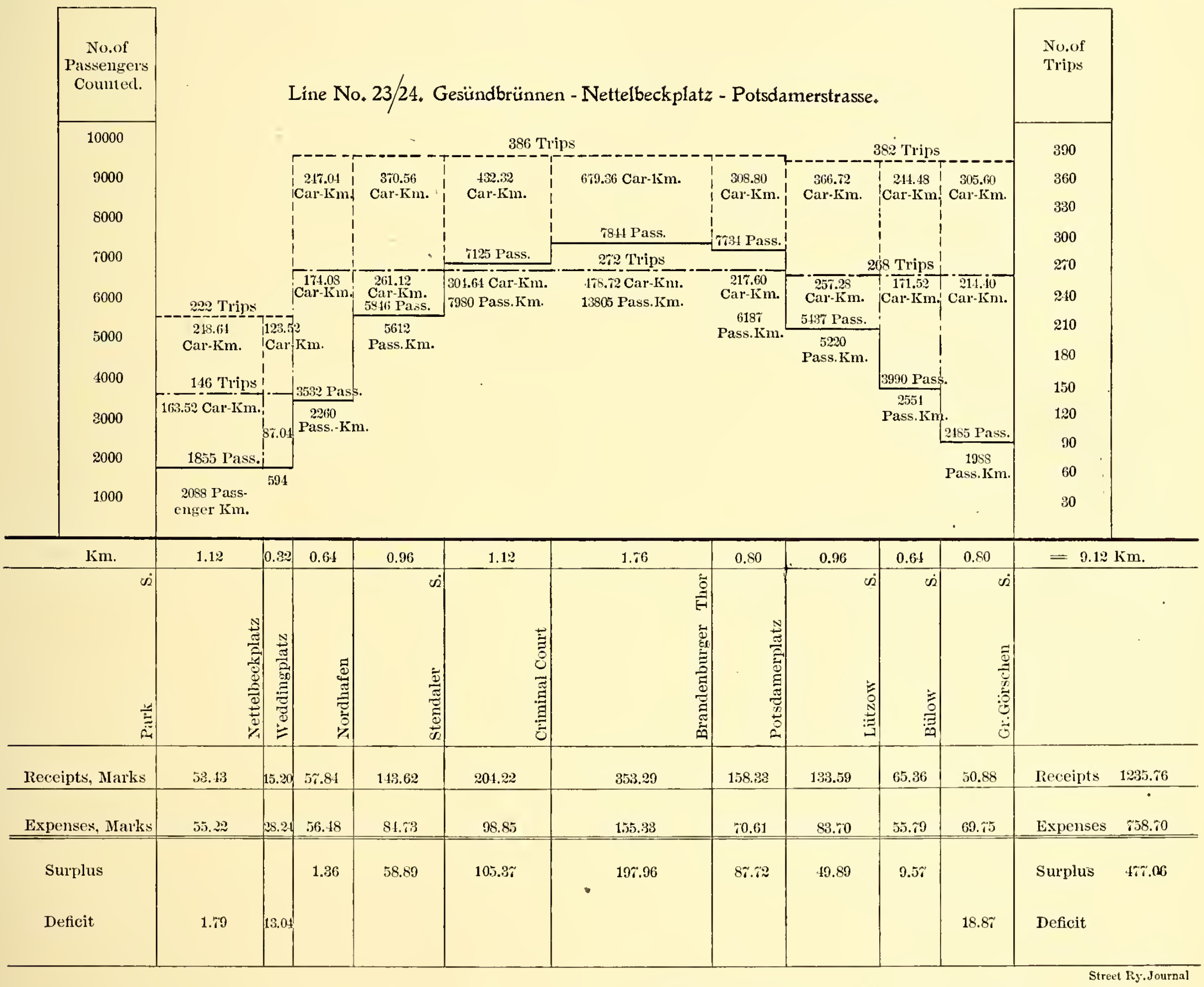


FIG. 2.—REPRODUCTION OF BACK OF TRAFFIC CARD, COMPILED EVERY SIX MONTHS FOR EACH LINE.

and so economize in operating expenses. In determinations of this kind, statistics point the way with greater accuracy than the opinions of conductors or the suggestions of passengers. Both conductors and passengers are often guided in their advice by purely personal reasons. Thus the higher class residential districts are occupied, as a rule, by influential citizens who will often demand better transportation facilities than their patronage warrants. On the other hand, the people in the more densely populated sections, who do not

authorities and others that its decisions are based upon a scientific and business basis.

City electric railroading has now reached a point where the most serious technical questions concerned with construction and equipment have been settled. Apparatus is now so standardized that the most important problems connected with city transportation is the proper handling of the traffic. This is, of course, as it should be, because the handling of traffic is the life business of every railway company. In Berlin the work of keeping track of the changes and traffic conditions is carried on as explained in the following paragraphs:

An elaborate report or "census" is taken twice a year of the passengers carried on a day of normal traffic. For this purpose the entire surface railway system of Berlin, which includes the Grosse-Berliner Strassenbahn, the Western and Southern Berlin Suburban Line and the Berlin-Charlottenburg division is divided into about 300 sections, from 1 km to 1½ km (2-3 mile to 1 mile) in length. Upon entering each section, the conductor looks over his passengers and marks their number on a special form. He also notes the number of seats within the car, and how many of them are empty. Further, the conductor must indicate how many persons were not permitted to ride on account of the necessity of complying with the police regulations, which permit only a certain number of standing passengers. For instance, only three school children, riding on reduced fare tickets, are permitted to stand in a car.

The different classes of passengers are tabulated according to the following six classes of tickets, which are in force: (a) Ordinary tickets sold by the conductor; (b) monthly commutation tickets; (c) workingmen's weekly tickets; (d) school tickets; (e) postmen's tickets; (f) policemen's tickets; (g) free tickets for the employees of the railway, nurses in charitable institutions, etc.

The figures thus compiled are compared for the different lines, and calculations are made of the receipts and expenses per passenger kilometer; motor-car kilometer, and the trail-car kilometer. The average operating expenses for all lines last year, exclusive of depreciation, was 27 pf. (6¾ cents) for a motor-car kilometer, and 13 pf. (3¾ cents) per trail-car kilometer. It will be noted that the novel features of these statistics are the determination of the passenger kilometers, the income per passenger kilometer, and the average length of a ride taken by a passenger. This last fact naturally is of great value in determining the earning capacity of a given line.

FIG. 3.—RELIEF MAP OF THE SURFACE RAILWAY SYSTEM OF BERLIN AND ENVIRONS, INDICATING THE DENSITY OF TRAFFIC

A typical card, tabulating the results secured at the "census" taken Wednesday, Feb. 8, 1905, on line No. 23-24, is reproduced in Figs. 1 and 2. The front of the card (Fig. 1) gives a resumé of the detailed data presented on the back (Fig. 2), and shows the average income per passenger kilometer and the length of an average ride. From Fig. 2 it will be seen that for varying distances along the line observations are taken of the number of passengers, the number of trips, car kilometers, etc. The operating expenses are then figured out for every section of the line, so that it is possible to tell whether the service is paying expenses or not. Reference to the number of passengers on the different sections will show the possibility of cutting down useless mileage, by reducing the number of trips on sections where the passenger traffic begins to show a decided decrease.

If objection be made that the statistics thus secured are inexact, the writer would point out that the same relative figures were obtained when observations were obtained on a number of days. It is understood, of course, that the entire inspection staff gives careful attention to statistical work of the conductors on the day set, helping them out where necessary. The results are then worked out by one official, who has done this work for the last five years. The statistics thus secured, and the results deduced from them, are of great assistance to the traffic officers, and give them additional pleasure in pursuing their work.

In connection with the annual traffic census, the writer has devised a method for showing the density of traffic on all of the lines of the Berlin Street Railway system and its suburban connections. For this purpose strips of wood of varying thickness are prepared and placed on a map of the city, so as to cover the routes of the different lines. The thickness or height of each piece of wood is made proportional to the passenger traffic per kilometer, that is, 1-mm thickness corresponding to every 1000 passengers. The strips are also colored, blue strips being used for traffic between 1000 and 25,000, yellow for 25,000 to 50,000, green for 50,000 to 75,000, red for 75,000 to 100,000, and white for 100,000 to 125,000. It is possible, therefore, from this relief map, to secure rapidly an exact idea of the amount and distribution of traffic on all the lines. It will be noted from the perspective view, Fig. 3, that the heaviest traffic is in the center of Berlin, along Potsdamerstrasse and Leipzigerstrasse. Along this route the company intends to build a four-track shallow subway, through which it will operate cars of the ordinary surface type. The completion of this subway would greatly reduce the traffic congestion on two of the main streets of Berlin.

AUTOMATIC SPRINKLER SYSTEM IN CLEVELAND

The Cleveland Electric Railway Company, of Cleveland, has just completed the equipment of all of its permanent car houses with automatic sprinkler systems. There are twelve houses, including the repair and car shops, making the most

WINDERMERE CAR HOUSE

extensive installation of sprinklers ever ordered by a street railway company. It will be remembered that the first tests of automatic sprinklers for car house protection took place in Cleveland, and the installations which have been perfected as the results of these tests may now be regarded as standard. After the first tests the company placed its entire contracts open for competitive bidding, and the order was secured by the General Fire Extinguisher Company, of Providence, R. I. The system of placing sprinklers between tracks of car houses, which was demonstrated in the early Cleveland tests to be most desirable, was adopted for all of these installations,

WINDERMERE CAR HOUSE, SHOWING SIDE LINES AND NEW FIRE WALL

the repair shops included. The extent of the Cleveland installation may be seen from the following table showing the number of roof and side sprinklers installed, the height and size of tanks, etc.

CLEVELAND FIRE PROTECTION EQUIPMENT

Name	Cars, Cap.	Roof Sprinklers	Side Sprinklers	Tanks	Height, Feet	Capacity, Gallons
Windermere	84	942	592	1	65	50,000
Lake View shops...	..	1,440	521	1	65	50,000
Wilson	54	742	440	1	75	50,000
Rocky River	64	1,036	700	1	75	40,000
Lorain	64	1,345	612	1	75	50,000
Hough	40	540	390	1	75	30,000
Cedar	72	900	700	1	55	40,000
St. Clair	40	433	235	1	55	40,000
Superior	60	550	450	1	75	50,000
W. Madison	40	282	346	1	65	30,000
S. Brooklyn	36	336	420	1	65	30,000
Miles Ave.	80	795	800	2	75	35,000

The sprinkler heads are of the standard Grinnell type which are fusible at a predetermined temperature. The roof and side sprinkler systems are connected separately, and there is a 6-in. riser to each 200 sprinkler heads. The side sprinkler lines are placed according to the height of the standard car, so that the water will discharge just below the top of the car windows. The sprinklers under ordinary pressure will cover 64 sq. ft. of surface. The side sprinklers on the lines between the cars are placed 7 ft. apart. Those in the roof are 8 ft. to 9 ft. apart, depending somewhat upon the character of the roof. In the early fire tests it was thought that it would be necessary to provide some sort of a hood for the aisle sprinklers to prevent them becoming flooded and cooled by those above, as the roof sprinklers usually open first, but in later tests it was found that this was not necessary, so that the sprinkler heads are uniform throughout. The various mains are controlled by gate valves at the bases of the risers, so that in case of breaks in any portion of the system, that section can be cut off. There are also post indicator valves on the outside of the building, and some 30 ft. away, so that in case of fire and a desire to throw extra pressure on certain sections, any section can be shut off from the outside without endangering the lives of attendants.

At the Lake View shops, which are heated, the various pipes are constantly under water pressure, but during the winter in the other houses the air system is used. The various pipes are charged with air at from 20 lbs. to 40 lbs., and the water is held below the freezing point by a valve in which the area on the air seat is 8 times greater than the area on the water seat. When a fire occurs and the sprinklers are fused, the air pressure is released and the water quickly follows to the sprinkler heads that have been fused.

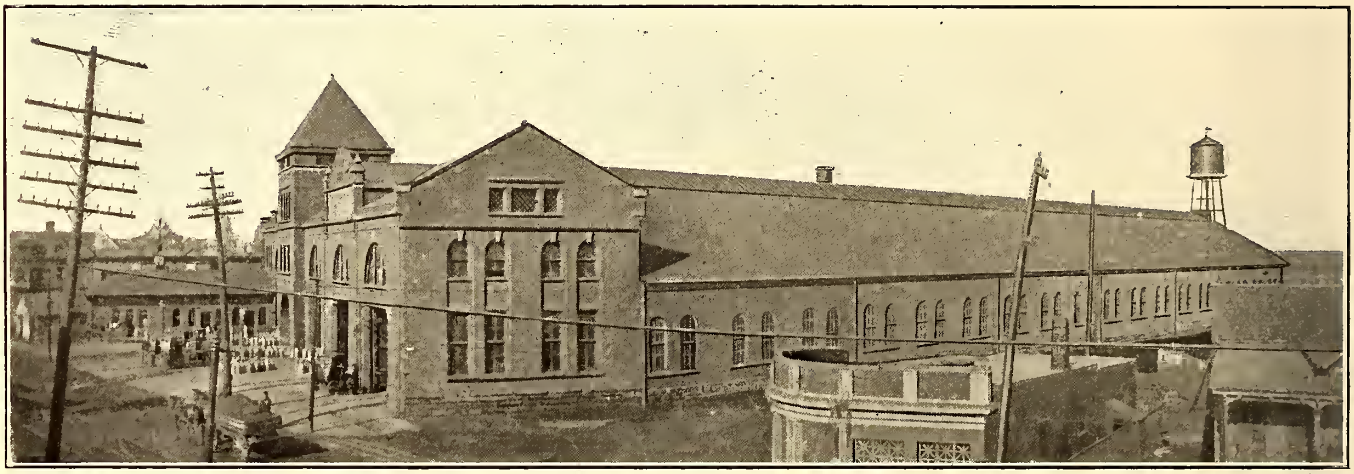
Each system has two sources of water supply; water from the city mains and pressure from a large wood tank placed on a steel tower. In various parts of the city, where the city water pressure is from 70 lbs. to 90 lbs., this is used as the main supply, and the tanks are considered an auxiliary, while in other parts of the city, the chief dependence is placed upon the tanks. At the Miles Avenue car house, two 35,000-gallon tanks were erected to insure ample pressure and supply. Each system is provided with two or more Siamese fire steamer connections, and the chief of the fire department, after seeing numerous tests, has given orders that the first steamers arriving at a car house fire shall connect with the Siamese sprinkler connections and throw their pressure into the sprinkler system. It has been found that the pressure furnished by a steamer is sufficient to deluge any fire in a very short time.

All parts of the Lake View shops are protected by roof sprinklers, and wherever cars are placed for repairs or painting there are aisle sprinklers as well. The company stores a number of cars in the open, and plans are being made to place sprinklers between the tracks in these yards. In these cases it is not the intention to install automatic sprinklers, as each yard has attendants whose first duty it would be to open the valves as soon as a fire was discovered.

In connection with the installation of sprinkler systems, the company has done a large amount of work in the way of otherwise reducing fire risks. Fire walls were built in a number of car houses, thus reducing the chances of fire spreading. Tracks were inclined at the front entrances to facilitate easy removal of cars. A large number of windows were bricked up and fireproof doors installed in place of ordinary wooden doors. Fire hydrants with hose have been installed in a large number of places, and chemical extinguishers have been placed in all buildings. An employee of intelligence and ability has been appointed at each building to have charge of the fire apparatus and make inspections, and printed instructions as to the general care and degree of cleanliness to be observed are posted in all buildings.

A chief inspector also examines all buildings twice a week and reports all necessary repairs. Floors must be swept once a day and all dirt and refuse placed in proper receptacles. Smoking is not permitted in any building, except in club rooms, motormen's and conductors' rooms and other places designated for that purpose. Oil must be kept in the oil storage house. If a fire is started in a car stove while the car is in any building, or if kindling is saturated with oil in any building, or if ashes are taken from any car stove while the car is in the building, the fact must be reported. If a car stove or chimney is broken or in bad condition, it must be reported at once for repair. The apparatus for heating must be safely arranged and all chemical extinguishers charged free from frost and in good order. Fire pails must be kept full of water in summer and with sand in winter. All fire hose must be in place and in good condition, and employees should know where to find it and how to use it. Hydrant houses must be kept in good order and equipped with lanterns, axes, spanners, wrenches and hose ready for use. All pits, closets, floors, benches, shelves and corners must be kept free from dirt and grease, and all oily waste not in immediate use must be placed in standard waste cans with self-closing lids. The inspectors are encouraged to suggest any improvements or changes in construction or operation that will, in their opinion, lessen the hazard of fire. All reports of repairs or suggestions must be sent to the master mechanic.

The equipping of the various houses with sprinkler systems and other improvements instituted represent an investment of between $175,000 and $200,000, but it has effected a saving in premiums of more than $35,000. The company also has the protection, which cannot be measured in dollars and cents, of feeling almost absolutely assured that it is not likely to again have its service interrupted by the loss of a lot of cars, which was its experience in three serious fires within the past few years.



LORAIN CAR HOUSE, SHOWING TANK

The Central Passenger Association has decided that steam roads in Ohio shall make a charge of 10 cents more than the regular fare for cash fares on trains. The cash-fare receipt to be good for a rebate of 10 cents if presented at any station in the State within 30 days. Several of the electric railways in that State have also adopted this policy, as it discourages the payment of cash fares on trains and relieves the conductors of having to carry so much change. The Central Passenger Association has announced that in the future all fare-and-a-third convention rates will be cut out in Ohio, as the result of the 2-cents-a-mile law in that State.

The waiting room for the interurban lines leading into Detroit has been moved to a more accessible location in the Newberry Building, on the corner of Larned and Griswold streets.

PLANS FOR THE COLUMBUS CONVENTION

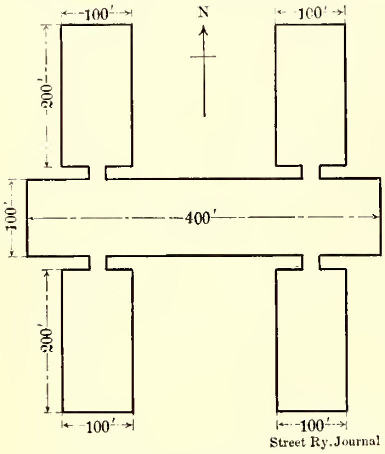
A meeting was held in Columbus, May 14-15, of representatives of the American Street & Interurban Railway Association, the American Street & Interurban Railway Manufacturers' Association, and the Columbus Board of Trade, to discuss the preliminary arrangements for holding conventions of the four street railway associations in Columbus next October. There were present from the American Street & Interurban Railway Association, President Ely, Secretary Swenson, Richard McCulloch, of St. Louis; John J. Stanley, Cleveland; F. N. Brooks, of Detroit, and Theodore Stebbins, of Columbus, and the following representatives of the street railway companies in Columbus: Columbus Railway & Light Company, President R. E. Sheldon, Vice-President and General Manager E. K. Stewart, Secretary and Auditor P. V. Burington, Assistant General Superintendent L. G. White; Columbus Railway Company, President Butler Sheldon; Scioto Valley Traction Company, President Frank A. Davis, Vice-President E. R. Sharpe, Counsel H. N. Daugherty; Columbus, New Albany & Johnstown Railway Company, President D. J. Ryan; Columbus, London & Springfield Railway Company, General Manager J. L. Adams. Those representing the American Street & Interurban Railway Manufacturers' Association were: James H. McGraw, of New York; Charles C. Pierce, of Boston; E. H. Baker, of New York; J. R. Ellicott, of New York; C. A. Tupper, of Milwaukee; C. K. King, of Mansfield, Ohio; D. B. Dean, of Chicago, and Secretary Keegan. Those representing the Columbus Board of Trade were: President R. Grosvenor Hutchins, Secretary John Y. Bassell and Henry C. Pirrung, chairman, and B. H. Harmon, secretary, of the Convention Committee of the Board of Trade. The State Board of Agriculture, which extended the use of the Fair Grounds, was represented by Messrs. Taylor, Calvert and Fleming. D. N. Kelly, president of the Iroquois Hotel Company, which controls a number of the principal hotels in the city, was also present.

The delegates first visited the State Fair Grounds, where it is proposed to hold the convention, and were taken there on one of the private cars of the Columbus Railway & Light Company. The grounds are reached in about 15 minutes from the center of the city by the street railway line extending out High Street. The Ohio State Fair Grounds comprise 115 acres, and are undoubtedly the largest and finest in the country. They represent, with their buildings, an investment on the part of the State of about $2,000,000, and heretofore have been used exclusively for the State agricultural fairs, which are held during the first part of September. Through the courtesy of the State Board of Agriculture, however, permission has been accorded to the Columbus Board of Trade to extend their use, without charge, to the American Street & Interurban Railway Association during its convention on Oct. 15-19.

THE SCIOTO RIVER AT COLUMBUS

VIEW OF COLUMBUS, LOOKING NORTH ON HIGH STREET TOWARD STATE FAIR GROUNDS

For practically the first time in the history of the association, with the exception of Philadelphia, more exhibit space is available than will be required. The spacious grounds are dotted with a large number and variety of buildings for exhibit purposes, but it has been decided to confine the exhibits at the convention to a substantial and handsome group of five brick buildings, which are near the entrance to the grounds, and which provide in the neighborhood of 120,000 sq. ft. All of this space will probably not be required. The central building of the group, shown in the accompanying plan, is divided by walls into three rooms and the meetings of the main association will be held in one of these rooms, known as "West Central Hall." This hall is approximately 100 ft. x 150 ft. Several smaller halls adjoin this main hall and are well suited for the meetings of the Engineering, Accountants' and Claim Agents' associations. There is also a large number of still smaller rooms, suitable for committee use. It has also been thought advisable to establish a buffet on the grounds during the convention week for the convenience of those who do not wish to return to the city between the morning and afternoon sessions. The grounds are eminently suited for this purpose, as they possess several buildings with permanent kitchens and dining rooms, and arrangements will be made for having a first-class caterer on the grounds.



PLAN OF CONVENTION BUILDINGS AT COLUMBUS

As the State Fair will be held about a month before the street railway convention, the grounds will be put in good shape at that time and the Board of Trade has agreed to see that the grounds are maintained in good condition at the time of the meeting, to make provision for heating the buildings if necessary, for lighting them and for supplying them with power. Telephone, telegraph and postal facilities will also be installed. The power for the buildings will be taken from the mains of the Columbus Railway & Lighting Company near the grounds, and will be 500-volt d. c. and 110-volt and 220-volt a. c. The Board of Trade has also agreed to see that no excessive charges are made to exhibitors by local teamsters, carpenters, sign painters and others who will be required to put the exhibits in condition, also to secure a switch into the grounds from either the Big Four Railroad or the Pennsylvania Railroad, both of which pass by the grounds, so that exhibits can be taken directly to the buildings. Satisfactory arrangements have also been made with the proprietors of four principal hotels in the city by which accommodations, which it is expected will be sufficient for the purposes of the associations, will be reserved for those attending the convention. If this number is not sufficient the hotel proprietors promise additional rooms, and have given every assurance that ample space will be provided. An agreement has been made that only regular rates will be charged. As Columbus is the capital of Ohio, it is exceptionally well provided with good hotel accommodations.

In the evening of May 14 the delegates present were entertained by Mr. Pirrung, of the Board of Trade, at a very handsome dinner at the Hotel Chittenden. Among the table decorations was a miniature electric train, which traveled around the table and was stopped by the toastmaster in front of each speaker as he was called upon for remarks. The menu was in the form of a strip of street railway tickets, similar to those issued by the Columbus Railway & Light Company.

PROGRAM OF THE CONVENTION

During the meetings of the convention committee, a meeting was also held of the Committee on Papers and Topics, of which two members, Messrs. McCulloch and Stebbins, were present with the secretary of the association. While the program cannot yet be announced in detail, it might be said that it is proposed at present to hold sessions of the Engineering and Accountants' associations on Monday, Tuesday and Wednesday; of the main association on Wednesday, Thursday and Friday, and of the Claim Agents' Association on Thursday and Friday of Convention Week. Meetings of all the associations will be held both morning and afternoon. The Wednesday morning session will probably be made a joint session of all five of the associations, including the Manufacturers' Association, with addresses by the five presidents, which will outline the progress made during the year in association work.

VIEW OF STATE HOUSE AT COLUMBUS

The Wednesday afternoon session of the main association will be devoted to reports of standing committees. At Thursday morning's session interurban railway topics will be considered and an excellent line of papers discussing interurban railway management and operation has been secured. Thursday afternoon's session will be devoted to subjects connected with employees, and several papers have been promised on welfare work, selection, instruction and discipline of employees and kindred topics. Friday morning's session will probably be executive in its character and Friday afternoon will be devoted to unfinished business and the reports of any

HIGH STREET, LOOKING SOUTH, COLUMBUS

committees, such as the Nominating Committee, which have been appointed during the session.

COLUMBUS AS A CONVENTION CITY

Columbus seems eminently suited for the purposes of the association as a convention city, and its choice is particularly appropriate at this time, as it possesses an up-to-date and well-equipped street railway system of its own, and is also the terminus of a large number of extensive interurban systems, among which are some of the longest and highest speed lines in the country. It is possible to travel from Columbus by electric car to all of the principal cities in Ohio, such as Cleveland, Toledo, Dayton and Cincinnati, and the city is connected by several routes with the interurban electric railway systems of Indiana and Southern Michigan. Although in size the city is somewhat smaller than any which has been adopted as a convention city by the association in recent years, its hotel facilities are excellent and commodious, and its facilities for exhibits, as already outlined, are unexcelled. Moreover, the city has taken care of a number of conventions during past years and is used to carrying meetings of this character. It is the capital city of Ohio and has a population at present, on a basis of registered voters and school enumeration, of somewhat over 160,000, or nearly double the population in 1890.

It is reached by all of the principal trunk lines, eighteen steam railroads entering the city. A circle with a 500-mile radius and drawn with Columbus as a center would include a large number of the most thickly populated portions of this country, and would embrace within its outside limits such cities as New York, Toledo, Milwaukee, Dubuque, St. Louis, Memphis, Birmingham, Ala., Atlanta, Savannah, and Norfolk, Va. This location brings the city within a night's ride of a very large portion of the Eastern, Middle and Southern States.

TRAFFIC STATISTICS FOR NEW YORK CITY

The Board of Railroad Commissioners has just issued its quarterly report of statistics of passengers carried, car mileage, etc., for the street railway companies of New York City, covering the first three months of 1906. The principal figures are given below, with the percentage increase in the cash fares, transfers, and car miles run. As will be noticed, the increase is large, owing largely in the case of the surface roads to the fact that the very severe winter experienced during the first three months of 1905 reduced the traffic on these lines below the normal. On the other hand, the Subway figures cover a larger mileage than did those of 1905.

TABLE SHOWING TRAFFIC STATISTICS FOR ALL ROADS IN NEW YORK CITY FOR FIRST THREE MONTHS IN 1906

	Cash Fares	Increase	Transfers	Increase	Car Miles	Increase
New York City Railway	89,454,011	8,769,416	44,436,241	6,820,867	13,620,424	1,382,099
Interborough—Elevated	65,733,985	3,219,025	†	....	15,253,524	1,147,729
Interborough—Subway	41,029,733	11,491,007	†	....	8,469,144	1,498,505
Total Manhattan Borough	196,217,729	23,479,448	44,436,241	6,820,867	37,343,092	4,028,333
Brooklyn Rapid Transit	80,184,600	10,021,446	19,679,629	4,763,391	14,723,417	1,646,438
Coney Island & Brooklyn	6,520,794	323,111	1,335,259	11,201	1,406,494	87,833
Van Brunt Street & Erie Basin	418,310	21,285	31,730	*2,873	53,549	3,617
Total Brooklyn Borough	87,123,704	10,365,842	21,046,618	4,771,719	16,183,460	1,737,888
New York & Queens County	3,379,883	615,110	771,210	182,903	828,246	102,964
Long Island Electric	599,305	82,556	†	....	184,495	21,199
Ocean Electric	95,022	35,667	†	....	48,340	14,454
Total Queens Borough	4,074,210	733,333	771,210	182,903	1,061,081	138,617
Staten Island Midland	603,535	110,967	53,110	9,001	274,730	64,388
Richmond Light & Railroad	966,670	154,061	96,501	13,910	286,237	29,799
Total Richmond Borough	1,570,205	265,028	149,611	42,911	560,967	94,187
Union Railway	8,156,836	2,161,718	1,711,808	*970,955	1,762,625	516,847
Southern Boulevard	196,481	55,881	97,276	*24,574	86,991	6,562
Total Bronx Borough	8,353,317	2,217,599	1,809,084	*995,529	1,849,616	523,409
Total New York City	297,339,165	37,061,250	68,212,755	10,822,871	56,998,216	6,522,434
Percentage increase	12.4	....	15.7	....	11.5	....

* Decrease. † No transfers reported.

STREET RAILWAY SITUATION IN SAN FRANCISCO

(*From Our Own Correspondent.*)

Through the magnificent work of the officials and employees of the United Railroads the street railway situation in San Francisco is being materially improved every day. On May 8th every electric line in the city outside of the burned district was in operation. Cars are now operated on Market Street as far as Twentieth and Castro Streets, which is as far as electric cars can be operated in that direction, on account of the heavy grades on Castro Street.

O'Farrell, Ellis, Eddy and Turk streets have practically been cleared of all dangerous walls, and as a result there will be an improved service between Fillmore and Market streets. Cars on the Ellis and O'Farrell Street lines will run through the burned district as far as Market Street, and on the Turk and Eddy Street line to the Ferry, by way of Market Street.

A regular service has been established to San Mateo, the first car getting through to San Mateo on May 5th. The tracks of this line were badly depressed at several places where they crossed filled ground, and a large force of men has been continuously engaged since the first day of the earthquake in getting the roadbed into shape. The car that first reached San Mateo, eighteen days after the earthquake, received a big ovation from the citizens of that popular suburb.

The large North Beach power plant of the United Railroads, which suffered considerable damage from the earthquake, has been repaired and was placed in operation on May 6 for the first time since April 18. Steam and water pipes had to be repaired and the heavy roof of the power house, which partially fell in on the machinery, had to be removed and replaced by a temporary canvas covering. Damaged walls also had to be torn down in places, and braced in others. From now on the company expects to have plenty of power to operate sufficient cars to meet street railway transportation needs of the city.

Under the temporary system of making the trolley wires carry the current, the feed wires having been disconnected by orders of the lighting committee, the United Railroads is experiencing considerable difficulty in meeting the heavy demand for power at points remote from the power stations. This condition of affairs, however, will be remedied as fast as the construction crews can restore the connections.

The officials of the United Railroads are bending every effort toward placing the system on a practical operating basis, and already has 350 cars in operation. Out of a total of 3000 men employed previous to the fire, 2200 men are now at work. Weekly pay days have been established to meet the necessities of its employees, in lieu of the former practice of paying once a month.

VIEW REPRODUCED FROM PHOTOGRAPH TAKEN MAY 6, 1906, INDICATING RESTORATION OF ELECTRIC RAILWAY SERVICE TO SAN FRANCISCO'S FAMOUS FERRY BUILDING

In a report on the street railway situation to the general relief committee, Thornwell Mullaly, assistant to the president of the United Railroads, stated that of the 280 miles of street railways in San Francisco 258 miles belonged to the United Railroads. Ninety-three miles of road lay within the burned district, and of this eighty miles were in the United Railroads system, consisting of twenty-five miles of cable road and fifty-five miles of electric lines. He declared that the work of reconstruction following the earthquake and fire had never been equaled in the country, and praised the labors of the company's employees that resulted in putting a number of its lines in shape for operation so soon after the calamity.

At the request of the relief committee, the company is now keeping its receipts from car fares, after having donated for the relief work about $10,000 of gross receipts for the first four days' operation. In addition to this donation, the United Railroads contributed $75,000 to the relief fund. Of this latter amount $14,000 was expended for provisions at the very beginning of the trouble. A man had been hurried to Sacramento to purchase supplies, and a boatload of provisions had been hurried to San Francisco and landed at the Government dock, where they were distributed by the military authorities. This was the first boatload of supplies that reached San Francisco.

The officials of the United Railroads state if the company is given a free hand it will provide San Francisco with adequate transportation facilities in every section of the city. Discussing the situation, President Calhoun is quoted as follows:

"We are prepared to convert our cable roads, wherever practicable, into electric roads, and if the Board of Supervisors will give the United Railroads a permit—it would have to be something more than a temporary permit, owing to the

RUINS OF THE VALENCIA & MARKET STREETS CABLE POWER HOUSE, OFFICES AND MAIN REPAIR SHOPS OF THE UNITED RAILROADS, OF SAN FRANCISCO. THE BRICK-RIBBED CHIMNEY WAS CRACKED TO THE FOUNDATIONS BY THE EARTHQUAKE

great outlay involved—we will convert the Sutter Street system into an overhead trolley road and have it in operation in thirty days.

"An underground conduit system is out of the question so far as the United Railroads is concerned. Under no circumstances, after our experience with slots during the recent earthquake, would we think of installing any conduit systems in San Francisco. The damage done to the cable roads makes it clear to my mind that it would be foolish to install any conduit systems. It will take a year to repair the damage done to the cable roads, if they are to be repaired and operated as cable roads. Conduit systems would have been in a similar predicament had there been any in San Francisco during the recent calamity. Wherever we have had trolley lines, however, we have found it possible to resume operations the instant the roadbed could be cleared of debris. This has been one big object lesson in support of my previous contentions regarding the comparative efficiency of overhead and underground electric systems."

Mr. Calhoun says that if the people want a trolley system on Sutter, Larkin, and Polk streets and Pacific Avenue, he will put 2000 men to work immediately upon the granting of the necessary permit by the Supervisors, and will have the entire system in operation as an electric road within thirty days. He has ordered 7000 tons of 9-in. Trilby rails for reconstruction work in San Francisco, and has been assured by the United States Steel Corporation, which has the order, that it will be given precedence over all orders that its rolling

RUINS OF THE SUTTER STREET CABLE POWER HOUSE, UNITED RAILROADS, OF SAN FRANCISCO

mills now have on hand. Deliveries ought to be made very shortly.

It is pointed out that the conversion of the Sutter Street system into an electric road is the only chance that a considerable section of the city, including Pacific Heights, Presidio Heights and the Presido, now has for an early restoration of street railway transportation. The Union Street line is so badly crippled, by injury to the roadbed and the destruction of its power house and cars, that it will probably not be rebuilt except on a renewal of its franchise for a long term of years. The cable lines on Sacramento, Clay, Washington and Jackson streets will also be out of commission for perhaps a year.

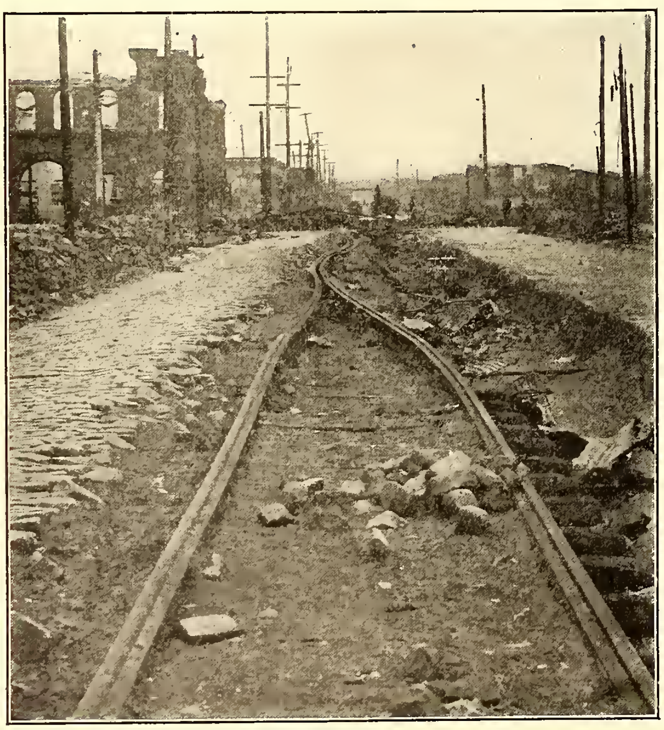
C. E. Loss & Company, the firm having the contract for building the Geary Street municipal road, have raised the question whether or not it is practicable to proceed with the

CAR HOUSE AT TURK AND FILLMORE STREETS, SLIGHTLY DAMAGED BY FIRE AND EARTHQUAKE, BUT NOW USED AS MAIN OFFICES BY THE UNITED RAILROADS, OF SAN FRANCISCO

underground conduit plans in the light of experience of the cable roads in the earthquake. C. E. Loss claims it is not advisable to use the conduit system in San Francisco, and points to the experience of the United Railroads as supporting his argument. He points out that the United Railroads was able to operate its overhead trolley system within a few days after the fire, while it will be months before any of the cable lines will be started. As it was with the cable, so it would be with the conduit, he claims, in case of another tremor. Both use the cable slot, and it was the closing of these

IRON TROLLEY POLE ON BRYANT STREET, BENT AS A RESULT OF THE INTENSE HEAT. THE VIEW, INCLUDING THE CHINAMAN REFUGEE ON THE LEFT AND THE DEAD DOG ON THE RIGHT, IS TYPICAL OF SCENES COMMON AFTER THE FIRE

slots which made it impossible to operate cars on the cable systems in this city. Mr. Loss suggests that the Mayor ap-



ELECTRIC RAILWAY TRACKS OF UNITED RAILROADS, OF SAN FRANCISCO, SHOWING HOW RAILS WHERE PAVING HAD NOT BEEN RELAID WERE TWISTED OUT OF SHAPE BY BURNING GAS FROM STREET MAINS. THE TIES WERE FIRST BURNED, PERMITTING THE HEAT TO WARP THE RAILS IN THE STRANGE MANNER INDICATED

point a committee of prominent citizens and experts to go over the Geary Street roadbed, and decide for themselves if an underground system is practicable.

Loss & Company have over 1000 men at work laying tracks in the streets of the city, under lease of the Ocean Shore Railway, and with the permission of the Mayor. When completed this road will be used to carry off debris from private property and will be used in conjunction with the Southern Pacific and Santa Fe railroads. The laying of the tracks has already been begun, and the road will be operated along the following route: From Twenty-Fourth and Clapp Streets to Fifteenth Street; along Fifteenth Street to Howard Street; Howard Street to Spear Street to Market Street, to connect with the State Harbor Commissioners' Belt Line Railway. These tracks will connect with the Ocean Shore tracks on Twelfth Street, for which it has a franchise granted by the Board of Supervisors some weeks ago.

Through the New York representatives of United Railroad interests it is stated that the affairs of the company are rapidly assuming even more satisfactory conditions than had been anticipated from the inventory taken after the fire showed the physical loss of the company to be surprisingly small. It has now been determined that the actual loss through destruction of property owned by the United Railroads will not exceed $1,500,000, all of which is covered by insurance. As far as earning capacity is concerned, the property is showing remarkable recuperative powers, the receipts, despite abnormal conditions, having increased satisfactorily since the disaster, and it is stated the company's earnings are now considerably more than 50 per cent of the normal earnings before the quake. By the middle of summer the company will have in regular operation a daily average of 400 cars, as compared with an average service of 518 cars before the fire, so that long before fall it is anticipated that the company's operations will be better than 60 per cent of normal and, if the present rate of progress is continued, by the end of the year the company will be earning as much as, or more than, it did before the quake. This condition of affairs offers eloquent testimony to the energy, courage and efforts of the personnel constituting the organization of the United Railroads of San Francisco, and of all those associated with electric railway interests in the city.

The interesting announcement is also made that the Board of Supervisors of San Francisco, on May 14, passed a resolution calling upon the United Railroads to proceed as rapidly as possible in the work of converting its cable roads into trolley lines, so that the great northern section of the city may be served, trade resumed and confidence restored. There is no question that the resolution will be finally passed, and that as one of the beneficial results of the disaster the entire city of San Francisco will be given a thoroughly up-to-date overhead trolley system, and will no longer be required to put up with the disadvantages and limitations of the cable roads or of conduit electric roads.

Through the courtesy of T. E. Mitten, president, and J. A. Spoor, chairman of the board, of the Chicago City Railway Company, Ford, Bacon & Davis have been able to purchase for immediate delivery in San Francisco fifty of the latest type of car that have been under construction for the Chicago City Railway Company at the works of the American Car Company. This car was fully described in the STREET RAILWAY JOURNAL for Sept. 16, 1905. The cars will be shipped direct from the plant of the manufacturers, and will be of the greatest help in enabling the United Railroads of San Francisco to restore its service. Ten of the cars will be equipped with four 75-hp motors, and will be immediately placed on one of the interurban lines out of San Francisco. The action of the Chicago City Railway Company in releasing these cars at considerable inconvenience to itself exhibits a spirit of courtesy and helpfulness that is fully appreciated by the United

Railroad interests. Concerning the general reconstruction of the city, the Council on Building Laws has definitely decided to recommend the following ordinances: "On streets 100 ft. wide or over, the height of buildings facing thereon shall be unlimited; on streets 80 ft. wide or over, the height of buildings shall be limited to 200 ft.; on streets less than 80 ft. wide, the height of buildings may be one and one-half times the width of the street upon which the buildings face."

A NEW AUTOMATIC WRENCH

The Bullard Automatic Wrench Company, of Providence, R. I., has placed on the market an automatic wrench which is a radical departure in wrench construction, being designed on a novel application of scientific principles to overcome all the defects of other wrenches. In the first place this tool does not convert the power applied to the handle into a crushing strain, as all other wrenches do. This is best illustrated by the accompanying Fig. 1, which shows a common type of wrench in operation. The handle H may be considered a lever fulcrumed at A, with its operative end, the jaw J, engaging the pipe P. It must be evident that a downward pressure, applied to the handle H, will be transmitted through the jaw J in the direction indicated by the arrow, directly toward the center of the pipe. This pressure on the pipe, then, is a crushing strain, increased several fold by leverage, over the power applied to the handle. If the pipe and the wrench can stand this strain, the joint will loosen up, but if the joint is a stubborn one, the chances are that the pipe will give first and be crushed. In time the wrench itself will succumb to this abnormal strain and the jaws will be bent out of alignment.

In the new wrench the principle of operation is entirely different. There are three separate levers, compounded, and so arranged that the power applied to the handle is transmitted through the jaws in a tangential direction to the pipe. Hence the power is applied in a wringing manner similar to what would be effected in using manual means. In fact,, the Bullard wrench is modeled exactly on the principle of the

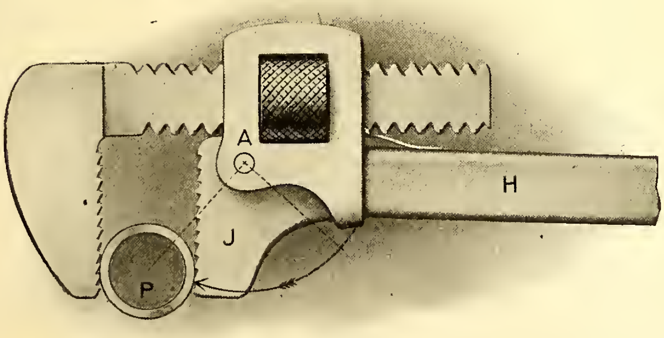


FIG. 1.—COMMON TYPE OF PIPE WRENCH WHICH EXERTS A CRUSHING STRAIN.

human hand. For instance, take any cylindrical object, as a mailing tube, about 1½ ins. in diameter, and grasp it with the right hand thumb down. Hold the tube firmly with the left hand and turn down with the right. This gives a torsional or twisting strain on the tube with no tendency to crush it, as is precisely the effect of this novel wrench. The outer jaw corresponds to the fingers, the inner jaw to the thumb, and the handle to the wrist.

The wrench is constructed to withstand the severest strains. The inner jaw, which takes the brunt of the work, is made of solid bar steel, machined to shape. The removable tooth section in the jaw is made of hardened tool steel.

The spring is merely auxiliary, serving only to keep the jaws together when the wrench is used with the jaw side up. Under ordinary conditions the weight of the jaws tends to keep them closed.

There are no sliding parts and no loose, shackly joints. All

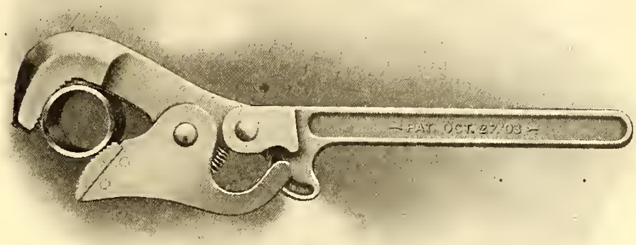


FIG. 2.—SCIENTIFIC WRENCH, DESIGNED TO EXERT WRINGING EFFECT ON PIPE, IMITATING HUMAN HAND GRASP.

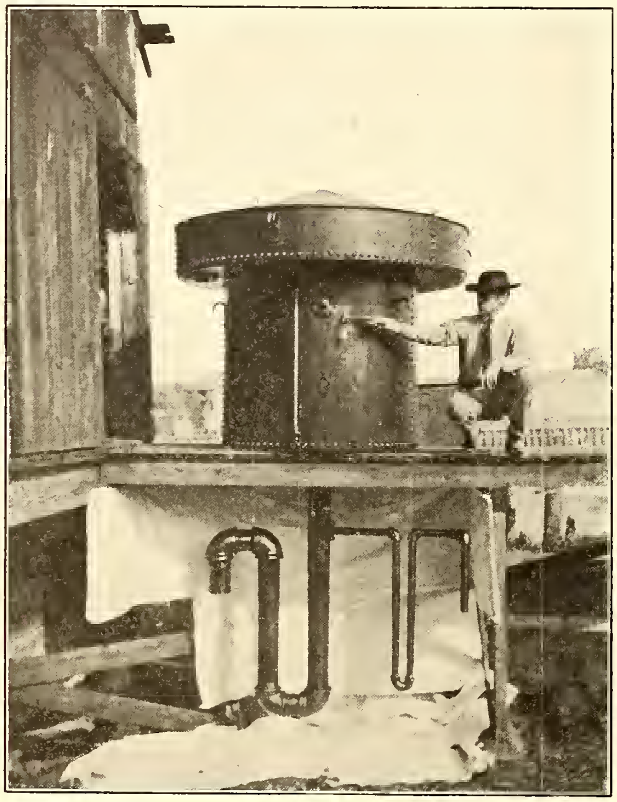
the joints are pivot bearings, and the strain at these points is a shear strain on the rivets. These are made of best grade Bessemer steel, of ample diameter to stand the wear.

A wrench of this type of the same capacity as an ordinary wrench is stated to weigh about half as much, that is, it has twice the strength and efficiency of the ordinary wrench. This is because all the power applied to the handle goes to turn the pipe and not to crush it. There is no wasted power, and no abnormal strain on the parts. It requires but one hand for operation. There are no nuts or screws to adjust, so that no time is lost in changing from one size pipe to another. All that is necesary to attach it, is to bring the outer jaw against the pipe and apply pressure. The jaws will then open automatically to receive the pipe. After the wrench is on the pipe it can be turned both ways, either backward or forward, if desired. It turns backward to get a new grip, in the manner similar to any ratchet wrench. It can be turned forward by applying an upward pressure on the handle to release the jaws. This is a desirable feature, for sometimes it is necessary to move the wrench to a new position on the pipe when there is no room to turn it backward. In all other wrenches, the adjustment must be loosened and the wrench taken off, before it can be turned forward; then the jaws must be tightened up again.

President Sullivan, of the Boston & Northern Street Railway and Old Colony Street Railway, in his reply to the requests of the employees of both of the companies, who, on April 24, asked for an increase in wages and other changed conditions, sets forth in detail clearly the objections. He says: "Careful analysis of said request shows amazing results, and also that you do not fully understand or appreciate the situation. There are three parties to a controversy between the employees of a street railway company and the company, namely, the public, the investor, and the employees. The first is entitled to reasonable accommodations at reasonable cost. The second to a fair return upon the investment, as fully as if such investment were made in a savings bank. The third to just treatment and to as good compensation for service as is paid for similar, or nearly similar conditions. Your request loses sight of all three conditions. If granted by this company it can be granted only by increasing fares from a unit of five (5c.) cents to a unit of six (6c.) cents, or by ceasing to pay dividends."

FEED-WATER MEASURING APPARATUS

The Willcox Engineering Company, of Saginaw, Mich., has developed a new automatic liquid measuring device, an important use for which will be the measurement of feed water at power houses. The apparatus accommodates itself



AUTOMATIC LIQUID-MEASURING APPARATUS

to an irregular supply and delivers in intermittent charges or units of uniform weight. It is designed to operate under a wide range of supply and delivery and adapts itself to extraordinary fluctuations. The device consists of two tanks, placed one above the other. The upper or receiving tank stores the liquid and automatically delivers it at intervals as required to the lower tank, where it is weighed. The lower or weighing tank delivers the unit charge intermittently, the intervals between deliveries varying with the rate of supply.

The engraving, reproduced from a photograph, shows the apparatus for weighing feed water supplied to a battery of six 350-hp Wickes vertical water-tube boilers, generating steam to operate a 1600-kw generator with auxiliaries and pumps. The average flow through the tank is 63,000 lbs. of water per hour, at a temperature ranging near the boiling point, fluctuating between 205 degs. and 210 degs. F.

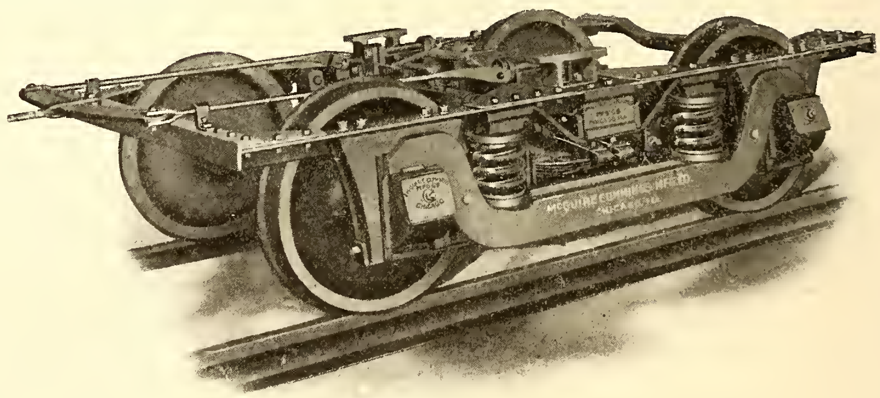
The dimensions of the tank illustrated are as follows: The upper tank is 72 ins. in diameter and 3½ ft. deep. The height from floor to top of cover is 5½ ft. The discharge pipe projects below the floor 5½ ins.

It is stated that numerous trials of this apparatus as a feed-water weigher show a maximum error, after four months' constant service, of less than one-fourth of 1 per cent. A temperature fluctuation of 10 degrees causes no appreciable error in operation. The error that would naturally be introduced by increase of volume incident to increased temperature is small, and even this small error appears in practice to be offset by expansion or contraction of the weighing tank as the temperature rises and falls.

As indicating that change in rate of supply does not affect the efficiency the company cites a test on its apparatus, made at the Mechanical Laboratory, University of Michigan, in April, 1906. In this test the rate of flow of water through the apparatus was varied from 460 lbs. per minute to 653 lbs. The efficiency was found to vary from 99.7 per cent to 100 per cent. The efficiency in this case was obtained by dividing the weight of water actually weighed by the weight of the unit charge. In the case where 100 per cent efficiency was obtained, these two quantities were the same. On another test, run on this same apparatus, the flow was as low as 116 lbs. per minute, at which flow the efficiency was 99.8 per cent. The device will be placed on the market by the Willcox Engineering Company under the name of the Lowrey patent automatic liquid measuring apparatus.

TRUCKS FOR THE HAVANA CENTRAL RAILWAY COMPANY

The McGuire-Cummings Manufacturing Company, of Chicago, has just finished an order for 200 trucks for the Havana Central Railway Company, Havana, Cuba, of the type illustrated in the accompanying cut. This truck was designed by the company for heavy loads especially, and also to meet the requirements of a truck for high-speed interurban service. It is, in fact, built to carry a load of 50,000 lbs., or a total load on two trucks of 100,000 lbs. As may be observed by reference to the reproduction, the truck is constructed along the M. C. B. lines. The top frame is of heavy angle bars, well braced by extra large gusset plates at the corners of the truck and at the transoms. To the side frames are bolted the cast-steel pedestals, a machine fit being secured between the pedestal and the frame. The journal boxes, which are of malleable iron, are fitted with oil-tight covers, and are machined to give a clearance of 1-31 in. on each side of the box between the box and the pedestal. The truck is so designed that when a pair of wheels is to be removed, it is necessary to take off but



HIGH-SPEED, HEAVY SERVICE TRUCK FOR THE HAVANA CENTRAL RAILWAY

two nuts to drop the boxes down out of the pedestals. The bolster, which is of the built-up steel type, is supported by links, provided with rocker bearings resting on top of the transom members. These bearings eliminate to a great extent the wear present on the pins in the usual construction. The truck has a wheel base of 6 ft. 3 ins., and is provided with 33-in Schoen rolled-steel wheels, mounted on 5½-in. axles.

The company has also shipped from its Paris, Ill., shops, 400 cars, of different types of construction, for this road.

SUMMER CARS FOR FORT SMITH, ARK.

The ten-bench open car shown in the photograph is one of six which have recently been put in operation on the lines of the Fort Smith Light & Power Company. The cars were built by the American Car Company, and the order placed through H. M. Byllesby & Company, of Chicago, and the cars are similar to others built for the same railway last year. This makes about forty cars in operation on the lines, which, with a trackage of twenty miles, gives a frequent schedule. Fort Smith is close to the western boundary of the State, on the Arkansas River, and is the second city in size and importance. Six railroads enter the city, which, together with the river, make it an important shipping center. Extensive coal mines are in the neighborhood and fruit growing is one of the principal industries. There are two union stations between which and the business section the cars of the city lines are constantly running, loaded to their full capacity. The lines are well laid out, and embrace the business streets and the principal residence sections. The baseball park makes it necessary to run a number of extra cars, and on holidays the capacity of these cars is taxed to the utmost. Baseball Park and Electric Park are owned and operated by the company.

The cars are of the standard form and are mounted on trucks of the No. 21-E type. The gates at either end are unusually high and of channel construction for extra strength; these are used to enable the motorman to prevent more passengers being carried on the platform than can be seated, as the large crowds carried to the park have at times in the past seriously interfered with operation. The general dimensions are as follows: Length over the end panels, 21 ft. and over the crown pieces, 28 ft. 8⅜ ins.; width over the sills, 6 ft. 3 ins.; and over the seat ends, 7 ft. ½ in.; sweep of the posts, 5 ins.; centers of the posts, 2 ft. 8 ins.; height from the floor to the ceiling, 7 ft. 11¾ ins.; from the track to the underside of the sills, 2 ft. 2⅝ ins., and from the underside of the sills over the trolley board, 9 ft. ½ in. The running boards are 17 ins. from the track, and from the boards to the car floor, 16½ ins. The side sills are 3¾ ins. x 7 ins. thick, with

TEN-BENCH OPEN CAR FOR FORT SMITH

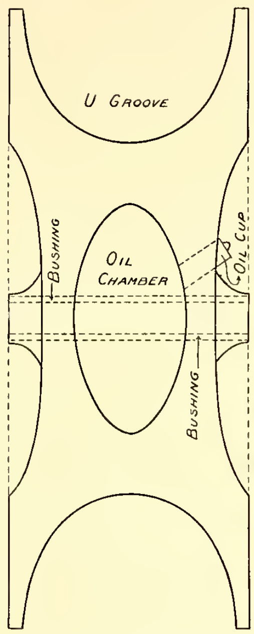
8-in. x ⅝-in. sill plates on the outsides. The truck wheel base is 8 ft.; diameter of the wheels, 33 ins.; diameter of the axles, 4 ins. Two 30-hp motors are used per car. The weight of the car and the truck without motors is 12,300 lbs.

Officers of the Chicago & Milwaukee Electric Railway have incorporated the Chicago & Milwaukee Power Company, to build and own the railway company's power plant, soon to be erected at Waukegan. It is said that by having a power company own the plant electricity may be sold to factories and farmers, or for any other use, along the line.

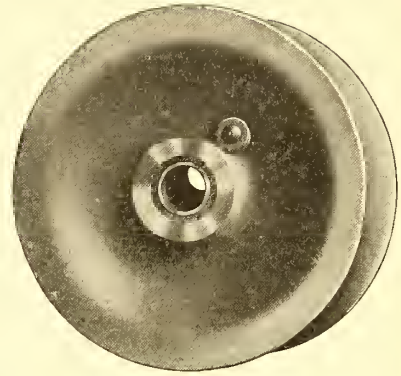
A U-GROOVE TROLLEY WHEEL

The Electrical Specialty Manufacturing Campany, of Allentown, Pa., is making a self-oiling trolley wheel, called the "Peerless," which has a U-shaped groove and is composed of a new alloy combining long life and high electrical conductivity.

This wheel is made with a U-shaped groove or slot, instead of the usual V shape, upon which fact the manufacturer bases the claim that the wheel will remain on the wire in ninety-nine out of every 100 cases where a V-grooved wheel would run out, thus saving time, anoyance and care. The self-oiling feature combines a chamber in the body of the wheel that will contain one-half ounce or more of lubricating oil, which is supplied through an oil-



CROSS SECTION U-GROOVE TROLLEY WHEEL



U-GROOVE TROLLEY WHEEL, SHOWING VALVE TO OIL CUP

cup equipped with a spring valve that closes automatically, and retains the oil. By this method the pinion is constantly lubricated in the proper manner, a constant feed is obtained, and the bushing is thus preserved to a marked extent. A record test of over 9000 miles on one bushing left the latter in prime condition as the result of this lubricating method.

The wheel is composed, as previously noted, of an alloy, from a secret formula. It is carefully machined and is finished in a thorough, mechanical manner. Its weight is 2¾ lbs.

The May number of the "Third Rail," the new magazine, edited and published under the auspices of the Brooklyn Rapid Transit Employees Benefit Association, is out. One of the striking features is a five-page article on "Veterans in Street Car Service," devoted to a mention of many of the very old employees of the Brooklyn Rapid Transit. The real "veteran" is "Pop" Burns, who first began working for the Brooklyn City Railroad in 1861. The first installment of Deputy Police Commissioner Arthur J. O'Keeffe's article on "Old Haunts of Criminals in Brooklyn" is another interesting feature, which will be continued. There are three pages, with illustrations, devoted to the San Francisco earthquake; one of "Reminiscences of the Early Days;" a well written article on "The Cause and Value of the Mardi Gras;" one on "Homes for the Men," and a goodly assortment of miscellany.

FINANCIAL INTELLIGENCE

Wall Street, May 16, 1906.

The Money Market

There has been a decided change for the better in the monetary situation during the past week, rates for all maturities working substantially below those prevailing at the close of last week. The improved conditions resulted largely from the extremely light shipments of money to San Francisco, and in banking circles the opinion prevails that the movement of funds to the Pacific Coast is practically over. The elimination of this important factor from the situation, together with the heavy influx of money from the interior, has materially strengthened the resources of the New York City banks. During the week ending May 11 the local banks gained on the interior movement more than $3,000,000, and it is expected that the movement in this direction will assume larger proportions and will continue for some weeks to come. These favorable developments resulted in some pressure of funds upon the market, which was reflected in a general reduction in interest charges for both call and time loans. Money on call was in plentiful supply at 3½ and 3 per cent. Sixty-day contracts were obtainable at 4¾ per cent, while for all other periods up to six months accommodations could be had at 5 per cent. A feature of the week was the sale and ready absorption of $50,000,000 4½ per cent notes by the Pennsylvania Company, due in November, 1907, and guaranteed by the Pennsylvania Railroad Company. It is understood that the notes were sold at 99¾, less a commission. Subscribers to the loan are required to make payment on May 29, but the bankers having the flotation in charge are of the opinion that no tension in the money market will result from this settlement, as the money received in payment for the notes will immediately be redeposited in the banks, and will be available for market purposes for some time to come. The continued strength in foreign exchanges has prevented further engagements of gold for import. The total engagements of gold from April 12 up to May 5, the date of the last engagement, amounted to about $48,500,000, of which about $32,575,000 has been received. The European money markets have displayed increasing ease, especially at London and Paris, and there was some talk at the close of a reduction in the Bank of England discount rate in the near future. The bank statement, published on last Saturday, made a very satisfactory exhibit. Loans decreased $16,460,400, due in part to the liquidation in stocks in the preceding week. The increase in cash was $3,815,800, or considerably smaller than expected, but as the reserve required was $3,179,275 less than in the previous week, the surplus reserve was increased by $6,995,075. The surplus now stands at $12,894,600, as compared with $16,712,575 in the corresponding week of last year, $12,827,250 in 1904, $8,990,625 in 1903, $8,346,525 in 1902, $12,299,925 in 1901, and $15,332,725 in 1900.

The Stock Market

Dealings in the local securities market was upon a fairly large scale during the past week, and although they were accompanied by more or less irregularity, the general trend of values was toward a higher level. During the early part of the week there was a continuance of the heavy buying by the strong interests which characterized the trading in the preceding week, and this resulted in a further sharp rise in prices practically throughout the entire list. Later on, however, there was a considerable falling off in the buying from this source, an opportunity which the speculative element was not slow to take advantage of. During the last half of the week the market was subjected to rather heavy profit taking, and although prices yielded rather sharply under this selling the undertone held decidedly strong, with final prices well above those prevailing at the close of last week. The noteworthy features of the week were the Hill stocks, the upward movement of which influenced the entire market. Union Pacific was also conspicuously strong. Later on Reading was taken in hand and made the feature, and the other coal stocks were advanced sharply. At the close the market is in a much stronger position. Sentiment was more cheerful, and in some quarters an active and higher market is looked for during the summer months. This belief is based upon the expectation that money will rule relatively cheap until the beginning of the outflow of funds for crop-moving purposes. In fact, there is nothing in the general situation that does not favor higher prices for stocks. Domestic conditions are all that could be desired. The great activity in the iron and steel industry continues. Copper metal is selling at the highest prices in years, and crop conditions are unusually good. In addition to these the foreign trade of the country is larger than ever before. According to the figures made public by the Department of Commerce, the increase in the foreign trade for the ten months ending April 30, amounts to $300,000,000, as compared with the corresponding period of last year, and an increase of $400,000,000 compared with the same months in 1904.

The local traction stocks have been decidedly strong, influenced largely by the favorable reports of the different properties. There was aggressive buying of Interborough-Metropolitan issues which advanced prices sharply, while in Brooklyn Rapid Transit the buying was based upon the largely increased earnings of the company.

Philadelphia

Extreme dullness prevailed in the local traction issues during the past week. Dealings included a much smaller number of stocks than in the preceding week, and while prices displayed some heaviness the net changes were for the most part confined to the fractions. A noteworthy strong feature of the trading was the sharp advance in Consolidated Traction of New Jersey, which moved up 2⅛ points to 81⅛ on investment buying. About 500 shares were dealt in. Philadelphia Rapid Transit sustained a loss of ½ point, about 2500 shares changing hands at from 27 to 26½. Philadelphia Company's stocks were unusually quiet, several hundred shares of the free common selling at from 50⅞ to 50⅜, a loss of ⅝, while 1500 unstamped receipts changed hands at 33⅞ and 34. The preferred stock sold at 49 and 49¼. Philadelphia Traction ruled fractionally higher, transactions taking place at 99 and 98¾. Union Traction was quiet but firm, several hundred shares selling at 63⅛ and 63. United Companies of New Jersey brought 263½ and 262, and odd lots of American Railways brought 51¾ and 51½.

Chicago

Trading in the Chicago market has been somewhat more active, but prices have displayed some irregularity. The shares of the surface lines ruled generally lower. North Chicago opened at 31, and rose to 33, but later fell back to 32, a loss of 3 points. West Chicago sold from 26 to 28, a loss of a point. Other sales included Metropolitan Elevated at 27½, the preferred at from 66¼ to 68½; South Side at 90, Chicago & Oak Park at 6½, and the preferred 22½ and 24. Northwest Elevated brought 5¾, Union Traction sold at 5¾.

Other Traction Securities

Greater activity accompanied by further sharp advances in United Railway issues constituted the chief feature of the week's dealings in traction issues at Baltimore. About 3500 shares of the free stock sold at 16¼ and 16, while upwards of 2700 of the pledged stock brought prices ranging from 16¼ to 16¾, the final transaction taking place at 16⅜. The 4 per cent bonds moved up a fraction to 92⅛ early in the week, but later went back to 92, upwards of $75,000 changing hands. The free incomes rose from 68½ to 72, on transactions aggregating about $100,000, while the certificates representing bonds deposited sold at from 69¾ to 71, a net gain for the week of 2½ points. The advance in these issues was attributed in part to the expectation of an early announcement of the company plans for improvements. Other transactions included $18,000 Norfolk Railway & Light 5s at 99½.

The Boston market was dull and irregular. Massachusetts Electric common was exceptionally strong, the price advancing about 2 points to 19⅝, on the purchase of about 800 shares. The preferred displayed considerable strength in the early part of the week by advancing from 64½ to 68, but toward the close there was a reaction to 65½. Boston Elevated sold from 154½ to 153⅛ and back to 154. Boston & Worcester common sold at 36, and the preferred brought 88. Other sales include West End common at 99 and 98, the preferred at 114 and 113, and $1,000 4 per cent bonds at 100½. In the New York curb market trading was practically at a standstill. Interborough Rapid Transit receipts sold as high as 232, about 1000 shares changing hands on the advance. Jersey City, Hoboken & Paterson 4s sold at 73 and interest for $5,000.

Tractions had a boom in Cleveland last week and nearly every issue showed an advance. The feature of the week was the activity of Northern Ohio Traction & Light, which sold to the extent of about 1200 shares. The demand was due to the announcement that the stock would be placed on a dividend-paying basis in the near future. It opened the week at 28¾, advancing to 32. The early part of this week it had another advance to 33⅛. The 5 per cent bonds of this company advanced to 89, while the 4s sold at 72¾. Cleveland Electric moved up from 78 to 79½. Cleveland & Southwestern Traction common advanced from 14½ to 16⅛. Aurora, Elgin & Chicago new securities came in for considerable activity. The common moved up from 31⅜ to 35¼, and the preferred advanced from 79½ to 81.

At Cincinnati the common stock of the Cincinnati, Newport & Covington had a phenomenal advance. It opened the week at 66, and sold as high as 73. Later it sagged and closed at 71¾. The advance was due to persistent rumors of negotiations by Eastern interests. Positive statements by President Ernst that no negotiations were on were disregarded. The preferred made only a slight advance to 97¾. Sales of the common aggregated about 3100 shares. Cincinnati Street Railway had a fractional advance to 144¾, Toledo Railways & Light had a fractional decline to 31½. Cincinnati, Dayton & Toledo was active to the extent of about 900 shares at 27; stationary with previous sales. The 5s of this company sold to the extent of $30,000 worth at 92⅞ to 93¼.

Security Quotations

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

	May 9	May 16
American Railways	51½	51½
Boston Elevated	153	154
Brooklyn Rapid Transit	82⅝	83¾
Chicago City	150	150
Chicago Union Traction (common)	6⅛	4
Chicago Union Traction (preferred)	21½	12⅝
Cleveland Electric	78	78
Consolidated Traction of New Jersey	79	80
Detroit United	94	95
Interborough Rapid Transit receipts	223	231
Interborough-Metropolitan Co. (common), W. I.	52	53¾
Interborough-Metropolitan Co. (preferred), W. I.	85¼	86¼
Interborough-Metropolitan Co. 4½s, W. I.	87¾	—
International Traction (common)	36½	38¼
International Traction (preferred), 4s	71	72
Manhattan Railway	152½	153
Massachusetts Elec. Cos. (common)	17¾	18
Massachusetts Elec. Cos. (preferred)	65	64
Metropolitan Elevated, Chicago (common)	26½	27½
Metropolitan Elevated, Chicago (preferred)	64½	68
Metropolitan Street	113	115
Metropolitan Securities	70¼	74¾
New Orleans Railways (common)	31	32
New Orleans Railways (preferred)	—	80
New Orleans Railways, 4½s	86	86
North American	96⅞	96¼
North Jersey Street Railway	27	27
Philadelphia Company (common)	50¾	50¾
Philadelphia Rapid Transit	26¾	26½
Philadelphia Traction	98½	99
Public Service Corporation 5 per cent notes	94	94
Public Service Corporation certificates	68	70
South Side Elevated (Chicago)	89	91
Third Avenue	127	130
Twin City, Minneapolis (common)	113½	117
Union Traction (Philadelphia)	62¾	62¾
West End (common)	98½	98
West End (preferred)	114½	113½

W. I., when issued.

Metals

The "Iron Age" says the most striking news of the week is that coming from Chicago, relating to steel rails for 1907. It is stated that the total new tonnage for 1907 thus far booked foots up to 562,000 tons. A very fair amount of business was also placed with the rail mills for delivery during the current year. There has been some fair buying of foundry iron. Steel-making irons are practically swept clean up to the middle of the year. Steel billets are somewhat easier in the Central West, and $26 is now being done. The enormous advance in pig tin, now selling at close to 50 cents a pound, is a serious calamity in the tin plate industry, since it must cause an advance in prices and may restrict consumption. Copper metals ruled very strong at an advance of 2¼c. a pound. Lake is quoted at 18¾ and 18⅞c., electrolytic 18⅜ and 18⅝c., castings 18¼ and 18⅜c.

GRANITE CITY PROPERTIES TRANSFERRED

The control of the Alton, Granite & St. Louis Traction Company, the Alton Gas & Electric Company, the Granite City Railway lines and allied corporations in Granite City passed under the management of the East St. Louis & Suburban, with L. C. Haynes, of East St. Louis, as general manager last week. Mr. Haynes has been elected president of the Alton, Granite & St. Louis Traction Company to succeed J. F. Porter, and F. E. Allen, of St. Louis, has been elected head of the Alton Gas & Electric Company, to succeed Mr. Porter, who resigned from the companies. It is said that while a new $14,000,000 corporation will hold the stock of the various corporations in the East Side railway, electric lighting and gas system merger, the names of the operating companies will be retained. It is announced that the Alton Gas plant will be materially extended. The change in the management of the interurban lines between East St. Louis and Alton and Mitchel and Edwardsville will mark the beginning of control of the entire East Side electric system by the Clark syndicate, of Philadelphia. R. W. Bailey, of East St. Louis, will succeed J. F. Porter at Alton in direct charge of the Alton, Granite & St. Louis Interurban Railway and the Alton street railway, electric lighting and gas plants.

FINANCING THE BALTIMORE TERMINAL COMPANY

A financing plan for the Baltimore Terminal Company, which the Bishop-Sherwin syndicate, of Cleveland, has organized for the purpose of providing terminals for the Washington, Baltimore & Annapolis Railroad, has been announced. The company will have a capital stock of $1,500,000 and a bond issue of the same amount. One-half of the stock will go into the treasury of the United Railways & Electric Company, of Baltimore, which owns the city lines in that city, while the other half will go into the treasury of the Washington, Baltimore & Annapolis Railway Company. The Bishop-Sherwin syndicate will build the road and the bonds to pay for it will be taken care of by the United Railways & Electric Company. Franchises and everything necessary for the terminal line and station have been secured.

NEW YORK CITY RAILWAY—REPORTS FOR QUARTER AND NINE MONTHS

The income account of the New York City Railway System. in which are embraced all the surface lines in Manhattan and the Bronx, for the quarter and nine months ended March 31, 1906, compares as follows:

Three months (Jan. 1 to March 31)—

	1906	1905
Gross receipts	$3,960,771	$3,639,467
Operating expenses	2,398,458	2,467,374
Net earnings	$1,562,313	$1,172,093
Other income	301,044	282,571
Total income	$1,863,357	$1,454,664
Charges	2,789,724	2,777,070
Deficit	$926,367	$1,322,406

Nine months (July 1 to March 31)—

Gross receipts	$12,924,256	$13,490,268
Operating expenses	7,162,178	7,610,899
Net earnings	$5,762,078	$5,879,369
Other income	954,416	900,080
Total income	$6,716,494	$6,779,449
Charges	8,404,774	8,703,876
Deficit	$1,688,280	$1,924,427

AFFAIRS IN CHICAGO—NO REHEARING IN 99-YEAR CASE

The order to equip with the overhead trolley the Blue Island Avenue line, Chicago, has been referred to the committee on local transportation. This action was taken after a report had been submitted of the condition of the Blue Island Avenue viaduct, the dangerous condition of which was responsible for the action of the Council recently, when it passed an order to electrify the line. Mayor Dunne opposes equipping the line with electricity, and with regard to this said in his message to the Council:

"I appreciate and fully sympathize with the desire of the citizens residing in that part of the city for safe and speedy transit. In view of the fact that we can confidently expect an early decision on the petition for rehearing now pending in the Supreme Court of the United States, and in view of the fact that both Walter L. Fisher and Major Tolman agree that permission to trolleyize on any ninety-nine-year line would be prejudicial to the city's interests, I am of the opinion that we can safely defer action on trolleyization of the Blue Island Avenue line until the petition for rehearing has been disposed of by the Supreme Court of the United States."

The officials of the railway companies say that the proposed terms for bringing about immediate improved service as set forth in Mayor Dunne's recent letter to Chairman Werno, of the local transportation committee, are indefinite. The position of the companies is that the terms offered them depend entirely on the meaning of the words "a fair return on their investment." All in excess is to go to the city. If this means 4 per cent or 5 per cent, they do not see why they should put $50,000,000 or $60,000,000 into the properties simply to draw on it the interest they would have to pay for the money borrowed to do the work with. They could do better by investing their money in bonds and take little risk and incur no trouble. When "a fair return" is explained to them they will be in a position to state their position.

It has been rumored that a new franchise ordinance for a twenty-year franchise will be sought by the traction companies. The union of the companies, in a proposition to the city, depends, it is said, on the result of negotiations for peace between the Union Traction Company and the corporations underlying it. The petition of the underlying companies to annul the leases whereby they agreed to let the Union Traction Company operate their lines for 999 years will be heard, it was announced yesterday, May 17, by Judges Grosscup, Anderson and Humphrey.

The United States Supreme Court has denied the petition of the Chicago street railway companies for a rehearing of the "ninety-nine-year act."

Traction affairs in Chicago have been practically at a standstill since the decision of the "ninety-nine-year case" in favor of the city, but the denial of a rehearing opens up the way for the immediate improvement of service on the several lines. As soon as Mayor Dunne was informed of the action of the Supreme Court, he immediately made arrangements with W. W. Gurley, counsel for the Union Traction Company, for a conference to take up the question of the equipment with electricity of the North and West Side cable lines. When these are equipped with electricity the tunnels under the river can be lowered, as has been ordered by the government. Heretofore the Mayor has refused to permit these to be electrified for fear that such action would impair the city's claims in the ninety-nine-year" case. The Mayor instructed Walter L. Fisher, his adviser in traction affairs, to notify Mr. Gurley that the city was ready to take up the plans of rehabilitating the lines. No time will be lost, the Mayor declared, in improving the service.

"I can see no further obstacles in the way toward rehabilitation of the street railway service," he said. "Improvements must be planned at once. There must be modernization and rehabilitation with municipalization throughout. If the underground trolley is feasible downtown, all well and good, but that is an engineering problem.

"It will be necessary now," he continued, "to have a traction expert, and he will be appointed as soon as I can find the proper man for the position."

Traction officials in general refused to discuss the subject of the refusal to grant a rehearing. President Mitten, of the Chicago City Railway, as well as W. W. Gurley, counsel for the Union Traction Company was reticent. Mr. Curley did say, however, that he saw no reason for delay in the electrification of his company's lines. He said it would take about three months to convert the available cars of the company into trolley cars.

AN INCLINE AND NEW LINE IN BROOKLYN

With the end in view of relieving traffic on its line to Carnarsie, on Jamaica Bay, between Coney Island and Rockaway Beach, of increasing the popularity of the resort with the class of people to whom it appeals and further adding to the stability of the real estate investments in the districts affected, the Brooklyn Rapid Transit Company now has under construction an incline from its elevated structure, on Pitkin Avenue, known as the Fulton Street line, to the surface, and so to the beach. The elevated portion of the new line extends from the turn of the present King County L, at Pitkin and Snediker Avenues, diagonally across private property into Van Sinderen Avenue—formerly Vesta Avenue. Through Van Sinderen the new elevated extends almost directly south to New Lots Road. It closely parallels the tracks of the Long Island Railroad leading from East New York to Manhattan Beach and Bay Ridge, throughout this entire distance. Station stops on the elevated structures have been planned at Sutter Avenue, Livonia Avenue and New Lots Road. The station stops through the ancient village of Carnarsie have not, as yet, been definitely determined. At the water's edge an attractive terminal will be erected, and the trains will there make a direct connection with fast boats for Rockaway.

So rapid has been progress on the new road that the company promises through service by June 15. Trains will run direct for the present from the Broadway ferries in Williamsburg, through Broadway to Manhattan Junction, and thence through Snediker Avenue to the new elevated structure and to Canarsie. When a terminal has been completed at Delancey Street, Manhattan, for the elevated train service over the Williamsburg Bridge, the Canarsie trains will run through from that point. Platforms and switch points on the new line are being designed for eight-car trains, and it is expected that trains of this length will be run as soon as it is possible to get them into Manhattan.

THE MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The regular meeting of the Central Electric Railway Association will be held at the Algonquin Hotel, Dayton, Ohio, on Thursday, May 24. As this will be the last meeting of the association until September, a full attendance is earnestly requested. The nature of the subjects for discussion and the opening of the meeting for general experience should appeal to every member.

On account of its accessibility from all points, Dayton was selected as the meeting place for this month, and it was decided to have as many of the members as possible attend the meeting in their own cars, thus giving the general public a demonstration of the possibilities for long-distance travel on electric lines. Secretary Merrill has communicated with officials at Columbus, Indianapolis, Ft. Wayne, Toledo, Detroit and Cleveland, asking them to bring parties in special cars from these points.

H. P. Clegg, president of the Dayton & Troy system of electric railways, will have the entire arrangement of the special cars. By communicating with him all arrangements will be made for cars. Everybody interested in electric railway work is cordially invited to attend. The programme is as follows:

10:30 a. m.—Business meeting.

11:00 a. m.—"Y. M. C. A. Work," by E. L. Hamilton, secretary, Chicago, Ill.

11:30 a. m.—"Best Methods for Stimulating Summer Riding," by J. W. Brown, superintendent transportation West Pennsylvania Railways Company.

2.00 p. m.—"Fire Insurance at Cost," by Henry N. Staats, manager Mutual Insurance Company, of Cleveland, Ohio.

2:30 p. m.—"Axles for Interurban Cars." Discussion opened by Mr. Replogle, expert for the Cambria Steel Company.

3:30 p. m.—Open discussion by all interested parties present on the following subjects:

1.—"Lost Articles—Disposition of the Same—Found on Cars and in Waiting Rooms."

2.—"Sealing Loaded Milk Cans."

3.—"What is the Proper Method of Inspection for Low Armature Bearings?"

4.—"What Style of Trolley Car do you Recommend? What are Points of Advantage of the Clinch, Semi-clinch or Soldered?"

5.—"What is the Best Method of Handling Employees' Transportation?"

6.—"What is the Best Method of Computing Car Mileage and Car Hours in Detail?"

THE ELECTRIC PROPERTIES COMPANY

The Electric Properties Company, incorporated May 10 under the laws of the State of New York with a capital of $6,000,000 preferred and $6,000,000 common stock, has been organized to acquire, finance and develop properties in which electricity plays the principal part, such as power, electric traction and electric lighting enterprises, and to invest and deal in and to guarantee the securities of corporations operating such properties. It will also conduct through Westinghouse, Church, Kerr & Company (all of whose capital stock is owned by the new company) a general engineering and constructing business.

The purposes of the company, as mentioned above, will be mainly financial. It is not intended to make any changes in the organization or personnel of Westinghouse, Church, Kerr & Company, whose operations have been highly successful, and they will continue to be conducted under the efficient administration of Walter C. Kerr, president.

While the Electric Properties Company will avail itself of the engineering and construction organization of Westinghouse, Church, Kerr & Company, it will also use other engineering organizations or independent consulting engineers as circumstances may require. One of the objects of the new company will be to co-operate with vested interests, such as railways and other public service companies, in the development of properties for their account, and either temporarily or permanently assist in financing such properties.

John F. Wallace, formerly chief engineer of the Panama Canal, has been selected as president of the new corporation, and two vice-presidents will be elected at the first meeting of the board of directors. The following gentlemen constitute the directorate, all of whom will be actively interested in the conduct of the business of the company: Charles H. Allen, vice-president, Morton Trust Company, of New York; Paul D. Cravath, Cravath, Henderson & De Gersdorff, of New York; H. D. Giddings, of New York; N. W. Halsey, N. W. Halsey & Company, of New York; George C. Smith, vice-president, Security Investment Company, of Pittsburg; John A. Spoor, president, Union Stock Yard & Transit Company and president, Chicago Junction Railway Company, of Chicago; Moses Taylor, Kean, Van Cortlandt & Company, of New York; E. G. Tillotson, president, Cleveland Trust Company, of Cleveland; F. D. Underwood, president, Erie Railroad, of New York; R. B. Van Cortlandt, Kean, Van Cortlandt & Company, of New York; John F. Wallace, president, Electric Properties Company, of New York; George Westinghouse, president, Westinghouse Electric & Manufacturing Company, of Pittsburg. The headquarters of the company will be at 111 Broadway, New York.

SUMMER SCHEDULES ON B. R. T.

The Brooklyn Rapid Transit Company's summer schedule on all lines was put into effect Saturday, May 12. Perhaps the largest improvement in the passenger express service to Coney Island, Sea Beach, Manhattan Beach and the other well-known recreation places will be brought about by the addition of 100 open elevated cars to the present summer equipment. These cars have a seating capacity of sixty-two passengers with the seats arranged crosswise on either side of the center aisle.

The surface service has also been largely augmented by the addition of 250 of the new surface cars, previously described in the Street Railway Journal, which have a seating capacity of forty-eight passengers each. These additions to the rolling stock of both the elevated and surface trolley lines constitute an increase of from 20 per cent to 25 per cent in the company's summer equipment of cars.

On the Sea Beach line, new and improved switching facilities are being installed. An improvement is being made in the terminal of the line which runs to Sheepshead Bay. Formerly this line came to an end at some little distance from the entrance to the race track, and by reason of this passengers were compelled to walk through the woods and across the Long Island Railroad tracks before they came to the race course. Arrangements have now been made whereby the company can make use of these same railroad tracks, which previously were an obstruction to its passengers, as a direct extension of its own line of rails, so that it will be possible for them to run their trains clear through to the very entrance to the course.

IMPORTANT MASSACHUSETTS BILL TO BE RECOMMENDED FOR PASSAGE

The bill which provides that electric railroads in Massachusetts may be constructed when in the discretion of the Railroad Commissioners public convenience and necessity require them, and that such lines shall have all the duties, rights and privileges of railroad corporations, including the right to take by eminent domain, which is now in the hands of the joint committee on railroads and street railways of the State Legislature, is likely to be reported favorably this week. This bill is the outgrowth of petitions for charters to build electric lines with the right of eminent domain, made to the Legislature a year ago by parties said to represent Stone & Webster interests, who have a line running to the Blue Hill district; the Kidder, Peabody-Boston Elevated interests, and the Shaw interest, owning the Boston & Worcester Electric Companies.

At present electric lines can take private property only to avoid some difficulty of construction or operation, such as a heavy grade or sharp curve, but under the proposed bill they can cut through fields and woods, and put in operation high-speed electric trains, carrying freight and baggage, stopping at stated points only, to which passengers and freight from outlying districts would be carried by the ordinary trolley feeders.

BOSTON TUNNEL BIDS OPENED

Bids were opened by the Boston Transit Commission May 8 for the work of constructing the ninth section of the Washington Street tunnel, running from Hanover Street to Haymarket Square. There is a big difference between the two smallest bids, but among the figures presented by contractors who have built parts of the Boston tunnel and subway system the figuring is close. Following are the contractors who figured on the new sections, and the amounts for which they offer to do the work:

Cranford Company	$253,865
Bruno, Salomone & Pettiti	268,650
Degnon Contracting Company	277,810
Jones & Meehan	258,000
Charles R. Gow Company	234,950
Patrick McGovern	236,150
Metropolitan Contracting Company	249,975
Coleman Brothers	236,360
W. H. Keyes & Company	265,050
Hugh Nawn Contracting Company	237,900
J. J. Coughlan Constructing Company	198,275
Fred S. & A. D. Gore Corporation	253,040
Seeley-Taylor Company	270,550

The Commission has taken the bids under consideration, and has not announced its award.

ANOTHER SYSTEM GOES TO SCHOEPF SYNDICATE

It is stated that the Schoepf syndicate has practically completed negotiations for adding two more important lines to its already extensive system in Ohio and Indiana. The properties are the Dayton & Northern Traction Company, extending from Dayton to Greenville, Ohio, and the Dayton & Muncie Traction Company, extending from Greenville to Muncie, Ind. These roads were built by the late Dr. J. E. Lowes, and were largely controlled by his estate. The system embraces about 90 miles of high-speed road, the Dayton & Northern being capitalized at $650,000 and the Dayton & Muncie at $800,000. The negotiations are being conducted by W. Kesley Schoepf and Randall Morgan, of Philadelphia. It is expected this deal will be closed in a few days, in which event it will give the Schoepf syndicate the first physical connection between its lines in Indiana and Ohio, and it will render possible through travel from Eastern Ohio to the western part of Indiana over the lines controlled wholly by this syndicate. It is also understood that the syndicate is again negotiating for the purchase of the Dayton & Western Traction Company, which is owned by Valentine Winters, of Dayton, and which the syndicate has heretofore been unable to acquire, owing to the high price asked for it. The line extends from Dayton to Richmond, Ind., and is in the direct route from Dayton to Indianapolis. The syndicate owns the Indianapolis & Eastern, which connects with the Dayton & Western.

LOS ANGELES-PACIFIC IMPROVEMENTS

Enlargement of the Vineyard power station of the Los Angeles-Pacific Railway has begun, with a view not only to installing sufficient machinery to double the capacity of the plant, but to be followed immediately thereafter by a building that will quadruple the present total power, and will cost, when completed, nearly $1,000,000. The doubling of capacity will be finished in time for the summer season, and the installation of two other units will be complete within a year, and will cost at least $700,000, according to statements by E. P. Clark recently. Other work now being done, or in contemplation, is the completion of the new branches started last year, preparation for extensions, work at Santa Monica and improving the terminals at all points. The Hill Street tunnel proposition is not the least of the projects on the list of improvements and general work, for which the company recently sold $12,000,000 worth of bonds.

FIRST NATIONAL CONVENTION OF INTERURBAN TRAINMEN

The Order of Interurban Trainmen held its first national convention at Lorain, Ohio, last week. The association was formed about two years ago by employees of the Lake Shore Electric Railway, and it now has membership representing trainmen on roads in Ohio, Indiana and Illinois. The organization is patterned after the Order of Locomotive Engineers, and its members aim to co-operate with operating officials. One of the important features of the convention was the establishment of a beneficial and insurance department. W. P. Rutledge, of Lorain, was elected grand master, and C. L. Root, of Rocky River, secretary and treasurer.

A. I. E. E. ELECTION

At the annual business meeting of the American Institute of Electrical Engineers, held in New York May 15, the following officers were elected: President, Dr. Samuel Sheldon, of Brooklyn; vice-presidents, A. H. Armstrong, Schenectady; H. H. Humphrey, St. Louis, and Frank G. Baum, San Francisco; managers, Paul Spencer, Philadelphia; Paul M. Lincoln, Pittsburg; John J. Carty, New York, and A. M. Stone, Atlanta; treasurer, George A. Hamilton; secretary, Ralph W. Pope. The total vote polled and counted was 2183.

IMPORTANT FRANCHISE DECISION AFFECTING BROOKLYN COMPANY

A decision has been handed down by the Court of Appeals which deals with an application on the part of the Brooklyn Rapid Transit Company to lay tracks on Saratoga Avenue, between Broadway and Fulton Street, on which it was claimed the company had a franchise. In 1893, the Board of Aldermen granted franchises to the company for a large number of streets in Brooklyn. During the last administration application was made to the then Commissioner of Public Works Breckenridge for a permit to lay tracks on Saratoga Avenue, under the franchise granted in 1893. The permit was refused. The court decision upholds this refusal.

TRANSIT APPROPRIATION IN NEW YORK

The Board of Estimate, of New York, on Friday, May 11, approved the request of J. W. Stevenson, the bridge commissioner, for an additional appropriation of $1,250,000 for the construction of the subway terminal connections with the Williamsburg Bridge in Manhattan, elevated connections in Brooklyn and the alterations of the approaches at the Manhattan end of the bridge. Mr. Stevenson said that this appropriation, together with the $750,000 previously allowed, provided for the completion of the approaches and connections at both ends of the bridge. The present work at the Manhattan end, he said, would provide much improved facilities for increased trolley service over the bridge during the summer.

CONTRACT FOR BUILDING SECOND SECTION OF PHILADELPHIA SUBWAY

The Millard Constructing Company, on Tuesday, May 15, was awarded the contract for building the eastern section of the Market Street subway in Philadelphia. The contract also includes the laying of two immense sewers, one on each side of Market Street, between the City Hall and Front Street, where connection will be made with an outlet now under construction. The award was announced by President Parsons, of the Rapid Transit Company. He said that the contract provides for the completion of the subway section within two years. The contracting firm has already filed a bond of $800,000 for the faithful performance of the contract, while the traction company has offered a bonus of $175,000 if the work is completed within eighteen months.

The work of building the loop around City Hall is being pushed vigorously. The contractors have begun work on the north side of the building, and within a few weeks the section on the south side of the building will be under roof, and the eastbound tracks of the Market Street line will be transferred to that side of City Hall. It is hoped to have the subway loop around the city building in operation by September next, when the Market Street elevated road will be placed in operation.

EARNINGS OF THE PHILADELPHIA COMPANY FOR THE YEAR ENDED MARCH 31

The net earnings of the Philadelphia Company for the year ended March 31, show $2,720,012 for the year, an increase of $161,819, or approximately 6.3 per cent over the previous year. During the fiscal year the company appropriated for betterments and improvements the sum of $993,143. Adding to the indicated surplus after charges of $2,348,137 this $993,143 for improvements and betterments, the earning power of the property is shown to be $3,341,280, sufficient to pay the preferred dividend of $294,679 and the common dividend of $1,800,000, and leave a surplus of $1,246,601. However, the surplus actually shown over the dividends was $253,458, due to the fact, as pointed out above, that $993,143 was appropriated out of income for extraordinary betterments.

The Pittsburg Railways Company, which is a subsidiary of the Philadelphia Company, increased its gross earnings in the last fiscal year by approximately $1,000,000 and net by about $570,000. Notwithstanding this considerable increase in net the Philadelphia Company in its report appears to show no increase in dividends from this source. For the year ended March 31, 1906, dividends on stocks owned amounted to $1,518,689, an increase of only $34,408 over the preceding year, and this increase does not appear to have been derived from the railroad earnings. In other words, the increased surplus earnings of the subsidiary for the year were not disbursed in the form of dividends.

Among the changes in the directorate which took place at the annual meeting was the substitution of R. Y. Cook, of the Guarantee Trust of Philadelphia, for Mr. Earle, who has become a member of the directorate of the United Railway Investment Company of San Francisco. Otherwise the old board was re-elected with the addition of B. S. Guiness, who represents the new interests in the company.

The combined income of the Consolidated Gas Company, of Pittsburg, the Allegheny County Light Company, Equitable Gas Company, Braddock Gas & Light Company, and Pittsburg Railways Company for the year ended March 31, 1906, compares as follows:

	1906	1905
Gross receipts	$11,970,542	$10,969,575
Expenses and taxes	6,874,470	6,448,120
Net earnings	$5,096,072	$4,521,455
Other income	157,024	168,192
Total income	$5,253,096	$4,689,647
Deductions	2,558,184	2,376,224
Balance	$2,694,912	$2,313,423
Fixed charges	2,086,103	1,992,800
Balance	$608,808	$320,623
Dividend on preferred stock	114,591	137,925
Surplus	$494,217	$182,698

THE ABNER DOBLE COMPANY'S PLANS

During the recent San Francisco fire, the Abner Doble Company suffered the loss by fire of its offices and shops, but is already resuming business on a larger scale than ever before. Temporary offices have been opened at 2611 Broadway, San Francisco, where the business of the company is being conducted for the present. There also is a branch office in Oakland, at 668 Broadway. The company is building large, new permanent shops and warehouses at Seventh and South Streets, in the Potrero district, where it will have the most completely equipped works on the Pacific Coast. Part of the company's manufacturing establishment is already running full force, and within a very few weeks the entire plant will be in complete operation. Unfortunately, the company lost in the fire some of its correspondence and drawings. In order to check up the files and make the records complete, the company is anxious to have clients send as soon as possible copies of all recent correspondence that refers to work which has not been closed up, and would also like to have copies of all drawings and blue prints sent to clients and sent by clients to the company before the fire. The company's organization is intact, and it is now ready to take orders and carry on the business as before. Every effort to help the company to complete its files will assist it materially and will be very greatly appreciated.

LARGE BRAKE ORDER

The Westinghouse Traction Brake Company recently closed a large contract with the Boston Elevated Railway for air brake equipment for forty-five elevated cars and fifty surface cars. The brake specified for these cars comprises the latest improvements in automatic air. The elevated cars are to be equipped with the Westinghouse "AMT" electropneumatic system, the electric equipment of which provides for the highest refinement in application and graduation of the release of the brakes, and at the same time secures absolutely instantaneous and uniform results on each vehicle in the train, no matter what the length of the train might be. The pneumatic side of the equipment is left intact, is complete and in reserve at all times for immediate use. The suitability of this system to the conditions prevailing on the Boston Elevated Railway has been practically demonstrated during a period of nearly two years.

The type of equipment decided on for the fifty surface cars is what is known as the Westinghouse "AMT" pneumatic, which is similar in all respects to the equipment adopted for the elevated cars, with the exception that the electric attachments are omitted. In this case, however, the trains will not consist of more than two cars, and consequently there is not the necessity for that refinement in operation that the electric features provide. Many of the important improvements to the Westinghouse automatic brake are contained in the "AMT" all-pneumatic equipment, such as graduated release, quick recharge of auxiliary reservoir, single train line, adding the flexibility of the straight air brake without the least disturbance of the thoroughly tested and highly satisfactory features of the Westinghouse automatic air brake.

ORDER FOR GENERAL ELECTRIC SINGLE-PHASE APPARATUS

The Anderson Traction Company, of Anderson, S. C., will soon operate a 10-mile suburban extension by the General Electric Company's alternating-current single-phase system, in connection with the present local direct-current trolley road. This is the second contract which has been received by the General Electric Company from this territory for single-phase railway apparatus within the past two months. For the present the new road will run between Anderson and Belton, but will eventually be extended to Greenville, a total distance of 35 miles.

The cars for the extension will be equipped so as to operate on either the present direct current city lines or on the new single-phase extension. For this purpose each is furnished with four 75-hp single-phase motors, adapted for operation on both alternating and direct current and fitted with the same controlling apparatus. Outside the city limits the trolley potential will be 3300 volts, but within the city the cars will operate on the ordinary 550-volt direct-current trolley. The cars will also be equipped with the General Electric air brake system adapted to operate on either direct or alternating current Power for the operation of the single-phase extension will be obtained from the Savannah River Power Company.

STREET RAILWAY PATENTS

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

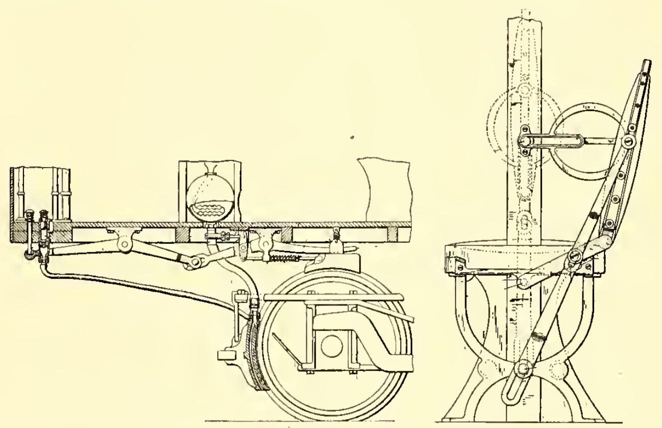
UNITED STATES PATENTS ISSUED MAY 8, 1906

819,736. Body Bolster; Samuel M. Curwen, Haverford, Pa. App. filed July 11, 1905. Comprises upper and lower longitudinal members having an intermediate strut to which are secured hangers adapted to be in turn secured to the car floor sills.

819,757. Car Seat; William H. Heulings, Jr., Philadelphia, Pa. App. filed Oct. 26, 1904. Details of a "walk-over" car seat.

819,762. Track Sander and Brake-Shoe; Eugene E. Keefe, Bellows Falls, Vt. App. filed Oct. 11, 1905. A brake-shoe having a grooved face and provided with a passage leading from said groove, and means for feeding sand through said passage.

819,808. Electric Block Signal for Railways; Walter E. Sands, Brooklyn, N. Y. App. filed March 18, 1905. A pleasure railway block signal system comprising a special conductor or trolley divided into sections and a brush or shoe depending from the cars which makes contact therewith to close certain signal circuits within the car.



PATENTS NOS. 819,762 AND 819,757

819,967. Fender Especially Adapted for Street Railway Cars; Matthew S. Aisbitt, Los Angeles, Cal. App. filed Oct. 12, 1905. Comprises a fender having a rounded, inclined nose of the "cow-catcher" type adapted to push obstructions from the track.

820,005. Fender for Street Cars; Anton L. Mazzanovich, New York, N. Y. App. filed Nov. 17, 1905. Details of construction of a fender adapted to pick up a person encountered and automatically fold to safely hold the person therein.

820,090. Mine-Gate; Newton K. Bowman, North Lawrence, Ohio. App. filed March 10, 1905. A mine-gate adapted to be folded up by means of suitable mechanical connections actuated by an approaching car and a bridge located upon one side of the gate in electrical connection with the trolley line and adapted to be tripped and swung across the path of the gate and make electrical connection with the trolley line on the opposite side of the gate.

820,117. Car Fender; Ernest A. Johnson, Brooklyn, N. Y. App. filed Jan. 11, 1905. Relates to a fender held normally in an inclined position and automatically released and permitted to drop into a substantially horizontal position when any heavy body falls therein.

820,143. Railway Signaling and Safety System and Apparatus; Georges M. Schreiber, Roubaix, France. App. filed Nov. 15, 1904. Means are provided for automatically blowing the whistle of a locomotive in case it passes a danger signal.

820,186. Device for Covering and Protecting Charged Rails; Gustave Egenolf, New York, N. Y. App. filed Nov. 25, 1904.

Comprises a V-shaped housing hinged on a vertical support so that the housing may be thrown back to permit inspection of the rail.

820,204. Car Fender; Joachim C. Jorgensen, Washington, D. C. App. filed Aug. 16, 1905. By the pressing of atreadle the brake-shaft is thrown into gear with the means for depressing the fender which is accomplished by a quarter turn of the brake-shaft.

820,260. Electrical Switch Indicator; William A. Rideout, Sr., Oshkosh, Wis. App. filed Dec. 11, 1905. A circuit is closed through a maget for each movement of the switch point, the magnet being effective to throw a semaphore arm or exhibit signal lamps at a station in the path of the train.

820,280. Trolley Stand; Warren W. Annable, Grand Rapids, Mich. App. filed Jan. 31, 1905. A wire is stretched from the trolley harp to a lever incorporated with the stand, in advance of the pole, so that when the wheel leaves the conductor and the wire strikes a guy-wire, the lever will be tripped and the upward spring tension on the pole relieved.

820,281. Taxometer or Fare Indicator; Gustav Baum, Breslau, Germany. App. filed Aug. 3, 1905. A fare indicator in which the adding or counting mechanism does not start working until the vehicle with which the apparatus is connected has traversed a distance corresponding to the minimum standard fare to be charged, or until an equivalent amount of time has been consumed by waiting after the vehicle has been hired.

820,317. Car Fender; Jearum A. Sage, Stryker, Ohio. App. filed March 31, 1905. Details of construction of a car fender so attached to the car truck as to follow curves in the track.

PERSONAL MENTION

MR. H. F. MERKER has been appointed engineer of maintenance of way for the St. Louis, Alton & Granite City Traction Company, with headquarters at Alton, Ill.

MR. T. B. REDMOND has resigned as general manager and purchasing agent of the Moline, East Moline & Watertown Railway Company, of Moline, Ill., to become associated with interests elsewhere.

MR. CHARLES A. HOBEIN, formerly in the engineering department of the United Railways of St. Louis, has identified himself with the East St. Louis & Suburban Railway Company as assistant electrical superintendent.

MR. J. B. WEEKS has resigned as general manager of the Spokane Traction Company, and has accepted the position of general manager of the Pacific Traction Company, with offices in the Provident Building, Tacoma, Wash.

MR. EDWARD H. RICHARDS, recently a division superintendent on the Southeastern Street Railway system at Middleboro, Mass., has been appointed assistant general manager of the Old Colony Street Railway, with headquarters at Quincy.

MR. CHARLES E. LENHART, master mechanic of the United Traction Company and Oley Valley Railroad Company, of Reading, Pa., has resigned to become master mechanic of an extensive electric railway under construction between Buffalo, N. Y., and Erie, Pa. His office is at Ellicott Square, Buffalo, N. Y.

MR. HENRY DOCKER JACKSON, of Boston, Mass., has opened offices at 4 State Street, that city, as consulting electrical engineer. Mr. Jackson will devote his time to the special subjects of electrolysis and power station economy. He has for a number of years lectured at the Massachusetts Institute of Technology on the subject of electrolysis, having extensive practical experience in the investigation of electrolytic action. In addition he has given expert testimony in a number of important law suits involving this subject.

MR. GRAHAM SMITH, formerly in charge of Westinghouse exposition and convention publicity as the New York Westinghouse press representative, and recently engaged in advertising work under his own name, is about to undertake a journalistic tour of several months abroad. On his return he will assume the direction of the Eastern advertising interests of several prominent corporations of the Middle West and West, with an office in the Flatiron Building, New York, and will make a specialty of the preparation of industrial books of the higher class.

MR. C. W. ROE has been appointed depot master of the Flatbush car house of the Brooklyn Rapid Transit Company. Mr. Roe, who is a young man, began railroading at the bottom in Detroit. Later he was connected with Messrs. Dupont and Grant in the management of the St. Louis Transit Company, but before the fair in St. Louis he left that city and entered the service of the Public Service Corporation of New Jersey. Here he served under General Superintendent Stanley for about two years as superintendent of Newark city lines and the Newark-Paterson line.

MR. A. GABOURY has been appointed assistant superintendent of the Montreal Street Railway system. This is a new position, which has just been created, and Mr. Gaboury is the first to occupy the office. Mr. L. Trudeau, the superintendent, has been confined to his home through illness, and Mr. Gaboury will perform the duties of superintendent until that official resumes work. The position will be maintained, and in the future Mr. Gaboury will retain the title of assistant superintendent. For the present he will have charge of all operations over the system. Mr. Gaboury has been in the employ of the Montreal Street Railway since 1892, when the electric system was inaugurated. He has worked his way from the ranks, having been conductor and motorman in the company. After leaving the cars he obtained an office position, afterwards becoming inspector and then depot master. Later he was appointed claim agent, which position he held at the time of his promotion.

MR. JOHN M. BRAMLETTE, general manager of the Philadelphia & Western Railroad, of which Mr. George K. Kobusch, of St. Louis, is president, and which is building an electric railway from Sixty-Third and Market Streets, Philadelphia, parallel with the main line of the Pennsylvania Railroad to York, Pa., with a spur to West Chester, resigned his position on Tuesday, May 15, to become general superintendent of the Michigan United Railways Company. Mr. Bramlette became associated with the Philadelphia & Western Railroad after ten years service as general manager of the East St. Louis Railway Company, of East St. Louis, Ill. During the year he has held the position of general manager of the Philadelphia & Western he has given his attention to the details of construction, and that part of the line from Sixty-Third and Market Streets to Wayne, about one-third of the entire system, will be put into operation in a few weeks. The company with which Mr. Bramlette will be associated controls all the street railways in Lansing, Battle Creek, Kalamazoo and Jackson; in all about 200 miles of track, with numerous additional lines in project, not a few of which are well along in construction. Mr. Bramlette will make his home at Kalamazoo. He will have an office there as well as the office at the general offices of the company at Lansing, Mich.

MR. DAVID YOUNG, JR., late superintendent of the United Railroads, of San Francisco, has entered upon his duties as general manager of the York Street Railway Company, of York, Pa. Mr. Young succeeds as general manager Mr. A. H. Hayward, who recently was elected vice-president of the York Street Railway Company at a meeting of its new directorate. Mr. Young is originally from Newark, N. J., where he gained his first street railway experience. He was connected with the North Jersey Street Railway Company. He has been on the Pacific Coast for a number of years, and was connected with the Mountain Cable Company before he became the superintendent of the United Railroads of San Francisco. In speaking of his experiences in San Francisco, Mr. Young said: "Six days after the quake we made an inspection. On the seventh day, at 11 a. m., the first car was moved over the lines. I had on board with me Mayor Schmitz, the supervisor of the roads, city officials and members of the press. For three days we handled all passengers and baggage free. For six days fares were collected from the men. Women and children were carried free. The receipts for the six days, which amounted to $25,000, were donated to the relief fund. In addition, the company gave $75,000 to the fund. Lodgings were provided in the car houses for 2000 homeless people. The cars were turned over to the homeless and became their temporary dwellings. The company brought in six boatloads of food from Portland. This was the first food to arrive in the stricken city. Supplies of clothing were provided by the company for its employees and others."

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, MAY 26, 1906. No. 21.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:

NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)............................$3.00 per annum

Single copies .... 10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)......................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 171,300 copies, an average of 8157 copies per week.

Fireproofing High-Tension Cables in Manholes

The importance of fireproofiing high-tension cables in manholes has for some time been recognized in central station circles, and in view of the large number of high-potential underground installations connecting street railway power plants and sub-stations, it may not be amiss to take a leaf from the electric lighting engineer's book and consider the matter for a moment. At first thought, it seems an almost needless precaution to spend money for protecting lead-covered cables in manholes from possible fires, but while the hazard from external sources is generally negligible, it cannot be denied that the accumulation of inflammable gases, electrolysis of cable sheaths and partial or complete short-circuits open the door to a great deal of trouble at times, even in the best regulated manholes. Leakage of illuminating gas through the earth, seepage of explosive or corrosive liquids through the ground, or even trouble at some distant point on the electrical system are by no means impossible occurrences.

In case a fire occurs in a manhole, whether in a group of high-tension or low-tension cables, the lead covering of most of the cables in the immediate vicinity of the trouble is very likely to be melted. Split clay tile covering has been successfully used for the cable under such circumstances, light angle-irons being installed to support the combined weights of cable and tile. The tile sections are cemented together, and while the cement is setting, a piece of light sheet iron, preferably galvanized, can be used to support the tiles between the angle-irons and the conduit openings. Where bends are necessary, 45-deg. tile elbows can be used without much trouble, and in cases where the curves of the cable cannot be accommodated to elbows, good protection can be assured by wrapping the cable with asbestos paper wound closely with brass tape, or some equivalent heat insulation. The cost of using clay tile upon a run of cables may easily amount to from $5 to $8 per cable per manhole, but the result is a construction which is about as near fireproof as is possible. Cables carrying thousands of kilowatts beneath the streets in the congested district of a city are usually important enough to justify stringent protective measures, and the cost of fireproofing the runs in the more important manholes is usually well worth while in the resulting insurance against damage and interrupted service.

The Location of the Fuse Box

A few years ago it was the custom almost invariably to locate the fuse box underneath the car, but at the present time its installation is not by any means limited to this one position. Underneath the car is a good location, so far as convenience in wiring and accessibility is concerned, but it has the great disadvantage that in wet weather serious damage is likely to result from the box and exposed parts getting wet and leaking current. In many cases, when the car steps and other parts of the platform are found to be charged, and the fuse box is located underneath the platform, the trouble will be found to be caused by a water soaked and, consequently, a leaky fuse box. The great advantage of placing the box under the car is that all the "fire works," if any, take place at a point where the passengers are not much disturbed by them.

It is the practice of some companies to place fuse boxes on the forward platform. This is, to be sure, a convenient location and one where the box is not likely to be affected by moisture, but in the event of a dead short-circuit, which may result when lightning gets into the car, there is likely to be some commotion among the passengers. Especially is this the case if passengers are allowed to crowd on the front platform, as is customary on some roads. Several incidents are on record where people, especially women, have jumped from the car and have been painfully injured because of fright occasioned by the burning and arcing of electrical apparatus on the front platform. Outside of this objection the platform appears to be the most desirable location for the fuse box. Enclosed fuses of the cartridge type, to be sure, practically eliminate fire works of all kind, but perhaps on account of the cost of renewals they have not been adopted generally by street railway people.

Sometimes the box is placed under a seat in the interior of the car. In view of the flashing that may occur unless an enclosed fuse of the cartridge type is employed, this would appear to be a rather dangerous location. When boxes are so located they are, of course, surrounded by asbestos, but nevertheless, it is, we believe, a rather dangerous practice to put a fuse box in such a confined place. Aside from a consideration of the possibility of fire, another objection is open to this location. To replace a fuse, the motorman is compelled to disturb several of the passengers.

The abandonment of the underside of the car for the installation of the fuse box, we believe, was partly due to the imperfect design of the older type of boxes. Within the last few years boxes with the interior better protected from dampness have been placed on the market, and when these are used, if enclosed fuses are not employed, the best place for the box, everything considered, is probably under the car.

Run-Down Systems in Small Towns

It is a noticeable fact that the street railway systems of the smaller towns are not nearly as well kept up as those of the larger cities. There is, however, no good reason why the smaller systems should not be kept in good order. Frequently the reason that they are allowed to run down is that when they once get in a somewhat dilapitated condition, the receipts are just about sufficient to operate them, and the stockholders do not feel warranted in taking money out of their pockets or borrowing the amount required to rehabilitate the system. If the road in its run-down condition is paying dividends the stockholders are probably satisfied to let well enough alone and continue to draw their money at regular intervals. In either case, the stockholders do not seem to realize that to rehabilitate the system means both increased revenue and reduced maintenance expenses. When cars are dirty, ill-smelling and unpainted, and in such a run-down condition that they appear to be ready to fall to pieces at any moment, it is certain that people will not ride in them for pleasure alone. And when these cars are operated over a rough and worn out track, so that passengers are kept bouncing about in them, it is punishment to be compelled to use them, and no one is going to do so except under unavoidable circumstances. Add to these conditions unreliability of service, resulting from break-downs of apparatus, and it is very evident that a road in such a condition will not collect all the fares that the town is ready to give.

The maintenance expenses on such a road are, of course, relatively high. To begin with, the power house machinery is usually inefficient, and a needless amount of money is put into the purchase of fuel. In addition, repairs are constantly being made to the track and overhead. The maintenance of car bodies and especially of trucks is increased by rough track, and the electrical equipment of the cars also requires constant attention and repairs. From a standpoint of earning capacity, it is, we believe, safe to make the statement that it is a bad proposition to allow a system to get in a run-down condition in the first place, or to let it remain in such a condition. Further, if a road will pay its operating expenses when everything is in a dilapitated condition, it may usually be considered certain that when improved it will more than pay expenses and the added interest on a reasonable investment necessary to put it in proper shape.

The stockholders of a run-down road that continues to pay dividends in spite of its condition should certainly have the best interests of the city deeper at heart than to let dilapidated cars continue to operate over its streets. A stranger into the city usually has his attention drawn to the cars and to the condition of the street railway system first of all. And he is likely to judge the town by these first impressions unless his stay is long enough to get acquainted with the true facts of the case. In general, therefore, there are very few instances of street railway systems in a run-down condition in which, from either a financial or a moral standpoint, the stockholders are warranted in letting such conditions continue to exist.

Routeing Cars Through a Common Point

In laying out the routes of cars the question often comes up how far is it desirable to pass the rolling stock through a common point on the system. The geography and population of the community served naturally influence the problem considerably, but in general two distinct reasons for and against common point routeing are plainly apparent. If all, or nearly all, the cars on a system pass over a certain common piece of track once or twice in every round trip, there is no doubt that in case of a breakdown the cost of the delay is likely to mount upward in a most alarming fashion. Unless the blockade is cleared within a very few minutes, complete paralysis of schedules and traffic follows in the direction of the track affected. The loss of revenue to the company and the shutdown of service available to the public cause great embarrassment in proportion to the size of the city and the time required to get things moving again.

On the other hand, the public usually prefers the common point routeing, so long as things go smoothly. Strangers in town find a great satisfaction in being directed to a certain square or street through which all local and possibly all interurban cars pass en route. The transfer problem, from the passenger's standpoint, is reduced to the simplest possible terms. The resident finds the common point transfer almost as convenient as the stranger, and the exchange of passengers between different lines is much simpler for the company than it is under conditions involving a multiplication of transfer points at track intersections. Doubtless the common point routeing plan increases the traffic congestion considerably in comparison with that obtaining with separated routes, but until one reaches a population of two hundred thousand or three hundred thousand, the congestion is likely to be more in name than in fact. The frequency of cars over a single piece of track is seldom sufficient to produce much congestion until the conditions of a large city are encountered.

On the whole, the great conveniences to the public offered by common point routeing, probably offsets the disadvantages except in fairly large cities. Whether the cars are looped around a square or operated over a single track in the center of the city, it is certainly the part of wisdom to provide an alternative route of some sort through which the cars can be operated when breakdowns occur in the common track section. If nothing better can be arranged, a few cross-overs can be employed to great advantage in the main line. When a town is traversed by a high-speed interurban line it is sometimes possible to divert the interurban cars to a side street route, to the great advantage of everybody. Local cars are then less liable to slow down the time of passing through the town by getting constantly in front of the limiteds, and it is a simple matter to step across a block or two to the interurban from the local common point. It is doubtful if transfers ought to be generally given all over a town to passengers arriving by through cars, and the public convenience can scarcely be said to suffer much by the removal of the interurban to a parallel street. An incidental advantage of common point routeing is the facility with which the traffic and car movement can be watched by an inspector located in the central district. The very pulse of the system can be counted when all the cars pass a given point. The small or medium-sized city offers the best field for common point routeing.

Look After the Feeders

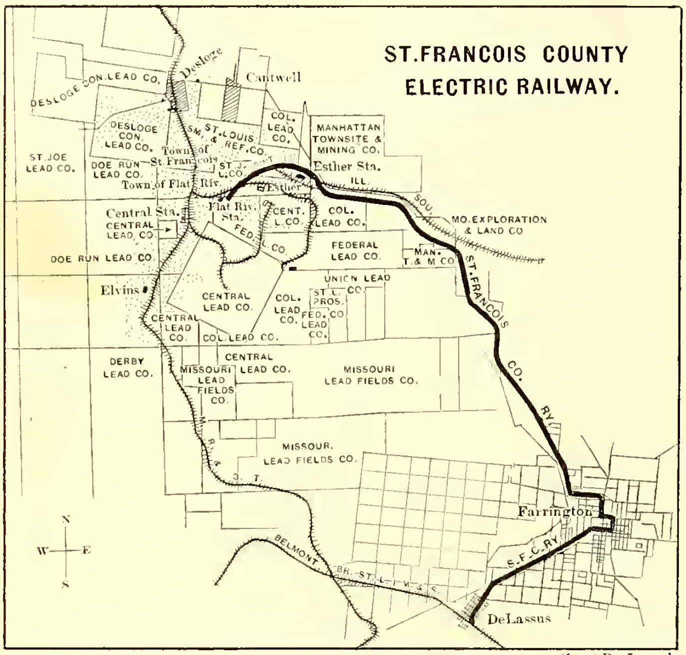
A roundup of the wasted energy on a railway system is not altogether easy unless made continuous, but it pays. Even on roads with generally well designed conducting systems it is not unusual to find weak spots that make a bad showing in economy. Of course, the first consideration is successful operation, and, after all, the power bill is only one item, and yet this is the very item most frequently neglected. The power house is in these days pretty carefully watched, and roads often look very sharply after cost in that quarter, but outside the power house the energy is too often left to take care of itself. If the power house cost per kw-hour suddenly rose 10 per cent there would be an investigation started at once. If, however, with the addition of more cars and the general increase of traffic the output is noticeably increased it very often happens that no inquiry as to the disposition of the extra energy is started. The losses incurred are of two distinct kinds. There may be considerable waste in the operation of the cars themselves, and there may also be increase of feeder and track losses. As to the first class the report we recently published of the operation of recording wattmeters on the Clinton, Ia., line gives a good deal of valuable information. Making all due allowances for the chances of getting experience on the part of the motormen it is clear that the silent teaching of the wattmeters was good for something like a 20 per cent saving in energy, amounting in this case to 2 kw-hours to 2.5 kw-hours per car per hour.

In other words, reckoning power at 1 cent per kw-hour the meters saved more than 2 cents per car per hour of run, which far more than offsets the charges against the meters and leaves a big profit besides. Nothing is here added for the incidental saving in lessening wear and tear on the equipment. Now, as to other losses, the wattmeters give a rough estimate of the total amount but tell nothing of the distribution of losses. It is no uncommon thing to find a needless drop of 100 volts to 150 volts on a long feeder, even in these comparatively educated days. Here is another loss of one or more cents per car hour that is not only bad on its own account, but bad for the car. Year in and year out it would pay the interest and maintenance on a good deal of extra copper. The trouble often comes from building up heavy service on a line without taking due account of the feeding system. Nearly every time a system is thoroughly overhauled a lot of weak spots of this sort are discovered, but they should be found and remedied without waiting for a general house-cleaning. The bonds are often defective and responsible for considerable loss, but that is another and a long story. For practical purposes the point is to get after the places that show low efficiency of transmission, and to keep after them until they are remedied. For this, frequent inspection is necessary. Many roads, particularly the larger city roads, get it, but the very roads that need it most, the smaller ones where the cost of power is relatively high, are the ones most frequently neglected.

It is, in fact, the smaller roads that need most critical and careful engineering. They have relatively higher expenses and less margin of traffic to cover losses. From power house to car they require to be watched, not only for obvious losses due to bad bonds and insufficient feeders, but for casual losses of traffic due to lack of judgment in operation. It is to the feeding system, however, that we wish particularly here to direct attention. An increase of 10 per cent in the cost of power is not infrequent enough to make the difference between profitable and unprofitable operation. Distances are apt to be rather long, and toward the distant end of the line is the place to look for trouble. We have known of losses of 20 per cent, and even more in such situations, going on steadily, and sometimes pushing the power house voltage to a point not to be recommended for the equipment. When the summer traffic comes on and extra cars begin to run, the trouble increases. Too often the weak spot in the feeding system is the very one to which extra cars are run, and in this case the mere loss of energy is often far less than the inconvenience it causes. Voltage inspection is quite the usual thing on a good many lines, but there are too many sins of omission left still in this particular. Another point too often forgotten is the relation of schedule to the distribution of current. Even so obvious a precaution as keeping cars from taking the grades all together is disregarded with shocking frequency. Neglect to tie lines together into a network, when it might be done with comparative ease, is still another thing that causes needless and sometimes serious loss of conducting capacity. It is not every road, even, that has a clear map showing the complete distribution of feeders and kept strictly up to date. The whole story is that leaks not obvious at a glance are apt to get neglected in every business. In electric railroading, however, it should be the special business of somebody to look out for the very things we are here discussing, and to see that the faults are remedied at the earliest possible moment.

THE ST. FRANCOIS COUNTY ELECTRIC RAILWAY

The peculiar location of the St. Francois County Electric Railway, of Farmington, Mo., together with a consideration of its earning capacity, makes it well worthy of attention.



TERRITORY TRAVERSED BY THE ST. FRANCOIS COUNTY ELECTRIC RAILWAY

Farmington is the county seat of St. Francois County, and is located about ninety miles south of St. Louis. The town is surrounded on three sides by steam railways, yet it is three miles distant from the nearest point on any of them. The accompanying map shows the relative position of the railways, as well as the location of the electric line. It may be seen that the electric line connects the town with all three of the steam roads, and it may be added that the revenue derived from freight traffic is largely in connection with the steam roads. The southern terminus of the road is De Lassus, a town of about 1500 people, on the St. Louis Iron Mountain & Southern Railroad, and the road might be said to have two northern termini, Esther, a small station, a point of interchange with the Illinois Southern Railroad, and Flat River, 1¼ miles distant at the junction of the Southern Railway with the Mississippi River and Bonne Terre Railway. Flat River is in the lead district of eastern Missouri, and surrounding it is a population of about 20,000 people. The district is said to be the largest lead producing territory in the world. The National Lead Company, the Federal Lead Company, the Desloge Consolidated Lead Company, the St. Louis Smelting & Refining Company and other large corporations all have rich mines in the region, and the investments of several of the corporations run far up into millions of dollars. There are no lead mines in the immediate vicinity of Farmington, but the town is the basis of supplies for all of the region in which the mines are located, and its importance to the district is augumented by the fact that it is the county seat.

VIEW IN FARMINGTON

A TANGENT BETWEEN FARMINGTON AND FLAT RIVER, SHOWING HEAVY BALLAST

PASSENGER TRAFFIC

Practically all of the passenger traffic of the steam roads to and from Farmington is carried by the electric line. The greatest passenger revenue, however, is derived from local people traveling from the terminal towns to Farmington. Farmington is a comparatively old town, and not being in the vicinity of the mines, it has a more quiet and refined atmosphere about it, and has greater social, professional, and commercial advantages than the purely mining towns. For this reason many mine operators and others whose business is in the mining region make Farmington their home, and travel to and from their work over the line. There are also numerous schools in Farmington, which are attended by those living in the mining towns. The courts hold four terms each year, and these sessions are the means of drawing many people from Flat River and the surrounding mining region to the town. Litigation, which is considerable, and the general settlement of estates, county court settlements, and other court proceedings usually necessitate the attendance of many people from the lead district. Quite a little travel is caused by the presence of the State Hospital for the Insane, which is located on the road between De Lassus and Farmington, and contains 400 inmates. The attendants make frequent trips to and from Farmington, and many visitors from the steam roads are carried to and from De Lassus.

The development of the mining industry is resulting in a rapid increase in population of the regions from which passenger traffic is obtained. Elvins, a town which in 1900 had

600 people, now has 3000. At Owl Creek, 4½ miles distant from the line, where two years ago there was a population of 100, there are now 5000 people. During the first year of operation of the road (1905) there was very little travel purely for pleasure. However, ground has been leased between the power house and Esther upon which a pleasure ground and park will be established, and, as a large percentage of the people are miners and of a money-spending class, it is believed that the park will be the source of considerable revenue.

FREIGHT TRAFFIC

As the electric line is the only connection with the steam roads, practically all the freight into and out of Farmington is carried over it. The receipts from freight at the present time amount to about 30 per cent of the gross receipts. The freight is of a miscellaneous character, consisting of coal, agricultural implements, dry goods, grain, building material and in general such commodities as are consumed in a small town and farming district, and such as are required by the lead mines. The road handles car-load lots on its own account, and these are billed through to and from St. Louis and other points. It acts only as a carrier for open local shipments, however. This class of freight is received and billed out by a freight agent maintained at Farmington jointly by the Frisco System and the Illinois Southern Railroad. Most of it is received at at the freight station in Farmington. Several of the larger shippers, however, have private switches and contemplated additional construction through the town provides for several other private sidings.

REVERSE CURVE BETWEEN FARMINGTON AND THE POWER HOUSE

THE LINE AND ROADBED

The line has a total length of 11½ miles, of which 9 miles is between Farmington and Flat River. It traverses a rather hilly country, which in order to avoid heavy grades made necessary numerous curves. These, however, are not sharp and, in fact, with the exception of a few in Farmington, are such as to permit trains to be operated around them at full speed. The maximum grade on the line is in Farmington and is 3.12 degrees. Between Esther and Flat River, 1 3-10 miles, cars are operated over the tracks of the Illinois Southern Railroad, a yearly rental being paid for the use of the tracks.

The track of the electric line is constructed of 60-lb. rails. No trestles of any considerable size were required in the building of the road. The frequent small streams are crossed by means of 15-ft. bridge spans, which are of standard steam road construction, and are supported by rock buttresses, as shown in one of the illustrations. The outside rail of the track is elevated on all curves, as in steam road practice. At the top of a grade, on an 8-deg. curve, this rail has a 4½-in. elevation, and where such a curve occurs at the bottom of a grade, the elevation is 5½ ins. In general, it may be said that the track is in excellent condition, and this is due largely to the fact that General Manager A. J. Zwart, previous to his identification with the electric line, was engaged in steam road track work, and has made a special study of track construction.

CROSSING UNDER THE ILLINOIS SOUTHERN RAILWAY

A 15-FT. SPAN WITH STONE BUTTRESSES

Practically the whole line is ballasted with "chatts," or tailings from lead mines. This is akin to flint in its nature, and has been crushed in the mills to about the size of pea coal. It makes an excellent ballast, and several miles of the road ballasted with it have for almost a year had no repair work done upon them whatever. Some of the road was ballasted under rather trying difficulties. The track was laid in the fall of 1904, on a fresh dump. The first rain to fall upon it froze, and made a solid roadbed throughout the winter. When the spring came, however, the roadbed became very soft, and in order to keep the cars on the track it was necessary to ballast the track with the roadbed in this condition.

POWER HOUSE, WITH REPAIR SHOPS ON THE LEFT

On all the private right-of-way bracket construction is employed to support the 00-round trolley wire. The poles are 30 ft. in length, with 6-in. tops, and are placed 110 ft. apart. A single cross-arm, immediately above the bracket, carries telephone wires and a feeder cable. Through Farmington telephone poles on one side of the street are used jointly to carry the span wires. Over the tracks of the Illinois Southern, between Flat River and Esther, the trolley wire is 22 ft. above the rail. In ordinary construction, however, it is but 16 ft. high. There are no crossings with steam roads. The line does, however, pass under the Illinois Southern Railroad at Esther, as is shown in one of the illustrations.

The power house and repair shops are located about two miles from Farmington, on the Flat River portion of the line, this location having been chosen because it is about an equal distance from the terminals. The power house is a brick structure containing two rooms. In the boiler room is installed three fire-tube boilers, in connection with which a Hoppes feed-water heater is used.

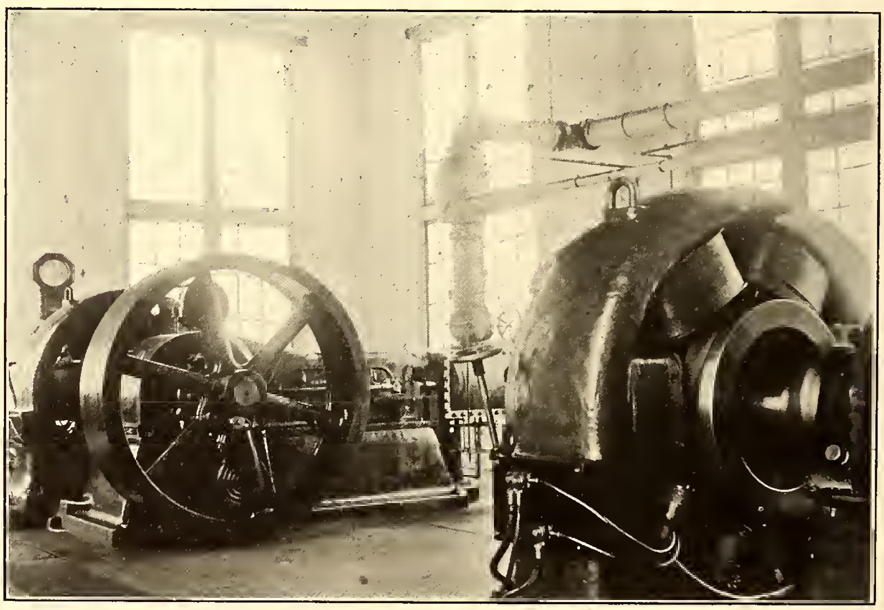
Water supply is obtained from an artesian well sunk through the boiler room floor to a depth of 400 ft. This is provided with a deep well pump, which forces the water into a 40,000 gallon tank built on a wooden structure near the power house. Under tests, the well has withstood all efforts to exhaust it. To provide for emergency, quite a large supply of coal is kept on hand in bins built outside, near the boiler room.

Power is supplied by two 150-kw 550-volt Western Electric generators, direct connected to simple non-condensing Chuse engines. A switchboard, consisting of two-machine and two-feeder panels, is located near the wall between the machines. The lightning arresters are placed on the wall behind the switchboard. Two 600,000 circ. mil feeders leave the station, one going in either direction, and continuing within about one and one-half miles from the end of the line at one terminus and three-quarters of a mile at the other terminus. The feeders follow the car line, with the exception of a short distance in Farmington, where they cut across a few blocks, and thereby avoid a long detour. The repair shop, containing two tracks, is built of corrugated iron, and is located close to the power house.

THE ROLLING STOCK

The system is operated with two passenger and one freight or express car. One of the passenger cars is 49 ft. 8 ins. in length over the bumpers, and is of the St. Louis Car Company steel bottom semi-convertible type. The remaining one is 48 ft. 2 ins. in length. Both are provided with Peter Smith hot water heaters and cross seats covered with rattan. They are equipped with GE No. 70 motors, K-28-A controllers and Christensen straight-air brakes. The express car is provided with four GE 57 motors and two K-14 controllers. As it is employed to haul railway freight cars, it is provided with automatic brakes and M. C. B. automatic couplers. With a gear ratio of 16 to 71, the car pulls trains of three loaded coal cars, each of 66,000 lbs. capacity, over a 2½ per cent grade without difficulty. It is, however, the intention to reduce the gear ratio.

Practically no trouble has been experienced with the electrical equipment since the road was put in operation. On its first trip an armature of the freight car was burned out through carelessness, but other than this there have been no armature troubles of any description. Under the present system one passenger car shows 34,800 miles, and another passenger car has a record of 42,000 miles without any renewal of armature bearings. The freight motor, with a mileage of 27,000, however, has had two pairs of bearings renewed. All motor bearings are provided with oil lubrication, oil being used in the grease boxes of the motors on the freight car. Bearings are inspected and oiled on the car every second day, while the passenger cars are gone over once



GENERATING UNITS IN THE POWER HOUSE

each week. The absence of trouble with the electrical equipment is due in a great measure to the method employed to prevent over-feeding by the motormen. The scheduled time is rigidly adhered to, and this enables the engineer at the power house, by noting ammeter readings, to accurately designate a careless motorman. When a line breaker goes out record is sent to the general manager, together with the time and cause. This policy tends to check careless feeding by the motormen.

The schedule of passenger cars is so arranged that all steam road trains are met. This necessitates their leaving terminals as well as Farmington at irregular intervals, and makes impossible the usual hourly schedule on interurban lines. Between Farmington and Flat River there are ten trains daily, the first leaving Farmington at 6:15 a. m., the last one arriving at 10:10 p. m. Seven trains are run daily between De Lassus and Farmington. Other trains are operated between the State Hospital and the power house. When trains operate on the tracks of the steam road between Esther and Flat River they are subject to the rules of the standard code for steam roads. Standard time is given the railway company every morning, and all train crews are required to have watches fulfilling steam road requirements. The watches are inspected weekly and are examined quarterly. With few exceptions cars are operated at all times under rules of the standard code. No car, except under special order, has the right-of-way over another. The office must be called and an order obtained to proceed beyond a meeting point when opposite cars are more than three minutes late. When a car leaves a terminal 5 minutes late, it must call the office and receive orders. The freight train operates as an extra, and is always under orders.

The regular schedule requires a passenger car mileage of 260 car miles per day, although there is a growing demand for extras for special parties.

OPERATING FEATURES

The regular fare between terminals is 30 cents. Between Flat River and Farmington the one-way fare is 25 cents, or 40 cents for the round trip, the return trip to be made on date of sale. A 25-ride ticket, limited to six months, is sold for $4.50, and one for 50 rides for $8.50. A charge of $8 is made for a 54-ride ticket with a 30-day limit, while a 46-ride school ticket with the same limit is sold for $5.25. As the distance between Farmington and Flat River is 9 miles, these fares are somewhat in excess of those usually charged on electric roads.

It is interesting to note the number of men necessary to operate a road of this size. The force is usually composed of one assistant manager, one express clerk and extra conductor, four power house men, two passenger conductors, two passenger motormen, one freight crew, composed of two men, two track and one extra car house man, who also serves as an extra motorman. This gives a total of fifteen men, exclusive of the general manager.

At the present time the road is being operated for 55 per cent of the gross receipts. This in itself is an excellent showing, and it is a somewhat remarkable one when it is considered that the road has been in operation but little more than a year. Every indication points to a continued increase in passenger travel, as well as freight traffic, and it is reasonable to presume that the ratio of operating expenses to gross receipts will be decreased when the fact is taken into consideration that a very decided car mileage may be operated without any very general increase in power house and car house expenses. The impression gained from a study of the road is that the field of the electric railway is not limited to lines operating in large cities or out from them, but if properly managed good return for capital invested may be obtained by what might be termed isolated installations.

STREET RAILWAY SITUATION IN SAN FRANCISCO

(*By Our Own Correspondent.*)

At a meeting of the Board of Supervision of San Francisco, on May 14, permission was granted the United Railroads to erect poles and wires on Market Street, Sutter Street and all other streets where the grades do not make the operation of electric cars impossible. The granting of this permission means much for San Francisco. It means the rehabilitation of the city's transportation system with the least possible delay. It means that cars will be running within thirty days over cable lines which could not be reconstructed and put into operation as cable lines within a year. Anticipating this action by the Board of Supervisors, President Calhoun has perfected every arrangement to convert the various cable roads into trolley lines immediately.

The conversion of the cable roads into electric lines will involve much labor and expense. On Sutter Street, for instance, the gauge will have to be reduced from 4 ft. 11½ ins. to 4 ft. 8½ ins. At the same time the tracks will have to be shifted so as to afford more clearance for passing cars. This work will be carried out on the line described in the Street Railway Journal for May 5, 1906. On the Clay, Washington and Jackson Street lines the gage will have to be widened. Haight and McAllister streets can be converted into trolley lines merely by the erection of poles and wires, and the overhead electrical equipment will be installed as soon as it arrives from the East.

The ordinance passed by the Supervisors settles the question of the future character of street railroads in San Francisco probably for a long time to come. It means the passing of the cable road and the abandonment of the scheme for underground conduits in Market and Sutter streets. By the adoption of the ordinance the temporary permits under which the United Railroads had been operating electric cars on Market Street were made permanent. The only cable lines that will remain in San Francisco when the United Railroads concludes its task, will be those on the hilly streets where the grades are too steep for the operation of electric cars, and those not embraced in the United Railroads' system.

The transportation conditions continue to improve daily. On Sunday, May 13, the United Railroads found it necessary to put into service practically every electric car, large and small, in its possession in order to handle the Sunday throng of sightseers. It was the company's banner day since the fire.

The Mission Street lines are now in complete operation to the Ferry, and this has greatly relieved the congestion on Market Street. The United Railroads will play an important part, together with the Ocean Shore and the steam roads, in the work of cleaning the burned district. It has laid considerable track on the south side of Market Street and more will be put in use for handling cars filled with brick and other debris. The United Railroads has generously agreed to clean Market Street, from curb to curb, without cost to the city.

A commissary department has been established by the company for the purpose of furnishing groceries and provisions to the company's employees at actual cost. Thomas Finigan, assistant purchasing agent of the company, has been placed in charge of the commissary department, and has laid in a large supply of staple groceries, including butter, eggs, tea, coffee, sugar, potatoes, flour, canned meats, canned vegetables, canned fruit, also fresh milk and bread, while fresh meats may be added. The commissary department's main depot has been established at the Turk and Fillmore streets car house, from which supplies will be distributed to the other car houses as they are needed to meet the demands of the men.

For years past the United Railroads has been making a large donation for band concerts in Golden Gate Park. The question of whether the company should continue its contributions to the concert fund was submitted to President Patrick Calhoun and he unhesitatingly ordered that the regular contributions be continued. The first Park concert since the fire was accordingly given at Golden Gate Park on Sunday, May 13.

TESTS OF AN INTERPOLE RAILWAY MOTOR

BY G. HERBERT CONDICT

In the STREET RAILWAY JOURNAL for April 21, the writer presented a series of speed-time and distance diagrams showing the possibilities in railway work of the interpole design of electric railway motor, and stated that the Electro Dynamic Company, of Bayonne, N. J., has in process of design a complete line of motors of this kind. Since the publication of this article a number of tests have been made of an interpole motor for railway work with very satisfactory results. The motor was overloaded more than 300 per cent and there were no signs of sparking or flashing at the brushes. The value of this characteristic in railway service is of the utmost importance, as the work is intermittent and often motors of great capacity are employed merely to surmount some excessive grade, or for quick acceleration. With the interpole motor the limiting factor is not commutation, as with the ordinary motor, but is the heating. As the extra heating of the motors can be readily taken care of by forced draught, it follows that a motor of much smaller size may be used for a given service, or a far greater power can be furnished by a motor of a given size. This last feature is of the utmost importance. A smaller motor for a given power gives greater clearance from the ground. This is a factor of great importance in suburban and heavy electric railway work, because the limited space underneath the car precludes, with the ordinary design, the use of motors having more than a comparatively small capacity.

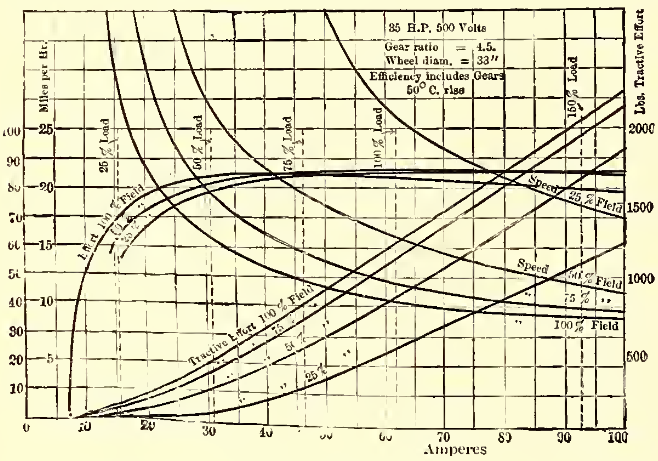


FIG. 1.—CHARACTERISTIC CURVES OF INTERPOLE RAILWAY MOTOR

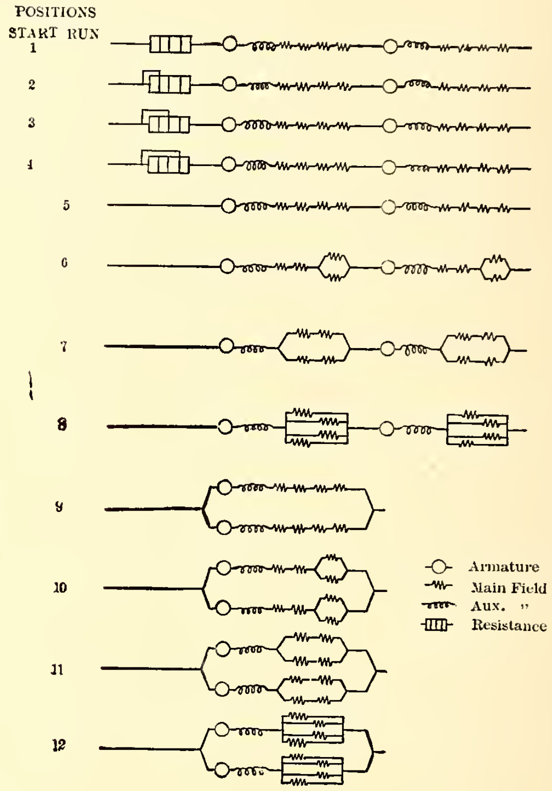


FIG. 2.—SERIES PARALLEL CONTROL FOR INTERPOLE MOTOR WITH EIGHT RUNNING POSITIONS

With commutator troubles practically eliminated, with the size of the motor per horse power reduced and with its ability for operating with weak fields and at a wide range in voltages, the interpole motor is the most practicable design for trunk line conditions. The ideal method is to equip each car with powerful motors so as to obtain the maximum speed with high voltages (2000 to 3000) upon the trunk lines and to divert the same cars on to city or branch tracks when they reach their destination. In the city the same motors and the same controllers can be used. Under these conditions, the traveler, instead of leaving the car at the railway station, a mile or more from his hotel or the center of the town, will ride from the city system in one town to the city system in another, and thus comfortably and easily be landed at his hotel or doorstep. It was considered a great improvement when baggage could be checked from the traveler's house to its final destination, but how much greater is the importance of being able to pass from one's own home to the final end of the journey, not only without change, but at the highest speed. The combination of the multiple-unit system with the interpole motor makes this commercially possible.

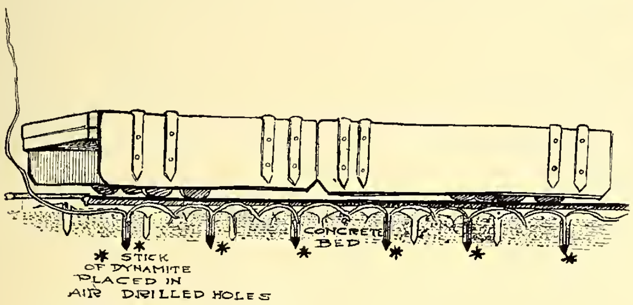
The accompanying characteristic curves of a 35-hp interpole motor in this connection cannot fail to be of interest, as giving the very remarkable performance of this motor when operated under weak field conditions. On account of the absence of commutator troubles, the field of the interpole motor, as stated, can be weakened to almost any extent, thus delivering high speeds, and at the same time the motor can be run at excessive overloads. Both of these advantages can be secured with a high degree of efficiency, as shown by the curves in Fig. 1. It will be noted, that this efficiency includes gears. The motor from which these curves were taken has a weight of less than 1500 lbs.

In Fig. 2 is shown one of the various possibilities of control of the interpole railway motor. This is a series-parallel system in which full use is made of the increased speeds obtained by weakening the fields of the motors. After starting up in series with resistance, the motors are brought into the running series position (No. 5), and from this point on have an almost indefinite number of efficient running positions, in this case eight, which may be obtained without the use of any resistance. A great improvement in economy of current consumption when compared with the ordinary type of railway motor will thus be secured.

Recent developments have demonstrated that the interpole motor, as used in railway work, has not yet reached its final stage and some surprising results may be anticipated.

WRECKING OLD CABLE ROAD IN ST. LOUIS

A unique method has been adopted by the management of the United Railways Company, of St. Louis, to remove the concrete, in which the old cable conduit on Olive Street was laid, quickly and with as little inconvenience as possible to the traveling public. It is accomplished by blowing the conduit up with dynamite. Each blast contains twelve cartridges, weighing one-tenth of a pound each and filled with 40 per cent dynamite. The work is now in progress, and extends over the entire Olive Street line, from Boyle Avenue to Fourteenth Street. One track is being blown up at a



"COVER" CAR TO PREVENT DAMAGE FROM EXPLOSION

time. The east bound track is now being removed, and the cars come downtown over another route. The dynamiting is not permitted to interfere with the movement of the cars on the west bound track.

The problem of dynamiting the great beds of concrete, either during business hours or at night, was a hard one for the managing and engineering departments of the railway.

CLEARING AWAY THE DEBRIS AFTER AN EXPLOSION

The question was simplified by the fact that the concrete for each track was separate, and if the jar of the dynamite was distributed so as not to disturb the adjoining track, the most important part of the plan, from a traffic standpoint, was solved.

It is done by sending a pneumatic drilling machine over the road to drill the holes in which the charges are placed. The drill was supplied with air from a motor compressor on the construction car.

The roadmaster organized six crews, of about 50 men each, a day and a night crew for each section. Most of the men are laborers, engaged with pick and shovel in throwing the debris to one side after the blast, and carrying the old rail and

VIEW ON OLIVE STREET, TAKEN DURING EXPLOSION

the new. About a dozen from each gang do the blasting. Flying debris are kept from doing any damage to buildings by a "cover" car, which is an ordinary flat or platform car covered with 6-in. oak ties, with curtains of oak suspended on hinges, so as to include effectually all space beneath the car.

After the cartridges are in place the "cover" car, propelled by an old passenger car, is stopped over the 10 ft. of track containing the blast. The motorman of the passenger car, into which the man who sets off the blast goes when it is all ready, gets a signal from the gang foreman, when everybody has been sent away from the immediate vicinity and the west bound cars stopped a block away. The blast is then fired. It is estimated that the three gangs, working day and night, will blow out about twenty blocks of single track in each twenty-four hours.

The company will use the old yokes for cast welding purposes. As they are cast iron, they come out broken and for the most part in sizes which can be put in the cupola. In some cases window glass of a poor quality has been cracked by the explosions, but no panes have been broken so as to cause falling pieces. The cover car has effectually prevented any flying pieces of concrete.

It is proposed to lay the new track with 9-in. rail on ties, instead of the 4½-in. rail now on the cable yokes.

E. Schondube, of Mexico City, has secured the contract for the electric street railway to be built there by the Compañia Industrial de Guadalajara, the French Light & Power Company, of Guadalajara.

THE COLUMBUS CONVENTION

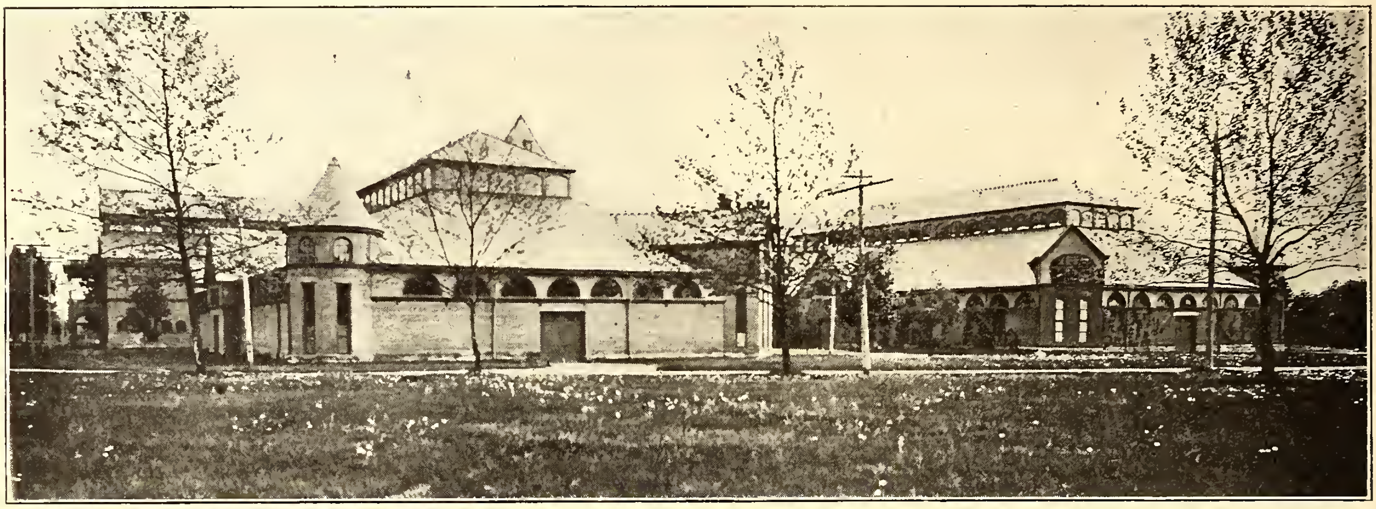
In the last issue of the STREET RAILWAY JOURNAL a short account was published of the preliminary plans for the Columbus convention, and the selection of five of the buildings at the State Fair Grounds for the meeting and exhibit halls. Two views of this group of buildings are presented herewith, together with a map of the City of Columbus, showing the location of the Fair Grounds and several of the principal hotels.

The program for the convention of the American Street and Interurban Railway Association and a list of papers has practically been decided upon.

The first session is to be held on the morning of Wednesday, Oct. 17. After the roll call and address of welcome, the president will deliver his annual address, which will be followed by the reports of the Executive Committee and secretary and treasurer. Accounts of the work done during the past year by, and the future plans of, the affiliated and allied associations will then be presented by the presidents of the four associations. It is thought that this will occupy the time from 10 a. m. to 1 p. m.

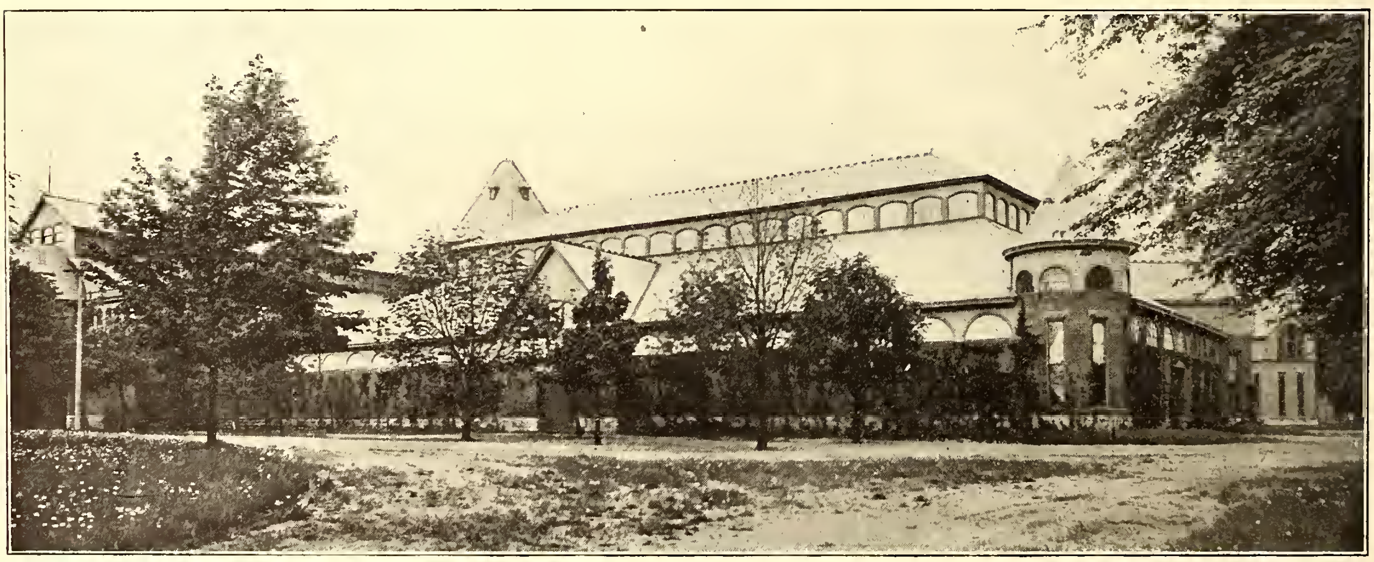
The afternoon of Wednesday, Oct. 17, will be devoted to the reports of the following standing committees: Membership; Compensation for Carrying Mail; Subjects; Car Wiring; Standardization of Equipment; Insurance, and Promotion of Traffic. Discussion on these reports will follow.

The morning of Thursday, Oct. 18, as announced in the last issue, will be an "interurban" meeting, and the following papers and reports of standing committees have provisionally been decided upon: Report of Committee on Heavy Electric Railroads; paper on "Electric Railways as Feeders to Steam Trunk Lines;" paper on "Electric Railways in Sparsely Settled Communities;" paper on "Interurban Limited Trains;" paper on "Interurban Freight and Express;" paper on "Tickets and Rates;" paper or discussion on "City, Suburban, Interurban and Railroad Traffic."



END VIEW OF STATE FAIR BUILDINGS, WHERE CONVENTION WILL BE HELD

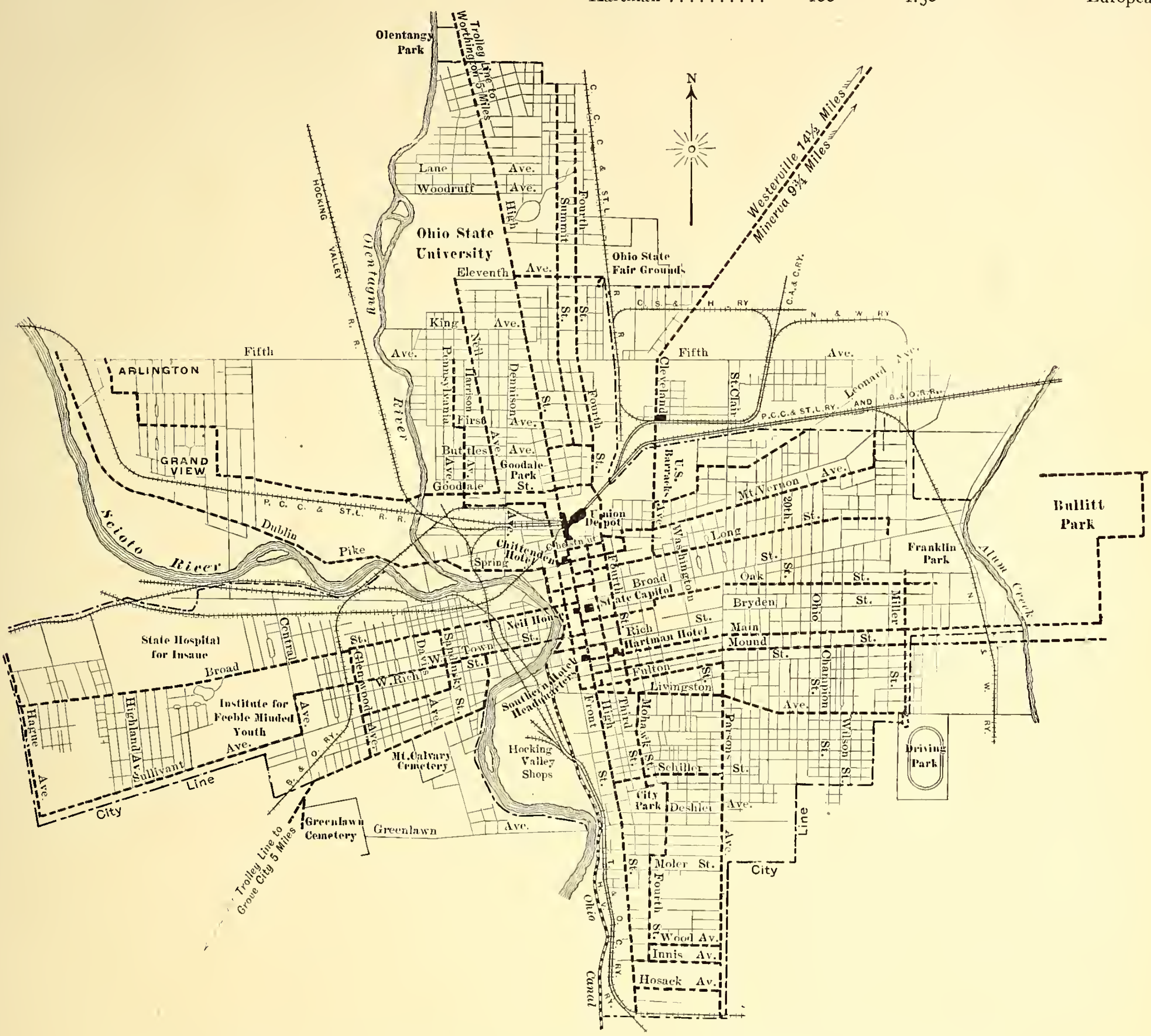
On Thursday afternoon, the session will be devoted to the subject of employees, with the following reports and papers: Report of Committee on Welfare Work; report of Committee on Rules; paper on "Y. M. C. A. Branches;" paper on "Instruction of Train Men;" paper on "Discipline of Train Men;" paper on "Uniforms and Badges."



SIDE VIEW OF STATE FAIR BUILDINGS, COLUMBUS

The session Friday morning will be an executive session, and Friday afternoon will be devoted to a report of the Nominating Committee, election of officers and unfinished business. The banquet will be held Thursday evening at the Southern Hotel.

It has been decided to print in advance of the meeting all of the papers and reports of committees. The former will be presented at the meeting in abstract only, and the speakers will be limited to a certain length of time, say five minutes, in which to outline their papers and bring out the principal points in connection with them. The object of this plan is to give as much time to the discussion as possible, and an attempt will be made to make preliminary arrangements by which certain members will agree to open the discussion or otherwise contribute to it. Written discussions from any who are unavoidably prevented from attending the meetings will also be welcomed.



MAP OF COLUMBUS, SHOWING LOCATION OF STATE FAIR GROUNDS, PRINCIPAL HOTELS, ETC.

The convention programs of the Accountants', Engineering and Claim Agents' associations have not yet been announced, but will probably be made public soon.

THE HOTEL ACCOMMODATIONS

As Columbus is somewhat smaller in size than any city at which the association has met for several years, some doubt has been expressed as to whether the hotel facilities would be sufficient to accommodate the association. To remove this impression the Board of Trade has submitted to the secretary of the association a list of the principal hotels in Columbus, with the number of rooms available, rate and plan. As will be seen, this list shows 1143 rooms. This list does not give the capacities of the hotels, but the number of rooms which each in October can easily furnish for convention purposes. Assurances have been received, however, from the proprietors of the leading hotels that the numbers mentioned in this list can be increased if necessary. The figures, therefore, give only approximately the number of rooms available.

SCHEDULE OF ROOMS AVAILABLE IN COLUMBUS DURING CONVENTION

Name of Hotel	No. of Rooms Available	Rate	Plan
Chittenden	175	$3.00 and upwards	American
Neil	90	1.50 "	European
Southern	175	2.50 "	American
Hartman	100	1.50 "	European
Newell	35	1.00 and upwards	European
Vendome	30	2.00 "	American
Lincoln	40	2.00 "	American
Bryden	25	2.00 "	American
Normandie	15	2.00	American
Columbus Club	4	Private	
Hutchins' Farm	4	Private	
Davidson Hotel	40	$2.00	American
Emerson	40	1.50	American
Star	75	1.00 and upwards	European
American	25	2.00	American
Kramer's	25	1.00 and upwards	European
Park	75	2.00 and $2.50	American
Lenox	20	2.00	American
Dennison	20	2.00	American
Capitol	20	2.00	American
Arcade	20	2.00	American
Norwich	40	2.00	American
Lexington	10	2.00	American
Roanoke	10	2.00	American
Richelieu	20	2.00	American
Llewelyn	10	2.00	American
	1,143		

THE SOUTHWESTERN ELECTRIC & GAS ASSOCIATION CONVENTION

The Southwestern Electric & Gas Association held its convention, May 16, 17 and 18, at the Tremont Hotel, Galveston, Texas. There was a good attendance. Arrangements for the entertainment of the convention were well looked after by H. S. Cooper, general manager of the Galveston Electric Company, and chairman of the local committee. The first session was called to order Wednesday morning at 10:30 by President M. M. Phinney, of Dallas, the general representative for Texas of Stone & Webster. He introduced Mayor H. C. Landes, of Galveston, who read a short address of welcome. This address was responded to by W. T. Edgar, of Waco. Secretary Frank J. Duffy, of Beaumont, then read the list of applicants for membership, of which there were sixteen for active and seven for associate membership, making twenty-three in all. The active membership of the association (that is, operating companies) is now eighty-three.

President Phinney, in his address, spoke of the enterprise of Galveston, which was manifested on every side in the reconstruction and grade raising that had followed the great storm and disaster of 1900. He hoped the convention might absorb and be inspired with some of this same energy and progressive spirit. During the past year the attempt of the association to establish permanent headquarters in charge of an assistant secretary at Dallas had been defeated by the removal in turn from Dallas of both of the men appointed, so that the office was now vacant. Nevertheless, if they could get an assistant secretary who would not move away he thought it well to maintain the office. He expressed his belief that the regulation of public service corporations is a good thing if intelligently done, and if plain, simple laws are in force. Many regulating bills were introduced at each session of the legislature. The legislature naturally looked to the members of the association for information on how the proposed measures would affect their business. He advised for this purpose the formation of a legislative committee to be made up of the best posted and most experienced men in the business. The committee should be prepared to furnish absolutely accurate information on technical and business questions raised by the legislation proposed. Finally they should never lose sight of the fact that they were public service corporations and should impress this on all employees.

A nominating committee was appointed, consisting of H. S. Cooper, of Galveston; Frank J. Duffy, of Beaumont; R. B. Stitcher, of Sherman, and Samuel Kahn, of San Antonio. G. C. Gum then read a paper entitled "Up-to-Date Methods of Increasing the Business of Public Service Corporations." It was devoted principally to electric lighting and gas methods.

On Wednesday afternoon the gas men had the floor for a time with a letter on "Retort House Practice," by Frederick Egner. After this a discussion of some of the Question Box queries was taken up. H. S. Cooper invited all who wished, to spend the evening at Garden Verein. This invitation was accepted by a large number.

On Thursday morning, at the opening of the session, invitations for meeting next year in San Antonio and Dallas were extended by representatives of those cities. No action was taken, as the matter is in the hands of the Executive Committee. The invitation from San Antonio was from H. M. Littell, general manager of the traction and lighting companies of San Antonio, and from the mayor and Business Men's Club, of that city. Dallas' invitation was given by Sam Hobson, of the Hobson Electric Company, of Dallas.

A paper on "What is Electricity?" was then presented by S. J. H. White. In this paper the author took up some theories he had worked out to explain electrical phenomena.

Frank J. Duffy, manager of the Beaumont Traction Company, then read a paper on the "Relations of Public Service Employees to the Public." An abstract of the paper and discussion follows:

RELATIONS OF PUBLIC SERVICE EMPLOYEES TO THE PUBLIC

In this paper Mr. Duffy discussed the qualifications of public service employees. He said, among other things, that they should not only be intelligent, capable, and upright, but they should be industrious, of quick perception and of good judgment and capable of accommodating themselves to all classes of people, even the most unreasonable. Politeness and diplomacy should be the aim of public service employees, as the public is inclined to judge a company by the acts of its employees.

DISCUSSION ON METHODS OF DISCIPLINE

Following the paper by Frank J. Duffy, on "Relations of Public Service Employees to the Public," several Question Box questions along the same line were discussed.

H. S. Cooper made the point that it was absolutely necessary for the officers of the company to set a good example to those below them. Example counts for more than talk without the example. Among other things, the company should impress its men with its desire to be absolutely honest in all its dealings and expect its men to be the same. If the officers cannot set the example for those under them they have lost the main thing with which they can control their forces.

H. T. Edgar, of Ft. Worth, thought trainmen were in a more difficult position because there were always certain fault-finding persons to deal with that took a great deal of patience. Such persons treated the trainmen as if they were below them and made it generally disagreeable for them. On the other hand, this attitude of part of the public was partly caused by the rude class of men sometimes employed in this work.

David Daly, of Houston, spoke of an attitude on the part of employees which he had to combat, viz., that of immediately putting themselves on the defensive and attempting to justify whatever an employee of the company had done, rather than presuming that the complainant was in the right and had some real grievance.

Mr. Cooper when hiring a man, among other things, put him under the instruction of the claim agent as to the making out of accident reports and the course to pursue in case of accident. Failure to report an accident was considered a serious offense. If a man showed himself lax about any duty or rule he was put back as a student under instruction of some other good man for a time. For an old man this was considered a serious punishment, and the offender would strenuously seek to avoid a repetition of it.

W. H. Young, of Austin, had been studying the reports made by various companies to the Secretary of State, and found that Mr. Cooper's system of handling employees and accident claims was evidently successful, as he had one of the lowest accident accounts of any city, being less than 1 per cent of the gross receipts. At Austin the company had paid out 4 per cent, owing mainly to one costly accident. He had adopted the plan of paying a premium of 1 cent per hour to conductors and motormen, and as a result the company had had to pay nothing for accidents for a period of six months.

President Phinney, of Dallas, objected to this plan on the ground that it encouraged men not to make reports of accidents, but Mr. Young explained that the number of accidents reported had nothing to do with the matter. It was the amount that a man's accidents actually cost the company in claims that reduced or wiped out his premium. There had been an increase of 100 per cent in the number of accidents reported, but a decrease in the amount paid in claims, as compared to a year ago.

Immediately after the noon meal cars were in waiting to take the whole convention party to visit the grade raising operations, and enjoy the interesting spectacle of one of the largest dredge boats in the world pumping its cargo of sand into a long pipe line and discharging it several blocks inland. The process followed was described in an article by Mr. Cooper in the Street Railway Journal for May 12.

At 4 P. M., the party having returned to the hotel, the convention was called to order, and a paper on "Care, Maintenance and Inspection of Street Railway Rolling Stock" was read by Mr. Cooper. An abstract of the paper and discussion follows:

CARE, MAINTENANCE AND INSPECTION OF STREET RAILWAY ROLLING STOCK

Mr. Cooper's paper was a plea in favor of the greatest care in maintenance. According to the speaker, "Some build rolling stock, others buy rolling stock, but many have rolling stock thrust upon them!" and to those who are in the third class maintenance is especially important. Depreciation can best be reduced by prevention and inspection, and the author suggested five rules to prevent troubles:

First. A few practical and reasonable rules, strictly and impartially enforced.

Second. A few simple forms that trace each car and its condition from man to man, over their signatures.

Third. An equitable system of punishments, including cash reimbursement to the company, for unnecessary maintenance expense entailed on it by the neglect, disobedience or carelessness of an employee.

Fourth. A simple system of reward for suggestions toward, or results tending to, lessening of maintenance expense.

Fifth. A system of inspection that not only inspects fully, but that also criticises and suggests.

Accompanying the rules should be some system of rewards for extra exertion or care in preserving apparatus. The rewards need not be cash, in fact, they had always better be something else, if possible—a posted public notice of commendation, a temporary or permanent change to a more pleasant or more profitable run or employment, a day or two vacation with wages—any small thing to show that the company appreciates extra interest and exertion that goes to benefit maintenance. The inspection should inspect, should criticise, should suggest and should follow up its own criticisms and suggestions when they are carried out.

The employees should be trained to care for the company's property as if it was their own, and the best motormen and conductors can be appointed as trainers for the new men. Suggestions for improving the maintenance should be encouraged from the employees. The greatest expense in railway operation is for labor, and liberality in repairs and material is in the end real economy, if it makes the labor more efficient.

The manager should keep ahead of his depreciation. He should renew the bearings before they cut the axle or scrape the armature, should replace the brake-shoes before they commence to mis-shape the wheels, change a worn-out wheel before it flats and fix a commutator or brush holder before it flashes. Some managers claim that they cannot do this, as they are a week or a month behind. If this is true it indicates that maintenance is proceeding at the same speed as depreciation, and it ought not to be very difficult, with a little extra exertion, to run even with or a little ahead of it instead of behind it.

Following Mr. Cooper's paper, Frank J. Duffy, of Beaumont, said that paint and varnish did not last nearly as long in Southern Texas as in northern cities.

Mr. Cooper found this true, and also said ash, the wood, should be avoided in cars, because of dry rot and worms. One of the commonest faults in car building was the failure to put enough lead on the joints. He aimed to repaint cars entirely every two years, and revarnish once between these times, which was about twice as often as he had found it necessary in other localities. Salt fogs were responsible for this. Green copper oxide from the trolley wheel and wire ran down the poles and ropes and helped spoil a car's appearance, in addition to the direct action of the fogs.

Mr. Daly, of Houston, had a similar experience. Cars bought last fall needed revarnishing now.

Mr. Young, of Austin, had for his principal equipment a lot of full-convertible cars. On account of accidents, when these cars were used as open cars, the company's last cars were made semi-convertible. These cars the company built itself. There had been some trouble originally from the rotting of canvas on the roofs of the cars. This fact suggested the very liberal use of paint on the canvas, and these roofs were easier to maintain. A large force of repair men is needed by any Texas company, because of the distance from manufacturing centers. To keep the force of trained men intact it could be used at odd times to build cars, a few at a time, to meet the growth of the road. It might not be feasible if a company wanted a large number of cars at once.

At the request of President Phinney, a short discussion of the relative merits of semi-convertible vs. a double equipment of car bodies for Texas was had.

Messrs. Cooper, of Galveston; Duffy, of Beaumont, and Daly, of Houston, favored fully open cars for summer. They thought people demanded the open cars.

Mr. Young, of Austin, favored the semi-convertible car.

Mr. Cooper uses two conductors on very crowded open cars.

Mr. Phinney reported fewer accidents per 100,000 passengers in Dallas with open cars than with closed.

In the evening, the Sons of Jove, an order which originated at one of the Southwestern conventions several years ago, held a grand rejuvenation, and after parading the streets in costume with the candidates for admission tied to a long rope, as is the custom of the order, initiated a number of new candidates.

Friday morning a paper was read by F. W. Yensen on "Telephone Engineering Problems," and A. W. Q. Birtwell presented a paper on "Organization and Operation of Purchasing and Supply Departments," which stirred up an animated discussion on the question of employing a regular storekeeper or stock clerk in a small company.

A letter was read from a member asking that some action be taken toward securing better insurance rates for electrically-lighted properties than on those lighted with gasoline vapor or acetylene plants. The matter was referred to the executive committee.

F. M. Lege, of the Finance Committee, reported auditing the accounts of A. E. Judge, treasurer, which showed receipts of $1,211.93 and $713.32 paid out, leaving a balance of $498.61. Secretary Frank J. Duffy made his report, which showed that the active membership had increased from 65 to 83 during the past year. The Nominating Committee reported the following ticket of officers, who were elected:

President, H. S. Cooper, of Galveston; first vice-president,

J. W. McLendon, of Fayetteville, Ark.; second vice-president, J. P. Crerar, of Denison, Tex.; third vice-president, Samuel Kahn, of San Antonio; secretary, E. B. Meginnis, of Dallas; treasurer, A. E. Judge, of Tyler. Executive Committee, H. S. Cooper, J. W. McLendon, J. P. Crerar, Samuel Kahn, M. M. Phinney, H. T. Edgar, J. F. Strickland, R. B. Stitcher, F. J. Duffy, E. B. Meginnis. Finance Committee, F. M. Lege, J. J. King, W. H. Young. Advisory Committee, J. E. Farnsworth, H. M. Littell, C. W. Ford, C. H. Dunbar, E. D. Kelley, E. M. Cooper, David Daly, C. W. Kellogg, W. Burns Head.

Friday afternoon, a special boat was put at the disposal of the party, which took a trip of about four miles to the entrance to the harbor to see the work done on the jetties.

H. S. Cooper, the new president, is well known in the street railway field. He was born in Isle of Wight, Eng., in 1856, and in 1876 he became a manufacturer of agricultural machinery in the South. This connection brought him in touch with electrical enterprises, and gave him an experience that later made it possible for him to reorganize and place many unstable properties on a profitable basis. His record in this line secured for him, in 1893, the position of general manager of the Schenectady Railway Company, including the entire electric lighting, railway and power service of the city, which was then in the hands of a receiver. Under Mr. Cooper's management these properties were placed in excellent physical condition and placed on a paying basis. His next important work was with the Ithaca Railway Company, of Ithaca, N. Y., which was also rehabilitated under his management. Mr. Cooper then organized the Electrical Engineering and Development Company, of New York, and made critical reports on all kinds of electrical propositions for clients, and so added to his already wide experience. In 1904, he accepted the position of general manager of the Galveston Electric Company.

ANNUAL MEETING OF NEW YORK STATE ASSOCIATION

Announcement is made that the twenty-fourth annual meeting of the Street Railway Association of the State of New York will be held at the Grand Union Hotel, Saratoga, N. Y., on June 26 and 27. On the first day, morning and afternoon sessions will be held, and on the second day, the morning session will be called at 9:30 and will continue until the business of the convention is completed. The annual banquet will be held at the Grand Union Hotel on Tuesday evening, June 26.

A considerable portion of the business sessions will be devoted to discussions on the reports of committees. During the past year a great amount of valuable work has been performed by special working committees and the various reports to be presented include matters of vital interest. Among the topics included in the committee reports will be the following: "Standard Application Blanks and Forms for Employees;" "Mechanical Statistics;" "Interchangeable Coupon Books;" "Station Rules," and "Revision of Constitution and By-Laws." Papers will also be presented on the important subject of "Sale of Water Power," and this topic will be discussed both from the standpoint of the power companies and of the consumers. Under this head it is expected an interesting review will be made of the water power situation in New York State, together with suggestions as to the proper basis upon which to formulate contracts for power. Arrangements have been made to have present representatives from the large power companies as well as from many of the consumers, in order to discuss both sides of the matter. There will also be presented a paper dealing with the subject of interurban railways, their development and their relation to steam roads. If time permits, a portion of one session will be devoted to an open Question Box, when opportunity will be given for asking and answering questions on practical topics.

Saratoga is the heart of a section famous for its attractive drives, walks, electric railway rides, etc., and the Entertainment Committee is arranging a series of attractive excursions and entertainments for the ladies and others during the two days of the convention.

It has been decided by the Executive Committee that no attempt will be made this year to arrange officially for exhibits of materials and supplies. The association, however, extends to representatives of manufacturing and supply houses a most cordial invitation to be present at the June meeting. Anyone desiring to make an exhibit or demonstration should make all arrangements with Messrs. Wooley & Gerrans, proprietors of the Grand Union Hotel, Saratoga, N. Y.

The Committee on Revision of Constitution and By-Laws has outlined a number of changes in the policy of the association, and it is probable that some action will be taken at the June meeting looking to the admission of associate members and of allied members. It is earnestly hoped, therefore, that companies who are not now members of the association will send representatives to the Saratoga meeting. It is stated that this invitation applies specifically to electric railway companies located in the States adjacent to New York, including particularly Pennsylvania, New Jersey, Ohio, Western Massachusetts and Connecticut, Vermont and Canada.

MOVING CABLE CONDUITS

A correspondent calls attention to the fact that a section of cable conduit in Kansas City was moved about 1900 in a very similar way to that recently done in San Francisco, and described on page 232 of the STREET RAILWAY JOURNAL for May 5. The Kansas City work, which was described in the STREET RAILWAY JOURNAL for July, 1900, page 660, involved the shifting of the double track curves at Eighth and Ninth streets with the connecting tangent tracks on Grand Avenue from a position running diagonally on Grand Avenue to the center of the street, also the rebuilding of the superstructure and the placing of new special work at the Eighth and Ninth Street ends. The curves were at the summits of steep grades and the Grand Avenue tracks about 4 ft. from their final location at each end.

The entire tracks were shifted bodily with the conduit, involving, because of the shortening of the distance, the cutting out of several feet of rails and conduit in each track. The system adopted in the execution of this work was quite similar to that adopted in San Francisco, skidding the entire mass on heavy planking by the use of heavy jacks and blocking.

The entire work was done without interruption of traffic and under the peculiar conditions of the location, as it was necessary for the grip cars to hold on to the rope and maintain speed until off of the curves and grades, unusual care was required to guard against accident to the traveling public and to those employed on the construction. Considerable interest was taken by the engineers and street railway men at the time of the execution of this contract, which was carried out by the Falk Company, of Milwaukee. W. Frank Carr, chief engineer of the Falk Company, had personal supervision of the work.

AN OPERATING DIFFICULTY IN SOUTHWEST MISSOURI

It is rather out of the ordinary for an electric railway line to employ an underground man, yet such is the case with the Southwest Missouri Electric Railway Company, operating between Carthage, Mo., and Galena, Kan. The road passes through a section thickly studded with lead and zinc mines. The ore occurs in pockets often an acre or more in area, and varying in thickness from a few feet to eighty or one hundred. To prevent miners working under the right of way of the railway company one man spends his time in inspecting the underground workings near the right of way. The necessity

CAVE IN ON THE DUNENWEG LINE OF THE SOUTHWEST MISSOURI ELECTRIC RAILWAY COMPANY

for doing so may be appreciated after noting the accompanying illustration, which shows a cave-in on the Dunenweg line operated by the company. The cave-in ground is an acre or more in area and about 60 ft. in depth. It occurred one night without previous warning. As the expense of filling up the cavity makes this out of question, the tracks will be changed to a new location entirely.

CORRESPONDENCE

TESTING ARMATURES IN THE WINDING ROOM

May 10, 1906.

EDITORS STREET RAILWAY JOURNAL:

I noticed in your April 7 issue an article signed "Armature Winder," giving some notes of armature room experience. I do not blame the writer for not giving his name, for with the conditions under which an armature winder has to work, he can hardly afford to make a public exposure of the ignorance of this foreman. I will tell of a joke that was played in our shop. In two days' time our foreman condemned six armatures, and would not let them be put in the cars. Some of them were new and some were second hand. I inspected them and could find nothing wrong, so I held them in the armature room for five or ten days. When I had an opportunity I painted them black, and sent them out on trial. The foreman lost track of them and the armatures proved satisfactory. I may have the wrong idea, still I think I am right when I say that a foreman should be a practical street railway man. A man who has dug ties out of the track, has worked two years or more in the pit and understands overhead work will make a more competent master mechanic, or foreman, than one who has simply been reading books and looking at pictures on a wall. The latter will tell the boys to put that armature in, feed up to full speed and plug on to 5 and 9. If it doesn't stay, he will say, "You made a mistake in your connections. Try it again." But he can't tell where the trouble is.

ANOTHER ARMATURE WINDER.

LOCATION OF INTERURBAN LINES

Kansas City, Mo., May 7, 1906.

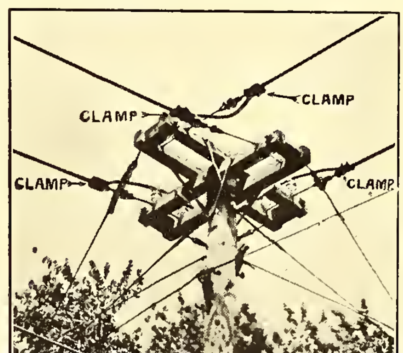
EDITORS STREET RAILWAY JOURNAL:

Your editorial, "Location of Interurban Lines," in the Feb. 10 issue, has just come to my notice. For more than two years our practice has been entirely in accord with the suggestions you make. Our proposed line, Kansas City to Iola, 110 miles, passes through Olathe, the county seat of Johnson County, and Ottawa, the county seat of Franklin County. Between the two terminal points it does not parallel any steam road, and will have a private right-of-way through the cities of Olathe and Ottawa. We believe it is better to put in the private right-of-way through cities at many times the cost of paving streets. By doing this we avoid many expensive annoyances incident to operating franchises through cities. It may not always be possible to do this for the entire distance within the city limits, but in most cases a private right-of-way can be had for the entire distance, and in many others for a greater portion.

HUGH A. HOLMES, PRESIDENT.

INTERESTING METHOD OF HANGING CABLES

The half-tone engraving herewith shows a pole owned by the Topeka Railway Company, of Topeka, Kan., and illustrates the method of turning a corner with two 500,000-cm cables by the use of four Kearney cable clamps. This work was done in very much less time than with the old methods of splicing the cables or using strand wire. At the same time a much neater and stronger piece of workmanship was secured.



POLE AT TOPEKA, KAN., SHOWING METHOD OF TURNING CABLES AT CORNERS

The Kearney cable clamp is being very generally and rapidly adopted by street railway companies all over the country. It is claimed that this device saves an immense amount of time, labor and material wherever cables of from 000 up to 1,500,000 cm have to be strung. The Topeka Railway Company has used nearly a thousand Kearney cable clamps in the past two years. W. N. Matthews & Bro., 217 North Second Street, St. Louis, who also handle the sale of the well-known Stombaugh guy anchor, are the manufacturers of the Kearney cable clamp.

NEW MATERIAL FOR CATENARY WORK

The Elmer P. Morris Company, of New York, is developing a line of material for use in connection with catenary construction, and in conjunction with the Oneida Railway Company, of Utica, which company is now electrifying the section of the West Shore Railroad between Utica and Syracuse, recently installed about 1000 ft. of overhead cantenary line at Reading, Pa., for the purpose of making certain tests.

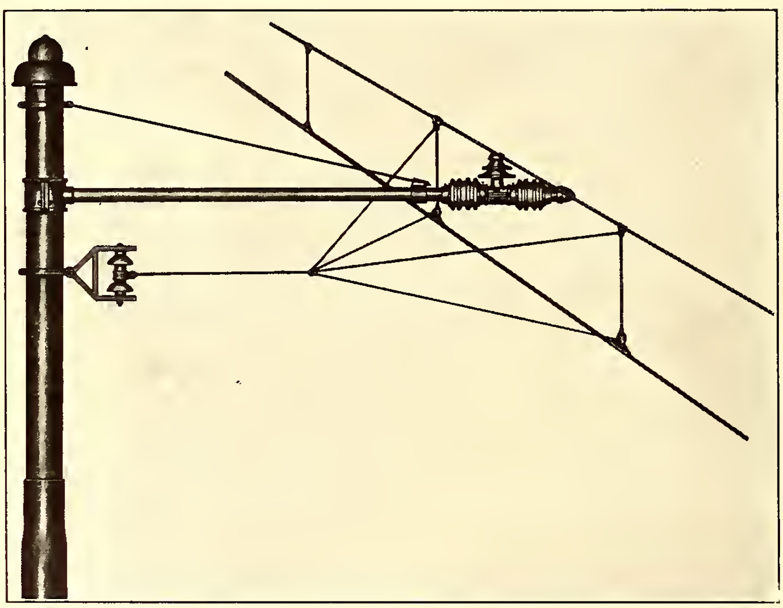
The line was supported on tubular iron poles, 48 ft. long, built in three sections, of which the lower section was 10 ins., the middle 9 ins. and the top section 8 ins. in diameter. The lower sections were "extra heavy" pipe, and the top or 8-in. section was standard weight. Each pole weighed approximately 2700 lbs. The line was built to secure as nearly as possible actual operating conditions.

The messenger wire was carried on a bracket arm by means of an insulator which was held in place by a special malleable-iron bracket pin, clamped around the bracket arm. This insulator was of well-known high-tension type, about 9 ins. high, and tested for 80,000 volts. Directly under this insulator and slipped under the bracket arm was a secondary insulator, consisting of porcelain spools, having grooves to catch the messenger wire in case the main insulator should break. This method of construction is the special improved feature on which Mr. Morris has obtained broad patents for making line construction of this character safe and positive. The advantages of this form of construction was claimed to be that at all times, irrespective of whether the main carrying insulator was broken, no interference to the service would occur, as the secondary insulator takes care of the lines in the same manner as other methods of construction now in vogue and prevents the messenger wire from coming in contact with the arm. Another feature of this method of construction is that the messenger wire may be composed of copper cable and used as a feed wire, while with the other methods of construction it is necessary to thoroughly insulate the messenger from the trolley. The views herewith shown indicate this method of construction.

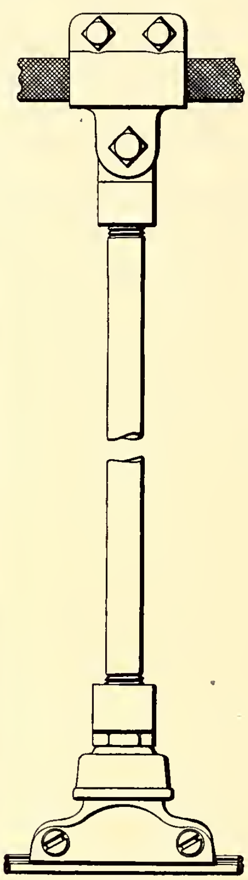
The catenary cable was composed of 5/8-in. extra heavy Siemens steel strand, covered with triple braid weather proof insulation, making a cable whose diameter was approximately 7/8 in. in diameter. This was hung with a sag of 5 ft. 5 ins. and from it was suspended a 0000 grooved trolley wire, the suspension being by means of spreaders of flat steel strips 1 in. x 1/8 in., spaced 10 ft. apart, and of varying lengths to suit the catenary curve. The spreaders were attached to the trolley wire by drop forged mechanical ears and to the messenger wire by a special clamp.

In future work of this kind it is the intention to strengthen the structure by the use of a special bridle, as shown in one of the illustrations. This bridle will be built of steel rods, centering in a common ring or eye guyed to the pole by a steel rod. In heavy service a special high-tension, 80,000-volt insulator of the form shown in one of the engravings will be used for fastening the bridle guy to the pole in the manner indicated. The bridle would serve as a side guy for both messenger and catenary, and in the case of a break in the messenger wire would prevent the rupture of the line from traveling beyond the next pole.

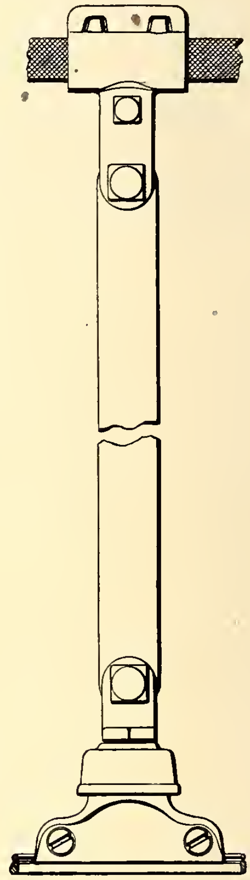
In the Reading installation the middle pole of the structure was side guyed with 5-16-in. cable to a Miller anchor. The tests were made on this middle pole, and were as follows:



SECTION OF CATENARY CONSTRUCTION, SHOWING BRIDLE GUY AT POLE



SPREADER MADE OF PIPE



SPREADER MADE OF FLAT STRAP

In Test No. 1, a 7-16-in. cable was attached at the top of the pole and extended in the direction opposite to the bracket, a distance of about 125 ft. to the ground, where the pull was to be made. At this point, a strain of 2050 lbs. was put on the pole, under which condition the pole was pulled considerably out of the perpendicular, due to the concrete foundation tipping. The pole itself seemed to be intact, the trouble appearing to be in the lack of resistance offered by the earth against the concrete foundation, which was approximately 3 ft. in diameter.

In Test No. 2, the pole was allowed to right itself as much as possible and was afterward pulled to its normal position. This left the original side guy tight, and a downward strain was put on the end of the bracket immediately under the catenary. The result of this, at a strain of 2000 lbs., was a permanent set of about 3 ins., in the bracket, the set appearing as a bow upward between the end of the tie rod and the pole.

In Test No. 3, the trolley was cut at approximately the middle of the 350-ft. section. The trolley slacked a little and the cut ends hung only a very few inches below the original horizontal position.

In Test No. 4, the trolley wire was first cut; then the catenary itself was cut at the dead-end stub. As the wire slacked off, it wrenched the bracket on the first pole to a position 90 degs. from its original position, snapping the casting on the under brace at the time. The middle bracket acted in the same manner, except that it did not turn the full 90 degs., nor was it in any way injured. The third bracket retained its position and also retained the catenary on the insulator. There was no effect of torsion on the pole as the bracket was fastened to it by means of a split collar, and this merely turned

RESULTS OF FINAL BREAKDOWN TESTS ON CATENARY AT READING, PA.

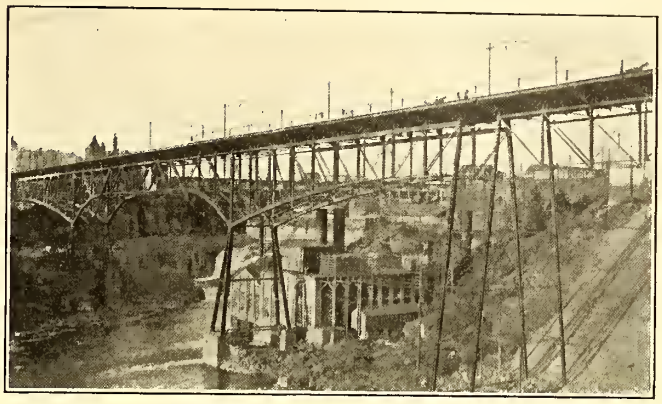
on the pole. The computed strain on the bracket, assuming the weight of the structure as 2 lbs. per foot, was approximately 5700 lbs. The entire catenary and trolley in the two full spans lay on the ground at the end of this test.

Among those present at the tests were the following: W. J. Harvie, electrical engineer of the Oneida Railway Company; C. B. Marsh, assistant bridge engineer of the New York Central & Hudson River Railroad; W. K. Archbold, of the Archbold-Brady Company; Charles H. Banghart, master mechanic of the New York & Queens County Railway Company; Elmer P. Morris, Robert Andrews, representing the Electric Railway Equipment Company; representatives of the Central Railroad of New Jersey, Pennsylvania Railroad and Reading Railway; and representatives of the technical press.

The Central Electric Railway Association has adopted a resolution of regret at the sad and untimely death of Joseph L. Breen, late general manager of The Peoples' Railway Company, of Dayton, Ohio. Mr. Breen was an active and efficient member of the association.

WASHINGTON WATER POWER COMPANY'S SYSTEM AND NEW EQUIPMENT

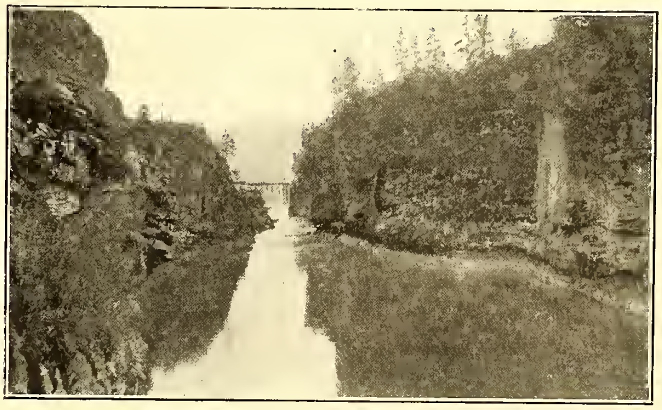
The Washington Water Power Company, of Spokane, Wash., has just received from the J. G. Brill Company twenty grooveless-post semi-convertible cars measuring 30 ft. 8 ins. over the bodies, four trailer interurban cars of the same type, 36 ft. over the bodies, and one combination passenger, smoking and baggage motor car, also having the semi-convertible



POWER HOUSE AND VIADUCT ON SPOKANE RIVER

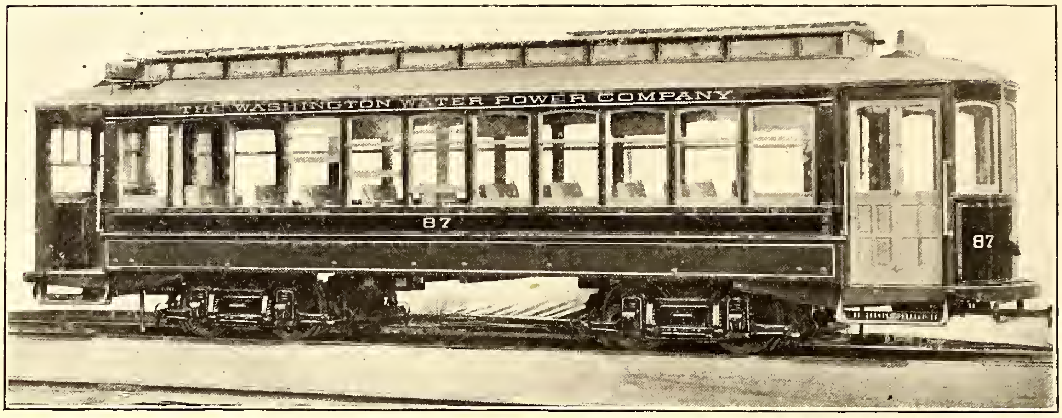
feature. The shorter cars are mounted on trucks of the 27-F1 type and the larger cars on 27-E1½ type, also of Brill manufacture. The entire equipment consists of Brill convertible and semi-convertible cars numbering seventy-five in all.

The Washington Water Power Company owns and operates the principal street railway system in Spokane, consisting of about 60 miles of track, and also a fifteen-mile line to the town of Medical Lake, for which the large cars are intended. About a year ago the Brill Company furnished three cars of practically the same type as the combination passenger, smoker and baggage shown herewith. These cars, with the new ones, will be run in trains of two cars each, and



POST FALLS, SITE OF NEW 18,000-HP POWER HOUSE OF WASHINGTON WATER POWER COMPANY

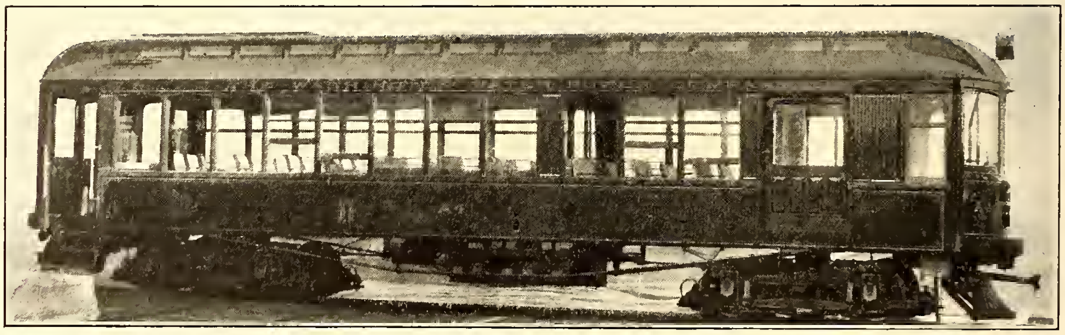
form as fine an interurban equipment as will be found anywhere in the country. When the Medical Lake line was opened a year ago, it was considered that the three combination cars would be able to take care of the traffic for some time to come, but the business increased at such a rate that a number of the large city cars were added to the regular schedule. Spokane has been for many years one of the most prosperous cities of the northwest. It is the center of a vast wheat producing section and of the mineral district of Eastern Washington. Its population numbers nearly 50,000. The railway company has a well laid out system in the city and suburbs, and owns a large power plant situated on the Spokane River just below the Spokane Falls, from which it derives its power. This plant at present has a capacity of 13,000 hp. Another plant is being constructed at Post Falls, twenty-five miles from the city, which will have a capacity of 18,000 hp. The water is converted from three channels into a huge natural basin between cliffs of rock, and a dam is substantially built from rock blasted out of the basin, part of which was converted on the spot into cement. The company furnishes power to the other street railways in Spokane and to several interurban lines and to the Coeur d'Alene lines. The various shops are of considerable size and all of modern construction, and a new car house, with a capacity of about 90 cars, has just been added. The heaviest traffic on the lines is to the pleasure park known as the Natatorium, owned and operated by the company, which includes swimming baths, a figure-eight roller coaster, "Ye Old Mill," circle swing and other amusements, and theatrical performances and concerts are given during the summer.



SEMI-CONVERTIBLE CAR FOR CITY SERVICE, WASHINGTON WATER POWER COMPANY

The line to Medical Lake, after leaving the city, crosses Hangman's Gulch on a high trestle and winds around a mountain up a 3-per cent grade for about five miles to a high plateau. The scenery along the route is very rugged and interesting, and fine views of the city of Spokane can be had from various points on the gradient. There are stations with platforms at the various villages and towns along the route, but most of the traffic is between the terminals. The products of a number of dairy farms are carried in the baggage compartments of the combination cars. Medical Lake takes its name from its famous curative properties. The water and the evaporated salts resulting from distillation are shipped to different parts of the country. The lake is one and a half miles long and a half mile wide, and is surrounded by an evergreen border of pine, fir and tannack. The town has a population of 2000, and includes the East Washington Hospital for the Insane, a large sanitarium and a number of hotels. An extension is proposed to Granite Lake, a few miles to the south of Medical Lake, where it is intended to establish an amusement park. The waters of the lake teem with fish and the bathing and boating facilities are excellent.

The cars for city service have the following dimensions: Length over all, 30 ft. 8 ins., and over vestibule, 41 ft.; width over sills, including panels, 8 ft. 2½ ins.; over posts at belt, 8 ft. 6 ins.; thickness of side sills, 4 ft. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, 15 ins. x ⅞ ins., are on the inside of the side sills. The cars are finished in ash with decorated birch ceilings. The cars have seats for forty-four passengers. The truck-wheel base is 4 ft.; wheel diameter, 33 ins. The combination passenger, smoking and baggage car measures 41 ft. 8 ins. over the body, and 46 ft. 6 ins. over the vestibules; the width over sills, including sheathing, is 8 ft. 8 ins.; height from track over the trolley boards, 12 ft. 8⅞ ins.; thickness of the side sills, 4 ins. x 8¾ ins.; end sills, 5¼ ins. x 6⅞ ins., and sill plates, 15 ins. x ⅜ ins. The car has double flooring for the entire width. The straight passenger compartment seats thirty-two passengers, and the smoking compartment twelve passengers. The motorman's compartment is separated from the baggage compartment with a partition having sliding door. At either end of the compartment are windows with the lower sashes arranged to be raised. The central sash of the vestibule may be lowered into a pocket, while the sashes at either side are stationary. Entrances are either side of the platform at the rear end. A center door in the rear vestibule gives access to the trailer car, which is also provided with a vestibule center door. The car is intended for operation in one direction, and is provided with a pilot at the forward end. Besides the extra wide sill plates, which have been mentioned, the bottom frame includes under trusses and double-trussed needle beams. The trailer cars measure 36 ft. over the bodies and 46 ft. over forward vestibules and rear platform crown piece. The width over sills, including sheathing, is 8 ft. 8 ins., and the dimensions of the bottom framing are the same as the motor car. These cars seat fifty passengers. In one corner at the rear of the car is a toilet room of standard character. The toilet room is lighted with an oval window, and water tank for closet is placed under the roof and arranged to be filled from outside of roof. The rear platform is adapted to observation purposes by the enclosure of substantial railings, gates at entrances and trap doors over steps. The forward end is vestibuled to correspond with the rear end of the motor car.

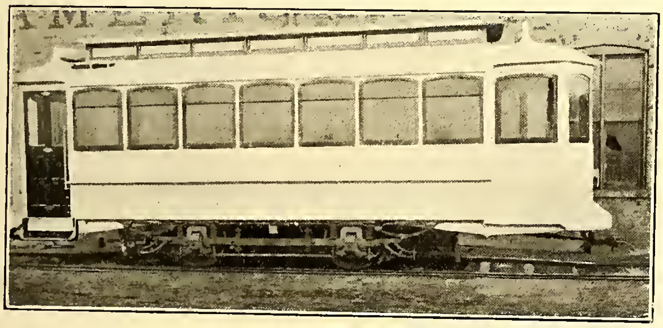

COMBINATION COMPARTMENT CAR, WASHINGTON WATER POWER COMPANY

Both types of cars are finished in quartered oak, stained dark and rubbed to a dull finish, and the ceilings are also quartered oak. Three-bar window guards are placed on the left side of the cars and extend from end to end. The cars are coupled with channel radial drawbars of Brill patented make. Other furnishings of same make include angle-iron bumpers, ratchet brake handles and "Retriever" signal bells. The cars are mounted on high-speed trucks of the Brill 27-E-1½ type with 6-ft. wheel base, 33-in. wheels and 4¾-in. axles. The trucks of the motor car are equipped with four 75-hp motors. Both city and interurban cars are furnished with seats of the Brill Company, the seats for the city cars being 36 ins. long, and those for the interurban cars, 38 ins. long. The seats are equipped with corner grab handles.

NEW EQUIPMENT FOR DUBUQUE, IOWA

The Union Electric Company, of Dubuque, Ia., which controls and operates the electric railway as well as the lighting system of that city, has recently added to its equipment some open and closed cars built by the American Car Company, and which are shown in the accompanying engravings. The company has made a number of important improvements in its railway system within the past two years, chief among them being the installation of a large new turbine plant for the combined operation of the electric railway, power and light circuits, and many special features have been incorporated which will make the plant one of the most modern in the country. This plant is situated near the Mississippi water front, in order to obtain the advantages of an abundant supply of water for condensing purposes. The rolling stock operated on the lines has been almost completely replaced within the past few years, and certain portions of the track system have been entirely rebuilt. A new car house and repair shop are also among recent additions.

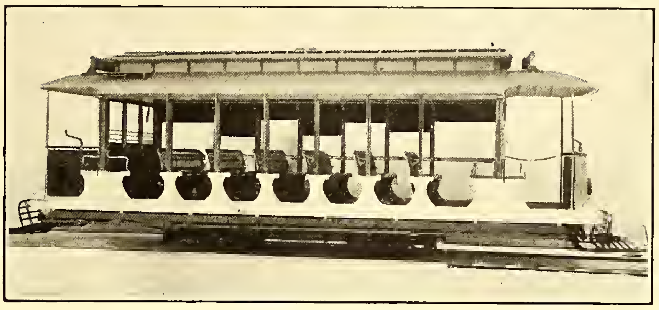
The system provides for the operation normally of about twenty-five cars, the trackage of the lines (which are single



EXTERIOR CLOSED CAR FOR DUBUQUE, IA.

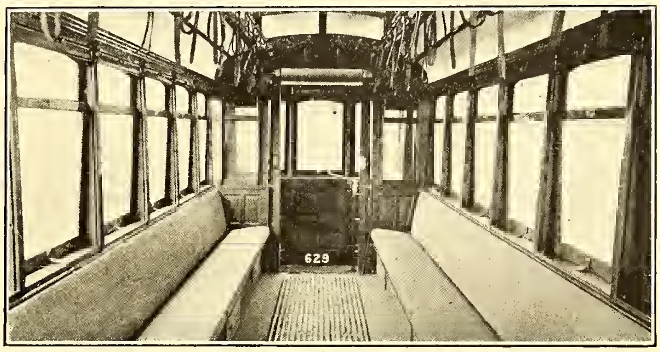
track) extending for about twenty miles. Among the places of interest reached by the lines are Union and Nutwood parks, both owned by the railway company; Ball Park is also easy of access by trolley. The city itself is second in size in the State, and has a population of 37,000. Four railroads connect it with Chicago, 150 miles to the west. The business portion occupies a terrace at no great height above the river and the rest of the city is picturesquely situated on the bluffs behind. As a port of delivery, railway junction and the center of the lead region of Iowa, Dubuque has an extensive and varied trade and engages in a large number of manufacturing industries. From 5,000,000 to 7,000,000 tons of ore are annually smelted in the vicinity, yielding about 70 per cent lead.

The closed cars measure 20 ft. over the body, and 29 ft. over the vestibules. The width over sills, including plates, is 6 ft. 3 ins., and over posts at belt, 7 ft. 5½ ins. The sweep of the posts is 8 ins; thickness of the side sills, 4¾ ins. x 7¾ ins., and center sills, 2¾ ins. x 5¼ ins.; end sills, 4 ins. x 5¾ ins. The interiors are finished in cherry with birch ceilings. The longitudinal seats are upholstered in spring cane, with the cushions in two sections. The seats have front panels with three electric heaters in each side of the car. Entrance is at one side only of the vestibuled platforms, and mutually operating double doors are in the body ends. All of the window sashes, both in the body and in the vestibule, are arranged to drop, with the exception of the small upper side sash, which is stationary. The 10-bench open cars are 20



OPEN CAR FOR DUBUQUE, IA.

ft. 11 ins. over the end post centers; 29 ft. 11 ins. over crown pieces; width over the sills, including the sill plates, 6 ft. 7¾ ins., and over the posts at seat ends, 7 ft. 4 ins.; sweep of the posts, 4 ⅜ ins; centers of the posts, 2 ft. 8 ins. The side sills are 4¼ ins. x 7 ins., with 8-in. x ⅝-in. sill plates on the outside. The cross members are 2¾ ins. x 5½ ins., and the crown pieces, 3¾ ins. x 15 ins. The cars are all mounted on Brill 21-E trucks, which are made with a wheel base of 8 ft., and have 33-in. wheels and 4¼-in. axles. Two motors, 40-hp capacity, are used on each car. The cars were shipped "in



INTERIOR CLOSED CAR FOR DUBUQUE, IA.

the white." The weight of closed car and truck, without motors, is 11,000 lbs.; the open car, with truck and without motors, weighs 12,800 lbs.

It is reported that the same interests which recently purchased from Wehrner, Beit & Company, of London, control of the Mexico City Street Railway lines, has also concluded negotiations for the purchase of the street railway and lighting interests at Pueblo, and that by Jan. 1, 1907, the Mexican Light & Power Company, whose interests are closely allied with the new Canadian syndicate, will enter Pueblo with electric power from Necaxa, and at the same time, the power transmission lines of the company will be extended to Pachuca, in order to supply electric power to the mines of Pachuca, Real del Monte, Zimapan, and neighboring mining districts.

THE BACKSTROM-SMITH STEAM TURBINE

The successful testing recently of the first Backstrom-Smith turbine in the Oneida Street plant of the Milwaukee Electric Railway Company, may be taken as marking an important step in turbine engineering. This turbine operates under constant stage-pressures in varying quantities to suit varying loads from the maximum down to the minimum and is instantly available for either condensing or non-condensing work, the output of the machine remaining unchanged. Another important feature of this machine is the simplicity of its mechanism and the ingenious methods of construction, which make it at once a commercial proposition. In a general way, this turbine may be described as multi-cellular of the inflow type (independently proposed and developed by C. A. Backstrom). The general form is shown in Figs. 1 and 2. Special means are provided for direct coupling to the alternator and exciter.

In order to do for the turbine what the Corliss valve did for the reciprocating engine, this turbine, for the first time in the art, it is claimed, is provided with means for meeting the requirements of changing loads without throttling, making it nearly as economical for light loads as for the heaviest. This object is accomplished by using flexible steel bands, which are secured to the periphery of the nozzle sections and to spools or rollers (Fig. 3) mounted on a collar or ring, which has a limited rotary travel around the housing in which each turbine wheel revolves. A movement of this collar winds or unwinds the steel tape on each of the spools, uncovering or covering the series of nozzles or ports, which admit steam to the active buckets of the turbine wheels. This winding or unwinding of the steel tape is automatic, the device being so arranged that the flow of steam is always in proportion to the load, steam entering the different stages at a pre-determined and constant pressure but in varying quantities, which depend upon the number of nozzles covered or uncovered by the steel tapes. This automatic regulation is accomplished by means of a shaft running the full length of the turbine in the bottom of the housings. At proper intervals on this shaft are keyed pinions which engage corresponding teeth, cut in the ring or collar on which the several tape rollers are mounted, these rollers engaging with short racks secured to the nozzle ring or housing. The minutest motion of the shaft results in winding or unwinding the tape on the rollers, thus closing or opening more or less of the nozzles. The motions of the shaft operating this ingenious cut-off mechanism are controlled by the governor shown at the left in Fig. 1. The governor controls a flow of oil under constant pressure, which, by means of a pressure cylinder and a rack and pinion, rotates the shaft in one or the other direction. The governor is dependent upon the proper action of the lubricating mechanism, as any accident to the latter results in an automatic stopping of the turbine which insures the machine against self-destruction. In addition to this governor, with its two important functions, a safety device is provided in the shape of a safety governor controlling a butterfly valve, which closes automatically when the turbine speed reaches 5 per cent above the normal, and is otherwise inoperative.

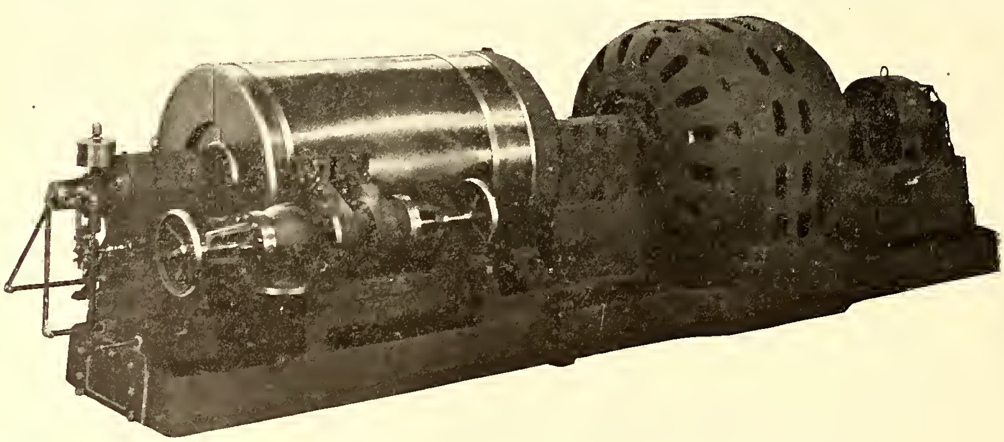


FIG. 1.—GENERAL VIEW OF BLACKSTROM-SMITH STEAM TURBINE

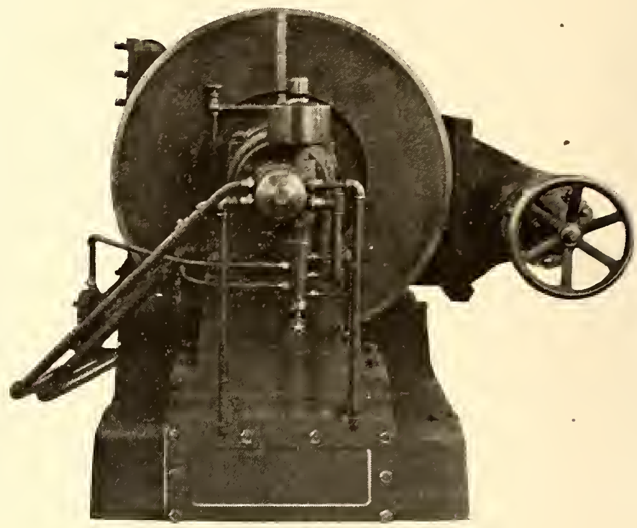


FIG. 2.—END VIEW OF TURBINE

In the size illustrated (400 kw), recently tested in the Oneida Street plant of the Milwaukee Electric Railway Company, there are ten turbine wheels or runners, the general form of which is shown in the vertical figure in Fig. 4. This figure illustrates a runner in one of the earlier stages, the bucket face of each successive wheel being wider. All the runners have an equal number of buckets of a uniform cross-section. This feature applies also to the nozzles.

It is held that superheated steam is not as essential to the economical operation of this turbine as in others. In the first place, it is claimed that there is a minimum of condensation, because of the constant pressure and temperature maintained at all loads in all the stages of the turbine. The next contention is that all the water contained in the steam is separated from it and that this drained into the succeeding stage by automatic means, is at once in part, if not wholly, re-evaporated, thus becoming useful energy. Again, by using high-steam velocities, the surplus velocity appears in the form of superheat—which greatly reduces internal condensation and skin-friction. As an illustration, steam at 150-lbs. gage pressure reaches the first stage of the turbine at a temperature of 366 deg. F. Any water contained in this steam (having naturally the same temperature) is separated from it, falling to the bottom of the stage chamber, from which it passes through an automatic device into the second stage, where the pressure is, say, 91 lbs. and the temperature 332 degs. F. An instantaneous evaporation naturally follows from these differences in pressures and temperatures.

A turbine of this type built and installed for use in connection with a condenser is arranged so that it may be quickly converted into an economical non-condensing type, should the condensing apparatus get out of order or become inoperative. This is done by providing an auxiliary exhaust at a point favorable for exhaust to atmosphere. This early exhaust relieves the turbine from a certain amount of back pressure which would arise from forcing a large volume of already fully expanded steam through a number of useless and idle turbine wheels, causing a considerably reduced efficiency and other unfavorable effects. The narrower opening in the housing, shown in the center of the turbine in Fig. 2, illustrates the auxiliary exhaust, while the wider opening at the end is the exhaust to the condenser. A permanent provision for operation under overload, with or without condenser, is provided through the valve shown at the right in Fig. 1. This valve may be operated by hand or it may be under direct control of the governor.

FIG. 3.—PORTION OF DEVICE FOR REGULATING STEAM SUPPLY

The builders have in operation a system by which the buckets to each of the wheels are cast in sections, all machining of these difficult and important parts being dispensed with. This is accomplished by the liberal use of finely polished, non-corrosive nickel steel to produce, in a practical way, an inexpensive and very effective casing for runner-buckets, as well as linings for nozzle openings, cast into attachable sections, as shown in Fig. 4. Assembling is facilitated by the fact that the turbine is made in independent standardised sections easily bolted to each other in erecting. The usual practice of making parts in halves is not resorted to, and yet any part is readily accessible and can be easily replaced when repairs are necessary.

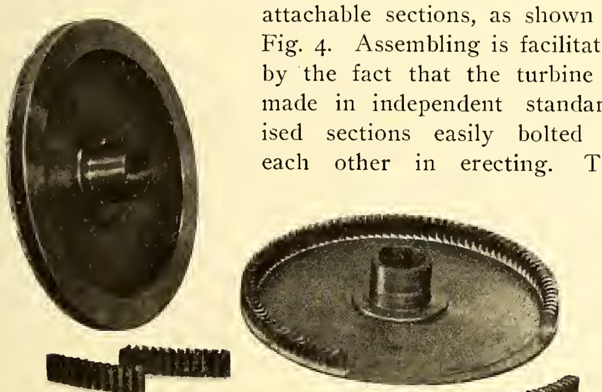


FIG. 4.—PORTIONS OF TURBINE WHEELS

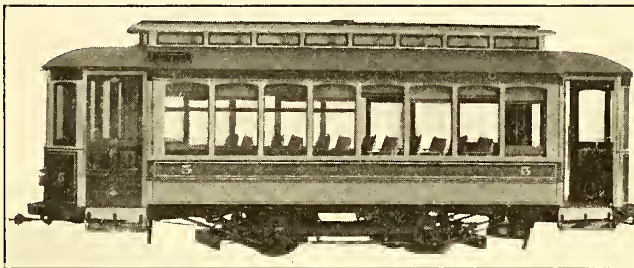
The builders are now prepared to take orders for short delivery for units not less than 400 kw nor more than 2500 kw. A new type of alternator, recently perfected by the Western Electric Company, will be used in connection with this turbine.

The Dayton & Troy, Western Ohio and Toledo Urban & Interurban lines have established through limited service from Dayton to Toledo. The distance is 162 miles, and the schedule is 5 hours and 51 minutes, and there is a limited car every two hours. This is the longest interurban run in this country, being 25 miles longer than the run from Indianapolis to Ft. Wayne, which previously held the record.

GROOVELESS-POST SEMI-CONVERTIBLE CARS FOR CHILLICOTHE, OHIO

Four single-truck, grooveless-post, semi-convertible cars of the Brill type, built by the G. C. Kuhlman Car Company, have lately been received by the Chillicothe Electric Railroad, Light & Power Company. Chillicothe is thirty miles directly south of Columbus, with which it is connected by the Scioto Valley Traction Company's interurban lines, as well as by steam lines. Another interurban line is planned to connect the city with Cincinnati, forty miles to the west. The city lies in a rich agricultural district and has excellent facilities for transporting products by the Baltimore & Ohio Southwestern, the Norfolk & Western and the Cincinnati, Dayton & Hamilton.

The new cars have the standard features and dimensions for this single-truck, semi-convertible type, being 20 ft. 8 ins. over the bodies and 30 ft. 1 in. over the crown pieces. The interiors are finished in cherry, with birch veneer ceilings. The incandescent lamps are placed singly at intervals under the monitor deck and along the lower ventilator rails. Push-over seats with corner grab handles are of Brill manufacture, and other specialties of the same make include angle-iron bumpers, folding-door controllers, ratchet brake handles and radial drawbars, "Dumpit" sand boxes, "Dedenda" platform gongs and "Retriever" signal bells. The width of the cars over the posts is 8 ins., and as the walls are without window pockets they are but 2 ins. thick, leaving an interior width of 7 ft. 8 ins. to be divided between seats and aisle. The seat cushions are 35 ins. long, and the aisle 22 ins. wide. The longitudinal corner seats are 31 ins. long. The bottom frame includes 12-ins. x 3/8-in. steel plates, and the side sills are 3 3/8 ins. x 5 ins. thick; end sills 3 1/2 x 8 3/8 ins.; thickness of the corner posts, 3 5/8 ins., and the side posts, 2 3/4 ins. The cars are mounted on No. 21-E trucks, which have a wheel base of 7 ft. 6 ins., and 33-in. wheels. Two 25-hp motors are used per truck.



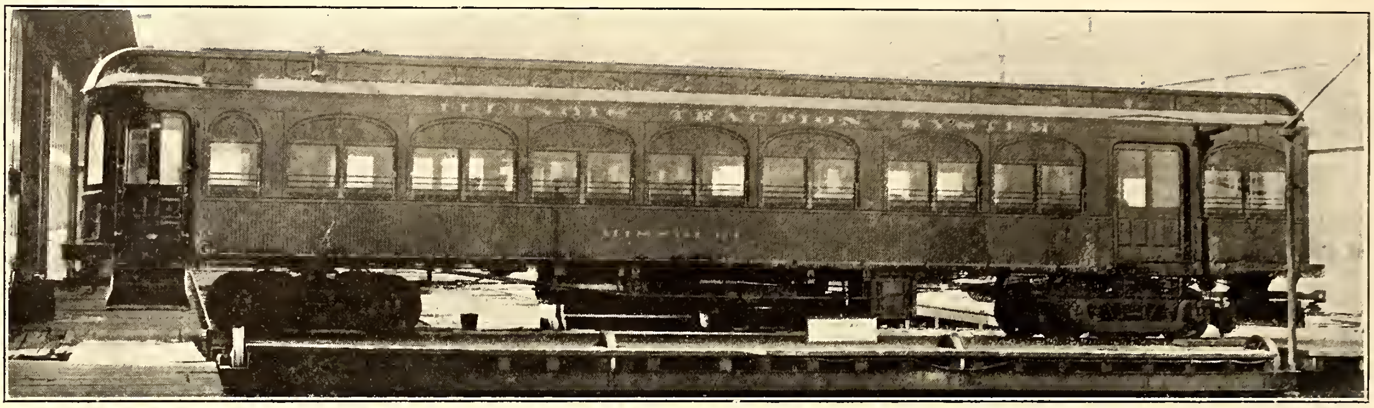
SEMI-CONVERTIBLE CAR FOR CHILLICOTHE ELECTRIC RAILROAD, LIGHT & POWER COMPANY

BASEBALL TROLLEY LEAGUE IN WHICH SIX CITIES ARE REPRESENTED

The Cleveland & Southwestern Baseball Trolley League has been formed for the fourth season by J. O. Wilson, general passenger agent of the Cleveland & Southwestern Traction Company, of Cleveland. Six towns touched by this system are represented. Mr. Wilson was chosen president of the league, and has the general management of its affairs. The company donates a beautiful silver cup for the winning team. It assists in the advertising, and furnishes free transportation to the players. The league has stirred up a great deal of local pride in various towns, and a great many people go from one town to another to attend the game. It is not the practice to give special rates, and special cars are seldom run, although it is frequently necessary to doublehead some of the runs.

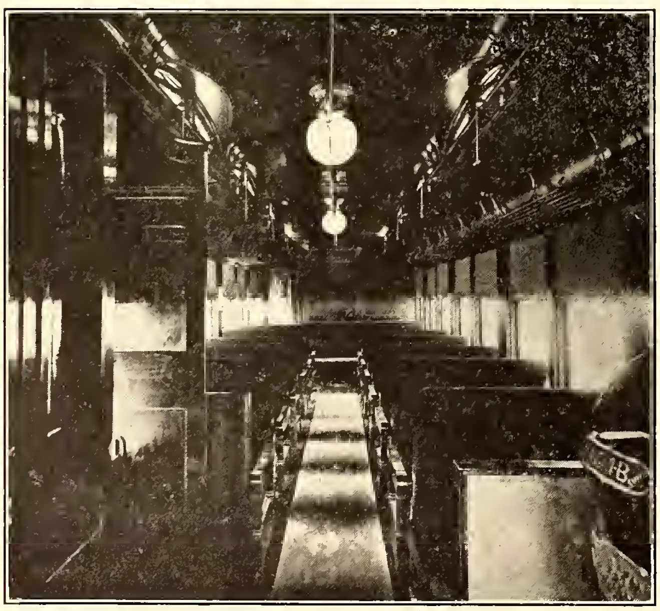
A BUFFET CAR FOR THE ILLINOIS TRACTION SYSTEM

The St. Louis Car Company has just completed three of the most elaborate cars ever constructed for regular service on an electric railway. The cars were built for the McKinley syndicate, whose headquarters are at Danville, Ill., and will be put in service on the lines of this company, which will operate cars from Danville, Ill., to St. Louis, upon the completion of certain links of track. The three cars are named for the States they will be operated in, Indiana, Illinois and Missouri. They are much larger than the usual type of interurban car, measuring 62 ft. 6 ins. long and 9 ft. 6 ins. wide over all, but the distinctive feature of the cars is the arrangement of the compartments in the interior and the completeness with which these are finished. The body is built on the standard steel bottom framing of the St. Louis Car Company and the sills extend clear through to the bumpers on each end, which construction gives added strength to the bottom framing. The cars are intended for operation in one direction only, and are provided with controllers and motorman's cabs on but one end. The interior of each car is divided into several compartments. A baggage room and motorman's cab occupy the front portion. The location of the cab is shown in one of the illustrations. Immediately behind this is a smoking compartment 11 ft. long. The main passenger compartment behind the smoker is 24 ft. 9 ins. in length and seats thirty-two passengers. Between the main and the baggage compartments is a buffet. What would usually be termed the rear platform is rather an observation compartment, it being 7 ft. 6 ins. in length. The entrance doors are double and are provided with trap doors which close down tightly and remove all appearances of the usual platform or vestibule. The only apparatus on this end of the car is a lever brake. The observation compartment has two leather-covered seats and wicker chairs and is heated by electricity. A large dome built in the ceiling contains in its center a large holophane globe, lighted by a cluster of incandescent lamps inside.



EXTERIOR BUFFET CAR FOR ILLINOIS TRACTION SYSTEM

The fact that the door leading from the main compartment to the smoker is on one side of the car makes possible the placing of one long seat extending almost across the car against the forward partition of the main compartment. In addition to this seat, there are in the main compartment thirteen additional ones of a special design of cross seats built by the St. Louis Car Company and provided with a mahogany arm rail with inlay to correspond with the finish of the compartment. The figured blue plush with which the cushions are covered harmonizes well with the interior finish of the compartment, which is of mahogany of special selection, and inlaid with neat marquetry work. Sockets are provided in



MAIN PASSENGER COMPARTMENT, LOOKING TOWARD FRONT END OF CAR

REAR OF MAIN PASSENGER COMPARTMENT AND OBSERVATION COMPARTMENT BEYOND the side finish below the arm rest for the support of card tables between the seats. The lavatory, toilet room, and the hot-water heater, which is of the Peter Smith type, are in the rear of the compartment, the heater being on the left side when facing the front of the car, and the toilet room directly opposite, while the lavatory is immediately in front of the toilet room. The lavatory is of the design usually found in Pullman cars. It is not enclosed, but is isolated somewhat by a partition. The toilet room is equipped for water, and the hopper is of the type found on the better class of steam coaches.

The smoker is finished in inlay mahogany to correspond with that of the rear compartment. Only two fixed seats are provided. These are covered with leather and are placed against the forward and rear bulkheads. The buffet in the rear of this compartment is complete in every detail. It is built across the car and measures 3 ft. 8 ins. wide and 6 ft. in length. A small window provided with a shelf permits coffee and sandwiches and other edibles to be served to people in the smoking compartment without being visible to those in other parts of the car. The buffet is provided with an Adams & Westlake urn which sets on a copper-covered table. The ice-box is of sufficient size to hold several hundred pounds of ice and drains to the under side of the car. A zinc-lined sink is also provided. All the space underneath the tables is taken up by lockers and shelves. Overhead is an annunciator connected to buttons in the different compartments of the car. Water for the buffet as well as for the lavatory and the water closet is obtained from a tank built in the car above the toilet room and filled from the outside of the car.

The motorman's cab occupies the left-hand corner of the forward or baggage compartment, from which it is separated by solid and glass partitions. Entrance to the cab is gained

BAGGAGE COMPARTMENT, SHOWING FOLDING SEAT, HEATERS AND SMOKING ROOM BEYOND

either through a door in the side of the car or through a low opening in the partition between the cab and the smoking compartment. Communication between the cab and the rear compartment is effected by means of a speaking tube. A seat which may be swung back against the rear partition is provided for the convenience of the motorman, and electric heaters, under the control of the motorman, provide sufficient heat in the cab at all times. The baggage compartment is finished in quarter sawed oak. Two permanent seats in this compartment are so built that they may be swung up against the wall when not in use or when the room becomes filled with baggage. In addition to the usual glass baggage compartment doors, a second set of doors is provided which are fitted with wire netting instead of glass.

The ceilings throughout the car are of the full empire

SMOKING COMPARTMENT FROM REAR END

type, the headlining being finished in a light blue to match the interior finish. Leaded art glass in both the upper sash of the side windows and in the upper deck sash add much to the interior appearance of the car.

Lighting is effected by means of both arc and incandescent lamps. The arc lamps, two in the main compartment and one in the smoker, are placed in the domes of the ceiling. The incandescent lamps are carried in neat electroliers on the moulding over the deck sill. In addition to the hot-water system of heating, electric heaters are also provided. These can be used when the car is only slightly chilly and will often avoid the necessity of building a fire in the heater. The fuses and switches for all of the electrical apparatus are located on a slate switchboard in a cabinet immediately behind the motorman. The board is wired from the back side and swinging doors opening into the baggage compartment permit access to the rear of the board and to the wiring. The car is equipped with General Electric type-M control, Christensen air compressor, and a pilot of the locomotive type.

General Superintendent E. P Shaw, Jr., has contributed liberally to the uniforming and equipping of a baseball team made up of employees of the Boston & Worcester Street Railway.

During the year ending March 3, 1906, the Brooklyn Rapid Transit Employees' Benefit Association paid out more than $22,000 to members or their families in benefits. During 1905, 525 members received benefits amounting to $14,777. Of this amount $7,050 was paid to the families of forty-seven members who had died. These figures do not adequately represent the protection afforded by the association's medical provisions, for 525 members amounted to only 25 per cent of the number of those given free medical treatment by the association's physician during the year. The association had on hand on March 31,1906, more than $25,000 in cash to meet its obligations.

FINANCIAL INTELLIGENCE

WALL STREET, May 23, 1906.

The Money Market

Increasing ease characterized the money market in all the branches during the past week, rates for both call and time loans ruling substantially below those prevailing at the end of last week. The improvement was due largely to the extremely light demand for funds from stock commission houses, resulting from an inactive and lower stock market, rather than to any pressure of funds by the local banks. As a matter of fact, the local institutions were not disposed to offer with as much freedom as heretofore, but the offerings from other sources were sufficient to meet all requirements. The resources of the New York City banks have been materially strengthened by the influx of funds from the interior, and the movement in this direction will assume much larger proportions in the near future. Indications point to the early return of a large portion of the money recently sent to San Francisco. The banks at the principal interior points have already received substantial amounts from the Pacific Coast, and it is expected that the return shipments to New York next week will be heavy. Foreign exchange continues firm, thus preventing a resumption of gold imports. The amount of gold received from Europe during the week amounted to about $3,250,000, making the total arrivals to date $41,037,806, and leaving $5,175,000 yet to come. The European money markets have ruled easier. The Imperial Bank of Germany's discount rate, which has ruled at 5 per cent since the beginning of the year, has been reduced to 4½ per cent, and a reduction in the Bank of England rate to 3½ per cent is expected in the near future. At the close all indications point to a continued easy market. About the only factor in the situation at the present time that is likely to result in a disturbance in rates is the payment for the $50,000,000 Pennsylvania notes on the 29th, but as the moneys received on this account will be redeposited in the banks immediately, little uneasiness is felt on this score. The bank statement published on last Saturday showed an increase in loans of $15,071,600, and an increase in deposits of $12,276,500. Cash increased $303,800, but as the reserve required was $3,069,125 more than in the preceding week, the surplus reserve was reduced $2,765,325. The surplus is now $10,129,275, as compared with $8,219,975 in 1905, $13,004,275 in 1904, $9,222,725 in 1903, $14,301,450 in 1902, $21,888,975 in 1901, and $16,555,225 in 1900.

Money on call loaned at 5 and 2½ per cent, the average rate for the week being about 3¼ per cent. Rates for time money ruled about ¼ per cent lower as follows: Thirty and sixty days 4 per cent, three and four months 4½ per cent, four and six months 4¾ per cent, and over the year maturities at 5 per cent.

The Stock Market

The course of the stock market during the past week was rather irregular, and the volume of business showed a considerable diminution from that recently transacted; in a word, the speculation was quite uninteresting, yet withal the market acted in a perfectly normal manner, considering the recent severe shakedown, which it is now thoroughly appreciated was wholly unwarranted, and the subsequent sharp recovery. In a few exceptional instances pronounced strength was developed, but this was the result more of special than of general causes. Amalgamated Copper, for instance, moved up considerably at one time, in response to the reports of unprecedented large earnings by the company; National Lead improved on the resumption of common stock dividends; Union Pacific made a substantial gain on prospects of an increased dividend in the not distant future; American Smelting & Refining did likewise, and from a similar cause; American Locomotive improved materially on reports that a dividend had been, or was about to be, declared, and Lackawanna scored a big rise to 550, thereby establishing a new high record. In the vast majority of instances, however, fluctuations in prices were of an uncertain character, due chiefly to the fact that the professional operators were disposed to take a somewhat gloomy view of the situation, even though underlying sentiment was unquestionably optimistic. That this should be so is perfectly natural, as all the dark clouds that have lately hung over the stock market have become dissipated, and the outlook for the general share speculation appears to be very bright. Monetary conditions have vastly improved, the great iron and steel manufacturers report record-breaking earnings, receipts of the railways, as a class, continue on a high plane, and crop prospects are at least fairly encouraging, notwithstanding recent exaggerated reports of lack of moisture in the winter wheat belt, which resulted in a sharp up-turn in the price of that cereal at one time during the week. These reports, together with the announcement from Paris that the Pennsylvania Railroad had concluded another loan there, tended to unsettle the general stock market a little at the end, but there was a noticeable lack of liquidation, and practically all of the selling came from professional traders, who are disgruntled on account of their recent experiences in the market and are seizing upon every possible opportunity to recoup their losses. Taken in its entirety, the market may now be described as being in a waiting attitude, from which position it does not seem likely to emerge until it has received some fresh impetus. Possibly the adjournment of Congress, which is expected to take place before long, may supply this.

The local traction stocks followed the same general course as did the balance of the market, and for the most part were dull. Toward the close of the week considerable selling of Brooklyn Rapid Transit was indulged in, on the announcement that a suit will be instituted compelling the company to reduce its fares to Coney Island to 5 cents. Meanwhile, the earnings of that company are continually piling up in a manner that suggests the possibility that present short sellers of the stock may some day be brought up with a round turn, more especially if the proposed suit against the company fails of its purpose, as is more than likely.

Philadelphia

A somewhat larger volume of business was transacted in the local traction shares during the past week, and while prices at times displayed some irregularity, the net changes in most instances were confined to fractional limits. Philadelphia Rapid Transit was the active feature, upwards of 4000 shares changing hands at from 26¾ to 25¾. The buying on the way down was considered good. Little interest was manifest in the shares of the Philadelphia Company. Small lots of the free common stock sold at prices ranging from 50¾ to 50¼, and the preferred changed hands at from 49 to 49½. The receipts, representing 1600 shares, sold at 33¾. Consolidated Traction of New Jersey displayed considerable strength, the price rising a full point to 82¼, on the purchase of a few hundred shares. Fairmount Park Transportation was strong, about 300 shares being transferred at prices ranging from 17 to 18½. American Railways moved up ½ to 52, and Railways General sold at 6⅞ and 7. Other transactions included odd lots of Philadelphia Traction at 99 and 98½, Union Traction at 63½ and 63⅛, and United Companies of New Jersey at 263½ to 262½.

Chicago

The progress of the negotiations looking to a settlement of the Chicago traction controversy, and the expectations of a full agreement in the near future, resulted in a decided improvement in the shares of the various street railways during the past week. Not only was the dealings considerably larger, but they were accompanied by sharp advances in prices. North Chicago rose from 32 to 40 without a reaction, upwards of 800 shares changing hands in the advance, while more than 1000 shares of West Chicago sold at from 28 to 36. Chicago City Railway stock was traded in for the first time in several weeks, several small lots selling at 155 and 160, an advance of 10 points over the last recorded sales. Union Traction preferred sold at 12½. The elevated issues were also more animated. South Side sold at from 94 to 95 for about 800 shares. Metropolitan Elevated, after selling at 28, dropped to 27, but rallied later to 27½, while the preferred brought 68 for 100 shares. Chicago & Oak Park common sold at 6¼, and the preferred at 23⅞. Northwestern Elevated brought 25½ for a lot of 100 shares.

Other Traction Securities

Dealings in the United Railway issues at Baltimore assumed much larger proportions during the past week, and prices for both the stocks and the bonds rose sharply. Interest centered largely in the free incomes, nearly $400,000 of which were traded in at prices ranging from 71⅞ to 74¼, the final transaction taking place at 73½. The certificates representing income bonds deposited advanced from 71 to 73, on the purchase of about 115,000. The 4 per cent bonds were comparatively quiet but firm, about $50,000 of them changing hands at 91¾ and 92¼. Both the free and deposited stocks ruled fractionally higher, the first named selling at 16 and 16⅜ for about 1000 shares, while about 2500 shares of the latter brought prices ranging from 16⅞ to 16½. Other issues were quiet but firm. Washington City & Suburban 5s were somewhat higher, sales taking place at 105½. City & Suburban 5s sold at 113, and Norfolk Railway & Light 5s brought 99½; Charleston Electric 5s sold at 95. The Boston market was dull and price movements were erratic. Boston Elevated, after an advance from 154 to 155, dropped to 153 on light sales, and Massachusetts Electric, after a decline of 1¼ points to 17¼, advanced to 19. Small lots of the preferred stock sold at 65½ and 66. Other sales included Boston & Worcester common at 36, West End common at 98 and 98½, and West End preferred at 113. Interborough receipts were entirely neglected in the New York curb market. New Orleans Railway common developed some strength, 700 shares selling at 34¼ to 33½. Public Service Corporation 5 per cent notes sold at 95¾ for $10,000.

There seems to be no limit to the bull movement of Cincinnati, Newport & Covington at Cincinnati. Last week it advanced from 71 to 71¼ on sales of about 1800 shares, and the early part of this week there was another raid which carried the price up to 76, on sales of about 1700 shares. A remarkable feature of this movement was that the preferred stock showed a decline from 98 to 97½. Toledo Railways & Light had an upward movement on a report that the property is to be merged with the Detroit United. The advance was from 31¾ to 33⅝. Cincinnati Street Railway was inactive at 144. Detroit United showed a decline of 2½ points for the week, common selling at 96½. Columbus Railway preferred gained 2½ points to 112. Cincinnati, Dayton & Toledo sold at 26¾.

Northern Ohio Traction & Light suffered a fractional decline in Cleveland from 33⅛ to 32½, in spite of the declaration of a 2 per cent dividend last week. Cleveland Electric Railway is showing new strength. A number of small lots sold as high as 79½, and one lot of 5000 shares was bid for at 78, but the offer was not taken. Cleveland & Southwestern common advanced from 15¾ to 16⅛. This property is showing gains in earnings at the rate of nearly $300 per day for May, and there is good prospects that dividends on preferred stock will be renewed this fall. Lake Shore Electric made a gain from 16¼ to 16⅝ on news of improved earnings. Western Ohio receipts sold at 16, and Aurora, Elgin & Chicago at 35. Bidders are offering 106 for Washington, Baltimore & Annapolis underwriting, and there was a sale of second mortgage bonds of this company at 35.

The small holders of Toledo & Western at Cleveland and Toledo are not looking with much favor upon the offer made by W. J. Hayes, of Cleveland, to buy the controlling interest in this property at $15 per share. The stock sold in Toledo last week at an advance from 16 to 17⅛, and brokers are advising holders not to sell at the price offered. The optional offer of 15 made by the firm mentioned has been extended to May 31.

Security Quotations

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

	May 16	May 23
American Railways	51½	51¾
Boston Elevated	154	a154½
Brooklyn Rapid Transit	83¾	81⅜
Chicago City	150	160
Chicago Union Traction (common)	4	3⅞
Chicago Union Traction (preferred)	12⅝	11½
Cleveland Electric	78	81
Consolidated Traction of New Jersey	80	81
Detroit United	95	94
Interborough Rapid Transit receipts	231	226
Interborough-Metropolitan Co. (common), W. I.	53¾	50⅛
Interborough-Metropolitan Co. (preferred), W. I.	86¼	84
Interborough-Metropolitan Co. 4½s, W. I.	—	—
International Traction (common)	38¼	40½
International Traction (preferred), 4s	72	74
Manhattan Railway	153	152
Massachusetts Elec. Cos. (common)	18	19½
Massachusetts Elec. Cos. (preferred)	64	68
Metropolitan Elevated, Chicago (common)	27½	26
Metropolitan Elevated, Chicago (preferred)	68	66
Metropolitan Street	115	112
Metropolitan Securities	74¾	—
New Orleans Railways (common)	32	32
New Orleans Railways (preferred)	80	80
New Orleans Railways, 4½s	86	—
North American	96¼	96¼
North Jersey Street Railway	27	27
Philadelphia Company (common)	50¾	50⅛
Philadelphia Rapid Transit	26½	25¼
Philadelphia Traction	99	98½
Public Service Corporation 5 per cent notes	94	95½
Public Service Corporation certificates	70	71
South Side Elevated (Chicago)	91	94
Third Avenue	130	130
Twin City, Minneapolis (common)	117	116
Union Traction (Philadelphia)	62¾	63
West End (common)	98	98
West End (preferred)	113½	113

W. I., when issued. a Asked.

Metals

The "Iron Age" estimates that 900,000 tons of steel rails have now been definitely closed for next year, and that nearly 300,000 tons in addition will be carried over from this year. The foundry pig iron market is easy under continued inaction. The billet market is working into a freer condition, more steel being available. Attention is still converging in the bar situation. Large contracts are impending, and the question is one of terms.

Copper metal continues strong, but prices are unchanged at 18¾ to 18⅞c. for spot Lake, 18⅜ to 18⅝c. for electrolytic, and 18¼ to 18⅜c. for castings.

DAMAGE TO OCEAN SHORE RAILROAD

The Ocean Shore Railroad, which is building a double-track electric railway from San Francisco to Santa Cruz, suffered damage to the extent of about $40,000 from the recent earthquake. The damage was confined to a landslide that destroyed about 4000 ft. of roadbed. Between the end of the Ocean Highway and Mussel Rock the route of the Ocean Shore road lies along the side of a precipitous bluff for a distance of 2 miles, and C. E. Loss, who has the contract for building the line, had about 4000 ft. of roadbed, cut out of the side hill by means of a steam shovel, completed at the time of the earthquake.

The formation of the ground in this neighborhood is of a loose and unstable character, consisting of soft earth and decomposed rock, and above the cut made by the grading forces an immense amount of material was loosened by the temblor and slid down the hillside toward the ocean, obliterating all trace of the Ocean Shore's roadbed. C. E. Loss says that the work of restoring the roadbed will involve the removal of an immense amount of material, and an additional steam shovel will shortly be put on the work. The clearing of the hillside, he estimates, will cost about $40,000. At other places along the route of the Ocean Shore embankments and fills were settled somewhat by the earthquake, but this is only calculated to make the embankments more solid. Grades can be restored by putting in more material.

"The earthquake's path of greatest activity seems to have run through the neighborhood of Mussel Rock," said Mr. Loss, "and from Mussel Rock it seems to have shot off at an abrupt angle toward the Santa Cruz mountains, which fact explains why the Ocean Shore road, which lies quite close to the ocean, suffered no appreciable damage south of Mussel Rock. It is a curious circumstance that whereas the eminences in San Francisco suffered less from the shock than the low places, further down the coast, and particularly in the Santa Cruz mountains, the high places experienced the greatest effect from the earthquake. The coast country below Mussel Rock was not disturbed to any noticeable extent."

THE WESTERN NEW YORK-PENNSYLVANIA MERGER

The holdings of the Cleveland security holders of the Buffalo, Dunkirk & Western Railway have been formally transferred to the syndicate headed by Joseph E. Mayer and W. F. Sheehan, of Buffalo, and Kuhn, Loeb & Company, of New York. As has been stated in these columns, the syndicate has acquired control of the Buffalo & Hamburg, the Erie Rapid Transit Company, the Lake Erie Traction Company, the Jamestown, Chautauqua & Lake Erie (steam) in addition to the Buffalo, Dunkirk & Western, embracing all the lines between Buffalo and Erie. These are to be merged into one company which will be capitalized with $2,500,000 5 per cent preferred stock and $5,000,000 common stock and a bonded indebtedness of $7,000,000. Joseph B. Mayer, of Buffalo, will have charge of the completion of the Buffalo, Dunkirk & Western between Buffalo and Dunkirk. It is learned from an apparently authoritative source that the new owners are acting for the New York Central Railroad in this transaction.

STREET RAILWAY SERVICE IN CHICAGO TO BE IMPROVED IMMEDIATELY

The refusal of the United States Supreme Court to grant a rehearing of the ninety-nine-year case, upon which a decision was given out against the Chicago street railway companies, March 12, as already announced in the STREET RAILWAY JOURNAL, has opened up the way for bringing about the immediate improvement in street railway service in Chicago and, incidentally, the lowering of the three tunnels under the river as ordered by the Secretary of War at Washington. Upon receipt of the news of the refusal to grant the rehearing, Mayor Dunne lost no time in arranging for meetings of the city authorities and the representatives of the street railway companies. The present plan is to electrify the cable systems at once, using the old rolling stock until a general agreement has been reached between the city and the companies. General Counsel W. W. Gurley, of the Union Traction Company, and T. E. Mitten, president of the Chicago City Railway Company, have agreed to reconstruct their lines and to operate them on the basis of an indeterminate license for future operation, as proposed in Mayor Dunne's recent letter to Chairman Werno, of the local transportation committee of the City Council, provided the details of the arrangement are satisfactory.

A plan for equipping with electricity the West Side and North Side cable lines immediately and lowering by means of new roofs the La Salle, Washington and Van Buren Street tunnels to a depth of 26 ft. below low-water level has been blocked out. It provides for electrifying the lines using the Washington Street tunnel first, and to have the work completed within sixty days. Within five months from the end of the sixty days the tops are to be removed from the tunnel. For the La Salle Street tunnel lines it is proposed to give ninety days in which to electrify and six months thereafter for lowering.

The lines using the Van Buren Street tunnel are to be electrified within ninety days, and the right is to be given to start trolley cars over the line as soon as it is electrified. The question of the time in which this tunnel shall be lowered is left entirely to the companies, inasmuch as they are under the direct orders of the Secretary of War on this bore, which they own. The companies are to pay the entire cost of putting in the new roofs and concreting, but if the city takes over the property for use by itself or by somebody else, the company will be repaid the actual cost of the work. The Commissioner of Public Works is to supervise the work and approve the bill.

At any time the city wishes the ordinance is to be revoked. The city may use the trolley poles for electric lighting, if it wishes. As compensation for trolleyizing its West and North Side lines, the company is to pay the city $25,000 a year in equal monthly installments. This sum will be a clear addition to the income from car licenses, for which the company now pays about $75,000 a year. All feeder wires east and south of the river are to be underground. Any or all of the provisions of the ordinance are to be subject to repeal or revision by the City Council at any time.

According to General Counsel Gurley, of the Chicago Union Traction Company, all the street railway interests concerned in the lowering of the tunnels have agreed to these general plans and an ordinance embodying them will be submitted to the City Council. Every indication points to an immediate substitution of the cable cars by those electrically operated, and an early improvement in the service in all other respects.

ROCHESTER-LOCKPORT ROAD TO BE BUILT BY J. G. WHITE & COMPANY

Arrangements have been completed whereby J. G. White & Company, of New York, will build a high grade interurban railway between Rochester and Lockport, generally paralleling the lines of the New York Central Railroad. The contract calls for an expenditure of $2,000,000 and the syndicate behind the project is represented by Frederic Nichols, E. R. Wood and Sir Henry M. Pellatt, all of Toronto, who are connected also with the Ontario Power Company.

Under the terms of the contract J. G. White & Company will grade 54 miles for double-track road, though only a single track will be laid at first, the second track being added when the traffic warrants further expenditure. The contract includes also all the overhead work, the building of five sub-stations with the electrical equipment, the construction of repair shops and car houses and the supply of all rolling stock. The track construction will be heavy and the gradients will be so restricted as to permit the maintenance of high speed. The rolling stock will be of the standard design for interurban service, and will include express cars, passenger cars, and snow plows. Power will be supplied by the Ontario Power Company at 60,000 volts pressure, which will be reduced to the standard working pressure for direct-current railway service. The transmission line is the only portion of the electrical equipment which is not included in the contract, that being supplied by the Ontario Power Company to the sub-stations. The bridge structures, of which there will be a considerable number, will be of steel and concrete. There will be no grade crossings.

From Rochester west to Brockport, a distance of 16 miles, including the towns of Spencerport and Adams Basin, the electric road will exactly parallel the main line of the New York Central on the north side. About 2½ miles west of Rochester the lines of the Buffalo, Rochester & Pittsburg will be bridged, and again ¾ of a mile further west there will be a bridge over the Barge Canal. From this point westward for a distance of more than 40 miles the electric railway will lie between the Barge Canal and the tracks of the Central. At Holley, 4½ miles west of Brockport, there will be a bridge over Sandy Creek. A short distance west of Holley there will be a deviation of about ¾ of a mile from the tracks of the Central, but the gap is closed again before reaching Albion, 9 miles further west. West of Albion the tracks of the Central break slighly to the southward and proceed direct through Medina. The electric road will run almost due west from Albion for 6 miles, to include the town of Knowlesville, which is only 1 mile north of the Central tracks. From Knowlesville the direction of the interurban will be slightly more southerly into Medina. The main construction offices of J. G. White & Company will be established at Medina. The right of way of the interurban will be adjacent to that of the Central for 7 miles west of Medina, passing through the town of Middleport; 2 miles west of Middleport the electric road will cross the tracks of the Central at a small angle on a long bridge. This is the only crossing of the New York Central tracks, and from this point west into Lockport, a distance of 9 miles, the interurban lies to the south of the route of the Central. Work will be commenced immediately.

BROOKLYN COMPANY AND BRIDGE ENGINEER AGREE ON TRANSIT PLAN

The suggestion made by Bridge Commissioner Stevenson, of a double-decker elevated structure from the Brooklyn Bridge to Delancey Street, in Manhattan, and a single elevated road on that thoroughfare to the Williamsburg Bridge, meets with the approval of the Brooklyn Rapid Transit. It is, in fact, a revival of the plan put forward by Borough President Littleton, when in office, except that Mr. Littleton's scheme contemplated the erection of a complementary loop in Brooklyn. In relation to the project, President Winter, of the Brooklyn Rapid Transit, has said:

"I am not fully informed regarding the Commissioner's latest plan, but in so far as it rests on an elevated connection between the bridges, it is on the right track. The only way to cure the bridge terminal nuisance is to kill it. After a good deal of study of this alleged problem, I have been able to see no other way of quite accomplishing it save by an elevated connection, and by this way, on right lines, it would be easily done. If the plan presented by President Littleton's committee a year and a half ago had been adopted, it would have been now in operation and the anomalous elevated bridge terminal half forgotten."

AN IMPORTANT SOUTHERN PROJECT WITH THOMAS TAGGART OF INDIANAPOLIS AS PRESIDENT

The Lakeview Traction Company, capitalized at $100,000, Thomas Taggart, of Indiana, president, proposes to build an electric railway from Memphis, Tenn., to Clarksdale, Miss., about 75 miles south, in the heart of the Mississippi delta. The survey as proposed will parallel the Yazoo & Mississippi Valley Railroad. The engineering department expects to effect a traffic arrangement with the Memphis Street Railway Company for entrance to the heart of this city. It is proposed to carry both freight and passengers. The vice-president of the company is Henry Craft, who is resident agent. C. P. Farnsworth, W. A. Percy, R. F. Tate, M. Rosch and Walter Goodman are stockholders. The capitalization is not indicative of the amount to be expended.

INCREASE IN WAGES AT MILWAUKEE

John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Company, has caused to be posted in all the stations of the company notices informing conductors and motormen of all lines, city as well as interurban, that their wages had been increased 1 cent an hour, beginning May 1. The announcement came as a welcome surprise to the men, as no intimation of an increase had been given by the management. Like that of Jan. 1 last, when the wages of men employed with the company for a term of ten years or more were raised, the advance was also voluntary on the part of the company, and in conformity with its policy of increasing wages as the earnings permit. Last January those who had been in the service of the company ten years received an increase of 1 cent an hour. Between 200 and 300 men profited by the advance. The announcement just made includes these men again, so that they have received an advance of 2 cents an hour in less than six months.

Men entering the employ of the company as motormen and conductors under the new order will receive 19 cents an hour. At the completion of the first year's service they will receive 20 cents. Another increase of 1 cent will be paid at the beginning of their third year. During the fourth and fifth year 22 cents an hour will be paid, and beginning with the sixth, and until the completion of the tenth year, 23 cents an hour will be the rate. Men employed as conductors or motormen longer than ten years will receive 24 cents an hour.

In addition to this the company maintains a strict civil service. Men who are found efficient in minor capacities are promoted to better positions as vacancies occur or new openings are made. The same holds good of boys who enter the service of the company as messengers.

BUFFALO SOUTHERN PASSES TO NEW INTERESTS

Control of the Buffalo Southern Railway Company, which operates the Buffalo, Hamburg & Aurora Electric Railway and Buffalo, Gardenville & Ebenezer Electric Railway, connecting Buffalo, Orchard Park, Armour and Hamburg and Buffalo and Ebenezer and Gardenville, has passed into the hands of new interests, it is announced.

G. Tracy Rogers, of Binghamton, president of the company, and the directors representing his interests and the Fidelity Trust Company have resigned, and in their place Alonzo C. Mather, of Chicago, and directors in sympathy with him have been elected. Those who resigned were Mr. Rogers, president; Edward M. Mills, secretary; Franklin D. Locke, Louis L. Babcock and Myron S. Hall. Messrs. Mather, H. M. Greer, of Buffalo; Malon G. Taylor, of Reading, Pa.; Fridolin Thoma, of Buffalo, and William L. Marcy, of Buffalo, were elected directors in their place. The other directors are: D. N. Rumsey, of East Aurora, who was treasurer and remains in that office; L. B. Seibert, of Coudersport, Pa., who remains as vice-president; H. C. Lein, of Ebenezer; Daniel W. Allen, of Buffalo; Asher B. Emery, of East Aurora, and F. L. Andrews, of Coudersport. J. B. Rumsey, of Oswayo, Pa., will become general manager in place of U. L. Upson. It is said the new management in the near future will extend the road to East Aurora and make other improvements. At a meeting of the directors no president was elected, but Mr. Greer was elected secretary. The treasurer and vice-president were re-elected.

DEPARTMENT OF ELECTRICAL ENGINEERING AT CORNELL

The trustees of Cornell University have recently assigned to the department of electrical engineering of Sibley College the major portion of Franklin Hall, now occupied by the department of physics. The latter department is now moving into commodious quarters in the new Rockefeller Hall of Physics, just completed. The electrical engineering department will thus be supplied with new quarters for conducting various lines of work. The electrical engineering laboratory will continue to occupy a part of the main building of Sibley College, as Franklin Hall does not contain sufficient floor space to accommodate all of the apparatus. The electric railway section will, however, be moved to Franklin Hall. This will contain a full line of railway motors, manual and multiple-unit control systems, trucks, air brake equipment and all other devices necessary for instruction in this line of work.

Franklin Hall, after the remodeling which will be necessary this summer, will contain large designing and lecture rooms, a number of smaller recitation rooms and offices, and the telephone and railway laboratorics. It is understood that the new arrangement will only be temporary, and the enlargement of the main Sibley College buildings will be an urgent necessity if the present rate of growth continues.

TRACTION DEVELOPMENT IN TEXAS

Considerable attention is being given to the building of interurban electric railways and the installation of electric light and power plants in Texas at this time. In the matter of electric railways, this is particularly true. Several lines are proposed to be built out of Dallas to neighboring towns. Some of these enterprises have progressed to a point where their consummation seems to be assured. McKinney, Sherman and other prosperous towns of that section are to be connected by electric lines. It is stated that the Northern Texas Traction Company, which owns and operates the electric line between Fort Worth and Dallas, has in view a number of important extensions to embrace several suburban towns in its system. The building of an electric railway between Fort Worth and Mineral Wells is being promoted. Projects are also on foot to give Waxahachie, Greenville, Cleburne and other towns electric railway connection with Dallas.

The construction of an interurban electric railway between Temple and Marlin is proposed by a Pennsylvania syndicate which is interested in other similar enterprises. It is estimated that the cost of building the road, including its equipment, will be approximately $1,000,000. The promoters are asking that a bonus of $300,000 in money and stock be subscribed by the people of the two terminal towns and by land owners along the right of way. A considerable part of the required amount has been already raised, and the prospects for the early building of the road are said to be bright.

R. A. Reese, of San Antonio, is acting as the representative of syndicate of Eastern men who contemplate building an interurban electric railway between Austin and San Antonio, a distance of 80 miles. Mr. Reese says that the financing of the project is assured if the people along the proposed route will give their aid in the matter of donating the right of way of the road. It is expected that the project will soon assume definite shape.

The firm of William Gallatin, Carroll & Company, of New York, has been investigating the situation with the view of financing the building of an interurban electric railway between Austin and Lockhart, a distance of about 30 miles. The engineer, Thos. Moore, has had active charge of the preliminary work.

The building of an electric railway to run from Georgetown to Briggs, by way of Florence, a distance of 22 miles, is under consideration. The right of way for the proposed road is being secured and bonuses raised in aid of the project.

The building of an interurban electric railway between Houston and Galveston, a distance of 51 miles, has been on foot for several years, and now seems to be assured. Considerable progress has been made in the preliminary work, preparatory to actual construction. It is stated that the road will cross Galveston Bay upon the new causeway that is to be constructed by a company which was recently organized for that purpose. The surveys for the proposed road have been made and the right of way and franchises secured.

It is announced that the right of way and liberal bonuses for an electric railway that is to be built between Taylor and Giddings, a distance of about 30 miles, have been secured and that the construction of the road will be soon commenced.

STONE & WEBSTER ACQUIRE MORE SOUTHERN PROPERTIES

Stone & Webster, of Boston, have acquired the entire electric railway and lighting systems of Pensacola, Fla., through the purchase of all the securities of the Pensacola Electric Terminal Railway Company and the Escambia County Light & Power Company. A new company, under the management of Stone & Webster, will be organized to operate these systems. The details of capitalization are not yet formulated. The railroad system now includes about 12 miles of track operated by electricity and 7 miles by steam power. It is proposed to convert at once this latter line to electricity, thus giving a through line to the government Fort Barrancas and the navy yard and military post. The new company will be financed so as to provide amply for putting the entire property in first-class operating condition, and for extending the system to meet the requirements of the growing population.

DINNER TO MEMBERS OF INVESTIGATING COMMITTEE OF THE NATIONAL CIVIC FEDERATION

A dinner was given at the Park Avenue Hotel, New York, Monday evening, May 21, by the New York Civic Federation to the members of the investigating committee of the National Civic Federation's commission on public ownership, who sailed Tuesday, May 22, to study conditions in Europe. There were about 120 at the dinner. Oscar S. Straus presided. Among the members of the investigating committee, who were the guests at the dinner, were the following:

Melville E. Ingalls, Big Four Railroad, Cincinnati, Ohio; Frank J. Goodnow, Columbia University, New York; Walton Clark, third vice-president the United Gas Improvement Company, Philadelphia, Pa.; John H. Gray, Northwestern University, Evanston, Ill.; William J. Clark, foreign manager General Electric Company, New York; Frank Parsons, president National Public Ownership League, Boston, Mass.; John R. Commons, University of Wisconsin, Madison, Wis.; F. J. McNulty, president International Brotherhood of Electrical Workers, Washington, D. C.; Albert E. Winchester, general superintendent City of South Norwalk Electric Works, South Norwalk, Conn.; Charles L. Edgar, president of the Edison Electric & Illuminating Company, Boston, Mass.

UTAH PROPERTIES REPORTED SOLD

It was announced at Salt Lake May 17 that the principal holdings of the Mormon Church in the Utah Light & Railway Company are to be taken over by a $25,000,000 corporation, composed of English and American capitalists. The new company, it is said, will also acquire the Ogden Street Railway. It will be known as the Inter-Mountain Consolidated Railroad Company, and the board of directors will include H. H. Vreeland, of New York City. Simultaneously, the announcement was made that the Salt Lake & Los Angeles Railroad, another church property, has been sold to a local syndicate for $500,000.

THE ELSBERG BILL SIGNED

The Elsberg Rapid Transit bill was signed by Governor Higgins, of New York, Tuesday, May 16. The bill briefly provides for the advertising for contracts separately for constructing, equipping and operating future subways, and the granting of contracts separately for any part of the procedure, unless the Board of Estimate deems it wise to let the contracts jointly, in which case the Rapid Transit Commission is empowered to use its discretion.

The city under this new law may if necessary build its future subways, equip them and, if after that no bidder for the operating franchise is obtainable on advantageous terms, operate them also. If the bidder for operation equips the road at his own expense he may operate it for twenty years, with privilege of renewing his contract for an additional twenty, a possible term of forty years instead of seventy-five granted under the old law, while if the city equips the new subway, the contractor for operation may have only a ten-year term with a ten-year renewal.

Full provision is made for the construction of pipe galleries for gas and water mains and other conduits in all future subways. The Rapid Transit Commission may grant no more perpetual franchises, and the character of that body itself is changed in the provision that hereafter vacancies will be filled by the Mayor instead of by the commission itself. Under the power thus delegated to him, Mayor McClellan, as noted elsewhere in this issue, has appointed L. C. Ledyard to the commission.

NATURAL GAS AT SHREVEPORT, LA.

On May 2 the Shreveport Traction Company began the use of natural gas under five horizontal return tubular boilers of 150-hp each, in its local plant at Shreveport. It is estimated that the monthly consumption of gas will approximate 7,000,000 cu. ft. The company uses a boiler gas regulator, which keeps steam at about 120 lbs. pressure, allowing a variation of less than 2 per cent, regardless of load. Forty Quinlan burners were installed to each boiler. The steam plant also consists of a Hamilton-Corliss twin engine of 900 hp, direct-connected to a GE 500 kw, 575-volt railway generator, and two Harrisburg simple engines each of 300 hp, belted to 150 kw GE 575-volt generators. The latter plant is for reserve purposes.

PORT CHESTER COMPANY GETS RIGHTS

The New York & Port Chester Railroad Company has obtained from the Board of Estimate and Apportionment the right to cross certain streets and avenues in the Bronx above or below grade and to construct and operate an electric railway from the Willis Avenue bridge to the city line. The company acquired franchises to run its railroad through eight towns in Westchester County three years ago. It is to be a four-track third-rail road, having a length of 25 miles, with a terminal at Port Chester. The route is to be entirely on property owned by the company.

By the terms of the franchise the company is to pay the city $8,000 a year for the first five years, $13,000 a year for the next five years, and $35,000 a year for the next fifteeen years, at the end of which time the company can get a renewal of the franchise for another twenty-five years on a revaluation. In addition, the company must pay 5 4-10 cents a lin. ft. a year for its trackage in the Bronx for the first five years, 7 7-10 cents a ft. for the next five years and 29 cents a ft. for the rest of the rest of the time the franchise runs.

It is provided also that the company must deposit $100,000 with the Controller as a guarantee that it will spend at least $1,000,000 in work on the railroads within five years. The company binds itself also not to sell or mortgage its property to another railway company. It is bound to run not less than sixty trains daily in each direction after the road is in operation, and to give a 5-cent fare within the city limits.

William C. Gotshall, president, promoter and chief engineer of the railroad, said this week that work on the road would begin in earnest about Aug. 1, and that the road would be in operation within three years. Five contractors are to have the task of building the road, each contractor having a stretch of 5 miles to cover. The estimated cost of the railroad and its equipment is $19,500,000.

Mr. Gotshall says that Charles D. Barney & Company, Edwin Gould, the Morris family, which owns Morris Park; C. D. Simpson, John B. McDonald and a group of Pittsburg steel men are all back of the enterprise. John B. McDonald, who was the contractor for the subway, will have a hand in directing the operations of the sub-contractors. Mr. Gotshall also has announced that the syndicate to finance the Port Chester road is also planning to build a branch line from New Rochelle to White Plains, and that the syndicate is also to be a bidder for the franchise for the proposed subway in Third Avenue, in Manhattan. In that connection Mr. Gotshall is reported to have said:

"We have estimated that the subway in Third Avenue, to extend to the Battery, will cost $32,000,000, and that its equipment will cost $18,800,000 in addition. We have been in correspondence on the subject with the Rapid Transit Commission for some time, and we shall be ready to build the subway, equip it and operate it on better terms, we think, than can be offered by other bidder. We could then have a rapid transit line all the way from the Battery into Connecticut. Part of the plan is to have a quick freight service by which the big department stores of the city could deliver parcels in Westchester County and Connecticut within a few hours after the purchases were made. Express cars would be run on sidings at depots convenient to the stores, loaded in the daytime and sent over the line before the evening rush hour began."

DEALING WITH THE ROWDY

With the inauguration on Decoration Day of the summer schedule to the beaches and the pleasure resorts will come again the trials of dealing with that class of passengers prone to create disturbances to the general discomfiture of the orderly and respectable pleasure seeker. No one locality is free from this disturbing element. Indeed, the hoodlum seems to increase directly as the number of passengers. Naturally, therefore, a company like the Brooklyn Rapid Transit, touching more places of amusement and carrying more pleasure seekers than any other company in the world, drawn from a motley, cosmopolitan throng, is confronted with this problem in an aggravated form. This year even more elaborate precautions have been taken to preserve order than ever before. With the placing in use of the summer schedule on May 12 in Brooklyn, Deputy Police Commissioner O'Keefe and Borough Inspector Cross took unusual precautions. In addition, the company now has more special officers on its cars than ever before, and in a short time will have completed its arrangements for a regular police station of its own at Culver Park, the summer headquarters of the company's police force. Regular blotters will be kept, there will be two desk sergeants and outwardly there will be little or nothing to show that it is not a station house of an ordinary city precinct. As a matter of fact, there really is practically no difference, except that the duties of the men stationed at Culver Park are more limited than those of the city police. But their authority is the same. The special officers of the traction company take the same oath as the policemen of New York, before the same man and are subject in the same way to the discipline of the Police Commissioner and his deputies. The discipline, however, is really more severe for the special officers. Though they cannot be fined, since the company, and not the city, pays them, they are not protected by Civil Service rules, and there is nothing to prevent the trial commissioner from dismissing them whenever he sees fit.

A. I. E. E. MEETING AT MILWAUKEE

The twenty-third annual convention of the American Institute of Electrical Engineers will be held at Milwaukee May 28 to June 1, with headquarters at the Hotel Pfister and sessions in the Public Service Building on Sycamore Street. The program is as follows:

Monday, May 28.—Address of welcome. Address, President Schuyler Skaats Wheeler. "Repulsion Induction Motor," by Maurice Milch. "Comparison of Two and Three-Phase Motors," by Bradley McCormick. "Direct-Current Motor Design as Influenced by the Interpole," by Charles H. Bedell.

Tuesday, May 29.—"Experiences with Lightning and Static Strains on 33,000-volt Transmission Systems," by Farley Osgood. "Cell-Type Lightning Arrester," by Prof. E. E. F. Creighton. "Protective Apparatus for Lightning and Static Strains," by H. C. Wirt. Standardization Rules. The proposed revision of the existing standardization rules will be reported for discussion by the committee on standardization. "Short-Circuit and Ground Currents in Alternating-Current Systems," by Chas. P. Steinmetz. "The Self-Synchronizing of Alternators," by Prof. Morgan Brooks.

Wednesday, May 30.—"Magnetic Properties of Electrolytic Iron," by Prof. Chas. F. Burgess and A. Hoyt Taylor. "Measurement of Temperature by Electrical Means," by Edwin F. Northrup. "The Educational Value of an Electric Test Car," by Prof. Thomas M. Gardner. "The Art of Inventing," by Edwin J. Prindle. "Shunt and Compound-Wound Converters for Railway Work," by W. L. Waters.

Thursday, May 31.—"Electrical Connections for Power Houses," by David B. Rushmore. "Economies Derivable from the Use of Relatively Small Water Powers of Low Head in the Middle West," by Prof. Dugald C. Jackson. "Oscillations and Surges Against Ground in Alternating-Current Systems," by Chas. P. Steinmetz. "Some Fundamental Characteristics of Mercury Vapor Apparatus," by Percy H. Thomas. "Safety Devices for Steam Engines, Turbines and Motors," by Charles M. Heminway. "Some Notes on the Lighting of Churches," by Edwin R. Weeks.

The local committee is Messrs. John I. Beggs, chairman; W. E. Dodds, W. F. Johnson, H. H. Cutler and C. W. Burkett, who have arranged a program of entertainment, etc.

PLANS FOR AN IMPORTANT PLEASURE RESORT AT OTTAWA BEACH, OHIO

The Toledo Railways & Light Company, which is back of the Ottawa Beach & Southern Railway, is planning to make Ottawa Beach one of the finest resorts on the great lakes. The company owns 1200 ft. of lake frontage and several hundred acres of adjoining land, and it is having plans prepared for improvements which, it is stated, will involve an outlay of about $300,000. A large amusement pavilion will be erected this year, as will also a number of bath houses, providing bathing facilities for 500 people. The property is said to have one of the finest natural bathing beaches on the lakes. The grounds are to be laid into a magnificent park, and the marshes on the water front are to be dredged and lagoons formed so that canoes may paddle the whole length of the lake frontage, a distance of about 2 miles. The lagoons are to be crossed at intervals with rustic bridges, and some of the best known landscape architects have been secured to lay out the ground. No liquor is to be sold on the grounds, the company having decided to make the park as inviting as possible to ladies and children, and will encourage picnicers to hold their outings here. The beach is 17 miles from the city and the new line will cover the distance in 45 minutes. It will be the nearest bathing beach to the city, and there is no doubt that it will be immensely popular with Toledo people. Next spring a large summer hotel and a number of cottages will be erected. It was planned to build this this year, but the project has been postponed owing to the fact that the new interurban road will not be open for traffic until July 1, at which time the park will be thrown open to the public.

MEETING OF TOLEDO AND DAYTON TRAFFIC REPRESENTATIVES

A meeting of traffic representatives of roads operating out of Toledo and Dayton was held at Bowling Green, Ohio, May 14. The following gentlemen were present: Erwin Fullerton and J. W. Parker, of the Detroit United Railway Company, of Detroit; C. T. Chapman and T. C. Franklin, of the Toledo & Western Railway, of Toledo; H. C. Young, of the Lake Shore Electric Railway, of Norwalk; C. M. Hawley, of the Toledo, Port Clinton & Lakeside Railway, of Toledo; W. L. Smith, of the Toledo Urban & Interurban Railway, of Findlay; C. C. Collins and R. H. Carpenter, of the Western Ohio Railway, of Lima; E. C. Spring, of the Dayton, Covington & Piqua Traction Company, of West Milton, and R. Baker, of the Dayton & Western Traction Company, of Dayton.

The matter of adding additional coupons to the interline tickets to take care of the city fare in Toledo was discussed, resulting in no agreement among the companies to add the coupon. The Detroit United Railway is at present printing tickets with this additional coupon, thus getting three reports from the conductor, one for the Detroit city fare, one for the interurban line between the terminals out of Detroit and Toledo, and one for the Toledo city fare. The company is arranging to place additional coupons on all its different forms of tickets to provide for city fares, and wanted the other companies to do likewise. The other roads, however, preferred to follow the plan at present in use, having the tickets read direct to the center of the city and making a monthly settlement with the city companies. The Toledo, Port Clinton & Lakeside Railway has the other arrangement, but this is a requirement of the contract between it and the Lake Shore Electric Railway. As soon as the new line is built so that cars can be operated to the Toledo city limits independently, it is the intention to discontinue the use of the additional coupon.

The matter of charging for baggage was brought up, and the Detroit United agreed to accept 25 cents per trunk, which will cover the transportation over any of its lines from Toledo north, and the present arrangement on the lines south of Toledo to remain in force, this being 25 cents per trunk, the company checking the trunk retaining the 25 cents. This makes a total charge of 50 cents, for example, for transportation of a trunk from Dayton to the northern part of Michigan. The Lake Shore Electric Railway has always checked trunks free, and thought it would be detrimental to its interests to make a charge for trunks.

THE DENVER ELECTION

At the election in Denver on Tuesday, May 15, the main issue was whether the city should grant public service franchises or try municipal ownership. Both Republicans and Democrats indorsed franchise extension. The Municipal Ownership party put up an independent ticket, which was supported by Senator Patterson and his two newspapers. Six franchises were voted on. Three related to terminals of steam railways. Two were light and street railway franchises for existing corporations that offered definite compensation. The sixth was for a new traction company. During the campaign there was published a letter from Senator Patterson's chief lieutenant, the president of the Municipal Ownership League, asking a Chicago bank to finance the "reform" campaign. In return the bank was to get a share of the profits accruing from the sale of the franchise sought to the old traction company.

The tramway company twenty-year franchise carried by a majority of 365 in a taxpayers' vote of nearly 16,000. The gas company franchise carried by 590. The amendment to the city charter to compel rate reduction carried by nearly 3000 majority, but its effect is somewhat doubtful in view of the fact that the combined Democratic and Republican machines elected fourteen out of sixteen Aldermen and all three Supervisors. Other propositions voted upon follow:

For the purchase by the city of an electric street lighting plant. Carried.

Franchise to permit the Moffat road to enter Union station. Carried.

Franchise for the Union Pacific Railway on wholesale business street. Defeated.

Park improvement bonds. Defeated.

Denver terminal franchise, to permit the entry into the city of an interurban electric line not constructed. Defeated.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MAY 15, 1906

820,407. Electric Railway; John A. Garey, Tarkio, Mo. App. filed May 23, 1905. Provides a current collector for underground conduit railways that may be readily shifted from one side of the plow to the other in accordance with the direction in which the car is traveling. An air blast is also provided for cleaning the conduit in advance of the shoe.

820,411. Railway Signaling System; Henry W. Griffin, New York, N. Y. App. filed Jan. 18, 1905. A block signal system of the overlap type adapted to display danger and caution signals. The track rails are divided into insulated sections charged with direct-current potential, and polarized relays are included for securing the overlap feature.

820,412. Railway Signal System; Henry W. Griffin, New York, N. Y. App. filed Jan. 31, 1905. Modifications of the above.

820,413. Railway Signaling System; Henry W. Griffin, New York, N. Y. App. filed Feb. 28, 1905. Further modifications.

820,423. Trolley for Overhead Trolley Systems; Ezra F. Landis, La Salle, N. Y. App. filed Feb. 20, 1905. The trolley wheel is completely housed in the harp, except for a slot in the top where the wheel engages the wire, and at this point a pair of spring arms are arranged to normally close over the wire.

820,440. Trolley Pole; Robert P. Rever, Newark, N. J. App. filed Feb. 18, 1905. To secure flexibility of the pole a hinge-joint is incorporated therein and the pole held in alinement by a spring sleeve.

820,481. Trolley; Jacob R. Deily, Philadelphia, Pa. App. filed Sept. 5, 1905. Two trolley wheels mounted at either end of a short wheel-frame pivoted in the trolley harp.

820,488. Electric Railway; John A. Garey, Tarkio, Mo. App. filed May 25, 1905. Third-rail supports including hollow cross-ties arranged at intervals and means carried by the car for forcing dirt from the conduit into such cross-ties, from which the accumulation may be withdrawn at intervals.

820,529. Automatic Train-Reporting System; Elmer E. Steiner, Knightstown, Ind. App. filed July 10, 1905. Tappets are provided in the roadbed adapted to be engaged by specially constructed shoes carried by the train. The latter has a plurality of projecting lugs spaced in a special and predetermnied way for each train so as to give a distinctive signal when passing over the tappets.

820,539. Railway; Alpheus H. Wood, Ann Arbor, Mich. App. filed Sept. 11, 1905. An inclined bearer fixed at a point along the roadway operates to raise a shoe or tappet depending from the train which serves to operate an electric switch on the car.

820,584. Trolley Pole Controller; Joseph F. Mackin, Columbus, Ohio. App. filed Aug. 21, 1905. Pneumatic means for controlling the trolley pole, consisting of a sleeve and rod so arranged that when their relative motion is slow they do not bind, but in case of a quick relative movement, the sleeve binds and a valve is opened which admits air to retrieve the pole.

820,607. Car Fender; Frank Seeley, New York, N. Y. App. filed Dec. 8, 1905. A horizontal platform suspended from the car and having a backward and downward movement whereby the fender throughout its whole extent is brought down near the pavement in a plane parallel with the surface of the street by impact with the person struck.

820,705. Composition for Filled Brake-Shoes and Process of Manufacture; Warner R. Crowell, Boston, Mass. App. filed Sept. 11, 1905. A composition containing comminuted iron, comminuted steel and sal-ammoniac.

820,733. Street Railway Car Fender; John Post, Philadelphia, Pa. App. filed Nov. 29, 1905. A car fender having its surface composed of inflatable cushions connected together for simultaneous inflation.

820,805. Amusement Device; William F. Mangles, New York, N. Y. App. filed March 21, 1905. Comprises an inclined surface having rising projections, and a car adapted to travel down the said surface and to bump against the projections, to change the course of the car, the car having means to turn on a central axis.

PERSONAL MENTION

MR. ROBERT GRINNELL has been promoted to be superintendent of employment of the Chicago City Railway Company.

MR. THOMAS BLAKELY has been promoted to be superintendent of transportation of the Chicago City Railway Company

MR. HORACE ANDREWS, president of the Cleveland Electric Railway Company, who is now in Europe, has just purchased a large German racing machine in which he will tour through lower France and Italy during the next few weeks.

MR. E. RITCHEY, who has been employed by the Mansfield Railway, Light & Power Company, of Mansfield, Ohio, for the past eleven years, has been appointed superintendent of transportation of that company, in charge of motormen and conductors.

MR. LEWIS CASS LEDYARD, of the law firm of Carter, Ledyard & Milburn, of New York, has been appointed a member of the Rapid Transit Commission of New York by Mayor McClellan, to succeed Mr. John Claflin, resigned, because of the new law requiring commissioners to be residents of New York City. Mr. Ledyard is fifty-five years old, and a graduate of Harvard University.

MR. RICHARD T. LAFFAN, former general manager of the Worcester Consolidated Street Railway, who went to Manila in 1902 to install the first electric railway, power and light plant ever operated in the Philippine Islands, is on his way to this country. Mr. Laffan will spend about six months here and then will return to the Philippines to resume his duties as general manager of the Manila Electric Railway & Light Company.

MR. GEORGE F. FABER has recently resigned his position as superintendent of the Columbus, Delaware & Marion Railway (Marion division) to accept the position as superintendent of the Elgin & Belvidere Electric Railway, of Elgin, Ill., a high-speed interurban line, which will be in operation about July 1. Mr. Faber previously was superintendent of two of the old Appleyard lines in Ohio, and his services with these properties was highly commendable.

MR. J. F. PORTER, who has assumed the management of the consolidated public utilities of the Moline, Davenport and Rock Island for the syndicate represented by J. G. White & Company, of New York, has been associated with the undertakings of the operating department of that company for a number of years. As president of the public service system of Alton, Ill., he has completed since 1893 an organization which controls practically all of the electric railway, lighting and gas properties in Alton and adjoining towns, and he goes to Davenport with the prestige thus established as an operating executive. Mr. Porter is a technical graduate, and before allying himself with the J. G. White & Company interests he was associated with the Edison Company, of Chicago, the Edison United Electric Manufacturing Company and the Railway Specialty Company, of New York.

Street Railway Journal

VOL. XXVII. NEW YORK, SATURDAY, JUNE 2, 1906. No. 22.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In tbe United States, Hawaii, Puerto Rico, Pbilippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....................$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Botb of tbe above, in connection witb American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....................$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid.................. $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8500 *copies are printed. Total circulation for* 1906 *to date,* 179,800 *copies, an average of* 8173 *copies per week.*

Conduct of Trainmen When Off Duty

If the present tendency of the employment departments of street railway companies continues, street railway employees, especially the motormen and conductors, and those that come in direct contact with the people, will, as a class, be regarded as far above the average workman so far as personality is concerned. Electric railway companies are beginning to realize the importance of having reliable and trustworthy men on cars, and in many places such men are required to sign agreements to abstain from all bad habits. Moreover, some companies take means to see to it that the conduct of the men, both when off duty as well as when on the cars, is not in violation of the agreement signed.

The rules of a great many companies now prohibit absolutely the use of intoxicating liquors while on duty, and only a moderate use of it at all other times. The habit of chewing tobacco is also discouraged. No one will dispute the right of a company to prohibit the use of intoxicating liquor while on duty, but some may think the company is assuming a little too much right when it undertakes to control a man's actions at times when he is not at work, especially when he is not in uniform. We believe, however, that a company is perfectly justified in doing so. When a man is employed by a railway company he is known as a part of an organization, and his actions when off duty, as well as when on, will influence public opinion with regard to the organization as a whole. Even if a man were able to drop his identity completely when on the car, there are reasons why the company has right to concern itself with a man's conduct at all times. In the first place, a drinking man is likely to go on duty when partly under the influence of liquor. Again, a man cannot be out all night and have full use of his mental faculties the next day. The responsibility resting on both motormen and conductors is too great to permit of a man acting except in the best of condition. A man with dulled faculties may operate a car under ordinary conditions continuously without accident, but he cannot be on the alert to avoid accidents from unlooked for causes. An accident out of the ordinary nature may occur for which he cannot be held strictly accountable, yet another man with a clear brain could have avoided it. It is the alert man that should be on cars, and it is safe to presume that he cannot be gotten from the ranks of those that dissipate when off duty.

So far as conductors alone are concerned, their responsibility with regard to the lives of the passengers is less than that of the motorman. But there is more call for honesty in their vocation. Honesty usually goes hand in hand with several other traits. Moreover, a man may, to a great extent, be judged by the company he keeps. As an employing company has no certain means of judging whether or not a man is honest, it has the right to form its opinion from the general conduct of the man, and from the class of men with which he associates when off duty. When a company insists on general moral behavior and discharges any man whose actions, when either on or off duty, are such as to throw reflection on the organization to which he belongs, it most assuredly is pursuing the right course and is not overstepping its prerogatives as an employer.

Boiler-Room Lighting

It is not an easy matter to determine the precise relation between the quality of illumination in a boiler room and the operating economy of the plant concerned, but, even if no mathematical expression lies close at hand, there is not the least doubt that good lighting pays in the fireroom quite as much as it does in any other part of the installation. Only a short-sighted policy will refuse to take account of factors which cannot be reduced to figures, but which really bear in no uncertain way upon the results which can be obtained from a given equipment.

Of late there has been a pretty general recognition of the fact that good lighting is essential to first-class work in the boiler room, but in many plants very little has been done to improve the existing conditions, except to substitute enclosed arcs for the open type without globes, or to scatter a few incandescents around in a promiscuous fashion. In some of the later isolated plants the boiler rooms are models of first-class lighting, but in far too many railway plants the question has received only the most hap-hazard attention.

The average boiler room is not very favorably supplied with natural light, even if the designer of the building chanced to put half a dozen windows or so in the boiler room walls. The presence of coal dust makes it difficult to kept the windows clean for any length of time, and the black painted boilers are of very little use as reflecting surfaces. The ordinary practice of hanging a 16-cp lamp here and there, without reference to much of anything except the steam gage, is scarcely to be commended on the score of effectiveness. As far as general illumination is concerned, there is no reason why boiler fronts should not be painted a more cheerful color than black, although perhaps this is the best color for all around service, on account of the presence of coal dust and the comfort which a black surface affords the eye.

In some cases a lamp hung in front of the steam gage and water columns of each boiler, with a reflector behind it, arranged to throw all the light upon these two appliances, supplies all the special illumination needed. General illumination, however, is important to secure, as well as special. There are often weighing scales, feed pumps, injectors, sump pumps, heaters, and damper regulators in the boiler room, and a good general illumination should be provided for these, with facilities for carrying a flexible lamp or two to any point when a brilliant lighting of any part is needed for inspection or temporary repairs. Very few boiler rooms are equipped with plug-socket facilities. It is hard to say just what the intensity of general illumination in a boiler room should be, but with an allowance of from 2.5 sq. ft. to 4 sq. ft. of floor area per candle power, the results ought to be satisfactory. The use of enamelled tile or even white-painted bricks in a boiler room is certain to be helpful, and under such conditions an allowance of 5 sq. ft. or 6 sq. ft. per candle power should be sufficient. With overhead coal bunkers and mechanical stokers, the higher intensities should be applied, particularly to afford easy examination of all moving parts. Cleanliness is a prime factor in the efficiency of boiler room operation, and it is rarely the case that a dirty boiler room is found to be well lighted. The moral effect of an ample light supply is excellent, and it stimulates more frequent cleaning of windows, tiling, lamp bulbs, and obscure corners in general. The whole idea should be to make the boiler room a comfortable place in which to work, in the matter of illumination. The best work cannot be done in anything but a well-lighted enclosure.

Discussion of Departmental Subjects at Street Railway Associations

We consider it our duty in the editorial columns of this paper to bring to the attention of our readers all important improvements which have been introduced to better street railway conditions and practice, as well as to make suggestions which may conduce to these ends. With this in mind, we wish to call attention to the radical departure, instituted about six months ago by the New York State Street Railway Association, in conducting departmental meetings, and to the value of such a plan for any technical organization which holds meetings sufficiently often so that this method can be adopted. The time has passed, or has practically passed, upon all except the very smallest roads, when one man has direct charge of all of the work of street railway company. The manager, president, superintendent, or whatever his title may be, who is giving attention to the subject of traffic and schedules, is not, as a rule, also the one who is most familiar with the company's repair-shop practice; and the master mechanic, in turn, is not, as a rule, conversant with the methods which the company follows in its track construction or the operation of its power house. If the meetings of an association are attended exclusively by the operating managers, it is natural that the subjects relating to this department should receive special attention, and if the engineering and mechanical departments are also represented, the time is usually too short to cover all of the branches of railway work. The work of the national association has wisely been divided into several branches, so that these topics can properly be considered at separate meetings at about the same time. But as this plan presents difficulties in the case of State associations, the New York body has very sensibly, it seems to us, followed the plan of quarterly meetings, at which each meeting is devoted entirely to some important branch of railway operation. Thus, the last quarterly meeting of the New York Association was given up to discussion of methods of constructing the traffic department, while that held at Schenectady in January was devoted to a consideration of mechanical subjects.

In this connection we believe that repair-shop topics are being neglected in association work more than their importance deserves. If one consults the disbursement sheet of the average street railway and notices the percentage of expenditures due to repairs of equipment, the effect of this factor on the total operating expenses of the line can easily be seen. It is so large as to justify a thorough discussion of the subject. Not only this, but our experience indicates that repair-shop practice differs widely between different roads. There is an infinite variety of methods of doing the same thing. Certain of these ways must be better than the others, and the sooner those in whose shops the more costly methods are in vogue learn the more desirable ways, the sooner the expense of maintenance of their equipment will be decreased. All of the best methods are not followed in any one shop, however; some are found in one shop and some in another. There is no better way of waking shop superintendents up to the fact that they are doing some things by time-taking and expensive methods and acquainting them with better schemes than by free discussions in meetings. By "free" discussion, we mean discussions on the cost of apparatus and methods, discussions which can be backed up by figures from the private note-books of those participating in debate, discussions not only of what has been done but of what that experience has taught and what the speaker is planning to do. In some cases, undoubtedly, figures of this kind will have to be given in confidence, but we believe that there will be less of a tendency toward secrecy in matters of this kind than there has been, as the advantages of publicity become more evident.

There is a variety of subjects which could be discussed in this way. For example, cost and methods of inspection, car cleaning, brake rigging, commutator repairs, field and armature repairs, motor lubrication, brake-shoes, babbitting methods, trolley wheels, brushes and brush holders. It is true, that these subjects are of direct interest to only a limited number of those who usually attend an association meeting, but the same is true of almost any traffic question which might be discussed, and indirectly, as we have already pointed out, the information which will be brought out is of great importance to any road.

The Auto-Omnibus in Cities

A great deal of interest has been manifested in this country during the past year in the gasoline-motor car for railway work. Its possible influence on railway development in sparsely settled districts has been discussed with a great deal of care, and papers have been presented upon the subject before engineering bodies. But there has been a dearth of interest and information in regard to the auto-'bus, which abroad is attracting more attention from street railway managers than the auto-car which runs on rails. No one can read the foreign technical papers, or, still more, can visit many of the European cities, without being impressed with the tremendous activity which is being shown in this branch of transportation. London at present seems almost to have gone mad on the subject. Omnibus transportation has always been a prominent feature of the British capital, but the motor 'buses are now replacing the horse 'buses at a rapid rate. New companies are being floated for the manufacture and operation of new lines of motor 'buses and there seems to be little doubt in the mind of the average Londoner that the horse 'bus is doomed. They are being replaced by motor 'buses as fast as the latter can be secured from the various manufacturers. There is a difference of opinion as to the best motive power between gasoline, gasoline-electric and steam, but there seems to be little doubt that the motor 'bus has come to stay. The earlier 'buses were equipped with motors of about 20 hp, but the later machines have a capacity of from 40 hp to 50 hp, and are much better in every way than those first installed. Their speed is about twice as fast as the old horse 'bus, breakdowns are getting less and less frequent, and all London seems gaily to have adopted the new method of transportation. It is estimated that there are in the neighborhood of 400 motor 'buses now in operation in London. The same condition of affairs, although in a somewhat less degree, exists in other European cities. In Berlin, for instance, there are now some fifty auto 'buses, but the street railway company and 'bus company have ordered some 200 more. In Paris the development has been prevented by the local franchise conditions, but the General Omnibus Company, tired of waiting upon the city to settle the question of its franchise extension, has boldly decided to undertake the exploitation of several lines.

Of course, the life of the motor omnibus is an unknown quantity, and no one knows how much to allow for depreciation. The tires were originally a very expensive item and are still very costly, except that most of the operating companies in London are now getting contracts with manufacturers to supply and mend tires at so much a car-mile (generally 4 cents), and in this way they are able to know exactly the cost. Provision is also made for depreciation in practically all of the prospectuses issued by the new companies, and in most cases the allowance for it is as high as 20 per cent of the first cost of the vehicle, but whether this is sufficient or not remains to be seen. It is certain, however, that the 'buses have had an effect upon street railway traffic, and even upon the receipts of the underground lines, with both of which they can compete to a fairly successful extent in point of speed.

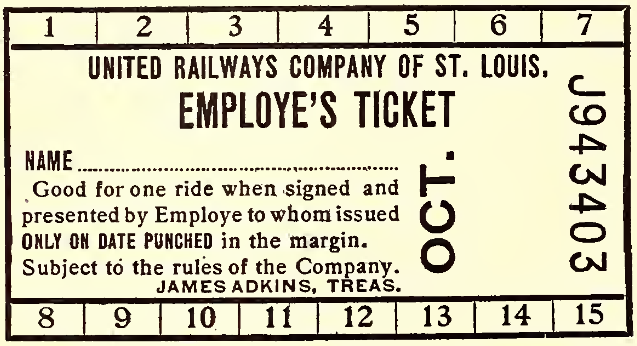
Of course, the conditions affecting street railway and 'bus operation in London are particularly favorable to the former, and would not find a duplicate in this country. In the first place, the street railway systems operate under tremendous restrictions so far as speed, franchises, type of construction and taxes are concerned. The memorable remark of Sydney Smith on taxation in England from birth to death, applies with especial force to British tramway undertakings. At the same time, and in marked contrast to this policy, omnibus undertakings have been particularly free from onerous conditions. Up to within recently, and we presume that the rules are still in force, anyone could start a 'bus line by paying a very small license fee and posting within the vehicle the rates of fare charged between different points. These posted rates of fare could be changed at will and this privilege was freely exercised by the proprietors of the 'bus lines in London during the coronation celebration, as those who were in London at that time will distinctly remember. Little capital is therefore required to operate a 'bus line, although the older companies naturally do what they can to put a newcomer out of business.

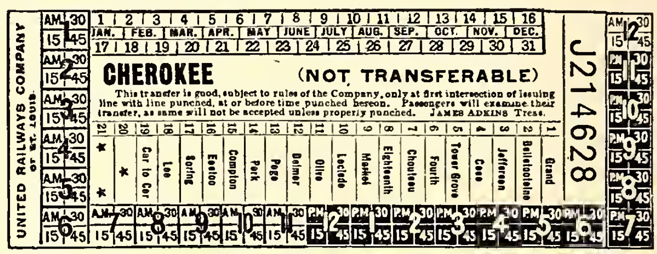
These same conditions would not apply in America, because the street railways already have a strong footing and are supplying good service, and because, in the larger cities at least, we imagine that franchises would be required for 'bus operation, with restrictions comparable, as they should be, with those for operating street cars. We have no fear, therefore, in regard to the effect of motor 'bus competition on street railways in this country or even a foreign city which is well equipped with electric tramways, as the cost of operation per car mile of the latter must certainly be considerably lower than that of motor 'buses, except where a very limited service is run.

On the other hand, there are undoubtedly situations in this country where it might prove profitable to operate 'bus lines. In almost every large city, for instance, there are a number of prominent streets on which tracks are not permitted, attractive places in parks not reached directly by street cars, racing grounds and similar places that require transportation. Conditions of this kind are usually concomitant with patronage from the more prosperous classes, who, for the extra facilities offered, would be willing to pay more than the customary nickel. But even under these favorable circumstances we believe that the traffic in sight would have to be fairly continuous to be profitable. The European experience has also shown that it is necessary to carry passengers on two decks to make operation pay, unless high fares are charged.

THE PRINTING DEPARTMENT OF THE UNITED RAILWAYS OF ST. LOUIS

It is quite unusual for a street railway system to print its transfers, stationery, miscellaneous notices and in fact do all its own job press work. About one year ago, however, a printing department for turning out such work was established in connection with the purchasing department of the United Railways, St. Louis, and put in charge of J. B. Price, the purchasing agent. It was started not with the idea of turning out work at a less cost than that at which it could be obtained when printed by outside concerns, but largely to avoid the inconvenience and delay attendant when having the work done outside and to obtain neater and more accurate job work. With regard to printing transfers the lessened inconvenience was of special importance. In order to guard against delays in shipment of new orders it was necessary, previous to the establishment of the department, to keep on hand a large supply of each kind of transfer, and even with the greatest of attention the supply of one or more styles often fell so low as to cause great inconvenience. All the work turned out by the department is especially noticeable because of its neat and clean appearance.





TWO SPECIMENS OF THE WORK DONE IN THE PRIVATE PRINTING PLANT OF THE UNITED RAILWAYS, OF ST. LOUIS

The press room occupies the basement of one of the office buildings on the corner of Park and Vandeventer Avenues. Several of the machines installed in it are shown in the accompanying reproduction. The equipment consists of a Harris automatic two-color 15-in. x 18-in. press for printing transfers; a 34-in. Holyoke paper cutter, a No. 4 New Jersey stitcher, a 12-in. x 18-in. Golden job press direct connected to a driving motor, a Chandler & Price 14½-in. x 22-in. job press, imposing stone, type and other necessary apparatus. With the exception of the Golding job press, all of these machines are driven from a 10-hp motor through line shafting. The printing of the transfers alone requires considerable work. Practically all of the lines of the city terminate in the downtown district, and as universal transfers are given, the consumption of these is enormous; in fact, it amounts to between 200,000 and 300,000 per day. The Harris press mentioned, however, has a capacity of 125,000 transfers per hour, so that the demand is easily supplied.

A VIEW OF THE PRESS ROOM

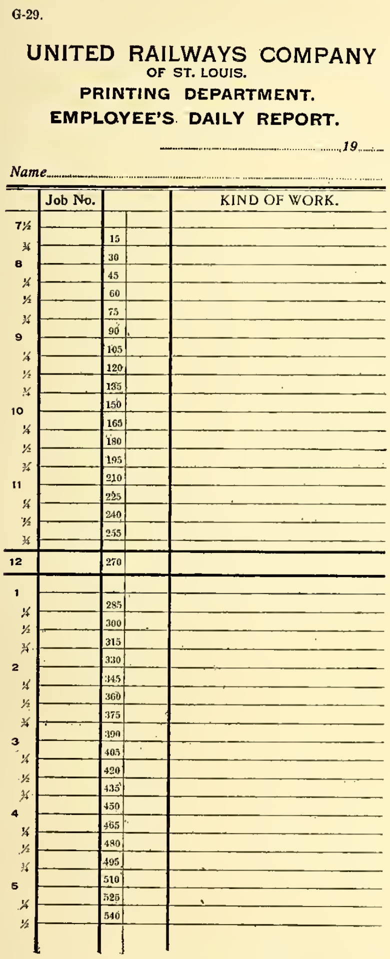
Stock paper for transfers is cut to 11¾ ins. x 18 ins. These are placed on the feed board of the machine several hundred at a time and the feeding is automatic. If for any reason more than one sheet or a torn sheet is fed into the machine an automatic mechanism throws off the power. Each impression of the machine prints eighteen transfers, the printing, numbering and perforating all being done in one operation. The machine has five speeds, varying from 5700 to 6970 impressions per hour. The transfers after being printed are mounted on a back of special board composed of three colors of paper pressed together. After being stitched and cut the pads are packed in wooden boxes each holding 1000 transfers. A slip with the packer's identification mark is placed in each box and the boxes are held until needed at the several division car houses.

Twelve different colors of paper are employed to distinguish the transfers of the several lines. The paper is of special manufacture and is ordered in 5000 lots of each color, which makes necessary the carrying of considerable stock on hand. On the railway system eighteen different kinds of transfers are employed, but by printing six of the different colors of paper in both red as well as black ink all the transfers are given a distinctive appearance with but twelve kinds of paper.

Matter such as workmen's reports, delay reports, passes and other small forms are printed on the transfer press. Passes are printed eighteen on a single sheet as are transfers. They are also numbered in the same manner. Other forms are printed two on a sheet. When it is not necessary to number the forms, as when turning out delay reports, the automatic numbering device is unlocked and rolled back from the press proper and only this portion of the machine is operated. When two forms are printed on a sheet the machine has a capacity of 1400 per hour.

The printing of transfers and small forms is, however, a small part of the work done in the department. Letter-heads and blank reports for the different departments, special notices and miscellaneous work of various kinds is turned out in large quantities. In all there are about three hundred differforms used by the several departments and many of these are electrotyped. Others which are used frequently are kept set up in type.

A very close record is kept of the costs of every piece of work. Each order is given a job number and an order blank is made out by the purchasing agent and sent to the foreman of the printing department. When the job is completed the order, with the sample of the work, is returned to the purchasing agent. Employees in the department make out a daily report of the time spent on each job. These reports, together with reports of stock used on each job, enable the cost of every piece of work to be accurately computed. Twice each month the storekeeper sends in a report of the number of transfers of each kind on hand, the number used and the stock on hand. The rate at which the transfers are being used is then computed and an estimate is made as to when the stock of paper on hand will run out. This assures orders for stock being placed several weeks before it is exhausted. The fact that the paper is of special grade, and its manufacture requires considerable time, necessitates this precautionary measure.


G-29.

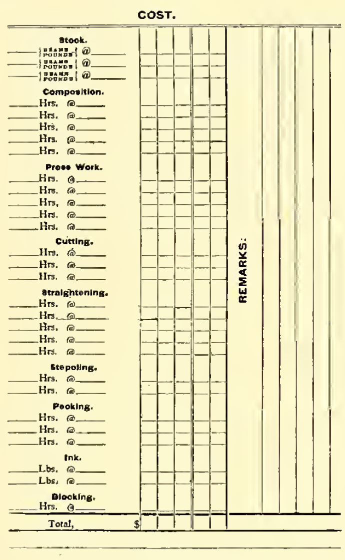
UNITED RAILWAYS COMPANY
OF ST. LOUIS.
PRINTING DEPARTMENT.
EMPLOYEE'S DAILY REPORT.

..........................19......

Name..

	Job No.		KIND OF WORK.
7½			
¼		15	
8		30	
¼		45	
½		60	
¾		75	
9		90	
¼		105	
½		120	
¾		135	
10		150	
¼		165	
½		180	
¾		195	
11		210	
¼		225	
½		240	
¾		255	
12		270	
1			
¼		285	
½		300	
¾		315	
2		330	
¼		345	
½		360	
¾		375	
3		390	
¼		405	
½		420	
¾		435	
4		450	
¼		465	
½		480	
¾		495	
5		510	
¼		525	
½		540	

EMPLOYEE'S DAILY REPORT OF OF WORK DONE


COST.

Stock.
...... REAMS / POUNDS @ ......
...... REAMS / POUNDS @ ......
...... REAMS / POUNDS @ ......

Composition.
......Hrs. @......
......Hrs. @......
......Hrs. @......
......Hrs. @......
......Hrs. @......

Press Work.
......Hrs. @......
......Hrs. @......
......Hrs. @......
......Hrs. @......
......Hrs. @......

Cutting.
......Hrs. @......
......Hrs. @......
......Hrs. @......

Straightening.
......Hrs. @......
......Hrs. @......
......Hrs. @......
......Hrs. @......
......Hrs. @......

Stapling.
......Hrs. @......
......Hrs. @......

Packing.
......Hrs. @......
......Hrs. @......
......Hrs. @......

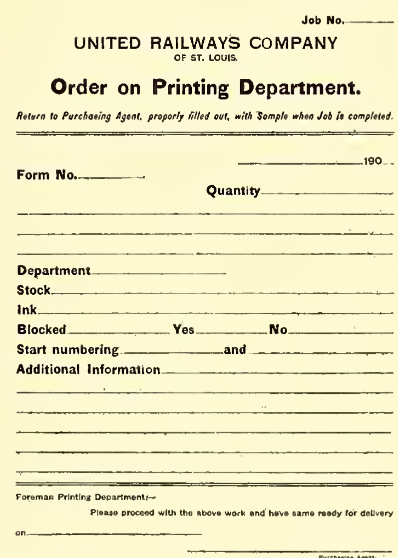
Ink.
......Lbs. @......
......Lbs. @......

Blocking.
......Hrs. @......

Total, $

REMARKS:

COST SHEET


Job No. ......

UNITED RAILWAYS COMPANY
OF ST. LOUIS.

Order on Printing Department.

Return to Purchasing Agent, properly filled out, with Sample when Job is completed.

......................190...

Form No.......... Quantity..........

Department..........
Stock..........
Ink..........
Blocked.......... Yes.......... No..........
Start numbering.......... and..........
Additional Information..........

Foreman Printing Department:—
Please proceed with the above work and have same ready for delivery on..........

.... Purchasing Agent.

ORDER ON PRINTING DEPARTMENT

It was the former custom of the road to chop or to burn canceledm transfers and tickets. Chopping them proved an almost endless job and likewise when burned a great deal of time was consumed in the operation. During the last two years canceled transfers and tickets have been the means of quite a little revenue, instead of being a burden. They are now bailed with other waste paper and sold to the paper mills. Baling presses are located in the basement of the office, and this work is done by the office porters at practically no extra expense. The bales are covered with burlap and sealed, the seals remaining unbroken until the bales are opened in the paper mills just before throwing the contents into the pulp mills. The sales of baled paper amount to about 150,000 lbs. a year. As 60 per cent. of this is made up of canceled transfers it may be seen that this method of disposition nets a considerable revenue. The company has recently placed an order for one additional 15 x 18 two-color Harris automatic press with numbering heads, dating heads and perforating attachments. It has also purchased dating heads for the present press. In addition to this the company has purchased a duplicate of its present No. 4 New Jersey wire stitcher.

THE NEW SUMMER TRAFFIC SCHEDULE OF THE CLEVELAND & SOUTHWESTERN TRACTION COMPANY

The Cleveland & Southwestern Traction Company has arranged an unually efficient service for the summer season. The new schedule calls for twelve limited cars daily between Cleveland and Oberlin, giving a half-hourly service between these points; every other car a limited. Four of the limited run through to Norwalk, and hourly cars for Wellington connect with the limited at Oberlin, giving these points better than hourly headway. The southern division to Wooster will have hourly local cars and half-hour cars to Berea, with four limiteds through to Wooster in addition. The company is receiving fifteen unusually fine cars from the Niles Car & Manufacturing Company, Niles, Ohio.

THE CLEVELAND LEASING PLAN

The directors of the Cleveland Electric Railway have again expressed their willingness to lease the property to the city, providing they can secure a reasonable offer for the stock as a basis upon which to carry out the leasing plan. At the present time, however, there is little possibility of the city and the company agreeing on a figure. Some time ago E. W. Bemis, acting for the city, and Secretary H. J. Davies, acting for the company, made careful investigation as to the company's finances and franchises, with a view to determining the present value of the stock. The reports of these two men have just been turned in, and, while the details are not announced for publication, it is stated that they could not agree on figures, due largely to a difference of opinion between the city and the company as to the life of the existing franchises.

INFLUENCES DETERMINING STREET RAILWAY TRAFFIC IN GERMAN CITIES

BY WILHELM MATTERSDORF

A study of traffic statistics to determine whether there are any general natural laws between the amount of city traffic and its determining factors, such as population, length of track, etc., can be undertaken satisfactorily only when every part of a system is examined in detail. There is no doubt that under present conditions an investigation of this kind is of the utmost importance, because most city street railway systems have now reached the point where any further extension of their lines or increase in their car mileage must be carefully considered. In the present article it is proposed, first, to consider the relations between the traffic and the population of a city; second, those between the traffic and its determining operating factors; third, those between operation and population; fourth, the relation of car-kilometers run to passengers carried.

Of course, all of these points may be summarily dismissed by saying that traffic increases with the population, that it may be taken for granted that the length of the lines, the car mileage and the income will also increase, but that every one of them is so liable to the influence of varying local conditions that any generalization is nothing but speculation and theory, and therefore without practical value. The following discussion, however, will attempt to prove by a comparison of all the evidence that by properly selecting and arranging the available material certain definite conclusions can be clearly derived.

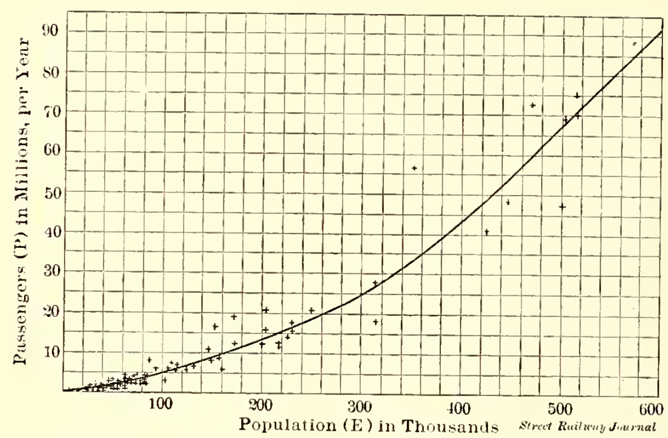


FIG. 1.—CURVE SHOWING RELATION OF PASSENGERS TO POPULATION IN SMALL CITIES

Until the publication of the extensive statistics contained in the 1905 supplement of the Zeitschrift für Kleinbahnen, the writer was unable to secure thoroughly reliable data on the street railways in Germany. These figures are for 1903, and, unfortunately, it is not possible to get the population statistics for the same period to use in connection with them, so that those for 1900 are employed. Interurban roads and the few remaining horse railways are omitted from consideration because their traffic and operating conditions differ so widely from those of city railways. The population served by a complete railway system was determined by adding the population of the city and that of the suburban towns reached by its lines. The length of line is the length of route, that is, 1 km of street containing a single or double track is reckoned as 1 km. To facilitate the plotting of curves and derivation of formulae, the following letters were adopted to represent the different factors:

E—Population.
B—Length of line in kilometers.
W—Car-kilometers per year.
P—Number of passengers per year.

From this it follows, for example, that P/E equals the rides per capita, W/E the car-kilometers per capita, W/B the car density, P/W the passengers per car-kilometer, etc. In the accompanying diagrams circles are used to denote all traffic systems serving populations of over 100,000 and crosses for those of less than 100,000. The curves in each of the figures

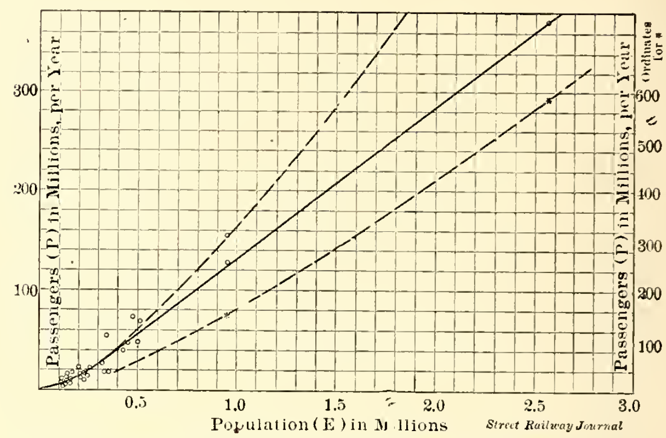


FIG. 2.—CURVES SHOWING RELATION OF PASSENGERS TO POPULATION IN LARGE CITIES

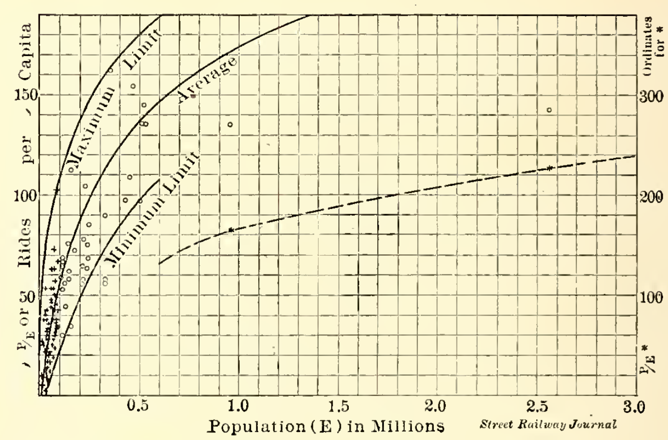


FIG. 3.—CURVES SHOWING RELATION OF RIDES PER CAPITA TO POPULATION

show averages and (with one exception to be noted later) were not mathematically developed, so that exact mathematical relations between them are not to be expected.

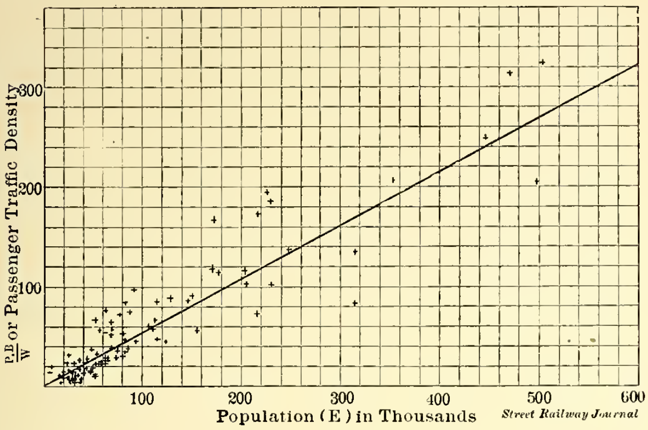
RELATION OF TRAFFIC TO POPULATION

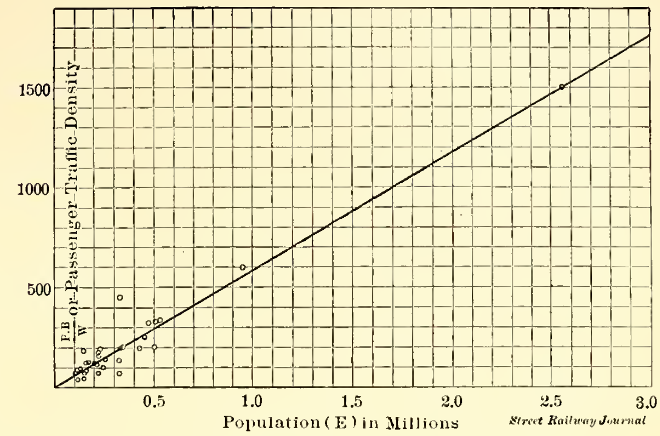
Figs. 1 and 2 were prepared to show the relation of traffic to population. The average curve shows that up to 500,000 the traffic increases as the square of the population, but above that only in direct proportion. This average curve corresponds to the following values:

Population	Annual Fares
50,000	2,000,000
100,000	5,000,000
200,000	14,000,000
300,000	25,000,000
400,000	43,000,000
500,000	67,000,000

Only two systems vary widely from these figures, namely, Munich, with 48,000,000 passengers for a population of 500,000; and Frankfort-on-Main with 57,000,000 passengers for only 350,000 people. Up to 80,000 population it will be noted that the values are very close. Outside of these two systems that of Wiesbaden, with 8,850,000 passengers for a population of 86,000, is also noticeable, the increase over the average being due to heavy tourist and through line traffic. Similar conditions may be prevalent in Bremen. Danzig falls below the average, showing only 5,500,000 fares for a population of 160,000, and Nürnberg and Barmen-Elberfeld with only 18,500,000 fares for a population of 316,000. In the latter case the longitudinal configuration of a small valley gives more play to competition from the local State Railway and suspended railway, which seriously affect the street railway traffic, but the traffic on these roads is not included in making this curve.

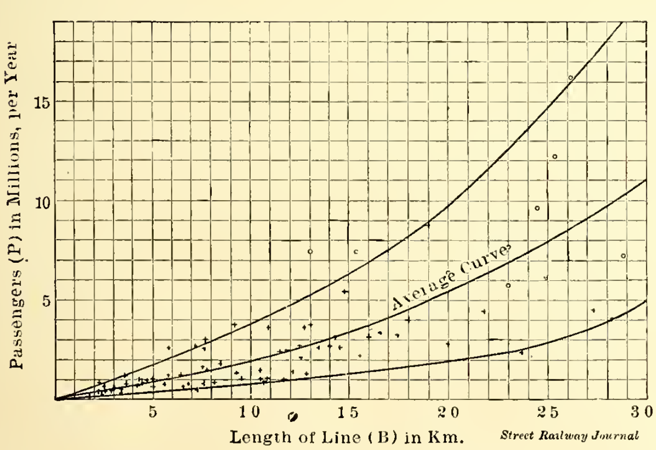
that the increase is less marked. Hamburg and Berlin again prove apparent exceptions, but if all the transportation means are taken the figure for Berlin is 581/2.56, or 227, and for Hamburg 155.5/.95, or 163.6. These values approximate to those given in the average curve of Fig. 3. The curve for Berlin and Hamburg is represented by the broken line that is given at one-half scale. The limiting or extreme values are denoted by the lines drawn outside the average. Among the higher values are those of Frankfort-on-Main, Bremen and Wiesbaden, while Munich, Barmen-Elberfeld, Nürnberg and Danzig will again be found among the lower values.

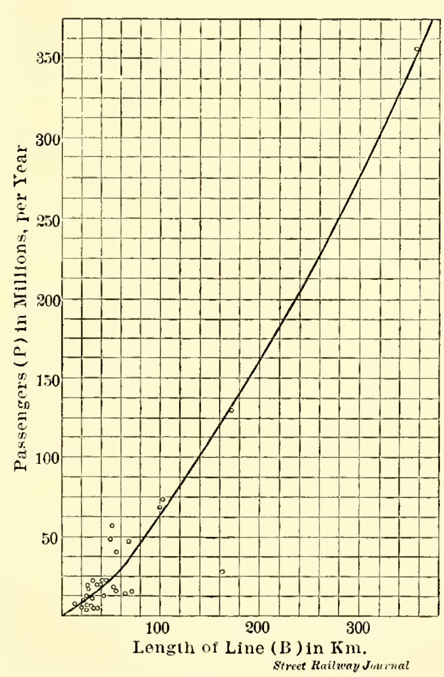




FIGS. 4 AND 5.—CURVES SHOWING RELATION OF PASSENGER TRAFFIC DENSITY TO POPULATION

Other conditions affect the higher values of the curve. In cities of more than 500,000 the traffic diverted by omnibuses, elevated railways and suburban lines becomes quite a factor. If, in the case of Berlin, we consider all of the means of transportation, the total fares during 1903 amount to 581,000,000. For Hamburg-Altona, the addition of the local steamer transportation and the Hamburg-Altona-Blankenese line would give for 1905 approximately 155,500,000 fares, of which 128,500,000 are handled by the street railway. These values for





FIGS. 6 AND 7.—CURVES SHOWING RELATION OF PASSENGERS TO LENGTH OF LINE

Berlin and Hamburg are given in half scale in Fig. 2, by the ordinates at the right and are indicated by asterisks. They show that it is probable that even in cities of over 500,000 the fares increase as the square of the population. Owing to the lack of values, the course of the upper part of the curve can only be assumed, as shown by the broken line in Fig. 2.

If the number of rides per capita (P/E) should be plotted with population as abscissae, the curve shown in Fig. 3 is obtained. From this the following law is clearly derived, namely, the number of rides per capita increases rapidly from 0 to about 54 at 100,000 poulation, but for populations above

The variations in car density (W/B), according to the population, were discussed by the writer in a previous article in the STREET RAILWAY JOURNAL for April 5, 1902. The curves showing this relation start from the origin or 0 point, as in Fig. 3, without, however, developing so clearly defined a law. The striking similarity of the curve, however, to that in Fig. 3 suggests the thought that the two relations P/E (rides per capita) and W/B (car density) stand in directly opposite relation. Hence a value may be developed which shows the number of passengers carried per unit of car density, namely PB/W, which may be called "passenger traffic density." The relation of this value to population is shown in Figs. 4 and 5. The average curve in each case is plainly a staight line directly from the origin. The tangent of the angle which this line makes with the axis of abscissae is about .55, while the extreme outside limts are about 1 to 1.1. An exceptional value of PB/W is that for Hanover, which shows 453 for a population of 315,000,—evidence that on this system an unusual condition exists in that the length of the line in comparison with the population is far beyond the average. For the line showing the average value

$$\tan \alpha = \text{constant} = PB/WE$$

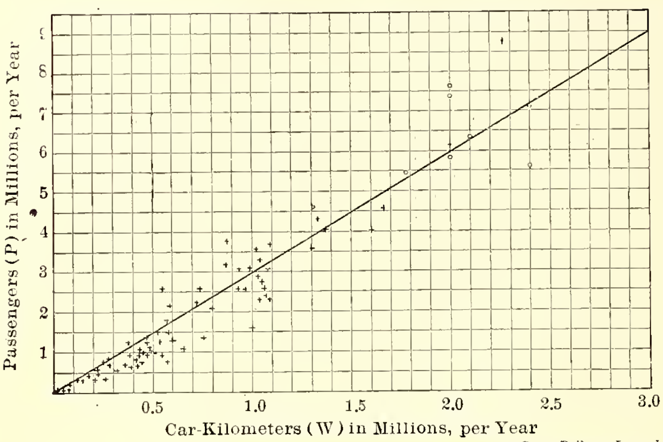
from which it follows that, other condition being equal, the rides per capita increase in the same ratio as the car traffic density.

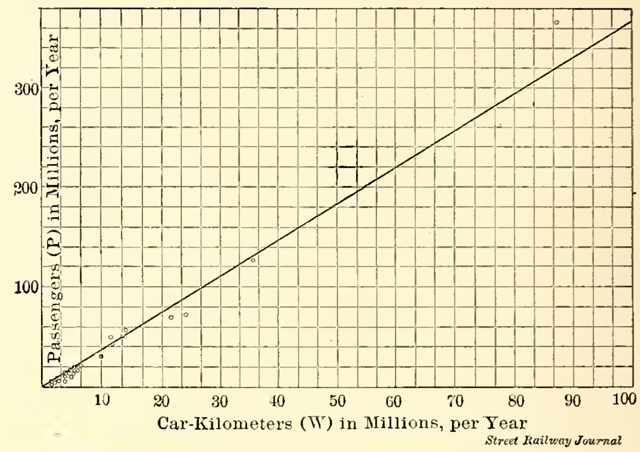
RELATIONS BETWEEN TRAFFIC AND OPERATION

Having examined the relations of the traffic and population, the question comes up as to the effect of the operating conditions on the traffic. Naturally, the operation of a line may be carried on not only to satisfy the ordinary traffic demands, but may increase it by improvements in service. Despite the many variable conditions, the fundamental factors may be taken to be length of line and the annual car-kilometers. The relation between the passengers carried and the length of line are shown in Figs. 6 and 7. Up to 10 km, the rise is rather slow, but it increases from that length up to 30 km, and above the latter becomes very steep. The average curve shows for a length of 10 km only 2,000,000 passengers, while for 30 km the number is 11,000,000, or 366 passengers per running meter; while for 350 km there are nearly 350,000,000 passengers, or 1000 per running meter. Strongly deviating values are presented by Frankfort-on-Main, with 1110 passengers per meter for a line 51 km long, with 57,000,000 trips; Hanover, with 174 passengers per meter for 162 km and 28,000,000 passengers, as well as Munich and Chemnitz, which also show variations above and below the average.

From this it appears that the passengers per meter have a certain relation to the length of the line, but no definite average was obtainable.

In Figs. 8 and 9 are shown the relation between passenger traffic and car-kilometers. The first part of the curve, or that near the origin, looks like a straight line without any startling deviations. The tangent of the angle which this straight line forms with the axis of abscissae is a measure for the "space-





FIGS. 8 AND 9.—CURVES SHOWING RELATION OF PASSENGERS TO CAR-KILOMETERS

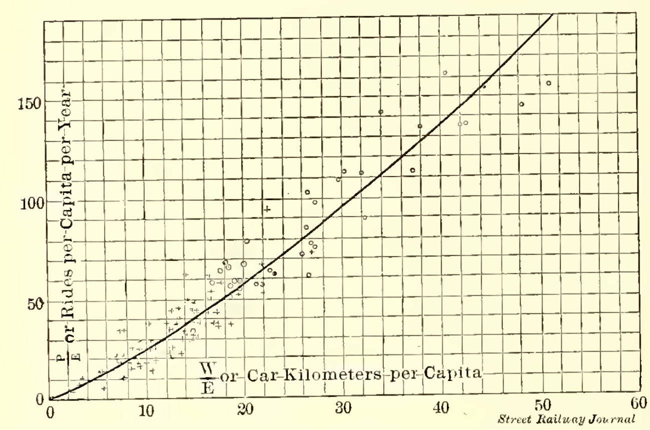


FIG. 10.—CURVES SHOWING RELATION OF RIDES PER CAPITA PER YEAR TO CAR-KILOMETERS PER CAPITA

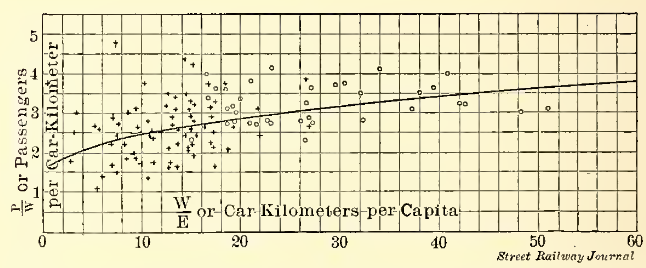


FIG. 11.—CURVE SHOWING RELATION OF PASSENGERS PER CAR-KILOMETER TO CAR-KILOMETERS PER CAPITA

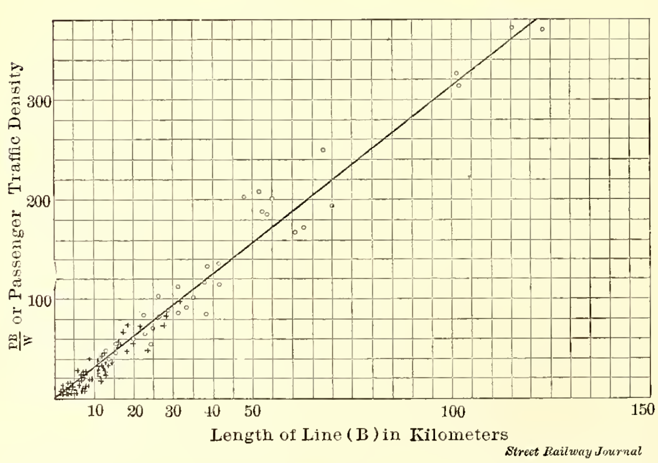


FIG. 12.—CURVE SHOWING RELATION OF PASSENGER TRAFFIC DENSITY TO LENGTH OF LINE

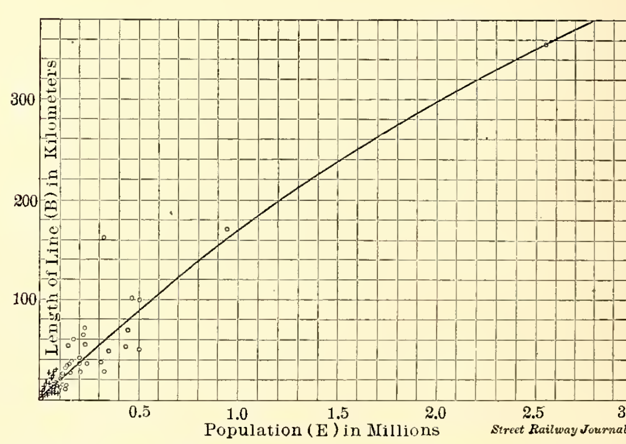
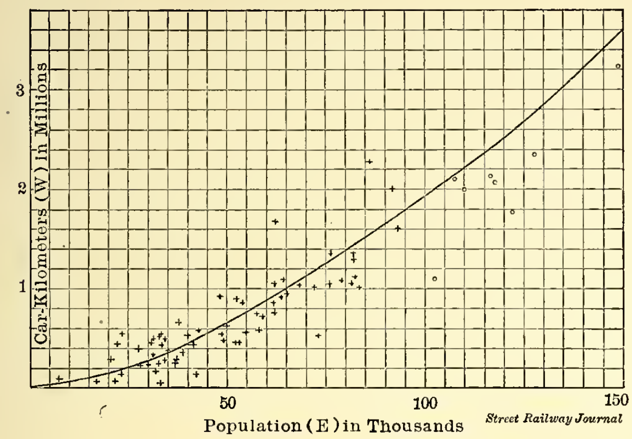
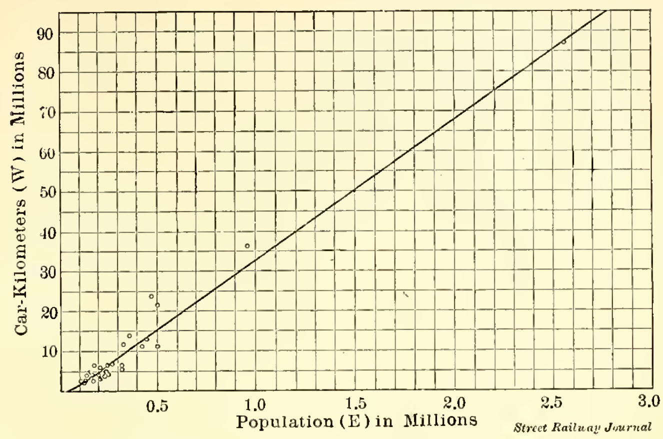


FIG. 13.—CURVE SHOWING RELATION OF LENGTH OF LINE TO POPULATION

use” or percentage use of the car, the exact value of which could be found by dividing the passenger-kilometers by the capacity-kilometers*. This value cannot be exactly determined. According to Fig. 6, the value P/W, or passengers per car-kilometer, is 3 for less than 3,000,000 car-kilometers per year and 3.5 for a greater number. It is interesting to note that a more exact value for P/W can be found if the ordinates and abscissae are divided by the population, or, in other words, if we determine the relation of rides per capita to car kilometers per capita. This has been done in Fig. 10, in which all





FIGS. 14 AND 15.—CURVES SHOWING RELATION OF CAR-KILOMETERS TO POPULATION

the values group themselves near the average curve, which is presented. This curve shows that relation P/E is proportional to $\left(\frac{W}{E}\right)^2$ and the gradual increase of P/W. It also indicates that the value P/W is between 2.3 and 4.2 in cities of over 100,000 and between 1.4 and 3.77 in smaller cities. Higher values for small cities are shown by Plauen with 4.74 and Freiburg with 4.4. In general, Dresden, with 50 car-kilometers per capita, shows the greatest service, then Leipsig with 40 and Frankfort-on-Main, which,

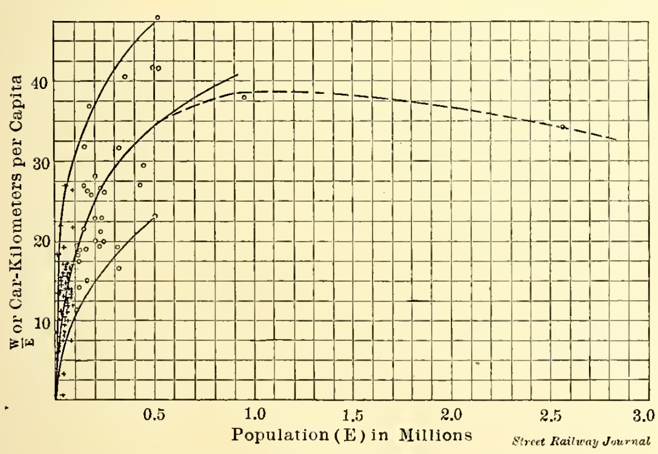


FIG. 16.—CURVES SHOWING RELATION OF CAR-KILOMETERS PER CAPITA TO POPULATION

with a space use of 4 rides per car-kilometer, shows the absolutely highest rides per capita.

An examination of the slow and steady increase of the passengers per car-kilometer (P/W), in relation to the car-kilometers per capita, shows that the curve follows no precise law, see Fig. 11. If, however, the average curve is determined mathematically from Fig. 10, and combined with the values in Fig. 11, all of the values derived would group themselves symmetrically around this mathematically determined curve. Certain cities, like Plauen, Freiburg and Guben, are far above the average, although they did not attract attention in Fig. 10 on account of their low car-kilometers per capita. Another remarkable feature shown in Fig. 11 is the sharp demarkation in car-kilometers per capita for systems serving communities below and above 100,000 population. This line of demarkation appears at about 18 car-kilometers per capita. For higher values of W/E, not enough points are obtainable to prove whether, after reaching a certain maximum, the car-kilometers per capita decrease with increasing population, as might be supposed from the extreme value which corresponds to Leipzig.

* The term “capacity-kilometers” is used instead of seat-miles (or seat-kilometers), so as to include the space which can be used in the cars by standing passengers. In Germany the number of passengers who are allowed to stand is limited by law.

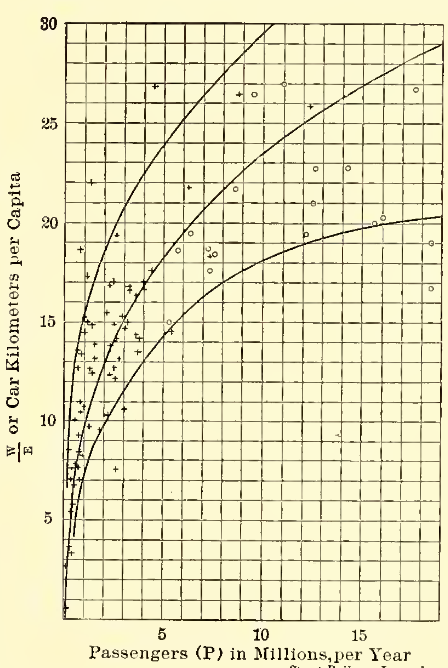


FIG. 17.—CURVES SHOWING RELATION OF CAR-KILOMETERS PER CAPITA TO PASSENGERS CARRIED IN SMALL CITIES

The relation between rides per capita and the car density has already been treated; the average passenger density (PB/W) determined therefrom may also be considered as a product of the average passengers per car mile (P/W) and the length of line. As the foregoing study has shown that the average number of passengers per car mile varies within comparatively narrow limits, so the passenger density must also vary within the same limits, chiefly in connection with the length of the line. In fact, Fig. 12 shows the direct or linear dependence of the passenger density on the length of the road. Corresponding to the somewhat less use of the cars on smaller systems the values for roads up to about 12 km fall below the average.

DEPENDENCE OF TRAFFIC ON POPULATION

From the foregoing investigation of the effect of the population on traffic, as well as on the length of line and car-kilometers, it is safe to assume that certain relations exist between these various factors. According to Fig. 13, the curve representing length of road in relation to population starts from the origin as a straight line, but after reaching a population of 500,000 the length of road increases less rapidly than the population. The car kilometers run also increase with the population, as shown in Figs. 14 and 15, but not directly. At first the increase is slow, but steadily grows in a higher ratio until 500,000 population is reached, but above that the increase apparently is linear. The car-kilometers per capita, according to Fig. 16, rise rapidly from the origin, but their rate of increase gradually decreases. The form of the curve is similar to that of Fig. 3, and for populations over 500,000 the car kilometers per capita appear to diminish. The fact that the curves just named all show a change at a point close to populations of over 500,000 is a further proof that in a traffic study of the larger cities, all transportation means should be considered. Unfortunately, it was impossible in this case to secure the necessary date.

The dependence of the car-kilometers per capita on the length of the line (see Fig. 16) shows the same general course as Figs. 14 and 15, since the length of the line, starting from the origin, increases in proportion to the population.

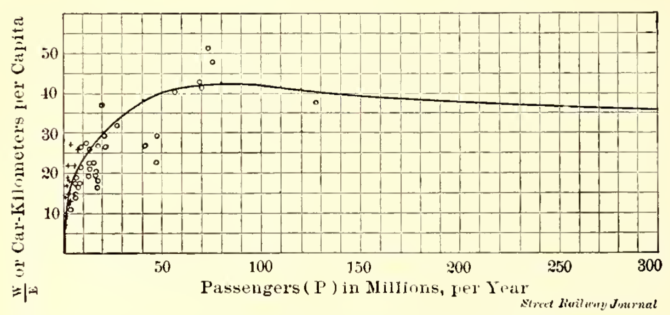


FIG. 18.—CURVE SHOWING RELATION OF CAR-KILOMETERS PER CAPITA TO PASSENGERS CARRIED IN LARGE CITIES

The value for Hanover naturally will be found far from the average.

RELATION OF TRAFFIC TO POPULATION

One more point remains to be considered, namely, the ratio between the car-kilometers per capita and the passengers carried. As shown in Figs. 17 and 18, this line after a rapid rise from the origin and reaching a definite maximum at 75,000,000 passengers, begins to droop, due possibly to the non-inclusion of other means of transit in the largest cities. Far away from the average curve will be found Munich, whose value for W/E is 23 with about 50,000,000 passengers. Above the curve will also be found Leipzig, Wiesbaden and Hirschberg; below it, Barmen, Elberfeld and Plauen.

SYSTEMS OTHER THAN ELECTRIC

To determine the effect of motive power, a number of horse and steam systems were considered. The examination showed that there is no fundamental difference between cities thus equipped and others of like size using electricity, although there are some exceptions, like Flensburg and Naumburg. Flensburg shows a traffic of about 1-10 the average curve of Figs. 1 and 3. The length of the line is also only ¼ of the normal value of Fig. 13, and accordingly the car density is abnormally high, but the passenger density of 2.5 and the average passengers per car kilometer 1.1 abnormally low. The income per car kilometer is 23.3 pfg., due to the high fare of 21.5 pfg. per passenger. In the case of Naumburg, the fare is also high (13 pfg. per passenger), so that the income per car kilometer reaches the extraordinary figure of 65 pfg.

CONCLUSIONS

Briefly recapitulated, the conclusions to be derived from the foregoing considerations are as follows:

The number of passengers carried and the car-kilometers run increase as the square of the population, while the length of the system and the passenger density increase directly with the population.

Rides per capita and car-kilometers per capita, car density or car-kilometers per kilometer of track, and income per car-kilometer tend to reach a point of saturation.

The number of passengers and of car-kilometers run increase as the square of the length of line, while the passenger density increases directly with the length of line.

The passengers carried increase directly with the car-kilometers.

The car-kilometers per capita increase to a saturation point, in relation to passengers carried, and then decrease.

In relation to car kilometers per capita, there is a quadratic increase in the rides per capita up to a certain point, of average passengers per car and of income per car-kilometer.

The income per car-kilometer varies directly with the average passengers per car.

The changes effected by the use of horse or steam power instead of electric power is small on lines with little traffic or of short length, as higher fares are usually charged, so that the car-kilometer income is often higher than on other roads with electric operation.

How the foregoing fundamental rules may be applied in practically financing and operating questions need not be especially considered in this article. It may be enough to state that the establishment of such rules does not reduce the necessity of properly combining the various factors in a study of a particular case. It may, however, be of some assistance in such an examination.

COLOMBIAN CITIES TO BE CONNECTED BY TROLLEY SYSTEM

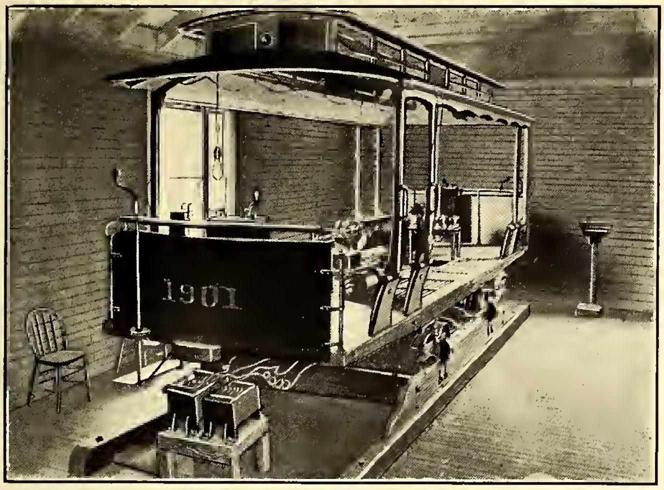
Consul P. P. Demers, of Barranquilla, announces that a Colombian Government concession has been given Francisco E. Baena, president of the Barranquilla tramway, prolonging for thirty-nine years a previous concession for the building and operating of an extensive tramway. The new concession includes the obligation to put into service modern cars, substitute electric traction for that of animals, and to extend the lines to Soledad and Sabanalarga. Barranquilla has about 50,000 inhabitants, having gained 30,000 in the last twenty years. Soledad and Sabanalarga are respectively six and thirty-six miles distant from Barranquilla, between which there is extensive cart and mule-back traffic over hot sandy roads. The tram company has also been granted an electric-light franchise. The concession is of interest, it being the intention of Mr. Baena to develop the enterprise with American capital and equip the whole service with American cars and machinery. Copies of the concession can be seen at the Bureau of Manufactures in Washington.

The Twenty-Second Street or Oakland branch of the San Francisco, Oakland & San José Railroad (Key Route) was opened for regular traffic on May 16th. A 20-minute schedule was inaugurated, the same as in force on the Berkeley and Piedmont lines. The terminus of the new line is at Broadway and Twenty-Second Street, only eight blocks from the center of Oakland's business section. A new $12,000 depot will be erected at the terminus. It will be in the form of an arcade, into which the trains will run under cover. The building will be finished by July 1st. Several new cars have been added to the Key Route's equipment, so as to take care of the Oakland traffic.

EMPLOYEES' TRAINING SCHOOL AT NEW ORLEANS

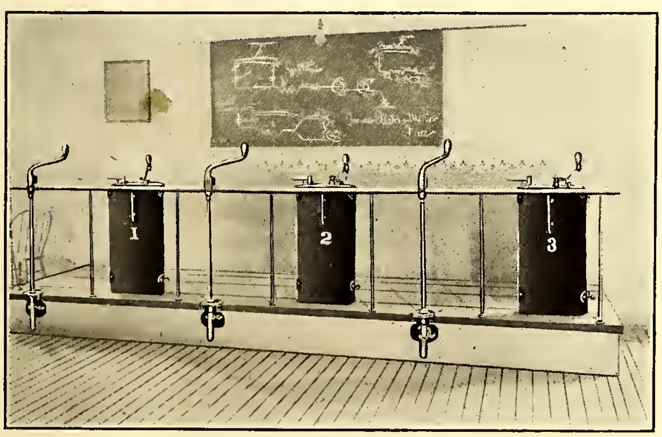
The New Orleans Railway & Light Company maintains a separate instruction department and training school for the purpose of educating and breaking in new men. The department is in charge of August Lais, chief instructor.

The equipment in the training school consists of a skeleton car fitted complete with all the regular brakes, controllers, electrical equipment, and other parts. There is also, at one side of the room, a raised platform provided with dummy controllers and hand brakes, with the use of which the new men receive their first instructions as to their duties.



SKELETON CAR IN INSTRUCTION SCHOOL AT NEW ORLEANS

Men applying for positions as motormen are required to pass a physical examination. If they pass this examination they are put on the dummy controllers and brakes in the training school, to become familiar with the apparatus used in starting and stopping a car. They are then put on the skeleton car in the school, after which they are sent to the station to which they have been assigned by the superintendent. They are then put on the various lines running out of that station in charge of motormen who are selected to instruct applicants, and remain at this work for eight to ten days. After they have been reported as competent to operate a car, they are returned to the instruction department for final instructions and examinations. The instructions consist of lessons in operating methods and locating troubles on all parts of the car. The examination is intended to show the new man's knowledge of the rules and regulations of the company, copies of which are furnished to the men when they are assigned to a station.



DUMMY CONTROLLERS AND BRAKES, INSTRUCTION SCHOOL AT NEW ORLEANS

After the men have been found competent they are sent to the claim agent, who examines them as to their ability in making out accident reports. They are then returned to superintendents for final approval or rejection.

Men applying for position as conductor are not required to pass physical examination. The preliminary examination of conductors consists of tests of their ability in reading, writing and arithmetic. If found satisfactory, the applicants are sent to the various stations as assigned by the superintendent, and are instructed by competent conductors for from five to seven days, after which they are returned to the instruction department for final instructions and examination as to the rules and regulations of the company, with which they are furnished copies when first assigned to a station. When found competent, they are sent to the claim agent, who examines them as to their ability in making out accident reports, after which they are returned to the superintendent for approval or rejection.

GENERAL VIEW OF INSRUCTION SCHOOL AT NEW ORLEANS

The Westinghouse Machine Co. of East Pittsburg, Pa., has recently received an order from the Portsmouth Street Railway & Lighting Co. to install in its plant at Portsmouth, Ohio, a 500-kw turbine. The turbine is to be of the multiple-expansion parallel-flow type, and direct connected to a 500-kw, 60-cycle, two-phase, 220-volt Westinghouse generator. Two 400-kw Westinghouse-Parsons turbines are already operating at this plant, serving the entire city with light and power. The plant was built entirely for turbine machinery. Superheated steam and high vacuum are used, condensing water being obtainable from an artificial lake which has been constructed upon the property. A rotary converter in the plant serves the nearby traction lines with 500-volt direct current, but the main power is transmitted over high tension a. c. lines into the city and outlying districts.

The Swedish Government recently introduced a bill authorizing a grant for the purchase of waterfalls belonging to private persons, with a view to utilizing them for supplying power to electric State railways. It is further proposed to empower the Government to expend a sum not exceeding 5,000,000 kroner ($1,350,000) to purchase waterfalls which may be considered necessary for working the State railways in the immediate future, and the purchase of which cannot be delayed without detriment to the State.

SCHEDULES

The last set of questions included in the Question Box referred to forms of schedules, methods of determining schedule efficiency and the general subject of suiting the service to changeable conditions of traffic. The communications received in response to this canvass have been compiled under the heading of "Schedules," and are given herewith. It is believed the answers contain a number of valuable suggestions. The questions on this topic, which are given below, were sent out as four separate queries, but as the questions are more or less interrelated, all the responses from each contributor under the various heads are grouped as one communication.

In what form do you make up your schedules for operating purposes? (Please send copies of typical schedules with full information.

How do you determine if your schedule is suitable for the traffic on any particular line? Do you obtain records of passengers carried per car at different intervals, and if so, how do you obtain these records and are readings taken at different points along the line? Ideas and suggestions on the theory and practice of making schedules are wanted and needed.

What methods do you take to inform crews regarding the details of the schedules, and how do you insure that employees know and understand the schedules?

What steps do you take for suiting the schedules to the weather and other changeable influences? For instance, suppose a given schedule has been decided upon for a park line for a pleasant Saturday afternoon and it begins to rain early in the afternoon. What is your system for calling in the cars that are not needed, in order to save useless mileage? In other words, how do you bend the service given to suit the probable traffic, and how do you secure flexibility and promptness in changing quickly from one schedule to another?

The accompanying portion of our schedule (No. 104-A) of the time table for the Seventh Street Division of the Capital Traction Company is perhaps a typical one for our daily work. We have a number of such time tables to cover week days, Sundays, and any special occasions that may arise, all based on the regular schedule, which is the one reproduced. For instance, the trains numbered from 325 up are what we call "trippers." The time tables are arranged to give "tripper" service from 6.58 in the morning until 12 o'clock at night, and these "trippers" are so run that they do not throw the first twenty-four trains more than two or three minutes off of the regular schedule. Should something extraordinary take place at 10 o'clock in the morning, we would have these "trippers" continued until that hour or a little later, as the occasion might require, and in that case we would have the table posted for that occasion. These time tables are posted (in blue print form) at the office of the division superintendents, from which the trains start. The conductor is given his "day-book" (as we call it), or manifest, in the morning, and he goes at once to the time table and copies from it the running time of his train for that day. Any changes made during the day is called to the conductor's attention, and he again goes to the time table to ascertain what particular schedule is in use at the particular time.

Each conductor keeps on his day-book a complete record of each half trip, showing the total number of passengers carried on each half trip. There are on the street a number of inspectors, and if they notice that cars are over-crowded at any particular hour of the day, they call the superintendent's attention to the fact. The conductor's day-books are then consulted, and a list is prepared, showing the number of passengers carried during the hours in question. From this we determine if the schedule is taking care of the traffic or not; if not, we revise the time table.

The condition of the weather, except for summer excursions and pleasant Sunday afternoons, does not effect our regular schedules. For the bright Sunday afternoons and evenings during the excursion traffic we have special time tables. Should a storm come up the special time table is put to one side and the regular schedule adhered to. Our trains are operated from different car houses, and division superintendents, should the occasion require, can promptly reduce the number of trains on the street, or with reasonable notice,

SEVENTH ST. DIVISION LEAVING CAR BARN.

A.M.

	1	2	3	4	5	6	7	8
301	5-04	6-24	7-36	8-49	10-01	11-13	12-31	1-43
325		6-27	7-39					
302	5-12	6-30	7-41^2	8-52	10-04	11-16	12-34	1-46
303			7-44	8-55	10-07	11-19	12-37	1-49
304	5-20	6-33	7-46	8-58	10-10	11-22	12-40	1-52
305	5-00	6-36	7-48	9-01	10-13	11-25	12-43	1-55
326		6-39	7-50					
306	5-08	6-42	7-52	9-04	10-16	11-29 MEALS	12-46	1-58
307	[illegible]	[illegible]	7-54	9-07	[illegible]	11-33	12-49	[illegible]
321	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
330		7-27	8-38^2					
322	6-16	7-30	8-41	9-52	11-04	12-22	1-34	2-46
323			8-43^2	9-55	11-07	12-25	1-37	2-49
324	6-20	7-33	8-46	9-58	11-10	12-28	1-40	2-52

P.M.

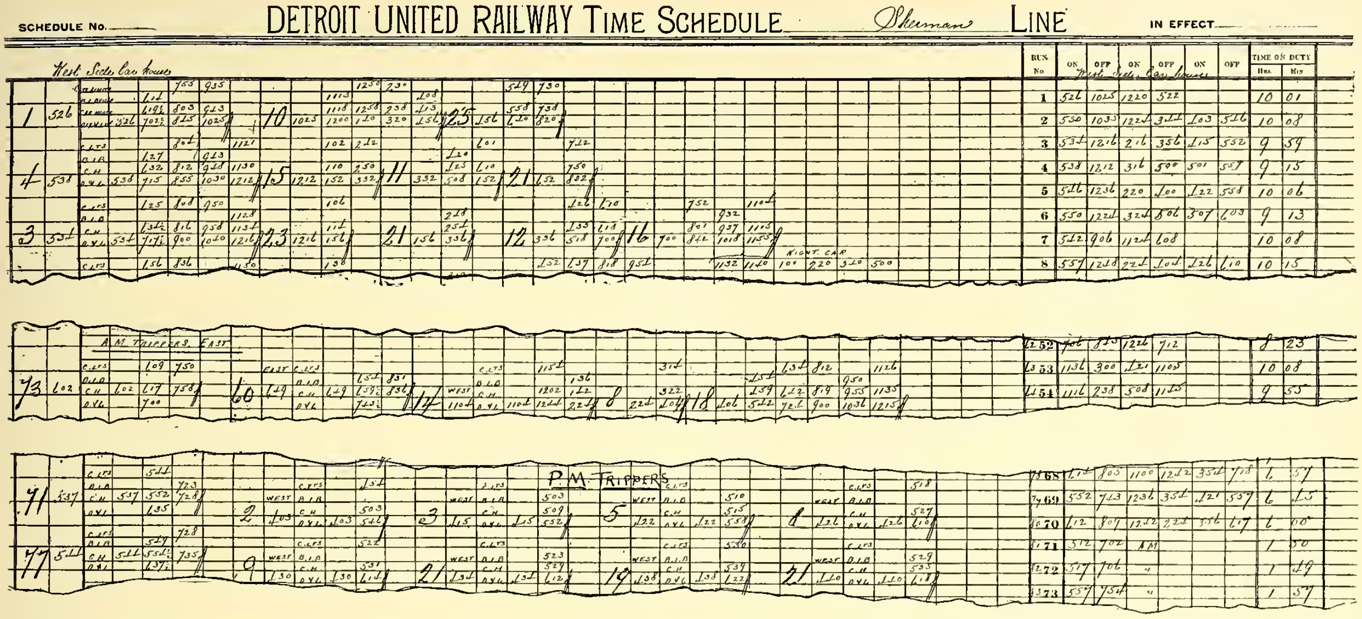
	1	2	3	4	5	6	7	8
301	2-55	4-10	5-25	6-42	7-54	9-06	10-18	11-30
302	2-57^2	4-12^2	5-27^2	6-45	7-57	9-09	10-22	11-34
325	3-00	4-15	5-30	6-48	8-00	9-12		
303	3-02^2	4-17^2						
304	3-05	4-20	5-33	6-51	8-03	9-15	10-26	11-38
305	3-07^2	4-22^2	5-36	6-54	8-06	9-18	10-30	11-42
306	3-10	4-25	5-39	6-57	8-09	9-21	10-34	11-46
326	3-12^2	4-27^2	5-42	7-00	8-12	9-24		
307	[illegible]	[illegible]						
321	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
322	4-00	5-15	6-30	7-45	8-57	10-09	11-22	12-48
330	4-02^2	5-17^2	6-34	7-48	9-00	10-12		
323	4-05	5-20	MEALS					
324	4-07^2	5-22^2	6-38	7-51	9-03	10-15	11-26	1-00

(Note.—On the original the figures indicating "leaving time for boundary only" are shown in red.)

PORTION OF SCHEDULE NO. 104A, INDICATING TYPICAL FORM OF SCHEDULES USED BY CAPITAL TRACTION COMPANY, OF WASHINGTON, D. C.

say a few hours, to secure the men, can put out additional trains. D. S. Carll, Ch. Engineer and Superintendent, Capital Traction Company, Washington.

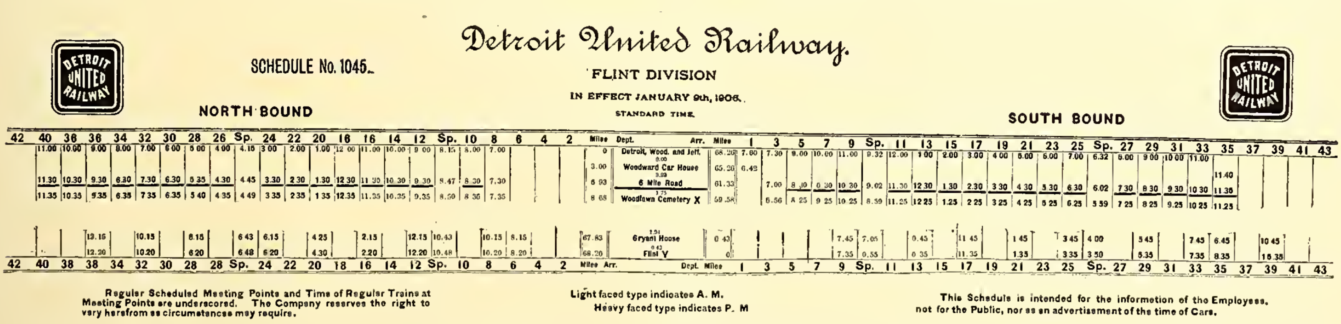
A copy of our schedule, No. 962, is sent herewith as a sample of the form used on our city lines, and of No. 1045 for the Flint Division, as sample of our interurban schedule. In schedule No. 962 the numbers of the runs, the starting and quitting time of the crews, and the amount of time on each time must include at least one relief for meal; all runs eight hours and over are "full paid," and all less than eight, and over six, are "shortpaid;" all runs are numbered and assigned in rotation, except the "short paid" runs, which are numbered in accordance with the amount of time in them, i. e., the longest "short paid" run is the next to the lowest "full paid" run, etc. The suburban schedules are made out on the same general plan as are steam road schedules. The time of cars or "trains" at every switch, and siding is given and cars or



SCHEDULE NO. 962, INDICATING TYPICAL FORM OF CITY SCHEDULE USED BY DETROIT UNITED RAILWAY

run are shown on the right-hand side of the sheet. Each crew finds the number corresponding to the number of its run, picks out the parts of it from the body of the schedule and copies them down, and if there are more than two ends to the line, as in this case, noting the destination of the car. The motorman is held responsible for putting up the correct sign in front, while the conductor attends to the signs on the side. The latter signs are carried in the vestibule when not in use. The route of each car is shown, across the page, from the time it is taken out until it returns to the car house, and when a crew is to be relieved, a space is left so that the num- "trains" are handled by a despatcher, who holds the same relative position as the steam road train despatcher.

The suitability of a schedule is determined by the division superintendent or road foreman, in conjunction with the general superintendent and superintendent of schedules. The division superintendent makes out a synopsis of what he thinks is necessary and shows his "passenger book," in which the passengers carried on each single trip during the busy hours, say, 5 a. m. to 9 a. m., 11 a. m. to 2 p. m., and 4 p. m. to 8 p. m., are recorded daily by the night car house foreman, who obtains the figures from the conductors' trip lists. Fur-



SCHEDULE NO. 1045, INDICATING TYPICAL FORM OF INTERURBAN SCHEDULE USED BY DETROIT UNITED RAILWAY

ber of the relieving crew may be inserted. In making its schedules, the Detroit United Railway is governed by certain restrictions which have a bearing on the way the runs are divided. Some of these limiting restrictions are as follows: Approximately nine hours, with a leeway of half a round trip, constitute a day's work on all week days, this work to be completed within 12½ hours; 12 hours may be used for a day's work on Sundays and holidays from May 1 to Oct. 15, inclusive, when necessary to accommodate the travel, but this ther than this, if the line be one across the city, so that each single trip will have practically two loads, men are sometimes placed at junction or other suitable points, who take both the register reading and the number of passengers actually on car. At circuses, race tracks and similar affairs, a man is usually placed at the point where passengers alight, to take records. These are usually obtained from the register readings, as often three or four cars are discharging their loads at the same time. This record is used in determining the number of cars required to take the crowd home again. Of course, allowance must be made in these cases for local passengers.

The men when practising or learning on the division to which they have been assigned, are supposed to learn how to read the schedules, and the division superintendent satisfies himself on this point when the men are turned in as competent to run a car. Conductors and motormen on interurban lines are obliged to carry with them at all times a copy of the entire schedule of their road, and to prove to the de-

FLINT DIVISION, SCHEDULE No. 1045

In effect January 9th, 1906

Car House	Run No.	Time On	Time Off	Train Numbers	Hours On
Rochester....	1	6:22	2:30	6-13-20	8:08
	2	6:26	3:30	2-5-12-21	9:04
	3	2:30	10:35	12-19-25-27-34-35	6:05
	4	2:30	12:35	20-29-36-†41	10:05
	5	3:30	1:30	21-28-37-*42-43	10:00
	6	7:26	2:30	4-7‡-10-11-18	7:04
Romeo......	7	6:00	4:00	3-10‡-7-14-15-22	10:30
	8	4:00	1:00	23-30-31-38-39-40	9:00
Flint........	9	6:55	6:48	Specials	10:53

* Change cars at Six Mile Road at 11:30 P.M.
† Change cars at Ortonville at 11:30 P.M.
‡ Change cars at Big Beaver at 9:00 A.M.

TYPICAL NOTICE, INDICATING METHOD OF POSTING ASSIGNMENTS TO RUNS ON DETROIT UNITED RAILWAY. THE NOTICES ARE POSTED IN TYPEWRITTEN FORM

spatcher, as well as to the division superintendent, that they thoroughly understand their schedules before being allowed to take out a run. It is not considered necessary for them to know such details as speed, headway of cars, number of cars operated, etc.

The division superintendent has authority to put on additional cars for a trip or two if he considers it necessary. He reports these additional cars each day to the superintendent of schedules and mileage. If they are found to be permanently desirable, they are incorporated in the old schedule, or a new schedule containing these additions, and such other changes as may have appeared advantageous, is made up. Also if there should be a tripper car or so which does not appear to carry as many people as it should, the division superintendent has the power to change its time, or to leave it off altogether, but he must keep the superintendent of schedules and mileage advised. Several schedules are prepared on each division for week days, Saturdays and Sundays for summer and winter, and also for special holidays, races, etc. From these various schedules one can be picked which can be substituted for another if desirable. This change can take place at the noon relief, or the division superintendent, with the assistance of his car house foreman, can copy on slips that portion of the new schedule which is assigned to each crew and distribute the slips to the crews as they arrive at the car house. Again, on Sundays in summer, when the travel is usually very heavy, especially in the afternoon and evening, the schedules on some of the heavy divisions are made so that the men going to work in the morning are relieved, commencing about 11 a. m., and report back to the car house, commencing about 1 p. m. These men take out cars and fill in between the regular service, and can be pulled off when desired by the division superintendent. The length of time required to change from one schedule to another is equal to the length of time required to make one round trip on the division. Of course, if the change is from a small to a larger schedule, it will be necessary to have the additional crews required, either on hand, or at least to know that they will be on hand, when needed.

Harry Bullen, Gen. Supt.,
Detroit United Railway.

Our schedules are prepared in printed form, corresponding substantially with steam railroad practice. On the ordinary interurban service cars are operated hourly, and an extra section is put on as extra travel requires. We run extra sections in preference to extra cars on shorter headway, because the people are accustomed to the regular hours of operation, and make their plans accordingly. Trains are operated according to printed schedules furnished to each trainman, and under established rules similar to steam railroad practice. Train movements other than those scheduled are made only under special train orders from the despatchers.

Theodore Stebbins, Gen. Mgr.,
Dayton, Springfield & Urbana Elec. Ry.

To determine schedule efficiency, a record of the number of passengers carried on each half trip is periodically taken from day cards and recorded on a day-card report. This

CONNECTICUT RAILWAY & LIGHTING CO.
DAY CARD REPORT.

Fair + Snow ¶ Cloudy :: Rain △ Small Car × Large Car *

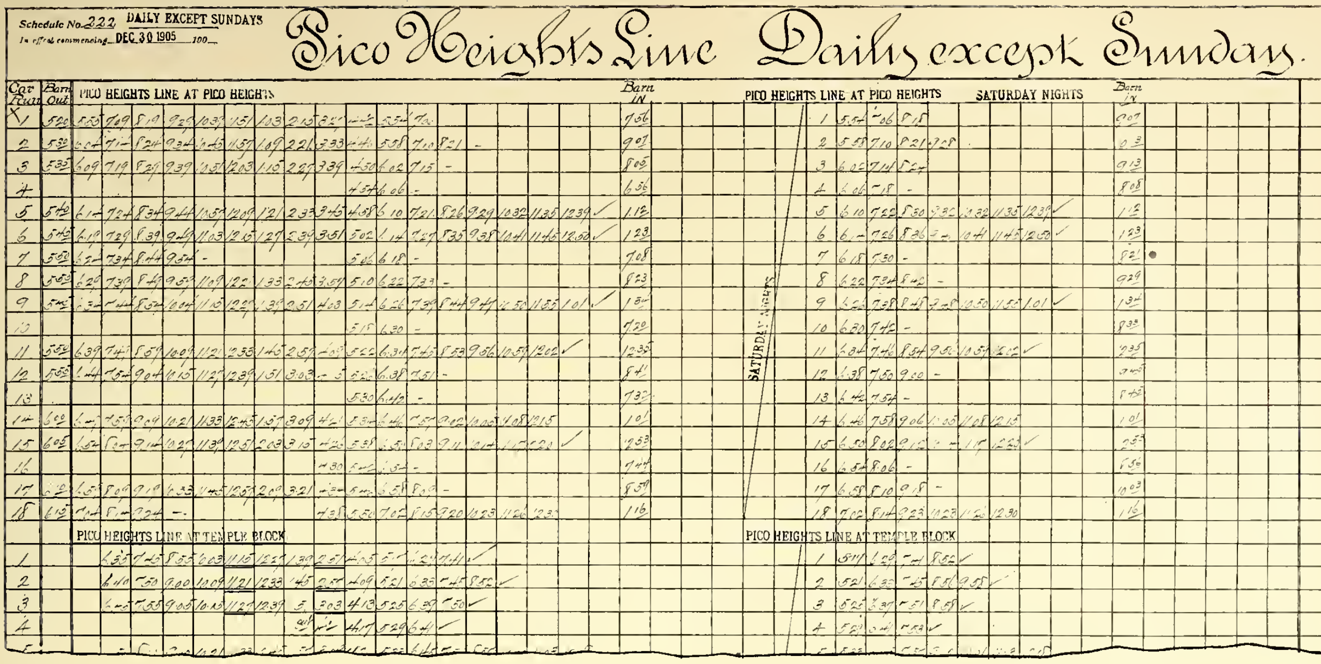
WEATHER		::	+	+	△	+	::	
December 05		M 4	T 5	W 6	T 7	F 8	S 9	AVERAGE
DESTINATION OF CAR	Time	NUMBER OF PASSENGERS						
Southport	P.M. 4.30	40	37	25	41	30	36	* 34.8
Ash Creek	4.40	27	28	19	20	28	31	× 25.5
Fairfield	4.45	27	35	41	19	25	29	* 29.3
Westport	4.50	56	50	44	56	34	38	* 46.3
Ash Creek	5.00	22	21	19	17	27	40	× 24.3
Ash Creek	5.05	19	25	43	13	10	15	× 20.8
Southport	5.10	45	44	41	45	56	64	* 49.1
Ash Creek	5.20	4	30	31	29	23	49	× 27.6
Fairfield	5.25	46	12	23	43	36	53	* 35.5
Westport	5.30	47	48	52	55	46	51	* 49.8

SECTION OF TYPICAL DAY CARD REPORT USED BY THE CONNECTICUT RAILWAY & LIGHTING COMPANY FOR DETERMINING SCHEDULE EFFICIENCY

report also indicates the weather conditions and type of car. The exchange of passengers at transfer points often makes the day card readings of little value in detecting crowded conditions, and in such cases records are taken at various points along the line by street inspectors and switch boys. A copy of typical day-card report is reproduced in this connection.

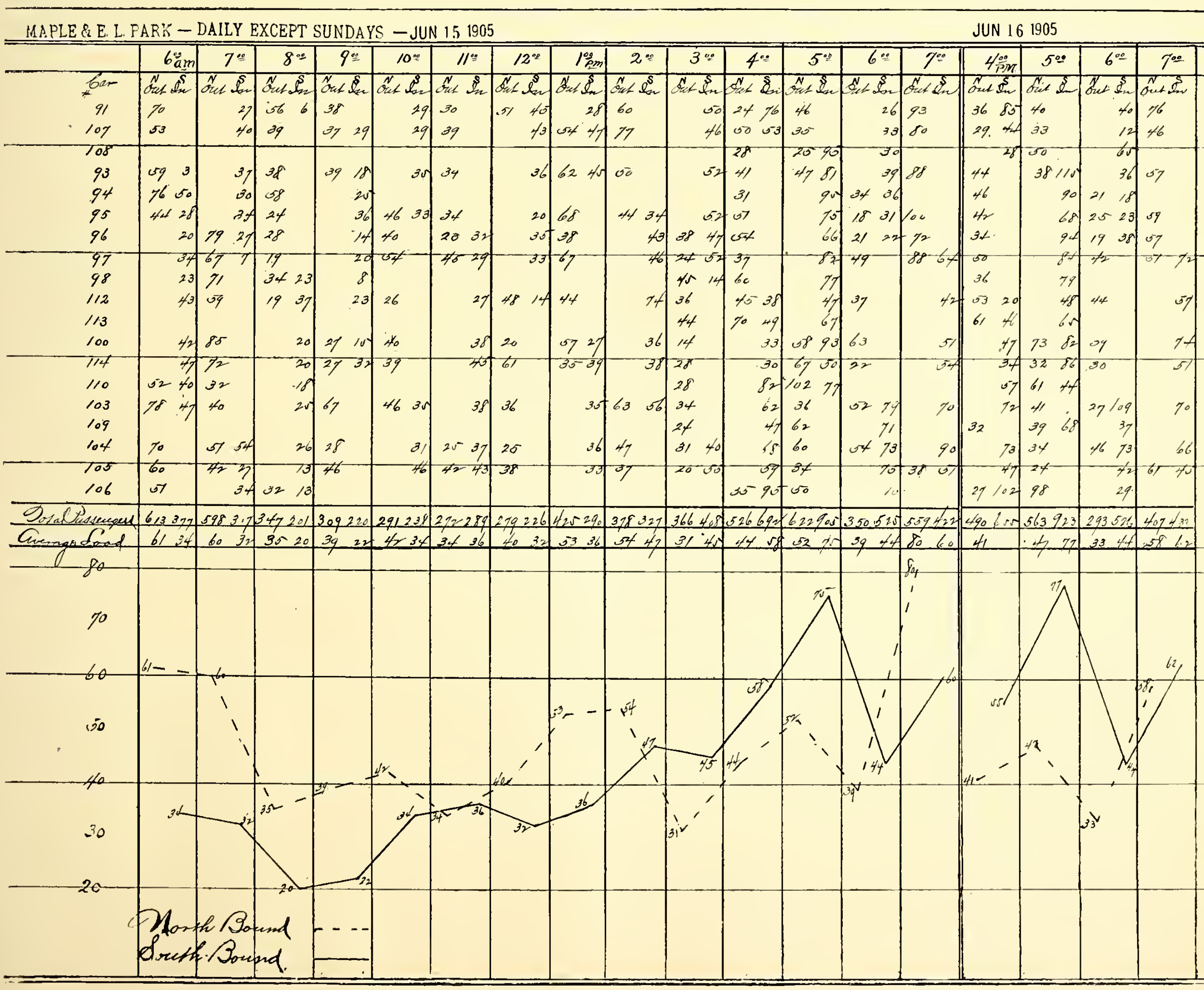
R. H. Smith, Supt.,
Connecticut Ry. & Lighting Co.

The movements of cars on the Los Angeles Railway are controlled by the despatcher system, each terminal being in communication with the office over private telephone. This requires the constant attendance of two men. Schedules are made out for the operation of the cars, but the despatchers vary these whenever the situation demands that it should be done. Herewith is fac simile copy of our schedules for our Pico Heights line, as posted in the car house for the information of the men. Sheet marked "No. 1" is the terminal time for this line during week days, showing additional time cars are kept in service on Saturday nights. Sheet marked "No. 2" is division of this into working runs, and also shows the running schedule for guidance of the motormen from time point to time point. These two sheets are kept in frames, side by side. Similar sheets are marked out for the Sunday schedule and for the wet weather schedule. The Temple Block time, underscored (in the original in red ink), is the



(Note—On the original the figures in columns headed "Car Run," "Barn Out" and "Barn In," the words "Saturday Nights," and all lettering and special notes are shown in red.)

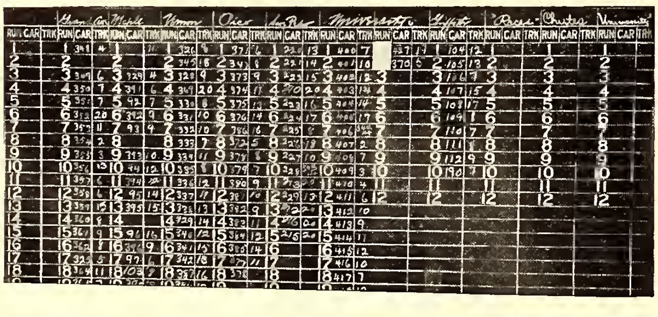
SHEET NO. 1, INDICATING FORM FOR POSTING TERMINAL TIMES, USED BY LOS ANGELES RAILWAY COMPANY



(Note—On the original all figures in the columns headed "S," also the curve shown as solid black in the reproduction are shown in red.)

SHEET NO. 3, INDICATING METHOD OF EXHIBITING AMOUNT OF TRAVEL AT CERTAIN HOURS, AND SYSTEM OF PLOTTING THIS INFORMATION IN CURVES TO DETERMINE SCHEDULE EFFICIENCY, LOS ANGELES RAILWAY COMPANY time the reliefs are made. The figures (in the original in red ink), in the center of the schedule marked "in" and "out," indicate the time each particular car goes into the car house and the time it pulls out of the car house.

We do not check a line at any point with a special view as to whether or not the schedule is sufficient for the travel. Instead, we take conductors' reports from time to time for several days and group them together by hours, giving us the maximum load and the minimum load during the hour, and then make a diagram, copy of which is reproduced, marked "No. 3," showing the fluctuation of the average load. Knowing the capacity of the cars, it is very easy to ascertain



CAR BOARD FOR ANNOUNCING ASSIGNMENT OF CARS TO RUNS, LOS ANGELES RAILWAY COMPANY

whether there is sufficient service. In addition to this, we take the car sheets in the despatchers' office and examine for delays caused from overload. This information is used in determining the time to be allowed for the round trip, as well as the headway on the line. After the schedule has been made out on the proper sheet, it is inclosed in the frame (all sheets and all frames being identical in size) and posted in the regular place, where this information can always be found for the particular line. Photograph of part of frames for the week-day time is reproduced in this connection. There is a shelf below these frames for the convenience of the man. At each car house there is a large frame holding all of the working runs for that division, made out on tyne-written sheets in consecutive order, as to the working run numbers. For illustration, we will assume that a new man is assigned by his foreman to working run No. 180. It will be noted that this means car on car run No. 5, on the Pico Heights line, out of the house at 5:40 a. m. The "S" immediately following the "out" time indicates the direction the car is to go, i. e., it is to go south, to the outer terminal of the line. Relief at 11:33 a. m. Then the man takes car on car run No. 3 at the regular relief point at 3:03 p. m., and pulls it into the car house at 8:05 p. m., and on Saturday he pulls it in at 9:13 p. m. When a man is assigned to this run, if he does not know the line it is on, he immediately goes to the large frame and looks up working run No. 180, to locate the line; then he will go to the frame for that line and copy the terminal time. The motorman will also go to this frame and copy the running schedule from point to point. Then to get their car, the crew will walk over to the car board (shown in one of the engravings), and look for the car on run No. 5, Pico Heights line, which is No. 375, on track 13; then for car on car run No. 3, which is No. 373, as that is the afternoon car for this run. This car the crew take at the relief point on the road. Thus the crew have no difficulty in locating their car in the car house. The Sunday time for the division is kept apart from the week-day time in another part of the trainmen's room. Wet weather Sunday time is kept under cover and is only put out when necessity requires. We do not take any measures to know that the men understand any specific schedules. While a man is on as a student he is carefully instructed in all the details of our system of information, and when he is finally "turned in" the student instructor gives him a thorough examination as to his knowledge in this respect. When the man is turned over to the division foreman,

PICO HEIGHTS LINE, DAILY EXCEPT SUNDAYS, RELIEF POINT AT TEMPLE BLOCK.

Working Run	Car Run	On	Off	On	Off	Working Time
			DAY RUNS			
171	7	5:50 S	10:45 In			
	11			11:57	5:57	10:55
172	8	5:55 S	10:33			
	5			11:33	5:33	10:38
173	9	5:45 N	10:39			
	6			11:39	5:37	10:52
			SWING RUNS			
177	1	5:20 S	11:15	(Sat.	8:56 In)	
	16			Out 3:36 N	7:44 In	10:03
178	2	5:30 S	11:21	(Sat.	9:07 In)	
	1			2:51	7:56 In	10:56
179	3	5:35 S	11:27	(Sat.	9:29 In)	
	8			3:21	8:23 In	10:54
			EXTRA SWING RUNS			
				(Sat.	8:08 In)	
185	4			Out 4:00 N	6:56 In	2:56
				(Sat.	8:21 In)	
186	7			Out 4:12 N	7:08 In	2:56
			NIGHT RUNS			
189	1	11:15	2:51			
	14			6:09	1:01	10:28
190	2	11:21	2:57			
	6			5:37	1:23	11:22
191	3	11:27	3:03			
	9			5:49	1:34	11:21

ROUTES LEAVING AND RETURNING TO CAR HOUSE.

Leaving Car House:

A.M. North bound cars, out via 5th and Spring and Temple Block.
A.M. South bound cars, out via 2nd and Broadway.
P.M. North bound cars, out via 5th and Broadway to Temple Block.

Returning to Car House:

From Temple Block, in via 5th and Main.
From Pico Heights, in via 2nd and Broadway.

PICO HEIGHTS LINE, DAILY, EXCEPT SUNDAYS

	6 A.M. to 10 A.M.	10 A.M. to 4 P.M. and 6:30 P.M. to 8 P.M.	4 P.M. to 6:30 P.M.	8 P.M. to 12:30 A.M.
Terminus:				
to Normandie........	5	5	5	4
to Pico and Figueroa..	11	11	11	9
to 7th and Broadway..	10	10	9	8
to Temple Block......	9	9	9	9
Lay over............	1	1	1	1
	36	36	35	31
Temple Block:				
to 7th and Broadway..	9	9	9	9
to Pico and Figueroa..	10	10	10	8
to Normandie........	10	11	11	9
to Terminus.........	4	4	5	4
Lay over............	1	2	2	2
	34	36	37	32

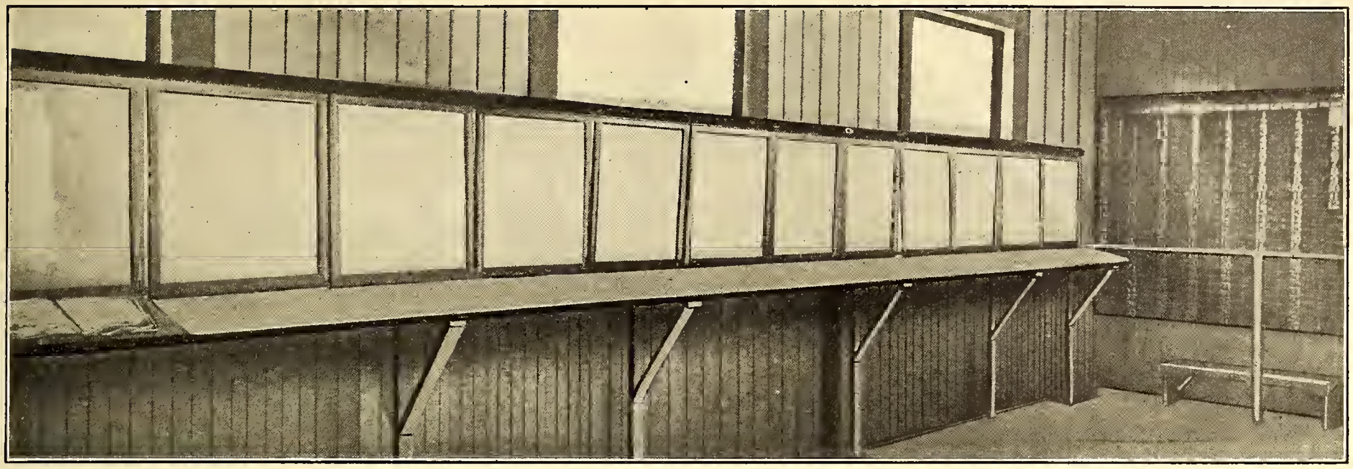
SHEET NO. 2, INDICATING METHOD OF SHOWING DIVISION OF SHEET NO. 1 INTO WORKING RUNS, LOS ANGELES RAILWAY COMPANY

the latter also gives him careful instructions along the same lines. As the information posted is very full, there is no reason for ignorance, except lack of time to secure the information. We rarely have any trouble on account of the men not understanding the schedules.

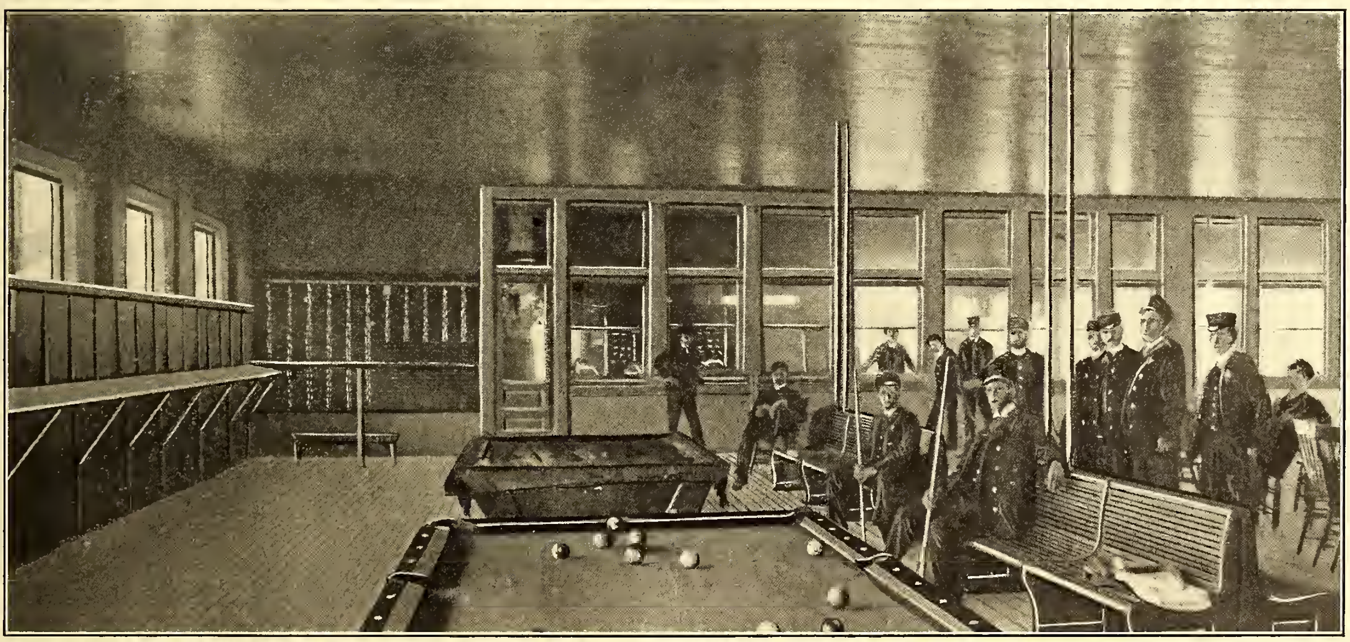
As our cars are handled by the despatcher system, we are constantly in touch with the men and can reduce our service very quickly. Thus, the Pico Heights line, as shown on the schedule noted, is operated through to the park on Sundays.

If it should rain in the afternoon, the despatcher would merely call in the extra cars. If it should become stormy, and we wish to reduce the service on that or other lines still further, the despatcher would be so instructed and enough early "in" cars would be pulled off to reduce the service to the desired headway. On account of our always being in communication with the men, ten minutes after an order is given for a reduction in the service, a number of cars are on their way to the car house. One of the engravings is a general view of the trainmen's room at one of our division headquarters. The foreman's office is in the background. This photo gives an excellent idea of the convenient arrangement between the foreman's office, car board and the frames where the schedules are kept, showing how little walking is necessary for a man to secure all the necessary information after he is assigned to his run.

J. J. Akin, Supt.,
Los Angeles Ry. Co.



VIEW INDICATING CONVENIENT ARRANGEMENT OF FRAMES FOR HOLDING SCHEDULES AND SHELF FOR USE OF MEN, LOS ANGELES RAILWAY COMPANY



VIEW IN TRAINMEN'S ROOM, SHOWING CONVENIENT ARRANGEMENT OF FOREMAN'S OFFICE, CAR BOARD AND FRAMES FOR HOLDING THE SCHEDULES, LOS ANGELES RAILWAY COMPANY

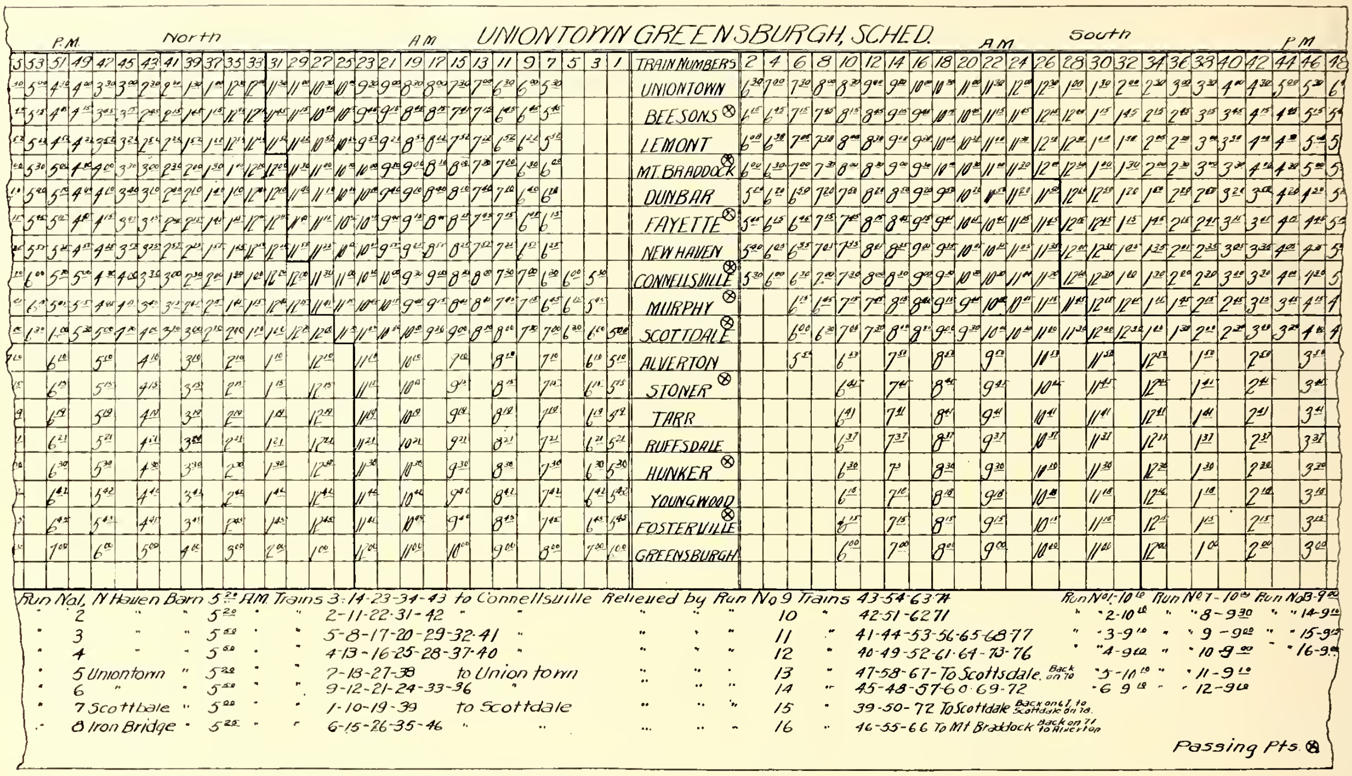
When running extra cars to our park our schedule calls for 30-minute time, through the summer months. This schedule is run with double or triple cars or as many headers as may be necesssary to accommodate the crowd. If it should happen to rain, in the afternoon or evening, the cars that are doubled up are taken off and the 30-minute time is run with single cars. During fair time we run cars every 15 minutes to the Fair Grounds, four and five together. As soon as the travel is over or the weather is bad these extra cars are taken off and the 15-minute time is run by a single car. In other words, we increase the number of cars on each run, instead of changing the scheduled intervals between the runs.

L. H. Mountney, Supt.,
L. M. & W. Pass. Ry., Milton, Pa.

Schedules on the West Pennsylvania Railways are made up when entirely new time tables are desired, by means of a large board on which is plotted the sidings and time points on the line. The time divisions are indicated in two-minute periods by lines drawn across this diagram. Pins and colored strings are used to indicate each particular run, and from this graphic layout the schedule is transferred in the form shown herewith to tracing cloth. Blue prints from this tracing are posted in advance at the various car houses, and a copy is given to each crew. Schedules for the public are put up in folder form and are freely distributed. Wall cards, such as in use on steam railroads, are placed in various hotels and public places Schedules are made up from information obtained in several different ways. Records of passengers carried per car at different intervals are easily secured, as our fares are registered in five-cent zones, and the number of passengers in any particular fare limit within a specified time are obtainable. Travel curves are plotted at various times, showing graphically the passengers per hour, and during what hours and days travel is the heaviest. From these two sources, together with actual inspection by transportation representatives and reliable information obtained from responsible patrons of the company, the company is able to decide whether or not the service is sufficient, and vice versa, whether or not too many cars are being run in relation to the travel. The posting of schedules and the instruction of despatchers and inspectors form the method of acquainting the crews with the details of the schedule, as it is one of the despatchers' and inspectors' duties to explain all the details to the road men.

On this system our largest park is located on a double-track line, and all park runs are operated as extras. The crews are given running time only, and the starters order park cars out or hold them back as the crowds gather or fall off. When the weather is bad or travel is light, the crews receive orders when arriving at the park or at the other terminal to pull in at the car house, which is located half way between the city terminal and the park. Every other car may be taken off, or, in case of continued heavy rain, all trippers may be run in. Car hours are thus reduced to a minimum. On interurban lines operating under single-track conditions, extra cars are operated as second sections of regular cars on a 30-minute headway. Telephones are installed at each siding, and if weather conditions arise which reduce travel, the extra cars are pulled off. On this system, where main line cars run at 30-minute intervals, and portions of the main line track are used at a number of places by side line cars, a change of schedule would be a complex matter. Therefore, the steady adherence to regular schedule and the operation of extra cars as second sections has been found the most desirable.

J. W. Brown, Supt. Transportation,
West Penn Railways Company.



SECTION OF SCHEDULE INDICATING TYPICAL FORM OF SCHEDULE USED BY WEST PENN RAILWAYS

Sample of printed time table used by the Columbus, Delaware & Marion Railway Company is shown in the accompanying illustration. This table is for the guidance and information of employees in the operation of trains, and shows the movement of all trains on the line except work trains. The heavy figures indicate meeting points. The train numbers of trains passed at regular meeting points are inserted in small type over the figures indicating time. On the back of the time sheet are printed twenty-eight special rules governing the movement of trains. As to keeping employees informed

THE COLUMBUS, DELAWARE & MARION RAILWAY COMPANY

ILY.					READ UP.											READ DOWN.						
221	219	217	215	213	211	209 U.S. Mail	207	205	203	201	No. of Train	202	204	206	208	210	212	214	216 U.S. Mail	218	220	222
P. M. 25	P. M. 1.25	P. M. 12.25	A. M. 11.25	A. M. 10.25	A. M. 9.25	A. M. 8.25	A. M.	A. M. 7.25	A. M. 6.45	A. M. 6.15	Ar ...... COLUMBUS ..... Lve.	A. M.	A. M.	A. M.	A. M.	A. M. 6.30	A. M. 7.00	A. M. 7.30	A. M. 8.30	A. M. 9.30	A. M. 10.30	
	1.04	12.04	11.04	10.04	9.04	8 04	......	7.04	6.24	5.53	SUMMIT ST. AND MOCK ROAD	......	......	......	......	6.56	7.26	7.56	8.56	9.56		
	00	12 00	11 00	10.00	9 00	8.00	......	7.00	6.20	5.48	......NORTH COLUMBUS......	......	......	......	......	7.00	7.30	8.00	9 00	10		
		11.55	10.55	9.55	8.55	7.55	......	6.55	6.14	5.42	........CLINTONVILLE........	......	......	......	......	7.05	7.36	8.05	9			

SECTION OF TIME TABLE, INDICATING FORM USED BY COLUMBUS, DELAWARE & MARION RAILWAY COMPANY regarding schedules, the writer believes a monthly conference with the men will always assure a thorough understanding of not only the schedules, but other instructions issued. The proposition submitted in question B4 is one that would be taken care of by extra service. This is best handled by having the traffic manager personally on the ground to watch conditions. If this is impossible, a reliable representative in whose judgment the manager has confidence, can regulate the service with but little useless mileage.

A. L. Neereamer, Traffic Mgr.,
Columbus, Delaware & Marion Ry. Co.

We submit copy of time table for our Albany Division, which shows the form used for interurban and local lines on the Schenectady Railway. The tables are posted on printed forms, ruled to give spaces for showing stations, run numbers, relief and distribution of time, assignment of runs, running time between points, summary and special instructions. In order to determine a proper schedule for use on our various lines, it is our practice to check loads carried at different points on each line during the full period that cars are operated. Our schedules are then arranged to fit the travel under normal conditions, and we run a sufficient number of cars to comfortably handle the traffic. Schedules are posted at the stations and are sufficiently clear for employees to read and understand them.

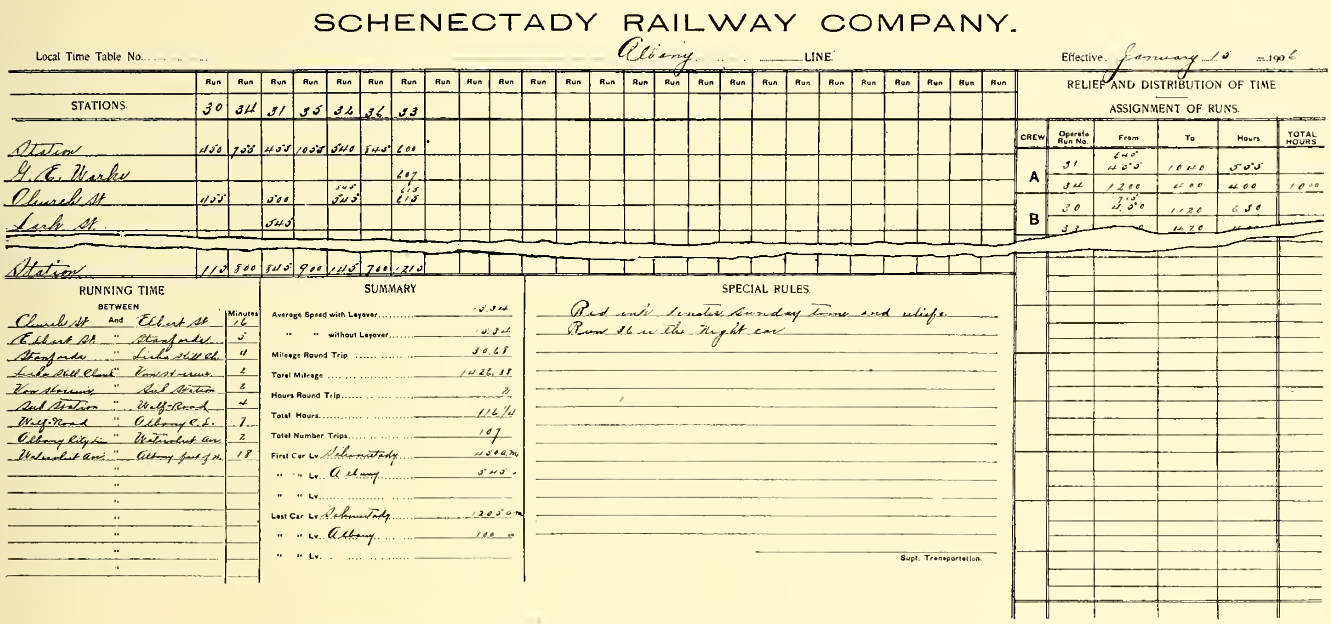
It is our practice to swell our schedules by increasing the number of cars to meet heavy travel which can not be taken care of by the regular cars. The necessity of putting out extra cars to take care of increased travel is determined by careful vigilance. Anticipating heavy travel on Saturdays, Sundays or holidays, extra crews are held at the car houses subject to call. When the travel on any one line becomes so heavy that it cannot be properly taken care of by our regular cars running on that line, the inspector increases the headway by calling out extra cars from the station, either increasing the line by even headway or running cars in sections, according to the conditions which must be met. As an illustration, when operating a 20-minute headway on our Albany Division, anticipating an increased travel on a Saturday afternoon or Sunday, we call out extra cars from the station, changing the line from a 20-minute service to a 15-minute service, the round trip consuming two hours. If this is not sufficient to handle the traffic, the line is increased to a 10-minute line, or a 7½-minute line, as occasion requires. Just as soon as we find the travel dropping off, the extra cars are pulled out of the service, again throwing the line back to the regular schedule. This same practice is followed out on all lines, throwing in cars and pulling them out, as the service demands.

E. J. Ryon, Supt.,
Schenectady Ry.

We make up our schedules according to previous results, based on earnings per car and per car mile. We obtain these statistics through the accounting office, from the conductors' reports; also from the inspectors, who make suggestions as to when trippers should be put in service to relieve overloaded cars. Schedules are made up and posted at the different stations. These show the time of leaving stations, also the time of meeting on switches. Schedules are posted some time in advance of the date when they go into effect, and motormen and conductors are required to make themselves familiar with the schedule. Any information they desire in regard to the same is secured from the despatcher. We operate our regular schedules with extras at intervals as frequent as traffic warrants. In case of bad weather, the road inspectors notify despatcher by telephone to withdraw extra service or such part of it as they think should be withdrawn. Cars once having left the terminal and passed the inspectors are required to go to the end of the line.

F. J. Gerdon, Supt. Treas.,
Utica & Mohawk Valley Ry. Co.

The chart on following page shows type of our schedules used in daily operation, this particular line being one of our best. The block numbers written over the top of the terminal indicate the division of running times on the schedule, as outlined hereafter. The small table on the right of the schedule gives the time the crews are relieved, the character of their run, and the run number. The top line, which reads run No. 77, runs on 161 block a. m., and goes to 194 block at night, which shows that this is a swing run, 194 block being a run on another line. Where the blocks are given a. m. and noon, as run No 19, a.m. 162 block, noon 165, this indicates a straight-day.



SCHENECTADY RAILWAY COMPANY.

Local Time Table No. .... Albany LINE. Effective January 10 1906

STATIONS	Run 30	Run 34	Run 31	Run 35	Run 32	Run 36	Run 33
Station	450	755	405	1055	540	845	600
G. E. Works							607
Church St	455		500		545 545		615 615
Lark St.			545				
Station	115	800	845	900	145	700	1210

RELIEF AND DISTRIBUTION OF TIME — ASSIGNMENT OF RUNS.

CREW	Operate Run No.	From	To	Hours	TOTAL HOURS
A	31	645 / 405	1040	505	
	34	1200	400	400	1000
B	30	715 / 450	1120	630	
	33		420		

RUNNING TIME

BETWEEN	And	Minutes
Church St	Elbert St	16
Elbert St.	Stanfords	5
Stanfords	Loudon Hill Ch.	4
Loudon Hill Church	Van Heusens	2
Van Heusens	Sub Station	2
Sub Station	Wolf Road	4
Wolf Road	Albany C. L.	7
Albany City Line	Watervliet Ave.	2
Watervliet Ave.	Albany foot of St.	18

SUMMARY

Average Speed with Layover	15.34
" " without Layover	15.34
Mileage Round Trip	30.68
Total Mileage	1426.88
Hours Round Trip	2
Total Hours	116 3/4
Total Number Trips	107
First Car Lv. Schenectady	450 a.m.
" " Lv. Albany	545 "
" " Lv.	
Last Car Lv. Schenectady	1205 a.m.
" " Lv. Albany	100 "
" " Lv.	

SPECIAL RULES.

Red ink denotes Sunday time and relief.
Run 36 is the Night car

Supt. Transportation.

(Note—On the original the small figures above larger figures in the same square are shown in red, and indicate Sunday time and relief.)

FORM OF SCHEDULES FOR CITY AND INTERURBAN LINES USED BY THE SCHENECTADY RAILWAY COMPANY

Run No. 51, noon 162 block, night 165 block indicates a late-straight, or a straight-from-noon. The small table on the left of the schedule shows the leaving time of the cars from the car house on Sunday, these leaving times being somewhat later than the first cars leave on week days. The time-point schedule on the left of the schedule shows the time given to run between various points. Notes are made on the schedules where special instructions are given concerning various details. The mileage table, as indicated on the schedule, is for the use of the operating and auditing departments. On the schedule proper, the leaving time from the car house is placed under the terminal to which the car goes on its first trip from the car house. For instance, 161 block goes from the car house to ferry, leaving the car house at 5:55 a. m. If, on the other hand, this car should be scheduled from the car house to N. C. Hill at 5:55 a. m., the leaving time would be placed under the terminal North Cramer Hill. The same rule applies to cars going to the car house after ending day's work, the arriving time at car house being placed in the bottom of the column indicating from which terminal the car finished the run. The schedules for our various lines are made out in a similar form, with the leaving time as indicated above.

We determine our schedules from studies made on cross section paper, taking the information from our conductor's coupons or day cards. This gives an accurate statement for each trip going in either direction. Sample of one of these cross section studies accompanies this article. This is a study of our main line running from Ferry to Merchantville and Moorestown. The distance to Merchantville is 5 miles, and to Moorestown is 12 miles. The fare from the ferry to Merchantville is 5 cents, and to Moorestown is 10 cents. The study marked "up" shows the trips from ferry to Moorestown and Merchantville. The study marked "down" shows the trips from Moorestown and Merchantville to the ferry. The space enclosed between the solid black line and the base line indicates the number of passengers carried per trip between the ferry and Merchantville, and between Merchantville and the ferry. The cross-section paper is ruled ten lines to the inch, and this makes ten passengers to the inch, that is, if the point is on the twenty-sixth line from the base it indicates that there were twenty-six passengers on that trip. The space enclosed by the dotted black lines (shown as red on the original) indicates the number of passengers carried between Merchantville and Moorestown and Moorestown and Merchantville. This travel is counted from the base line the same as in the other case. We do not plot out car miles on this study. A 10-minute headway is maintained on the line from the ferry to Merchantville, and a 30-minute headway between Moorestown and Merchantville. The time of the trips is placed under the base lines.

In explanation of the double row of time figures, would say that the leaving times 5:37, 5:47, 5:57 and 6:07 are the leaving times from Merchantville, the figure 5:20, which is placed under the figure 6:07, is the leaving time from Moorestown. This car is due at Cove Road at 6.07. This point is the end of the single-fare district. By looking at the chart on the division marked "down," and taking the point directly over the time 5:42, the space enclosed between the dotted line and the base line will give the number of passengers carried on this 5:42 trip from Moorestown to Merchantville, and then following from the base line directly over 6:07, the space enclosed by the black line will give the number of passengers carried from Merchantville to the Ferry. We do not have any regular time to make up these studies. If we find any particular line is carrying more people than usual, or the receipts are dropping off, we then make out a chart study to determine at what hours of the day the changes are taking place, and then arrange our schedules accordingly. For the lines on which extra service is run, and on which such extra service would be interfered with by the condition of the weather, we do not change our regular schedule. Our lines are all run, with the exception of Moorestown and Riverton, on a 10-minute headway. If extra service is required, we

N. C. HILL

SUNDAY - LEAVING TIME - FROM - BARN.			
BLOCK	BARN	FERRY	N C HILL
161	6 55	7.08	7.37
162	6.05	6.18	6.47
163.	7.15	7.28	7.57
164	6 25	6.38	7 07
165	7.35	7.48	8.17
166	5.45	5.58	6 27

TIME - POINTS - TO - N. C. HILL	MIN
FERRY	0
5TH AND STATE.	10
STATE - ST - BRIDGE	13
BEIDEMAN.	25
LAY - OVER	4

TIME - POINTS - TO - FERRY	MIN
BEIDEMAN.	0
STATE - ST. BRIDGE	12
5TH AND STATE	15
FERRY	25
LAY - OVER	6

NOTE
CREWS - MUST - RUN STRICTLY - TO - TIME POINTS - PASS - 8TH AND STATE

161				162				163				164				165				166			
FERRY		N C HILL		FERRY		N C HILL		FERRY		N C HILL		FERRY		N C HILL		FERRY		N C HILL		FERRY		N C HILL	
AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.	AR.	LV.
5^{55}				5^{5}				5^{15}				5^{25}				5^{35}				5^{45}			
				5^{16}	18	5^{40}	42	5^{26}	28	5^{53}	57	5^{36}	38	6^{3}	7	5^{46}	48	6^{13}	17	5^{56}	58	6^{23}	27
6^{6}	8	6^{33}	37	6^{4} SUN	18	6^{43}	47	6^{22}	28	6^{53}	57	6^{32} SUN	38	7^{3}	7	6^{42}	48	7^{13}	17	6^{52}	58	7^{23}	27
7^{2} SUN	8	7^{33}	37	7^{12}	18	7^{43}	47	7^{22} SUN	28	7^{53}	57	7^{32}	38	8^{3}	7	7^{42} SUN	48	8^{13}	17	7^{52}	58	8^{23}	27
8^{2}	8	8^{33}	37	8^{12}	18	8^{43}	47	8^{22}	28	8^{53}	57	8^{32}	38	9^{3}	7	8^{42}	48	9^{13}	17	8^{52}	58	9^{23}	27
9^{2}	8	9^{33}	37	9^{12}	18	9^{43}	47	9^{22}	28	9^{53}	57	9^{32}	38	10^{3}	7	9^{42}	48	10^{13}	17	9^{52}	58	10^{23}	27
10^{2}	8	10^{33}	37	10^{12}	18	10^{43}	47	10^{22}	28	10^{53}	57	10^{32}	38	11^{3}	7	10^{42}	48	11^{13}	17	10^{52}	58	11^{23}	27
11^{2}	8	11^{33}	37	11^{12}	18	11^{43}	47	11^{22}	28	11^{53}	57	11^{32}	38	12^{3}	7	11^{42}	48	12^{13}	17	11^{52}	58	12^{23}	27
12^{2}	8	12^{33}	37	12^{12}	18	12^{43}	47	12^{22}	28	12^{53}	57	12^{32}	38	1^{3}	7	12^{42}	48	1^{13}	17	12^{52}	58	1^{23}	27
1^{2}	8	1^{33}	37	1^{12}	18	1^{43}	47	1^{22}	28	1^{53}	57	1^{32}	38	2^{3}	7	1^{42}	48	2^{13}	17	1^{52}	58	2^{23}	27
2^{2}	8	2^{33}	37	2^{12}	18	2^{43}	47	2^{22}	28	2^{53}	57	2^{32}	38	3^{3}	7	2^{42}	48	3^{13}	17	2^{52}	58	3^{23}	27
3^{2}	8	3^{33}	37	3^{12}	18	3^{43}	47	3^{22}	28	3^{53}	57	3^{32}	38	4^{3}	7	3^{42}	48	4^{13}	17	3^{52}	58	4^{23}	27
4^{2}	8	4^{33}	37	4^{12}	18	4^{43}	47	4^{22}	28	4^{53}	57	4^{32}	38	5^{3}	7	4^{42}	48	5^{13}	17	4^{52}	58	5^{23}	27
5^{2}	8	5^{33}	37	5^{12}	18	5^{43}	47	5^{22}	28	5^{53}	57	5^{32}	38	6^{3}	7	5^{42}	48	6^{13}	17	5^{52}	58	6^{23}	27
6^{2}	8	6^{33}	37	6^{12}	18	6^{43}	47	6^{22}	28	6^{53}	57	6^{32}	38	7^{3}	7	6^{42}	48	7^{13}	17	6^{52}	58	7^{23}	27
7^{2}	8	7^{33}	37	7^{12}	18	7^{43}	47	7^{22}	28	7^{53}	57	7^{32}	38	8^{3}	7	7^{42}	48	8^{13}	17	7^{52}	58	8^{23}	27
8^{2}	8	8^{33}	37	8^{12}	18	8^{43}	47	8^{22}	28	8^{53}	57	8^{32}	38	9^{3}	7	8^{42}	48	9^{13}	17	8^{52}	58	9^{23}	27
9^{2}	8	9^{23}	37	9^{12}	18	9^{43}	47	9^{22}	28	9^{53}	57	9^{32}	38	10^{3}	7	9^{42}	48	10^{13}	17	9^{52}	58	10^{23}	27
10^{2}	8	10^{33}	37	10^{12}	18	10^{43}	47	10^{22}	28	10^{53}	57	10^{32}	38	11^{3}	7	10^{42}	48	11^{13}	17	10^{52}	58	11^{23}	27
11^{2}	8	11^{33}	37	11^{12}	18	11^{43}	47	11^{22}	28	11^{58}	57	11^{32}	38	12^{3}	4	11^{42}	48	12^{13}	14	11^{52}	58	12^{23}	24
12^{2}	8	12^{33}	34	12^{12}	13			12^{22}	23			12^{29}	30			12^{39}	40			12^{49}	50		
12^{59}	1			12.25 *				12.35 *				12.40 *				12.50 *				1.00 *			

1.10 *

SUNDAY.
FIRST - CAR - FROM - N.C. HILL - SUN. 6.27 A.M.
" " " FERRY - " 5.58 A.M.

FERRY - TO - BEIDEMAN 3.38 M.
" - BARN 1.20

RELEIF - AT - FERRY.		
BLOCK	NOON	NIGHT
161	12.02	6.02
162	11.12	5.12
163	11.22	5.22
164	11.32	5.32
165	11.42	5.42
166	11.52	5.52

CREWS.

RUN	A.M.	NOON	NIGHT
77	161		194
19	162	165	
18	163	166	
20	164	161	
76	165		162
74	166		163
51		162	165
50		163	166
53		164	161
58		211	164
104	136		153

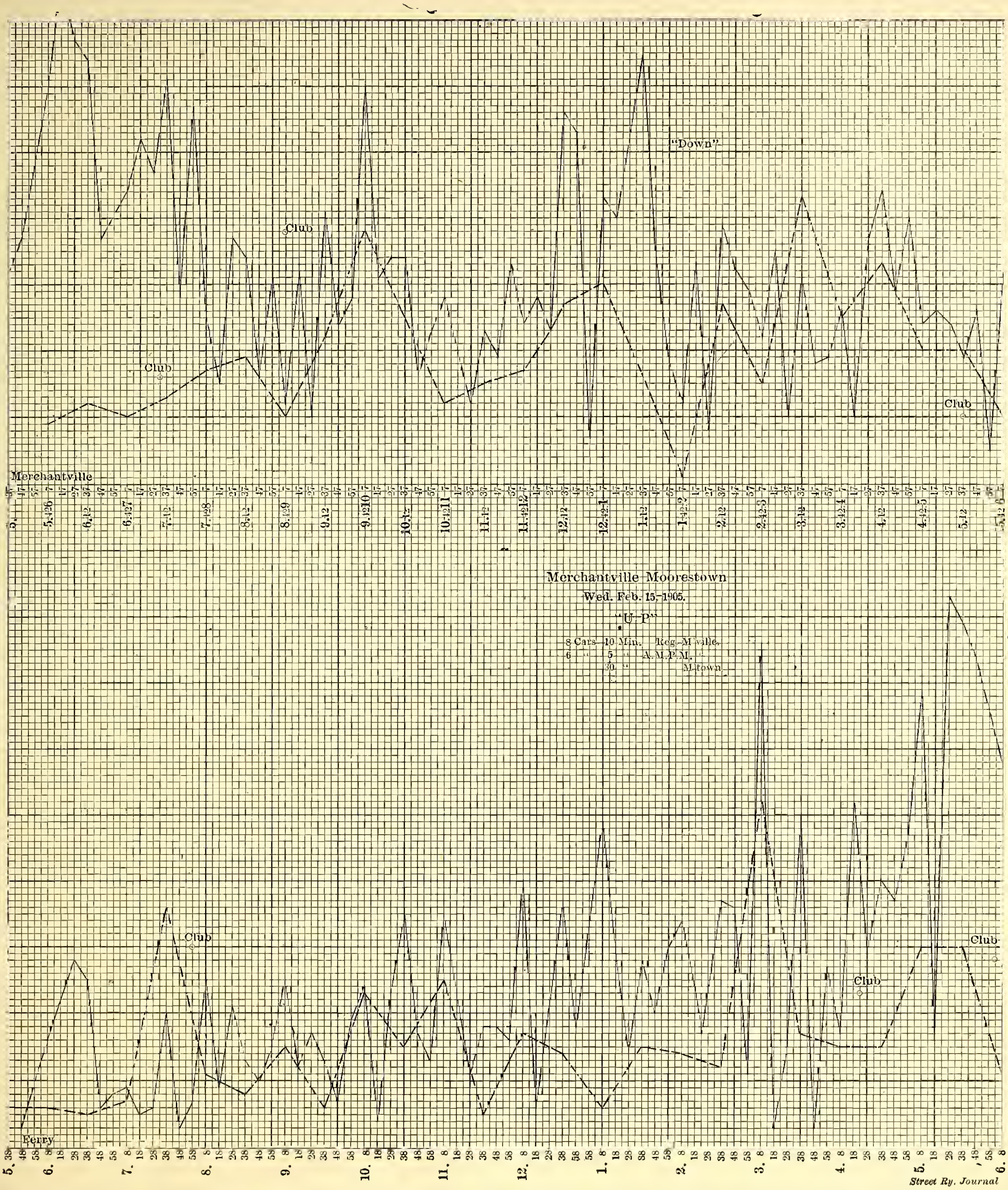
NOTE
RUN - No. 77 - TAKE - 164 BLOCK - SAT. AND SUN. NIGHT.

MILEAGE

BLOCK	DAILY	SUNDAY
161	130.84	124.08
162	130.84	124.08
163	130.84	118.72
164	130.84	124.08
165	130.84	118.72
166	130.84	130.84
TOTAL	785.04	740.52

FORM OF SCHEDULE USED BY PUBLIC SERVICE CORPORATION, SOUTH JERSEY DIVISION operate an independent schedule, making the headway every 5 minutes. These tripper cars are subject to despatcher's orders, and can be taken off, subject to the conditions of travel, without interfering with the regular schedules. We make similar chart studies for this tripper service. In operating cars for park service, our main line is not interfered with. We place as many cars on the street as we think are necessary to handle the traffic. In case of storm after these cars have been sent out, if travel stops, the cars are immediately sent to the car house. In cases where park travel is light and extra cars are run during the rush, these extras lay over until the park is closed, when they are run out one or two trips, as travel warrants, subject always to the despatcher's orders. Whenever new schedules are prepared, notice is posted to cover the details.

F. A. Hewett, Supt. Trans.,
Public Service Co., So. Jersey Div., Camden.



(Note—On the original the lines shown on the reproduction as broken lines are drawn in red.)

METHOD OF MAKING STUDIES OF TRAFFIC CONDITIONS FOR DETERMINING SCHEDULE EFFICIENCY USED BY PUBLIC SERVICE CORPORATION, SOUTH JERSEY DIVISION

The form in which schedules on the Madison & Interurban Traction lines are posted is indicated herewith. We have simplified the form as much as possible, believing that by so doing our employees can more readily understand and operate by it without confusion. In cities the size of ours, the conditions vary. We are operating a single-track system, with sidings, 1000 ft. in length, at suitable points, and are governed as to the number of cars to be run by the number of passengers carried. We run extra cars during hours of heaviest traffic, and the aim is to make the best possible headway with the least number of cars. For example, we have gradually reduced our headway from a 15-minute to a 10-minute schedule, without increasing the number of cars in operation. This improvement has been brought about by reducing the number of stopping places and long waits, and by improvements made in roadbed and rolling stock. The result of these changes has been a very satisfactory increase in our earnings, and the public is much better satisfied.

In making time schedules, we also make a table of changes and runs, showing the time and changes of each individual run, so that any man can take out his car in the morning and, by following directions and instructions for his run, can not possibly make any mistake nor become confused. The section of the "change" chart, reproduced in this connection, explains the reliefs for "dinner" and "afternoon." The original chart is extended to indicate the reliefs for "supper," "night," and the times at which cars arrive at the car house. We aim to let nothing interfere with our regular schedule. Picnics, ball games, circuses, etc., are taken care of by extra or special cars, whose movements are regulated by telephone orders, independently of the regular schedules, so that in case of storm we can take off part or all of the extra cars and not in any way interfere with the regulars. By this method we are enabled to secure greater flexibility and perfect control of all cars in operation. The question of schedule making is a very important one, and the writer hopes to see the question thoroughly discussed.

G. H. Shaw, Gen. Supt.,
Madison & Interurban Tract. Co., Madison, Wis.

TIME TABLE

FAIR-OAKS AND WINGRA PARK.

RUN	CAR	LEAVE CAR HOUSE	TO	RUN	CAR	LEAVE FAIR-OAKS GOING WEST.												
2	33	5:50 A.M.	Wingra Park	6	38	6:40	8:00	9:20	10:40	12:00	1:20	2:40	4:00	5:20	6:40	8:00	9:20	
5	36	6:20 " "	Cemetery	4	35	6:50	8:10	9:30	10:50	12:10	1:30	2:50	4:10	5:30	6:50	8:10	9:30	
7	39	6:30 " "	Cemetery	2	33	7:00	8:20	9:40	11:00	12:20	1:40	3:00	4:20	5:40	7:00	8:20	9:40	
8	20	6:00 " "	Wingra Park	8	20	7:10	8:30	9:50	11:10	12:30	1:50	3:10	4:30	5:50	7:10	8:30	9:50	
4	35	5:50 " "	Hayes Siding	3	34	7:20	8:40	10:00	11:20	12:40	2:00	3:20	4:40	6:00	7:20	8:40	10:00	
6	38	5:50 " "	Library Siding	1	32	7:30	8:50	10:10	11:30	12:50	2:10	3:30	4:50	6:10	7:30	8:50		
3	34	6:10 " "	Wingra Park	5	36	7:40	9:00	10:20	11:40	1:00	2:20	3:40	5:00	6:20	7:40	9:00	10:10	
1	32	6:10 " "	Cemetery	7	39	7:50	9:10	10:30	11:50	1:10	2:30	3:50	5:10	6:30	7:50	9:10	10:20	Last Car going west 10:20 P.M.

GOING EAST

RUN	CAR	LEAVE	AM	LEAVE CEMETERY													LEAVE	WINGRA PARK	
2	33	Wingra Park	6:25		7:40	9:00	10:20	11:40	1:00	2:20	3:40	5:00	6:20	7:40	9:00			10:15	
8	20	" "	6:35		7:50	9:10	10:30	11:50	1:10	2:30	3:50	5:10	6:30	7:50	9:10		–	10:25	
3	34	" "	6:45		8:00	9:20	10:40	12:00	1:20	2:40	4:00	5:20	6:40	8:00	9:20			10:35	
1	32	Cemetery		6:50	8:10	9:30	10:50	12:10	1:30	2:50	4:10	5:30	6:50	8:10	9:30				Last Car leaves Cemetery 9:30 P.M.
5	36	"		7:00	8:20	9:40	11:00	12:20	1:40	3:00	4:20	5:40	7:00	8:20			9:35	10:45	
7	39	"		7:10	8:30	9:50	11:10	12:30	1:50	3:10	4:30	5:50	7:10	8:30			9:45	10:55	
6	38	"		7:20	8:40	10:00	11:20	12:40	2:00	3:20	4:40	6:00	7:20	8:40			9:55		
4	35	"		7:30	8:50	10:10	11:30	12:50	2:10	3:30	4:50	6:10	7:30	8:50			10:05		Last Car leaves Wingra Park 10:55 P.M.

FORM OF SCHEDULE USED BY THE MADISON & INTERURBAN TRACTION COMPANY, MADISON, WIS.

TABLE OF CHANGES

FAIR OAKS AND WINGRA PARK

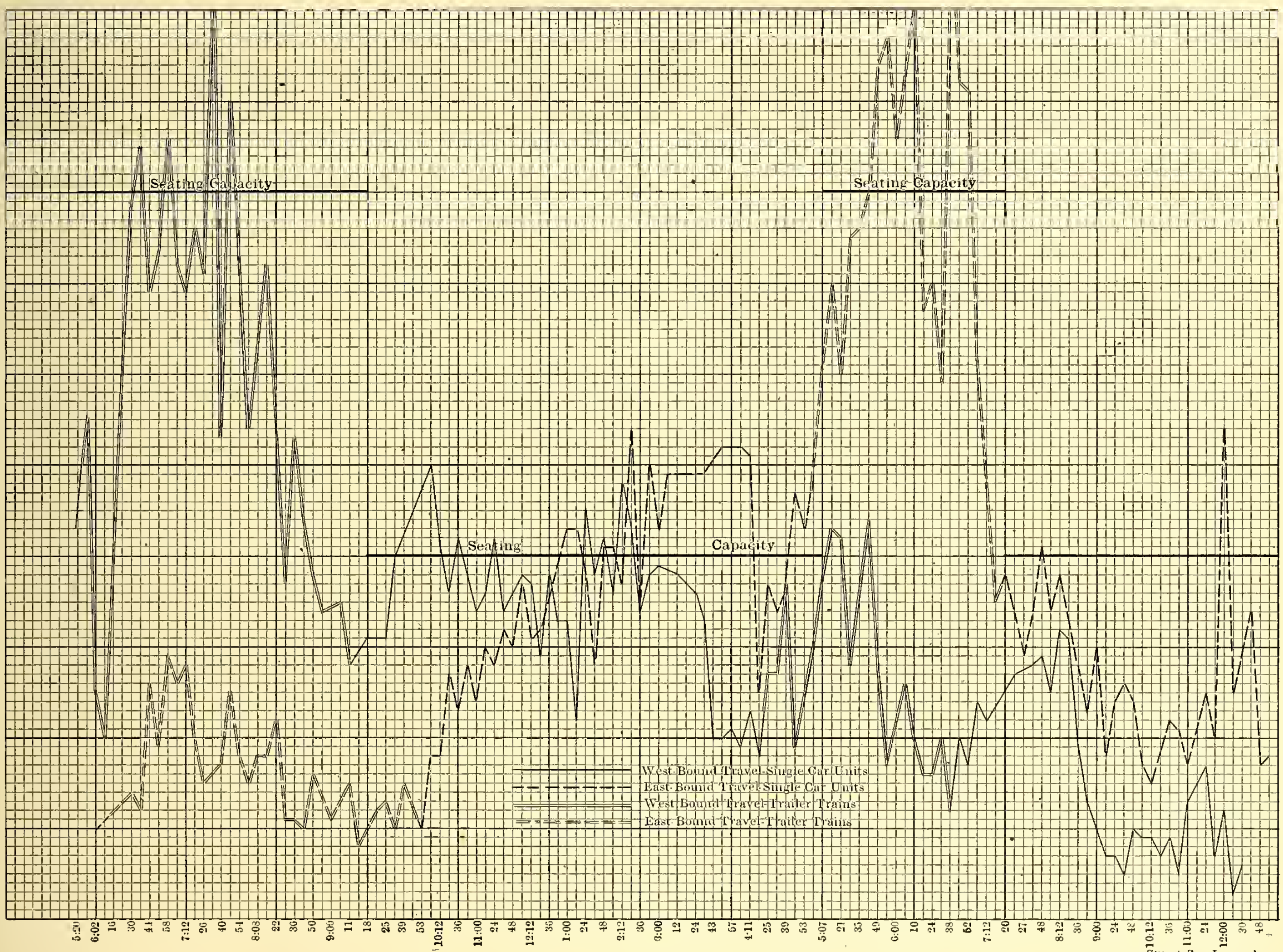
	DINNER
NO 1	No 1 Man leaves Fair Oaks 10:10 A.M. Goes to Library Siding, Meets and Changes with man on No 2 run, at 10:35 returns to Fair Oaks. Off for dinner 11:00 relieved by No 2 relief.
" " 3	" 3 " " " " 10:00 " " " Harrison Street " " " " " " No 8 " " 10:35 " " " " " " " 11:10 " " No 3 "
" " 5	" 5 " " " " 10:20 " " " Hayes Siding " " " " " No 8 man on No 3s run at 10:50 " " " " " " " " 11:20 " " No 4 "
" " 7	" 7 " " " " 10:30 " " " " " " " " " " No 2 " " No 1s run " 11:00 " " " " " " " " 11:30 " " No 5 "
	AFTER-NOON
NO 2	No 2 Man on No 7s run leaves Fair Oaks at 11:50 A.M. goes to Atwood Ave Siding, Meets and Changes with man on No 6 Run at 11:55 returns to Fair Oaks - off for afternoon 12:00 - Relieved by No 1 man
" " 4	" 4 " off at Fair Oaks for afternoon at 12:10 on his own run - relieved by No 3 man.
" " 6	" 6 " on No 7s run from Atwood Ave Siding at 11:55 - goes to East Madison Siding. Meets and Changes with No 2 relief man on No 2s run at 12:05 returns to Fair Oaks off for afternoon 12:20 relieved by No 5 man

SECTION OF "TABLE OF CHANGES" USED BY THE MADISON & INTERURBAN TRACTION COMPANY IN CONNECTION WITH ITS REGULAR SCHEDULES

The Indiana Union Traction Company prints its time tables in the form of comprehensive folders, which give detailed information regarding schedules on all lines, maps, connections and rules and regulations pertaining to tickets, baggage, etc. The time tables are prepared in accordance with regulation steam railroad practice. For determining schedule efficiency we keep the train earnings of each train separate, giving the number of passengers carried on each train run, and in this way keep watch to see if the schedules are properly covering the service. We examine each crew before they enter the service, to see that they thoroughly understand all rules, time tables and signals. On interurban lines, the train despatcher calls off all extra trains when the heavy travel is over. The different train masters call off all extra service on city lines as soon as the heavy travel is over.

C. A. Baldwin, Supt. Trans.,
Indiana Union Tract. Co.

[The Birmingham Railway, Light & Power Company, of Birmingham, Ala., in determing if schedules are suitable for the traffic, plots the number of passengers carried by hours in diagrammatic form on cross-section paper, in about the same way as described elsewhere in this issue of the Question Box, but it adds one commendable feature not mentioned in the other systems described. That is, a line is added to the load curves, showing the seating capacity of the car. In other words, the seating capacity is taken as the base line, and the variations of the load lines above or below this base indicate at a glance the relation between seating capacity and the number of passengers actually carried. A sample study in the form followed at Birmingham is shown herewith.—Editors.]



(Note—On the original the lines shown on the reproduction as double lines are shown as single red lines.)

METHOD OF MAKING STUDIES OF TRAFFIC CONDITIONS FOR DETERMINING SCHEDULE EFFICIENCY USED BY BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY, BIRMINGHAM, ALA.

We make a monthly "board," showing the run each man is entitled to and also the time that each car is due to leave the car house. Printed schedules of running time and headway are furnished to the trainmen. The starting time from end of line is given by the despatcher by telephone, each trip. In order to determine if the schedules are properly meeting the conditions, we obtain from the auditor records of passengers carried per car or trip, going in and out, and we often have conductors report on separate trip sheets or day cards the number of passengers carried from, to, or between points, when desired. We also have division superintendents and inspectors watch the traffic at certain specified times and places. We watch changeable conditions by stationing division superintendents or inspectors at resorts or along the routes to such parks or resorts, and these officers keep the superintendent informed in regard to the state of travel.

Our system of telephones keeps the despatcher and superintendent in touch with every point on the road, so that there is never delay in adjusting the service to meet the traffic; and in like manner the superintendent may be immediately informed should any accident, delay or blockade occur. We have in Denver a central loop, around or through which pass nearly all lines in the city and nearly all the lines leading to parks or resorts. We have extra storage tracks in and around this loop. On special occasions when there is likely to be heavy traffic, and there is some doubt as to which point will demand the heaviest service, these cars are stationed upon these loop tracks, and sent out to the best advantage.

John A. Beeler, V. Pres. & Gen. Mgr.,
Denver City Tramway.

[Note.—The following communication from Mr. Hibbs, general superintendent of the United Railroads of San Francisco, was received prior to the disaster that recently overtook that city. It is printed herewith as showing the practice of the United Railroads in handling the matter of schedules before the earthquake and fire. Undoubtedly, the same general principles will be applied as soon as conditions again become normal.—Editors.]

On the United Railroads of San Francisco traffic statements are made at frequent intervals, using the conductor's day card as a basis. These traffic sheets show the number of passengers carried on each half trip, by hours, for the entire day. In addition, we have the cars of the line under investigation ridden by persons trained for this purpose, who ascertain: first, the carrying capacity of each car for each hour; second, the load conditions of each car at various points on the line. In addition to this we make an analysis of the issue and collection of transfers at the different transfer points and intersections on the line. We find from these different processes; first, the number of passengers for whom provision must be made at different hours during the day; and, second, the number of cars necessary to transport the said number of passengers—which fixes the headway at which cars are to be operated. We also obtain, from the records referred to, information that enables us to turn certain cars back before reaching the outer terminus, and lengthen the headway in the suburban district to the extent of accommodating our patrons and yet not run unnecssary mileage. Schedules are posted in the car houses at least three days before being placed in operation, and the carmen are, under agreement, permitted to pick runs according to seniority of service, which process is known as "signing up." A man's signature opposite the run number picked by him is notification by him that he has examined the schedule and is familiar with the details, and is accepted as such by the superintendent or operating officer in charge. Inspectors, or—as they were formerly known here—timers, make a copy of the leaving time of each run, at both the inner and outer terminus of the line, by trips, and with the information furnished by the "running time and time points," are enabled to check up each crew at any point on the line at any time during the day. Inspectors are required to board any car not conforming to the schedule, and inquire into cause of running either ahead or behind time, and report this fact to the superintendents.

It so happens that in San Franciseo all resorts which attract large numbers of people are so located that lines running to these resorts also run through thickly populated districts via. main thoroughfares, which require frequent service and short headway under all conditions, and, in case of unexpectedly heavy riding, all cars can be sent to outer terminus, to enable other cars to be sent out by car despatcher to cover the gap which would otherwise occur, and to maintain the headway provided for by the schedule. The reverse of this operation is effective when weather conditions are such that the service provided is in excess of the requirements. An inspector, located at the outer terminus, has certain runs noted in his time book which turn in the car house when notified by him to do so. The runs to be turned in are selected with a view of maintaining a regular headway, and also with the purpose of enabling each crew to obtain a fair day's pay. To illustrate this point, a crew who would go to work at 7 o'clock in the morning could be turned in at 2 o'clock in the afternoon, rather than another crew whose work only commenced at noon. Inspectors are in constant communication with the operating officials at car houses by means of a private system of telephones, and keep headquarters advised of the traffic conditions, in order that all persons interested in the operation of the line may be kept informed of what every other operating man is doing, and so everyone acts in harmony with everyone else.

E. D. Hibbs, Gen. Supt.,
United Railroads of San Francisco.

On the Buffalo system the traffic on the different lines is watched by the division superintendent and inspectors, and the schedules made up according to travel. Occasionally, the number of passengers on cars are estimated by men assigned for this purpose at different points along the lines. All schedules are made by the division superintendent, and approved by the superintendent of transportation. (The schedules are prepared in form practically identical with the form reproduced in this connection, as used by the Schenectady Railway Company.—Eds.) Time cards are posted at all stations and the men familiarize themselves with these cards before going on duty. All time tables are thoroughly explained to all employees by the division superintendent. The schedules are compiled to suit ordinary travel. If anything special takes place on a line it is taken care of by extra cars, which are added to the regular line in such manner as not to interfere with the regular schedule. If weather conditions are such that cars are not needed, extra cars do not go out. Extra cars are pulled in by the division superintendent or an inspector when travel will so permit.

C. A. Coons, Supt. Trans.,
International Ry. Co., Buffalo.

Our schedule is printed in the form of a vest-pocket guide and is published with the idea of familiarizing the public with the running time of city cars. This was more or less necessitated by the fact that we cut down the total number of cars, in order to reduce excessive city car mileage. The schedules were changed to give cars 20 minutes to 30 minutes apart. In order to assist the public in learning the time of these cars, the same as they would interurban cars, we have marked the exact time when the city cars pass most of the prominent street car corners in the city. We keep the cars absolutely on time by compelling motormen to have their watches in a suitable watch pocket in front of them in the vestibule. Over the watch is hung a copy of the schedule, and motormen must arrive at a certain corner at the exact time shown in the time schedule. Any deviations from schedule time, without reasonable excuse, are punished by lay-offs. It is interesting to note how accurate the men have become, and how much the public have grown to rely on these time tables. We have apparently not lost any fares on account of the reduced schedule, and we have gained the advantage of considerably increased car mile receipts.

Ernest Gonzenbach, Gen. Mgr.,
Sheboygan Lgt., Pow. & Ry. Co.

In Louisville we first make out a time table setting forth the due time for each car at the various points along the route, and a copy of this time table is furnished to the motorman and conductor who operate that particular car. These men are also required to study the entire time table, as displayed in the office of the car house foreman at the place of reporting. We use what is known as the inspector system. It is the duty of the inspectors to ride back and forth over a particular line, covering the entire time that the cars are in operation. They note carefully the travel, and the trends of travel and report daily to the superintendent on the results of their observations. The reading of the register would not as accurately give the information desired in making up the proper schedule as the above plan. Each inspector has a blank that he is required to fill out, showing the number of passengers on cars at the various points along the line. We find this an excellent plan.

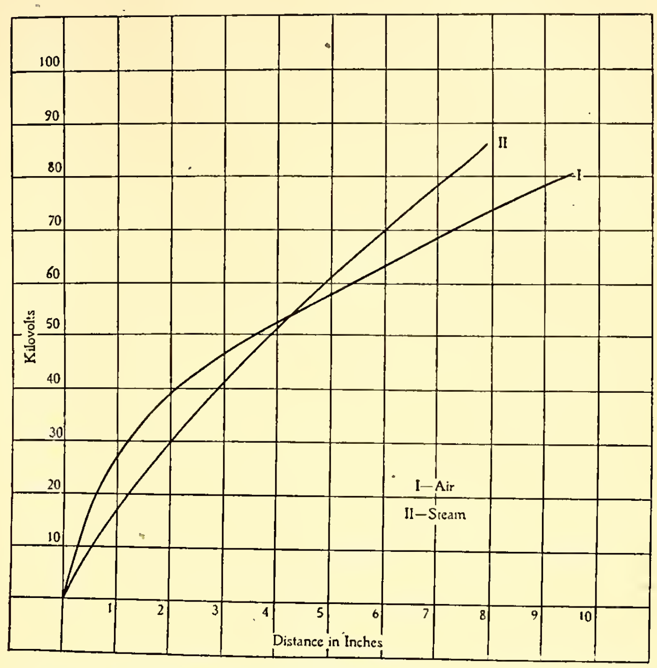
We have a bulletin board in the offices of the car houses where crews are required to report, and the time table is framed and put upon this bulletin. The crews are required to read each day before they take out their runs everything appearing on this bulletin. We also require all car house foremen to read over these schedules to the men at reporting time, and in order that they may be certain that all have been fully instructed, the foreman is required to take the name of each employee as he instructs them, and to preserve the list, so that ignorance of the instructions will not be taken as an excuse for not knowing. This plan works all right. We have a series of time tables always on hand, and these are termed "Fair Weather," "Rainy Weather," etc. There are also tables to be used when there are attractions, and these will include cars for handling the park travel. In this city there are a number of public and private parks, and the tables are all numbered. We watch closely for all attractions and, to a great extent, govern our schedules in that way. We keep on hand (especially during the park season) a large number of extra men, that is men who have no regular runs, but are reporting for work, and in this way we rarely ever run short of a sufficient number of cars to transport the travel with reasonable comfort. The telephone is a great adjunct in the moving of our business. We have our own telephone service, connected with the superintendent's office and residence, and it is rarely, by close observation and application, that we fail to transact the business in a satisfactory manner. There is no question of greater interest to street railways than the matter of schedules, and the writer has only briefly outlined a few of his ideas bearing on the information requested. The question of moving the people at all times and under all circumstances and conditions, is of the greatest importance both to the public and to the street railway companies throughout the country.

J. T. Funk, Gen. Supt.,
Louisville Ry. Co., Louisville, Ky.

EFFECT OF SMOKE ON TROLLEY WIRE IN JOINT OPERATION

Apropos of the general interest in the outcome of the many proposals now under way looking to joint operation of electric cars and steam locomotives over the same tracks, there has been considerable discussion as to whether if high-voltage trolley wires are placed over the tracks of railroads using steam locomotives, and particularly at such places as in tunnels and under bridges, there might be dielectric discharges from the trolley to the locomotives and ground caused by the steam and smoke of passing locomotives acting as conducting mediums. To determine the actual properties of steam and smoke under these conditions and to find out the likelihood of trouble from this source, certain tests have recently been made, and are described by S. M. Kintner writing in a recent issue of "The Electrical Journal." Mr. Kintner states that in the first test two terminals were placed one above the other and arranged so that the space between them forming the discharge gap could be varied at will. The terminals were ½ in. in diameter with spherical ends, and were so mounted that jets of steam and smoke could be projected around the terminals in a direction parallel to their axis of support.

In the first test a column of steam was projected across the gap between the two terminals. The steam was purposely made very moist by passing it through a long line of pipe, so that it lost a large quantity of heat before arriving at the gap. The results of this tests are shown in the curves on the accompanying diagram. In summarizing the results the author points out that the striking distance, or distance at which current will jump the gap, is greater for a given voltage in air than in smoke for voltages below approximately 55,000, but that at this point the curves cross each other, and it requires a greater voltage to jump a given gap in steam than in dry air. The jumping distance in air, as plotted in this curve, was obtained by measurements taken at the time the curve for steam was determined, the same terminals being used and the points checked several times, so that it seems certain that the values are relatively correct. During the test with steam



GRAPHIC REPRESENTATION OF TESTS TO DETERMINE RELATIVE TENDENCIES TO DIELECTRIC DISCHARGES IN ORDINARY AIR AND STEAM

the terminals were saturated with moisture to such an extent that the water dripped from them freely. No perceptible change was noted, however, when the steam was somewhat drier.

The next test was made to determine the conductivity of smoke and cinders. The terminals were immersed in a dense volume of smoke produced by building an intense fire in a small stove. After a hot bed of coals was obtained some fresh coal, containing considerable dirt, sulphur, etc., was thrown on to the fire to prevent perfect combustion and produced large quantities of very dense black smoke. It was in this case impossible to maintain constant conditions through a sufficient period to obtain a curve, but a number of observations were taken which indicated that the striking or jumping distance through dense smoke was not materially reduced from that of the steam or air in the previous test.

One set of readings was as follows:

TABLE OF VOLTAGE-STRIKING DISTANCES IN DENSE SMOKE AND STEAM

Voltage	Distance in Inches
14,000	1.375
25,000	2
35,000	3
42,000	3.75

From these tests the conclusion is made that with a reasonable factor of safety, of possibly six or seven, over the dielectric strength of air, no difficulty will be encountered through steam and smoke from locomotives attracting current from an overhead trolley wire.

REPORT OF ELECTRIC RAILWAY TEST COMMISSION—I*

REVIEW BY LOUIS BELL, PH. D.

There lies before me the Report of the Electric Railway Test Commission, which served at the St. Louis Exposition. It is a volume of more than 600 pages, containing by far the most valuable collection of data upon electric railroading that has yet been gathered. In some respects the information secured is unique, and in nearly every case it is thorough and far reaching to a rare degree. In initiating such a series of tests two courses were open—to make a scientific reconnoisance over a wide field, or to select certain important phases of the work, hitherto insufficiently understood, and upon them to concentrate effort. Very wisely, the Commission took this latter course, and as a result we have a mass of detailed information about certain important matters that will be, for years, a mine of information to the engineer. Of course, electric railways have been much investigated, but as a rule under very unsatisfactory conditions, and with inadequate equipment. Such tests are always difficult, since they have all out-of-doors for a laboratory, so that minor sources of error may remain in spite of every effort, yet by persistently directing attention, as did the Commission, to certain important things, these at least can be very satisfactorily determined.

The investigations were directed by exceptionally competent committees and seem to have been carried out with most conscientious care. Naturally, not all of the subjects considered could be of equal importance from an engineering standpoint, nevertheless they unite in being thoroughly practical and of direct applicability to standard existing conditions. Some of the number, however, are of singular importance, and are worthy of somewhat detailed discussion on account of their direct bearing upon future work in electric railroading.

The first subject to engage the attention in this volume is the series of tests upon single-truck, double-truck and interurban cars, under service conditions. Special importance is given the first two items from the fact that the types tested were those standard in St. Louis, so far as general character is concerned, and which represented, as every one who visited the Exposition will agree, a very high degree of efficient service. In so far the tests of these, as in case of the interurban car, are interesting and valuable, yet of much more interest were the tests of some details later reported. If one were to select from the mass of valuable material reported, the topics of most vital future bearing, these would be the braking tests, the determination of rail constants for alternating currents, and the train resistance trials of high-speed interurban cars.

It is hard to overestimate the usefulness of exact data on the making of electric cars. As electric traction developed, its growth in speed and power far outran the braking equipments, and entirely new conditions were encountered. In a few years, both the weight of the cars and their speed were doubled. The kinetic energy of the car at speed increased enormously, while the power of absorbing this energy for a quick stop remained practically constant.

Every car may be conceived of as bearing ahead of it a dangerous space equal to the distance required for stopping. Within that space no stationary object is safe, and hence a knowledge of this dangerous space is a fundamental requisite for the avoidance of accidents. As the weight and speed of the car increases, so does the length of the dangerous space, and a majority of the accidents upon interurban roads may be charged directly to lack of appreciation of this simple fact. On a single track cars that get within double the dangerous space when running in opposite directions must inevitably collide, and, as we shall presently see, the distance thus indicated is much longer than one would at first be disposed to think. Likewise, on a double city track, rear-end collisions occur because the motorman miscalculates the intentions of his mate on the car ahead and slips within dangerous distance before he realizes it. For safe running, it is not enough to provide powerful brakes, but the motorman must know their capacity for a quick stop. On the fast interurban cars this knowledge is even more important, since the distances which must be judged are longer and there is less by which to gage them.

The braking tests of the Commission were thorough, and made with the latest appliances. A careful study of them, checking the results for his own equipment, should be the self-imposed duty of every manager of an electric road, and time and money spent in this manner will pay for itself a dozen times over in immunity from accident.

The tests of the Commission on the single-truck city car braking problem are particularly interesting as involving the very ingenious Westinghouse magnetic brake, which simultaneously brakes on wheels and track, and brakes the armatures by setting the motors on short circuit through the energizing coils of the brakes. The traveling power thus obtained is enormous, since the track is brought into service as well as the wheels, and it seems to be feasible thus to push the deceleration up to a point as high as the safety of the line load will permit. As the experiments were actually carried out, the car, which weighed as equipped for the test 14.3 tons, was brought to rest from maximum speeds ranging from 15.8 m. p. h. to 20.8 m. p. h., and averaging 18.15 m. p. h. The mean distance required to stop in the twenty-five test runs was 114.67 ft. This is a most excellent showing for the average deceleration of 2.57 m. p h. per sec., and at a pinch one could have shortened the distance without taking undue chances with the line load. Examining the details of the runs one finds the braking distance varying according to the manipulation of the brake controller and the speed, from 90 ft. up to 164.4 ft. The decelerations ranged at times to an average of about 3 m. p. h. per sec. and a maximum of about 4 m. p. h. per sec.—in other words, pretty near the limit advisable unless in dire extremity. The report states that these results are rather better than with air brakes under similar conditions, so that taking the data as a whole, one must conclude that the real braking space of a city car of this description on a good, level track is somewhere from 30 yards to 40 yards. Under unfavorable conditions it would quite certainly rise to 50 yards, which should be taken as an approximate value of the dangerous space for a car of similar weight to the one tested at maximum speeds of 15 m. p. h. to 20 m. p. h. Hand brakes give less favorable results.

The value thus obtained ought, when opportunity offers, to be checked on a line with considerable grades and with track in bad condition, and also for somewhat lower maximum speeds, but the report certainly gives a good line on probable performance under favorable conditions.

It is a pity that similarly complete tests could not have been made with the heavy double-truck city cars, but although an elaborate test was made of the air-brake system as such, it was made on service runs which did not admit of heavy braking tests of the kind that could be made on experimental runs. Still it is well known that the order of magnitude of the braking distance is not widely different from that in the former case. Some interesting data were obtained as

* Report of Electric Railway Test Commission. McGraw Publishing Company, New York; 621 pages. Price, $6.

to the actual amount of power required to operate the air-brake system. Two different arrangements were employed, one using stored air taken from a compression station, the other a motor compressor on the car itself. The car considered weighed 22.5 tons and operated at a schedule speed of about 9 m. p. h., including stops, of which there were in the various runs 4 to 6 per mile. In this service the power required for furnishing compressed air for the brakes totaled to a very small amount, less than 2 per cent of the entire power required for the car. Oddly enough, the advantage in power taken lay with the individual motor-compressor, which took just about 1 per cent of the total power demanded by the car, while the tank system took 1.75 per cent. In either case it is obvious that the actual power required is entirely trivial.

By far the most striking series of braking tests was that executed on a fast interurban car on the lines of the Indiana Union Traction Company. The car concerned weighed 39.66 tons, was driven by four No. 85 Westinghouse motors, and had a "straight" air-brake system with motor compressor. The braking tests were made at the regular working speeds of nearly 50 m. p. h., and are particularly important as giving definitive braking figures for the heavy and fast interurban cars now so widely used. The air pressures used were 20 lbs. to 40 lbs. per square inch.

In the general result it was found that the braking distance at the heavier pressures was normally nearly a thousand feet, but could be reduced to between 600 ft. and 700 ft. by letting the maximum deceleration rise to between 4 m. p. h. per sec. and 5 m. p. h. per sec. This amount would never be permissible save in an emergency stop, which might be made at a pinch in 500 ft. under the conditions taken. The proper braking distance without severely sharp deceleration seems to be, on good track, about 300 yards. The effect of slightly unfavorable grades and bad track can only be estimated, but it seems within bounds to say that under ordinary conditions, even assuming an emergency stop, a car like that used in these tests would take 200 yards to 250 yards in stopping from 50 m. p. h. In other words, the dangerous space is roughly an eighth of a mile. If, therefore, two fast interurban cars, running in opposite directions on a single track, get within a quarter of a mile of each other without reducing speed the chances for a collision are of the best. The obvious moral is that in any place, or at any time, when there is not a clearly visible quarter of a mile of clear track ahead a speed of anywhere around 50 m. p. h. is dangerous, and either track conditions or schedule should accordingly be modified. As the working speeds are increased there is, of course, more energy to be disposed of in braking, and also there was found in these tests the usual decrease in the effectiveness of the brake pressure at the higher speeds. Everything, in fact, points to the need of great caution in handling these fast interurban cars on single track. The writer is strongly of the opinion that the frequent serious accidents upon lines of the interurban class are very largely due to ignorance of the real braking conditions or to disregard of such knowledge concerning them as is at hand.

The second subject taken up by the Commission, of those specially noted, was that of the resistance of steel and iron sections and rails to alternating current of various frequencies. In view of the certainty of the extended use of alternating-current motors of various sorts for traction the behavior of the rails as conductors of alternating current rises to great importance. Two entirely different factors enter into the final determination—first, the inductance as such, and, second, the "skin effect," which, while insignificant in ordinary conductors, is no longer so when large iron or steel sections are considered. Experiments on the subject have, until the work of the Commission, been rather few and of very small range. The conditions of flow of alternating currents in such conductors can, of course, be subjected to mathematical analysis, but with complicated sections of unknown permeability the expressions obtained are intricate approximations of no practical value.

Hence, the experiments here reported are of singular importance, constituting, in fact, a large proportion of the available knowledge of the subject. The study of lost power is of particular interest as showing the actual net effect of the skin phenomenon in increasing rail resistance. The whole matter really turns upon the permeability of the material for small magnetizing forces. With permeability at or near the values commonly taken in magnetic calculations, the skin resistance would become very serious indeed. In actual practice, not only are the values of the magnetizing force moderate, by reason of low-current density, but the character of the steel is such that the permeability is decidedly low under all working conditions. Nevertheless, the difference in actual watts lost with direct and with alternating current, even if low frequency is startlingly great, and especially so, of course, with the heavy rail section of which the ohmic resistance is very small.

A good idea of the general nature of the results may be had from those derived from a standard 80-lb. T-rail. With a current of 100 amps. per rail at 25, the ratio of impedance to d. c. resistance rose to 6.0. With a 56-lb. rail and the same current this ratio fell to 3.0. In each case the ratio increases with increase of current up to about 500 amps. per rail, after which the diminishing premeability begins to show its effects. At 500 amps. per rail the above figures become 9.8 and 6.2, respectively.

These results show very clearly the importance of low-current density in the rail in traction by alternating currents, adding another urgent reason for working a. c. traction systems at high voltage. At a few thousand volts on the working conductor the current in the rails falls, under ordinary conditions, so low that the impedance factor is very moderate, say between two and three. With the same traffic at 500 volts on the working conductor, the factor would be more than double, to say nothing of the increased ohmic loss.

If the current densities in the rails are high, the only way to keep the impedance factor within reasonable bounds is to lower the frequency, say, to 10 cycles or 15 cycles per second, and even this is comparatively ineffective. A study of the detailed curves in the report is exceedingly instructive to anyone interested in a. c. traction, and must inevitably lead to the conclusion that the strongest hold of a. c. traction is in work that permits of high trolley voltage. It is a pity that the Commission was unable to extend this research to the deep-girder rails used in heavy urban service. These, from the shape of the section, would tend to reduce the relative skin resistance, without, however, much chance of thus averting the effects of high-current density.

In the study of square and round sections, as might be expected, the impedance effects were very marked, indeed. Certainly, in dealing with any a. c. traction problem, diminished rail conductively will have to be taken seriously into account. A comparative study of permeability in rails of different composition would be a very useful addition to the data of this report. It might be feasible to secure a rail steel of good mechanical properties which would give considerably lower values of the permeability for the practical magnetizing forces than either of the rails studied by the Commission, so that one could draw a track-rail specification with impedance in mind just as one now includes the specific resistance in a third rail.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The May meeting of the Central Electric Railway Association held at the Algonquin Hotel, Dayton, May 23, was noteworthy from the fact that fully three-quarters of the 150 present came to the meeting on electric cars, furnishing a remarkable demonstration of the facilities offered by interurban roads for long-distance trips through the States of Ohio, Michigan and Indiana.

The Indianapolis, Columbus & Southern Traction Company operated a car from Columbus, Ind., to Dayton by way of Indianapolis, and brought members from the Southern portion of the State, and from the neighborhood of Indianapolis. The car made a remarkable run of 3 hours and 20 minutes over the 108 miles from Indianapolis to Dayton, a full hour less than the limited schedule over this route. The Dayton & Muncie Traction Company had a special car from Muncie, bringing delegates from Anderson, Marion, Muncie and other cities in that vicinity, while the Ft. Wayne & Wabash Valley sent its private car "Lawton" by way of Lima, covering the 145 miles in fast time. Michigan was represented by a large party who came from Detroit and vicinity on the Detroit United parlor car "Yolande," a distance of 222 miles. A number of ladies accompanied this party and they made the trip in easy stages, running to Lima, where they remained over night, going to Dayton in the morning. A party of Clevelanders left Cleveland on the morning limited of the Lake Shore Electric, going to Toledo, where they caught the noon limited on the new Toledo-Dayton service which was started last week, arriving at Dayton for supper, making the run of 282 miles in the remarkable time of less than 12 hours elapsed time. Members from as far east as Newark went by way of Columbus and Springfield on regular cars. The special cars from distant points in three States attracted a great deal of attention on the streets of Dayton and in the numerous cities and towns through which they passed and resulted in a great deal of excellent newspaper publicity for the interurbans of the district.

President E. C. Spring, who presided, announced a new plan in the appointment of local committees for taking care of matters of local interest with a view to keeping the permanent secretary in touch with the situation in all parts of the district, and to act as an advisory board to the executive committee. These local committees were announced as follows: Cleveland—J. O. Wilson, Cleveland & Southwestern Traction Company; F. W. Coen, Lake Shore Electric Railway; Charles Kenworthy, Electric Package Company. Toledo—E. E. Darrow, Toledo & Indiana; C. T. Chapman, Toledo & Western; Charles Hawley, Toledo, Port Clinton & Lakeside. Findlay—C. F. Smith, Toledo Urban & Interurban Railway; F. W. Adams, Toledo, Fostoria & Findlay; E. H. McKnight, Lake Erie, Bowling Green & Napoleon Railway. Lima—C. C. Collins, Western Ohio, and H. M. Dicke, Ft. Wayne, Van Wert & Lima Traction Company. Ft. Wayne, Ind.—C. F. Shelton, Ft. Wayne & Wabash Valley Traction Company; W. Fledder-Johann, Ft. Wayne & Springfield Railway Company. Indianapolis—F. D. Norvall, Indianapolis & Northwestern; A. A. Anderson, Indianapolis & Cincinnati; W. G. Irwin, Indianapolis, Columbus & Southern. Dayton—Valentine Winters, Dayton & Western; John F. Ohmer, Ohmer Fare Register Company. Columbus—George Whysall, Columbus, Delaware & Marion; L. C. Bradley, Scioto Valley Traction Company; L. C. Davies, Columbus, Buckeye Lake & Newark. Cincinnati—F. J. J. Sloat, Cincinnati Northern; C. E. Hooven, Cincinnati, Lawrencebury & Aurora Railway. Canton—J. R. Harrigan, Canton-Akron Railway. Youngstown—C. J. A. Paul, Mahoning & Shenango Valley Traction Company. Pennsylvania—J. W. Brown, West Penn Railway.

A. N. Neareamer was appointed a member of the transportation committee, representing the Columbus, Delaware & Marion Railway, Columbus, Ohio.

Mr. Spring said that while the office of the permanent secretary had accomplished an immense amount of good for the roads in the association, its usefulness was limited without the co-operation of the various members. The secretary has recently sent inquiries for information on various subjects about which inquiries have been made by members, but very few had taken the trouble to reply to these communications. He urged that various roads pay more attention to this matter and reply promptly to all requests for information and he said that where it is desired, the information would be kept strictly confidential. Without this co-operation the secretary's work will be handicapped and the results will be likely to prove incomplete and unsatisfactory. He also urged

THREE OF THE CONVENTION CARS: 222 MILES BY DETROIT UNITED; 145 MILES BY FORT WAYNE & WABASH VALLEY; 168 MILES BY INDIANAPOLIS, COLUMBUS & SOUTHERN

that the members make prompt remittances for assessments due for various funds. Thus far the association has met its obligations promptly and it has some money on hand, but recent consolidations of a number of properties have reduced the number of individual roads considerably, the managers of these properties claiming that the assessment should be for a single line instead of for the number of roads consolidated. This is likely to reduce the amount guaranteed for the secretary's office, and also for the interchangeable transportation bureau fund. It has been suggested that it would be more equitable to divide these funds on a basis of gross earnings or mileage, and this is a matter which will probably be taken up later.

Later in the day the supply men held a meeting and appointed a committee composed of John Ohmer, of the Ohmer Fare Register Company; Wm. Bloss, Buda Foundry & Machine Company, and C. Drake, of the Galena Oil Company, to formulate a plan whereby the supply men will make up the small amount required for the maintenance of the secretary's office the first year. The committee will send a circular letter to the various supply men who are represented in the association.

The constitution and by-laws of the Central Electric Association have been printed through the courtesy of the Pogue Printing Company, of Cincinnati, and are being distributed. The next meeting of the association will be held in September, probably at Indianapolis, and arrangements will be made for an outing for the members who attend.

Secretary J. H. Merrill gave a brief outline of the work of the secretary's office since it was instituted March 1. The office maintains a mailing list of fifty-two companies in Ohio, twenty-six companies in Indiana, and forty-one companies in Michigan, to whom a total of 21,165 circulars have been issued. In addition to this, a total of about 1500 letters have been mailed in caring for the general correspondence. Thirty- four companies in the three States agreed to pay an assessment of $50 each towards the maintenance of the secretary's office to June 1, 1906, all of which have responded promptly to the remittance with the exception of ten companies. The membership represents a total of 366, of which 152 are railroad men and 107 supply men. The payment of dues, especially by the railroad men, has not been as prompt as could be desired.

The Muncie & Portland Traction Company, which will open service May 30, between Muncie and Portland, Ind., has signed the interchangeable coupon ticket agreement. Inquiries have been received from wholesale houses in New York, Philadelphia, Boston, Buffalo, Cleveland, Chicago and other cities regarding the conditions of the interchangeable coupon book for the use of their traveling men, which indicates the growing popularity of this transportation. Members were asked to instruct their conductors to take up book No. 24,036, issued by the Muncie, Hartford & Ft. Wayne Traction Company, said to have been fraudulently used. A circular letter sent to the members of the interchangeable transportation agreement, asking them to signify their approval or disapproval of a plan to handle the accounting of these books in the office of the secretary, resulted in six companies with a mileage of 404 miles voting in the affirmative; fifteen companies representing 1120 miles voting in the negative, and ten companies representing 372 miles failing to make any response. In view of this vote the present practice of each company accounting for the interchangeable books and settling by balance will remain in force.

The Assistant Quarter-Master General, of Ohio, recently made application to the association for a uniform rate of 1 cent per mile and free transportation of baggage in consideration of the mobilization of the Ohio National Guard by means of the traction lines for the annual encampment this summer. The transportation committee to whom the matter was referred declined to accede to this request, but the official was urged to use the traction line for this purpose, emphasis being laid upon the already low rates being given by the electric roads.

The traffic committee held meetings on April 15, at Bowling Green, Ohio, May 12, resulting in the adoption of a uniform practice of lifting interchangeable coupon tickets within the limits of large cities where there are traffic agreements with city companies, for the handling of interline tickets in these cities, and for the checking of through baggage. Each road has handled these matters in its own way heretofore, resulting in some confusion. A standard form of passenger tariff is being prepared by the committee. A form of "loading platform permits" has been adopted by the committee and copies forwarded to the members.

The secretary's office compiled an outline of the bills passed by the recent Ohio Legislature relating to steam and electric roads, and copies of these will be forwarded to members on application.

The new law relating to the sprinkling of streets is regarded by many of the interurban roads as unconstitutional, as it is said to be class legislation, and it is not required in many of the franchise grants. Some of the companies are planning to test this law. On the other hand, some companies are offering to take the contract for sprinkling the whole of a street on which their tracks are built. Upon request the secretary recently communicated with a large number of cities to secure the prices paid for sprinkling of improved and unimproved streets within the corporate limits of cities. The prices ranged from $14.50 to $15.50 per thousand square feet per season.

A plan for uniform practice of bonding employees has been suggested, but the number of replies has not been sufficient to warrant action.

The secretary's office is keeping in close touch with the plans of the American Street & Interurban Railway Association for its annual meeting at Columbus in October, and it is co-operating with that organization by forwarding its literature to the roads in this district.

ACCIDENT DATA

E. M. Hoover, of the Hoover-Holmes Information Bureau, of New York, addressed the morning session on the subject of his information bureau for protection against fraudulent and excessive accident claims. The company has been in existence for a number of years and it compiles data relating to accidents of all kinds, keeping its members informed as to duplicate accidents to the same individual. As evidence of the widespread prevalence of fake accidents, he stated that the first year the bureau started business, the number of duplicate accidents amounted to 5 per cent or 6 per cent of the claims reported, while at present nearly 33 per cent of the claims reported come from individuals who have had previous accidents, or, where there were two or more reports of the same accident. The association co-operates with both insurance companies and the transportation companies, having forty-six of the former and forty of the latter on its lists. The association has over one million reports of accidents filed by card system and carefully indexed so that information regarding any accident is quickly accessible, and these reports are now increasing at the rate of about 200,000 a year. He pointed out that the co-operation between the accident companies and the transportation companies was a valuable feature in their work. Accident fakers frequently try to work several companies for the same accident, although insurance companies are harder to beat than the transportation companies, because the former have a plainly stated contract providing for immediate notice of accident, certified statements, examinations and other protecting clauses. The transportation company has no such protection, as claims are frequently instituted months after accidents occur and witnesses are lost. He cited several instances where parties had brought claims against several transportation companies for the same "accident," and where the bureau had promptly revealed the true condition of affairs.

H. C. Moore, of the Pitman-Myers Company, Indianapolis, described the advantages of the company's "First Aid Box," a package containing gauzes, bandages, salve and antiseptic preparations for the treatment of wounded before a surgeon can be reached. The box also contains a booklet giving full instruction for first aid treatment by inexperienced hands. Such outfits are in use on a great many steam roads and have recently been adopted by a number of electric roads.

Y. M. C. A. WORK

E. L. Hamilton, railway secretary of the Young Men's Christian Association, of Chicago, reviewed the history of Young Men's Christian Association club work on steam railroads, which he said had been a most potent factor in promoting temperance and efficient service among steam railroad men. There was a time when train crews at the end of their runs frequented the saloons and cheap lodging houses where they were subject to intemperance and other undesirable influences. Of late years the steam roads have come to recognize the Young Men's Christian Association as a business proposition favorable to their interest, and nearly every large steam road in the country has made liberal donations for the erection and maintenance of Young Men's Christian Association club houses. Usually these are located at the terminals, so that men after finishing their runs can congregate in a place where they are surrounded by elevating influences. In many of the branches there are restaurants, where the men can obtain meals at low cost, reading rooms, and numerous other amusement features, and many of them are provided with sleeping rooms where the men can obtain a comfortable bed at a nominal cost, thus keeping employees within call and giving them proper rest after long runs. This feature alone had been of tremendous benefit in creating a better feeling towards the company and insuring the best possible work from the men. Mr. Hamilton quoted from an address made by W. C. Brown, vice-president of the New York Central Railroad, at the opening of a railroad Young Men's Christian Association building at Collinwood, Ohio, a month ago, this building having been erected by the company at a cost of $32,000. Mr. Brown said: "If a railroad officer seeking an excuse to decline to make the contribution of this character propounds the ancient interrogatory 'Am I my brother's keeper,' the reply should be emphatically in the affirmative. The railroad, which annually draws thousands of young men from the villages and farms to fill up its ranks depleted by age, accident and disease, owes something to this army of young men. Above all, they owe it to the public who daily place in the custody of these men their lives and property, to do everything within their power to make them the best and safest and most efficient men possible, and in doing this, in my opinion, no agency can be enlisted so adapted, so consecrated, and so successful in the work as the railroad branch of the Young Men's Christian Association."

Mr. Hamilton said that the railway branch of the Young Men's Christian Association had 212 club houses and 85,000 members. Formerly the railroads gave about 60 per cent towards the maintenance of these organizations and the men about 40 per cent, but of late years, due to the growing interest, the per cent has been reversed. Last year the companies paid about $260,000 towards the support of branches, while the men themselves contributed $340,000. This work has been extended to the street as well as interurban railways. Three years ago the Rochester Railway Company, of Rochester, N. Y., opened a Young Men's Christian Association branch, and after two years it opened a second. The Richmond Passenger & Power Company, of Richmond, Va., recently opened a fine building. At Memphis, Tenn., there is an organization with 615 members, while others are being talked of for various sections of the country. Mr. Hamilton said that the growth of the long-distance interurban service, which required men to remain away from home over night, should make it an incentive for interurban companies to pay more attention to this class of work. He said that C. D. Emmons, general manager of the Ft. Wayne & Wabash Valley, had recently been appointed a member of the State railway committee in Indiana, being one of the first traction men to become active in this work. Of the thirty-one interurban companies in Indiana, the headquarters of at least twenty of them are accessible to the railway branches in these cities. Mr. Hamilton said that his organization would be glad to cooperate with any of the traction managers that were interested in this work, with a view to supplying them with information and advice as to how to start and handle such organizations. The talk was illustrated by lantern views of a large number of fine club houses devoted to this work.

Henry N. Staats, manager of the Associated Railway & Light Insurance Companies, reviewed some of the recent work of his mutual fire insurance companies, whose objects have been outlined in the columns of the STREET RAILWAY JOURNAL on several occasions. Two of his companies are ready to write business and have a large amount of insurance ready to sign up. Four of the old line insurance companies have agreed to take insurance at a low rate on sprinkled risks where the inspections are made after the rules laid down by the new companies, while several of the Eastern factory mutual companies have agreed to do the same. The American Railway Insurance Company, which is a stock company allied with the traction mutual companies, is planning to increase its capital stock from $500,000 to $1,000,000, which will enable it to take $100,000 on any one piece of property instead of half that amount, the maximum heretofore.

AXLES

J. R. Replogle, superintendent of the Cambria Steel Company, presented a paper on "Axles for Interurban Cars." He divided his subject into four subheads: "Steel vs. Iron Axles," "Forged vs. Cold-Rolled Axles," "Broken Axles," and "Specifications." He said that experience of years had demonstrated that the steel axle was superior to the iron axle, not only on account of its greater power of resistance against shocks and vibrations in service, but on account of its better wearing qualities, the friction being less than in the iron axle, where lack of sufficient heat, presence of scale and other conditions often prevent perfect adhesion. Even a perfectly welded iron axle will not allow high polish and minimum amount of friction obtainable in the steel axle. While the art of steel making has grown more and more perfect, the material and skill for making good iron have retrograded, due largely to the difficulty of securing a good quality of scrap, that now available being composed of inferior iron, intermixed with pieces of steel, which produce irregular welds and irregularities in the finished axle. This permits torsional strains and friction to separate the fibres of the metal, finally resulting in the failure of the axle.

In tests made by the United States Government on wrought iron and .45 per cent carbon steel bars, 1 in. in diameter and 36 ins. long, loaded in the middle so that the fibre stress was 40,000 lbs per sq. in., and rotated at 1500 r. p. m., the former broke after 95,000 revolutions while the latter broke after 976,000 revolutions. To test the value of iron and steel axles and the effect of strains similar to those imposed by service, Mr. Wohler, chief engineer of the Prussian State Railway, constructed a machine for the purpose by which the bars were exposed to vibrating actions and repeated strains within adjustable limits. A bar placed in bearings was revolved and to one end was attached a spring, giving a constant downward pull, by which action the bar was bent down at the end. The breaking strain of the fibrous iron under these conditions was 22,400 lbs. per square inch; soft steel, 33,600 lbs. per square inch. In other tests the effect of repeated strains applied to the center of the axle in which the fibres in each section were strained in the same direction each time; the tension of each fibre varying from zero to the strain imposed, was that the fibrous iron broke at a tensile strain of 33,600 lbs. to 40,320 lbs. per square inch, and soft steel at 50,400 lbs. to 56,000 lbs. per square inch.

Walter E. Koch, a prominent engineer, in a recent paper on "Fifteen Years' Experience With Open-Hearth Steel," says that "statistics show in Great Britain that eight iron axles break to every one of steel, and it is astonishing that so many iron axles are still used in this progressive country."

Mr. Replogle said, that in the early days of steel axles the steel maker had difficulty in proving the superiority of his product, as there were numerous breakages for which he could not account. This was found to be due to the fact, that while light hammers of perhaps 2000 lbs were sufficiently powerful to build iron bars probably 1 or 2 ins. thick into an axle about 5 ins. in diameter, it was inadequate for forging steel axles, as steel, not possessing the welding properties of iron, could not be made in the same manner. Instead, the process had to be reversed and the axle hammered down from a billet about twice the size of the finished forging. The hammer not being sufficiently powerful to penetrate though the mass did not give the axle the homogeneous structure essential for a forging subjected to heavy alternating stresses which a car axle undergoes in service. The end of the forging showed a deep concave, indicating that only the surface metal had expanded. It also showed an inclination to "pipe."

Heavier hammers were then installed. These brought about a distinct improvement, but still the forging did not give absolute satisfaction, and it was found that the heat treatment was largely responsible. The axle maker reasoned that as no two parts of the axle were subjected to the same temperature, internal strains set in. To relieve these internal strains, annealing was resorted to. By heating to a temperature slightly above the recalescent point, he eliminated all crystalization resultant from the cooling from the forging temperature of about 1800 degs. and a fine amphorous structure was obtained. While the ductility of the annealed forging was greatly increased it suffered a slight loss in elasticity. Realizing the importance of a high degree of elasticity in metal subjected to alternating tension and compression and often to torsional strains, the axle maker started on experiments to increase the elasticity. Oil tempering and toughening processes were tested with the following results: The elastic limit was increased to a marked degree; the percentage of elongation and reduction of area were greatly increased; a high degree of toughness was obtained; the steel changed from a crystalline to an amorphous state; internal stresses were eliminated, and uniformity of structure and strength were obtained.

The increase in elasticity is of the greatest possible benefit, because once the elastic limit of metal has been passes and the forging distorted it will not stand even minor loads. In wrought-iron forgings the elastic limit does not exceed 20,000 lbs. per square inch, which steel of .45 per cent carbon will show three times as much elasticity.

Cold-rolled axles have been extensively used for some years, but have not been found wholly satisfactory for heavy interurban or elevated service. The process of cold rolling is simply one in which the steel is stretched beyond its elastic limit to a point near the ultimate strength, the degree of stretch being indicated by the reduction of elongation. This introduces internal stresses which may result in failure under even normal condition. To advocate cold-rolled axles is about as consistent as to take a member off a bridge after stretching 25 per cent, cut it off, put it back and say it is superior to its former condition; or to take an engine shaft which has been twisted, straighten it and claim it is superior to its initial condition.

To determine the comparative merits of cold-rolled axles and "Coffin process" axles, tests were recently made, using axles 4 ins. in diameter, 6 ft. 9 ins. long in each case. The axles were tested under standard M. C. B. standard-drop testing machine 1640 lbs. weight falling 24 ft., striking the axles resting on supports 3 ft. center to center. The cold-rolled axle stood an average of fifteen blows with 7.75 deflection at first blow, as against an average of fifty blows with 7.63 deflection on the "Coffin process" axle.

Pieces were then cut from the outside of rounds, turned down to cylinders 1 in. long and 1 in. square area in cross-section. These were tested in an abrasion machine and run without abrasive material on a hardened steel plate under a pressure of 100 lbs. per square inch. The cold-rolled axle wore to the extent of 33.9 grams and the forged-steel axle 17.5 grams, the resistance to wear closely following the physical tests.

Mr. Replogle said that in seventeen years' experience he could recall only seven of his company's steel axles broken in service, four of these being due to inferior design. He believed this record was due not only to the superior quality of steel used, but to the policy of thoroughly annealing all forgings. Examinations of broken axles found in various railway shops lead to the belief that failures were largely due to "fatigue of metal," or a gradual parting of the steel extending inward all around the piece, being due, undoubtedly, to the use of low-carbon steel having low elastic strength.

A marked characteristic of the fractured surface of a piece of metal broken from long continued alternating stresses, is that it never presents fibrous appearance in the fracture, but is more or less smooth, due to the fractured parts rubbing each other and having the appearance of an old break. This breaking slowly, a little at a time, is known as a "detailed fracture," and should not be confounded with a rupture produced in any other way.

Steel axles were first used on the Pennsylvania Railroad in 1875, and its early experiences were interesting. The maximum calculated fibre stress between the wheels was about 15,000 lbs. per square inch, and the maximum fibre stress in the journal was 6700 lbs per square inch. The steel in these axles was an open-hearth steel containing from .22 per cent to .28 per cent. carbon and not over .04 per cent phosphorous, and with tensile strength of about 65,000 lbs. per square inch and an elongation in 2 ins. of over 25 per cent. So tough was this steel that one passenger-car axle was tested under the drop test with 67 blows without rupture. Some 300 of these axles were put in service, and in the course of two years the journals began to fail from detail fracture. The matter became serious, and a consultation was held as to how to meet the difficulty. There seemed but two ways of procedure, either to increase the size or to change the nature of the metal. Since an increase in size meant a redesign of all the parts, the latter alternative was chosen, and a metal of 80,000 lbs. tensile strength was substituted for the softer steel, no other changes being made. This completely cured the difficulty, and no case of breaking in detail in car axles is known to have occurred since that time, unless the metal was of a lower tensile strength than the figures given, or the axle was worn to limit, so that the maximum fibre stress was too high.

Another frequent cause of trouble is the failure to provide good fillets in the journals and back of wheel fit. This centralizes the strain at these points and frequently results disastrously.

Mr. Replogle recommended that all axles should be purchased subject to a chemical and physical test, as by this method only can the product of irresponsible manufacturers be eliminated, who have no facilities for doing high-grade work and who have failed to realize the heavy responsibility attached to the manufacture of axles for high-speed interurban service. The following chemical and physical property was recommended:

Carbon, .35 per cent to .50 per cent.
Manganese, not over .60 per cent.
Phosphorus, not over .05 per cent.
Sulphur, not over .06 per cent.
Elastic limit, not less than 50 per cent of tensile strength.
Ultimate strength, not less than 80,000 lbs. per square inch.

Elongation, not less than 20 per cent in two inches.

Reduction of area, not less than 40 per cent.

All axles should be thoroughly annealed in an annealing furnace, as by this method only is the true intrinsic strength of the steel represented. It would be beneficial, from the consumers' standpoint, to adopt a "maximum weight clause" compelling manufacturers to rough turn the axles to within 1/8 in. of the finishing dimensions, thereby eliminating the necessity for the payment for probably 50 lbs. per axle of excess material, which also necessitates a vast amount of extra work at the finishing shop, subjecting the lathes to both roughing and finishing duties, which are detrimental to the best results in fitting. The name of the manufacturer and date of application should be plainly stamped on all axles, so that acomplete record could be kept of its service.

F. J. J. Sloat, of the Cincinnati Northern Traction Company, said that at one time he bought a lot of fifty new axles, and after about two years of service they commenced to break. Within a few weeks practically every one of them had broken at about the same place and at practically the same mileage. Although they had had numerous broken axles, they never had a serious accident resulting from this cause, the wheels simply dropping between the tracks and bringing the car to a stop. He thought a broken axle much less dangerous than a broken wheel.

SEALING MILK CANS

Charles Kenworth, general manager of the Electric Package Company, operating on the Cleveland interurbans, discussed the advisability of sealing milk cans. His company handles about 1000 cans of milk per day and had never heard any complaints about milk or cream being stolen by the train crews, which he supposed was the reason for bringing up this subject. He thought that the odor of milk cans was so unpleasant that the men had no inclination to tamper with the contents. The farmers handle their own milk at cross-road stations, and it would probably be difficult to induce them to use any kind of a sealing device. He thought there would also be an objection to this plan on the part of the health authorities, who open cans and take out samples at frequent intervals. The company itself would also have an objection to the plan, as it desires to see whether the cans contain milk or cream, cream being charged for at a higher rate than milk, as the big creamery associations have a trick of extracting the water and condensing it and then turning the hose on the milk after they get it into the city, making it milk again.

MOTOR INSPECTION

A. A. Anderson, of the Indianapolis & Cincinnati Traction Company, opened the discussion on the subject "Inspecting Motors for Low Bearings." He thought that the best method depended upon the type of motor. Some motors have hand-holes in which a gage can be inserted, while others have peep-holes through which the condition of the bearing can be seen by the use of a light. As a rule, bearings do not receive enough attention and they are allowed to run until the bands are rubbed off and then the pieces get into the armature and make trouble. Frequent inspection was the only remedy he knew of.

C. N. Wilcoxson, Cleveland & Southwestern, agreed with Mr. Anderson that troubles with bearings could not be attributed to lack of ample means for making inspections, but they were due, as a rule, to inspections not being regular and systematic, and also to the bearings not being properly lubricated.

R. Palmer, of the General Electric Company, said that the only satisfactory method to avoid such troubles was to keep a record of mileage and not attempt to exceed a fair mileage.

C. Clark, of the Muncie, Hartford & Ft. Wayne, said that bearings on his road were inspected daily by the use of a gage, and they had had no trouble in two years.

TROLLEY EARS

F. Wickwire, of the Ohio Brass Company, spoke on the subject of "Trolley Ears," illustrating his talk with a large line of samples. He said that the quality of metal should be pre-eminent. Above all, trolley ears should not be made of scrap metal, as it was impossible to secure a uniform composition when scrap was used. There is a great difference of opinion as to the best sizes and shapes of ears for certain service. Of late the bronze ear has been growing in popularity. Bronze has great strength and toughness and at the same time has the ductility which permits it to be clinched and unclinched and used over again. The galvanized clamp continues to be very popular. The short clamp is no longer used to any great extent, as the wires have a tendency to break near the ends. On round wire the most popular length for heavy interurban service is the 15-in. ear, of the clincher type and not soldered. The practice of soldering ears seems to be dying out, as it seems to injure the wire. For Fig 8 or grooved wire the popular length is 12 ins. When properly clinched, this gives no trouble without the use of solder.

L. J. Schlesinger, of the Muncie, Hartford & Ft. Wayne, said they used both clincher ears and clamps. Clincher ears were found very satisfactory where the trolley wire was kept fairly tight, but when pulling on a wire, the clincher ear was of some disadvantage. They used a mechanical clamp ear at splices. They use bronze soldered ears on curves and points of special strain.

TRANSPORTATION FOR EMPLOYEES

In introducing the subject of "Transportation for Employees," F. J. Sloat, of the Cincinnati Northern, said that his views had undergone a change of late. Instead of allowing men to ride on badge or card pass, he aimed to supply a form of transportation which gave a conductor a coupon in each case. Passes for section men are issued by the section foreman, who is provided with a punch and issues passes as they are needed, good for the day and certain trip only. Emergency crews are supplied by the despatchers in the same way. Other employees are given books containing 62 tickets, good for one month, in some cases limited to distance and in some others unlimited.

A. A. Anderson, Indianapolis & Cincinnati Company, said that all subordinate officers were supplied with card passes and the conductor takes a receipt and registers it as a ticket. Car service men must make written application to superintendent, and they are given trip passes with reasonable limits. Transportation to families of employees has been discontinued. Men sent out on business for the company are given employees tickets which contain space for name, date and limiting points.

C. N. Wilcoxson, Cleveland & Southwestern, thought that the matter of granting passes to employees depended a great deal upon local conditions. Where the headquarters are in small towns it is necessary to furnish more transportation than otherwise. Their higher officials and heads of departments are given books of coupons, good for rides between stations, punched on the back. Books are good for one year. In every case the cover of the old book must be returned before another can be secured. Train service men are given straw-board tickets similar to transfers on which limitations are punched. Section men are given books good between certain points but they are good only for the month, and the old cover must be turned in before another is issued. Section foremen are provided with unlimited tickets and punches. Shop and power house men have books of sixty tickets. The tickets are large enough so that they can be signed in every case, and they are rung up as passes on the register. Train men are given almost unlimited transportation when they apply for it, but it has been found that as a rule they do not do much riding on days off. Wives of employees only are furnished trip passes within reasonable limits.

Mr. Anderson asked Mr. Wilcoxson if he knew the percentage of free riding on his road.

Mr. Wilcoxson replied that he did not, but that it was probably higher than on the majority of roads as the system is in six divisions and it is necessary to do a great deal of dead heading of train crews. On the other hand, transportation to other than employees is very limited.

Mr. Anderson said that on his line about 8 per cent of those riding were carried free. Wives of a few heads of departments and assistants are carried free, but not to families of employees in general.

Mr. Jordan, of the old Appleyard system, said that they formerly kept a close record of free riding, but it had been discontinued under the new management and the free transportation had been cut down considerably. Monthly passes are issued to some of the employees, while those whose duties call for regular riding are provided with books of five-cent coupons, and coupons are detached according to the distance. Wives of trainmen are supplied with free transportation, but it is not asked for very often.

H. A. Nicholl, of the Indiana Union Traction Company, said that free transportation aggregated about 5 per cent of the total traffic. Card passes have been eliminated. Books of 200 five-cent coupons are issued to the general officers and heads of departments and linemen, and coupons must be turned in to correspond with the length of ride. Some of the books are limited for use between certain stations. Covers must be turned in in every case. Free transportation to those outside the service has been cut down to the minimum.

E. C. Spring, of the Dayton, Covington & Piqua Traction Company, said that their headquarters was 17 miles from Dayton in a small town where there were few stores and it was necessary to go to the city for many supplies. Wives of employees are furnished with all the transportation they want up to a limit of one trip a week. Many, however, do not use it once a month. He much preferred having the employees ask for the transportation, because he believed that Sam Brown would carry Bill Jones' wife any way, and vice-versa.

COMPUTING MILEAGE

Introducing the subject of the "Best Method of Computing Mileage," Mr. Wilcoxson, of the Cleveland & Southwestern, said that they had blanks containing the number of each car and the mileage was taken daily from the despatcher's sheet which shows the distances between points. Four copies of this report are made; one for the master mechanic, another for the executive office, the third for the general manager and the fourth is in a book kept by the despatcher. Mileages are entered daily for cars, bodies, trucks, wheels, axles.

Harrie Clegg, of the Dayton & Troy, said that this plan would be unsatisfactory and inaccurate on their road because they frequently change wheels and trucks from one car to another.

Mr. Wilcoxson said they did the same thing. That in addition to the ledger they kept a card index of the various parts and when they were changed from one car to another the card was simply transferred to the proper car with the date of change noted on it. All wearing parts mentioned are numbered separately and in series.

Mr. Evans, of the Indianapolis Traction & Terminal Company, thought that it was an easy matter to carry the car mileage record to the extreme. He thought that on city lines where they had short runs and frequent trippers, it was almost impossible to keep a record for each car. They secure a statement of the revenue miles for each month or week by adding up the number of regular trips for each line and adding the extras and deducting the cars delayed or taken out. By dividing by the number of days they secured the approximate mileage for any period.

Mr. Fitzgerald, of the Cincinnati Traction Company, said that they kept the totals in a similar manner. On trolley wheels they take the total number of car miles and multiply it by two (they have the double trolley system) and divide by the wheels given out, of which they have a record. He thought that to secure the actual figures would mean an immense amount of clerical work which would require special men as the average car house men were not capable of handling the matter.

Mr. Jordan, of the Columbus, London & Springfield, said that he formerly was record clerk on a city line having 100 cars, and figured accurate mileage on every truck, car body and set of wheels.

Mr. Anderson, of the Indianapolis & Cincinnati Traction Company, said that they kept mileage on trucks, bearings, wheels and car bodies, using the train sheet of the mileage and the master mechanic's reports for changes of parts.

Mr. Mitten, of the Indiana Union Traction Company, said they did the same thing and entered the mileages on individual car sheets, truck sheets, wheel sheets, etc.

Mr. Evans stated that he was on the committee for standardization of the national association, and he asked various members to be sure and furnish all desired information to Secretary Swenson, of the National Association, who would send out blanks. The topics for consideration are of special importance to interurban roads and are as follows: "Brake-Shoes," "Wheel Flanges and Treads," "Journal Boxes and Bearings," and "Standard Sections of Rails."

BAGGAGE REGULATIONS

The traffic men of a number of roads in Ohio, Michigan and Indiana held an informal conference during the Dayton meeting, and discussed the subject of free checking of baggage. The sentiment in favor of eliminating all charge for the handling of baggage, especially on interline trips, is gaining ground in Ohio and Indiana, especially in the latter State, due to the recent passage of the 2-cent fare bill on steam roads, which renders it necessary for the traction lines to make certain concessions in order to keep their rate below those of the steam roads. The traction rates in Michigan, however, have always been considerably lower than those in Ohio and Indiana, the average rate being only 1.4 cents per mile. Under these circumstances Michigan roads were unwilling to make this further concession, although on trips over two or more lines they were willing to confine the charge to one collection of 25 cents. No action was taken in the matter, but, as intimated, there is a growing sentiment in favor of cutting out the baggage charge altogether. Some of the roads have recently increased the limit from 100 lbs. to 150 lbs. for 25 cents.

EXHIBIT NOTES

Several manufacturers of street railway material had exhibitions of new devices at the Dayton meeting of the Central Electric Railway Association.

The W. R. Garton Company, Chicago, showed a line of its supplies and porcelain insulators. A sample of a large insulator designed to handle 100,000 volts of the type adopted by the Hudson River Power Company, and said to be the largest insulator ever built, attracted a great deal of attention.

The Garton-Daniels Company, of Keokuk, Ia., showed a new automotoneer, an improvement on its well-known device for limiting the speed of feeding the controller by the motorman.

The Electric Shade Light Company, of Lima, Ohio, showed a headlight shade for screening an arc lamp while on city streets. It consists of a simple roller curtain placed back of the glass where it is protected against the weather. The shade is operated by a string leading to the motorman's cab, so that it is not necessary for the motorman to stop the car or reach outside to dim the lamp. The company is also bringing out an adjustable headlight which swings on the dash, following the movements of the truck, thus permitting the rays of light to follow the curves.

The Cary Inventions Company, of Chicago, showed the Cary automatic car and train pipe coupling, by the use of which the air brake pipes are automatically coupled at the same time as the car. The samples shown were the same as those in use on the Aurora, Elgin & Chicago Railway.

ENTERTAINMENT AT LIMA

The delegates from Fort Wayne and Detroit, who traveled in special cars to the meeting of the Central Electric Railway Association, stopped in Lima over night and were entertained at the Lima Club by Hon. Walter B. Ritchie, a prominent politician and general counsel for the Lake Erie & Western Railroad (steam). In an informal address he congratulated the electric railway managers upon the splendid development of electric railway interests, and appreciated the growing tendency on the part of the steam and electric lines to co-operate and work together. He said that the steam roads were becoming reconciled to the fact that the electric lines were entitled to the local passenger traffic and to the local package freight business, but he said that in attempting to handle heavy carload freight in trains the electric lines were going outside of their province. He said that not only would the steam roads resent the attempt at usurping business which they believed to be their own, but the cities and towns would cry out against freight being hauled through the streets. He gave the electric lines which are attempting this class of traffic eighteen months in which to discover that they were not only not equipped to handle carload freight, but that it would be a losing proposition financially.

ELECTRICAL ENGINEERING AND RAILWAY LABORATORIES AT WORCESTER POLYTECHNIC INSTITUTE

The board of trustees of the Worcester Polytechnic Institute has just awarded the contract for the erection of a new electrical engineering building which upon completion will house the largest and most extensive electrical engineering and electric railway engineering laboratories to be found in any college in the world. The building itself will cost about $125,000, and it is expected that its construction will have progressed to a point where the most of the laboratories will be available early in the next college year. It will be constructed of red brick, with darker red brick and brownstone trimmings and a roof of light-green slate. The laboratories have been planned by the members of the electrical engineering department of the institute.

Besides recitation rooms, auditorium, library and general laboratory there will be a telephone laboratory and electric railway laboratory. The general laboratory will have a length of 200 ft. and a width of 55 ft., and, with the three galleries, will have a floor area of 19,400 sq. ft. and volume of about 400,000 cu. ft. This laboratory is to be served by a 10-ton electric traveling crane covering the entire central portion of the laboratory between the galleries. Upon the second or upper floor of the building will be located, in the west wing, a large high-potential and insulating laboratory, where are located the high-potential transformers, permitting the use of voltage of any desired frequency and potential up to 750,000 volts, for the study of the various problems of long-distance high-potential power transmission, and the dielectric and electrostatic phenomena of insulating and other material.

Referring again to the general laboratory, the galleries will be designed to accommodate the lighter and accessory laboratory equipment, such as the switch signal, air brake and controller apparatus for the electric railway work, the arc lighting apparatus, transformers, and all other equipments not having heavy rotating or reciprocating parts. These galleries are to be served by 2-ton trolley hoists, covering their entire length, the trolleys being arranged so that a load may be transferred form the traveling crane, covering the main floor to the trolley hoists covering the galleries. On the main floor there will be five generators of from 30 kw to 60 kw capacity. Each will be directly connected to induction motors receiving power from the Institute service power plant, which is located in another building on the campus. These generators will comprise 110-volt and 500-volt direct-current machines, and single, two and three-phase alternators. There will also be a 300-hp, two-phase, 60-cycle synchronous motor, driving a double-current generator, delivering 500 volts direct current, or 350 volts single-phase, 25-cycle alternating current. This machine will supply power for railway experimental and testing purposes.

Two tracks, connecting with the tracks of the local railway company, and in that way with the suburban and interurban railways of New England, are to enter the building at the west end. Both of these tracks are covered by the traveling crane, and one, the inspection track, is for its entire length over a pit, from which work may be done on the trucks, brakes or motors. The second track will enter a testing plant, where the car under test is supported on 36-in. wheels, the tires of which are of the same section as the top of a No. 100 A. S. C. E. rail. These supporting wheels will be carried to a standard gage on axles which revolve in bearings carried by pedestals which can be moved to accommodate cars of any truck and wheel base, up to a maximum of 48 ft. between front and rear wheels. Generators mounted on the supporting pedestals and geared to the support axles will provide a load, as well as keep the rotation of the axles synchronous with one another.

On each supporting axle will be mounted a fly-wheel the weight of which is capable of variation to suit the weight of the particular car under test, so that in acceleration or retardation the inertia due to the weight of a moving car will be faithfully imitated, and all of the actions of the equipment from the start, through acceleration, constant speed running, coasting and braking to a stop may be studied while the car body itself remains stationary in the laboratory. The effects due to wind resistance and grades will be obtained by means of varying the loads on the generators geared to the supporting axles. The draw-bar pull will be measured by a traction dynamometer.

As a part of the railway laboratory equipment, the Institute will own a double-truck four-motor car of the high-speed interurban type. Exteriorly, this car will greatly resemble an ordinary interurban car, but instead of being equipped with seats for passengers, the interior will contain special recording apparatus for automatically registering speed, distance, voltage, current, etc., whether operating on the laboratory testing stand or on lines of an electric railway. The car will also be fitted for making tests of bonds, feeder losses and other physical determinations of the track and electrical systems passed over.

As the testing stand will be arranged to accommodate any electric car, and the test car can operate on any standard-gage track, the connection of this laboratory with any of the New England railways by means of the tracks of the Worcester local street railway should be of quite a practical advantage to these railways, as well as providing unexcelled facilities for instruction.

Besides the equipment of motors, controlling, lighting, heating and braking apparatus permanently mounted on the test car, various other makes and systems of such apparatus, as well as signaling apparatus and overhead and third rail and track material will form parts of the laboratory equipment, so that tests may be made on various systems under various conditions of service. A system of wires and pipes will enable the test car to be operated, while on the test stand, by any of the control or air-brake systems outside of the car, if desired.

DISCUSSION ON THE FIRE PROTECTION OF CAR HOUSES

At the annual convention of the National Fire Protection Association, held in Chicago, May 22, 23 and 24, the report on car houses, which appears in the STREET RAILWAY JOURNAL for May 12, was considered in detail before being adopted by the convention. The discussion in part related to the wording of the different paragraphs, thickness of walls, and other details, but the greater portion of the discussion dealt with the installation of sprinkler systems. A question was raised as to whether or not it was preferable to follow the wording of the National Code, and allow parapets of division walls to extend from 3 ft. to 5 ft. above the roofs rather than not less than 5 ft., as the paragraph under section I. (b) required. On this point Convers Goddard stated that the car-house committee felt that the extra height of these parapets should be required, in view of the fact that car houses were filled with combustible material. On a suggestion from H. A. Fiske, the word "sliding" was inserted in that paragraph relating to automatic closing fire doors under Section I., in order to prevent the installation of folding or other forms of doors. The word "wall" was substituted for "opening" in the same paragraph in that sentence relating to the position of doors.

Chairman C. H. Patton, of the committe on car houses, stated that paragraph (b), under Section 4, relating to roofs and roof supports, had been revised so as to require all roof girders to be covered on sides with 4 ins. of fire resisting material, and on top and bottom with 2 ins. of fire resisting material, instead of requiring 4 ins. on all sides. The committee had also added a note to this section, requiring all necessary tie-rods, templets, etc., to be, in quality and design, in accordance with the requirements of the National Board of Fire Underwriters.

H. A. Fiske thought Section 9, relating to pits, should state definitely the requirements for the cut-off walls between pits, and the committee was instructed to add a clause specifying the character of these cut-offs.

E. T. Cairns objected to Section 1, under sprinkler requirements, in that it permitted ceiling curtains to be of 1-in. tongued and grooved boards. He thought nothing but non-combustible curtains should be permitted. However, the section, by vote, was allowed to stand as printed.

Regarding the height of aisle sprinklers, H. N. Staats, of the committee, in response to a suggestion to place these sprinklers opposite transom windows, stated that one objection to placing them at this height was that these windows were often of heavy plate or wire glass, and were not easily broken. A further objection was that the depth of the windows was so small as to prevent a large amount of water from the sprinklers entering the interior of the car through them. He said better results were obtained when the sprinklers were from 4 ins. to 6 ins. from the sides of the car, and about 4 ins. below the top of the car window.

J. E. Curtis thought the minimum size of pipe in aisle lines should be 1¼ ins. This suggestion was based on the fact that it was often quite difficult to support the pipe at close enough intervals and the increased size of pipe would add to the rigidity. The convention, however, decided to allow the wording of the report permitting 1-in. pipe to stand.

Mr. Fiske thought paragraph (e), under Section 2, relating to aisle sprinklers, should be modified so as not to compel the installation of two lines of aisle sprinklers, where the distance between the sides of cars on adjacent tracks was more than 4 ft. Even with cars 6 ft. distant from each other, he did not believe that the fire would get from one line to the next with but one line of aisle sprinklers.

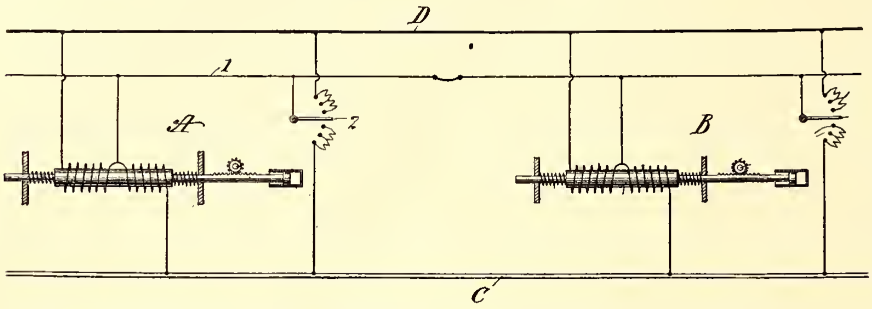
In reply to Mr. Fiske, Mr. Cairns stated that, in actual experiments, best results were gotten with the sprinklers up close to the car. When removed a short distance a current of cold air passed up between the side of the car and the sprinklers, and prevented the latter from opening. Mr. Fiske explained that he had no thought of putting the sprinklers half way between cars, but his idea was that one line of sprinklers placed up close to the bodies should take care of one line of cars. Albert Blauvelt, a member of the committee, said he hoped the report would not be changed regarding two lines of sprinklers. The second line of aisle sprinklers did not add much expense. In the Cleveland experiments he remembered that, although one line of sprinklers put out the fire, it was done at a very close margin, as the paint on other cars was blistered. This blistering would not have occurred with two aisle lines. On a motion of H. Bennett, the section under discussion was referred to the committee for further consideration.

The question of shields for aisle sprinklers was the subject of considerable discussion. Mr. Staats thought that these shields complicated the sprinkler system. It was stated that there had been several tests in which the overhead sprinklers opened before the side sprinklers, and that these latter were then prevented from opening because of the water falling upon them. After considerable discussion in which widely varying opinions were expressed, the convention, on a vote, referred the paragraph relating to shields to the committee for further consideration.

Another point which was discussed at length was the placing of aisle and overhead sprinklers on separate supply systems. The cost was an argument against equipping them in this manner, while the fact that one system would be in commission when repairs were being made on the other was urged in favor of so doing. It was finally voted that the report be changed to state that it was preferable to place the two lines of sprinklers on separate dry pipe systems. Afterwards the report as a whole, with the recommendations suggested, was accepted by the convention. The committee was also requested to draw up a standard set of rules for reinforced concrete car houses, based on the standard for that construction in the building code of the National Board of Fire Underwriters.

SINGLE-WIRE MULTIPLE-UNIT SYSTEM

An ingenious method of operating a multiple-unit train by a single-train wire was patented last week by H. McL. Harding and Charles M. Martin, of New York. As is well known, all previous multiple-unit systems have required two or more train wires, and in some cases the connecting cable had to be manufactured with a large number of conductors. The tendency towards high voltages suggested to the inventors the desirability of reducing the number of pilot wires, and this



WIRING DIAGRAM OF MULTIPLE-UNIT SYSTEM USING A SINGLE-TRAIN WIRE

has finally been accomplished by their reduction to a single wire. The method of accomplishing the result is shown by the accompanying engraving, in which D is the third rail, or trolley wire; B is the motor car; A is the second car in the train; C is the return circuit, and 1 is the pilot wire. Each car is supplied with one or more solenoids differentially wound and with the middle point of the winding connected with the pilot wire. The master controller is at 2, and consists of a switch with resistances, so that the middle point of the solenoid winding can be connected either to trolley voltage or ground. The operation of the system will then be easily understood.

When the master controller switch is at zero position, current flows through the differential winding from the trolley voltage to ground and produces no effect on the solenoid. When the pilot wire is connected to the trolley voltage, the left half portion of the solenoid winding on each car is out of circuit and the solenoid plunger is thrown forward. When the master controller switch is connected with ground, the right hand side of the differential solenoid winding is out of circuit and the plunger is thrown backward. When the master controller is shifted to the zero position, the plunger returns to its original position.

In the accompanying illustration is illustrated a method of operating the car controllers from the solenoid plunger by means of a rack and pinion, and of regulating the throw of the plunger by the dash-pot, and by varying the resistance at the master controller. It is stated in the patent, however, that this is simply one possible method, and the claims cover the method of controlling any kind of motor circuit on the car and securing forward, stop, reverse or any intermediate condition of the motors by changing the potential of the single pilot wire.

According to an announcement made in Boston, the Boston Suburban Street Railway Company is to put in operation between South Framingham and Worcester, as an experiment, a combination car with a smoking compartment, the first of the kind in eastern Massachusetts.

NEW EQUIPMENT FOR THE NEW ORLEANS RAILWAY & LIGHT COMPANY

The New Orleans Railway & Light Company has recently received from the American Car Company twenty-five groveless-post, semi-convertible cars built under Brill patents with 30-ft. 8-in. bodies and mounted on Brill 27-G trucks; also twenty single truck closed cars measuring 20 ft. 8 ins. over the bodies. Both types are vestibuled. The New Orleans Railway & Light Company's system has a trackage of 185 miles, embracing twenty-seven different routes, among them being four belt lines. The company operates all of the electric lines and controls all the electric and gas lighting business in the city, and operates on an average 350 cars. The roadbed and tracks in the central portion of the city have lately been entirely relaid, and the company is spending upwards of two and a half millions of dollars in improvements and extensions. The company's lines radiate to every part of the city, and the excellent street railway facilities given have been a great factor in the development of the city. New Orleans has a population of 350,000 and is rapidly growing. In addition to Audubon, City and Athletic Parks, all of which are reached by the lines of the street railway company, and the numerous squares which are in the residence section, New Orleans is well supplied with open air resorts, those situated on Lake Pontchartrain being the most popular. Along the gulf coast, within easy access, are a number of popular resorts, where fine fishing and boating attract many visitors.

The single-truck cars have transverse seats with a capacity of twenty-eight passengers per car. They are finished in mahogany with ceilings of maple veneer. Folding gates as well as folding doors close the vestibule entrances. The win-

DOUBLE-TRUCK CAR FOR THE NEW ORLEANS RAILWAY & LIGHT COMPANY

dow sashes drop into pockets in the sides and the small upper sashes are stationary. The following are the principal dimensions: Length over the bodies, 20 ft. 8 ins., and over the vestibules, 29 ft. 4 ins.; width over the sills, including panels, 7 ft. 7½ ins., and over the posts at belt, 8 ft.; sweep of the posts, 2⅝ ins.; centers of posts, 2 ft. 10⅜ ins.; height from the floor to ceiling, 8 ft. ⅞ in.; from the track to the under side of the sills, 2 ft. 5½ ins.; and from the under side of the sills over the trolley board, 9 ft. 2½ ins.; from the track to the platform step, 13¼ ins., and from the step to the platform, 13¼ ins. The side sills are 3¾ ins. x 7 ins., and the end sills 3¾ ins. x 6 ins.; thickness of the corner posts, 4½ ins., and the side posts 1¾ ins. The seats are 33 ins. long, and the aisles 21 ins. wide. The truck-wheel base is 7 ft. 7 ins., and the trucks are fitted with 33-in. wheels and 4-in.

axles. Two 40-hp motors are used per car. The weight of the car and the truck without the motors is 14,000 lbs.

The double-truck, grooveless-post, semi-convertible cars seat forty-four passengers each, the seats being of Brill manufacture. The illustration shows one of the windows entirely open, with the sashes in the roof pocket and two of the windows raised at different heights. Five window lock stops are provided in the posts, so that the sashes may be held at any height desired. Stationary ventilators are used at the sides of each end of the monitor deck to permit a current of air to circulate through the upper part of the car when the ventilator sashes are closed. The bottom framing is unusually substantial and includes 12-in. x 3/8-in. sill plates and under trusses with king posts. The outside platform timbers are reinforced with angle-iron, and a pair of angle-irons, offset for the purpose, support the center of the platforms and extend well back of the body posts. The bronze trimmings of the

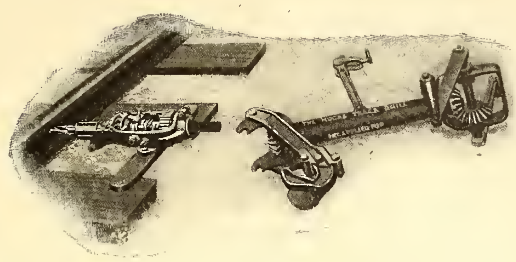
SINGLE-TRUCK CAR FOR THE NEW ORLEANS RAILWAY & LIGHT COMPANY

car throughout are nickel-plated, including corner grab handles on the seat backs. The interiors are finished in cherry, with three-ply poplar veneer ceilings painted robin-egg blue and decorated with gold. The lights are placed in the center of the deck in clusters of five and inclosed in frosted glass bulbs. The dimensions are as follows: Length of the car over the end panels, 30 ft. 8 ins., and over the crown pieces, 40 ft. 8 ins.; width over the sills, including the panels, 7 ft. 11½ ins.; width of the posts at the belt, 8 ft. 2 ins.; sweep of the posts, 1¾ ins.; centers of the posts, 2 ft. 8 ins.; height from the floor to the ceiling, 8 ft. 5½ ins.; from the track to the under side of the sills, 2 ft. 8⅝ ins.; from the under side of the sills over the trolley board, 9 ft. 5½ ins.; from the track to the platform step, 16⅞ ins. The side sills are 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; thickness of the corner posts, 3¾ ins., and the side posts, 3¼ ins. The seats are 36 ins. long, and the width of the aisle is 22 ins. The truck wheel base is 4 ft. 6 ins.; wheel diameter, 33 ins.; axle diameter, 4½ ins. Four 50-hp motors are used per car. The weight of the car and the trucks without the motors is 27,000 lbs.

DRILL FOR TRACK WORK

To meet the demand for a rail-drilling machine designed for heavy and severe work, the Kalamazoo Railway Supply Company, of Kalamazoo, Mich., has brought out the Moore track drill, which possesses a number of commendable features. This drill was especially designed for use in yards and on busy lines without interrupting traffic. It is arranged to be placed between the rails, and the upright and cranks can be quickly and easily detached, leaving the lower parts lying below the top of the rail to allow cars or trains to pass. The working parts can then be re-attached and work resumed with very slight delay. This is a convenience which will be appreciated by track men.

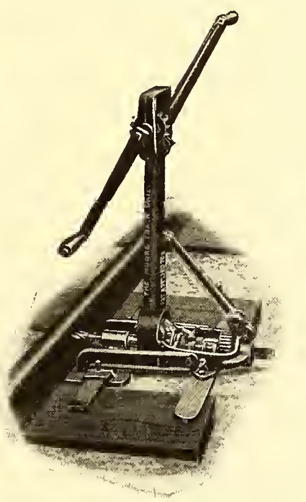
The drill has variable feed which can be adjusted to meet any requirement, as to size of drill and degree of hardness or softness of rail. It will be found especially convenient for reaming in bonding work, etc. By throwing the feed mechanism out of gear, the drill bit can be quickly fed up to or returned from the work. The under clutch is a new feature, which can



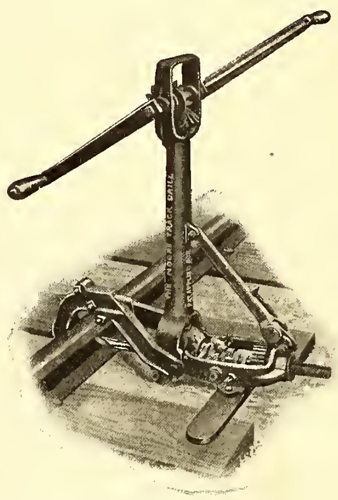
DRILL WITH OVER-CLUTCH ATTACHMENT, SHOWING UPPER PARTS DETACHED FOR PASSING TRAINS

be attached to the rail very quickly without digging under the rail. The drill can be equipped with either under or over clutch, or both as desired. Ball thrust bearings are used on spindle instead of friction washers, thus reducing friction to a minimum.

The machine is offered in two sizes, size No. 1, weighing 60



DRILL WITH UNDER-CLUTCH ATTACHMENT



DRILL WITH HOOK OR OVER-CLUTCH ATTACHMENT

lbs., designed for drilling holes 1 in. and smaller, but having sufficient power to drill holes 1⅛ ins. and 1¼ ins. in diameter; and size No. 2, weighing 100 lbs., recommended for contiuous heavy work and designed for drilling holes 1⅛ ins. and 1¼ ins. in diameter. The accompanying engravings make clear the various details of the device.

EXCURSION CAR SERVICE ON AN IOWA INTERURBAN

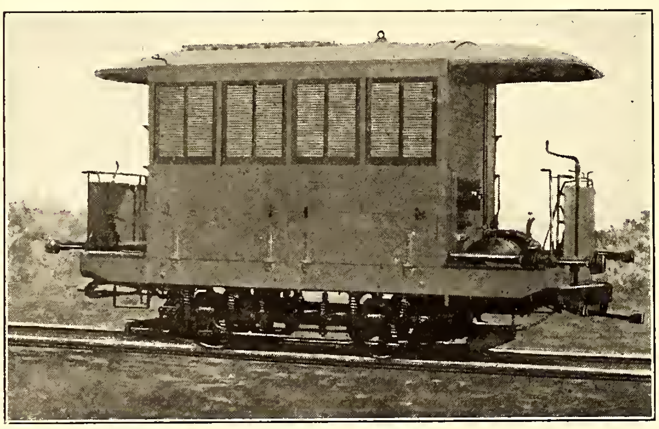
The Inter-Urban Railway Company, of Des Moines, Ia., has inaugurated somewhat of a novelty in renting out special excursion or observation trolley cars. A special car named the "Iowa" was recently built for this service. It is 46 ft. in length, and in addition to kitchen, lavatory and motorman's cab, contains an observation room about 8 ft. long, and a dining room several feet longer. An observation platform on the rear is 5 ft. long and is surrounded by an ornamental brass railing. The company has issued a booklet descriptive of the car, and giving several reproductions of the interior arrangements. Other views given in the booklet are intended to give the reader an idea of the attractive features along the line of the Inter-Urban railway. The reading matter is gotten up in such a manner as to incite one who has never been over the line to make the trip for no other purpose than to view the scenery. On the Beaver Valley division, the road passes over the Des Moines River twice and continues for quite a distance along the bank of the river, and the scenery along this portion of the line is a series of attractive views, with the river in the foreground.

The special car "Iowa" can be rented with the services of a porter, waiter and chef, in addition to the regular trainmen. The company is also prepared to furnish provisions for meals at cost. When kitchen services and the services of the waiters is required, the total charge for the run of 90 miles is $30. Without the service of the waiters and the use of the kitchen, the fee is $25.

After June 1, the "Iowa" will make schedule trips each Wednesday and Sunday, alternating between Colfax and Granger. It will leave Des Moines at 5 o'clock in the evening, and will return to the city four hours later. Twenty people can be accommodated and the fare for the round trip, which includes supper enroute, will be $2.

CENTRIFUGAL SPRINKLING CARS FOR MILAN

Among the shipments of sprinkling cars made by the J. G. Brill Company during the past spring were two of its patented centrifugal type to Milan, Italy, for use on the lines of the Commune di Milano. This type of sprinkler was introduced last year, and a brief description was published in the Street Railway Journal for Sept. 2, 1905. The sprinklers



SPRINKLER EQUIPPED WITH CENTRIFUGAL PUMP

sent to Milan each consist of a centrifugal pump operated by a direct connected motor, both located on the platform at one end of the car. This pump draws the water from one pipe leading from the bottom of the tank and forces it into the sprinkling heads at each end of the car at a pressure sufficient to distribute the water over 50 ft. of roadway on each side of the track. As there is no air pressure, expensive double riveting and special bracing of the tank are not required, as only the weight of the water has to be taken into account. Another important advantage claimed for the centrifugal over other power sprinklers is that there are no wearing surfaces other than the shaft of the centrifugal pump, and, as no check valves, inlet valves, crank shafts and piston rods are used, the old and common difficulty of heated parts is obviated. Aside from the gate valves there are but two valves in the pipe, one on the suction pipe leading to the pump, and the other on the delivery pipe. The latter has a spring-pressure valve which opens automatically when the sprinkling heads are closed and thus prevents back pressure on the motor. The rheostat, which controls the motor, is conveniently placed against the end of the tank housing, as will be seen in the illustration. The pump may be used for filling the tank as well as for expelling the water, and the connection for this purpose is arranged directly under the pump. Water may be easily lifted vertically 20 ft. and drawn from a considerable distance. The tank may be filled in the usual way by an inlet valve at the side of the piping or through the manhole. The special sprinkling heads control the amount and range of the water so that the water may be cut down to the thinnest volume, closed off entirely or directed upon any part of the roadway from a point between the rails to a distance of 50 ft. outside of the rail. If it is desirable not to change the adjustment of the sprinkling head, such as at street crossings, or when passing vehicles, the water may be instantly cut off by the gate valves. The tanks of the Milan cars have a capacity of 2480 gals., and measure 6 ft. 6 ins. x 10 ft. The car measures 16 ft. 6 ins. over the end sills, and without truck motors weighs about 16,000 lbs. The cars are mounted on Brill No. 7 trucks.

LOCOMOTIVE CRANES FOR RAILWAY COMPANIES

The use of locomotive cranes for coal handling has become quite common on a number of American steam railroads, but they can also be used on electric railways where large quantities of heavy freight are handled, for coaling power plants, wrecking purposes, etc. These machines are built for service on a standard gage track, which allows them to be hauled any

LOCOMOTIVE CRANE USED FOR ERECTING A SMOKESTACK

distance, and, if necessary, they can do the switching of a number of loaded freight cars at one time.

An interesting example of what can be done with a locomotive crane may be noted by referring to the accompanying illustration, which shows a No. 2 crane, made by the Browning Engineering Company, of Cleveland, placing a 4½-ton section on the top of a power-house smokestack at 25-ft. radius, making the total height of the complete stack 100 ft. The long-boom arrangement was fitted up especially for the occasion by fastening a heavy 40-ft. timber on the 65-ft. iron boom, allowing 10 ft. for lap.

LEGAL DEPARTMENT*

THREE-CORNERED FIGHTS

It has been often explained in this place that street cars, drivers of vehicles, equestrians and pedestrians in general have concurrent rights to use the public streets and the street crossings in a city. In a certain sense, a street railway company's right is preferential because of the rigid nature of the course which its cars must follow. Attention has been called, from time to time, to many cases illustrating the common right and also the incidental differences developed by the necessities of the situation, either in favor of or against a street railway company. Questions of difficulty arise when either a passenger or another person is injured by concurrent action of the operator of a street car and the driver of some other kind of vehicle. If the accident was due to negligence of both parties, they, or their masters, may be treated as join tort-feasors and held jointly and severally liable. The street railway company and the owner of the colliding vehicle may be, and frequently are, sued in the same action, when there ensues a three-cornered fight in which each defendant will strive to show (1) that there was no negligence on the part of either defendant; (2) that if there was any negligence by either defendant, plaintiff's contributory negligence prevents a recovery; and (3) if there was any negligence on the part of defendants, it was solely the negligence of one of them, and that the other must be exonerated from liability.

A typical illustration is furnished by the case of Denver City Tramway Company v. Norton, recently on appeal before the U. S. Circuit Court of Appeals in the Eighth Circuit (141 Fed. 599). It was held that in a joint action against a street railway company and an omnibus company for personal injuries to a passenger, resulting from a collision at a street crossing, tried to a jury, with a verdict of not guilty as to the omnibus company and guilty as to the street railway company, no error committed by the Trial Court in favor of the omnibus company can avail the plaintiff in error (the street railway company) except in so far as it may have prejudiced the defense of the plaintiff in error in showing that the injury resulted from the negligence of the omnibus company without the concurring negligence of the street railway company.

The Appellate Court shows that the Trial Court had not adequately and justly charged the jury as to the duty of persons driving a tallyho coach with four horses to avoid a collision with an electric street car, saying in part:—

> While the general rule in respect of the driver of a vehicle in approaching a railroad crossing, a known place of danger, to stop and listen where his view is cut off, may not generally apply to the use of such crossings in a city, yet, under the circumstances of this case, it was the driver's imperative duty, where, as his evidence tends to show, the heads of the lead horses would almost reach the railroad track before the car came into full view from his seat, to at least so slacken the speed and so slowly approach it that with his horses well in hand he could at once bring them to a standstill or turn them, in the event of the approach of a street car. On the contrary, his evidence is that he did not slacken the speed of the horses, but went in a jogging trot onto the track, so that it was impossible to have stopped the vehicle readily on the approach of the car. If he judged for himself that he could clear the track before the car reached him, and that was a reasonable judgment, how can the motorman be condemned if he, viewing the same situation, reached the same conclusion?

It is, of course, the rule that an error in favor of the party who escapes liability at the hands of the jury cannot, as such, be taken advantage of by the other defendant who is rendered liable. Nevertheless, in a large number of cases arising it will be found that the conduct of the party who was exonerated will bear quite materially upon the question of the legal responsibility of the other defendant against whom a verdict was given.

In three-cornered trials of this kind, evidence is sometimes offered which may be competent for or against one defendant but not for or against the other. As each party tries the case for his own benefit, testimony must be admitted, though it have but a particular application and force, and the jury are instructed to limit its consideration and weight to its strictly legal bearings. The fact that the jury may not be very successful in actually carrying out such instruction does not affect the rule of admissibility itself.

* Conducted by Wilbur Larremore, of the New York Bar, 132 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

CHARTERS, ORDINANCES, FRANCHISES

FLORIDA.—Municipal Corporations—Separation of Races on Street Cars—Ordinance—Authority to Enact—Delegation of Authority—Penalties—Reasonableness.

1. Although the municipality of Jacksonville is not by its charter of incorporation, approved May 31, 1887, expressly authorized to provide by ordinance for the separation of the races on the street cars in such city, yet it has such authority in the general welfare clause of its said charter, enabling it to "pass all ordinances necessary for the health, convenience, and safety of the citizens, and to carry out the full intent and meaning of this act, and to accomplish the object of this incorporation." But even without such general welfare clause, or other express authorization, the design of such an ordinance being to safeguard the peace and good order of society within such city, its enactment and enforcement is within the incidental police powers of the city directly resulting from its incorporation into a municipality.

2. An ordinance of a city designed to separate the two races upon the street cars in such city, that requires the companies operating such cars to effect such separation in one or the other of two clearly defined modes: (1) By providing separate cars for the two races; or (2) by division of the car when the same car is assigned to the two races—leaving it discretionary with such carrier as to which one of the two prescribed modes of separation it will adopt, is not an unauthorized delegation of authority or discretion to such carriers.

3. Where the Legislature has defined the delegated powers, and prescribed with precision the penalties that may be imposed, a municipal ordinance within the powers granted, prescribing a penalty within the designated limit, cannot be set aside as unreasonable.

4. A passenger on a street car has no right to any particular seat in such car, nor to a seat in any particular end of such car, and a regulation of a street car company, acting under the provisions of a city ordinance designed to effect a separation of the races on such cars, by which the seats in the rear end of its cars are assigned to the use of passengers of the colored race and the seats in the front end of such cars to passengers of the white race, or vice versa, is not an unreasonable regulation, nor an unlawful discrimination between the races.—(Patterson vs. Taylor, 40 S. E. Rep., 493.)

GEORGIA.—Carriers—Separation of White and Colored Passengers—Mistake of Conductor.

If it be actionable per se, as against a street railway company, for its conductor, in endeavoring to comply with the statute requiring the separation of white and colored passengers, to negligently mistake a white passenger for a colored one, and in the presence and hearing of others inform him that he must be seated in the portion of the car set apart for negro passengers, it is essential to the maintenance of such an action that the petition allege the plaintiff to be a white man. The petition in the present case not containing such necessary allegation, it was properly dismissed on general demurrer.—(Wolfe vs. Georgia Ry. & Electric Co., 53 S. E. Rep., 239.)

ILLINOIS.—Street Railroads—Franchises—Construction — Nature of Right—Mandamus—Petition—Necessary Allegations —Excuse for Delay—Construction—Limitation of Time.

1. Grants by the public, such as are given by a city to a street railway, authorizing it to build its road in the street, are to be construed most strongly against the grantee.

2. A grant to a street railway, authorizing it to lay its tracks and operate its road in the street, is a mere license, to be exercised upon the conditions named in the grant.

3. Where a street railroad is authorized by ordinance to lay its tracks in the streets of a city within a certain time, and that time has expired, and it seeks by writ of mandamus to enforce the rights conferred on it by the ordinance, it must allege such a state of facts as excuses the delay in not building its road within the time specified.

4. Where an ordinance authorizing the construction of a street railroad required the road to be built within a specified time, but provided that the time of any delay caused by an injunction should not be computed as a part of the time limited, the failure of the railroad to build a certain part of its line within the time limited was not excused by the pendency of an injunction restraining it from building a small and relatively unimportant connecting line situated several miles from the portion of the road in question, in the absence of anything to show that the portion of the road covered by the injunction was connected with the rest of the system in such a way as to make it undesirable or inconvenient to build one without the other.—(Blocki vs. People ex rel. South Chicago City Ry. Co., 77 N. E. Rep., 172.)

ILLINOIS.—Appearance—General Appearance—What Constitutes—Effect—Eminent Domain—Condemnation Proceedings Pleading—Jurisdictional Allegations—Pleading—Plea to the Jurisdiction—Appeal—Presumption—Propriety of Court's Action—Eminent Domain—Condemnation Proceedings— Petition—Inclusion of Separate Tracts—Right to Separate Trials—Evidence—Similar Transactions—Value—View by Jury—Consideration—Review of Facts—Conclusiveness of Verdict—Record—Matters to be Shown—Party Requesting Instructions—Exceptions, Bill of—Construction—Appeal—Abandonment of Errors—Failure to Argue.

1. Where a property owner appeared in condemnation proceedings and moved for a separate jury trial without limiting his appearance, he thereby subjected himself personally to the jurisdiction of the court, and could not deprive the court of the jurisdiction so conferred by afterwards entering a special appearance and filing a so-called plea to the jurisdiction.

2. Failure of the petition in condemnation proceedings to allege that petitioner has located its line of railroad over the strip sought to be condemned does not deprive the county court of jurisdiction to entertain the petition; but the court may, under the express provisions of the eminent domain act, permit the petition to be amended, and thereby supply the defect.

3. After motion to dismiss has been overruled, a plea to the jurisdiction based on the same ground should not be entertained.

4. Under the provisions of the eminent domain act, which authorizes any number of separate parcels of property to be included in the same petition, and authorizes the compensation for each to be assessed separately by the same or different juries, as the court or judge may direct, the Supreme Court will presume that the discretion of the lower court in denying separate jury trials was properly exercised, in the absence of anything in the record to show the reasons making separate trials desirable, or to show any injury to the persons demanding such trials.

5. The provision of the eminent domain act that any number of separate parcels of property situated in the same county may be included in one petition does not require the separate parcels to be owned by the same person in order that they may be included in the same petition.

6. Under the provision of the eminent domain act which authorizes any number of separate parcels of property to be included in the same petition, and requires the compensation for each to be assessed separately by the same or different juries, as the court or judge may direct, a property owner whose property is included in the same petition with other property is not entitled to a separate trial as a matter of right.

7. In condemnation proceedings, evidence of the sale price of platted lots in the vicinity of the tract in question, which was not platted, was inadmissible.

8. In condemnation proceedings, a question as to whether or not the village in which the property was situated was improving was too indefinite, and properly disallowed.

9. In condemnation proceedings questions relating to the location of a naval school in the village in which the property was situated were immaterial, in the absence of evidence that such school had been located there.

10. In condemnation proceedings, questions concerning factory sites in the village in question, how they were acquired, and whether they were usually sold or donated, were immaterial.

11. In condemnation proceedings, questions as to how certain property near factories rented and as to the rental demand therefor were immaterial.

12. In condemnation proceedings, questions asking a witness what value he placed upon lots in certain sub-divisions in the vicinity of the tract in question, what he considered the lots worth, and whether the lots ran in his mind at from $100 to $1,000 per lot, were immaterial.

13. In condemnation proceedings, plans showing a certain manner of sub-dividing the tract in question into lots, and thereby illustrating the testimony of a witness, were properly excluded, the tracts not having been actually sub-divided; but it could be shown that the land was adaptable to sub-division, and its enhanced value on account of such adaptability could be taken into consideration.

14. In condemnation proceedings, the jury may consider, in connection with the evidence, what they see while visiting and inspecting the premises in determining questions of values, benefits and damages.

15. In condemnation proceedings, where the evidence is conflicting, and there is nothing to show that injustice has been done, or that passion or prejudice influenced the action of the jury, the verdict will not be disturbed by the Supreme Court.

16. Errors in instructions will not be considered on appeal, in the absence of anything in the record or bill of exceptions to show at whose request such instructions were given, or whether they were given by the court of its own motion.

17. A bill of exceptions is to be taken most strongly against appellant.

18. Alleged error in the refusal of instructions must be regarded as abandoned, when not mentioned in appellant's brief or argument.—(Martin et al. vs. Chicago & M. Electric Ry., 77 N. E. Rep., 86.)

ILLINOIS.—Railroads— Interests in Land—Forfeiture—Pleading—Legal Questions—Railroads—Right of Way—Abandonment — Intention — Evidence Parol — Invalidating Deed — Quieting Title—Pleading—Allegation Showing Possession.

1. The fact that a railroad represented, when land for a right of way was deeded to it, that it had theretofore located its line of road over the land conveyed and would do certain things in the future, and subsequently abandoned the proposed route, is not ground for cancellation of the deed, in the absence of anything to show that such representations were false when made.

2. In the absence of an allegation of acts of a railroad manifesting an abandonment of its right of way, an allegation that it had abandoned a portion of its right of way at a certain time is a mere conclusion of the pleader and is bad.

3. In order to constitute an abandonment by a railroad of a part of its right of way, an intention to abandon the right of way must coexist with non-user.

4. A deed acknowledging the payment of consideration cannot be contradicted by parol, for the purpose of invalidating the deed or impairing its legal effect.

5. A bill to cancel a deed as a cloud on title is bad, where it alleges that the grantee is in possession of part of the premises covered by the deed.—(Stannard vs. Aurora, E. & C. Ry. Co., et al, 77 N. E. Rep., 254.)

NEW JERSEY.—Street Railroads—Power to Regulate.

1. Though a city may have had no power to impose on a street railroad the burden of repaving any portion of its streets, or to exact a contract for such repaving, it could impose on the company, as a condition to granting it the right to use the electric motors as the propelling power of its cars, and for that purpose to erect poles and string wires thereon in streets, that the company should pave the parts of the street between and adjoining the tracks.

2. Providing that any street railway company may use electric motors as the propelling power of its cars, instead of horses, provided it shall first obtain the consent of the municipal authorities, a contract whereby a city gave the street railroad company the right to use electric motors on condition that it should pave certain parts of streets was not *ultra vires*.

3. Providing for the taxation of all the property and franchises of corporations using or occupying public streets, and that the franchise tax provided by that act shall be in lieu of all other franchise taxes, does not relieve a street railroad company of its duty to pave certain parts of streets imposed as a condition to its right to use electric motors.—(Inhabitants of City of Trenton vs. Trenton St. Ry. Co., 63 Atl. Rep., 1.)

NEW JERSEY.—Street Railroads—Use of Streets—Reasonableness of Ordinance—Enforcement of Restrictions—Defenses—Undue Consideration—Sale of Franchise—Liabilities of Purchaser—Mandamus—Duty to Pave Streets.

1. Where, under the general traction act of 1893 an ordinance is passed by the Common Council of a municipality granting a location of street railway tracks, subject to restrictions in the ordinance specified, the question whether such restrictions are reasonable is a question of fact, and the burden of proof is upon him who asserts them to be unreasonable.

2. The restrictions in the case under review held not unreasonable.

3. The ordinance having been carried into effect by the construction, maintenance and operation of the street railway, the traction company and its successors in title, while retaining and enjoying the privileges and franchises granted by the ordinance, cannot resist the claim of the municipality for enforcement of the restriction, on the plea that the ordinance was *ultra vires* the municipal corporation.

4. Where an ordinance granting a location for street railway tracks pursuant to the general traction act of 1893, contains restrictions in the form of covenants requiring the traction company to pave the streets in which the tracks are laid, the fact that performance of this covenant would to some extent relieve the municipal treasury from expense does not taint the proceeding; there being no interest on the part of the members of Council beyond their interest as ordinary taxpayers.

5. An ordinance granted a location of street railway tracks to a traction company and its assigns, subject to restrictions and conditions to be observed and performed by the grantee. Held, that the restrictions and conditions are obligatory upon any subsequent purchaser of the street railway tracks and franchises, even without an express assumption.

6. Mandamus is the proper remedy for enforcing performance by a traction company of its duty to pave a street pursuant to the terms of the ordinance granting to its predecessor the right to locate tracks in such street.—(Mayor, etc., of Borough of Rutherford vs. Hudson River Traction Co., 63 Atl. Rep., 84.)

NEW JERSEY.—Mandamus—Street Railroads—Transfers to Passengers.

A writ of mandamus should not issue at the instance of a municipal corporation to compel a street railway company to give transfers to its passengers within the municipality, when the obligations of the company to do so arises wholly from its assent to certain municipal ordinances which, of themselves, have no legislative force.—(Mayor, etc., City of Newark vs. North Jersey St. Ry. Co., 62 Atl. Rep., 1003.)

NEW YORK.—Carriers—Street Railways—Transfer—Obligation to Issue—Operation and Control of Road—What Constitutes.

Under Railroad Law, Laws 1890, p. 1113, c. 565, sec. 101, as amended by Laws 1897, p. 776, c. 688, relating to street surface railroads, and providing that no corporation constructing and operating a railroad under the provisions of this article, etc., shall charge any passenger more than five cents for one continuous ride from any point on its road, "or on any road, line or branch operated by it, or under its control," to any other point thereof, etc., and Railroad Law, Laws 1890, p. 1096, c. 565, sec. 39, imposing a penalty on any railroad corporation receiving more than the lawful rate of fare, etc., the operation or control of a road within the meaning of such sections means a control of the operation of the road, and not merely a control of the corporation or individuals operating it by reason of the ownership of a majority of the road's capital stock.—(Senior vs. New York City Ry. Co., 97 N. Y. Sup., 645.)

NORTH CAROLINA. — Municipal Corporations — Streets — Street Railroads — Construction — Additional Servitude — Abutting Owner—Rights.

1. The construction of a street passenger railway does not impose an additional servitude on the property fronting on the street so occupied, though in the original laying out of the street a mere easement was taken, and not the fee.

2. A city sidewalk being a part of the street which the city has set apart for the use of pedestrians, an abutting proprietor has no more right therein than in the roadway of the street.

3. An abutting proprietor is only entitled to have the street and sidewalk in front of his premises open and obstructed so as not to impair ingress or egress to his lot by himself and those whom he invites there.

4. Complaint owned an irregularly shaped lot, which was only 7 ft. 7 ins. wide at the intersection of two streets, on which street car tracks were laid; the length of the curb in front of such lot at the intersection of the streets being but 22 ft. 5½ ins. The sidewalks adjoining the lot on the two streets were 10 ft. and 8 ft. wide, respectively, and between the curb and the nearest rail of the track was a distance of 15½ ft. on one street and 13½ ft. on the other. In order to transfer cars from one track to the other, a curve was constructed in front of the narrow portion of complainant's lot in such a manner that cars passing over it extended over a small corner of one angle of the sidewalk; the rails being laid level with the street, and the ties being buried at the shortest part of the curve slightly under the sidewalk. On three or four occasions when the curve was first used, cars ran off the track at such place. Held, that such facts were insufficient to show that complainant's right of egress and ingress to his lot was damaged by the curve.—(Hester vs. Durham Traction Co., 50 S. E. Rep., 711.)

WISCONSIN.—Eminent Domain—Taking of Property—Appropriation of Streets—Measure of Damages—Appeal—Harmless Error—Erroneous Theory of Damages—Presumptions—Deliberations of Jury—Obedience to Instructions—Errors Reviewable—Instructions—Necessity of Specific Exceptions.

1. Under Rev. Stat. 1898, secs. 1862, 1863a, authorizing the formation of corporations for constructing and operating street railways, providing that municipalities may grant to any such corporation the use of streets or bridges within their limits for the purpose of laying tracks, and empowering such corporations to exercise the right of eminent domain, the use of a street by an electric railroad, for interurban traffic is a burden not contemplated by the original taking of the land for street purposes, and the appropriation of the street by the railroad for that traffic constitutes a taking of private property for public purpose, for which the abutting owners are entitled to compensation.

2. The measure of damages to abutting premises, for the appropriation of a street by an electric railroad for interurban travel, is the difference, at the time of the filing of the Commissioner's award, between the market value of the premises with the road located upon it, and their market value freed from the use and burden of the road.

3. On the issue of damages to abutting property by the appropriation of a street by an electric railroad for interurban travel, the admission of evidence of the value of the premises in 1898, when the railroad first commenced its interurban business, and the giving of an instruction that the measure of damages was the difference between the market value of the premises just before the railroad commenced its interurban business upon the street, and its market value in 1904, when the award of damages was made by the Commissioners, were not prejudicial to the railroad where the market value of the property, as shown by the evidence covering the period prior to the filing of the award, was substantially the same as it would have been without the burden of the railroad in 1904, when the award was made.

4. In proceedings by an electric railroad to condemn a right of way over a street for interurban travel, where the court repeatedly charged that the abutting owners were not entitled to any damages due to the conduct of a city street railroad business along the street in question, it would be presumed on appeal that the jury followed the charge and did not allow any damages for the operation of a city street railroad.

5. A general exception to the refusal of a number of requested instructions covering distinct propositions, presents nothing for review.—(Abbott vs. Milwaukee Light, Heat & Traction Co., 106 N. W. Rep., 523.)

LIABILITY FOR NEGLIGENCE

ALABAMA.—Carriers—Injury to Passenger—Action—Allegations of Negligence—Sufficiency—Duty of Carrier—Existence of Relation.

1. A complaint alleging that plaintiff, while a passenger upon defendant's railway, was injured, and that his injuries were proximately caused by the negligence of defendant's servants, was not demurrable on the ground that it did not specify with sufficient particularity the manner in which plaintiff was injured.

2. A complaint alleging that plaintiff, while a passenger upon defendant's railway, was injured, etc., was not defective for failure to show that defendant owed any duty to plaintiff; the existence of the duty being inferable from the allegation of the relation of carrier and passenger.

3. A complaint alleging that plaintiff, while a passenger upon defendant's railway, was injured, etc., was sufficient to show that the relation of carrier and passenger existed at the time of the injury, although there was no direct allegation that defendant was a common carrier.—(Birmingham Ry., Light & Power Co. vs. Adams, 40 S. Rep., 385.)

CALIFORNIA.—Carriers—Action for Injury of Passenger on Street Car—Evidence of Negligence—Appeal—Review of Instructions—Harmless Error.

1. While the injury of a passenger while on a street car is not of itself sufficient to raise a presumption of negligence in the operation of the car, evidence that when a passenger was about to step off a car, which had almost come to a stop, and while he was

standing with one foot on the step, and holding to a stanchion with one hand, the car suddenly jerked ahead with such violence as to break his hold and throw him to the ground with his head toward the rear of the car, is sufficient *prima facie* to charge the company with negligence, and the passenger is not required to show the cause of the sudden movement of the car.

2. Where there was no evidence of a want of proper and skillful surgical attention to a personal injury for which plaintiff sued, an instruction that his right to recover, or the measure of his damages, would not be affected by want of such care and attention if he was financially unable to procure the same, even if erroneous, was harmless error.—(Renfro vs. Fresno City Ry. Co., 84 Pac. Rep., 357.)

COLORADO.—Trial—Consolidation of Suits—Courts—Jurisdictional Amount—Appeal—Review—Joint Action Against Two Defendants—Street Railroads—Vehicles—Relative Rights—Negligence of Motorman—Sounding of Gong on Car Pursuant to City Ordinance—Witnesses—Instruction—Interest of Plaintiff—Contributory Negligence of Plaintiff—Damages—Personal Injuries—Personal Examination of Plaintiff.

1. Where separate actions are brought by separate plaintiffs against the same defendants, pending in the same court, for personal injuries sustained in the same accident, depending upon the same evidence, with the only difference in the extent of the injuries to the respective plaintiffs, the causes, under section 921, Rev. Stat. U. S., are properly consolidated for trial.

2. Under the judiciary act the amount in dispute or matter in controversy, determining the jurisdiction of the court, is the amount demanded in the petition in good faith, and not the amount ultimately recovered.

3. In a joint action against a street car company and an omnibus company for personal injuries to a passenger, resulting from a collision at a street crossing, tried to a jury, with a verdict of not guilty as to the omnibus company and guilty as to the street car company, on writ of error sued out only by the street car company, no error committed by the trial court in favor of the omnibus company can avail the plaintiff in error, except in so far as it may have prejudiced the defense of the plaintiff in error in showing that the injury resulted from the negligence of the omnibus company without the concurring negligence of the plaintiff in error.

4. While street cars and drivers of vehicles, equestrians and pedestrians, as a general rule, have concurrent rights to occupy the public street crossings in a city, the right of the railroad at such point is superior, in the sense that it is preferential, as to the right of way.

5. Facts reviewed as to whether or not the motorman was guilty of negligence in approaching a street crossing, and held to be a question for the jury.

6. Where a city ordinance requires the motorman of a street car on approaching a street crossing to sound a gong within 60 ft. of the crossing, and the evidence tends to show that the gong was not so sounded, but that the driver of the coach approaching the crossing in fact saw the car more than 60 ft. from the crossing. Held, that the court erred in its charge in directing particular attention to the failure to give the signal as required by ordinance.

7. Where the plaintiff in an action for damages on account of personal injuries testified to material facts respecting the character and extent of such injuries, and especially in contradiction of other witnesses. Held, that the defendant was entitled to an instruction to the effect that while under the statute the plaintiff is permitted to testify in her own behalf, yet in considering such evidence the jury may take into consideration the fact that she is directly interested in the result of the suit. Held, further, that the duty to so charge is not met by a general instruction to the effect that the jury are the judges of the credibility of the witnesses and the weight to be given to the testimony of each.

8. While the court does not assent to the proposition that in all given cases contributory negligence may not be attributed to a person riding in a vehicle with a driver, not the passenger's servant, yet, where the passenger is riding in a coach, the driver not being her servant or under her control, on a seat several feet from the driver and at an elevation of 7 ft. from the ground. Held, that contributory negligence is not attributable to her for either failing to warn the driver of danger, or in not leaping from the coach under the circumstances.

9. In the Federal jurisdiction, in an action for personal injuries, in the absence of some enabling statute of the State, the plaintiff cannot, by order of court, be required to submit to a personal examination by a surgeon. All the right the defendant in such instance has is to make request upon the plaintiff to consent to such examination, and in case of refusal the defendant should be permitted to disclose such refusal on the trial, and comment thereon to the jury, to the plaintiff's prejudice.—(Denver City Tramway Co. vs. Norton et al. Same vs. French et al., 141 Fed. Rep., 599.)

GEORGIA.—Negligence—Pleading and Proof—Trial—Instructions—Invading Province of Jury—Electricity—Street Railways—Live Wires—Injury to Pedestrian.

1. In a suit to recover damages for personal injuries alleged to have been sustained by reason of negligence on the part of the defendant, the plaintiff must recover, if at all, upon proof establishing the specific acts of negligence alleged in his petition.

2. Even in a case to which the doctrine of "res ipsa loquitur" is applicable, it is erroneous for the court to charge the jury that a given state of facts either constitutes, or affords prima facie proof of, negligence, when there is no statute expressly declaring that this is true as matter of law.

3. The charge of the court being in certain respects inaccurate and prejudicial to the excepting party, a new trial is ordered.—(Augusta Ry. & Electric Co. vs. Weekly, 52 S. E. Rep., 444.)

ILLINOIS.—Trial—Arguments of Counsel—Comments on Witnesses—Instructions—Invading Province of Jury—Creditability of Witnesses—Abstract Instructions—Carriers—Injury to Passenger—Question for Jury—Who are Passengers.

1. Counsel, in an argument before the jury, have a right to attack the testimony of witnesses as untrue, though there has been no attempt to impeach them.

2. An instruction that denunciations of witnesses by counsel should not influence the jury to disregard the testimony, if unimpeached, is erroneous.

3. There is no presumption of law that an unimpeached witness has testified truly, and an instruction to that effect is erroneous, as infringing on the province of the jury.

4. Where an instruction states a rule of law, which, though not incorrect, does not relate to any fact in the case, it is improper.

5. In an action for injuries to a passenger, an instruction as to the duties of a carrier of passengers for hire is not unwarranted, though that the relation exists is denied by the carrier, where the facts alleged in the declaration, if proved, would establish such a relation.

6. The question of the credibility of a witness testifying in contradiction of others is for the jury.

7. The relation of passenger and carrier is created by contract, and does not necessarily arise from the mere fact that a person runs toward a moving car to get on board.—(Chicago Union Traction Co. vs. O'Brien, 76 N. E. Rep., 341.)

ILLINOIS.—Appeal—Harmless Error—Negligence—Trial—Instructions—Questions of Law—Review—Questions of Fact.

1. In an action for personal injuries, error in refusing to strike out an answer to a question to plaintiff as to her physical condition since the injury, "I have been a nervous wreck ever since," is harmless error, where there is ample evidence to show plaintiff's physical condition.

2. Where, in an action for personal injuries, the court instructed that the questions involved, as alleged in the declaration, as to negligence of defendant, if any, and reasonable care by plaintiff, if any, "are what is known as questions of fact, which it is the duty and province of the jury to determine under the law and the evidence," the instruction was not erroneous, as summarizing the elements of recovery and directing a verdict without requiring proof of injury.

3. An instruction, in an action for personal injuries, that, if the jury believe the plaintiff has proved the allegations in one or more of the counts of the declaration by a preponderance of the evidence, she can recover, does not submit a question of law to the jury.

4. In an action for personal injuries, question whether the verdict is excessive is a question of fact, on which the judgment of the Appelate Court is conclusive.—(Chicago & J. Electric Ry. Co. vs. Patton, 76 N. E. Rep., 381.)

INDIANA.—Trial—Peremptory Instructions—Carriers—Injury to Passenger—Contributory Negligence—Passengers—Trespassers—Payment of Fare—Appeal—Briefs—Recital of Evidence.

1. In considering a motion for peremptory instruction, the court must accept as true all facts which the evidence tends to prove, and all such inferences as are reasonably deducible therefrom against the party asking a protection of the verdict, and, in case of conflicting evidence, excluding that favorable to him.

2. In an action by a passenger for injuries, the question of contributory negligence held under the evidence, one for the jury.

3. Where a street car company stops a car equipped for carrying passengers at a place selected by it to receive passengers, a person who, desiring to be transported, boards or attempts to board the car for such purpose, becomes a passenger, as the stopping of the car at the customary place is an implied invitation to those waiting to take passage.

4. A person desiring passage, who boards a street car stopping at a customary place to receive passengers, and indicating his intention to become a passenger, without notice that persons are not invited to board, cannot be treated as a trespasser.

5. A special contract with a street car company, based on the payment of fare, is not essential to make a person boarding a car stopping at the customary place a passenger.

6. Rule 22 (55 N. E. v.) requiring that, if the insufficiency of the evidence to sustain the verdict is assigned, the statement in the brief shall contain a condensed recital of the evidence in narrative form, so as to present the subject clearly and concisely, cannot be invoked as a basis for refusing to determine the substantial issues presented, when the brief sufficiently conforms to the rule to enable the court to comprehend the proposition relied on.—(Hall vs. Terre Haute Electric Co., 76 N. E. Rep., 334.)

INDIANA.—Negligence—Contributory Negligence—Defense—Trial—Special Findings—Conflict with General Verdict—Carriers—Injuries to Passenger—Presumptions by Passenger—Question for Jury—Similar Injuries—Damages—Special Damage—Interference with Business—Necessity of Pleading.

1. In an action for personal injuries, a general verdict in favor of plaintiff is, in effect, a finding in his favor on the issue of contributory negligence and upon every issuable fact necessary to sustain his cause of action, and is supported, as against special findings, by every presumption and inference of fact which may be drawn from the evidence properly admitted under the issues, and will yield only after resolving all reasonable presumptions against such special findings.

3. A passenger on a street car may presume, in the absence of knowledge to the contrary, that all necessary precautions for his safe transportation have been and will be taken.

4. A passenger who knowingly exposes himself to danger in a way that an ordinarily prudent person would not have done under the circumstances, and is thereby injured, or who by reasonable precautions could have foreseen the danger and avoided the injury, cannot recover on account of such injury.

5. The question of contributory negligence is for the jury, except where the exact standard of duty is fixed.

6. In an action against a street railway for injuries to a passenger riding on the running board of an open car, caused by his coming in contact with iron posts of a bridge over which the car passed, whether plaintiff was guilty of contributory negligence, in that he might have taken a position in the front vestibule of the car, where he would not have been injured, and in that he had ridden over the bridge before and had a general knowledge of its construction, held, under the evidence, a question for the jury.

7. In an action against a street railway for injuries to a passenger standing on the running board of an open car, caused by his coming in contact with the structural work of a bridge over which the car passed, the fact that no passenger had ever before been injured by coming in contact with the bridge, during the long use thereof by defendant, was to be considered by the jury, but would not of itself relieve defendant from liability for the injury, if it so maintained its road as to endanger the lives and limbs of passengers riding on the running board of its cars by its invitation and with its permission, and with the recognition of the public that such running board was for the carriage of passengers.

8. Damage consisting of loss of time or interference with the business, trade, or profession of the person injured, is regarded as special, and is recoverable, in an action for the injuries, only when specially averred in the complaint..—(Union Traction Co. of Indiana vs. Sullivan, 76 N. E. Rep., 116.)

IOWA.—Carriers—Injuries to Passengers—Actions—Evidence—Appeal—Review—Harmless Error—Admission of Evidence—Withdrawal—Duties toward Passengers—Employment of Competent Servants—Actions—Admissibility of Evidence—Trial — Instructions — Construction — Costs—Appeal — Unnecessary Abstract.

1. In an action against a street railroad for the death of a passenger, who jumped from the car in an excess of fright on seeing apparent electrical disturbances at the front end of the car, where the evidence was not conclusive as to whether it was the electrical display, or that connected with the high rate of speed and rocking motion of the car, which induced deceased to jump, evidence of the rocking motion of the car and of irregularities in the track was admissible, not only on the issue of the railroad's negligence in causing the electrical disturbance, but as showing an independent ground of negligence.

2. In an action against a street railroad for the death of a passenger, the admission in evidence of rules of the railroad regulating the speed of its cars and requiring stops at specified points was not prejudicial to defendant, where the rules did not require a higher degree of care than is imposed by law, and their effect was properly limited by an instruction.

3. In an action against a street railroad for the death of a passenger, the admission of evidence as to the speed of the car on which the accident occurred at a different time and place than the one in question was not reversible error, where it was withdrawn, and the jury were directed not to consider it, and no prejudice appeared to have resulted from its introduction.

4. A street railroad company, engaged in operating cars by electricity, must employ men of experience and competency, and its failure to do so is negligence.

5. In an action against a street railroad for the death of a passenger, who jumped from the car on seeing an apparent electrical disturbance in the forward end of the car, evidence that the conductor of the car became frightened, and jumped before deceased did, was competent to show negligence in operating the car with an incompetent conductor in charge of it.

6. In an action against a street railroad for the death of a passenger, a charge that it was the duty of defendant to transport deceased safely was not misleading, as a charge that defendant was an insurer of the safety of its passengers, in view of other portions of the same, and of other instructions in which the measure of defendant's duty was properly stated.

7. The cost of printing an unnecessary additional abstract filed by appellee and of appellant's denial of the same, and the cost of certifying the record in such case, will be taxed to appellee, although the judgment is affirmed.—(Blumenthal vs. Union Electric Co., 105 N. W. Rep., 588.)

MAINE.—Carriers—Injuries to Passenger—Care Required—Instructions — "Great Care" — Negligence—Care Required—Definitions.

1. The plaintiff was a passenger on one of the street railway cars of the defendant. There was evidence tending to show that the car, an open one, had come to a stop near the point of intersection with the tracks of a steam railroad, that it was the practice and custom of the defendant to stop there, but that the only purpose of the stop was to safeguard the crossing of said tracks; it not being a place where a stop was regularly made for passengers to get off or on the defendant's cars, although it was also in evidence that passengers did sometimes get off or on the cars while so stopping. There was likewise evidence tending to show that, while the car was stopping at said point of intersection, the plaintiff undertook to alight therefrom, but that while she was in the act of alighting, and before she had reasonable time to alight, the car was started, whereby she was thrown and injured. At the trial of this action the presiding justice, at the request of the plaintiff's counsel, gave the following instruction to the jury: "If you believe that this was the crossing of tracks, and that under the practice and custom of the company the cars stop at this crossing, and believe that people get on or off at this place while cars are stopped, then it was the duty of the conductor in charge of the car to ascertain for himself whether passengers wanted to get on or off; and if he could by great care discover who wanted to get off, whether they wanted to get off, that would be equivalent to actual knowledge on the subject."

2. This instruction imposed upon the conductor the duty of exercising "great care" to discover if any one wanted to get off the car. It is not modified by any other clause in the charge, but rather emphasized by a statement made immediately before it that "the railroad was bound to use greater than ordinary care." The law requires that the conductor should have acted only in the exercise of reasonable care. The phrase "great care," as used in the instruction, was without limitation. It was left entirely to the jury to say what meaning should be attached to it. Under it the jury may have said that it was the duty of the conductor to inquire of every passenger upon his car if they wished to alight, and that if he failed to do this, in the exercise of the duty requiring "great care," he was negligent; or, if so strenuous

a duty as to inquire of each passenger was not deemed necessary in the exercise of "great care," the jury might have found that some other burdensome duty was imposed by the instruction given.

3. The rule of law now generally recognized by the great weight of authority is that the legal measure of duty, except that made absolute by law, with respect to almost all legal relations, is better expressed by the phrases "due care," "reasonable care," or "ordinary care," terms used interchangeably. "Reasonable care" may be defined as such care as an ordinarily reasonable and prudent person exercises with respect to his own affairs, under like circumstances. In this definition it is the phrase "under like circumstances" that imposes upon the term "reasonable care" both its limitations and its elasticity. The term is a relative one. The same act under one set of circumstances might be considered due care, and under different conditions a want of due care, or negligence. Therefore the duty intended by the use of the phrase "ordinary care" is always referable to the circumstances and conditions, under which the act or omission to act is required to be performed. These limit or define the scope of the situation within which the performance of the same act may be called reasonable or unreasonable. Held, that the exceptions to the requested instruction given as aforesaid must be sustained.—(Raymond vs. Portland R. Co., 62 Atl. Rep., 602.)

MARYLAND.—Carriers—Duty Toward Passengers—Discharge of Passengers—Duration of Stop—Action—Evidence—Sufficiency—Trial—Directed Verdicts—Negligence—Question of Fact or Law—Injuries to Passengers—Contributory Negligence—Question for Jury.

1. While carriers of passengers are not insurers of absolute safety, yet they are bound to exercise the highest degree of care which is consistent with the nature of their undertaking.

2. Where a railroad stops its car to allow a passenger to alight, it is bound to stop a sufficient length of time to enable him to alight in safety, and is liable for an injury to a passenger occasioned by reason of its failure so to do.

3. In an action against a street railroad for injuries to a passenger, evidence held sufficient to show negligence on the part of the railroad in suddenly starting the car while plaintiff was alighting.

4. The court, in passing upon defendant's prayers for a directed verdict, must assume the truth of plaintiff's testimony.

5. The question of negligence is ordinarily one of fact and not of law, but the court may hold plaintiff guilty of contributory negligence when some prominent and decisive act of negligence has been committed by him, in regard to the character and effect of which no room is left for ordinary minds to differ.

6. A passenger was not guilty of contributory negligence per se in attempting to alight from a street car while it was moving very slowly and smoothly, but whether her act in so doing was negligent was a question for the jury under all the facts in the case.—(United Railways & Electric Co. of Baltimore vs. Weir, 62 Atl. Rep., 588.)

MASSACHUSETTS.—Evidence—Admissions by Servant—Competency Against Master—Witnesses—Impeachment—Conflicting Statements—Scope of Examination—Discretion of Court—Competency of Testimony—Appeal—Preservation of Error Below—Exclusion of Evidence—Necessity of Offer of Proof.

1. In an action against a street railway for injuries to a traveler on a highway, an admission by the motorman that he was at fault was incompetent against the street railway.

2. Where a witness testifies to a fact relevant to the issue, the adverse party may, for the purpose of impeachment, show that the witness has made prior or conflicting statements, either by eliciting such statements on cross-examination of the witness himself or by proving them by other witnesses.

3. To what extent a witness may be cross-examined on collateral issues to test his credibility must be left largely to the discretion of the trial court, but the rule has no application where the statements of the witness relate to the main issue on trial.

4. In an action against a street railway for injuries to a traveler on the highway, the motorman was a witness for the defendant, and on cross-examination testified that, although he had been stung on the hand, yet at the time of the accident he had one hand on the controller and the other hand on the brake. In response to a further question he denied having said that he had been stung on the hand or that at the time of the accident he was rubbing his hand.. Held, that it was competent for plaintiff to impeach the motorman by showing that he had stated that he had been stung on the hand and was rubbing his hand.

5. The fact that plaintiff failed to formally state what answer a witness was expected to make to an excluded question does not preclude him from obtaining a review of the ruling excluding the question, where, from the purport of previous questions, it was obvious what the answer of the witness was expected to be, and the court distinctly excluded the question upon the same ground as it had excluded the previous question.—(Robinson vs. Old Colony St. Ry. Co., Thompson vs. same, 76 N. E. Rep., 190.)

MASSACHUSETTS.—Trial—Requests to Charge—Time—Rules—Leave to Present—Construction of Rule—Carriers—Injuries to Passengers—Beginning of Relation.

1. Superior Court rule 48, requiring requests to charge to be submitted before argument, does not prevent the presiding justice from receiving and passing on requests subsequently presented, if he so elects, and allowing an exception to the party aggrieved by giving or refusal thereof.

2. Where the trial judge received and refused certain requests to charge, presented after argument, his act in so doing was in effect the giving of special leave to present such instructions at the time they were presented.

3. Superior Court rule 48, requiring instructions requested to be presented before argument, does not mean that leave must be obtained to present requests later, but that requests presented later cannot be entertained without leave of court.

4. Where plaintiff boarded a street car, and on the conductor's announcing that the car only went to the stables plaintiff attempted to leave the same, and was injured by the sudden starting of the car as he attempted to do so, plaintiff not having been accepted as a passenger at the time of the accident, the carrier was only bound to exercise ordinary care.—(Robertson vs. Boston & N. St. Ry. Co., 76 N. E. Rep., 513.)

MISSOURI.—Municipal Corporations—Streets—Restrictions on Control—Street Railroads—Occupation of Streets—Appliances—Liability for Injuries.

1. The legislative or municipal control over streets in the matter of authorizing the placing of obstructions therein is not absolutely unlimited, but must be exercised for the public welfare, and private structures which are inconsistent with the primary use of the streets, or structures which prevent the use of streets for travel or access to abutting property, cannot be licensed.

2. Under Rev. Stat. 1899, Sec. 1187, and Municipal Code 1901, p. 220, authorizing the city of St. Louis to license, control and regulate railroad tracks in its streets, and to direct how they shall be constructed and maintained, a switch laid by a street railway in a street pursuant to a license from the city, is, *prima facie*, a lawful occupation of the street, and the street railway is within its rights in maintaining it, and is not liable for an injury to a traveler on the street caused by his buggy wheel coming in contact therewith, provided due care has been observed to keep it in good order and to select a reasonably safe appliance, if different kinds are available, and provided further that the danger and inconvenience to the public caused by the presence of the switch, is not so great as to make it a nuisance, notwithstanding its authorization by the city.

3. The fact that a street railway switch was so constructed that it was liable to "catch and hold vehicles," does not, of itself, show that the switch was such a structure as to render the railroad liable for injuries to a traveler in a buggy, the wheels of which were caught by the switch and who was thereby thrown to the ground and injured.—Morie vs. St. Louis Transit Co., 91 S. W. Rep., 962.)

MISSOURI.—Justice of the Peace—Procedure—Complaint—Sufficiency—Carriers—Injury to Person Attempting to Board a Car—Instructions—Evidence—Damages—Personal Injury.

1. A complaint in justice's court, which alleges that plaintiff, while attempting to board a car of defendant with intent to become a passenger, was by reason of the starting of the car thrown to the ground, whereby his right shoulder was fractured, and whereby he was otherwise injured, to his damage in the sum of $500, is sufficient.

2. An instruction, in an action for injuries received while attempting to board a car, that if, while plaintiff was boarding a car, defendant's motorman started the car, so as to drag plaintiff from the platform from which defendant was accustomed to receive passengers, thereby injuring him, plaintiff was entitled to recover, required the jury to find facts constituting negligence, and the omission of the word "negligence" was not erroneous.

3. Where, in an action for injuries received while attempting to board a car, plaintiff's evidence showed that the injuries re-

sulted from the sudden starting of the car, and defendant's evidence showed that plaintiff walked off the end of the platform from which passengers were received without touching the car, instructions directing a verdict for plaintiff if the car started while he was in the act of boarding it, and authorizing a verdict for defendant if plaintiff fell from the platform before touching the car, or if he relied on a third person in boarding the car, and he was guilty of negligence directly contributing to the injury, properly submitted the case to the jury.

4. Where, in a personal injury action, there was no proof that plaintiff had paid or incurred any liability for medical expenses, and the instruction on the measure of damages did not include medical expenses as an element of damages, but only authorized the jury to assess compensation for the injury and pain, the refusal to charge that the jury should not allow any damages for medical expenses was not erroneous.—(Barr vs. St. Louis & S. K. Co., 90 S. W. Rep., 107.)

MISSOURI.—Street Railroads—Care as to Trespassers—Licenses—Care Required—Evidence—Patrol Evidence Affecting Writing—Collateral Issue.

1. A motorman running over the company's private right of way is not bound to keep a lookout for tresspassers when he has a right to assume that the track is clear.

2. Where pedestrians have for a considerable time been in the habit of walking along a street railway's private right of way, a motorman, before reaching a point where he has reasonable grounds to anticipate the presence of persons, is required to be on the alert and to keep a lookout.

3. In an action against a railroad company for injuries to one walking on the track, testimony of an officer of defendant that the right of way was a private right of way acquired by purchase was admissible, as the question was a fact collateral to the principal fact in issue.—(Levelsmeier vs. St. Louis & S. Ry. Co., 90 S. W. Rep., 104.)

MISSOURI.—Death—Action for Causing Death—New Trial—Inadequate Damages—Appeal—Discretion of Lower Court—Granting New Trial—Review.

1. Where, in an action by a wife for the death of her husband, no instructions in mitigation or aggravation of damages were requested or given, and the case admitted of no such instructions, but depended on decedent's contributory negligence, it was not error to set aside a verdict for $500 on the ground that the verdict was substantial, and that the granting of a new trial subjected defendant to a new inquisition of damages, and to danger of being mulcted in $5,000, the maximum amount recoverable under Rev. St. 1899, Sec. 2866, for the death of a person.

2. In an action by a wife for the death of her husband, the evidence showed that he supported her; that he was forty-nine years of age, in good health, and with an earning capacity of $90 a month; and that he was industrious and stood well as a citizen. Held, that a verdict of $500 was inadequate, justifying the court to award a new trial on that ground.

3. The Supreme Court will not interfere with the discretion of the trial court in granting plaintiff a new trial on a question of fact, except where he is not entitled to recover.—(McCarty vs. St. Louis Transit Co., 91 S. W. Rep., 132.)

MISSOURI.—Death—Action for—Penal Statutes—Construction—Amount of recovery—Petition—Sufficiency.

1. Rev. St. 1899, Sec. 2864, providing for the forfeit of the fixed sum of $5,000 for wrongful death occurring through the negligence of the officers, employees, etc., of a corporation, etc., as therein provided, is a penal statute and in derogation of the common law, and is to be strictly construed.

2. Rev. St. 1899, Sec. 2864, provides that when any person shall die from any injury resulting from the negligence of any officer, servant, or employee whilst managing any locomotive, car, or train of cars, etc., the corporation, or individuals in whose employ such officer, etc., shall be at the time such injury is committed, shall forfeit and pay for every person so dying the sum of $5,000, which may be sued for and recovered: First, by the husband or wife of the deceased, etc. Section 2865 provides that whenever the death of a person shall be caused by the wrongful act of another, such as would, if death had not ensued, had entitled the party injured to maintain an action and recover damages, the person who, or corporation which, would have so been liable shall be liable to an action. etc. Section 2866 provides that on a recovery for such wrongful death mentioned in the preceding section the jury may give such damages, "not exceeding $5,000 as they may deem fair and just," etc. Held, that one suing under section 2864 must demand and recover the precise amount of the penal sum therein provided, and a petition which seeks to recover a less sum states no cause of action in such section.—(Casey et al. vs. St. Louis Transit Co., 91 S. W. Rep., 419.)

MISSOURI. — Tender—Waiver—Release—Validity—False Representations—Questions for Jury—Instructions—Trial—Ignoring of Issues—Correction of Omissions.

1. Evidence that plaintiff's attorney went to the office of defendant's attorney and offered to pay him the amount paid by defendant for a release of plaintiff's claim, and that defendant's attorney stated that defendant would not accept the money and that there was no necessity of making a tender at defendant's general offices, was sufficient to show a waiver by defendant of a technical tender of the amount paid for the release.

2. A release of a cause of action obtained by defendant from plaintiff through false representations of defendant's claim agent, which induced plaintiff to sign the release, believing it to be simply a receipt and nothing more, constitutes no bar to a suit by plaintiff on the cause of action purported to be released.

3. Whether a release of a cause of action for personal injuries was obtained from plaintiff fairly, or was obtained through the false representations of defendant's claim agent that plaintiff was signing a mere receipt for money paid to her, held, under the evidence, a question for the jury.

4. On the issue of fraud in a release, a charge that if plaintiff was an ignorant woman, and within a few days after her injury defendant's claim agent called on her and induced her to accept the sum of $10 by representing that defendant could not be compelled to pay her anything, but would do so as a gratuity, and procured her to sign the release in question without understanding its contents and in the belief that it was a mere receipt, the release was invalid, was not erroneous.

5. In an action against a street railway for injuries to a passenger, where a general denial and a release were pleaded in defense, a charge given at plaintiff's request authorizing a recovery on the establishment of defendant's negligence and plaintiff's freedom from contributory negligence, without reference to the question of release pleaded, was erroneous.

6. Instructions given for defendant which covered fully the question of release executed by plaintiff cured error in the omission of a charge for plaintiff to refer to the question of the release in stating the conditions of plaintiff's right to recover.—(Austin vs. St. Louis Transit Co., 91 S. W. Rep., 450.)

MISSOURI.—Malicious Prosecution—Arrest of Passenger—Termination of Presecution—Carriers—Ejection of Passenger—Disorderly Conduct.

1. Plaintiff's petition was in three counts; the first for willful and unlawful ejection from one of defendant's street cars, the second for false imprisonment, and the third for malicious prosecution. The evidence showed that an altercation took place between defendant's conductor and plaintiff in regard to the payment of fare by plaintiff; that the conductor called a police officer and told him that plaintiff refused to pay his fare, but the officer refused to put plaintiff off unless the conductor would prefer a criminal charge. The conductor then preferred a charge of disturbing the peace, and plaintiff was conducted to a police station and locked up. Held, that if plaintiff was guilty of disturbing the peace, then his arrest on the car and commitment to jail were lawful, and he was not entitled to recover without showing that he had been tried and acquitted of the criminal charge, or that it had been dismissed.

2. Although a passenger on a street car has paid his fare, he cannot recover for ejection and arrest at the instance of the conductor, if he was guilty of the offense of disturbing the peace.—(Leonard vs. St .Louis Transit Co., 91 S. W. Rep., 452.)

MISSOURI.—Jury—Competency of Jurors—Bias or Prejudice—Question for Court—Appeal—Questions Reviewable—Discretionary Action—Rulings on Challenges to Jurors—Presumption of Error—Prejudice—Street Railroads—Operation—Negligence—Rate of Speed—Duty to Sound Gong—Contributory Negligence—Negligence of Motorman—Failure to Keep Lookout—Proximate Cause.

1. The question of the qualification of a juror, as against a challenge for prejudice, should be decided by the court on the facts stated by the juror with reference to his state of mind, and should not be allowed to depend upon the conclusions of the juror himself as to whether or not he could or would divest himself of an admitted prejudice existing against either of the parties, or against the character of the subject matter in litigation, or against a party as a class and not against him as an individual.

2. The discretion of the trial court in overruling a challenge to a juror is subject to appellate review where the facts are practically undisputed.

3. Under Rev. Stat. 1899, Secs. 3783, 3785, which provide for peremptory challenges and challenges for cause, respectively, the Supreme Court, in reviewing the action of the trial court in overruling a challenge for cause, will not consider whether or not appellant had exhausted his peremptory challenges, but will presume that the action of the court, if erroneous, was prejudicial, without regard to the state of the peremptory challenges.

4. In an action against a street railway for injuries, jurors, one of whom had some years before the trial been thrown off a car and had since that time entertained a prejudice against street railways in general which would influence him in the trial, and the other of whom had a prejudice against defendant which he did not think would influence his verdict, but which "would probably unconsciously bias his opinion," were disqualified for prejudice, although the former stated during his voir dire that he would be governed by the testimony and instructions, and believed that he could render an impartial verdict, that he had nothing against defendant, that he could try the case impartially, and that his prejudice had "just" been removed.

5. A rate of speed of from 8 to 15 miles an hour is not of itself a dangerous speed for a street car to maintain, and, in the absence of further evidence on the subject, it is not negligence for a street car to run at the rate of speed in an outlying district of a city over an unimproved street.

6. A street railway is not bound to sound a gong at a point where there is no intersecting street, in the absence of knowledge that any one is on the street at that point.

7. Persons passing over a street and driving on street car tracks are bound to know that street cars are constantly passing over the tracks, and to take proper precautions to get off the tracks in time to avoid a collision.

8. A street railway was not rendered liable for the death of a teamster driving on its tracks, caused by a collision of the car with his wagon, by the fact that the motorman in charge of the car momentarily ceased to keep a lookout, where the collision occurred on a dark night, and there was nothing to show that, if the motorman had been constantly looking ahead, he would have been able to discover the presence of the wagon any sooner than he did, or in time to avert the collision, and as soon as he did discover the same he immediately applied the brakes and reversed the power.—(Theobald vs. St. Louis Transit Co., 90 S. W. Rep., 354.)

MISSOURI.—Carriers—Injury to Passenger—Negligence—Evidence — Contributory Negligence — Appeal — Instructions—Harmless Error—Evidence—Verdict—Manner of Arriving at Verdict.

1. Evidence, in an action against a street car company for injuries received by a passenger while boarding a car, in consequence of the premature starting of the car. Held, sufficient to justify a finding that the company was guilty of actionable negligence.

2. For one to board a moving street car is not necessarily such negligence as will bar a recovery for an injury caused by the acceleration of the speed of the car while he was in the act of boarding it, but whether there is negligence depends on the circumstances.

3. The error, if any, in an instruction in an action against a street car company for injuries received by a passenger in consequence of the starting of the car, that plaintiff could not recover if he attempted to board the car while moving, was not prejudicial to defendant.

4. In an action against a street car company for injuries received by a passenger while attempting to board a car, plaintiff testified that he was thrown 10 ft. by the movement of the car on it starting while he was boarding it. The conductor testified that plaintiff was dragged along some distance and thrown to the ground. Other witnesses showed that he was not thrown 10 ft. Held, that the verdict for plaintiff would not be reversed, because his testimony was contradicted by physical facts based on the improbability that a car could start from a motionless state with such violence as to throw a person in the act of stepping on it 10 ft. away.

5. Where, in an action for personal injuries, the testimony does not show beyond dispute any fact rendering it impossible, according to the laws of nature, for the accident to have occurred from defendant's negligence, unless the injured person was also negligent, an instruction requiring the jury to determine the issues and to weigh the testimony of the witnesses according to the probability thereof is sufficient, without a charge that the finding must be in accordance with the physical facts.—(Schmitt vs. St. Louis Transit Co., 90 S. W. Rep., 421.)

NEBRASKA. — Carriers — Injury to Passengers — Tort of Stranger.

1. In order to render a street railway company liable for injuries received by a person traveling upon one of its cars, the negligence of its servants, either alone or in concurrence with the negligence or wrongful act of other persons, must be the proximate cause of the injuries.

2. The wrongful act of a stranger is not sufficient to make it liable, unless it might reasonably have been foreseen and guarded against by the carrier.—(Bevard vs. Lincoln Traction Co., 105 N. W. Rep., 635.)

NEBRASKA. — Carriers — Injury to Passenger — Burden of Proof—Negligence—Presumptions—Evidence—Duty as to Passengers—Witness—Impeachment.

1. In an action against a street railway company for damages for injuries sustained by one of its passengers, the burden of proof on the question of negligence does not shift to the defendant upon proof that the injuries resulted from a derailment of the car.

2. In such case a presumption of negligence arises from the fact of derailment; but, when that presumption is met by evidence which makes it equally probable that the accident was not due to negligence on the part of the defendant, in the absence of other evidence tending to establish the affirmative of the issue, the defendant is entitled to a verdict.

3. A street railway company is not an insurer of its passengers. It is not bound to do everything that can be done to insure their safety. It fulfills its obligations in that regard when it exercises the utmost skill, diligence, and foresight consistent with the practical conduct of the business in which it is engaged.

4. On a subsequent trial the evidence of a deceased witness, taken at a second trial, cannot be impeached by showing that some of his statements on the witness stand at the first trial are inconsistent therewith, where, upon the second trial, his attention was not directed to such statements, and he was given no opportunity to explain the alleged discrepancies.—(Omaha St. Ry. Co. vs. Roesen, 105 N. W. Rep., 303.)

NEW HAMPSHIRE.—Appeal—Review—Presumptions—Negligence — Contributory Negligence Injuries — Last Clear Chance—Street Railroads—Persons in Street—Injuries—Proximate cause—Instructions.

1. Where, in an action for injuries, the jury were not directed to pass on certain evidence, it would be presumed on appeal that such evidence was true, and would have established in the hands of the jury everything it tended to prove.

2. If a person is injured, in part by the negligence of another and in part by the insufficiency of the driver, horse, or carriage by which the person injured was being conveyed, which insufficiency was due to his own want of care in selecting them, no recovery could be had, not because the driver's negligence, or the defect in the horse, harness, or carriage, was imputable to the person injured, but because his own fault in selecting them was the proximate cause of the injury.

3. Where, in spite of plaintiff's negligence in selecting an incompetent driver, defendant street car company by the exercise of care could have prevented injury to plaintiff in the position he occupied in the care of such driver, defendant's failure to do so constituted the sole cause of the injury, for which plaintiff was entitled to recover, notwithstanding his prior negligence in selecting such driver, or the driver's negligence at the time of the accident.

4. Plaintiff was injured in a collision with a street car while he was being driven in a carriage by a driver claimed to have been negligent and intoxicated. There was evidence that, notwithstanding the driver's negligence and condition, the accident could have been prevented by defendant's motorman by the exercise of ordinary care, but the court charged that plaintiff's previous negligence in riding with such driver, or his misconduct in getting drunk, were not matters which would excuse defendant, if at the time of the accident plaintiff was doing all that prudence required of a person in his situation, and that in law plaintiff's prior negligence merely furnished an occasion for defendant to negligently injure him, and that its fault would be the legal cause of the accident, and the fact that the driver was drunk and was grossly negligent would be no defense; the question being, could plaintiff, at the time of the accident, have avoided the effect of the driver's fault by the use of ordinary care? Held, that such instruction was objectionable, as tending to mislead the jury in determining whether the insufficiency or negligence of the driver or defendant's failure to prevent the accident was the proximate

cause thereof.—(Hanson vs. Manchester St. Ry., 62 Atl. Rep., 595.)

NEW YORK.—Trial—Instructions—Pleading and Evidence to Sustain—Carriers—Injury to Passenger—Variance.

1. In an action for injury to a street car passenger, a charge that the mere fact of a car moving does not militate against the plaintiff, that it is a question for the jury whether there was negligence on the part of defendant, and that, if the plaintiff could reach the car and the car was slowly moving, the law leaves it for the jury to say whether the plaintiff was guilty of negligence in attempting to board the car at the time, was erroneous, under the allegation of the complaint that the car had come to a standstill and plaintiff's testimony that it might have been moving "a little bit; a child could have got on it though."

2. Where plaintiff alleged in his complaint that the car came to a standstill for the purpose of allowing him to board it, he could not recover on proof that the car was moving, no matter how slightly, when he attempted to board it.—(Wainwright vs. Interurban St. Ry. Co., 96 N. Y. Sup., 114.)

NEW YORK. — Carriers—Injuries to Passengers — "Sudden Jerk"—Res Ipsa Loquitur—Proof of Negligence.

1. Plaintiff, a passenger on an elevated railroad, testified that on arriving at a station she got up and was just going out of the car, when it gave such an extraordinary jerk that she was forced forward, causing her to fall and be injured. Held, that plaintiff's injury was not due to defective means or appliances employed in operating the train, and that the doctrine of "res ipsa loquitur" did not apply.

2. Where an action for injuries to a passenger was based on the fact that the car gave an extraordinary jerk or jolt, which forced her forward and knocked her down, and no error on the part of defendant's servants in operating the train was pointed out, it did not appear that the jerk was not incidental to the stoppage of the train in the usual and customary method of operation.—(Flynn vs. Interborough Rapid Transit Co., 96 N. Y. Sup., 259.)

NEW YORK.—Carriers—Injuries to Passengers—Street Railroads—Contributory Negligence—Question for Jury.

In an action for injuries to a passenger while standing in the aisle of a crowded street car, evidence held to require submission to the jury of the issue of plaintiff's contributory negligence in failing to have hold of a strap at the time he was injured.—(Butler vs. New York City Ry. Co., 96 N. Y. Sup., 254.)

NEW YORK.—Carriers—Injury to Passenger—Collision of Street Car with Wagon—Negligence.

In an action for injury to a passenger in a street car from collision with a heavily loaded wagon, which, after meeting the car and passing the front of it, 2 ft. to 4 ft. from it, struck a curve and slewed into the car, the motorman, who had the car under such control that it was stopped within a foot after the collision, cannot be held to have been negligent; the circumstances not indicating an apparent danger requiring him to stop and wait for the wagon to pass.—(Freeland vs. Brooklyn Heights R. Co., 96 N. Y. Sup., 251.

NEW YORK.—Carriers—Transfers—Ejection of Passenger—Action for Assault.

1. The reasonableness of a provision in a transfer ticket that it is good only at intersection of issuing line is a question of law.

2. In an action against a carrier for an assault committed by defendant's conductor in ejecting plaintiff from a car on her refusal to pay fare, when informed by the conductor that the transfer ticket presented by plaintiff was void under the provision therein that it was good only at intersection of issuing line, it was reversible error to submit to the jury the question of substantial violation of the rule, where there was no dispute as to the fact that plaintiff boarded the car at a point substantially distant from the intersection, notwithstanding testimony of the plaintiff that she first waited at the intersection between five and ten minutes for a car, that none came, that she was just convalescent, that the day was windy and chilly, and that she walked away on the street of intersection and boarded the car at the distance of a block therefrom.—(Hanley vs. Brooklyn Heights R. Co., 96 N. Y. Sup., 249.)

RHODE ISLAND.—Carriers—Street Railroads—Injury to Passenger—Evidence—Stopping Places—Custom—Actions—Instructions.

1. Where, in an action for injuries to a passenger while attempting to alight from a street car, defendant introduced a plan showing the street where the accident occurred, with its intersecting streets, track, location of "white poles," and various distances between "white poles," it was error for the court to exclude a question as to whether the defendant had any established stopping places on that street, for the purpose of explaining the meaning of the "white poles" already shown to exist.

2. Where, in an action for injuries to a passenger while attempting to alight from a street car, the testimony as to the cause of the accident was conflicting, evidence that defendant had established stopping places at the time of the accident, and the relations of such fact to defendant's rules as to the stopping and starting of cars for passengers to alight, was admissible.

3. In an action for injuries to a passenger while alighting from a street car, by an alleged premature start, it was error for the court to refuse to charge that, if the car came to a full stop, and before plaintiff's wife had fully alighted therefrom it was started on a signal to start, given by some person not authorized to give the same, and the accident could not have been prevented after the giving of such unauthorized signal by the exercise of due care on the part of the conductor or motorman in charge of the car, plaintiff could not recover.—(Moore vs. Woonsocket St. R. Co., 63 Atl. Rep., 313.)

RHODE ISLAND.—Appeal—Verdict—Sufficiency of Evidence—Damages—Personal Injuries—Fractured Kneecap—Parent and Child—Earnings of Infant—Loss of Services—Damages—New Trial—Excessive Damages—Disregard of Instructions.

1. Where plaintiff's evidence, if believed, is sufficient to support the verdict, it cannot be interfered with on appeal.

2. Twelve hundred dollars is not excessive damages for a fractured kneecap.

3. A father is presumptively entitled to the earnings of an infant son.

4. In an action by a father for injuries to his child, the measure of damages is the son's full earning capacity, and not merely the "net result" of his earnings.

5. In an action by a father for injuries to his son, the fact that the verdict for $400 was $1.50 in excess of the damage proven did not require the granting of a new trial on the ground of excessiveness of the verdict.

6. The fact that in estimating damages the jury disregarded an erroneous instruction is not ground for a new trial, the verdict being justified by the evidence.—(Galligan vs. Woonsocket St. Ry. Co. (two cases), 62 Atl. Rep., 376.)

RHODE ISLAND.—Carriers—Injury to Passenger—Contributory Negligence—Question for Jury—Obligation of Company—Assumption of Risk—Evidence — Opinions — Competency of Witness.

1. It is not negligence per se for a passenger on a street car to stand on the running board, and hold the post or handle affixed thereto, where the car is so filled that there is no room inside.

2. A street railway company, accepting a passenger obliged to stand on the running board of the car because he cannot be accommodated inside the car, must do all that human vigilance reasonably can to prevent injury to him.

3. Where, in an action for the death of a street car passenger occasioned by his being thrown from the car, the evidence showed that decedent was obliged to stand on the running board of the car because of its crowded condition, and that he held onto the post with both hands, and that previous to the accident the car swayed violently, the question of the negligence of the company in operating the car was for the jury.

4. A passenger on a street car, who stands on the running board of the car, assumes only the risk of the ordinary motion of the car.

5. A witness who does not know the ordinary rate of speed of a street car on a particular route is not competent to testify that a car on a particular occasion on that route was run at an extraordinary rate of speed.—(Verrone vs. Rhode Island Suburban Ry. Co., 62 Atl. Rep., 512.)

RHODE ISLAND.—Carriers—Injuries to Passenger—Negligence—Burden of Proof—Evidence—Mortuary Tables.

1. In an action for injuries to a passenger, evidence of a collision between two cars controlled by the carrier cast on it the burden of explaining the implication of negligence arising therefrom.

2. Where, in an action for personal injuries, evidence to prove the permanent disability of plaintiff was admitted without objection, though not pleaded, the admission of Carlisle life tables was not error, such tables being admissible where permanent injury is averred and proved.—(O'Clair vs. Rhode Island Co., 63 Atl. Rep., 238.)

TEXAS.—Carriers—Action for Injuries—Burden of Proof—Trial—Question for Jury—Appeal—Review—Verdict—Sufficiency of Evidence.

1. In an action by a passenger for injuries he must make out his case by a preponderance of the evidence.

2. It is the province of the jury to weigh the evidence and determine the preponderance.

3. An appellate court cannot disturb a verdict, unless the evidence is such that no reasonable mind can form from it the conclusion reached by the jury.

4. In an action for injuries to a passenger, evidence held sufficient to show that plaintiff was not injured while a passenger on defendant's road.—(Domenico vs. El Paso Electric Ry. Co., 90 S. W. Rep., 60.)

TEXAS. — Carriers — Personal Injuries — Contributory Negligence — Negligence — Proof Required — Damages — Instructions—Method of Estimating.

1. A boy, riding on the running-board of a street car, putting one foot on the ground, and jerking it up again for amusement, was guilty of contributory negligence, if of sufficient discretion to understand the danger.

2. In an action for personal injuries, contributory negligence need be proven only by a preponderance of the evidence, and not "by a preponderence of the evidenc to the satisfaction of the jury."

3. In a suit by a parent for injuries to an infant, an instruction that the value of the boy's services during minority was to be ascertained by the jury from their common sense, sound discretion, and the evidence, was not erroneous.—(El Paso Electric Ry. Co. vs. Kitt, 90 S. W. Rep., 678.)

TEXAS.—Damages—Personal Injuries—Instructions.

Where, in an action for injuries to plaintiff's wife, the court charged that recovery could be had only for expenses for medical services and medicines theretofore insurred, and there was no evidence before the jury of a greater amount for such expenses than that claimed in the petition, the refusal to caution the jury not to go beyond the amount so claimed, and consider future expenses, was not error.—(San Antonio Traction Co. vs. Menk, 88 S. W. Rep., 290.)

TEXAS.—Appeal—Presumptions—Propriety of Instructions—Negligence—Contributory Negligence—Burden of Proof—Trial—Instructions—Necessity of Request—Street Railroads—Injuries to Persons on Tracks—Discovered Peril—Duty of Motorman.

1. In an action for injuries, a charge that, "in view of the argument of plaintiff by his counsel, you are charged" that, unless plaintiff was injured through defendant's negligence, it will be the duty of the jury to return a verdict for defendant, though it may believe a verdict for plaintiff would brighten his life and make him happier, will be presumed on appeal, in the absence of a showing as to what the argument was, to have been inspired and warranted by the argument.

2. In an action for injuries, plaintiff has the burden of establishing by a preponderance of evidence all facts necessary to his recovery; and, until he has made a prima facie case by producing evidence sufficient to establish such facts, it is not incumbent on defendant to prove plaintiff's contributory negligence.

3. An omission to charge on certain issues raised by the pleadings and evidence is not ground for reversal, in the absence of any request to charge upon such issues.

4. A motorman who discovers the peril of a person on the tracks is bound to use only ordinary care to use all the means at hand to avoid injuring the person in peril.—(Beaty vs. El Paso Electric Ry. Co., 91 S. W. Rep., 365.)

TEXAS.—Evidence—Opinion Evidence—Admissibility.

In an action against a street railroad for injuries to a child ten years of age, it is competent to prove plaintiff's age and all other facts necessary to enable the jury to decide the question of her contributory negligence, and persons, who are acquainted with her, may testify that she is intelligent or the reverse; but after such facts have been narrated, the inferences and conclusions to be drawn therefrom are for the jury, and it is not competent for witnesses, whether experts or non-experts, to testify to their opinion that plaintiff is not of sufficient intelligence to appreciate the danger of going on a street car track without looking and listening for a car and has not the circumspection to avoid danger which an adult person would have.—(Citizens' Ry. Co. vs. Robertson, 91 S. W. Rep., 609.)

VIRGINIA.—Electricity—Injury from Live Wire—Presumption of Negligence—Rebuttal of Presumption—Evidence—Sufficiency—Proximate Cause—Harmless Error—Expert Testimony—Instructions—Damages.

1. Electric companies are not insurers against accidents, but they are held in a high degree of care in the construction and maintenance of their dangerous appliances.

2. The fact that a child was injured by picking up a live electric wire which had fallen to the sidewalk, created a presumption of negligence on the part of the corporation owning and maintaining the wire.

3. In an action for injuries sustained by a child picking up a live electric wire that had fallen to the sidewalk, the testimony of a lineman that he looked over the wire every day, and that between 6 and 7 o'clock in the morning of the day of the accident he had looked over the wire in question, and had found it all right, was not sufficient to remove the presumption of negligence on the part of the corporation owning and maintaining the wire.

4. The presumption of negligence which arises from an injury to a pedestrian in a public street from a broken electric wire is not overcome by testimony of employees of the one owning and maintaining the wire that the wire was properly constructed and put up.

5. Through a question asked a witness and his answer thereto are improper, if the propounder's case has been completely made out otherwise, the error is harmless.

6. Though exception to the testimony of a witness is well taken, if the same fact is proved by other witnesses without objection, the error is harmless.

7. In an action for injuries to a child caused by his having picked up a live electric wire that had fallen to the sidewalk, a witness testified that two women were struck in the face by the wire, but not injured, and that the child grasped it at a point where it was not insulated, and that he thought he (the witness) took hold of it at a place where it was insulated without being hurt. Held, that such evidence did not show that a lack of insulation, and not the falling of the wire, was the proximate cause of the injury.

8. In an action for personal injuries, it was proper to permit the physician who attended plaintiff to testify as to the probable future effects of the injuries.

9. In an action for personal injuries, the jury may consider, in addition to the expense and pain and loss already incurred and suffered, such as will reasonably and probably result as a consequence.

10. On appeal in an action for personal injuries suffered by a child, the question whether there was error in permitting his mother to testify that she had spent $7 for medicines was precluded by the maxim, "De minimis non curat lex."

11. Where no exception was taken to certain testimony when the question was asked the witness, and no bill of exceptions subsequently asked for, and there was no mention of such an assignment of error in the petition to the Supreme Court for a writ of error, the admissibility of the testimony could not be considered on appeal.

12. The verdict of the jury in an action for personal injuries could not be disturbed on appeal where there was nothing to show that the jury were actuated by prejudice or partiality.—(Norfolk Ry. & Light Co. vs. Spratley, 49 S. E. Rep., 502.)

WASHINGTON.—Carriers—Injury to Passengers—Evidence—Negligence—Presumptions—Evidence—Question for Jury.

1. An accident resulting in injury to a passenger on a street car was caused by the blowing out of the controller on the car. The company had control over the equipment and operation of the car, and the passenger was not charged with contributory negligence. Held, the company was presumptively guilty of actionable negligence, it being presumed that the acident was caused by a defect in the controller.

2. A passenger on a street car, who, on being placed in danger in consequence of the blowing out of the controller on the car, jumped from the car with a view of saving himself and was injured, was not deprived of the right to insist that proof of the accident presumptively showed actionable negligence on the company's part.

3. In an action against a street railway company for injuries to a passenger by reason of the blowing out of the controller on the car, witnesses for the company testified that they did not know what the cause of the accident was, and that sometimes a blowing out would occur and the cause could not be ascertained. Plaintiff showed different causes for the explosion which might have been controlled and remedied by the company. Held, that the question whether the company rebutted the presumption of negligence arising from the occurrence of the accident was for the jury.—(Firebaugh vs. Seattle Electric Co., 82 Pacific Rep., 995.)

LONDON LETTER

(*From Our Regular Correspondent.*)

The Houses of Parliament are at present full of electrical affairs, and the London County Council is at present one of the chief promoters of electrical enterprise. Dealing first with its regular tramway work, the Council recently secured a victory as regards its bill for the construction of tramways along the Victoria Embankment and over Westminster Bridge and also over Blackfriars Bridge. The committee of the House of Commons has given its decision on these points favorably and the bill has now been ordered for third reading. It is not expected that the House of Lords will offer such strenuous opposition to the bill as in past years, especially as the Corporation of London has agreed with it. Pending the widening of Blackfriars Bridge, the tramways on the embankment would have to stop at a point opposite John Carpenter Street, and the committee has also insisted that the roadway at Westminster Bridge would have to be widened by taking 2 ft. away from each of the two footways. Clauses giving authority to the Metropolitan Police to control the traffic over these bridges on state occasions have also been inserted, and the period of construction has been reduced from seven years to five years. The bill, however, for the construction of a tramway from Cricklewood to Marble Arch by way of Edgware Road, which was a joint bill with the Middlesex County Council, has not been successful, the committee not having found the preamble of this bill proved. The Embankment and Bridges bill has, of course, met with the most strenuous opposition, the chief among the opposition being the bus owners and motor bus owners, who have balked the bill for so many years. It is a bill, however, which is bound to succeed in time, as it is one in favor of the general public, and there is a better chance now than heretofore with the strong Liberal Government now in office. It was brought out in committee that the tram lines on Westminster Bridge would not be placed in the middle of the bridge, but would keep to the side, and also that the lines on the embankment would be on the water side. In this way they would interfere with carriage and 'bus traffic as little as possible. When the work is done, the new subway line will be continued from the Strand to the western steps at Waterloo Bridge, emerging on the surface at that point. Mr. Fitzmaurice, chief engineer to the London County Council, also brought out the interesting information that the embankment was amply strong enough to sustain the weight of the tramways, and that although the embankment near Blackfriars Bridge especially had been some time in settling, the popular view that the embankment was founded on mud was a delusion. Another important decision laid down by the committee was that the Council would not have power to lay down tramway rails on the surface of the streets during the reconstruction of tramways for electric service. In the meantime, the work of the extensions already granted is being vigorously pushed. The Greenwich central station will soon be ready for work. Two new sub-stations are in course of construction at Battersea and Wandsworth, and there will be three new sub-stations at Limehouse, Mildmay and Shoreditch, while some of the older existing sub-stations will be discontinued as soon as the Greenwich central station is put in service. The new line from the corner of Victoria Street and Bridge Street near Victoria Railway Station is practically completed, and one of the interesting features of this section is that the lines are continued across the new Vauxhall Bridge, and while this has not yet been opened for service, trials of electric tramway cars across this bridge have already been made.

Important as this work is, much greater interest is being aroused at present by the bill which the London County Council has in Parliament to supply electricity in bulk for practically all purposes in the area of the county of London, and a committee is now sitting on that question and taking expert testimony from various sources. This bill is much in the same line as the bill brought forward last year by the Administrative and County Syndicate, which was thrown out at the last moment. J. H. Rider, electrical engineer to the London County Council, has been perhaps the most important witness, and he has been subjected to a most severe cross-examination, although he appeared to enjoy the hackling, and was never put out by any of the searching questions of the opposition. Mr. Ryder stated that the voltage would be 6000, which would give good, economical distribution, although to the far eastern sections of the area step-up transformers would be used. He felt not the slightest nervousness in placing high-tension mains underground in London, as the risk of breakdowns was practically nil. The Blackwall tunnel under the river would also be used for carrying cables. He stated that he considered the London County Council proposition to have its power houses on the Thames more practicable than if the electricity were generated some distance from London at the mouth of the coal pits, as such a scheme would necessitate overhead transmission, which would be a source of danger. Robert Hammond also gave a vast amount of testimony as to the capital expenditure, maximum load, plant, capacity, etc., of practically all of the companies at present serving London. He gave also all the prices charged by the various local authorities, and found that they ranged from less than 2½d. per unit in Stepney and Poplar to just over 5d. in Ealing, while the average price charged by companies averaged from a fraction over 2½ in Bermondsey to a fraction over 7d. in Chiselhurst. Previous to this, T. McKinnon Wood, M. P. and chairman of the Parliamentary committee, gave valuable evidence as to the extent of the scheme which the Council had in mind, the expenditure being something like £355,000 in 1907, £545,000 in 1908, and £449,000 in 1909. This bill has, of course, been vigorously opposed by the existing electric lighting companies, and by the local authorities already furnishing current within the London area. Certain compromises will undoubtedly be made, and it is thought that with the present government, the London County Council has a very fair chance of getting its bill passed.

The Hastings & District Electric Tramways Company has during the past month started a service of electric cars between Bexhill and St. Leonards-on-Sea, a distance of about 3 miles, and this route has already become very popular. The fight as to the equipment of the Hastings front has now been settled, the Town Council having consented to the laying down of a tramway on the Dolter surface contact system. This is extremely satisfactory, as experience elsewhere has proved that the conduit system on the front would not have been so satisfactory, and as up to the present time the Town Council has thoroughly opposed overhead construction on the front, the surface contact system is undoubtedly the best solution of the difficulty for the present. This ought to be a valuable franchise to the company, and will, so far as the writer can think of for the moment, be one of the very first electric tramways to be permitted to run along the front of any of England's fashionable watering places.

The London United Tramways Company is vigorously completing some of its various extensions, and the line between Malden and Kingston and the line from Kingston by way of Richmond Road to the Kingston entrance of Richmond Park are now practically completed. The extension from New Malden to Raynes Park by way of Wimbledon is also almost completed, and will be open for service in the near future. The company is also seeking Parliamentary powers this year for various other additions and extensions to its system, which from all appearances will have a successful issue.

In connection with the electrification of the railway between Victoria Station and London Bridge Station, and the London, Brighton & South Coast Railway, about which so much has been written, owing to the fact that it will be equipped by single-phase, high-tension system, it is interesting to note that the London Electric Supply Corporation has been awarded a contract to supply the London, Brighton & South Coast Railway with current for the new electric trains for the next seven years. In a recent interview with Philip Dawson, the consulting electrical engineer of this railway, the writer was informed that the work of the overhead catenary construction would be commenced within a couple of months, and that the construction of the first electric trains was well in hand. It is expected that in about nine months to a year this first section of the railway will be in operation. The sooner it gets in operation the better it will be for everyone, and there is little doubt that many electrical schemes of this nature for main line equipment are being held up until some definite results are seen from this most interesting piece of work.

The Lancashire & Yorkshire Railway Company, however, is evidently not inclined to wait for results of any other railway, and has decided to make considerable extension to its already existing electrical line from Liverpool to Southport, using the same system which is at present in service, and which, it will be remembered, was installed by Dick, Kerr & Company, of London. The results from the electrification of this branch of the Lancashire & Yorkshire Railway have been marvelously good, and, for this class of traffic, the Lancashire & Yorkshire Railway is evidently well convinced that electric trains are the most suitable.

So successful has the Falkirk Tramway been that the Falkirk District Tramways Company is promoting a bill in Parliament this year for considerable extensions, one of these being about

2 miles to Laurieston and the other between 3 miles and 4 miles to Grangemouth, situated on the River Forth. The whole district around Falkirk is a busy one, and no doubt the extensions of these tramways will be extremely popular. Laurieston has a population of about 3500, and at present has only indifferent transportation by brakes and buses. There is a railroad from Falkirk to Grangemouth, but there are no intervening stations, and the district will undoubtedly be better served by a tramway. The extension will cost about £57,000, and the Parliamentary committee has passed the preamble of the bill.

The Ardrossan, Saltcoats & District Tramways Company has also a bill in Parliament, which is for the construction of a tramway from Portincross to Noble's dynamite factory at Ardeer. The total length is 11½ miles, with a pier at Portincross, and the character of the country through which the tramway will run is very varied. Ardrossan and Saltcoats are, of course, large towns, and Stevenston is also an important industrial center. The scheme is naturally being opposed by the local railways, but a service of tramways in this district would undoubtedly be useful.

It would almost appear that a letter relating to British transportation matters, especially in London, would be incomplete without a reference to the motor-bus mania, which seems to have struck its roots deeply into the metropolis. There are now something like 400 motor omnibuses plying in the streets of London, and the noise and smell is beginning to be annoying. Motor buses have undoubtedly achieved a big success, but whether it is to be continued or not, remains to be seen. Electric cars will undoubtedly continue as before, and with their cheap fares and smooth running are undoubtedly in a firmly entrenched position. The horse omnibus in London is practically doomed, and these are being replaced practically every day just as fast as motor buses can be secured, both by new companies operating motor buses alone, and old horse omnibus companies, which are replacing the horse omnibus by motor omnibus. New companies are also being floated, and we ought, perhaps, to refer particularly to the one which was recently placed before the public under the name of the London Electrobus Company. It is quite evident that a large number of the public, attracted by the success of the motor-bus companies, applied for shares of this concern, but various technical journals and the daily press immediately afterward began to attack the company in most severe fashion, so that a large portion of the subscribers have canceled their subscriptions, and the money, the writer understands, is to be returned to them, when a legal mode of doing so is arrived at, thus avoiding many threatened lawsuits. It is not to be wondered at that the position of the company was attacked, as, so far as can be gathered, there is little new in the system which this company intended to use, the system being simply a storage battery bus with suitable electric motor, etc. As anyone knows who is the least bit versed in electric traction matters, the history of the storage battery has been one of constant failure in electric traction, so it is not to be wondered at that soon after the issue the papers attacked the venture.

A much more interesting case, however, is that of the Gearless Motor Omnibus Company, which has not yet been floated, but which will go to the public in a few days. The system of propulsion to be adopted in this case is that known as the auto mixte, which is the name given to the arrangement of gasoline-electric combination, with storage battery auxiliary. This particular company has extremely good backing, E. Manville and Philip Dawson, the well-known consulting electrical engineers, both being directors. It will be an interesting system, and we hope in a later issue to give a description of it.

A month or so ago, we published an illustrated description of the Romapac system of patent renewable tram rails, with views of the special engine and apparatus for laying these rails and removing the worn out top when necessary. At that time only a very small portion of this system had been placed in Leeds, and we now have pleasure in reporting that the Leeds Corporation has placed with this company, the Romapac Tramway Construction Company, Ltd., an order for replacing a considerable portion of its wornout track, and has decided that a length of not less than 1 mile shall be laid as soon as possible. This decision has undoubtedly been arrived at in consequence of the satisfactory working of the short length referred to which was laid at Headingley last year. It will be remembered that this system consists in laying a special T-rail in the ordinary way, to the top of which is attached a tread rail by means of a special flanging machine. The system undoubtedly possesses many merits, and the experiment in Leeds will undoubtedly lead to further business for the company from other corporations.

The Dudley Town Council has reported that the arbitrator has decided that the Council can acquire the electric tramways in the borough for upwards of £71,000, and as negotiations are taking place for acquiring the Netherton Tramways for £16,000, the Board of Trade will be asked to sanction the obtaining of a loan for £90,000, to complete the purchase and payment expenses.

The Leyton District Council has been endeavoring to obtain from the conservators of Epping Forest permission to widen Whipp's Crossroad and Lea Bridge Road by the acquisition of a portion of forest land for the purpose of the new electric tramways, the construction of the permanent way of which is now proceeding, or to use the forest land on which to place the poles and switch pillars for the overhead wires. From the beginning the conservators have been decidedly averse to encroaching on forest land, but in a letter which has been received from the solicitor to the City of London Corporation the alternative concession has been granted on condition that the Leyton Council pay the nominal rental of £1 annually for every pillar erected on the forest land. The Leyton Council has decided to accept this condition, and at the annual meeting several members expressed their pleasure at the way in which the Epping Forest conservators had considered the district's request.

Progress still continues to be made along the East Coast of Fife Tramway route. From the terminus at Carberry, Leven, to Muiredge Colliery the line has now been completed, and the section from Muiredge to the coal town of Wemyss will probably be finished very soon. From Coaltown to a point well on to the West Lodge the field rails have been laid, and work is being pressed forward also with the construction of the lines on the turnpike. The work of fitting up the engines at the power station at Denbeath is being pushed forward with all possible haste, and the car shed at Aberhill is practically finished.

The promoters of the scheme for the construction of a tramroad between Southport and Lytham—one feature of which is the erection of a conveyor bridge over the estuary of the Ribble—have recently been before a committee of the House of Lords with a proposal for an extension of time for the completion of the works, the necessary capital not having so far been raised. It was agreed that the building of the embankment in the neighborhood of Southport, apart from the tramway, should be completed by December, 1907, and the tramway by July 31, 1908. This gives one year's extension to the company for so much of the tramway as is on the land of the Corporation. The rest of the works is to be completed by 1910.

The Mansfield Council has informed the Board of Trade that it strenuously objects to the proposal of the Mansfield & District Light Railway Company to utilize its lines for goods traffic between the hours of 8 p. m. and 8 a. m., and to use electric locomotives with trailers, each capable of carrying 10 tons. The idea of the company is to convey coal from neighboring collieries to the town, and it is held that the traffic would constitute a danger to the public and a nuisance to people living alongside the line by preventing them from sleeping.

On May 31 the Corporation of Croydon will take over its own tramways from the British Electric Traction Company, and the system will be worked in direct communication with that of the South Metropolitan Company.

MASSACHUSETTS STREET RAILWAY MERGER

At a special meeting of the New Bedford & Onset Street Railway Company, the necessary two-thirds vote of the stock was secured, approving the terms of the contract for the consolidation of the New Bedford & Onset Company and the Taunton & Buzzards Bay Company, as agreed upon by the directors of the two companies. By the terms of the contract the New Bedford & Onset Company will seek authority from the Railroad Commissioners for leave to issue $50,000 additional stock, increasing the capital stock from $500,000 to $550,000, the new issue to be given the present owners of the Taunton & Buzzards Bay Company in exchange for the surrender and cancellation of the stock of the Taunton & Buzzards Bay road. In addition to this the New Bedford & Onset assumes the payment of 4 per cent interest on the bonded indebtedness of $150,000 of the Taunton & Buzzards Bay road.

A proposal has been made by the Postoffice Department to the Milwaukee Electric Railway & Light Company to operate two postal cars between the five sub-stations and the general postoffice in Milwaukee.

UNDERLYING COMPANIES OF THE CHICAGO UNION TRACTION COMPANY TO FORM AN AGREEMENT FOR DEALING WITH THE CITY

An agreement which has been drawn up and which will be submitted for ratification to the stockholders of the North and the West Chicago Street Railway Companies, provides for settling the differences between these companies and the Chicago Union Traction Company, so far as dealing with the city is concerned. It is reported that the agreement provides for a new company, which will take over all the rights and interests of the companies concerned. The new company will have absolute ownership of the properties, and can turn them over to the city with a clear title should the latter decide to buy them. The arrangements for a new company will not, however, affect the details of the troubles between the Union Traction Company and the underlying companies. These will be threshed out in the courts.

Difference over the manner of reconstructing the La Salle and Washington Street tunnels have been adjusted. Engineer Ericson for the city, who favored reinforced concrete construction without cross I-beams, for the new roofs of the tunnels, has agreed to the plan of Samuel Artingstall, engineer for the traction companies, who favors the use of I-beams. The increased cost of the latter construction, about $25,000, it is reported, will not be charged against the city should the latter purchase the railway systems at any time. This dispute as to the form of construction prevented the passing of the ordinance at a recent meeting of the Council, but it is now probable that the ordinance, with full provisions for lowering the tunnels, will be passed at the June 4 meeting of the Council.

PROGRESS ON THE ELECTRIFICATION OF THE WEST JERSEY & SEASHORE DIVISION OF THE PENNSYLVANIA RAILROAD

Work on the construction of the electrified section of the trunk-line railroad between Camden and Atlantic City is progressing rapidly. In order not to interfere with the regular operated steam trains, much track work has been done at night. In addition, an 8000-kw generating station and seven separate sub-stations are being erected and equipped. At South Camden, Glasboro, Newfield and Reega, each sub-station contains two 750-kw rotary converters with auxiliary apparatus, with arrangements for a third complete set. At Mizpah and Clayville there are two 500-kw rotary converters, with room for a third, while at Atlantic City two 750-kw machines are being installed, with an ultimate equipment to consist of two additional 1000-kw units. The eighth sub-station is at the main generating plant and contains two 750-kw rotary converters.

The third rail is of the over-running type and is mounted on reconstructed granite insulators. The cable is laid in bituminized conduit, embedded in cement. A terra cotta cap completely protects the cable entrance of the conduit from the weather. The bonding on the 140 miles of track is well in hand and more than two-thirds is completed.

The power station will contain three 2000-kw Curtis steam turbines with 6600-volt alternators, and 33,000 volts is used for transmission. The third rail carries 650 volts. In the city of Camden, and between Newfield and Millville the overhead trolley will be installed.

It is entirely probable that when this appears the turbines will be in process of erection at the main station, and that a month from now they will be operating the cars over the new line—the longest section of trunk-line steam road up to the present electrified.

EDUCATING THE BROOKLYN PUBLIC

It is not usual but all the more commendable for a large public service corporation to take its patrons into its confidence and tell them of the work being done for their comfort. This progressive spirit is shown by the Brooklyn Rapid Transit Company, and is especially exemplified in the publication of a well-written and neatly printed pamphlet describing in popular style the merits of the Brooklyn Rapid Transit Company's new standard car (described in the Street Railway Journal of Nov. 18, 1905), and explaining to patrons the local conditions that led to its adoption. This booklet is to be distributed among the patrons of the company, many of whom have already expressed their appreciation of this type. It has been established beyond dispute that this car has improved the running time on all the lines where it has been installed.

FROM ATLANTA TO MACON

Application is to be made to the City Council of Atlanta by the Atlanta, Griffin & Macon Electric Railway Company, shortly to be formally organized, to build into Atlanta on streets now occupied by the Georgia Railway & Electric Company. The petition asks for the right to enter the city at the south end of Capitol Avenue, and to run a double track along Capitol Avenue to Little Street, on Little Street to Fraser, on Fraser to Rawson on Rawson to Crew; a single track from the corner of Capitol Avenue and Little Street west, on Little Street to Crew, on Crew to Rawson, there to join the double track; then from Rawson to Trinity Avenue, with double track, then along Trinity Avenue to Washington, on Washington to proposed viaduct, to cross the viaduct to Gilmer Street, on Gilmer Street to Ivy, on Ivy to Exchange Place, and thence to Pryor Street, the terminus.

Briefly, the plan of the company is to build from Atlanta to Hapeville, Forest Park, Jonesboro, Hampton, Griffin, Forsyth and Macon, the total length being a little over 100 miles. The projectors say that they will probably select a route in the country districts through private land rather than on the public roads, as that will give a more direct route and save distance. The men interested in the company are N. B. Drewery, of Spalding County; W. J. Massee, Minton Wimberly and J. T. Moore, of Bibb County; N. P. Pratt, Clifford L. Anderson and W. A. Wimbish, of Atlanta.

THE UNION TRACTION COMPANY'S TERMS IN ANDERSON

The Indiana Union Traction Company is seeking a settlement of its franchise rights in Anderson. In 1902 the city granted the company an extension of franchise for a period of thirty years, making the present franchise reach to 1952. This extension was on condition the company would do four things, namely:

(1) Increase the power plant in North Anderson. (2) Build the company shops in or near Anderson. (3) Build a line from Anderson to New Castle by way of Middletown. (4) Build a line from Anderson to Elwood and Frankton. The company was given two years within which to complete these improvements, and this was extended to Dec. 1, 1906.

President Brady recites that the company has extended its power house plant, built the Anderson-New Castle line as far as Middletown, and says the company is now ready to build the proposed shops, the material investment to be $125,000. He says, however, that the company is unprepared at present to go ahead with the work of constructing the Elwood and New Castle lines, and that conditions have so changed that it would be inexpedient to build the Elwood line even though the company were prepared. He asks that the city give the company twenty years and six months of the thirty years extension, because of the part of the agreement it has fulfilled, and will fulfill, by erecting its shops. He then asks that the remaining ten years be given if in that time it constructs the Elwood and New Castle lines. The city has taken the matter under advisement.

THE PACIFIC TRACTION COMPANY'S PLANS

Benjamin J. Weeks, formerly of the Spokane Traction Company, has assumed his duties as general manager of the Pacific Traction Company, recently organized. He says that work on the Centralia and Chehalis lines will begin as soon as franchises and rights of way matters can be settled, and that it is the intention of the company to build the line from Centralia north by way of Olympia to Tacoma and south to Portland. The supposition is that the line will extend from Tacoma to Seattle via Julius Gulch. The plans for a through line from Seattle to Portland are not sufficiently advanced for official announcement. The Centralia-Chehalis proposition is altogether separate from the Felt projects, and it is backed by different interests. C. H. Weeks, Cyrus Bradley, Ernest Leverson of Spokane, and Mr. Kennon, of Centralia, are interested with Mr. Weeks in the building of that line. The Centralia-Chehalis line will be built to Portland south from Centralia and Chehalis and north into Tacoma. As for the extension of the line to Grays Harbor, that has not yet been considered.

RAILROAD LEGISLATION IN MASSACHUSETTS

The two railway committees of the Massachusetts Legislature have voted to report without change, except clerical corrections and immaterial details, the bill for interurban electric railroad companies as printed on pages 183-196 of the report of the joint special committees on railroad and street railway laws. This bill provides that fifteen or more persons may form an electric railroad company. Such company shall have authority to construct, operate and maintain such a railway, at least one-half of which shall be upon private land. The agreement of association shall state the corporate name, which must contain the words "electric railroad company" at the end. It must also state the termini of the railroad, the length and name of each county, city and town in which it is to be located. The gage must be broad, 4 ft. 8½ inches standard. The capital stock must be not less than $10,000 for each mile, the par value not less than $100 per share. At least five persons, who shall be subscribers to the agreement, shall be directors until others are chosen and qualified.

Within thirty days after the first publication of notice, the directors shall apply to the Railroad Commissioners for a certificate and public convenience and necessity require the railroad, and must file a map. If the Railroad Commissioners refuse to issue such a certificate, then no further proceedings shall be had, but application may be renewed in one year.

In case the Commissioners grant the certificate the directors may, within sixty days, apply to the Aldermen or Selectmen of the localities affected to fix the route, and such boards shall give a hearing.

If there is a disagreement as to the route between the authorities and the directors, the latter may apply to the Railroad Commissioners, who may in their discretion, after due notice to the Aldermen or Selectmen and public hearing, fix the route. But such route shall not be deemed fixed until all requirements which may be imposed by the Aldermen or the Selectmen have been compiled with.

Aldermen or Selectmen may prescribe how tracks shall be laid and the kinds of wires and poles and other appliances to be used.

The certificate of incorporation issued by the Secretary of State shall contain the words "electric railroad companies" instead of the words "railroad corporations."

An electric railroad company may act as common carrier of baggage, express matter and freight, subject to regulations and restrictions made by the local authorities, with the approval of the Railroad Commissioners.

If an operating electric railroad company is located partly within and partly without the limits of this Commonwealth, has paid dividends in excess of 8 per cent preceding the date of return, it shall for every such year in addition to the regular corporate franchise tax pay a tax equal to the excess to be determined by the Tax Commissioner.

There is a provision for a commutation excise tax to be computed upon a basis prescribed in the bill by the assessors in each city and town through which the route of said electric railroad company runs. All taxes thus paid to cities and towns shall be applied to the construction, maintenance and repair of the public ways and places upon which such electric railroad company is located, and to the removal of snow, etc.

AGREEMENT BETWEEN BOSTON & NORTHERN AND OLD COLONY AND ITS EMPLOYEES

An agreement has been reached, regarding operating questions, between the management of the Boston & Northern and Old Colony Street Railway Companies, and representatives of the men employed on the system. What the terms are will not be disclosed before the agreement has been reduced to writing and signed by the respective authorities, but they were reached in friendly discussion at the fourth conference, and probably are concessions from both sides.

The following statement agreed upon in the conference was given to the press for publication:

"We have arrived at what we consider a mutually satisfactory basis. All that is lacking to complete the negotiations is getting into writing, for purpose of signature, various items agreed upon. Throughout the whole negotiations the pleasantest relations prevailed; there was no attempt made at technicalities, there was on both sides an endeavor to arrive at what would be a fair conclusion."

CALUMET ELECTRIC STREET RAILWAY SOLD

The Calumet Electric Street Railway, along with all other assets of the National Bank of Illinois, which failed in December, 1896, has been sold to a Chicago syndicate. An order was entered by Judge Grosscup in the United States Circuit Court last week recording the sale of all the assets of the National Bank of Illinois to Messrs. Cole & McKinnon, of this city. The order provides that the transfer of the properties shall be made unless valid objection is offered before June 8, 1906. The purchased assets include all of the stock and all of the bonds of the Calumet Electric Railway. The other property involved consists of miscellaneous parcels of real estate, notes, judgments, etc. The purchase price, exclusive of cash in the receiver's hands is about $3,150,000. On this basis the railroad property sells for approximately $3,000,000.

THE MEXICO CONSOLIDATION

President F. S. Pearson, of the Mexico Consolidated Electric Companies, has fully set forth the plans of the Mexico consolidation, to which reference has been made before in the STREET RAILWAY JOURNAL. According to him, the Mexican Consolidated Electric Company has been organized with the object of acquiring and consolidating the tramway systems in the City of Mexico and the surrounding Federal District. With this in view it has acquired the controlling interest in the capital (£1,000,000) and the whole (with the exception of £2,000) of the "B" debentures (£287,000) of the Mexico Electric Tramways Limited (the Tramway Company), the only other debenture issue of the company being £400,000 5 per cent first charge debentures.

The Tramway Company operates under valuable concessions and under a lease from la Compania de los Ferro Carriles del Distrito Federal de Mexico (the District Railway Company) for the whole term (namely, till 1982) of such company's concessions, the rent providing for the fixed charges and 3½ per cent dividend on the capital of the District Railway. The Tramway Company now owns the entire share capital ($5,000,000) and the whole of the second debenture issue ($4,000,000 Mexican) of the District Railway, thereby reducing the actual rent to the annual interest on the $6,000,000 (Mexican) 6 per cent first debentures of the District Railway.

The consolidated company will, as the holder of such capital and debentures of the Tramway Company, control and operate the tramway systems in Mexico and the Federal District, subject only to: (1) The $6,000,000 (Mexican, say, £600,000) 6 per cent first debentures of the District Railway (the interest on which is provided by the rent payable by the Tramway Company): (2) £400,000 5 per cent first charge debentures of the Tramway Company.

To provide for the purchase of all the capital and the "B" debenture of the Tramway Company and for immediate extensions, additional equipment for freight and passenger service, the consolidated company has issued $7,500,000 general consolidated first mortgage fifty-year 5 per cent gold bonds, which $7,500,000 are now being offered for sale. A portion of the unissued bonds will be specifically set aside to retire the outstanding debentures above mentioned, and the remainder will be held in reserve for future extensions and development.

The tramway systems in operation consist of about 160 miles of track, of which 90 miles are operated by electric traction, 13 miles by steam and about 57 miles by animal traction. Equipment about 600 cars, with further cars ordered. The steam-power station has a capacity of 3200 kw. A contract has been entered into with the Mexican Light & Power Company, Ltd., for hydro-electric power up to 7500 hp, and, for the purpose of utilizing the same, 4000 kw of motor generators are under construction. It is expected that this plant will be ready for use on Oct. 1, 1906.

The right possessed to carry freight will enable the company to establish a terminal freight system for handling the freight to and from the steam railways through the city. When the consolidated company has completed its consolidation and carried out the improvements and extensions which will be made with the proceeds of the bonds, and the steam power is replaced by the hydro-electric power, the following statement may be taken as a conservative estimate: Gross income, $4,400,000 Mexican (say, £440,000); net profit, $2,200,000 Mexican (say, £220,000); less interest on underlying charges, £56,000; interest on the $7,500,000 bonds, $375,000 (gold) (say, £75,000); balance, net surplus applicable to depreciation, etc., and dividends on share capital equal to $445,000 (gold) (say, £89,000).

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MAY 22, 1906

821,000. Brake-Shoe; William Perry Taylor, Buffalo, N. Y. App. filed March 13, 1905. A brake-shoe comprising a cast body and a plurality of parallel fairly thin flat-surfaced reinforcing plates embedded in said body and having notched edges.

821,138. Merry-Go-Round Museum; Jacob L. Tidd, Lancaster, Ohio. App. filed Oct. 5, 1905. A pleasure railway consisting of a continuous track formed in the shape of a loop, one side of which is elevated and overlooks an inclosure which is provided with suitable scenery, so as to present a panoramic effect.

821,252. Railway Signal; James P. Norwood, Chicago, Ill. App. filed June 23, 1905. Indicators in each train to show the next station and the movement of other trains, and indicators at stations showing the movements of the different trains, all operated by suitable contacts and circuits along the trackway.

821,279. Car Truck; John A. Brill and Walter S. Adams, Philadelphia, Pa. App. filed April 4, 1900. A bolster comprising a cross-piece and oppositely disposed and centrally depressed slotted webs, side bearings, and a center bearing on the cross-piece.

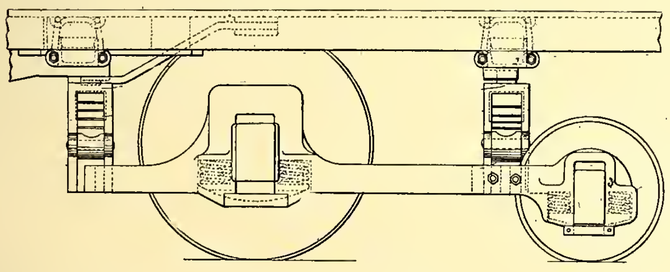
821,287. Multiple-Unit Control System; H. M. Harding, New York, and Charles M. Clark, of Summit, N. J. (See description on page 874.)

821,317. Conductor for Electric Cars; Frank L. Sessions, Columbus, Ohio. App. filed Aug. 14, 1902. A flexible cable for furnishing power to mine locomotives, unwinds from a drum on the car as the latter moves along.

821,346. Car Fender; Harry Ekrem, San Pedro, Cal. App. filed Oct. 31, 1905. The fender is yieldably supported in an elevated position, and a trip member located in front of the fender has a toggle connection therewith to positively depress the fender when the trip is moved rearwardly.

821,352. Traction-Increasing Device for Street Cars; Harry H. Fox, Duquesne Junction, Pa. App. filed Dec. 5, 1905. Electromagnets on the car, the cores of which are arranged in close proximity to the rails whereby the traction is increased when the magnets are energized. The magnets are in circuit with the operating circuit of the car.

821,381. Signaling System; Wilmer W. Salmon, Buffalo, N. Y. App. filed May 22, 1905. A continuously rotating shaft and a magnetic clutch which engages a winding mechanism for hoisting the semaphore arm. Also has means for releasing the clutch to restore the arm to safety position.



PATENT NO. 821,279

821,385. Railway Switching and Signaling Apparatus; John D. Taylor, Buffalo, N. Y. App. filed Feb. 10, 1903. The objects of this invention are to guard against the bad effects of crossed wires and of an open common wire, to enable the operator to readily determine which wires are in trouble, and to reduce the effects of a fall in potential in the common wire on the safety appartus itself.

821,386. Apparatus for Operating and Controlling Railway Switches and Signals; John D. Taylor, Buffalo, N. Y. App. filed June 20, 1903. Improvements on above.

821,400. Ball-Bearing Electric Trolley Wheel; Robert S. Bolye, Fort Branch, and Walter G. Cleveland, Cynthiana, Ind. App. filed June 16, 1904. Journal bearings of the trolley wheel are made in two parts so as to be capable of receiving the raceways of a ball-bearing, and which is thereby removable when desired.

821,435. Railway Switching and Signaling Apparatus; Wilmer W. Salmon, Buffalo, N. Y. App. filed March 28, 1904. A magnetic generator has a rack and pinion connection with the semaphore arm so as to be rotated and transmit a signal whenever the semaphore arm is moved to safety position.

821,495. Railway Switching and Signaling Apparatus; Winthrop K. Mowe, Buffalo, N. Y. App. filed Aug. 29, 1905. Details of construction of a motor connection for throwing the switch point, positioning the usual guard and transmitting a signal.

821,512. Trolley Wire Hanger; Adam J. Laverty, Athens, Ohio. App. filed April 21, 1905. The hanger is provided with grooves for the reception of the wire and a yoke with a screw connection for pressing it into the groove so as to bind the wire and hold it in place. The device is applicable to joining the ends of a broken conductor.

821,515. Railway Signal; John B. Lineback, Siloam Springs, Ark. App. filed Dec. 14, 1905. Electric lights are installed along the roadway in such a manner that one is constantly in view of the engineer. By means of a code of signals based on the fluctuations of the lamps, messages may be transmitted to the trains.

PERSONAL MENTION

MR. PHILLIP SWING, of Cincinnati, has resigned as secretary and general manager of the Cincinnati & Columbus Traction Company.

MR. EDWARD E. WINTERS, assistant to the president of the South Covington & Cincinnati Street Railway Company, is enjoying a European trip.

GEN. WILLIAM A. BANCROFT, president of the Boston Elevated Railway Company, was elected president of the Commercial Club of Boston at its annual meeting, held at the Parker House, on May 24.

MR. EDWARD H. RICHARDS has been appointed street aid for the Quincy division of the Old Colony Street Railway Company instead of assistant general manager of that division, as stated in the issue of May 19.

MR. M. J. MANDELBAUM, of the Pomeroy-Mandelbaum syndicate, has been elected vice-president of the Aurora, Elgin & Chicago Railroad, and will assume the active executive direction of the company's affairs in the absence of the president, Mr. L. J. Wolf, of the company, who will shortly take an extended trip abroad.

MR. ROBERT LONG, traveling engineer for the National Brake & Electric Company, of Milwaukee, Wis., sails this month for Buenos Aires, South America, where he will install eighty-five air-brake equipments for the Lacroze Tramways, which are being constructed by J. G. White & Company. Mr. Long expects to remain in South America about eight months, or until the cars are in operation.

MR. ROBERT H. DERRAH, who recently resigned as passenger agent of the Boston & Northern and Old Colony Street Railways, has accepted a similar position with the New Hampshire Electric Railways. Mr. Derrah was for ten years connected with the president's office of the West End and Boston Elevated Railways, of Boston, and was secretary to Mr. Samuel Little while the latter was president of the West-End Company.

MR. W. S. McCALL, formerly general sales agent for the St. Louis Car Company, has been appointed to the position of vice-president of the company, from which Mr. Henry F. Vogel resigned some weeks ago. Mr. A. H. Sisson, formerly assistant general manager, has been made general manager, and Mr. Walter S. Miller has been promoted from superintendent of tools and machinery to manager of works. Mr. Miller is also manager of the automobile department.

MR. GEORGE P. DOLE, formerly superintendent of the Providence & Fall River Street Railway Company, now of the New Bedford & Onset & Taunton & Buzzards Bay Company, was recently presented a handsome couch and pillow by the employees of the road from which he is retiring. The presentation was made in the presence of a large number of the motormen and conductors of the Old Colony and Rhode Island divisions, the speech being made by Foreman and Electrician Samuel C. Messenger. Mr. Alvah C. Dole, conductor on the Providence & Fall River Street Railway, has been appointed acting superintendent of the road to fill the vacancy caused by the resignation of his brother, Mr. George P. Dole. Mr. Dole, who is 30 years old, began railway work when he was 18, as driver-conductor on the bob-tail horse cars of the Haverhill, Merrimac & Amesbury road. He was later conductor on the Brockton, Bridgewater & Taunton, New Bedford, Middleboro & Brockton and Newton & Boston. He came to Swansea in 1901, and was employed at the car house until the opening of the Providence & Fall River, when he was conductor on the first car which went over the line. He has been with the Providence & Fall River Company since that time.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Apr. '06	72,368	41,920	30,448	22,667	7,781
	1 " " '05	68,838	39,565	29,273	22,917	6,356
	4 " " '06	283,603	162,665	120,938	90,668	30,271
	4 " " '05	261,728	150,285	111,444	91,668	19,777
AURORA, ILL. Elgin, Aurora & Southern Tr. Co	1 m., Feb. '06	37,062	21,513	15,549	8,989	6,560
	1 " " '05	31,390	20,825	10,566	9,133	1,432
	8 " " '06	344,803	186,248	158,555	74,162	84,394
	8 " " '05	305,387	173,889	131,498	74,306	57,192
BINGHAMTON, N. Y. Binghamton Ry. Co	1 m., Apr. '06	22 012	12,461	9,550	7,363	2,188
	1 " " '05	19,642	11,414	8,227	7,182	1,046
	10 " " '06	236,950	124,312	112,637	72,936	39,702
	10 " " '05	211,631	114,006	97,625	70,096	27,529
CHAMPAIGN, ILL. Illinois Traction Co	1 m., Apr. '06	222,200	*140,675	81,525	......	......
	1 " " '05	178,505	*105,962	72,543	......	......
	4 " " '06	880,767	*505,689	375,078	......	......
	4 " " '05	718,511	*400,739	317,772	......	......
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Feb. '06	38 549	25,733	12,816	......	......
	1 " " '05	23,099	18,898	4,201	......	......
	8 " " '06	443,259	237,059	206,200	......	......
	8 " " '05	316,899	175,224	141,674	......	......
Chicago & Milwaukee Elec. R. R. Co	1 m., Apr. '06	57,015	24,131	32,884	......	......
	1 " " '05	35,827	16,507	19,320	......	......
	4 " " '06	177,505	90,093	87,411	......	......
	4 " " 05	114,543	61,193	53,349	......	......
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co	1 m., Apr. '06	18,202	*12,118	6,084	......	......
	1 " " '05	16,105	*10,640	5,465	......	......
	4 " " '06	63,440	*39,704	23,736	......	......
	4 " " '05	54,793	*38,483	16,310	......	......
Cleveland & Southwestern Traction Co.	1 m., Apr. '06	47,394	29,339	18,055	......	......
	1 " " '05	39,404	25,375	14,029	......	......
	4 " " '06	176,000	111,181	64,820	......	......
	4 " " '05	141,789	95,710	46,079	......	......
Lake Shore Electric	1 m., Mar. '06	53,459	*30,321	23,138	20,404	2,733
	1 " " '05	56,973	*35,450	21,523	20,404	1,119
	3 " " '06	165,215	*100,691	64,524	61,212	3,311
	3 " " '05	145,850	*95,771	50,079	61,212	†11,133
DETROIT, MICH. Detroit United Ry	1 m., Apr. '06	446,439	*263,713	182,726	95,512	87,214
	1 " " '05	390,623	*239,122	151,501	91,059	60,442
	4 " " '06	1,671,127	*1010987	660,140	373,685	286,455
	4 " " '05	1,450,720	*915,576	535,144	367,752	167,392
DULUTH, MINN. Duluth St. Ry. Co	1 m., Mar. '06	58,402	33,904	24,498	17,496	7,001
	1 " " '05	50,863	29,217	21,646	16,747	4,898
	3 " " '06	163,174	97,349	65,825	52,482	13 343
	3 " " '05	141,908	82,460	59,447	50,188	9,260
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co	1 m., Mar. '06	81,253	47,356	33,897	......	......
	1 " " '05	80,625	36,418	44,207	......	......
	3 " " '06	235 213	134,238	100,975	......	......
	3 " " '05	217,578	110,252	107,326	......	......
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co	1 m., Mar. '06	79,992	51,473	28,519	......	......
	1 " " '05	67,502	43,398	24,103	......	......
	3 " " '06	232,088	143,733	88,356	......	......
	3 " " '05	198 088	125,396	72,692	......	......
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., Mar. '06	64,738	39,826	24,911	9,942	14,970
	1 " " '05	53,689	31,221	22,468	9,938	12,531
	12 " " '06	694,654	419,063	275,591	120,429	155 162
	12 " " '05	581,717	336,173	245,544	110,908	134,636
GLENS FALLS, N. Y. Hudson Valley Ry. Co.	3 m., Mar. '06	99,362	73,453	25 909	64,178	†38,269
	3 " " 05	84,962	72 821	12,141	63 172	†51,031
	9 " " '06	431,100	237,689	193,411	196,159	†2,748
	9 " " '05	384,017	251,413	132,604	187,008	†54,404
GREENSBURG, PA. Pittsburg, McKeesport & Greensburg Ry. Co.	1 m., Apr. '06	15,163	7,561	7,603	4,507	3,095
	1 " " '05	12,468	6,649	5,819	4,506	1,313
	4 " " '06	54,507	27,248	27,259	18,917	8,342
	4 " " '05	43,587	22,611	20,976	18,057	2,920
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Mar. '06	15,251	11,751	3,500	3,937	†437
	1 " " '05	458	20,475	†20,017	3,527	†23,544
	12 " " '06	182,550	158,865	23,685	44,981	†21,296
	12 " " '05	188,171	145,558	42,613	41,412	1,502

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
HOUSTON, TEX. Houston Electric Co.	1 m., Mar. '06	44,328	*30,503	13,824	7,692	6,133
	1 " " '05	38,837	*25,708	13,129	8,646	4,483
	12 " " '06	539,661	*333,941	205,720	103,568	102,153
	12 " " '05	377,500	*322,208	55,292	99,029	†43,737
HUDSON, N. Y. Albany & Hudson R. R. Co	1 m., Apr. '06	21,305	*15,201	6,104	8,796	†2,692
	1 " " '05	21,122	*14,351	6,771	7,496	†725
	10 " " '06	278,946	*209,298	69,648	57,592	12,056
	10 " " '05	249,261	*189,638	59,623	54,517	5,106
KANSAS CITY, MO. Kansas City Ry. & Light Co	1 m., Mar. '06	407,830	*355,338	156,408	......	......
	1 " " '05	377,783	*120,280	157,503	......	......
	10 " " 06	4,257,474	*3488215	1,801,681	......	......
	10 " " '05	3,645,273	*2109173	1,536,100	......	......
LONG ISLAND CITY, N. Y. L. I. Elec. R. R.	3 m., Mar. '06	29,481	32,611	†3,130	8,821	†11,951
	3 " " '05	24,519	26,166	†1,647	8,945	†10,592
	9 " " '06	130,527	92,169	38,358	27,238	11,120
	9 " " '05	112,173	83,195	28,978	27,263	1,715
MANILA, P. I. Manila Elec. R. R. & Lt. Co., Railway Dept	1 m., Apr. '0	46,750	22,000	24,750	......	......
	3 " " '06	129,500	64,000	65,500	......	......
	1 " " '06	74,750	36,100	38,650	......	......
Total, all depts	3 " " '06	217,850	109,593	108,257	......	......
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co	1 m., Apr. '06	273,534	134,435	139,099	88,364	50,735
	1 " " '05	255,887	125,942	129,946	74,975	54,971
	4 " " '06	1,086,368	540,383	545,985	347,692	198,293
	4 " " '05	1,002,501	515,832	486,669	294,619	192,050
Milwaukee Lt., Ht. & Tr. Co	1 m., Apr. '06	46,682	19,208	27,475	24,306	3,168
	1 " " '05	42,574	19,820	22,754	19,539	3,214
	4 " " '06	177,323	76,517	100,806	92,500	8,306
	4 " " '05	154,263	78,674	75,589	75,906	†318
MINNEAPOLIS, MINN. Twin City R. T. Co	1 m., Apr. '06	415,414	197,157	218,257	109,708	108,548
	1 " " '05	355,213	170,808	184,405	97,325	87,080
	4 " " '06	1,621,914	789,575	832,339	438,833	393,506
	4 " " '05	1,389,516	689,169	700,347	389,300	311,047
MONTREAL, CAN. Montreal St. Ry. Co	1 m., Apr. '06	235,615	136,663	98,953	41,114	57,839
	1 " " '05	202,946	125,350	77,596	22,454	55,142
	7 " " '06	1,641,938	1,065 294	576,643	219,739	356,905
	7 " " '05	1,439,392	986,233	453,158	140,905	312,253
OLEAN, N. Y. Olean St. Ry. Co	1 m., Mar. '06	8,782	4,793	3,989	2,809	1,180
	1 " " '05	7,624	4,175	3,449	2,693	755
	9 " " '06	94,682	47,434	47,248	24,111	23,137
	9 " " '05	83,405	41,592	41,813	23,900	17,913
PHILADELPHIA, PA. American Rys. Co	1 m., Apr. '06	203,928	......	......	......	......
	1 " " '05	186,704	......	......	......	......
	10 " " '06	1,627,118	......	......	......	......
	10 " " '05	1,439,046	......	......	......	......
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Apr. '06	760,197	*467,755	292,442	198,026	94,416
	1 " " '05	699,483	*473,783	225,700	199,069	26,631
	4 " " '06	2,803,682	*1750061	1,053,621	793,270	260,351
	4 " " '05	2,542,505	*1772485	770,020	797,541	†27,521
SAVANNAH, GA. Savannah Electric Co.	1 m., Mar. '06	47,300	*30,840	16,460	10,904	5,556
	1 " " '05	44,555	*27,449	17,106	10,554	6,552
	12 " " '06	603,590	*363,245	240,345	128,745	111,599
	12 " " '05	551,818	*320,365	231,453	126,998	104,454
SEATTLE, WASH. Seattle Electric Co	1 m., Mar. '06	233,930	*160,781	73,149	27,520	45,629
	1 " " '05	194 204	*135,708	58,496	24,862	33,634
	12 " " '06	2,676,294	*1734204	942,090	294,788	647,302
	12 " " '05	2,351,730	*1620859	730,870	300,132	430,738
SYRACUSE, N. Y. Syracuse R. T. Co	1 m., Apr. '06	86,864	49,285	37,579	22,907	14,672
	1 " " '05	75,743	43,875	31,868	20,450	11,418
	4 " " '06	340,496	193,589	146,907	89,144	57,763
	4 " " '05	295,678	174,285	121,393	81,567	39,826
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Mar. '06	57,951	*39,018	18,933	12,950	5,983
	1 " " '05	45,827	*32,800	13,027	9,726	3,300
	12 " " '06	669,624	*435,196	234,428	130,631	103,797
	12 " " '05	578,730	*371,036	207,693	113,482	94,211
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Mar. '06	158,285	*84,702	73,583	42,200	31,383
	1 " " '05	146,565	*75,672	70,893	42,863	28,030
	3 " " '06	460,147	*243,016	217,131	126,794	90,337
	3 " " '05	430,915	*220,994	209,921	128,383	81,538

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, JUNE 9, 1906. No. 23.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieher's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....................$3.00 per annum

Single copies .... 10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies .... 20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 187,800 copies, an average of 8164 copies per week.

Cross-Overs on City Systems

The extent to which cross-overs should be installed in city trackage is a matter of considerable uncertainty at times. All special track work is more or less of a nuisance in a large city, but in most cases it is impossible to avoid it. Right-angled crossings and Y's at street intersections where routes pass or diverge cannot well be dispensed with if the traffic is to be handled with any flexibility, but in the case of the cross-over from one to another of two parallel tracks the situation is very different. Unless it be in front of a terminal, car house or repair shop, the city cross-over has little excuse for being unless it is installed as a preventive of traffic stagnation in times of emergency.

Every cross-over in a street railway track slows down the speed of an approaching car and interposes a series of vicious hammer blows upon the equipment at each passage which are seldom enjoyed by the passengers or helpful toward reduced maintenance. At the same time, when a blockade occurs beyond a cross-over in an important piece of urban track there is no doubt that the special construction which in normal operation is dubbed a nuisance often proves to be invaluable. A golden mean should therefore be practiced in laying out cross-overs in the tracks of a large city system, with provision for the most trying emergencies. As for the smaller blockade on branch lines there is little need of special cross-over facilities here, and if the cars on the main line can be diverted through parallel streets, it would seem that even here emergency cross-overs can be largely, though not entirely, eliminated.

Alternating-Current Motors in Repair Shops

The vast majority of motors used in street railway repair shops are of the direct-current type, but the development of single-phase motors for car service and the building of roads which are alternating-current propositions throughout, except for the generator excitation, opens an interesting question with respect to the repair shop. On a purely a. c. road, should one install a rotary or motor-generator set for shop service, or is it a better plan to stick to the alternating motor, which has yet to win its laurels in extreme variable-speed machine tool driving?

The decision in a case of this kind depends to a considerable degree upon the amount of variable-speed work which the shop is likely to handle. Generally speaking, the street railway repair shop can be operated satisfactorily without a great speed range in its individual tools, for the reason that the machine-tool work required is fairly constant in character. The work of car maintenance calls for about the same operation one week as the next. Turning, grinding and planing take place on material which is fairly even in quality, and the necessary speed changes can, as a rule, be obtained by mechanical means. For a shop which can be operated with machines group-driven from constant speed motors, the ordinary induction motor with a short-circuited secondary winding ought to satisfy every requirement. Everyone knows the greater ability of the induction motor to withstand severe conditions, and even abuse, in comparison with the usual designs of direct-current motor, although the latter machine has made some wonderful records in the last few years.

For ordinary variable speed work, the single-phase induction motor of the repulsion type is making a name for itself under all sorts of conditions, and there is little ground of hesitation to equip a shop with these machines. Thoroughly satisfactory speed control over a range of certainty from about 30 per cent to 40 per cent of full speed to normal can be had with this type, which is being developed to meet all usual conditions, in conjunction with speed cones and gears. If a speed range of four to one or six to one is wanted, without mechanical changing, it would probably pay to install a small motor-generator set for the machines in question. The first cost of alternating motors is likely to run considerably higher than that of direct-current types, but it is a constant source of loss to be obliged to depend upon a motor-generator for shop service. Certainly if the series-alternating motor is equal to the exacting variable-speed demands of car service —and it looks as though it were—the repair shop problem ought not to be difficult to solve with the equipment now on the market, to say nothing of that likely to be designed in the near future.

A Question of Single-Phase Traction

One of the numerous side issues of the alternating motor traction proposition is the probable effect upon telephone and telegraph systems. No definite reports on the subject have as yet been made public, although a number of single-phase lines are and have been for some months in operation. We are not at all disposed to make gloomy predictions, but there certainly will be a serious question raised ere long that will have in some fashion to be settled. It does not take a long memory to run back to the time when the new-born trolley system was hailed with choice invective for its use of the grounded current. An acrimonious season followed which ended in the general adoption of metallic circuits for the telephones, a great improvement in service quite irrespective of the moving causes. The grounded circuit was bad, and in course of time would have been abolished, though we make bold to suggest that it would still be widely used in local service except for the certainty of trouble from trolley circuits. Then with the increase of the alternating-current system came renewed limitations which will well be remembered by those who had a hand in the battle of the systems fifteen years ago. Not only was the alternating current deadly at long range, but it was going to be fatal to telephoning and should be kept out of town, in fact off the earth. But it came, and we have not been able to discover that it has done anything in particular to the telephone service when properly arranged.

Undoubtedly one hears, so to speak, a sort of substratum of murmuring like the drone of a bagpipe, particularly in bad weather, but it is seldom of much account. The single-phase trolley, however, is another matter. Ordinary a. c. circuits are generally pretty well balanced in themselves, and it is only some of the wandering arc circuits that are much in evidence. In these a. c. roads there is a single wire suspended in the air and the return is through the earth. The conditions for interference are thus singularly favorable, and the current being heavy there is ample energy to make itself felt even on lines at some little distance. In spite of this we do not see why a properly installed complete metallic circuit should be seriously interfered with. Many transmission lines carry telephone circuits within a few feet of wires carrying very heavy a. c. current and still maintain fairly good conditions of service. Such lines are of course sensitive to balance, and a little leakage produces large results, yet a double conductor accurately transposed gives good service. Undoubtedly we shall at first hear a good deal about the terrible effects on telephones. In the long run we fancy that history will repeat itself and it will be found that a little caution in planning line work will practically obviate any serious results. An auxiliary overhead return on the railroad lines might help out in extreme cases, and this is a remedy easily applied. Ordinary telegraph service should hardly be effected at all, although it is possible that high-speed systems with automatic transmission might feel the induction. It is certainly one of the factors which must be considered in the a. c. traction question, and for a time it may make itself felt. That it will be permanently a grave element in the situation we are hardly disposed to think.

Five Years of Elevated Operation in Boston

On June 10 the elevated system of the Boston Elevated Railway Company will have been in operation five years. From time to time we have described the various improvements in the equipment and service which the company's experience has shown to be desirable, so it is scarcely necessary to refer to them in detail at this writing, or to mention the novel features introduced. It was to be expected that the operation of a system possessing so many new and untried features would be extremely instructive to transportation engineers, and there has been no disappointment on this score.

Two points of special importance stand out in bold relief as the first half-decade of elevated train service in Boston closes. The first is the skill with which the component parts of a most intricate transportation system have been co-ordinated into a complete and uniform whole. Surface-car routes, elevated, subway and tunnel lines have been brought into close relation by a large number of transfer points; connections have been in the main quickly made, and even the terminals have been little more than way stations. Short interval service on all important lines has reduced the congestion of platforms and passageways close to an irreducible minimum, and the addition of numerous explanatory signs, maps, etc., at the stations, has largely reduced the difficulty of the transit problem from the standpoint of the passenger unfamiliar with the geography of the Boston system.

The other point is the influence of the physical characteristics of the elevated division upon the equipment. We think it has been pretty thoroughly demonstrated that the Tremont Street Subway is no place for economical train operation, and believe that the removal of the trains to the new Washington Street Tunnel upon the completion of that route will be followed by a pleasing reduction in the wear and tear of the rolling stock. Rapid transit urban service cannot in the nature of things be produced with an energy consumption in watt hours per ton mile as low as that of an interurban line with few stops, but there is no reason why the service given upon a fairly straight and reasonably level tunnel track should not be much less expensive from the power consumption and maintenance standpoints than that in a subway characterized by sharp curves and frequent heavy grades. Nothing emphasizes the wear and tear of the present equipment more than the necessity for grinding every wheel on the elevated system about every two weeks. The problems of maintenance of way have been equally interesting on the Boston Elevated, and have furnished railway engineers with no small amount of material having important bearing upon the wear of rails on curves and in special work. The road has provided an excellent test ground for improvements in multiple unit control and brake systems, studies of motor heating, pneumatic door operation and the like.

As the free bodily transfer in effect at various stations between the trains of the elevated division and the company's surface cars precludes anything like an accurate statement of the number of passengers carried by the elevated cars during the five years, we must turn to the car mileage to realize the safety with which the road has been operated. The revenue mileage of the elevated cars for the five years aggregates 33,500,000, or about one-third the distance from the earth to the sun. In handling the volume of traffic which this mileage infers, not a single passenger has been killed through the fault of the company, and there have been few, if any, accidents of consequence. Such a record is certainly cause for congratulation.

Interurban Railways and Suburban Service

The extent to which an interurban railway terminating in a large city should adapt its schedules to the requirements of purely suburban service is an interesting question at the present time. The distribution of the rolling stock to reap the maximum number of through and local fares is naturally the desire of every progressive manager, but it is sometimes difficult to know how this can best be accomplished.

Conceptions of what passenger transportation ought to be in the vicinity of densely populated communities are becoming broader, and in many quarters there is a growing demand for a class of service which will reduce to a minimum the amount of walking necessary at each end of the line in passing between home and office. The feeling is becoming apparent in some cities that the great steam railroad terminal stations are more satisfactory to through passengers than to commuters, although, in cases where these large terminals are located near the heart of the business district, there are some notable exceptions. It is a well-known fact that in some of the large steam railroad terminals suburban passengers are daily obliged to walk nearly a thousand feet each way between their trains and the station entrances, to say nothing of the walk to the local station at one end of the line and the pedestrian tour between the terminal and the office on arrival at the city. It is not uncommon for 50 per cent or 60 per cent of the entire time of transit between office and home to be occupied in walking to and from the train. In the winter season, the complicated interlocking switches of the most costly and elaborately designed steam railroad terminal yard are often an easy prey to the snow storm, with complete paralysis of suburban traffic resulting.

From the earliest days in which electric cars were run into suburban territory, one of their greatest advantages to the public has been the continuity of the ride between the suburban street corner and the different points of the business district. This fact, coupled with the lower fare and greater frequency of service, as compared with the steam road, has been responsible for the diversion of a large traffic from the steam lines to the suburban trolley routes. The expansion of the suburbs, however, has forced the commutation limit farther and farther away, and the advent of interurban lines has resulted in a demand of increasing intensity for higher-speed service between remote suburbs and all parts of the business district. The purely suburban electric line, operating entirely upon the highways, cannot supply the kind of service needed, nor can the steam railroad, leaving its commutation passengers far from their destination, satisfy all the requirements. It remains for the interurban line, operated in part at least upon a reserved or private right of way, to offer the compromise facilities wanted. Neither of the old forms of transit meets all modern needs with exactness. What is essential is the cross-country speed of the steam road, with the distribution facilities now offered by the local trolley lines in the city proper.

The solution of the problem depends more upon the roadbed than upon anything else. In localities where land is cheap this means a private right of way; where land is costly the cars must be operated upon the highway. Time is more a factor than the cost of the trip in cents. Without the right of eminent domain, the interurban line cannot strike boldly across the fields and woods and furnish essentially high-speed service. This question has been settled in many States, but is still pending in others, which are endeavoring to determine the public need of high-speed interurban facilities. The tendency of the entire age is away from transportation facilities which are inconvenient; which stop every few rods along the route, or which stop at a few points in the remote districts only to fall short of broad distribution in the terminal cities.

The division of interurban cars between local and through service is a matter depending almost entirely upon the conditions prevailing upon the system. The through service should in any case be adequate for the traffic normally offered; if anything, it should be ample enough to allow a steady expansion of business—to encourage the creation of new travel. If the system offers good opportunities for local and suburban service, the road should operate cars enough to at least take care of the local traffic upon its own lines. If the interurban cars are handled by another company in one or more of the terminal cities, the number which it is advisable to operate in the city service will depend largely upon the traffic agreement reached, and the willingness of the passengers to transfer at the end of the interurban company's own lines of track. As a general thing, transfers are to be avoided as far as possible in deference to the wishes of the public, but it is frequently out of the question to carry every passenger in the interurban-suburban territory to the city business district without change of cars, unless the city company's cars operate under a traffic agreement upon the interurban company's suburban territory. The more remote suburbs can be treated as tributary to the main interurban line in many cases, passengers being carried to the center of the city by the through cars of the interurban line. Only a careful analysis of the conditions will enable the most profitable arrangement of schedules to be prepared, but the interurban line which can pick up the passenger near his own door and carry him to the center of the business district at high speed—say, 40-m. p. h. or 50-m. p. h. maximum, —is well in line to secure traffic which even an electrified steam road with a terminal remote from the business center cannot capture. High average speed outside and few stops within the outlying residence sections of the terminal city are of prime importance.

THE POWER TRANSMISSION LINE AND THIRD-RAIL SYSTEM OF THE LONG ISLAND RAILROAD—I

BY W. N. SMITH

The high-tension electric transmission line of the Long Island Railroad constitutes the means of distributing to its sub-stations the electric current generated in the Long Island City power station of the Pennsylvania Railroad Company, described in the Street Railway Journal for April 7. As the transmission system was naturally governed as to dimensions and length by the number of sub-stations and their location with reference to the power house, it is proper to preface a detailed description of it with some general remarks on the arrangement of the power transmission and distribution system, as required properly to meet the demands of the electrically-operated traffic on the Long Island suburban lines.

The lines first equipped comprise the Atlantic Avenue Division, between Flatbush terminal and Belmont Park, and the Rockaway Beach Division, between Woodhaven Junction and Rockaway Park. The equipment of this latter division has also been extended to enable electric operation via. Far Rockaway to Valley Stream.

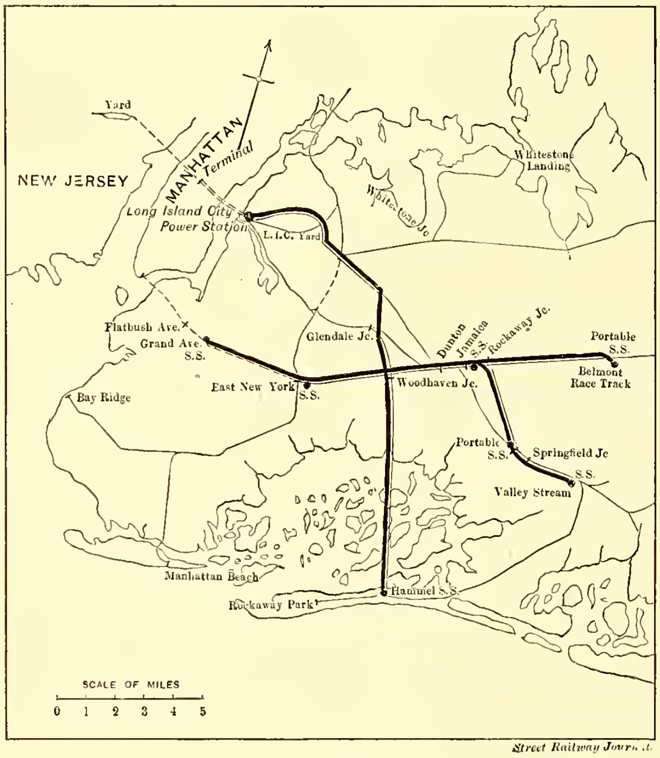


FIG. 1.—MAP OF TRANSMISSION LINES OF LONG ISLAND RAILROAD

A study of the traffic conditions to be met by the electrical equipment upon these divisions resulted in a preference for sub-station sites at Woodhaven Junction, East New York, Flatbush Avenue, Rockaway Junction and Hammel. These were ultimately selected as permanent sub-station locations, except that Grand Avenue, about one mile out from the terminal, was later on substituted for Flatbush Avenue. Since the original installation described in this article was completed, a sixth sub-station has been located at Valley Stream, receiving its power from an extension of the overhead line by way of Springfield Junction.

Two portable sub-stations, as illustrated in the Street Railway Journal for Nov. 4, 1905, were also provided as the most economical method of supplying current for the very heavy periodic traffic to and from the Metropolitan race track south of Jamaica, and the new Belmont Park race track, about five miles east of Jamaica. These loads occur for two hours each day, for periods of two weeks, twice a year.

The portable sub-stations consist of 100-kw rotary-converter outfits, complete with transformers and switchboard, each mounted in a heavy steel box car. A lightly constructed house, built of structural steel and enclosed with expanded metal and concrete, is provided at each site to enclose the terminals and shelter the portable apparatus when in use. From Rockaway Junction sub-station, one branch of the high-tension transmission line is run to the portable sub-station terminal house built at Belmont Park, and another to that at Springfield Junction.

In reaching a decision as to whether the overhead or underground type of construction should predominate, a very careful study was made of the record of experience in operating lines of great length and of large carrying capacity. It appeared that the troubles in overhead lines were generally from the following causes: Wind, lightning and sleet storms, or structural weaknesses of poles, cross arms, pins, and insulators, or outside interference, either from branches of trees or mischief makers and thieves; and very rarely, by heat from a conflagration close to the route.

In case of conduit construction, it was found that breakdowns were generally due either to capacity effects causing extraordinary voltages, or to depreciation of cable sheaths from electrolysis, or to short-circuits by reason of mechanical injury, imperfect insulation or failure of joints; and occasionally to overloading or to gas explosions in manholes.

Comparing the causes and effects of the troubles in the two classes of construction, the general conclusion was reached that, while an overhead line is liable to more frequent interruption through minor troubles than an underground line, the interferences with continuous operation on an underground line, when they do happen, are likely to be of a more serious character, and of longer duration. Experience showed conclusively, that the principal causes of interruption to service in overhead circuits could be prevented by proper attention to mechanical sufficiency in the overhead structures; a characteristic which, though necessary, has frequently been overlooked in the past. Although underground construction might have been preferred, could its cost be brought down to something like an equality with overhead costs, financial considerations favor the adoption of the overhead type because its cost is only a fraction of that involved in high-tension cable and conduit work, and because its reliability is assured when properly installed. Overhead construction was, therefore, adopted wherever it was usable.

The topography of the system is such that Woodhaven Junction sub-station becomes a natural distributing center between the power house and the other sub-stations, and it was, therefore, decided to make it the objective point of a main power transmission trunk line, which should bring directly to it the entire output of the power station for distribution among the sub-stations. The problem of line construction was therefore to build a trunk line from the main power station to Woodhaven Junction, with two branch transmission lines running along Atlantic Avenue, between Grand Avenue and Rockaway Junction, with two subordinate branches from Rockaway Junction to the two race tracks, and a third subordinate branch running directly south from Woodhaven to Hammel sub-station, across the Jamaica Bay trestle. Fig. 1 is a map showing the route followed by the transmission lines.

The general conditions controlling the location of the power transmission lines were such as to render difficult the construction of certain parts of it. Although the railroad right of way is, in most places, available, it is not always straight, and is sometimes so narrow as to make it difficult to meet the usual and desirable restrictions, with respect to close proximity of the line to telephone and electric light wires, trees, and other abutting property, which are commonly regarded as conducive to safety in operation. Although the expense of underground cable construction precluded the possibility of recommending it uniformly for all locations, nevertheless, the impracticability of constructing high-tension overhead lines in thickly populated sections of Brooklyn and Queens, required recourse to underground construction in two sections of the line. One of them comprises 1⅛ miles of main trunk line, from the power station to Dutchkills Street, and the other traverses Atlantic Avenue, between Flatbush terminal and Dunton, just west of Jamaica. Except where submarine cables were used, at the Broad Channel and Beach Channel drawbridges in the Jamaica Bay trestle, the remainder of the transmission line is of the overhead type of construction.

The trunk line as originally built carries five circuits from the power station to Woodhaven Junction sub-station, running in an eighteen-duct conduit line to Dutchkills Street, thence on a line of steel poles which follows the right of way of the Main Line Division, to a point about due north of Glendale Junction, where it bends to the south across the fields for about a mile, until it strikes the Rockaway Beach Division, which it follows to Woodhaven Junction. A branch line of three circuits runs westward from Woodhaven Junction to the East New York sub-station, two circuits running thence to Grand Avenue sub-station, all these being run in underground

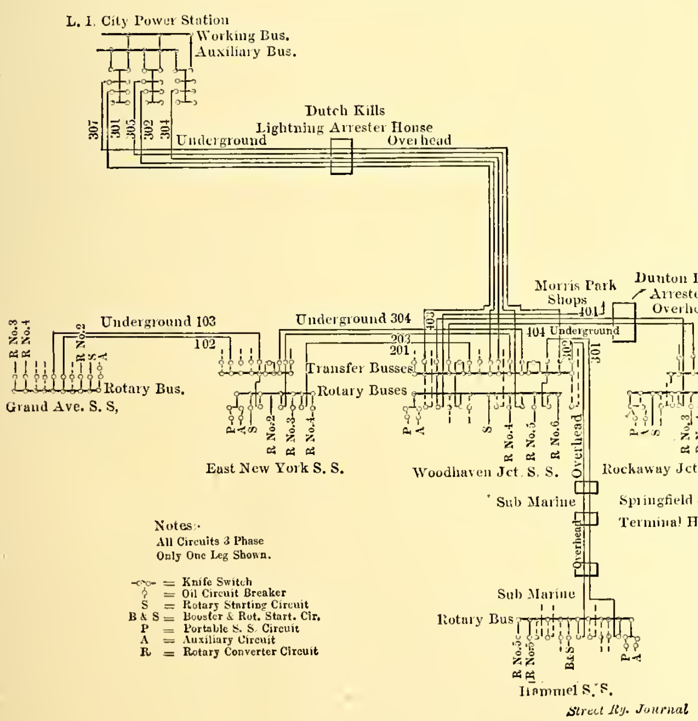


FIG. 2.—OUTLINE DIAGRAM OF CIRCUITS

conduits. To the east of Woodhaven Junction there are two circuits run underground to Dunton, where the transmission is changed from underground to overhead, continuing easterly on steel poles to Rockaway Junction sub-station. The branch circuits from Rockaway Junction to the portable sub-station terminal buildings at Belmont Park and Springfield Junction, are carried on wooden poles running along the Main Line and the Montauk Division, respectively, to their destination. Southward from Woodhaven two circuits follow the Rockaway Beach division across the Jamaica Bay trestle to Hammel sub-station. These circuits are carried on a line of steel poles to the southern outskirts of Ozone Park, half a mile or more from the sub-station, and the remainder of the distance on wooden poles.

The general arrangement of the transmission circuits is shown in Fig. 2. It will be noted in this diagram that the incoming-trunk line circuits at Woodhaven Junction are distributed along a set of bus-bars called the "transfer bus," and divided into sections from which the outgoing transmission circuits lead in various directions. It is possible by manipulation of the bus junction switches to operate these circuits separately or together, from outlying sub-stations all the way back to the power station. The same general arrangement is carried out in a smaller degree by similar transfer buses at East New York and Rockaway Junction.

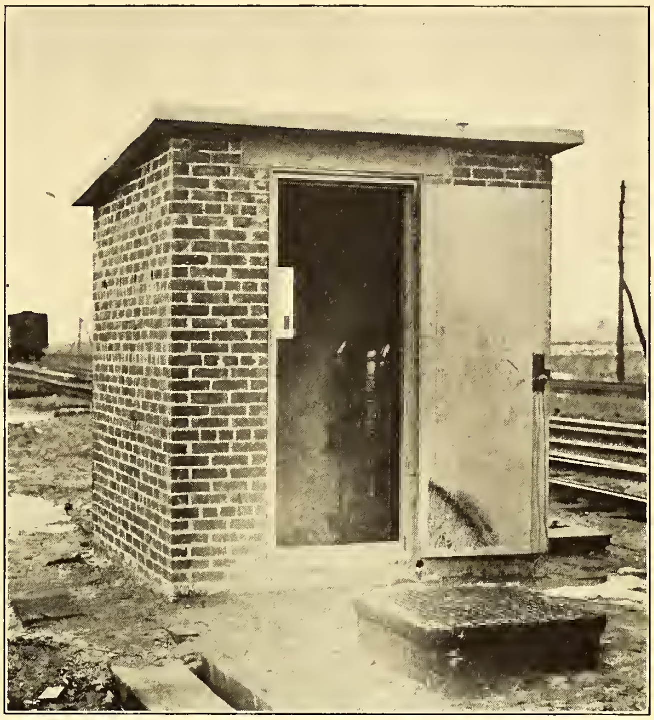


FIG. 3.—VIEW OF PUMP HOUSE ON MAIN CONDUIT LINE, NEAR LONG ISLAND CITY

The lengths of the various sections of the transmission lines are as follows:

Conduit section of trunk line, power station to Dutchkills Street, 1.12 miles. Overhead trunk line, Dutchkills Street to Woodhaven junction, 7.85 miles. Conduit section, from Woodhaven to East New York, 3.23 miles, and from East New York to Grand Avenue, 3.04 miles, Woodhaven to Dunton, 1.7 miles. Overhead, from Dunton to Rockaway Junction, 1.73 miles; Rockaway Junction to Belmont Park, 3.71 miles; Rockaway Junction to Springfield Junction, 3.35 miles; Springfield Junction to Valley Stream, 2.57 miles; Woodhaven Junction to Hammel, 6.98 miles.

The total mileage of conduit lines now in use is therefore 9.09, and that of pole lines, 26.19 miles.

CONDUIT CONSTRUCTION

The duct line leading from the manhole directly outside of the Long Island City power station, runs out Fourth Street to West Avenue, thence to Sixth Street, which it follows to the railroad tracks. Thence it runs along near the northern edge of the railroad right-of-way to the arrester house at Dutchkills Street. Between the power station and the railroad tracks, the construction involved no serious complications, except such obstructions as are frequently met with in city streets. The remainder of the line involved not only some blasting through a ledge of rock, but was also rendered especially difficult because much of it was situated below the level of the ground water, which, for a large part of the distance, was nearly at the surface, so that special provision for the drainage of the ducts and manholes was necessary. The manholes in this part of the line are connected by a line of 8-in. sewer pipe laid beneath the ducts and entering the manholes about 18 ins. from the bottom, thus forming a catch basin to prevent silt or other foreign matter from getting into and clogging the pipe. This conduit line is so pitched as to bring all the drainage into three sumps, one located at the power station, one about one-half mile from it, and the third near the Dutchkills Street end of the conduit line. These sumps are kept pumped out by electrically-driven submerged centrifugal pumps, automatically controlled, and discharging into


FIG. 4.—CONDUIT MANHOLES CLOSE TO TRACK, ATLANTIC DIVISION

the city sewer system. An illustration of the pumping house at the Dutchkills sump is shown in Fig. 3.

This conduit line is constructed of single vitrified-clay ducts, 18 ins. long, with square holes 3 13-16 ins., inside measurement, and walls ¾ in. thick. They were designed especially for the construction, and the ducts are 7-16 in. greater diameter than usual in order to facilitate the installation of the three conductor high-tension cables, which are nearly 3 ins. in diameter. A single duct was preferred to multiple ducts because of the thicker wall between ducts, which is better able to resist heat in case of a possible short-circuit. A square hole, with rounded corners, was preferred as affording space for dirt and pebbles to slide to one side, instead of being dragged along underneath the cable and injuring the sheath, as would be the case if round ducts had been used. The ducts are laid in cement mortar in such a way as to break joints in all cases, and are surrounded on the top, bottom and sides by a covering of concrete 4 ins. thick, composed of one part Portland cement, two and one-half parts of sand and five parts broken stone. The ducts are arranged three wide and six high.

The foregoing type of duct construction was adopted after duly considering the merits of various other types of ducts.

Manholes for drawing in and splicing the cables are located 400 ft. apart on straight work and a shorter distance on curves. The standard manhole for straight-line work is 8 ft. long, 4 ft. wide, and 6½ ft. high, inside dimensions. The corners are cut off, so that a horizontal section of the manhole resembles an elongated octagon. The side walls at the bottom are 12 ins. thick, and at the top 6 ins. thick, reinforced with expanded metal. The manholes are built of concrete, having a composition the same as that surrounding the ducts. An opening at the top is 25 ins. square, and is closed by two covers, the inner one of which can be locked, clamped, and packed gas tight if found desirable. Where, as sometimes happens, it was necessary to locate a manhole underneath the railroad tracks, it was strengthened by inserting additional I-beams in the roof. When the conduit line was placed between the edge of the right-of-way and the tracks, the limited space available made it necessary to change the shape of the manholes, which was done by making the side away from the tracks perfectly straight, and about on a line with the outside row of ducts. The interior arrangement was in every case such that cables could be spliced and carried across from one duct to another without introducing any sharp bends or leaving the cables unsupported.

During the construction of the conduit line out of Long Island City through the wet ground, it was necessary to line the trench with 3-in. tongued and grooved sheathing, and to use sump pumps continuously to remove the water. The sheathing was left in place at the completion of the work.

The conduit system on Atlantic Avenue comprises two kinds of construction. The portion lying between Atkins Avenue and Dunton, a distance of 4.4 miles, is in general identical with the above described construction for the main transmission line. It is installed on the south side of the tracks near the edge of the right of way. On this part of the construction the soil is of a very light sandy nature, so that the system is sufficiently drained by providing openings at the bottom of the manholes. As shown in Fig. 4, this section of the conduit construction was very close to the railroad track, in fact, the track overhung it for a good part of the distance, so that it became necessary to support the railroad track (which was in continual use) on one edge of the excavation, requiring a large amount of careful shoring to insure safe operation. The Atlantic Avenue Improvement conduits are built of four-way vitrified-clay duct, 36 ins. long, with square holes 3⅜ ins. on a side. These ducts are laid in cement mortar, the joints being first covered by a wrapping of cotton cloth saturated in Portland cement grout. Where the ducts are laid beneath the surface of the street, the assembled ducts are surrounded by a wall of concrete, 3 ins. thick on the sides and 4 ins. thick on the top and bottom.

On the Subway portion of the Improvement, the manholes for the conduit lines consist of niches in the side walls, 5 ft. wide, 8½ ft. in length, and 15 ft. high. These manholes are accessible from the street through regular manhole openings, and can also be reached from the Subway, as the side nearest the tracks is closed only by a rolling steel shutter.

On the other portions of the Atlantic Avenue Improvement the manholes are built of concrete, and are generally oval in form, 7 ft. long, 5 ft. wide, and 6½ ft. high, inside. The roof of this type of manhole is supported by I-beams, having an opening through it 24 ins. square closed by two covers, one of which can be locked gas tight. The manholes are located not more than 400 ft. apart. Where necessary, several of them are provided with a sump and automatically controlled electric-driven pumping apparatus. The pumps are of the submerged vertical centrifugal type, with 3-in. discharge, and when running at 840 r. p. m. will deliver 300 gals. per minute. They are controlled by an automatic starting device operated by means of floats, which prevent the water from rising above a certain height. The discharge pipes are connected to the city sewerage system. The motors are of the direct-current type, of 5½-hp at 220 volts.

UNDERGROUND CABLES

The underground high-tension cables are of the three-conductor type, each conductor having a cross section of 250,000 circ. mils, and being composed of thirty-seven copper wires. Each conductor is covered with a wrapping of impregnated paper, 7-32 in. thick. The interstices between the insulated strands are then filled in with jute insulation and another layer of 7-32-in. thick paper insulation is wound over the entire group. The outside sheath is 9-64 in. thick, and is composed of lead, with about 1½ per cent of tin added. The completed cable is 2⅞ ins. outside diameter. Each length of the cable was tested at the factory by applying 30,000 volts between each pair of conductors, and between each conductor and the sheath. After the cable was installed in the ducts and joined up ready for service, it was again tested by applying between each pair of conductors 30,000 volts, and between each conductor and the sheath 27,000 volts for a period of 30 minutes.

At each end of every high-tension cable there is sweated on a spun-brass end-bell, which is filled with "No. 67" GE compound, to properly seal the ends of the cable and prevent injurious static discharges. The end-bell is about 7¾ ins. in diameter, and about 7 ins. high. The three conductors are brought out separately through a wooden head in the end-bell, after being wrapped with varnished cambric tape, and are surrounded by micanite tubes, to give additional insulation.

At the drawbridges in the Jamaica Bay trestle, the cables are of the armored submarine type, and the conductors are insulated with 7-32 in. of rubber around each strand, with another 7-32 in. of rubber around the group of three. This insulation is composed of 30 per cent pure Para rubber, and is covered with a sheathing 9-64 in. thick, and composed of lead with about 1½ per cent of tin added. Over this is an armor of No. 4 B. & S. galvanized-iron wires laid spirally on the outside of the lead covering, with a thin layer of jute between the lead and the armor. There are two such cables at each drawbridge.

The high-tension cables are located in the lower portion of the conduit system wherever possible with the idea of separating them from any other cables for different purposes which may be installed subsequently. They are carried around the sides of the manholes in racks. The minimum radius of bend in this type of cable is 18 ins. Where exposed in the manholes, and at the sub-station terminals, the cables are wrapped with a layer of hard-rolled asbestos mill board, ⅛ in. thick, and outside of the asbestos mill board there is a wrapping of asbestos listing 2 ins. wide, laid on until it averages ⅜ ins. thick. The whole is then wrapped with galvanized-iron tape, 1-64 in. thick and ½ in. wide, laid on with edges overlapping. At each manhole, there is a strip of sheet copper sweated on to the lead sheath and brought out through the wrappings, to allow of grounding the cable should it be necessary to protect it from electrolysis.

Before the cables were pulled into the ducts, a wooden mandrel, 3 ft. long and 3⅛ ins. in diameter, was pulled through, to insure a clear passage.

At the Jamaica Bay drawbridges, the armored cables were laid across the channel and allowed to settle to the bottom. A diver then arranged them so that they were properly separated, and they were sunk into the mud by means of a water jet, supplied by pumps at 100-lbs. pressure. By means of this jet, the diver was able to scour out a trench wide enough to contain the cables, 4 ft. below the bottom of the channel. This method of installation was preferred to dredging because of the difficulty which would have been encountered in attempting to dredge the trench through the fender piles on either side, and because of the rapid current through the channels, which would fill with sand a trench so dredged immediately after excavation, unless the cables should be laid during the dredging process, which is obviously impracticable.

There is in all about 25 miles of high-tension underground cable installed, besides 418 miles of armored submarine cable.

ARRESTER HOUSES

The vulnerability of underground cables to lightning and to other static disturbances which may be set up in the transmission line, require that the outlying ends of transmission cables exposed to lightning discharges be provided with protective apparatus. Wherever the underground cable section of the transmission line is jointed up with the overhead system, lightning arresters and choke coils are installed, suitable houses being provided to shelter this apparatus. There is one of these houses on the main transmission line at Dutchkills Street, Long Island City, and another at Dunton, on the branch line running east of Woodhaven. Smaller houses were also provided for the same purpose at the two drawbridges.

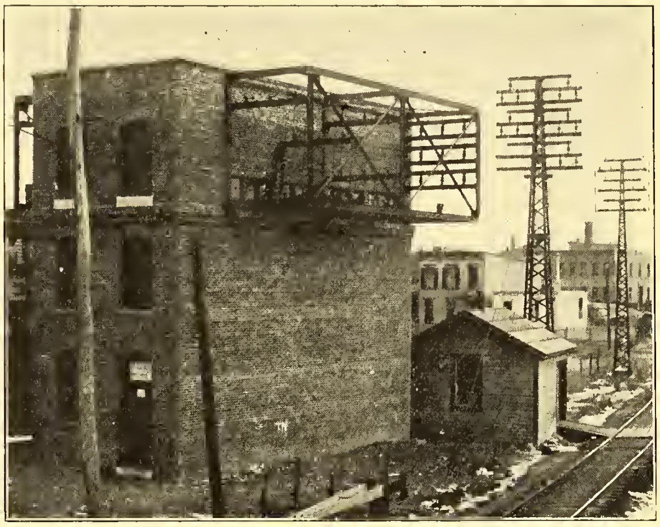


FIG. 5.—ARRESTER HOUSE AT DUTCHKILLS STREET

The house at Dutchkills Street is a brick structure, a photographic view of which is shown in Fig. 5. This at present contains room sufficient for eight outgoing overhead circuits, which leave the house four on a side. The general design of the transmission line is such that the circuits on one side of the poles can be shut down for repairs without shutting down those on the other side, and this idea was carried out in the construction of the arrester house, so that there would be no confusion possible between live conductors and dead conductors whenever it might become necessary to do any repair work on the line. The arrester house is 33½ ft. in length, 17½ ft. wide and 30½ ft. high, inside, and is constructed of brick, with a concrete floor and roof. The disposition of the apparatus in the interior is shown in Fig. 6, and it will be noted that the steel beams supporting the apparatus extend to the outside of the building, forming a series of racks for the support of the transmission cables, which are dead ended upon them. The arresters are all provided with knife switches, so that they can be readily disconnected from the circuit. A choke coil is also provided in series with each main circuit, and another knife switch between the choke coil and the cable bell, enabling the cable to be entirely disconnected from the overhead line. The disposition of the material is such as to economize space, and at the same time makes each circuit capable of ready access without the necessity of incurring risk from other apparatus, in case it needs repair. Wood has been entirely omitted from the construction of this

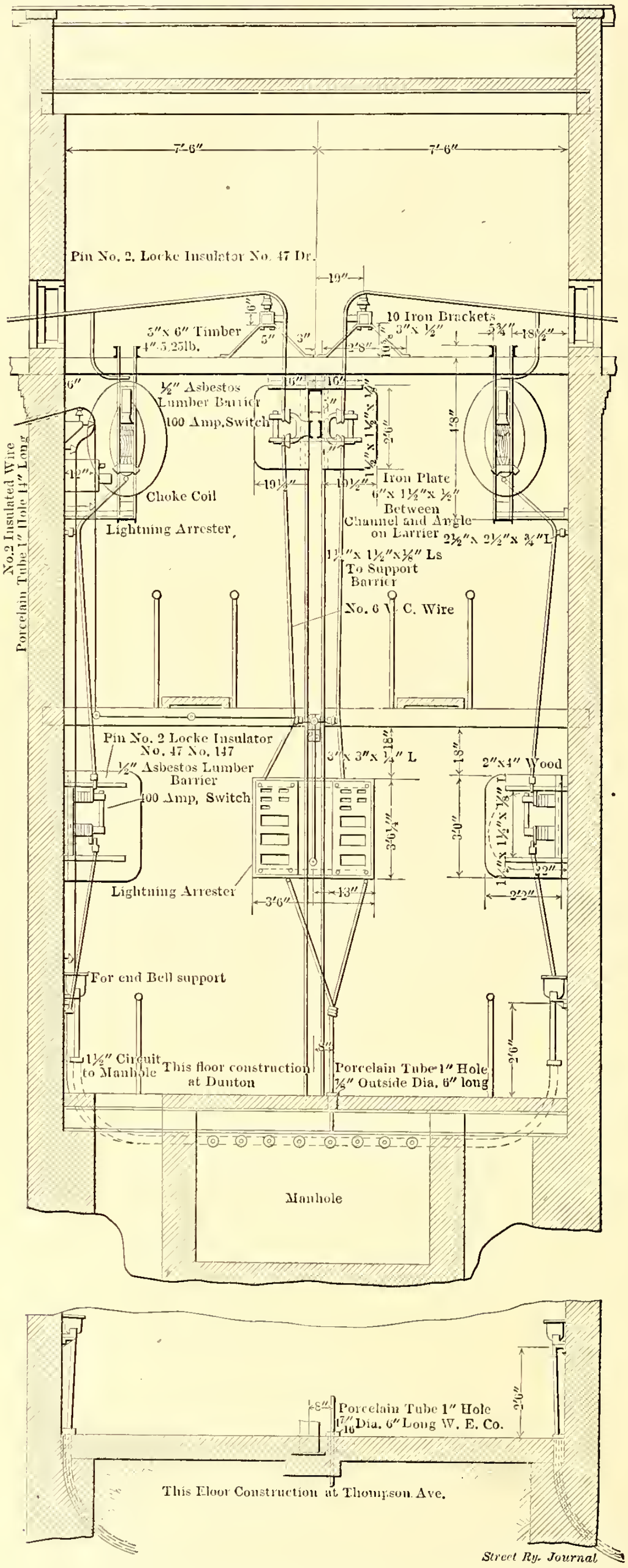


FIG. 6.—CROSS-SECTION OF LIGHTNING ARRESTER HOUSE. MAIN TRUNK LINE

arrester house, making it fireproof. The incoming cables are carried through the floor by means of ducts reaching to the last manhole in the conduit line, and are arranged along the wall, running through switches and through the choke coils to the various outlets along the various portions of the outside walls. The arresters are mounted on either side of the steel framework in the center of the building, and the ground connections all run to a single ground lead, consisting of 5½ square feet of copper plate buried in the ground between layers of crushed coke. The arresters are of the Westinghouse low-equivalent type, mounted on marble slabs, which in turn are carried upon porcelain insulators.

The outgoing cables on each side are anchored on a strain pole after leaving the racks upon the sides of the building, which in themselves are not intended to carry the longitudinal stresses of the overhead cables.

The openings in the side of the house through which the cables run, are 18 ins. square, enclosed by two glass plates ⅜ in. thick, and separated 5 ins. with 2½-in. holes in the centers, through which the cable passes without touching the glass. A thin disk of brass, 2½ ins. in diameter, is attached to each wire midway between the glass plates, and thus pre-

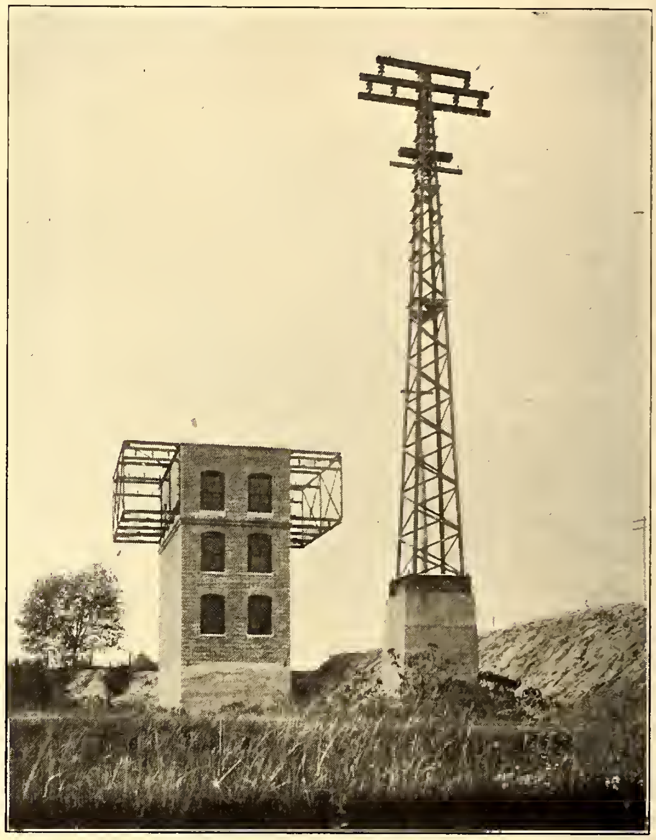


FIG. 7.—ARRESTER HOUSE AT DUNTON AND ADJACENT STRAIN POLE

vents the direct access of rain or snow through the openings. Standard straight-line insulators are used for supporting the bare wires inside of the building.

A house similar to the foregoing is located at Dunton, where the branch transmission line running eastward from Woodhaven is changed from conduit to overhead construction. The design of this house and the arrangements of the apparatus inside it are identical with the one above described, but with capacity for six circuits instead of eight. An illustration of this house is shown in Fig. 7.

At the drawbridge channels in Jamaica Bay, three houses are provided to shelter similar apparatus. Each of these consists of a steel framework covered with expanded metal and concrete side walls, and a corrugated copper roof resting upon a pile foundation. The method of entrance of wires is similar to that above described, and the strains of the overhead line are taken by a separate anchorage, composed of four poles braced together, forming a stiff wooden tower, which carries the longitudinal strains of the line without guying. The pile foundation is protected from ice by clusters of fender piles suitably located around them. There are two of these houses at Broad Channel, and one for the north side of Beach Channel, as the south end of the submarine cable at the latter place after passing to the shore runs through ducts directly to Hammel sub-station, which is only a few hundred feet from the drawbridge. A photographic view of the arrester house at Broad Channel is given in Fig. 8.

OVERHEAD-LINE CONSTRUCTION

The overhead construction is of the most substantial character. Up to about five years ago, the line construction of almost every electric railway and power transmission system was patterned after the standards which were evolved from telegraph construction practice where the conditions were not particularly exacting, and the penalty for breakdown was not great. The absolute necessity for reliability in a transmission line that serves a public utility of such magnitude as the Long Island Railroad, requires a stability in all parts of the construction that calls for the exercise of engineering skill and foresight to a greater extent than has hitherto been usually brought to bear. To give the continuous service which conditions demand it is necessary to construct a line in which the chance of failure of any part is reduced to a minimum, and that cannot be torn down or seriously disabled, except through some extraordinary catastrophe which would compel the temporary suspension of railroad operation. Consequently, instead of building a pole line by rule of thumb methods, all lines of engineering experience were brought to bear upon the problem with the object of carrying its mechanical sufficiency and stability to a degree of perfection that would afford the least possible chance for a shutdown from any of the usual causes.

There are two general divisions of the overhead consturction, the trunk line between Dutchkills Street and Woodhaven Junction, and the branch lines between that point and the other outlying sub-stations. The trunk line, shown in Fig. 9, is built of steel poles, and the branch line between Dunton and Rockaway Junction, through which the latter sub-station and two portable sub-stations are fed, and upon which the circuits to stations not yet constructed may eventually run, is also equally important with the trunk line, and is

FIG. 8.—ARRESTER HOUSE AT BROAD CHANNEL DRAWBRIDGE

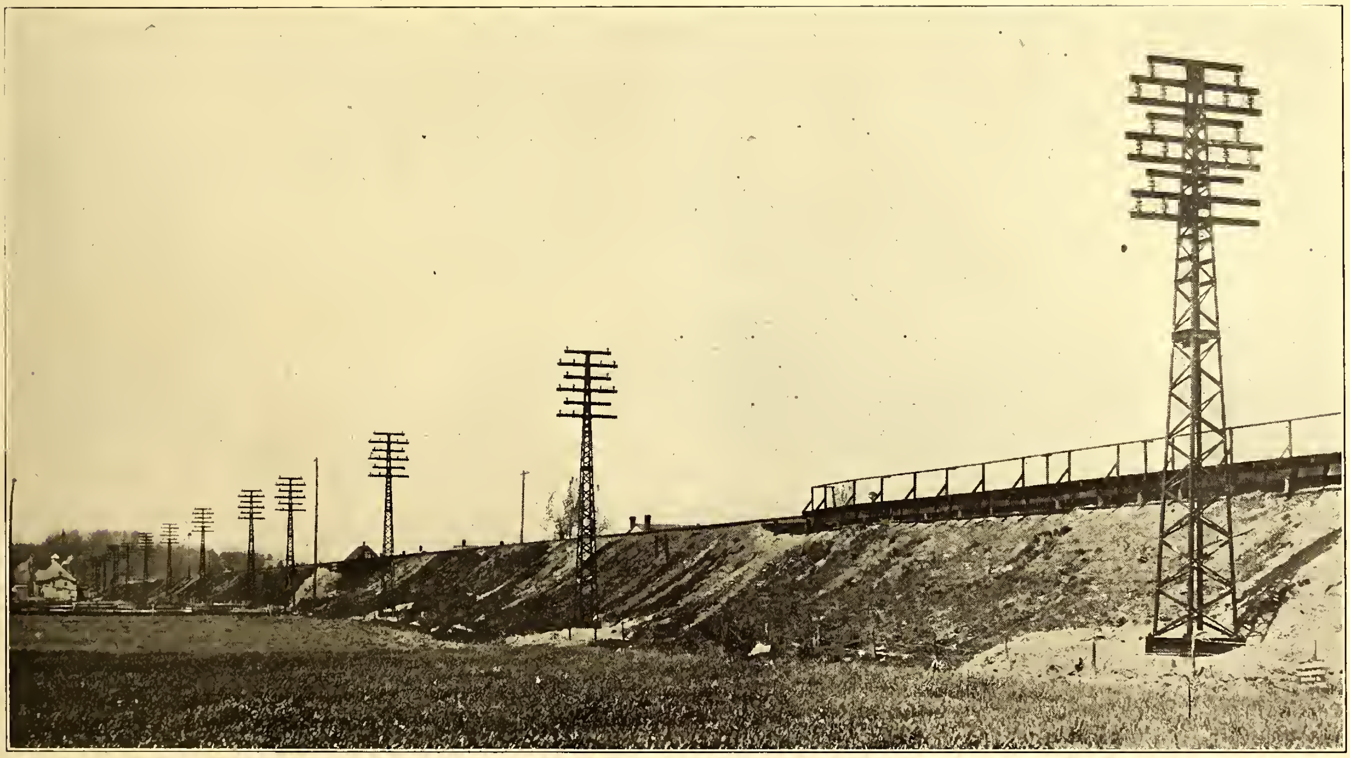


FIG. 9.—MAIN OVERHEAD TRUNK LINE NEAR WOODHAVEN JUNCTION

therefore built of steel. From Rockaway Junction, the branch pole lines to the separate outlying sub-stations are of wood, as shown by Fig. 10. From Woodhaven Junction south the poles are of steel to the southern outskirts of Ozone Park, because of the rather exceptional height at which the cables have to be carried to clear other wires, but from Ozone Park to Hammel they are of wood.

The pole lines have not been duplicated for the sake of greater security, as is sometimes done where plenty of room is available for pole lines, and where other conditions make it desirable. It was decided that a sufficient degree of insurance would be obtained by constructing a single-pole line in the most substantial manner. The suburban lines of the Long Island Railroad form several loops or meshes of a net work which may afford an opportunity for the construction of additional transmission lines by other routes, should future conditions require such a development.

The trunk line is designed to carry eight three-phase transmissions circuits, consisting of three 250,000-circ. mil cables each, together with eight low-tension cables of 500,000 circ. mils each. As the latter, when installed must be 25 ft. above the ground, and as there must be a reasonable clear space between the low-tension and high-tension circuits, no argument is required to demonstrate the necessity for using steel-tower construction to carry such an unusual weight of overhead conductors.

The branch line transmission circuits, however, are not intended to carry more than two three-phase transmission circuits and four low-tension cables on a single line of poles. This condition enabled the use of wooden poles, of which an

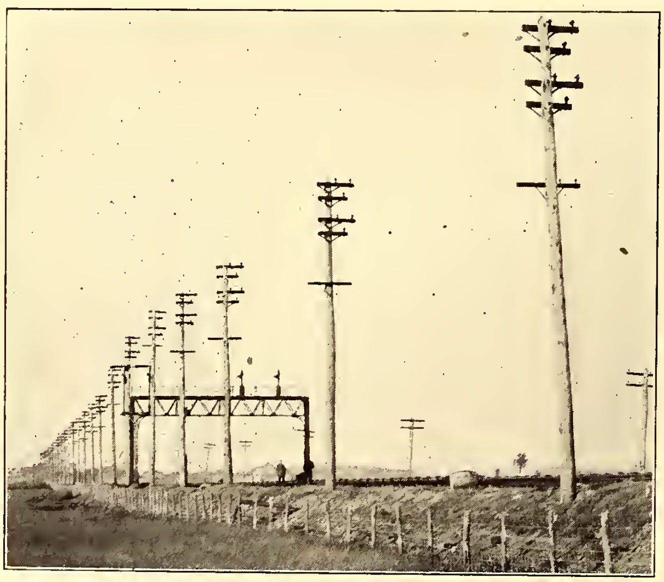


FIG. 10.—WOOD POLE CONSTRUCTION, LOOKING NORTH FROM JAMAICA BAY

extra heavy type was selected in order that the idea of stability might be consistently carried out.

STEEL POLES

The steel poles are of various sizes to meet different conditions. They are all designed to carry twenty-four 250,000-circ. mil cables, on their upper portions, and underneath them an additional load of eight 500,000-circ. mil low-tension cables which local regulations require to be at least 25 ft. above the ground. The spans between steel poles average 150 ft. in length, except where turning corners or carrying the cables over railroad tracks. The poles when fully loaded as above, are able to carry safely a weight of 4500 lbs. of cable.

The steel poles are built of four corner angles, connected together by angles and plates forming a lattice type of construction. They are tapered uniformly to the top on two sides and to within about 7½ ft. of the top on the other two sides, the taper being ⅜ in. per ft. This taper is uniform to the bottom of the pole and is the same for all lengths of poles. The tops are in every case 6 ins. x 11 ins. At the bottom the corner angles are tied to a base composed of plates and channels through the corners of which the four anchor bolts pass.

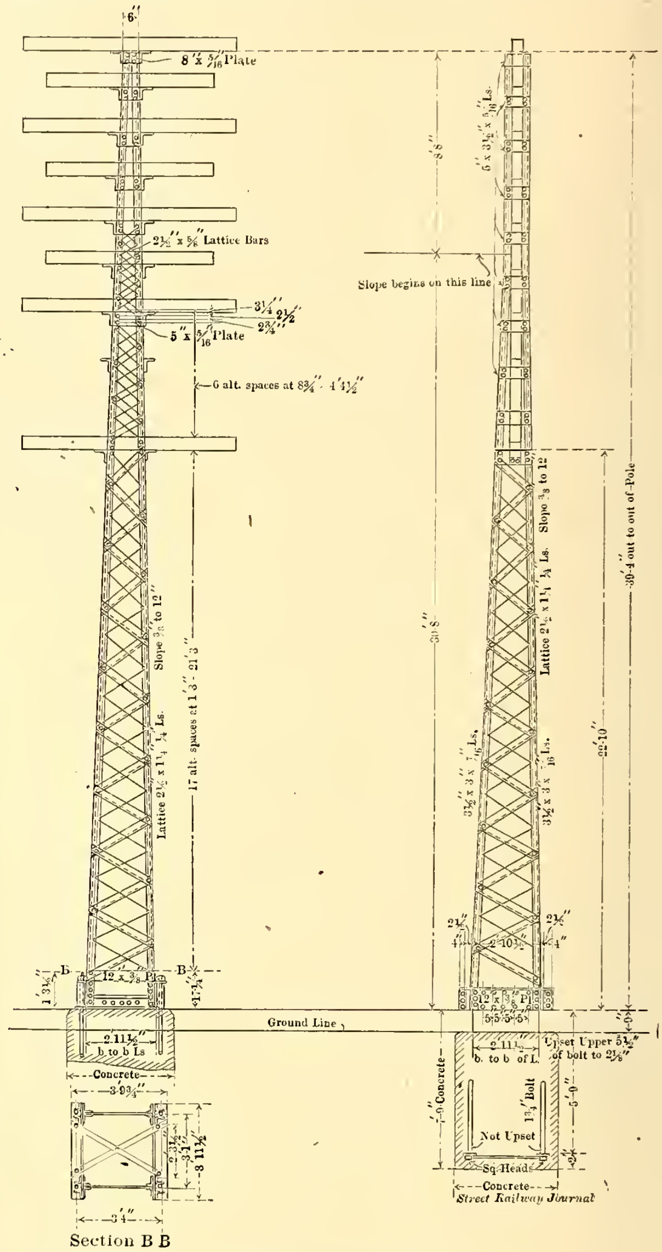


FIG. 11.—39-FT. 4-IN. STEEL POLE FOR STRAIGHT-LINE AND CURVE CONSTRUCTION

This forms a sort of box construction around the base of the pole, and greatly increases its stiffness and stability. This type of construction enables a foundation to be built, and the anchor bolts set at any convenient time independent of the delivery of the poles. This permits the most desirable degree of flexibility in the organization of the pole-setting force, thus dividing it into practically two separate gangs, neither of which is hampered by the movements of the other.

The standard poles are made in four lengths, increasing by 5 ft. from 39 ft. to 54 ft. in length, the 39-ft. pole being the standard, the other lengths being only used where necessary. On account of the above mentioned uniform taper, the sizes of the bases vary from 3½ ft. x 4 ft. to 4½ ft. x 5 ft., depending on the height of the pole. The foundations are therefore proportioned accordingly. From a detailed survey of the line, the length and the location of every pole was determined upon before construction began, and every foundation built to fit the size of pole assigned to that particular location.

The poles are designed to withstand a wind pressure at right angles to the line corresponding to a wind velocity of 100 miles per hour. This was calculated from data obtained in the Berlin Zossen high-speed railway tests, which showed the pressure on a flat surface due to a wind velocity of 100 miles per hour to be about 27 lbs. per square foot, which applies to the flat surfaces of poles and cross-arms. For the projected area of cylindrical conductors, one-half of this value or 13½ lbs. per square foot was the factor used for the above wind velocity.

For standard straight-line poles, without side strains other than wind pressure, the corner angles are 3 ins. x 3 ins. x ⅜ ins. For the heavier strains at curves and corners, the general design of the poles is the same, but they are given greater strength by using heavier corner angles.

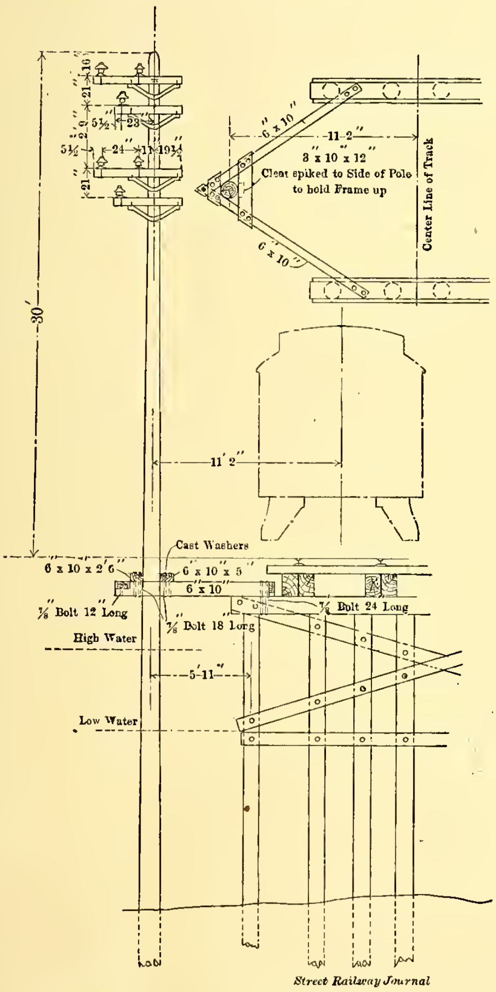


FIG. 12.—HIGH-TENSION POLE CONSTRUCTION ON JAMAICA BAY TRESTLE

The design of the curve poles was made dependent on the distance by which the curve pole is offset from a straight line joining the two poles on either side of it. For offsets up to 6 ft., the corner angles of the pole construction are 3½ ins. x 3 ins. x 7-16 ins., while the offsets between 6 ft. and 10 ft., the corner angles are 3½ ins. x 3 ins. x ½ in. A drawing of the curve pole is shown in Fig. 11.

The foregoing types of pole are each designed in the four lengths. By reason of the uniform taper, an extra length does not result in an increase of the size of the corner angles, but only in the enlarged dimensions of the base. The moment of resistance at the base is thereby increased in proportion to the height of the pole.

Besides the standard poles above described, designed to meet the ordinary conditions, an extra heavy pole was designed in three lengths. This type is called the strain pole, and is used for offsets up to 32½ ft., for turning sharp corners, or for anchoring the line at special points. These poles are similar in design to the standard poles, but the taper is uniformly increased to ½ in. to the foot, and all four sides taper uniformly all the way to the top, which is 8½ ins. x 12 ins. The base of the 41-ft. pole is about 5 ft. square, that of the 51-ft. pole being about 5 ft. 9½ ins. x 5 ft. 11½ ins. The corner angles of these strain poles are 4 ins. x 4 ins. x 9-16 in.

FIG. 13.—WOODEN-POLE CONSTRUCTION ON JAMAICA BAY TRESTLE

All the poles are designed to withstand the side strains on 150-ft. spans due to the offsets above specified. For greater offsets the length of span is shortened. At all sharp turns, three poles of the heavy-strain type are used, two to take the longitudinal strains and guyed back to the base of the middle pole, which takes the side strains due to the offset.

The three first-mentioned standard types of poles were designed to take the necessary side strains without guying. The longitudinal strains due to anchoring the lines are so great, however, that the strain poles used for anchorage are guyed fore and aft to the bases of the adjacent poles with 7-16-in. galvanized steel cable. On some sharp curves the poles were guyed laterally as an additionl precaution, using 7-16-in. guy cable and Stombaugh guy anchors.

The construction of the steel pole includes angle-iron seats for the cross-arms which pass through the pole structure, the weight of the cables holding the cross-arms down on the seats and requiring only the simplest type of fastening, which consists of two ¾-in. "U" bolts, which clamp the cross-arms immovably to its seat. The use of the ordinary type of cross-arm brace is rendered unnecessary.

The ability of the steel pole to act as a lightning rod is turned to advantage, and each pole is thoroughly grounded to a copper plate beneath the foundation and connected to one of the anchor bolts by a copper wire.

The poles were transported from the steel works without "knocking down," and were erected whole upon their foundations with the aid of a gin pole. After erection, cement grout was run underneath the base and the pole permanently set by tightening the foundation bolts. There are now in position in the line 358 of the standard straight-line and curve poles, and nineteen of the heavier type of strain poles.

POLE FOUNDATIONS

The size of the concrete foundation varies with the height and character of the pole. For the straight-line pole the dimensions are 4½ ft. to 5 ft. square, averaging 8 ft. deep, with 1⅜-in. anchor bolts. For the curve poles, the foundations averaging from 4½ ft. x 6 ft. to 5½ ft. x 7 ft. 3 ins. on the side faces, with a depth of between 7 ft. 9 ins. to 8 ft. 9 ins., and employing 1¾-in. anchor bolts. Strain pole foundations are from 7 ft. to 8 ft. square, and from 9 ft. to 10 ft. deep, and employ 1⅞-in. anchor bolts. The tops of foundations are usually about 9 ins. above the ground level. After the poles were all set and the line construction entirely completed, the box-shaped bases of all the steel poles were filled with concrete, brought up to a pyramidal form, as shown in the pole drawings.

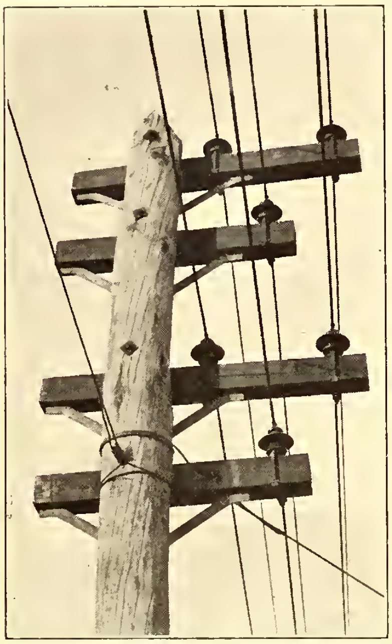


FIG. 14.—METHOD OF ATTACHING CROSS-ARMS AND INSULATORS IN WOODEN-POLE LINE CONSTRUCTION

WOODEN POLES

The wooden poles are of two kinds; chestnut, which is the standard for ordinary work, and creosoted yellow pine, which is used only along the trestle over Jamaica Bay. The chestnut poles are 45 ft., 50 ft., and 55 ft. in length, and 25 ins. in circumference at the top. The creosoted poles are from 60 ft. to 80 ft. long, with the same dimensions at the top, and treated with 15 lbs. of dead oil of coal tar per cubic foot of timber. Creosoted poles are all set 15 ft. into the bottom of the bay, by means of a water jet. They are all set so as to have the tops 30 ft. above the rails and are located far enough away on one side of the trestle to obviate any interference with the wires on the part of the pile driver that is used to renew the piles of the trestle bridge. These poles were braced to the trestle with creosoted yellow-pine timber, and a drawing of the pole and its setting is shown in Fig. 12. A general view of the pole line construction on trestle is given in Fig. 13.

This method of pole construction along the trestle was adopted only after a most careful consideration of various ways that were proposed for carrying a line across the bay. A separate trestle, carrying a line of conduits made up as when laid in a trench, was found too expensive. A pole line directly supported on the existing trestle would not afford the necessary clearance from traffic. Various plans were made for driving piles alongside the trestle and then splicing transmission poles to them, but even this construction, though practicable, does not compare in simplicity or durability with the long pole in one piece, which by the aid of a water jet can be driven down into the mud butt first, instead of being treated as an ordinary pile, and driven point first.

This portion of the line is exposed in winter to a very severe strain, due to the movement of ice with the tide. The poles were set during a very severe winter, and the strains due to the ice were, at times, sufficiently great to cause the trestle to be moved out of line in places, but the poles set as above described successfully withstood the action of the ice. For a large part of this distance, the trestle runs across a series of low islands, which are covered with water at high tide only, so that it was difficult to reach them during construction, but, with very few exceptions, the poles were set by a floating pile-driving apparatus without going on the trestle or interfering with train operation.

The total number of steel poles employed is 377, of chestnut 490, and of creosoted yellow-pine poles 264.

CROSS-ARMS

The cross-arms are of yellow pine, 5-in. x 6 in. cross section, housed on top to a 12-in. radius, and they are painted with one coat of asphaltum paint. The method of attaching them to the steel poles has already been described. On the wooden poles they are gained 1 in. into the pole and held by one ¾-in. through bolt with 2-in. square washers, as shown in Fig. 14. Bracing, though unnecessary on the steel poles, was effected in the case of wooden poles by angle-iron braces made in one piece of 2-in. x 2-in. x ¼-in. angle, bent into V-shape. For standard steel poles the arms are 7 ft. and 9 ft. long. For steel strain poles, they are 7 ft. 10 ins. and 10 ft. 6 ins.

The two circuits on the Jamaica Bay trestle and on the line immediately north of it, were carried one above the other on two sets of cross-arms on the side of the pole, the cross-arms being flush on the side of the pole opposite to the circuits. On the trestle itself, the circuits were both on the side of the pole away from the track, in order to get them as far as possible outside the sweep of the pile driver used to replace piles in the trestle bents. On the main line, to the north of the trestle, however, this position was reversed because, on

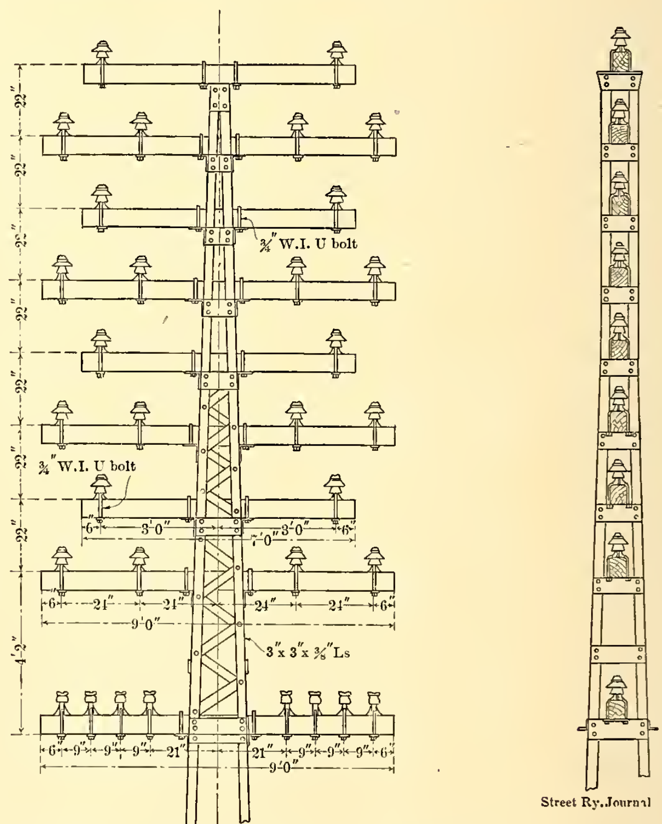


FIG. 15.—STANDARD POLE TOP FOR STRAIGHT-LINE POLE

account of the four tracks here laid, the poles had to be set as far as possible toward one side of the right-of-way, and there was not room enough to carry the wires on the outside of the pole without overhanging the adjoining property. The cross-arms here are 4 ft. and 5 ft. long, but the standard bracing and fastenings are used.

On the steel-pole line, the apex of the triangle, at the points of which the wires are carried, is placed on top, while on wooden-pole portions of the line the apex is at the bottom. The latter position is that generally preferred for the arrangement of high-tension circuits, as it allows repair men to get up more easily between the circuits. On the trunk line, however, the necessity for carrying the maximum number of circuits made it desirable to reverse the usual order, and the apex was accordingly placed on top.

The drawing in Fig. 15 shows the design adopted for the pole top for the standard trunk-line pole on straight line and curves, and the arrangement of the insulators. Fig. 16 shows the corresponding arrangement for the standard wooden-pole top; Fig. 12 illustrates the unbalanced type pole top used on the Rockaway Beach Division. Fig. 17 shows the arrangement of the pole top for the strain pole.

PINS

The insulator pins consist of malleable-iron castings clamped to the cross-arms by means of U-bolts threaded through the body of the pin, and held by a plate fitting over

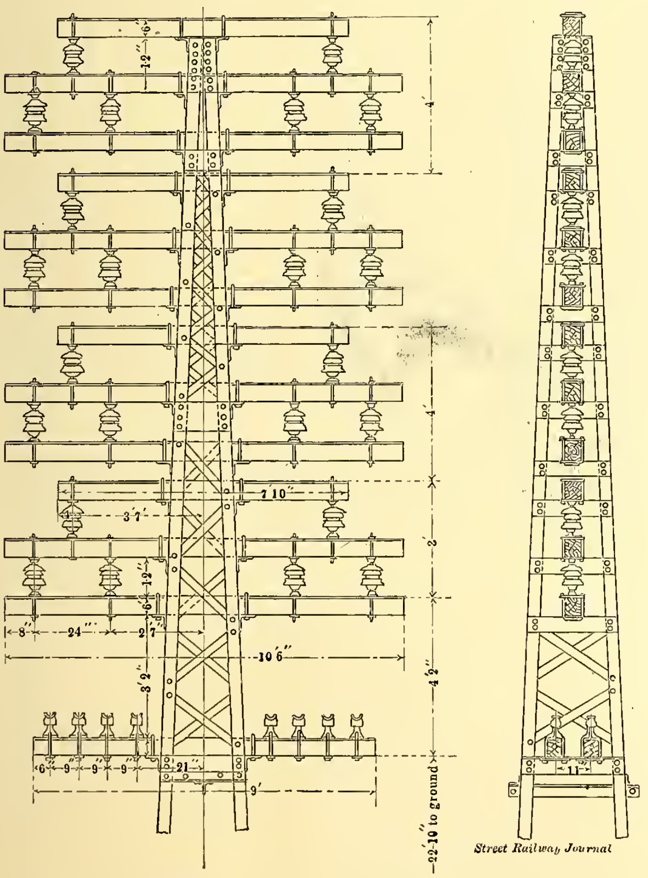


FIG. 17.—STANDARD POLE TOP FOR STEEL STRAIN POLE

the U-bolts and against the cross-arm. This type was first used on this transmission line, and represents a new departure in pin design, inasmuch as by its use all boring of the cross-arm is avoided. The strength of the cross-arm is maintained, and the depreciation resulting from entrance of moisture through holes bored in the arm from top to bottom, is obviated. The form of pin used is also of much greater strength than is possessed by a pin in which the bending moment where it enters the arm has to be met by small cylindrical cross section, which in case of the iron pin is sometimes not more than ¾ in. in diameter, and in a wooden pin, 1½ ins. to 2 ins. The strongest part of this pin is at the base where it joins the cross-arm. It admits of easily following up any shrinkage of the cross-arm (which cannot be done in a pin which is set in a hole in the cross-arm), as all that is

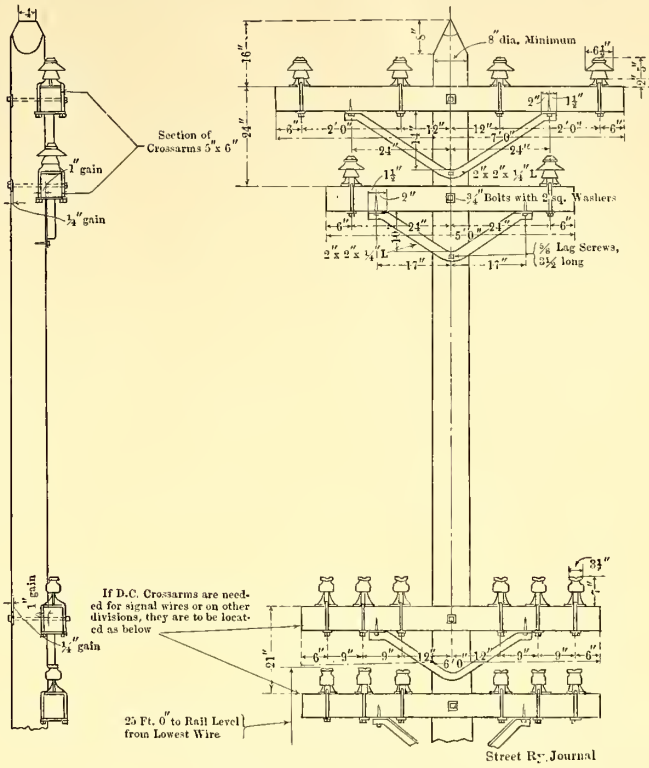


FIG. 16.—STANDARD WOOD POLE

necessary, if the pin comes loose, is to tighten up the nuts on the underside of the clevis.

INSULATORS

The straight-line insulators are 6½ ins. in diameter and 5 ins. high, made of porcelain in two parts, cemented together. The insulators are colored with a brown glaze to render them less conspicuous. They are designed particularly for the conditions here imposed. The pin and insular together carry 250-circ. mil cable 6½ ins. above the cross-arm. The ties are made of ordinary soft copper wire, tied on top.

The tests to which the insulators were subjected at the factory include a rain test at 30,000 volts, and a salt water flash test of 50,000 volts for two minutes. The insulators were further obliged to pass the test of plunging them into hot water and then into ice water without cracking. After the insulators were erected, and the cables strung upon them ready for operation, they were tested by applying 30,000 volts between the conductor and the ground for 4 minutes. The insulators underwent all these tests successfully.

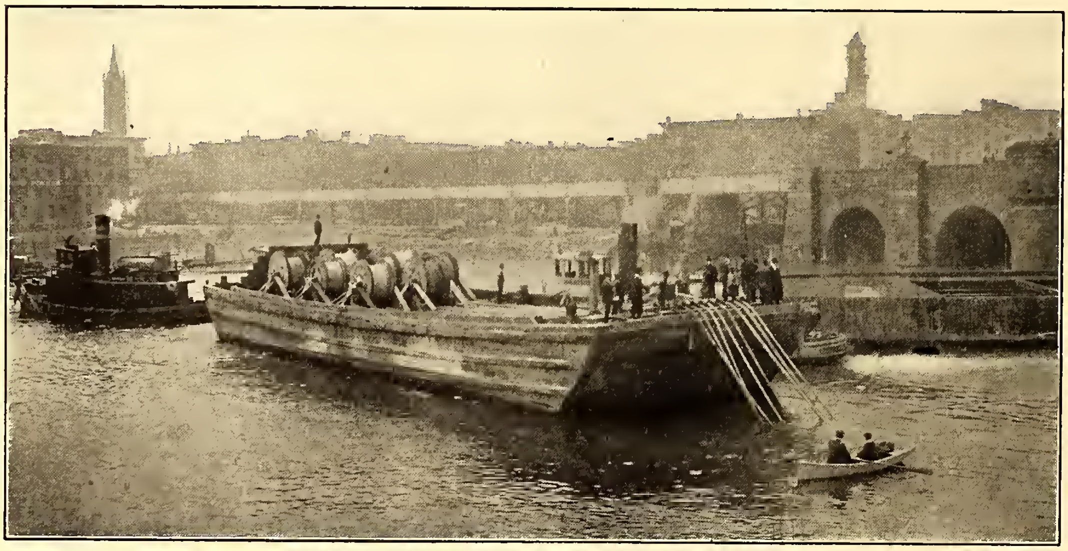
The strain insulators are of the "spool" type and made in one piece, 7½ ins. in diameter and 8 ins. high. Each strain insulator has two petticoats, one above and one below the point where the wire is attached. A 1⅛-in. x 12-in. steel pin is cemented in the center of the insulator, and this steel pin rests in sockets at the top and bottom, which are firmly clamped by U-bolts to the cross-arms. This obviates the boring of arms, and thus preserves consistency with the design of the straight-line insular pins.

The Western & Atlantic Railroad has announced a reduction of fare between Atlanta and Marietta, Ga., to a figure competitive with the rate charged by the new trolley line.

CABLE-LAYING ACROSS THE HARLEM RIVER

A very important work in laying power cables was carried out May 12, when the New York Central & Hudson River Railroad laid nineteen cables under the Harlem River just east of its railroad bridge. The work was carried out under the direct supervision of W. H. Rodier, superintendent of construction of the Safety Insulated Wire & Cable Company, and in the presence of E. B. Katte, electrical engineer, and J. D. Keiley, assistant electrical engineer of the New York Central & Hudson River Railroad Company.

The following is a description of the cables: Four lengths, approximately 730 ft. each, of a 3 conductor No. 4-0; each conductor was composed of nineteen strands of tinned copper wire insulated with 13/64-in. wall of 30 per cent fine, pure, para rubber, taped. The three conductors thus insulated and taped were laid up with jute, covered with 13/64-in. jacket of same compound, then covered with tape, 9/64-in lead sheath juted and armored with No. 4 B. W. G. galvanized steel wire, and finished with two layers tarred jute over all. These cables were tested at 40,000 volts for 5 minutes, and showed an insulation resistance of 2000 meghoms per mile. The weight per foot is approximately 18 lbs., and the outside diameter 3⅞ ins. These cables were designed for the New York Central working pressure of 11,000 volts.



METHOD OF LAYING CABLE ACROSS THE HARLEM RIVER

There were also five lengths, approximately 750 ft. each, of 1,000,000 circ. mil. cable composed of 91 strands, insulated with a 7/64-in. wall of 30 per cent pure para rubber, taped and covered with 9/64-in. lead, juted and armored with No. 4 B. & S. galvanized steel wire, and with two layers of jute over the armor. These cables were tested at 5000 volts for half an hour, and are designed for working pressure of 600 volts. The insulation resistance is 500 megohms per mile. The weight of these cables is approximately 12 lbs. per foot; the outside diameter is 2 9/16 ins.

There was also one length, 730 ft. of 1,250,000 circ mil. cable composed of 127 strands, and with approximately the same specifications as the 1,000,000 circ. mil. cables. The weight is approximately 13 lbs. per foot, and the outside diameter is 2 11/16 ins.

There were also four cables, 700 ft. long, of 1,250,000 circ. mil. bare wire, composed of 127 strands, and with a weight of approximately 4 lbs. per foot.

There were also three cables, 710 ft. long, each for signal cables, to be used under the General Railway Signal Company's contract.

There were also two cables in 750 ft. lengths of telephone cable; one ten pair and one thirty pair.

The power cables were manufactured by the Safety Insulated Wire & Cable Company; the telephone cables by the John A. Roebling Sons' Company, and the signal cables by the Okonite Company. Owing to the exceptional facilities of the Safety Insulated Wire & Cable Company, the armoring and finishing of all the cables was done at the works of the latter company.

The accompanying view shows the method of laying followed. Eight cables were laid at a time—probably the first time this number has been laid successfully. To insure that they were in proper position in a trench that had already been dredged across the river, a diver was sent down, and his investigation proved that all the cables were in exact position.

NEW ENGLAND STREET RAILWAY CLUB

The May meeting of the New England Street Railway Club was held in Boston at the American House on the evening of the 24th, with President Winsor in the chair. The usual dinner preceded a paper on "Rubber," by George W. Knowlton, of Boston. Mr. Knowlton presented a large number of stereopticon views of rubber plantations in South America and other parts of the world, showing also factory views and samples of rubber treated in various ways. He spoke briefly of the value of rubber for insulating purposes, and pointed out the influence of the world's demand for this product upon the price. It is doubtful if the price will ever go below $1 per lb., the present figure being about $1.35. About 50,000 tons of rubber are now produced annually.

The June meeting of the club will probably be a water excursion to Quincy and Nahant. It is hoped to arrange for the club to visit the works of the Fore River Ship and Engine Company at Quincy, and also the Quincy Point power station of the Old Colony Street Railway, closing the afternoon with a dinner at Nahant, and leaving the evening free for a trip to Wonderland Park at Revere Beach.

The Grand Rapids, Grand Haven & Muskegon Railway Company has announced that all mileage books issued over the road will be withdrawn from sale. In place of the mileage books the company will issue a coupon book containing coupons to the value of $2.50, which will be sold for $2. These coupons will be good for the payment of cash fares on the cars at the cash rate, no amount less than 10 cents being accepted. Commutation books, good only for the purchaser and containing 50 rides on a 30 day limit, between Grand Rapids and stations west of Grand Haven, will be issued at the rate of 1¼ cents per mile.

THE UNIVERSITY OF ILLINOIS ELECTRIC TEST CAR

The department of electrical engineering of the University of Illinois has recently added to its equipment a car, of the regular interurban type, which is being used in making various tests on the lines of the Illinois Traction System. The car body was built by the Jewett Car Company, and the principal dimensions are as follows: Length over body, 34 ft. 4 ins.; length over all, 45 ft.; width over all, 8 ft. 4 ins.; height from underside sill to top of roof, 9 ft. 6 ins.; distance between truck centers, 22 ft. 4 ins.

The car is divided into two compartments, one 22 ft. 6 ins. long and the other 11 ft. 10 ins. The larger compartment is furnished with a desk, filing cases and chairs in lieu of the usual seats. The smaller compartment contains an instrument table and some of the electric control apparatus which in common practice is placed under the car.

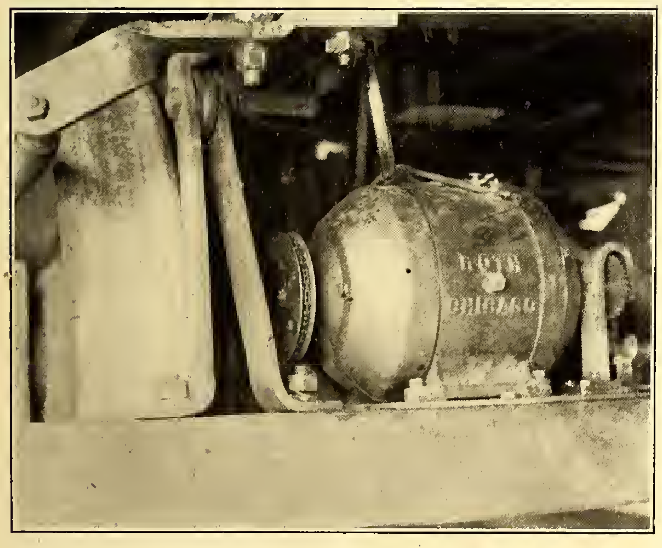
TEST CAR USED BY THE UNIVERSITY OF ILLINOIS

The trucks are of the C-60 type of the Standard Steel Car Company, with the exception that the wheels on one truck are rolled steel and were supplied by the Standard Steel Company. The wheel base is 6 ft. 4 ins. and the wheels are 33 ins. in diameter and have the M. C. B. tread and flange. The motive power equipment consists of four No. 101-D Westinghouse motors with a nominal rating of 40 hp, and the gear ratio is 22:62.

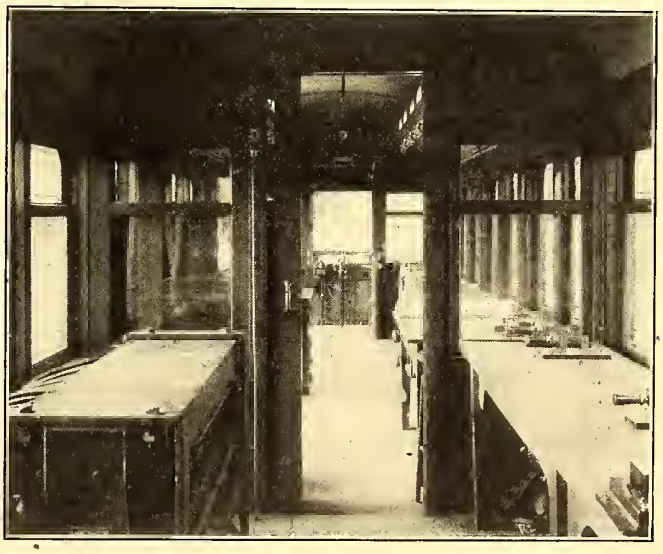
The electric control equipment is the Westinghouse unit switch system of multiple control. The switch group, circuit breaker, reverser, limit switch and line relay are hung in the smaller compartment for the purpose of observation under running conditions, and the cables used for connecting these pieces of apparatus and the motors are laid in a transit-lined space between the car floor and a false floor. The brake system is the straight air system and the compressor, compressor motor governor, brake cylinder and storage tank were supplied by the National Electric Company. Hand brakes have also been installed for use in case of emergency.

Two DeFrance automatic air sanders and a simplex headlight are also used.

The instrument equipment consists of an integrating wattmeter for measuring the total power supplied to the motors, an integrating wattmeter for measuring the power supplied to the compressor motor, a G. E. graphic recording ammeter in the motor circuit, and a G. E. graphic recording voltmeter which is generally used to record the trolley voltage, although by means of a voltmeter plug board on the instrument table the voltage on any individual motor armature or field may be recorded. A switch with ammeter leads connected to it has been placed in the circuit of each motor so that the current in each individual motor may be obtained at any time by connecting the ammeter leads to an ammeter and opening the switch.



SPEED-INDICATOR GENERATOR



SWITCH GROUP AND INSTRUMENT TABLE

The speed is obtained in two ways. First, by an autometer made by the Warner Instrument Company, Beloit, Wis. This instrument is geared to the axle, and besides indicating the miles per hour also records the mileage per trip and the total mileage. The speed is also indicated electrically. This is accomplished by having a $\frac{1}{2}$-kw 10-volt generator driven from the axle by a chain drive and separately excited by means of a storage battery. In the generator armature circuit is connected a resistance coil of about one ohm resistance in series with the low tension coil of a 1-kw transformer ratio 20-1 and a low-range ammeter. This ammeter has been carefully calibrated and a curve plotted which gives the miles per hour for all currents. The high-tension coil of the transformer is

ARRANGEMENT OF LARGER COMPARTMENT

connected to a low-range voltmeter with a zero center scale. This voltmeter has been calibrated for acceleration and gives excellent results.

Both the speed and acceleration are recorded by means of pointers which are moved by hand and made to follow the movements of the needles, the pointers being connected by a small steel wire to pens on the recording tables. Pens time every five seconds and every fourth revolution of the axle, while another pen is operated from push buttons and is used to special points such as stations, etc. To obtain the degree of curvature on the curves a small drum has been bolted to each bolster, and these drums have been arranged to rotate with any relative motion between the car body and the trucks. These drums are connected by means of a small steel wire to pens on the recording table, and records of curves are automatically obtained.

Two theses are being prepared by seniors on results obtained on the car, and indications point to very satisfactory results. One thesis deals with the consumption of power on different schedules varying the number of stops, time and rate of acceleration. The other takes up the question of increase of power consumption due to curves and also goes into the question of the time lost on curves and the speed at which different curves may be taken.

As stated, the track of the Illinois Traction System has been used in making the different tests, and it is owing to the courtesy of the officials of the Illinois Traction System that the university has been enabled to perform these tests and also give the students some idea of actual traction work.

INTERIOR, SHOWING TABLE ON WHICH ARE RECORDED SPEED ACCELERATION AND CURVE

BLOCK-SIGNAL SYSTEM OF THE NEW YORK CENTRAL ELECTRIC ZONE

As announced in the STREET RAILWAY JOURNAL several months ago, the contract for all block-signaling and interlocking in the electric zone of the New York Central and Hudson River Railroad has been awarded to the General Railway Signal Company of Buffalo, N. Y. Besides being the largest signal contract ever awarded, this work represents an important advance in the art of signaling. Both block and interlocking work will be all-electric, operated by current taken from a power line running the whole length of the system. All track and signal circuits will be operated by alternating current; the only batteries to be used will be storage batteries for the operation of interlockings, which will be charged by an a.c-d.c. motor generator drawing current from the power line. In comparing proposals, the New York Central Railroad Company gave special consideration to safety and reliability and economy of operation, and also to quickness of delivery and erection, and the selection of this system was made only after the most systematic and careful deliberation.

At terminals and on short sections at interlockings, it was practicable to give up one of the rails of each track for signaling purposes, but for the greater part of the system it was of considerable advantage to the electric traction system to allow both rails of each track to be used for the return current.

The system offered by the General Railway Signal Company, and known as the "Young System," was adopted. Alternating current is used for track circuits in connection with reactance bonds, permitting the passage of the direct propulsion current freely through both of the running rails, while preventing the flow of the alternating current which is used in signaling. This two-rail system was deemed best suited to the conditions.

Track plans showing the spacing and arrangement of all signals were prepared by the railroad company, and together with specifications were submitted to all the signal companies capable of handling the work. Separate bids were requested for the block signaling and the interlocking work.

To assist in finally deciding the system to be adopted, bids for block signaling were requested in eight different forms covering both normal clear and normal danger systems, all-electric and electro-pneumatic design, and either with one rail of each track given up for signaling purposes or with both rails left available for power return. Bidders were encouraged to make suggestions as to design and requirements of specifications, so that the specifications might not be considered to act as a restriction on the exercise of their best skill. In canvassing the proposals the Signal Committee of the New York Central Lines was called into consultation, and every feature was gone over in detail.

The work included by the contract covers what is known as the electric zone, extending from the Grand Central Station to Croton, on the Hudson Division, a distance of thirty-five miles, and from Mott Haven to White Plains, on the Harlem Division, a distance of nineteen miles. Throughout this distance there will be four main tracks, and the work includes about 3000 interlocking levers and 1400 track circuits, aggregating about 250 miles. The work to be undertaken at the present time covers only that portion of the road to be electrified this year, which carries the work from the Grand Central Station to High Bridge, on the Hudson Division, and to Wakefield on the Harlem Division.

equipped with the transformers for the signal service, delivering alternating current at 3000 volts to the signal transmission line, which although extending the entire length of the district to be signaled, is cut half way between each pair of sub-stations, thus making that portion of the line fed by each sub-station entirely independent of the adjoining one.

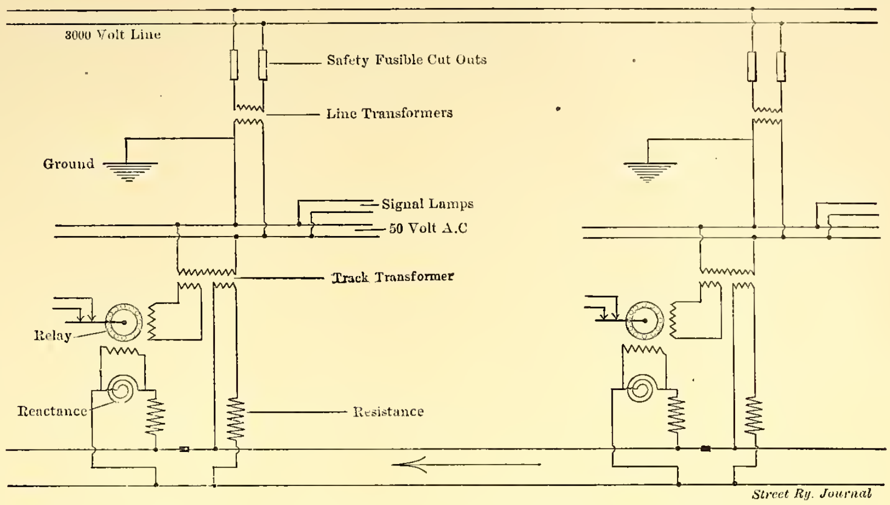


FIG. 3.—TYPICAL A. C. TRACK CIRCUIT, ONE RAIL GIVEN UP FOR SIGNALING PURPOSES

The apparatus in each sub-station is properly protected with automatic and hand-operated switches, and to insure operation, should the alternating current fail, d.c.-a.c. motor generators taking current from the storage battery system installed in each sub-station for use of traffic, will continue to

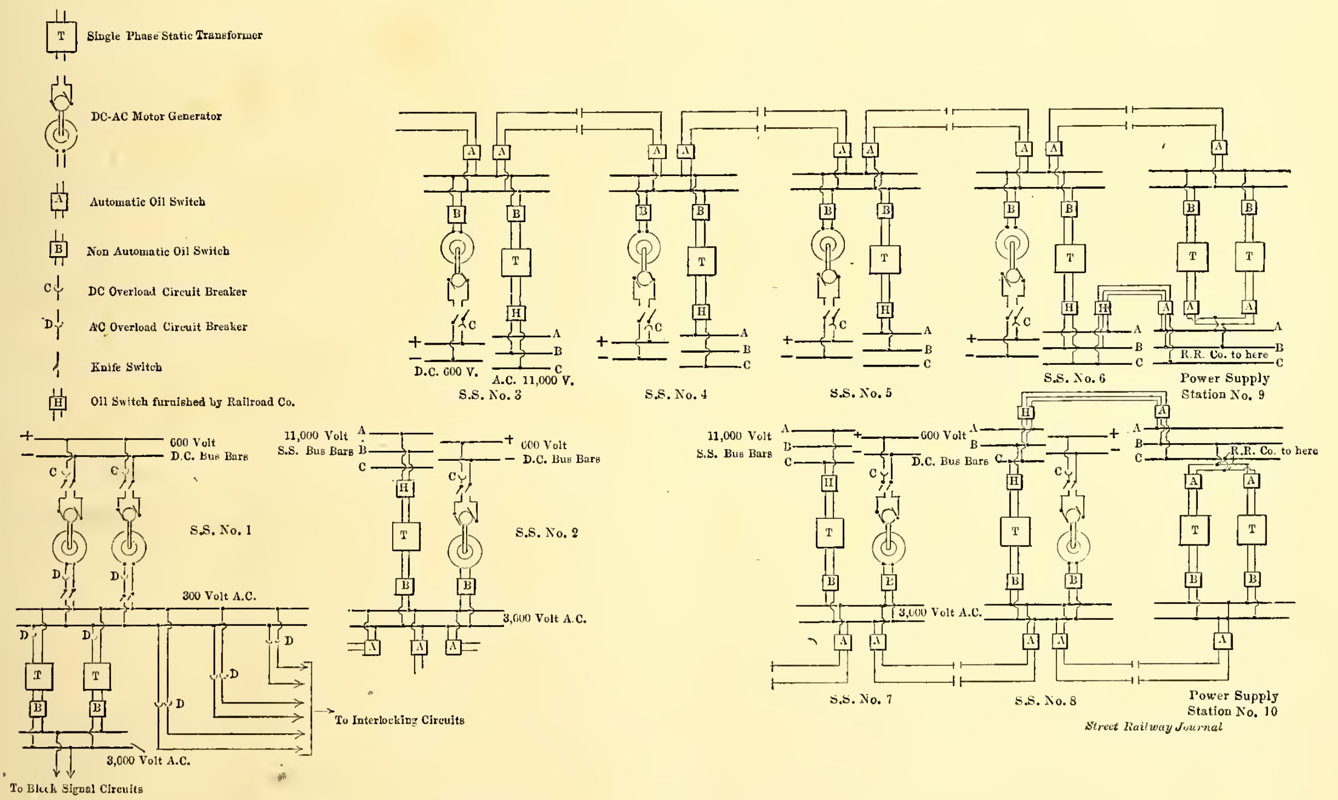


FIG. 1.—DIAGRAM OF CONNECTIONS FOR POWER-SUPPLY EQUIPMENTS FOR AUTOMATIC BLOCK SIGNALS AND INTERLOCKING

Power for operating the signal system will be taken from the two main power stations of the company at Port Morris and Yonkers, which deliver three-phase alternating currents of 25 cycles and 11,000 volts, and from the various sub-stations which deliver direct current at 666 volts to the third rail for operating purposes. These sub-stations are also

feed the signal transmission line with alternating current, and the signal system will continue to work under all conditions under which traffic will be operated. A synchronizer is installed between the transformer and the motor-generator set.

The 3000-volt transmission line consists of No. 0 bare cop-

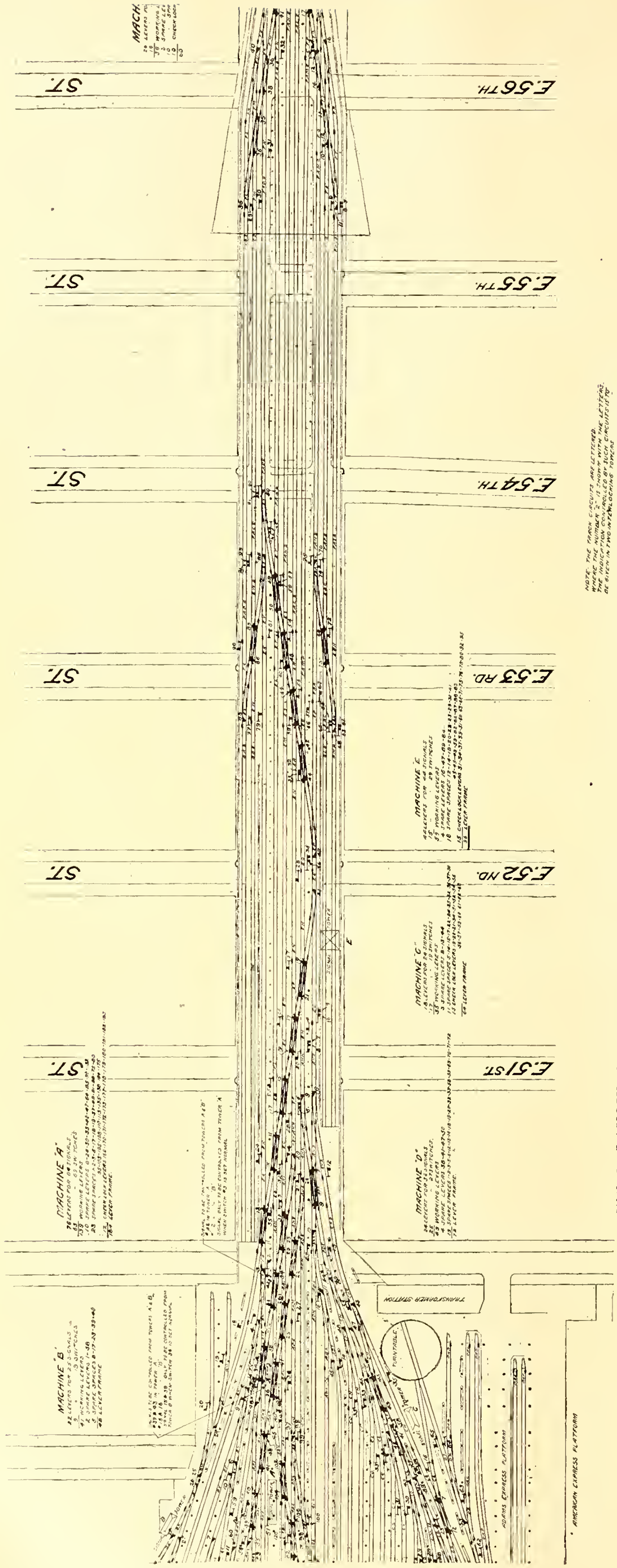


FIG. 2.—LAYOUT OF INTERLOCKING PLANT, FROM FORTY-NINTH STREET TO FIFTY-SIXTH STREET

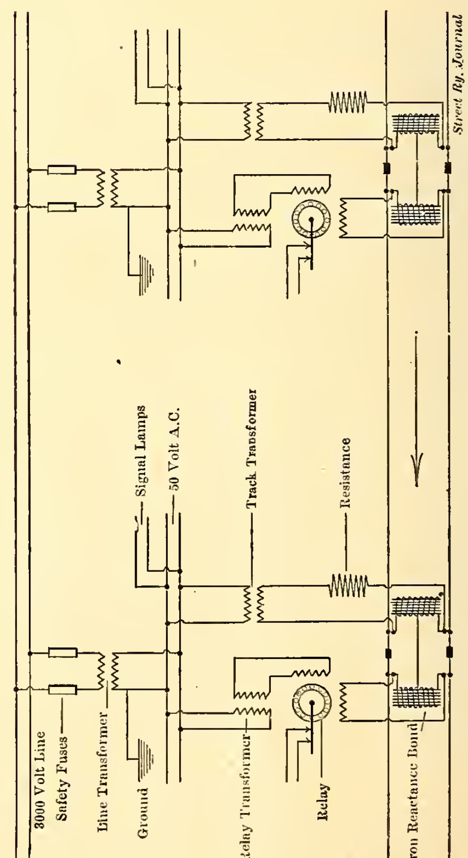


FIG. 4.—TYPICAL A. C. TRACK CIRCUIT, ONE RAIL GIVEN UP FOR SIGNALING PURPOSES

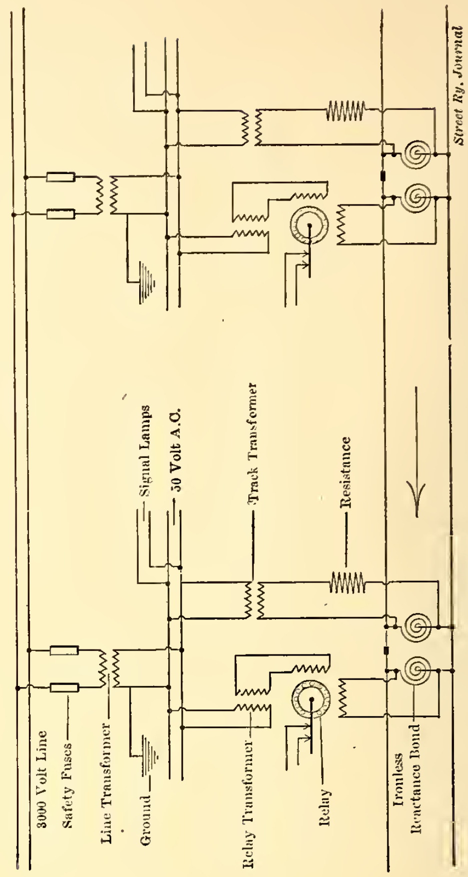


FIG. 5.—TYPICAL A. C. TRACK CIRCUIT, TWO-RAIL RETURN, USING IRONLESS REACTANCE BONDS

per wire, carried on the pole line and in the conduits used for the main transmission system, and the signal bridges are equipped with extension brackets, with cross arms, for convenience in running wire lines to signals.

For the operation of signal circuits, signal motors, indicators, and signal lighting, the 3000-volt current is stepped down 50 volts, through transformers placed on signal bridges or transmission line poles. The secondary of the transformer is provided with a ground connection, formed by burying a 2-ft. x 3-ft. x 1-16-in. copper plate, to which is brazed a No. 4 B. & S. gage copper wire.

For track circuit operation the voltage depends on the length of track circuits, and varies from 1½ volts for circuits of 200 ft. to 8 volts for circuits of 5000 ft. The reduction from 50 volts to the track voltage is made by a transformer provided with four taps, which will permit of one type of transformer being used on all track circuits. The diagram of connections for power supply equipment is shown in Fig. 1.

In laying out the block signaling plan, the length of the block was determined by the braking distance. For speeds not exceeding 45 mph the blocks were made 1200 ft. long; for speeds between 45 mph and 60 mph, 2500 ft., and for speeds over 60 mph, 3000 ft., the average length of the long blocks being about 3200 ft. All blocks have a full block overlap. A distant signal is provided for each home signal. On account of the density of traffic and the necessity for quick operation the clearing time of signals is limited to three seconds. A typical arrangement of the block signals is shown in Fig. 2, covering the section from Forty-Ninth Street to Fifty-Sixth Street.

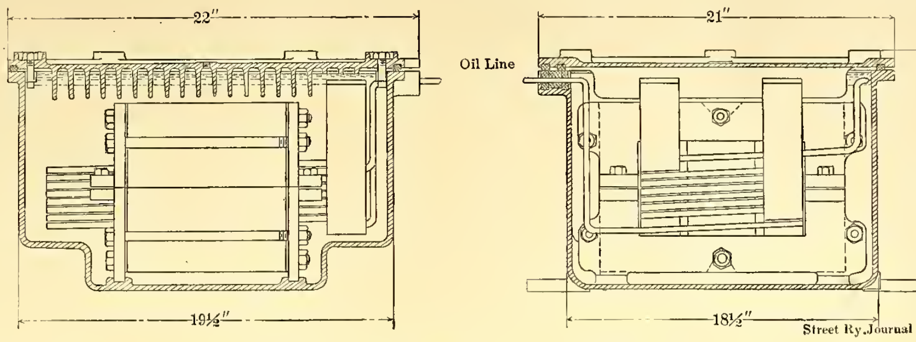


FIG. 6.—REACTANCE BOND AND CASE

The track circuits are of three types, as shown in Figs. 3, 4 and 5. Where they are 500 ft. or less in length, and where the drop in potential in the length of the track circuits is not greater than 50 volts, the "one rail" system is used, and one rail of the track is given up for signaling purposes and the arrangement shown in Fig. 3 is used. There being no direct current on the signal rail it is not necessary to use any reactance bonds.

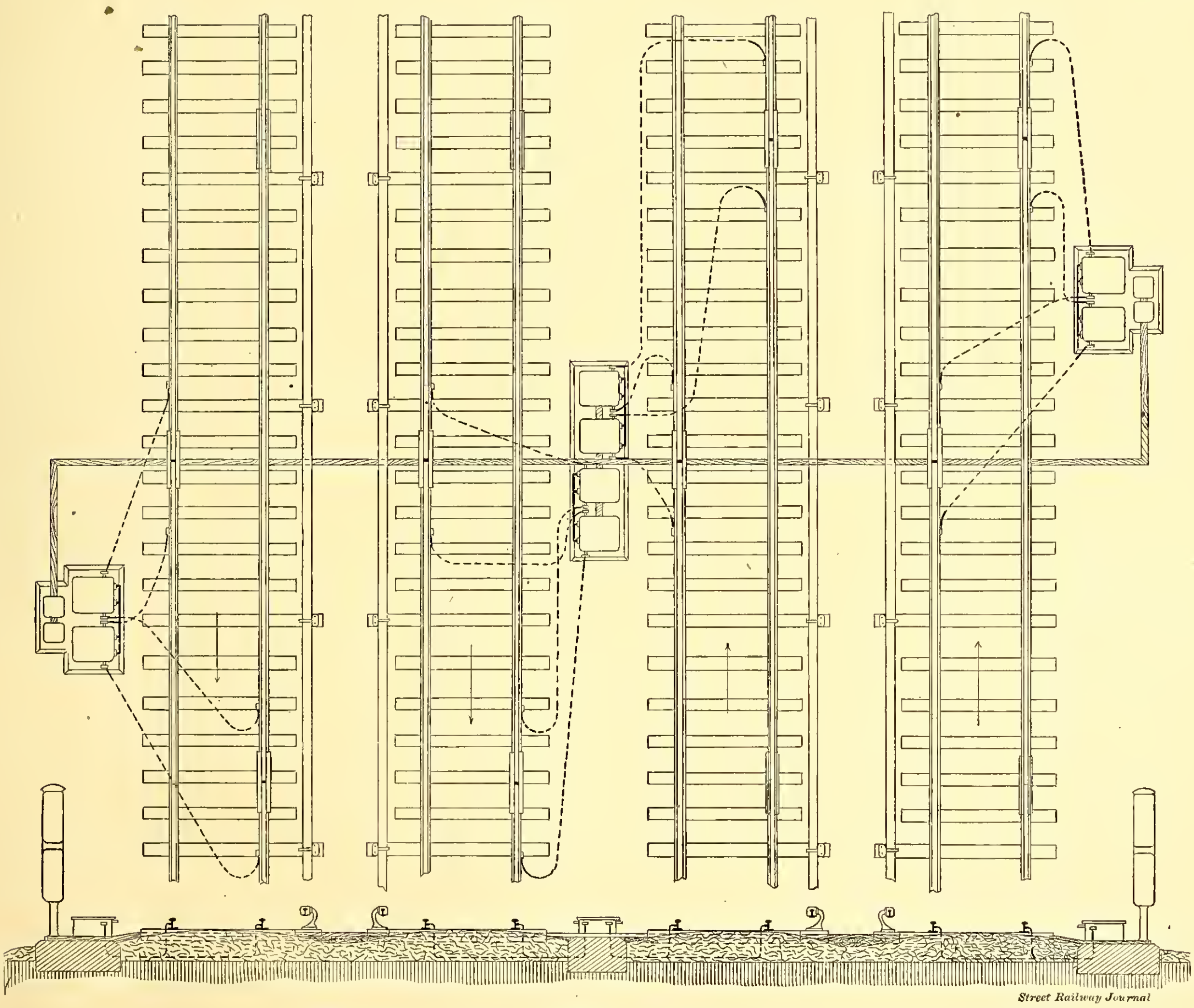


FIG. 7.—PROPOSED ARRANGEMENT OF REACTANCE BONDS, SHOWING FOUR TRACKS

On all track circuits over 500 ft. in length, the two-rail system is used, and both track rails are employed for the return of the direct power current. On all of these circuits it is necessary to use the reactance bonds, by which the connection is made around the insulated rail joints, permitting the direct current used in operating to pass, while impeding the alternating current used for track circuit work. The insulated rail joints are of the Weber pattern, with a steel angle plate on the inside.

On track circuits between 500 ft. and 1600 ft. in length the two-rail system is also used, and the reactance bonds consist of a copper bar 1 in. in cross section and 30 ft. long coiled in eight turns around an iron core, as illustrated in Fig. 6, the arrangement of the circuit being as shown in Fig. 4.

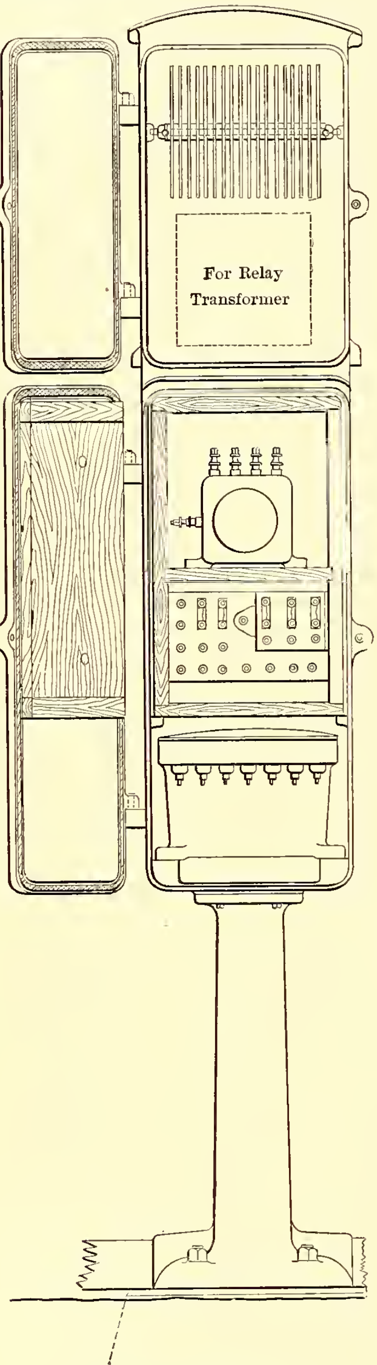


FIG. 8.—RELAY AND TRANSFORMER BOX

The use of two styles of bonding was determined by the cross-bonding for the electric traction system. The Engineering Department of the railroad company determined that the distance between such cross-bonds should not exceed 1600 ft. For blocks that are 1600 ft. or less in length the type of bond shown in Fig. 6, allowing cross-bonding at the ends of the track sections, was best suited to the conditions. For track circuits over 1600 ft. in length, where a cross-bond between one rail of each track was required every 1600 ft., the ironless reactance bond illustrated in Fig. 5 is the least expensive and the one to be used.

In Fig. 7 is shown the proposed arrangement of the reactance bonds on all four tracks, and also the connections from the bonds to the rail, which consist of bare stranded copper cable of 1,200,000 circ. mils. Specifications require that the connections shall not be made within 2 ft. of the rail joint, and that 2 ft. of slack shall be allowed to provide for creeping of rails.

All of the reactance bonds are enclosed in water-tight cast-iron boxes, set on foundations, and the boxes are filled with oil to carry off the heat generated. The bond is designed to permit the continuous passage of 3000 amps for each rail of the track without injurious heating. The casing of the box is made to cover the terminals and connections to the rail to keep them from being tampered with.

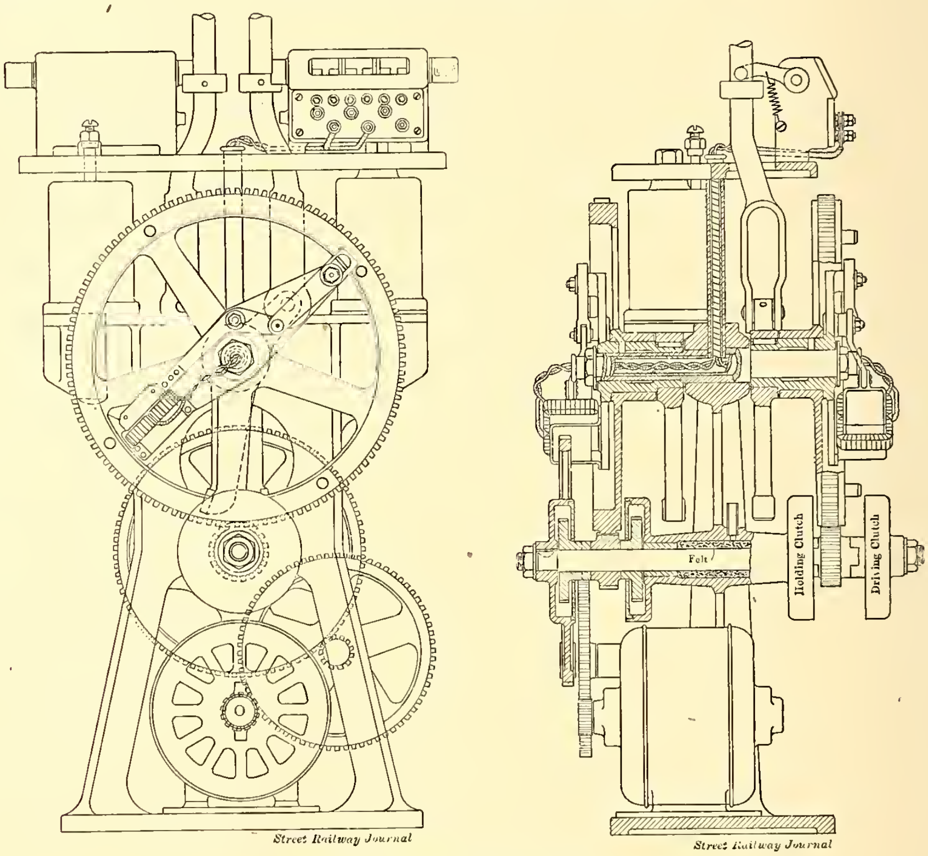


FIG. 9.—MECHANISM OF SIGNAL

It will be seen that the block sections are of two types, the one-rail and the two-rail systems. In the former the propulsion current flows along the continuous rail, and in the event of a defect in the continuous rail, this current must avail itself of the conductivity of adjacent tracks, through the cross bonding.

In sections of the two-rail system each of the traffic rails of a track forms separate and independent conductors, so that if one rail is interrupted, the other would act as a return conductor, even if there were no cross-bonding to adjacent tracks.

The track relay is of the induction motor type with two field coils. One coil is energized by the 50-volt signal operatig current which gives the greater part of the energy required to magnetize the fields and armature. The other coil is energized by the current from the track rails, and this current need only be strong enough to give sufficient magnetism to rotate the armature. The armature revolves through an angle of 37½ deg., during which movement the contacts are separated through 23½ deg., and made up through 14 deg., thus giving a good rubbing contact. Especially hard carbon is used for the fixed point of the contact, while the moving point is of platinum. As the controlled current is an alternating one, there is little sparking, although currents of from 2 to 3 amps. are used.

The box containing the track relay and transformer and the grid resistance is shown in Fig. 8. This box also has a plug in which an electric light can be cut in for use in night inspection.

The signals are to be of the General Railway Signal Company's motor-operated type, with mechanism placed in the base of the signal mast, and worked by a single-phase alternating motor of ¼ hp, using current at 50 volts. The general arrangement of the mechanism is shown in Fig. 9. The slot mechanism is exceedingly simple, and under alternating current operation is very quick in releasing.

The signals are of the 60-deg. two-position type, using New York Central standard spectacles and blades, which impose on the signal motor a load equal to the lifting of a 17-lb. weight, at a distance of 4 ft from the center of the shaft. With this load the motor will clear the signal in from two to three seconds. The New York Central Standard signal blades have square ends for home signals at interlockings, and pointed end blades on automatic home-block signals. The circuits by which signals are controlled are shown in Fig. 10, which calls for a full block overlap, and the control of the distant signal through a circuit breaker on the home signal. The signal lamps are of 4 cp, working on a 50-volt circuit, and are connected in parallel with a fuse cut out, to allow any lamp to be disconnected, without affecting other lamps supplied on the same circuit. The filament of the lamp is wound in a small circle, to bring the point of maximum illumination within the focus of the lens.

The signals to be used in the Park Avenue tunnel will consist of lights only, without any moving parts whatever. Electric lights will be arranged in a box behind lenses of proper color, and the current for the lamps will be directly controlled by the relay contact. Lamps giving the proper color for the stop or caution indication will be lighted when the track relay contact is closed.

With this installation the colors used by the New York Central for the night signal indication will be changed in the electric zone, and instead of using white for proceed and green for caution, the system of using green for proceed and yellow for caution will be used for the first time on this line.

The interlockings are of the standard type, manufactured by the General Railway Signal Company. Direct current furnished from storage batteries is used to operate the switch movements and signals. As usual with this type of apparatus the indication is given by the current formed by the motor, which on completing its stroke at the signal or switch movement, is changed to a generator and gives sufficient current to release the lock of the lever of the machine. Typical interlocking circuits are shown in Fig. 11.

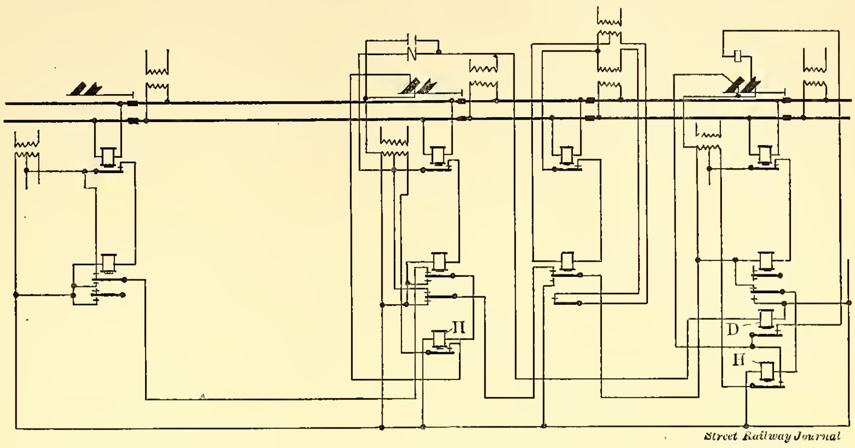


FIG. 10.—A TYPICAL SIGNAL CIRCUIT, POWER SUPPLIED BY TRANSFORMERS

The current to change these storage batteries will be obtained from an a.c-d.c. motor generator set, taking current from a transformer fed from the 3000-volt signal transmission line and furnishing current of 150 volts. The storage battery consists of fifty-five cells of capacity varying from 80 amp-hours to 320 amp-hours, according to the number of daily lever movements to be made. The average time between charging will be four days. The motor generators with switchboards will be placed in the basement of tower buildings and a separate battery-house will be provided to keep the fumes of the batteries away from the signalmen and the apparatus in the towers.

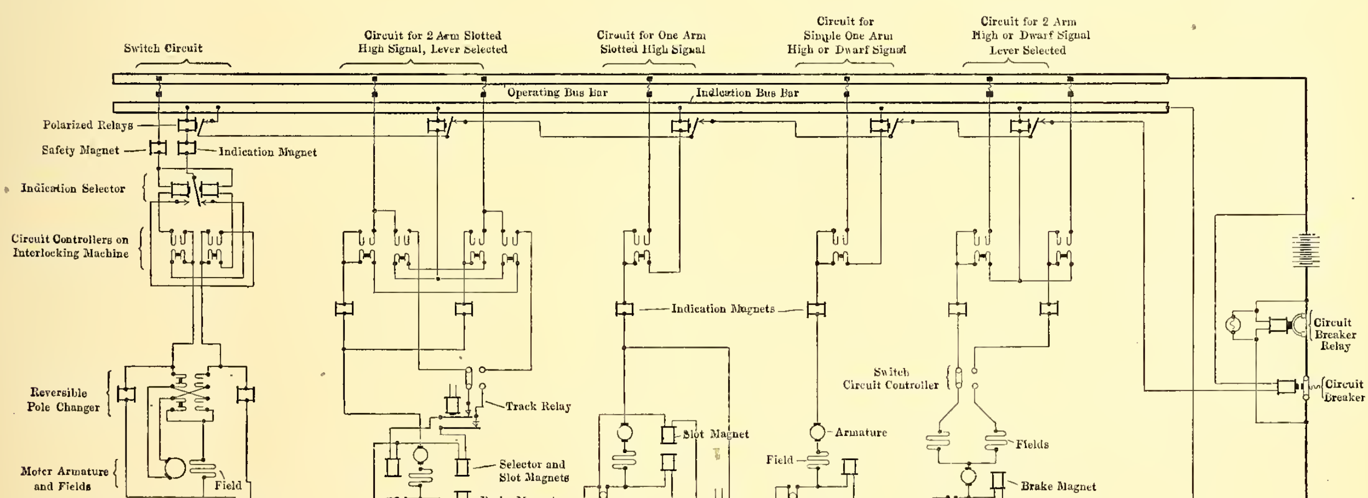


FIG. 11.—TYPICAL INTERLOCKING CIRCUITS

The interlocking machines are of the usual type made by the General Railway Signal Company, and are provided with

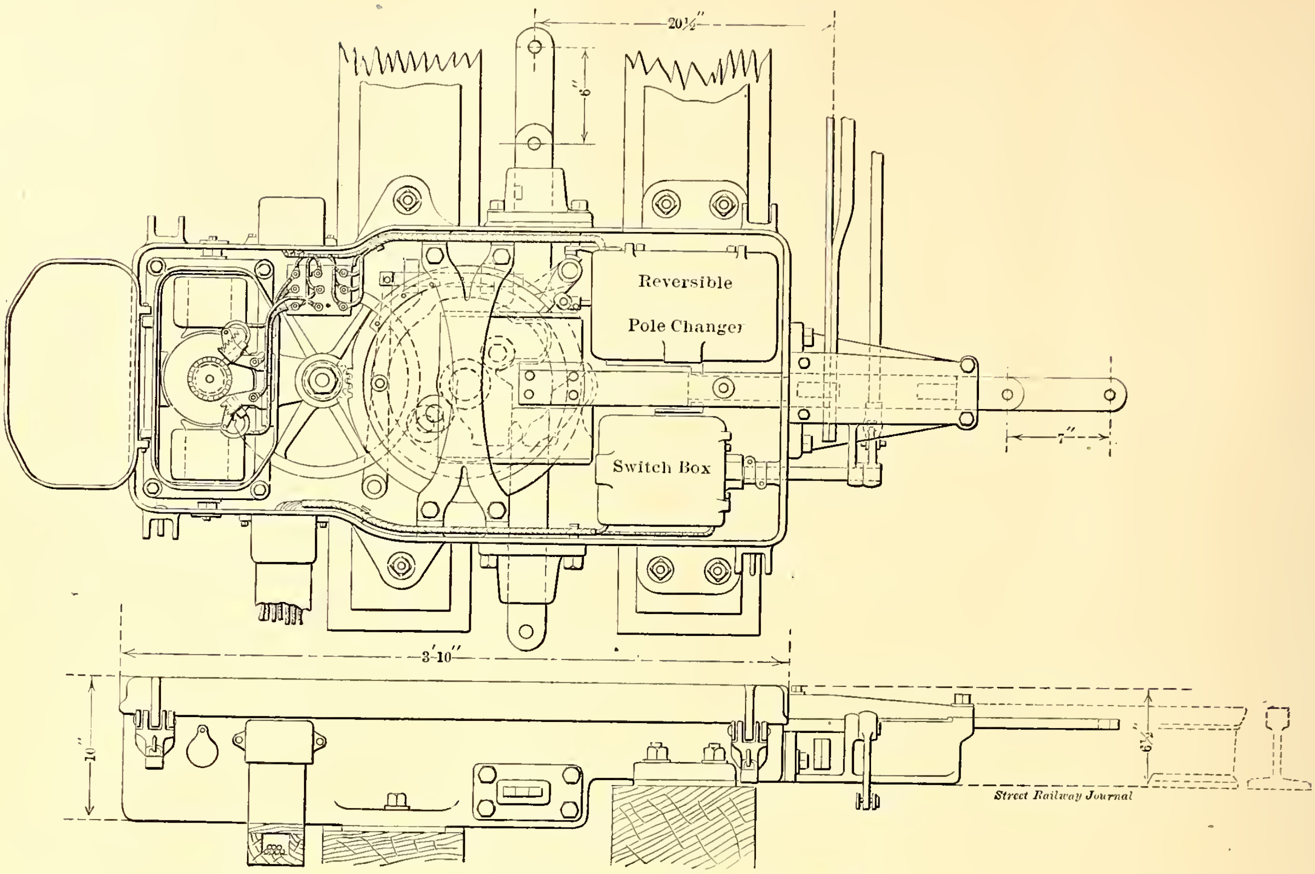


FIG. 12.—SWITCH-MOVEMENT MACHINE

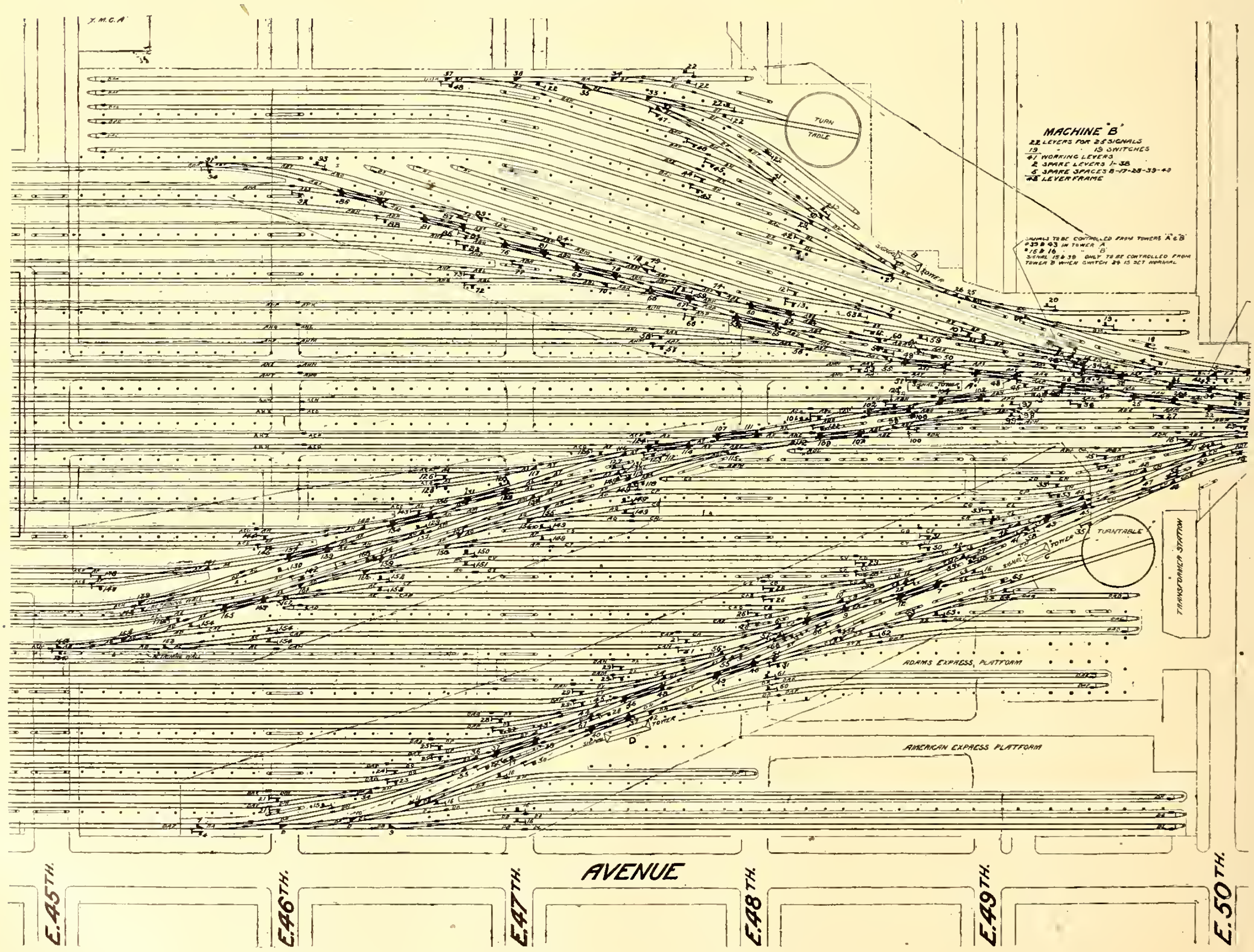


FIG. 14.—INTERLOCKING PLAN, GRAND CENTRAL STATION

a latch for each lever to require a definite action on the part of the operator to change the position of the lever. The lever handles are colored according to their functions. There will be a separate lever for each high signal arm and no selectors will be used.

The interlocking signals will be of the General Railway Signal Company type with dynamic indication current return. These signals, where slotted, will return to the stop position when the current through the slot magnet is open, but the return indication from the signal motor is not received at the lever until the lever is restored to the normal position. The operating circuits for the signals are run through controllers on all facing switches in the main line, insuring that the switches are properly set before the signals can be cleared.

Block signals on the same mast with distant signals are controlled by a lever in the machine requiring the block signal to be changed to the stop position before a signal can be cleared for a reverse movement on the main line.

The advance signals for each track, although operating as automatic block signals, are controlled from the interlocking and are provided with a square end blade to enable the signal man to hold a train, if it is desired to do so.

Approach locking will be provided for all main-line switches. This locking becomes effective when a train has reached a point at least one mile in the rear of the distant signal.

To permit the signal man to change the route for a train, in case of a mistake in setting it up, a mechanical screw release is provided. This will allow the releasing of the lever and changing the route on the expiration of a time interval of 1½ minutes after the signals have been returned to the stop position. A counter reading to five figures is to be placed on all high signals to register the number of movements.

The movement to be used to operate the switches is of an entirely new type and is shown in Fig. 12. With the small clearance under the third-rail contact shoe, a mechanism that will not project above the top of the running rail is absolutely necessary. This movement is enclosed in a neat casing with the gear and escapement crank horizontally arranged. The reversible pole changer and indication switchbox are also enclosed in the casing with the switch mechanism, protecting these parts and giving an exceedingly neat appearance to the apparatus.

The movement is fitted with an improved locking device which, in the case of the plunger catching on the locking rod, as it will do if the switch does not lock up properly, will release the plunger, allowing it to stop while the main part of the movement completes its stroke. The arrangement prevents the motor from forcing the plunger through the lock rod in case it should not have come to the proper position.

The type of dwarf signal to be used is a new one, the signal arm being moved by a motor mechanism arranged horizontally at the base of the post. With this apparatus the indication will be returned to the lever by the current generated by the motor instead of by battery current, as is required with a solenoid mechanism.

In this installation the use of detector bars is practically abolished, a few only being used on the outside rail on sharp curves. Short electric track circuits are provided in their place, effecting the locking of the switches during train movements by controlling the locks on the switch levers. The use of these short-track circuits with the controlling wires to the interlocking machine, makes possible at small expense the use in the interlocking tower of illuminated track indicator. It will consist of a track plan of the interlocking painted on a piece of ground glass with the track circuit sections divided on the back of the glass into separate compartments in which are a red and a white electric light. When the track section is occupied a red light will be shown on the indicator plan, and when unoccupied a white light will be shown.

In places like the Grand Central Terminal, where the tracks will be entirely roofed over, it will not be possible for the signal man to observe the movements of many of the trains; and an indicator of this kind is an absolute necessity to enable him to keep in touch with the situation. A plan of the signaling in the upper or express level of the Grand Central Terminal is shown in Fig. 14. As in the Park Avenue tunnel,

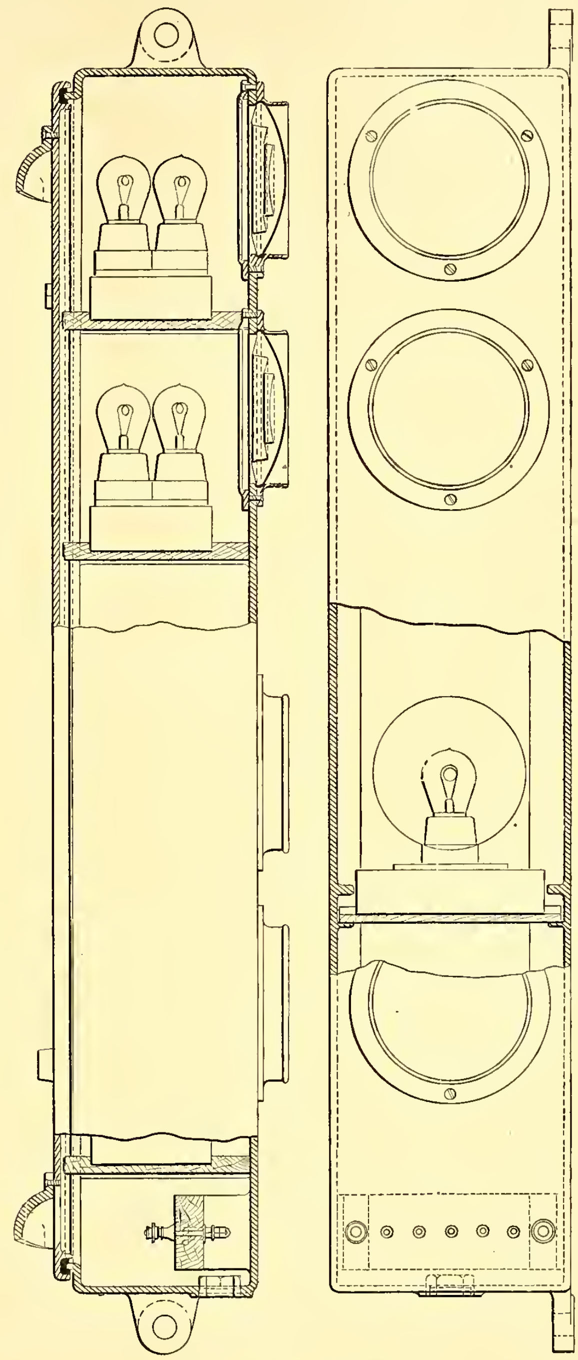


FIG. 13.—LAMP SIGNAL

the signals in the Grand Central Station interlocking will be shown entirely by lights without any blades or moving parts. In this interlocking work, however, the lever for the signal completes the circuit for the lamps to give the proper color for the indication required. The signal towers will be of brick and of very attractive design, with as much window space as possible.

REPORT OF THE ELECTRIC RAILWAY TEST COMMISSION—II.

REVIEWED BY LOUIS BELL PH. D.

The tests of the Commission on the subject of Air and Train Resistance Tests are particularly valuable for being conducted on ordinary standard trucks and with standard high-speed motor equipments for interurban cars. The subject is one which has provoked great discussion, and the many formulæ which have been brought forward have been exceedingly divergent. Of course, so far as air resistance alone is concerned, the results of the Berlin-Zossen tests leave little to be said regarding the absolute value of the normal coefficient, since these tests were extended to a range of speeds entirely beyond the scope of the Commission's tests. On the other hand, the Commission made a thorough trial of various forms of front and rear vestibules, actually weighing the resulting pressures, and the results give very valuable information about these important features of design. In the matter of train resistance, the data obtained have great practical utility as pertaining to the usual constructions of track and trucks, while the Berlin-Zossen work was confined to tests made with roadbed and cars highly specialized for use at extreme speeds.

Taking up first the air resistance tests of the Commission, the striking fact appears at the outset that the air resistance obtained at the lowest speed was higher, and that at all the other speeds lower than the values given in the Berlin-Zossen work, when the flat-fronted car is considered. The air coefficient in the foreign tests is 0.0027 V^2, while the Commission's results give about 0.00225 V^2 for 40 m. p. h. and above, with considerable increase at 20 m. p. h. and 30 m. p. h. Such an increase appears to be without a proper physical basis. An inspection of Fig. 201 of the Commission's report suggests that the eight runs from which the coefficient for the flat-fronted car were obtained should have been more critically examined. A single aberrant observation appears to have had undue influence upon the curve at higher speeds, and if this were rejected the discrepancy would be greatly reduced. However, it is clear from these results that 0.0027 V^2 is at least a conservative value for the higher speeds.

Another very interesting feature is the very great beneficial effect obtained by the use of parabolic and parabolic wedge fronts, much greater than has heretofore been believed, although the general fact is well known. The results of the air resistance tests seem to leave no doubt as to the value of a properly shaped front and rear on a car even at speeds as moderate as 50 to 60 m. p. h. It is a pity that similar data could not have been also obtained for considerably higher speeds, at which the Berlin-Zossen tests would suggest a smaller difference, due to shaping the front, caused, perhaps, by variation in the stream lines from various fronts as the speed rises.

This much is clear at all events, that air resistance at high speeds is much less formidable than was once supposed, and can be kept to moderate limits even for speeds much greater than are now customarily employed. At very high speeds, it would seem advisable to give the rear of the car as well as the front a parabolic wedge shape, since the suction effect becomes very perceptible. The value of the parabolic wedge front becomes very evident in view of the fact that the power used to drive a flat-ended car at 50 m. p. h. was actually sufficient to run the same car at 75 m. p. h. when equipped with a parabolic wedge vestibule. The criterion of equality of input leaves no room for debate upon the subject.

The train resistance tests made by the Commission are interesting as embodying the method of measurement from motor input and efficiency, but they also tend to show some flaws in this method. If one plots upon Fig. 162 of the Report, showing the car resistance derived from various published formulæ, the data given by the tests reported on the opposite page, those for instance of the test car with standard vestibule, the result is very singular. The curve thus drawn shows an absolute term in the resistance formula more than double the magnitude of that found in any of the recorded formulæ, in fact, approximately 13 lbs. per ton. For a track of 70-lb. T-rail in first-class condition such a value is evidently inadmissible on any theory of track resistance yet advanced. This difficulty appears in all the tests with the car Louisiana, whatever the shape of the vestibule. The runs with car 284 show the same failing in a less degree. Putting the car resistance into the usual form, $A + BV + CV^2$, the tests cannot be satisfied by any value of C compatible with the air resistance tests, save by giving improbable values to A and B, and particularly the former. There are indications, too, that A and B cannot be taken as rigidly constant. On all the facts presented in this section of the Report one is rather drawn to the conclusion that the reduction to tractive effort via the motor efficiency led to errors at the lower speeds. Such may easily occur by taking the combined motor and gear efficiency at somewhat too high a value when working under practical conditions at moderate speed. On the other hand, coasting experiments seem to give exaggerated values of car resistance at the higher speeds.

The general value of car resistance from these experiments runs about midway between the values derived from the formulæ cited, and may probably be regarded as conservative for interurban cars like those tested. It could hardly be expected to be as low as the resistances found in the Berlin-Zossen runs, where the car was heavy, track was exceptionally good and the trucks were rigorously balanced for high-speed running. On the other hand, it is very much lower than the enormous figures found in the coasting experiments of Davis at high speed. The figures for the various runs are somewhat discordant, owing to the varying conditions that can hardly be taken into account. Their value lies in the fact that they well represent service conditions and variations of conditions in interurban railroading. The last word has by no means been said on car and train resistance. At great speeds, when air resistance is considerable, a tonnage formula can be obtained only by an air resistance term including both car area and car weight. Otherwise, as in case of the Berlin-Zossen formula quoted, the values deduced for light cars will be too small. The same reasoning applies to other formulæ based on heavy trains or on locomotives. Any tonnage formula is bound to run to high values for light cars. The term in V^2, to judge from the values in this Report and the Berlin-Zossen tests, was not over 0.0027 for its basic coefficient, and would take the general form

$$0.0027\,k\,\frac{A}{T}\,V^2,$$

k being the form coefficient for the front. The value of k from this Report may be as low as 0.25, but should be confirmed at higher speeds, since the other available data make it considerably larger. The absolute term A of the typical formula should hardly exceed 4, and the term in V shows every indication of being very variable with balance of running gear, flange friction, condition of track, and so forth. In view of the large values of A and B indicated by this report, experiments by other methods, such as towing through a dynamometer and a long cable, would be very desirable additions to our knowledge.

MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The annual convention of the American Institute of Electrical Engineers was held last week in the auditorium of the public service building of the Milwaukee Electric Railway & Lighting Company, said to be the largest and finest railway terminal building in the world. In addition to the auditorium the building contains offices of the departments of the company, dining rooms, small halls, committee rooms, billiard rooms and bowling alleys. It is also used as a terminal for the interurban electric lines of Milwaukee, and this portion of the building is provided with waiting rooms, check rooms, news stands, reading rooms and a lunch counter. A description of this building will appear in an early issue of this paper. Many congratulatory remarks were extended to John I. Beggs, president of the Milwaukee Electric Railway & Lighting Company.

The convention of the Institute extended from May 28 to May 30 inclusive, and four of the papers relating to electric railway engineering are published below. In addition Prof. T. M. Gardner of the University of Illinois presented a paper on the educational value of an electric test car in which he described the car of the University of Illinois. A description and illustrations of this car are published on another page of this issue.

AUTOMATIC ENGINE STOPS

The author, Charles M. Hemenway, stated that automatic stops bear the same relation to steam engines and turbines that safety valves do to boilers or circuit-breakers to dynamos. Most of them are designed merely to stop the engine mechanically in case of over-speed. There is a growing tendency toward the use of electric current to trip the engine stops, thus allowing them to be operated from any number of points. In all cases when it would be impossible to reach the throttle promptly, the automatic stop is invaluable.

One stop is designed to be attached to the governor column, and upon being tripped electrically, opens a steam valve, allowing steam to enter a small cylinder against a piston which raises the governor balls to their maximum position, thereby cutting off the supply of steam to the cylinder. This is a reliable stop, and in connection with a speed limit device is very effective.

Other forms are applied to special valves which must be placed in the steam line and operated as an auxiliary to the main throttle valve. The valve in these forms is usually closed by steam pressure, the steam being admitted to some small cylinder and moving a piston in closing. These forms have many points in their favor, but care must be taken to keep them in order, and the expense of inserting a special valve in a steam line already erected is rather great.

Another type of engine stop operates directly upon the throttle valve and can be easily applied to any engine without interfering with its regular work. This stop is bolted to the engine frame at any convenient place, and is attached to the valve stem by means of a sprocket wheel and chain. As the valve is opened, a cable, to one end of which is attached a weight, is wound on a drum on the stop and is held by a pawl which engages in a ratchet wheel. When the stop is tripped electrically the weight is released, revolving the sprocket wheel and thus closing the valve, a dash-pot in the stop forming a cushion to prevent jamming the valve. This, in connection with the speed limit, forms a very satisfactory device, and as gravity is depended upon for doing the work there is nothing that is likely to fail in operating.

Another engine stop also operating on the throttle and connected to it with a sprocket wheel and chain, similar to the one just described, is operated by a small electric motor. This is more expensive on account of the motor and the necessary generating apparatus. The current can be taken from busbars; but in order to insure reliability it is advisable to have the engine furnish its own circuit. This kind of stop is particularly desirable on units having 12-in. valves, or larger.

To insure protection for all contingencies, an automatic vacuum breaker is wired in the circuit with each of the engine stops where condensing engines are equipped with this safety device, so that if the engine should be shut down automatically, the automatic vacuum breaker will operate simultaneously with the engine stop opening the exhaust to the atmosphere.

SELF-EXCITATION OF SYNCHRONOUS CONVERTERS

W. L. Waters read a paper on the subject of shunt and compound-wound synchronous converters for railway work. By the use of a sufficient inductive reactance in the supply leads and a series winding on the magnets of the converter the terminal voltage of the machine will rise as the load comes on, so that a synchronous converter may be compounded in a manner similar to that employed with direct-current generators.

This system, whch gives automatic control of the voltage, is obviously extremely useful and convenient. Unfortunately, however, the system presents a number of disadvantages in practice: a series winding is needed on the converter magnets, artificial reactance coils are practically always needed to insert in the alternating-current line so as to bring its reactance up to the required value, and there is need for extra switchboard arrangements. This means increased complication and cost and a loss of efficiency. A compound-wound converter costs about 7 or 8 per cent more than a shunt-wound converter. Reactance coils usually cost about 5 per cent as much as the converter. The efficiency of the system is lowered probably 1 to 2 per cent. Moreover, the system is more complicated, and in consequence more liable to break down. There is also liable to be trouble in operating the system. A series field winding on a synchronous converter is always a source of danger on account of the liability of its reversing. When starting a converter the series field coils can be short-circuited and the danger at that time avoided; but if the attendant forgets the short-circuiting switch at any time, there is liable to be trouble.

The results from the over-compounding of synchronous converters are not always satisfactory, due to the fact that as solid steel field magnets are always used, the magnetism cannot change quickly, and there is often a considerable time lag before the voltage changes to correspond with the change in the load. However, when the converter is flat-compounded instead of under or over-compounded, the result is more satisfactory, as the natural tendency of the solid poles is to hold the magnetism and the voltage constant.

In small sub-stations which are supplied from comparatively small power stations, the effect of the variation in speed of the engines often masks all of the results of the compound winding. Moreover, this method of compounding is often a nuisance. The power factor of the system very often varies widely with the load. A shunt-wound converter, however, tends to keep the power factor the same at all the loads. In any case the power factor can be adjusted by means of the field rheostat without in any way upsetting the regulation.

The result of all the complication and disadvantages of a compound-wound converter with reactance coils is that often after the system has been in operation for some time the series magnet coils and the reactance coils are cut out and the converter is run as a straight shunt machine.

Probably the best system for general work is to have shunt-wound converters, standard transformers and no reactance coils. The converters should be overexcited somewhat so as to keep the introduced wattless currents leading at all times, and then the machines should be left to take care of themselves, the excitation being adjusted in case they fail to divide the load properly.

COMMUTATION POLES IN DIRECT-CURRENT MOTORS

C. H. Bedell, of the Electro-Dynamic Company, discussed the design of direct-current shunt motors as influenced by the use of the inter-pole. After outlining the limitations in output which are soon reached when no special means are employed to control the field distribution, descriptions were given of the advantages attending the use of small auxiliary poles placed midway between the main poles with pole faces covering the region of commutation.

In order that the proper commutating field may be obtained that would vary with the load, the inter-poles are wound with the necessary number of turns and connected in series with the armature, while the main poles are wound with a shunt winding. Thus when the load on the armature is heavy, the ampere-turns on the inter-poles are large, resulting in a powerful commutating field; and when the armature load is light, the excitation of the inter-poles is light, resulting in a weak commutating field. That is, by this construction a heavy commutating field is provided when required, independent of the main field strength, and this commutating field varies with the load.

The question may be asked whether the same excitation is required on the inter-poles for a given load, for both high and low speeds. Experiment has proved conclusively that if the excitation of the inter-poles is correct for high speeds it is also correct for all lower speeds. Although the same number of lines of force are sent into the armature from an inter-pole for a given load, irrespective of the rate of rotation, yet the electromotive force generated in the short-circuited coils in the armature is proportional to the rate of rotation. Thus a high electromotive force is provided for the very quick reversal of the current at high speed, and a much lower electromotive force is provided for the slower reversal at the low speed.

In the designing of machines along the old lines, some of the dimensions are limited by the sparking condition. For example, it will not do to put more than a certain number of ampere-turns per inch of periphery on the armature, as a larger number produced too great armature reaction. Similarly it will not answer to have too small an air-gap for the same reason. With the inter-pole construction these conditions do not obtain, for no matter what the armature reaction may be over the face of the main pole, the inter-pole always gives the proper field for commutation. It follows, therefore, that radical changes in proportions may be made, materially reducing the size of the machine.

The change in the relative amount of iron and copper in the armature makes quite a change in the form of the efficiency curve. As the amount of iron is less, the hysteresis and eddy-current losses are less. The increased amount of copper makes I_2R armature loss greater. The full load efficiency is practically the same as in the standard motor, but on light loads the efficiency is increased. The motors, therefore, show a much better efficiency under varying loads approaching the condition of the all-day efficiency of the transformer.

The author stated that by the use of the inter-pole the following advantages were obtained: A powerful commutating field is provided to assist the carbon brushes in resisting the sparking tendency, and this field is independent of the main field. The intensity of the commutating field is proportional to the load on the armature. The brushes are placed on the neutral line, and in consequence the machine is perfectly reversible, and may operate either as a motor or dynamo without shifting the brushes or changing any of the connections. A large number of ampere turns per inch of periphery is permissible, also small air-gaps, resulting in a large output for the material used. The form of the efficiency curve is better suited to tne average load.

ELECTRICAL CONNECTIONS FOR POWER STATIONS

Mr. Rushmore, in a paper read at the Milwaukee meeting of the American Institute of Electrical Engineers, discussed the principles governing generators, transformers, lines, bus bars, switches, etc. Among other things he said that the number of generators, if a one-plant system, should never be less than four, preferably five; and beyond that, as few as conditions will admit.

Generator voltages increase with capacity; 2300 volts if standard up to about 2000 kw.; above which 6600 volts is desirable. Above 5000 kw, machines may be wound for 11,000 volts, 60 cycles, and 13,200 volts, 25 cycles. With certain capacities, speeds, and frequencies, 22,000 volts are permissible. The cost of switches is closely connected with generator voltage and capacity. In many cases, transformers may be omitted and power distributed directly from the machine.

Generator regulation has a direct bearing on the rating of switches employed. A very good regulation makes more difficult the opening of the circuit and produces an explosive action which is undesirable. When considered in view of the increased expense, a regulation better than 8 per cent or 10 per cent for power transmission has few compensating advantages, if a comparatively straight saturation curve is employed. A star generator winding is almost universal; occasionally the neutral is grounded. Generators will stand short-circuit conditions for some time, so that automatic generator switches are unnecessary. A circuit-breaker should not be used in the generator field, although one with a reverse-current trip is desirable when exciters are run in parallel. The exciter field-switch may be automatic instead of the high-tension switches, if the results are allowable.

At least two transformer banks should be used, and duplicate lines fed to any sub-station where the continuous supply of power is essential. If a large number of generators are installed, it may be desirable to make a unit of one transformer and two generators. In other cases, the number of transformers is entirely independent of that of the generators. If it is desired to avoid high-tension switching and the use of current transformers on the high-tension side, the transformer bank may sometimes advantageously be made a unit with the line. The transformer bank can always equal the generator capacity, but the reverse is not true. It is desirable, whenever possible, to have the transformer banks make a unit with either the generator or line.

The transformer connections to be used are not definitely decided by conditions, and the use of the star or delta on the high-tension side is still a matter of discussion. The subject is too large to be discussed at length here. As a matter of fact, experience shows that either system, if properly installed and carefully operated, will give satisfaction. The writer, however, believes that in most cases of high-voltage transmission, the preponderance of advantage is on the side of the grounded star connection. There are, however, cases where the delta is preferable. A delta low tension may be almost called standard.

The use of single or of three-phase transformers is a matter of building design, transportation, cost, reserve capacity, and repairs. In the case of many large units, it costs no more to have a spare three-phase unit than a single phase and, if a transformer-generator system is used, the disablement of a three-phase transformer is no more serious than one of a single-phase bank, unless the load be carried on two transformers. The matter of cost can be calculated for each case, and there is always a dividing line where the relation of cost is reversed. Three-phase transformers are more difficult to transport. A reserve unit in either case is necessary.

In many cases, a local low-voltage distribution is necessary, and two or more voltages can often be run from the same transformer bank with simplicity of connection and low cost as compared with the installation of separate banks.

A switch must withstand the electrical stresses, carry the current, and be able to open the circuit under the worst conditions to which it will be subjected. Standard insulation is for at least 2.5 times rated voltage. Current-carrying capacity is in accordance with the two-hour overload rating of generators and transformers. Recommendation is sometimes made that two oil-switches be placed in series to open together, although they close separately. With the well-deserved reputation of modern oil-switches, now long past the experimental stage, the advisability of this is unquestionable. To allow for testing switches, before using two in series, is a great advantage.

GENERATOR SWITCHES

Generator switches control and protect the generator. Like all other switches in a power house, the conditions to be met, and the proper type and rating to be installed, depend not only upon the output and characteristics of the machine, but also upon the general connection system, the capacities and action of other switches, and the plan of operation. With a selector, bus-bar, or low-tension transformer switch in series, possessing automatic overload features, the generator switch is preferably non-automatic. Sometimes it is equipped with reverse-current relay, but this is not recommended as—the relay being dependent on voltage for operation—it is not reliable under short-circuit conditions. Occasionally, where conditions demand it, an inverse time-limit relay is employed. With more than two generators on a bus-bar section, this will cut out the injured machine. If the generator switch is non-automatic, it will have less to open than the line-switch, and a less expensive type can be used. It should, however, be able to open the normal short-circuit current of all generators, less one, on a bus-bar section. With two electrically operated switches in series, both may be tried before being finally closed, and the one without the automatic feature may be used for synchronizing. Where no low-tension bus-bar is employed, or only a transfer bus-bar used, the generator switch may be omitted; this is frequently done in railway generating stations where the number and size of units permit of a generator-transformer unit combination. Not infrequently the desire for symmetry is the reason for installing all switches of the same general type.

SELECTOR SWITCHES

A selector-switch may be defined as one which will throw a circuit on any of two or more sources. It may be used for generator, transformer, line, or bus-bar. With duplicate bus-bars and single-throw switches, two are necessary to allow a circuit to be thrown on either bus-bar. If it is not necessary to throw them under load, air-brake disconnecting switches may be used.

Selector-switches are frequently automatic with an inverse time-element giving practically instantaneous trip under severe short-circuit conditions.

TRANSFORMER SWITCHES

Both high and low-tension transformer switches are used in stations with many units. Both may be tripped from a differential relay which operates only in case of internal short circuits. The current-carrying capacity of transformer, as of other switches, is equivalent to the two-hour overload rating of generators. In some arrangements the oil-switch is omitted on the high-tension side of the transformer, and an air-break disconnecting switch used. If a transformer-line unit combination is employed, the high-tension switch may be omitted. With an automatic line-switch, that on the transformer is made automatic only for internal troubles, the overloads being cared for by the attendant.

BUS-BAR SWITCHES

Bus-bar switches, which tie the various units of a bus-bar, are used for paralleling in case of transfer bus-bars. Where no necessity exists for operating under load, an air-break disconnecting switch may be all that is needed; in other cases, an oil-switch is used. Where automatic features are desired, an inverse time-limit relay may be used which, in a station consisting of unit systems, will entirely isolate the unit in trouble, which should also be simultaneously cut off from the sub-station. In parallel operation, these switches are used for synchronizing. It is sometimes arranged to have the same overload relay trip both the low-tension bus-bar and generator switches.

LINE SWITCHES

Switches for outgoing lines may be considered of first importance, most disturbances being external to the station and necessarily removed under emergency conditions. They are to disconnect all line and distribution troubles, and consequently are subjected to severe conditions. They should always be of ample capacity. With more than two transmission lines, automatic features are desirable and, in combination with automatic sectionalizing switches in the sub-station, will cut out a disabled line.

SECTIONALIZING SWITCHES

Most of the remaining switches in a station may be less expensive and of smaller capacity, if the high and low-tension sectionalizing switches are fitted with instantaneous relays. These switches, opening before the others, reduce the capacity which a switch must handle. The bus-bar may be sectionalized in a number of places, and simple disconnecting switches may be used if conditions of operation permit. For a station of large capacity, operating in parallel, an oil-switch with instantaneous time feature should be used.

RELAYS

Small stations may rely upon an operator. Large plants need automatic switches.

Relays are electrical devices which operate switches at predetermined points. They allow sensitiveness of operation to be combined with powerful action. Alternating-current relays may operate for overload, reverse current, reverse phase, and low voltage. The time element may be instantaneous, inverse time-limit, or definite time-limit, and the action may be to either open or close an auxiliary circuit. Overload and reverse current relays may have any time attachment. Reverse-phase and low-voltage relays are usually instantaneous. "Circuit-closing" relays imply direct-current switch actuation; and "circuit opening," alternating current from current transformers.

Instantaneous relays are used at points of load, and to sectionalize the bus-bars at both generating and sub-stations, and relieve switches with time-limit attachments from opening total generator capacity; also, where fire risk is great, and a disconnection of part of the load is preferable to temporary disturbance. If used on feeders, a switch of maximum capacity is necessary to open the large circuits existing during initial short-circuit conditions. Most systems are subject to disturbances and it is better, as a rule, to allow such disturbances rather than cut off the power.

Inverse time-limit relays protect apparatus from injurious heating by excessive overloads. When placed on parallel feeders, they will cut off the faulty one, and may be used on generator switches instead of reverse-current relays, which are not satisfactory under short-circuit conditions. Generator switches are preferably non-automatic.

With unit systems the transfer bus-bar switch is usually operated by an inverse-time relay. An inverse-time relay is also used when large variations of load occur in starting of synchronous or induction motors. Definite time-limit relays are used, and occasionally placed so that they open switches in sequence, beginning with the remote load until the trouble is removed. They are used on line-switches and for disconnecting transformers in conjunction with instantaneous relays on bus-bar sectionalizing switches, and inverse-time limit of bus-bar switches.

The use of the time-limit feature of relays is subject to some personal equation.

Reverse-current relays are theoretically desirable on generator switches, and to protect sub-stations with multiple feeders, but practically they are not satisfactory.

Low-voltage relays are employed mainly on motor switches to ensure having resistance in series when starting, or the proper controller connections at such time. The time function is instantaneous.

Reverse-phase relays, which are usually of the instantaneous type, are used to trip a switch in case of improper motor connections.

Relays are now to be had which are entirely reliable and, if given proper inspection, adjustment and care, add greatly to the satisfactory operation of a large plant.

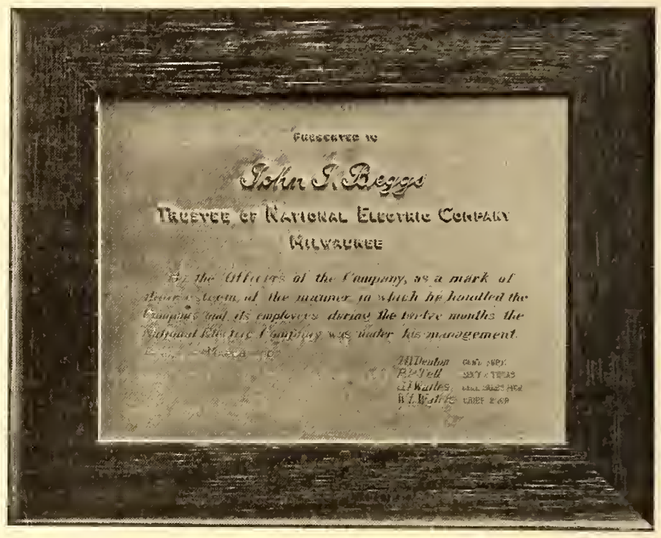
A double bus-bar throughout, sectionalized, is the most flexible arrangement, and many plants are so constructed. A single bus-bar subdivided, with jumpers, comes next and for many conditions is sufficient. With a generator, transformer, and line unit, high and low-tension transfer bus-bars are all that is necessary. If generator and transformer units are used with a large number of feeders, a low-tension transfer bus-bar and duplicate high-tension bus-bar are desirable. Where a large number of generators are used, the low-tension bus-bars may be dispensed with. Occasionally two generators are used with one transformer bank, in which case the low-tension bus-bar need not be continuous. A sectionalized bus-bar can be used for the same purpose as a duplicate arrangement, but lacks the flexibility of the latter. In high-tension stations, the cost of the oil-switches becomes an important factor, and every effort is made to keep their number as small as possible.

There is evidently no fixed rule by which the bus-bar arrangement can be definitely decided; any decision being a matter of judgment between conflicting tendencies of cost, convenience, reliability and safety.

The Brooklyn Rapid Transit Company has adopted the plan of giving transfers through men stationed at the important intersections, instead of through the conductors. This will allow the conductors more time to run the cars and look after passengers.

PRESENTATION OF A MEMORIAL TABLET TO JOHN I. BEGGS, BY OFFICERS OF THE NATIONAL BRAKE & ELECTRIC COMPANY

It will be recalled that the financial embarrassment of the old National Electric Company led to the appointment as receiver of John I. Beggs, the president of the Milwaukee Railway & Electric Company. His efforts in reorganizing this company under the name of the National Brake & Electric Company were so successful that upon the termination of his receivership and trusteeship the officers of the company, in recognition of his services, presented Mr. Beggs a bronze tablet which bears the following inscription: "Presented to John I. Beggs, trustee of the National Electric Company, of Milwaukee, by the officers of the company as a mark of esteem in the manner in which he handled the company and its employees during the twelve months the National Electric



MEMORIAL TABLET TO MR. BEGGS

Company was under his management, April, 1905, to May, 1906." The names of the officers inscribed on the tablet are: J. H. Denton, general superintendent; R. P. Tell, secretary and treasurer; S. I. Wailes, general sales manager; W. L. Waters, chief engineer.

An interesting account of the business done under Mr. Beggs' management follows. Mr. Beggs was appointed receiver May 15, 1905. At that time the company had unfilled orders on its books totaling $557,932.59. Orders taken from May 16, 1905, to the time of the trustees' sale on March 26, 1906, amounted to $865,148.91, and unfilled orders on hand on March 26, 1906, amounted to $367,228.62. The total amount of shipments made during his trusteeship and receivership amounted to $1,055,862.88. When Mr. Beggs was appointed receiver cash on hand amounted to $20,597.67. During his trusteeship he collected the sum of $1,172,400.31, and disbursed the sum of $1,053,494.60, having a balance in bank on date of sale of $139,503.38. These expenditures include payments on preferred claims amounting to $166,892.37.

The Boston & Worcester Street Railway proposes to run the first express passenger electric service into Boston as soon as it has completed the double tracking of a short section of its road. There was a section of 4½ miles where a double track has heretofore been impracticable. Now the road has the right to double track all but 2 miles of this section, and has asked for the right to complete its double tracking. The proposition is to run a car each way at morning and at night, covering the 44 miles in 1 hour and 50 minutes.

INDIVIDUAL RECORDS OF SHOP REPAIRS

It will be recalled that at the St. Louis convention a joint committee of the American Railway Mechanical and Electrical Association and the Street Railway Accountants' Association of America recommended a set of blanks for keeping shop records and accounts, and after considerable discussion the report as presented was accepted, with the official endorsement of both associations. (The report of the joint committee and the forms recommended will be found in full in the STREET RAILWAY JOURNAL for Oct. 15, 1904.)

In line with making a practical application of the recommendations presented by the committee, H. H. Adams, superintendent of shops of the United Railways & Electric Company, of Baltimore, Md., shortly after the convention instituted a card-index system of keeping individual repair records, based upon the action of the associations, with such modifications as were deemed desirable to meet the practice in vogue in the Baltimore shops. This is entirely in accordance with the sense of the joint session, as the report of the committee was intended only to present general principles, and was approved subject to such modifications in any particular form as each company might find necessary for its own individual uses.

Mr. Adams concurs in the opinion expressed at the St. Louis meeting, that individual car, truck and armature records are desirable, but believes that care must be exercised in not making the system too complicated or trying to show too many things on one set of blank forms. Repair shop accounting can be very easily overdone; that is, a point may be reached where the labor of keeping up the records will not only make a serious increase in the general shop expenses, but, and this is a very important consideration, if the records are too intricate, there will be a temptation, in the rush of more important work, for the men to become lax in keeping up the records and thus render the system useless in accomplishing the purposes for which it was planned. In instituting the individual record system at the Baltimore shops the idea has been to avoid making it too elaborate or too burdensome to keep up, and at the same time to furnish records that will be of actual value to the foremen and the men handling the repair work. It is essentially a system for reference purposes.

For these records, there was adopted a good, heavy quality of cardboard stock, the individual cards measuring 9¾ ins. long x 7 ins. high. In considering the form which was recommended as Form 10 by the joint committee, combining on one card the record of repairs to trucks, car bodies and electrical equipment, it was deemed advisable in order to simplify matters and meet the needs of the Baltimore company to subdivide this record into three parts, and three separate card indexes are maintained to keep these records. In other words, there is one card for car body repairs and painting, another for truck repairs, including wheels, and a third for electrical equipment. The fourth card shown in this connection is the armature record. By referring to the forms recommended by the joint committee, it will be seen that the individual items suggested under each of the several headings have been followed in the main, although certain modifications in the wording and, in some instances, other items not included in the recommended forms, have been introduced in the Baltimore system in accordance with the latitude endorsed by the joint resolution.

Form D76-12-6-1904-2000 THE UNITED RAILWAYS & ELECTRIC CO.

RECORD OF REPAIRS Car No. 334 Body Brill 30'5"

		CAR BODY REPAIRS													PAINTING								
Date In	Date Out	Overhauled	Accident Repairs	Panels Repaired	Corner Post Repaired	Side Post Repaired	Sash Repaired	Dasher Repaired	Vestibule Repaired	Hood Repaired	Sills Repaired	Platform Repaired	Seats Changed	Car Converted	Burnt Off	Painted and Varnished Outside	Cleaned, Touched Up and Varnished	Cleaned and Varnished Inside	Painted Roof	Painted Floor	Painted Truck	Mileage	Names of Workmen
1/27/05	2/8/05		✓				3		1	1							✓						Pletz – Wagner.
8/23/05	9/1/05		✓	✓													✓						Burgess – Wagner.
9/5/05	9/5/05													✓									Young-Kaste-Volkel
11/1/05	12/12/05														✓	✓		✓	✓	✓	✓		Rapp-Ward-Litz-Rae.

CARD FOR KEEPING RECORD OF REPAIRS TO INDIVIDUAL CAR BODIES, UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE

Form D77-12-6-1904-2000 THE UNITED RAILWAYS & ELECTRIC CO.

RECORD OF REPAIRS Car No. 347 Truck Brill Max. Traction.

		TRUCK															
		WHEELS															
Date In	Date Out	No. 1 Driver	No. 2 Driver	No. 1 Pilot	No. 2 Pilot	Axle Numbers	Diameter of Axle	Diameter of Journal	New Journal Brasses	Brake Shoes Shop	Brake Shoes Barn	New Brake Chain	New Sterling Sprockets	Brake Rod and Turn Buckle Thread Inspection	General Overhauling	Mileage	Names of Workmen
3/21/05	3/21/05			18666 16834	16877 16792	3263 -2228				ok		ok	ok	ok	ok.		Fuller – Jones.
4/26/05	4/26/05	19269 19214	19484 19296			3613 2359	5"		ok	ok		ok	ok	ok			Miller – Barton.
6/3/05	6/3/05										✓	✓					Brady.

CARD FOR KEEPING RECORD OF REPAIRS TO INDIVIDUAL TRUCKS AND TRUCK PARTS, UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE

The company has followed, however, very closely the main principle involved in the joint committee's report, namely that the list of repairs should be minutely itemized and printed at the head of suitable columns, so that the records can be kept with the minimum amount of writing and clerical work, and the larger part of the entries can be made by either a cross or a check mark without additional writing. An important feature of the official forms recommended in this connection is the adding of the name of the workman who executed the particular repairs, and this column has been embodied in the Baltimore system and is conscientiously adhered to, as it has been found of prime value in fixing responsibility for any particular repair job. In some of the forms presented by the committee space was left for inserting the cost of repairs, but this has been entirely omitted in the Baltimore record, upon the grounds that the keeping of costs properly belongs in another department and would but add another complication if embodied in these particular shop records.

THE UNITED RAILWAYS & ELECTRIC CO.

RECORD OF REPAIRS Car No. 347 Truck Brill M.T. Motors W.H. 56 Controllers K 11

ELECTRICAL EQUIPMENT

Date In	Date Out	Armatures No. 1 Motor	Armatures No. 2 Motor	Fields Ren'd No. 1 Motor	Fields Ren'd No. 2 Motor	Gears Ren'd No. 1 Motor	Gears Ren'd No. 2 Motor	Armature Bearings No. 1 Motor	Armature Bearings No. 2 Motor	Axle Bearings No. 1 Motor	Axle Bearings No. 2 Motor	Gear Case	Resistance	Clearance Inspected	Controllers Overhauled	Switches Inspected	Trolleys Inspected	Heaters Inspected	Electric Bells Inspected	Mileage	Names of Workmen
3/21/05	3/21/05	70261	70024	OK OK		OK	OK	2 RBL	2 RBL	2/7 RBL	1/7 RBL	OK	OK			OK	OK	OK	OK		Shoul-Fitzgibbon-Evans & Ross
4/26/05	4/26/05					OK	OK			OK	OK	OK	OK			OK	OK	OK	OK		Miller-Barton-Evans
10/24/05	10/25/05	70164	70001					2 RBL	2 RBL				371 [illegible]			OK	OK		OK		Dyson-Haslip-Hutchins

CARD FOR KEEPING RECORD OF REPAIRS TO INDIVIDUAL ELECTRICAL EQUIPMENT, UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE

With the present system of individual car and armature records, it is quite possible to check closely all the repair work done in the shop; to obtain a measure for keeping track of the use of equipment by the operating department; and also to get at the respective merits or demerits of any particular type of equipment. Under the old system, a particular armature might come into the shop two days after it had been repaired, and every two or three days thereafter for a long period without detection unless somebody in the shop happened to recognize it as an old friend. Or again, one particular car might come in a dozen times a month with blown controllers, and the trouble would be repeatedly repaired without anyone thinking to look deeper and find the cause for the recurrences of the defect. With the aid of the individual records, every car, and all of the essential parts of each car, are under constant surveillance by everyone who happens to refer to the card records. If the number of entries starts to assume untoward proportions, the fact glares everyone in the face who looks at the card, and it cannot go on very long before proper steps are taken to get at the root of the matter. This paper is indebted to Mr. Adams for his courtesy in permitting the presentation of the record forms devised for use in the Baltimore shops.

THE UNITED RAILWAYS & ELECTRIC CO.

ARMATURE RECORD Armature No. 50115 Type W.H. 49 Date New 1898

Car No.	Date In	Date Out	Rewound	Coils put in	Coils Repaired	Open Circuit Repaired	Leads Repaired	New Commutator	Commutator Repaired	Commutator Ground Repaired	New Mica Rings	New Flash Rings	New Heads	Bands	New Bearings	Commutator Turned	Shaft Straightened	New Shaft	New Pinion	Keyway	Mileage	Names of Workmen
21	3/19/03	7/21/03													✓	✓			✓			Walters - Upp.
"	7/21/03	4/30/04													✓	✓						Walters
"	4/30/04	1/6/05													✓	✓						Walters - Murray.
"	1/6/05	5/1/05	✓					✓					1	5	✓	✓						Ebaugh-Carter Walters
26	5/17/05	6/30/05		✓									1	5	✓	✓						Carter-Wise-Walters
290	7/15/05	7/16/05											1	4								Carter-Shillenberg
1283	7/16/05	7/28/05					✓						1	2	✓	✓						Taylor-Dorsey-Walters-Upp
2253	7/30/05	9/11/05			1								1	5	✓	✓						Krouse-Dorsey-Walters-Upp

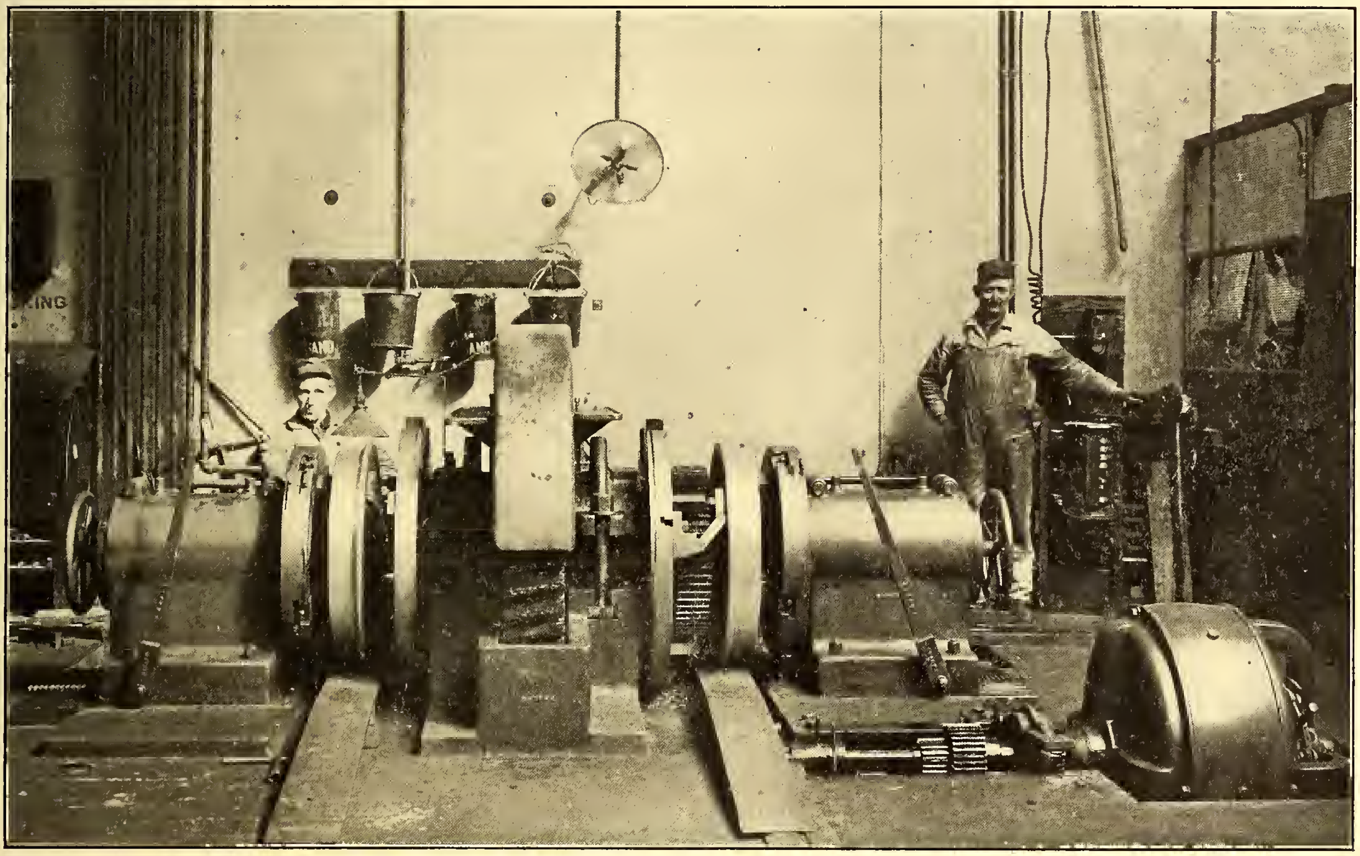
CARD FOR KEEPING RECORD OF REPAIRS TO ARMATURES, UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE

Referring to the advantages in general of keeping individual records of this nature, the opinion of Mr. Adams, based upon actual experience, is valuable. He finds that the results secured are of such value as to far more than compensate for the slight cost and trouble necessary to keep the records up to date. Under the former method, where the records were kept by classification of repairs, and no separate account was made of the actual repairs to individual cars, trucks and armatures, much had to be left to the memory of the foremen and there was no means of checking up the performance of individual equipment.

J. R. Harrington, general manager of the Canton-Akron system, has placed in effect on this system a standard steam railroad time-table giving each car a train number and providing passing points and making a distinction between different classes of trains.

NEW STEEL-TIRED CAR WHEEL LATHE

Owing to the increased use of steel-tired wheels on interurban and street railway equipment, the problem of keeping these wheels in good condition is seriously confronting electric railway men at the present time. The material of which steel tires are made is exceedingly hard to turn, especially when there are flat spots, as these are like glass when sand and dirt have become fused into the tire. The Niles-Bement-Pond Company, of New York City, has for many years given especial attention to the needs of the steam railroads for apparatus that will satisfactorily turn steel tires, and of late has adapted its heavy-duty wheel lathes to meet the conditions encountered in electric railway practice. The engraving reproduced in this connection illustrates the new Pond steel-tired car-wheel lathe, built for service in the repair shops of the Interborough Rapid Transit Company, at One Hundred and Forty-Eighth Street and Seventh Avenue, New York City.



WHEEL LATHE FOR TURNING STEEL-TIRED WHEELS AT SHOPS OF INTERBOROUGH RAPID TRANSIT COMPANY

The question of getting power enough in the machine to turn steel-tired wheels is simple when compared with the difficulty of holding wheels rigidly so that the full power of the machine can be used in the tools. In the lathe illustrated, special saw-teeth drivers engage the tire directly, the teeth of the drivers being forced directly into the tire by set screws. On the other side of the tire, chuck jaws grip it firmly, so that the tires are wedged between the driving plates and the face plates of the machine, thus doing away with any chance for chatter or vibration. The machine is driven by a very large central gearwheel. A section of this gear is made removable, so that the wheels can be rolled in. This construction makes a very compact machine and one of great power.

This type of machine has long been used by the steam railways for turning their steel-tired equipment, and it has been modified so as to be adapted for electric railway use. As many of the wheels in electric cars have a driving gear on the axle, provision is made for this feature, and the patented drivers are arranged to reach out over this gear and engage the tire. The illustration shows a pair of these wheels in place in the lathe. The lathe has capacity of from seven pairs to twelve pairs of steel-tired car wheels, for a day of ten hours. The actual time of taking out a pair of wheels and putting in another pair should not be more than six minutes to ten minutes, with wheels convenient to the lathe.

In order to get the highest rate of production, it is necessary to have the lathe supplied with a full set of tools, including flange tools and forming tools for the tread, as well as to have conveniences for getting the wheels to and from the lathe.

The Niles-Bement-Pond Company recommends the following procedure in handling wheels in connection with the Pond steel-tired wheel lathe:

The lathe should be set level with the floor, and provided with a pit in front for the convenience of the operator. It is also desirable to have tracks, which may be made of ⅝-in. x 2-in. bar iron, planed with a groove for the wheel flanges, leading to the lathe so that the wheels may be rolled in absolutely central. Air lifts may be used to transfer the wheels from the longitudinal track to the crosstrack, or the wheels may be brought into the shop on a special truck from which they can be rolled off onto the cross-tracks. If the journals need truing, the wheels first go to the journal lathe.

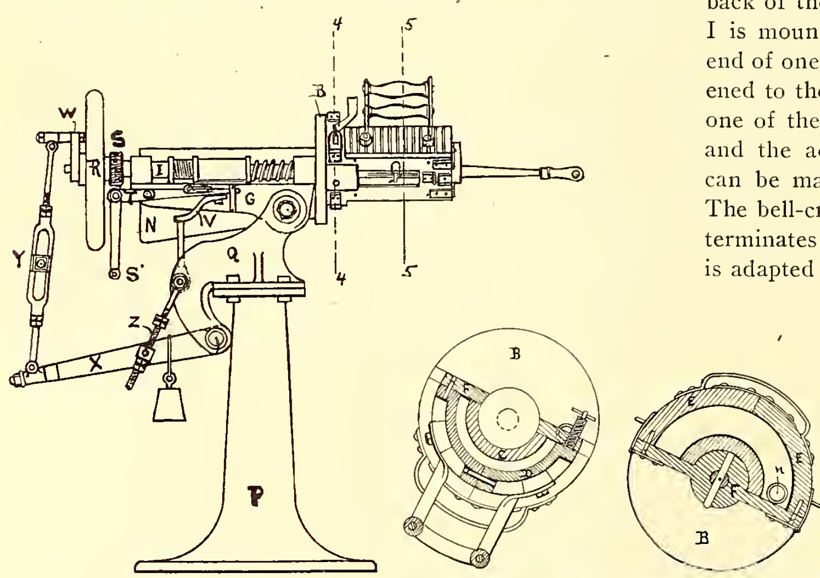
In putting a pair of wheels in the car-wheel lathe, first the bushings should be put on the journals, then the wheels rolled in, and the tail stocks brought up and clamped and the journal chucks screwed up. Next, the chuck jaws are brought out, gripping the tires firmly. The tails of the special sure-grip drivers are placed so as to bear against the strips on the driving plates, and the grip pieces are forced directly into the tires by screwing up the set screws. The tires are thus firmly wedged between the driving plates and the chuck-jaws.

The smallest wheel having been selected, cut in to lowest spot. Mark slide rest, withdraw tool, move rest to outside of tire and run tool in to mark on slide rest. Start cut and caliper, making other wheel same size. Using a 5-16-in. to 7-16-in. feed, run across the tread with whatever speed the tool steel and the hardness of tire will allow, usually between 10 ft. and 15 ft. per miute. The tread will be roughed out in about eleven revolutions. Withdraw tool to height of flange, 1⅛ ins. Feed across top of flange about three revolutions. With the same tool rough down back of flange, one revolution, and rough down front of flange one revolution. All this is done at one setting of the tool.

Next apply scraper to tread of wheel, smoothing it up in two revolutions, but this operation can frequently be done in one revolution if correct size is gotten on roughing cut. The rest is now in correct position for finishing the flange which is done by means of forming tools. About two revolutions are required for each side of flange. Finally apply chamfering and beveling tool to outside of tread, finishing it in about two revolutions. The wheels are now finished and the rests are in the right position for the next pair.

DEVICE FOR CASTING BRONZE BEARINGS

It is known that any molten metal poured into any wet sand mould will oxidize. This is caused partly by exposure to the atmosphere and also to the oxidizing effect of the steam generated when the hot metal comes in contact with the wet sand. Even when great care is exercised by the use of skim gates and in the pouring, it is virtually impossible entirely to prevent the oxides formed within the metal from passing through the gate in the form of scum and becoming imbedded in the castings. The entrained or embedded oxide in castings is especially undesirable and injurious to castings intended for bearings.



Side Elevation Section Through 5—5 Section Through 4—4

FIGS. 1, 2 AND 3.—DETAILS OF DEVICE FOR CASTING BRONZE BEARINGS

The Lumen Bearing Company, of Buffalo, has developed a machine for casting Lumen-Bronze bearings, in which the aim has been to attain two objects: first, to produce a machine whereby full and perfect castings could be made economically by the use of permanent metal moulds, and second, to make castings which would be entirely free from entrained scum or metallic oxides.

The invention consists of a method of making castings by the use of moulds in which the mould and gate are movable relatively to each other, and mounted in such a manner that the part of the mould remote from the gate is filled in advance of the part adjacent to the gate. The filling of the mould is an even and continuous operation, in that the metal flows into the mould without spattering or having its surface film broken, resulting in a clean casting, since no part of the interior of the casting has been exposed to the air during the process of forming. The metal flows from the reservoir beneath its surface and is, therefore, perfectly skimmed before it enters the mould, and the metal is cast at the lowest possible temperature at which the mould will fill completely. It is stated the castings are free from shrinkage, cracks or other imperfections and entirely without entrained oxide or scum. The corrosion of a molten metal flowing into a hot metal mould is naturally very slight, and for the fact that the surface film remains unbroken, even this slight oxidation remains on the outside of the casting.

Referring to the accompanying drawings, the machine consists of a pedestal (P), upon which is mounted a special-shaped bracket (Q), to which is pivoted a yoke (G) that is free to move in a vertical plane. The shaft I is supported in the yoke G, and it has mounted upon one end the hand-wheel R and the worm-wheel S, by means of which the shaft is rotated; on the other end of this shaft, beyond the face plate B, is mounted the mould, which bears against the face plate. The reservoir N for holding the molten metal is shown in Fig. 2, and is fastened to the rear side of the face plate B. On the lower arm of the bracket Q the lever X is pivoted, and its opposite end carries an adjustable turn-buckle tilting rod Y; near the middle of the arm X is a lug through which the rod Z slides; rod Z is provided with adjustable nuts. Near the middle of the rod Y is mounted a handle shown in Fig. 1. The other end of the rod Y is connected by means of a universal joint to the eccentric W upon the end of the shaft I, back of the hand-wheel. On the middle portion of the shaft I is mounted a spring, one end of which bears against the end of one of the two adjustable sleeves, one of which is fastened to the shaft. The other end of the spring bears against one of the lugs of the casting G. By means of this spring and the adjustable sleeves, therefore, any desired pressure can be maintained between the mould and the face plate. The bell-crank T is pivoted near its center, one end of which terminates in a bearing for a worm shaft, the worm of which is adapted to engage with the worm-wheel S. The other end of the worm-shaft is provided with the crank-handle S[1]. The opposite end of the bell-crank T is actuated by a spring tending to engage the worm with the worm-wheel. The extreme end of this bell-crank is free to move vertically in a guide. Attached to the same end of the bell-crank is the arm V, adapted to engage the adjustable stop V[1], which disengages the worm from the worm-wheel when the tilting portion of the machine is in the position as shown in Fig. 2.

The cast-iron plate F, Fig. 3, has a tapered socket on one end, to which is pinned the shaft I. This plate F constituting a part of the mould, has mounted upon it the remaining necessary parts. The part C is a half-cylidrical shell of an inch or more in thickness and is made of a 94 per cent. copper alloy. This constitutes the mandril upon which the casting is made. Attached to one end of it (Fig. 2) is a handle by means of which the mandril is manipulated. D is made in two halves and forms the outer casing of the mould. Both parts are made of cast iron and are provided with radiating ribs. The collar E is made of pure copper, and forms the part of the mould against which the heavy flange is cast.

The different parts of the moulds are fastened together in any convenient manner by means of hinges, dowel-pins and hasps, so as to permit the different parts to be taken apart and reassembled quickly while in a heated state. The reservoir N is lined with asbestos cardboard. The cardboard is first cut to exact pattern and is then placed in position while soaked with water; the end pieces are put in last and firmly pressed in position, after which the seams are wiped over with asbestos cement. The gate or opening (n) through the face-plate B, leading from the reservoir N into the mould, is also lined with asbestos flush with the front face of the face-plate. The lining is then dried by filling the reservoir with pieces of live coke from the furnace; after it has been thoroughly dried, it is then in condition to last for weeks.

When the machine and the mould are in position as shown in Fig. 2, the reservoir N is filled with the required amount of molten metal. The operator then places his left hand on the handle Y and the right hand on handle S. He then tilts the machine until the lug on the arm X is brought in contact with the upper adjustable nuts on the rod Z, and, at the same instant, begins to turn the crank S^1. This causes the shaft I carrying the mould to rotate evenly and uniformly. By means of the eccentric W, the tilting of the mould is gradually and uniformly increased until the shaft I is turned through a half revolution. At this instant the handle Y is moved down and the machine is brought back to the position as shown in Fig. 1, by means of which the worm is automatically disengaged from the worm-wheel and the operator is enabled to quickly complete a revolution of the mould by the use of the hand-wheel, and then by means of a wooden plug he pushes the solidifying plug of metal in the gate (n) in the reservoir N. The mould is then opened up by releasing the fastenings. The collar E and the outside casting D are then removed. The mandril C, having the casting adhering to it, is next removed, and by gently tapping the casting against a block upon the floor, the casting is easily removed from the mandril. The mandril C and the collar E are then dipped into a tub of water for a short time, not long enough, however, to cool them completely, but so as to retain sufficient heat to dry them almost instantly the moment they are withdrawn from the water. The different parts of the mould are then asembled, and, after refilling the reservoir with an additional amount of molten metal, the machine is ready for making the next casting.

As the first metal enters the mould it flows in a line parallel with the cylindrical portion of the casting. The nuts on the rod Z are so placed that, if the tilting were not increased, due to the eccentric W, the entire mould would fill while the metal was flowing parallel to this cylindrical part. It is obvious, however, that it would be impossible to fill a mould completely under these conditions, and therefore it is necessary that the tilting of the mould be gradually increased by some such means as the eccentric W. This causes the end of the mould remote from the gate to gradually fill in advance of the end adjacent to the gate. The machine is adjustable throughout for the making of castings of this general style, though they may vary as to size and proportions. The weight of the arm X is adjustable so as to counterpoise the weights of the different moulds. Although the surface of the face-plate is perfectly smooth and at right angles to the shaft I, it was found, nevertheless, that a spring action is necessary between the two, owing to the fine fins that are liable to form at the edge of the gate. Each casting requires a mould especially designed for its own requirements, as the part of the mould against which the heavier part of the casting is made requires a greater chilling effect, and for this reason must be made of metal having a greater chilling capacity. In these experiments, for the sake of comparing the different metals and alloys for their "chill effect," it was assumed that the product of the co-efficient of heat conductivity multiplied into the specific heat of any one metal or alloy represented the relative value of its "chill effect." All results seemed to verify the correctness of this assumption.

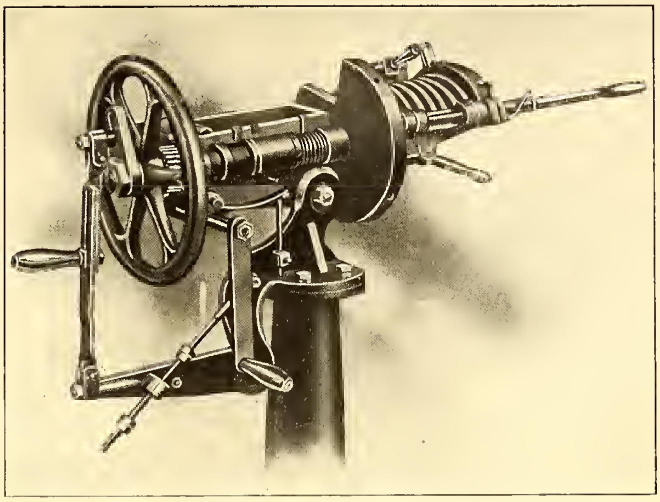
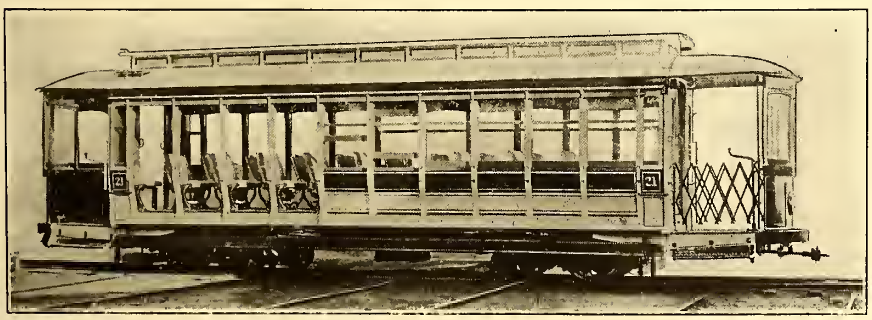


FIG. 4.—MACHINE FOR MAKING BRONZE BEARINGS

CONVERTIBLE CARS FOR ROANOKE, VA.

The accompanying illustration shows a convertible car recently put in operation by the Roanoke Railway & Electric Company, and received from the J. G. Brill Company.



CONVERTIBLE CAR FOR ROANOKE, VA.

The new cars measure 28 ft. 4 ins. over the end panels, and over crown pieces 38 ft. 4 ins.; panel over crown piece, 5 ft.; width over sills, 7 ft. 3¾ ins.; width over posts at belt, 8 ft. 2 ins.; over grab handles, 8 ft. 9½ ins.; sweep of posts, 5 ins.; height of car from rail over trolley board, 11 ft. 8 ins.; size of Z bars sills, 8 ins. x 3 ins. x ½ in.; size of end sills, 4¾ ins. x 8 ins.; thickness of corner posts, 3⅝ ins.; thickness of side posts, 3⅜ ins. The cars embody the Narragansett step feature, which makes it easy for passengers to get on and off the car, providing as it does a double step within and over all limits of a single step. This is not very clearly shown in the illustration, due to the angle at which the car was photographed. The step is formed by an extension to the lower outward extending flange of the Z bar sill, making an upper step 8½ ins. wide; the posts are secured to the sill by malleable iron brackets, through which they are bolted, and are also held by strap bolts through the lower flange. The finish of the cars is natural quartered oak; the ceilings are of the same wood, decorated; seats with double grab handles; other specialties are: Folding gates, angle iron bumpers, alarm gongs, radial drawbars, etc. Another feature is the Brill portable vestibule, which, as will be readily understood, is particularly suitable to this type of car. The style of truck is the Eureka maximum traction, with wheels having a diameter of 33 ins. and 20 ins. Two 40-hp motors are used per car.

EXPRESS CAR FOR THE ILLINOIS TRACTION SYSTEM

An account was published in the Street Railway Journal for May 26, 1906, of some elaborate cars recently completed by the St. Louis Car Company for the Illinois Traction Company, of Danville, Ill. This company is planning an extensive system in Southern Illinois, and expects to conduct a considerable freight and express business. For this purpose five freight and express cars have recently been secured from the St. Louis Car Company, and one of them is illustrated herewith. The general dimensions of this car are as follows: Length of carbody over all, 39 ft. 9 ins.; width over sills, 8 ft. 6 ins.; width over all, 8 ft. 10 ins.; height of body, 9 ft. 8 ins.; height from rail to top of roof, 12 ft. 10⅝ ins.

The car framing is of the most substantial construction. The bottom framing consists of six sills of yellow pine, each sill measuring 5 ins. x 7½ ins. The car bolster is of the flitch type trussed. There are two needle beams of oak 5½ ins. x 7 ins., placed 9 ft. 1½ in. centers and two side truss rods 1¼ ins. diameter attached to the bolster. As shown in the illustration, the cars are framed for monitor roof with ventilators, which are glazed with D. S. A. glass. The hoods are finished in the steam-coach style with no vestibules. The car is not provided with windows, but has on each side one sliding door 6 ft. wide and 6 ft. 3¼ ins. high. The bumpers are of oak faced with 9-in. x ½-in. steel plates. The floors are of 1½-in. thick oak which are placed crosswise of the car. The cars are lighted by one circuit of five incandescent lamps.

THE NEW EXPRESS CAR FOR THE ILLINOIS TRACTION SYSTEM

The cars are equipped with air brakes, also with the St. Louis Car Company's vertical malleable iron wheel brake, the St. Louis Car Company's heavy-type radiating drawbars, and are mounted on Diamond frame freight-car trucks having a 5-ft. wheel base.

The Toledo Urban & Interurban Railway is preparing to offer better facilities for the through Dayton-Toledo Limited service, which was instituted recently. Six right-angle curves north of Findlay are to be lengthened so that they can be taken at high speed, and this will save several minutes. The company is also going to install a dispatching system. Its block-signal system has been very satisfactory, but the other roads in the interline arrangement have no means at present of knowing whether a car on this portion of the run is late or out of service. When these improvements are completed, it is probable that the running time for 162 miles will be cut down to five and one-half hours, saving twenty minutes over the present schedule. The through freight business over these lines is increasing with the passenger business, and the company will erect a large freight station in Findlay.

A FOUR-TRACK LINE ON THE PACIFIC COAST

Orders have been given by Henry E. Huntington to begin work at once on the project for four-tracking the Long Beach line of the Pacific Electric Railway system as far as Watts station, and to rush operations to completion as rapidly as can be done. This will give Los Angeles the only four-track trolley line west of New York, and will be the culmination of plans that have been under consideration for nearly a year. More than eight miles of double track will be built, and the right of way has already been secured. At the present time the Pacific Electric Company is running more than 600 cars a day over the Long Beach line and its connections,—the Whittier, Santa Ana, Newport Beach and Wilmington-San Pedro lines, and traffic is daily becoming more congested. As the Whittier line branches off at Slauson Junction and the Santa Ana line at Watts, it is not until the latter station is reached that this crowded condition is relieved. It will be no surprise to the company to find that the four-track system will have to be extended in less than a year.

After the work of four-tracking to Watts has been completed the next step will be that of building a line from Santa Ana to Newport Bay to connect with the line just completed to that point from Newport Beach, and known as the East Newport Branch. The East Newport line, which was opened to traffic only a few days ago, is two miles long, from Newport Beach east across the Southern Pacific tracks to the bay. It makes the Newport Beach line the longest of the entire Pacific Electric System,—forty miles. The schedule time from Los Angeles to the end of this line is 1 hour and 15 minutes. From Mount Lowe, the farthest point north, to the farthest point south and east on the Pacific Electric system the distance is 55 miles. The new East Newport line building was encouraged largely by the fact that private enterprise had decided to make a big beach resort out of the bay town and has built a large pavilion and skating rink; also that the Pacific Electric has just finished work on a power plant at the point where the new line crosses the Southern Pacific tracks. Mr. McMillan, to whose offices as traffic manager have also been shifted the offices of H. S. Kneedler, industrial and advertising manager of the company, admits that the Santa Ana-East Newport line is a possibility, but is not in the plans of the company for the immediate future.

The Connecticut Railway & Lighting Company has resumed the service stripe system among its employees. Hereafter the men who have been employed by the company will receive one long stripe for every five years of service. One short stripe will be worn by the three years' employees.

FINANCIAL INTELLIGENCE

WALL STREET, June 6, 1906.

The Money Market

There has been a decided change for the better in the monetary situation during the past week. The payment of the first instalment amounting to about $10,000,000, on the Pennsylvania note issue, the payments on account of new stock issues, and the June 1 interest and dividend disbursements were made without causing the slightest disturbance in the local market. About the only effect of these extraordinary demands was to hold rates for time money steady, but at the close the tendency was toward a lower level. Early in the week the banks and other lenders were not disposed to offer money for fixed periods with much liberality, but later on offerings became free, and were reflected in a sharp decline in the asking rate for over the year money. The improvement was due to the heavy arrival of funds from San Francisco and other Pacific Coast points, and the assurance that the receipts of money from that center will assume much larger proportions during the current week. From May 11, the date of the beginning of the return flow, up to the present time, upwards of $11,000,000 have been received, and in banking circles it is estimated that about $10,000,000 more will be received from the Pacific Coast this week. This heavy inward movement, together with the usual receipts from other Western and nearby points, will materially strengthen the position of the New York City banks, and is expected to be reflected later on by a general lowering of interest charges. The demand for money has been confined almost entirely to the call loan department, borrowers generally being inclined to draw their immediate wants from this source, rather than to commit themselves for fixed periods. In some instances stock commission houses have reloaned their unemployed balances. Foreign exchange has ruled firm, thus preventing the importation of gold from Europe. Gold amounting to $1,500,000 was, however, engaged in Australia for shipment to this center, and this amount was made immediately available for market purposes, the engagement having been made before the announcement by the Secretary of the Treasury that no further advances would be made on gold engaged for import. The European market continued to improve, and it is expected that the governors of the Bank of England will soon order a reduction in the official discount rate. The bank statement published on last Saturday was not up to expectations. Loans increased $2,152,400, despite the inactivity in the stock market. Deposits increased $4,019,300. The increase in cash of only $1,126,700 was due to the fact that about $5,000,000 which was received from San Francisco did not figure in last week's operations. The reserve required was $1,004,825 larger than in the previous week, and deducting this from the gain in cash, left the surplus $121,875 larger than in the preceding week. The surplus now stands at $6,816,025, as against $6,050,275 in the corresponding week of 1905, $31,760,675 in 1904, $4,775,650 in 1903, $11,285,575 in 1902, $13,341,500 in 1901, and $20,123,275 in 1900.

Money on call loaned at 5 per cent and at 2 per cent, the average rate for the week being about 3½ per cent. Sixty and ninety-day money was quoted at 4½ per cent, four to seven months' at 4¾ to 5 per cent.

The Stock Market

The stock market has improved very materially during the past week, not only in recording a higher range of values, but in developing a decidedly better feeling with regard to the future. During the first half of the week prices worked up gradually, but toward the close the buying became more aggressive and the advances were of greater proportion. This change in sentiment is the result of easier monetary conditions, due to the return of a large amount of money from San Francisco and other Pacific Coast points, and the assurance that the movement to this center will continue heavy during the current week. Other important developments included the publication of the government report on cotton, which was regarded bullish from a railroad standpoint, as indicating a large crop and increased prosperity for the South, and the publication of the annual report of the Amalgamated Copper Company, which, superficially, appeared unfavorable, but, as a matter of fact, did not reflect the true conditions. General conditions are highly encouraging. Great activity continues in the iron and steel industry, the consumption being equal, if not larger, than in 1905; railroad earnings show substantial increases over those of previous years, and reports from the Western traffic managers of all the leading roads are that the volume of business is larger than in several months, and all indications point to a steady growth in the volume of traffic. Crop prospects are good, and with easy money the outlook is much brighter for an active bull speculation. Pool activity has been largely in evidence during the week, and while ordinarily this is not regarded with favor, it has served to lift the market out of the rut of inertia and to develop a better feeling. Noteworthy strong features of the week have been Reading, Union Pacific and Southern Pacific, the buying of the last named being on expectations that the company will in the near future make some distribution to the shareholders. Colorado Fuel, American Smelter, Amalgamated Copper and many of the minor industrials also displayed considerable strength. Congress is expected to adjourn the latter part of the month, and with this out of the way the situation will be much clearer.

In the local traction group, Brooklyn Rapid Transit has been active and strong, having advanced on increasing earnings. It is said that the company continues to purchase property in the neighborhood of Coney Island.

Philadelphia

Extreme dullness characterized the market for local traction issues during the past week. Dealings included less than a dozen issues, none of which displayed any degree of activity, but prices generally displayed firmness. Philadelphia Rapid Transit was the leading feature, about 2500 shares changing hands at from 26 to 26½. At the end of the week, the company announced a call for a payment of $5, payable on July 10, which will make the stock $25 paid. Following the announcement the stock sold off fractionally to 25¾. Consolidated Traction of New Jersey was quiet but firm, less than 300 shares changing hands at from 82 to 82¼. Upwards of 300 shares of Philadelphia Traction sold at 98¾, and 200 shares United Traction of Pittsburg preferred brought 77⅛. Union Traction was dealt in to the extent of about 1000 shares at prices ranging from 63 to 63½. The company has declared the usual semi-annual dividend of $1 per share, payable on July 1. Philadelphia Company's issues were very quiet, about 1000 common changing hands at 50½ to 51, and odd lots of the preferred at 49¼. Small lots of American Railways brought 51½ to 51⅜. Other sales were: United Companies of New Jersey at 263, and Railways General at 6¾.

Chicago

Dealings in the tractions at Chicago were fairly active, and prices generally held firm. North Chicago rose from 44½ to 47 on the purchase of about 500 shares. West Chicago brought prices ranging from 36 to 37½ for about 300 shares, while the debenture bonds sold at 65. Upwards of 500 shares of Union Traction common changed hands at 5 and 4¾, while several hundred shares of the preferred brought 13½ and 13¼. South Side Elevated sold at 96 and 96½ for 250 shares. Northwestern Elevated sold at 26, and Chicago & Oak Park brought 6¼. Other transactions included Metropolitan common at 27 and the preferred at 70.

Other Traction Securities

Very little activity developed in the Baltimore tractions, and apart from United Railway free incomes, which fluctuated sharply, the dealings were devoid of special feature. Opening at 73½, the free incomes advanced to 74½, but on the announcement that the coupon on the bonds due June 1 would not be paid, the price ran off to 72½. The passing of the June 1 coupon brings the total amount of interest due on the bonds up to about 10 per cent. Upwards of $275,000 bonds were dealt in. Certificates representing bonds deposited sold at 71¾ for $5,000. United Railway 4s sold at 92¼ to 92⅛ for about $27,000. Other transactions included $20,000 Norfolk Railway & Light 5s at 99, Baltimore City Passenger 5s at 103¾, Knoxville Traction 5s at 106¾, and Augusta Railway & Electric 5s at 104. The feature of the Boston market was the strength in Massachusetts Electric issues, the common advancing to 20¾ on purchases of about 800 shares, while the preferred rose from 68½ to 70⅜ and closed at 70, upwards of 900 shares being traded in. Otherwise the trading was dull and featureless. A small lot of Boston Elevated changed hands at 153. Boston & Suburban common rose from 21¾ to 22¼, while the preferred sold at 69¼ and 70. Other sales were: Boston & Worcester common at 37, the preferred at 88; West End common at 98 and 97½, and the preferred at 112½ and 11. Dealings in the New York curb market have been very light, due to the fact that all of the active issues have been transferred to the Stock Exchange. Public Service Corporation 5 per cent notes sold at 97½ and interest for $10,000, and $2,000 New Orleans Railway 4½s brought 90.

Cincinnati, Newport & Covington continues very active in Cincinnati, about 1800 shares changing hands at between 73¾ and 75, the closing figure indicating a lull in the upward movement which has been going on for several weeks. The Cincinnati Street Railway sold for 143¼, a fractional decline. Toledo Railways & Light sold at 33½, also a slight decline. Cincinnati, Dayton & Toledo 5s sold at 93, a fractional advance.

Tractions were inactive at Cleveland. Northern Ohio Traction & Light led in the selling, several lots changing hands at 30½, which was two points lower than before the recent dividend was announced. The consolidated 5s of this company sold at 100¼. Aurora, Elgin & Chicago common came into demand on news of greatly improved earnings since the consolidation. It sold at 34¼, and advanced to 35 the early part of this week. Cleveland Electric sold at 78½. A small lot of Lake Shore Electric common sold at 15¾, and early this week another lot at 16. Western Ohio receipts sold at 14, a mark three points lower than last sale.

At Columbus, Columbus Railway & Light, after a reaction to 83, worked up to 85. Columbus Railway common sold at 102½, and the preferred at 111. Scioto Valley Traction common continues to move upward, and sold last week at 38. Small lots of the preferred changed hands at 93½.

At Toledo last week there was a sale of $152,000 of Toledo & Indiana 5s at around 60, and of $180,000 Toledo, Ann Arbor & Detroit 5s at 20. The bonds had been hypothecated by the Hirsch Construction Company, which built these roads and failed some months ago. The first-mentioned company is paying its interest while the second-mentioned road is in an unfinished condition.

Security Quotations

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

	May 31	June 6
American Railways	52½	51½
Boston Elevated	153	153
Brooklyn Rapid Transit	81⅞	84
Chicago City	160	170
Chicago Union Traction (common)	4½	4½
Chicago Union Traction (preferred)	13	13
Cleveland Electric	81	81
Consolidated Traction of New Jersey	81	81½
Detroit United	94	94
Interborough-Metropolitan Co. (common)	50⅜	50¼
Interborough-Metropolitan Co. (preferred)	84	84
Interborough-Metropolitan Co. 4½s	—	—
International Traction (common)	59	59
International Traction (preferred), 4s	80	80
Manhattan Railway	152	152
Massachusetts Elec. Cos. (common)	20	20⅝
Massachusetts Elec. Cos. (preferred)	69	70⅜
Metropolitan Elevated, Chicago (common)	27½	27½
Metropolitan Elevated, Chicago (preferred)	69	69½
Metropolitan Street	a114	a114
Metropolitan Securities	—	—
New Orleans Railways (common)	32	32
New Orleans Railways (preferred)	80	80
New Orleans Railways 4½s	88¾	88¾
North American	97⅜	98
North Jersey Street Railway	27	27
Philadelphia Company (common)	51	51
Philadelphia Rapid Transit	26	25½
Philadelphia Traction	98¾	98½
Public Service Corporation 5 per cent notes	95	95¼
Public Service Corporation certificates	69	69
South Side Elevated (Chicago)	96	96½
Third Avenue	128½	129¾
Twin City, Minneapolis (common)	116	115¼
Union Traction (Philadelphia)	63	63
West End (common)	—	—
West End (preferred)	—	—

a Asked.

Metals

The "Iron Age" says, the market for steel-making pig iron continues stiff. Outside of some further buying of foundry iron by pipe makers in Eastern Pennsylvania, the volume of business in iron for melters has been very light throughout the whole country. The associated Birmingham makers are firmly holding at $14, but outside makers are shading this 25 cents. Moderate sized orders for rails for this year's delivery are still being entered. Japan has again appeared in our markets as a buyer of bridge material and of rails. German iron and steel makers have been putting up prices rather sharply, and reports from England have been more encouraging.

Copper metal holds firm at unchanged prices. Lake, 18¾ to 18⅞c.; electrolytic, 18⅜ to 18⅝c., and castings, 18¼ to 18⅜c.

CONSOLIDATION OF PENNSYLVANIA COMPANIES

Under the title of Pittsburg, Harmony, Butler & New Castle Street Railway Company, with a capital of $3,000,000, the following street railway lines now operating, or to be built in Allegheny, Butler and Lawrence Counties, have filed notice of merger in the State department, at Harrisburg. Pittsburg & Harmony, $500,000; Thornhill, $250,000; Callery & Evans City, $609,000; Evans City, $326,000; Butler & Harmony, $400,000; Pittsburg, Harmony, Butler & New Castle, $300,000; Elwood City & Hazledell, $300,000; Elwood City Electric, $9,000; Wayne, Electric, $6,000; New Castle & Harmony, $300,000. The officers of the new company are: Stanley C. Vickers, of Pittsburg, president; Harry Ethridge, of McKeesport, vice-president; E. M. Balsinger, of Pittsburg, secretary; Mark G. Hibbs, of Crafton, treasurer.

RHODE ISLAND SECURITIES SALE OFF

Recent rumors concerning changes in the ownership of the Rhode Island Securities Company, which controls practically all the trolley lines in Rhode Island, have been set at rest by a statement by President Marsden J. Perry, saying that while President Chas. S. Mellen, of the New York, New Haven & Hartford Railroad, had opened negotiations for the control of the company such plans have now been abandoned on account of the declination of his proposals by the present owners of the company, the United Gas Improvement Company, of Philadelphia. At one time, President Perry states, an agreement was reached as to the terms of a possible sale, but President Mellen encountered difficulties causing much delay, with the result that the present owners called the deal off.

ADDITIONAL STOCK FOR TWIN CITY RAPID TRANSIT

The directors of the Twin City Rapid Transit Company have authorized an additional issue of the company's common stock. Privilege will be given to holders of preferred and common stock to subscribe at par for the new common stock to the extent of 10 per cent of their respective holdings as registered on June 11. The subscription privilege may be exercised on June 18 next, and will terminate at the close of business on July 6. Warrants to subscribe will be mailed to stockholders or may be obtained from the Farmers' Loan & Trust Company, New York. Warrants for fractional shares, which will pass by delivery, will be convertible into full share warrants in amounts of $100 or multiples thereof. An instalment of 50 per cent must be paid in at the time of subscription, and the remaining 50 per cent will be payable on or before August 15. Full paid warrants will be exchangeable for stock certificates when presented to the Farmers' Loan & Trust Company on and after August 15. Such certificates will carry all subsequent dividends.

BION J. ARNOLD TO REPORT ON ADVISABILITY OF SUBWAY IN CHICAGO

The City Council Committee on local transportation of Chicago, at a meeting May 31, employed Bion J. Arnold to make a report on the advisability of subways, the underground trolley and the overhead trolley, with reference to a general settlement of street railway situation by the city with the traction companies. Mr. Arnold informed the committee that he would be able to report in about ten days. In answer to Mayor Dunne's query as to how long it would take to get a subway in operation in the downtown district, Mr. Arnold stated that it would be three years before cars could be run. In his opinion it will be necessary to use the overhead trolley for a time, in order to obtain quick rerouteing of cars and improvement in the transportation facilities. President Mitten, of the Chicago City Railway, and General Counsel Gurley, for the Union Traction Company, informed the local transportation committee that they had not yet arrived at figures for the value of their lines to be used as the basis of negotiations for permanent settlement. Mr. Gurley stated further, that he could have his figures ready in about ten days, while President Mitten stated his would not be completed before the middle of June. An ordinance to electrify the cable lines of the Chicago City Railway was considered by the committee, and it was agreed that the city should receive a compensation of $20,000 a year from the company. President Mitten stated that if the lines were equipped with electricity, about five months would be required to put the new system in working order, and he added further that the best of the cable trailers would be utilized as trolley cars.

The arguments in the suit between the North and West Chicago Street Railway Companies, and the Union Traction Company have been completed in the Federal Court. The argument has been largely confined to the question as to whether the Union Traction Company or the underlying companies were responsible for the floating indebtedness of $3,300,000 which is now charged up to the underlying compaines. In view of the fact that an early decision will facilitate the negotiations of the companies with the city, Judge Grosscup will decide upon the several questions involved as soon as possible.

Arguments in the suit brought by the North Chicago and West Chicago Street Railroad Companies against the Chicago Union Traction Company for annulment of the leases of the North and West companies to Union Traction were concluded before Judges Grosscup, Humphrey and Anderson Friday, June 1.

"We will try to settle the general principles as quickly as we can," Judge Grosscup told the lawyers at the end of the arguments.

Attorney Henry S. Robbins' attack on the veracity of W. W. Gurley, general counsel for the Union Traction Company, caused John P. Wilson to take the witness stand and tell the court that while he (Mr. Wilson) was acting as attorney for the protection committee of the North and West Side stockholders he was told by Mr. Gurley that the notes representing the floating debt of the companies had been retired. This testimony was in opposition to the charge of Mr. Robbins that Mr. Gurley had deceived the North and West interests.

The decision of the court will concern not only the continuation or cancellation of the leases, but also the liability for the $3,406,000 of floating debt as between the Union Traction interests on the one side and the North and West interests on the other.

FATAL TROLLEY ACCIDENT AT PROVIDENCE

Eleven persons are dead, a score seriously and another score slightly injured as the result of the overturning of an open electric car at Moore's Corner, in East Providence, at 1 o'clock Sunday morning, June 3. More than 100 young men and women, members of a Catholic society, who had been passing the evening at Crescent Park, a pleasure resort on the Providence River, 6 miles below Providence, were on a chartered car returning to their homes in Providence, Olneyville and Thornton. At Moore's Corner the track curves sharply at the foot of a long but not particularly heavy grade. Fog prevented a clear view of the road ahead, and an electric arc lamp at the corner is said to have been hardly visible. Realizing the peril, the motorman applied the brakes and reversed the motors in an effort to prevent an accident, but the car left the track and was overturned. Seven of the passengers were pinioned beneath the car and instantly killed. Immediately those who escaped with little or no injury began the work of rescue.

FIRE IN THE NEW YORK SUBWAY

A fire occurred at 5:45 p. m., June 1, in the New York subway, between 107th and 108th Streets, in which three empty cars were badly burned. At this point of the subway there are three tracks, of which the middle is used for storage purposes. Four empty cars were standing on this track and an empty train was run on to the track from the north. The cars collided, three of the trucks were derailed and the platforms of three of the cars were smashed in. The trucks were not thrown across the third rail, but short circuits were caused in the three cars with the demolished platforms and arcing occurred in several places. The middle car of the three injured was of steel construction, while the other two were of the first type installed by the Interborough Rapid Transit Company, and were of wood with copper sheathed sides. The fire from the combustible material in the burning cars created considerable excitement, and traffic was stopped for some time while the firemen put out the fire by pouring their streams through the openings from the street above. Automatic devices for tripping the circuit breakers in the sub-stations are located in the subway every 400 ft., and 4 minutes after the cars came together two of these devices were pulled almost simultaneously at the 103d Street and 110th Street stations, cutting out this section of track. The lights in the subway are on a separate circuit and were not affected except those directly above the cars, where the cables were burned and where the heat burst some of the globes. This did not occur, however, for over half an hour after the collision. The accident demonstrated the superiority for subway operation of steel cars, but it also showed that the copper sheathing on the wooden cars was a considerable protection against fire.

PREPARING INTERLINE TARIFF RATES

John H. Merrill, secretary of the Central Electric Railway Association, has begun the work of compiling interline rates for the various roads in Ohio, Michigan and Indiana, which are allied with this association. The work will be taken up in districts for the lines radiating from certain centers. Mr. Merrill's first work is the compilation of interline rates for the routes between Indianapolis, Dayton and Columbus, and Indianapolis and Toledo. The idea is to compile a tariff sheet which will show the rate between any two points in this district. The fact that there are, in a number of instances, several routes between certain points, complicates the task. For instance, between Indianapolis and Toledo, there are eight routes over which it is possible to travel, and each route must be shown and the rates given. Mr. Merrill's first compilation shows simply the sum totals of the local rates between these points; no attempt being made to reduce the rates so as to come below the steam lines in cases where the steam roads have a considerably shorter route between two terminals. This gives the steam roads a lower through rate in spite of the lower rate per mile offered by the electrics, and reductions will have to be made in many cases to secure through business. It will be necessary for each of the roads concerned in the through rate to make some reduction in its pro rata in order to get below the competing steam rate. The situation is further complicated by reason of the fact, that the steam roads in Indiana have a 3-cent per mile rate, while in Ohio, as the result of recent legislation, the steam rate is 2 cents per mile.

Incidentally, there is another phase to the Indianapolis situation which may or may not cause trouble. It will be remembered that about two years ago, before many of the lines in this district were connected up, several of the electric lines made alliances for interline business with the Clover Leaf Railroad, and the reduced rates which resulted caused storms of protest from the steam roads and threw considerable business to the electrics. Now, that roads in Western Ohio have secured an inlet to Toledo, and are giving fast limited service, with connecting limiteds for Indianapolis, the Ohio roads find the aforesaid alliance a drawback to the routeing of through business over their lines, and they want the Indiana roads to withdraw from their "unholy alliance" and send their Indianapolis-Toledo business by the "all electric" route. The Indiana roads are unwilling to do that at present, fearing it would cut off some of their business.

As soon as the Indianapolis tariff is compiled, Mr. Merrill will take up the question of through rates out of Toledo, Detroit, Cleveland and Columbus. The aim is to provide every station agent in the three States with tariffs which will enable him to sell through tickets to all points without having to call upon the general office for information concerning rates and routes.

DETROIT UNITED AFTER LONG DISTANCE BUSINESS

Officials of the Detroit United Railways, who attended the meeting of the Central Electric Railway Association at Dayton recently, said that the company is going after the long-distance traffic by instituting through limited service from Toledo to Port Huron, Mich., a distance of 130 miles. Heretofore the company has operated two limited trains a day between Detroit and Port Huron. For some time past the Detroit, Monroe & Toledo Short Line has been planning to institute limited trains between Toledo and Detroit. Now that the Detroit United has acquired the short line the service will be made a through one. Much faster service will be made possible by reason of the fact that a turbo-generator of 2000-kw capacity is soon to be installed in the Monroe power station of the Short Line, while another unit of the same size is to be installed in the New Baltimore station of the Detroit United. Both the Short Line and the Detroit United have recently purchased some very fine cars, and it is the intention to run them in three-car trains. Each train will be made up of a combination baggage and smoker, a passenger car and a parlor-chair car. It is claimed that the heavy traffic to the pleasure resorts at Port Huron and vicinity will warrant this equipment. It is also the plan to run the chair cars through from Port Huron to Cleveland over the Lake Shore Electric Railway, making a run of 250 miles, which will be the longest electric run in the country. It is stated that the Toledo-Port Huron service will be started in June.

EVERETT-MOORE SYNDICATE BUYS TWO LINES

The Everett-Moore syndicate of Cleveland, whose financial embarrassment in 1902 affected the entire traction situation of the Central West, has practically regained its prestige. Indications are that it will soon have under its control all the interurban lines sold at that time which were in operation or under construction.

Two months ago the Detroit United secured control of the Detroit, Monroe & Toledo Short Lines, thus giving the Everett-Moore syndicate a line which it had under construction at the time of its embarrassment. The Cleveland, Painesville & Ashtabula Railway, which had been laid out by the Everett-Moore people as an extension of the Cleveland, Painesville & Eastern, and was afterward built by Cleveland people who bought the right of way, now comes back to the Everett-Moore syndicate. The syndicate bought 6000 shares of the stock, paying cash for it at $20 per share. The road will be operated in conjunction with the Cleveland, Painesville & Eastern, and the cars will run through from Ashtabula to Cleveland. This gives the syndicate an unbroken line from Ashtabula, Ohio, to Port Huron, Mich., of about 305 miles.

As intimated in a recent issue, the syndicate has been negotiating for the purchase of the Canton-Akron system, and it is now announced that the deal has been effected, and that these properties will be turned over within the next thirty days. The Everett-Moore syndicate had arranged to acquire this property shortly before its financial difficulties. After the embarrassment the Tucker-Anthony people of Boston took the road back again and now for the second time it passes to the control of the Everett-Moore syndicate. The Canton-Akron Railway, the Canton & New Philadelphia Railway, and the Tuscarawas Traction Company, which are included in the deal, will be consolidated and will then be taken over by the Northern Ohio Traction & Light Company. The Northern Ohio Company will guarantee the underlying and consolidated bonds of these properties, and will increase its capitalization to $8,000,000, giving its stock in exchange for that of the acquired properties.

Recent rumors from New York have intimated that the New York Central interests had arranged to purchase the Lake Shore Electric Railway along with other lines between Cleveland and Erie. This is positively denied by the members of the Everett-Moore syndicate. While admitting that the New York Central interests may get control of these properties some time in the future, it is pointed out that the syndicate has just regained control of the roads, and it will now carry out its original plan of operating and developing them.

It is interesting to note that while the Everett-Moore syndicate has regained control of all the interurban properties owned at the time of its embarrassment, it has just sold the bulk of its holdings in the independent telephone properties, in which it was formerly a very heavy investor.

EASTERN OHIO TRACTION COMPANY REORGANIZATION

The property of the Eastern Ohio Traction Company will not be foreclosed as intimated would be done some weeks ago. The stockholders who objected to the original reorganization plan calling for an assessment of approximately $38 per share have agreed to another plan providing for an assessment of about $32 a share, payable in installments. In order that the road may be taken out of receiver's hands as quickly as possible, a new company, to be known as the Cleveland, Youngstown & Eastern Railway Company, has been incorporated to take it over. Incorporators are: A. M. Snyder, H. Clark Ford, A. A. McCaslin, H. M. Roberts and E. G. Derr. The company will proceed at once with the building of a cut-off from Chagrin Falls to Garrettsville in accordance with an agreement made with the Mahoning & Shenango Valley Traction Company, which will build from Leavittsburg to Garrettsville to connect with the line to Cleveland, thus giving a comparatively straight line from Youngstown to Cleveland. The new lines will be constructed for high-speed service, with a view to competing with the steam roads from Cleveland to Youngstown. The company will also double-track the line from Lee road to South Euclid, which will enable it handle the large suburban traffic over this route to better advantage.

WORK TO BEGIN ON PITTSBURG SUBWAY

Announcement has been made in Pittsburg that the Pittsburg Subway Company, otherwise known as the Frick-Mellen-Cassett-Oliver-Flinn syndicate, will ask the City Councils within a month for rights of way for the proposed subway. The new road is expected to cost $20,000,000, based on the cost of the construction of the New York subway. It is proposed to start work immediately.

REPORT OF THE PARIS METROPOLITAN RAILWAY

The annual general meeting of the Paris Metropolitan Railway Company was held on May 12. In the report of the directors it was stated that with the opening of line No. 2 (south part) the first section of the railway, comprising, roughly, an ellipse trisected lengthwise by two irregular lines, was completed. After referring to the several lines under construction the report goes on to state that on account of the intense traffic on the existing lines, especially at intersecting stations, a duplication of certain of the present lines is necessary. Steps have been taken to bring this question before the City Commission. The lines in service throughout 1905 included an average of 31 km, and during rush hours a 3-minute service was maintained over the three lines in service, by means of 305 motor cars and 378 trailers. The cars in construction number 149, all mounted on swivel trucks, and of these fifty-six were motor cars. The question of elevators for the deeper level stations has been settled, and stations of more than 12 m. below the surface will be provided with elevators. There are only a few stations at this depth. The ventilation of the deeper level stations has also received attention, owing to repeated complaints of the traveling public. The total number of employees of all grades belonging to the company was 2730.

The total gross receipts of the company for 1905 amounted to frs. 26,194,136, and the expenses of operation were frs. 11,353,482, giving a ratio of 43.44 per cent against 42.50 per cent in 1904. This gives a net profit of frs. 14,840,654, out of which sum about 60 per cent is payable to the city, representing interest on the capital expended in the construction of the line. The net profits remaining the company, therefore, amounted to frs. 6,443,747, giving net receipts per kilometer in service of frs. 202,927, against frs. 200,104 in 1904. The average fare per passenger amounted to fr. 0.1728.

The capital expenditure of the company to the end of 1900 was frs. 85,938,425, an increase of frs. 13,572,127 over 1904. The capital of the company is frs. 75,000,000, and there is a special reserve fund (created after the disaster of August, 1903) of frs. 1,363,885. The shares are of frs. 250 each, and a dividend of frs. 19 per share was declared, as against frs. 20 for 1904. The same rate of dividend could have been paid if frs. 121,000 were included from the sums brought forward from 1904. It is proposed to make a further issue of capital next month (June) of 50,000 shares, and a larger issue in 1907, this to take care of new lines to be handed over by the city for service.

The present power station of the company has reached its capacity, and power is being purchased in increasing quantities from outside sources.

AN IMPORTANT IMPROVEMENT AT LOS ANGELES

According to George E. Pillsbury, chief engineer of the Pacific Electric Railway Company, a "shorter short line" will be in operation between Los Angeles and Pasadena sometime in the fall. The new cut-off is from Aliso and Anderson Streets to a point on the Pasadena short line, and besides being a little shorter in point of mileage than the short line, the new line is through private right of way, thus permitting cars to run at greater speed, and allowing the use of more cars than at present. The idea of the cut-off was considered by Mr. Huntington a year or more ago, but has taken shape only in the last few months. A large force of workmen has been engaged in grading, and now the contractors are waiting for the steel work of the bridge, which is being set up in this city. This bridge is to be a fine steel and concrete structure. Grade crossings, prohibited by law, are avoided by an under crossing at Macy Street, and an overhead crossing over the Southern Pacific Railroad at Alabama Avenue, and it is here that this magnificent bridge is being erected.

CONVENTION OF THE MASTER CAR BUILDERS' AND MASTER MECHANICS' ASSOCIATIONS

These conventions are to be held this year in Atlantic City. The Master Car Builders meet June 13, 14 and 15, and the following program has been adopted:

June 13. Discussion on the following reports: "Revision of Standards and Recommended Practice," "Tests of M. C. B Couplers," "Composite Design of Coupler," "Cast-Iron Wheels," "Triple Valve Tests." Topical discussions on the following subjects: "Circumferential Variation Allowable in Mating Wheels," "Piece Work on Freight Car Repairs," "Should Not the Practice of Hinging the Running Boards at the Ends to Uncover Ice Hatches on Refrigerator Cars be Abandoned?"

June 14. Discussion on the following reports: "Brake-Shoe Tests," "Air-Hose Specifications," "Brake-Beam Specifications," "Axle Limits," "Revision of Rules for Loading Long Materials." Topical discussions on the following subjects: "Should Not the Uncoupling Chains of Passenger Equipment be so Arranged as to Guard Against the Uncoupling of Cars in Transit by Passengers Who May be on the Platforms?" "Advisability of Splicing Center Sills on Cars of 50,000 Lbs. or Less Capacity, in Order to Perpetuate the Cars for Two or Three Years Longer, With the Least Possible Expense."

June 15. Discussion on the following reports: "High-Speed Brakes," "Height of Brake Staff," "Combination Automatic Couplings for Steam Heat, Air Brake and Air Signals," "Location of Ladders," "Tank Cars." Topical discussions on the following subjects: "Methods of Handling Car Scrap and Usable Material," "Desirability of Adjusting Brake-Pressure to Light and Loaded Cars," "Better Fitting Up of Couplers, Even to the Point of Machining, or at Least Drilling the Pivot-Pin Hole Through Coupler Lugs and Knuckle, With Knuckle in Place and Tail of Knuckle Forced Against Lock, and Proper Contour Preserved Under this Condition."

The American Railway Master Mechanics' Association will meet June 18, 19 and 20, according to the following program:

June 18. Discussion on the following reports: "Reports of Committees on Shrinkage Allowance for Tires, and Design of Wheel Centers," "Flexible Stay-Bolts." Topical discussions on the following subjects: "Is not Boiler Pressure of 185 lbs. Better Than 200 lbs. for Locomotives?" "The Necessity of Proportioning Brake-Pressure to Wheel Loads," "Is it Practical to Use the Prosser Tool in Roundhouse Running Repairs?" Paper on "Valve Gears for Locomotives."

June 19. Discussion on the following reports: "Locomotive Tests of Pennsylvania Railroad at St. Louis Exposition," "Water Softening for Locomotive Use," "Locomotive Front Ends," "Mechanical Stokers," "Classification of Locomotive Repairs," "Engine House Running Repair Work on Locomotives." Topical discussions on the following subjects: "Grease vs. Oil in Driving Box Cellars," "The Relation of Roundhouse to Shop and Road," "The Best Roundhouse Organization for Properly Taking Care of Locomotives," "Distortion of Wheel Centers and Tires Out of Round, Due to Heavy Counterbalance on 100-Ton Engines." Paper on "The Modern Locomotive Injector."

June 20. Discussion on the following reports: "Locomotive Lubrication," The Use of Cast-Iron in Cylinders," "Electricity on Steam Railroads." Topical discussions on the following subjects: "To What Extent Should an Engine be Repaired in the Main Shop, and What Class of Repairs Could be Made to Advantage in the Roundhouse?" "Relative Advantage of the Piston-Valve as Compared with the Slide-Valve," "Is the Walschaert Valve-Gear an Improvement Over the Stephenson Link Movement?" Papers on "Best Method of Welding and Repairing Locomotive Frames Without Taking Down or Removing from Engine." "Fire Kindling, Cost of Material, Labor and Time Kindling Fires in Locomotives Using Either Anthracite of Bituminous Coal."

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MAY 29, 1906

821,611. Trolley for Electric Railways; Edward F. Creevy, Chicago, Ill. App. filed July 11, 1900. The conductors are round cables, and the contact devices are provided with wheels or rollers which engage the cable.

821,616. Actuating Mechanism for Car Brakes; Ethan I. Dodds, Pullman, Ill. App. filed Sept. 18, 1905. A brake-shaft having one or more friction discs movable therewith, a rotatable brake handle having one or more friction discs movable therewith, cam devices serving to force the friction discs together and the handle is turned forwardly, and means preventing backward movement of the shaft.

821,617. Car Brake Operating Mechanism; Ethan I. Dodds, Pullman, Ill. App. filed Sept. 18, 1905. The brake-shaft is provided with a friction surface, the brake handle having an integral co-operation friction surface, and means to force the friction surfaces together to secure an operative frictional connection between the handle and shaft as the former is moved.

821,618. Operating Mechanism for Car Brakes; Ethan I. Dodds, Pullman, Ill. App. filed Sept. 18, 1905. Friction surfaces between the handle and shaft are forced into engagement by a compression member carried by the handle and slidable on the shaft and a thrust member pivotally mounted on the shaft to co-operate with the compression member when the handle is turned forwardly.

821,719. Trolley; Minas H. Kashian, Amesbury, Mass. App. filed Sept. 26, 1904. Provides a removable tread and special lubricating boxes in which the axle is journaled.

821,767. Railway Signaling System; Louis H. Thullen, Edgewood Park, Pa. App. filed Jan. 12, 1906. The motors for working the signals are operated by a three-wire polyphase system, the circuits of which are closed by relays operated by short circuiting the track rails. The latter are normally maintained at a direct-current difference of potential.

821,768. Controller Regulator; Joseph V. E. Titus, Keokuk, Ia. App. filed April 11, 1904. A device for retarding the movement of the controller in the "on" direction, including means arranged to render it operative continuously while the operating circuit is on, and means for rendering the device inoperative when the operating circuit is broken to permit an unimpeded movement of the controller.

821,801. Electric Railroad Signaling Device; Henry A. Hoeschen, Omaha, Neb. App. filed May 2, 1905. The car wheels engage a lever adjacent the rails which transmits a signal and operates a current generator when the train is moving in one direction, but not when the train is moving in the opposite direction.

821,835. Railway Signal; William A. D. Short, Lexington, Ky. App. filed Sept. 14, 1905. A signal casing having a transparent face, an opaque background and a semaphore indicator arranged to operate in front of said background. An opening is provided in the background having a lamp therein and a colored transparent disc arranged to operate behind the opening and in front of the lamp.

821,914. Automatic Electric Signaling Device for Railway Switch Systems; David C. Wolfe, Lyons, Kan. App. filed Aug. 9, 1905. An arm depending from the locomotice engages a special trolley adjacent to the track rails and completes a signal circuit to the cab.

821,916. Railway Signaling System; Azel Ames, Jr., Cleveland, Ohio, and John S. Hobson, Edgewood Park, Pa. App. filed Feb. 24, 1906. Details of a block-signal system employing track rails, energized to direct current difference of potential and polarized relays to give the overlap feature.

821,923. Railroad Signal; Walter C. Burton, Fitchburg, Mass.

App. filed Sept. 30, 1905. A box adjacent the track rails has a magazine of torpedoes, and an electromagnetic feeder impels the torpedoes in the path of a plunger depressed by the train whenever desired.

822,028. Railway Signaling System; Jacob B. Struble, New York, N. Y. App. filed March 7, 1905. Employs batteries for the motor signal which are of high electromotive force, and has means for opposing the counter electromotive force to such batteries for the energization of the track rails, whereby the latter are maintained at a low potential difference.

822,055. Tramway Point; William Kneen, London, England. App. filed Dec. 27, 1904. Two levers extending longitudinally of the track, and each depressible on its pivot or fulcrum, and connections for imparting movement from each of said levers to the other and to the switch rail, whereby depression of one lever elevates the other and moves the switch rail in one direction, and vice versa.

822,230. Switch-Throwing Device; Thomas J. Colburn, Argenta, Kan. App. filed Oct. 27, 1905. Details of a depressible switch-throwing lever on the platform of the car.

PERSONAL MENTION

MR. W. J. GOODENOUGH has been appointed purchasing agent of the Chicago & Milwaukee Electric Railroad, with headquarters at Highwood, Ill.

MR. L. J. WOLFE, of Cleveland, president of the Aurora, Elgin & Chicago Railroad, sailed last week from New York for Europe. He will be gone six months.

MR. C. G. GILPIN, superintendent of the Mill Creek Valley line, of Cincinnati, has been appointed assistant general superintendent of the Cincinnati Traction Company.

MR. E. A. TURPIN has resigned as purchasing agent of the Chicago & Milwaukee Electric Railroad to become associated with A. L. Drum & Company, consulting and constructing engineers, of Chicago.

MR. J. M. ENRIGHT, who has been superintendent of the Maumee Valley Railways Company, has been appointed assistant superintendent of the Toledo Railways & Light Company and the Maumee Valley Company.

MR. WALDO G. PAINE, formerly traffic manager of the Coeur d'Alene & Spokane Railway Company, has been appointed general passenger agent of the Inland Empire Railway system, with headquarters in Spokane.

MR. FRED SURTEES has been appointed superintendent of the Cincinnati Interurban Railway, succeeding Mr. H. Gordan Gilpin, who has been appointed assistant general superintendent of the Cincinnati Traction Company.

MR. JOHN F. COLLINS, superintendent of the Toledo Railways & Light Company, has been appointed superintendent of the Maumee Valley Railways Company, in addition to his duties as superintendent of the Toledo Company.

MR. W. P. SAWYER has resigned as general manager of the Auburn & Turner Electric Railway, of Auburn, Me. Mr. Sawyer will resume the position of manager of the Eastern Electric Express Company, with which he formerly was connected.

MR. EDWARD J. DAVIS, for several years passenger agent of the Columbus, Buckeye Lake & Newark Traction Company, with headquarters at Columbus, has resigned to become assistant traffic manager of the Columbus, Delaware & Marion Railway.

MR. JOHN E. BREAK, superintendent of the London Street Railway, of London, Ont., who has been with the company for twelve years, has resigned. He is succeeded by Mr. E. Whittaker, assistant superintendent. Mr. Break resigned to go into business for himself.

MR. W. S. McCALL, for several years general sales agent of the St. Louis Car Company, has been appointed vice-president of the company, which office was made vacant by the resignation of Mr. H. F. Vogel, as previously announced in the STREET RAILWAY JOURNAL.

MR. L. J. SHLESINGER, former manager of the Muncie, Hartford City & Ft. Wayne Company, has been made superintendent of motive power for the entire Indiana Union Traction Company's system, vice Mr. P. J. Mitten, who is made master mechanic of the Union Traction Company's shops in Anderson.

MR. W. S. MILLER has been appointed manager of works of the St. Louis Car Company. Mr. Miller has been associated with the St. Louis Car Company for several years, having been in charge of the mechanical department as superintendent of tools and machinery. Mr. Miller is also manager of the Kobusch Automobile Company.

MR. J. McQUARRIE, for several years assistant manager of the Vancouver department of the British Columbia Electric Railway, has been appointed manager of the New Westminster department, with headquarters in New Westminster. The present manager, Mr. F. R. Glover, has been compelled through illness, to move to the interior of the country, where he will take up farming on an extensive scale.

MR. CABOT STEVENS has resigned as electrical engineer of the Edison Electric Illuminating Company, of Brooklyn, N. Y., to accept a responsible position with Messrs. Stone & Webster, of Boston, Mass. Mr. Stevens' first work in his new field will be at Columbus, Ga., where he will represent Messrs. Stone & Webster in the construction and operation of a large light, power and railway plant.

MR. F. A. BURKHART, a well-known steam road man, of Lima, Ohio, has been appointed district passenger and freight agent for the Schoepf syndicate property centering in that city. He will have charge of freight and passenger business on the Ft. Wayne, Van Wert & Lima Traction Company, the Lima & Toledo Traction Company, the line building from Lima to Bellefontaine and the Columbus & Lake Michigan steam road, and will report to Mr. D. G. Edwards, general traffic manager of the Schoepf syndicate, with headquarters at Cincinnati.

AT THE CELEBRATION of the seventy-fifth anniversary of the Koeniglich Preussische Technische Hochschule, of Hanover, Germany, the honorary degree of doctor of engineering was conferred on Mr. Ernst Koerting, the noted European engineer, and of the well-known firm of Gebr. Koerting, A. G. Koertingsdorf, Hanover, for his scientific researches and discoveries in gas engines, and other important branches of engineering. Dr. Koerting lives in Pegli, Italy. He is interested in a number of large enterprises in the United States, among them the De La Vergne Machine Company, of New York, as well as the Schutte-Koerting Company, of Philadelphia, and is at present sojourning in this country.

MR. C. M. CORY, auditor and treasurer of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., will associate himself with the Newman interests in the South as auditor of the operating department of Ford, Bacon & Davis. Mr. Cory succeeded Mr. C. O. Simpson as auditor of the Birmingham company last August. In this new position he will have full charge of the accounts of the Ford, Bacon & Davis Company, in Birmingham, Memphis, Little Rock, Knoxville, Nashville and Houston. Mr. Cory succeeds Mr. W. B. Brockway, of New York, and in turn will be succeeded by Mr. E. M. White, formerly assistant treasurer and secretary of the Birmingham Railway, Light & Power Company. Mr. E. C. Jolly succeeds Mr. White.

MR. EDGAR K. RAY, one of the most prominent street railway promoters in New England, and head of what is known as the Ray system of street railways in Rhode Island and Southern Massachusetts, died at his home at Elm Farms Wednesday, May 30. Death was caused by a complication of diseases which followed the amputation of Mr. Ray's right leg three years ago. He had been an invalid for nearly two years. Mr. Ray was a native of Franklin, where he was born July 17, 1844. He was educated in the public schools of his native town, at the Woodstock Academy, Woodstock, Vt., and at a commercial college in Boston. Beginning business life in cotton and woolen manufacturing interests, he emerged from them into other lines of activity, and two decades ago was instrumental in connecting Woonsocket and Pascoag with the Woonsocket & Pascoag Steam Railroad, which was later acquired by the New York, New Haven & Hartford Railroad. He was connected in an official capacity with numerous street railway, banking and manufacturing corporations. He was president and general manager of the Woonsocket Street Railway Company, president and general manager of the Columbian Street Railway Company, treasurer and general manager of the Milford, Attleboro & Woonsocket Street Railway Company, and treasurer and general manager of the Providence & Burrillville Street Railway Company. He was president of the Citizens' National Bank, of Woonsocket, president of the Elm Farm Milk Company, treasurer of the Putnam Manufacturing Company, of Putnam, Conn.; president of the Franklin National Bank, a director in the Franklin & Milford Railroad, a director of the Woonsocket Electric Machine & Power Company, president of the Ray Cotton Company, of Woonsocket, and a director in other corporations.

Street Railway Journal

Vol XXVII. NEW YORK, SATURDAY, JUNE 16, 1906. No. 24.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)............................$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)........................$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid.................... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8000 *copies are printed. Total circulation for* 1906 *to date,* 196,000 *copies, an average of* 8166 *copies per week.*

Measuring Power Consumption at Cars

A frequent method of obtaining a rough idea of the power consumption of the rolling stock of a street railway per car-mile is to divide the total switchboard output at the generating plant by the total mileage in the time considered. This is well enough as far as it goes, but the fact is sometimes overlooked that such an estimate includes the losses in the overhead and return systems, and is therefore of very little use as a means of checking the actual performance of the rolling stock. It is pretty hard to take any intelligent action on the basis of so general a figure. If the feeder system remained unchanged from year to year, and if the bonding retained a constant resistance—or possibly conductivity is the better word—then a very approximate comparative idea of the power consumption per car-mile could be obtained by the method mentioned. The actual cost of power per car-mile is worth knowing, but for intelligent appreciation of conditions which may be improved, the recording wattmeter on the individual car certainly supplies the best information, and it is surprising that so few companies take advantage of their opportunities in this direction. The wattmeter tells the story a great deal better than a collection of hybrid voltmeter and ammeter readings on 20 second or 30 second intervals in a round trip, and it affords an excellent means of checking up the performance of individual motormen. While we are not prepared to say that it is as necessary to the motorman as the fare register is to the conductor, it supplies the same function, as it guards the treasury of the company against loss.

Meetings of Shop Foremen

On large interurban and city systems, where the cars are cared for in several different car houses and repair shops, the foreman of one shop or car house often knows nothing of what is going on in other car houses, and frequently is not even acquainted with the other foremen of the system. The consequence is that each foreman must work out for himself every little detail of operation, and the practice in the various shops consequently differs widely. This of itself is not only unwise, but it is noticeable that where the foremen are not intimately acquainted, there is often a tendency for one to "knock" on another's method of doing things or of turning out work. Nothing is more conducive to uniformity of practice and to good feeling among the foremen than to give the men opportunity to get thoroughly acquainted with each other, and this is best accomplished by arranging for periodic meetings of all the foremen. On many roads such meetings are held with very beneficial results. The comparison of practice possible at such meetings and the consequent adoption of the best is worth all the trouble involved. One mistake sometimes made, however, in the arrangement of such meetings is that they are often held in the evening after working hours. If the meeting takes the form of a dinner at the expense of the company, all well and good, but if the men are forced to give up an evening once or twice a month, without the company going to any expense in providing entertainment, the men often feel that the company is trying to get something for nothing, and consequently do not enter into the meetings with a spirit that promises the best results.

If no entertainment is provided, certainly the meetings should be held during work hours. Then each man will feel that he is being called upon to discharge part of the duties of his position, and will enter into the spirit of the occasion with a better heart. Holding the meetings at such times, of course, requires the foreman to leave his shop or car house at hours when his services are required there, and this in turn is not very desirable.

A better method probably is to hold the meetings in the evening, and attempt to give the meeting the appearance of a social gathering, by providing a dinner or cigars, or at least go to some expense to show the men that the fact that they are giving their time to the company is being appreciated. Such meetings are valuable to a road, even if shop subjects are not discussed, simply because of the closer acquaintance the men gain with each other. Such an acquaintance is conducive to a better understanding at all times, and likewise fewer misunderstandings. It isn't hard to keep the conversation on shop subjects, if a little tact is used by a leader, and a discussion of these topics, with the consequent interchange of ideas among the men, is certainly conducive to better practice in general and to reduced maintenance expenses.

Operating a Single-Phase Road

We are glad to present to our readers a summary of the results obtained in the operation of the Bloomington, Pontiac & Joliet line. The data cover nine and a half months working, up to the beginning of the present year. Owing to extensions of line and equipment since then the conditions have not been uniform, but the period reported gives a clear notion of the situation existing during the period when 10½ miles of road were in regular use. The analysis of results is further simplified by the fact that power was purchased, so that the energy required for operation was measured and paid for without introducing any questions of station operation. The average amount per car-mile proved to be 2.1-kw-hours, certainly not a conspicuously large figure considering that the schedule speed for the 32-ton cars was 21 miles per hour. Assuredly there is nothing in this to cause unfavorable comment as to energy required. Of fundamental importance is the report on the maintenance of the electrical equipment of the cars. Here, if anywhere, one would expect to find trouble, due to the system. To be sure, on standard equipments one does not expect the first year to show heavy repairs, but on a new system anything radically wrong should certainly show up within a twelve-month. That not an armature coil or field coil was damaged during this period, and that no material trouble was noted in the operation or life of commutators or brushes, is a most hopeful sign. Trouble with brush holders is noted as occurring, a trouble not uncommon and well known to be easily remediable. The total amount of maintenance reported is $341.83 for nearly 50,000 car miles. It would have been very interesting had this cost been itemized, for obviously it is not all chargeable to brush-holder studs. We fancy, however, that it would prove to be made up of a lot of rather inconsequential items rather than to any general defects inherent in the equipment. All this is cheerful news. There are now in operation a respectable number of single-phase roads, and we have yet to hear any consensus of opinion regarding the development of faults. Whatever the future may bring forth, we are at least glad that the stagnant uniformity of electric traction has at last been stirred up. It is not so much the question between a. c. and d. c. motors that is important as that of high-voltage distribution on which the larger work of traction depends.

Incidentally we are interested to note the plans for the electrification of the Rochester division of the Erie Railroad. It is another case of a. c. work, following in general the lines of the New York, New Haven & Hartford Railroad installation, but with the significant variation that it is intended to operate upon the multiple-unit system, alleged inability to use which has been one of the accusations raised most loudly against a. c. traction. The last word has not been said on the subject of heavy electric traction, but if the advocates of high-voltage d. c. work, which admittedly has some attractive features, do not busy themselves, they will start with a serious handicap not easily to be overcome. On the evidence now available there is no reason to expect the failure of a. c. traction either on a large or small scale, and unless the advocates of high-voltage d. c. equipments get actively about reducing their system to practice, they will have to shoulder the burden of proof in the ensuing competition. Meanwhile we shall hope for further light on the operating expenses of the single-phase roads already in operation. Every bit of evidence of this sort is valuable, and the more in detail the better.

A Lesson in Substantial Construction

We commend to our readers the accounts of the electric system of the Long Island Railroad which are being published in these columns. The description of the power transmission line and third-rail system is completed in this issue, and other features will be described in subsequent editions. The installation as a whole is an admirable example of work done thoroughly and well, while following lines in general familiar. The problem before the engineers was to work within necessary and sometimes troublesome limitations and to produce a thoroughly reliable and efficient system. One of the first serious questions to be raised was that of overhead vs. underground construction. The decision turned upon the relative reliability of the two systems more than upon the relative costs, and we think the final outcome of a really substantial overhead line with cables used only when necessary for particular reasons, was the logical result of sound engineering. It is perfectly true that an ideal cable system is free from certain sources of interruption to which overhead lines are subject, but it is also true that cables have troubles of their own, and that when anything does happen on a conduit line, it is generally far more serious from the standpoint of continuity of service than an accident on an overhead line. The result of the decision was a system of pole construction that ought to prove singularly reliable. Most of the lines are built of substantial steel lattice poles, firmly set in concrete. The cross-arms, however, are of yellow pine, extra heavy and coated with asphaltum paint. This wooden cross-arm construction we regard as rather important as giving considerable additional security in the matter of insulation without any sacrifice of security. Certain steel tower lines in which the use of wood was avoided almost as a matter of conscience, have had so direful experience with their insulators as to indicate that a grave mistake had been made. Great care has also been taken on the Long Island system to protect the lines against lightning, and especially to protect the cable terminals. It is well to observe that the lightning arrester houses installed for this purpose are completely fireproof in construction, and are big enough to accommodate apparatus for a considerable group of circuits.

The portion of the system most interesting to the traction engineer is undoubtedly the third rail with its supports and protection. The rail itself is of special section, weighing 100 lbs. per yard, and is of rather higher conductivity than most conducting rails, being equivalent to 1,650,000 circ. mils of copper. It is also insulated as the early third rails were not, with some proper regard of leakage, being supported every 10 ft. on vitrified clay insulators. The rail is housed in well-supported planking, with additional protection at the stations, and the experience with it has shown its value both in general safety and in useful protection of the rail. Such precautions are absolutely necessary on lines running as does this one through densely populated districts. The bonding of these heavy rails involved some special difficulties, finally overcome by the use of laminated copper with terminals riveted into the base of the rail. The east-bound and west-bound tracks of the system are interconnected only at a few places, and there through circuit breakers, and the system, as a whole, is pretty thoroughly sectionalized so that trouble originating at any point may be localized. In this particular, as elsewhere, the practical working details of the system with respect to continuity of service have been very thoroughly looked after. The ordinary interurban road with moderate traffic may occasionally take chances, but with the enormous service of the Long Island Railroad no precautions against interruption can be neglected. In this particular the construction described is a very valuable lesson.

Inspection of Cars by Motormen

One point in which a wide diversity of practice on electric railways is found is the extent to which motormen are required to know the apparatus of their car. On some roads all that is required of a motorman along this line is that he know how to cut out the motors by means of the switches in the controllers should they become grounded or refuse to work because of any other reason. Other roads, however, require that the motorman be a thorough electrician and be able to discover and repair a loose ground wire of a burned-off lead, to clean commutators, replace brushes and do other small jobs that would otherwise cause the car to be sent into the shop.

Some managements argue that "a little knowledge is a dangerous thing," and prefer that their motormen know very little about the electrical apparatus. It must be admitted that there are some grounds for such a stand. On a city system where cars are run under a very short headway, time does not permit of making any repairs at all on a disabled car. It is usually better simply to let the next car behind push the disabled car to the nearest siding without attempting repairs. In such an instance a motorman with a little knowledge of the apparatus might attempt repairs and cause delays by so doing. It is, moreover, difficult to provide an organization to educate the army of motormen in a city system so that they are competent to make repairs. Again, a motorman with but a few ideas about the equipment is likely in attempting to make repairs to damage the apparatus to a considerable extent and thus cause additional work to the shop force.

On long interurban runs, we venture to say that as a general proposition the more a motorman knows of the apparatus of his car, the fewer times his car will have to be taken off the schedule, and the shorter the delays when something goes wrong. The writer remembers an occasion where only a slight knowledge would have saved a needless trip. The report that a certain car was lying disabled at a siding about 35 miles distant was received at the shops. The passengers of the disabled car had been delayed an hour, and then put aboard the next car going in their direction. On reaching the disabled car the shop man simply cut out motor number 1, which had become grounded, and the car was run in with the remaining motor and could have been run several trips with it. A very little knowledge of the machinery in this instance would have saved considerable expense, and would have prevented several passengers becoming impressed with the idea that electric lines were less reliable in operation than steam railroads.

Some managements go even further than require a motorman to know the apparatus of his car. They insist on his taking care of his car to the same extent that engineers on steam lines are required to take care of their locomotives. This requires an inspection of bearings at the ends of the run, oiling trolley wheels and polishing the commutators at certain intervals, cleaning controllers, replacing worn-out brushes, and in general doing everything to keep the car in running order, except the heavy repair work that can only be done in the shops. This plan has many points in its favor. The motorman knowing he is responsible for the condition of the car is much more apt to do the inspecting in a more thorough manner than it is usually done in the shops. Moreover, the fact that there is only one car to inspect is likely to result in better inspection. When the shop man is compelled to go over several cars in succession, the work often gets monotonous, and he is then apt to do it in a careless manner.

The fact that the car is inspected several times a day may result in defects being found and remedied before serious damage is done. Inspection of the motor, for instance, might show a brush holder or a connection that was not tight, which, if not tightened before the end of the day, would probably work loose and result in a grounded machine. Again, if bearings are inspected at the end of every run of three or four hours, there is little likelihood of them becoming hot and causing delays usually resulting from such occurrences.

That the motorman may inspect the car in the manner suggested, it is necessary to allow a layover at one end of the run, preferably about every 4 hours. A half-hour interval is sufficient to make a very good general inspection of the car. Sometimes it happens that the time of arrival at a terminal necessitates such a layover, and again it might be necessary to add one car to the schedule in order to permit of a car being laid over a sufficient time to make inspections. It may happen, too, that a layover of less than an hour cannot be made. In such an instance, it might be well to add to the duties of the motorman and require him to replace trolley wheels, adjust brakes, repair controllers and do all the ordinary repair work on the car with the exception of changing armatures and bearings and doing such work as requires special apparatus.

THE POWER TRANSMISSION LINE AND THIRD-RAIL SYSTEM OF THE LONG ISLAND RAILROAD—II

BY W. N. SMITH

CABLES

The transmission cables are of 250,000 circ. mil stranded copper, and are fastened to the insulators with ties of No. 6

FIG. 18.—STRINGING CABLE ON JAMAICA BAY TRESTLE

copper wire, 3 ft. long. Splices were made by cutting back the core of the cable and wrapping the outer layers of strands around the abutting cables, after the manner of the ordinary Western Union splice. All the joints were soldered. Where jumpers were used to lead into sub-stations or arrester houses, the ordinary half-connection joint was made and carefully soldered. The cables were strung for the most part by means of teams of horses and running lines of 1000 ft. or more in length, the cable reels being mounted on stationary stands.

On the trestle, however, this method could not be so readily followed, and the cables were strung in the following manner: The reel of wire was carried on a flat car upon which was carried a boom, capable of being swung to one side to the position which would be occupied by the wires. At the end of this boom was a snatch block, through which the wire passed and by which it was guided on the cross-arm. The car was moved along slowly by a locomotive and wire paid out, and the boom being raised at each cross-arm so that the wire would drop down onto the arm. This method proved very economical, and is illustrated in Fig. 18. The total amount of overhead transmission cable erected, is 62.03 circuit miles, or 186.09 miles of cable.

No low-tension cables were required for the initial installation, except to connect up isolated sections of third rail where it became necessary to break the third rail at switches and crossings. There are, therefore, no low-tension cables on the poles at present, but when installed they will be carried upon heavy porcelain top-groove insulators and pins of the same general type as described above.

Wherever the power transmission circuits cross the highways or railroad tracks, special precautions are taken to insure against the possibility of a cable falling off a cross-arm and hanging down in position to endanger passing traffic. At such points the spans are shortened as much as possible. In some cases an extra straight-line pole is used in the line, and at other points a strain pole is placed on each side. Wherever the wires cross other electric circuits the high-tension wires are carried above the others, as their large size and strong mechanical supports make them less liable to fall upon others than would be the case if their positions were reversed. At all crossings, and over station platforms, and on the inside of curves, vertical angle irons, called "retainers," are bolted to the ends of the cross-arms, so that, in case of the insular breaking or cross-arm burning off, the wire cannot fall any distance away from its normal position. The detailed design of this device is shown in Fig. 19, and Fig. 20 shows the retainers in position on a pole carrying the trunk line over the tracks near Glendale Junction.

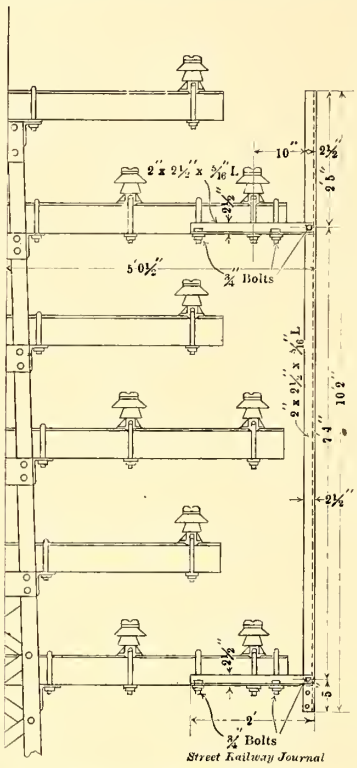


FIG. 19.—CABLE RETAINER FOR CURVE CONSTRUCTION

TELEPHONE LINE

After the line was finished, the railroad company installed a telephone line, which is carried on the same poles that support the power circuits, and con-

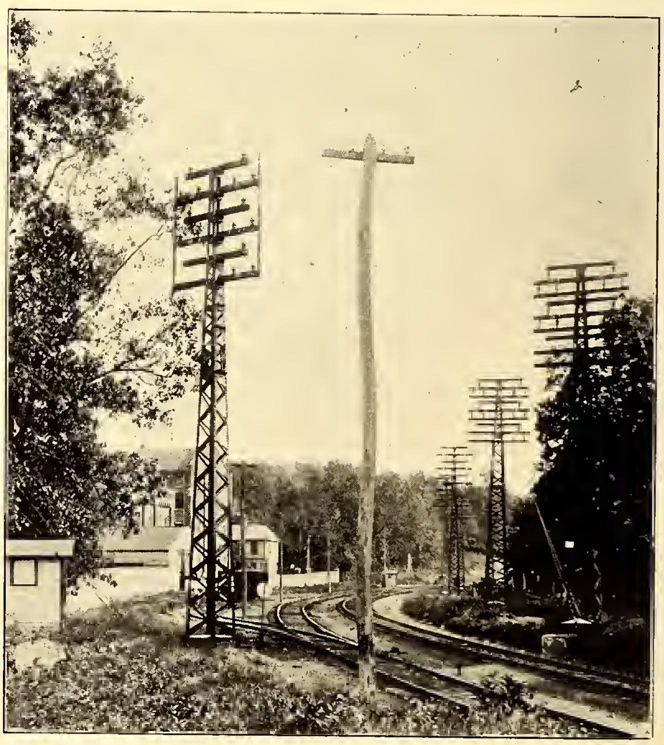


FIG. 20.—CABLE RETAINERS IN POSITION, TRUNK-LINE POLES OVER RAILROAD TRACKS

nects the power house with all the sub-stations. It also has instruments connected to it and mounted in boxes at intervals of about 2000 ft., which are used by the men patrolling the line.

TERMINAL CABLE RACKS

At the Woodhaven and Rockaway Junction sub-stations, special terminal poles or racks are provided to distribute the overhead circuits along the face of the building parallel to the high-tension switching galleries in such a manner that the disposition of the cables after entering the building will be most convenient. The conditions to be met at such places were somewhat conflicting. The disposition of the circuits on the line poles is such as to enable those on one side of the pole to be shut down for repairs, while those on the other side are kept in operation, and it was desirable in leading the cables into the sub-station buildings to adhere as closely as possible to a disposition that would be consistent with this scheme.

The sub-station galleries were laid out for the most convenient subdivision of the high-tension bus into section for distributing power to the branch-feeder circuits, as above noted, so that it was necessary to lead certain circuits into particular openings in the side of the building without special regard as to whether that particular disposition was the most convenient for keeping the circuits clear and free from crosses outside of the building. An idea of the manner in which these conditions were met is best given by a photographic view, Fig. 21, being the terminal pole at Rockaway Junction.

The wires of the circuits, as they come from the trunk lines, are brought into the same plane, the upper circuits going to the top cross-arm, which is located at the rear or farthest end of the terminal pole. The next lower circuits are anchored directly in front of these, and so on, gradually working toward the front of the pole, and downwards from the top of the pole, as one circuit after another is added, thus obviating interference with working circuits when new ones are being erected. By an arrangement of jumpers, the outside circuits are led around without interfering with other circuits, and brought opposite their proper pigeon holes in the side of the sub-station structure. At Woodhaven Junction the trunk line reaches the station from the north, and the branch line running to Hammel leaves on the southern end of the same pole. The strains, therefore, balance each other to some extent.

At Rockaway Junction, the location of the sub-station is such that the entering circuits coming from the west had to be taken around to the east side of the building and distributed from the rack there situated. The entering circuits are kept on the west side of the cable rack next the building, while the outgoing circuits, which continue eastward, are kept on the east or outer side of the rack, thus preventing crosses and making it possible for either set of circuits to be repaired independently of the other set.

The terminal racks at both stations, consist, as shown in the photographic view, of steel truss bridges about 11 ft. wide, and practically as long as the side of the sub-station building, supported on lattice steel columns which are carried on concrete foundations. The wires are supported on standard insulators, which are carried on the regular type of cross-arms, sawed long enough to project over both sides of the truss, to which they are fastened by U-bolts, as they are on the standard poles. Where the cables are dead ended they are fastened to the strain type of insulator which is mounted in the manner before described. The adjacent poles on the trunk line are of the strain type, so as to relieve the terminal poles of longitudinal strains. Special cross-arms are provided where necessary to carry the jumpers that connect the dead-ended cables with the apparatus inside of the building, and they are led around in such a manner as to afford not less than 2 ft. of clear space between all wires and to minimize the risk to linemen when repairing circuits. Supports for plank runways are provided in the trusses to facilitate access for repairs.

At the larger lightning-arrester houses, the terminal-cable racks are integral with the building framework and project from the sides of the building, as shown in Fig. 5. The general arrangement of cross-arms and insulators is the same as above described; all circuits are carried with the cables in a horizontal plane, and the uppermost circuits run to the rear end of the rack, the jumpers being used to couple up to the interior apparatus.

In Fig. 8, of the lightning-arrester houses, at Broad Channel drawbridge, on the Jamaica Bay trestle, is shown the method of anchoring the longitudinal strain of the high-tension line. This anchorage consists of a tower-like structure of four creosoted poles, latticed and braced together with heavy timbers, the cables being dead ended on standard strain insulators in a horizontal plane, and jumpers being dropped down through the inside of the tower and across the lightning-arrester houses, through which they are connected to the sub-

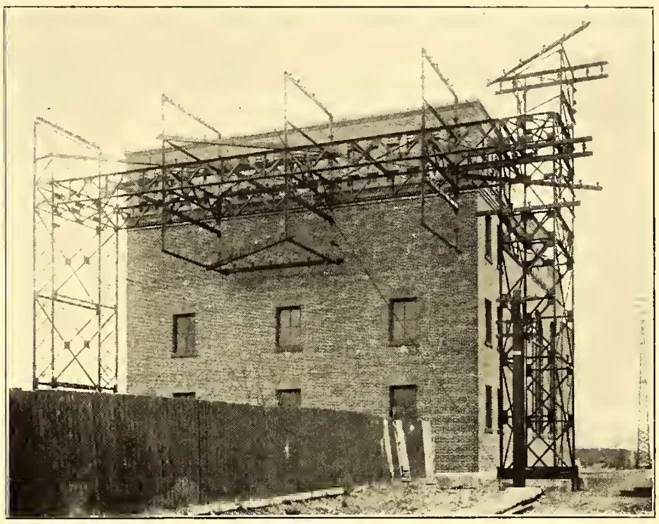


FIG. 21.—TERMINAL CABLE RACK AT ROCKAWAY JUNCTION

marine cables. This construction is strong, self-contained, and extremely simple, and enables side guying and end guying to be dispensed with.

TYPE OF THIRD-RAIL CONSTRUCTION

In the selection of the general type of third-rail construction adopted for the Long Island Railroad, the general requirements were that both the rail and the contact device must be suitable for collecting heavy currents at any speed. The rail must be so placed as to encroach as little as possible beyond the fixed clearances of the permanent way, and it must clear all forms of equipment in general use on the road. The design of mounting must be mechanically stable, and besides including good insulation, must provide a reasonable degree of protection to employees against accidental contact, and be proof against interruption of service by weather conditions.

It was also desired to settle upon a standard form and location of rail that would permit a free interchange of ordinary passenger and freight equipment between the Long Island Railroad and other roads in the vicinity.

A study of the equipment clearances pointed to the necessity of locating the third rail with its gage line 26 ins. from the inside of the gage line of the running rail, and its top at a height of 3½ ins. above the top of the track rail. After considering a great variety of designs, both of rails and contact shoes, it was decided to adopt the top contact type. In order best to combine the qualities affording protection to employees and immunity to weather troubles, it was decided to provide a horizontal type of guard extending directly over the rail, requiring the use of the slipper-type of contact shoe. With this type of contact rail, a tee section was naturally adopted on account of its stability. The location of the contact rail, with reference to the track, was also governed by the fact that it could not be placed much farther away from the track rail without interfering with bridge gussets and other fixed objects, while, if placed higher, the guard would be interfered with by 50-ton hopper-bottom steel coal cars when heavily loaded.

RAIL

The rail used for most of the construction is a modified tee shape, weighing 100 lbs. to the yard, in 33-ft. lengths. The section is 4 ins. high, with a head 3 ins. wide, bottom flange 6 ins. wide, and web 1½ ins. thick. This particular shape was selected because of the limited vertical distance between contact and running rail required that the upper rail be of as low section as possible to provide maximum insulation distance to tie. In some cases, running rails were only 60-lbs. section, reducing the available distance from the top of the

SPLICE BARS

Splice bars are of rolled steel, 18 ins. long, with four holes carrying bolts ¾ ins. x ¾ ins. They were rolled especially for the third-rail section adopted, and, as they are not subjected to unusual strains, they were made of the minimum weight suitable for a third-rail fastening. The unusual breadth of the base of the rail allows ample space between the splice-bar and the edge of the flange, to accommodate the head of the compressed type of rail bond. On the 70-lb. and 60-lb. rails such was not the case, and the splice-bars were notched out to accommodate the bonds.

INSULATORS

The contact rail is supported every 10 ft. on vitrified-clay insulators, set on extra long ties. The insulator consists of a cylindrical piece of vitrified clay, with a beveled flange projecting at the base and 2-in. hole through the center to aid in manufacture. A malleable-iron ring, having two projecting lugs and holes in each lug for lag screws, fits over the flange

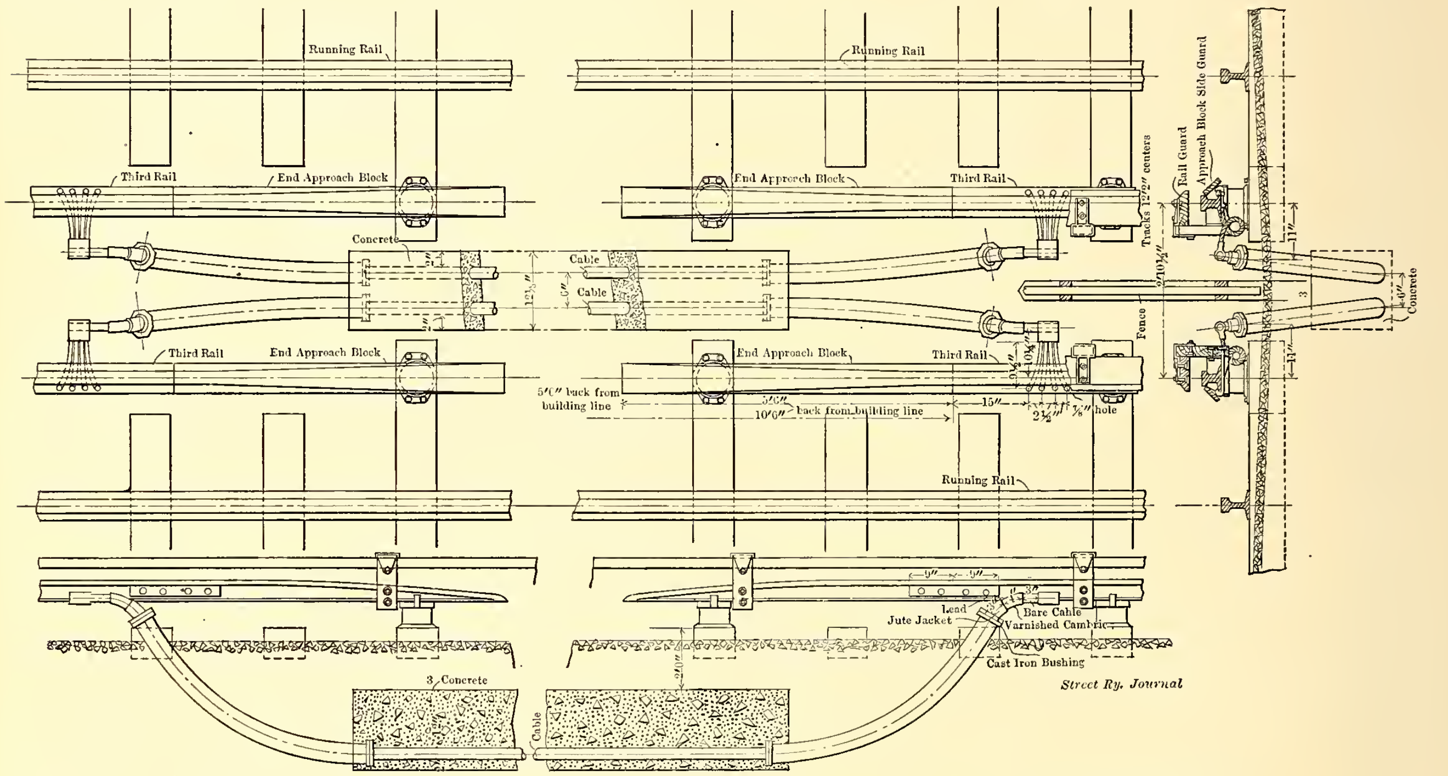


FIG. 22.—STANDARD ARRANGEMENT OF THIRD-RAIL CONNECTING CABLES AT PUBLIC CROSSINGS

tie to the top of the third rail, to only 7½ ins. The section, therefore, is that of heavy rail squeezed out horizontally, with a broad base, adapted to prevent overturning. The section, together with the guard and the equipment clearances, is shown in Fig. 26.

The rail is of extra soft steel, as it will be seen by the following analysis:

Carbon	.08
Silicon	.074
Phosphorus	.074
Sulphur	.029
Manganese	.022

The resistance of the sample in the above analysis is by measurement of a 100-lb. section, equivalent to 1,650,000 circ. mils of copper.

All of the main-line tracks, including the elevated line, are provided with the 100-lb. third rail, excepting about 7½ miles, which are fitted with 70-lb. standard relaying T-rails. For side-tracking and unimportant spur work, 60-lb. relaying rails were used.

at the base of the insulator, two lag screws being used to fasten it to the tie. Resting on top of the insulator is a malleable-iron cap, which projects down over it for a distance of 1⅛ in., and has two ears 1¼ ins. long projecting upwards. The rail rests on top of the cap between the ears. With this type of insulator, no vertical strain comes upon it, due to the sagging of the tie when a train passes, as the rail is in no way directly attached to it. The design also facilitates the removal of broken insulators, as the whole device may be removed by taking out two lag screws in the base. As there are four different sizes of running rails and three sizes of third rails, the dimensions of the insulators are made in three sizes to suit the conditions. Two of them are 6 ins. in diameter, and 3⅞ ins. and 5 3-16 ins. high, respectively, the other being 4½ ins. in diameter and 3⅝ ins. high, but of the same general form. In this way, the proper height of third rail above the running rail is maintained.

APPROACH BLOCKS

The end approach blocks and inclines for lifting the third-rail shoes, are of cast iron. Two lengths are used. One is

5½ ft. long, and is employed on the main-line tracks, where the shoes must be raised and lowered at high speed. The other, which is 2½ ft. in length, is used only on spur track and sidings. The approach blocks are attached to the end of the rails by the regular splice plates, and are supported on standard third-rail insulators at their outer ends. The general design and arrangement of the approach blocks in position is shown in Fig. 22. The side approach blocks used at switches are of wood, and were chosen in preference to metal blocks because the blocks must project several inches sidewise from the third rail beyond the guard, exposing trackmen to danger if made of metal. The wooden block consists of a piece of maple, 1¼ ins. thick and 4 ins. wide, set at an angle of about 45 degs. on the side of the rail, as shown in Fig. 23. This strip of wood is about 14 ft. long, and is nailed to maple blocks which are set against the web of the rail, spaced at intervals of 2 ft. A 3-16-in. x 1-in. steel strap, which fits into the block, holds it securely in place, being fastened underneath the foot of the rail, and clinched over it, thereby avoiding drilled holes and unnecessary expense. Although subjected to severe service, the durability of these wooden side approach blocks has been satisfactorily demonstrated.

BONDS

The third-rail joints are bonded by laminated-copper foot bonds with plug terminals. They are of varying sizes, according to the weight of the rail to which they are applied, 300,000, 350,000 and 400,000 circ. mils sizes being employed. The holes for the plug terminals were punched in the base of the rail by hydraulic punches and the terminals riveted into the holes by hydraulic compressors. The terminals of the two larger sizes are ⅞ in. in diameter, and for the 300,000-circ. mil bonds they are 13-16 in. The terminals of the 300,000-circ. mil bonds and the 350,000-circ. mil bonds are 5 ins. apart when installed. The 400,000-circ. mil bonds are 10 ins. long between centers of terminals when installed. Fig. 24 is a drawing of the standard method of bonding a 100-lb. third-rail joint. All the work of punching and bonding was done after the rails were in place.

CABLE-JUMPER CONSTRUCTION

As at present installed, the third-rail system is not fed in separate sections from the sub-stations, but is treated as a continuous conductor between sub-stations, except where the

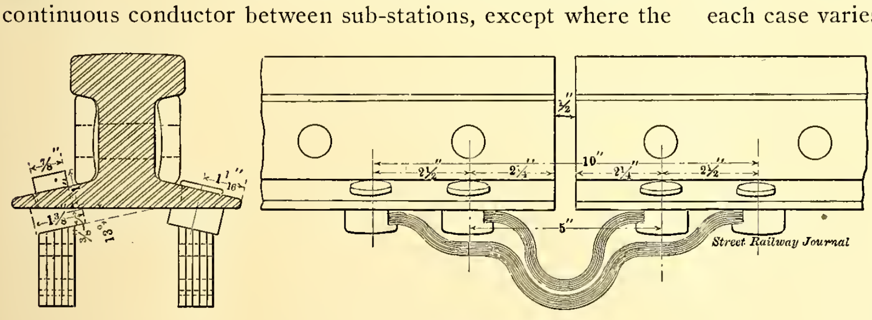


FIG. 24.—THIRD-RAIL BONDS

number of switches and cross-covers incidental to a station terminal or junction necessitates dividing it into sections that can be easily isolated from the remainder of the third rail should emergency require. There are no low-tension cables running along the tracks to reinforce the third rail at points distant from the sub-stations. To maintain the electrical continuity of the third rail where interrupted at switches and highway crossings, underground jumper cables are provided.

These cables are in three sizes, 500,000 circ. mils, 1,000,000 circ. mils, and 2,000,000 circ. mils. The cable is insulated with varnished cambric, 4-32 in. thick, which is covered with a lead sheath ⅛ in. thick for the 1,000,000 circ. mil and 2,000,000 circ. mil, and 3-32 in. for the 500,000-circ. mil cable. Outside of the lead there is a layer of prepared paper, and two layers of jute, wound on spirally in opposite directions and thoroughly impregnated with asphalt. This unusual precaution is taken to protect the lead from acids and alkalies in the soil, and from possible electrolytic action of return currents in the ground. The cable was subjected to a 3500-volt factory test. It is buried not less than 2 ft. below the surface

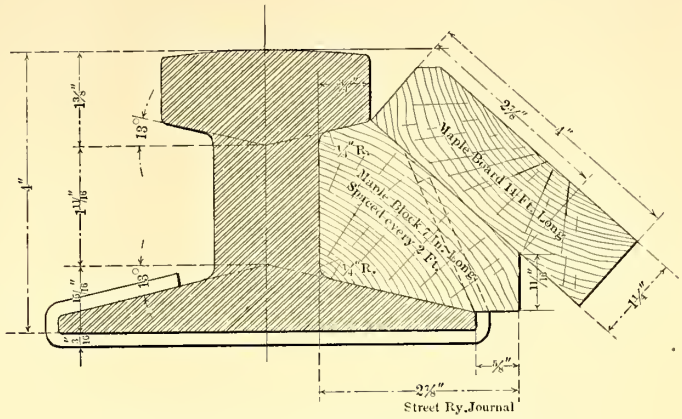


FIG. 23.—STANDARD SIDE APPROACH BLOCK

of the ground, and, except where run under public highway crossings, a 2-in. plank laid on top of it constitutes its only protection. At highway crossings, however, a concrete matrix about a foot thick is substituted for the plank, in order to insure protection against injury in case the streets are opened by gas or water pipe workmen. Fig. 22 shows the standard arrangement of running and connecting up the jumper cables at public crossings. The ends of the cables come to the surface through curved 3½-in. iron pipes, fitted with regular conduit bushings, and extending about 6 ins. above the surface of the ground. The ends of the conductors are connected to the third rail by having sweated upon them special brass terminal lugs, each lug having sockets for four 400,000-circ. mil flexible cables. Short lengths of cable bonds, each with a copper plug terminal drop forged on one end, are soldered into the socket, and after pigtailing these terminals to provide flexibility, the plug terminals are compressed into holes in the base of the rail. The number of bonds used in each case varies with the size of the cable, being four for the 2,000,000-circ. mil cable, two for the 1,000,000-circ. mil cable, and one for the 500,000-circ. mil cable, in which case the bond is soldered by means of an ordinary sleeve connection to the cable.

Being very close to the ground level, and always exposed to the weather, these cable terminals are insulated with especial care. The lead and jute coverings are cut back for a distance of 7 ins. from the point where the cable enters the lug, and the insulation is cut back so as to leave 3 ins. of bare cable exposed. This space, as well as the 4 ins. of exposed insulation, is then wound with varnished cambric tape, applied with Sterling varnish between the layers. It is then coated with insulating paint and wound all over with adhesive tape, including the whole surface of the lug, thus leaving only the bond connections bare, and it then receives a final coat of insulating paint. The ends of the iron pipe are plugged with oakum around the cable, to prevent dirt from entering and to prevent movement of the cable in the pipe.

Wherever these third-rail jumpers are used to preserve the continuity of the regular third-rail system, they are made of sufficient size to carry as much current as the rail. For the 100-lb. special rail, which is equivalent to 1,650,000-circ. mil copper, 2,000,000-circ. mil cable is used, the additional area being allowed to compensate for the decreased radiating capacity of the cables. For the 60-lb. and 70-lb. third rails, 1,000,000-circ. mil cables were used under same conditions. For the sidings short lengths of third rail, which only have to supply heavy currents momentarily, the size of the cable generally used is 500,000 circ. mil.

For a portion of the distance on Atlantic Avenue, the manholes of the conduit system are directly beneath the third rail, the right of way being extremely narrow. To allow access to these manholes, the third rail is interrupted on either side of the manhole, and a removable wooden dummy rail inserted, consisting of a strip of oak 10 ft. long and 3 ins. x 4 ins. in cross section, as shown in Fig. 25. The third rail is made continuous by means of a cable jumper, similar to that described above.

FIG. 25.—10-FT. BREAK IN THIRD RAIL OVER MANHOLE COVERS ON ATLANTIC AVENUE

THIRD-RAIL GUARD

The Stillwell-Slater type of guard was adopted for the third rail. It consists of yellow-pine plank, 1⅞ ins. thick, 7 ins. wide, placed above the rail, with 2½-in. clear space between the top of the rail and under side of the plank. The edge of the plank nearest the track extends ⅞ in. beyond the line of the third-rail head, and is beveled back to give the necessary clearance for running equipment. Each plank has a saw cut, ⅜ in. deep, in the middle of the underside to prevent warping. The planks vary in length from 14 ft. to 16 ft. The guard is supported directly from the third rail, there being four supports to each plank. The planks are butted together without splicing, so as not to interfere with the free expansion and contraction of the rail and to facilitate repairs. Fig. 26 shows the guard in complete detail. The supports consist of upright posts of oak and chestnut, 1⅞ ins. x 3⅞ ins. x 11 ins. long, carrying on top a malleable-iron cap, which fits down over the top of the post and is held to it by a carriage bolt. This cap has a projecting bracket against the under side of which the guard plank is fastened by two carriage bolts, with heads countersunk on the underside of the plank. One of the bolt holes in the iron cap is slotted transversely, so that the plank may not split by shrinkage. The wooden post is carried on a malleable-iron casting, which fits closely against the web and around the bottom flange of the third rail, so that a single hook bolt, engaging with the bottom flange of the rail, firmly clamps the guard post.

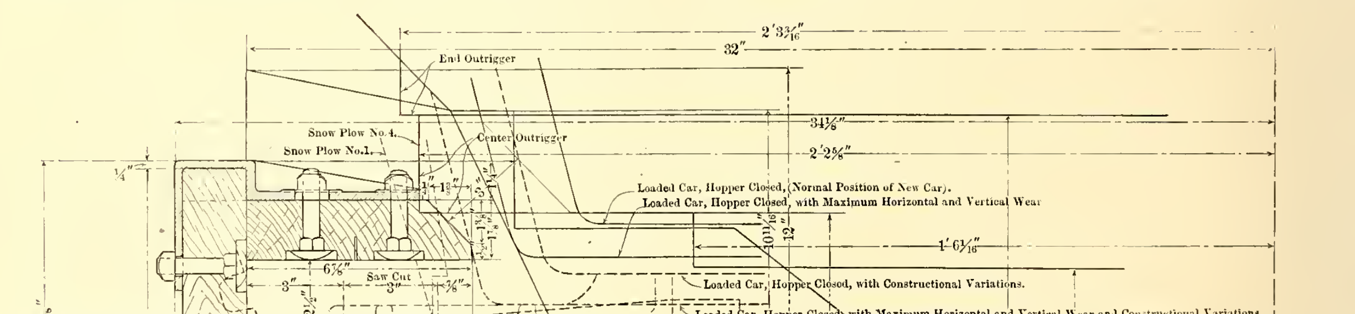


FIG. 26.—THIRD-RAIL GUARD AND CAR-CLEARANCE DIAGRAM

Fig. 27 is an excellent view of the standard third rail and guard construction as it appears on top of the elevated structure on Atlantic Avenue.

Additional protection is provided for the third rail at stations. This additional protection consists of a yellow-pine strip, 4 ins. wide and 1¼ ins. thick, set on the outer side of the rail at an angle of about 45 degs. with the rail, and almost completely covering tne side of it. This strip is nailed to wooden blocks, fastened to the web of the rail in a manner similar to that used on the side approach blocks. Where necessary, this side guard is placed on both sides of the third rail, thus reducing the chance of workmen coming in contact with them. At station platforms protection is also provided against car shoes, whether there is a third rail close to the edge of the platform or not. This protection consists of a 2-ins. x 7-ft. yellow-pine plank supported by malleable-iron castings, the top being nearly on a level with the platform. These castings rest on the ties, and are spaced 6 ft. apart. This guard is so located that there is plenty of room underneath for the third-rail shoes. The arrangement at a platform where there is no third rail is shown in Fig. 28.

All the timber guards are painted with two coats of a good quality of weatherproof paint.

Experience, up to the present time, leads to the belief that the guard will prevent most of the troubles that commonly arise from sleet.

Fig. 29 is a photographic view of this same type of guard placed adjacent to grade crossings, together with the fences, cattle guards and gates usually employed by the railroad.

DRAWBRIDGE CONNECTIONS

At the drawbridges in the Jamaica Bay trestle, the third rail

FIG. 27.—STANDARD THIRD-RAIL CONSTRUCTION ON ATLANTIC AVENUE ELEVATED STRUCTURE

is interrupted, and to maintain this continuity three submarine cables are installed, one for each third rail, and one as a spare. These cables consist of 2,000,000-circ. mil copper core, insulated with 4-32 in. of 30 per cent Para rubber, incased in a lead sheath, ⅛ in. thick, and armored with one layer of No. 4 B. & S. galvanized steel wires, laid on spirally with a layer of jute covering. These cables were laid in the same manner as the high-tension power transmission cables, which have already been described. The short length of third rail on the drawbridge is connected by brass contact shoes, which make connections at each end of the draw when it is closed.

SYSTEM OF THIRD-RAIL CONNECTIONS

The cables connecting the third rail with the sub-stations

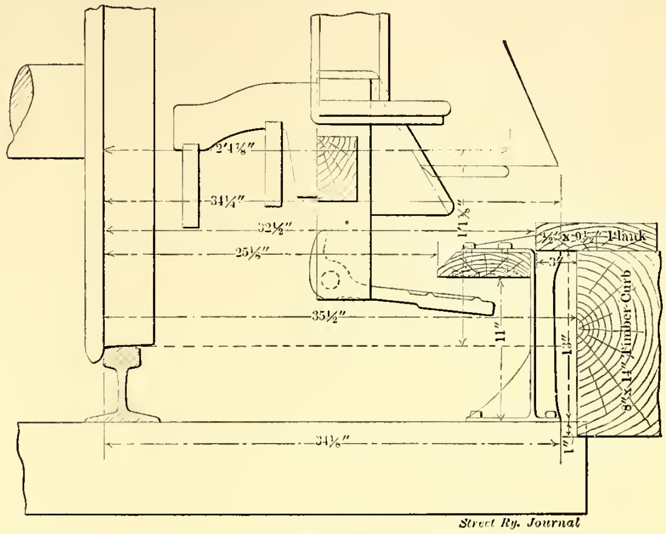


FIG. 28.—PROTECTION AT STATIONS FOR THIRD RAIL AND SHOES

are all of 2,000,000 circ. mils, and connections are made directly in front of the sub-stations. In some cases these short feeders are located in conduit, and in other cases laid directly in the ground in the manner above described for the crossing jumpers. Such cables when laid in ducts are insulated with 5-32 in. of paper, covered with a layer of sheathing, ⅛ in thick.

Near each sub-station, the third rail is interrupted by a 40-ft. gap. Should any section break down, it is then impossible for a single car to bridge the gap between the live rail and the grounded one, thus avoiding the possibility of injury to the car wiring and equipment. The east-bound and west-bound tracks are, in most cases, supplied by a separate set of feeders, and are not cross connected, except through the station bus-bars. Current can, therefore, be cut off from the section of either track lying between two sub-stations simply by opening the proper feeder switches in the stations at each end of the section.

In order that part of a section between sub-stations may be disconnected in case of emergency, instead of requiring the whole section to be thrown out of service, 1600-amp. disconnecting switches are installed at suitable intervals between sub-stations, and are cut into the third-rail circuit so that, by opening any two of them, the section between them can be cut out, though normally these switches are kept closed. They are generally located near the cross-overs, to enable trains to switch around the opened section on the other track. The switches are of the quick-break knife-blade type, and are located in wooden boxes fastened to the third-rail guard, as shown in Figs. 30 and 31.

In some instances fuses alone are installed. A view of the

4-ft. break in the third rail at a switch or fuse is given in Fig. 32.

Practically all the line is double tracked, excepting two stretches, which are four tracked, one on Atlantic Avenue, between Chestnut Street and Woodhaven Junction, and the other running south from Woodhaven Junction as far as the north end of the trestle. The third rails on the former of these two sections are supplied by separate feeders from Woodhaven Junction, and it is not cross-connected with the main-line tracks. South of Woodhaven, however, the third rails of the four tracks are cross-connected. Each of the four third rails has a separate feeder leading into Woodhaven Junction sub-station, but at the other end, near the trestle, the two east-bound tracks are connected together through a knife switch and a 2000-amp. circuit breaker, located in the switch house at one side of the track. The two west-bound tracks are similarly connected, so that in ordinary conditions they work in multiple. In case of a short-circuit, however, the circuit breaker will open, separating the tracks at that end, and this separation can be completed by throwing the switches in the sub-station.

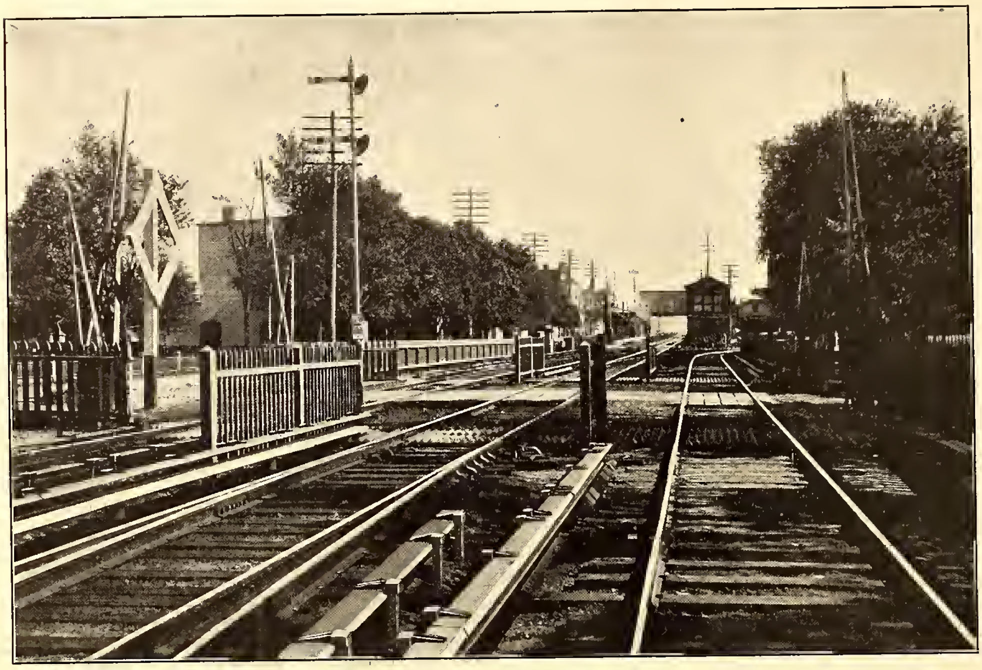


FIG. 29.—THIRD-RAIL CONSTRUCTION, FENCES, GATES AND CATTLE-GUARDS AT GRADE CROSSINGS, ATLANTIC DIVISION

The only place where the east-bound and west-bound tracks are connected together occurs at the entrance to the yards, at the Rockaway Park terminal, at Jamaica Station, and at the north end of Jamaica Bay trestle. At these points, the two tracks are tied together by a 2000-amp. switch, and circuit breaker, mounted under shelter conveniently located, by means of which they can be separated when necessary. This point being at the extreme end of a short section, no embarrassment can result to other sections of the line from this cross connection of the two tracks.

There are several very important places on the line where the arrangement of interlocking switches is such as to require special provision for cutting the third rail into sections. Woodhaven, Ozone Park, Jamaica and Hammel are points where the arrangement of intersecting and side tracks is such as to require this special treatment. Figs. 33 and 34 show the arrangement of the third-rail circuits at a rather complicated

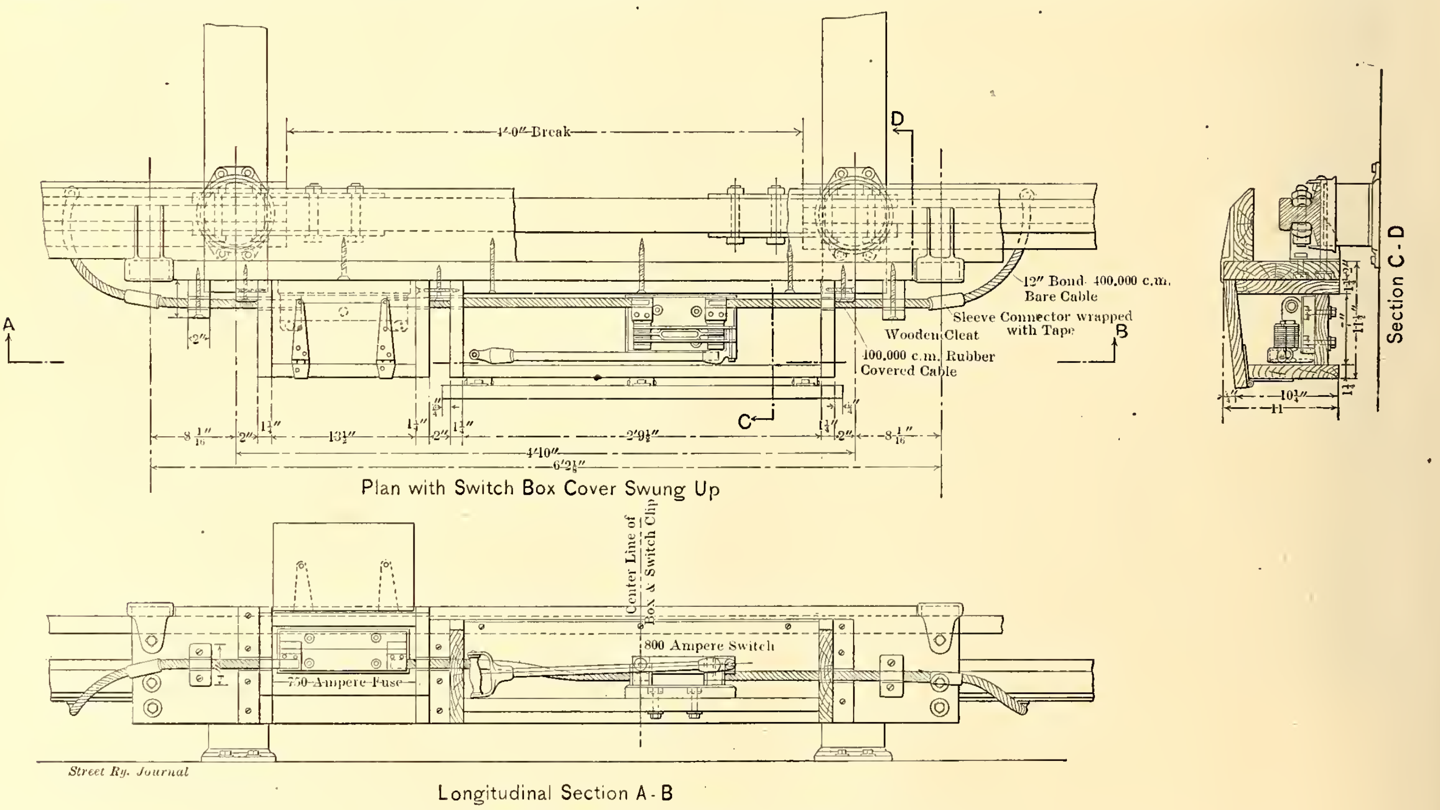


FIG. 30.—THIRD RAIL DISCONNECTING SWITCH AND FUSE

interlocking point, just east of Jamaica station. It will be noted that the main third-rail circuits are carried around this section by separated cables, which run through a small switch house standing beside the tracks, in which are located the switch and fuse board. As will be seen, by referring to the diagram, the main cables, which are of 2,000,000 circ. mils, are continuous, and feed the various disconnected sections of third rail lying within this section through two disconnecting switches of 1600-amps. capacity, from one of which branch out four separate cable connections, and from the other one eleven separate cable connections, to the smaller subdivisions of third rail lying within the section. These short sections of third rail are each fed by a 500,000-circ. mil

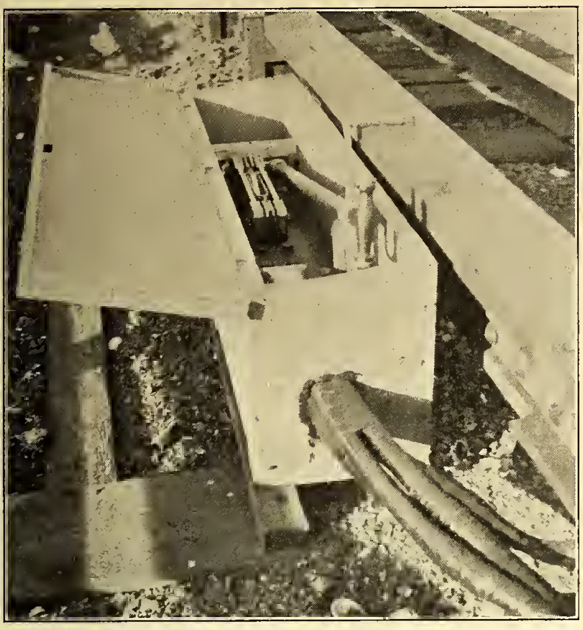


FIG. 31.—SWITCH IN BOX BEHIND THIRD RAIL

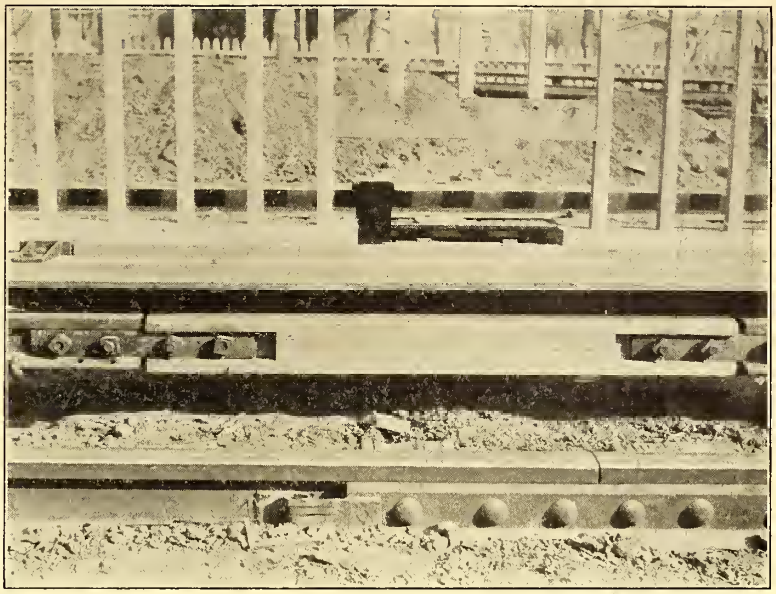


FIG. 32.—DUMMY RAIL IN 4-FT. BREAK AT FUSES AND SWITCHES IN THIRD RAIL

FIG. 34.—VIEW OF MAIN LINE AND SIDINGS, EQUIPPED WITH THIRD RAIL, EAST OF JAMAICA STATION

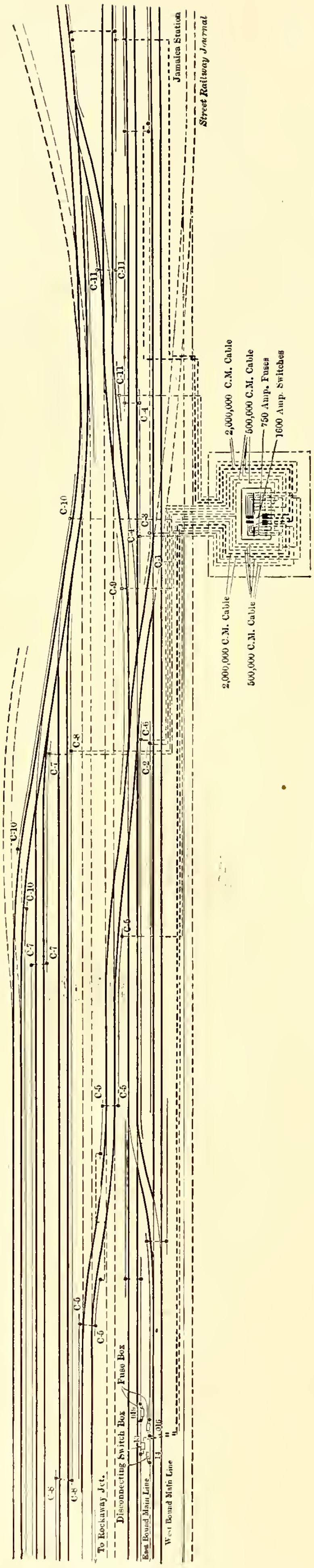


FIG. 33.—DIAGRAM OF THIRD-RAIL CIRCUITS EAST OF JAMAICA STATION

cable of the type described above. Fuses, through which they are attached to the main switch terminals, are of 750 amps. capacity, and consist of copper ribbon of the open-air type with a 10-in. break. Fig. 35 is a view of the interior of such a switch house, showing its equipment.

At points distant from the above-mentioned interlocking stations, the third rails on such tracks are fed through copper fuses and quick - break - knife switches, placed so that a fuse may be safely replaced. These are similar in type to the fuses in the interlocking stations, and are installed in wooden boxes fastened to the third-rail guard.

RETURN CIRCUIT

Both running rails of each track are used for the return circuit. On a considerable portion of the line an automatic block signal system is used, requiring the use of both running rails for its operation, so that a special method had to be used in order to allow the tracks to be used jointly as a power return circuit and for signal purposes. The signal system was developed by the Union Switch & Signal Company, and employs alternating current for the operation of the signals. With the aid of a special arrangement of bonding, to be described hereafter, the track is used for carrying both direct current and alternating current without the former affecting the latter.

About 20 miles of track on Atlantic Avenue are laid with 100-lb. T-rails. The remaining portion of the electrified system is laid with various weights of rail, running from 60 lbs. per yard to 80 lbs. per yard.

The problem of bonding the rail joints was solved by different methods on different portions of the line, depending largely upon the local conditions. The rails had been practically all laid when the work of equipment began, and the type of joint plate then in position had much to do with the various types of bonds employed.

It was found impossible to install bonds of sufficient size beneath the splice bars already in use. Foot bonds could not be used on the elevated portions of the Atlantic Avenue Improvement, because this track had supported joints, and where the tracks were laid on the surface, they could not be used, because the leakage through them would unfavorably affect the operation of the signal system. Over a portion of

FIG. 35.—SWITCH AND FUSE HOUSE, CONTROLLING THIRD-RAIL SECTIONS IN YARD EAST OF JAMAICA

the line, which has no automatic block-signal system, however, soldered foot bonds, placed underneath the rail joints, were used.

A good deal of the bonding was done with laminated bonds of the soldered type, attached to the ends of each splice bar, requiring four bonds per joint. The bonds have a cross section of 486,000 circ. mils and are ¼ in. thick and 2 ins. wide, composed of successive layers of copper ribbon. In the tunnel sections cable bonds, 45 ins. long, spanning the splice bar, and with terminals compressed into the rail webs, were used. These are of 350,000-circ. mil cross section, and three are installed per joint, as the rail is of 100-lb. section. On the elevated portion of the line, and on Jamaica Bay trestle, the guard rails, which are 56 lbs. per yard, are bonded together and used as a part of the return circuit. The bonds used for these rails are also of the soldered type, built up of copper ribbon and fastened to the side of the rail head. They have a cross section of 560,000 circ. mils per joint.

The rail bonding was a difficult piece of work to execute, as much of the track was in constant use and the work had to be done during a severe winter, under the worst conditions. The spots where the bonds were applied on the rails and splice bars were cleaned by means of sand blasts operated by air compressors, driven by steam or oil engines. After a little practice, it was found that the soldered type of joint could, with the exercise of proper care, be made efficient and durable, but the vibration of the splice bars under heavy traffic subjected them to unusual punishment, and on new work, where it was possible to control the cross section of the splice bars, they were especially designed to accommodate the protected type of bond between the running rail and the splice bars, and this type of bond was used.

Where the automatic block-signal system is used it is not possible to cross-bond the running rails, on account of the disturbance in the signal system which would thereby be occasioned. On other portions of the line two 350,000-circ. mil bonds of the plug terminal type were installed between the rails of the same track and between adjoining tracks at intervals of about 1500 ft. A special arrangement was devised for cross-bonding a portion of the line where the automatic block signal system is used. The cross connections only occur at the end of the signal blocks where the special inductive bonds are cut into each track rail. These inductive bonds serve to keep out signal current, but for the direct current act exactly the same as the ordinary bond, and maintain the continuity of the running rail. The cross-connections between the tracks are made at these points, the inductive bonds being used in both tracks, so that the signal system is not affected by the flow of current between them.

At the two drawbridges in the Jamaica Bay trestle the continuity of the return circuit is maintained by four 2,000,000-circ. mil, rubber-covered, armored cables at each crossing, similar to those used for the third-rail circuit, and connected up to the rails in like manner.

The feeder connections between the track rail and the negative bus-bar connections in the sub-stations are 2,000,000-circ. mil, bare tinned copper cable. In some cases these cables are buried directly in the ground without protection, while at others, they run in vitrified clay ducts.

CONCLUSION

The completed overhead line was first put in service on April 27, 1905, and the third rail was first put in service about May 13, 1905. Regular operation began July 26, 1905. The operation of the transmission line and the third rail have been remarkably free from interruption of whatever nature, and have demonstrated their efficiency as a substantial and reliable transmission system for a suburban railroad on whose regularity of operation thousands of people are daily dependent.

The design and construction of the foregoing transmission system was carried out by Westinghouse, Church, Kerr & Company, engineers for the Long Island Railroad Company, and the entire work was under the direction of George Gibbs, chief engineer of electric traction of the Long Island Railroad, subject to the approval of an electrical committee, consisting of the chief operating officials of the road, with the president as chairman.

RECOMMENDATIONS FOR NEW YORK SUBWAY CARS MADE BY CHIEF ENGINEER RICE

As a result of the collision and fire in the New York Subway on June 1, mentioned in the last issue of this paper, George S. Rice, chief engineer of the Rapid Transit Commission, has made the following recommendations to the board.

1. No parts of cars used in subway service should be constructed of inflammable material.

2. An adequate fire-line service should be installed throughout the whole subway, so that water could be had at interior points.

3. Means should be provided for quickly removing the smoke from the subway in such emergencies.

BLOOMINGTON, PONTIAC & JOLIET SINGLE-PHASE LINE

BY JOHN R. HEWETT

In the Street Railway Journal for May 6, 1905, an account was published of the Bloomington, Pontiac & Joliet single-phase line, and it will be remembered that at that date the line extended from Pontiac to Odell, a distance of 10.4 miles. The line has now been extended, and is at present in operation to Dwight, making a total of nineteen miles in service.

By reference to the illustrations in the former article, it will be noticed that a double trolley was originally used, two parallel wires being spaced a distance of 10 ins. Cars running in one direction used the one, and those going in the reverse direction the other. Both were used as feeders. This type of construction is only now used within the city limits of Pontiac. One of the trolleys having been moved further along the arm, serves as a feeder only. Fig. 1 illustrates the present form of overhead construction. The feeder, messenger cable and trolley are tied together at intervals of approximately a mile, a piece of No. 00 trolley wire being used for this purpose. There are no sub-stations on the line and no apparent drop of voltage is noticeable at the Dwight end of the line, which is remote from the power-house.

FIG. 1.—OVERHEAD CONSTRUCTION ON STRAIGHT TRACK

The trolley voltage is 3300 and no trouble has been experienced with operating at this pressure. In fact the results have been so satisfactory that there is every likelihood of this pressure being doubled in the near future. Fig. 2 shows the overhead construction at a single-track curve near Dwight, and Fig. 3 the span construction where the line enters Dwight.

By the courtesy of Mr. Corothers and Mr. Lucas, respectively the president and general manager of the line, the writer has been given every opportunity for going into the maintenance and operating expenses for the first nine and one-half months, from March 15 to Dec. 31, 1905, inclusive.

Table I. gives the details of maintenance expenses.

TABLE I.

Maintenance		Per car-mile in cents
1 Track and roadway	$152.76	.31
2 Electric line	43.32	.09
5 Electric plant (power plant)	.50	.001
6 Cars	95.31	.195
7 Electric equipment of cars	341.83	.7
9 Miscellaneous shop expense	8.00	.016
Total maintenance	$642.72	1.312

The figures for maintenance are undoubtedly satisfactory when taking the local conditions into consideration. The track needed a considerable amount of ballasting after the line was opened for traffic, and no doubt this figure (.31 per car mile) would have been higher, but for the fact that the company owned a large shale pile just outside Pontiac on its own right of way. A large amount of the ballast was hauled on flat cars drawn by the passenger cars when running on ordinary schedules.

As all the power is purchased from the Pontiac Power & Light Company, the maintenance of power plant may, for all practical purposes, be considered as not entering into these accounts.

The most interesting item of all is that for maintenance of the electrical equipment of cars. During the earlier months covered by this period of operation, the cars were equipped with GE A-604 single-phase motors, which were lent by the General Electric Company until the present GE A-605 equipments were shipped from Schenectady. The figures given above include everything, with the exception of changing the equipments. Of interest is the fact that not a single armature or field coil has been burned out on either equipment, not only during the period under consideration, but also from the time that the road was started up to the present date, which is considerably over a year's operation. The commutation of these motors has proved most satisfactory, the car Dwight having run for over 25,000 miles without any work having been expended on the commutator. It is further of interest to note that the brushes are giving no trouble, as some apprehension was felt on this score with the a. c. motor. The life of a brush varies from 10,000 to 12,000 miles, and is usually nearer the latter figure. The only trouble experienced with the present equipments has been some slight and easily remedied trouble with the brush holder studs. This figure, 7 cents per car mile, for maintenance of electrical equipment of cars, would have been lower had better facilities been provided in the car house; and further it should be noted that the bill for fuses, etc., may always be expected to be heavier when starting up a new road with motormen unaccustomed to their work. The life of a trolley wheel is about 3000 miles.

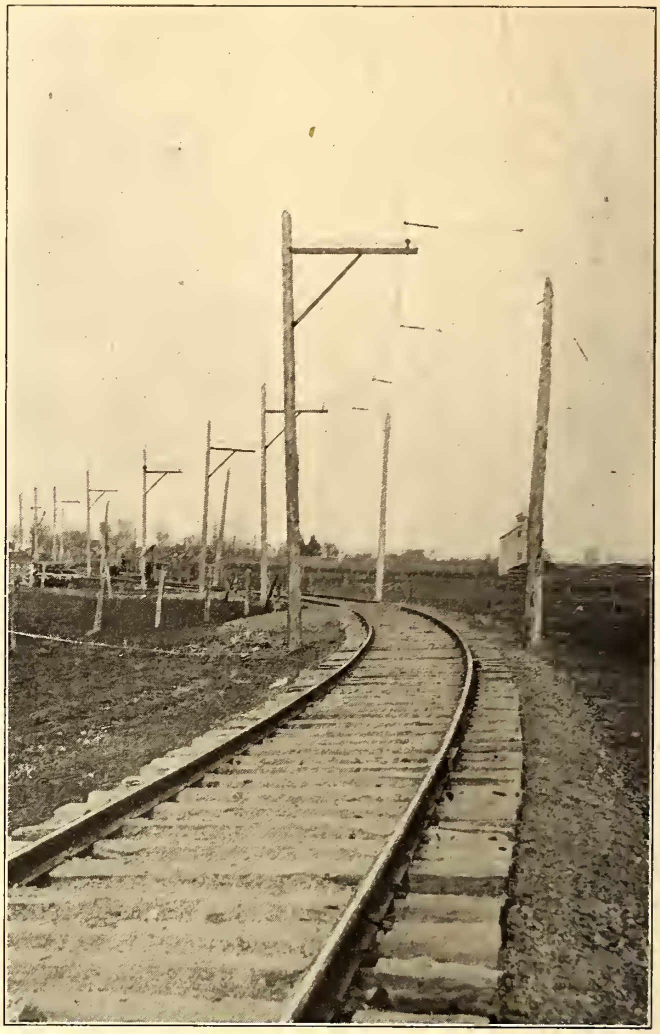


FIG. 2.—OVERHEAD CONSTRUCTION AT A CURVE

FIG. 3.—SPAN CONSTRUCTION WHERE BLOOMINGTON & PONTIAC LINE ENTERS DWIGHT

Table II. gives the charges against transportation.

TABLE II.

Transportation		Per car-mile in cents
11 For power	$2,751.56	5.625
17 Wages of conductors and motormen	1,825.70	3.73
19 Wages or other car service employees	315.21	.645
20 Wages of car house employees	65.26	.135
21 Car service supplies	325.60	.67
22 Miscellaneous car service expense	341.54	.705
22a Bus transfers	375.00	.775
Total	$5,999.89	12.285

The last item on Table II. refers to the expense incurred in providing for free busses from Pontiac to the city limits before the right of way across the steam line track was secured in the law courts, enabling the cars to run into Pontiac itself.

Table III. gives the miscellaneous expenses in detail.

TABLE III.

Miscellaneous		Per car-mile in cents
23 Storeroom	$19.25	.039
26 Salaries of clerks	442.50	.905
27 Printing and stationery	179.45	.366
28 Miscellaneous office expenses	117.92	.24
30 Stable expenses	10.50	.021
31 Advertising and attractions	109.27	.224
32 Miscellaneous general expenses	66.28	.135
33 Damages	12.30	.025
38 Insurance	190.96	.39
Total	$1,148.43	2.345

Table IV. is a resume of the three previous tables.

TABLE IV.

	Cents
Maintenance per car-mile	1.312
Transportation per car-mile	12.285
Miscellaneous expenses per car-mile	2.345
Total cost of operation per car-mile	15.94

Table V. gives further particulars of operation.

TABLE V.

Average mileage per car per day	167.2
Average watt-hours per car-mile	2100.
Average watt-hours per ton-mile	65.6
Earnings per car-mile (cents)	23.1
Operating ratio	68.8
Weight of cars each (tons)	32
Schedule speed (m. p. h.)	21
Maximum speed (m. p. h.)	42 to 44

Table VI. gives the names of the different villages and townships on the line, with their population.

TABLE VI.

Name	Population
Pontiac	5000
Owega	400
Esmen	400
Odell Township	792
Cayuga	78
Odell	1050
Total	7720

During the nine and one-half months to which the foregoing data relates, there were only 10.4 miles of track in operation. On an average each person in the community used the road 11.08 times, and the average earnings of the road per capita of population amounted to $1.47.

THE SITUATION IN SAN FRANCISCO

The legal holidays in San Francisco which were declared from day to day since the fire of April 18 have ceased, and in order to prevent any question being raised as to the legality of their acts during the holiday period, the Board of Supervisors on June 4 readopted all the resolutions it had passed since April 18, and once more passed to print all the ordinances enacted in the same period. Among the ordinances re-enacted was that permitting the United Railroads to change its former cable roads to electric trolley lines.

The United Railroads is progressing as rapidly as conditions will permit in its work of restoring the old electric railway service and changing the cable lines for electrical operation. The work is being retarded somewhat, however, by delay in receiving shipments of materials from the East, the principal trouble being caused by the lack of trolley wire and poles. Every effort is being made toward placing the Sutter Street line in operation, as there is at present no car service north of O'Farrell Street, although all other sections of the city have service. It is hoped that the work of changing this line from cable to trolley will be completed so that it can be operated by June 20 from Fillmore Street to the ferry. The necessary Y at Sutter and Market Streets has already been placed. Eventually the line will be run out to the Cliff House, through the Richmond district, connecting with the Presidio.

The Hayes Street line is also to receive early attention. The old route of this line is to be considerably changed, the cars starting on Masonic Avenue, going down Page to Fillmore, along Fillmore Street to Hayes, down Hayes to Market, and thence to the ferry. The cars will return by the same route, with the exception that the return trip will be made along Oak Street instead of Page Street. This line is now ready, with the exception of the wires and poles, and will be in operation a few days after the materials arrive.

Work is progressing on the Folsom Street line, and cars will be running along this street from Sixteenth Street to the ferry within a few days. Both the Folsom Street and the Kearny and North Beach lines will be in operation before the Sutter Street and Hayes Street lines. The Kearny Street line will run from Third and Townsend along Kearny Street to North Beach, and, returning, will run via Broadway to the ferry. This line will also be in operation by June 15, as practically all of the materials necessary are now on the ground and there is little clearing to do.

Workmen are engaged in taking down the 125-ft. brick stack of the Geary Street railroad power house, which was badly cracked during the recent earthquake. The brickwork will be removed by means of an inner scaffolding to a point about midway the height of the stack, below which the construction is solid. As crude oil has recently been used in the boilers of the power house, requiring less draft than coal, it has been decided not to rebuild the chimney to its former height. As soon as the chimney-repair work is completed the plant will be ready to resume operations, as the machinery was not injured. Whether the road will be placed in operation again as a cable road has not been decided, but it is asserted by A. D. Shepard, vice-president and secretary of the company, that the system could be put in shape to operate in ten days. The slot rails are warped in places, but the conduit is believed not to be injured. The road ran its cable for an hour after the earthquake on April 18, which shows that it suffered no material damage from the shock. One or two cars reached the down-town section and were subsequently burned.

William Muir, who made a similar application once before, has filed a paper with the city recorder, applying for the right to tunnel under the Bay of San Francisco for mining, domestic and transportation purposes, which he claims by right of location. His scheme includes a tunnel which is to extend under the Bay of San Francisco and across to Alameda. The tunnel is to begin at the Alameda Pier, 144 ft. below low-water mark; to run 10,500 ft. to the deepest part of the bay, and then to the west shore of the bay, terminating at Townsend and Second Streets, with branches to distributing points on the present railroad levels. The tunnel is to have a double track, standard gage, for the operation of electric cars. The upper half of the tunnel is to be equipped with roadways for teams, automobiles, bicycles, and pedestrians. The roadway is to terminate on Brannan Street, upon a level with that street. The tunnel is also to carry water for domestic purposes.

ROLLED STEEL WHEELS FOR INTERURBAN SERVICE

BY H. S. NEWTON,
General Manager, Hartford & Springfield Street Railway Company

The fitness of the forged and rolled steel wheel, which has been receiving so much advertising in the past year or two, to the class of interurban roads which is found in New England, has apparently been questioned by some of the railroad fraternity who have been solicited to purchase. It is entirely possible that the production of these wheels up to date has included some which were not well suited by design and physical characteristics to the service which they were intended to perform. Some specimens have been rolled which were undoubtedly too low in carbon, others have been poorly matched in diameters when pressed on the axles, and still further difficulties have developed, perhaps, which have influenced results. Yet, after an experience with these wheels of about two years, under conditions which could hardly be more severe, the writer has concluded that they deserve the serious consideration of every electric railroad management which is looking for economy in that very important item of operating expense, wheel wear.

As is well known, comparatively few New England interurban roads are built to any great extent on private right of way. The Hartford & Springfield Street Railway, upon whose lines the rolled steel wheel has been in use during a period of two years, is no exception to the rule, and when the route taken by the cars is not through the streets of the two cities, which are largely paved, it is confined largely to public highways and streets of the villages between, where, as the rail is laid flush with the surface of the road, the factor of sand and grit from the road material becomes a very important one. Attention is called to this characteristic of the route, since it is in marked contrast to the conditions existing on most of the interurban roads in the Central and Western States where the country rail is largely exposed.

It is not the purpose in this article to attempt an expert scientific demonstration of the inherent virtues of steel as applied to the manufacture of car wheels, nor does the writer care to make any formal comparison between the solid steel car wheel and the cast-iron or cast-steel wheel with a steel tire. Although past service on this road appears to demonstrate satisfactorily the superior advantages of the former, it is considered sufficient to limit all comparisons to the record of the rolled-steel wheel versus the chilled-iron article. Naturally that comparison, in terms of dollars and cents, forms a most important detail in the discussion, but it is also hoped to set forth in a form which will appeal to those financially responsible for operating expenses, some other points of interest in connection with rolled-steel wheels which, although often touched on before, have not to the writer's knowledge been brought out with any too great clearness and exactness from sources not allied with the manufacturers.

The record made by the wheel in the service of the Hartford & Springfield road can be best illustrated by the facts which have been developed in connection with it from a careful observation which has been made of the wheels under one car, selected at random, and with no special characteristics in design or in chemical analysis. The car weighs 21 tons, was employed only in winter service, and the wheels ran through the winter of 1904-5 and part of the winter of 1905-6. The facts may be set down under four headings.

(1) The amount and character of the wear, as shown by templates taken when the wheels were new, and again after they had run 50,880 miles.

(2) The apparent relation of the chemical composition, especially the carbon component, to the life of the wheel.

(3) The re-shaped wheel and the shop methods adopted for the re-shaping.

(4) A comparison from the standpoint of electric railway economics of the rolled-steel wheel, with its chilled-iron competitor.

Before preparing to ascertain by test the accuracy of the claims made for the rolled-steel wheel, the writer investigated carefully the conditions of track and road bed which would naturally affect the life and wear. It was found that the ideal arrangement for flange wear, viz., a condition of comparatively narrow gage between the wheels on axle was not possible, owing to the design of much of the rail used in Hartford and in Springfield. This is of the so-called Trilby section, laid in part at correct gage and in part to a gage somewhat wider than the standard 4 ft. 8½ in. A uniform wheel gage for all cars was, therefore, adopted of 4 ft. 8¼ ins. between centers of fillets, which, while it seemed sufficiently narrow to avoid cramping between rails of the track, was at the same time not so narrow as to cause the flanges of the wheels to ride on the inside of the grooved tram of the city rail, while the original thickness of those flanges remained.

The results shown by wear, and corroborated by chemical analysis, suggest that the wheels selected for special observation may differ somewhat from one or two previous sets purchased, in the amount of the carbon component. On this set the mileage shown before the first turning is probably somewhat larger than that obtained from some of the original wheels. It seems probable, however, that it will agree with the records which may be expected from all the later purchases. The relation between amounts of tread and flange wear, so far as can be seen from inspection of other wheels and comparison with these, is apparently normal, and indicates that the objection which has been so often urged against steel tires and wheels, viz., that the flanges wear excessively and the treads hardly at all, is not borne out. Thin flanges develop, but they are inevitably accompanied by heavy wear in the treads.

THE AMOUNT AND CHARACTER OF WEAR

The amount and character of wear obtained on this test set of wheels is shown in the accompanying sketches. They represent graphically the effects of 50,880 miles of service, and the general conclusions indicated are as follows:

(a) That the rolled-steel wheel, having a carbon component of 0.70 per cent, or thereabouts, may be reasonably expected to show in city service an average mileage of 10,000 for each 1-16 of an inch wear.

(b) That the density and resistance to wear of the wheel tread and flange is, to all intents and purposes, the same at all parts of the circumference. In no case did these wheels appear after service to be more than the merest trifle out of round.

(c) That on nearly every axle one wheel is found which has worn more or less thin in the flange, whereas the flange of its mate shows comparatively slight wear. In each of the four pairs observed, it is significant that the former shows a smaller diameter. The one wheel is apparently softer or of a texture more susceptible to wear; both tread and flange on this wheel have yielded more rapidly than they have on its mate, and, as the reduction has taken place, the flange has been crowded more and more against the rail, and the wear intensified by the tendency of the other wheel to advance farther in each rotation.

No evidence has developed to show that with brake-shoes of equal hardness and abrasive power this difference in wear may be attributed consistently to other causes. The car under which the wear took place is operated from both ends, there was no excessive play in the journals and the truck, of

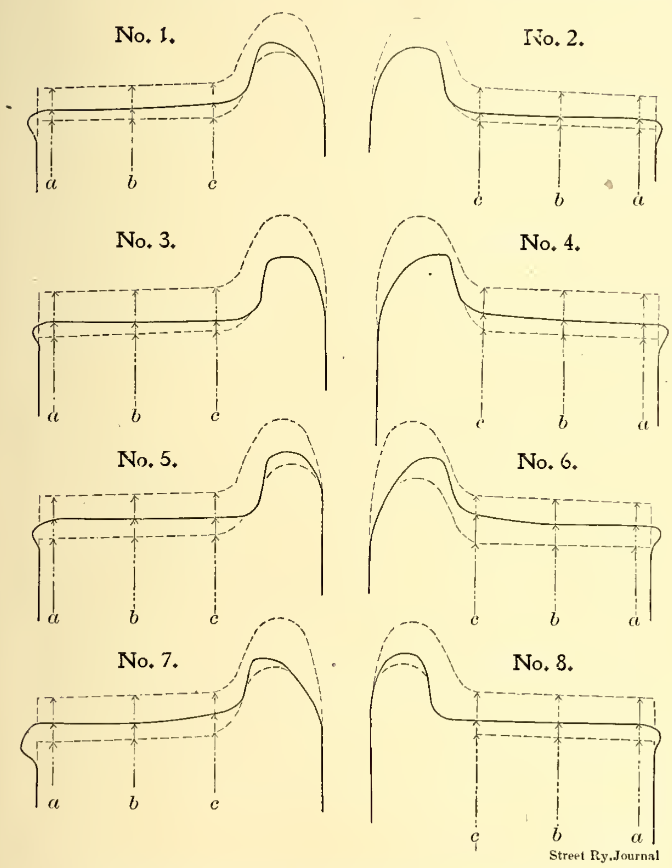
TABLE I.

SHOWING DIAMETERS AT THREE POINTS ON TREAD OF NEW, WORN AND RESHAPED WHEELS

	New Wheel			Worn Wheel			Reshaped Wheel		
Diameter	a	b	c	a′	b′	c′	a″	b″	c″
Wheel No. 1	33.9375	33.96875	34″	33.362	33.38	33.54	33.104	33.164	33.204
" 2	"	"	"	33.392	33.402	33.462	33.124	33.184	33.222
" 3	"	"	"	33.164	33.164	33.234	32.846	32.904	32.964
" 4	"	"	"	33.156	33.252	33.442	32.826	32.896	32.924
" 5	"	"	"	33.330	33.338	33.422	32.884	32.944	33.004
" 6	"	"	"	33.330	33.372	33.596	32.864	32.904	32.944
" 7	"	"	"	33.294	33.322	33.522	32.856	32.916	32.966
" 8	"	"	"	33.262	33.262	33.342	32.876	32.934	32.994

the M. C. B. general type, shows no indication of being out of true. It seems, further, so reasonable to expect difference in wear from wheels of different hardness and density, and when this wear occurs, to look for thin flanges on the soft wheels, that it appears unnecessary to cast around for other and what are apparently more remote causes.

(d) That homogeneous brake-shoes, having equal coeffi-



PROFILES SHOWING THE GRADUAL WEAR OF A SET OF ROLLED STEEL WHEELS UP TO 50,880 MILES

cients of friction, as far as possible, should be used in all wheels. It is not beyond belief that the wear of wheels may be somewhat influenced thereby.

(e) That there are no observable effects produced by the heat generated by braking. Measurements taken between inside faces of wheels reveal no distortion of web or rim.

THE CARBON COMPONENT

It is fair to presume that with uniform density in all cases the carbon component should be the determining factor in the grade of steel used for the manufacture of the rolled wheel. The presence of manganese, phosphorus and other elements, although modifying undoubtedly the characteristics of the metal, are, it seems probable, of decidedly secondary importance. To the percentage of carbon and the density of material is chiefly due the resistance to wear and the life of the wheel.

When it was decided to ascertain what the wheels under discussion had done under the test of 50,880 miles, and to estimate, if possible, what other wheels could be expected to do, a necessary part of the investigation was to determine by analysis this carbon component. Chips taken from the treads were furnished Prof. N. W. Lord, of the chair of metallurgy and mineralogy at the Ohio State University, and an analysis made. The results of this analysis are given in Table II.

TABLE II.

SHOWING CARBON COMPONENT AND WEAR OF THE EIGHT WHEELS

No. of Wheel	Mileage made in Service	Carbon Component	Total Average Reduction by Wear	Miles per 1-16″ wear	Stock Removed in Lathe	Total Reduction by Wear and Tool
1	50,880	.79	.2550″	12,717	.135″	.39″
2	"	.71	.2594″	12,257	.1213″	.3807″
3	"	.725	.37505″	8,479	.1417″	.51675″
4	"	.701	.32709″	9,724	.2007″	.52775″
5	"	.71	.28705″	11,082	.2097″	.49675″
6	"	.75	.25245″	12,595	.2643″	.51675″
7	"	.71	.27905″	11,396	.2334″	.51245″
8	"	.69	.32442″	9,802	.14255″	.50175″

While the wheels were purchased as .72 carbon, the analysis shows an even better percentage in some of them, and only one is below the .70-carbon mark. An ability to obtain uniform results at the mills is revealed also, which is creditable when it is remembered that the rolled-steel wheel is still somewhat of an innovation.

It will be seen, however, by examination of the diagrams, that the carbon component has not apparently been the determining factor in the wear of different wheels on the same axle. In one case (Nos. 1 and 2), a wheel with a high percentage shows a hardly appreciable better wear than its mate, which is .08 per cent lower carbon. In another case (Nos. 3 and 4), the wheel of lower carbon shows a decidedly better resistance than its higher carbon mate. On the other two pairs the wear is as might be expected, the lower carbon wheel in both cases showing the less resistance. In view of these anomalous results, the conclusion is suggested that there is quite a difference in the density of material making up the rims, and this conclusion is strengthened by the inequalities which appear in wheels on separate axles. A microscopical examination of etched sections of these wheels would probably show how much this theory has basis in fact. Naturally, however, such a determination by section examination was not possible in this case, since the wheels were desired for further service.

SHOP METHODS

It is probable that the lack of shop facilities for turning and grinding have stood in the way of the adoption of steel-tired and steel wheels by many roads which otherwise would have fallen in line at once. If these facilities are not at hand, the cost for freight, hauling and outside shop work is a great handicap. A modern lathe, suitable for turning car wheels, can be purchased for little short of $2,000. This sum is often more than a hard-fisted board on a small road feels like appropriating for what they are sometimes prone to believe is an experiment of doubtful success, and the old chilled wheels, requiring no turning, quickly available and, when worn out, having a considerable money value for scrap, remain the standard.

The record of large sections broken out of six different chilled wheels during the winter of 1903 and 1904, however, made a change on the Hartford & Springfield road imperative. In the absence of a large lathe, arrangements were made with one of the neighboring companies, possessed of a first-class machine shop, to do the necessary work of re-turning the wheels and putting them in shape for further service when the occasion required. Fortunately, however, the good offices of this company were never required, since before the first set of wheels were ready for turning, a tool was found on the bargain counter which was thought sufficient for all needs, and which was promptly set up in the shop, where it performs the work, with the aid of an auxiliary device, in a very satisfactory manner.

On a lathe of proper design and adequate weight of parts, it is undoubtedly practicable to dress with cutting tools rolled-steel and steel-tired wheels without serious difficulty. Such a lathe was not secured, however, by the Hartford & Springfield road, and it was early found that the qualities characteristic of a wheel tread after it had seen service were such as to make the turning down of the wheel with recourse to no tool but the lathe tool tedious, difficult and long drawn out. With these difficulties in evidence, the ingenuity of the master mechanic was called into play, and the result was the construction of a swing frame, holding a carborundum wheel for grinding, supported on the lathe countershaft, and of such a design as to allow the grinder being advanced to and from the wheel, as the axle holding it rests on centers in the lathe.

The principal difficulty in cutting the tread of either the steel-tired or the rolled-steel wheel is in getting below the hard spots, which have been formed from skidding of the wheels in service. These spots seem to be in the nature of chilled spaces, having the same ear marks as the chilled-iron castings, viz., the minute and almost microscopic chill checks which, in the form of wavering lines, cover the surface. The cutting tool on a light lathe will invariably jump and pass over these spots, and the inference is that not only must the frame work of a lathe be exceedingly stiff and unyielding, but the wheels themselves must be supported by a very rigid rest between centers before much progress can be made in turning off these spots. An attempt to mount first an emery and then a carborundum wheel on the tool rest, and to grind the entire surface of the wheel, resulted in the expenditure of a great deal of time to very little effect.

The swing frame holding a carborundum wheel is highly satisfactory. The hard spots only, and not the balance of the tread, are ground, and this work of grinding forms naturally the first process after the wheels are placed between centers. The turning, which follows, is done with tools of the very highest grade of self-hardening steel which can be procured. At the start an effort was made still farther to harden this steel by heating to a white heat and then plunging it in oil. This seems to give the material a crumbling tendency, however, and the practice has recently been discontinued.

The nature of the re-shaping of the tread and flange on the wheel after they have been worn is a subject which has been given a good deal of study. With a flange considerably worn, like some of those shown in the diagrams, it is clearly unnecessary to attempt to obtain a new flange of the full size secured on the wheel in its original shape, provided measures can be taken to prevent the worn flange from receiving a like amount of wear when the wheel is again put into service. The practice so far has been not to attempt to get full flanges again where they have worn thin, but to leave them when returned to the car with the profile of the flange and tread, as shown in the diagrams. It will be noticed in these cases that parts of new fillets have been turned up, which end rather abruptly when they infringe on the old ones, which have resulted from the continuous grinding of the flange against the rail. To prevent this new fillet being ground out and the wear coming again on the old flange, the practice is to turn the thin-flanged wheel to a diameter slightly larger than that of its mate. In this way it is hoped that the tendency to greater wear shown by the wheel having the thinner flange will be offset, and the wear thrown on the other wheel by the increase in diameter of the first. To what extent this scheme will succeed has not yet been developed. On no wheels which have been turned up in this way does a casual examination show signs of abnormal new wear in the old flange.

The work of turning and grinding must be done under the general supervision of a skilled mechanic. The lathe hand himself need have no more than apprentice's skill, as the tool must necessarily run slowly, and a large part of the attendant's time will be spent in watching the cut or in holding the grinding wheel against the tread.

Any old heavy duty lathe, which can be built up 6 ins. or less, so as to get a 36-in. swing, can be pressed into service provided the grinding frame suggested before is made a part of the tool. A turning speed of 10 ft. a minute has been found to be as high as is permissible when roughing off the worn tread and flange and naturally the heavier the bed, headstock and other parts, the less chatter and more rapid the results. In some shops it is apparently not considered necessary to taper the treads of wheels when re-shaping, but in the Hartford & Springfield Company's shop the taper is considered a most essential detail in the preparation of the wheel, and a good sharp one is considered conducive to less flange wear.

In the estimate of ultimate mileage of the rims on steel wheels it is calculated that a somewhat longer service will be obtained after the last turning than after the others. The reason for this expectation will be obvious when it is remembered that the intention is to use the old centers for new tires. It will not be necessary to take wheels out of service so quickly on account of thin flanges after they have been re-shape for the last time, since there will be no objection to the latter running until the limit of flange safety is reached. The intention now is to fit the new tires either with the Gibson retaining ring or by simply shrinking them on against a shoulder. It is probable that the former method will be adopted, in view of the risk involved of tires getting loose when worn thin and held on only by the shrink .

ROLLED-STEEL VERSUS CHILLED-IRON WHEELS

As a substitute for the chilled wheel the record of the eight rolled wheels tested shows them to be a success. A really noticeable flat has never been developed either on these or on any other wheels of the rolled-steel variety in the two years during which they have been in service on the Hartford & Springfield road, and the trifling flats, occasioned by careless braking, have invariably worn off in forty-eight hours of service. The centers and rims are naturally both unbreakable, a chipped flange impossible and a broken one incredible. In the light of past experience under severe winter conditions even the cast-iron center wheel with a steel tire seems undesirable. Uniformity in production is something which few of the cast-iron wheel manufacturers seem to have attained, and a brittle center may be nearly, if not fully, as dangerous as a brittle wheel. The rolled wheel is safe.

A consideration of the estimate given below will indicate from the standpoint of dollars and cents what may be expected in medium-speed interurban service from the use of the two kinds of wheels. A life of 37,500 miles is allowed the chilled wheels, and is considered a liberal average through the year under the present conditions of track and special work. It is possible that were the conditions more favorable a greater mileage might be expected, especially if the climate were less severe. As it is, however, only a minor percentage of the chilled wheels which have been employed on this road in winter service have made good records for wear. The majority have either prematurely developed chipped flanges or soft spots, or have succumbed and become flat under the too earnest application of the air brakes. For summer or open cars the chilled wheel still remains the standard, and is making a record sufficiently good to warrant serious consideration before it is definitely superseded.

A very natural question which arises in connection with the adoption of steel wheels on this road, and the proposed plan of equipping the centers with tires when the original rims are worn out, is, why not adopt steel-tired wheels in the first place?

The wheel records here demonstrate that the steel tires will not show a greater mileage per unit wear than was shown by the rims on the rolled wheels under test. Therefore, as the solid rims may be worn down deeper than the tires, they are the more economical. The centers for tired wheels, which are furnished for duty similar to that performed here by the rolled wheels, are usually cast iron, which is not safe, or cast steel, which is expensive and, in a measure, also undesirable. The rolled centered, tired wheel has not been offered to the trade, so far as the writer knows.

Everything being taken into account, economy would seem to indicate the purchase in the first place of the rolled-steel wheel with the tire and center one piece. When the time for renewal comes a tire at an outside cost for material and labor of $14 is apparently more reasonable than the expenditure of $27 for a new wheel. The amount to be realized from the return of rolled centers as scrap to the mill is small, and would be largely eaten up probably by return freight charges and other incidentals.

In the compiling of the data used in the preparation of this record, much assistance was received from William F. McCoy, master mechanic of the Hartford & Springfield Street Railway Company.

TABLE III.
SHOWING COST OF 150,000 MILES SERVICE FOR ROLLED STEEL VS. CHILLED IRON WHEELS

ROLLED STEEL WHEELS		
One pair of 34-in. diameter rolled steel wheels, 2½-in. thickness of rim, 2½-in. tread, ⅞-in. flange, at $27.00 per wheel, pressed on axles and delivered at freight station, Warehouse Point............	$54.00	
Haulage from station	.50	
Cost of labor, substituting same for discarded wheels under car..............	1.25	
Cost of labor, taking out and replacing same under car twice, at $1.25.............	2.50	
Cost of labor, re-shaping treads and flanges twice, at $2.87........................	5.74	
	$63.99	
Less value of center to be used for re-tiring.	17.00	
		$46.99
Operating cost per 1000 miles.............		$ .3133
CHILLED-IRON WHEELS		
One pair 33-in. diameter chilled iron wheels, 2½-in. tread, ⅞-in. flange, pressed on axle and delivered f. o. b. at freight station, Warehouse Point	$20.60	
Haulage from station.....................	.50	
Cost of labor, substituting same for worn-out wheels	1.25	
Cost of three renewals, f. o. b., Warehouse Point, credit being allowed for old wheels returned as scrap, at $15.75.....	47.25	
Hauling old wheels to station three times...	1.50	
Hauling new wheels from station three times	1.50	
Cost of labor, taking out and replacing with new wheels three times...............	3.75	
Cost of removing last pair when worn out..	.625	
	$76.975	
Less value of old wheels as scrap at car house	4.35	
		$72.625
Operating cost per 1000 miles.............		$ .4842

BUFFET AND LIMITED SERVICE INSTITUTED BETWEEN INDIANAPOLIS AND FT. WAYNE BY THE FT. WAYNE & WABASH VALLEY TRACTION COMPANY

Quite a distinct departure in the way of high-speed limited service has been instituted by the Ft. Wayne & Wabash Valley Traction Company and the Indiana Union Traction Company on the route between Ft. Wayne and Indianapolis. The service was instituted May 1 with a reception, given at the Traction Terminal station at Indianapolis. Two thousand invitations were issued and a number of traction officials from Ohio and Indiana attended. Two of the new cars for the service were on exhibition at the station, and light refreshments were served to guests.

OLIVES PICKLES
CHICKEN SANDWICH 15c
TONGUE SANDWICH 10c HAM SANDWICH 10c
SWISS CHEESE SANDWICH 15c
AMERICAN CHEESE SANDWICH 15c

EGGS COOKED TO ORDER
ANY STYLE 15c
TEA BISCUITS BREAD AND BUTTER
SALT WAFERS

PRESERVED FIGS ASSORTED FRUIT

TEA COFFEE
TABLE WATERS
CIGARS

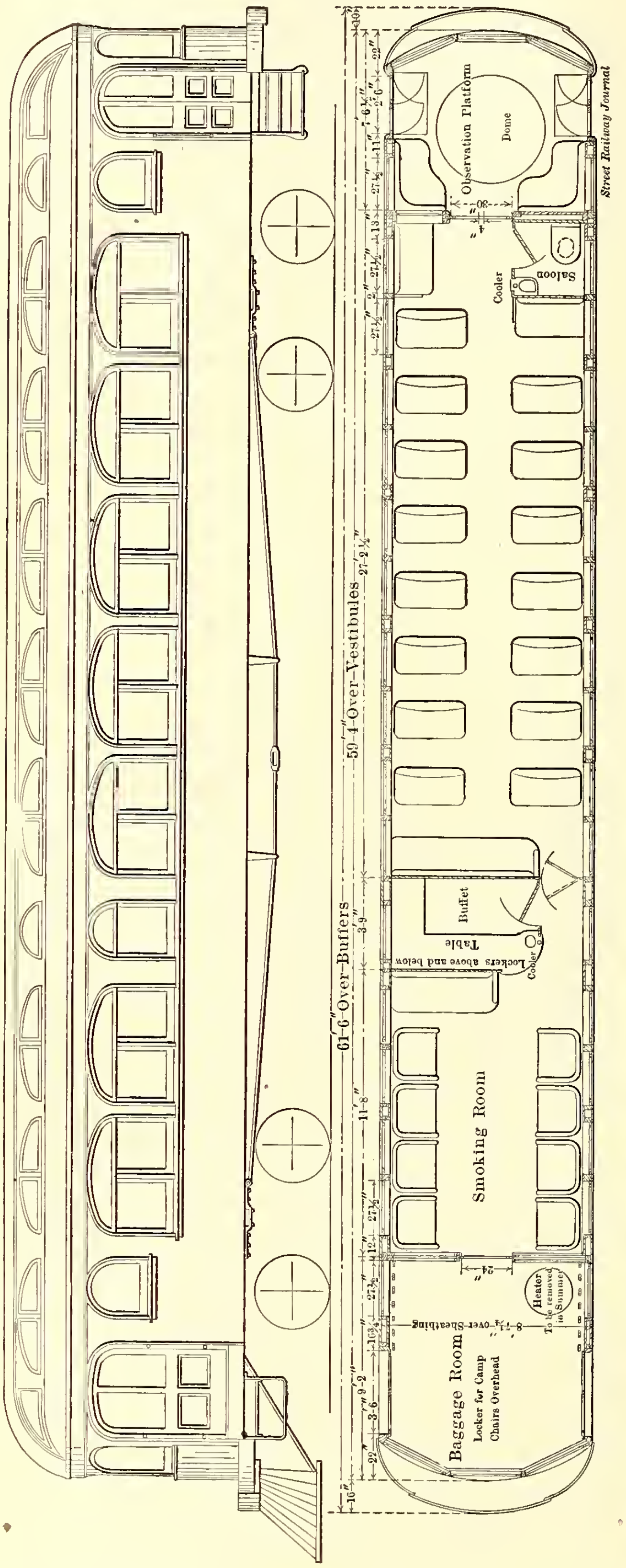
DISTILLED WATER SERVED ON OUR TABLES

REPRODUCTION OF MENU ON BUFFET CAR

The length of this run is 138 miles, and the time is 4 hours, 40 minutes. Sixteen scheduled stops are made, the route being by way of Noblesville, Tipton, Kokomo, Peru, Wabash and Huntington. There are four trips a day in each direction . The fare on the trains between Indianapolis and Ft. Wayne is $2.45 one way, and $4.40 for the round trip, if tickets are purchased. One hundred and fifty pounds of baggage will be checked free on each full fare ticket, which is a departure from the practice heretofore in vogue on the majority of the roads in this district. The schedules are so arranged that they connect at Ft. Wayne with limited cars of the Ft. Wayne, Van Wert & Lima Traction Company for

BUFFET AND SMOKING COMPARTMENT OF CAR FOR SERVICE BETWEEN FORT WAYNE AND INDIANAPOLIS

Lima, Ohio, making possible the trip of 200 miles in 7 hours and 10 minutes. Connection is also made with the Clover Leaf (steam) trains for Toledo.



SEATING PLAN AND SIDE ELEVATION OF BUFFET CAR OPERATED BETWEEN FORT WAYNE AND INDIANAPOLIS

The new cars for this service are probably the longest and heaviest interurban cars ever built. They are 62 ft. over all and weigh 45 tons. Two of them, the "Kenilworth" and the "Peru," have just been placed in service, while several others are under construction by the Cincinnati Car Company. The arrangement of the interior is shown by the accompanying floor plan. Each car has three compartments. The forward compartment is for baggage. The smoking compartment is finished to correspond with the same accommodations given on the Chicago-New York trains of the Pennsylvania and Lake Shore railroads. A buffet is provided in the center of the car, accessible to both smoking and main compartments. Chairs are used in the smoking compartment, but to secure larger seating capacity the seats in the main passenger compartment are of the high back walk-over type, upholstered in figured plush, and there are reclining lounges at each end of the same material.

A novelty in the car is the observation rear end. The rear platform is 9 ft. long, and it is completely enclosed by heavy oval-shaped plate-glass windows. Cozy corners and portable leather seats are provided for this end of the car. The forward compartment has two sliding side doors. A permanent stool is supplied for the motorman, and he is protected from the baggage by a substantial pipe frame work. In this compartment are placed the hot-water heater, a Babcock fire extinguisher, emergency tools and telephone instruments.

The interior finish of the car is rich inlaid mahogany. The windows are double, and have leaded art glass in the upper portions. The cars are lighted by clusters of lamps, enclosed in inverted holophane globes. A toilet room is provided in the rear of the passenger compartment, with a drinking water tank recessed in its partition wall. The underframing of the cars is of very substantial and rigid construction, all sills being reinforced with heavy 6-in. I-beams. They are equipped with Westinghouse No. 85 and No. 121 motors, with the Westinghouse multiple-unit switch control for the operation in trains of two or more cars, and they are mounted on Baldwin M. C. B. heavy interurban trucks. The motors are geared for a maximum speed of 60 m. p. h

REGULAR PASSENGER SECTION OF BUFFET CAR RUNNING BETWEEN FORT WAYNE AND INDIANAPOLIS

A NEW AUTOMATIC COUNTING BLOCK SIGNAL

The United Electric Signal Company, of Providence, R. I., has just produced a new automatic counting block signal for use on single-track electric railways, which possesses some very novel features of construction, the most striking of which is its extreme simplicity. The signal mechanism consists of two powerful magnets provided with gravity-controlled armatures, a ratchet wheel mounted between the magnets designed to be rotated forward and backward by the movement of the armatures, a single-tooth wheel mounted upon the same shaft with the ratchet wheel and rotated therewith; an arm carrying a transparent red target mounted directly over the single-tooth wheel and having its lower end forming a segment to be engaged by the single-tooth wheel.

There are two openings in the signal casing, the larger of

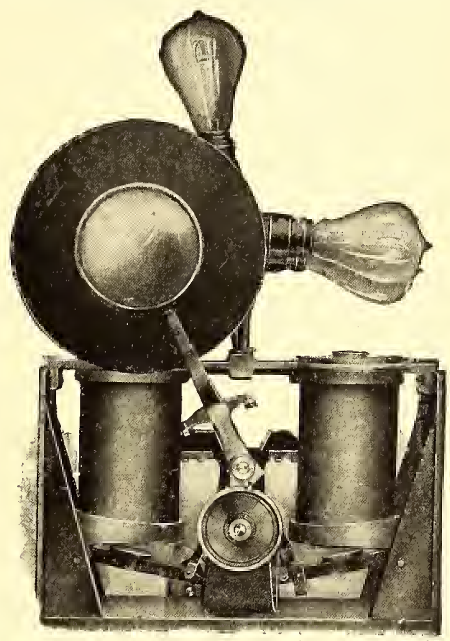
SIGNAL LANTERN

which is protected by a white glass and the smaller by a green bull's-eye. Both openings are illuminated by an incandescent lamp, and each opening also contains a reserve, or spare lamp, designed to be automatically cut in should the first lamp burn out. The large white opening is the one behind which the red transparent target falls when in danger position, and the green bull's-eye is the "answer back" or telltale signal, the illumination of which in the near signal is a positive indication that the danger target is set in the distant signal.

When the block is clear the larger opening will show a clear white light and the green bull's-eye will not be illuminated. As long as there is a car or cars within the block, the forward end of the block will display a red signal within the larger opening, and at the rear end the larger opening will show a white light, while the green bull's-eye will also be illuminated. The incandescent lamps do not form the main part of the system, but are only supplemental to the danger target.

As a car leaves a turn-out to enter a stretch of single track, a momentary impulse is sent to the operating magnet of the distant signal mechanism by means of an overhead device, which causes the armature thereto to rise, and by means of a pawl in engagement with the ratchet wheel to move the ratchet wheel one step forward. The single-tooth wheel, being mounted on the same shaft and traveling therewith, will also move one step forward and throw the target to danger position.

The falling of the target establishes a permanent circuit to the lamps behind the green bull's-eye of the near signal, giving a positive indication to the entering car that the danger signal has been set. Following cars that approach the block going in the same direction will see the green signal, indicating a car or cars in the block ahead. As the following cars enter the block with caution, each in turn operates the setting magnet, as above described, but gives no visible change at the danger end, though each car moves the ratchet wheel and the single-tooth wheel one step forward, all the while holding the danger target securely locked in danger position. The fact that each following car operates the setting mechanism is positively indicated at the point of entry by a flash upon the green bull's-eye, caused by the cir-



SIGNAL MECHANISM WITH COVER REMOVED

cuit being temporarily broken while the armature is in action. This is accomplished by a simple brush switch mounted upon the armature of the setting magnet.

As the cars leave the block each in turn, by means of the clearing magnet, rotates the ratchet wheel and also the single-tooth wheel one step backward, until the last car to leave the block brings the single tooth into engagement with the segment at the end of the target arm and throws the target back to safety position.

That the idea of extreme simplicity is well carried out is evidenced by the small number of parts, the entire absence of springs, and the general substantial construction. One of the most novel and ingenious features of the mechanism is the simple and positive device for locking the danger target in danger position. An extension of the target arm is formed into a segment with concave faces which bear upon the periphery of the single-tooth wheel and hold the target firmly in its assumed position until released by the single tooth in its rotation. A short auxiliary arm is also mounted loosely upon the target arm shaft, and is designed to take up lost motion, so that the armature of the magnet can complete a part of its stroke before the real work of throwing the target commences.

This system requires three line wires. The magnets are of a special type, the upper half of the core being fixed to the coil, and the lower half of the solenoid type. Although in actual practice the coils receive but a momentary current at the usual 500 volts, they are wound to withstand a continuous current at a much higher voltage, and to operate at a much lower voltage than is required to move the cars. Furthermore, while the actual pressure needed to operate the target is but a quarter of a pound at the start, up to a pound and a half to complete the stroke, the initial pressure generated by these coils is over a pound and a half, with a maximum thirty-five pounds at its finish, thus allowing a very heavy margin for safety.

The entire wiring of the signal inside the case is brought to double binding posts set in a fiber block mounted upon the frame, and are permanently connected to one end of the binding posts; the line wires are brought into the casing from underneath and inserted into corresponding binding posts, and can be thus quickly disconnected when it is desired to remove the mechanism from the casing. The signal has been designed with such simplicity that should it become deranged it can be practically rebuilt at any machine shop, thus avoiding the necessity of being dependent upon the manufacturer for a new mechanism.

The overhead contact device is designed to be permanent, and needs no inspection. It consists of two short metal strips parallel to and on either side of the trolley wire, and designed to be short circuited by the trolley wheel, and will operate at any speed. The duration of the contact necessary to overcome the inertia of the magnets and operate the mechanism is maintained by an extremely simple device within the signal box, by which the current is maintained upon the coils until the mechanism has been operated. The overhead contact device is also differential, cars going in one direction operating the setting magnet and those going in the opposite direction operating the clearing magnet. The purpose of this system is to meet the needs of electric railroads desiring a simple and effective signal method at a small outlay and low maintenance cost.

ELECTRIFICATION PLANS OF THE ERIE RAILROAD

The contract for the electrification of the Rochester Division of the Erie Railroad between Mt. Morris and Rochester, N. Y., was awarded last week to Westinghouse, Church, Kerr & Company. This section is about 35 miles in length and extends south from Rochester to the junction of the Rochester branch with the Delaware, Lackawanna & Western Railroad. Work has already been commenced. The next section of the Erie Railroad in Western New York to be equipped is from Avon to Corning, a distance of about 70 miles. The single-phase system has been adopted and the operating voltage will probably be the same as that adopted by the New York, New Haven & Hartford Railroad, or 11,000 volts. In this case only one sub-station, located about the middle of the line, will be required. Power will probably be taken from the transmission lines of the Ontario Power Company, which cross the tracks of the Erie Railroad to be electrified. The cars to be used will be very similar to the standard Erie Railroad passenger coach, but slightly shorter and slightly heavier. It is proposed to run the cars in trains with the multiple-unit system, and part of each train will be composed of trailers. Later, electric locomotives may be used on some trains.

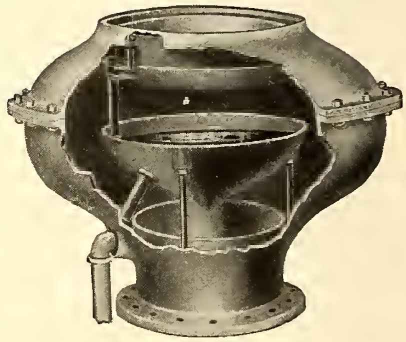
The electrical commission of the Erie Railroad has now practically completed its work of preparing estimates upon the cost of electrification of the Greenwood Lake and other suburban divisions of the Erie Railroad near New York by the various systems in most common use, and these estimates will be considered by the executive committee at an early date.

LONG DISTANCE EXCURSION BUSINESS IN OHIO

While the recent passage of a two-cent-per-mile rate law in Ohio will doubtless affect the long-distance one-way travel on interurban roads, the ruling of the steam-road people in refusing to grant low rates for conventions and special events places the electric lines in a position to secure a considerable portion of this business without materially reducing their established rates. The steam roads recently refused to grant reduced rates to the State G. A. R. encampment at Dayton this month, and the electric roads are offering through special cars and reduced rates from points as far distant as Columbus and Toledo. The indications are that the electric railways will get considerable of this business, as the veterans are inclined to be disgruntled at the withdrawal of the low rates heretofore made them by the steam roads

CAST-IRON EXHAUST HEAD

The Hoppes Manufacturing Company, of Springfield, Ohio, is placing on the market a new exhaust head which is made entirely of cast iron with the exception of the drain pipe. The apparatus, as will be noted from the accompanying illustration, is symmetrical in design and liberal in its proportions. The principles involved in the construction are those used in the company's well-known steam separators and oil eliminators. Intercepting troughs partly filled with water prevent the entrainment of water and oil in the exhaust pipe from passing through and falling on the roof of the building, while the cone in the center prevents excessive moisture in the steam from passing out without coming into contact with the inner surface of the head and having the moisture and oil removed. A special feature is an annular groove surrounding the outlet, which prevents condensation and oil from running over and down the outside of the head and pipe.



EXHAUST HEAD

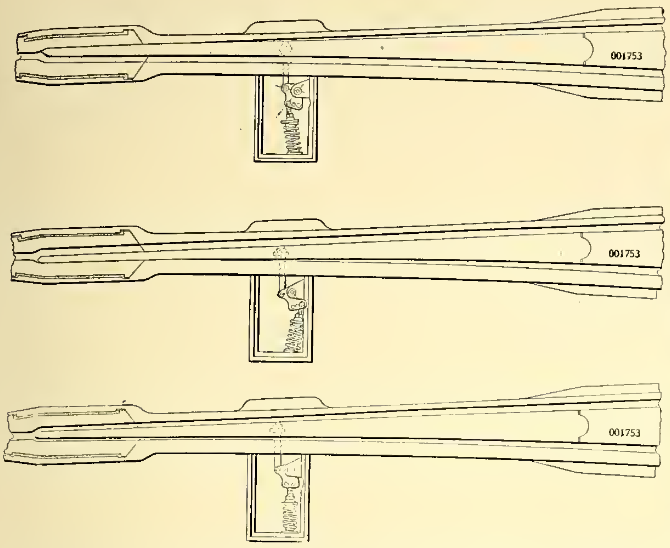
The exhaust head is made in sizes of pipe up to 48 ins. in diameter. Being constructed of cast iron, which is impervious to the action of the corrosive gases and atmosphere, it is free from the corrosive action to which sheet metal is subject.

INTERURBAN LINE NEAR DUNDEE, SCOTLAND

The Dundee, Broughty Ferry & District Railway, whose system was described in the issue of May 12, was financed and built throughout by J. G. White & Company, Ltd., of London, whose names were omitted in the previous article through an oversight. Although a comparatively short line, the system has attracted considerable attention in Great Britain on account of its interurban character.

HOLDING DEVICE FOR SWITCH TONGUES

The accompanying illustration shows an ingenious device recently put on the market by the Lorain Steel Company, for holding switch tongues in either a right or left-hand position or giving them an adjustment by which the tongue can be held in either direction as thrown. It is intended to prevent



APPEARANCE OF SWITCH TONGUE AND HOLDING DEVICE FOR THE THREE POSITIONS

any possibility of a car doing what is known as straddling a switch.

As will be seen, the tongue is connected by a lever to an irregularly-shaped plate or fulcrum, to which a spiral compression spring is connected. There are three holes in this disc, giving three adjustments, viz: for holding the tongue to the right-hand track, for holding it to the left-hand track, or for either direction, as shown in the lowest diagrams.

MORE SEMI-CONVERTIBLES FOR CHARLESTON, S. C.

The Charleston Consolidated Railroad was one of the last roads to be electrified in the South, so that its equipment is quite modern. Thirty miles of tracks are operated in the city through the principal business and residential sections, and reach the ferries, depots and places of amusement, as

HOTEL, FERRIS WHEEL AND PAVILION ON ISLE OF PALMS, NEAR CHARLESTON, S. C.

well as a number of parks. The Seashore division, 10 miles in length, is operated through and to three summer resorts, Mt. Pleasant, Sullivan's Island and the Isle of Palms, and the latter, which is shown in the engraving, is the leading seashore pleasure resort of this section of the South. This division of the Consolidated Railroad enjoys a large travel during the summer months. It also operates through Fort Moultrie, one of the largest military reservations of the Government and one of the harbor defenses. On the city lines are situated several pleasure parks, namely Battery Park, Hampton Park, where the recent exposition was held, and the South Atlantic Baseball Park. The suburban line passes through a very large and flourishing truck country, and handles the traffic of fifteen fertilizer and lumber mills

INTERIOR OF PAVILION, ISLE OF PALMS, CHARLESTON, S. C.

employing 4500 to 5000 hands daily. This line also handles the traffic of the new Navy Yard now being constructed directly opposite the terminal of the street railroad.

The present equipment of the road consists of twenty-five double truck cars, fifty-two single truck open and closed cars, two flat freight cars, two construction cars, two combination freight and passenger cars, and one box car. The city lines are equipped with 92½-lb. girder rail; the suburban and seashore lines with 60 and 50-lb. T rails. The climatic conditions of Charleston and vicinity are such that traffic is good during the entire twelve months. The winters, balmy and spring-like, make it popular as a tourist resort, and the exhilarating climate of this celebrated coast resort, the Isle of Palms, owned by the Consolidated Railroad, brings thousands to Charleston during the summer months.

The business of the company has grown to such an extent that an order has been placed with the J. G. Brill Company for a number of Brill grooveless-post, semi-convertible cars, this type now having been adopted as the company's standard. These cars, which are now being delivered, will be operated over the belt line of the street railway, which passes all the most prominent hotels and public buildings, steamship lines, ferries, union station, and also through the best residential section of Charleston. It is mainly due to the building of the new union station, which will materially increase traffic on the belt line, that these new cars have been ordered. The company states that it has been operating single-truck cars of the same type for the past year with considerable success, and is satisfied that this type is the best for its conditions.

The dimensions of the cars are as follows: Length over

SINGLE TRUCK, SEMI-CONVERTIBLE CAR FOR CHARLESTON, S. C.

the end panels, 20 ft. 8 ins.; length over the crown pieces and vestibules, 30 ft. 1 in.; width over the sills, 7 ft. 8½ ins.; width over the posts at belt, 8 ft.; sweep of posts, 1¾ ins.; centers of posts, 2 ft. 5 ins.; size of side sills, 3⅜ ins x 5 ins.; thickness of corner posts, 3⅝ ins.; thickness of side posts, 2¾ ins. The cars have a natural finish of cherry and the ceilings are of maple, decorated. The seats are upholstered with spring cane seats and back and fitted with corner grab handles. The Brill 21-E single truck on which the car is mounted has a wheel base of 7 ft. The wheels have a diameter of 33 ins., with 3¾ ins. axle diameter. Two motors of 40-hp capacity each are used per car.

HIGH-PRESSURE PUMPS FOR FIRE SERVICE

In taking care of an amusement ground, one of the principal points to look after is the protection of the buildings from fire. Park buildings are usually of very light construction, but even if intended for only one or two seasons the management should not neglect the possibility of fire, for one large conflagration may do irreparable injury to the park business. As many resorts of this kind are located far from municipal water mains, the high pressures required for effective fire-fighting must be obtained through special pumping machinery. For situations of this character and other places where the water pressure is too low, the Goulds Manufacturing Company, of Seneca Falls, N. Y., builds several types of fine pumps. Rather than go into any detailed description of their construction, it may be of more interest to describe at some length the characteristic high-pressure fire-protection plant installed by this company at Coney Island, New York.

Frequent fires made it necessary for the city officials to devise some means for better fire protection than could be given by the city fire department with the limited facilities at its command. It was therefore decided to construct a high-pressure water works system capable of delivering 4500 gallons of water per minute with a pressure at the pumps of 150 lbs. per sq. in., producing a pressure at the fire hydrant of at least 125 lbs. when the full capacity of the station is utilized. This project has been completed, and the city has now a fire system ready for any emergency.

The fire-fighting force located at the Island consists of two fire engines and one truck; forty minutes more are required to bring four additional steamers into service, and their supply of water was drawn from the domestic service pipe which supplied the island. This pipe was but 12 in. in diameter from a pumping station two miles distant, and the supply was barely sufficient for the ordinary daily demands of the service. As a fire started in this congested and highly inflammable district would spread with great rapidity, it was deemed necessary to provide for a large volume of water that could be concentrated at any point in the protected area. In view of the distance of Coney Island from the high-pressure city mains, a decision was reached to install a special pumping station. This is located on Coney Island Creek adjoining the sewerage disposal plant, about 1800 ft. from the main avenue of the protected area and about opposite the center of that area. The building is 37 ft. x 62 ft., one story, brick, built on heavy concrete base laid on a pile foundation, the floor level being about 4 ft above mean high tide. In this building are installed three Goulds triplex double-acting piston pumps, especially designed to resist the action of salt water, and provision is made for adding another pump in the future. Each pump is direct connected to and driven by a Nash vertical three-cylinder gas engine, and the combination is an independent unit not dependent upon any other. A special 16-in. high-pressure main leads from the pumping station to the main avenue of the protected area, and along this avenue in both directions to the limits of the district.

TEST OF HIGH-PRESSURE WATER SERVICE AT CONEY ISLAND, N. Y.

Several 12-in. branches are laid under the walks leading out toward the beach, and a number of private connections have been made for fire protection only. The hydrants are located about 150 ft. apart in such positions that the full capacity of the system can be concentrated upon any one block of buildings.

Fresh water is supplied to the pumps from two practically distinct sources. The old city service 12-in. main is connected to a 12-in. service pipe which enters one end of the building extending its full length, just below the suction of each pump, to which it is connected. A new 20-in. city service pipe from a storage reservoir in the city is also connected to this 12-in. station main, and this station main is also connected to the discharge pipe from the pumps to keep the system at all times under full city pressure. In addition to these two sources of supply, suction connection is made with the pumps to draw water from Coney Island Creek, adjacent to the station building, so that salt water can be used in an emergency. A concrete pump well 6 ft. x 14½ ft. and 14 ft. deep is located just at the rear of the station building, this well being connected with a 24-in. intake main with a brick manhole, which in turn has an intake from the creek 9 ft. below mean high tide. The discharge from each pump is fitted with a water-relief valve that can be set for any pressure up to 200 lbs. When the pressure in the main exceeds that at which this valve is set, the valve opens and the pump discharges through suitable connections into the overflow pipe which ends in the salt-water well.

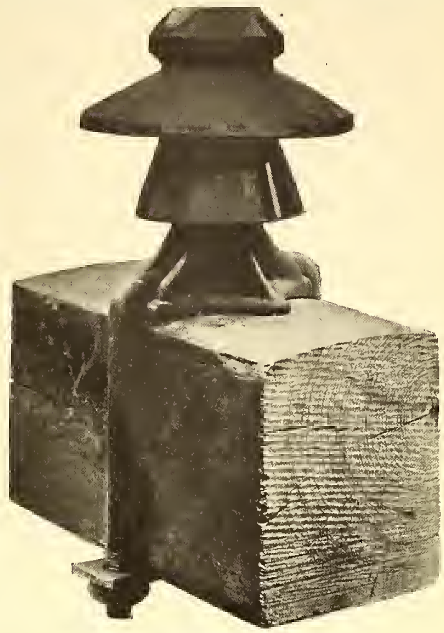
Each pump is also fitted with a by-pass connecting the discharge from pump with the overflow pipe. This by-pass is controlled by an electrically operated gate-valve. Each engine is started with the by-pass valve of its pump open, and when the engine has attained full speed this valve is gradually closed by an electric motor, which automatically stops when the valve is fully closed or opened; the pump then begins to deliver water to the mains.

A NEW INSULATOR PIN

In the description of the transmission line and third-rail system of the Long Island Railroad published in the June 9 issue, attention was called to the new type of iron insulator pin employed. This pin, which is a radical departure from previous practice in pin design, is the invention of W. N. Smith, of Westinghouse, Church, Kerr & Company, who has applied for a patent on the device. The design has been further improved, and arrangements are now being made for manufacturing and placing it on the market under the name of the Smith-grip insulator pin.

It combines several important advantages, as follows: It does away with the necessity of boring holes in the cross-arms, thereby conserving the whole strength of the arm and lengthening its life; the metal composing it is distributed in the most effective manner possible, as its cross section is greatest next to the arm where the greatest resistance to bending is required. Finally, the shrinkage of the arm can more effectively be taken care of by the U-bolt and strap than by any of the other forms of pin fastening in common use, as there is no tendency to distort the bolt, and consequently there is no possibility of the pin standing crooked upon the arm after the shrinkage has been taken up. Furthermore, it is practically indestructible, and instead of being one of the weakest factors in line construction, this pin is expected to be the strongest.

More than 8000 of the pins, as originally designed and shown in the accompanying illustration, were used in the transmission line construction of the Long Island Railroad, carrying 250,000 circ. mil cables in spans averaging 150 ft. in length, and no failures have yet been reported after over a year of service. A dozen or more standard sizes of the improved design are being worked up to fit several sizes of cross-arms and pole tops, and to carry insulators of varying sizes up to the highest voltages in practical use. The pins will be made of either cast or malleable iron. While it is designed particularly for use with wooden cross-arms, it can readily be adapted to steel cross-arms, and to such special fixtures as are often necessary in heavy transmission line construction.



GRIP TYPE INSULATOR PIN

ELECTRIC LOCOMOTIVE AT ATLANTIC CITY

One of the 100-ton electric locomotives which the General Electric Company and the American Locomotive Company are furnishing for the electrification of the New York Central lines in New York City arrived in Atlantic City June 8 from Schenectady, N. Y. During the attendance this month at various electrical and railroad conventions, prominent offi-

ELECTRIC LOCOMOTIVE EXHIBITED AT ATLANTIC CITY

cials from all parts of the country will have an opportunity to inspect the locomotive. Its capacity under ordinary working conditions is 2200 hp, and it is said to be able to develop a speed of 80 m. p. m. when in regular operation. The locomotive is the same type as the famous "6000" which has many times distanced its steam competitor while working out on the test track on the New York Central road near Schenectady, but bears on its side the number 3404 and the inscription "New York Central Lines."

The electric locomotiive is primarily on the ground to serve as an actual example of what many of the master mechanics will soon encounter in their daily work.

FINANCIAL INTELLIGENCE

WALL STREET, June 13, 1906.

The Money Market

Increasing ease characterized the money market in all its branches during the past week. The heavy receipts of funds from San Francisco and the expected arrival of large amounts of money from other sources in the near future were reflected in a further material decline in interest charges for all maturities. Money on call, which loaned as high as 5 per cent in the preceding week, was obtainable in quantities during the current week at 3½ per cent and 3 per cent. Asking rates for time accommodations ruled fully ¼ per cent below those prevailing a week ago, and even at the reduced quotations borrowers were not inclined to enter the market upon a large scale. The demand for money was principally for over the year, which was supplied at 5 per cent. Lenders generally experienced considerable difficulty in placing short-time loans, this probably being due to the fact that contracts made for sixty and ninety days would carry the borrower well into crop moving season, when renewals would be difficult, except at materially higher rates. At the present time there is nothing in the situation calculated to cause any disturbance in the market. The demand for money for stock speculation is very light, while the banks continue to strengthen their resources by the influx of funds from all parts of the country. In addition, Government disbursements on account of pensions are expected to be larger during the balance of the month, and arrivals of gold from the Klondike will soon materially increase the supply of funds at this center. The latter movement has already begun, and it is estimated that between $30,000,000 and $35,000,000 gold will come from the Klondike and Alaska this summer. It is expected that final arrangements for floating the $50,000,000 Pennsylvania loan in Paris will be completed in a few days, and this will divert a strain to which the local money market would otherwise have been subjected. Foreign exchange has ruled decidedly strong, owing to the extremely light supply of commercial bills and other classes of remittances. The European markets have ruled easy, but without important changes in discount rates. The bank statement, published on last Saturday, was rather disappointing. Loans were $7,619,400 larger than in the preceding week, while deposits increased $10,384,300. The gain in cash was $2,942,100, but as the expansion in deposits caused an increase of $2,596,075 in the reserve required, the surplus was increased by only $346,025. The surplus reserve now stands at $7,162,050, as against $6,816,025 in the previous week, $9,827,500 in the corresponding week of last year, and $35,562,400 in 1904.

The Stock Market

The stock market during the past week has been very irregular, and the price movement has reflected the conflicting opinions regarding the ultimate outcome. Throughout the week the market has been influenced almost entirely by crop reports. For a time there was considerable apprehension that the Government crop report would be unfavorable, but the publication of this on Monday last showed the condition of winter wheat to be 83 per cent, as against 91 per cent on May 1, 86 per cent on June 1 of last year, 78 per cent on June 1, 1904, and 78 per cent as a ten years' average. The publication of the report was followed by a higher range of values, but toward the close of the week there was heavy selling of stocks by Western houses which caused sharp reactions. This selling was based largely upon the belief that both the wheat and corn crops have suffered since the compilation of the Government figures. This belief was also shared by the grain trade, prices for both wheat and corn advancing sharply at the close. A noteworthy feature of the week was the pronounced strength in St. Paul, which was accompanied by reports that the company will issue stock or bonds to finance the Pacific Coast extension, and that this issue will carry important rights to the stockholders. General conditions continued encouraging. Railroad earnings show gratifying increases over those for the corresponding period of last year, and the great activity in the iron and steel trades continues unabated. Money is cheap and in plentiful supply, and apart from a flurry in rates at the close of the month, as a result of the July 1 interest and dividend disbursement, there is nothing in the monetary situation to carry any material change in the rates for either call or time loans. The general market was dull, however, and failed to respond to these influences. Taking the situation as a whole there is no good ground for pessimism. The banking interests are indifferent, and operations are confined largely to the speculative element.

The local traction stocks ruled quiet but firm, especially Brooklyn Rapid Transit, which advanced on increased earnings and reports of a dividend on the stock in the near future. The other traction issues also displayed moderate strength on reports of larger earnings.

Philadelphia

Greater activity developed in the traction issues during the past week, but the dealings were accompanied by generally lower prices. Philadelphia Rapid Transit was again the leader of the group, about 2500 shares changing hands at from 25½ to 25. Philadelphia Company's issues displayed some strength early in the week, the common rising to 52, but toward the close there was a reaction to 50½, a net loss of ½ for the week. The preferred held steady, several hundred shares selling at 49⅛ and 49¼. A meeting of the stockholders of the company has been called for August 14, to ratify an increase in the capital stock from $36,000,000 to $42,000,000, by issuing 120,000 shares of the par value of $50 each. The proceeds of the new stock will be used for improvements, etc. The company has declared the usual quarterly dividend of 1½ per cent on the common stock, payable on Aug. 1. Fairmount Park Transportation sold at 17½, and small amounts of Consolidated Traction brought 82. Philadelphia Traction held firm at 98¾; Union Traction displayed decided strength. Early transactions were made at from 63¼ to 63¾. Later transactions were at 62½ and 63, ex. the dividend of $1 per share, which is equivalent to an advance of ½ point. American Railways also displayed considerable firmness, the price rising to 52¾ and closing at 52½, a net gain of 1⅛ points. Other sales included United Railway Investment of San Francisco at 65⅞, Railways General at 6¾, and United Traction of Pittsburg preferred at 51.

Chicago

Interest in the Chicago market centered largely in the elevated issues, nearly all of which advanced sharply on a somewhat larger volume of business. Metropolitan common rose 3 points to 30 on the purchase of 600 shares, while the preferred stock advanced 2 points to 72, on the exchange of nearly 1000 shares. South Side Elevated ruled 1½ higher at 98. Northwestern common jumped up 2 points to 28, and the preferred stock ended the week with a gain of 3 points. Chicago & Oak Park common brought prices ranging from 6¼ to 6⅞, while the preferred advanced from 22 to 24. The shares of the surface lines were extremely quiet, but prices held firm. North Chicago rose from 47¾ to 49, but reacted a point at the close. West Chicago was practically unchanged, with sales at 37 and 37¼, but Union Traction was firmer with transactions at 5½ and 5⅛.

Other Traction Securities

In the Baltimore market United Railway incomes furnished the leading feature of the trading, upwards of $235,000 changing hands at from 72½ to 73⅝, a net gain of more than a point. It was reported that a plan was being considered by banking houses by which sufficient money could be raised to pay off the accrued interest on the income bonds, which now amounts to about $1,400,000, and also to provide for a sufficient sum to put the property in good physical condition. The income bond certificates were also stronger, $70,000 changing hands at prices ranging from 71¼ to 72⅛. The 4 per cent bonds were quiet and steady, $40,000 selling at 92¼ and 92½. United Railway free stock sold at 16⅛ for 200 shares, and 400 shares of the pooled stock brought 16⅛ and 16⅜. Other transactions included Norfolk Railway & Light 5s at 99, Charleston Consolidated Electric at 95½, and Macon Street Railway & Light 5s at 101.

Apart from the unusual activity and pronounced strength in the Massachusetts Electric shares, the Boston market was devoid of noteworthy feature. Massachusetts Electric common opened at 20¾, and on purchases of about 6000 shares the price rose to 23, while the preferred stock moved from 70½ to 73, on the exchange of more than 4000 shares. Otherwise the trading was quiet. Boston & Suburban common moved between 21½ and 22¾, and the preferred sold at 70 and 70½. Boston & Worcester common sold at 35 and 37 for odd lots, and the preferred brought 87½ and 88. Boston Elevated was steady at 153. West End common sold at 97½, and the preferred at 112.

Cincinnati, Newport & Covington Traction continues to be the active feature of the Cincinnati market. About 600 shares changed hands at practically stationary figures, 73½. Cincinnati Street Railway sold at 144, a fractional advance. Cincinnati, Dayton & Toledo declined a quarter to 26¼. Toledo Railways & Light was stationary at 34.

There was comparatively little activity in tractions in Cleveland. Aurora, Elgin & Chicago was the most active issue, the common selling at 35 and the preferred around 79½. These figures are in keeping with the past sales. Northern Ohio Traction & Light was a shade off in spite of the dividend announcement of last week. Several lots sold at 30, a decline of 2 points. Cleveland Electric continues quiet, selling at 79 to 79½. Lake Shore Electric sold at 16 for several lots of a fractional decline.

Toledo & Western was quite active in Toledo on the announcement that Mathew Slush had been unable to buy control of the stock at 15. It advanced steadily from 15½ to 18, and closed the week at 19 bid and 20 asked. The 5 per cent bonds of this company sold at 89½.

Security Quotations

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

	June 6	June 13
American Railways	51½	52½
Boston Elevated	153	151
Brooklyn Rapid Transit	84	84⅛
Chicago City	170	170
Chicago Union Traction (common)	4½	4⅞
Chicago Union Traction (preferred)	13	13
Cleveland Electric	81	80
Consolidated Traction of New Jersey	81½	81½
Detroit United	94	95
Interborough-Metropolitan Co. (common)	50¼	51
Interborough-Metropolitan Co. (preferred)	84	85
Interborough-Metropolitan Co. 4½s	—	—
International Traction (common)	59	58
International Traction (preferred), 4s	80	80
Manhattan Railway	152	151
Massachusetts Elec. Cos. (common)	20⅝	22⅜
Massachusetts Elec. Cos. (preferred)	70⅜	73⅝
Metropolitan Elevated, Chicago (common)	27½	29
Metropolitan Elevated, Chicago (preferred)	69½	70
Metropolitan Street	a114	112
Metropolitan Securities	—	—
New Orleans Railways (common)	32	32½
New Orleans Railways (preferred)	80	82
New Orleans Railways, 4½s	88¾	89¼
North American	98	97
North Jersey Street Railway	27	27
Philadelphia Company (common)	51	51
Philadelphia Rapid Transit	25½	24¾
Philadelphia Traction	98½	99
Public Service Corporation 5 per cent notes	95¼	95½
Public Service Corporation certificates	69	69
South Side Elevated (Chicago)	96½	98
Third Avenue	129¾	128
Twin City, Minneapolis (common)	115¼	114⅛
Union Traction (Philadelphia)	63	*63
West End (common)	—	—
West End (preferred)	—	—

a Asked. * Ex-dividend.

Metals

The "Iron Age" says that so far as stocks of iron are concerned, it may be stated, with the reserve which the absence of official statistics from the East and Central West imposes, that accumulations are very light. Consumption is keeping wonderfully close to an enormous production. Some wild reports of large sales of Bessemer pig for forward delivery have come from Pittsburg, which prove to be incorrect, at least so far as the United States Steel Corporation is concerned. That interest has not purchased more than trifling quantities for the third quarter. Only a moderate business for forward delivery is being done in foundry iron. The markets for structural material are rather quiet.

Copper metal continues firm at unchanged prices. Lake copper, 18¾ and 18⅞c.; electrolytic, 18⅜ and 18⅝c.; castings, 18¼ and 18⅜c.

ENTERTAINMENT PROGRAMME FOR NEW YORK STATE CONVENTION

In connection with the annual convention of the Street Railway Association of the State of New York, to be held at Saratoga on Tuesday, June 26, and Wednesday, June 27, the association has decided upon the following entertainment programme.

On Tuesday afternoon there will be a carriage drive in and near Saratoga for the ladies, and on the evening of that day the banquest will be held. There will be a trolley ride and luncheon on Wednesday morning, and a dancing party in the ball room of the Grand Union Hotel on Wednesday evening. For Thursday an excursion has been planned to the General Electric Works for such of the delegates and guests who desire to remain for the same. Luncheon will be served at the General Electric Company's works.

IMPORTANT JERSEY DECISIONS

The Supreme Court at Trenton, N. J., held June 11, that the suit of Jersey City against the North Jersey Traction Company should not be pressed, because the company's charter is plainly not void. The city said the charter was void. The court holds an act extending the charter legal, and also that even if this were not the case the company could legally operate under the traction act. The city has several other actions pending by which it expects to regain the franchises granted thirty and forty years ago.

The Supreme Court also gave a decision holding that a person or corporation liable to a franchise tax for the use of the public streets under the act of 1900 is not liable to a property tax on the same property. Jersey City claimed the right to tax the properties of the Public Service Corporation. The company, under the act of 1900, pays a license tax for the right to use the highways. The city claimed the further right to tax the real value of the tracks and rolling stock. This, the court holds, cannot be done.

HIGH-VOLTAGE DIRECT-CURRENT LINES ON THE CONTINENT

In view of the experiments now being made in this country with direct-current motors using potentials above the present standard, it is interesting to note that in Germany and other countries, the Siemens-Schuckert Works have completed, or have under construction, a number of lines of this character. At the present time they are building several lines exclusive of the 1000-volt Cologne-Bonn Railway, which was described in this paper recently, and the Berlin elevated and subway lines, which use 800 volts.

One contract covers various branches of the Cologne suburban lines, which are to employ 700-800 volts direct current. On the Castellamare de Stabia-Sorrento (Italy) line, an operating current of 825 volts will be used, and also one of 750 volts at the center of the line. This system will be 19.4 km (12 miles) long, have a 950-mm (3 ft. 1½ ins.) gage, and with a maximum grade of 6.2 per cent and a minimum curve of 15 m (49 ft.). The highest speed at which cars will be run will be 30 km (18.6 miles) per hour. Current will be taken through trolley bows. At present there are twelve cars in operation, carrying 50-hp motors. Another line under construction is the Moselhütte Freight Railway (Maizieres-St. Marie). It will be 14.5 km (9 miles) long, and will use 2000 volts direct current. A freight railway is also being built for the Anhalt Coal Works, Reppist, near Senftenberg. This is to be a 900-volt line, 6.5 km (4 miles) long, 1435 mm (4 ft. 8½ ins.) gage with a grade of 1 per cent.

NEW ORDINANCE DRAFTED FOR THE SETTLEMENT OF THE CHICAGO TRACTION PROBLEM

Walter L. Fisher, special counsel on traction matters, has drafted an ordinance which embodies a plan for bringing about a settlement between the city and the street railway companies, and which has met with the approval of Milton J. Foreman and other prominent Aldermen. Mr. Fisher's plan is for the city to deal directly with the Chicago City Railway Company, and another termed in the draft of the ordinance the Unified Street Railway Company, which is to take over the properties of the Union Traction Company and its underlying companies. The proposed ordinance provides that the two companies shall proceed at once to reconstruct the tracks and roadbeds and put the entire systems in first-class condition. As long as they operate the systems, the companies are to expend certain amounts in renewals and repairs, and if the amounts specified are not expended in repairs, the balances are to be deposited with a trust company. The city has reserved the right to purchase and take over the properties of the systems on the first day of January, or the first day of July, upon giving at least six months' previous notice of its intention to do so. The plan provides for the immediate determination of the value of the physical properties, and also of the value of the franchises and rights, and these figures together with the costs of reconstruction and re-equipment of the lines are to be used in determining the purchase prices to be paid by the city for the lines. All the work of reconstruction and re-equipment is to be supervised and directed by a board of supervising engineers. The city also reserves the right to designate any person, firm or corporation as its licensee to purchase the systems at the expiration of twenty years upon the same terms that the city could purchase them. Of the gross receipts the railway companies shall first pay the costs of operation, maintenance and extensions and of the balances a certain per cent of the value of the present tangible properties is to be retained by the company. The remainders of the gross receipts are to be divided between the city and the companies in proportions to be decided upon.

At a meeting of the various Chicago traction interests in New York, an agreement was reached and formal action taken which will help materially to unravel the traction situation. Interests identified with the Chicago Union Traction Company and the North and West Chicago Street Railway Companies purchased and turned over to two trustees the stock of the Chicago Railways Company, which will be the parent company in the new scheme. Frederick H. Rawson, president of the North and West Chicago Street Railway Companies, was elected president of this parent company, while Henry H. Blair, receiver of the North and West Companies, was elected its vice-president. The Chicago Railways Company was organized some little time ago with a nominal capital of $10,000 for the purpose of holding the securities of the other companies and operating these companies. Under an agreement reached on May 25 last, between the various parties at interest, including the banking house of H. B. Hollins & Company, of New York, and representatives of the North and West Chicago Street Railway Companies, the stock of the Chicago Railways Company will be held in trust by George W. Wickersham, representing the New York interests, and L. C. Krauthoff, the representative of the Chicago traction interests. The present nominal capital of $10,000 of the Chicago Railway Company will be increased to whatever extent may be subsequently deemed necessary when full details are worked out in connection with the reorganization and the exchange of securities of this company for those of the Chicago Union Traction and the North and West Chicago Street Railway Companies. It has been agreed that the trustees shall formulate and promulgate a plan for this reorganization and financing, which, when formulated, shall be operative and binding. If the trustees themselves fail to agree upon such a plan, the Circuit Court of the United States for the Northern district of Illinois is to become practically the arbiter in the situation. The final plan for the distribution of any allotment of stock or securities to stockholders of the North and West Chicago Street Railway Companies or the Chicago Union Traction Company is to be submitted to Hollins & Company, and Henry H. Blair, Frederick H. Rawson, and George E. Adams, and upon its acceptance by them is to become binding. In the case of any dissent the final allotment may ultimately be determined by the decree of the Circuit Court of the United States for the Northern district of Illinois, as in the case of the reorganization plan itself. While all the negotiations regarding ordinances, under which the new company will operate the present traction systems, are to be conducted primarily by President Rawson, of the new Chicago Railways Company, and Vice-President Blair, the trustees of the Chicago Railways Company stock, Messrs. Wickersham and Krauthoff, will be represented in these negotiations by their counsel, W. W. Gulliver.

AN IMPORTANT JERSEY PROJECT

In accordance with the recent law passed by the State Legislature, a public hearing was given at the meeting of the Common Council of Summit, N. J., on June 5, to the Morris County Traction Company, which is applying for a forty-year franchise. The company wishes a feasible route to pass through Summit in order to get to Morristown and Dover, and so form connecting links between Dover, Morristown, Summit, Newark and Elizabeth. The line is completed and cars are in operation between Summit, Springfield and Union, the tracks having been laid about a mile in Summit's territory on a private right of way. At the conclusion of the hearing a motion was adopted referring the matter to the trolley committee of the Council, to report the necessary ordinance at the next meeting of Council.

F. H. Alleman, superintendent of the company, says he expects to have a full schedule running between Summit and Elizabeth within four months' time. When the entire line is completed there will be 104 miles of tracks, made up in sections as follows:

Dover division, Tabor to Stanhope, 20 miles; Morristown division, Tabor to Summit, 18 miles; Paterson division, Denville to Singac, 17 miles; Elizabeth division, Summit to Elizabeth, 9 miles; Newark and Westfield division, Springfield to Newark and Springfield to Westfield, 10 miles. The line will connect with the Easton Railroad at Stanhope, and with the Public Service Corporation at Elizabeth and at Paterson. At Maplewood it will connect with the Orange and Newark branch of the Public Service, and at Westfield with the Plainfield branch of the Public Service and with the Jersey Central Railroad. Private right of way has been secured wherever possible, and up to date the franchises obtained have been perpetual. The officers of the company are: Robert D. Foote, of Morristown, president; D. P. Skellenger, of Morristown, vice-president; D. L. Kay, of Morristown, treasurer; F. H. Alleman, of Summit, secretary and general manager; former Judge W. W. Cutler, of Morristown, counsel.

NEW YORK TRANSIT COMMISSION CONSIDERS BROOKLYN PROSPECTS

At the meeting of the Rapid Transit Commission of New York on Thursday, June 7, matters were considered that are largely of interest to Brooklyn. The first subject discussed was the question of the probable time of the completion of the Brooklyn tunnel. Mayor McClellan expressed concern as to the finishing of this work, because of the recent accident, to which reference has been made before in these columns. Mr. Rice, the chief engineer of the Commission, said most emphatically that in his opinion work would be completed by Jan. 1. The board then proceeded with other business. It formally approved of the loop terminal for the Coney Island subway. This will now be returned to the Board of Estimate, where it will be approved. Albert B. Boardman reported that, on June 18, the courts would confirm the reports of the commissioners on the Brooklyn routes. If all were well with the Manhattan routes, this would remove the last obstacle in the way of putting up the routes for bidders, but the opposition to the line through William Street, which is really the key to the Brooklyn system, is quite as active as ever, and on this account a further delay of the Brooklyn lines is not unlikely.

F. H. Behr, promoter of the Behr monorail system, appeared before the commission and explained the merits which he claims for his system. Mr. Behr said his proposition was to construct an elevated line from Flatbush and Atlantic Avenues to Coney Island. He said he had the money pledged for this line, and would not ask the city to put up a cent. The running time between these points, he said, would be substantially 8 minutes, the cars running at a speed of 60 miles an hour. Alternate cars will stop at alternate stations, so the service at way stations will be on an 8-minute headway, while cars will leave Flatbush Avenue every 2 minutes. Mr. Behr said he would build a loop line tapping Coney Island and going over the Williamsburg Bridge in less than one year. He offered in evidence letters written by William Barclay Parsons, late chief engineer of the Rapid Transit Commission; Gustave Lindenthal, late Bridge Commissioner, and Joseph Ramsey, Jr., the well known railroad engineer, all indorsing the plan.

DEAL COMPLETED FOR LINE FROM PITTSBURG TO WHEELING

Announcement has been made of the consummation by W. Caryl Ely, of Buffalo, and his associates, as the Ohio Valley Finance Company, of the plan to secure a through electric railway line in the Ohio Valley from Pittsburg to Steubenville and eventually to Wheeling. According to the statement issued the merger has been perfected connecting up the lines from Steubenville to Beaver, Pa. Connection from Beaver will be made via the Pittsburg Railways Company, which is now building a double track line to the former point. The plans were all completed some time since and the work of construction is now well under way on the double-track lines that will, eventually, by means of the proposed extension of the Pittsburg Railways company, mean trolley service from Wheeling to Pittsburg. The East Liverpool Traction & Light Company, the Ohio River Passenger Railway Company, with a Pennsylvania charter, to build 11.17 miles of track, and the Steubenville & East Liverpool Railway & Light Company, to build 8 miles of track to connect with the lines of the Steubenville Traction & Light Company at Toronto, are the companies closing up the gaps. All told, the companies, of which the officers are identical, control and will operate 66 miles of river front electric railway with easy curves and low grades, the maximum being not over 1½ per cent. The lines will serve a population of about 225,000 people. The capital interested has purchased the East Liverpool Traction & Light Company, owning the street railway lines in East Liverpool and Wellsville, Ohio, and Chester, W. Va., with the bridge over the Ohio River, and the summer resort of Rock Springs Park, W. Va., the entire system being about 12 miles in length. These lines will connect at the State line with the lines of the Ohio River Passenger Railway, now being built, a distance of 11.17 miles, passing through the new town site of Midland to Beaver, where connection will be made with the lines of the Beaver Valley Traction Company. Steubenville is now the terminus of another line connecting on the West Virginia side of the river with Wheeling, W. Va., and there is being constructed on the Ohio side a line connecting Steubenville with Wheeling, which when completed will make a double-track line from Steubenville to Wheeling. It is expected that all these connections and improvements will be completed by next year, when continuous trolley service will be inaugurated between Wheeling and Beaver. The syndicate also owns the right of way for a line from East Liverpool to Lisbon, Ohio, where connections are made with the Youngstown & Ohio River Railway Company's lines and through them with the interurban lines in Ohio and Indiana, and the great trunk lines running between Buffalo and Cleveland and other towns along the lake shore, both east and west.

ELEVATED RAILROAD RECOMMENDATIONS FROM THE RAILROAD COMMISSIONERS

The State Railroad Commissioners of New York have made a number of important recommendations regarding improvements to the elevated lines of the Interborough Rapid Transit Company. Most important among them are those that call for additional tracks. The recommendations are these:

1. That the Interborough Rapid Transit Company, operating the Manhattan Railway, extend the spur of the elevated structure now ending near the junction of Willis Avenue and 145th Street through Willis Avenue to Bergen Avenue to Westchester Avenue, there connecting with the tracks of the elevated extension of the subway system.

2. That a third track be placed on the Second and Third Avenue lines from the Harlem River as far south as practicable.

3. That additional track or tracks be constructed from 129th Street north to Bedford Park.

4. That when the above-mentioned tracks are constructed an express service shall be installed on the Second and Third Avenue lines, which shall be operated during the entire day, a portion of which trains shall be run to and from West Farms.

The Board suggests to the Interborough Rapid Transit Company that it institute an express service to be operated all day between West Farms and the City Hall via the subway.

While this communication, with its findings, suggestions and recommendations, is primarily intended for the Interborough Rapid Transit Company, a copy is forwarded to the Board of Rapid Transit Commissioners, with the respectful suggestion that such action as is necessary to make these recommendations effective be taken by the Rapid Transit Commission.

'BUS LINE FOR PHILADELPHIA

A bill authorizing the Department of Public Works of Philadelphia, to issue licenses to the People's Vehicle Company for operating an automobile 'bus line in the city has been approved by Councils' highway committee. According to the bill, the rate of fare will be 5 cents, six tickets to be sold for 25 cents and twenty-five for $1. Public school children will be carried for a 2-cent fare on Saturdays, between 8 a. m. and 4 p. m., on all vehicles running to and from Fairmount Park. They will also be carried for the same fare on other days between 9 a. m. and 3 p. m., when accompanied by their teachers. The company agrees to pay a license fee of $100 for a vehicle having a seating capacity of twenty passengers, $150 for a thirty and $200 for a forty-passenger omnibus. A thirty-year franchise is desired, with the understanding that the city may at the termination of that period renew the franchise for a like time or acquire the stock of the concern at its appraised value. The bill provides for the installation of auto-omnibuses on the following streets:

Broad Street, from League Island to the city line and return.

Market Street, from Broad to the Delaware River and return.

Delaware Avenue, from Callowhill to Dock, Dock to Third, Third to Market, both ways.

Diamond Street, from Front to Ridge Avenue, to Dauphin, to Park entrance and return.

Hunting Park Avenue, from Broad Street to Hunting Park and return.

The Parkway, from Twenty-Sixth Street to Broad, to Locust Street, to Fourth, to Walnut, to Delaware Avenue; return on Walnut to Broad, to Parkway, to Twenty-Sixth Street.

Aspen Street, from Haverford Avenue to Lancaster Avenue, to Hamilton, to Thirty-Second, to Spring Garden, to Broad, to South Penn Square; return to Spring Garden, to Lancaster Avenue, to Aspen, to Haverford Avenue.

Forty-First Street, from Parkside Avenue to Lancaster Avenue, to Thirty-ninth, to Walnut, to Broad, to Filbert; return to Walnut, to Fortieth, to Parkside Avenue, to Forty-First Street, with the privilege of using such other streets as are necesary to reach barn or garage.

PLAN TO ELECTRIFY MARYLAND & PENNSYLVANIA

It is reported in Baltimore that the General Electric Company has been engaged by the Maryland & Pennsylvania Railroad to report regarding the electrification of the company's line, which extends from Baltimore to York, Pa., a distance of 79 miles. Gen. Brown, of the company, is quoted as stating that at present perhaps the line may be electrified only as far as Belair, a distance of about 25 miles.

GRATUITY FOR MANILA EMPLOYEES

On April 1, 1906, the Manila Electric Railway & Light Company set aside a certain sum of money for the purpose of rewarding faithful, efficient and continuous service on the part of the motormen and conductors. The circular announcing the gratuity, which was posted conspicuously, says: Every regular motorman and regular conductor in the employ of the company on April 2, 1906, and who shall remain in the employ of the same for six months continuously thereafter, rendering faithful and efficient service, shall receive as a gratuity a sum equal to one and one-half centavos per hour for each hour of service rendered during the months of April, May and June of the same year; and every three months thereafter shall receive a like gratuity while so employed, provided he shall continue to render efficient service.

Regular motormen and conductors are those who have a car assigned to them daily, and extra motormen and conductors are those who take the places of regular motormen and conductors when absent. Regular motormen and conductors only are eligible to receive this.

On the first day of each month, after April 1, every motorman and conductor who shall have become a regular motorman or regular conductor during the preceding month, shall be eligible to receive the gratuity after six months' continuous service.

This gratuity will not be presented to any employee who shall have been discharged, or who voluntarily leaves the service.

In the event of the death or the permanent disability of motorman or conductor the gratuity will be presented to his estate or himself, as the case may be.

CANADIAN ASSOCIATION MEETS

The semi-annual meeting of the Canadian Street Railway Association was held at Chateau Frontenac, Quebec, last week. W. G. Ross, Montreal, presided, and these companies were represented: London Street Railway Company, Southwestern Traction Company of London, Niagara, Toronto & St. Catherines Railway Company, Toronto Railway Company, Toronto & York Radial Company, Toronto Suburban Railway Company, Montreal Street Railway Company, Quebec Street Railway Company, Halifax Street Railway Company, St. John (N. B.) Street Railway Company. Among the papers read was that by Mr. Neilson, Toronto, on track construction and maintenance of way, and the one on gasoline-operated motor cars.

REFERENCE BOOKS FOR ELECTRICAL ENGINEERS

The electrical engineering department of Sibley College has recently issued a bulletin giving a list of reference books for electrical engineers, which have been selected in conference with the leading teachers of electrical engineering and with a number of prominent practicing engineers. Each book represents the judgment of a number of persons, and the list is arranged in order of the number of votes cast. The list has been condensed so as to include only those books which are deemed most useful to a young engineer leaving a technical school. It is proposed to issue this list annually for the benefit of each senior class.

Electric Lighting—"Electric Lighting," F. B. Crocker, two volumes, $6.00; "The Art of Illumination," Louis Bell, $2.50.

Electric Railways—"Electric Railways," Ashe & Keiley, $2.50; "Electric Railway Economics," W. C. Gotshall, $2.00; "Power Distribution for Electric Railways," Louis Bell, $2.00; "Practical Electric Railway Handbook," A. B. Herrick, $3.00; "Engineering Preliminaries for Interurban Electric Railways," E. Gonzenbach, $1.00; "Report of the Electric Railway Test Commission," $6.00.

Telephony—"Telephony," A. V. Abbott, six volumes, $6.00; "American Telephone Practice," K. B. Miller, $4.00.

Power Generation and Transmission—"Electric Power Transmission," Louis Bell, $4.00; "Electric Transmission of Energy," A. V. Abbott, $5.00; "Storage Battery Engineering," Lamar Lyndon, $3.00; "Electrical Conductors," F. A. C. Perrine, $3.50; "High-Tension Power Transmission, A. I. E. E. and International Electrical Congress Papers," two volumes, $5.50.

Design and Construction of Electrical Machinery—"Design of Dynamos," S. P. Thompson, $3.50; "Electric Motors," H. M. Hobart, $5.00; "Induction Motors," B. A. Behrend, $1.50; "Alternating Currents," Alfred Hay, $2.50; "Practical Calculations of Dynamo Machines," A. E. Wiener, $3.00; "Armature Windings of Direct-Current Dynamos," E. Arnold, $2.00; "Induction Motors," B. de la Tour, translated by C. O. Mailloux, $2.50.

Measurements—"Testing of Electro-Magnetic Machinery," Swenson and Frankenfield, $3.00. "Electrical Engineering Measuring Instruments," G. D. A. Parr, $3.50; "Electrical Instruments," Carhart and Patterson, $2.00.

General Practical Works—"Electrical Engineers' Pocketbook," H. A. Foster, $5.00; "Mechanical Engineers' Pocketbook," Wm. Kent, $5.00; "Standard Polyphase Apparatus and Systems," M. A. Oudin, $3.00; "Mechanical Engineers' Reference Book, P. B. Supplee, indexed $5.50, not indexed, $5.00; "Steam Power Plants," H. C. Meyer, $2.00; "Practical Management of Dynamos and Motors," Crocker & Wheeler, $1.00; "Laboratory and Factory Tests in Electrical Engineering," Sever and Townsend, $2.50; "Electrical Engineering," E. Rosenberg, $1.50; "Central Electrical Stations," C. H. Wordingham, $7.50.

General Theoretical Works—"Theoretical Elements of Electrical Engineering," C. P. Steinmetz, $2.50; "Alternating Current Phenomena," C. P. Steinmetz, $4.00; "Alternating Currents," Bedell and Crehore, $2.50; "Alternating Current Engineering," E. B. Raymond, $2.50; "Elementary Lessons in Electricity and Magnetism," S. P. Thompson, $1.40; "Cyclopedia of Applied Electricity," American School of Correspondence; "Dynamo Electric Machinery," S. P. Thompson, $7.50; "Elementary Book on Electricity and Magnetism," D. C. and J. P. Jackson, net $1.40.

The most valuable reference books are the volumes of transactions of the engineering societies. It is suggested that students in electrical engineering join the A. I. E. E. either as students or associates. The value of the engineering periodicals also should not be overlooked.

THE RIGHT TO CHARGE EXCESS FARE ON LIMITEDS TO BE TESTED

The rights of interurban companies to charge excess fare on limited cars are to be tested in Indiana. N. A. Ward recently purchased a ticket at New Castle for Indianapolis over the Indianapolis & Eastern Company's line, which was stamped "not good for stopovers." After riding over the spur from New Castle to Dunreith he was required to change cars, and the first car that came on the main line was a limited, on which Mr. Ward took passage. The conductor, however, refused to accept the ticket unless 15 cents excess fare was paid. Mr. Ward refused to pay and was ejected. It is expected that this case will result in the handing down of a decision that will finally settle the question.

PECULIAR RULING BY OHIO ROAD COMMISSION

Traction companies in Ohio are likely to experience some difficulty in the future in securing right of way along the highways through the country districts of that State by reason of a ruling made by the State Highway Commissioner. The Commissioner has just rejected a number of applications for funds for road improvements, because portions of the highway are occupied by traction lines, and he says he will adhere to this policy of not allowing improved roads where the people have shown that they care more for trolley lines than for good roads. He claims that where trolley lines are located in such a manner as not to permit a ditch between the two, thus making them independent, it is impossible to maintain a satisfactory highway; that traction lines are usually built and repaired without due reference to the grades of the highway, and believes it inexpedient to improve such highways under State aid. He cites that New York, New Jersey, Massachusetts and Maryland have improved no roads where trolley lines are located on the traveled way, and when on the side of the road a trolley line must be so located that the two are independent of each other.

Fortunately for all concerned, the majority of new traction lines in Ohio have been built on private right of way, and in a great many cases the old roads are throwing their lines off from the highway to private right of way at the side of the road.

SOME EXCELLENT TRAFFIC CIRCULARS

There are three folders in this year's issue of pleasure pamphlets issued by the Boston & Northern and Old Colony Street Railway Companies, through their passenger department, for distribution among the patrons of the road. One of the folders is devoted expressly to the many parks and groves and beautiful recreation points along the lines of the two divisions of the road. The other two, which comprise within their pages schedules and time-tables as well as descriptive articles and rustic scenes, are devoted, one to the Boston & Northern division and one to the Old Colony division. The pamphlet descriptive of parks and groves is appropriately named "Parks and Groves." This folder contains instructive information and beautiful views. On the cover is a sketch showing a family, father, mother and little child, entering the gates of a park. The Old Colony folder is named "Old Colony Trolley Trips." Naturally the first thing to attract the attention is the beautiful cover. Standing high up on a great rock is shown the famous Indian chief immortalized by the poet Whittier, whose tribe, the Massasoits, once roamed and hunted the region now covered by the network of the modern trolley system. In full regalia he stands, overlooking silently the hills and great valleys and meadows of the South Shore. At his feet sweeps a beautiful lake. The folder, called "Trips by Trolley," is, from an external viewpoint at least, a complete contrast to the former. Portrayed on the cover is a typical modern mill city on the Merrimac. Standing a little apart on a rise of land, hat in hand and gun on shoulder, is an old-time colonist. Near him, among great trees stands his log cabin, and he gazes out, wonderingly, upon the city. Both of these folders are filled with descriptions of the many beautiful rides on the old South Shore and the rugged North Shore.

Still another circular, less elaborate than the others, describes a trip from Boston to New York by trolley and boat at a fare of $1.75. Through trolley cars are run between Boston and Fall River, where connections are made with the boats of the Enterprise Transportation Company. This service was begun June 11. The run from Boston to Fall River is made in 3 hours.

CONTRACT LET FOR BUILDING THE CLEVELAND, ASHLAND & MANSFIELD COMPANY'S LINE

The Cleveland Construction Company, of Cleveland, has been awarded the entire contract for building and equipping the line of the Cleveland, Ashland & Mansfield Traction Company. This road will be an extension of the Cleveland & Southwestern Traction Company system branching off from the southern division of that road at Seville and extending to Ashland and Mansfield. The new line to be constructed will be about 46 miles in length. It will be built entirely on private right of way except through villages. The Cleveland Construction Company is to commence work within sixty days, and will close contracts for construction work and material immediately. Track will be laid with 70-lb. T-rail, 60-ft. length in the country and 74-lb. 7-in. T-rail on paved streets. There will be approximately 362,450 yds. of excavating, and about 122,000 ties. Some 8050 soldered bonds will be required for the track work. Six inches of gravel or crushed stone ballast will be laid. The right of way will be fenced and vitrified, clay cattle guards will be used. There will be nine timber bridges of from 98 to 136 ft, and three girder spans 60 to 80 ft. long. The trolley wire will be two 000 figure 8, with bronze ears. Direct-current feeders will be 300,000 cm., and the high-tension lines No. 2 and No. 4. There will be approximately 87 miles of trolley wire, 12 miles direct-current feeders, 48 miles No. 2 and 126 miles No. 4 wire.

No power station will be built, and high-tension current will be sent from the Elyria power station of the Cleveland & Southwestern Traction Company over two circuits. There will be a cross-country line from the Wellington branch of the system to Polk on the new line, a distance of 16 miles, while another feeder will connect with the southern division of the Cleveland & Southwestern at Seville. The lines will be designed for 33,000 volts transmission, but 20,000 volts will be used at first. There will be five sub-stations, one of them a portable station, while the others are to be located in buildings at Leroy, West Salem, Nankin and Ashland. These buildings will include freight and passenger stations, residence for the attendant and machinery room. The buildings will be fireproof, built of concrete and steel with expanded metal roofs. There will also be switching stations at Wellington and Polk for operating the cross-country high-tension lines. These buildings are to be of concrete and will contain waiting room, freight room and ticket office. There will also be ten small waiting rooms built of concrete and expanded metal. The sub-stations will be equipped with one 300-kw rotary convertor, two 100-kw transformers, switchboard, lightning arresters, etc. The stations will be of sufficient size to permit of doubling the capacity later.

A car house and repair shop, 41 ft. x 184 ft., with a wing 10 ft. x 71 ft. will be erected near Mansfield. This building will be either of reinforced concrete or brick. It will be equipped with steel rooling doors, a crane and chain hoist of 3 tons capacity, two concrete pits, one of them fitted with four pneumatic car hoists. The building will be equipped with an automatic sprinkler system after specifications of the Traction Mutual Fire Insurance Company, and water supply will be furnished by a centrifugal pump with a capacity of 100 gals. per minute and a 300,000-gal. reservoir. There will also be a fireproof oil house adjoining the car house. At Seville there will be a brick car house 27 ft. x 126 ft., capable of holding four cars.

The rolling stock is not provided for in the present contract, but will be purchased a little later. It will include eight passenger cars, one express car and a portable sub-station. The passenger cars will be 51 ft. over all, having baggage, smoker and general compartments, and will be equipped with four 75-hp motors, air brakes, extra heavy trucks, fitted with 36-inch steel tired wheels. The express car will be 50 ft. long and will be equipped for double end control. The entire specifications were prepared by the Roberts & Abbott Company, of Cleveland.

Practically all of the underwriting of $1,000,000 of 5 per cent bonds and stock of the same amount has been subscribed, a greater portion of it being taken by the Pomeroy-Mandelbaum interests of Cleveland. The road will be operated by the Cleveland & Southwestern Company, and through cars will be run from Cleveland to Mansfield. The 82 miles will be covered by limited cars in 3 hours. Connection will be made at Mansfield with the line of the Ohio Central Traction Company, which is owned by the same interest, and eventually this will form the through route to Columbus.

DATE SET FOR CONVENTION OF THE COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION

The next convention of the Colorado Electric Light, Power and Railway Association will be held in Denver, Sept. 18, 19 and 20, 1906. The details of the programme have not yet been arranged.

ALLIS-CHALMERS COMPANY TO BUILD AIR BRAKES

Allis-Chalmers Company, of Milwaukee, has purchased the right to manufacture and sell the Christensen air brakes and air compressors, and has also secured the service of N. A. Christensen, who invented them. The immediate result of this new acquisition is that one of the Allis-Chalmers Company's shops is being fitted with a mechanical plant of original design for the construction of the Christensen air brake and compressors, and the next few months will witness the employment of 800 or 900 additional mechanics in this branch of the immense business.

Mr. Christensen, who is well known in the electric railway field, is not yet forty-one years old, and the air brake, his greatest achievement, was perfected when he was only twenty-seven, although not put into practical use until three years later. Its immediate success led to the formation of the Christensen Engineering Company, which was subsequently merged in the National Electric Company. He was born Aug. 16, 1865, at Toerring, a village in Denmark, and studied engineering at the Polytechnic Institute of Copenhagen. While in Copenhagen he made the first quick-firing Maxim gun built outside of England and America. It was constructed according to designs of Hiram S. Maxim, modified and improved by Mr. Christensen, and the Danish Government adopted it quite largely. In 1888 he moved to England and was engaged in engineering and engine design, first in London and later in Liverpool and Darwen, Lancashire. In 1891 he came to the United States and entered the employ of the Fraser-Chalmers Company, of Chicago. While inspecting the then new electric railway, known as the "Cicero & Proviso" system, at Oak Park, a Chicago suburb, an accident occurred resulting in the killing of two people and the injury of many others, due to the inefficiency of the hand brake. The young mechanic made up his mind that a power brake was needed and set to work upon the problem. He therefore developed the Christensen scheme of applying air brakes to such cars, and subsequently protected it by patents in this and all the European countries. Owing to the panic of 1893, the commercial development of this brake was delayed for several years.

The Christensen Engineering Company was organized in Milwaukee, in early part of the year 1897, and from small beginnings grew rapidly. At the outset Mr. Christensen did practically all the work of designing, selling, installing and collecting, but before the close of the first year the business had grown so that he demanded more assistance, and F. C. Randall (now district manager of the Allis-Chalmers Company at New York) was induced to associate himself with the company as chief of the sales department, and, with his active and successful management, the business grew so rapidly that the sales of air brakes in 1904 aggregated nearly $1,300,000. In the fall of 1902, against the judgment of Mr. Christensen, who was not himself a stockholder in the company, it was decided to broaden the scope of the business and include general electrical manufactures. This step led to the retirement of Mr. Christensen as general superintendent, and the Christensen Engineering Company was later merged in a new corporation known as the National Electric Company. Mr. Christensen engaged in the business of constructing air compressors and others of his patented articles, leaving to the company the construction of air brakes for electric cars under his patents, he receiving a royalty for their use. The National Electric Company went into the hands of a receiver in the spring of 1905. The company was recently sold at auction to interests, some of whom are identified with the Westinghouse Air Brake Company, and surrendered its rights to the Christensen patented devices to Mr. Christensen.

Since this settlement, negotiations have been brought to a successful issue with Mr. Christensen for the consolidation of the Christensen air brake and compressor business with that of the Allis-Chalmers Company, Mr. Christensen himself going to this institution as consulting engineer. The immediate result of this will be to put the manufacture of the Christensen air brake for electric traction on a stable basis.

NEW PUBLICATIONS

Pocket Book of Mechanical Engineering. By Charles M. Sames. Published by the Author, Jersey City, N. J. 176 pages; leather. Price, $1.50.

This book is the result of an effort to compact the greater part of the reference information usually required by mechanical engineers into a volume whose dimensions permit of its being carried in the pocket without inconvenience. The chapters include materials, strength of materials, transmission of power, steam engine, hydraulic machinery, shop data and electro-technics. The choice of information to be presented has been carefully made, and the book should prove useful as a handy reference volume.

Illustrated Technical Dictionary in six languages, English, German, French, Spanish, Russian and Italian. Vol. I. Elements of Machinery and the Tools Most Frequently Used in Metal and Woodworking. By K. Deinhardt and A. Schlomann. Published at New York by McGraw Publishing Company. 403 pages. Price, $2.

This dictionary is brought out by six prominent publishing houses in as many different countries, and will, it is thought, supply a demand which has long existed. The most striking feature of the dictionary is the arrangement followed. Heretofore, works of this kind have been very broad in their scope, and the alphabetical order has almost always, if not entirely, been used. In the book under review the technical terms have been classified, and so far as possible each term is illustrated by a sketch or diagram so as more clearly to define its meaning. In addition, alphabetical indices are added of each word of the several languages contained. The book under review is the first of a series which is to appear. The next volume will contain electrical terms.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JUNE 5, 1906

822,314. Railway Signaling System; Jacob B. Struble, New York, N. Y. App. filed July 13, 1904. Storage batteries connected to the track rails through Ruhmkorff coil, energize the rails to an alternating difference of potential. The storage batteries also have connections to direct-current magnets operating the semaphore signal. This circuit is closed by short circuiting the track rails.

822,474. Car Construction; Alamanza Porter, Scranton, Pa. App. filed July 3, 1905. An open car provided with side walls, having means for engaging tracks at the top and bottom and adapted to fold and be stored on the car platform when not in use. A door is provided in the walls opposite each seat.

822,508. Railway Traffic Controlling Apparatus; Clyde J. Coleman, New York, N. Y. App. filed Dec. 4, 1905. Details of a signal operated by short circuiting the track rail sections which are energized by an alternating current.

822,522. Car Brake; Owen M. Jones, Chicago, Ill. App. filed Oct. 19, 1903. The brake-chain is wound upon the axle of a ratchet wheel, which is operated through the medium of an oscillating lever pivoted beneath the platform and extending vertically through the platform of the car convenient for the motorman.

822,606. Tramway Line and Railway Line at Level Crossing; Walter J. Hollick, Manchester, England. App. filed Aug. 2, 1905. By a system of levers a filling block is caused by the approach of a train automatically to fill the space between adjacent ends of intersecting rails. The block again drops to normal inoperative position after the train has passed.

822,625. Railway Signal Apparatus; Emil L. Nolting, Elgin, Ill. App. filed Sept. 18, 1905. An audible signal in the cab of the locomotive, a third rail adjacent the track rails connected electrically with a battery through line wires, and an electrical knife-switch attached mechanically to the railway switch in such manner that the opening and closing of the railroad switch will cause a corresponding opening and closing of the knife-switch, the latter being in electrical connection with both the line wire and the main rails of the railroad, so that when the railway switch is open the electrical switch is closed, and vice versa.

822,626. Railway Signal Apparatus; Emil L. Nolting, Elgin, Ill. App. filed Feb. 16, 1906. Relates to modifications of the above.

822,703. Guard for Open Railway Cars; Etta W. Wheelock, East Milton, Mass. App. filed July 31, 1905. The guard rail is hung by means of cords provided with counterpoise-weights.

822,709. Trolley Stand; John Zielinski, Detroit, Mich. App. filed Oct. 22, 1903. Comprises a pivoted arm having a spring-impelled block sleeved thereon and link connections from said block whereby the spring action produces an angular movement of the pole.

822,845. Trolley Wheel; George W. Jobe, Indianapolis, Ind. App. filed June 23, 1905. The wheel has incorporated therein a plurality of radial fingers capable of movement in an axial direction. These fingers close over the trolley wire in passing.

PERSONAL MENTION

MR. HORACE E. ANDREWS, president of the Cleveland Electric Railway Company and an active figure in the New York Central Railroad Company's electric railway properties in New York, has returned to his home in Cleveland after a two months' tour to Europe.

MR. RICHARD T. LAFFIN, manager and vice-president of the Manila (P. I.) Electric Railway & Lighting Company, whose proposed visit to the United States was noted recently in the STREET RAILWAY JOURNAL, has arrived in this country. Mr. Laffin was formerly general manager of the Worcester Consolidated Street Railway, and before that was connected with the Boston elevated.

MR. GEORGE FLETT, managing director of Dick, Kerr & Company, the large British electric railway manufacturers and contractors, is making a visit in New York. Mr. Flett left London for India last January on a trip around the world, and will sail for England June 19. On his journey he spent considerable time in the Far East, where his company has built a number of tramway systems.

MR. FREDERICK L. COOLIDGE died at his home in Fitchburg (Mass.) June 8. Mr. Coolidge was well known in street railway circles through his position as president of the Gardner, Westminster & Fitchburg Street Railway and as director of the Northampton & Amherst and Turner's Falls & Connecticut Valley Companies. He was elected to Congress as a Democrat in a Republican district in 1890.

MR. S. B. FORTENBAUGH, formerly electrical engineer of the Underground Electric Railway Company, Ltd., of London, has joined the traction department of the General Electric Company at Schenectady. Prior to his connection with the Underground Electric Railway Company, Mr. Fortenbaugh was associated with the English Electric Manufacturing Company at Preston, England, and still previously with the Walker Company, of Cleveland.

MR. M. J. FORD, who retires from the position of master mechanic of the Wheeling Traction Company, of Wheeling, W. Va., to his home in Massachusetts, because of ill health, was surprised at his home in Wheeling a few days ago by the employees under him and the officials of the company, who presented Mr. Ford and his wife with a number of handsome tokens of their esteem. Among those present were Mr. and Mrs. J. G. Crawford, of Camden, N. Y. Mr. Crawford will succeed Mr. Ford at Wheeling.

MR. SAMUEL MARTIN has resigned as general foreman carpenter of car equipment of the subway division of the Interborough Rapid Transit Company, which position he has held since June, 1904. Before that time Mr. Martin was foreman of car repairs of the Manhattan Elevated Railway Company. At one time Mr. Martin was connected with the Brooklyn Rapid Transit Company as inspector of car construction. Mr. Martin has now accepted the position of foreman car builder of the Trajano de Madeiros Car Company, of Rio de Janeiro, Brazil.

MR. JOHN H. BICKFORD, consulting engineer, of Boston, recently presented to the railroad committee of the Massachusetts Legislature an extended argument in favor of granting electric railways the right of eminent domain. This address has been reprinted in pamphlet form, and is an interesting and able presentation of the case. Mr. Bickford is an electric railway engineer of about eighteen years' experience, and took an active part in the construction of many of the early electric railway lines in Massachusetts. He discontinued his consulting business some years ago on account of poor health, but has now regained his health and has opened an office at 110 State Street, Boston.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, JUNE 23, 1906. No. 25.

Published Every Saturday by the

McGraw Publishing Company

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)............................$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy).......................$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid.................... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1906 to date, 204,400 copies, an average of 8176 copies per week.

Alcohol Motor Cars

The passage by Congress of the bill to provide for the cheap production of denaturized alcohol raises an interesting question as to the possibilities of this fuel for railway purposes. As our readers know, there has been a strong movement during the last year toward the construction of gasoline motor cars, and if all the claims made for denaturized alcohol as fuel are correct, it would seem as if there might be a future for it in traction. The evidence, however, is that comparatively little has been done abroad with alcohol motor cars, although gasoline and independent steam cars are employed to a considerable extent and denaturized alcohol is used quite largely in Germany and some other Continental countries for illumination and in stationary motors.

At the present time alcohol motor-cars seem to have been used for traction purposes in Germany only in certain coal mines. For this service the cost of fuel per ton-mile, as reported by the manufacturers, the Gasmotoren-Fabrik Deutz, which makes engines which can be used with either gasoline, alcohol or petroleum, is about $.002 for locomotives of 8 hp. On the other hand, there seems to be a wider field for the use of alcohol in stationary internal combustion motors as well as for lighting, heating and cooking purposes. Its substitution to any great extent for any of these varied uses would greatly relieve the present demand for the lighter petroleum distillates, which have shown a marked tendency to increase in cost in late years. Altogether, therefore, the direct field open for alcohol in traction does not seem to be large unless important improvements are made in the type of engine to be used with the fluid or in the employment of alcohol itself. For instance, certain tests recently made in France seem to show that a mixture of alcohol and gasoline is more desirable as a fuel than either by itself. With the inventive genius which will be brought to bear on this problem, future improvements seem by no means visionary.

Exciter Driving

A point which often comes up in the design of an alternating-current plant is the method most desirable for exciter driving. For large generating units, say above 300 kw, the advantages of direct connection are so great that there is rarely any question about the matter, but with the low-capacity units needed for excitation there is something to be said in favor of the belt drive. In the first place, it is less expensive, and it is also more flexible in that the exciter may be readily moved to another part of the plant in case of emergency. It can be used as a motor in case of need, and in the event of a sale of equipment, is likely to bring a better price than a more restricted machine adapted only to direct driving. The higher efficiency of a direct-connected exciter set counts for very little in a water-power plant, where energy in small quantities is exceedingly cheap; and in installations where a driving shaft is available the belted excited, taken as a whole, is probably more efficient than a motor-driven exciter. An exciter belt driven from a generator shaft is generally as efficient, or nearly so, as one driven by a small direct-connected water wheel. Spare armatures can be carried in either case.

On the other hand, there is no denying that belts are a source of a great deal of trouble, even in small sizes and short lengths. The direct-connected exciter is almost certain to mean economy of floor space, less trouble and inconvenience generally. In a plant consisting of steam-driven alternators, motor-driven exciters with a single steam exciter for starting service are probably the best solution of the problem, which is, after all, largely one of convenience rather than efficiency. As the direct-connected unit will ordinarily run at a slower speed than the belted outfit, there will be a slight gain of efficiency for this cause. If an exciter battery is in service, the problem of flexibility drops out of sight. Compactness and simplicity are strong points in favor of direct connection, especially in steam plants.

An Inside View

The report of a committee of the Master Mechanics' Association upon electric traction upon steam railroads, which we publish this week, is most interesting as affording a view of a much mooted topic from the railroad man's point of view. The report is rather of a preliminary nature, and the committee has hesitated to attack the most serious problems, in view of the changing state of the art, yet it has gone fairly upon record in deliberate and, we think, unbiased judgment upon some important matters. The committee unhesitatingly takes the position that whenever the density of traffic is considerable it will pay steam roads to handle local suburban and interurban traffic electrically, but over separate tracks from the regular train service. This apparently passes over the common case where local suburban traffic is carried on the regular tracks in large volumes. There certainly are many cases in which the density of traffic should warrant electric service carried on as a substitute for existing local service, without independent tracks. Electric trains on the multiple-unit system can be worked on the regular tracks quite as easily as local trains with locomotives, in fact much more easily, on account of the more rapid acceleration possible. Of course, when local traffic is dense enough to require separate tracks, it goes almost without saying that electrification is desirable, which is perhaps what the committee really meant to imply. It is interesting to note that the committee considers the history of electric railway working in its effect on other motive powers as almost a complete argument against the steam car or other types of self-propelled cars, except for special situations.

As regards a. c. vs. d. c. traction, the committee very wisely declines to commit itself at this time. It does, however, call vigorous attention to the fallacy of theoretical comparisons of cost based on assumed roads. We have seen and published various such comparisons, and do not feel ourselves unduly critical in saying that the results figured necessarily followed from the assumptions with which the computation was intentionally started. In other words, the conditions have been assumed to fit the thesis defended.

The report goes into considerable detail upon the subject of gasoline cars. The committee evidently regards the gasoline-electric cars, in their various forms, as involving complication and expense altogether outweighing their advantages in facile control. On the other hand, the regular gasoline car, as typified by the motor cars used on the Union Pacific system, is evidently considered as a good practical solution of the transportation problem for branch lines with light traffic. In fact, the report states that the service thus accomplished is highly lucrative, and figures that in this class of work the gasoline car costs materially less than locomotive service or electric cars, per car mile, the charges including fuel, labor, maintenance and similar charges. The reports from these Union Pacific motor cars have been uniformly favorable, and it looks very much as though they were of a type that would often prove valuable on lines hardly yet economical for electric service. The great simplicity and moderate weight of these cars are very strong points in their favor, while the reduced height and the pointed and smooth exterior enables high speed to be easily made. More than one valuable innovation has come out of the West, and it would not be surprising if these cars, with their advanced design and convenience in operation, should come into somewhat considerable use.

Sub-Station Equipments

The article we publish this week on the sub-stations of the Long Island Railroad is a good compendium of sub-station work as at present practiced. So long as direct-current motors are the main reliance for heavy traction, sub-stations with synchronous converters are part of the program. In general there is nothing in the least sensational about them, since the apparatus in this country has been pretty thoroughly standardized, so that a sub-station specification may be put up as a sort of prescription running somewhat in this wise:

℞

M kw type Q converter, 25 cycles........ 1
$\frac{M}{3}$ kw type R transformers............... 3
H. T. panel board, type S................ 1
L. T. panel board, type T................ 1
Lightning arrester, 3ph, type U.......... 1
Oil switches and cables, q. s.
Make up in brick box.
Sig. Take one station for each N miles of track.

W. Waggles, E. E.

Our friends of the Long Island Railroad seem to have tired of this dull routine a bit, and besides planning stations carefully with regard to future traffic, have made very skillful use of the portable sub-station, really the most interesting development of the system.

Having to deal with the enormously heavy traffic of a couple of popular race-tracks, the Long Island Railroad was confronted with a shifting load of very formidable character. To meet this either exaggerated capacity in fixed sub-stations was necessary, or some means of locally reinforcing the capacity, hence the portable sub-stations. In these we have, compressed into the limits of a single large steel car, a complete sub-station of 1000-kw capacity, equipped with all necessary and no unnecessary accessories, and capable of being worked at short notice at any point of the entire high-tension system. The whole equipment is of the most compact and workable description, and is invaluable in helping out the regular sub-stations at times of excessive load, or of being pushed into service to tide over a temporary breakdown if one should occur. The whole electrical apparatus weighs only about 70 tons.

For such portable sub-stations there is no inconsiderable field of employment in general electric railway service. There are many interurban systems of which portions are liable at times to exceptionally severe loads, and we see no reason why the portable station should not be very freely used in dealing with them. It could very readily be shifted from town as occasion might require, following up the shifting of spare cars and supplying additional power even at somewhat severe loss in the high-tension feeders. In fact, some interurban lines are trying the plan, although hardly in the generalized way which we have here suggested. There has been a strong tendency toward consolidation of connecting electric lines, yet much remains to be done in making the most of the advantages of consolidation. The wandering of the load from hour to hour can not be remedied, but something certainly can be done to remedy the larger shifts that occur at irregular but determinable intervals, by furnishing extra rolling stock, extra men, and additional power. There is no reason why the portable power station should not become an important part of the equipment of the larger electric railway systems, whether for such occasional use or to meet the exigencies of normal growth by shifting sub-station locations to correspond with the shifting of the center of load.

Discipline and Promotion

One of the sessions at the Columbus Convention is to be devoted to a consideration of the best methods of handling employees, and other proof that this subject is attracting much more attention than in the past is shown by several papers on the same topic at various recent conventions. The questions of discipline and promotion go hand in hand, and many good results have come from the adoption of modern systems of discipline, particularly the merit system. The tendency to introduce the merit system of discipline in street railway work is increasing, largely, perhaps, on account of the influx into the field of steam railroad operators, most of whom are familiar with the plan as practiced on the steam roads under the name of the Brown system. The fundamental basis of the Brown, or merit system, the absence of the lay-off, can be adopted by any road, but it is a question whether its refinements as employed by many of the smaller electric railway companies and on steam railroads with beneficial results would be equally successful on large street railway systems.

The reason is not far to seek. It is well known that the trainmen on the smaller roads usually come of sturdier stock and are more amenable to discipline than many of the city-bred car men on the extensive urban lines. In the former case, and the same is true in the case of steam railroads, the work is sought as a permanent calling, but on the city roads the applicants, particularly those for the back platform, often seem to seek employment as a convenient hold-over until they can return to some previous trade. It follows that employees of this type are not likely to have their conduct favorably influenced by the purely moral effect of the ordinary merit system. As a recent paper on this subject stated, "complete success cannot be attained unless some more substantial reward is given." This is a truth which applies with double force on comprehensive city properties.

The fact may be recognized that, owing to the closer regulations existing between the traffic employees and the public in the smaller cities and on interurban and even steam railroad systems, passengers are far more likely to report good or bad actions than in the larger cities. There the rider seldom comes in contact with the same trainmen day after day, and few passengers will take the trouble to report deficiencies in the service, even if serious. Still less is the average passenger apt to notify the company of politeness or other commendable action on the part of the conductor. The only exception to this rule of ignoring the service of the car crews is the chronic misanthrope, whose criticism is usually so unfair that an attempt to grade the men on his communications would be very apt to inflict injustice. Again, the crowded condition of most city thoroughfares is responsible for so many accidents, blockades and other injuries that it is very difficult indeed to decide at times whether the trainmen should receive demerits for street troubles. Car inspectors are not omnipresent, and there is plenty of opportunity for unjust censure, a situation which does not tend to secure the good will of the platform man. It is evident that these conditions make it impossible to keep such accurate records of car performance in large cities as are made by small companies.

Since accurate classification of city railway car employees along the lines of the merit system is impracticable, except as regards flagrant offenses, some other criterion for conduct must be adopted. In most cases the only course possible is the adoption of the seniority rule, on the theory that that car man is best who has served the company the longest. Every one admits that this rule does not hold strictly true, but if accompanied with the exercise of discretion in promotion, is perhaps the best policy, because it can be most impartially enforced. On practically all large roads, therefore, it is customary to increase the wages of platform men annually to a stated maximum.

But the ambitious man must be offered the opportunity of ultimately attaining something better than an increase of several cents an hour. One of the largest roads has solved this problem satisfactorily by providing a position beyond that at the front or rear end of a car. The plan is based on the fact that the average motorman or conductor is not an engineer in embryo. Consequently the official organization is so divided that the traffic department is an entity, kept altogether separate from any feature involving engineering ability. This scheme makes it possible to promote an experienced car man to the position of traffic inspector and eventually to that of car-house foreman. No man is advanced from the ranks until he has been in the company's service for at least five years. As a traffic inspector his principal duty is to keep the rolling stock in his territory to schedule, but he is not asked to make engineering reports, that work being done by others. Even when advanced to the care of a car house, his new duties are still a development of his old ones except that they cover a larger field.

This method of rewarding car men by appointing them to higher positions for which their experience and temperament fits them has proved an excellent incentive in holding the better grades of men in the company's employ. Conversely, there is less trouble in securing good discipline through the medium of men who have been through the mill than would be the case if the traffic department was in charge of engineering men. Of course, the practice outlined would not be feasible on small systems where one man must combine engineering and traffic handling duties, but it certainly offers some hints to the larger systems where some inducements must be offered to secure high-class men.

THE ROTARY-CONVERTER SUB-STATIONS OF THE LONG ISLAND RAILROAD

BY W. N. SMITH

Previous articles in this paper have described, first, the main power station which furnishes electrical energy for train propulsion on the Long Island Railroad (see STREET RAILWAY JOURNAL for April 7), and, second, the power transmission line (see STREET RAILWAY JOURNAL for June 9 and 16). Attention is now invited to the general scheme of power distribution to the several railroad lines.

The article in the issue of June 9 specified the divisions which have been changed from steam to electricity, and the locations of the various temporary and permanent sub-stations. The arrangement adopted lends itself readily to the gradual development of a comprehensive system of electric rapid transit, suitable, and in fact necessary, to the suburban territory served. Ample provision has been made in the general design not only for permitting the increase of equipment in the present sub-stations, but also for adding other sub-stations as may be required from time to time, which can easily be done without altering the present ones, and with the addition of only a small amount of apparatus.

The central position of Woodhaven Junction (see map on page 896 of June 9) led to its adoption as the principal distributing point for the high-tension circuits, the main trunk line of the transmission system being brought to that point from the power station. This particular sub-station is, therefore, somewhat more complicated and makes use of somewhat heavier apparatus than is required in most of the other sub-stations. For this reason, the Woodhaven Junction sub-station will be referred to hereafter somewhat more in detail than the others, particularly as regards the switching equipment.

The distances from Woodhaven to the various sub-stations are as follows: East New York, 3.2 miles; Grand Avenue, Brooklyn, 6.2 miles; Rockaway Junction, 3.4 miles; Hammel, 7 miles. Belmont Park is distant from Rockaway Junction 3.5 miles. Springfield Junction is distant from Rockaway Junction sub-station 3.4 miles. The branch feeder lines to the portable sub-stations at these two latter points are manipulated from Rockaway Junction, where they can be thrown to one or both of the two main transmission lines which connect Rockaway Junction sub-station with Woodhaven Junction sub-station and Long Island City.

SUB-STATION CAPACITY

The capacity of the sub-stations was determined after a very careful examination of the electric schedule proposed by the Long Island Railroad officials. The heaviest traffic movement over the Atlantic Division is that due to the operation of racetrack trains to Belmont Park, besides the regular trains, and particular attention was given to the conditions that prevail at the time of racetrack train movement, which, of course, affects the output required for the Atlantic Division and the amount of equipment needed in the four sub-stations which supply the division.

A portion of the Rockaway Beach Division is also used by Brooklyn Rapid Transit trains, and while these trains are not as heavy as the Long Island trains, they are sometimes on much closer headway and the power required for them is supplied chiefly by Woodhaven Junction and Hammel sub-stations, which are powered accordingly.

Due consideration of the tonnage and the proposed schedule of (a) the initial traffic, and (b) that ultimately to be handled on these lines, led to the adoption of machinery at the various sub-stations, in accordance with the table given below, which shows, first, the amount of machinery that constitutes the present or initial installation, and second, the ultimate installation that can be accommodated in each of the sub-stations as now constructed.

The principal feature of each sub-station is its equipment of rotary converters and transformers. In a single instance, namely, at Hammel, a storage battery was installed as an adjunct to the sub-station machinery. The location and arrangement of all the sub-station buildings is such as to enable the ultimate use of a storage battery should future conditions justify it, and the apparatus in each building is so laid out that if the storage battery should be installed the necessary boosters can occupy the space allotted to one rotary converter.

Station	Rotary Converters Kw.	Transformers Kw.	Boosters Kw.	A. C. Feeders	D. C. Feeders
Grand Avenue:					
Present installation..	3-1000	9-375	....	2	5
Ultimate capacity...	5-1500	15-550	....	4	11
East New York:					
Present installation..	3-1000	9-375	....	5	6
Ultimate capacity...	4-1500	12-550	....	12	16
Woodhaven Junction:					
Present installation..	3-1500	9-550	....	12	10
Ultimate capacity...	6-1500	18-550	....	18	18
Rockaway Junction:					
Present installation..	2-1000	6-375	....	4	6
Ultimate capacity...	4-1500	12-550	....	11	16
Hammel:					
Present installation..	2-1000	6-375	2-162	2	6
Ultimate capacity...	5-1500	15-550	2-162	5	13

At Hammel, the initial installation also includes one storage battery of 32 ampere-hours capacity at the one hour rate at 6000 volts.

The sub-station equipment also includes the two portable sub-stations mentioned in the previous article. Each consists of a car containing one 1000-kw rotary converter, three 375-kw transformers, and the necessary blower and switchboard panels, high-tension oil circuit breaker, and connecting leads to the outside circuit breakers.

After carefully investigating the applicability of the storage battery to the Long Island Railroad distribution system, its value as an adjunct appeared to be chiefly in proportion to the protection from interruption afforded by it. Consequently, it was decided to employ a storage battery at a sub-station where the insurance feature could demonstrate its value to the best advantage. A battery was accordingly installed at Hammel, which is farther from the power station than any of the other sub-stations, and which, by reason of the exposed position of the transmission line running across Jamaica Bay, might be considered somewhat more liable to interruption in service through accident to the transmission. The marked fluctuations in load at this point, due to heavy travel to Rockaway Beach on summer afternoons and evenings, affords a better opportunity than almost any other location for testing the general applicability of the battery. The fact that the station load in the winter time is extremely light enables it to be operated for much of the time at this season from the battery alone, with the minimum cost of sub-station attendance during the greater part of the year. The storage battery equipment consists of 300 cells of 3200 amp hours capacity and two boosters of 162 kw capacity each.

Besides the rotary converters, transformers and battery apparatus listed in the foregoing table, there is in each sub-station the requisite equipment of minor auxiliary apparatus, which will be duly described in detail.

SUB-STATION BUILDINGS

The sub-station buildings are of a uniform type of construction throughout, excepting at Grand Avenue, where the reduced area of the lot made its adoption impracticable. This type consists of a central section of about 51 ft. span, which is wide enough to accommodate two 1500-kw rotaries and the necessary transformers. The central space is flanked on each side by a narrow section, that on one side being devoted to high-tension bus-bars and switch gear, while that on the other side contains the low-tension switchboard and operating gallery. These leading features are illustrated in plan and elevation in Figs. 1 and 2.

The bents which form these three parallel sections are spaced 16½ ft apart. At Woodhaven Junction and Hammel there are four of these bays, while at East New York and Rockaway Junction there are three. The low-tension gallery section is uniformly about 13 ft. wide. The high-tension gallery section varies in width, depending on whether one or two sets of high-tension bus-bars are required. For reasons which will appear later, some of the sub-stations are fitted with one set of high-tension bus-bars, and others with two sets, requiring the above-mentioned variation in the extreme width of the buildings. The length of the building, i. e., the dimension along which it can be extended in the future if desired by adding more standard bays, varies with the amount of equipment of rotary capacity allowed for in the initial installation as noted in the table of sub-station capacities. The general dimensions of the standard building, indicating how these varying conditions of length and width are met, are given in Fig. 1.

All of the sub-stations except Woodhaven Junction received an initial equipment of 1000-kw rotary converters. The machine foundations and general interior arrangement are, however, such as will accommodate a complete outfit of 1500-kw units at all stations, should traffic requirements in the future make it necessary to fill the buildings with apparatus to their utmost capacity.

The only variation in the heights of the buildings is due to the presence of overhead high-tension circuits. Where underground circuits only are used, as is the case at East New York and at Hammel, there are but two floors in the high-tension gallery. At Woodhaven and Rockaway Junction, however, where overhead circuits are employed, a third story is added to the high-tension gallery, and serves the double purpose of affording a convenient entrance to the building for the cables, about on a level with the cross-arms, and of providing a suitable chamber for enclosing the high-tension lightning-arrester apparatus.

The main portion of the building is about 30 ft. in height from the main floor to the bottom of the roof trusses. Each story of the side galleries is about 12 ft. in height. At Woodhaven Junction and Rockaway Junction, where the overhead lines require a third story, this lightning-arrester gallery is about 18 ft. higher.

The only external architectural effect sought is to provide a permanent and durable structure of simple and dignified but pleasing appearance, in harmony with the general treatment of the main power station building, where the same motive was worked out.

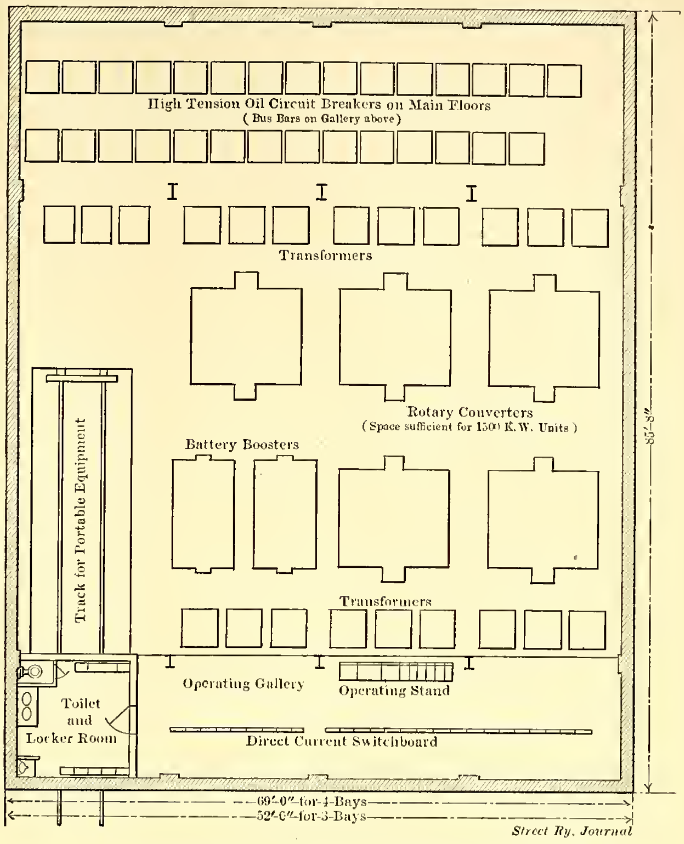


FIG. 1.—TYPICAL SUB-STATION, WITH A DOUBLE ROW OF ROTARIES

All the buildings have a white granite ashlar footing course as a base, extending up nearly to the floor level. Above this the walls are entirely of brick, faced outside with hard burnt repressed red brick laid in white mortar. The window sills, cornice, coping and the name panel are of terra cotta, of about the same color as the brick. All the small window openings and door openings are spanned by Kahn truss lintels with flat ground brick arches. Rowlock arches are carried over the large window openings. All window frames and sash are of 16-oz. sheet copper throughout, made up in hollow form and riveted together so as to be mechanically rigid before soldering, and soldered before erection in order to secure a suitable finish and to exclude the weather. The sash are all glazed with ¼-in. Mississippi rough wire glass. The doors are of the metal-covered type, completely encased in 16-oz. sheet copper.

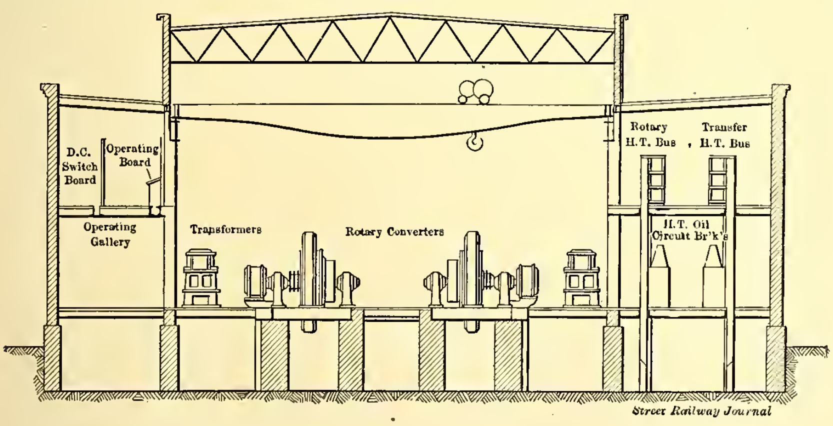


FIG. 2.—CROSS-SECTION OF TYPICAL SUB-STATION

The steel framing consists mainly of the columns between the bays, together with the crane runway and roof trusses which they support, and the floor beams for the main floor and galleries, the outside ends of which bear upon the walls.

The floors consist throughout of concrete slabs, reinforced with ⅜-in. twisted bars, of a thickness conforming with the load to be carried. The roofs consist of 4-inch cinder concrete slabs reinforced with ⅜-in. bars and waterproofed with 5-ply tar paper, pitch and gravel. All stair strings and railings are of steel with slate treads.

Each sub-station is served by a 16-ton Niles crane, hand-operated from its trolley, thus obviating the usual hanging chains. It spans the central bay and it is available not only

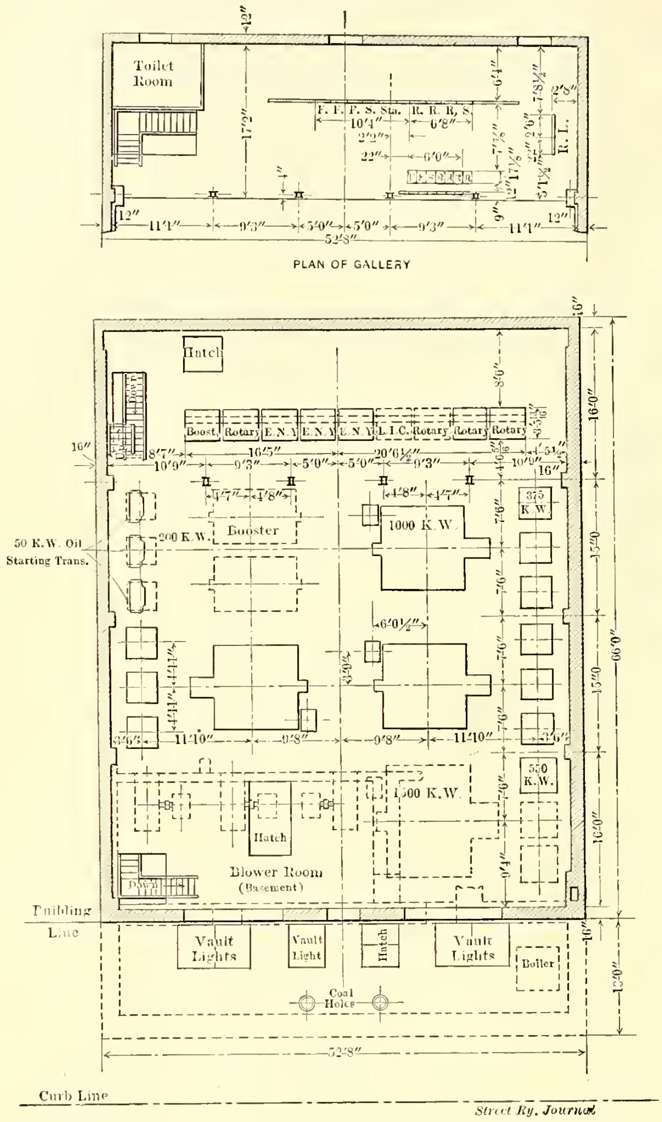


FIG. 3.—OUTLINE OF SUB-STATION AT GRAND AVENUE

for handling the permanent heavy sub-station machinery, but also the apparatus of the portable sub-stations, which (excepting at Grand Avenue) can be run under it upon a track that enters one of the end bays of the building.

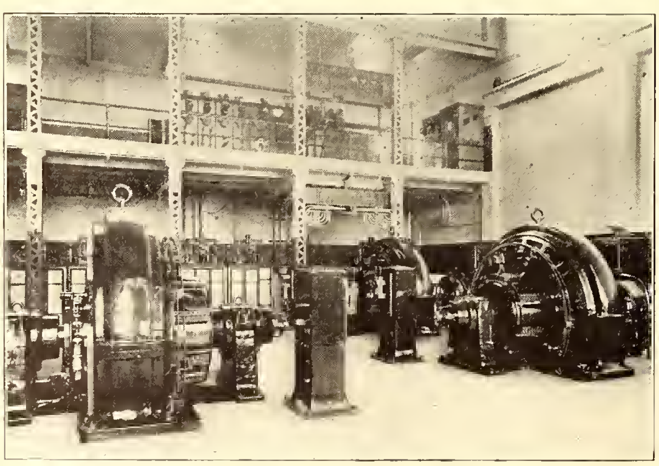


FIG. 5.—A VIEW IN THE GRAND AVENUE SUB-STATION

Sub-station No. 1, at Grand Avenue, is located in the building-up section of Brooklyn, and its interior arrangement was therefore modified to conform to the available ground area. The building consists of a series of bays carrying the crane girders, which traverse the building length-

FIG. 4.—THE GRAND AVENUE SUB-STATION

wise from front to rear. The switchboard gallery is installed at the rear end instead of on the sides. The switching equipment, being somewhat simpler than that at other stations, was more easily taken care of in the reduced space, and the basement was utilized for the high-tension bus-bars, so that only one gallery was needed above the main floor.

The position of the building in the lot is such as to provide room for the construction of a battery house in the future should it ever be needed. The building itself is 52 ft. 8 ins. wide and 66 ft. deep. A general plan of its arrangement is shown in Fig. 3, and a view of its exterior in Fig. 4.

The rotary converter foundations are arranged in two lines, from front to rear, with room enough for the accommodation of five 1500-kw machines, should that amount of rotary capacity ever be required. The transformers are placed in banks along the side walls. The location of this station, adjacent to a subway section of the Atlantic Avenue Improvement, makes it impossible to provide a track entrance for the portable sub-station, all provision for which is consequently omitted. Fig. 5 is a view of the interior.

Sub-station No. 2, at East New York, is situated at the

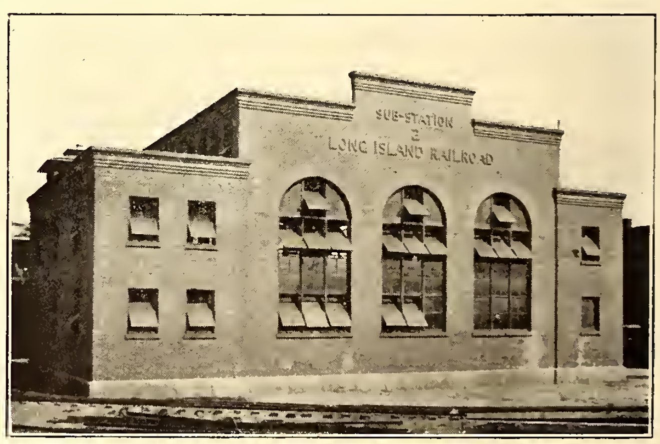


FIG. 6.—THE EAST NEW YORK SUB-STATION

southeast corner of the intersection of the Atlantic and Manhattan Beach Divisions, on railroad property large enough to afford room for a possible future extension of the building should it ever be desired to install storage batteries. This building is of the standard type of construction, three bays in length.

A side track enters the station, the first bay providing space enough to permit the entrance of a portable sub-station, which can thus be coupled up with the apparatus at this station if required. This track was also of material assistance in unloading the apparatus into the sub-station during construction. The location of East New York sub-station is such as to preclude the possibility of overhead high-tension line construction, and consequently all arrangements for entrance and exit of high and low-tension feeder cables are through a vault in the basement. As two sets of alternating-current bus-bars are required at this station, the high-tension gallery is built to the maximum width. A view of this sub-station from the northeast corner is shown in Fig. 6.

Sub-station No. 3, at Woodhaven Junction, is similar to that at East New York, but has an additional story over the high-tension gallery to accommodate the entrance and exit of the incoming feeder trunk lines from the main power station, and the outgoing line to Hammel. This station is also longer than No. 2, consisting of four bays instead of three, which will enable it to ultimately accommodate six 1500-kw rotaries instead of four. Fig. 7 is the general plan of the main floor and galleries of this station. The high-tension section is of the maximum width to per-

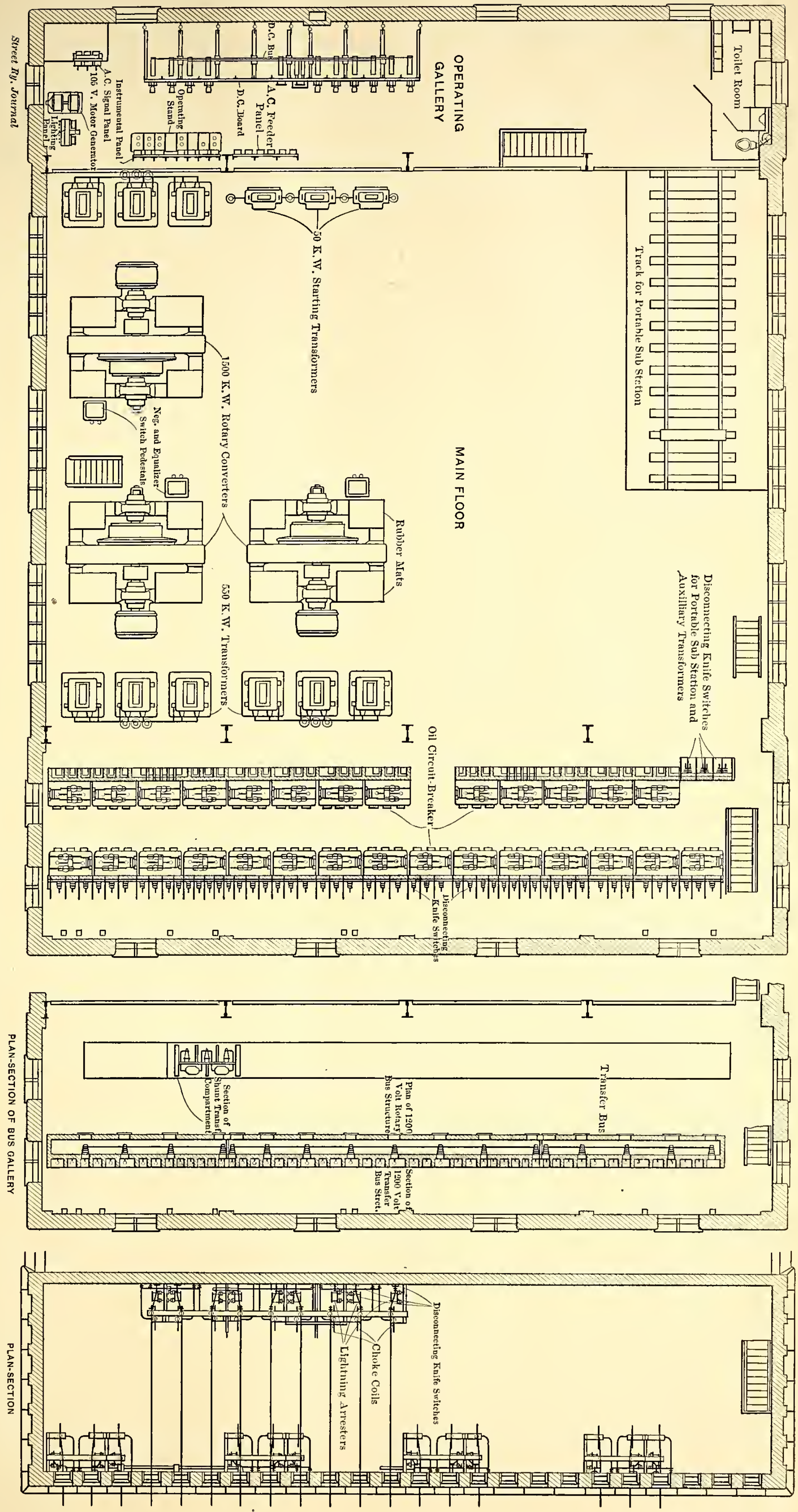
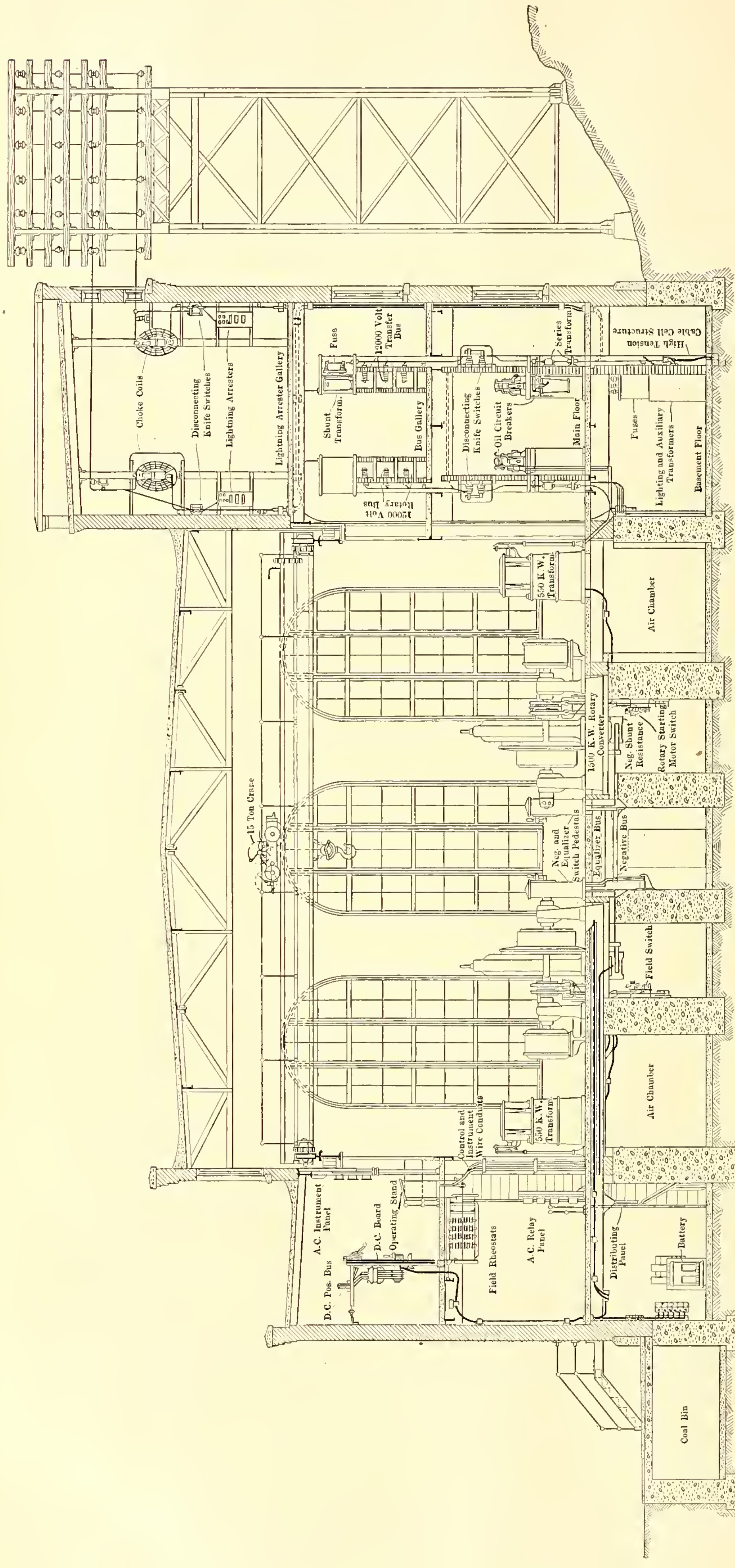


FIG. 7.—GENERAL PLAN OF MAIN FLOOR AND GALLERIES OF THE WOOD HAVEN SUB-STATION



Street Railway Journal

FIG. 8.—ELEVATION OF WOOD HAVEN JUNCTION SUB-STATION

mit the installation of two sets of high-tension bus-bars. The size of the building as compared with other standard-type buildings is readily noted by referring to Fig. 1, and then to Fig. 8, which is a complete sectional elevation of the building. This station, like sub-station No. 2, is provided with a track entrance for the portable sub-station. It stands on railway property of sufficient size to accommodate a battery house immediately in its rear, should one ever become necessary.

Sub-station No. 4, at Rockaway Junction, is also of the standard construction, comprising three bays in its lengthwise dimension. At this station all the high-tension circuits are overhead, necessitating the upward extension of the high-tension gallery into a lightning arrester chamber of the same type as at Woodhaven. The portable sub-station houses at the two race-tracks are supplied with high-tension current through this station, which, as a distributing point, thus requires two sets of bus-bars; so that the high-tension gallery of this station is of the same width as at Woodhaven and East New York.

The sub-station is situated in the middle of a block, a short distance to the west of Rockaway Junction. It is so placed that in case an enlargement is necessary in the future, the station can be extended toward the rear of the lot, where there is also room for a storage-battery house. This provision necessitated placing the gallery for the incoming and outgoing high-tension overhead lines along the east side of the building, and the cable terminal rack is designed to carry the cables from the railroad right of way around the corner of the building, and to distribute them properly for entrance along the east side of the house. An external view of this sub-station is shown in Fig. 9. This building also has a track entrance for a portable sub-station.

Sub-station No. 5, at Hammel, comprises a main sub-station building of the above described typical construction, four bays deep, and a storage-battery house. The entrance and exit of feeder cables is underground at this station, because it is too short a distance from the Beach Channel drawbridge to make it worth while to change from underground to overhead transmission. The fact that no transfer bus is required in this station permits the high-tension gallery section to be narrower than that in stations Nos. 2, 3 and 4. The main floor level of the building is about 4 ft. above the ground line in order to bring it to the same height as the floor in the portable sub-station car, there being track space provided to introduce it here, as in the other stations.

The sub-station building is 78 ft. 10 ins. x 69 ft. 4 ins. outside. The battery house, which forms an extension of it, is 101 ft. 8 ins. x 63 ft. This battery building is of special reinforced concrete construction throughout, there being no exposed metal used in any part of it. It is a one-story structure with brick walls about 15 ft. high, surmounted by a low parapet, and having a monitor roof about 15 ft. wide and about 6 ft. in height running the entire length of the building at the center. A photographic view of the building is given in Fig. 10. Wooden doors and window frames are used throughout in the battery house, and the sash is glazed with ¼-in. ribbed wire glass.

PORTABLE SUB-STATION BUILDINGS

The portable sub-stations, while being used at the race-tracks, are housed in buildings especially designed to accommodate them. The buildings are located at Belmont Park and Springfield Junction, and are each 88 ft. 4 in. long and 17 ft. wide over all, with a tower at the end opposite the entrance, about 36 ft. in height, for the purpose of affording a convenient entrance for the high-tension cables and providing an enclosure for the high-tension lightning arresters. The buildings were illustrated on page 832 of the STREET RAILWAY JOURNAL for Nov. 4, 1905, and each can accommodate two portables.

ROTARY CONVERTERS

The electrical machinery in the sub-stations is all of Westinghouse manufacture.

The rotary converters are of the two-bearing type with field frames divided in a horizontal plane. Each converter is provided with a starting motor, whose frame is mounted upon an extension of the base of the rotary converter. The base frame is set into the floor so that the top of it is level with the floor line. It is entirely open below the commutator so that there is easy access to the lower brushes from the pit in the interior of the foundation, which can be easily reached from the basement.

The 1000-kw rotaries are rated to deliver 1600 amps. at 625 volts, and 1667 amps. at 600 volts. The three-phase potential at the alternating end is approximately 370 volts, for 625 volts at the direct-current end.

The 1000-kw machines have eight poles and operate at 375 r. p. m., corresponding to a frequency of 25 cycles per second.

The 1500-kw rotaries are rated to deliver 2400 amps. at 625 volts, or 2500 amps. at 600 volts. They have twelve poles and run at 250 r. p. m.

In nearly all respects the two sizes of machine are very similar. The fields are compound wound with the shunt winding arranged for self-excitation. The machines are so over-compounded, that if operated as direct-current generators at constant speed, the voltage will rise from 600 volts at no load to 650 volts at full load. The converters are guaranteed to stand overloads of more than 2½ times the normal load at 600 volts d. c. without falling out of step, providing the e. m. f. at the alternating end is maintained within 14 per cent. of the normal. Ample provision is made for ventilation by passages through the armature core and windings and also through the field coils.

FIG. 9.—SUB-STATION AT ROCKAWAY JUNCTION

TRANSFORMERS

The transformers used with the converters are of the air-blast type throughout. Those for the 1000-kw rotary converters are grouped in banks of three 375-kw transformers to one rotary converter. For the 1500-kw converters they are in groups of three 550-kw each.

The high-tension winding is designed for a normal e. m. f. of 12,000 volts, with taps arranged to enable other voltages to be utilized down to 10,000 volts. The low-tension winding is designed to normally carry 400 volts, with taps which will

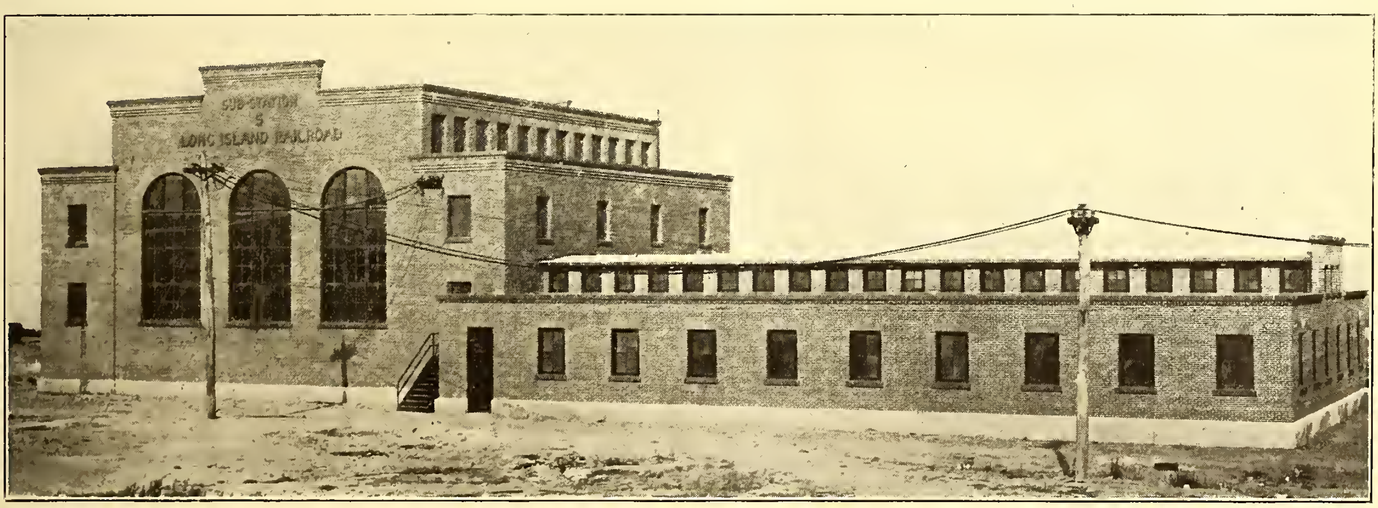


FIG. 10.—THE HAMMEL SUB-STATION

enable other voltages to be taken off it down to 340 volts. The high-tension terminals are at the top of the transformer. The low-tension leads are brought to suitable terminals in the bottom of the transformers.

AUXILIARY TRANSFORMERS

In each station there are four sets of auxiliary transformers which supply current for the following purposes: (1) To the rotary converter starting motors. (2) To the motors driving the booster generators and their exciters. At Hammel station these transformers are made large enough to also drive rotary starting motors at the same time. (3) For driving the transformer blower motors, and an induction motor generator set, used to charge the small auxiliary storage battery that supplies current for the electric switch-control system. (4) For house lighting.

The following particulars regarding these four sets of transformers are of interest.

At sub-stations Nos. 1, 2, 3 and 4, where there are no storage batteries, a group of three transformers is employed to furnish current for the starting motors of the rotary converters. These are of 50 k. v. a. capacity each, the bank being able to start up and synchronize three 1500-kw rotary converters simultaneously, and are of the oil-insulated, self-cooling type, reducing the three-phase, 25-cycle current from 12,000 volts to 400 volts. They are placed in a row on the main floor and are connected to the rotary bus by an automatic oil circuit breaker, electrically operated from the main control stand.

At sub-station No. 5, where a storage battery is employed that involved the use of two 162-kw booster generators, each driven by a 235-hp induction motor, there is provided a bank of three 200-kw air-blast transformers, affording sufficient capacity not only for operating the battery boosters under the maximum conditions of load, but also for simultaneously starting one rotary converter without dropping the secondary voltage of the transformers sufficiently to affect the booster regulation. These transformers are set on the main floor over the air ducts for the main transformers and in line with the latter.

The 7.5 k. v a. transformers are provided for the blower motors and the induction motor which operates a small booster generator used for charging the auxiliary storage battery that furnishes current for the electrically-operated switch control system. At Woodhaven Junction these are of 10-kw capacity. These transformers are of the oil-insulated type, with the windings placed in substantial sheet-iron cases, with cast-iron top and base. The transformation is from 12,000 volts to 400 volts.

STORAGE-BATTERY EQUIPMENT

As previously outlined, storage batteries are provided at Hammel sub-station only, though provision is made in the design of the other sub-stations for the ultimate installation of storage batteries should future conditions appear to require them.

The equipment installed at Hammel sub-station, with its auxiliaries, is made up as follows: The battery itself comprises 300 elements of the Electric Storage Battery Company's chloride accumulator, each element containing fifty-five type R plates, in regular service. At the temperature of 70 degrees F. they have the following capacities:

Rate	Time	Capacity
700 amp	8 hrs.	5600 amp. hrs.
1000 "	5 "	5000 "
1500 "	3 "	4500 "
3200 "	1 "	3200 "

The normal rating of the battery is the one hour, for which time it can discharge at the rate of 3200 amps. In case of necessity, however, there is sufficient capacity in the battery to discharge at the rate of 6400 amps for a space of twenty minutes. For instantaneous fluctuations it can discharge up to a momentary maximum rate of 9600 amps, or three times the one-hour rate. The positive plates are of the so-called "Manchester" type, composed of cast grids, the holes in which are circular.

To properly effect the charging and discharging of the battery when used as a regulator for the rotaries, there are two direct-connected, motor-driven, separately-excited boosters, each consisting of one three-phase induction motor and one direct-current generator mounted on a common bedplate. The booster generator is rated to deliver 1200 amps at 135 volts continuously, with a rise of temperature not to exceed 40 degs C. above the temperature of the surrounding air. It has an overload capacity of 1600 amps for one hour, and of 3200 amps for two minutes. Two of these boosters in parallel are required to take advantage of the full discharge rate of the battery. It was thought desirable to split the booster capacity so that in case of accident to the booster the whole battery capacity of the station would not be tied up by the failure of a single booster unit. The two boosters together can, therefore, completely discharge the battery in one hour,

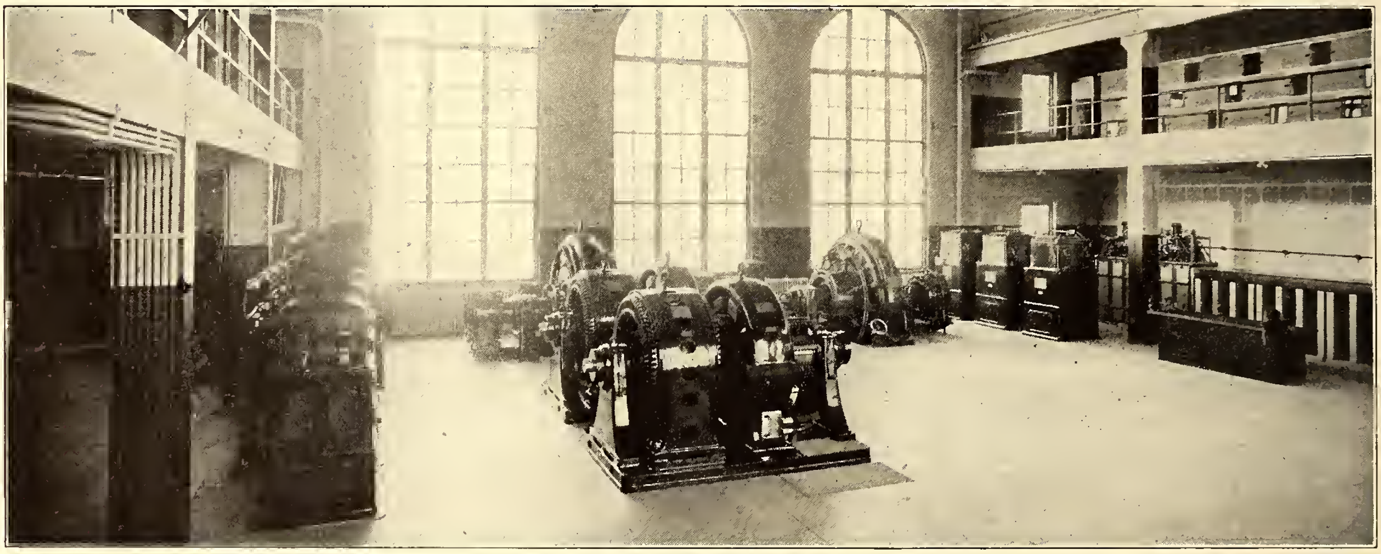


FIG. 11.—BOOSTERS, ROTARIES, TRANSFORMERS AND SWITCHBOARD IN HAMMEL SUB-STATION

as their combined rating of 3200 amps for one hour is equal to the one-hour discharge rate of the battery.

Each booster motor is of the three-phase induction "squirrel cage" type for 25-cycle current at 400 volts, rated at 235 hp. The transformer equipment which supplies the induction motors consists of the three 200-k. v. a. air-blast transformers previously described. Fig. 11 shows the interior of Hammel sub-station with the motor-driven booster rotaries and transformers.

In order to use the battery to maintain a comparatively steady load on the rotary converters, the boosters which are in series with the battery and the third-rail circuit must have their magnetic field excitation changed, both as to intensity and as to polarity, by an amount that will cause the boosters either to change the battery from the rotaries or, when reversed, to discharge it to the third-rail circuit; and they must effect this regulation as nearly as possible instantaneously with the fluctuations as they actually occur in the system. In other words, the function of the storage battery and booster is to act as an instantaneous reservoir of power to relieve the rotary converters of the instantaneous fluctuations in load.

The effectiveness of the battery for this purpose, therefore, depends upon the quickness with which the intensity of the booster field can be varied and its polarity altered. This is accomplished by means of a small booster-exciter generator driven at a constant speed by an induction motor. The current from the armature of this exciter flows directly through the field of the booster. The desired change in the conditions of strength and polarity in the booster field can, therefore, be effected by altering the output of this little exciter generator and reversing its polarity. This is done by strengthening, weakening, or reversing the field coils of the exciter, which is introduced into the system simply because it can deliver the relatively large current needed for exciting the booster field —this amount being much greater than it would be possible to pass through the very sensitive regulator, which can, however, easily and instantly change the small magnetic field excitation of the little exciter. The action of the regulator is shown diagrammatically in Fig. 12.

As mentioned above, the booster is in series with the battery across the 600-volt station bus-bars. From the opposite ends and from the middle point of a section of 100 cells of the storage battery three circuits are led, one of which passes through the field of the small exciter to a connection that joins together two piles of carbon disks which are subject to the pressure of a lever. The outer end of one carbon pile is then connected to one of the wires leading to the positive pole of the 100-cell section of storage battery, and the wiring from the outer end of the other carbon pile is joined up to the negative end of the 100 cells. Two circuits are thus formed, each of which includes a separate half of the battery section and one carbon pile, while both have a common connection from the center of the battery section, which passes through the field of the little exciter. The resistances of the two carbon piles, when subjected to equal pressures, are equal, and current will then flow from the battery through both carbon piles and back to the negative pole of the battery, there being then no tendency for any current to flow from the central point of the two carbon resistances back to the central point of the battery or vice versa, through the field of the small exciter.

The lever which bears upon the tops of the two carbon piles is balanced upon a knife edge, and from one end of it is freely suspended the soft iron core of a solenoid, through the coil of which passes the entire output of the rotary converters. To the other end of the lever is attached a helical spring whose tension may be adjusted by hand to counterbalance the pull of the solenoid at any desired load on the machines. Through the action of the suspended core of the solenoid slight variations of load above or below this amount will cause changes in pressure on the carbon piles by means of this lever, and will result in wide variations in the contact resistance in the carbon piles. The pile that is compressed through the action of a small increase of current in the solenoid will have its resistance reduced, and more current will flow through it than through the other one upon which the pressure has been simultaneously released. If the carbon pile thus pressed happens to be the one whose outer end is attached to the positive pole of the battery section, for instance, the current will flow from the positive terminal of the battery around through the compressed pile and through the booster exciter field to the middle point of the battery, inducing polarity in one direction in the booster field to an extent corresponding to the increase of current that caused the solenoid to compress the carbon plates. When the current in the main circuit is slightly reduced, the solenoid action is reversed, pressure on that particular pile is released, and the other carbon pile, whose outer end is coupled to the negative pole of the battery section, is compressed, the current in the regulator circuit flows from the middle point of the battery back through the booster-exciter field in the opposite direction, and through the other pile to the negative pole of the 100 cells. The booster-exciter field is thus reversed, which reverses the polarity of the booster field, and consequently the polarity of the booster itself, finally resulting in the reversal of battery action. The action of the regulator is somewhat analogous to that of the Wheatstone bridge.

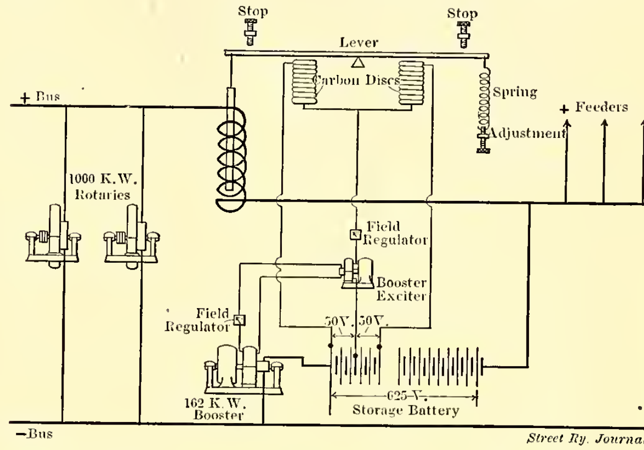


FIG. 12.—DIAGRAM OF WIRING FOR CARBON REGULATOR FOR THE HAMMEL BATTERY

By means of this regulator mechanism, the strength and the polarity of the booster-exciter field coils responds instantly to the fluctuations in the main power circuit from the rotary converters. The action of the exciter is simply to multiply this effect in the field of the booster itself, which changes its intensity or polarity in exactly the same way, and consequently charges or discharges the battery in almost instantaneous harmony with the changes in load upon the rotary converters.

The solenoid, through whose action the pressure on the carbon piles is varied, is shown in the diagram as a plunger working up and down in a coil inserted in the bus; but as installed here for handling large currents, it consists simply of a soft iron inverted U magnet suspended over the main busbar. It has practically no inertia, so that the only lagging effect in the train of operations is that due to the self-induction of the field coils of the booster exciter and the booster itself. It responds to a very small change in the generator load, and no preliminary determinations are required. The tension of the spring is easily adjusted by hand, the effect of this adjustment being to raise or lower the total amperes that will exert a given amount of action in the regulator, i. e., to raise or lower the neutral point between charge and discharge. The range of action of the apparatus is thus very easily al-

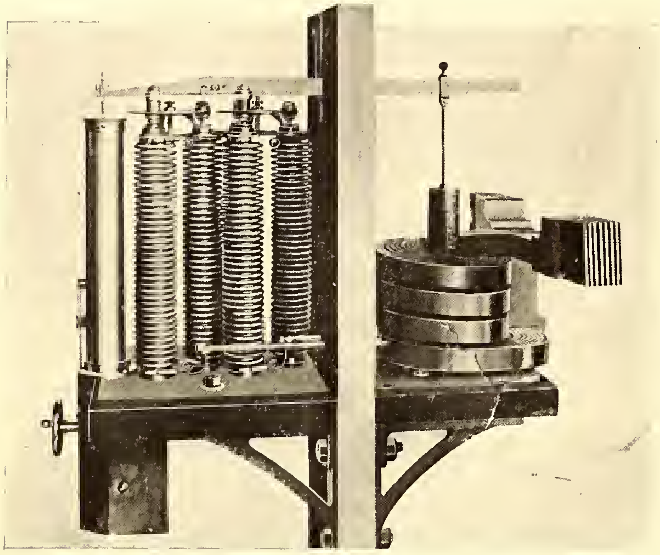


FIG. 13.—CARBON REGULATOR FOR STORAGE BATTERY

tered. The action of the lever is limited in either direction by adjustable stops which limit the battery charge and discharge, so that any further swing of the load will be handled by the rotaries only. The sensitiveness of the regulator can be adjusted by varying the resistance in the exciter field circuit. It has the additional advantage of obviating the necessity for carrying the total output of the station around the booster field, and simplifying the station wiring, and it is equally sensitive over a very wide range of load.

Fig. 13 is a typical view of this carbon regulator as applied for general work, and illustrating the principle above outlined. The arrangement of bus-bars and solenoid is different from that adopted in the Hammel installation, but the apparatus on the front of the panel is shown exactly as furnished.

By means of this system of regulation, the battery can be made to charge and discharge at any rate within the limits of 3200 amps. charge to 6400 amps. discharge, within ten seconds. By means of the adjustments above mentioned, the load upon the rotaries can be prevented from fluctuating by more than 5 per cent on either side of the average. Increased fluctuations on the rotaries by as much as 50 per cent on each side of the average can be permitted if desired.

This carbon regulator for automatic booster control was designed and manufactured by the Electric Storage Battery Company, of Philadelphia. The small exciter for the storage battery booster is of special design on account of the peculiar work demanded of it. It is of capacity sufficient to excite the fields of both booster generators when operating continuously. In order to overcome the counter e. m. f. of induction quickly, and thus enable the booster to pick up its load rapidly, the exciter is able to give a voltage considerably in excess of that required for a steady maximum booster excitation. As the booster generator responds to this exciter, the retrograde action of the regulator automatically reduces the excitation of the exciter. The exciter is driven by an induction motor wound for three-phase, 25-cycle current at 400 volts, provided with an auto starter. The two machines are mounted on a common bedplate. The booster exciters are located in the operating gallery near the low-tension switchboard.

SYSTEM OF HIGH-TENSION CONNECTIONS

Before describing the high-tension switchboards, bus-bars and circuit breakers, the general scheme of feeder distribution will be reviewed in order to convey a clear understanding of the objects to be accomplished.

In the initial installation all high-tension feeders are run in one trunk line from the power station to Woodhaven Junction. From this sub-station three general branches of the transmission line are run, one westward to East New York and Grand Avenue, one eastward to Rockaway Junction, to the two portable sub-station terminal houses, and to Valley Stream, and one south to Hammel. The general working diagram of the feeder system (Fig. 14), which fully illustrates the method of distribution, is reproduced from the issue of June 9 for the convenience of the reader.

Referring to this diagram, it is to be noted that two other sub-stations besides Woodhaven, namely, East New York and Rockaway Junction, each have to distribute alternating current to feeders supplying the outlying sub-stations near the terminals of the railway system. At these three principal sub-stations mentioned, therefore, the scheme of connections was so designed as to provide flexibility in shifting feeders about among all the sub-stations. This is done by an extra set of bus-bars suitably subdivided into sections and called the "transfer bus" in distinction to the regular working bus-bars of the

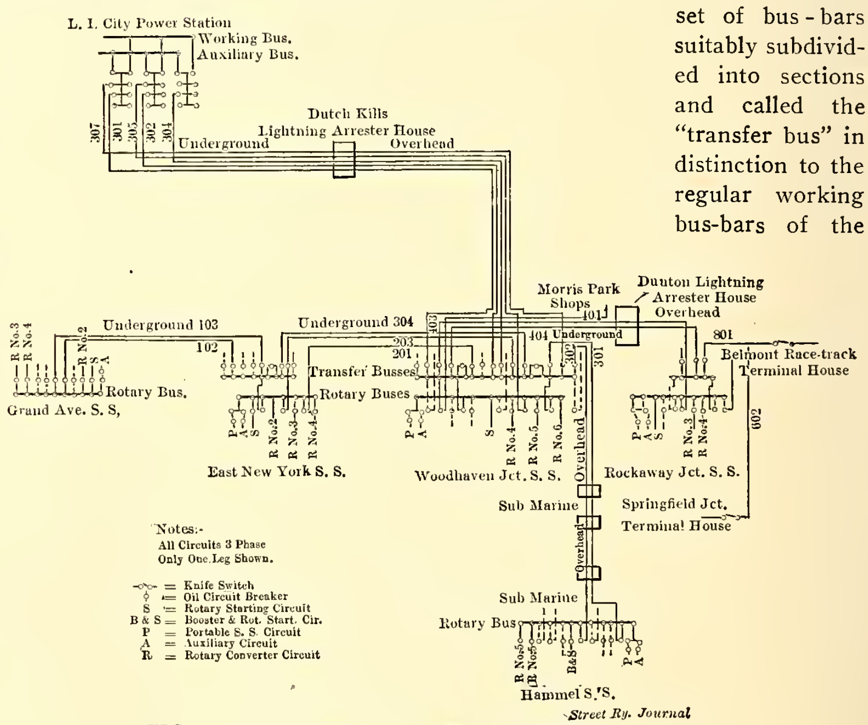


FIG. 14.—OUTLINE DIAGRAM OF FEEDER CIRCUITS

station, which are hereinafter referred to as the rotary bus.

The rotary bus in each station receives current directly through a feeder independently of the transfer bus in that particular station. This enables high-tension current to be passed through an intermediate sub-station to one or more beyond, independent of the operation of apparatus in the former. The diagram in Fig. 15 illustrates the high-tension connections at Woodhaven sub-station on a larger scale, and shows how the three outgoing branches of the feeder line each receive current through a separate section of the transfer bus in that station, each section having an independent feeder on the main trunk line coming from the power station.

The transfer bus is sectioned by non-automatic oil circuit breakers, so that all branches can be run separately or together as desired. A separate feeder connection to the Woodhaven rotary bus is also clearly shown, as well as the other bus connecting switches which enable the Woodhaven rotary bus to be coupled to either of the three sections of the transfer bus.

As will be noted in Fig. 14, the general arrangement at East New York and Rockaway Junction sub-stations is similar to that at Woodhaven, but considerably simpler, as less apparatus is required in the initial installation at those two stations. In the ultimate installation it is planned to have main feeders run direct from the Long Island City power station of the Pennsylvania Railroad Company to each of these three principal sub-stations. The feeders now connecting to these transfer buses will then be available as relays.

At sub-station No. 1 and No. 5, the only bus needed is that required for the operation of rotary converters, there being no stations beyond to which power is to be sent. Consequently the switching apparatus at these two sub-stations consists simply of that required to connect the incoming feeders and the sub-station apparatus to a single bus.

HIGH-TENSION BUS-BARS AND CIRCUIT BREAKERS

The disposition of the high-tension switching apparatus varies slightly at the different sub-stations, due to the considerations mentioned above. The most complete development is at Woodhaven Junction sub-station on account of its position in the system, and the arrangement of this place will, therefore, be described and illustrated quite fully. The other sub-stations will be mentioned mainly in connection with the more important variations.

The sectional elevation of Woodhaven Junction sub-station, Fig. 8, shows the high-tension cables entering through the lightning arrester gallery in the third story. The cables are then carried down the wall into the basement, where they cross to septums built into the back of the brick cubicles enclosing the oil circuit breakers on the main floor of the high-tension gallery. This bank of oil switches is directly underneath the transfer bus and controls all the circuits that enter and leave the bus. The incoming cables of each circuit, therefore, run first to the proper oil switch, continuing thence up to the transfer bus in the gallery overhead, each cable being run in a separate brick septum. The outgoing branch circuits are tapped out of the transfer bus, each tap coming down a septum in the back wall of the bus structure to the oil switch directly underneath. The oil switches both for the incoming and outgoing circuits are all in the same line underneath the transfer bus on the outer side of the gallery.

On the inner side of the gallery, the station or "rotary" bus-bars and the switches connecting them to the transformers and rotary converters in this station are arranged in line in like manner, on the two gallery floors. The brick structures enclosing the oil switches and bus-bars of these two distinct sets are practically identical in design. From Fig. 8 the general course of the high-tension cables from the lightning arrester gallery through switches, bus-bars and transformers to the rotaries can be readily traced. Between every oil switch and the bus to which it is connected is a set of three disconnecting knife switches, one in each phase. These are mounted upon the wall which extends upward from the back wall of the circuit-breaker compartments, and are on the opposite side of the wall from the circuit breakers. The switches are of the hook type, and are mounted upon porcelain insulators and are opened and closed by hand by means of a hook on the end of an insulating wooden rod. The blade of the switch is hinged on the dead side of the connection when open. Their function is to isolate completely the circuit breaker from the bus-bars, to facilitate inspection, cleaning and repairs. Their capacity is proportionate to that of the oil switches they protect.

At Woodhaven Junction sub-station two of the outgoing branch circuits emerge underground, while the third leaves by the overhead route. The underground feeder cables drop directly from their oil circuit breakers into septums in the basement, where the three cables of one circuit are brought together into a single three-conductor, high-tension cable, lead covered, which carries the current out into the underground portion of the transmission system.

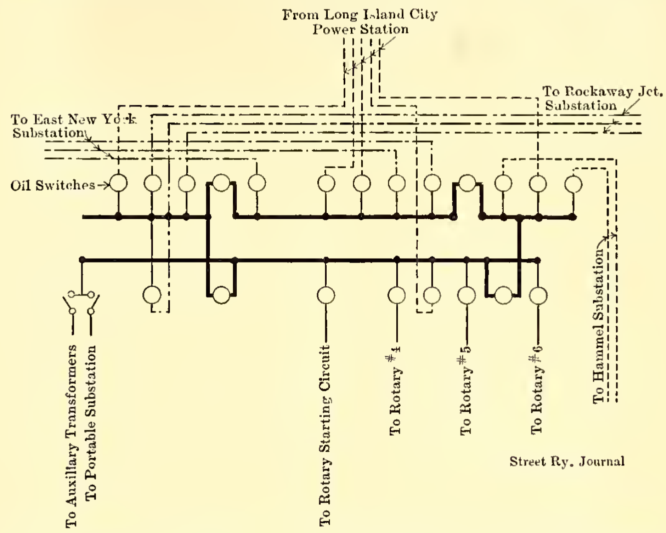


FIG. 15.—ARRANGEMENT OF CONNECTIONS TO HIGH-TENSION BUSES AT WOODHAVEN

At East New York, both the entrance and exit of high-tension cables is underground, and there is no need of a lightning arrester gallery. The incoming cables enter the basement, run up to the switches and transfer bus-bars and down again to their exit into the conduit system toward Grand Avenue. The arrangement of bus-bars, transformers, switches, and rotaries is practically identical with that at Woodhaven Junction.

Sub-station No. 1 at Grand Avenue has but a single set of bus-bars. The feeder cables all enter by underground conduits. The general arrangement is therefore quite simple. The rear end of the basement is utilized for the bus structure, the line of the oil circuit breakers being upon the main floor directly over the bus structure and under the operating gallery, all this gear being at the rear end of the building.

Rockaway Junction has no underground cables, so all circuits enter and leave overhead through a lightning arrester gallery like that at Woodhaven Junction. As the conditions here are quite similar to those at East New York, the arrangement of transfer and rotary buses, oil switches and apparatus generally is practically identical.

At Hammel there is no transfer bus, and the feeder cables enter the station under ground. So there is but one set of bus-bars, the high-tension gallery is narrower than in the other sub-stations of standard design. In other respects the relative arrangement of bus-bars, oil switches and cables on the floors of the operating gallery is the same as at the other stations.

The high-tension bus-bars each consist of three sets of bars of rolled copper mounted on porcelain pillars and carried in closed compartments placed one above the other in a structure of yellow pressed brick with alberne stone slabs separating the three tiers. The holes by which the taps enter and leave the compartments are made through alberene stone slabs bushed with heavy porcelain insulating bushings. Where the bus-bars are sectioned, the compartments in the same tier are completely divided off by stone slabs. Every precaution was taken to isolate electrically every bar and live connection from every other and from the ground. The potential transformers are in separate closed compartments on top of the bus structure. The type of structure is practically identical for all stations. On the back of each bus structure is built a set of vertical septums or compartments to separate the cables that enter and leave the structure to tap the bus-bars. The septums are continuous with those in the upward extension of the back walls of the oil switch structures, which are type C Westinghouse oil circuit breakers. They are all lined up directly underneath the bus structure excepting at Grand Avenue, where their relative positions are reversed.

HIGH-TENSION SWITCHES

The switches for manipulating the 12,000-volt current for the feeders and for the leads to the main transformers are three-pole, with two stationary contacts per pole, one for the incoming and the other for the outgoing lead of the same phase. The connection between the switch terminals of these two leads is made by raising into contact with them against the force of gravity, a bridging piece which is held against the contacts by mechanism operating against the force of gravity, which consequently tends to keep the switch open. The contacts are submerged in oil, the bridging piece of each pole of the switch being at the lower end of a heavy vertical wooden rod. Each pole of the oil circuit breaker is enclosed in a separate fireproof chamber of brick, capped with a slab of alberene stone upon which the operating gear is mounted. The front of each compartment is enclosed by a cover of asbestos lumber, held in place by eccentric clamps.

These oil circuit breakers are nominally of 600 amps. carrying capacity, but can handle short circuits of a maximum kilo-volt-ampere capacity equivalent to a generator capacity of 33,000 kw. The switches will open or close the circuit within one-half second after the control handle on the operating stand has been moved to the open or closed position. Even if the tripping coil be energized while the closing magnets are also energized, the circuit breaker will open as soon as the circuit of the closing coil has been opened by the operator.

Both automatic and non-automatic circuit breakers are employed. They are all automatic except those used for connecting the sections of the transfer bus and for connecting the two transfer buses to the rotary bus. The switches controlling feeders that pass through a station, and also those which control apparatus supplied from the rotary bus, are all automatic.

The non-automatic circuit breakers are electrically controlled from the operating galleries, but are not provided with automatic tripping attachments. The automatic circuit breakers, although electrically operated by the manual control of switches on the operating stand, are also automatically opened through relays by the current in the circuit in which the circuit breakers are located. These operating appliances will be described under the head of "Indication and Control Apparatus." A view of the high-tension switch gallery on the main floor level of the Woodhaven Junction sub-station is shown in Fig. 16.

INDICATION AND CONTROL APPARATUS

As may have been surmised from the description of the high-tension feeder system, comprising as it does both the working or rotary buses and a set of transfer buses, in the three principal stations, the indicating and control apparatus governing the movement of these switches is somewhat intricate. For the sake of clearness in description, it is perhaps best to classify the various functions performed by the switches before describing in detail the individual pieces of apparatus by which control is effected.

Being the central distribution point, and having the largest equipment of high-tension connections, Woodhaven Junction sub-station will again be taken as a typical illustration. The apparatus in the other sub-stations is all identical with this as to type and general arrangement, the only difference being that due to less apparatus and resulting greater simplicity.

At Woodhaven Junction, the switches may be divided into

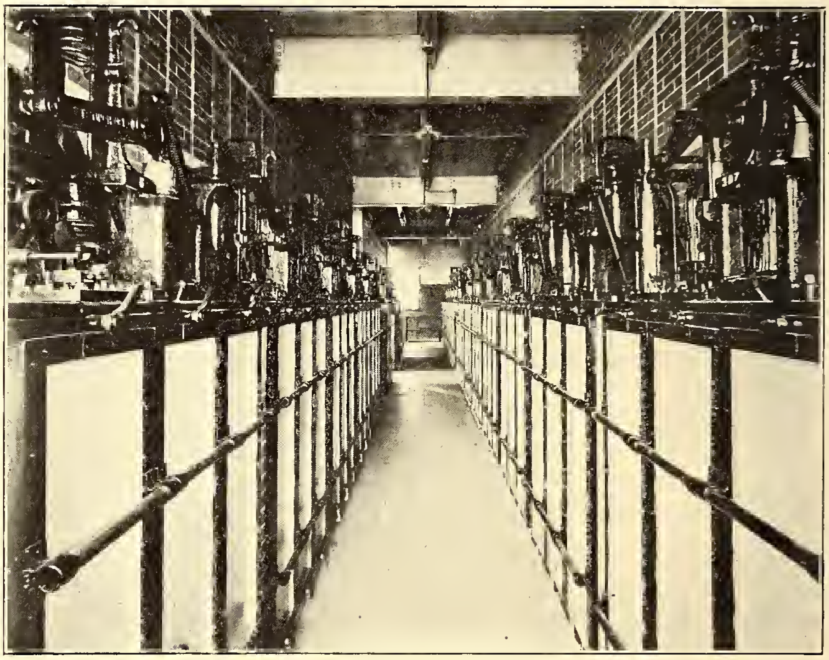


FIG. 16.—HIGH-TENSION SWITCH GALLERY IN THE WOODHAVEN JUNCTION SUB-STATION

a group of three classes for each bus. The first group is as follows: (1) Switches controlling incoming feeders from power station to transfer bus. (2) Bus junction switches connecting the sections of the transfer bus. (3) Outgoing high-tension feeders from transfer bus to sub-stations.

The second group is as follows: (4) Switch controlling the feeder from the power station direct to rotary bus. (5) Switches connecting the transfer bus with rotary bus. (6) Switch connecting main transformers (for rotary converters) with the rotary bus.

The apparatus controlling the first group of switches, which deal entirely with the transfer bus, is mounted on a separate set of three marble panels, each 24 in. wide and 8 ft. 1 in. high, set to the left of the main operating stand. Upon the central one of these three panels are mounted, four ammeters for current indication, and four operating handles for switch control, with provision for two more, for the ultimate capacity of six incoming feeders for which this sub-station is designed. On this panel are also mounted two controls for the two bus junction switches needed for connecting the three sections of the transfer bus. At the right and left of this central panel are similar panels upon which are mounted four feeder ammeters and four switch-operating handles, each to control an outgoing high-tension feeder leading to a sub-station. Each one of the above-described panels has provision for mounting upon it the following apparatus:

Six 500-amp A. C. ammeters.
Six controllers for type C automatic circuit breakers.
Six red signals for control indication.
Six green signals for control indication.
Two controllers for type C non-automatic circuit breakers.
Two red signals for control indication.
Two green signals for control indication.

The second group of control apparatus, which has to deal with the apparatus directly operated in the sub-station itself, is mounted upon a separate bank of control stands and instrument panels, so arranged as to form a single fixture composed of unit sections, and capable of extension in either direction. The control stand portion of this apparatus consists of a bench with an inclined top, upon the front and top of which are carried the control instruments. The operator stands directly in front of this, and the space immediately over it is left vacant, permitting the operator to have an unobstructed view into the station. Above the level of the operator's head there is mounted a system of unit-instrument panels of the same width as the control panels upon the bench and corresponding each to each across the width of the bench. The control panels and the instrument panels are each 12 in. wide.

Going from the left to right, the designation of the control and instrument panels in this bench and overhead framework is as follows:

(1) Two rotary bus connecting switches. (These connect the rotary bus with the transfer bus.)
(2) A. C. feeder direct from power station to rotary bus.
(3) Blank panel reserved for booster in case of storage battery installation.
(4) Switches connecting rotary bus with transformers supplying rotary converter starting motors (and booster motors when installed).
(5) Blank panel for future rotary converter.
(6) Panel for rotary converter installed.
(7) Panel for rotary converter installed.
(8) Panel for rotary converter installed.

The apparatus on each one of these control panels on the top of the bench consists of either one or two switch-control handles as the case may be, each with a red and a green lamp signal for control indication. Each of the booster panels has one switch control with lamps, and these two panels are also fitted with two booster and motor-starting switches and a relay push-button, which is used to stop the ringing of the circuit breaker alarm gong.

The rotary converter panels are each fitted with a control operating handle, a red and a green signal lamp, a starting motor switch, and a synchronizing receptacle.

On the front of the operating control bench are panels 12 ins. wide extending across the entire front of the bench. Beginning at the left-hand end, the first five of these panels are blank. Upon the last three, which correspond to the control panels of the rotary converters now installed, are mounted rheostat handles for the fields of the three rotaries.

The instruments which indicate the conditions of the circuits corresponding to each one of the control panels are mounted upon the corresponding panels directly over the operator's head. Beginning at the left, upon the rotary bus connecting switch panel are mounted a synchroscope and a voltmeter, beneath which is a row of 3-4-point voltmeter receptacles. Upon the second instrument panel corresponding to the a. c. feeder in the power station, there is room for two a. c. ammeters, and there is also an eight-point voltmeter receptacle. Upon the third panel corresponding to the blank booster panel there is room for mounting two polyphase indicating wattmeters, of which one is now in position. Upon the fourth panel is mounted one indicating wattmeter with room for another. The fifth panel is blank, being reserved for a rotary converter. The sixth, seventh and eighth panels are identical, there being mounted on each:

One power factor meter.
One polyphase indicating wattmeter.
One polyphase integrating wattmeter.
One synchronizing lamp.
One field pilot lamp.

As above explained, the larger amount of apparatus in Woodhaven Junction sub-station, due to the greater extent of the transfer bus, results in its having more switches and a larger switchboard. The control stands and instrument panels at the other sub-stations are identical with that above described, as regards their general makeup and the order of panels from left to right, except at Grand Avenue, where the order is reversed.

The description of one is, therefore, a description of all.

The control apparatus by means of which the electrically-operated switches are worked from the control stand consists of a circuit supplied by a storage battery, whose current is conveyed to the two closing coils and the one tripping coil of each oil circuit breaker, the control circuits being closed either by means of a handle on the control stand or (if control is automatic) by the time-limit relay which is actuated from a series transformer in each high-tension circuit. The contacts operated by the switch handle on the control stand, and this time-limit relay, are in multiple across the switch-opening circuit; while contacts operated by the control handle only are used to close the switch-closing circuit.

The position of the switch is indicated to the operator by means of a red and a green signal lamp placed one on each side of the switch handle upon the control stand. These signal lamps are lighted by current from the above-mentioned auxiliary storage battery, and the lamp circuits are closed through a little rocker-type double-throw knife switch on top of the oil-switch structure, which is thrown to the one side or the other by the oil-switch mechanism when it changes from one position to the other.

There are sixteen relays in the Woodhaven Junction sub-station, enabling the automatic control of that number of oil circuit breakers. Of these sixteen circuit breakers automatically controlled, five are from the incoming power circuits from Long Island City, three are in the out-going circuits to East New York and Grand Avenue, two are in the outgoing power circuits to Rockaway Junction, two are in the outgoing circuits to Hammel, and three control the rotary converter circuits in the sub-stations. The remaining one controls the circuit supplying the auxiliary starting transformers. The bus junction and bus connecting switches are non-automatic, and therefore no relays are provided for them. The relays are mounted on a black-finished marble panel on the main floor directly under the operating gallery. The source of supply for this electric system is separate from that of any of the other electrical circuits in the station, consisting of a small storage battery of 53 cells of the Electric Storage Battery Company's type D-5.

DIRECT-CURRENT SWITCHBOARDS

Direct current for the third-rail and track circuits is distributed from the rotaries to the outgoing circuits through panel switchboards of the standard direct-current type, the panels consisting of marble slabs of standard dimensions, upon which are mounted switches, circuit breakers and instruments of standard design for the various functions required of them. These direct-current switchboards are situated in the operating gallery which contains the high-tension control apparatus mentioned above, and is directly opposite the gallery containing the high-tension oil-circuit breakers and bus-bar connections. All the essential switching and control apparatus used in regular operation is, therefore, easily handled by a single operator. The only exceptions to this are the equalizer and negative rotary converter switches, which are on pedestals adjacent to the rotary converters on the main floor.

The direct-current switchboard at the Hammel sub-station differs somewhat from the others on account of the storage battery which is there installed as an adjunct to the rotary converters. At the top of the booster regulator panel is mounted the carbon regulator which has previously been described. The carbon piles rest upon a bracket on the rear of the board and the balanced lever passes through a slot in the panel; from the rear end of this lever the horse-shoe magnet which actuates the control is suspended over the positive bus-bar, while the balancing spring with its adjusting screw and hand wheel are mounted upon a bracket upon the front of the panel. Directly beneath the regulator are two carbon break circuit breakers, one in the field circuit of each booster, i. e., the main circuit of the booster exciter. Below these are the booster field ammeters, which are of the round pattern. Directly beneath the ammeters are a set of small switches used to transfer the connections between the main battery and the carbon piles from one 100-cell section of the battery to another, so as to equalize the current consumption over the various sections of the battery. Below these are the two rheostat regulating hand wheels for the fields of the boosters and the exciters. On the booster panel are mounted four small switches for separately controlling the field circuit and the armature circuit of the two booster exciters.

The two booster panels are identical, each having two 3000-amp. switches so arranged that the booster and battery can be placed in series across the main bus, or the battery can be placed across the bus without the booster if desired. The booster panels each have circuit breakers of 4000-amp. capacity, and an ammeter of 2500-0-5000-amp. scale. The station load panel carries a Thomson recording wattmeter and the main ammeter of 15,000 amp. capacity, with two voltmeters above. There are six feeder switches mounted upon four panels, there being also a spare feeder panel arranged as described on the Woodhaven switchboard.

There is also provided at this station a battery panel of 4000 amps. capacity, upon which are mounted a large brush type circuit breaker, two switches, and a double-reading Thomson recording wattmeter. This panel is in series with the negative bus connection of the storage battery.

PORTABLE SUB-STATIONS

Frequent reference has been made in the foregoing to the portable sub-stations which were made necessary by the extremely heavy but very infrequent loads incidental to the service of race-tracks during the racing season at Belmont Park and at the Metropolitan race-track south of Jamaica.

Two portable sub-stations were provided, each consisting of a 1000-kw rotary converter with transformer, switchboard apparatus, and the necessary auxiliaries, carried in a heavy steel car resembling a freight car in general appearance. A plan of this freight car is given in Fig. 17, which shows the disposition of the apparatus. The bottom of the car is of very heavy steel beam construction, but the superstructure is as light as is consistent with the proper amount of strength. The end of the car containing the rotary converter is so built that it can be readily taken to pieces and, in fact, entirely knocked down so that the rotary converter can be easily taken apart, if necessary, by being run under the crane in any of the sub-stations.

The car in which the portable sub-station is mounted weighs without load, including trucks, draw-bars, brakes and other fittings, 49,000 lbs. The weight of the equipment mounted in it, including rotary converter, transformers, high-tension switch, low-tension switchboard panels, transformer blowers, etc., is 142,400 lbs.

Besides the rotary converter, which is identical with the previously described standard rotary converters of 1000-kw capacity, are three 375-kw transformers of the air-blast type, fitted with a blower and motor of a type similar to those described above for the sub-stations. The high-tension switching apparatus consists of a standard type "C" oil circuit breaker in a standard brick setting which is arranged between the incoming connector lugs and the transformers. High-tension current is taken into the portable sub-station through three connecting lugs placed at the high-tension end of the car, which afford a connection to three flexible leads properly supported over the track in the portable sub-station buildings. Direct current is led out of low-tension connecting lugs, placed opposite an opening in the side of the car. Lightning protective apparatus for the high-tension circuits is located permanently in the tower at one end of the building, which has been already described. The construction and arrangement of this tower is practically identical with that of the lightning-arrester houses on the trestle. It contains room for two complete arrester outfits for the protection of two entering high-tension circuits (of which only one is now installed), comprising simply the usual choke coils, low equivalent arresters and disconnecting switches. Access to the tower containing this apparatus is by means of a ladder extending up from the platform at the end of the house farthest from the entrance. Permanent low-tension connections suitably mounted on the wall within the sub-station building are connected directly to the third rail and the tracks.

The apparatus can perhaps be best described in detail by following the course of the current through it.

The high-tension connections enter through an opening in one end of the car which, when not in use, is closed by a steel flap hinged so as to fall directly over the aperture. Three connections are provided for the three-phase current, which are tapped directly to lugs that project through the rear of the oil-switch structure. The oil switch is identical in type and construction with those used throughout the sub-stations, being of 600 amp. capacity, three-pole, and electrically operated. It is set in the usual pressed yellow brick cubicle with alberene stone top and trimmings. Just before entering the oil switch, taps are taken off for two potential transformers, both of them being used for the wattmeter connections, and one of them being used as the line side of the synchronizing apparatus.

After leaving the oil switch the main connections pass through series transformers of the through type, from which run connections for the integrating wattmeter. The main connections thence run directly to the main transformers, where they fasten to the terminals of the high-tension coils. On the low-tension side of the main transformers, four connections are made between each transformer and a transformer terminal panel. These four taps are arranged so as to give four different voltages for the rotary converter, as on such a large system as this it is quite likely that the voltage at different sub-station points may vary from time to time under different conditions. This transformer terminal panel is provided with several switches, making possible four combinations of voltage. From this transformer terminal panel the main alternating connections run directly to the a. c. rotary converter panel through heavy bus-bars running up past the top of the panels. On the main a. c. panel, taps are taken off for the rotary starting motor and also for the synchronizing transformer on the machine side. From this panel the main cables run direct to the a. c. side of the rotary converter.

It should be stated here that the portable sub-station rotaries are synchronized from the low-tension side, by means of a synchroscope. That is, the rotary converter is started up by the starting motor after the transformers have been cut in, and by the aid of a synchroscope the low-tension a. c. switches on the rotary panel are thrown in by hand at the instant of synchronism. From the d. c. side of the rotary the negative connection runs direct to a lug mounted on a slab placed conveniently at the side of the car opposite the opening through which connections are made to the fixed lugs in either the portable sub-station house or in the permanent sub-station. There is no switch in this connection. The equalizer is also taken from the negative pole of the machine and run to an equalizer switch mounted on the inside of the car, conveniently to the slab supporting the outgoing lugs, whence a connection can be made to the other portable sub-station if it is in the same

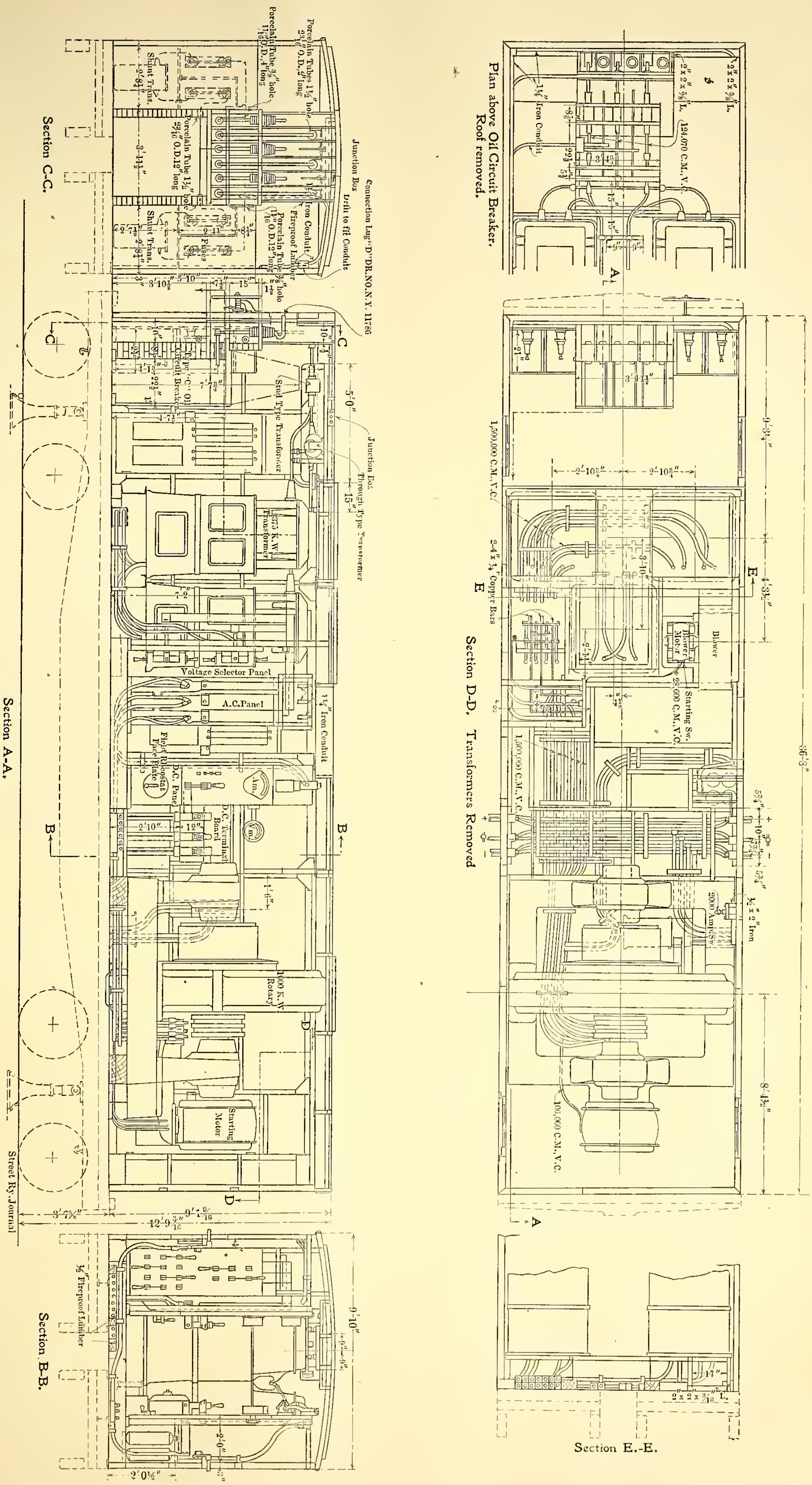


FIG. 17.—LOCATION OF ELECTRICAL APPARATUS IN SUB-STATION CAR

house, or to the equalizer bus of the permanent sub-station if that is where the portable sub-station happens to be working. The positive leg goes to a direct-current panel in the car which carries a single 2000-amp. switch, with 3000-amp. ammeter and circuit breaker. From the circuit breaker a connection is led to the slab where the taps are made to whatever third-rail circuits the portable sub-station is connected.

On the a. c. rotary converter panel are connected the power-factor meter, voltmeter, synchroscope, integrating voltmeter, an overload relay, synchronizing lamp, and the controlling handle of the oil switch.

This control is practically identical with the controls governing the switch operation in the permanent sub-station, except that as no auxiliary storage battery is carried in this car, the solenoids operating the oil switch and governed by the control handle are wound for 500-volt current taken directly from the third rail, which, of course, is always alive when it is necessary for the sub-station to be in action. There are two closing coils on the switch, and one tripping coil for opening the circuit, which operation is completed by gravity when once the tripping coil has been actuated.

The three 375-kw air-blast transformers are kept cool by a 50-in. steel plate blower fan which is able to deliver 4500 cu. ft. of air per minute at one ounce pressure when running at 710 r. p. m. This fan is driven by one 3-hp three-phase 400-volt induction motor receiving current from the a. c. rotary panel. Fig. 18 shows the car in position and connected up in the interior of a sub-station.

HIGH-TENSION LIGHTNING ARRESTERS

The disposition of the apparatus in the high-tension gallery at Woodhaven Junction sub-station is shown in Figs. 7 and 8. The arresters are of the Westinghouse low equivalent type, mounted upon marble panels which are carried on a steel angle-iron framework. The three arresters on the three legs of the high-tension circuit are separated by barriers of asbestos lumber. The arresters are all provided with knife switches so that they can be readily disconnected. There is a choke coil in series with each main circuit, mounted near the top of the steel framework. The arresters are mounted upon special porcelain insulators, and the use of wood is entirely dispensed with in the lightning-arrester gallery, thus insuring fireproof construction. The openings in the side of the house through which the cables enter are 18 ins. square, enclosed by two glass plates 3/8 in. thick, and separated 5 ins., having 2½-in. holes in the centers through which the cable and feeders pass without touching the glass. Access of rain or snow through the openings is prevented by a thin brass disk about 2½ ins. in diameter which is fastened upon each cable between the two glass plates. Standard straight-line insulators are used for supporting the bare wires inside of the building.

HEATING SYSTEM

Each sub-station is fitted with a hot-water heating system supplied from a boiler situated in the basement. The boiler burns anthracite coal and is composed of seven sections, with grates 30 ins. wide, the whole boiler occupying a space about 3½ x 4 ft.

SUB-STATION LIGHTING EQUIPMENT

The lighting in each of the sub-stations is accomplished through a transformer which has been mentioned along with the other auxiliary transformers, which supplies a 105-volt three-wire lighting bus. Switches for the lighting circuits are mounted upon a separate marble panel situated at one end of the operating gallery, which also carries the indicating and control apparatus for the small motor generator set which charges the battery that supplies current to the electrically-operated switch-control system.

Ten lighting circuits are distributed from fuse slabs carried on the back of this panel, enclosed type fuses with ferrule contacts being used. Two of the lighting circuits are fitted with double-throw switches by means of which they can be thrown either on the 105-volt transformer bus or on the direct-current bus which connects the small generator with the above-mentioned auxiliary storage battery. The switchboard panel carries a 150-volt voltmeter and a round-pattern ammeter, 25-amp. circuit breaker, and a field rheostat for controlling this small generator, and also a battery switch. Besides the foregoing there are ten switches for the accommodation of the various lighting circuits that run about the building. The number of lamps in the sub-station lighting circuits is as follows:

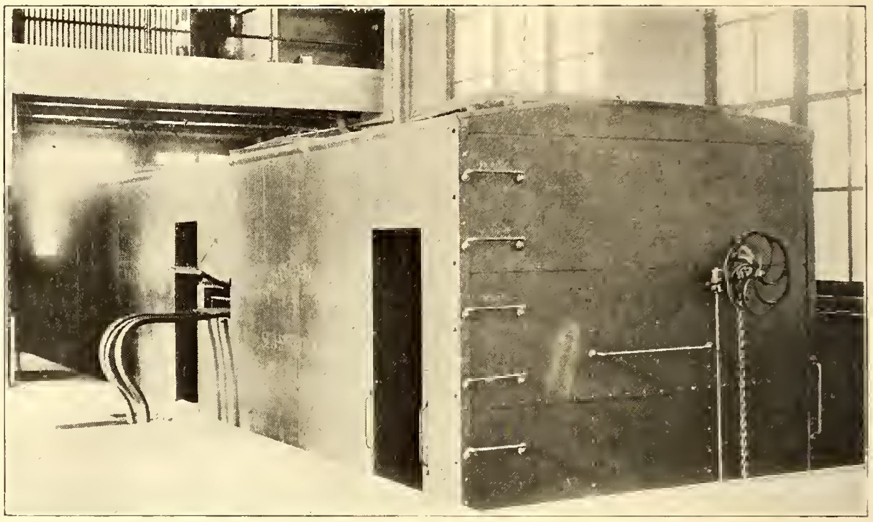


FIG. 18.—PORTABLE SUB-STATION CAR CONNECTED UP IN ROCKAWAY JUNCTION

	Incandescents	Nernst
Grand Avenue................	124	6
East New York..............	124	6
Woodhaven Junction..........	184	8
Rockaway Junction...........	140	6
Hammel	209	8

The incandescents are 16-candle power and the Nernst lamps have four glowers each.

TRANSFORMER BLOWER OUTFIT

As the main transformers in these sub-stations are all of the air-blast type, electric-driven blowers are provided to furnish the necessary draft. They are in two sizes. At Woodhaven and at Hammel sub-stations there are two fans running at 480 r. p. m., built to deliver 18,000 cu. ft. of air per minute, at 70 deg. F., against a maintained pressure of 1 oz. per square inch. They are operated by 9.8 hp motors.

At each of the other three stations there are two blower sets, each being able to deliver 12,000 cu. ft. of air under the same conditions as above, and requiring a 6.6-hp motor at 480 r. p. m.

The fans are built of steel plate, full housed, with horizontal top discharge. The floats of all the fans are of No. 10 U. S. gage steel plate. The side sheets are of the same thickness, and the scroll sheets No. 11 U. S. gage. The shafts are about 2 11-16 ins. in diameter.

The smaller fans are built up with one spider carrying all the fan blades, while on the larger fans there are two spiders.

There are two fan bearings designed for lubrication by grease.

The motors, which are coupled direct to the fans through flange couplings, are of the three-phase induction type, operating at 400 volts from auxiliary transformers.

SIGNAL-SERVICE APPARATUS

The railroad lines are protected by a block signal system especially devised to work with alternating current, by which means it becomes possible to make use of the well-known feature of short-circuiting the two rails of the track without requiring that one of them shall be devoted only to signaling purposes, which would cut down by one-half the capacity of the track return circuit. Accordingly this power is taken from a set of transformers placed in the Woodhaven Junction sub-station. There are two transformers of 100 kw each, only one being in service, the other being used as spare. These take 11,000-volt current (single phase) and transform it to 2200-volt current for use in the signal system. The transformers are located in the basement and are supplied through a type B, 11,000-volt oil switch mounted on a separate marble panel.

AIR-CLEANING SETS

There is provided at each sub-station an electric-driven air compressor of the Westinghouse Traction Brake Company's "type D-4." The motors driving these compressors are wound for 600 volts direct current. Their capacity is 50 cubic feet of free air per minute, up to 100 lbs. pressure. The motor is geared to the compressor. The compressor supplies a system of air piping running to outlets conveniently placed for blowing air into the rotary converters and the switching apparatus for cleaning.

CONCLUSION

The sub-stations were first supplied with high-tension current from the overhead lines, and tested out on April 27, 1905, and current was first furnished from Woodhaven Junction to the third rail for car tests May 13, 1905. The portable sub-stations were first placed in operation June 12, 1905. Regular operation of the permanent sub-stations began July 26, 1905.

The design and construction of the foregoing sub-station system was carried out by Westinghouse, Church, Kerr & Company, engineers for the Long Island Railroad Company, under the direction of George Gibbs, chief engineer of electric traction of the Long Island Railroad Company, subject to the approval of an electrical committee consisting of the chief operating officials of the road, with the president as chairman.

The Pennsylvania Railroad Company has made another movement in its fight against trolley competition between Mount Holly and Philadelphia. Shortly after the lines of the Burlington County Railway Company were placed in operation and connected with what are now the Public Service Corporation's lines between Moorestown and Camden, the electric railway rate was fixed at 46 cents for an excursion trip between Mount Holly and Philadelphia. About a year ago the Pennsylvania Company evidently felt the effect of the competition, and its excursion fare was reduced from 70 cents to 59 cents, and tickets sold in strips of ten were reduced so that the excursion rate would be 54 cents. Those who frequently make trips to Philadelphia took advantage of the strip tickets, but the return to the Pennsylvania lines was so great that now 100-trip tickets, good for one year from date of issue, have been placed on sale, at the rate of $17.50. This makes an excursion trip to Philadelphia cost but 35 cents, which is eleven cents less than the trolley road offers.

REPORT OF COMMITTEE OF AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION ON ELECTRICITY ON STEAM RAILROADS

The instructions of your committee on electricity on steam railroads read as follows: The committee to consider and present to the association the relative advantages of the different systems of electric traction now in use as applied to interurban and suburban lines; also, as far as possible the relative cost of operating such lines by electricity and steam. The committee are also instructed to include in its investigations the different systems of gasoline, gasoline-electric and steam motor cars. This commission is almost the first recognition in this association of other motive power than the steam locomotive, and your committee doubts its ability to cover the whole ground of its instructions in a perfectly satisfactory and comprehensive manner, for the reason that the factors in each railroad proposition vary from its neighbor even as men vary in their personal characteristics.

We understand that main-line operation is not to be considered, but that branch lines, suburban and interurban lines which are feeders to main lines are to be discussed. We understand, also, that the question relates mainly to passenger traffic on account of the expression "now in use," as electric traction of freight is carried on to a limited extent only at the present time. Mail, baggage and express are being handled, but these are generally considered in connection with or a part of the passenger traffic. No steam railroad will consider abandoning its freight service in favor of electric passenger service, and we are therefore under the necessity of considering provisions for both classes of service, and for convenience the passenger service will be taken up first. The class of service we have to consider breaks away from the steam-railroad ideas of trains of cars drawn by locomotives, and takes up the individual car or cars, each provided with means of propulsion taking power from some central source.

The main business of railroads is to sell transportation, and the only object in considering electric traction is to ascertain whether the cost of carrying passengers can be decreased or the amount of travel be so increased as to provide additional revenue to the road offering it. Inasmuch as the proposition in hand is based on the street car idea and methods it might be well to look up the history and development of that branch of traction which began in this country about 1850, the cars being drawn by horses. In 1873 the cable system was introduced, and after twenty-five years very few survived, although the cost of their construction was very heavy. The early development of motor-driven electric cars occurred mainly after 1880, and in the year 1890 the census report gives for the United States the following mileage for street and suburban railways:

Electric	1,261.97	miles
Animal	5,661.44	"
Cable	488.31	"
Steam	711.30	"
Total	8,123.02	"

In 1902 the mileage was:

Electric	21,907.59	per cent, increase	1636.
Animal	259.10	per cent, decrease	95.4
Cable	240.69	per cent, decrease	50.7
Steam	169.61	per cent, decrease	76.2
Total	22,576.99	per cent, increase	177.9

Thus it will be seen that, although there was a very large increase of total mileage in the above twelve years, yet the greater proportion of the increase of electric traction was at the expense of the other methods of traction. During this period there were some ephemeral experiments in the use of batteries and of stored compresssd air for power purposes on cars, but none of these survive.

The above figures show the backward development also of the steam-driven or "dummy" for such service, despite the vast advance in steam railroading proper during these years, and this in itself is almost a complete argument against the steam car or other types of self-propelled car, except for special situations.

In early electric street railway traction several attempts were made to utilize an electric locomotive, but these were generally abandoned, although it is customary now on some roads to have trail cars attached to leading motor cars. The latest and most advanced practice is to have all cars equipped with motors controlled from the leading car. The development in electric cars has been marked, not only by their increase in size and carrying capacity, but also in the size of motors employed. The earlier cars had 15 or 20-hp equipment, but it was soon found that these were inadequate to properly accelerate loaded cars, and now many heavy suburban cars are equipped with four 75-hp motors each, and in some cars the motor equipment totals 400 hp. We have, therefore, available for comparison the steam railroad train, consisting of a locomotive with as many cars as the service demands, running at infrequent intervals, and covering perhaps 200 miles per day, as against the same road operated with individual electric cars, obtaining power from a general source, running at frequent intervals and fairly equivalent mileage. It is perfectly apparent that the density of traffic is the ruling factor as to whether the steam or the electric road will prove the more profitable.

It is quite well known on old-established lines what the passenger returns will be with fairly steady business conditions, provided there is no change in the train accommodations, but if there is an increase in train service it is almost sure to build up an induced traffic, the amount of which is difficult to estimate. Unless, therefore, there is a reasonable basis of expectation for such traffic, the steam railway that can fully care for its own is not in need of a new system, and the expediency is doubtful. On the contrary there are many sections of the country, well populated and suburban districts, where an increase of travel may be induced by improved facilities, the amount of which can be gaged by the density of population.

The travel which is contemplated is the local, short runs, which in many cases has been taken from steam railroads by competing electric lines, this proving that the more frequent service and general convenience of the trolley line is more attractive. Absence of smoke and cinders, open cars in season, connections with city lines, all add to the popularity of the trolley and give a business that can be profitably carried at lower rates, which, after all, is the main inducement. It is believed, therefore, that where there is a sufficient density of traffic it will pay steam railroads to handle their local suburban and interurban travel electrically, giving frequent trains and frequent stops, equaling the convenience and accessibility of trolley lines, for which the public does not have to stop to consult time tables, buy tickets and go to inconvenient points to get on trains. Traffic of this kind should have its separate tracks, as it would get in the way of fast through trains and itself would be impeded by slow freight trains, using the same tracks.

It would be possible to make a combination service in some territories, running slow freight through at certain hours when travel was light, or if the character of the freight would permit, to have special separate freight units which could keep out of the way of passenger traffic. As before stated, the particular class of service and the system to be used must be chosen with special reference to the situation, and these vary so that no general rule or information will apply. It is our belief, however, that few situations will figure out profitably with the combination service, and that if electrification is warranted for passenger traffic, that a complete change will be desirable, except possibly where there is through travel involved also.

RELATIVE ADVANTAGES OF DIFFERENT SYSTEMS OF ELECTRIC TRACTION NOW IN USE

By far the greater portion of the present car equipments are for the use of direct current, but of late alternating current has entered the field and there are some very interesting single-phase operations, the motors employed being capable of running on either direct or alternating current, and by having suitable transformers on the cars, high line voltage may be carried, thus reducing the cost of distribution.

Long-distance distribution is best accomplished by alternating current of high voltage, and if direct-current motor equipments are used the current is transformed at sub-stations at suitable intervals and generally not over ten miles apart. These stations are equipped with transformers for stepping down the voltage, and with rotary converters for changing the current direct at suitable voltage for the line. Sub-stations on lines employing single-phase machinery have only the transformers, no rotaries being required, and this also cuts off cost of attendance except occasional inspection.

The single-phase operation is economical on account of high voltage used on the line, and cheapens very much the cost of distribution from the sub-stations, there being no difference between the power station and sub-stations. The car equipments, however, are more expensive than direct-current apparatus, so that, assuming both to be of equal efficiency, the number of equipments and apparatus required must be considered, and their extra cost weighed as against the low cost of direct-current machinery and more expensive distribution to the line. The present New York Central-New Haven Railroad situation is an interesting example of the application of these two systems of electric traction, and the ultimate working out of these two great problems will add greatly to the shaping and development of the future of electric traction.

RELATIVE COSTS OF OPERATING BY ELECTRICITY AND STEAM

The relative costs of operation with electricity and steam are difficult to state as there is very little accurate information of value. The results obtained by attempting to draw comparisons from hypothetical roads would depend entirely upon the assumptions which were made. For instance, a set of conditions could be assumed which would show a much lower cost of operation by electricity than by steam; another set could be assumed which would show practically equal cost, and a third set which would show that steam operation would be the most economical. In view of the fact that the assumptions would govern the results, it is believed that information of this nature would not be of value to the association and might lead to erroneous assumptions and misunderstanding.

A number of electrifications are under way at the present time, employing various systems of distribution, and a considerable amount of data will no doubt be available in the near future.

Relative subjects which would be of interest and value to this association are the character of the shops, shop equipment and apparatus necessary for the maintenance and repair of electric equipment; also the power houses and their equipment.

GASOLINE, GASOLINE-ELECTRIC AND STEAM MOTOR CARS

Some time prior to the development of electric interurban railways the steam motor car or dummy, in many cases hauling a trailer, was used to a moderate extent, but at the present time few of these remain. In response to a demand from railroad managers for a motor car to operate on branch lines and special situations, there has been recently a development of motor cars employing gasoline in an internal combustion engine, this engine either directly driving the car or driving a dynamo to generate current to be used for driving motors in the trucks. Some builders interpose batteries between generator and motors to store the current when it is not all needed for propulsion, and to assist in starting on grades when the generator capacity may be insufficient. There is very great flexibility and convenience in this combination, but it is attained at very considerable expense and complication, and requires unusually skilled attendance not commonly available in railroad service.

The examples of the gasoline engine, electric generator, battery and motor types are the cars of the St. Joseph Valley Traction Company's line, built by F. M. Hicks, and the Strang car that lately made a successful run from New York to Kansas City. The gasoline engine on these types is set to run at a constant speed, and this characteristic is essential for the best economy of the internal combustion engine. The size of the engine used may be proportioned to the average power required for normal operation, and the speed variation and excess of power above normal requirements may be supplied by the battery equipment, which also comes into play for lighting and short movements and would also be available to bring the car in in case of a breakdown of the engine or generator.

The gasoline-electric type not employing batteries is illustrated by the D. & H. car recently built by the General Electric Company. The generator on this type of car has to be equal to the maximum requirements, and in order to vary the current for the conditions to be met, the field excitation is handled by a separate exciter, chain-driven from the main generator. The controller is semi-automatic and can be set for any predetermined maximum acceleration, and the speed of the car is governed by varying the field strength of the generator. The speed of the engine remains constant after acceleration. This application is very ingenious and effective, and we understand that the car has been put into regular service between Schenectady and Saratoga.

The Union Pacific motor car, representing the direct mechanical drive application of gasoline power, is driven by a six-cylinder reversible gasoline engine, with crank shaft at right angles to the length of car; a sprocket mounted on same, driving a special chain, transmits the power direct to the driving axle through a second sprocket attached to the axle. The chain easily shows a transmission of power with an efficiency of 97 per cent, which clearly demonstrates that this method of transmission is very close to the maximum efficiency possible. For the initial start of car, or putting it in motion, a reducing gear is used, and, until the car attains a speed of six or seven miles per hour the economy of this transmission is somewhat reduced; but, as the use of the gears is only temporary and lasts only a few seconds, it can almost be left out of consideration.

The roof of the Union Pacific motor car is 24 in. lower than the standard height of coach roof. As the car is built of steel, with pointed end and smooth exterior surface, the wind resistance is materially reduced, enabling a 100-hp gasoline engine to drive the car at the rate of 65 to 70 miles an hour.

The car framing is a combination of steel shapes and braces, the whole tied together by steel plates, making a unit structure, each part supporting the adjacent ones and bearing its proportion of the burden imposed upon it. These cars weigh, motor and all, 26 tons, which of course is a very material factor in the high speed attained by cars in service, and affords considerable economy in comparison with the heavier steam motor cars, some of which weigh seventy-five tons and over, with the same seating capacity. Motor car No. 7 has seating capacity for seventy-five people, and has, in actual service, carried ninety-five. One of the most important features in the development of the steel motor car is the reduction in height of car and consequential reduction in weight and decreased wind resistance, a result of which is the system of ventilation—taking fresh air from the front of a car, delivering it at floor level and by suction drawing the foul air out of the roof.

Motor car No. 7 is equipped with metal round-sash windows—a window impervious to cold air, dust or water; in fact, is tight as a porthole on an ocean-going vessel. These windows have demonstrated themselves to be a great luxury to the traveler. The enclosed inside steps, with side-door entrance, have also proven very popular with the traveling public. This side-door entrance is permissible with steel-car construction without weakening it. The side sill is depressed and divided, a portion being carried over the door and the other portion under, all being tied rigidly in combination with the plate and steel sheathing of the car. This forms a structure of such strength as to eliminate the usual weakness caused by a side aperture the size of door-opening in these cars. The first cars—55 ft. in length, seating capacity seventy-five and with an engine of 100 hp—are particularly adapted for branch-line service, where the traffic is insufficient to support a steam service or anything like electric service.

Interest in the steam car is also being revived, as, for example, the Ganz cars imported from Budapest by the Florida East Coast Railways; also the Erie Railroad and the C. P. R. R. are experimenting with a steam car equipped with a Scotch marine type of boiler, using a superheater and oil fuel. It is believed that some one may undertake to make a so-called flash boiler that will be applicable to this service.

SERVICE AND UTILITY OF MOTOR CARS

It is recognized that the so-called motor car, one carrying its own motive-power plant, whether gasoline, gasoline-electric or steam, occupies a distinct field of usefulness. On many branch lines, now existing, where travel is light, and on new extensions into unsettled country where the business will not return a profit on steam train service, it would have to be run at a loss until a sufficient business was induced or built up by the travel facilities afforded. These situations are the distinct field of the motor car, which can be operated for less per car-mile than by regular steam train or electric methods until the volume of business will warrant the regular transportation methods.

The use of motor cars on the Union Pacific is picking up passengers on branch lines; and in delivering passengers at connecting points for through trains, the service of these motor cars is exceedingly lucrative. The matter of giving the branch-line patrons of any steam road increased service, with more frequent trips per diem, is very much appreciated by the local community, and their good will is beneficial.

On the hypothesis of the same density of traffic, with the same class of service as would be encountered on one of the ordinary branch lines of the territory west of the Missouri River, the cost per mile for local train service, equipment consisting of two cars and a locomotive, would be about 24 cents, including repairs, fuel, oil, labor, cleaning, etc.; this for passenger, as well as baggage, mail and express service.

Electric service equipment, consisting of one car and trailer, figuring that the density of traffic is sufficiently regular to support same seven days in a week, is estimated at about 18 cents a mile.

The gasoline service (mechanical-drive only considered), consisting of one car and trailer, with baggage, mail and express service, would cost 15 cents per mile. The latter, of course, would be independent of whether service was six days or seven days per week, the cost simply depending upon the service rendered.

Railroads, therefore, have a choice of the various systems proposed, and a study of the conditions to be met and facilities afforded, both in the way of care and maintenance, as well as the train service proposed, will give the elements by which each situation will have to be studied. The motive power departments will be called upon to participate more and more in advising as to these questions, and in order to be qualified to undertake such work it is very desirable to introduce information and discussion of these subjects in this association.

C. A. Seley, Chairman,
W. R. M'Keen, Jr.,
L. R. Pomeroy,
C. F. Street,
F. J. Cole,
Committee.

DEPRECIATION TO BE DISCUSSED AT ACCOUNTANTS' CONVENTION

W. B. Brockway, the president of the American Street and Interurban Railway Accountants' Association, has sent an important letter to the members, calling their attention to the fact that the subject of depreciation is one which this association has not carefully discussed, although it received some attention at the organization convention in 1897. For several years it has been contemplated by the different administrations of this association as a subject for the convention programme, and each time it has been, for various reasons, laid aside for future consideration. Mr. Brockway feels confident that the members agree with him that it cannot longer wait for careful and searching investigation, not only on account of its own worth and importance, but also because of the report upon municipal trading to be made by the National Civic Federation before the 1907 convention will be held. This year the Accountants' Association has the hearty support of the American Street and Interurban Railway Association, and that, in connection with the importance of the subject itself, bids fair to put before it the most far-reaching subject it can consider for some time to come.

The executive committee has discussed the method of approaching the subject, and has decided to arrange an executive session at the coming convention in Columbus, and to hold the publication of the discussion completely within the range of those companies represented. It must be explained that it is by no means intended to try to make this one session cover the whole subject. It is intended to only form the groundwork, so that what further steps may be taken will be left to the action taken by the meeting.

Arrangements so far made provide for a paper, or more properly a review, of what can be found upon the subject of "Depreciation and Appreciation as Applied to Electric Railways." This is being prepared by Robert N. Wallis, treasurer of the Fitchburg and Leominster Street Railway, Fitchburg, Mass., and second vice-president of this association. This will place before those present the subject as he finds it. Then, with what has been written upon the subject in mind, there will be an academic diseussion upon the question, "Does the Maintenanee of an Electrie Railway, at a High Standard of Efficiency, Eliminate the Necessity of a Charge for Depreciation?" It is intended to hold the discussion quite to this question, bearing in mind that other questions and other features of the subject will, in all probability, follow for eonsideration at another time.

In conclusion, President Brockway requests the members to write their views to him as promptly as possible, care of the Hotel Schenley, Pittsburg, Pa., that he may gather the opinions for the use of the executive committee.

SINGLE-PHASE EQUIPMENT FOR RICHMOND & CHESAPEAKE BAY RAILWAY COMPANY

The Richmond & Chesapeake Bay Railway Company, which was recently incorporated to build an electric railway from Richmond to Ashland, Va., has decided to equip about 15 miles of track immediately with single-phase apparatus. Eventually this single-phase road will extend from Richmond to Chesapeake. The contracts for the equipment of this section have been let to the General Electric Company.

The road will practically parallel the Richmond, Fredericksburg & Potomac steam road from Richmond to Ashland, and it is the intention to maintain a fast schedule between these two points, operating cars at very frequent intervals.

The line in general will follow the plans which several roads in the Middle West have adopted, but the trolley voltage will be higher. The catenary method of suspension will be used, adapted for a trolley potential of 6600 volts. Each of the cars will be equipped with four GE A-603 (125) single-phase motors. Multiple-unit control will be furnished, using the Sprague-General Electric system. The air-brake system will be of the combined straight and automatic type, with C. P. A.-52 motor compressors.

Power for the operation of the new road will be furnished by the Virginia Passenger & Power Company. Two generating sets will be furnished, both to be operated ordinarily by water power, but arranged for electrical drive when necessary. The first unit will consist of a 750-kw, 6600-volt, three-phase, 25-cycle generator, mounted on the same shaft with a 750-kw, 2300-volt, 60-cycle, three-phase generator, the shaft being extended at one end for connection with a water wheel of sufficient power to drive both generators at their rated output.

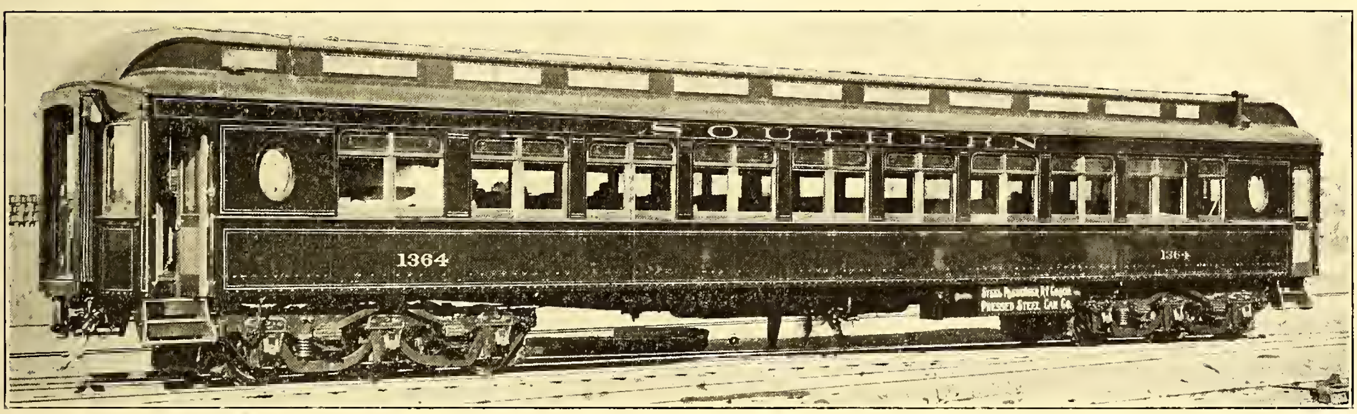
The second set will be made of a 25-cycle, 6600-volt generator, a duplicate of the first, but instead of being mounted with a 60-cycle machine, this generator will be mounted on the same shaft with a 750-kw, 550-volt direct-current machine. When there is sufficient water to operate all of the water-wheel generators in the station, these sets will be driven by the water wheels; if at any time there is sufficient water to drive the generators, or flood conditions render it advisable to close the gate valves, the sets will be disconnected from the wheels and operated as straight motor-generator units. In their respective cases, the 60-cycle generator will run as a 60-cycle synchronous motor, and the 550-volt machine will operate as a direct-current motor. Power for driving the motor end of the 25-cycle sets in this way will be obtained from the engine-driven units of the Virginia Passenger & Power Company already installed. When the motor-generator units are operated as water-wheel driven machines, the 60-cycle generator will be operated in parallel with the present 60-cycle machines, and the 550-volt machine in the other set will run in multiple with the present 550-volt maehines. The

750-kw, 25-cycle generators in each set will for the present be operated as single-phase machines, and will supply current directly to the trolley of the Richmond & Chesapeake road at 6600 volts.

In addition to the main apparatus outlined for the road, there will be a lighting station at Ashland. This will consist of a 100-kw, 2300-volt, 60-cycle, three-phase generator mounted upon a common base with a 150-hp, 440-volt, 25-cycle single-phase induction motor. This set will be operated from the 6600-volt trolley through a 150-kw, single-phase, oil-cooled transformer. The motor-generator set will be provided with a direct-connected exciter mounted on an extension of the shaft. The voltage will be controlled by a Tirrill automatic regulator, which will insure a uniform voltage at the generator end of the lighting service regardless of the fluctuating trolley voltage.

PRESSED STEEL CAR AT ATLANTIC CITY

The Pressed Steel Car Company, of Pittsburg, which has recently gone into the building of steel passenger cars on a large scale, and which delivered last spring to the Metropolitan Street Railway, of New York, a steel street car for the Broadway line, has within the last few days completed another steel street car for San Francisco.



PRESSED-STEEL CAR FOR TRUNK-LINE SERVICE, BUILT FOR THE SOUTHERN RAILWAY

The latter is of the California combination type. Although built of steel it has the same general appearance as a wooden street car, due to the graining of the visible steel posts, etc., so as to resemble wood. Hence it is not noticeably different from a wooden car of the same general type.

The Pressed Steel Car Company has also under construction a number of all-steel and combination steel and wood passenger cars for electric and steam railroads, among which may be mentioned three passenger coaches for the Southern Railway. The company had one of these Southern cars on exhibition at the Master Mechanics' and Master Car Builders' Conventions at Atlantic City this week, and as these cars represent entirely new departures in passenger construction, a short description of them may be of interest, even if the car itself will not be used directly in electric railway work.

The length over the platforms of these cars is 74 ft. 6¼ ins.; length over the body end sills, 66 ft.; total inside length, 65 ft. 3¼ ins.; distance from the center to the center of the trucks, 50 ft.; width over the side sheets, 9 ft. 10¼ ins.; width inside between finish, 8 ft. 10¾ ins.; height from the top of rail to the top of the body, 14 ft. 2 ins.

These dimensions are those of the standard coaches of the Southern Railway, and the interior arrangement of seats, smoking room and saloons, as well as the general equipment of the car, is the railway company's standard whenever practicable. The underframe, superstructure, platforms, platform sills, body carlines, and the side sheets of the cars on the outside below the windows are made of steel in the form of plates, pressed, rolled or built-up parts, according to the requirements and the adaptability of the material.

The interior finish, doors, windows, window sash, upper part of floor, roof, and the outside above the window sills is made of wood. The floor is of ⅛-in. steel plates upon which are laid two courses of wooden flooring, each ¾ ins. thick, with ⅛-in. felt paper between. The top of the floor is covered with 3-16-in. thick linoleum. The framing at the ends consists of angles at the corners and of three channels reinforced with plates on each side of the door. The platforms are supported on the center sills and on 6-in. channels. The platform end sills are pressed of 5-16-in. steel plate into channel shape and to suit vestibule fixtures.

All vertical lines of rivets on the outside of the car are covered with special drawn-steel mouldings, which give the appearance of broad panels as used on some wooden cars. On account of using the Railway Company's standard six-wheel trucks with standard height of bolsters and center plates, it was impossible to make the depth of center sills over the trucks sufficient to bring the center line of the draw gear above the lower edges of the center sills; the center line of the draft gear is therefore below the sills.

The following specialties are used on these cars: Westinghouse high-speed automatic air brakes and Lindstrom hand-brake lever; Diamond special brake beams; Buhoup three-stem couplers; Pantasote curtains with Forsythe fixtures; Southern Railway standard draft gear; Gould car-heating system, and one 16 "D" stove; McCord journal boxes; the Pintsch system of lighting; Buhoup platforms, wide vestibules, with King automatic closers; Chicago automatic frictionless side bearings, and 36-in. steel-tired McKee-Fuller wheels.

The construction of these cars has been worked out by the Pressed Steel Car Company, subject to the approval of important parts by Mechanical Superintendent A. Stewart and Consulting Mechanical Engineer R. L. Ettinger, of the Southern Railway, and while the construction as a whole, as well as in details, may be more or less changed in future similar cars, it shows a decided improvement in the right direction, namely, a car offering greater resistance to damage in accidents as well as minimizing danger to passengers in such emergency. It is understood that the Pressed Steel Car Company is now preparing drawings of still further advanced types of steel passenger coaches and steel trucks, these constructions to embody the use of fireproof materials.

EXTENSIVE TRANSMISSION PLANT AT WINNIPEG

On May 30 the Winnipeg Electric Railway Company officially completed one of the most modern water-power constructions on this continent. The hydro-electric station just built utilizes the water of the Winnipeg River at a point about 65 miles from Winnipeg, where a head of about 40 ft. has been obtained. The power station, which is of concrete, contains four 1000-kw and five 2000-kw 60-cycle, three-phase, General Electric alternators coupled to McCormick turbines and Lombard governors, as well as a number of smaller machines, exciters, etc. Power is generated at 2300 volts and is stepped up to 60,000 volts, which is the transmission voltage. There are fifteen transformers comprising five banks, consisting of two banks of 830 kw and three banks of 1800 kw. The secondary and primary coils are provided with taps for the following voltages: 2200, 2300, 2400 volts secondary; 40,000, 50,000, 60,000 volts primary. The transformers are arranged for delta connections on both the high and the low-tension side; the voltage in operation is stepped up from 2300 volts to 60,000 volts for transmitting to the sub-station at Winnipeg over a distance of 65 miles. The 1800-kw transformers bear a manufacturer's guarantee of efficiency at full load of 98.2 per cent; regulation non-inductive, 1 per cent; regulation, 90 per cent power factor, is 2.5 per cent. The 830-kw transformers have a guarantee of full-load efficiency of 97.7 per cent, the regulation to be the same as that of the 1800-kw transformers.

As the transformers are of the oil and water-cooled type, there is provided a duplicate system of piping for both water and oil, with valves so that any one transformer or any bank can be cut off. The water piping is tapped from the tube of the exciter water wheel. The oil system is operated from oil tanks in the basement of the generator room by means of an air compressor driven by a three-phase, 220-volt induction motor, which was furnished by the Canada Foundry Company. There are three oil tanks, a receiving, a supply and an emergency.

From the power house duplicate transmission lines of No. 2-0 cable, with a hemp center, are run on steel towers to the sub-station at Winnipeg. The line crosses the Winnipeg River with a span of about 760 ft., on 72-ft. towers, each weighing about six tons, with a sag in the line of about 23 ft. at 50 deg. F. The standard towers are spaced 500 ft. apart, are 40 ft. high and the line sags about 14 ft. at 50 deg. F. Each tower weighs about 2400 lbs. There are four railroad crossings. The Red River crossing at Winnipeg near the sub-station has a span of about 1100 ft., the towers being 105 ft. high, the sag in the line about 45 ft. at 30 deg. F. Each 105-ft. tower weighs about 15 tons. The railway and the river crossing towers are built up on concrete footings. All of the towers are well grounded and are provided with lightning arresters, consisting of steel rods with ends pointed, bolted to the verticals and projecting mid-air above the highest point of the line. The transmission line, which has ten complete transmission spirals, is paralleled by a telephone line of No. 8 hard-drawn copper wire on the towers, which is transposed at each tower. The telephones are of the iron-box type, purchased from the Mayer & Englund Company, Philadelphia, with 2500-ohm ringers, so arranged that when the door of the telephone is closed the ringer is cut out of the circuit. These instruments are located every five miles along the line. There will be six patrolmen who will also be provided with watch-case transmitters for testing purposes.

Where the line leaves the power house and where it enters the sub-station, there are left in the wall of the building openings in which are mounted 60,000-volt insulators, and on the outside of the buildings there are provided hoods of expanded metal with cement coating, the bottom of which carries a high-tension Locke bushing, using 24-in. tube which has withstood test voltage of 130,000. The line passes through these bushings over insulators supported on brackets to the towers. The line was designed for a drop not to exceed 10 per cent.

The sub-station at Winnipeg is a brick and steel structure, having a length of 176 ft. and a width of 70 ft. 6 in., the height being 49 ft. 10 in.

The high-tension switches, the low-tension transformer and bus sectionalizing switches are of the motor-operated oil type. The feeder and motor-generator oil switches are of the solenoid-operated type. Disconnecting switches are placed between the high-tension and the low-tension buses and the oil-switches.

The source of supply for operating the motor-operated and solenoid-operated oil switches consists of 55 cells of chloride accumulators located in the basement of the building. The storage battery panel containing the 500-volt charging rheostat is located on the switchboard gallery about in the center of the main switchboard, where it is convenient for the operator. The low-tension buses are located in pressed brick compartments back of the low-tension switches, each phase being separated by a concrete slab.

In the sub-station there are six 1800-kw and nine 800-kw step-down transformers. The transformers are oil and water-cooled, with the same guarantee as to efficiency and regulation as those at the power house.

For direct-current railway and stationary motor work the ultimate capacity of the station will be seven 800-kw synchronous motor-generator sets operating at a speed of 400 r. p. m., with 2300 volts on the alternating side, 550 to 600 volts on the direct side. The generators may also be operated as shunt-wound generators at 600 volts. With a proper shift of the brushes the direct-current machine may operate as a direct-current motor giving 630 to 700 kw from the synchronous motor operating as a generator. These machines are provided with 17-kw, 125-volt exciters mounted on brackets on the extension of the synchronous motor shafts, and are provided with speed-limiting switches and end-play devices. The cost of the complete plant will amount to approximately $4,000,000.

The officers of the Winnipeg Electric Railway Company are as follows: William Mackenzie, president; William Whyte, vice-president; F. Morton Morse, secretary and treasurer; W. Phillips, manager. F. S. Pearson, of New York City, is the consulting engineer of the whole work, the details of which were carried out by L. J. Hirt, as mechanical and hydraulic engineer for Mr. Pearson.

The electrical apparatus was furnished by the Canadian General Electric Company, Limited; the turbines by the S. Morgan-Smith Company; the towers, air compressers and centrifugal pumps by the Canada Foundry Company, Limited; the transmission line copper by the Ansonia Brass & Copper Company, and the insulators by the R. Thomas & Sons Company.

The National Fire Protection Association, at its meeting in Chicago, passed a series of resolutions calling attention to the tremendous fire waste in this country, which it says involves a loss per capita several times greater than in other countries, and the public protection has not kept pace with the growth of buildings and increase of valuation in congested centers. The association therefore issued an urgent appeal to adopt approved methods of construction and introduce automatic sprinklers and other private protection.

SARATOGA CONVENTION OF THE NEW YORK STATE ASSOCIATION

As previously announced, the twenty-fourth annual convention of the Street Railway Association of the State of New York will be held at the Grand Union Hotel, Saratoga, June 26 and 27. Morning and afternoon sessions will be held on Tuesday and a long morning session on Wednesday to complete the work of the convention.

The executive committee announces the following list of papers and reports:

In addition to the reports of regular committees important recommendations will be made by the special committees on "Standard Application Blanks and Forms for Employees"; "Collection and Compilation of Mechanical Costs"; "Interchangeable Coupon Books"; "Rules"; and "Revision of Constitution and By-Laws."

Papers will be presented as follows: Three papers on "Sale of Water Power," by S. B. Storer, general manager Niagara, Lockport & Ontario Power Company; Charles E. Parsons, electrical engineer Hudson River Power Company, and G. A. Harvey, electrical engineer International Railway Company, Buffalo. Paper on "Interurban Railways," by C. Loomis Allen, general manager Utica & Mohawk Valley Railway Company. Paper on "Car Inspection," by D. F. Carver, general superintendent Rochester Railway Company.

There will also be a question box, comprising the following questions:

1. What has been your experience during the past year with steel wheels?
2. What has been your experience during the past year with the brake-shoe question?
3. What progress have you made in oil lubrication?
4. What is the best form of car sign for indicating routes?
5. What new methods or schemes for creating summer pleasure travel have you found?
6. What new methods or schemes for creating winter pleasure travel have you found?
7. What is the status of the express and freight question on electric roads? What are some of the "does" and "don'ts" that have come under your observations in connection with this matter?
8. State one or more particular things done by you that have reduced, or tended to reduce,
   - (a) Maintenance of track and roadbed?
   - (b) Maintenance of electric line?
   - (c) Maintenance of steam and electric plant?
   - (d) Maintenance of cars and equipment?
   - (e) Miscellaneous shop expenses?
   - (f) Cost of producing power per kilowatt-hour?
   - (g) Number and cost of accidents?
9. Has Young Men's Christian Association work proved a desirable adjunct in electric railway operation?
10. How can we enlarge the scope and usefulness of the Street Railway Association of the State of New York

The entertainment committee promises a number of pleasant events and outings, among which will be a carriage drive in and around Saratoga for the ladies on Tuesday afternoon; banquet Tuesday evening; trolley ride and luncheon Wednesday morning; dancing party in the ballroom of the Grand Union Hotel, Wednesday evening. On Thursday there will be an excursion to the General Electric Works for such of the delegates and guests as desire to remain after the convention adjourns. Luncheon will be served at the works.

The steam railroads have made the usual reduction of a fare and a third for the round trip to Saratoga, but in order to secure advantage of this reduction each attendant must obtain a certificate from the railroad ticket agent at the time the ticket is purchased, and this certificate must be vised by the secretary at the meeting.

There will be no official exhibits under the auspices of the association, but a cordial invitation to attend is extended to representatives of supply houses and manufacturing concerns. It has been decided to charge representatives of manufacturing and supply houses $15, payable as a registration fee at the time of registration for the annual meeting. This fee will entitle the concern or company to send two representatives to the annual meeting, and will include one banquet ticket. If more than two representatives are sent, a fee of $10 will be charged for each additional representative, and each such additional fee will also include one banquet ticket. Additional banquet tickets will be sold at $6 each.

If attendants take last year's convention badge to Saratoga a new bar for this meeting will be furnished free. Anyone requiring a new badge will be charged $1, or actual cost, of the same.

It is probable some action will be taken at the Saratoga meeting looking to the admission of electric railway companies located in adjacent and neighboring states, not now included in any of the state or sectional associations, to associate membership in the New York State Association. This will also apply to the roads in the portion of Canada bordering on New York State. It is probable the associate membership class will also be extended to include individuals, firms and companies identified with engineering, financial and other interests associated with electric railway work.

The executive committee in issuing the call for the meeting extends a cordial and urgent invitation to be present and co-operate in the convention to everyone in any way interested in, or identified with, electric railway work, including representatives of member companies, non-member companies in the state, railway companies located near New York State, and representatives of engineering, financial, supply and manufacturing houses.

A BOOKLET ON SYDNEY'S TRAMWAY SYSTEM

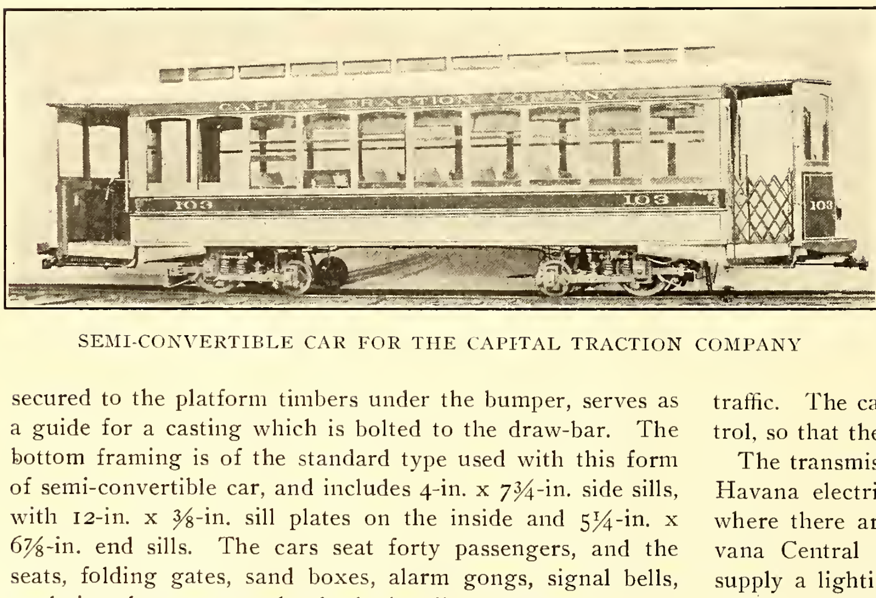
That the American railway manager is not the only one who practices the art of inducing traffic through advertising is clear from a little booklet issued by the New South Wales Railway Commissioners on the Sydney tramways. Flamboyant posters and multi-colored cards are all right in their way when some special event at an amusement resort is to be advertised, but there is also room for the unobtrusive pamphlet which tells the traveler where and how to go to the places worth seeing almost any time. In this publication is given a list of all the localities on the system, what is to be seen along and at the end of the route, the time of travel, cost, and other facts to assist both the stranger and the native. The Sydney tramway system is quite a comprehensive one, as may be noted from the fact that 1450 cars arrive and depart daily from the circular quay in the ten hours between 8 a. m. and 6 p. m. Almost any point in the city or its suburbs may be reached, the routes varying from 3 to 11 miles in length. The traffic superintendent is John Kneeshaw.

The Detroit United Weekly of June 14 says: "In the summer months there are many uses for one's eyes. Reading is not among them. One has little time for reading in the out-of-door months. Heretofore, the Detroit United Weekly has appeared every seven days in the year. We are precisely four years old. We are going to take a vacation. We are going to give our clientele and own intellectual equipment a rest. In other words, the Detroit United Weekly these coming weeks will join the riotous pursuit of that summer boon that makes a vigorous youth and contented old age. During the recess we may be missed. We hope we shall be. But that will but make our welcome return to familiar fields the more tumultuous."

FIRST SEMI-CONVERTIBLE CARS FOR WASHINGTON

The Capital Traction Company, of Washington, D. C., has recently placed in service a number of cars built by the J. G. Brill Company, of the type shown in the illustration. The heavy traffic on the lines and the large number of short-trippers carried has necessitated the use of types of cars which have a large amount of standing space and facilitate ingress and egress. A large part of the equipment consists of longitudinal seat cars, the majority of which have been furnished by the Brill Company. The type shown in the illustration is of the first lot of semi-convertible cars to be used in the city of Washington, and is intended to suit both the heavy traffic conditions and the service on the long lines running into the suburbs; therefore transverse seats are used. Considerable standing space is obtained by having a longitudinal seat 5 ft. 6 in. long at each corner which occupies the space of two windows. There is also a 6-ft. Detroit platform at the rear end, furnished with a dividing rail. The vestibules are of the standard round-end type of the builder, and are without doors. Folding gates form the closures. The window system is the builders' grooveless-post, semi-convertible type with pockets in the side roofs.

The cars are mounted on "Eureka" maximum traction trucks, which have the advantage of carrying them extra low. The step heights are given on the diagram, and will be found to be the same as a car mounted on a single truck. Instead of the usual draw-bar slide of stirrup form, a curved eye-beam, secured to the platform timbers under the bumper, serves as a guide for a casting which is bolted to the draw-bar. The bottom framing is of the standard type used with this form of semi-convertible car, and includes 4-in. x 7¾-in. side sills, with 12-in. x ⅜-in. sill plates on the inside and 5¼-in. x 6⅞-in. end sills. The cars seat forty passengers, and the seats, folding gates, sand boxes, alarm gongs, signal bells, angle-iron bumpers, ratchet brake handles and other furnishings are of Brill manufacture.



SEMI-CONVERTIBLE CAR FOR THE CAPITAL TRACTION COMPANY

A recent report from the Capital Traction Company shows that it is now building an extension to the Fourteenth Street line, embracing about 1¾ miles of double track on which the conduit system is used. This extension will open up a practically new section which heretofore has had no street railway facilities. On this new branch is being constructed a fireproof car house 537 ft. x 200 ft., built of reinforced concrete. In addition, the traction company is making some important improvements in its shops.

The new Vauxhall Bridge, which was opened for service last month, will be the first London bridge to carry an electric railway. This connection will greatly shorten the time taken by those residents in South London whose places of employment are in the neighborhood of Victoria. The line over the bridge connects the existing tramways at Vauxhall Cross with Victoria Station,

TRAMWAY STATISTICS OF NEW SOUTH WALES

The railway commissioners of New South Wales, Australia, have recently published a report giving some interesting facts regarding tramway development in that State up to March 31, 1906. It appears that there are 126 miles of track in operation, for which the quarterly revenue was $1,071,946, an increase of $77,318 over the same quarter of 1905, although the track increase was only one-quarter of a mile. The operating expenses were $777,108, a decrease of $5,735, which reduced the percentage of expenditures to earnings from 78.73 to 72.51. These exceptionally high percentages are due in some measure to the heavy depreciation charges on certain old cable and steam motor lines. The number of car miles run was 4,076,201, or 28,732 car-miles more than the corresponding quarter of 1905. The earnings per car mile were 26 cents, and expenditures 19 cents. In all, 37,672,452 passengers were carried, an increase of 2,627,610 over the same quarter of 1905.

A DEPARTURE IN CUBAN RAILWAY WORK

The city of Havana, Cuba, is well equipped with electric railways. Within the city limits the lines are operated by the Havana Electric Railway Company, while the interurban service between Havana and the surrounding towns is handled by the Havana Central Railway Company. These companies are developing rapidly. The equipment for both the present and additional rolling stock and track material is of American manufacture. The Havana Electric Railway, the city line, has recently ordered 100 GE-52 railway motors for additional cars. The Havana Central Company operates an electric railway system between the Cuban capital and several surrounding towns. The entire equipment is of the most modern type, including Curtis steam turbines. Both electric locomotives and motor cars are employed in the service, ten 40-ton G. E. locomotives being used for freight and about twenty-five motor cars for passenger traffic. The cars are equipped with GE-73 railway unit control, so that they can be operated singly or in trains.

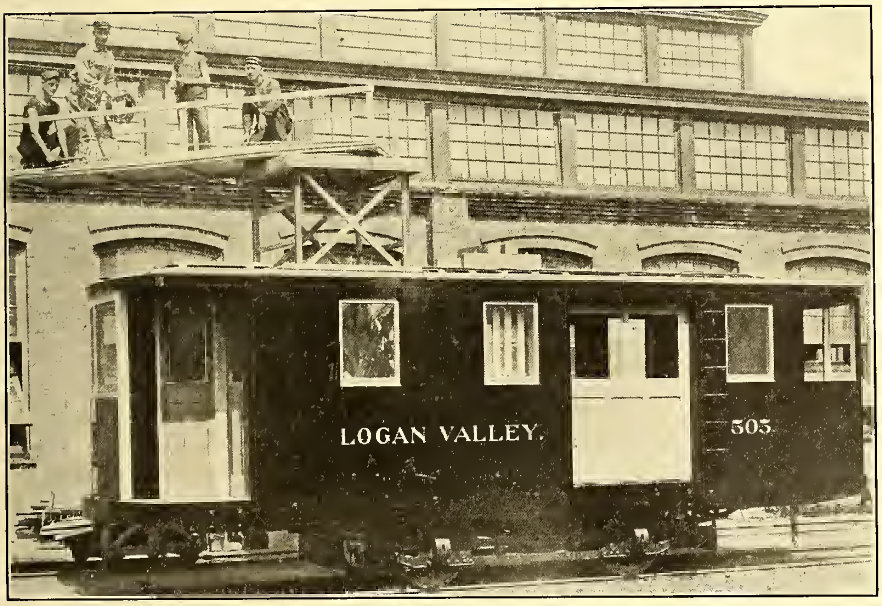
The transmission system from the central power station at Havana electrically connects the capitol with many places where there are at present no lighting stations. The Havana Central Railway Company is therefore preparing to supply a lighting service to the cities of Guinea, Guanajay, San Jose and Regla, making use of the present railway transmission system and constructing sub-stations at the towns mentioned, to change the 25-cycle current to one of higher frequency for lighting purposes.

For this purpose, the five sub-stations are each to be provided with an indication motor alternating-current generator set which will transform the present 25-cycle alternating current into one having a frequency of 60 cycles. Each set comprises a 150-hp, 750-r. p. m., 370-volt induction motor, taking current from the step-down line transformers, and direct connected to a three-phase, 100-kw, 750-r. p. m., 2300-volt alternator, delivering current at approximately 60 cycles. For stepping down the railway transmission line current, a single 150-kw three-phase transformer is to be installed at each sub-station. The windings on the transformers are provided with taps to take care of variations in line voltages, and are so arranged that the transformers can be operated on either 19,000 or 33,000 volts, and the secondaries connected to give 370 volts or 185 volts on either of the primary connections. Including the necessary switchboards, instruments, wire and cable, the complete sub-station apparatus will be furnished by the General Electric Company.

Beside the fixed sub-stations at the points mentioned, two complete portable sub-stations of like capacity and equipment will be constructed. These will be mounted on regular freight trucks so that they can be easily transported by rail to points where there is a special local demand for electric lighting. The whole arrangement presents an interesting development in railway street lighting, particularly since it is taking place in a country which has adopted electricity within a very few years.

COMBINATION TOWER AND CONSTRUCTION CAR FOR THE LOGAN VALLEY RAILWAY

The interesting tower car shown in the illustration has just been shipped to the Altoona & Logan Valley (Pa.) Electric Railway Company by the John Stephenson Company. The tower is of the McArdell type and is equipped with a revolving platform. The tower is raised with gears and pinions, and when lowered the platform extends slightly over the end of the car. The main compartment has 5-ft. sliding doors and is intended for construction material. The motorman's compartments at each end are entered from small triangular platforms at diagonal opposite corners of the car.



COMBINED TOWER AND CONSTRUCTION CAR FOR THE LOGAN VALLEY RAILWAY

The dimensions are as follows: Length over the end panels, 20 ft. 10 ins.; length over the vestibules, 28 ft. 6 ins.; width over the sills, including the sheathing, 8 ft. 1½ ins.; height from the floor to the ceiling, 7 ft. 4¼ ins., and height from the under side of the sills over the trolley boards, 8 ft. 6¾ ins. The side sills are 4 ins. x 12 ins., and the cross members 4 ins. x 6 ins.; cross pieces, 3¾ ins. x 16 ins.; thickness of the corner posts, 4⅝ ins. and 4¾ ins.

The Dayton & Western Traction Company has made an interline arrangement with the Chicago, Cincinnati & St. Louis Railroad (steam) for through business between Dayton and Chicago. The traction line makes connection with the steam road at Richmond. Last week the company made a $4 round-trip rate to Chicago and handled quite a large excursion, the rate being considerably lower than ever before offered to that city .

VACUUM DRYING AND IMPREGNATION OF COILS

The Standard Varnish Works, of New York, announce that they have recently installed in their factory at Elm Park a complete Passburg system for the vacuum drying and impregnation of coils. This method is receiving considerable attention from the mechanical and electrical engineers in charge of large railway systems, as it is expected greatly to minimize motor field troubles.

The method consists in placing the wound field coils in closed vacuum chambers equipped with steam coils. The heat vaporizes the moisture in the cotton covering of the wire used in the coil, at a comparatively low temperature, and this is drawn from the vacuum chamber through a condenser. After about two hours under a heated vacuum, the air and the moisture in the coils have been exhausted and they are therefore in the best possible state to receive the insulating compound. The vacuum chamber is connected by means of a pipe line with a similar tank, into which has been previously placed a solid insulator. This solid compound is brought to a liquid state by means of heat, and after the evacuation of the coils has been completed, the line connecting the vacuum chamber with the melting tank is opened and the compound is forced over the coils in the vacuum chamber by atmospheric pressure. Sufficient of the liquid compound is allowed to flow over fully to cover the coils in the vacuum chamber. The line connecting the two chambers is then closed and air is put on until a pressure of 60 lbs. to the square inch is shown in the vacuum chamber. This pressure is maintained on top of the compound in the vacuum chamber for a period of from one to four hours, depending upon the number of turns and layers of wire in the coils. The pressure is then taken off and the compound forced back into the liquor tank by means of air pressure, or allowed to flow back by gravity. The vacuum chamber is then opened and the coils taken out and allowed to cool, after which they are ready for assembling.

The solid compound, which is made liquid under heat, again solidifies immediately upon exposure to air temperature. This method not only produces a coil which is absolutely impervious to the action of water, but provides for superior heat-conducting properties, as the compound has filled the interstices in the coil, thus practically cementing together each turn and layer of wire in the coil. This process further produces the best possible insulation, and the cementing and holding together the turns and layers of wire in the coil absolutely prevents possible short circuiting from chafing, by vibration, when the motor is in operation. It is claimed that the method outlined is theoretically and practically perfect where care is observed in operating the machinery required.

In addition to this apparatus, the Standard Varnish Works have a full line of solid compounds of varying dropping points which are suitable for use in impregnating field coils, small armatures and armature coils. They also have compounds which are made especially for use in impregnating transformer coils designed to operate in the oil bath. This latter compound has all the properties of the ordinary impregnating compounds, and in addition is absolutely impervious to the action of hot transformer oil.

THE MASTER CAR BUILDERS' AND MASTER MECHANICS' CONVENTIONS AT ATLANTIC CITY

The annual conventions of the Master Car Builders' and the American Railway Master Mechanics' Associations were held at Atlantic City, June 13-20. The Car Builders convened on the mornings of June 13-15, and the Master Mechanics on those of June 18-20. The meetings were held in the music room of the steel pier, and the rest of the pier, about 58,000 sq. ft., was devoted to the usual exhibits. The attendance was larger and exhibits were more numerous than ever before in the histories of the two associations.

Only one paper relating directly to electric railway work was presented. This was the report of the committee of the American Railway Master Mechanics' Association on "Electricity on Steam Railroads," and it is published in full in another column of this issue. The interest of the convention from an electric railway standpoint centered, therefore, largely in the exhibits, and especially those of cars and locomotives at the terminal on Atlantic Avenue of the West Jersey & Seashore Branch of the Pennsylvania Railroad. Heie were collected the most modern types of steam locomotives and cars, together with one of the New York Central electric locomotives and the electric cars which are to be used on the New York Central lines and on the Pennsylvania Railroad between Philadelphia and Atlantic City. The New York Central electric locomotive has already been described in these pages, and no further account of it need be given. The opportunity to inspect it was embraced by a large number of the delegates, and many comments were made upon its small size and weight compared with those of the neighboring steam locomotives. which had the same tractive power.

Adjoining the New York Central locomotive was one of the steel cars to be used in the New York Central service. These cars were illustrated from the preliminary drawings in the Street Railway Journal for Nov. 4, 1905, but photographs of both the exterior and interior are presented herewith. They were built by the American Car & Foundry Company, are mounted on American Locomotive Company's trucks, equipped with General Electric Company's motors, and are lighted by gas and electricity. Adjoining this car were two of the trucks upon which these cars are mounted. These trucks were fully described in the Street Railway Journal for April 28, 1906.

On an adjoining track was the car adopted by the Pennsylvania Railroad for its electric service between Philadelphia and Atlantic City. This car, as will be seen by the photograph presented, bears a close resemblance to the standard Pennsylvania Railroad coach except in the construction of the vestibule, which is fitted with the General Electric master control and the Westinghouse traction brake lever. The car was built by the Wason Car Company, was mounted on Baldwin Locomotive Works trucks with Symington boxes, and was fitted with Hale & Kilburn seats and Curtain Supply Company's shades. It is lighted by five electroliers of five lights each, and is fitted with two trolley poles and third-rail shoes. The trolley poles are provided with trolley catchers manufactured by the Manhattan Railway Specialty Company, of Little Falls, N. Y.

Adjoining the electric cars was the Union Pacific motor car No. 7, which was run with its own power from Kansas City to Atlantic City. An account of this car is given in the report of the committee of electricity on steam railroads already referred to, and a great deal of interest was taken in it.

No attempt will be made to describe all of the exhibits, but the following were among the most interesting from an electric railway standpoint:

CONVENTION NOTES.

THE BULLARD AUTOMATIC WRENCH COMPANY, of Providence, R. I., exhibited the famous Bullard wrench, now in general use in steam and electric railway repair shops. J. L. Blaisdell attended the convention and demonstrated the application of the wrench.

SPRAGUE ELECTRIC COMPANY, New York. The Sprague electric mono-rail crane was exhibited at the convention, and its actual operation was shown uniquely in a space not over 10 ft. or 12 ft. long. Flexible steel armored conduits, Greenfield flexible steel conduits and steel armored flexible cord outlet boxes were also exhibited. Represented by A. E. Bradford, A. C. Bakewell and F. S. Douglass.

AMERICAN LOCK NUT COMPANY, Boston, Mass., exhibited the American lock nut. Considerable interest was manifested in the absolute locking qualities of this lock nut. William A. Eldredge, Geo. F. Higgins and Henry P. Allen attended the convention.

NATIONAL BRAKE COMPANY, of Buffalo, N. Y., was represented at the convention by its treasurer and general manager, G. S. Ackley and E. C. Rutherford, of Toronto, Can. A type of brake, similar to the well-known Peacock brake now in universal use on electric roads, applicable to steam passenger and freight car service, is being placed on the market by this company. With the interest shown in this brake at the convention, its construction and merit and the business energy behind it, there is no question of its ultimate adoption and success among steam roads.

THE COMPOSITE BOARD COMPANY, New York, was represented by Edward H. Chapin.

RUBBERSET BRUSH COMPANY, of Newark, N. J., had on exhibition all sizes and styles of paint brushes. The company was represented at the convention by A. L. Holtzman.

AUTOMATIC VENTILATOR COMPANY, New York, had its ventilators installed on one of the railway coaches on exhibition at the Pennsylvania depot. This company has recently secured an order from the New York Central Railroad for the equipment of 180 cars with its ventilators. These cars are to be operated within the electric zone in New York City. The company was represented at the convention by its general manager, George H. Ford, and Ross Taylor.

CROCKER-WHEELER COMPANY, Ampere, N. J., was represented at the convention by Rodman Gilder, H. C. Petty, F. B. De Gress, Julian Roe, S. Russell, Jr., and H. L. Patterson. Catalogues, pamphlets and literature of the company were distributed from its booth to the delegates to the convention. The well-known trade mark of the company was prominently in evidence throughout convention week.

CONSOLIDATED CAR HEATING COMPANY exhibited at the convention its standard electric heaters and some new types, as follows. Cross-seat type of heater designed for New York Central steel cars, cross-seat type with junction box, designed for Brooklyn Rapid Transit Company, and independent vestibule heater. Also special switches for use on heater circuits, car light circuits and arc lights, and a complete switchboard for use on elevated cars. Also steam heating equipments for use on all classes of railroad cars, and the McElroy automatic axle lighting system. The company was represented at the convention by Francis C. Green, general manager; James F. McElroy, consulting engineer; Cornell S. Hawley, general sales agent; William S. Hammond, Jr., district manager; S. Butler Keys, district manager, New York office; C. C. Nuckols, of the New York office; F. W. Brownell, of the Albany office. Consolidated Car Heating Company's electric heaters are installed in the New York Central steel car, for suburban service, exhibited at the convention. This is one of the 180 cars building for the New York Central Railroad, all of which are being equipped with these heaters. There are thirty-six heaters per car, arranged for four gradations of heat. The cab heaters are wired in series with the car heaters, and short circuited by an automatic switch when no heat is required in the cabs. This switch is placed in the line of movement of the cab door.

STANDARD PAINT COMPANY, New York, had an attractive booth, exhibiting its ruberoid roofing for cars and ruberoid red and brown roofing, flexite metal preservative paints, Giant and P. & B. insulating paper, and P. & B. backing and air-drying varnishes. Those present were Paul M. Wade, J. N. Richards, E. C. Beckman and H. J. Thomas.

GOLDSCHMIDT THERMIT COMPANY, New York, had an attractive exhibit, consisting of samples of thermit welds of rails, shafting and piping, samples of patterns, flasks for making molds and molds for thermit welds; cans of thermit and ingots to increase the temperature and purify the iron to prevent blows, automatic and flat-bottom crucibles in which thermit is ignited to produce the enormous temperature of over 5000 degs. F.; elaborate illustrative drawings were also exhibited. Demonstrations of the actual application of thermit in welding were also made on the beach adjoining the pier. Geo. E. Pelissier and A. M. Gunther were in charge of the exhibit.

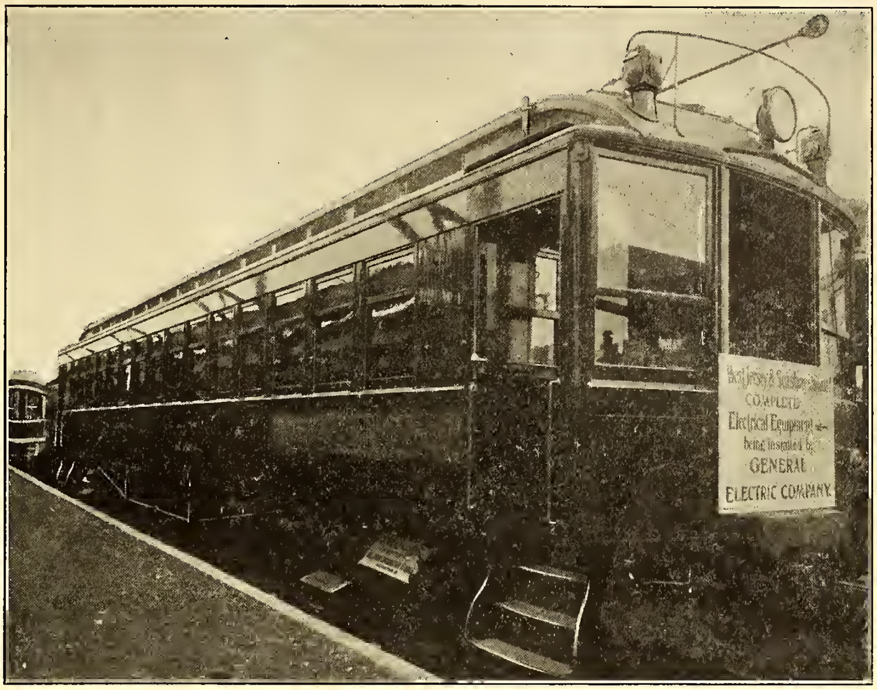
GREENE, TWEED & COMPANY, New York, exhibited its Palmetto packing, Exacto packing gages and cutters, and its favorite reversible wrenches. H. S. Demarest, F. E. Ramsley and B. H. Ham attended the convention.

AMERICAN BRAKE-SHOE & FOUNDRY COMPANY, New York, was represented at the convention by Otis Cutler, J. B. W. Sargent, J. D. Gallagher, F. L. Gordon, W. S. McGowan, Chas. Heron, F. W. Sargent, J. S. Thompson, L. R. Dewey, R. T. Hatch, A. L. Streeter, F. H. Coolidge, C. C. Higgins, E. L. Janes, H. S. Bradfield, E. B. Smith, E. J. Searles, W. F. Walsh, N. J. Holden, B. H. Grundy and J. H. Yardley. A comprehensive exhibit was displayed. All types of brake-shoes, together with a number of worn shoes, showing the nature of service and the wear to which brake-shoes are subjected, were exhibited. The company had one of the prominent locations on the pier, and distributed, as a souvenir, an attractive leather-bound memorandum book.

PANTASOTE COMPANY, New York, had a neat and comprehensive exhibit of pantasote for coach curtains and car seats.

AMERICAN MASON SAFETY TREAD COMPANY, Boston, Mass., exhibited carborundum and carbolith safety treads and Mason lead. Represented by W. S. Lamson, H. C. King and J. W. Scott. As a souvenir the company had some tasteful paper-weights in the form of a safety tread.

GOULD STORAGE BATTERY COMPANY, New York, exhibited its batteries for signal and train lighting service. This

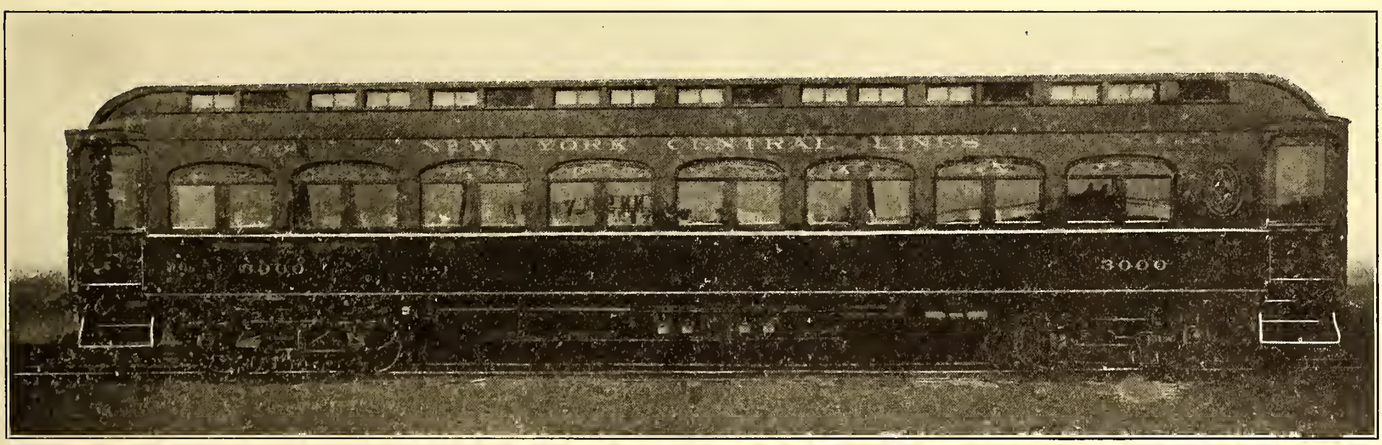


STANDARD MOTOR CAR FOR THE WEST JERSEY & SEASHORE RAILROAD

company was represented at the convention by W. S. Gould and George S. Milne.

GOULD COUPLER COMPANY, New York, had a comprehensive exhibit of Gould couplers, Gould spring tender buffer, Gould Z-beam steel platform with friction buffer and draft gear, and Gould C. M. B. journal boxes. Those representing the company at the convention were W. S. Gould, C. M. Gould, F. P. Huntley, W. F. Richards and T. L. McKeen.

THE BRADY BRASS COMPANY, New York, was represented at the convention by its president, Daniel M. Brady, Chas.



ALL-STEEL MOTOR CAR FOR THE NEW YORK CENTRAL LINES

John High and D. E. Bonner dispensed the hospitality of the company to the delegates at the convention.

CLING SURFACE MANUFACTURING COMPANY, Buffalo, N. Y., had a neat exhibit, illustrating the difference between belts treated with Cling surface and ordinary belts. Chas. F. Chase, of New York, attended the convention.

WEST DISINFECTING COMPANY, New York, was represented by E. Taussig and W. R. Noxon. Exhibit consisted of liquid soap containers and disinfectants of all kinds, as well as automatic disinfecting apparatus.

M. Reubens, William Krantz and Henry Lahey, and had an extensive exhibit of its Cypress bronze journal bearings, motor bearings for electric railway service, Brady genuine babbitt metals and Cypress anti-friction metals. A very handsome souvenir in the form of a pig-skin pocketbook was distributed. This is the thirty-third convention of the Master Car Builders and Master Mechanics which has been attended by Mr. Brady, who received many congratulations upon this record.

ROBINSON COMPANY, Boston, Mass., had on exhibition the Robinson exhaust nozzle for locomotives, an automatic brake-slack adjuster, air strainers for air pumps, and track jacks. Chas. L. Snow, Frank Robinson and Frederick Parker were present at the convention.

POWER SPECIALTY COMPANY, New York, was represented by E. H. Foster and L. B. Nutting. Foster superheaters and Duval metallic packing were exhibited.

INTERIOR OF NEW YORK CENTRAL CAR

DOSSERT & COMPANY, New York, were represented by E. A. Dossert, J. J. Dossert and H. B. Logan. All types of the well-known Dossert joint were exhibited.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., jointly with the American Locomotive Company, had on exhibition tracks at the Pennsylvania depot, a complete electric locomotive, built by these two companies for the New York Central Railroad in New York City. An all-steel car for the New York Central electric service, with full electrical equipment, was also exhibited, as well as one of the West Jersey Seashore cars, similarly equipped. At the booth on the steel pier, F. H. Gale dispensed the hospitality of the company to the delegates of the convention. The company was represented at the convention by C. C. Peirce, Ralph Moore, L. R. Pomeroy, H. D. Hawkes, W. B. Potter, J. G. Barry, H. D. Tremper and J. R. Lovejoy.

O. M. EDWARDS COMPANY, Syracuse, N. Y., had a well arranged and extensive exhibit of all types of its window fixtures. Model windows were shown illustrating the application of these fixtures to all types of coach construction, as well as the facility and ease with which windows operate when the Edwards fixtures are employed. One type of fixture has been especially designed to meet the requirements of steel passenger cars, which at the present time are coming into use. The well-known Edwards vestibule platform trap-door and the Edwards brand of tin rollers were shown. This company's business has expanded to such an extent that its present factory is entirely inadequate to take care of its increasing orders. A new plant is at the present time being erected in the center of Syracuse, and will be ready for occupancy in the early fall. This plant is 211 ft. x 55 ft., five stories high. It will be constructed of steel and brick. There will be one wing running off of the main building three stories high, which will be used for woodworking purposes. Another wing running off from the main building will contain boiler and engine rooms. A large brass foundry will be erected, in which all the various types of brass castings used by this company will be turned out. A tinning and tempering plant will also be erected, as well as a dry kiln for lumber. The plant, when erected, be one of the most complete of its kind in the country. The company was represented at the convention by O. M. Edwards, E. F. Chaffee, G. G. Nooris, G. E. Bake.

E. L. POST & COMPANY, New York, exhibited Post's "Zero" and motor metals for journal bearings. Those representing the company at the convention were E. L. Post and F. O. Ketcham.

THE CELLULOID COMPANY, of Newark, N. J., exhibited its "Texoderm" material for car curtains and car seats. The company was represented at the convention by W. S. Sillcocks and W. C. Crosby.

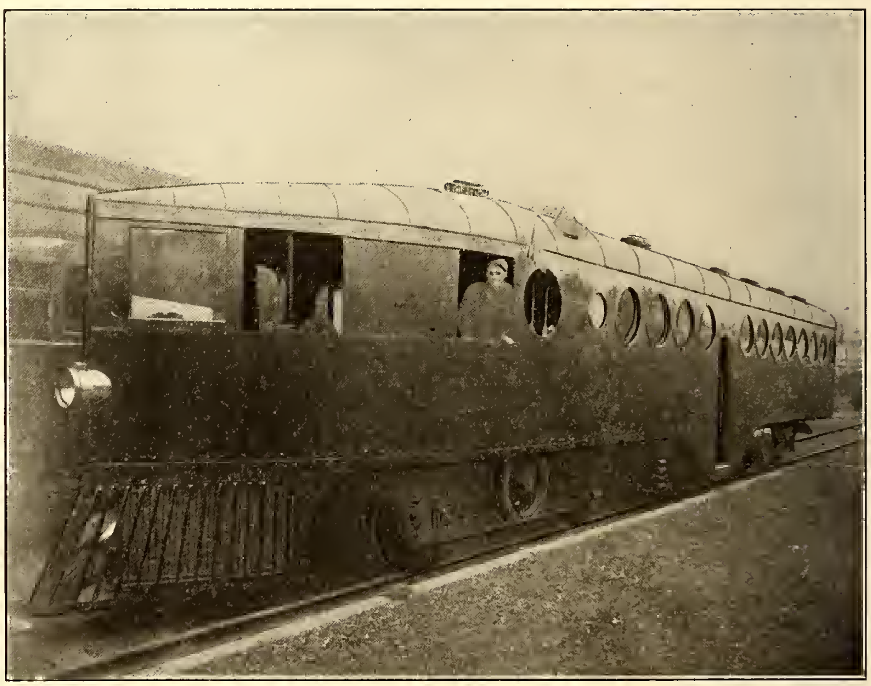
THE DRESSEL RAILWAY LAMP WORKS, of New York, exhibited all its types of headligihts, switch lamps, semaphore lamps and locomotive headlights. The company was represented at the convention by F. W. Dressel, C. H. Dressel, Robert Black, F. W. Edmunds, E. W. Hodgkins and Jos. M. Brown.

THE GENERAL STORAGE BATTERY COMPANY, New York, exhibited its battery for signal car lighting and power regulation. The company was represented at the convention by R. C. Shaal and F. E. Booss.

THE NORTON GRINDING COMPANY and NORTON EMERY WHEEL COMPANY, of Worcester, Mass., had, together, one of the largest and most complete exhibits of all types of its grinding machinery. Large samples of piston rods, valve stems and crank pins, ground and polished by the Norton emery wheels, were on exhibition. All shapes and grades of its India oil stone were displayed. Alundum ore, crushed, and in its original form, was also on exhibition. The company was represented at the convention by George C. Montague, George A. Stone, Chicago manager; Arthur C. Scott, New York agent.

THE GOLD CAR HEATING & LIGHTING COMPANY, New York. This company had an extensive exhibit of the improved Gold system of car heating by direct steam apparatus as well as hot water circulation, temperature regulators, automatic steam traps, steam couplers, locomotive reducing valves and train pipe valves, refrigerator car heating apparatus and electric heaters for electric railroad service. The company was represented at the convention by Edward E. Gold, John E. Ward, William E. Banks, W. H. Stocks, A. E. Robbins, J. M. Stayman, J. V. Brombaugh, Richard Voges and E. B. Wilson.

THE ANGLO-AMERICAN VARNISH COMPANY, Newark, N. J., and Montreal, Can. William Marshall and Franklin W. Fort distributed attractive advertising matter from the company's booth on the steel pier.



UNION PACIFIC GASOLINE CAR NO. 7

THE AMERICAN LOCOMOTIVE COMPANY, of New York, exhibited at the Pennsylvania depot on the exhibition tracks a splendid example of locomotive construction in the Erie Pacific type locomotive and the Baltimore & Ohio consolidation locomotive, electric motor trucks for the New York Central electric service, together with the trailer trucks for the same service. In joint exhibit with the General Electric Company were shown the electric locomotives for the New York Central electric service. The rigid and ponderous construction of this locomotive was admired by all the delegates who examined the exhibit. The company was represented by F. D. Sawyer, G. M. Basford, R. J. Gross and J. E. Sague.

THE YALE & TOWNE MANUFACTURING COMPANY, of New York City, was represented by W. C. Bigelow, who had charge of the check padlocks, and by C. W. Beaver, who represented the hoist and trolley department. The exhibit comprised 20-ton triplex chain blocks, 2-ton electric hoists built in trolley, 2-ton electric hoist with graduated speed control, 5-ton triple chain block in operation under load, one triplex and differential chain block, padlocks for switches, toolhouses, etc., standard car doors, controlled by Blount coach door check, and hardware for station use, cabinet locks, etc., for dining and Pullman cars. The company had as a souvenir a neat paper-weight in the form of a Yale lock.

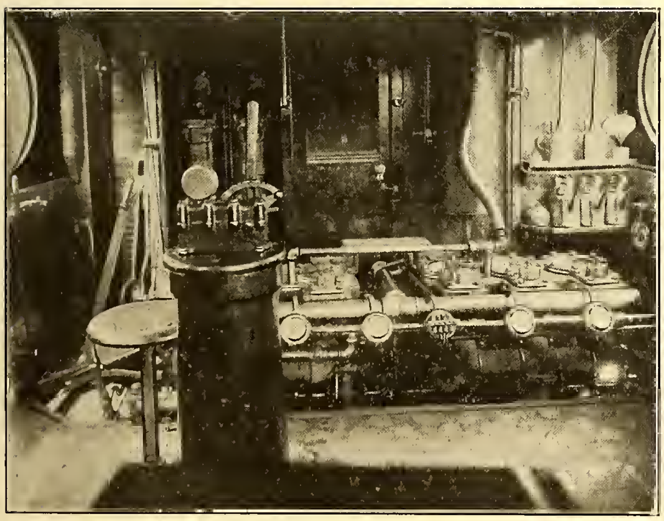
JOS. DIXON CRUCIBLE COMPANY, of Jersey City, N. J., displayed the various Dixon graphite specialties and lubricants. The company was very liberal in the distribution of its lead and indelible pencils. It was represented at the convention by W. A. Houston, Lewis F. Lyne, Malcolm McNaughton, E. M. Taussig and C. H. Spatts.

THE WILLIAM C. BAKER HEATING & SUPPLY COMPANY, NEW YORK, was represented at the convention by Mrs. L. Baker Vaux, James G. Demarest and J. H. Gadsden. The exhibit consisted of Baker double-coil car heaters with steam attachment, the mighty midget Baker heater No. 4, and the street car heater No. 6. Various independent steam attachments and supplies were also exhibited.

THE HEYWOOD BROS. & WAKEFIELD COMPANY, Wakefield, Mass., had a very complete and comprehensive exhibit of car seats, upholstered in plush, rattan and leather. The company was represented at the convention by its New York agent, Bertram Berry, C. H. Lang, Jr., E. C. Lang and C. W. H. Frederick.

THE NATIONAL LOCK WASHER COMPANY, of Newark, N. J., had a neat exhibit of car curtains and curtain fixtures, sash locks, sash balance and the well-known National lock washers and nuts. Those present at the convention from this company were William C. Dodd, Frank B. Archbald, John B. Seymour and Daniel Hoyt.

AMERICAN STEAM GAUGE & VALVE MANUFACTURING COMPANY, Boston, Mass., exhibited American deadweight gage tester, locomotive muffled and open pop safety valves, steam heat gage, American duplex gage, locomotive steam gages, hydraulic relief valves, American-Thompson improved indicator



MOTORMAN'S COMPARTMENT OF GASOLINE CAR

with new improved detent motion. Represented by Ralph B. Phillips, W. E. Jerauld, Chas. A. Allen, R. M. Turner, C. H. Craig, Jr., Horace Parker.

A. O. NORTON, INC., Boston, Mass., exhibited Norton ball-bearing jacks and Sure-Drop jacks. Represented by A. O. Norton, H. A. Norton, Chas. G. Erickson and J. O. St. Pierre.

THE PATTON PAINT COMPANY, of Newark, N. J., and Milwaukee, Wis., exhibited its well-known railroad paints and "Iron-Hide" rustless paint for iron and steel. The representatives from this company present at the convention were James G. Mowry and John L. Brown.

VACUUM CLEANER COMPANY, New York. This company had a very interesting exhibit on the exhibit track at the Pennsylvania Railroad station, in a Kenney portable vacuum cleaning plant for cars, stations and subways. The portable plant is extensively used by both steam and electric railroad managers for the cleaning of cars, stations and subways. The portable plant

PASSENGER COMPARTMENT OF GASOLINE CAR

is especially adapted for this purpose, as it can be moved with facility and ease from one part of the road to the other. The company was represented at the convention by R. C. Hallett.

H. W. JOHNS-MANVILLE COMPANY, New York, had a very complete exhibit of all of its asbestos products, transite for the fire-proofing of electric railroad cars, fire-proof lumber fibers, and cements, asbestos textile materials, pipe covering cement, felting and roofings. Vulcasbestos pump packing, piston-rod packing, throttle-rod packing, Keystone combination pump packing and its 85 per cent magnesia and fire-felt sectional boiler lagging. The company was represented at the convention by L. B. Melville, J. C. Younglove, M. Fuhrer, W. F. Taylor, E. C. Sawyer, F. M. Gilmore, H. O. Fettinger and J. E. Meek.

UNITED STATES METAL & MANUFACTURING COMPANY, New York, had on exhibition at the Pennsylvania depot, the Ideal draw-bar centering device, "Almetl" lumber stake, collapsible brake staff and Columbia lock nut. On the steel pier were displayed Columbia lock nut, Western malleable iron brake jaws, "Victor" cast steel replacer and pressed steel car replacer and an automatic hose reel. Those present at the convention were B. A. Hegeman, Jr., E. D. Williams, Fred. C. Dunham, Fred. Atwater and John J. Varian.

MAJOR MANUFACTURING COMPANY, New York, represented by A. Major, exhibited Major cement, compartment water coolers and head rest.

THE ASBESTOS SHINGLE, SLATE AND SHEATHING COMPANY, of Ambler, Penn., had an exhibit of asbestos "Century" shingles, asbestos building lumber and other fire-proof building material. The company was represented by its chief engineer, Charles Edward Wade.

THE AJAX METAL COMPANY, of Philadelphia, showed specimens of its plastic bronze locomotive bearing, car journal brasses, phosphor and manganese castings and ingots as well as a line of anti-friction metals. The repesentatives were G. H. Clamer and S. E. McClure.

DODGE & DAY, the well-known consulting engineers of Philadelphia, had a representative on the ground in the person of H. F. Sanville.

THE PITTSBURG SPRING & STEEL COMPANY, of Pittsburg, was represented by its president, D. C. Noble.

H. B. UNDERWOOD & COMPANY, of Philadelphia, makers of the portable valve seat rotary planer, were represented by A. B. Pedrick and E. W. Whitaker.

THE DUFF MANUFACTURING COMPANY, of Pittsburg, Pa., occupied space No. 514, with a line of Barrett lifting jacks and Duff roller-bearing screw jacks. The roller-bearing jacks comprise a new line for handling loads up to 70 tons. Each jack contains two roller bearings made from crucible steel, which are said to give better service than any other anti-friction bearing made. The No. 130 Barrett geared ratchet jack shown has a capacity of 35 tons, and is used for the rapid handling of coaches and loaded freight cars. The company was represented by Chas. A. Foster.

THE LEHIGH CAR WHEEL & AXLE WORKS, of Catasaqua, Pa., was represented by B. F. Swartz.

THE PHILADELPHIA AIR BRAKE & MACHINE COMPANY had a genial representative in its manager, Col. W. W. Lambert.

THE HOME RUBBER COMPANY, of Trenton, N. J., showed a complete line of N. B. O. sheets, tubular gaskets, diaphragms, inlaid matting, O. I. M. packings, air brakes and steam hose, etc. The company was represented by G. J. O. Stokes, Chas. E. Stokes, H. M. Royal and A. R. Foley.

THE UNION SPRING & MANUFACTURING COMPANY, Pittsburg, was represented by A. M. McCrea, president.

THE STANDARD STEEL WORKS, of Philadelphia, showed a number of 33-in. and 34-in. diameter rolled-steel wheels and steel-tired wheels. The representatives present were the following: H.W. Sheldon, New York; Frank Carpenter, Philadelphia; George F. Jones, Richmond; Robert Radford, Philadelphia; C. H. Peterson, Chicago; H. De H. Bright, Philadelphia, and Edward B. Halsey, St. Louis.

DUQUESNE STEEL FOUNDRY COMPANY, Pittsburg, occupied sections 589 to 592, inclusive, where it showed a number of solid rolled steel car wheels and open-hearth steel railroad castings. The gentlemen in attendance for the company were as follows: Thomas H. Barewell, vice-president and treasurer, Pittsburg; Arthur W. Field, general sales agent, New York and Boston, and Lewis A. Way, chief clerk, Pittsburg.

BAEDER, ADAMSON & COMPANY, Philadelphia, exhibited a complete refrigerator car showing their method of refrigeration and hairfelt insulation. The company was represented by Henry J. Bellman.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, Pa., had a very extensive exhibit of standard and specially designed types of storage battery cells for railroad car lighting, automatic block and semaphore signal, track circuit and interlocking service. Both stationary and portable cells were shown. A feature of the exhibit was the car-lighting cells in rubber jars and lead-lined tanks, encased in strongly constructed wood boxes, with a special elastic compound between the rubber or lead cell and the containing box. Five sizes of these cells were shown. There was also a standard railway switchboard panel, equipped with the Electric Storage Battery Company's carbon regulator. A large chloride accumulator cell, of type R-73 in type R-83 reinforced tank, was exhibited as a sample of 2692 similar cells contracted for in connection with the electrification of the New York Central terminal lines to New York. A cell of type R-55 in type R-57 reinforced tank, illustrated the battery of 313 cells of this size installed at the Hammel station of the Pennsylvania, New York & Long Island Railroad. Manchester positive and box negative plates of the standard chloride accumulator type were shown mounted on attractive panels. There were also shown an automatic water filling device and a recording and signaling hydrometer for pilot cells. Bulletins giving complete description of types of cells recently developed for car lighting and signal service were distributed, as well as bulletins illustrating the application of large chloride accumulator batteries in central station work. The exhibit, which presented a most attractive appearance, was in charge of Chas. Blizard, J. A. White and H. E. Hunt.

THE LANDIS MACHINE COMPANY, of Waynesboro, Pa., had an exhibit consisting of regular bolt cutters and of machines adapted for stay-bolt cutting without the aid of a lead screw. The Landis machine is a departure from the hobbed dies machines. The dies of this machine are milled from flat pieces of steel, which have teeth cut their full length on one side. The chasers are 4 inches long, and can be reground many times. The life of this die is said to be from ten to twenty times that of the hobbed. The lead in the die is positive, insuring correct pitch. The rake is flexible to suit any kind of material to be cut. The throat is permanent, allowing the machinist to cut close to shoulders and heads of bolts, and it has a wide range for special work. Another important feature is that one set of dies will cut all diameters of the same pitch. The machine is built in single, double and triple heads, ranging from 1/4 inch to 2 inches. The company was represented by J. G. Benedict.

THE GEORGE W. LORD COMPANY, of Philadelphia, the well-known manufacturer of Lord's boiler compounds, had an attractive booth and exhibited samples of different boiler compounds. The company was well represented by V. O. Lawrence, Col. Nat. P. Lane and Capt. J. E. Doughty, who had charge of the exhibit.

JOHN LUCAS & COMPANY, of Philadelphia, had one of the most attractive and unique paint and color displays at the pier. The most prominent feature of the exhibit was a series of panels which enabled the visitor at a glance to get acquainted with the products of this firm, which makes a specialty of coach and car colors. Lucas' Mirac, which removes old paint and varnish, was also shown. The house of Lucas was represented by a corps of able, hustling representatives, whose geniality made them many warm friends. The Lucas "souvenir" was a "glad hand," which consists of a celluloid hand with the index finger showing white lead that has rubbed off, and telling the advantage of Lucas' tinted gloss paint. A calendar on the cuff made the gift valuable, as it can be used as a book marker. An attractive match-box was also distributed. H. A. Clark, W. C. McMullin, W. I. Lewis and J .C. Holmes looked after Lucas' interests.

THE PHILLIPS-LAFFITTE COMPANY, of Philadelphia, exhibited its Laffitte welding plates and many test welds in steel castings. The welding of locomotive frames without dismantling the engine was of particular interest to railroad men, and can be successfully done by the use of Laffitte welding plates. This is done by jacking the frame apart and dressing out fracture to a V-shape. A fire-brick furnace is then built around the fracture. The frame and a V-shaped "dutchman" (slightly larger than the fracture) are brought up to a cherry red heat by the use of an old blaze. A piece of Laffitte plate is then placed V-shape over the "dutchman" and inserted into the fracture. The jacks are then released, allowing the frame to spring into position and the whole is brought up to a strong heat. The pressure from the spring of the frame is sufficient to effect a perfect weld. Physical tests show that steel castings welded with Laffitte plates not only have the strength of a solid casting, but increase tensile strength per square inch over 7000 lbs. while elongation is practically maintained. Welds in soft steels are said to show an increase of 4000 lbs. to the inch. The representatives at the exhibit were F. Rees Phillips and W. Vernon Phillips.

THE McCONWAY & TORLEY COMPANY, of Pittsburg, was represented by William McConway, Jr., E. M. Grove, I. H. Milliken, and had on exhibition a full line of passenger, freight and tender couplers, including the company's latest production, the Pitt freight coupler, which combines all of the requirements of the Master Car Builders' Association, and which throws the knuckle to a full coupling position from any point. The company also showed its Buhout three-stem coupler applied to the Standard Coupler Company's steel passenger platform. This coupler has only been on the market a little over ten years, but already almost 8000 passenger cars have been equipped with it. A recent example of its adaptability is its application to the electric cars built for the West Jersey & Seashore division of the Pennsylvania Railroad, was shown by the sample car on exhibition at the conventions. In view of the fact that a number of steam railroads are considering the question of electrifying their branch roads, this coupler seemed to attract a great deal of attention, as it will couple with the cars on the main line, and on account of its pivoted head will operate around curves where it would be impossible to run a rigid coupler.

THE F. R. PHILLIPS & SONS COMPANY, of Philadelphia, Pa., exhibited its Velos high-speed steel and Velos high-speed twist drills, both of which are made in Sheffield, England, by the Walter Spencer Company. The Velos drill is not only capable of running at high speeds but is designed for very heavy feeds. In tabulating results of tests made in 197 different plants the company reports that 174 firms report the Velos drill to be superior to any high-speed drill they have ever used. The company's representatives at exhibit were F. Rees Phillips, W. V. Phillips and C. A. Gridley.

WESTINGHOUSE EXHIBIT.—The exhibit of the Westinghouse companies was at the extreme end of the Steel Pier, and comprised the products of the Westinghouse Air Brake Company, the American Brake Company, Westinghouse Automatic Air & Steam Coupler Company, and the Westinghouse Electric & Manufacturing Company. The apparatus on exhibition by the Air Brake Company was very elaborate, and naturally was devoted in large part to steam railroad service. It included the equipment for two 75-car freight trains arranged in parallel, so as to demonstrate the advantages of the new quick-service freight triple, designated as the type "K," over the present standard quick-action freight equipment. In addition, the Air Brake Company showed sectional models of the new apparatus as well as samples and full-sized sections of the Westinghouse friction draft gear and of the new cross-compound locomotive air pump. The American Brake Company, of St. Louis, Mo., had on exhibition a rack showing the opeation of the slack adjuster for passenger cars and models of the equalized brake as applied to both locomotive driving wheels and engine trucks. The Westinghouse Automatic Air & Steam Coupler Company, of St. Louis, Mo., exhibited car models, showing the application of its automatic couplers as applied to modern rolling stock. The Westinghouse Electric & Manufacturing Company showed a full line of arc lamps for all currents, also their alternating and direct-current fan motors for desk and wall service. Motors for use on alternating and direct currents for shop driving were exhibited, including the well-known types "S," "R" and "CCL." A very extensive collection of Westinghouse current-measuring instruments were also shown, as well as other miscellaneous electrical apparatus suited for use in and about railroad shops. The exhibit was lighted by Cooper Hewitt mercury vapor lamps. Four type "K" lamps and six type "H" lamps with automatic tilters were kept burning. The company also distributed a pamphlet, recently issued, and entitled "Electricity in Heavy Railway Service." It contained some figures on cost of electric railway operation, tables of draw-bar pull of electric and steam equipment, and data in regard to the New Haven and Swedish Government lines, and from other heavy traction and single-phase lines built by the company. The representatives present included for the Air Brake Company, John F. Miller, A. L. Humphrey, W. S. Bartholomew, Joseph R. Ellicott, E. L. Adreon, T. A. Hedendahl, F. V. Green, Chas. Paine, S. G. Down, S. J. Kidder, F. T. Reese, S. D. Hutchins, Walter V. Turner, C. C. Farmer, C. J. Olmsted, M. Arthur Johnson, Robert Burgess, C. P. Cass, Henry S. Mann. For the Automatic Air & Steam Coupler Company, N. F. Niederlander. For the American Brake Company, E. L. Adreon. For the Electric Company, E. M. Herr, C. F. Street, J. H. Klinck, J. M. Barr, D. D. Pendleton, Charles Robbins. For the associated interests, Frank S. Smith, O. H. Miller and J. C. McQuiston.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, was represented at the convention by F. C. Randall, C. A. Tupper and Guy Slafer. The company's booth was devoted to showing samples of stationary motors for repair shops and steam turbine vanes and discs.

THE AMERICAN CAR & FOUNDRY COMPANY had as its principal exhibit the all-steel passenger coach of the New York Central Railroad. This car is illustrated and described elsewhere in this issue. The interests of the company were cared for by Scott H. Blewelt, W. M. Hager, N. A. Williams, Clarence Price, A. E. Ostrander, T. R. Brown, W. C. Dickerman and E. S. Marshall.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia, were represented by W. J. McCarroll and Fred. Woollven. Although the company's exhibit was for the most part in its steam railroad locomotive department, the company's electric railway work was represented by the trucks under the West Jersey & Seashore Railroad. A view of this car is published on another page.

THE HALE & KILBURN MANUFACTURING COMPANY, of Philadelphia, showed a full line of car seats for steam railroad work of the walk-over and reversible types, upholstered in plush, leather, rattan, etc. Although the exhibit was devoted in most part to the company's steam railroad seats, considerable attention was given by the electric railway men present to the company's new seat, adapted to the narrower electric cars used on high-speed urban and interurban railways. This seat has a low curved arm rest combined with the regular steam railroad seat movement. All parts of this seat movement are of metal, and it is equipped with an automatic single foot-rest, which makes the car very easy to sweep. The aisle end and the base of this seat are very handsome. The company also showed photographs of the fireproof seats built for the Chicago City Railway and the Boston elevated and surface lines. The company is finding that a great deal of interest is being taken in fire-proof seats, and there is a considerable demand for the company's steel seat frame, which is built entirely of pressed steel. These seats are in all cases upholstered with rattan, which has been treated so as to make it non-inflammable. It was also a significant fact that all of the cars exhibited at the Pennsylvania station in Atlantic City were equipped with Hale & Kilburn seats. The company was represented by A. F. Old, of New York; H. T. Bigelow, of Chicago; S. A. Walker, of New York, and T. F. Tilson, of Washington.

S. F. BOWSER & COMPANY, of Fort Wayne, Ind., occupied one of the large spaces on the south side of the pier, and exhibited their method of measuring and storing oil. Those present representing the company were E. M. Savercool, C. A. Dunkelberg, W. T. Simpson and A. H. Collins.

THE BROWN HOISTING MACHINERY COMPANY, of Cleveland, exhibited a full line of views of different hoisting installations made in different parts of the country. They included photographs of coal and ore-handling machinery and different types of cranes. Richard Devens and J. P. Case cared for the company's interests.

THE CARBORUNDUM COMPANY of Niagara Falls, attracted attention at Atlantic City by its samples of carborundum and carborundum products. Those attending the convention in the interests of the company were E. J. Eames, C. O. Taylor, C. C. Schumaker and W. W. Sanderson.

THE KALAMAZOO RAILWAY SUPPLY COMPANY, of Kalamazoo, Mich., exhibited an interesting line of pressed steel wheels for hand cars, car jacks, etc., but called particular attention to the Root pneumatic track scraper and the Moore track drill. The Root scraper has now been adapted for pneumatic operation, and the equipment for a steam locomotive was shown in the exhibit. The same apparatus could equally as well be employed on any electric motor car equipped with air reservoirs. The scrapers are mounted on a shaft and are raised and lowered by pneumatic power from the motorman's cab. Any pressure can be applied to the scraper springs according to the conditions of snow, whether dry, wet or packed. The scraper cleans the rail and removes the snow 8 ins. on each side. It also cleans the groove of a grooved rail, and thus prevents the wheel flanges from compressing the snow into ice. The Moore track drill also attracted much favorable comment, and figures were given by those in charge of the exhibit of a test recently made on the Pennsylvania Railroad of the efficiency of this drill. The company presented as a souvenir a key-ring and leather case, and was represented by H. G. Haines, F. N. Root, John McKinnon and D. A. Moore.

THE PHILIP CAREY MANUFACTURING COMPANY, of Cincinnati, showed an extensive line of boiler and pipe coverings of asbestos and magnesia, as well as roofing, asphalt paints, packings, etc. Those representing the company at Atlantic City were N. S. Kennedy, S. J. Bowling and F. R. Collins, Jr.

THE CURTAIN SUPPLY COMPANY, of Chicago, had a tasteful booth near the end of the pier. Its headquarters were fitted up with comfortable chairs and rugs, and were presided over by W. H. Forsyth, A. L. Whipple and R. F. Hayes. The company showed a large number of fixtures, including the Forsyth, Keeler, Climax, Acme and Burrows, also a new fixture, known as the ring fixture. There was also a full line of curtain material for steam and electric cars.

THE JOHN DAVIS COMPANY, of Chicago, exhibited a full-sized model of reducing valves for train heating, hose couplers and armored hose. George F. Hughson was present.

THE HARRISON DUST GUARD COMPANY, of Toledo, exhibited the Harrison car journal lubricator, vestibule journal box and engine cylinder lubricator in various sizes suitable for steam and electric cars. The vestibule box is set into the journal box of the car and is held by spring pressure against the journal. As there is an air space between the box and the lubricator the temperature of the journal is reduced, and as the lubricator houses practically all of the packing, if any dirt or grit drops into the bottom of the box it does not foul the oil. The lubricator can be removed from the journal box in half a minute by withdrawing a bolt. The box itself is completely enclosed and protected by two covers. The company was represented by Frank B. Harrison and Lacey Y. Williams.

THE CRESCENT MACHINE COMPANY, of Letoonia, Ohio, showed a Crescent angle-band saw, No. 3, saw table and jointer and a 36-in. band saw. C. G. Wilderson was in attendance.

THE CHISHOLM & MOORE MANUFACTURING COMPANY, of Cleveland, Ohio, exhibited a fine line of hoists, including the direct differential block, Moore anti-friction block and the Cyclone hoist, which is new in principle and is very rapid. In this hoist the chain drives an internal gear by an eccentric shaft, so that the load is positively and absolutely held at all times. The block needs no oiling, as all of the six bearings are fitted with anti-friction bushings. J. V. Vetterlein represented the company.

THE ADAMS & WESTLAKE COMPANY, of Chicago, had one of the largest and handsomest booths at the convention, and showed a full line of its steam railroad fittings, car hardware, electric fixtures, signal lamps and a model of its axle lighting system. The representatives present were F. B. Jones, J. L. Longworth, A. S. Anderson, F. N. Grigg, William S. Ham and R. N. Newbold.

THE G. DROUVE COMPANY, of Bridgeport, Conn., exhibited window and skylight opening devices. A. C. Bradley, W. F. Plass and S. Cibulas were present.

THE GREENAWAY COMPANY, of Detroit, showed steam and oil separators, steam traps and exhaust separators. G. A. Harris and A. Schade were present and distributed fresh carnations, the company's souvenir at the convention.

THE GRIP NUT COMPANY, of Chicago, had on exhibition at Atlantic City a full line of grip nuts, which are eccentrically cut and so hold the bolt. They are useful both for track work and for miscellaneous work, as on motors and elsewhere where the bolt is subject to jar. George W. Carhart and R. S. Wickersham were present for the company.

MERRITT & COMPANY, of Philadelphia, had samples of their metal lockers at the pier. They were represented by L. S. Engless and S. Morris.

THE AMERICAN WATER SOFTENER COMPANY, of Philadelphia, exhibited a model of its water softening apparatus and photographs of typical installations made in different parts of the country. A. S. Garrett, G. S. Garrett, W. H. P. Fisher and A. C. Tomlinson were present.

THE BELLE CITY MALLEABLE IRON COMPANY, of Racine, Wis., had on exhibition its anti-rail creeper and adjustable draft-plate. J. H. Dwight and T. W. Harvey were present in the interests of the company.

THE L. J. BORDO COMPANY, of Philadelphia, exhibited a full line of its locomotive specialties, valves, cocks and couplings. L. J. Bordo, L. W. Kramer, C. R. Weaver and E. A. Knowlton were present.

THE STAR BRASS MANUFACTURING COMPANY, of Boston, Mass., had quite an extensive exhibit in the form of valves, gages, whistles, cocks and other appliances for engines. The following were present: George H. Musgrave, James H. Sewell, William S. Levins and J. H. Edgar.

THE QUINCY-MANCHESTER-SARGENT COMPANY, of Chicago, Ill., made an extensive exhibit of Stanwood car steps, car and engine replacers, snow flangers and shop tools, represented in some cases by the actual apparatus and in other cases by photographs. Those present in the interests of the company were C. F. Quincy, G. H. Sargent, Percival Manchester, Paul R. Brooks, C. H. Holbrook, R. G. Cumback, George C. Isbester and B. T. Lewis.

THE RIVERSIDE METAL COMPANY, of Riverside, N. J., exhibited an extensive line of phosphor bronze, german silver and white metal products in the form of castings, sheets, rods and wire. The exhibit of the company proved especially popular on account of the attractive souvenirs which were issued, and which were manufactured of white metal. Those present from the company were Wm. P. McGlynn, H. W. Berroth, T. F. McGlynn and L. J. Kane.

THE SCHOEN STEEL WHEEL COMPANY, of Philadelphia, exhibited samples of its wheels in different stages of manufacture, from which the character of the process could easily be seen. The company had no electric car wheels at the convention, but reported a growing interest in the use of rolled steel wheels for electric cars. Those present were C. T. Schoen, W. Martin Johnson, M. Jackson and N. B. Twist.

THE MODOC SOAP COMPANY, of Cincinnati, Ohio, had an exhibit in which the representatives present demonstrated the method of cleaning cars with the Perfect Car Cleaner. The company distributed to good advantage its booklet of instructions for car cleaning. The president, Henry Rober, who was the representative in attendance, says that it is his intention to bring the means of cleaning cars to the attention of street railway companies. The real object of the Perfect Car Cleaner is to save painting bills and keep the cars in trim, neat condition all the time at a comparatively small cost. At the Pennsylvania depot the company showed an example of its work in cleaning part of one of the cars there and leaving the rest uncleaned.

JAMES BOYD & BROTHER, of Philadelphia, agents for the Electric Hose & Rubber Company, had on exhibition a reel containing 1250 ft. ¾-in. electric hose in one continuous length, the longest piece of hose ever manufactured. A better appreciation of this achievement may be had when it is understood that 50 ft. is the longest length attained by other manufacturers except where 50-ft. sections are spliced by unwieldy joints, as is the case in one or two instances at present. The electric hose is made by a new and improved process and used only by the Electric Hose & Rubber Company. The fabrics, consisting of seine twine, are braided directly on the hose, independent of each other, without ends, laps or seams, all forced into a solid and homogeneous mass by hydraulic pressure during vulcanization. The hose is light and durable, and cannot be unwound or readily kinked. It is made for all purposes, and is especially adopted to rough usage. It is in use by the largest railroads and manufacturing and mining concerns in the United States, and large quantities of hose are now being exported to all foreign countries and as far away as Japan, Austrialia, South Africa and the Philippine Islands. So rapid has been the growth of the business of the Electric Hose & Rubber Company that the works have been enlarged as required, new machinery installed, until all available space has been occupied, and new additions are now under way that will double the present capacity. The Electric Hose & Rubber Company confines itself to the manufacture of hose exclusively. James Boyd & Brother are the Eastern sales agents, and are rapidly expanding their business in the sale of these goods. Those present in the interests of the firm were C. P. Green, T. W. Watson, B. Travis and W. Hymas.

THE T. H. SYMINGTON COMPANY, of Baltimore, had an interesting exhibit of the well-known Symington journal boxes of various kinds for both steam and electric railroads. Baltimore ball-bearing center and side bearings for steam and electric cars were also shown. The sample car of the Pennsylvania Railroad to be used on the Camden & Atlantic electric line was equipped with Symington boxes. The representatives of the company present were T. H. Symington, H. W. Baldwin, J. F Symington, D. L. Symington, C. J. Symington, T. C. de Rossett, Carll Tucker and A. H. Weston.

THE McGUIRE-CUMMINGS MANUFACTURING COMPANY, of Chicago, was represented by John J. Cummings, W. J. Cooke and Edward M. Kerwin. The company's principal exhibit, an interurban snow-plow, did not arrive during the first few days of the convention. Mr. Cooke, however, showed blue prints of this plow which attracted a great deal of attention. It consisted of a car 53 ft. over all, equipped with a nose plow at one end, a sweeper at the other end and a derrick in the center between the two cabs. The snow-fighting apparatus was arranged so that it could be easily unshipped, so that in summer the car could be used as an ordinary work car and the center loaded with track or other material of any kind. The 10-ton derrick was arranged to be driven with a 25-hp motor, and the sweeper end was fitted with a shaft by which the motor could drive either one of the two sets of brushes. An interesting feature of the car was that it was fitted with the company's new rain door, with which 2300 cars of the Alton Railroad have been equipped.

THE WHEEL TRUING BRAKE-SHOE COMPANY, of Detroit, exhibited samples of wheel truing shoes for both steam and electric roads. The company has 400 patterns of brake-shoes in stock, and is constantly adding to this number, so that it can supply shoes for any type of wheel used in either steam or electric railway work. J. M. Griffin, president of the company, and F. Griffin, treasurer of the company, were present. As a souvenir the company presented a handsome pack of playing cards.

THE DEARBORN DRUG & CHEMICAL COMPANY, of Chicago and New York, had an elaborate exhibit at the convention. One of the most striking features was a handsome hardwood case, in which various products of the company were exhibited, together with samples of pitted boiler pipes and incrustations caused by using water containing sulphates. At the rear of the booth were posted leaves from the company's calendar for the year. Those present were Robert F. Carr, first vice-president and general manager; W. B. McVickar, second vice-president and Eastern manager; George R. Carr and G. F. Duemler. Sample bottles of perfumery were presented to the delegates as a souvenir of the convention.

THE DUNER COMPANY, of Chicago, exhibited toilets for railway use. John C. Duner, F. L. Wells and J. A. Bunting were present.

THE FOX MACHINE COMPANY, of Grand Rapids, Mich., attracted much favorable comment by its exhibit of milling machines, cutters, mitering machines, saws and drills of various patterns. The representatives of the company present were S. Owen Livingston, Hiram W. Fox and George Schow.

THE GALENA SIGNAL OIL COMPANY, of Franklin, Pa., which had one of the largest spaces at the convention, devoted its space to a reception room, which was handsomely fitted with rugs, paintings and pictures. As souvenirs a very attractive telephone directory was presented to the delegates with a pamphlet on car and engine lubrication. The latter was written in colloquial style, and described an imaginary conversation between a number of steam railroad engineers and firemen and an expert of the Galena Signal Oil Company. The company was well represented by S. A. Megeath, J. S. Coffin, Robert McVicar, C. C. Steinbrenner, W. E. Amann, E. H. Baker, W. E. Brumble, J. W. Bunn, J. B. Ferguson, J. F. Gettrust, B. H. Grundy, E. W. Grieves, F. A. Guild, J. E. Hall, A. F. Miller, G. L. Morton, J. S. Patterson, J. A. Roosevelt, J. S. Seeley, W. O. Taylor, W. A. Trubee, A. Turner, J. A. Wilson, J. W. Walsh E. McVicar, Wm. Steel, and L. S. Baddour.

THE CHICAGO PNEUMATIC TOOL COMPANY, of Chicago, had one of the largest exhibits at the convention. Pneumatic tools of all kinds were on exhibition, including hammers, riveters, drills and compressors. The company also showed storage batteries and speed recorders. Those present in its interests were W. O. Duntley, J. W. Duntley, Julius Keller, W. H. Traver, Thomas Aldcorn, W. P. Pressinger, W. Curtis, G. A. Barden, Fred. Severin, Jas. M. Towle, C. E. Walker, W. Keller, H. E. Epley, B. H. Tripp, H. Hunter, H. Keller, Julius Keller, Jr., Jas. L. Fannon, Charles DeC. Aldcorn and R. Kimman. A great deal of interest was taken in the Duntley electric drill which has recently been put on the market by the Chicago Pneumatic Tool Company, and which is especially adapted for drilling rails on electric roads. Power is taken from the trolley wire, and the rail is pierced in a few seconds.

THE COLUMBIA BOLT & NUT COMPANY, of Bridgeport, Conn., was represented by F. Atwater and exhibited samples of the Columbia lock nuts.

THE DETROIT LUBRICATOR COMPANY, of Detroit, Mich., had an attractive exhibit of lubricators of various kinds designed especially for locomotive service but including some of other types. Those present in the interests of the company were F. W. Hodges, A. B. Wetmore and A. D. Homard.

THE HOMESTEAD VALVE MANUFACTURING COMPANY, of Pittsburg, Pa., exhibited valves of various kinds, including blow-off valves for locomotives and stationary engines, straight-way, three-way and four-way valves and Homestead locking cock. The company was represented by C. B. Ault and F. R. Schuchman.

THE INGERSOLL-RAND COMPANY, of New York, had a large exhibit of pneumatic tools of various kinds, including chipping and riveting hammers, drills, fans, forges, air compressors, reservoirs, etc. Among those representing the company were C. H. Haeseler, J. H. Jowett, James Moran, W. H. Armstrong, C. Bollinger, George F. Zollers, C. R. Hewitt, J. W. Mooney, R. H. Cunningham, Philip Weiss, E. P. Mooney, W. H. Stephens, Alan Wilson, James Bradley, Clarence Peck, Caid Peck and Marion Priseler.

THE OLIVER MACHINERY COMPANY, of Grand Rapids, Mich., exhibited a large number of interesting views showing its machinery and supplies. George C. Hubbard and J. W. Oliver were present in the interests of the company.

THE PENNSYLVANIA RUBBER COMPANY, of Jeanette, Pa., had an extensive exhibit of rubber goods, including packing, gaskets, hose of all kinds, rubber tiling, mats and matting. The exhibit attracted considerable attention from the delegates present, and the advantages of the company's products were explained by L. L. Torrey, Wilmer Dunbar, George Shiveley and H. Wifred DuPuy.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, of Scranton, had an exhibit of its railway department car, "Scranton," at the exhibit tracks on Atlantic Avenue. Those present were W. M. Mitchell, Frank McManamy, C. B. Congor, W. J. Hill, J. F. Cosgrove and E. E. Ramsey.

THE NILES-BEMENT-POND COMPANY, of New York, had a working exhibit close to the Pennsylvania Railroad tracks on Atlantic Avenue, of a 90-in. extra heavy driving wheel chucking lathe. Locomotive drivers were taken from a car equipment, hoisted by a Niles crane, and put on the lathe, where they were turned down. The company also had an office near the ball room, where its freinds were entertained. It was represented by James K. Cullen, J. W. McMurray, Frank B. Ward, E. C. Lewis, D. A. Normoyle, Geo. T. Watts, J. P. Ilsley, W. W. Ricker, L. A. Williamson, J. J. Hay and Henry Cleaver.

THE V. O. LAWRENCE COMPANY, of Philadelphia, had a very interesting exhibit of its patent trap for car vestibules. This trap, known as the "Filion" trap, differs from others in that the trap is hinged in a diagonal line, making two triangular pieces. The outer piece is hinged on to the door, and the inner piece to the side of the car. The trap opens and closes with the door by the pressure of the foot upon a treadle. As the parts are hinged there is a tendency to crush any ice which may form on the lower side of the trap. When the door is open the two parts fold behind it so as to offer no obstruction to egress from the car. The trap is also arranged to be raised by a lever between the cars if desired. The trap is covered in the usual way with rubber, and the edges are bound with brass. The trap has been adopted by some eight or ten railroad companies, and the Canadian Pacific Railway has recently given an order for the equipment of all of its vestibuled cars with this trap. The company was represented by V. O. Lawrence and N. P. Lane.

J. H. WATTERS, of Augusta, Ga., presented a model of his company: E. Taussig and W. R. Noxon.

THE SEAMLESS TUBE COMPANY OF AMERICA, with headquarters in Pittsburg, Pa., exhibited seamless wrought steel boiler tubes, forged steel superheater tubes and other steel products. The company was represented by George A. Dickson, C. M. Porcher, Charles E. McInness, I. W. Bollinger, Julian L. Yale, Horace L. Winslow and H. Llewellyn.

THE CLEMENT RESTEIN COMPANY, of Philadelphia, was represented by Norman Bruce Miller. The company exhibited packings for all general purposes and for high-pressure steam and hydraulic work. Among the brands shown were the "Bell," made of flax; "Red Seal," which is a rubber cord packing; "Belmont," and "Asbestos Diagonal." The company also had on exhibition "Belmont" steam hose.

WENDELL & MACDUFFIE, of New York, the well-known supply house, were represented by both Messrs. Wendell and MacDuffie, and contributed greatly to the enjoyment of the delegates by furnishing the cast for a play at the supply men's entertainment on Friday night. On this occasion Mr. Wendell and his brother, with two friends, acted in the attractive dramatic sketch, "Col. Carteret, V. C.," and displayed histrionic ability which would have been the envy of many professionals.

THE PRESSED STEEL CAR COMPANY, of Pittsburg, exhibited a new steel car, recently built by the company for the Southern Railway. This car was used by the representatives of the company in going to Atlantic City from Pittsburg, and developed no hot boxes or other troubles. A view and description of this car appears on page 987 of this issue. Those present in the interest of the company were C. E. Postlethwaite, O. C. Gayley, C. A. Lindstrom, F. M. Robinson, J. F. McEmulty, L. O. Cameron, C. D. Terrell, W. H. Wilkinson, H. S. Reeder, J. H. Mitchell, John S. Turner and D. J. Farragut.

STEAM LINE TO BE PARALLELED FROM SANDUSKY TO PEORIA

The Lake Erie & Western Railroad (steam), a subsidiary property of the New York Central, will soon be paralleled by traction lines throughout its entire length from Sandusky, O., to Peoria, Ill. Of the 417 miles of main-line track 225 miles are now paralleled by roads in operation. The Lake Shore Electric Railway will shortly commence work on its line from Sandusky to Fremont, and next summer the Western Ohio will build from Fostoria to Fremont. Last week a contract was let for a line between Peoria and Bloomington, Ill., and when these are in operation the paralleling of this road will be complete. This line has suffered perhaps more than any other steam road in the country from the competition of the electrics, because its through passenger business is not heavy and it has had to depend largely upon the local trade.

FINANCIAL INTELLIGENCE

WALL STREET, June 20, 1906.

The Money Market

A somewhat firmer tendency developed in the local money market during the past week, rates for all classes of accommodation ruling about 1/4 per cent higher than those heretofore prevailing. At the beginning of the week, quotations for all maturities ruled comparatively easy, but later on there was a general marking up in interest charges. Call money advanced to 5 per cent, owing to the shifting of loans preparatory to the payment of the Standard Oil and other corporate dividend disbursements, but later on there was a gradual easing off in the rate to 3½ per cent. Time money, on the other hand, has remained decidedly firm throughout the week. The demand for the long periods has been considerably larger, despite the heavy liquidation in the stock market. The supply of funds, however, was not large, and banks and other lenders experienced no difficulty in holding the market firm at 4¾ per cent for sixty and ninety days, 5¼ per cent for six months and 5½ per cent for over the year maturities. It is not expected that time money rates will work materially higher until preparations begin for the usual outflow of funds to the interior for crop-moving purposes. Already foreign bankers are disposed to offer with some degree of freedom, at prevailing rates, and the offerings of finance bills for this purpose have been the principal factor in bringing about a sharp decline in the rates of sterling exchange. The successful flotation of the Pennsylvania loan in Paris is also calculated to relieve the local monetary situation. It is pointed out that, while the placing of this $50,000,000 loan abroad may not result in a resumption of gold imports in the near future, it will certainly increase the supply of credits, and thus eliminate the possibility of gold exports. Another factor in favor of the continuance of the present conditions is the large supply of new gold from the Klondike which is now practically assured. Conservative estimates of the receipts from that source during the coming season are considerably in excess of $35,000,000. The first consignment of gold from the North, amounting to $2,000,000, was received this week, and it is expected that from now on the arrivals will be frequent. As this money is usually transferred from San Francisco to New York by telegraph, the money at once becomes available for market purposes. Another favorable development was the decision of the Secretary of the Treasury to place $12,000,000 special deposits with the banks at San Francisco, part of which may eventually find its way to this center. About the only unfavorable factors in the situation are the heavy July 1 disbursements for interest and dividends, preparations for which are usually accompanied by flurries in call money rates, and the fact that on July 10 the banks will be obliged to pay into the Government Treasury $10,000,000 special deposits. The European markets have ruled easy, despite the Russian disturbances. The bank statement published last Saturday was unsatisfactory. Loans increased $913,700. Deposits were $1,046,700 larger than in the preceding week, thus increasing the reserve required by $261,675. Cash increased $173,000, which, deducted from the increase in deposits, diminished the surplus by $88,675. The surplus now stands at $7,073,375, as against $7,209,500 in the corresponding week of last year; $38,869,975 in 1904, $10,099,575 in 1903, $12,158,250 in 1902, $6,611,350 in 1901 and $17,498,750 in 1900.

The Stock Market

The past week has been one of depression in the stock market, and under pressure of liquidation and short selling, prices recorded very substantial declines. The selling movement culminated in a sharp drive at the market late on Monday, and it was then obvious that the market was pretty well oversold. This break was followed by the official announcement that the Pennsylvania loan of $50,000,000 had been successfully placed in Paris. The effect of this was a sharp decline in sterling exchange and an upward movement in stocks, the recovery having been due to a retreat of the short interest, rather than to the advent of any new buying. The market has been entirely professional, and the public continues to ignore Wall Street and to give its attention to other speculative ventures, principally real estate. Speculative conditions have been adverse to bullish operations in stocks. The delay in passing the railway rate bill by Congress, together with unfavorable crop advice, supplemented by strength in the grain markets, encouraged bearish operations, but the more important influence was the opposition of banking and other large interests. Speculation has run largely into a comparatively small number of stocks. These had been advanced to unreasonable levels, and the market became top-heavy. There has been liquidation in Union Pacific, St. Paul, Copper and Steel stocks, and in Reading, the latter having been a conspicuously weak feature. On the other hand, Baltimore & Ohio has advanced sharply, the stock selling at the highest price ever attained. The buying of the stock was based upon the expectation that the directors of the company declare a dividend on the stock at the rate of 6 per cent, as compared with the 5 per cent annual rate now paid, and which was subsequently fulfilled. Fundamental conditions are all that can be desired. Call money is likely to remain cheap up to near the end of the month; the activity and strength in iron and steel continues unabated; railway earnings are largely in excess of those for the corresponding periods of last year, and crop reports are more favorable than those put out earlier in the week. The country's foreign trade for the fiscal year ending June 30 next, promises to break all previous records. Should May and June show as large a monthly average as the previous ten months, the imports will reach a total of $1,225,000,000 and the exports $1,786,000,000, making a total of $3,011,000,000. The position of the market was greatly improved as a result of the heavy liquidation above referred to. Sentiment was more cheerful, and it looks as if the downward movement in prices is near its culmination.

The local traction stocks were prominent in the week's transactions, the feature having been the break of 7 points in Interborough-Metropolitan common, on withdrawal of pool support. Brooklyn Rapid Transit declined on selling by a bear pool. There is nothing in the traction situation that is unfavorable, other than the efforts to force the Brooklyn Rapid Transit Company to carry passengers from Manhattan to the seaside for a single fare.

Philadelphia

Very little activity developed in the local traction shares during the past week, and prices generally reflected the weakness prevailing in other quarters of the market. Philadelphia Traction was exceptionally firm, the price advancing 1/4 to 99 on purchases of a few hundred shares. Philadelphia Rapid Transit was under pressure and declined to 24, the lowest price recorded for the stock for some time. About 2500 shares were traded in. Philadelphia Company common, after selling at 51 declined to 50 on light transactions, and the preferred sold at 49¼. Other sales included Union Traction at 63¾ to 63¼, Railway General at 6⅞, United Companies of New Jersey at 263, American Railways at 51½ and 52, and United Traction of Pittsburg preferred at 51.

Chicago

Dealings in Chicago street railway issues were considerably smaller than in the preceding week, and prices generally reacted rather sharply. West Chicago lost 5½ points to 32, on light transactions. Chicago Union Traction ran off from 5 to 4⅜, and the preferred sold at 14. Metropolitan Elevated lost 2 points to 28, and the preferred declined to 67¼. South Side Elevated lost 1½ to 96½ on sales of 265 shares. Northwestern Elevated common rose from 25¾ to 27⅞, and the preferred brought 67. Chicago & Oak Park brought 6⅞.

Other Traction Securities

Trading in the Baltimore tractions was confined almost entirely to the United Railway issues, and particularly to the income bonds. In the early part of the week the incomes held firm at 74¾ and 74⅞, but toward the close heavy selling developed which carried the price off to 73. The selling was accompanied by the usual crop of rumors, none of which could be confirmed.

About $600,000 of the free bonds were dealt in. About $100,000 of the deposited bonds brought 72¾ and 72½. The 4 per cent bonds were quiet and unchanged at 92⅜ and 92½. Other transactions included 150 United Railway free stock at 16¼, 300 deposited stock at 16, $16,000 Norfolk Railway & Light 5s at 99¼, and $15,000 Macon Railway & Light 5s at 101½.

There was a marked falling off in the dealings in Massachusetts Electric, and prices for both issues reacted rather sharply. The common, on sales of about 1100 shares, declined 1½ points to 20½, while the preferred dropped from 74¾ to 71 on transactions aggregating about 1000 shares. Otherwise the market was dull and devoid of feature. Boston Elevated rose from 152 to 153½ on purchases of odd lots. The Boston & Suburban sold at 22½, Boston & Worcester at 36, the preferred at 88, West End common at 96½ and 97, and the preferred at 112½ and 112. In the New York Curb market, $15,000 Jersey City, Hoboken & Paterson 4s sold at 73 and interest, and $10,000 Public Service Corporation certificates at 69 flat.

There was little trading in traction securities in Cincinnati last week. Cincinnati, Newport & Covington common declined fractionally to 73¼. The preferred sold at 98. Cincinnati, Dayton & Toledo lost fractionally, selling at 26⅛. A small lot of Scioto Valley preferred sold at 98. Toledo Railways & Light sold at 33¾. A block of Northern Ohio Traction 5s sold at 100½.

In spite of a fresh outbreak by the city administration, Cleveland Electric made a slight gain in Cleveland last week, selling up to 79½ on lots aggregating about 600 shares. Lake Shore Electric came in for a small amount of activity, the old preferred selling at 67 and the new preferred at 60. Northern Ohio Traction & Light sold at 30½ for a small lot. Aurora, Elgin & Chicago common sold at 35½ and the preferred at 79¾, a slight decline from last sale.

An unexpected announcement of a second dividend on the stock of the Columbus Railway & Light Company was the signal for considerable activity in that stock at Columbus. Several hundred shares changed hands at from 83 to 85. The new stock of the Columbus, Delaware & Marion Railway made its appearance, and a small lot sold for 45. Since the recent refinancing, the preferred was exchanged for bonds, and the new company has but one kind of stock. The road is making numerous important improvements and its earnings are increasing rapidly.

Security Quotations

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

	June 13	June 20
American Railways	52½	51½
Boston Elevated	151	152
Brooklyn Rapid Transit	84⅛	81½
Chicago City	170	167
Chicago Union Traction (common)	4⅞	4⅞
Chicago Union Traction (preferred)	13	15¼
Cleveland Electric	80	80
Consolidated Traction of New Jersey	81½	81
Detroit United	95	94½
Interborough-Metropolitan Co. (common)	51	42½
Interborough-Metropolitan Co. (preferred)	85	77¼
Interborough-Metropolitan Co. 4½s	—	—
International Traction (common)	58	59¼
International Traction (preferred), 4s	80	80
Manhattan Railway	151	149
Massachusetts Electric Cos. (common)	22⅜	20
Massachusetts Elec. Cos. (preferred)	73⅝	70
Metropolitan Elevated, Chicago (common)	29	26
Metropolitan Elevated, Chicago (preferred)	70	66
Metropolitan Street	112	105½
New Orleans Railways (common)	32½	32½
New Orleans Railways (preferred)	82	81½
New Orleans Railways, 4½s	89¼	89¼
North American	97	96
North Jersey Street Railway	27	27
Philadelphia Company (common)	51	51
Philadelphia Rapid Transit	24¾	24
Philadelphia Traction	99	99
Public Service Corporation 5 per cent notes	95½	95
Public Service Corporation certificates	69	69
South Side Elevated (Chicago)	98	96½
Third Avenue	128	128
Twin City, Minneapolis (common)	114⅛	112¾
Union Traction (Philadelphia)	*63	63¼
West End (common)	—	—
West End (preferred)	—	—

a Asked. * Ex-dividend.

Metals

The "Iron Age" reports the dissolution of the Southern Foundry Association, an organization based upon a gentlemen's agreement among the leading Birmingham furnace companies. For months Northern furnaces have taken the greater part of the business coming up in foundry iron. The crisis was reached this week, one of the Southern makers entering the market. Just how much business was secured cannot be determined, but one of the principal transactions was the sale of 10,000 tons of No. 2 Birmingham at $13, a decline of $1 a ton. The situation is entirely different in the markets for steel making irons. The markets are absolutely bare of Bessemer, and there is not much basic immediately available. The demand for finished material is very good. The leading interests during the first half of this month booked an aggregate of orders in excess of its best shipping records. Some large orders for structural material have been entered. Steel rail makers have added 37,000 tons to their 1907 commitments.

Copper continues firm on the basis of 18⅞ for spot lake.

PLANS OF THE UNITED RAILWAYS OF BALTIMORE

Copies of the plan of the Income Bondholders' Association, recently formed by several banking firms for the purpose of offering the United Railways & Electric Company funds for immediate improvements and for paying interest on the income bonds, have been shown to trust companies with a view of having them join in the underwriting, says the "Wall Street Journal."

The plan provides for an issue of $7,500,000 of debenture bonds, which are really a third mortgage on the property of the United, and which are to run from ten to twenty years. While all the details of the plan have not been made public it is understood that a bonus of $4,000,000 of stock, equal to 80,000 shares, is asked for. The United Railways has in its treasury $9,000,000 of stock. The par is $50 and the market about $16.

It is said that the plan provides for the issuance at once of $3,500,000 of bonds, reserving the other $4,000,000 for future improvements. The plan provides for interest on the income bonds up to June, 1907. The interest on the bonds amounts to $1,400,000.

There is no assurance that this plan will be accepted by the United Railways. The management is working on a plan of its own, to provide for the use of the charter of the Maryland Electric Railway Company, which it owns, in raising funds. The feature of the association's plan, however, is that it will be underwritten when offered to the management. It will probably be submitted this week.

IMPORTANT TRACTION CONSOLIDATION IN EASTERN PENNSYLVANIA

The banking house of William A. Read & Company, of New York, and Forrest & Company, of Philadelphia, are now working out the financial details involved in the proposed equipment and control of the existing electric railway and lighting interests in and adjacent to Schuylkill County, Pa. All of the properties have been examined and reported upon by J. G. White & Company, of New York, who are also to operate the consolidated companies. The electric railways included in this merger are the Pottsville Union Traction Company, Pottsville & Reading Railroad Company, Schuylkill Haven & Orwigsburg Street Railway Company, Schuylkill Electric Railway Company, Tamaqua & Lansford Street Railway Company, Tamaqua & Pottsville Electric Railway Company, Coal Castle Electric Railway Company, and the Port Carbon & Middleport Electric Railway Company.

The plan comprehends, besides ample capital for future extensions and acquisitions, provision of over $1,500,000 to cover the cost of immediately making contemplated railway connections, additions and improvements as well as improving the lighting properties. The mileage of the foregoing lines is 57.18, and with the 20 miles to be built there will be in all 77.18 miles to serve a population of about 110,000. The capitalization is to be made up of $1,000,000 5 per cent cumulative, convertible preferred stock, $5,000,000 common stock, and $6,000,000 in 5 per cent first mortgage thirty-year gold bonds.

CHICAGO TRACTION AFFAIRS

The Chicago City Railway Company and the Union Traction Company have about completed the preparation of figures of the value of their tangible properties, to be submitted to the City Council committee on local transportation. According to Walter L. Fisher's proposed plan of settlement of the companies with the city these figures are to enter into the purchase price paid by the city when the city takes over the lines.

Mr. Fisher's draft of an ordinance for the permanent settlement of the traction question along the indeterminate license plan, as outlined in the last week's issue of the STREET RAILWAY JOURNAL, has been pronounced satisfactory in its essential features by representatives of the traction companies.

John P. Wilson, for the Chicago City Railway Company, stated that he saw nothing objectionable in the general features of the draft, and that his company would be prepared to take up the details of the draft and negotiate with the city as soon as the figures on the value of their properties were ready.

W. W. Gurley, general counsel of the Chicago Union Traction Company, said there were two or three objections to the general features of the draft.

The ordinances permitting the trolleyizing of the cable lines of both the Chicago City Railway and the Union Traction Companies and ordering the Union Traction Company to lower its tunnels were vetoed by Mayor Dunne, and the ordinances were again passed by the City Council with the amendments suggested by the Mayor added. The added clauses provide:

That within sixty days of the date at which the Council has ordered the trolley wires and poles removed the companies shall get them off the streets.

In case the companies do not so remove them within the sixty days' time, then the wires and poles shall become the property of the city.

The companies have ten days to accept the ordinances. Mayor Dunne, in giving his reasons for agreeing to the ordinances, said that he felt that ultimate ownership by the city would be the result of present negotiations. The trolleyizing of the North and West Side lines, he said, was necessary, because of the Federal laws requiring the lowering of the tunnels under the river. There was, however, no such necessity for trolleyizing the Chicago City Railway lines, but he did not think that the street car patrons of the South Side should, under any circumstances, be discriminated against in the matter of the good service which has been promised by the companies upon the granting by the city of trolley permits. He therefore favored granting the permits for the South Side, as well as for the North and West Sides. He said that heretofore the city could not safely grant permits for this purpose, because the companies made extravagant claims under the so-called ninety-nine-year act, and there was danger that trolley permits might possibly have strengthened these claims in law.

APPLICATION FOR UNDERGROUND AND SURFACE GRANTS IN PITTSBURG

Under the title of the Pittsburg Subway Company the right is asked the city of Pittsburg to construct a tunnel from Smithfield to Neville Streets, with a loop around the down-town district, and a number of connecting surface lines to the East End. The request was made in the form of a communication which was sent to Mayor Guthrie and to Councils. An ordinance has been prepared for presentation at a later date. In the application of the syndicate it is signified that the promoters of the enterprise stand ready to meet the all important requirement of compensation to the city. A percentage of the gross receipts to be agreed upon later will be paid to the city. The communication reads in part as follows:

To the Honorable Mayor and Councils of the City of Pittsburg:

The Pittsburg Subway Company, proposing to construct an underground passenger railway in the city of Pittsburg, hereby applies for the consent of the local authorities to such construction.

The company is incorporated under the elevated and underground passenger railway act of June 7, 1901 (P. L. 523). By its charter from the Commonwealth it has the franchise to construct and operate such railway around a circuit described as follows: Beginning at the intersection of Smithfield Street and Oliver Avenue; running thence along Oliver Avenue to Liberty Street, along Liberty Street to Ferry Street, along Ferry Street to Third Avenue, along Third Avenue to Smithfield Street, and along Smithfield Street to the place of beginning.

Under the authority of its charter, the company has also located branches or extensions over the following lines:

The first, beginning at the intersection of Smithfield Street and Oliver Avenue; running thence along Virgin Alley to Grant Street, thence across Grant Street, thence in a straight line to a point in the westerly line of Neville Street, 130 ft. northerly from the north line of Center Avenue, thence across intervening properties and streets a distance of about 255 ft. to the intersection of Center Avenue and Enfield Street, thence along Center Avenue to Penn Avenue, thence across Penn Avenue to Frankstown Avenue, thence along Frankstown Avenue to the angle in that avenue next easterly from Finley Street, thence across intervening properties to a point in the westerly line of Fifth Avenue extension opposite Kelly Street.

The second, following the line of the first to a point from which a perpendicular to the southward will intersect the center line of Bouquet Street at its intersection with the center line of Bayard Street, and thence southward along the said perpendicular to Bouquet Street; and,

The third, following the line of the first to a point from which a perpendicular to the southward will intersect the northerly line of Forbes Street at its intersection with the westerly line of Brady Street; thence southwardly along the said perpendicular to the northerly line of Forbes Street, and thence over the surface of Forbes and Brady Streets to the northerly end of the approach of the Twenty-Second Street bridge.

The plan of this company is to make its downtown circuit a common terminal loop for passenger traffic coming into the business district from all directions; thus taking off the crowded surface a great proportion of the cars which now impede traffic, and putting them under ground.

The plan is to reach the Southside, the West End and Allegheny by means of tunnels under the rivers, so that cars operated on the surface of the suburbs can be handled under ground in the crowded district.

It is also proposed to reach the East End by means of a tunnel connecting with the downtown loop at the corner of Smithfield Street and Oliver Avenue, and running thence directly through Herron Hill on the line of the above first branch to a point in Junction Hollow, just north of Center Avenue, coming out of the hill on the west slope of Junction Hollow at such a level that cars may be run from that point, both on the surface of the East End Streets, and also through a subway under Center Avenue. From this point it is proposed to extend the underground construction by the line above described to Kelly Street. From the latter terminus also the cars can be run out over the surface to the north, east and south.

The first construction which this company proposes to undertake in connection with the downtown circuit is the branch from Smithfield Street to Junction Hollow. Afterward the extension of this branch to East Liberty and Kelly Street can be undertaken, as well as the branches extending to Allegheny, the West End and the Southside.

For the present purpose this company therefore asks the consent of the local authorities to its construction of its proposed underground railway around the said circuit under Oliver Avenue, Liberty Street, Ferry Street, Third Avenue and Smithfield Street; also from Smithfield Street along the said branch locations to Neville treet, to Boquet Street and to Brady Street; all this on such reasonable terms and conditions as may be deemed proper by the Mayor and Councils.

THE TUNNEL TO LONG ISLAND CITY—STATUS OF THE WORK

William Barclay Parsons, vice-president of the company which is constructing the Belmont tunnel under the East River from Forty-Second Street to Astoria, testifying this week before Justice Fitzgerald in the Supreme Court, in connection with the differences between the New York & Long Island Railroad Company and the City of New York, told some interesting facts relative to the progress of the work. Mr. Parsons informed the court that the work of construction is being pushed forward with great rapidity. The tunnel is practically finished under Forty-Second Street from Fourth Avenue to the East River, and out under the river for 30 ft. beyond the pier line. In round figures the company has dispensed $1,000,000 in the acquisition of property necessary to the work of construction, while $2,000,000 has been expended for the labor of digging the tunnel.

It was not brought out what the company's plans are in regard to future extensions and proposed termini, with the exception of the statement by Mr. Parsons that there would be a terminal at or near the Grand Central Station.

The Supreme Court hearing is a part of the proceedings in the city's attack on the validity of the franchise under which the tunnel is being constructed. The city contends that the construction of the work lacks legal support, and that a franchise of such magnitude should be a much greater source of revenue to the municipality than it is. The company sued to have the city restrained from interfering in any way with the work. The city bases its contention that the route proposed twenty years ago has been abandoned. The company says that with the extensions which have been granted from time to time it has until Jan. 1, 1907, to finish the tunnel.

THE TEMISKAMING & NORTHERN RAILWAY TO USE ELECTRICITY

The Temiskaming & Northern Railway, being built by the Ontario Government, is operating from North Bay to New Liskeard, about 130 miles, and is building 100 miles, so as to tap the Grand Trunk Pacific when it reaches the junction point this fall. Owing to the danger to the valuable forests through which the road runs from sparks from the locomotives, the Government has decided to do away with steam altogether, and substitute electricity as the motive power, at an estimated cost of $1,000,000. Tenders will be called for as soon as the plans and specifications are prepared. Information may be obtained by communicating with D. E. Ryan, the secretary of the Government Commission, Toronto, Ont.

STONE & WEBSTER ENGINEERING CORPORATION

An engineering and construction company, with a fully paid-in cash capital of $250,000 has been organized by Stone & Webster, under the laws of Massachusetts, to engage in a general engineering and construction business in connection with large undertakings. The Engineering Corporation will take over the engineering part of the business of Stone & Webster, which was originally the important part of their general business.

Stone & Webster, some sixteen years ago were among the first to enter the field of electrical development as electrical engineers and experts, the business soon reaching large proportions. During the last few years, however, on account of other important interests of the firm, their efforts along these lines have been almost exclusively devoted to the requirements of the various companies under their management. As the firm desire to devote their time and energies to financial affairs and the management and development of the numerous properties which they operate, they have formed the Stone & Webster Engineering Corporation, the personnel of which will largely consist of men who have been associated with the firm for years in connection with the engineering and construction side of their business. In addition, arrangements have been made to associate with the new company engineers of prominence in their various lines with the idea of placing it in a position to undertake engineering and construction work of importance throughout the country. All the stock of the company has been taken by Stone & Webster and their associates.

BROOKLYN AND NEW YORK AT ODDS OVER BRIDGE PLANS

Brooklyn and New York are at odds over the plan of Bridge Commissioner Stevenson for connecting the Williamsburg and Brooklyn Bridges by an elevated loop. Naturally, Brooklyn contends that the loop is essential to the solution of the traffic problems confronting that borough. New Yorkers on the East Side are opposed to the structure in what is the most crowded part of the city, and favor a subway, which, from many standpoints, would not answer at all as a temporary expedient. When the hearing was called in the City Hall last Friday there was a goodly array for and against the plan. Dr. McKelway, editor of the "Brooklyn Eagle," was foremost among the Brooklynites representing that borough. The meeting was adjourned until Friday, June 22. The commissioners appointed by the Appellate Court to consider subway routes in Brooklyn have approved a loop connecting the two bridges, the line from the Williamsburg Bridge crossing over Delancy Street to a point near Norfolk Street, and thence under the Bowery, Walker and Center Streets to Brooklyn Bridge, and Bridge Commissioner Stevenson has opened bids for the construction of an underground station in Delancy Street at the Manhattan end of the Williamsburg Bridge. The purpose of this station is to receive both elevated and trolley cars from Brooklyn and eventually to become a part of the subway system connecting the two boroughs. Five bids were received, as follows; Richard Henningham, $1,345,662; Snare-Triest Company, $1,167,000; Norton & Company, $1,260,000; Degnon Construction Company, $1,297,930, and John J. Hopper. Mr. Hopper's bid in one place stated that he bid $1,000,799, and in another place it stated that he bid $1,799,000. The detail of the items would seem to indicate that the larger amount is correct. If the other is correct Mr. Hopper will be the lowest bidder, so, in order to settle the question, the matter will be referred to the Corporation Counsel for an opinion.

TERMS OF NORTHERN OHIO MERGER

The terms for the consolidation of the Canton-Akron system with the Northern Ohio Traction & Light Company have been signed, but the actual consolidation will not become effective for about sixty days, owing to the many details to be carried out. The first step will be the consolidation of the three Tucker-Anthony properties, the Canton-Akron Railway Company, the Canton & New Philadelphia Traction Company and the Tuscarawas Traction Company, into one company. This new company will then be merged with the Northern Ohio Traction & Light Company. The Tucker-Anthony properties have a total outstanding debt of $4,500,000, and capital stock of $1,038,000. To take care of these issues, the stock of the Northern Ohio Traction & Light Company will be increased to $7,938,000, and the bonded indebtedness to $10,500,000. The consolidation is, therefore, simply an exchange of securities, and the Eastern interests which owned the Canton-Akron will be represented on the directorate of the Northern Ohio Traction & Light Company. The merged properties will have nearly 200 miles of track, with annual earnings of $1,600,000.

THE MASSACHUSETTS MERGER BILL

Massachusetts worked itself into a frenzy over the "merger" bill, relative to investments by railroad companies in street railway companies, and then the legislators referred the measure to the next session. Considering the power vested in the Railroad Commissioners, whose rights it was not proposed to curtail, some of the statements made by the opposition as to the results likely to follow the passage of the act seem positively asinine. The bill was simply nothing more nor less than a measure to effect an end that even now can be accomplished by a home corporation controlling another home company through the medium of a holding corporation.

SCHOEPF SYNDICATE GETS A CONNECTING LINK

It is reported that the Schoepf syndicate has finally concluded negotiations for the control by lease of the Dayton & Western Traction Company, whose lines extends from Dayton to Richmond, Ind., and includes about 43 miles of track. The syndicate had been negotiating for this property for the past year or more, as it was needed to connect the Ohio and Indiana properties of the syndicate and complete a through line from Indianapolis to Columbus. The road was owned by Valentine and J. H. Winters, of Dayton, and it was unique in that it had no bonded or floating debt, and was paying 5 per cent dividends on $850,000 of preferred stock and 2 per cent on $450,000 of common stock. According to report the owners will receive 6 per cent per annum on the total capitalization of $1,300,000. The road gives the Schoepf syndicate an unbroken line of 310 miles from Terre Haute, Ind., to Zanesville, Ohio, and with the exception of the Dayton & Troy and the Western Ohio, leading north from Dayton, it now has all the lines necessary to carry out its plans for a system connecting up the leading cities of Ohio and Indiana.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JUNE 12, 1906

822,924. Brake-Shoe; Frank P. Collier, Wilmette, Ill. App. filed Feb. 20, 1905. Details of construction of hard metal insert plates.

822,925. Brake-Shoe; Frank P. Collier, Wilmette, Ill. App. filed April 1, 1905. Has a transversely corrugated plate at or adjacent to the back of the shoe.

822,951. Railway Signal; John S. Jeffrey, Columbus, Ohio. App. filed Nov. 15, 1905. A device for flagging a train consisting of a manually-operated swinging arm carrying a signal device and car-operated means to withdraw the signal.

822,961. Trolley Placer and Guide; Edgar A. Leake, Lawrence, Mass. App. filed Oct. 18, 1905. Guiding eccentric plates having a tapered flange adjacent the wheel mounted to turn on each side of the trolley wheel, the widest portion of the flange being normally uppermost, and each eccentric plate having inwardly-projecting overhanging lugs.

823,003. Car Fender; Einar Tallaksen, Chicago, Ill. App. filed Dec. 20, 1905. The fender is mounted upon an auxiliary truck, thereby causing it to follow curvatures of the track.

823,040. Automatic Safety Trolley Pole; John R. French, Los Angeles, Cal. App. filed March 3, 1905. The trolley pole has a hinge near its upper part, and the hinged section is connected with the tension spring at the base of the pole, so that when the wheel leaves the wire the hinged section is caused to fly upward, which movement at the same time relaxes the spring and allows the trolley pole to drop.

823,067. Electric Railway System; John L. Moore, New York, N. Y. App. filed Nov. 16, 1904. Details of a sectional conductor, the divisions of which are successfully energized during the passage of the car.

823,095. Slack Adjuster; Charles O. Anderson, Omaha, Neb. App. filed Aug. 26, 1905. Relates to means for automatically taking up slack which may occur in the brake rigging, due to wear on the brake-shoes or other parts.

823,136. Apparatus for Operating Railway Switches; Martin M. McNeley, Des Moines, Ia. App. filed Sept. 29, 1905. Two pairs of levers connected at their ends by a cross-bar, and each lever pivoted to the under side of the car and provided with a cam on its lower free end, and treadles for throwing either pair of levers into engagement with the switch point.

823,147. Railway Switch; Edward Wartman, South Bend, Wash. App. filed Sept. 18, 1905. In a single-track road, means whereby each car in passing automatically reverses the switch at turn-outs, so that the next car will be switched upon the diverging track.

823,196. System of Train Control; August Sundh, Yonkers, N. Y. App. filed Dec. 4, 1905. Relates to a multiple-unit control system for electric trains.

823,255. Car Brake; Henry T. Brown, Wilkinsburg, Pa. App. filed Sept. 25, 1905. A combined track and wheel brake adapted to be simultaneously actuated by the operator.

823,285. Car Brake; Charles B. Mead and Robert S. Fullerton, East Palestine, Ohio. App. filed Feb. 28, 1906. An emergency brake of the "chock-block" type.

823,292. Rail-Bond; Edwin W. Robinson, Punxsutawney, Pa. App. filed July 12, 1905. The rail-bond has threaded ends which project through the web of the rail and are engaged by conical nuts, which may be set up to bring the bond into close engagement with the rails.

823,310. Self-Acting Switch; William H. Taylor, Philadelphia, Pa. App. filed Feb. 2, 1906. A system of levers by which the switch may be thrown from a moving train.

823,311. Metallic Railway Tie; Frederick H. Urban, Brazil, Ind. App. filed Sept. 28, 1905. A metal cross-tie provided with a pair of oppositely extending and inclined rail-holding abutments, one of which is integral with the cross-tie and the other is removably secured thereto, a plate of wood or other similar material between the rail-holding abutments upon which the rail rests, and removable means for holding the wooden plate in place.

823,315. Air Supply Apparatus for Air Brakes; Ernest B. Allen, Louisville, Ky. App. filed Feb. 13, 1906. An auxiliary air-pump driven by the car axle, is automatically started the moment the brakes are applied, to thereby store air in a tank from which the train line pressure is quickly replenished when the brakes are released.

823,325. Step Holder for Cars; Joseph Edwards, New York, N. Y. App. filed March 15, 1906. Means for securing the step in its folded position, consisting of a vertical stem slidably mounted in a sleeve and having a hook adapted to engage the upper edge of the step.

823,332. Trolley Finder; William J. Hinton, Danville, Ill. App. filed Aug. 16, 1905. Guiding arms pivoted in the trolley harp are placed in operative position by pulling upon the trolley cord.

823,438. Trolley Hanger; Thomas Price, Minneapolis, Minn. App. filed June 5, 1905. The hanger is provided with depending ears, which engage the trolley wire, and which may be clamped thereagainst by a hollow sleeve and pressed downward thereon.

823,478. Safety System for Motor-Propelled Cars; John A. Miller, Baltimore, Md. App. filed Nov. 6, 1905. The motor circuits are prevented from completion by circuit breakers under the car until the doors are closed.

823,490. Electric Motor Truck; William Dalton, Schenectady, N. Y. App. filed Aug. 29, 1905. Details of a truck designed to afford improved facilities for the support of the motor and brake rigging.

823,491. Locomotive Truck; William Dalton; Schenectady, N. Y. App. filed Aug. 29, 1905. Details of construction.

PERSONAL MENTION

MR. WILLIAM B. FLYNN, assistant electrical engineer of the New York, Westchester & Boston Railway Company, was married June 16 to Miss Edna Anson, of Hasbrouck Heights, N. J.

MR. ARTHUR A. LIGHTFOOT, who has been connected with the office of the Hartford & Springfield Street Railway Company for the past four years, has resigned his position to become assistant superintendent of the Fitchburg & Lowell Street Railway Company.

MR. GEORGE FOWLER has resigned as superintendent of the Southern Car Company, of High Point, N. C., and returned to Amesbury, Mass. Mr. Fowler has been superintendent at High Point for three years. Before moving to High Point he was superintendent for the Briggs Car & Carriage Company, for fourteen years at Amesbury.

DR. SCHUYLER SKAATS WHEELER, president of the Crocker-Wheeler Company, Ampere, N. J., sailed June 14, on the Lloyd steamship "Barbarossa" for a short European trip. He was accompanied by Prof. Francis B. Crocker, professor of electrical engineering at Columbia University, who has been associated with him in business for many years.

MR. WALTER L. ADAMS, general superintendent of the Milford & Uxbridge Street Railway, had a narrow escape from serious injury on June 15, when, in attempting to turn his automobile in the Hopedale (Mass.) Cemetery, the machine ran backward down a 20-ft. terrace. Mrs. Adams suffered from a dislocated shoulder and a cousin was seriously injured. Mr. Adams was only slightly injured.

MR. WALTER HURD, a steam road man, has been appointed general passenger and freight agent of the syndicate territory about Columbus. Mr. F. A. Burkhardt, of Lima, has been appointed to a similar position in charge of traffic of the lines centering at Lima. Both men will come under the jurisdiction of Mr. D. G. Edwards, general traffic manager of the Schoepf-Morgan system of Ohio and Indiana.

MR. GEORGE FLETT, managing director of Dick, Kerr & Company, Ltd., of London, left New York this week for London, after a stay of a few days. This will complete a trip around the world lasting six months. On June 18 Mr. Flett was entertained at a farewell luncheon at New York, at which there were present Messrs. F. J. Sprague, J. G. White, H. H. Vreeland, H. McL. Harding, James H. McGraw, T. C. Martin, P. G. Gossler, J. M. Wakeman, H. G. Stott, M. G. Starrett, S. M. Curwen, W. S. Burnham, J. Goodell, A. N. Connette and W. S. Doran.

MR. S. W. MOWER, secretary of the American Railway Mechanical and Electrical Association, has resigned his position with the Detroit United Railway Company and has accepted that of general manager of the Southwestern Traction Company, of London, Ont. This is the company which is planning to use three-phase electric railway operation under the Ganz patents. It has already built about 20 miles and has 9 miles under construction. Mr. Mower has occupied the office of secretary of the Engineering Association and its predecessor, the American Railway Mechanical and Electrical Association since the organization of the latter in Detroit in 1902. His many friends will congratulate him on his appointment as manager of this company, whose work in this country is so unique that it will possess a special interest to all railway managers and engineers.

MR. J. R. HARRIGAN, general manager of the Canton-Akron Railway system, has announced several changes in the personnel of the operating force of that company. Mr. William E. Rolston has been promoted to master mechanic and chief engineer of the Canton-Akron Railway Company, Canton-New Philadelphia Railway Company, and the Tuscarawas Traction Company. Mr. Rolston formerly was superintendent of the Dayton & Troy Electric Railway Company, and came to Canton March 1, and assumed his duties as engineer at the power station. Mr. D. A. Scanlon has been appointed division superintendent of the Canton-Akron City lines and the Massillon City lines. Mr. Scanlon formerly was superintendent of the Raleigh Electric Company at Raleigh, N. C. Mr. George E. Barber has been appointed train master of the Canton-Akron Railway Company and the Canton-New Philadelphia Railway Company. Mr. Barber formerly was connected with the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville Electric Railway Company, in the capacity of despatcher. Mr. William T. Luxton has resigned as superintendent of the Canton-Akron Railway Company.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, JUNE 30, 1906. No. 26.

Published Every Saturday by the

McGraw Publishing Company

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)........$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)........$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid........ $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

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

Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1906 to date, 212,600 copies, an average of 8177 copies per week.

The New York Inter-Line Coupon Book

One of the most important subjects discussed at the Saratoga Convention of the New York State Street Railway Association this week was that relating to the adoption of an inter-line coupon book. The advantages of a book of this kind have already been demonstrated by the interchangeable mileage books of the steam railroad companies, and still more directly by the interchangeable coupon book employed by the Central Electric Railway Association. There is no doubt that a plan of this kind stimulates riding, especially through travel, and saves a great deal of trouble to both the passenger and conductor in the way of making change, so that it is worth all it costs. The rate at which the book is sold, 240 coupons, or $12 worth of travel, for $10, is the same as that adopted by the Central Electric Railway Association, and the clauses covering the use and redemption of these coupons, proposed for adoption at the Saratoga Convention, are also very similar. We shall not comment in detail upon the various provisions of the interchangeable coupon book contract until the final form as adopted at Saratoga this week is available, but touch upon the plan this week as a step in the right direction.

T-Rails in the Convention City

Sensational daily newspapers of Columbus, Ohio, are making an uproar because the Columbus, London & Springfield Railway wants the privilege of removing the grooved rail on its interurban loop and on the track leading out of the city and substituting high T-rail in its place. The company offers to use suitable paving for such rail and keep it in repair. Recently the company took a party of city officials to Dayton, Indianapolis, and several other places, and showed them the use of T-rails on paved streets, and part of the daily press is now endeavoring to show that the company's methods look like graft, and that the company wants to operate freight trains and high-speed passenger trains through the city. There is no question that the company's objection to grooved rail in this case is well founded. Its cars are unusually heavy, and are built for high speed, and to insure safety a wheel flange is used that is too large for the groove of the present rail. The danger of operating under such conditions is well known to every traction manager. The wheels bear only on the flange instead of on the tread, and in wet weather it is almost impossible to secure proper braking effect. In severe winter weather the conditions are even worse. The groove fills with ice and snow, derailments are liable, and it is almost impossible to handle the car properly or even safely. Two recent accidents in Cleveland, where cars crossing viaducts were derailed by small obstructions in the groove, and where great loss of life was prevented only by miracle, afford the best possible argument in favor of the contention of the company in Columbus, and elsewhere where the same conditions prevail. That the power consumption is greatly increased and wear on the flanges is excessive are of course among the objections which the company has against this track. Some years ago, at Springfield, Ohio, the former manager of the Columbus road, after several accidents caused by grooved rails, armed a force of men with cold chisels one night and chipped the groove from a mile of track through Springfield, and then defied the authorities to take action. The track remains in that condition to-day. It is to be hoped that a similar measure will not be necessary in Columbus, although there would be strong provocation for it if the city insists upon the use of a piece of track which is dangerous to the public and needlessly expensive to the company. There are many miles of T-rails on city streets in large municipalities in the Central West, and where a street is properly paved and maintained there is no more, if as much, danger of annoyance to drivers of horse-drawn vehicles, as with the grooved or girder rail.

Track Layouts at Summer Resorts

Electric railway systems at seashore and other summer resorts do not usually do a very profitable business on account of the shortness of the season, and for this reason this class of railways is looked upon with considerable disfavor by investors. Nevertheless, the conditions under which they operate have their compensating advantages. One is that people visit a resort of this kind to spend money, and higher fares can and ought to be charged for transportation compared with those in force on roads elsewhere. Again, the construction and equipment need not necessarily be of as high class, nor need the power station and distribution system be as efficient, owing to the short period for which they are called upon to transmit the maximum output. Again, it is nearly always possible to develop a considerable excursion business. Residents of one seashore resort can be encouraged to visit other resorts by a proper amount of advertising or something in the way of attractions, such as fireworks or park amusements. And if the line runs by the shore for any considerable distance, or through an attractive territory, considerable purely pleasure riding can be developed. Of course, owing to the short season, a system of this kind can best be worked in connection with a city property, because the power required during the summer months can be secured without any large permanent investment in power generating or translating apparatus, and because a satisfactory arrangement for the use of cars and labor can usually be planned.

The determination of the best track layout for a road of this kind is an interesting question. The geography of the city or town served is, of course, the principal factor in the problem, although the location of special attractions for the public is of almost equal importance in its bearing upon the best track location.

In most resorts located on the sea coast or on the shores of any considerable body of water, the visitor soon discovers that the town consists in the main of a narrow strip of streets and buildings skirting the shore. Width does not count for much in these communities. Rockaway Beach and Far Rockaway furnish an excellent illustration of attenuated topography, and the Jersey seashore resorts of Long Branch, Elberon and West End another. Perhaps the most typical layout of this sort is in Atlantic City, N. J.—a town whose fixed population is some 28,000, with a summer population of 200,000. In Atlantic City the main line of electric railway service traverses the town in a double-track route parallel to the ocean shore, and consequently parallel to the famous seven-mile Board Walk, but about a third of a mile distant. A few branch lines intersect the main line at right angles, but they are far between. Eight-cent exchange tickets are furnished between the main line and the spurs.

In all of the seashore resorts of the kind we have been considering, the center of interest and activity is, of course, on the shore, and if the railway company wishes to secure any considerable amount of business it is self evident that the line must be near enough to the shore so that it is a convenience and saves time and distance as compared with walking. Of course in all of these resorts there is a permanent population in the village away from the shore, so that the best location for winter traffic is not necessarily the same as that for summer. What we wish to emphasize, however, is that persons wishing to travel from one point to another on the shore in one of our elongated summer resorts will not walk back to a trolley line a quarter or a half mile away if they can avoid it.

Alcohol Motors

Since the passage of the free alcohol bill we have been pleased to see the favorable information regarding alcohol motors which has come to hand. Alcohol has so many advantages for use as fuel in internal combustion engines that its advent at a low price should work, not perhaps an industrial revolution, but very material changes in practice. Looking at the matter in its broader aspects, the greatest advantage of alcohol as a fuel lies in the fact that it makes very little draft on the world's capital account. It is practically an agricultural product instead of a rather meager by-product of the petroleum industry, the resources of which are in the nature of things limited. At the present range of prices abroad gasoline is ranked as slightly cheaper than alcohol, but with the rapidly increasing demand of internal-combustion engines this condition can not long be maintained. Gasoline has, it is true, the advantage in thermal value, but alcohol can be worked at enough higher economy to nearly offset the difference. During the hearings on the free alcohol bills, the evidence given by experts on engines was very definite upon this point. Prof. Elihu Thomson, who has studied internal-combustion engines for years, was very explicit in this regard, stating that, gallon for gallon, alcohol can develop substantially the same power as gasoline, less energy being rejected in the exhaust, and the conditions of combustion being more favorable. Mr. Goebels, of the Otto Gas Engine Company, went even further, stating as a result of experiment that with engines of the same cylinder capacity the alcohol engine would give about 20 per cent more power than the gasoline engine, and would give a thermal efficiency of 30 per cent.

Such a gain in output, even were it accompanied by no gain in efficiency, would be of considerable value in the automobile industry, leading to a lighter engine. In larger industrial work the gains are perhaps less material, but it seems certain that in alcohol we have a fuel of about the same present cost as gasoline and having advantages in safety, cleanliness, and freedom from offensive odors. Reports from abroad on locomotives driven by internal-combustion engines were referred to briefly in an editorial way last week, and indicate that for light work and industrial purposes very excellent results can be attained. Considering the interest now increasing in independent motor cars for casual railway purposes, the advent of alcohol motors is of particular importance. That it will greatly change the conditions of economy in such cases can hardly be expected, but it will at least keep them from becoming more unfavorable owing to increasing cost of fuel. All sorts of waste material now thrown away can be worked up in the alcohol industry, so that there is no danger of the supply running short even in years of meager crops, and with the product duty free there can be an interchange of resources that will be very helpful in steadying prices. The main industrial danger is the creation of an alcohol monopoly, which will have to be watched for and guarded against from the very outset. With the duty off, such a combination will not be easy to create or maintain, but it will infallibly be tried. Meanwhile we hope that the makers of engines will busy themselves to meet the demand which certainly will arise. The alcohol engine must be slightly modified from the gasoline type in order to reach the best results, but in the long run it should be rather less than more difficult to make and to maintain.

Hydro-Electric Power for Railways

With the increasing availability of transmitted power, more and more railways are enabled to take advantage of it, and the questions of economy connected with it are therefore to the front. Electric railway plants have generally undesirable load factors and heavy losses in distribution. On the other hand, they are often of large output, and hence in a position to put power on the bus-bars at a comparatively low figure. With respect to load factor two entirely distinct conditions arise. First, the load factor for the station as a whole may be low; second, the working load factors on the machines may be low. If both conditions coexist, the outlook for economy is bad, but the load factor of the machines affects the economy of operation, while the load factor of the station affects mainly the fixed charges. In planning for the use of transmitted power, it is the machines that should particularly be borne in mind, for ordinarily the existing equipment will still be carried, with somewhat lessened maintenance charges, it is true, although disuse cannot cut off all expense. In contracting for transmitted power it therefore behooves the manager to make plans for decreasing his operating losses. This can be done in two ways, first by cutting off distribution losses and, second, by improving the load-factor conditions. It will often happen that in arranging for transmitted power a considerable saving in the total amount of energy furnished can be made by one or more deftly-arranged sub-stations, and when possible this is a very profitable use to make of transmitted power.

In the main station attention should be directed to applying the power under conditions that will enable the steam-driven units in use to work at or near full load, in case transmitted power for the whole load is unavailable. So long as a direct-connected unit is running in the vicinity of its rated load, it makes little or no difference in economy whether the total output of the station is caring for a peak or not. It strikes us as important, therefore, so to draw contracts for power that even if the hydro-electric source wishes to avoid peak loads it shall still be able to carry through load until an added steam unit can be put into service at a fair load factor. In buying power, therefore, it is better not to buy a block with sharply-defined limits, but rather to make a contract with a certain amount of leeway above the block guaranteed, so as never to run engines badly underloaded. We believe an arrangement of this kind is better than any maximum-demand system both for buyer and seller. The former knows exactly what his power is costing, and the latter knows that he can be called upon for a reasonable amount of extra power and no more, which is very important in a hydro-electric plant of limited capacity. The fact is that when the maximum-demand system is arranged so as theoretically to protect the seller's capacity it is almost invariably disadvantageous to the buyer. The simpler a contract for power and the more definite the rates, the less likelihood of misunderstandings. Peak loads are undesirable for all parties concerned, and have to be paid for, but certainly the buyer does not want to pay for hypothetical peaks, particularly if he can carry them himself on well-loaded generators. As to equitable prices, the railway manager knows, or ought to know, how much his power is costing at the bus-bars and how much output he can save by the installation of sub-stations, and he can very generally show a saving by buying transmitted power, particularly in buying a considerable block on a long-term contract. It may pay handsomely to buy power for outlying districts, even when the costs of central station generation are too low to show economy in purchase.

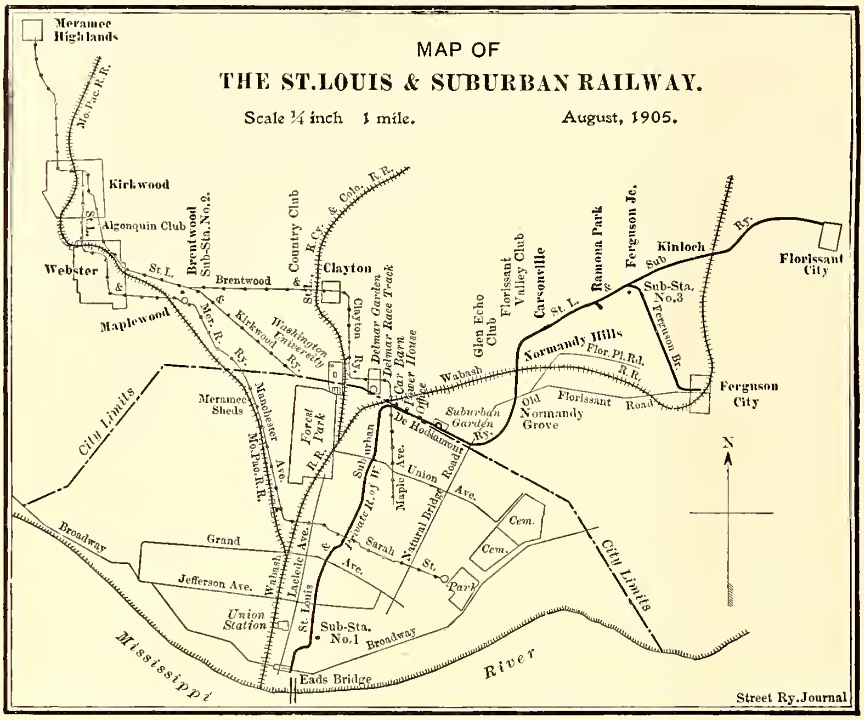
Sub-Station Lighting at Night

In the operation of electric roads covering a large amount of suburban or rural territory, the question of lighting sub-stations and sometimes small shops in the small hours at remote points on the system assumes a certain importance. The lighting load in such cases is often entirely too small to be efficiently handled by a single large generating unit in the power house, and yet light must be had from some source. It is not feasible either to inspect or repair equipment with any thoroughness by the light of an oil lantern, although in an emergency an oil headlight with a locomotive type of reflector is better than nothing. The installation of a small storage battery for sub-station lighting is generally too expensive a way out of the trouble, and the combined load of half a dozen sub-stations is too small to be handled economically by the exciter plant in the main power house, supposing two or three of these units were connected in series to give a fair value of voltage at the nearer sub-stations.

When a sub-station is equipped with a regulating battery for railway service, ample light can, of course, be had for any purpose whatever, and in shops where machine work is carried on at night by motor-driven tools, it is a simple matter to obtain all the light which is required from the power circuits. Sometimes a company can fall back upon the local central station with advantage. A case of this kind occurs in Southern New Hampshire, where the Rockingham County Light & Power Company, of Portsmouth, supplies eight sub-stations of the New Hampshire Traction Company with lighting current in the small hours in the form of 600-volt single-phase energy transmitted to the sub-stations through the trolley wire, using the regular ground return as one side of the circuit. In this scheme the most distant sub-station is about 60 miles away, on the borders of Nashua, but the total load for lighting seldom exceeds 8 kw or 9 kw. On roads where current is available for moving cars at any time of night the lighting problem cannot be said to exist, but some provision is desirable in all cases, either by local arrangement, the use of large acetylene or oil lamps, or the installation of a small generating unit at the main power house which can be run with fair earning at light loads.

IMPROVEMENTS ON THE ST. LOUIS & SUBURBAN RAILWAY

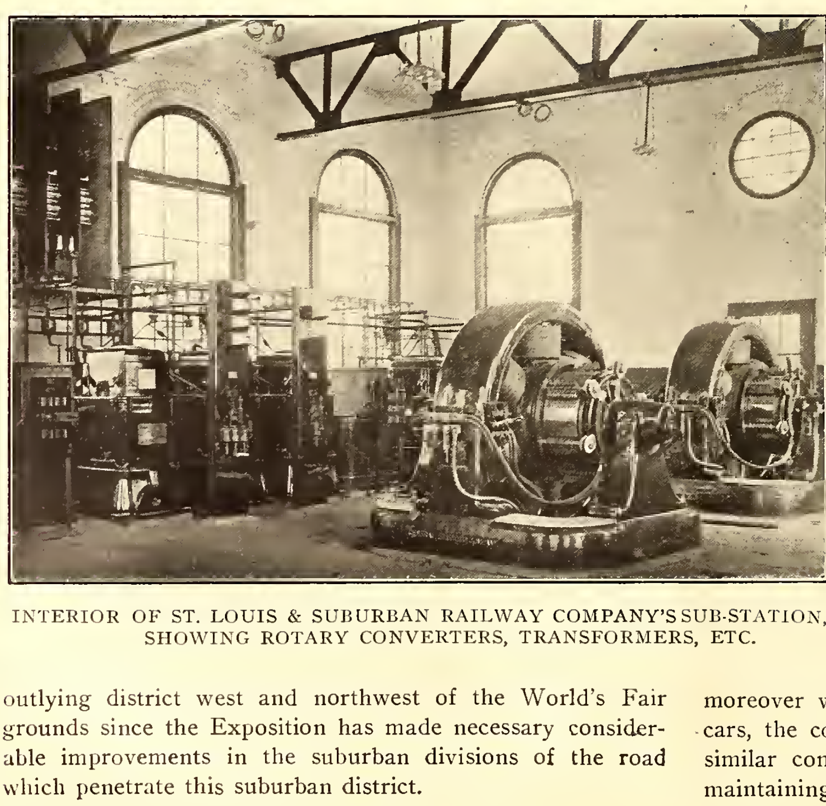
Occasioned partly by the World's Fair, just previous to the opening of the exposition, the power house of the St. Louis & Suburban Railway Company was overhauled and new generating units were installed, several new cars added to the equipment and new extensions of the lines were made to the fair grounds. Because of the preparations made at the time for handling visitors to the Exposition the company has not since been compelled to make any extensive improvements on the portion of the line in the city. However, the location of factories and the building of suburban residences in the outlying district west and northwest of the World's Fair grounds since the Exposition has made necessary considerable improvements in the suburban divisions of the road which penetrate this suburban district.



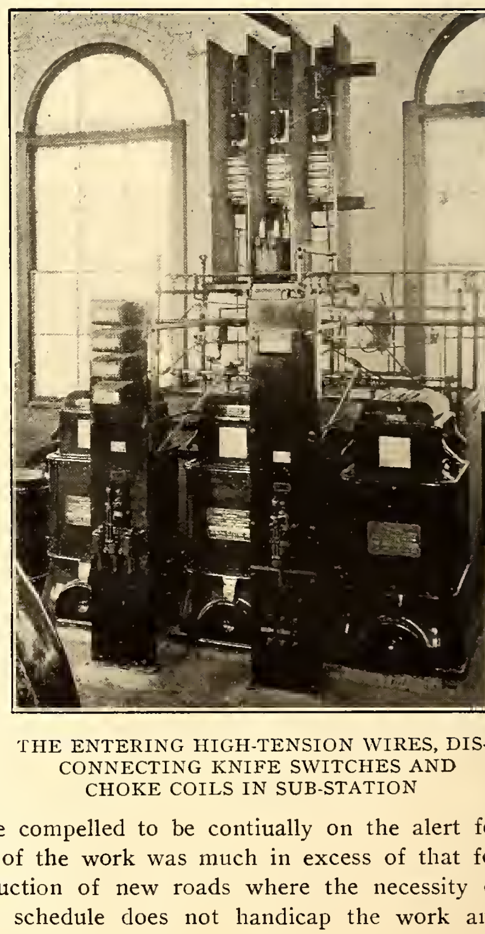
MAP OF TERRITORY TRAVERSED BY THE ST. LOUIS & SUBURBAN RAILWAY

The more extensive of these improvements has been the reconstruction and double tracking of the Florissant-Ferguson division, together with the erection of a new sub-station on the line to meet the demands of the heavier loads occasioned by the increased number of cars operated. The relative location of this division, as well as that of the newly built sub-station, may be understood by reference to the accompanying map of the system. The track improvements consisted in reconstructing and laying a double track from Suburban Garden the entire distances to both Florissant and Ferguson. The original single track to Florissant was laid about 25 years ago by the Narrow Gage Steam Railroad Company. It is interesting to note that this rail was in constant service up to the time of its removal, and when taken up was in good relaying condition and is now in use in side tracks and switches. In the work of reconstruction the greater portion of the track was laid with an 80-lb. rail of standard cross section. However, some rails of 70 lbs. were also used. Span wire construction is employed to support the trolley, one set of poles carrying the high-tension wires, while telephone wires and direct-current feeders are carried by a single cross arm on the poles on the opposite side of the track. Practically the entire line is ballasted with cinders.

The line passes over the tracks of the Wabash Railroad near Normandy Hills on a steel structure. Several heavy grades are encountered on the route. As it was necessary to do all the grading with pick and shovel, and the workmen moreover were compelled to be contiually on the alert for cars, the cost of the work was much in excess of that for similar construction of new roads where the necessity of maintaining a schedule does not handicap the work and



INTERIOR OF ST. LOUIS & SUBURBAN RAILWAY COMPANY'S SUB-STATION, SHOWING ROTARY CONVERTERS, TRANSFORMERS, ETC.



THE ENTERING HIGH-TENSION WIRES, DISCONNECTING KNIFE SWITCHES AND CHOKE COILS IN SUB-STATION where steam shovels and other appliances can be employed. The cost of the line was materially increased by the cost of the right of way for the additional track. The distance from Suburban Garden to Florissant is 10 miles, and the Ferguson branch adding three miles gives a total of about 13 miles over which right-of-way for the double track was acquired. With property ranging in value from $5 to $15 per foot the amount invested in the division will easily reach over half a million dollars.

The whole region traversed by the line will ultimately be built up with suburban residences. The fact that the city lines of the railway company is operated on a private right-of-way well into the center of the city brings the district comparatively close to the business portion of the city. The country is somewhat rolling and by reason of this, and the fact that much of it is in natural woodland, many excellent sites are offered for suburban residences of the costly type. Already several of these have been built adjacent to the line. Some of the more wealthy property owners have provided elaborate private stations on their grounds. One of these, a stone structure with tile roof and cement platform, immediately in front of it, is shown in an accompanying illustration. People of modest means are also being attracted to the district. Several large tracts which have been acquired by real estate dealers have been plotted and lots are being disposed of at reasonable prices.

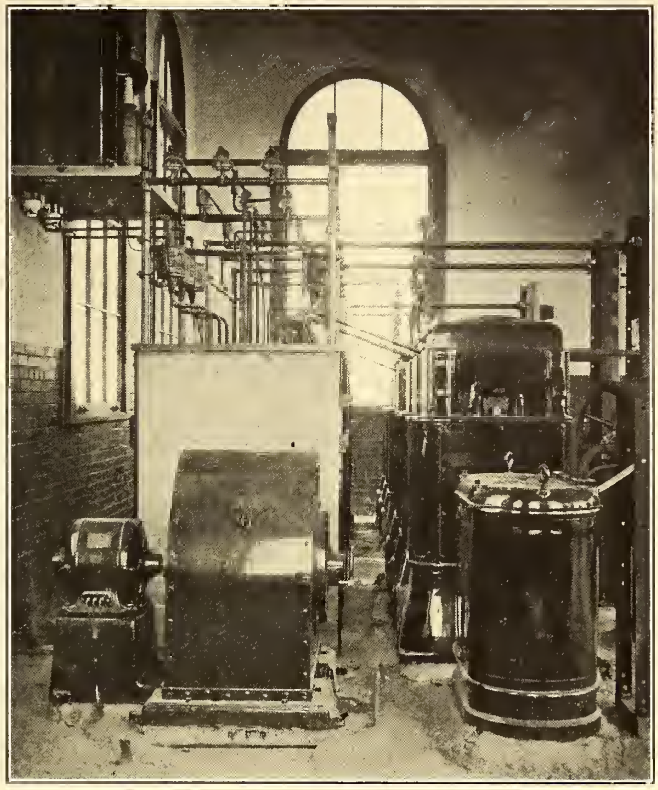
The vicinity of Suburban Garden is desirable property for factory sites. It is convenient both to the west belt of the Terminal Railroad and to the Wabash Railroad. Two factories, each employing several hundred men, have already located here and several others will follow in a short time. Both gas and oil have been located on the property of the railway company and this has given quite an impetus to this district.

At the present time no attempts are being made to handle freight on the Florrissant-Ferguson division. The location of the road, however, is such that it can be made to serve as feeders to the steam railroads, and the company is contemplating hauling freight with this purpose in view, in the near future and the location of the Florissant offers special inducements for the development of freight and express traffic. The town has a population of 1500 and the electric line is the only railway entering it.

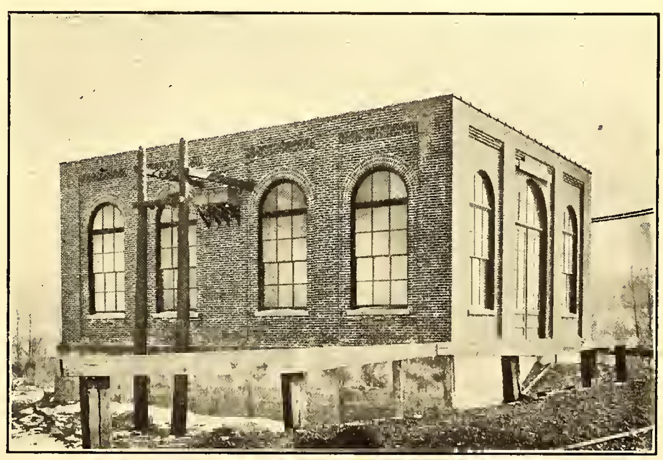
PRIVATE WAITING STATIONS ON THE FLORISSANT-FERGUSON DIVISION OF THE ST. LOUIS & SUBURBAN RAILWAY

THE NEW SUB-STATION

Current for operating the Ferguson-Florissant division is obtained from the power house at DeHodiamont and is transmitted to the new sub-station at the junction of the Florissant and Ferguson divisions at 6600 volts. The sub-station building is of brick with concrete basement and floors. Installed at the present time are two 330-kw rotary converters, but in the construction of the building space has been provided for an additional one. The main floor of the sub-station contains but one room and all of the electrical apparatus is installed in this. The high-tension wires enter through the wall of the building in a manner well shown in one of the accompanying views. Protection from moisture is afforded by a head house built over the square openings in the wall through which the wires pass. The three legs of the circuit after entering the building are separated from each other by slate barriers and the disconnecting knife switches, choke coils and lightning arresters are placed in the compartments formed by the barriers. The ground for the arresters is run



SWITCHES AND TRANSFORMERS IN ST. LOUIS & SUBURBAN RAILWAY COMPANY'S SUB-STATION, ALSO SHOWING METHOD OF CARRYING HIGH-TENSION BUS-BARS



EXTERIOR OF SUB-STATION, SHOWING ALSO ARRANGEMENT FOR ENTRANCE OF HIGH-TENSION WIRES down the wall of the building and terminates in a buried ground plate set in pulverized coke. After passing through the choke coils, the high-tension wires drop along the wall to the General Electric hand-operated oil switches.

By reference to the plan it will be observed that all the high-tension apparatus has been so placed as to require the minimum length of high-tension cable. The bus line is immediately over the oil switches and is carried on an iron frame supported partly by the switch structures. This frame is of wrought iron pipe, the insulators being supported by pins clamped around the pipe. From the bus-bars leads to the oil switches for the machines drop directly down. The emerging wires from the switches are carried up over the frame again and into the air blast transformers. The secondaries of the transformers are taken out through the base into the air chamber in the basement and then along the underside of the floor to the machines. The direct current leads from the machines drop down through porcelain insulators and are carried to the switchboard on the side of the room opposite the entering high-tension wires. At present two blowers for the transformers and the reactance coils are installed. The blowers are of the Buffalo Forge Company type and are driven by 1-hp induction motors. Plans, however, provide for four separate blowers, one for each of the three sets of transformers and an extra one for emergency.

The converters are started from the alternating-current side by means of the reactance coil previously mentioned. A starting panel for each machine is located near the reactance coil and adjacent to the alternating-current machine panel upon which is the control for the high-tension oil switches. The equalizer stands for the separate machines are located at the direct-current end and nearest the switchboard. The switchboard consists of four direct-current feeder panels and three direct-current rotary panels. The feeder panels are provided with General Electric form K circuit breakers and Thomson recording wattmeters. The outgoing feeders drop down below the floor immediately behind the switchboard and are then carried up along the wall to a point near the roof trusswork, where they pass through the wall to a pole line. The sub-station was built and designed under the supervision of John A. Kreis, Jr., master mechanic and superintendent of power stations of the road.

One express aim in the design was the accessibility of apparatus and cables, and reference to the plans will show that the idea has been well carried out. It may be noticed that the wiring of the cables is all open work. No tubes or ducts are employed except where the wires pass through floors or partitions.

THE OPERATION OF CARS IN TRAINS AT COLUMBUS

A novel method of train operation has been inaugurated by the Columbus Railway & Light Company, of Columbus, Ohio. Practically all of the city cars are operated over High Street,

FIG. 2.—A TWO-CAR TRAIN IN COLUMBUS, OHIO

in the downtown district, and the tracks in this street have about reached the limit of their carrying capacity. To lessen the congestion on this street, as well as to increase the carrying capacity during rush hours, some of the city cars are operated in two-car trains, with two motors on each car. Only

FIG. 3—CABLE RECEPTACLE ON THE DASH

FIG. 4.—JUMPER TERMINAL WITH WIRE EXPOSED

FIG. 5.—COUPLING BETWEEN TWO CARS

one of the cars of each train is provided with a multiple-unit control system. The rear one has a controller of the K-10 drum type, and the motor circuits of the two cars are connected by means of jumpers between the cars. The accompanying drawing, Fig. 1, shows the wiring of the two controllers and the manner in which the connections are made. Fig. 2 shows a train of two motor cars, as operated at Columbus.

Each of the cars is equipped with two motors, but the forward car of the train is provided with a type-M General Electric multiple-unit equipment for four motors. The wiring of the multiple-unit controller is identical with that of an ordinary four-motor equipment, with the exception that the leads for motors No. 3 and 4, instead of going to motors, are tapped into a bus line, extending the full length of the car, and terminating in receptacles on each dash. On the rear car wires leading from the receptacle on each dash are tapped in on the motor leads, and other than this addition no changes from the usual K-10 controller wiring is made.

Fig. 3 shows the receptacle on the dash, while Fig. 4 is a view of the jumper terminal inserted in the receptacle, with the outer insulation pulled down to show the wires. As all the current for the rear car is carried by the jumper, the wires in it are necessarily larger and the sockets and terminals are much heavier than are the jumpers for the control circuits of multiple-unit equipment. Fig. 5 shows the electric and air couplings.

The cars are equipped with controllers at each end. The terminals of the wires of the bus lines in the receptacles are so arranged that the proper connections are made, no matter what end of the cars is connected. A lug on the jumper terminal, which fits into a slot in the receptacle, prevents the terminal being inserted in any other than the proper position.

The chief advantage of the employment of the two different kinds of controllers is that the extra expense of installing a multiple-unit controller on the rear car is avoided. The plan was first suggested by M. S. Hopkins, general superintendent of the railway system, and was afterward worked out by Charles E. Hott, master mechanic, and his assistants. Up to the present time ten cars have been fitted for operation in trains in this manner, and ten more are now being equipped.

The Supreme Court of Ohio has handed down an interesting decision on transfers in the case of the Cleveland City Railway Company vs. John Connor. Mr. Connor was a passenger on the Franklin Avenue line and asked for a transfer on St. Clair Street. The transfer was punched so as to make it good on the Woodland line, and on refusing to pay another fare Connor was ejected, and he then sued for damages. In the trial the attorneys for Mr. Connor asked the court to order the jury to return a verdict for damages, if they found that an error had been made by the conductor who issued the transfer, and that it could not have been obviously correct to Connor, but the court refused to do so. On that as an error, the case was carried up and the Circuit reversed the Common Pleas, and now the Supreme Court affirms the Circuit, so the case will now go down for new trial, and in that trial the court will be required to instruct the jury as Connor contended it should be instructed.

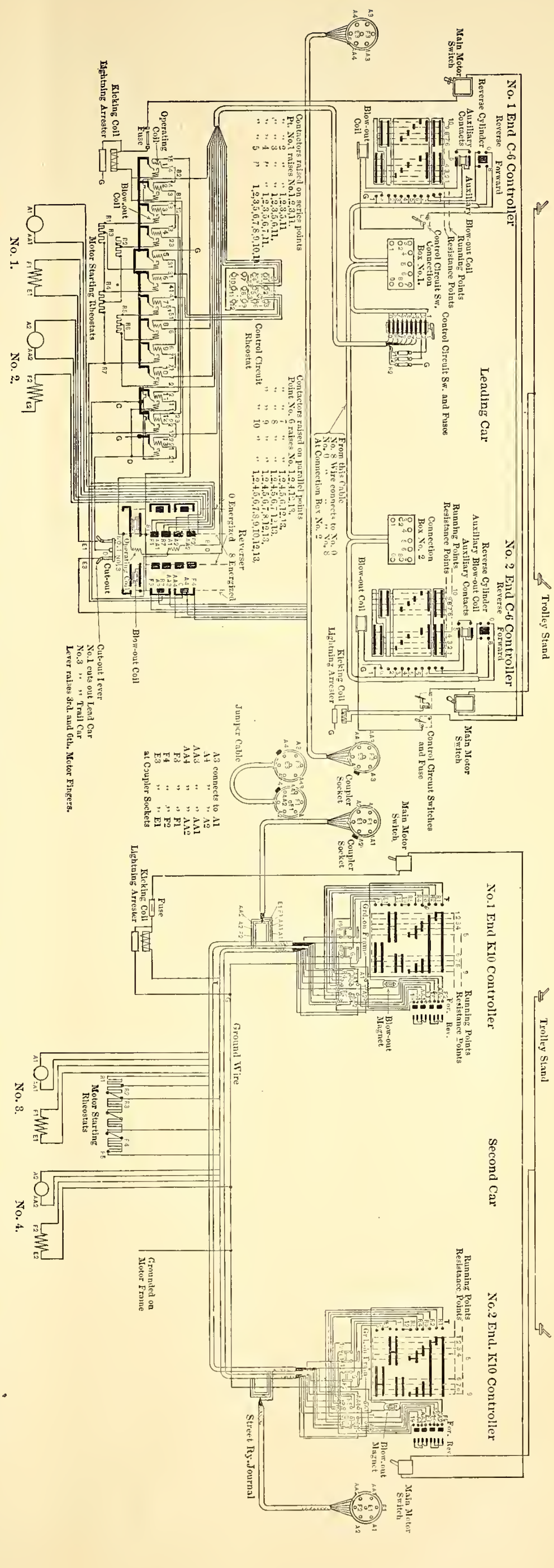


FIG. 1—WIRING DIAGRAM OF TWO-CAR TRAIN, ONE CARRYING COMPLETE MULTIPLE-UNIT SYSTEM AND THE OTHER THE STANDARD K-10 TYPE CONTROL

ACCIDENTS FROM RUNAWAY CARS

One person was killed and several were seriously injured as a result of the failure of the brakes of a car on the Orange Mountain Traction Company's reconstructed line up Orange Mountain in New Jersey on Sunday. According to an unofficial account, the car to which the accident happened had recently been received from the builders, and was the first to be operated over the line experimentally since the substitution of electricity for the cable as motive power on the road. It is said that in the test up the grade the car behaved well and was under complete control of the operator until the summit of the mountain was reached. Here the grade is steepest, and although the emergency brake was applied the car failed to respond. It slid backward gently at first, and then soon was speeding down the grade. All but one of those on board jumped from the car, with casualties mentioned above. The man who remained on the car received only slight injuries.

The accident in London occurred in the vicinity of the Archway Tavern, Highgate, on June 23, when an electric car became uncontrollable while descending a hill and dashed into a motor omnibus. Of the passengers on the runaway car and motor omnibus three were killed, two others are not expected to recover, twenty were seriously hurt, and many received slight injuries.

COOLING THE NEW YORK SUBWAY

The Interborough Rapid Transit Company is planning to install an ammonia refrigerating plant at Times Square, so as to reduce the temperature on hot days. The plant will be ventilated to the street, so that the ammonia fumes may pass directly to the outside air. There are to be brine tanks and mains to distribute the refrigeration to the proper points in the Times Square and Grand Central stations. Chief Engineer Rice, in commenting on the plan, recommends it for temporary use, but thinks there may be too much danger of leakage of anhydrous ammonia to permit of permanent, wholesale refrigeration by this method. The cost of the proposed refrigerating plant is said to be $45,000. The subject of the best method of cooling other important stations along the line is under consideration by the company and the Rapid Transit Commission. Thus, for the Brooklyn Bridge station a plan has been proposed by Mr. Rice of sinking wells beneath the Bridge station, evaporating the water secured therefrom by fans, and distributing the cooled air along the platforms. No definite decision has been made upon this scheme.

GROSS RECEIPTS FOR 1905

The publication of "American Street Railway Investments," the Red Book for 1906, makes available the operating reports for 1905 of the principal electric railway companies of the country. The gross earnings for this period, and also in most cases for 1904, of 437 companies, as printed in the Red Book, are presented herewith. The figures given do not in all cases represent the same trackage for each year, both on account of extensions and consolidations. The fiscal year of the companies also varies. Thus the fiscal year of the Pennsylvania and New York State companies in most cases ends on June 30, and of the Massachusetts companies on Sept. 30. Other companies have their fiscal year end Dec. 31.

The 1906 edition of the Red Book contains 432 pages of statistical matter, an increase of 17 pages over the edition of 1905. There are 49 maps this year, on which the systems of fifty-two separate companies are shown. A comparison of gross receipts follows:

COMPANIES HAVING GROSS RECEIPTS FOR 1905 OF OVER $1,000,000.

NAME OF COMPANY.	1904.	1905.
New York City Ry. Co., New York, N. Y.	$21,894,004	$17,789,490
Manhattan Ry. Co., New York, N. Y.	14,529,190	17,328,411
Brooklyn Rapid Transit Co., Brooklyn, N.Y.	14,950,562	16,585,580
Philadelphia Rapid Transit Co., Philadelphia, Pa.	16,096,362	16,188,646
Boston Elevated Ry. Co., Boston, Mass.	12,436,594	12,714,569
Pittsburg Railways Co., Pittsburg, Pa.	8,665,196	9,597,171
Public Service Corporation of New Jersey, Newark, N. J.	8,529,822	9,145,165
United Railways Co. of St. Louis, St. Louis, Mo.	†9,977,564	8,460,016
Chicago City Ry. Co., Chicago, Ill.	6,668,979	7,322,080
United Railroads of San Francisco, San Francisco, Cal.	6,652,630	7,066,892
Massachusetts Elec. Companies, Boston, Mass.	6,380,863	6,734,128
United Rys. & Electric Co. of Baltimore, Baltimore, Md.	5,451,180	6,026,423
Cleveland Electric Ry. Co., Cleveland, O.	4,544,943	5,308,780
Detroit United Ry., Detroit, Mich.	4,584,582	5,169,639
New Orleans Ry. & Lt. Co., New Orleans, La.	4,674,344	5,121,103
Twin City Rapid Transit Co., Minneapolis and St. Paul, Minn.	4,308,080	4,759,263
International Traction Co., Buffalo, N. Y.	4,088,426	4,484,643
Kansas City Ry. & Lt. Co., Kansas City, Mo.	3,403,125	3,923,346
Cincinnati Traction Co., Cincinnati, O.	3,770,022	3,806,705
Milwaukee Elec. Ry. & Lt. Co., Milwaukee, Wis.	3,285,378	3,348,696
The Rhode Island Co., Providence, R. I.	2,754,655	3,242,972
Washington Ry. & Elec. Co., Washington, D.C.	2,644,360	2,905,907
Toronto Ry. Co., Toronto, Ont.	2,444,534	2,747,324
Montreal Street Ry. Co., Montreal, Can.	2,463,825	2,707,474
Seattle Electric Co., Seattle, Wash.	2,321,235	2,565,914
Georgia Railway & Electric Co., Atlanta, Ga.	2,112,973	2,500,574
Metropolitan West Side El. Ry. Co., Chicago.	2,160,941	2,452,327
Louisville Ry. Co., Louisville, Ky.	2,048,263	2,298,619
Consolidated Ry. Co. (The), New Haven, Conn.	1,542,415	2,112,460
Indianapolis Traction & Terminal Co., Indianapolis, Ind.		1,915,104
Toledo Railways & Light Co., Toledo, O.	1,752,602	1,913,456
Columbus Ry. & Light Co., Columbus, O.	1,328,802	1,798,463
Rochester Ry. Co., Rochester, N. Y.	1,499,719	1,787,862
Northwestern Elev. R. R. Co., Chicago, Ill.	1,724,930	1,786,414
United Traction Co., Albany, N. Y.	1,704,742	1,732,452
South Side Elevated R. R. Co., Chicago, Ill.	1,574,828	1,713,348
Capitol Traction Co., Washington, D. C.	1,536,080	1,656,659
Birmingham Ry., Light & Power Co., Birmingham, Ala.	1,424,146	1,630,514
Connecticut Ry. & Ltg. Co., Bridgeport, Conn.	1,426,160	1,627,483
Coney Island & Brooklyn R.R. Co., Brooklyn.	1,648,995	1,605,861
Havana Electric Ry. Co., Havana, Cuba.	1,270,624	1,542,870
Indiana Union Traction Co., Anderson, Ind.		1,522,229
Oakland Transit Consolidated, Oakland, Cal.	1,258,136	1,441,471
Cincinnati, Newport & Covington Ry. Co., Cincinnati, O.	1,293,419	1,406,295
Worcester Consolidated Street Ry. Co., Worcester, Mass.	1,336,441	1,379,015
American Light & Trac. Co., New York	1,151,503	1,373,620
Washington Water Power Co., Spokane, Wash.	1,029,006	1,277,919
Nashville Ry. & Light Co., Nashville, Tenn.	1,010,081	1,174,377
Winnipeg Electric Ry. Co., Winnipeg, Man.	831,737	1,119,769
Memphis Street Ry. Co., Memphis, Tenn.	979,513	1,114,022
Springfield St. Ry. Co., Springfield, Mass	947,863	1,013,396
Total, 51 companies	$212,114,374	$227,946,916

†Exposition period.

COMPANIES HAVING GROSS RECEIPTS FOR 1905 BETWEEN $1,000,000 AND $500,000.

NAME OF COMPANY.	1904.	1905.
Northern Ohio Traction & Light Co., Akron, O.	$895,731	$963,187
Hartford Street Ry. Co., Hartford, Conn.	898,001	962,462
Fort Wayne & Wabash Valley Traction Co., Fort Wayne, Ind	597,611	949,298
Dallas Electric Corporation, Dallas, Tex.		934,707
Scranton Ry. Co., Scranton, Pa.	873,627	916,684
British Columbia Elec. Ry. Co., Ltd., Vancouver, B. C.		903,014
Syracuse Rapid Transit Co., Syracuse, N. Y.	839,373	894,622
Hamilton Cataract Power, Light & Traction Co., Hamilton, Ont.	761,170	878,164
Chicago & Oak Park Elec. Ry. Co., Chicago	824,931	842,945
Wilkes-Barre & Wyoming Valley Traction Co., Wilkes-Barre, Pa.	805,179	840,067
United Power & Transportation Co., Phila.	708,512	809,720
Utica & Mohawk Valley Ry. Co., Utica, N.Y.	728,811	798,796
Lake Shore Electric Ry. Co., Cleveland, O.	659,873	788,268
St. Joseph Ry., Light, Heat & Power Co., St. Joseph, Mo.	683,954	754,954
Tri-City Ry. & Light Co., Davenport, Ia.	645,380	748,684
New York & Queens County Ry. Co., Long Island City, N. Y.	661,760	745,734

NAME OF COMPANY.	1904.	1905.
Schenectady Ry. Co., Schenectady, N. Y....	$837,119	$726,542
Portland R. R. Co., Portland, Me...........	732,969	724,798
North Shore R. R. Co., San Francisco, Cal .		721,897
Fonda, Johnstown & Gloversville R. R. Co. Gloversville, N. Y........................	675,575	705,583
United Traction Co., Reading, Pa...........	609,806	666,111
Northern Texas Trac. Co., Ft. Worth, Tex...	564,711	661,037
Tacoma Ry. & Power Co., Tacoma, Wash...	579,367	657,451
Michigan United Rys. Co., Lansing, Mich...		649,872
Terre Haute Electric Traction & Light Co., Terre Haute, Ind.........................	569,429	629,760
Lehigh Valley Transit Co., Allentown, Pa..	837,632	616,346
Charleston Consolidated Ry., Gas & Electric Co., Charleston, S. C..................	558,046	614,963
Chicago & Milwaukee Elec. R. R. Co., Chicago, Ill............................	464,655	609,335
Savannah Electric Co., Savannah, Ga.......	544,144	586,236
Cleveland & Southwestern Traction Co., Cleveland, O...........................	475,361	543,226
San Francisco, Oakland & San Jose Ry., Oakland, Cal..............................	419,349	535,133
Central Pennsylvania Traction Co., Harrisburg, Pa..................................	510,860	529,526
Conestoga Traction Co., Lancaster, Pa......	468,762	525,078
Pueblo & Suburban Traction & Ltg. Co., Pueblo, Col...............................		524,559
Houston Electric Co., Houston, Tex........	366,591	517,315
Puget Sound Electric Ry. Co., Tacoma, Wash.	499,148	511,339
Cincinnati Northern Trac. Co., Cincinnati, O.	504,387	508,332
Hudson Valley Ry. Co., Glens Falls, N. Y..	488,672	506,317
Aurora, Elgin & Chicago Ry. Co., Chicago, Ill.	427,530	505,454
Total, 39 companies,....................	$21,718,026	$27,507,516

COMPANIES HAVING GROSS RECEIPTS FOR 1905 BETWEEN $500,000 AND $100,000.

NAME OF COMPANY.	1904.	1905.
Little Rock Ry. & Elec. Co., Little Rock, Ark.		$496,259
Mobile Light & R. R. Co., Mobile, Ala......	$427,008	482,142
Canton-Akron Ry. Co., Canton, O..........	424,326	480,251
Lexington & Interurban Rys. Co., Lexington, Ky....................................		471,324
Norfolk Ry. & Light Co., Norfolk, Va.......	429,845	471,272
Elgin, Aurora & Southern Traction Co., Aurora, Ill................................	379,045	454,814
Trenton Street Ry. Co., Trenton, N. J......	421,941	453,650
Ottawa Electric Ry. Co. (The), Ottawa, Ont..	384,939	449,634
Boston & Worcester Street Ry. Co., Boston, Mass..................................	400,022	448,366
American Railways Co., Philadelphia, Pa...	443,196	444,254
City Ry. Co., Dayton, O....................	423,804	442,174
Altoona & Logan Valley Elec. Ry. Co., Altoona, Pa....................................	395,590	439,210
Holyoke Street Ry. Co., Holyoke Mass.....	383,411	420,652
Tampa Electric Co., Tampa, Fla...........	364,645	411,763
Detroit, Ypsilanti & Ann Arbor & Jackson Ry. Co., Detroit, Mich.....................		406,539
Pittsburg, McKeesport & Connellsville, Ry. Co., Pittsburg, Pa......................	514,886	404,388
Northern Indiana Ry. Co., So. Bend, Ind....		394,514
Norfolk, Portsmouth & Newport News Co., Norfolk, Va............................	342,247	376,904
New Jersey & Hudson River Ry. & Ferry Co., Hackensack, N. J.....................	293,490	376,618
Union Street Ry. Co., New Bedford, Mass...	369,420	371,563
Halifax Elec. T'way Co., Ltd., Halifax, N. S.	379,465	370,368
Manchester Trac., Light & Power Co., Manchester, N. H............................	285,827	358,505
Johnstown Passenger Ry. Co., Johnstown, Pa.	340,070	341,189
Chicago & Joliet Electric Ry. Co., Joliet, Ill..	316,867	341,030
Indianapolis & Northwestern Traction Co., Indianapolis, Ind......................	302,283	334,423
Rockford & Interurban Ry. Co., Rockford, Ill.	250,499	330,524
Richmond Light & R. R. Co., Richmond, S. I., N. Y...............................	329,934	329,355
Alton, Granite & St. Louis Trac. Co., Alton, Ill.	98,524	324,188
Newton St. Ry. Co., Newton, Mass.........	283,542	323,743
Schuylkill Valley Traction Co., Norristown, Pa.	312,463	320,224
Southwest Missouri Elec. Ry. Co., Webb City.	267,115	317,812
Lincoln Traction Co., Lincoln, Neb.........	272,314	316,922
People's Traction Co. (The), Dayton, O.....	298,158	308,391
Toledo, Urban & Interurban Ry. Co., Toledo, O.		307,571
Jacksonville Electric Co., Jacksonville, Fla..	290,498	305,639
Chester Traction Co., Chester, Pa..........	320,419	303,113
Wilkes Barre & Hazelton R.R. Co., Hazelton, Pa....................................	290,666	294,592
Manchester Street Ry. Co., Manchester, N. H.	285,827	291,730
El Paso Electric Co., El Paso, Tex.........	250,510	288,934
Michigan Traction Co., Kalamazoo, Mich....	236,199	287,384
Augusta Ry. & Electric Co., Augusta, Ga....	250,317	286,023
St. John's Ry. Co., St. John's, N. B..........	264,141	280,569
Springfield Ry. & Light Co., Springfield, Mo.		280,000
Binghamton Ry. Co., Binghamton, N. Y.....	251,230	277,032
Wilmington & Chester Traction Co., Wilmington, Del......................................	$240,652	$275,781
Macon Ry. & Light Co., Macon, Ga..........	237,035	273,673
Auburn & Syracuse Electric R. R. Co., Auburn, N. Y............................	240,335	269,574
Los Angeles & Redondo Ry. Co., Los Angeles, Cal...............................	280,210	269,347
Atlantic Coast Elec. Ry. Co., Asbury Park, Pa.....................................	231,142	267,675
Niagara, St. Catharines & Toronto Ry. Co., St. Catharines, Ont........................	223,924	264,311
Peoria & Pekin Terminal Ry. Co., Peoria, Ill.	210,722	262,376
Erie Electric Motor Co., Erie, Pa............	264,902	262,367
Washington, Alexandria & Mt. Vernon Ry. Co., Washington, D. C...................	246,491	252,999
Topeka Ry. Co. (The), Topeka, Kan.........	218,000	252,000
Easton Transit Co., Easton, Pa.............	44,519	251,365
Toledo & Western Ry. Co., Toledo, O.......	222,005	251,125
Pottsville Union Traction Co., Pottsville, Pa.	227,267	251,123
Knoxville Ry. & Light Co., Knoxville, Tenn.	193,473	249,290
Columbus, Buckeye Lake & Newark Traction Co., Columbus, O........................	225,410	248,912
Beaver Valley Traction Co., Beaver Falls, Pa.	233,017	248,248
Cleveland, Painesville & Eastern R. R. Co., Cleveland, O............................	225,751	245,089
Albany & Hudson R. R. Co., Hudson, N. Y.	232,790	242,866
Fitchburg & Leominster Street Ry. Co., Fitchburg, Mass...........................	226,403	242,002
Columbia Electric Street Ry., Light & Power Co., Columbia, S. C......................	153,576	241,197
Lewiston, Brunswick & Bath Street Ry. Co., Lewiston, Me...........................	235,335	237,814
Evansville Electric Ry. Co., Evansville, Ind..	209,202	230,987
Western Ohio Ry, Co., Lima, O............	205,806	230,758
West Penn Ry. Co., Pittsburg, Pa...........		228,587
Columbus, London & Springfield Ry. Co., Columbus, O............................	157,200	223,990
Dayton, Springfield & Urbana Electric Ry. Co., Dayton, O..........................	231,143	223,605
Rochester & Eastern Rapid Ry. Co., Canandaigua, N. Y............................	76,615	221,331
Wisconsin Traction, Light, Heat & Pwr. Co., Appleton, Wis............................	123,423	218,671
Springfield, Ry. Co., Springfield, O.........	203,107	212,839
Cape Breton Electric Co., Ltd., Sydney, N. S.	202,019	211,980
Indianapolis, Columbus & Southern Traction Co...................................		210,259
Interurban Ry. & Terminal Co., Cincinnati, O.	160,852	208,614
Asheville Electric Co., Asheville, N. C......	178,630	203,026
Whatcom County Ry. & Light Co., Bellingham, Wash................................	163,058	195,009
Elmira Water, Light & R. R. Co., Elmira, N.Y.	196,924	194,334
London Street Ry. Co., London, Ont........	180,018	194,026
Bangor Ry. & Electric Co., Bangor, Me......		193,866
Columbus, Delaware & Marion Electric Ry. Co., Columbus, O.........................	115,518	192,785
Consolidated Railways, Light & Power Co., Wilmington, N. C.......................	154,909	192,198
Dayton & Western Traction Co,. Dayton, O..	106,295	191,477
Fort Smith Light & Traction Co., Fort Smith, Ark...................................	147,153	191,428
Berkshire Street Ry. Co., Pittsfield, Mass....	200,295	188,736
Newport & Fall River St. Ry. Co., Newport, R.I.	180,586	187,461
Toledo & Indiana Ry. Co., Toledo, O.......	65,172	186,239
Phila. & West Chester Traction Co., Phila., Pa.	174,085	182,737
Montreal Park & Island Ry. Co., Montreal, Can...................................	165,890	179,559
Columbus Railroad Co., Columbus, Ga......	155,078	173,699
Staten Island Midland R. R. Co., S. I., N. Y.	165,655	170,049
Pittsburg, McKeesport & Greensburg Ry. Co., Greensburg, Pa.........................	159,058	168,541
Houghton County Street Ry. Co., Hancock, Mich..................................	199,513	167,067
Wichita R. R. & Light Co., Wichita, Kan....	119,106	166,910
Hoosac Valley Street Ry. Co., No. Adams, Mass.	155,530	166,900
Lehigh Traction Co., Hazleton, Pa..........	155,379	166,544
Mansfield Ry., Light & Power Co., Mansfield, O	147,311	163,702
Long Island Electric Ry. Co., Jamaica, Long Island, N. Y............................	133,127	162,416
Lexington & Boston St. Ry. Co., Boston, Mass.	161,995	162,404
Pittsfield Electric St. Ry. Co., Pittsfield, Mass.	154,168	161,635
Coeur D'Alene & Spokane Ry. Co., Ltd., Coeur D'Alene, Ida............................	127,125	158,783
Cincinnati, Georgetown & Portsmouth R. R. Co., Cincinnati, O......................	142,966	157,464
Jackson & Battle Creek Traction Co., Jackson, Mich................................	148,549	156,257
Dartmouth & Westport St. Ry. Co., Natick, Mass...................................	147,963	154,499
Dayton & Troy Electric Ry. Co., Dayton, O..	130,960	154,098
Jamestown Street Ry. Co., Jamestown, N. Y.	150,163	153,358
Waterloo, Cedar Falls & Northern Ry. Co., Waterloo, Ia................................		152,658
Interstate Consolidated Street Ry. Co., North Attleborough, Mass.....................	150,665	152,036

NAME OF COMPANY.	1904.	1905.
Northampton St. Ry. Co., Northampton, Mass.	149,387	151,205
Milford & Uxbridge Street Ry. Co., Milford, Mass	142,745	150,927
York Street Ry. Co.. York, Pa	136,128	150,362
Fries Manufacturing & Power Co. (The), Winston-Salem, Del	130,118	148,997
Rockford, Beloit & Janesville R. R. Co., Rockford, Ill	136,918	147,851
Hartford, Manchester & Rockville Tramway Co., Hartford, Conn	139,704	147,795
Lansing & Suburban Traction Co., Lansing, Mich		146,860
Allentown & Reading Trac. Co., Allentown, Pa	132,494	145,699
Portsmouth, Dover & York Street Ry. Co., Portsmouth, N. H	143,050	145,011
Interurban Ry. Co., Des Moines, Ia	130,244	144,042
Valley Traction Co., Harrisburg, Pa	127,539	143,643
Stark Electric R. R. Co., Alliance, O	130,535	142,883
Meridian Light & Ry. Co., Meridian, Miss		142,168
Boston & Maine R. R., Concord, N. H	106,653	141,685
Atlantic Shore Line Ry., Sanford, Me	85,944	132,332
Camden & Trenton Ry. Co., Camden, N. J	117,965	131,308
Tamaqua & Lansford Street Ry. Co., Lansford, Pa	108,669	128,758
Hartford & Springfield Street Ry. Co., Warehouse Pt., Conn	81,033	128,169
Kingston Consolidated R. R. Co., Kingston, N. Y	124,783	126,230
New York & Stamford Ry. Co., Port Chester, N. Y	122,527	125,894
Winnebago Traction Co., Oshkosh, Wis	133,887	125,831
Oklahoma City Ry. Co., Oklahoma City, Okla.	86,353	125,768
Richmond Street & Interurban Ry. Co., Richmond, Ind	135,000	125,602
Oakwood Street Ry. Co., Dayton, O	125,494	125,240
Rockland, Thomaston & Camden St. Ry. Co., Rockland, Me	135,091	125,225
Southern Street Ry. Co., Chicago, Ill		123,764
Citizens Ry. & Light Co., Muscatine, Ia	112,130	123,627
Kokomo, Marion & Western Traction Co., Kokomo, Ind	81,437	122,860
Niagara Gorge R. R. Co., Niagara Falls, N.Y.	107,829	122,311
Worcester & Southbridge Street Ry., Worcester, Mass		120,958
Green Bay Traction Co., Green Bay, Wis		120,887
Connecticut Valley Street Ry. Co., Northampton, Mass	57,666	119,803
Orange County Traction Co., Newburgh, N.Y.	113,615	119,731
Seattle, Renton & Southern Ry. Co., Seattle, Wash	100,002	118,916
Oneonta, Cooperstown & Richfield Springs Ry. Co., Oneonta, N. Y	77,979	118,362
Olean Street Ry. Co., Olean, N. Y	102,717	118,306
Williamsport Pass. Ry. Co., Williamsport, Pa.	107,686	116,231
Springfield & Eastern St. Ry. Co., Palmer, Mass	110,450	114,348
Zanesville Ry., Light & Pwr. Co., Zanesville, O.	98,621	113,921
Shamokin & Mt. Carmel Electric Ry. Co., Shamokin, Pa	84,039	113,569
Bridgeton & Millville Traction Co. (The), Bridgeton, N. J	117,910	113,060
Haverhill & Amesbury St. Ry. Co., Haverhill, Mass	109,725	111,486
Central Market Street Ry. Co., Columbus, O.	51,512	109,981
Dayton & Xenia Transit Co., Dayton, O	110,736	109,961
Columbus, Newark & Zanesville Electric Ry. Co., Newark, O	86,302	108,418
Lorain Street Ry. Co., Lorain, O	95,862	108,240
Stamford St. R. R. Co., Stamford, Conn	98,985	107,098
Washington & Canonsburg Ry. Co., Washington, Pa	90,614	106,756
Poughkeepsie City & Wappingers Falls Electric Ry. Co., Poughkeepsie, N. Y	102,305	106,712
La Crosse City Ry. Co., La Crosse, Wis		105,750
Dayton & Northern Traction Co., Dayton, O.	94,537	105,654
Hamburg Ry. Co., Hamburg, N. Y	88,538	104,930
New York & Long Island Traction Co., Long Island City, N. Y	133,127	104,806
Denison & Sherman Ry. Co., Sherman, Tex	89,449	104,591
Indianapolis & Cincinnati Traction Co. (The), Indianapolis, Ind	93,800	104,448
Ithaca Street Ry. Co., Ithaca, N. Y	99,721	103,946
Woonsocket St. Ry. Co., Woonsocket, R. I	102,619	102,567
Brockton & Plymouth Street Ry. Co., Brockton, Mass	104,059	102,143
New Jersey & Pennsylvania Traction Co., Trenton, N. J	90,184	101,326
Holmesburg, Tacony & Frankford Electric Ry. Co., Philadelphia, Pa	108,395	100,954
Youngstown & Sharon Street Ry. Co., Youngstown, O	108,291	100,897
Total, 170 companies	$29,472,956	$37,199,011

COMPANIES HAVING GROSS RECEIPTS FOR 1905 BETWEEN $100,000 AND $50,000.

NAME OF COMPANY.	1904.	1905.
Syracuse, Lake Shore & Northern R. R., Syracuse, N. Y	$ 83,791	$99,815
Cleveland, Painesville & Ashtabula R. R., Cleveland, O		98,503
Augusta, Winthrop & Gardiner Ry. Co., Augusta, Me	91,592	97,989
Southern Lt. & Trac. Co., Natchez, Miss		97,955
Portsmouth Street R. R. & Light Co., Portsmouth, O	81,876	97,876
Citizens' Electric Street Ry. Co., Newburyport, Mass	102,060	96,227
Indianapolis & Martinsville Rapid Transit Co., Indianapolis, Ind	107,000	96,011
Northampton Traction Co., Easton, Pa	85,171	94,872
DeKalb-Sycamore Elec. Co., DeKalb, Ill	82,922	95,898
Danbury & Bethel St. Ry. Co., Danbury, Conn.	86,566	92,747
Woronoco Street Ry. Co., Westfield, Mass	82,725	92,720
Syracuse & Suburban R. R. Co., Syracuse, N. Y	84,007	92,678
Augusta & Aiken Ry. Co., Augusta, Ga	87,868	91,753
Media, Middletown, Ashton & Chester Elec. Ry. Co., Chester, Pa	72,232	91,206
Warren St. Ry. Co., Warren, Pa	87,560	90,147
Natick & Cochituate St. Ry. Co., Natick, Mass.	89,438	90,138
Delaware Co. and Philadelphia Electric Ry. Co., Philadelphia, Pa	89,392	89,986
Evansville & Princeton Trac. Co., Princeton, Ind	73,517	88,720
Peekskill Lighting & R. R. Co., Peekskill, N.Y.	82,303	88,698
Ponce Elec. Co., Ponce, P. R		88,574
Pennsylvania & Ohio Ry. Co., Ashtabula, O.	84,872	88,255
Washington, Arlington & Falls Church Ry. Co., Washington, D. C	65,065	87,456
Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., Geneva, N. Y	78,574	86,414
Burlington Traction Co., Burlington, Vt	84,882	85,862
Bristol & Plainville T'way Co., Bristol, Conn.	75,744	85,788
Dayton, Covington & Piqua Traction Co., Dayton, O	84,395	85,637
Providence & Danielson Ry. Co., Providence, R. I	80,809	84,346
Hudson, Pelham & Salem Electric Ry. Co., Hudson, N.H	83,906	84,176
Dover, Somersworth & Rochester St. Ry. Co., Dover, N. H	83,069	82,945
Atlantic City & Suburban Traction Co., Atlantic City, N. J	78,419	82,363
Lebanon Valley Street Ry. Co., Lebanon, Pa.	79,654	82,148
Greenwich Tramway Co., Greenwich, Conn	64,699	80,566
Ohio Central Traction Co., Galion, O	85,055	80,098
Pascagoula St. Ry. & Pwr. Co., Scranton, Miss.		79,701
Blue Hill Street Ry. Co., Canton, Mass	72,864	78,294
Lewistown & Reedsville Electric Ry. Co., Lewistown, Pa	72,860	78,193
Milford, Attleboro & Woonsocket Ry. Co., Milford, Mass	78,875	77,928
Philadelphia, Bristol & Trenton St. Ry. Co., Philadelphia, Pa	68,402	76,348
Athens Electric Ry. Co., Athens, Ga	67,131	76,321
Hudson River Traction Co., Rutherford, N.J.	61,955	75,897
Trenton & New Brunswick R. R. Co., Trenton, N. J	72,404	75,152
Joliet, Plainfield & Aurora R. R. Co., Joliet, Ill.		75,076
Black River Traction Co., Watertown, N. Y	70,877	74,700
Electric Ry., Lt. & Ice Co., Junction City, Kan.	60,873	73,548
Berkley Street Ry. Co., Berkley, Va	65,396	72,496
Nashua Street Ry. Co., Nashua, N. H	72,286	72,458
Raleigh Elec. Co., Raleigh, N. C		71,830
Columbia & Montour Electric Ry. Co., Bloomsburg, Pa	59,982	71,225
South Middlesex St. Ry. Co., Natick, Mass	69,591	70,812
Worcester & Blackstone Valley Street Ry. Co., Worcester, Mass	67,685	67,064
West Chester Street Ry. Co., West Chester, Pa	56,586	66,532
Conneaut & Erie Trac. Co., Conneaut. O		66,436
Chambersburg, Greencastle & Waynesboro Street Ry. Co., Waynesboro, Pa	65,184	65,337
Erie Traction Co., Erie, Pa	64,650	65,279
Tarentum Traction Passenger Ry. Co., Tarentum, Pa	56,904	64,859
Waverly, Sayre & Athens Traction Co., Waverly, N. Y	64,116	64,593
Freeport Ry., Light & Power Co., Freeport, Ill	57,500	64,289
Butler Passenger Ry. Co., Butler, Pa	48,641	64,264
Lawrence & Methuen Street Ry. Co., Lawrence, Mass	55,335	63,867
Portsmouth Electric Ry., Portsmouth, N. H	66,487	63 864
Sea View R. R. Co., Wakefield, R. I	56,051	63,614

NAME OF COMPANY.	1904.	1905.
Olean, Rock City & Bradford R.R. Co., Bradford, Pa.	63,106	63,400
Bradford Electric St. Ry. Co., Bradford, Pa.	54,759	63,354
Newton & Boston Street Ry. Co., Newton, Mass.	62,074	63,323
Meriden, Southington & Compounce Tramway Co., Meriden, Conn.	65,087	62,553
Northern Illinois Lt. & Trac. Co., Ottawa, Ill.		62,431
Gardner, Westminster & Fitchburg Street Ry. Co., Gardner, Mass.	61,504	62,300
Burlington County Ry. Co., Mt. Holly, N. J.	44,269	62,162
Warren, Brookfield & Spencer Street Ry. Co., Brookfield, Mass.	63,512	61,416
Biddeford & Saco R. R. Co., Biddeford Me.	58,498	60,990
Rochester & Suburban Ry. Co., Rochester, N. Y.	73,380	58,907
Dunkirk & Fredonia R. R. Co., Fredonia, N.Y.	59,111	58,789
Quebec Ry., Lt. & Pwr. Co., Quebec, Ont.		58,641
Toledo, Fostoria & Findlay Electric Ry. Co., Findlay, O.	62,771	58,542
Steubenville & Wheeling Traction Co., Steubenville, O.		58,291
Sterling, Dixon & Eastern Elec. Ry. Co., Sterling, Ill.		58,258
Philadelphia & Eastern Ry. Co., Doylestown, Pa.	22,626	57,220
Wilkes-Barre, Dallas & Harvey's Lake Ry. Co., Wilkes-Barre Pa.	57,166	57,090
Newtown Electric St. Ry. Co., Newtown, Pa.	61,375	56,820
International Transit Co., Sault Ste Maire, Ont.	48,439	56,517
Chillicothe Elec. R. R., Light & Power Co., Chillicothe, O.		56,229
Wrightsville & York St. Ry. Co., York, Pa.	10,640	56,065
Southern Street Ry. Co., Philadelphia, Pa.	55,445	55,804
Norfolk & Bristol Street Ry. Co., Norwood, Mass.	50,011	55,719
The Suburban R. R. Co., Chicago, Ill.	49,487	55,040
Van Brunt St. & Erie Basin R.R.Co., Brooklyn.	55,794	55,010
Jersey Central Traction Co., Keyport, N. J.	33,802	54,277
Bristol Gas & Electric Co., Bristol, Tenn.	37,372	53,455
Ohio River Electric Ry. & Power Co., Pomeroy, O.	45,591	53,197
Norton & Taunton Street Ry. Co., Norton, Mass.	48,864	52,930
People's Light & Ry. Co., Nanticoke, Pa.	36,042	52,609
Lake Erie & Bowling Green Ry. Co., Bowling Green, O.		51,834
Farmington Street Ry. Co. (The), Hartford, Conn.	48,850	51,029
Concord, Maynard & Hudson Street Ry. Co., Maynard, Mass.	53,946	50,556
Providence & Fall River Street Ry. Co., Swansea Centre, Mass.	46,938	50,537
Ashtabula Rapid Transit Co., Ashtabula, O.	54,322	50,489
Monmouth County Electric Co., Red Bank, N. J.	46,923	50,408
Waterville & Fairfield Ry. & Light Co., Waterville, Me.	44,576	50,402
Torrington & Winchester Street Ry. Co., Torrington, Conn	54,251	50,251
Tiffin, Fostoria & Eastern Electric Ry. Co., Tiffin, O.	49,088	50,115
Total 100 companies,	$5,731,417	$7,145,504

COMPANIES HAVING GROSS RECEIPTS FOR 1905 BETWEEN $50,000 AND $25,000.

NAME OF COMPANY.	1904.	1905.
Branford Street Ry. Co., Branford, Conn.	44,060	49,690
Cortland County Traction Co., Cortland. N.Y.	47,985	49,627
Oswego Traction Co., Oswego, N. Y.	47,178	49,585
Uniontown & Monongahela Valley Electric Ry. Co., Uniontown, Pa.	59,825	49,249
Centre & Clearfield Ry. Co., Phillipsburg, Pa.	22,795	48,979
Citizens' R. R., Light & Power Co., Fishkill, N. Y.	51,081	47,922
Columbus, Grove City & Southwestern Ry. Co., Columbus, O.	40,258	46,666
Sharon & Wheatland Street Ry. Co., Sharon, Pa.	48,503	46,433
Coney Island & Gravesend Ry. Co., Brooklyn, N. Y.	44,082	46,339
Chautauqua Traction Co., Chautauqua, N.Y.		46,061
Escanaba Electric Street Ry. Co., Escanaba, Mich.		45,907
Exeter, Hampton & Amesbury Street Ry. Co., Exeter, N. H.	47,296	45,226
Slate Belt Electric Street Ry. Co., Bethlehem, Pa.	5,748	44,586
Kittanning & Leechburg Rys. Co., Kittanning, Pa.	40,323	44,015
Erie Rapid Transit Street Ry., Erie, Pa.		43,318
Valley Street Ry. Co., Sharon, Pa.	40,640	43,091
Citizens' Electric Co., Eureka Springs, Ark.	36,504	43,080
Phillipsburg Horse Car R. R. Co., Phillipsburg, N. J.	38,789	42,868
Portland & Brunswick Street Ry. Co., Brunswick, Me.	42,502	42,604
Haverhill & Southern New Hampshire Street Ry. Co., Haverhill, Mass.	39,978	42,409
Kenosha Electric Ry. Co., Kenosha, Wis.	36,789	42,214
Ocean Electric Ry. Co., Rockaway and Far Rockaway, N. Y.	3,521	42,120
Meadville & Cambridge Springs Street Ry. Co., Meadville, Pa.	40,302	42,043
Corning & Painted Post Street Ry. Co., Corning, N. Y.	41,833	42,005
Barre & Montpelier Traction & Power Co., Barre, Vt.	37,898	41,676
Bennington & Hoosick Valley Ry. Co., Hoosick Falls, N. Y.	39,681	41,673
Worcester & Holden Street Ry. Co., Holden, Mass.	36,244	41,598
Athol & Orange Street Ry. Co., Athol, Mass.	39,513	40,654
Berlin Street Ry. Co. (The), Berlin, N. H.	40,876	40,569
Meadville Traction Co., Meadville, Pa.		40,329
Springfield Electric Ry. Co., Springfield, Vt.	39,310	39,578
Titusville Electric Traction Co., Titusville, Pa.	34,201	39,103
York-Haven Street Ry. Co., York, Pa.	22,517	38,692
Railways Company General, New York		38,215
Ballston Terminal R. R. Co., Ballston Spa., N. Y.		37,417
Sarnia Street Ry Co., Sarnia, Can.	32,577	36,962
Oley Valley Ry. Co., Boyertown, Pa.		36,503
Templeton Street Ry. Co., Templeton, Mass.	42,373	36,394
DuBois Traction Co., DuBois, Pa.	24,392	35,977
Groton & Stonington Street Ry. Co., Groton, Conn.		35,122
Elmira & Seneca Lake Ry. Co., Elmira, N.Y.	39,461	34,714
Columbus, New Albany & Johnstown Ry. Co., Columbus, O.	31,999	34,513
Vallamont Traction Co., Williamsport, Pa.	32,060	33,798
East Taunton Street Ry. Co., Taunton, Mass.	34,644	33,731
Buffalo Southern Ry. Co., Buffalo, N. Y.		33,352
Willimantic Traction Co., Willimantic, Conn.	26,767	33,129
Montgomery Traction Co., Norristown, Pa.		32,948
Millville Traction Co., Millville, N. J.	31,385	32,810
York & Dallastown Electric Ry. Co., York, Pa.	20,660	32,343
Shamokin & Edgewood Electric Ry. Co., Shamokin, Pa.	32,828	31,970
Marlborough & Westborough Street Ry. Co., Westborough, Mass.	33,703	31,884
Troy & New England R. R. Co., Troy, N.Y.	29,577	31,631
Amherst & Sunderland Street Ry. Co., Amherst, Mass.	31,634	31,423
Webster, Monessen, Belle Vernon & Fayette City Street Ry. Co., Webster, Pa.	23,966	30,883
Henderson City Ry. Co., Henderson, Ky.	22,223	30,416
Waterville & Oakland Street Ry., Waterville, Me.	29,225	30,204
Bangor & Northern R. R. Co., Bangor, Me.		30,017
Buffalo & Williamsville Electric Ry. Co., Williamsville, N. Y.	24,980	29,575
Sharon & Newcastle Street Ry. Co., Sharon, Pa.	30,510	29,401
Price Hill Inclined Plane R. R. Co., Cincinnati, O.		29,332
People's Traction Co., Galesburg, Ill.	25,853	28,339
Lancaster & York Furnace Street Ry. Co., Lancaster, Pa.	4,242	28,335
Somerset Traction Co., Skowhegan, Me.	28,469	28,190
Coal Belt Electric Ry. Co., Marion, Ill.	45,995	28,144
Calais Street Ry. Co., Calais, Me.	27,953	27,855
Ogdensburg Street Ry. Co., Ogdensburg, N.Y.	28,029	27,686
Galesburg & Kewanee Electric Ry. Co., Kewanee, Ill.	18,250	27,439
Keene Electric Ry. Co., Keene, N. H.	26,844	27,312
York & Dover Electric Ry. Co., York, Pa.	25,871	26,695
Susquehanna Traction Co., Lock Haven, Pa.	23,909	26,586
Laconia Street Ry. Co., Laconia, N. H.	25,867	26,487
Wellston & Jackson Belt Ry. Co., Wellston, O.		25,883
Trinidad Electric Co., Trinidad, Col.		25,744
Penn Yann, Keuka Park & Branchport Ry., Penn Yann, N. Y.	21,767	25,594
Lancaster Traction Co., Lancaster, Pa.	23,680	25,316
Pawtucket Valley Street Ry. Co., Westerly, R. I.	20,677	25,042
Latrobe Street Ry. Co., Latrobe, Pa.	25,201	25,005
Total, 77 companies,	$2,057,803	$2,800,225

PAPERS AND REPORTS, NEW YORK STATE CONVENTION

CONTRACTING FOR USE OF HYDRO-ELECTRIC POWER ON RAILWAY SYSTEMS

BY G. A. HARVEY,
Electrical Engineer International Railway Company, Buffalo.

The majority of railway managers and engineers in this section of the country have had occasion during the past few years to consider the subject of using electric power developed from water-power for the operation of their cars. The first point for definite investigation is invariably the matter of cost, as it has long ago been shown that electricity can fulfill all the power requirements of any sort of transportation system. If the system of the prospective purchaser happens to be so fortunately located that he can receive offiers from different sources, his inquiries are apt to bring together figures which at first sight appear to be widely at variance and cause him to conclude that there are excellent opportunities for bargaining. Investigation soon shows, however, that the prices are not very unequal if the use of power under the different proposals is reduced to a uniform footing, and the fact at once becomes apparent that the most advantageous conditions are those under which the consumer uses power at a high load-factor.

The effect of load-factor on cost of power is thoroughly understood where steam plants are concerned, but it might be supposed in the case of hydraulic power, where no furnaces have to be banked and inefficiency at light loads becomes unimportant, that the conditions would be diffierent. Hydraulic turbines of modern design, however, usually have such characteristics that their over-load capacity is very slight, and it therefore becomes necessary, if peak-loads are to be handled, to provide extra machinery to take care of these. With no provision for peaks it is still necessary to hold at least one generating unit in reserve, and a margin of capacity must be left unused in the operating turbines for gate travel in regulation, and to allow for partial clogging of distributors by refuse which accidentally enters the penstocks. As the water is available and costs no more if used to the full capacity of the plant, it is plain that the power-selling company will strive vigorously for a uniform load as high as is practicable for the installed machinery to carry. This results in making peaks a prohibitive element to power deals where the hydraulic plant has been some time in the field and has been able to discriminate in the choice of its customers. The plants now operating at Niagara Falls have been particularly fortunate in this respect, one of the oldest having a twenty-four-hour load-line of about 26,000 hp and fluctuations not exceeding 5 per cent of the average load. Needless to say the portion of this power supplied for railway and lighting purposes is very small. The Niagara conditions are unique on account of the electro-chemical plants which provide an ideal load and consume the greatest part of the power now developed.

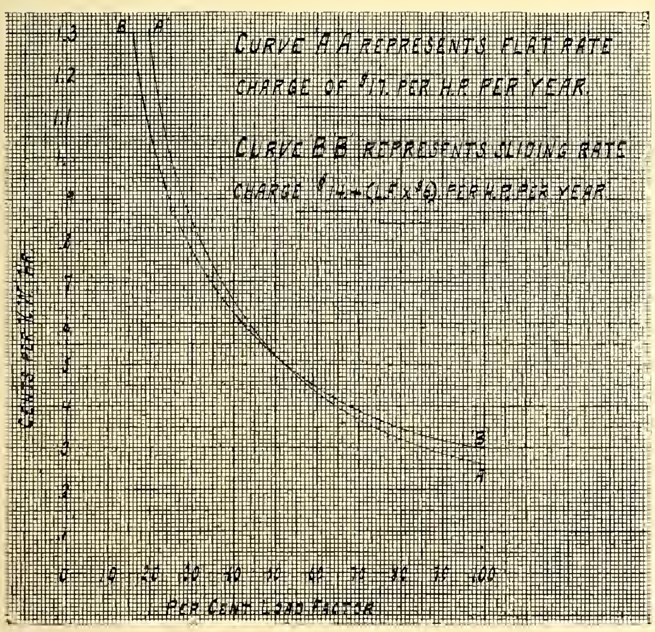
The foregoing is not intended to convey the idea that railways cannot contract. advantageously for hydro-electric power. The typical street-railway load necessarily has prominent peaks, and, if these cannot be smoothed down by adjustments of service, it is still possible, where a fair price is asked for the water power, to carry the heaviest part of the all-day load by means of this and the remainder by steam engines, gas engines or storage batteries, or combinations of engines and batteries.

The point is frequently raised that power companies undertaking to supply customers of any sort should be equipped to take care of all requirements of these customers, including peak-loads. This is done in some cases, the power companies going so far as to provide steam plants for reserves and peak purposes. The character of local demands for power will usually determine this matter, and if the power companies eventually install auxiliary steam plants, it will be only because they are forced to it by periodic shortages of water or inability to obtain customers whose aggregate use of power results in a high yearly load-factor. The power company wants to sell all of its power all of the time, and in a thriving, progressive community it is probable that it finally will come very near doing this. The load-factor will improve as customers increase in number, and as the load approaches the full capacity of the plant the power company will become more discriminating about closing new contracts, or renewing old ones, that involve conditions tending toward poor load-factor. When power plants are new, and struggling for an early return on investment, there are good chances of railway companies being able to contract with them for power to cover full requirements. In making such agreements it is well for railway companies to make the contract period of considerable duration, as there is little likelihood of rates being dropped by competition, except in such localities as Niagara, and there is also small chance of any other power being able to underbid the price of hydro-electric power where conditions are at all favorable to the latter. Power contracts covering periods of twenty years or more are not unusual. In drawing such agreements there should always be provision for increasing the amount of power, at the same or better rate, as the railway service grows, and it is well to specify that if power is later sold at a lower rate by the power company to other parties no more favorably situated, the railway company is also to have the benefit of such rate.

If it is possible to make contracts for full power requirements, it is usual for power companies to place some penalty rate on the peak-power or to arrange the terms of charge so that there are distinct advantages to the purchaser in keeping the load-line as nearly straight as possible. The most common method is to sell a solid block of "firm" power, which can be used at a load-factor of 70 per cent to 80 per cent or better, charging the minimum flat rate for this, and providing power above the firm amount on a kilowatt-hour basis at rates gradually increasing with the height of the peaks. Sometimes provision is made for charging extreme rates for possible peaks of such height that the railway company has no expectation of ever reaching them. These clauses should be avoided, if possible, as the unexpected is constantly happening in the operation and growth of a railroad. Where measurement of peaks is dealt with at all, it should be specified that they are not to be counted unless they continue for two minutes or longer. Uncontrollable occurrences, such as the partial grounding of a feeder, or the performance of a defective car, may produce peaks of short duration which are of small consequence to the power company, but might be very costly to the railway company under an unreasonable power agreement.

A very fair method of billing for power is on a sliding rate depending on the monthly load-factor. The maximum two-minute peaks are recorded in kilowatts each day and averaged for the month. The total number of kilowatt-hours for the month, divided by the kilowatt of this average peak times the number of hours in the month, represents the monthly load-factor. The charge for the month is then made up as follows: A definite service charge plus (load-factor times a fixed amount) times average daily maximum kilowatts. A moderate penalty for peaks is thus included, and the customer pays, according to the load-factor, as nearly for what he consumes as can be expected. This method of charging is now being offered extensively by one of the companies which is about to do business over a large portion of New York State. In effect it corresponds very closely with a flat-rate charge, but gives the purchaser a slightly less cost per kilowatt-hour at low load-factors, as shown by the examples on curve sheet No. 1. The total load of most any street railway is pretty sure to have a load-factor of less than 50 per cent. If the details of peak-power measurement are successfully carried out in practice, this plan of charging will probably prove popular when customers become familiar with it.

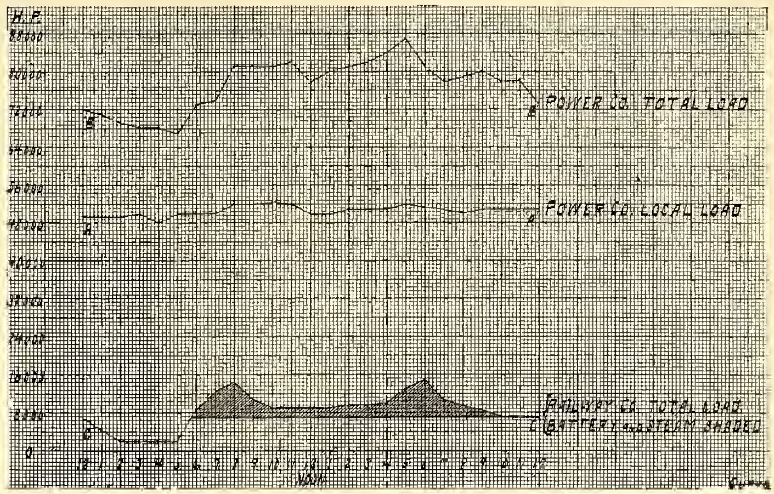
If power companies cannot entertain peak propositions at all, or if they place prohibitive rates thereon, the purchaser must then provide the steam plant or storage battery, or both, to care for a part of the load. In this case the hydro-electric power purchased should form the solid twenty-four-hour base of the area inclosed by the total load-curve, and should extend up to such height as to cover a chart-area bounded at the top by a line closely corresponding with the base of the average daily fifteen-hour load-line (fifteen-hour load-peak). The purchaser should be allowed, without charge, swings of about 10 per cent above the firm line of purchased power, provided the kilowatt-hours used above the line do not exceed those unused below it. It is impossible to always carry the



CURVE SHEET NO. 1, SHOWING SUGGESTED PLAN FOR CHARGING FOR ELECTRIC POWER

load directly on the limiting line, even with the aid of batteries and the most approved regulating devices. The 10 per cent swings should be allowed for this reason.

Very careful consideration must be given to proportioning the division of load to water power and steam power. The cost of hydro-electric power at 100 per cent load-factor should be somewhere in the neighborhood of one-third the cost of steam-generated power at 100 per cent load-factor, assuming reasonable first cost of plant and moderate distance of transmission in the first case and average cost of coal and labor in the second. Obviously the bulk of the load should be carried by the purchased power, but the higher the limiting firm line of this power is raised the lower will the load-factors



CURVE SHEET NO. 2.—SHOWING LOAD CURVES OF ONE OF THE NIAGARA COMPANIES

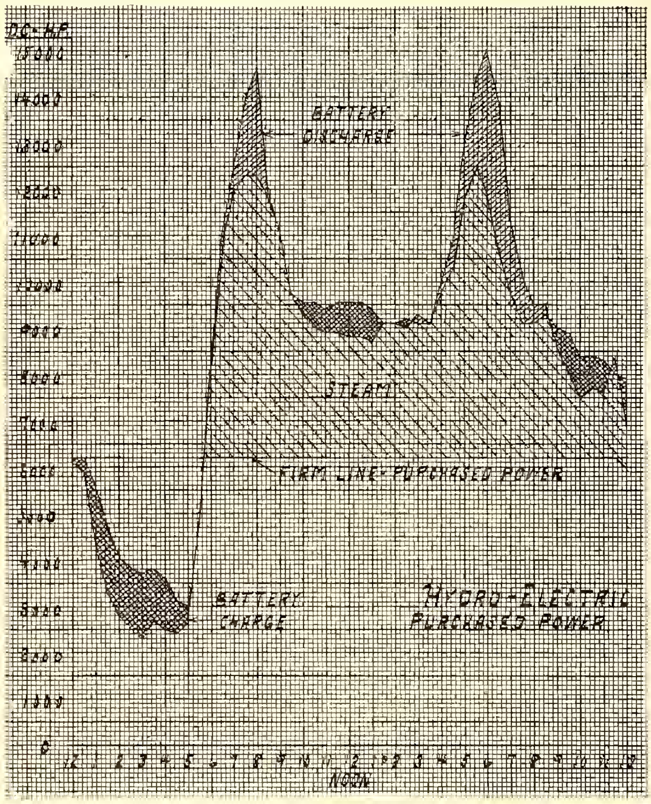
of both steam power and purchased power become, and the cost per kilowatt-hour of each will increase. There is a certain critical point, however, to which the firm purchased power line may be raised before the total cost (which is of prime importance) of combined purchased power and steam power will commence to increase. In raising the firm line of purchased power to this point the total cost will be decreasing. It is hardly possible to evolve an exact formula for the location of the firm line of purchased power, and if one were worked out the weekly variations of load conditions would probably make its accuracy look doubtful. A safe point for this line (about as previously described) is at such height that the fifteen-hour daily use of purchased power will be fairly close to it at all times. It is important, in starting to make this adjustment, to know the cost of steam power per kilowatt-hour at various load-factors under local conditions.

Railway systems supplied with purchased hydro-electric power afford ideal opportunities for application of storage batteries. The batteries can be charged at night with power that otherwise could not be used, and the discharge of the load-peak provides power at an extremely low load-factor which costs only the fixed charges, operation and maintenance of the battery.

The possibility of power interruptions should be recognized in agreements and have penalties placed upon them. An interruption of six minutes is of comparatively small consequence to the railway and might be ignored if not repeated too frequently. Interruptions due to lightning, mistakes in switching, cable burn-outs, etc., are bound to occur, and six minutes is a reasonable allowance for testing cables and lines and returning power. Longer interruptions should entail forfeitures by the power company, increasing considerably in amount as the length of interruption increases. A mere abatement of power charge during an interruption is practically no consideration at all. Power companies by providing sufficient reserve in apparatus, lines, cables, etc., will protect themselves against penalties and insure their customers against interruptions.

Purchased power should be delivered on the premises of the purchaser by means of cables and lines installed and operated by the power company. Measurements for determining monthly bills should be made on the purchaser's premises, the power company supplying and maintaining the meters for this purpose. These meters should be checked each month. The railway company should take daily readings from them, keeping a permanent record in chart form which will show hourly changes of total load and any important subdivisions cf load. Such records are invaluable in adjusting the use of power to the most economical conditions and in figuring on extensions of the system. They are needed for daily reference, and, if the meters on which readings are taken for rendering bills do not provide proper character of measurements for making up load-curves, other suitable instruments should be installed.

Curve sheet No. 2 shows at "A-A" the remarkably straight local load line of one of the Niagara power companies. At "B-B" is shown the total load line, including the long-distance



CURVE SHEET NO. 3.—SHOWING LOAD LINE REPRESENTED AS C-C ON CURVE SHEET NO. 2

load, of the same company. "C-C" shows a railway load, the shaded portion of which is carried by the railway company's steam engines and storage batteries. The unevenness of the power company's total load is not contributed to by the railway company except to the extent of a dip during the early morning hours. The peaks of the railway load would, if included in the power company total load, distort it considerably in an undesirable way. The curves are all plotted from the same base line and represent the same day.

Curve sheet No. 3 shows on a more open vertical scale the same railway load that is represented at "C-C" on sheet No. 2. The firm line of purchased power is here located lower with reference to the total load than has been described as the economical point. This is partly for the reason that the chart represents a winter day (the heavy load season of the year). The total load drops below the firm purchased power line during the middle of the day at some seasons, and, as the firm line can not be shifted back and forth, there are necessarily times when the proportions of purchased power and steam are not the most economical, as in the instance of this particular day.

In cases where steam plants are already in service on railway systems when the companies commence buying additional power, the interest, depreciation, etc., on these plants, although charged to total cost of power, should not enter into the cost of steam-generated power when balancing up the amount of this to be used in conjunction with the purchased power. The steam plant fixed charges continue, regardless of the power turned out, and only the actual operating expenses (coal, labor, etc.) should be figured against the steam power in this case. If the steam plant is installed, either at or after the time of contracting to buy power, the fixed charges might be considered as against "peak-power," but it does not alter the case materially in proportioning the amount of steam power to be used. Operating cost per kilowatt-hour at various load-factors and the normal capacity and dependable overload capacity are the governing features.

THE SALE AND MEASUREMENT OF ELECTRIC POWER

BY S. B. STORER,

General Manager Niagara, Lockport & Ontario Power Company.

Since the day when the first commercial electric light entered the field of artificial illuminants, there have been endeavors to find an equitable way of charging for energy supplied in the form of electricity. At first, in the absence of any measuring instruments, the flat rate was the only method. This was soon found to be impractical for most cases, and the ampere-hour meter, followed by various types of integrating and recording wattmeters, soon brought into use the idea of paying for the exact amount of energy used, at a given price per ampere-hour or per kilowatt-hour. This method is still in very general use in its simplest form, but there has been dissatisfaction with it from the time it started. The fact of the matter is that neither the straight flat rate nor the straight kilowatt-hour rate is equitable except when applied in connection with a definite load factor—and even then it may not be entirely so, due to uncertainty as to the number of hours per day that full-load conditions prevail, with corresponding high efficiency, and to the hours during which operation continues at light loads with resultant low efficiency.

It is fully recognized now, however, that the load factor is the root of the trouble, and unless a system of charging gives due consideration to it there will always be inequality of rates and dissatisfaction on the part of the power company or of its customers, or of both. This has been shown in all classes of service,—incandescent and arc lighting, heating and power purposes, including railway lines,—and in power companies and consumers of all sizes.

Nor are power companies the only ones so affected by the load factor. No manufacturing company is entirely successful in the ordinary sense of the word unless it keeps all of its tools and equipment in use all of the time. No railroad can earn its full quota until it finds its tracks carrying their maximum number of trains every twenty-four hours and every train carrying fully loaded cars throughout. Robbed of unnecessary verbiage, it means that on every investment the interest, tax, insurance and depreciation charge—commonly referred to as the fixed charge—continues at a uniform rate over twenty-four hours of every day in the year, and unless the apparatus or material representing that investment is put to its maximum use every hour in the day and every day in the year, there is an opportunity for increase in efficiency until the theoretically possible condition of maximum use is reached. And the ratio of the use actually obtained to that theoretical or possible maximum use is the load factor of the manufacturing establishment and of the railway line just as it is of the power house or transmission system.

Before taking up the question of rate-making and methods of charging, brief reference will be made to the cost of production of power from hydro-electric plants and from steam plants. In the former the cost is almost solely one of fixed charge, while the latter is made up from fixed charge coupled with variable items of coal, water, oil, waste and incidentals. With the hydro-electric plant, consequently, the cost per horse-power per year is almost constant regardless of whether supplied one hour per day or twenty-four hours per day. Repairs are about the only variable, and they may be considered as increasing in direct proportion to the load factor. Labor, oil, waste, etc., are nearly the same irrespective of the proportion of light loads to full load.

With the steam plant, on the contrary, the items of coal, labor, etc., increase rapidly with the load factor, and hence the cost per horse-power per year increases in almost the same proportion. The costs per horse-power per year may be shown graphically, as in Fig. 1, the curves being plotted in terms of load factor and price per horse-power per year.

The curve marked "Hydro-Electric" is intended to represent cost of power after transmission for some distance, while that marked "Steam Plant" represents cost at the power-house switchboard. These curves are about the best obtainable from any power houses of 5000 to 10,000-hp capacity with coal from \$2.50 to \$2.75 per ton.

In Fig. 2 the same costs are shown, but plotted in terms of load factor and price per kilowatt-hour. Particular notice should be given to the wide variation in cost per kilowatt-hour, it ranging in the steam plant from 9 cents at a load factor of 4 per cent to about three-quarters of a cent at 100 per cent load factor. The hydro-electric plant varies under the same range of load factors, from 10 cents to less than half a cent per kilowatt-hour.

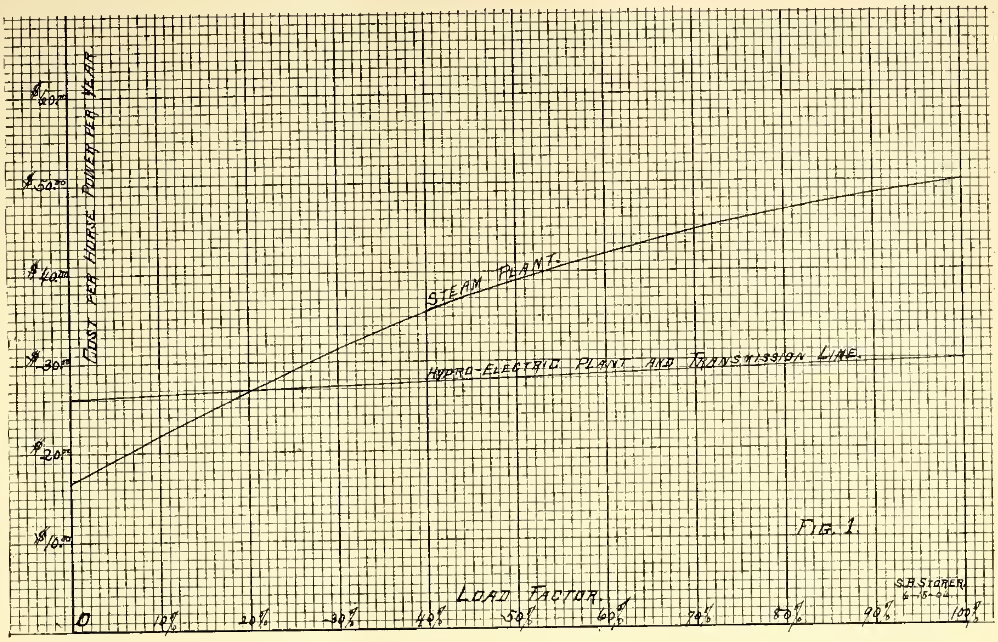


FIG. 1.—METHOD OF PLOTTING COSTS PER HORSE-POWER PER YEAR IN TERMS OF LOAD FACTOR, AND PRICE PER HORSE-POWER PER YEAR

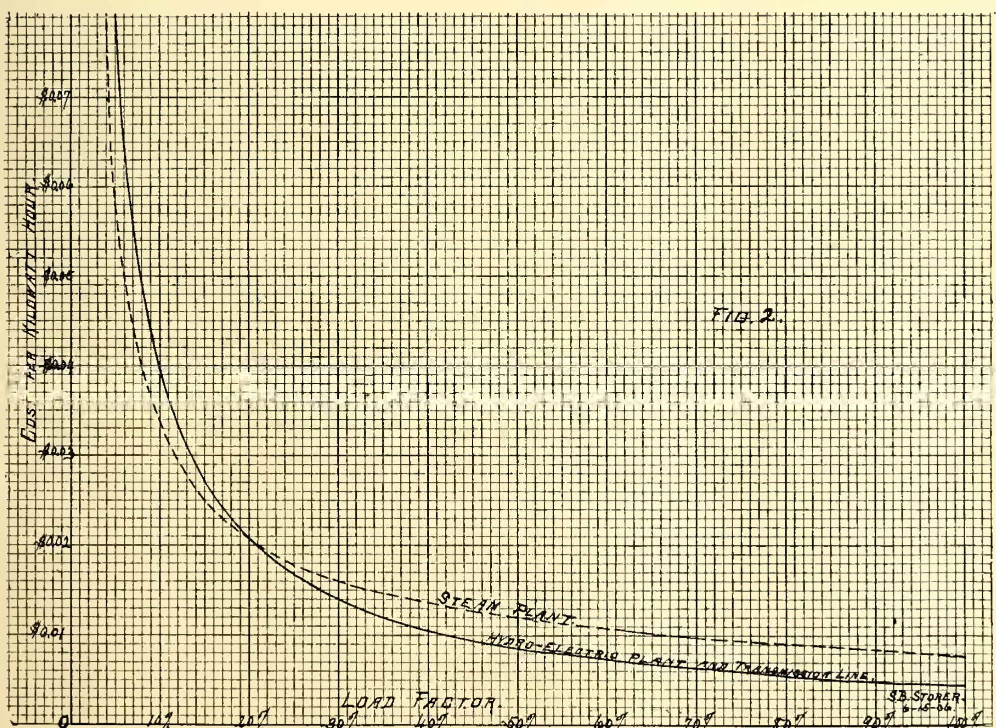


FIG. 2.—METHOD OF PLOTTING COSTS PER HORSE-POWER PER YEAR, IN TERMS OF LOAD FACTOR, AND PRICE PER KW-HOUR

In Fig. 3 is given a very convenient and easy method of changing cost per horse-power per year at various load factors to equivalent cost per kilowatt-hour or vice-versa. The method to be followed in making the change is self evident, so no explanation of it is needed.

If we now take up the case of a hydro-electric plant and transmission system with a wholesale cost of \$30 per horse-power per year, and attempt to make a flat rate to all consumers, we quickly find there is little demand for power, as nearly every consumer has an intermittent load, or, in other words, a low load-factor, and cannot afford to pay or will not pay the price it is necessary to ask for flat rate twenty-four-hour power. It then becomes incumbent on the power company to devise a system of charging that will not only enable it to market its output but to do so at prices that will secure a net revenue for the power equal to \$30 per horse-power-year, besides an additional amount sufficient to cover the cost of retailing or distributing it, but to further enable it to sell at rates low enough to be attractive to consumers. It is believed that the method described hereinafter offers a solution that is equitable to both power company and consumer, and at the same time gives the ordinary small consumer a low rate per horse-power per year in spite of heavy distributing cost, and also gives the power company the necessary return on its maximum demand output.

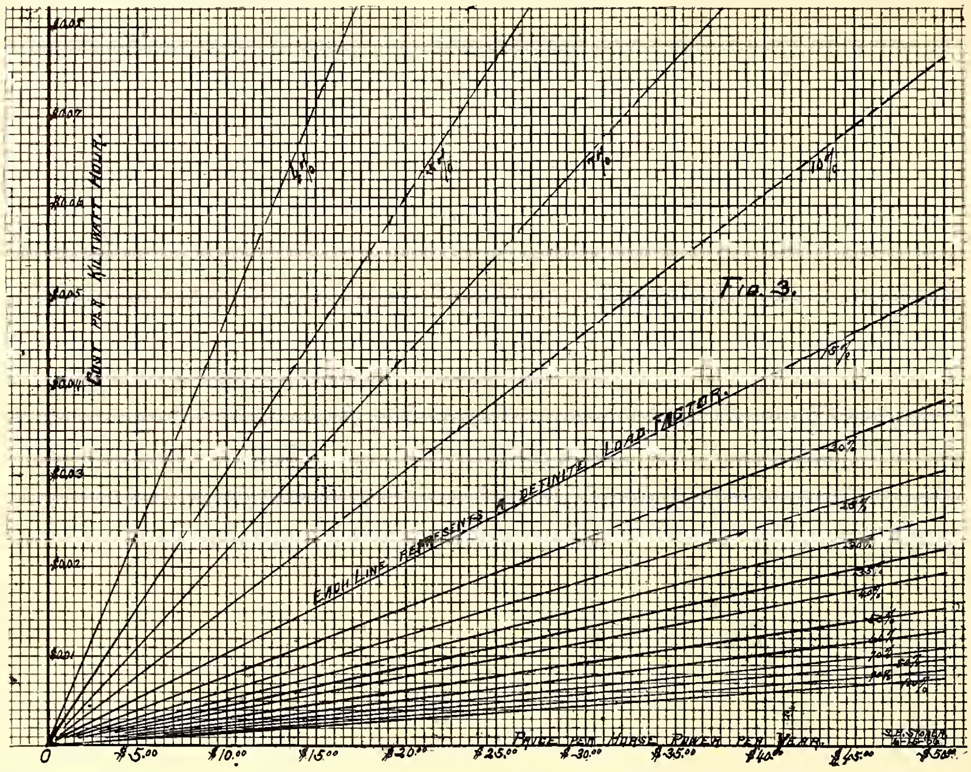


FIG. 3.—METHOD OF CHARGING COST PER HORSE-POWER PER YEAR AT VARIOUS LOAD FACTORS, TO EQUIVALENT COST PER KW-HOUR, AND VICE VERSA

In the proposed system everything is sold on a maximum demand basis, with the rate per horse-power per year varying between fixed limits in accordance with the consumer's load-factor. In order that this method may be clearly understood, mention is here made of the fact that the load-factor is computed on the basis of a twenty-four hour day; the kilowatt-hour consumption per day, divided by 24, being taken as the average demand, and dividing this average demand by the maximum demand for that day, we have a fraction—or in one case unity—representing the load-factor for the given twenty-four-hour period. In the same way the load-factor for any month may be obtained by dividing the average rate of consumption for the entire month by the average of the daily maximum demands, thus obtaining the average load-factor of all the days in the month.

The maximum demand is taken as being the highest rate of consumption for any one minute during the day; or, as it is perhaps more commonly expressed, the highest one-minute peak occurring during any day is considered as the maximum demand for that day. The average of these highest daily one-minute peaks occurring during any month then becomes the average maximum demand for that month and is so used in the calculation of load factor.

Assuming that a manufacturer has made a contract to buy 400 horse-power for the operation of his factory, and that the rate per horse-power year varies between the limits of \$16 and \$43, depending on the load factor, the determination of his rate per horse-power per year for any given month would be as follows:

If the kilowatt-hours consumed during a thirty-day month are 43,200, then the average demand for power is 43,200 divided by 720 (the number of hours in the month), equal to 60 kw or 80 hp. Assuming further that his maximum demand each day was just 400 hp, then, of course, his average maximum demand for the month will be the same amount, and the load factor is 80 divided by 400 = .2, or, as commonly expressed, 20 per cent.

If the rate per horse-power year varies between \$16 and \$43, it will be evident that the variable quantity is the difference between \$16 and \$43, or \$27. The rate is therefore equal to the minimum rate (\$16) plus the load-factor (.2) times the variable (\$27). Two-tenths of \$27 is \$5.40, so the rate per horse-power per year for that month will be \$16 plus \$5.40 equals \$21.40. The total charge for the month would there-

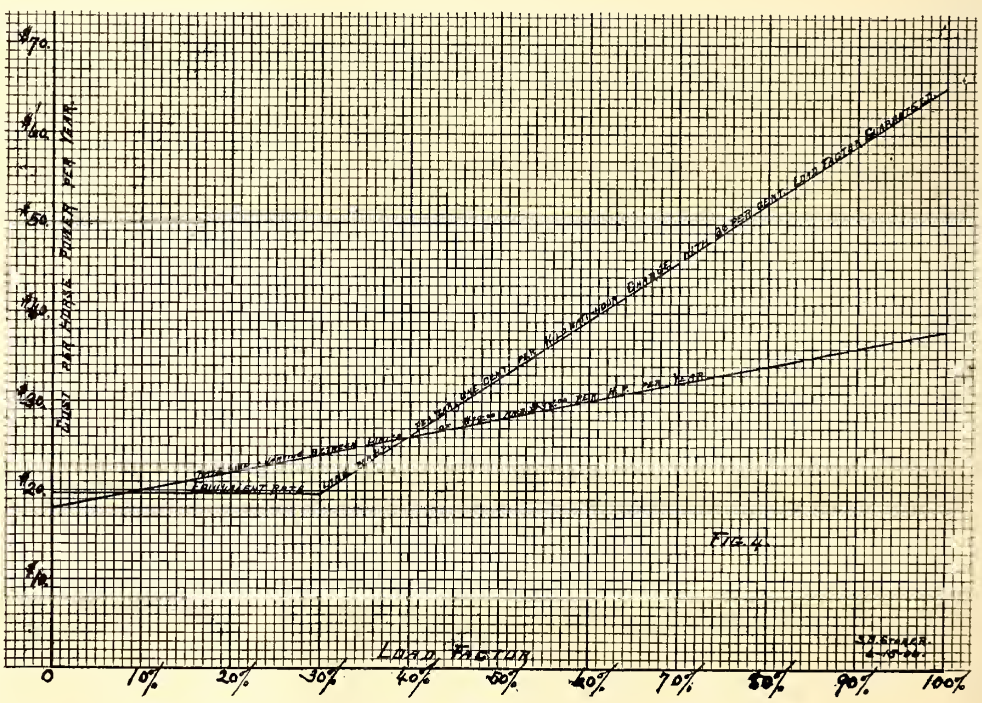


FIG. 4.—SUGGESTED PLAN OF CHARGING FOR ELECTRIC POWER

fore be 400 times $21.40 divided by 12, or $713.33. This is equal to 1.65 cents per kilowatt-hour. If his use of the power had been such as to give a load factor of 30 per cent, the rate per horse-power per year would have increased to $24.10, but the equivalent cost per kilowatt-hour would have decreased to 1.24 cents—a reduction of almost 25 per cent in cost per kilowatt hour due to increasing the load factor to 30 per cent.

This may readily be put in the form of an equation which,

if the desired rate per horse-power per year is	R
the minimum rate limit is	A
the maximum rate limit is	B
and the load-factor is	L

is expressed by $R = A + L\ (B\text{-}A)$.

This method is much more equitable than that sometimes used, of selling all the power on a kilowatt-hour basis with a guarantee from the consumer of a specified load-factor. By referring to Fig. 4, there will be seen the diagrammatic equivalent of such a method of charging converted into a cost per horse-power per year basis. The example given there is that of a kilowatt-hour cost of one cent with a guaranteed load-factor of 30 per cent. This simply means that the consumer pays a flat rate per horse-power per year of $19.60 at all points from zero load-factor to 30 per cent load-factor inclusive, and from 30 per cent to 100 per cent load-factor the rate increases in direct proportion until it reaches the limit at $65.35 per horse-power per year at 100 per cent load-factor.

This method is bad for both parties to a contract. For the power company, if we assume that any considerable transmission is involved, and that a relatively large amount of power is under contract to be delivered, the price of $19.60 per horse-power per year is too low to cover cost—much less than necessary to pay a profit. There is also no probability that the rate will ever be much higher than this, as there is no inducement to the consumer to increase his load-factor above the guaranteed 30 per cent.

On the other side, the consumer has a right to assume that the price at the guaranteed load-factor offers a fair return per horse-power per year to the power company, and consequently no effort is made to increase his load-factor, particularly as his cost per kilowatt-hour remains the same. If, however, the contract is one of long duration and, due to natural causes beyond control of the consumer, the load-factor should increase to a high value, say 75 or 80 per cent, the consumer would be paying over $50 per horse-power per year for power that he is justified in thinking does not cost over $20 or $25.

A better way of charging—certainly a much more equitable way—would be to sell the power on a maximum-demand basis with the rate varying between the limits of say $18 and $38 per horse-power year,—this rate-line also being shown in Fig. 4. With this way of charging there is a continual inducement held out to the consumer to increase his load-factor. The power company would probably also increase its profits somewhat by the increase in load-factor, but only to a comparatively small extent.

In Fig 5, the two curves of load-factor and cost per kilowatt-hour are given, and they indicate more clearly than words the advantage of the system having as its basis the load-factor of the consumer. The dotted line represents the one cent per kilowatt hour rate with a guaranteed revenue equal to that from a 30-per-cent load-factor consumption; the full line or curve gives the equivalent cost per kilowatt-hour of the variable $18 to $38 per horse-power-per-year rate.

With such a system of charging established, the question immediately arising will be as to the manner in which the limiting values per horse-power per year are established, with power companies of different capacities to supply demands of all kinds and sizes.

Referring to the assumed case of a hydro-electric plant and transmission line wherein the wholesale cost is $30 per horse-power per year, and further assuming that the rated

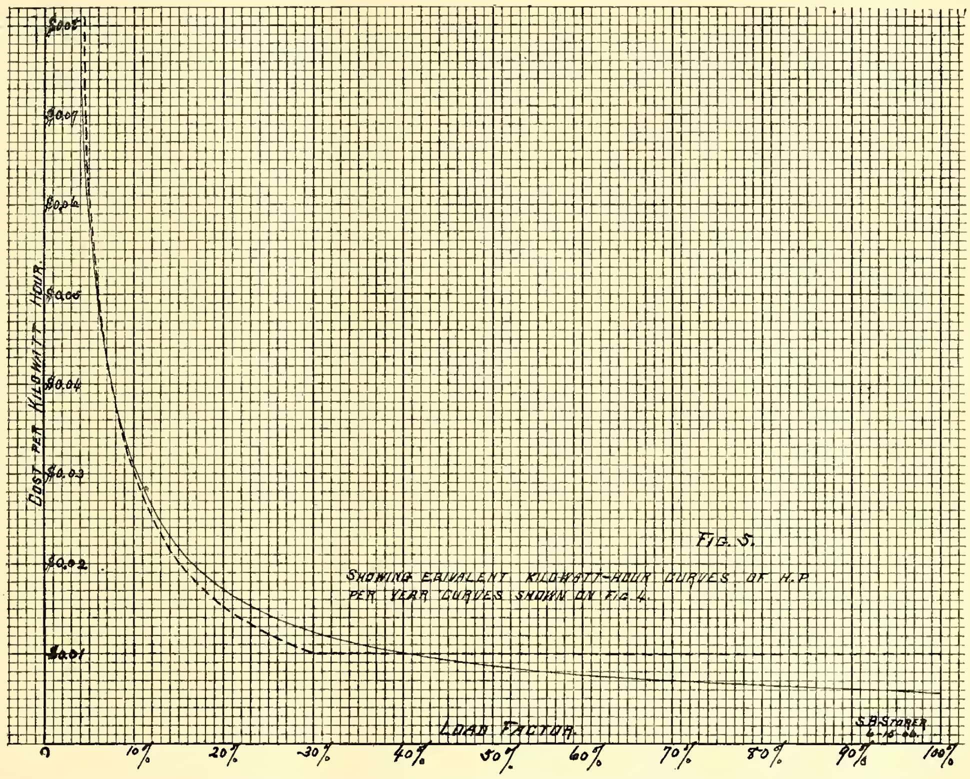


FIG. 5.—EQUIVALENT KW-HOUR CURVES OF HORSE-POWER PER YEAR CURVES SHOWN IN FIG. 4

capacity of the system as a whole is 10,000 horse-power, we then have a basis with which to start. In Fig. 6, a vertical line is drawn from the zero point at the middle of the lower line, and laid off in price per horse-power per year. On the lower line to the left is laid off the amounts of power that may be sold, up to the capacity of the plant. To the right is laid off the load-factors that may be obtained by the various consumers. From the $30 point on the vertical line a horizontal line is drawn to the left that may be known as the "base-rate line."

If power is to be furnished to consumers having a load-factor of approximately 100 per cent and sold on a straight flat rate per horse-power per year, then the cost of retailing the power in small amounts will increase the cost as the amounts decrease, approximately in accordance with the curve starting from the base-rate line on the 4400-hp point, and increasing to $43 on the zero horse-power line. If the consumer takes anything over 4400 hp, he may be considered as being entitled to the wholesale rate of $30 per horse-power per year.

If, however, the consumers operate at a low load-factor, the power company may "oversell" its plant to an extent directly dependent on the relation between the capacity of its plant and the amount of firm power sold to each one. The amount it may be oversold may be determined approximately from the equation of the "Law of Probability," or graphically from the "Probability Curve," both of which may be found in books on higher mathematics, but which will not be taken up here, as this is not intended to be a treatise on that subject.

It may be said, however, that if a large number of motors are operating in a city, performing all classes of work, starting and stopping, running part of the time at full load and part of the time at light loads, the ordinary amount of power required to supply them will be much less than the total rated capacity of the motors, and still every one of the motors may at some time during the day have been operating at full rated load. As a matter of actual practice the ratio is about three to one, the motors, of course, being mostly of from one-quarter horse-power to 20 or 30 hp. The 10,000-hp plant could therefore safely connect on its circuits small motors having a total rated capacity of 30,000 hp. The average load-factor of the different installations would not be much, if any, over 15 per cent, and where occasional large installations are operating somewhat more uniformly, the load-factor would reach perhaps 25 per cent, it being assumed, of course, that they are practically all ten-hour factories. To such factories, of say 400-hp capacity, the power house could not be oversold more than twice. If the entire output were sold to one, two, or even three large consumers, the plant could not be oversold at all, as the chance of both or all three of the consumers taking their maximum of power at the same time is so high as to become almost a certainty. With a single 10,000-hp consumer there is no "chance" about it, and such a customer must pay the full flat rate of $30 per horse-power per year regardless of load-factor.

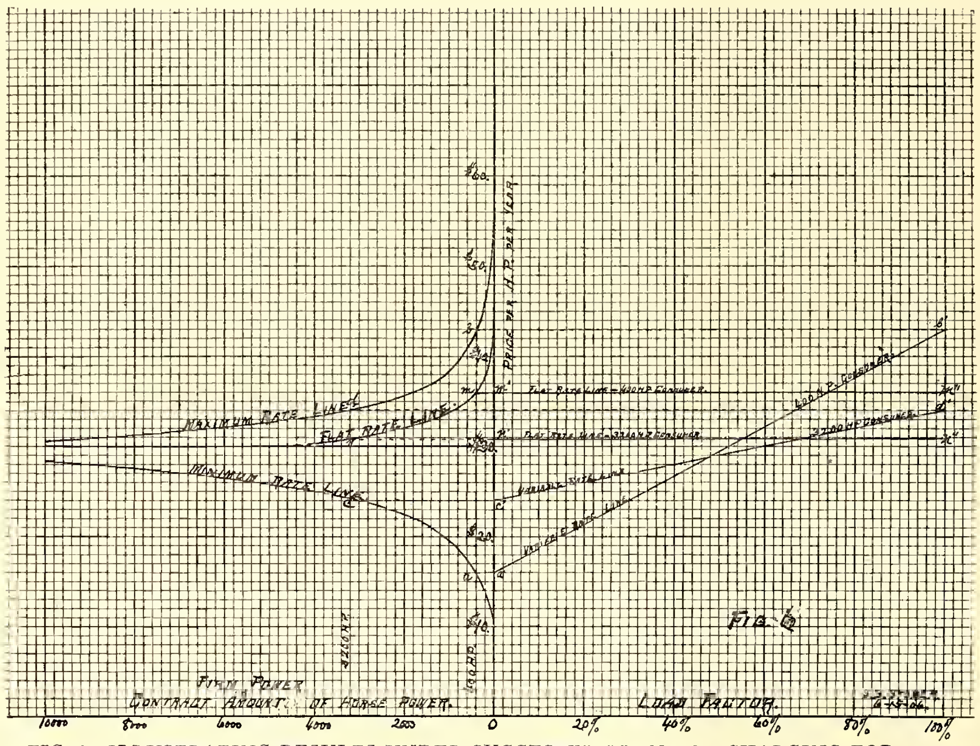


FIG. 6.—ILLUSTRATING RESULTS UNDER SUGGESTED PLAN FOR CHARGING FOR ELECTRIC POWER

In Fig. 6, the curve marked "maximum rate line" is an approximation of the "probability curve," drawn with reference to the $30 base-rate line and the central vertical line. The curve marked "minimum rate line" is also an approximation of the "probability curve," drawn with reference to the same line but on the lower side of the $30 base-rate line.

The minimum rate or the zero load-factor rate for any amount of power may now be found by following the vertical line from the desired amount of power indicated by the figures at the bottom line of the diagram until it intersects the minimum rate line. From the point of intersection follow the horizontal line to the right of the vertical line at the middle of the sheet, thereby obtaining the amount in dollars per horse-power per year. In the same way, from the intersection of the vertical line indicating the horse-power with the maximum rate line, the amount of the maximum rate per horse-power per year is obtained.

Taking as an example a 400-hp consumer, the intersections are found to be at a and b on the minimum and maximum rate lines, corresponding to $16 and $43, respectively. Carrying a horizontal line to the right from b to b' on the 100 per cent vertical load factor line, and connecting a' and b', we then have a variable rate line for 400-hp consumers. The rate for consumers desiring to buy on a straight flat rate regardless of load-factor is obtained from the point m where the 400-hp line crosses the flat-rate line, or at the $36 point.

In the same way a 3200-hp consumer's variable rate would be from $24 to $34, with a corresponding flat rate of $30.40, and the variable rate line runs from point c' to d'.

Referring to the small consumers having a load-factor of approximately 15 per cent, and following the same method given above, ascertaining that the variable rate is from $11 to $52,—at 15 per cent load-factor the rate would be $11. + .15 ($52. — $11.) = $17.15.

In view of over-selling three times for this class of consumers, the gross income derived for each horse-power actually delivered from the plant would be three times $17.15, equaling $51.45, or practically the maximum rate. This increased return per horse-power output of the station, over the corresponding straight flat-rate price of $41 per horse-power year, is made necessary by the fact that three installations must be made to get the gross revenue of $51.45, while only one is required for the $41 revenue. The difference in revenue is therefore just about sufficient to make up for this additional expense.

In the same way, the 400-hp consumer with a load-factor of 25 per cent would pay at the rate of $22.75 per horse-power per year, and over-selling twice would bring in a gross revenue of $45.50 per horse-power per year.

The combination of these two rate-curves, both approaching the $30 base rate line as the firm power increases, taken in conjunction with the method of charging that depends on the load-factor of the consumer, furnishes a system that affords absolute protection to the power company and at the same time gives all consumers every benefit of low price that can be done with safety to the vested interests of the power company. Each consumer would pay a rate per horse-power per year such as to give the power company a uniform percentage of profit on all its business, so there could be no question as to "preferential rates" and certain consumers having advantages over others.

It may be said that the maximum demand is hard to measure, but with a demand for that class of meters there will come an instrument capable of fulfilling the requirements. For the most part, in small installations, the maximum demand may be taken as the rated capacity of apparatus installed, and an ordinary integrating wattmeter giving the kilowatt-hour consumption per month, for use in determining the load-factor, is all that will be required. With large installations, where greater accuracy is required, more money may be spent on individual measuring instruments with no relative increase in cost of meters over that of the many small consumers, and the total error in records would probably be very much less than under present service.

In the sale of power on the maximum-demand basis, the question of the amount of firm power to be taken, and the permissible demands above that amount, are always the subject of much discussion. In this system, however, intermittent demands in excess of the firm power may be permitted in percentages approximately those obtained by following about the same curve as the maximum rate curve,—measurement being made from the $30 base line up to the curve. For example, the small consumer may be permitted to take power 100 per cent above his firm amount; the 2000-hp consumer, allowing for probable maximums occurring at the same time, would be entitled to about 25 per cent intermittent demand. At the 10,000-hp limit, no intermittent demands could be permitted, as there is nothing with which to furnish them.

It must be understood, of course, that all permissible intermittent demands are paid for at the same rate per horse-power per year as the firm power, and are to be measured by the highest, daily, one-minute peaks, or average one-minute demands in excess of the firm power. The one-minute peak is taken for the reason that any load lasting for a full minute means a definite and corresponding opening of the gates controlling the water wheels, and therefore limits their output as much as if it lasted a much longer time.

It is not to be expected that this system of charging—based as it is on the "Law of Probability"—will apply where only one class of service is supplied, as, for example, incandescent lighting. There is very little "probability" about that service, for people want the light when it is dark and the demand consequently comes at that time. Where, however, lighting is only one of many other uses for power, the system indicated above applies with equal force and may be used for every consumer, regardless of size or of the use to which the electric energy is put, and also of the number of hours per day it is supplied.

The same system may also be applied to steam plants if consideration is given to the range in cost due to change in load-factor. The modification would appear in Fig. 6 by using two base-rate lines, one at about $20 and the other one at about $55. The minimum and maximum rate curves would then be drawn with reference to these two lines, leaving a considerable variation in price per horse-power per year between zero and 100 per cent load-factor even for the largest consumers. Greater leeway as to permissible intermittent demands could also be given, due to steam engines being capable of temporary overloads to a much greater extent than are water wheels. The general principles underlying all power plants of whatever type are, however, the same; and one system of sale and measurement of their output, giving due considerations to local conditions, would, if universally used, do much to establish a better relationship between producer and consumer,—if, as in the one proposed, it is founded on equity.

SALE OF WATER-POWER FROM THE POWER COMPANY'S POINT OF VIEW

BY C. E. PARSONS,

Chief Engineer Hudson River Electric Company.

There are three important factors which have to be considered in determining the cost of hydroelectric power for a railway system: the first cost of the power plant and distributing system; the amount of power to be delivered, and the load-factor.

There is no reason to expect a railway manager to consider a proposition for power unless there is a saving over the cost of operation by steam, and the stumbling block in the way of a contract is usually the amount of this saving. The railway companies as a rule are not thoroughly conversant with the first cost of a plant and distributing system, and do not realize the magnitude of the interest and maintenance charges.

Before considering the sale of power from the power company's point of view, it may be of interest to describe the system of the Hudson River Electric Power Company, together with some of the more important work in connection with its high voltage transmission.

There are three water-power plants in operation, and the present plans provide for the construction of nine additional plants of capacities varying from 2000 hp to 40,000 hp. These plants will be built as the demands for power increase. The total amount of power developed and undeveloped, owned or controlled by the company, is over 150,000 hp. This figure is based on the average flow of the various ctreams.

An auxiliary steam plant has been built at Utica, and when all the apparatus has been installed it will have a capacity of 15,000 hp. Another auxiliary plant of equal size will be built near the eastern end of the transmission system, and the total amount of power then available in all plants, both steam and water, will be 165,000 hp.

The most important plant now in operation is at Spier Falls. The construction work was begun in June, 1900, and current was put on the lines in September, 1903. The dam is the fourth largest in the world, but will be the fifth when the Roosevelt dam in Arizona is completed. Its maximum height is 157 ft., and the total length is 1500 ft. The power house is 80 ft. wide and 400 ft. long, and is designed for ten units; six units are in operation, and the seventh will be delivering power in September.

The wheels were started in 1903 under a temporary building, and the permanent structure has been extended as fast as new units were installed. The entire building will be completed in August, and work is now progressing on the canal and penstocks, so that by October the plant will be entirely completed and the power house ready for ten units. The eighth generator is on order, and the plans are to operate the last two machines during the eight months of high water, sending the power into the Mohawk valley. Energy for this end of the system will be supplied during the remaining four months from the Utica steam plant.

The rated capacity of the generators is 2500 kw each, and the water wheels can develop 5300 hp, so that an overload of 50 per cent can be carried for short periods. Under emergency conditions the generators have been operated at 3400 kw on an eighteen-hour run without an unusual rise of temperature. Experience, however, seems to indicate that it is not advisable to install wheels which will develop more than a 33 per cent overload on the generators, and all new plants will be so designed.

Under normal operating conditions the current from each generator is taken through a separate bank of transformers of the same capacity as the generator, delta connected on both the 2000-volt and the 30,000-volt sides, but in cases of necessity the low-tension bus may be used for paralleling or for running a generator on a spare bank of transformers.

The lines leading from the 30,000-volt side of the transformers are connected through motor-operated, remote-control oil break switches, and continue to the center clips of double-throw air break selector switches. By means of these latter switches a generator may be connected to either of the two high-tension buses. These buses are provided with sectionalizing air break switches between each of the generator connections by means of which the buses may be split up into as many sections as there are generators, thus making it possible to easily run several independent circuits. There are also in the upper bus two motor-connected oil switches for sectionalizing, by means of which the different sections of the bus may be paralleled or separated while supplying current. All the generators are paralleled on the high-tension side of the transformers.

The secondary lines from the high-tension current and potential transformers are grounded for safety; the cases are also grounded. These secondary lines and all other lines that lead to the switchboard are carried in ducts laid in a brick wall. For voltage regulation Tirrill automatic voltage regulators are used, one being connected to each of the exciters.

The station was designed for a maximum of 30,000 volts, but the oil and water-cooled transformers for number seven and number eight units will have a capacity of 5000 kw each, wound for either 2000-30,000 or 2000-60,000 volts. An addition will be built back of the present high-tension end of the building, in which will be installed the automatic 60,000-volt oil-break switches which will be connected with the Utica line.

The second plant in importance is located at Mechanicsville. This plant was built in 1897, and was acquired by the Hudson River Electric Company in 1902. Power from this plant was sent over the transmission lines to Spier Falls during 1902 and 1903, and used for construction work. This plant was a striking example of poor design from the hydraulic standpoint. The water wheels were in very poor condition, and on account of the contracted area for the head-water and tail-water it was impossible to get more than 75 per cent of the rated power from the generators. During 1903 and 1904 the entire water-wheel equipment was replaced by McCormick wheels, the head race was enlarged, and the area of discharge from the wheels was greatly increased. These changes were satisfactory, and it is now possible to run the machines at their full capacity.

The Hudson River at this point is divided by an island into two channels with a combined width of about 1200 ft. The western channel is used for the head and tail-race.

The power house extends into the river 257 ft., and is connected with the island by a concrete dam 26 ft. above the bed of the river. The main dam is built entirely of concrete; the up-stream face is vertical and the down-stream face has an ogee curve. The dam is 15 ft. in height above the river bed, 16 ft. thick at the base, and 30 ft. thick through the base and apron. The total length of the spillway between abutments is 850 ft. In the western abutment are twelve waste gates, each 4 ft. x 6 ft., motor operated.

The power house lies between the west bank and the island, and is practically a continuation of the dam.

The power house is divided into two parts by a head wall 6 ft. thick. The up-stream part contains wheel chambers for seven 1000-hp power lines of wheels for the main generators, and two sets of smaller wheels for the exciters.

The down-stream portion of the power house contains the governors and electrical apparatus. The total length of the power house is 257 ft. and the total width 66 ft.

The tail-race is 200 ft. wide, and joins the main stream 750 ft. below the power house.

The water-wheel plant consists of fourteen pairs of 51-in. McCormick turbines. Each unit has two pairs of wheels designed to operate at a speed of 114 r. p. m., and rated at 250 hp; the total power of each set of wheels is therefore 1000 hp. The normal head under which the wheels operate is 17 ft.

The total generator capacity is 7000 hp in seven generators of 750-kw capacity each. They are the General Electric type, 40-cycle three phase, with revolving fields and stationary armatures wound for 12,000 volts. The current is delivered to the line without the use of step-up transformers.

The switchboard along the north side of the generator room is of the latest design, and the circuits are so arranged that they can be split up and the various machines run on separate and distinct transmission lines.

An auxiliary steam plant of 1000-hp capacity was installed during the summer of 1901. This plant consists of two 505-hp Heine water-tube boilers and one Hamilton Corliss tandem compound engine of about 1000-hp capacity, which can be connected by means of a rope drive to one of the water-wheel driven 750-kw generators, the coupling being so arranged that the change can be made in a very few minutes.

The third water-power plant is located on the Schoharie Creek, seven miles south of Amsterdam. This plant was built in 1900 by the Empire State Power Company, and during the first three years had a checkered career. The first designs called for a masonry dam about 350 ft. long, a canal 3500 ft. long, with eight foot penstocks about 200 ft. long, connecting the end of the canal with the power house.

The plant was completed and put in operation, supplying power to the Helderberg Cement Company at Howes Cave in 1901. During a high flood in the spring of 1901 the water cut a channel 200 ft. wide around the end of the masonry dam, and also washed away several hundred feet of the canal, completely shutting down the plant. A temporary timber dam was built to close the opening between the masonry and the south shore, and the canal was repaired.. The plant was again in operation early in 1903, but during an exceptionally high flood in October the water again cut a channel around the end of the timber dam, and for financial reasons the company did not make any effort to rebuild. Control of the Empire State Power Company was obtained by the Hudson River Electric Company in 1904. During that summer a heavy timber spillway about 300 ft. long, and a timber dike about 400 ft. long, were built, extending from the end of the masonry dam to a high rocky bank on the south side of the stream. Four heavy floods have passed over the structure without injury, and the plant has been in continuous operation since early in 1905.

The equipment in the power house consists of two 700-kw Stanley Indicator alternators, one 250-kw General Electric belted alternator, and three 500-kw, 2000 - 15,000 - 30,000-volt AB General Electric transformers. The machines were originally built for 60-cycle 11,000 volts, but have been rewound for 40 cycle 2000 volts.

This plant is one of five which will eventually be built on the Schoharie, and when storage reservoirs have been completed the minimum flow will produce about 12,000 hp on an eighteen-hour basis.

During the past year an auxiliary steam turbine plant has been built at Utica. The total capacity of this plant will be 8000 kw at normal load, with sufficient boiler capacity for 50 per cent. overload, giving a total output of 15,000 hp. Transformers will be installed for 2000-60,000 volts so that power can be taken from or delivered to the lines.

A change in the type of construction of the transmission lines of the company is being made. All new lines are to be of the steel-tower type, and the old lines will be rebuilt with towers as rapidly as the necessary arrangements can be made.

The change to the tower type was brought about primarily by the adoption of 60,000 volts for the line from Spier Falls to Utica. Another very strong reason for the change is the short life of the wooden poles and fixtures.

The experience of the company has been that the life of a wooden pole is from nine to twelve years, and the life of a cross-arm in many instances is even less. Within the past year cross-arms on twelve miles of pole line have been replaced at a cost of about $500 per mile. The first cost of material and labor for poles and fixtures was about $500 per mile, and the cost for repairs on cross-arms alone during eight years was equal to the first cost of poles and fixtures. This expense consisted almost entirely of labor, as the work was done at night, on Sundays, and at such other times as the current could be taken off of the line. The poles carried two circuits, and power could be off from only one circuit at a time. Some of the poles are beginning to show signs of weakness just below the surface of the ground, and are being replaced as rapidly as necessary. All of these poles were of sound chestnut and the cross-arms were of first quality Southern pine.

In order to maintain a wooden pole line in first-class condition the experience of this company has shown that maintenance and depreciation amount to 20 per cent, or that the amount of money expended in ten years is twice the first cost on the poles and cross-arms.

The cost of steel towers for two circuits and ground wire, including special construction for corners and transpositions, is about $2,500 per mile. This includes first cost of towers, freight, concrete foundations, erection, and all work except labor of putting on insulators and stringing cables.

On a comparative basis the cost of steel tower construction is five times that of the pole line. Records show that galvanized towers for windmill purposes are in perfect condition after thirty years of service, and it is therefore evident that the tower line will be the cheaper type of construction.

The cost of insulators built for the same voltage is about equal in either type of construction, but the leakage must be greatly reduced on the towers.

The effect of lightning on a steel tower line in this climate is problematical, but with the towers well grounded and with copper ground wire of large capacity it would seem as though the conditions were more favorable with towers than with the pole line.

The line from Ballston to Utica, now under construction, is being built of galvanized steel angle towers designed for two circuits, with a ground wire placed in the center of the tower three feet above the top of the conductors. The towers are all of the same general type of construction, and there are three different arrangements of cross-arms and insulators.

The standard towers, which are used on tangents and where the deflection angle is less than 20 degs., weigh 4200 lbs. each, and have an ultimate breaking strength of 8000 lbs., the pull applied at a point 50 ft. above the ground and equally distributed over the four pins of the lower cross-arm. The towers will also have an ultimate strength of 8000 lbs in a direction normal to the pull of the main conductors. The transposition towers weigh 5600 lbs. each and stand the same strain as the standard towers. These towers are placed 2½ miles apart. The corner towers are of very much heavier construction, and weigh 10,000 lbs. each, having an ultimate breaking strength of 17,000 lbs. applied in either direction. These towers are only used where the deflection angle exceeds 20 deg. The same arrangement of pins is used on all angles between 20 deg. and 90 deg.

The usual spacing of the towers is 550 ft., but the distance depends largely on the contour of the ground, some of the towers being 750 ft. apart and others not more than 400 ft. The average number of towers per mile is about ten.

All towers are arranged for a separation between wires of 6 ft. at all parts of the span, which necessitates a greater spacing between the insulators at the corner towers. The steel angles forming the upright members are built in the form of "A" frames, as viewed from a point normal to the direction of the line.

The view in the direction of the transmission line shows the corner angles perpendicular, with diagonal angles from the apex at one side tied to the foundation at the opposite lower corner. These angles cross at a point 25 ft. above the ground and are tied to a common gusset plate. The four angles at the top of each side near the end of the lower cross-arm are notched and clamped together with a very heavy cast-iron clamp held with four ¾-in. bolts. The main vertical and diagonal members are held with diagonal struts and tie-rods in all directions. The base of the tower is 17 ft. square.

The foundations for the standard and transposition towers are built of reinforced concrete buried five feet below the surface of the ground. The lower part of the foundation consists of a concrete slab 4 ft. square and 12 in. thick. The anchorage is a 3-in. x 3-in. x 5-16-in. angle with two cross-angles, 3 ins. x 3 ins. x ¼ in., riveted back to back across the bottom of the upright. The cross-angles are embedded in the concrete about four inches above the bottom, and ¼-in twisted steel bars, placed six inches apart, are laid in both directions immediately above these angles. A concrete column 10 in. square, reinforced with ordinary chicken wire, extends from the flat concrete base to a point 8 in. above the surface of the ground, completely surrounding the vertical 3-in. x 3-in. angle. The foundations for the corner towers are 5 ft. square, and the other dimensions are the same as for the standard towers. There are, however, two upright angles, 3 ins. x 3 ins. x 5-16 ins., at each corner of the tower, and these angles are tied together with a 2-in. x ¼-in. strap about half way between the bottom of the concrete base and the surface of the ground. All the anchorages are set with a templet to grade, and the towers are then assembled on the ground and raised and bolted to the foundation angles.

Both upper and lower cross-arms are built of 3-in. x 3-in. x ⅜-in. angles, latticed, the upper arm being 11 ft. 9 ins. long and the lower arm 17 ft. 9 ins. long. For each conductor single pins are used on the standard towers, while three pins, so placed as to evenly distribute the load, are used on the corner towers.

On the transposition towers the conductor is dead-ended on two pins, thus requiring four pins in a straight line for each conductor in order to make the transpositions.

All inside pins are made of 3-in. standard pipe, and outside pins of 3-in. extra heavy pipe drawn down at the top end fitted with a 1½-in. bolt thread 2½ in. long, which engages a metal bushing in the top of the insulator. All pins have been tested with a strain of 2000 lbs. applied at a point 18 inches above the cross-arm. The pins will stand a pull of 3000 lbs. at this point without permanent deflection.

The insulators are made with four petticoats, are 15½ ins.

high, and the greatest diameter is 18 in. A metal bushing with 1½-in. thread is cemented in the top of the insulator. The head of the insulator is so arranged that the pull of the tie wires is applied directly in line with the metal bushing below the top of the pin. There are 2¼ ins. of porcelain between the top of the pin and the conductor. The various parts of the insulator are tested to 60,000 volts, and the insulator when assembled is tested wet to 140,000 volts. The insulators before the final test are turned bottom up, filled with water and allowed to stand twelve hours in order to be sure that all parts have been thoroughly fired and glazed. The weight of the insulator is about 45 lbs.

The conductors are six-strand, hemp-center copper cable, the equivalent of 000 solid wire; the outside diameter is ½ in., and the breaking strength under test is about 6100 lbs.

A ground wire of the same size and material is strung the whole length of the line. Every fourth tower is grounded by means of a galvanized iron plate, 20 ins. x 30 ins., buried in moist ground and completely surrounded by six inches of crushed coke.

The conductors are tied to the insulators by means of copper cable, single 0 equivalent. There are two tie cables, one to take the strain in each direction on either side of the insulator. Each tie is wrapped around the head of the insulator, and the ends are brought back and fastened to the main conductor by a specially designed malleable-iron clamp with three grooves.

All of these towers were built by the Aermotor Company, of Chicago, and were erected by the construction department of the Hudson River Electric Company.

One of the largest items in the cost of a system for supplying power is the sub-station and apparatus. There are at the present time eleven sub-stations in operation, with capacities ranging from 1000 kw to 10,000 kw. The total cost of the distributing system, including transmission lines and sub-stations, is about equal to the cost of the generating stations.

The second item to be considered in determining the cost of hydroelectric power is the total number of kilowatt-hours required. It is self-evident that an average load of 2000 kw is more to be desired than a load of 500 kw, as the fixed charges and operating expenses of the distributing system in either case are practically the same. This is not exactly true in regard to the interest on copper and distributing apparatus, but this item is small compared with the operating expense and depreciation on lines, etc.

The load-factor is the third and most important item in determining the cost of power, load-factor being the ratio of average to maximum load. It is evident that when the load-factor is near 100 per cent all of the machinery is in operation on all parts of the system, and the transmission lines are carrying their full load; the entire investment will have an earning power, and the charges will be a minimum per kilowatt hour. This is an ideal condition, and one which cannot be realized. Nevertheless, it has to be used as a basis to work from in determining the cost with various load-factors. If a plant is built for supplying power for a railway only the cost per kilowatt-hour will be higher than where power is also supplied to factories and for lighting purposes. In a large mixed system consideration must be given to the loads which are on at a time when the railway demand is low and when the machines set aside for railway purposes can be used for partially carrying other loads. The value which is to be given to these separate loads must vary according to the character of the load and the time of year.

There are two methods which may be considered in making contracts for railway energy. One is the flat rate per horse-power per year, based on the maximum demand, the other method is on the kilowatt-hour basis. In either case a fixed amount of power as the maximum load is agreed upon, and momentary overloads of 5 per cent or 10 per cent are allowed.

With the flat-rate method the power company is not interested in the load-factor, and the burden falls on the railway company. The only way for the railway company to take advantage of the cheaper hydroelectric power is by the use of storage batteries or by the operation of an auxiliary plant to carry peak loads.

With the second method of charging on the kilowatt-hour basis the power company must be protected by a minimum monthly payment. This minimum payment must be determined by the average load-factor. The load-factor, therefore, is the basis for determining the cost with the kilowatt-hour method.

The items to be considered in fixing the cost to the railway company per horse-power per year are the fixed charges, consisting of interest, depreciation, taxes, and insurance; the cost of manufacture, consisting of labor, repairs and supplies; the cost of distribution; and the cost of management. There should then be added a reasonable dividend on the stock. The sum of these items, less the dividend, divided by the average amount of power which can be supplied at the distributing stations throughout the year, determine the cost per horse-power per year to the power company. This cost with large customers determines the price which they are to pay for energy. If, now, the power company is to be subject to the loss of income due to apparatus being idle for a part of the time, on account of low load-factor, the railway company's cost per kilowatt-hour must be correspondingly increased.

The gist of the matter is that with the flat-rate method, in order to obtain the benefit of the cheaper power, the railway company must make an investment in either a storage battery or an auxiliary power plant and bear the interest and depreciation of the same; while with the kilowatt-hour method the rate to the railway company is higher but the power company bears the interest and depreciation of the apparatus which is idle part of the time, but which must be maintained in readiness to supply the maximum demand. In the kilowatt-hour method consideration should be given to the factory and lighting loads whose peaks do not overlap the railway load. In this manner the load-factor on each individual machine is increased and the railway company derives the benefit of this greater load-factor. In other words, the railway load-factor may be 45 per cent, but by means of the loads which can be carried on the plant the average load-factor on the machines supplying the railway company, which are usually running in parallel with some of the other machines, can be built up to say 70 per cent. This load-factor of 70 per cent is used instead of 45 per cent in determining the cost of the power for the railway company.

To analyze the methods of determining the cost, a concrete example will be given. The figures used are for comparison only and do not represent conditions of operations.

The maximum railway load is 3000 kw, or 4000 hp, and the load-factor is 45 per cent. Considering the fixed charges and cost of operation, it is determined that the value of the power at the railway company's sub-station is $100 per horse-power per year. The cost to the railway company with the flat-rate method will, therefore, be $400,000 per year, or, if the full amount of power could be taken for twenty-four hours per day every day in the year, the cost would be $.0153 per kilowatt-hour. With a load-factor of 45 per cent the average power would be 1350 kw, or 1800 hp, and the cost would therefore be, with no storage battery on the system, $.0338 per kw-hour. The cost to the railway company is therefore $100 per horse-power per year, based on the maximum amount of power used, and the cost based on the average of 1800 hp used is $222 per horse-power per year. On account of the great cost per horse-power per year based on the energy actually used, the railway company is compelled to install a storage battery and decrease the maximum demand. The maximum demand will therefore be 1350 kw, the average load, plus a battery loss of approximately 350 kw, making the maximum demand on the power company 1700 kw, or 2260 hp. The cost to the railway company for the hydroelectric power will therefore be 2260 hp times $100, or $226,000 per year. To get the total cost for power there must be added the interest and depreciation of the storage batteries, which will amount approximately, on a comparative basis, to $30,000 per year, making the total cost to the railway company $256,000.

With the kilowatt-hour method the value of the power at the distributing station is the same, or $100 per horse-power per year, or $.0153 per kilowatt-hour. Instead of using the load factor of 45 per cent in determining the cost to the railway company, the railway company is given the benefit of the average combined load-factor of the generating plant. This load-factor is 70 per cent, and the cost to the railway company is $142 per horse-power per year for power actually used, or $.021 per kilowatt-hour. The total cost, therefore, to the railway company is 1800 hp times $142, or $255,600 per year.

The power company must have a minimum guaranteed monthly payment based on the maintenance of the load-factor by the railway company. The power company is also protected by the maximum demand which cannot be exceeded, and is assured of a stipulated income; so that if the railway company's load factor drops below whatever amount is stated in the contract, the railway company will be the loser by reason of paying for power which they have not used. Thus the railway company derives the benefit of the larger combined load-factor of the plant in determining the cost per kilowatt-hour, but is obligated, by reason of the minimum payment, to keep its load-factor within reasonable limits.

It is evident that the actual cost in either case is approximately the same, but with the flat-rate method the railway company has to make a larger investment in order to take advantage of the hydroelectric power.

REPORT OF COMMITTEE ON INTERCHANGEABLE COUPON TICKETS

The report of the committee of the Street Railway Association of the State of New York on interchangeable coupon tickets was as follows:

The committee appointed to consider an interchangeable coupon ticket begs to report as follows: An arrangement for the sale and use of such books will necessarily have to be a matter of individual and collective contract between the companies entering into such an arrangement, and attached we submit a form of such contract which we hereby recommend.

We also hereby recommend that the conditions to be printed on such books, and under which they are to be sold, be the same as attached. Respectfully submitted,

J. H. Pardee.
George G. Blakeslee.
R. P. Stevens.
Committee.

PROPOSED FORM OF CONTRACT COVERING INTERCHANGEABLE COUPON TICKETS

Whereas, certain of the electric railways of the State of New York, doing a general interurban business, are desirous of forming an association for the purpose of issuing interchangeable coupon books, and

Whereas, it is desired that said interchangeable coupon books shall be good for transportation upon all the lines that are parties to this agreement,

Therefore, it is hereby covenanted and agreed by and between the respective electric railways signing this agreement that the following rules and regulations be and are hereby adopted and agreed to as the rules and regulations governing said roads in issuing said interchangeable coupon books, and providing for the method of redeeming the same and the settlement of balances between said roads, to-wit:

In consideration of the adoption by all parties of this contract of the uniform interchangeable coupon book, we, as authorized representatives of our respective railways, do hereby agree to abide by the following rules for the regulation of the use of said interchangeable coupon books, and for the settlement of the revenue arising therefrom.

ARTICLE 1

The coupon books shall be uniform in every respect, differing only in the name or initials of the various railways by which they are issued, and shall be known as Form S. R. A. S. N. Y. No. 1.

ARTICLE 2

A committee of three, called the transportation committee, shall have charge of the details of the issuance of the interchangeable books provided for in this contract, and the settlement of all questions arising thereunder as may be hereinafter provided for. This committee shall be appointed by the parties to this agreement, and such committee shall elect a chairman. The members of this committee shall continue as such members until the expiration of one year from the date of their appointment, and until their successors shall be appointed.

ARTICLE 3

The books and necessary accounting forms shall be procured only from an official printer by requisition made upon the chairman of the transportation committee, who will order the shipment made and the bill rendered direct to the railway from which the requisition may have been received, which requisition shall not be honored by the chairman until the fifteenth of each month covering the following thirty days' supply, requisition to state numbers on books unsold, and number of books sold since previous requisition. The books will number consecutively for the entire association, that all books may bear different numbers without regard to the source of issue. Not more than three books per month per mile of single track or terminal mileage to be ordered by any one company.

ARTICLE 4

These coupon books, when regularly issued, shall be honored for passage over all the railways, parties to this contract, upon the conditions of the contract under which they are sold, and it is agreed that the contracts under which said respective roads sell said interchangeable coupon books, shall be identical in form, and the observance of this provision as to making said contract under which said books are sold, shall constitute a vital part of this contract.

ARTICLE 5

The settlements of the revenue derived from the sale of the coupon books shall be made as follows:

A. All foreign coupons collected by companies, party to this contract, shall be mailed to the company whose initials or numbers are stamped on each coupon, not later than the fifth of the calendar month following the month in which honored. A statement shall be rendered for the coupons so sent, on a basis of 83 1-3 per cent of their face value, and a remittance for such statement, if found correct, shall be made by the issuing railway not later than the tenth of the same month, provided settlement between two companies, each of which has mailed a statement to the other for the same month, shall be made by the payment of the balance.

B. The failure on the part of any company to make settlement with all other companies by the tenth day of each month, shall be made known at once to the chairman of the transportation committee by written notice, briefly stating the facts.

That the chairman of the transportation committee, on receipt of such a notice, shall promptly notify all other companies, party to this contract, of the facts by written notice served by registered mail, and that after the receipt of such notice from the chairman, the amount due each month from each company to said defaulting company or companies, shall be remitted to the chairman of the transportation committee instead of to the defaulting company or companies. Accompanying such remittance shall be rendered a copy of the bill or statement, together with the coupons collected, which statement shall show the amount due the sending company from the defaulting company, and the chairman shall be authorized to take such steps as are found necessary for the collection on behalf of the companies so sending him their accounts, the balances, if any, due them from the defaulting company.

C. When a company has once defaulted on its settlements, the chairman shall refuse to honor requisitions for said company for any more interchangeable coupon books, unless, at a meeting of the officials representing the roads parties to this contract, at which meeting not less than three-fourths of all the companies parties hereto are in attendance, action be taken on the affirmative vote of not less than three-fourths of the companies represented, authorizing the chairman of the transportation committee to supply the defaulting company or companies with coupon books at not to exceed the maximum rate per month provided for in said contract.

ARTICLE 6

Each company shall keep a daily record of the serial numbers of each company's coupons collected, which record shall be the basis of settlement in case of loss of coupons in transmission, provided copy of record is furnished by collecting railway, who shall, however, indemnify the issuing railway against the possibility of the lost coupons again being presented for payment.

ARTICLE 7

Expired or unused coupon books must be redeemed only by the railway by which issued, if presented within eighteen months of date of sale, but only on the following basis: Full fare or face value shall be computed for all the coupons which have been used, and the remainder of the original purchase cost shall be the proper redemption value.

Example.—A book is returned for redemption containing sixty coupons, showing that 180 coupons have been used, redemption value shall be computed as follows:

Original cost of book (240) coupons	$10,00
Coupons used, 180 at 5 cents each	9.00
Redemption value of unused coupons......	$1.00

ARTICLE 8

Additional companies may become parties to the use of the interchangeable coupon book on approval of the transportation committee, and by subscribing to and complying with the terms of this contract. Such additions shall be bulletined by the chairman of the transportation committee.

ARTICLE 9

These rules and such regulations as may be adopted thereunder shall bind all companies, parties thereto, from the time they respectively become parties hereto as provided in Article 8 hereof. Any company may withdraw therefrom by giving sixty days' notice to the chairman of the transportation committee, provided it has adjusted all balances due or accruing to the companies, parties to this contract. Further, that notice of withdrawal shall begin with and run from the first day of the calendar month. The chairman of the transportation committee will bulletin in the name of the company desiring to withdraw from this agreement with the advice that the withdrawal shall be effective on a certain date, after which date the name of the company withdrawn must have been erased from all new books sold. The company withdrawing must return to the chairman of the transportation committee all unsold interchangeable coupon books, the numbers of which shall be shown on the above mentioned bulletin. The company withdrawing shall continue to honor for passage all books which may have been sold prior to the bulletined date of withdrawal, up to the date of the expiration of each coupon according to the contract date of sale.

ARTICLE 10

Any violation of this agreement shall be promptly reported to the chairman of the transportation committee, and by him brought before a meeting of the committee, and will be acted upon by such committee or referred to the meeting of the parties of this agreement for further action, called for action thereunder.

ARTICLE 11

These articles and the rules of this contract may be amended only by a two-thirds vote of the companies subscribing, provided ten days' notice of the proposed changes has been given all members, through the office of the chairman of the transportation committee.

ARTICLE 12

The expense of the maintenance of this contract and the interchange of coupon books hereunder shall be adjusted and paid semi-annually by the constituent parties hereto, on the basis of the number of miles of main line of interurban railway operated by the respective companies outside of municipal limits. Each company shall pay such proportion of said expenses as the main line of such company operated outside of the municipal limits, shall bear to the total number of miles of main line of all the companies, parties hereto, operated hereunder, and the term "main line" shall be understood to mean a single track between given points, exclusive of side-tracks, turn-outs or sidings, said expense not to exceed $25 per annum per company without the consent of the majority as provided in this contract.

ARTICLE 13

It is mutually agreed by the parties to this contract that the individuals signing this agreement as representatives of all respective railways, parties to this contract, shall each constitute a special trustee to hold, and as such trustee to become responsible for all monies held by their respective roads for the purpose of paying for the coupons redeemed for such companies, or other roads parties to this contract. That is, the said officials shall each respectively become the trustee for all funds received by their said road, under the terms and conditions of this agreement, and shall hold said monies as trust funds for the use of the said roads entitled to same under the terms of this contract.

ARTICLE 14.

Each copy of this contract shall be considered as an original, and when any company signs such copy, such signing shall be considered as the signing of the original contract jointly with all constituent companies, whether such companies are then, or thereafter become parties hereto.

ARTICLE 15

The transportation committee shall construe the articles and rules and issue such general bulletins to the companies, parties to this agreement, as occasion may demand. The decision of the transportation committee shall be final in all matters of dispute arising from the interchange of tickets.

This agreement, and the foregoing rules and regulations as they may exist, or as hereafter amended under Article 11 hereof, shall continue in full force and effect and be binding on each constituent company, parties hereto, from the date any such company becomes a party hereto as herein provided, to the time of withdrawal of such company herefrom as provided in Article 9 hereof, and it shall not be necessary at any time hereafter to renew this agreement between the parties hereto.

By the foregoing agreement, rules and regulations, and by the terms and conditions of the contract printed in the interchangeable coupon book, we as authorized representatives of our respective railways, agree to be bound.

....

....

Dated at ....

this..............day of................190...

CONDITIONS TO BE ATTACHED TO INTERCHANGEABLE COUPON TICKETS.

1. The holder of this interchangeable coupon book is entitled to receive an aggregate of $12 worth of transportation over the several lines of electric railway named on the cover of this book, or which may be hereafter bulletined, which transportation will be given at rates of fare, and under the local regulations of the respective lines so named in bulletin and subject to all the terms and conditions of this contract.

2. In selling this interchangeable coupon book over the line of any other company, the selling company acts as agent only, and assumes no responsibility beyond its own line.

3. The coupons contained in this book shall not be honored for transportation if detached by any person other than the conduc-

tor, or if the serial number on left side of each coupon is altered, or in case of the number on outside cover of book not agreeing with contract number, which is the number on each coupon, and if for any reason the conductor demands the surrender of this book and the payment of full fare, then said book shall then be surrendered to the conductor, who shall issue his receipt therefor, and application for rebate on account of such surrender shall be made to the company from which the book was originally purchased. No attempt shall be made by the purchaser to adjust any such differences with the conductor.

4. The conductor will detach, in the presence of the passenger, a sufficient number of coupons at their face value to cover the local cash fare on his train, or the local one-way ticket fare if same is lower than local cash fare.

5. The interchangeable coupon book does not permit the checkings of baggage thereon under any terms or conditions differing from the rules of the road over which said book is being used, and under no circumstances shall the liability of any company permitting the checking of baggage on this book be greater than the sum of fifty dollars ($50) in case of loss or damage to any such baggage.

6. This interchangeable coupon book expires one (1) year from the date of purchase. Expired or unused coupon books may be redeemed only by the railway by which it is issued, if presented within eighteen months of date of sale, but only on the following basis:

Full fare or face value shall be computed for all coupons which have been used, and the remainder of the original purchase cost shall be the proper redemption value.

7. It is understood and agreed that not less than two (2) five-cent (5c.) coupons will, under the contract conditions governing the use of this interchangeable coupon book, be accepted for any distance, no matter how short.

8. The further stipulations and conditions printed on the cover of this interchangeable coupon book constitute and form a part of this contract.

9. Any person using this ticket shall be bound by all the conditions and provisions of this contract, as fully as the original purchaser of same.

10. I have read all of the conditions of the above contract, and I hereby accept the same.

REPORT OF COMMITTEE ON STANDARD APPLICATION BLANKS AND FORMS

The report of the committee on standard application blanks and forms of the Street Railway Association of State of New York was as follows: The committee on standard application blanks and forms respectfully reports as follows: The committee held two meetings, on Jan. 11 and April 27, 1906, respectively, in Utica, and adopted the accompanying blanks, which are submitted for the consideration of the association as standard for application and surgical examination. These are the result of study of a large mass of blanks in use by the various railways, which were courteously furnished by the respective superintendents on request of the secretary. C. C. Coons was appointed a sub-committee to draft the application blank, and the thanks of the committee are hereby tendered him for his work.

We believe these blank forms, with slight modifications, will suit the individual requirements of various roads and will cover the necessities of all.

In the surgical examination blank we have submitted but one form to cover the requirements of city and interurban service, leaving it to the judgment of the respective surgeons to adopt a rating which shall show the grades of service for which the applicant is fitted. Thus an applicant rated "first class" would receive a mark of 9 to 10 and be recommended for the most responsible position; one rated "average" should be marked 7 to 9 and be assigned to less important service, while old employees receiving a rating of "average" with a mark of 6 to 8 could be retained in the less responsible positions.

We wish to tender our thanks to Secretary Fairchild for

Form 264-5-9-'06-300.

Applicant's Signature at Superintendent's Office....

SURGEON'S CERTIFICATE OF EXAMINATION.

Of....

Occupation.... Age (should be between 21 and 40)....

Vision: Distance	Near	Color Sense	Hearing
Right eye.... 20	 20	Green....	Right ear.... 20
Left eye.... 20	 20	Red....	Left ear.... 20
Does he need glasses?....		Purple....	

What is the rate of Pulse.... of Respiration....

	Name	Date	Results
What diseases has he suffered from?	....	....	....

Has he hernia?.... What form?....

It's present condition....

Has he ever been injured?.... If so what and when?....

Is he the subject of any deformity, from injury or otherwise?.... If so, note here and locate on skeleton blank herewith....

Has he any present source of disability in.... (Applicants should be stripped for this examination. Note with care varicose veins, enlarged joints and anything tending to produce or prolong disability.)
- Heart....
- Lungs....
- Kidneys....
- Joints....
- Veins....
- Feet and Legs....
- Hands and Arms....
- Spine....
- Urinary Organs....
- Nervous System....

Does he use intoxicating liquors?.... Is his appearance that of a temperate man?....

Has he had small pox.... or been recently vaccinated?.... His height is.... feet .... inches; weight.... lbs.; color of eyes.... of hair....

He is physically a { First-class / Average / Defective } subject for position as....

Mental characteristics { Alert / Average / Dull } (Signature).... *Surgeon.*

Examined....

Date.... 19....

Signature of applicant to be taken at Surgeon's office.

(Sign here).... *Applicant.*

REMARKS:

(Anytbing lacking in spaces above should be added here.)

....

FACE OF SURGEON'S CERTIFICATE PROPOSED BY THE STANDARD COMMITTEE

No....

Application for Employment.

SURGEON'S CERTIFICATE.

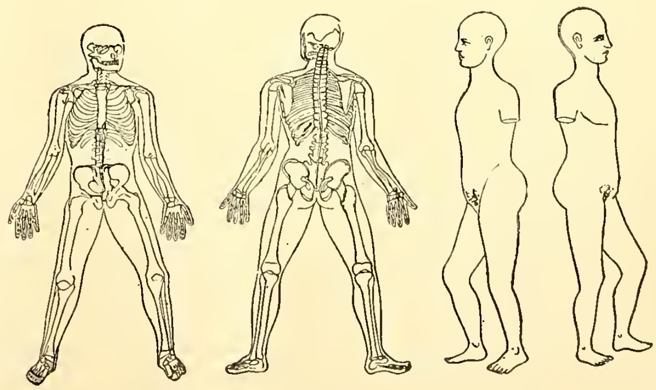
Name....

For position as....

Approved.

Supt.

REMARKS:



☞ LOCATE ANY DEFORMITIES ON THE SKELETON.

REVERSE OF SURGEON'S CERTIFICATE PROPOSED BY STANDARD COMMITTEE

BODY OF APPLICATION BLANK FOR EMPLOYMENT, RECOMMENDED BY COMMITTEE

Penal Code.—Chapter 6, No. 570. A person who obtains employment or appointment to any office or place of trust by color or aid of any false or forged letter or certificate of recommendation, or of any false statement in writing, as to his name, residence, previous employment, or qualification, is guilty of a misdemeanor.

A person convicted of a crime declared to be a misdemeanor is punishable by imprisonment in a penitentiary or county jail, for not more than one year, or by a fine of not more than $500.00, or by both.

Applicant must answer the following questions and sign this application in ink *in his own handwriting:*

Name in full..
(No initials.)

Address in full..

Name and address of parents or relatives..........................

....

Age................Height..............Weight ....

Single or Married, if latter give extent of family and their residence ....

Position desired........How long have you lived in Blank?.....

Where were you born?..

If out of the United States, how long have you lived in this country? ....

Are you, or have you declared your intention to become a citizen of the United States?..

Have you ever been in the employ of this Company before?......

If so, in what capacity, on what division, and why did you leave the service?..

....

Were you ever employed by a street or steam railway? If so, when, where, and in what capacity?............................

....

Why did you leave the service?..

Have you ever been discharged or suspended from any situation? If so, state when, where, and for what reason?..................

What is your trade or occupation?............................

Where were you last employed and in what capacity?............

When, and why did you leave?..

State on the following blank your employment and employers during the last five years:

From What Date	To What Date	Employed As	Name and Address of Employers
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....

I agree to submit to a medical examination by the Company's Doctor and pay.............. for same.

In part consideration for my employment, I agree to return upon demand or on severing my connection with the Company, all the Company's property then in my possession, and whenever requested, to make and verify an affidavit containing a full and truthful statement of any and all accidents, ejections, refusal of transfers, and assaults, of which I may have knowledge, (and I agree to deposit with the company......................as security for my performance of my agreements herein contained, which deposit is to be retained by the Company as liquidated damages in case of any breach thereof.

I agree to make application for a bond with such surety association as the company may designate, and in the event of their refusing to become my bondsmen, that I will, upon notification to that effect, resign from the service, and hereby agree to waive all claim for any damages resulting therefrom.*)

I agree to work under instruction on trial, without pay, at least......days and such additional time in excess thereof as the Company may deem necessary.

I agree, as a punishment, in case of any infraction of the Company's rules, to serve time practicing or while under suspension without pay.

I understand that no compensation is paid to trainmen for time spent while engaged "on watch," (meaning waiting at any designated point for opportunity to work), but that Company's standard wages are allowed only for service rendered while actually employed on its cars.

I further agree that if I am discharged, or leave the Company's service voluntarily at any time during or after the trial period above referred to, I shall have no claim against the Company for services rendered, or expenses incurred by me during said trial period or while performing duty "on watch," as above explained.

I agree to at once provide myself with a standard uniform in accordance with the rules and regulations of the Company.

While in the Company's service, I agree to study carefully and comply faithfully with all its rules, regulations and orders.

I,.. have read the foregoing, and clearly understand all conditions specified therein; and to the truth of all statements made, and my willingness to abide by the conditions of this contract, I hereby make affidavit.

State of New York,
County of............................ } ss.
City of..............................

....

...., being duly sworn, deposes and says that the above statement is true to the best of his knowledge and belief.

Sworn to me this........day of ...., 190.

....

....

....

* Each company to retain or eliminate according to individual necessities. Retain or eliminate.

We, the undersigned, request the Blank Railway Company to employ ....

....................................as ....

and do state that we have known him intimately for the past ....years, and that he is a man of good moral character, of sober, temperate and industrious habits; not addicted to the use of intoxicating drinks, and no violator of law and good order. And we further represent that he is a man of truth and integrity, good understanding, and of temper and manners fit to be employed on your system.

(Give Street No., City and State.)

..........................Address ....

..........................Address ....

..........................Address ....

BLANK RAILWAY COMPANY

Station........ Bond No........ Badge No........

..................................Employed as ....

Nationality........Age........Height........Weight ....

Married or Single............General Appearance.............

....

Introduced by..................Turned in by...................

Appointed by............................

....
Superintendent.

*CASH DEPOSIT

Date.....................190

This is to certify that there has been deposited with the Treasurer the sum of $............as a forfeit as provided for in this application.

....
Treasurer.

Received..............190....of Blank Railway Company, the sum of $...........being refund of above deposit.

....

Note.—Each company to retain or eliminate the clauses inclosed in brackets about cash deposit, surety, etc., according to individual needs.

valuable assistance freely and repeatedly given, and to Mr. W. B. Brockway, president, and Mr. Elmer M. White, secretary, of the American Street and Interurban Railway Accountants' Association for loan of book of railway labor statistics. (Signed) F. H. Peck, Chairman.

REPORT OF COMMITTEE ON REVISION OF CONSTITUTION AND BY-LAWS

The report of the committee on revision of constitution and by-laws was as follows:

Article II. It is suggested that the constitution be changed to form three classes of members, namely, active members, associate members and allied members.

(a) Active Members, to consist of railway or railroad companies whose properties are operated wholly or in part by electricity as the motive power, and located wholly or in part within the State of New York. Each active member shall be entitled to one vote, which shall be cast by the proper accredited delegate.

(b) Associate Members, to consist of individuals, copartnerships and corporations, who are actively identified with street and interurban railway interests, and other persons, who, in the opinion of the executive committee, have had experience of such a nature as to render desirable their connection with the association.

This class of membership is intended to include more particularly engineering firms and financial institutions, independent engineers, bankers and brokers, power companies and electric railway companies situated adjacent to New York State, who may desire to have the privilege of attending the various meetings. The privileges of associate members shall be similar to those of the active members, except that they shall not be entitled to vote or hold office.

(c) Allied Members, to consist of individuals, copartnerships and corporations who are engaged in manufacturing, selling or dealing in electric railway supplies and materials.

Allied members shall have the privilege of sending representatives to the annual meetings, but shall not vote, hold office or have the privileges of the floor.

FEES

Article 15. Associate Membership.—The dues of associate members shall be $25 per year, which shall entitle the member to send delegates to the quarterly and annual meetings of the association

Allied Membership.—The dues of allied members shall be $15 per year, payable as registration fee at the time of registration for the annual meeting. This fee shall entitle the member to send representatives to the annual meeting, and shall include one banquet ticket.

On motion the report was adopted as read.

REPORT OF COMMITTEE ON DETAILED OPERATING EXPENSE OF THE MECHANICAL DEPARTMENT

The committee on collection and compilation of mechanical tests made the following report:

At a special meeting of the association, held in Schenectady, June 10, 1906, for the discussion of cost of inspection and maintenance of cars and equipment, a committee was appointed to prepare a standard system of records and blanks so that unit costs of inspection and maintenance of cars and equipment, in such detail as was found advisable, might be obtained in a uniform manner.

The committee begs to submit blanks presented herewith, which, under accounts 6, 7, 20 and 21, may be given unit costs of the more important items entering into these accounts for the purposes of comparison.

In the first column to the left will be noted letters a, b, c, etc., which may be used as sub-divisions of the account under which they appear.

In the second column, the names of the articles, and in the subsequent column, the kind, number and unit cost per thousand car-miles, wheel-miles or motor-miles, as may be required, and in the last column, the total cost of the items indicated. It is proposed that each item in the maintenance accounts shall include labor and material, and cost to prepare the article ready for use on the cars, but shall not include cost of installing on the car. For example: The cost of maintaining GE-800 motors shall include labor and material expended in repairing such motors, including the turning down of commutators, replacing coils, etc., but not the cost of removing and replacing such armatures in the motors. The total at the bottom of the page should show the total cost of the account, and not simply the total of the items given above.

From actual practice it is found that the records necessary to obtain the cost called for in these blanks may be obtained at a small expense by either dividing the accounts in the sub-heads, as indicated, and requiring that such sub-divisions shall be marked on the time slips and material requisitions, or the sub-division may be made in the general office, or in the office of the master mechanic directly from the time slips and requisitions, which of themselves indicate what kind of work was done, or what kind of material was used in each instance.

Your committee feel that in the items included in these blanks it has given those which may most profitably be compared on the requisition, and ask that an effort be made by all members to keep their records, commencing July 1, so as to obtain the information required for the purposes of this comparison.

The report of the committee was accepted, and the committee was continued with instructions to prepare suggestions as to the best method of keeping the records recommended.

The blanks prepared by the committee for collecting and compiling statistics on the cost of various detail items included in accounts 6, 7, 20 and 21 of the standard system of accounts are the result of much hard study and consideration, and it is believed the forms offered combine all the requirements in simple and convenient shape. There are three blanks, each 8½ ins. x 11 ins., arranged to be used with the loose-leaf filing system. The column headings are the same for each sheet and are shown in the engraving herewith.

In designating the particular items on which data should be collected, the committee did not attempt to include all the items that enter into the cost of maintaining cars and equipment, but in order to make a start and not complicate matters at the outset, it was decided to include merely the more important detail items that constitute the larger part of these amounts. The items finally selected are printed down the left-hand side of the forms as will be understood from the portion of the form reproduced in this connection. Space is left under each item to divide the data into "city," "interurban" and "total."

Form 204-A-1000 6-06

DETAIL COST OF MAINTENANCE OF CARS AND EQUIPMENT

__________ RAILWAY CO. FOR __________ ENDING __________

ACCOUNT 6

			NO.	KIND	COST PER 1000			TOTAL VALUE
					CAR MILES	WHEEL MILES	MOTOR MLS.	
A	AXLES	City						
		Interurban						
		Total						
B	BRAKE SHOES	City						
		Interurban						
		Total						

COLUMN HEADINGS OF BLANK FORMS SUBMITTED BY COMMITTEE ON COLLECTION AND COMPILATION OF MECHANICAL COSTS

Of the three sheets submitted by the committee the first is devoted to account No. 6, and contains the following items:

A—Axles.
B—Brake-shoes.
C—Journal Bearings.
D—Painting.
E—Car signs.
F—Wheels—Cast.
G—Grinding.
H—Wheels—Steel.
I—Turning.
J—Damaged cars.
K—Car body repairs, except items D and J.
Total of account No. 6.

All of the second sheet and the top half of the third sheet are devoted to account No. 7. The second sheet comprises the following items:

A—Armatures (with blank space left to enter data on several different types).
B—Field coils (with blank spaces as above).
C—Commutators.
D—Brushes.
E—Brush holders.
F—Armature bearings.
G—Motor axle bearings,

H—Total motor repairs (including all labor and material charged to repairs and installation).

The top half of the third sheet is a continuation of account No. 7 and contains the following items:

I—Controllers (with blank space left to enter data on several different types).

J—Gears.

K—Pinions.

L—Trolley wheels.

Total of account No. 7.

The lower half of the third sheet gives items from accounts 20 and 21 as follows (these items to include material and labor, except cost of installation):

Labor—Car cleaning.

Material—Car cleaning.

Car Inspection—Including minor repairs in car houses.

Lubrication.

The summary at the bottom of this sheet calls for the following information:

Total car-miles during period.

Total car-hours during period.

Average eighteen-hour cars.

Average maximum number cars in daily service.

Number cars ready for service.

Number defective cars "pulled in" during period.

EXHIBITS AT SARATOGA

There was no attempt to make a full line of exhibits. A few companies, however, had exhibits of light material on the veranda. The most important of these were as follows:

The Ohio Brass Company, of Mansfield, Ohio, displayed its single-phase overhead line material.

Dossert & Company, of New York, exhibited all of its various types of cable joints.

The National Lock Washer Company, Newark, N. J., had a neat exhibit of its curtain fixtures and sash locks.

The Crouse-Hinds Company, of Syracuse, N. Y., showed its Imperial Arc Headlight for suburban and interurban service.

The Rail-Joint Company, of New York, showed at Saratoga a full line of its various types of rail-joints.

The T. H. Symington Company, of Baltimore, Md., had an exhibit of its railway specialties.

The Franklin Car Heating Company, of Syracuse, N. Y., had a neat exhibit of its Western car heater.

The Gould Storage Battery Company, of New York, had a neatly arranged exhibit on the veranda of the Grand Union Hotel, of the Gould type of storage battery plates.

G. F. Taylor, of Randolph, Mass., exhibited an automatic fender, which applies the air brakes when it strikes an object.

HURRYING WORK ON THE WEST JERSEY AND SEA SHORE ELECTRIFICATION

The statement is made in Philadelphia that President Cassatt, of the Pennsylvania Railroad, has issued special instructions for hurrying work on the electrification of the company's line between Camden and Atlantic City, and that in accordance with his instructions the construction force has been increased. Just when the line will be ready for service it is impossible to predict, but the operation of trains will surely be begun early next month, so it is said. Already the cars on hand for use on the line are being run between Westville and Woodbury to acquaint the crews with their working. Power for this purpose is being taken from the Camden & Suburban Company's station. The sub-stations at Reega, Mizpah, Newfield, Clayville, Glassboro, South Camden and Atlantic City are all within a few days of completion, as is also the main station at Westville. The greatest amount of work to be accomplished is in Camden and in Atlantic City. In order to bring the electric line into Camden without interfering with the steam railroad, the structure of the proposed elevated roadway will be used. Where the stone sections are not connected, the railroad will erect frame structures upon which the rails of the electric line will be placed. Temporary stations will be used in Camden and Atlantic City.

THE SARATOGA CONVENTION

The twenty-fourth annual meeting of the Street Railway Association of the State of New York was held at the Grand Union Hotel, Saratoga, June 26 and 27. There were over 250 delegates in attendance.

The morning session on Tuesday was called to order at 10:30 with President Danforth in the chair. The annual address of the president follows:

PRESIDENT'S ADDRESS

The selection of a place at which to hold the twenty-fourth annual convention of this association was left to your executive committee, who, after careful consideration, determined upon Saratoga Springs as the best available place, and I hope that all the delegates to this convention will be pleased with their selection.

The past year has been fruitful of many events of importance to the electric railways of this State, chief among which, the change in policy regarding electric railways by the steam railroads, and the entrance of such railroads in the electric traction field.

While New York has been for years notably backward in the development of interurban lines, it undoubtedly leads to-day all other States in the newly established community of interest between steam and electric railways in the electrification of a heavy steam railroad terminal, and in the successful operation of electric cars over tracks in regular and frequent use by heavy trunk-line steam traffic. The extension of this latter class of service on the tracks of the West Shore Railroad, between Rome and Syracuse, by the operation of cars of the Utica & Mohawk Valley Railway Company, will be an established fact before the close of this year. The joint operation of steam and electric trains between the points named, will be closely studied by railroad officials of both classes of service throughout the country. It might be well to note at this time that a protected third rail is to be used, instead of the overhead trolley, to transmit current for the electric cars. Far-sighted railroad men see the necessity of offsetting the inroads into their freight and passenger earnings made by parallel electric lines, by furnishing equivalent service, on their own tracks, by the use of electric cars operated at high speed and frequent intervals. Plans have been prepared, and, I understand, some contracts have been let for the electrification of certain branches of a number of the steam trunk lines in this State. The successful operation of long interurban lines in direct competition with steam railroads has already impressed the steam railroads with the obvious advantages in the use of electric power for the operation of passenger, and of some classes of freight trains. For years there has been more or less open warfare between steam and electrical interests, and we note with pleasure the change in conditions as above outlined.

The business prosperity enjoyed by the country at large, continues to favorably affect the receipts of the steam railroads of this State, and will, apparently, continue during the entire year. The report of the Railroad Commissioners shows that the gross earnings of 106 street railways of the State of New York, for the year ending June 30, 1905, were $70,730,085.66, an average of $33,684.20 per mile of road, showing an increase over the preceding year of $1,134.48 per mile. It is interesting to note that the steam surface railroads report for the same time shows gross earnings from operation, per mile of road operated, $19,034.35.

The transmission of Niagara Falls power to Syracuse marks a new epoch, and brings more nearly an accomplished fact,—the operation of trains on all railroads by electricity.

Public sentiment regarding street railways is assuming varied forms; in some places, the tendency is toward municipal ownership; in others, to a liberal treatment of public service corporations, only requiring in return, a fair and honest service. Tendencies—almost anarchistic—are clearly shown by people of one city, while those in another advocate strongly, corporate ownership of public utilities, with a wise and just form of municipal supervision. The members of this association can best offset the growing demand for municipal ownership of public utilities by giving the public adequate service, and by pointing out the evils attending municipal ownership. The work of the Civic Federation in obtaining accurate information concerning the results of municipal ownership of public utilities in Europe will give us the ammunition necessary to overcome the forces now working against corporate interests.

During this winter your executive committee has called two special conferences of the members for the informal discussion of various problems arising in the operation of street railways.

At the January conference, held in Schenectady, Jan. 10, subjects relating to the maintenance of cars and equipment were thoroughly discussed. This meeting was attended by the master mechanics and mechanical engineers of nearly all the railways in the State, and by a number of others from neighboring cities and Canada.

At the meeting held in Elmira in March, problems of the transportation department were discussed. Both meetings have satisfied your executive committee that an opportunity for various departmental officials to meet together for an informal heart-to-heart discussion of the problems which they have to overcome, is not only appreciated by such officials, but does much to increase their efficiency. It is not to be expected that the railways in Greater New York receive, directly, a great amount of material good through a discussion of various topics by this association; they do, however, gain in the fact, that through their work in the association, they are educating men whom they may, some time, find it advantageous to employ, and, in return, through their advice given at these meetings and through the exploitation of their system, greatly aid the other railroads in the State in improving their operating methods, and, incidently, their earnings.

At the annual meeting last year, a resolution was adopted and referred to the executive committee for further consideration and report on the proposition of obtaining the appointment of a commission to revise Article 4 of the Railroad Law, authorizing the expenditure of such moneys as may be necessary for the expense of this commission, from the regular funds of the association, or from the proceeds of the special assessment heretofore authorized. Your executive committee advises deferring action of this character for at least another year.

Your executive committee would like to have, for the benefit of those whom you may elect for the ensuing year, an expression of your opinion, as an association, of the advisability of continuing these special meetings, and of having the annual meeting in June.

By consolidations and withdrawals of several roads, our membership has been reduced to thirty-six roads.

Your executive committee recommends a change in the constitution and by-laws which will permit electric railroads in adjoining States and Canada to become associate members, and also recommends a revision of the dues as now levied upon active members. By cutting out all unnecessary expense, the maximum dues may be materially reduced and the roads placed upon a more equitable basis. This association has been in existence for twenty-four years, and its policy has changed from time to time, with the change in conditions. We are all alive to the fact that we have reached another turning point and must decide at this meeting the future policy of the association.

Your respective committees have prepared careful reports on the subjects assigned them, and several important papers are to be read and discussed.

In closing, I desire to express my appreciation of the hearty co-operation I have received from the various members during the past year, and will ask all the members present to aid me in making this a most profitable convention.

The report of the treasurer for the year ending June 30, 1906, showed a balance of $2,204 in the treasury.

After the general business of the convention had been completed the reports of the special committees on standard application blanks and forms, collection and compilation of mechanical costs, interchangeable coupon books, and revision of constitution and by-laws were read. These reports will be found elsewhere in this issue.

The convention session on Tuesday was devoted to a consideration of three papers on the sale of water power, viz: By S. B. Storer, general manager Niagara, Lockport & Ontario Power Company; Charles E. Parsons, chief engineer Hudson River Electric Power Company, and G. A. Harvey, electrical engineer International Railway Company, Buffalo. These papers are published in this issue, and the discussion will be published in detail in the issue of next week. An addition to Mr. Harvey's paper will also be published.

On Wednesday morning a paper on car inspection was presented by D. F. Carver, general superintendent of the Rochester Railway Company, and was discussed by those present. A consideration of the question box followed. A report of this meeting will be published next week.

The officers elected for the ensuing year on June 27 were: President, J. N. Shannahan, general superintendent Fonda, Johnstown & Gloversville Railroad, Gloversville, N. Y.; first vice-president, T. W. Wilson, general manager International Railway Company, Buffalo, N. Y.; second vice-president, Edgar S. Fassett, superintendent United Traction Company, Albany, N. Y.; treasurer H. M. Beardsley, secretary and treasurer Elmira Water, Light & Railroad Company, Elmira, N. Y.; secretary, C. B. Fairchild, Jr., associate editor Street Railway Journal, New York City; executive committee, the officers and W. H. Pouch, vice-president Orange County Traction Company, Newburgh, N. Y.; Oren Root, Jr., general manager New York City Railway Company; C. D. Beebe, general manager Rochester, Syracuse & Eastern Railway Company, Syracuse, N. Y., and C. Gordon Reel, vice-president Kingston Consolidated Railroad, Kingston, N. Y.

ENTERTAINMENTS AT THE SARATOGA CONVENTION

The entertainment committee of the Street Railway Association of the State of New York provided an excellent entertainment programme for the ladies who attended the convention in company with the delegates. The weather was excellent throughout the convention period, and all of the entertainments provided were carried through most successfully. The first outing was on Tuesday afternoon, June 26, when the ladies were taken in carriages for a drive in and near Saratoga.

Probably the most enjoyable feature of the convention was the banquet held on Tuesday night, not only on account of the excellent menu provided but also for the good music and speeches. The toastmaster was Hon. A. B. Colvin, who introduced the speakers of the evening, Hon. Edgar T. Brackett, Thomas R. Kneil and J. M. Wakeman. Senator Brackett's subject was entitled "A Lawyer's Paradise," and he characterized the meeting as "The twenty-fourth annual gathering of the New York State Negligence Case Defendants." Mr. Kneil extolled the glories of Saratoga and invited the association in the name of Saratoga's business men to come again. J. M. Wakeman, the last speaker of the evening, made a humorous address, entitled "The Third Rail," which created great merriment. Between the speeches violin and vocal solos were rendered.

Wednesday morning a large party made a trip to Lake George, where luncheon was taken before returning. On Wednesday afternoon the delegates visited the Spier Falls power plant of the Hudson River Electric Company, making the trip via trolley and teams. Those who remained after the regular convention work was over made a visit on Thursday to the works of the American Locomotive Company and the General Electric Company. An elaborate luncheon was served in the latter company's works.

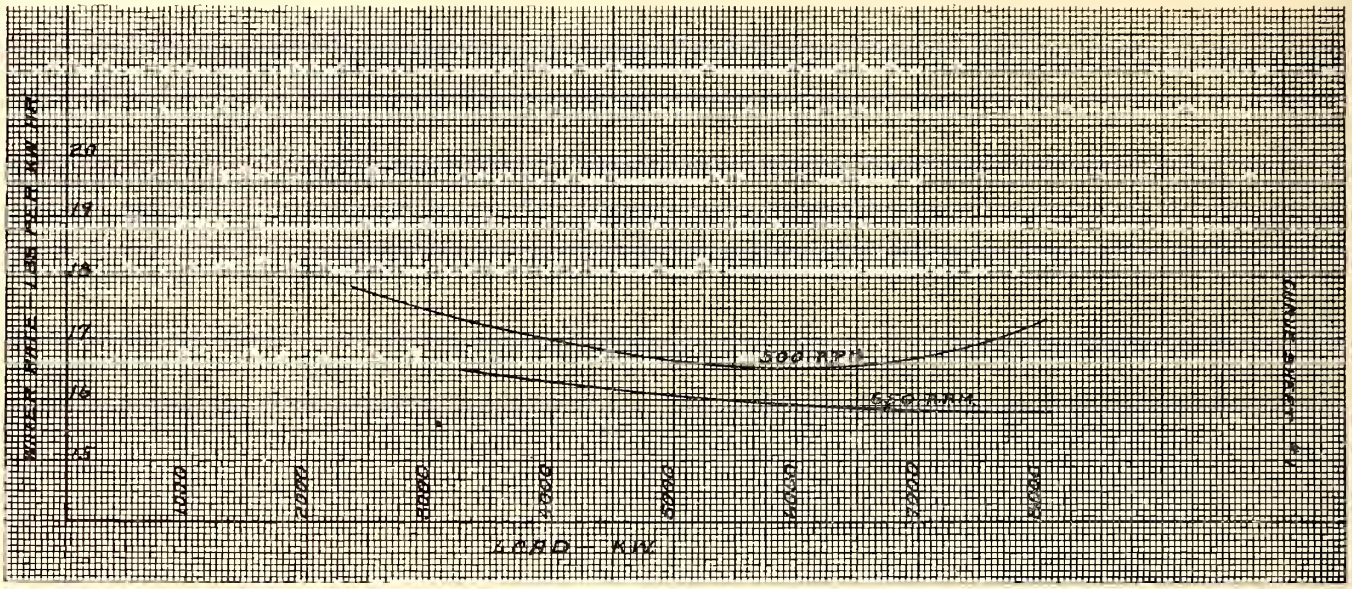
ENTERTAINING THE CHILDREN MADE A PLEASURE RESORT FEATURE

Manager Charles Ross of the Steubenville Traction & Light Company, of Steubenville, Ohio, adopted a rather novel plan in opening for the season Stanton Park, the pleasure resort owned by the company. He instituted a "Children's Day," and placed advertisements containing coupons in the daily papers. The coupons were good for free transportation to and from the park, and about 5400 of them were turned in. The big crowd of youngsters was handled without accident, although the majority of them were unaccompanied.

TEST OF A 5000-KW. CURTIS STEAM TURBINE

In March, 1906, a series of tests was made on one of the 500-kw Curtis steam turbines which has been in commercial service for about one year in the Fisk Street station of the Commonwealth Electric Company, Chicago, Ill. The turbine set is one of four installed in this station. The tests were conducted under the supervision of the representatives of the purchasers, Sargent & Lundy, and those of the General Electric Company. The generating unit consists of a 5000-kw turbine, direct connected to a six-pole, three-phase, 5000-kw, 900-volt, 500-r. p. m. revolving field generator. All the tests, except those for speed, were made under regular commercial conditions. On account of the change in frequency during the speed tests, the load was absorbed by a water resistance, composed of plates in the Chicago River. It was found that the commercial load-water rate was identical with that obtained by use of a water rheostat, other conditions remaining the same.

In the commercial tests the load dispatcher maintained a



CURVE NO. 1

TABLE I.

Load K.W.	Steam Press (Gage).	Superheat Degrees Fahr.	Gross Flow Lbs. per Hour.	Condenser Leakage per Hour.	Back Press. Inches. Mercury.	R.P.M.	Water Rate—Lbs. per K.W. Hr. Actual.	Reduced.*	Notes.
3,340	171	151	56,690	1,070	.89	500	16.66	17.29	Water Rheostat
5,940	169	180	98,370	950	1.72	"	16.40	15.55	Commercial
2,920	172	158	50,930	1,050	1.08	"	17.08	17.61	"
4,860	179	180	81,550	1,700	1.55	"	16.50	16.81	Water Rheostat
7,525	175	147	130,200	820	2.09	"	17.19	16.91	" "
4,950	180	171	80,570	220	1.48	"	16.23	16.55	Commercial
0	178	150	3,520	220	1.40	"	.....	.....	Full Votlage

* Reduced to 150° F. superheat, 1½" back pressure, 175 lbs. (gage) steam pressure.

TABLE II.

Load K.W.	Steam Press (Gage).	Superheat Degrees Fahr.	Gross Flow Lbs. per Hour.	Condenser Leakage Lbs. Hour.	Back Press. Inches Mercury.	R. P. M.	Water Rate—Lbs. K.W. Hr. Actual.	Reduced.**	Notes.
†3,530	170	165	55,900	1,070	.85	650	15.55	16.40	Water Rheostat
5,140	180	179	81,930	1,700	1.50	640	15.67	16.03	" "
8,090	177	141	131,160	820	2.03	640	16.11	15.80	"

** Reduced to 150° F. superheat, 1½" back pressure, 175 lbs. (gage) steam pressure, 650 r. p. m.
† Average of two points.

TABLE III. (Summary Table I.)

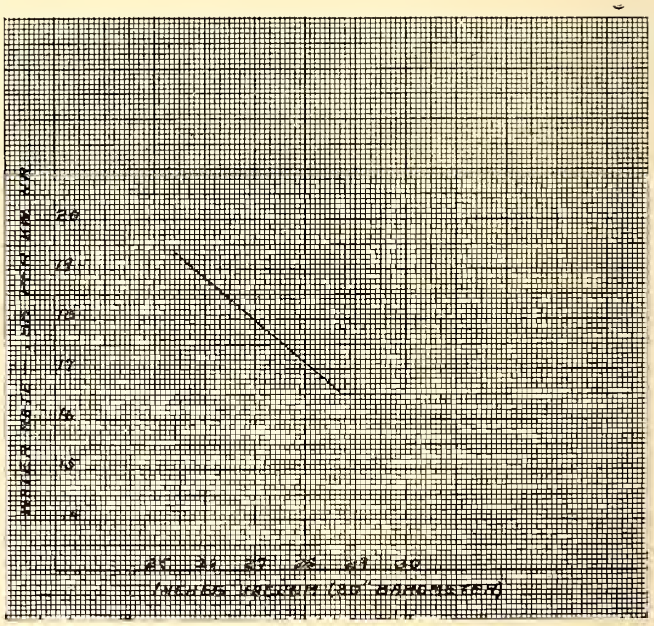
500 r. p. m.
150 F. superheat.
1½" back pressure.
175 lbs. (gage) steam pressure.

LOAD	WATER RATES
2500 kw. (½ load)	17.74
3750 " (¾ ")	17.08
5000 " (full ")	16.62
6250 " (1¼ ")	16.52
7500 " (1½ ")	16.90

TABLE IV. (Summary Table II.)

650 r. p. m. load.
150 F. superheat.
1½" back pressure.
175 lbs. (gage) steam pressure.

LOAD	WATER RATES
3750 kw. (¾ load)	16.35
5000 " (full ")	16.07
6250 " (1¼ ")	15.88
7500 " (1½ ")	15.80



CURVE NO. 2

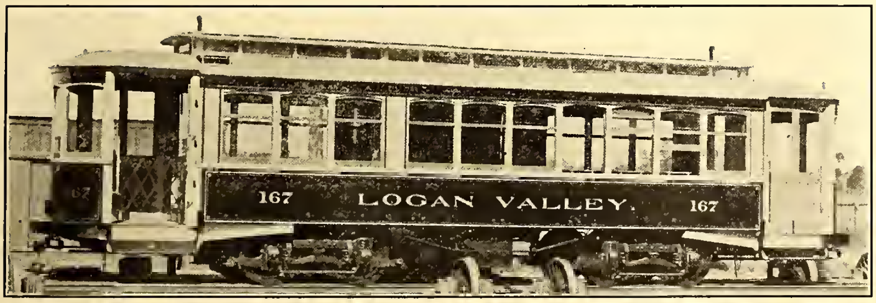
constant load on the turbine under test by varying the tension of the auxiliary governor spring, controlled from the switchboard by a motor. Steam pressure and superheat were kept as constant as possible by proper attention to the boilers. The load was measured by special indicating wattmeters, connected to independent potential and current transformers. All instruments were carefully calibrated at Schenectady and the calibration later verified in the laboratory of the Commonwealth Electric Company. As an additional precaution to insure accuracy, the readings taken were checked by readings obtained from a duplicate set of instruments, calibrated by the Electrical Testing Laboratories of New York. The load readings were recorded at intervals of two minutes.

All tests were made at about 150 deg. F. superheat, the temperature being read by calibrated mercury thermometers. The thermometers were placed in wells filled with mercury, proper correction was made for the exposed stem. Temperatures and pressures were recorded every five minutes. The amount of steam used was obtained by discharging the condensed steam into tanks, where it was weighed. After each run the condenser was tested for leaks, which, as shown by the tables, were of small amount.

The detailed results of the tests at 500 r. p. m. are shown in Table I. Table II. indicates the readings obtained at 650 r. p. m. To make the tests comparable, all results were reduced to 150 deg. superheat, 1½ in. back pressure and 175 lbs. (gage) steam pressure. The reduced water rates are given in the ninth column of Tables I. and II. Tables I. and II. are summarized in Tables III. and IV., respectively, and from these were obtained the curves in Figs. 1 and 2.

COMBINATION CARS FOR LOGAN VALLEY RAILWAY

The attractive-looking combination smoking and passenger car shown in the engraving is one of four recently put in service on the lines of the Altoona & Logan Valley Electric Railway Company, of Altoona, Pa., the road being controlled by the American Railways Company, of Philadelphia, The cars were built at the works of the John Stephenson Company, Elizabeth, under Brill patents, the grooveless-post, semi-convertible feature being utilized throughout the cars. The length of the car over the end panels is 29 ft. 6 ins., and over the crown pieces 41 ft. 6 ins.; width over the sills, including plates, 8 ft. 2 ins.; distance between the centers of the posts, 2 ft. 8 ins.; height from the floor to the ceiling, 7 ft. 10½ ins.; height from the track to the under side of the sills, 2 ft. 7⅛

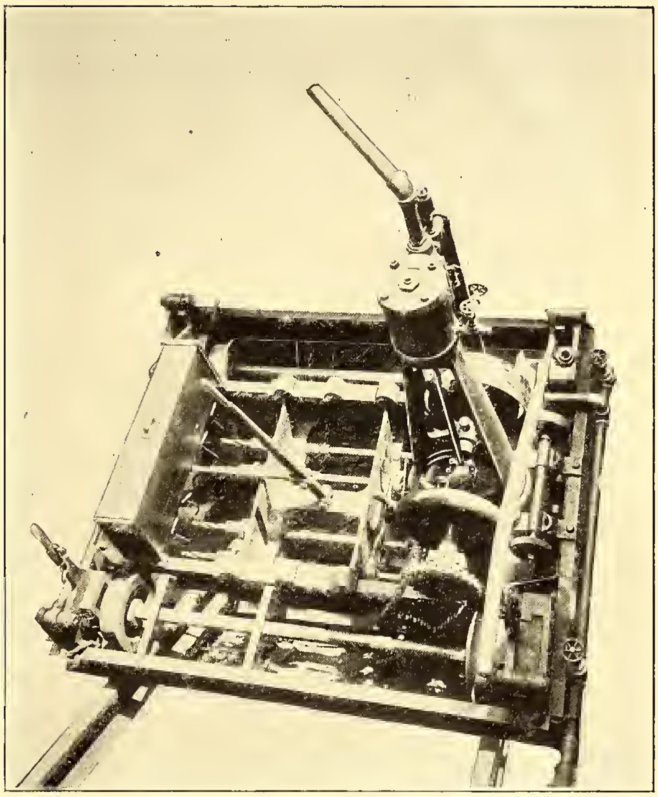


CAR FOR ALTOONA & LOGAN VALLEY ELECTRIC RAILWAY

ins.; height from the track to the platform step, 1 ft. 4½ ins.; size of the side sills, 8¾ ins. x 3⅞ ins.; size of the end sills, 7⅞ ins. x 4¾ ins.; thickness of the corner posts, 3¾ ins.; thickness of the side posts, 3¼ ins. The smoking compartment measures 9 ft. 5 ins., and is furnished with longitudinal seats; this compartment is separated from the passenger compartment by double sliding doors instead of the usual single sliding door. At diagonal opposite corners of the car double folding doors and folding gates are used to protect the step openings. The adoption of the semi-convertible feature makes possible a seat measuring 36 ins. in length and an aisle space of 21 ins. The inside finish of the cars, including the ceilings, is of quartered oak. The type of truck is the No. 21-GE-1, having a wheel base of 4 ft. 6 ins. and a wheel diameter of 2 ft. 9 ins. Four motors of 40-hp capacity each are installed on each car.

QUADRUPLE TRACK DRILL

The track drill shown in the accompanying illustration is a power-driven machine furnished recently to the New York


QUADRUPLE TRACK DRILL

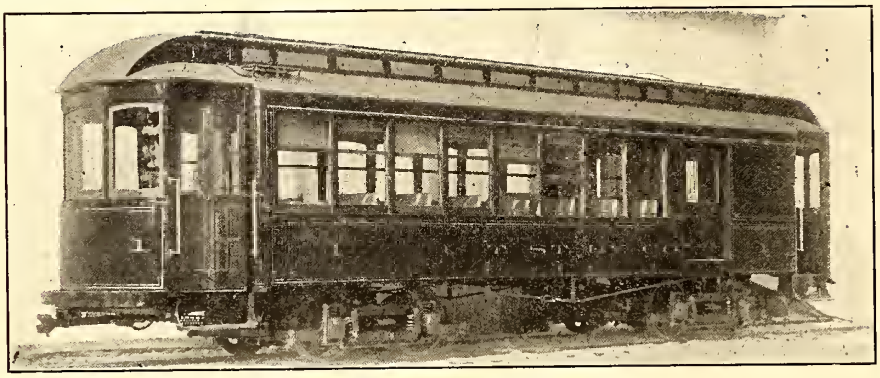
Central Railroad by the Columbia Machine Works & Malleable Iron Works, Brooklyn, N. Y. This particular drill has been operated by steam secured from the boiler of an adjacent locomotive, but it can be adapted for operation by electricity, gasoline or other power. It is furnished with four 1⅛-in. drills capable of drilling through a 90-lb. rail in 2¾ minutes. The drive is through a worm gearing.

When it is necessary to move the machine along the track to some other job, the drills are raised to 6 ins. above the rails to enable them to clear ties, frogs and switches. For this purpose a lever is placed at each corner so that four men can raise the drill frame in a very short time.

A glance at the right side of the illustration will show the grinding attachment. The power for running the grinder is secured by adjusting a few thumb-screws and throwing the friction wheel of the grinder against the revolving fly-wheel of the engine. Another feature is the water or oil tank for keeping the drills cool, as well as a tool-box.

PASSENGER AND BAGGAGE CARS FOR DU BOIS, PA.

The United Traction Street Railway Company of DuBois has added a number of combination passenger and baggage cars to its equipment, one of them being shown in the accompanying photograph. The cars were built by the J. G. Brill Company, and embody that company's grooveless post, semi-convertible feature (patented). The baggage compartment measures 9 ft. 2 ins., and has a sliding door on each side. The seats in this compartment are of the slat type, arranged to fold up when not in use. A hardwood partition having a single sliding door separates the baggage compartment from the passenger compartment. At the step openings double folding doors are utilized. The cars are finished in cherry, natural, having ceilings of decorated birch veneer. The seats in the passenger compartment are 36 ins. wide, allowing an aisle space of 22 ins.; arm rests are provided for the comfort of the passengers. Numerous of the car builder's specialties are provided throughout the car, such as sand boxes, gongs, signal bells, and a channel iron draw-bar for hauling trailers. The truck wheel base measures 4 ft. 1 in.; wheel diameter is 33 ins. There are four motors of 40-hp capacity each.



NEW CAR FOR DU BOIS, PA.

The general dimensions of the car are: Length over the end panels, 31 ft. 8 ins.; over the crown-pieces and vestibules, 41 ft. 1 in.; width over the sills, including the sheathing, 8 ft. 2 ins., and the same measurement applies to width over posts; centers of posts, 2 ft. 8 ins.; size of the side sills, 5¼ ins. x 6⅞ ins.; size of the sill plates, ⅜ in. x 12 ins.; thickness of the corner posts, 3⅝ ins.; thickness of the side posts, 3¼ ins.

THE "THIRD-RAIL EYE" RECALLED BY DECISION IN BOSTON SUIT

A decision has just been handed down by the Supreme Court, sitting in Boston, in which a verdict of $1,000 damages is returned in favor of John H. Woodhall for injuries received from particles of iron from the third rail on the Boston Elevated Railway, injuring his sight. The Superior Court, in the same case, returned a verdict of $2,000. The jury found that the falling of the metal was due to the failure of the company to provide a receptacle for the metallic dust, and for the protection of travelers on the street.

The defendant contended, first, that there was nothing to show that what injured the plaintiff's eye came from the contact-shoe; and, second, that there was nothing to warrant the jury finding that the defendant was negligent in failing to apply to the Railroad Commission for approval of the pan.

After carefully reviewing the evidence and explaining in detail its ruling on each point, the court takes up the defendant's contention that the road was not liable, because the Railroad Commissioners had approved its plans for building and operating the overhead structure, and says:

The Railroad Commissioners approved the plans for the railway as constructed, and gave the certificate required before it could be operated, and allowed it to be continued as before after investigating the subject of sparking. The defendant contends the action of the Commissioners is not reviewable by the court or jury; that the effect of it is to authorize the operation of the railway without a pan, and that therefore there could be no such thing as negligence on its part in failing to apply to them for approval.

Having quoted certain statutes the court further says:

The effect of these various provisions is to require the Commissioners to approve the plans before the railway can be constructed, and to require after the completion of the whole or a part of it, a certificate from them that it appears to be in a safe condition for operation before the corporation can operate it. In examining the plans, the Commissioners are required to consider the strength and safety of the proposed structure, the rolling stock, motive power and method of proposed operation, and the comfort and convenience of the public, and their judgment, in respect to these matters, as far as they enter into their approval of the plans, cannot be impeached or controlled.

It cannot be shown, for instance, that the railway is unlawfully maintained because the approval by the Commissioners of the plans was due to a mistake on their part if such was the fact, as to the strength and safety of the proposed structure, or the comfort and convenience of the public. Their approval is conclusive on the right and authority of the corporation to construct its railway as proposed, and has the same effect as an authority conferred by the Legislature to construct it in the manner proposed would have. Taken in connection with their certificate under section 18, chapter 548, that the railway appeared to have been constructed in accordance with the plans and appeared to be in a safe condition for operation, it established the structure as a lawful structure and as lawfully maintained and operated by the defendant.

But neither the approval of the plans nor their certificate of operation relieves the corporation from liability in case anyone who would otherwise have a cause of action by negligence on its part in the construction or operation of the railway. In the absence of anything to exonerate it, the corporation is still bound to exercise reasonable care and diligence in all matters relating to the construction and operation of its railway.

If the approval of the plans by the Commissioners and their certificate of operation are not conclusive on the question of the exercise of reasonable care and diligence by the defendant, manifestly the fact that the Commissioners had the matter of sparking under investigation and had made no recommendations and taken no action except to cause an investigation to be made, cannot held to be conclusive.

Moreover, it is to be noted that the trouble from sparking was not anticipated when the railway was constructed, and therefore the safety of the structure with reference to sparking could not have been included in the approval of the plans by the Commissioners. It is also to be noted that the certificate required before the corporation can operate the railway is a certificate that it appears to be in a safe condition for operation, not that it is safe, thus leaving open the question of safety with all the consequences involved.

If a pan was reasonably necessary, then it was either the duty of the defendant to apply to the Commissioners for their approval, or to proceed to put up one without such approval.

Interchangeable tickets are now being sold by the Norfolk & Portsmouth Traction Company. These tickets are good on the lines in Norfolk, Portsmouth and Berkley, on the lines now controlled by the traction company. Tickets marked by the individual companies and issued prior to the formation of the Norfolk & Portsmouth Traction Company are only good upon the lines designated upon the face of the tickets.

Two large consignments of trained wild animals sent from Europe to the Frank C. Bostock show at Coney Island several weeks ago were moved on to Paragon Park, at Nantasket Beach, Boston, and to Luna Park, Pittsburg, a few days ago. The animals were loaded on Brooklyn Rapid Transit express cars. This is the first time wild animals have been carried over the Brooklyn surface lines.

FINANCIAL INTELLIGENCE

WALL STREET, June 27, 1906.

The Money Market

There has been no appreciable change in the monetary situation during the past week. Despite the heavy liquidation in stocks the tone has ruled firm, and rates for maturities remain practically the same as those prevailing at the close of last week. The demand for money has been somewhat larger than heretofore, and there is nothing in the situation at the present time to warrant the expectation of easier conditions in the near future. This week preparations will be made for paying the July 1 interest and dividend, which will call for a considerable amount of money, and later on the banks will be obliged to pay into the National Treasury about $10,000,000 of special deposits. It is not likely, therefore, that money for fixed periods will be offered freely by local institutions until these payments are made. A feature of the week has been the sharp decline in sterling exchange, bringing the rate down to near the gold import point, and while rumors of possible gold imports in the near future are current, nothing definite has as yet developed. Foreign bankers have been rather free sellers of finance bills, the proceeds of which are available for market purposes, but there is no disposition on their part to shade the quotations for time money now asked by local lenders. The bank statement, published on last Saturday, was extremely favorable, but had not the slightest influence upon rates for either call or time money. For the first time in several months there was a heavy contraction in loans. The decrease in this item amounted to $2,318,000, and reflected the increased offerings of foreign capital. Deposits increased $1,290,200, and consequently there was an increase in the reserve required of $322,550. The increase in cash amounted to $4,162,100, or nearly three times as much as was indicated by the preliminary estimates. The surplus reserve was increased $3,839,550, and brings the total surplus up to $10,912,925. This compares with $15,094,675 in the corresponding week of last year, $38 452,675 in 1904, $12,923,850 in 1903, $12,978,350 in 1902, $8,428,200 in 1901, and $15,526,850 in 1900. The European money markets have ruled easier, the feature being a reduction in the Bank of England discount rate of ½ of 1 per cent to 3½ per cent.

Money on call has been in plentiful supply at rates ranging from 3½ to 2 per cent, the average for the week being about 3 per cent. Time money has ruled firm, with a fairly good demand for three and four months' maturities. Sixty-day money was obtainable at 4½ per cent, ninety days at 4½ and 4¾ per cent, four months at 5 per cent, five and six months at 5¼ per cent, and seven and eight months at 5¾ per cent. Mercantile paper has been quiet and unchanged at 5 and 5½ per cent for the best names.

The Stock Market

The stock market during the past week has been somewhat abnormal, to the extent that it absolutely ignored favorable developments, which under ordinary speculative conditions would have caused a decided appreciation in values. The successful flotation of the $50,000,000 Pennsylvania loan in Paris is one of the most important developments, as it implies the probability of the placing of similar loans abroad, and increasing our credit balances thereby, with resultant beneficial effects to our money market. The increase in the Baltimore & Ohio dividend from a 5 to a 6 per cent basis should have been sufficient to carry the price of that stock very much higher, and the declaration of an initial dividend on American Locomotive common reflected the prosperity of all industrial companies. In this connection there is a probability of increased dividends on Norfolk & Western and Chesapeake & Ohio, and the beginning of dividends on Southern Pacific in August, with the possibility, if not probability, of an increase in the Union Pacific dividend to a 7 per cent basis, together with some distribution of accumulated profits in the form of an extra dividend. The Anaconda dividend was increased 25 cents per share, while the declaration on Ontario & Western was ½ of 1 per cent larger than the previous payments. These, with favorable crop reports and with generally satisfactory conditions in trade throughout the country, and with call money in liberal supply, would naturally influence bullish opinion on stocks. The result, however, was just the contrary. Material and fundamental conditions were made secondary in importance to the announcement from Washington that the Department of Justice will undertake the prosecution of Standard Oil and Pennsylvania officials, and later by rumors that the Steel Corporation and other industrial corporations are under investigation. This decision of the Administration has not thus far had any disturbing influence on trade, but it has had a very unsettling effect upon the stock market. Prices for stocks have declined very materially during the past week, and the weaker stocks have been those in which the Standard Oil interests are dominant. The break in St. Paul and Amalgamated Copper indicated that insiders were not ready to support their stocks, while the selling of the steel stocks was due, in a measure, to the unfounded report of a proposed new combination of independent companies. The weakness in Reading and Pennsylvania may be ascribed to a report that the Interstate Commerce Commission will recommend Federal control of the anthracite coal lands, but taking the market as a whole the decline represents lack of confidence on the part of outsiders and the professional element, together with the operations of a rather aggressive bear party. Just now monetary conditions will play an important part in stock market affairs, and as we are at the end of the month and the July disbursements are due, temporarily higher rates for money will probably result in lower prices for stocks.

The local traction stocks have been a feature, the most noteworthy being a further sharp break in Interborough-Metropolitan to a new low record. Brooklyn Rapid Transit has experienced a substantial decline on the agitation for a 5-cent fare over all of its lines, but there does not appear to be any reason to expect any official action until after the heavy summer season traffic is over.

Philadelphia

Extreme dullness prevailed in the market for local traction issues during the past week, and although prices displayed more or less irregularity, the closing in most instances showed fractional net gains. About the only activity displayed was in Philadelphia Rapid Transit, of which 7500 shares were dealt in. In the early dealings the price rose from 25 to 27¼, on buying said to be for New York account, but toward the close there was a reaction of 2¾ points. Philadelphia Company common was steady, several hundred shares selling at 50¾ and 51, while the preferred stock sold at 49½ and 50. Philadelphia Traction was strong at 99, and Union Traction held firm at 63 and 63¼. American Railways sold from 52 to 52½ for odd lots. The United Traction Company, of Pittsburg, has declared a dividend of 2½ per cent on its preferred stock, payable on July 20.

Chicago

Trading in the local traction stocks has been comparatively quiet, and apart from a sharp advance in Union Traction from 4⅜ to 7, on purchases of about 600 shares, the market has been without noteworthy feature. Union Traction preferred advanced a point to 15, on the exchange of 450 shares. West Chicago sold at 30 for odd lots, and North Chicago brought 40 and 41 for small amounts. Chicago City Railway was dealt in for the first time in several weeks, a small lot changing hands at 167½. Metropolitan Elevated common sold at 27½, and South Side Elevated declined from 96½ to 95.

Other Traction Securities

The Baltimore tractions have been unusually quiet, but prices generally displayed firmness. United Railway issues have been extremely dull, about $50,000 of the incomes changing hands at from 74 to 73. Of the 4 per cent bonds, about $25,000 sold at 92⅜. The certificates representing stock deposited sold from 16 to 15½ for about 1000 shares, showing a net loss for the week of ¾. Norfolk Railway & Light 5s advanced over a point to 100½ early in the week, but later lost all the improvement, the final transaction taking place at 99¼. Knoxville Traction 5s sold at 107, and Baltimore Traction 5s at 114. The feature of the Boston market has been the sharp fluctuations in Boston & Worcester common; opening at 35 it advanced to 36, but subsequently reacted to 32, which was the final figure. The preferred stock sold at 85. Massachusetts Electric was extremely quiet, several hundred shares of the common changing from 20½ to 19½, while the preferred ran off from 71 to 69¾. Other transactions included Boston Elevated at 153, Boston & Suburban at 20, West End common at 97 and 96¼, the preferred at 112 and $1,000 4 per cent bonds of 1932 at 102⅜.

There was a little activity in traction stock in Cincinnati last week, but some of the issues made good gains. Toledo, Bowling Green & Southern Traction sold at 45, an advance of 5¼ points since the last sale. Cincinnati, Newport & Covington common advanced from 72¾ to 74, and the preferred sold at 98. Toledo Railways & Light sold at 33¼, and Cincinnati Street at 142½. Cleveland Electric had a rise during the week in anticipation of a settlement with the administration, but lost on a break in the negotiations. The last sale was at 77. Lake Shore Electric advanced in all its issues, the common selling at 16⅞, the old preferred at 68½ and the new preferred at 60. Northern Ohio Traction & Light sold at 30⅛, a fractional decline. Cleveland & Southwestern common sold at 16. Toledo & Western declined from 15½ to 13¾, as the result of the announcement of the failure to sell the property.

Security Quotations

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

	June 20	June 27
Amcrican Railways	51½	52
Boston Elevated	152	153
Brooklyn Rapid Transit	81½	77⅝
Chicago City	167	165
Chicago Union Traction (common)	4⅞	4⅜
Chicago Union Traction (preferred)	15¼	12¼
Cleveland Electric	80	81
Consolidated Traction of New Jersey	81	80
Detroit United	94½	93½
International Traction (common)	59¼	58½
International Traction (preferred), 4s	80	82
Manhattan Railway	149	147¾
Massachusetts Electric Cos. (common)	20	19¼
Massachusetts Elec. Cos. (preferred)	70	68
Metropolitan Elevated, Chicago (common)	26	26
Metropolitan Elevated, Chicago (preferred)	66	66
Metropolitan Street	105½	*107
North American	96	95¾
North Jersey Street Railway	27	27
Philadelphia Company (common)	51	50¾
Philadelphia Rapid Transit	24	24¾
Philadelphia Traction	99	99
Public Service Corporation 5 per cent notes	95	95½
Public Service Corporation certificates	69	68½
South Side Elevated (Chicago)	96½	94
Third Avenue	128	128
Twin City, Minneapolis (common)	112¾	111
Union Traction (Philadelphia)	63¼	63
West End (common)	—	—
West End (preferred)	—	—

* Ex-dividend.

Metals

The scarcity of steel-making irons continues, and the indications are that there will be no appreciable increase in the supply for some time to come. Large inquiries and sales of pig iron are reported at Pittsburg. It is estimated that the volume of business of the steel mills for the month will be considerably larger than that of April. It is estimated that orders for steel rails this week will reach a total of 1,500,000 tons. Copper metal declined ⅛ of a cent a pound for all grades of refined, but the market rules steady at the new quotations. They are: Lake, 18½ and 18¾c.; electrolytic, 18¼ and 18½c.; castings, 18⅛ and 18¼c.

THE AMERICAN CITIES RAILWAY & LIGHT COMPANY

Isidore Newman & Son, bankers, of New Orleans and New York, have issued a prospectus outlining the organization and the capitalization of the American Cities Railway & Light Company, a new corporation which is to take over the properties of the Birmingham Railway, Light & Power Company, the Memphis Street Railway Company, the Nashville Railway & Light Company, the Little Rock Railway & Electric Company, the Knoxville Railway & Light Company and the Houston Lighting & Power Company.

The American Railways & Light Company was formed under the laws of the State of New Jersey, and has a capital of $15,000,000. This capital is to be increased to $27,500,000, of which $12,500,000 are preferred stock and $15,000,000 common stock. The preferred stock will be 6 per cent cumulative, with dividends payable quarterly, and is subject to redemption after three years from issue on any day when dividends are payable, at 107½, together with all cumulative dividends whether declared or not which are unpaid. It is proposed to issue immediately $10,000,000 preferred stock and $15,000,000 of common stock to secure the stock of the six local companies on the following basis, which are the terms offered to holders of the different companies:

FOR EACH SHARE OF	New Preferred	New Common
Birmingham 6 per cent preferred	$105.00	......
Birmingham common	10.00	$150.00
Memphis 5 per cent preferred	90.00	......
Memphis common	......	108.00
Nashville 5 per cent preferred	90.00	......
Nashville common	......	82.50
Little Rock 6 per cent preferred	105.00	......
Little Rock common	......	125.00
Knoxville 6 per cent preferred	102.50	......
Knoxville common	......	.90
Houston 6 per cent preferred	102.50	......
Houston common	......	187.50

The distribution of capitalization will then be as follows:

	Present Preferred	Present Common	New Preferred	New Common
Birmingham Railway, Light & Power Company	$3,500,000	......	$3,675,000	......
	......	$3,500,000	350,000	$5,250,000
The Memphis Street Railway Company	2,500,000	......	2,250,000	......
	......	2,500,000	......	2,700,000
Nashville Railway & Light Company	†2,000,000	......	1,800,000	......
	......	*3,500,000	......	2,887,500
Little Rock Railway & Electric Company	750,000	......	787,500	......
	......	1,500,000	......	1,875,000
Knoxville Railway & Light Company	500,000	......	512,500	......
	......	‡1,500,000	......	1,350,000
Houston Lighting & Power Company, 1905	500,000	......	512,500	......
	......	500,000	......	937,500
	$9,750,000	$13,000,000	$9,887,500	$15,000,000
Preferred stock applicable to defraying expenses and other corporate purposes			112,500	......
Total stock to be presently issuable			$10,000,000	$15,000,000

* Authorized issue, $4,000,000; $3,500,000 outstanding in hands of public; $500,000 owned by Nashville Company.

† Authorized issue, $2,500,000; $1,995,500 outstanding in hands of the public; $504,500 owned by Nashville Company.

‡ $1,491,900 outstanding in hands of public.

Stockholders in these companies who may elect to accept the opportunity afforded them to accept the proposition, must deliver to the depository, the Commercial-Germania Trust & Savings Bank, at its office, Carondelet and Common Streets, New Orleans, La., or to the sub-depository, the Standard Trust Company of New York, at its office, No. 25 Broad Street, New York City, on or prior to Monday, July 16, 1906, their certificates of stock in such local company, duly assigned. Negotiable receipts, substantially in the form set forth in the proposition, will be issued therefor.

For the convenience of local holders of shares of the respective local companies, United States Trust Company, of Louisville, Ky.; Bank of Commerce & Trust Company, of Memphis, Tenn.; Nashville Trust Company, of Nashville, Tenn., and American Trust & Savings Bank, of Birmingham, Ala., will receive delivery of certificates of shares of the local companies, and issue receipts therefor, exchangeable for the receipt of the depository required by this proposition, when the same shall be received.

An estimate by Messrs. Ford, Bacon & Davis of the gross earnings of the six properties involved is in excess of $6,000 000 for 1906. The estimated net earnings applicable to the stocks show an earning capacity of more than twice the dividend on the preferred stock and a surplus equivalent to 5.04 per cent on the common stock.

J. K. Newman has consented to accept the presidency of the new company.

THE CHICAGO UNION TRACTION COMPANY TO BEGIN WORK OF ABANDONING ITS CABLE LINES—VALUES OF STREET RAILWAY PROPERTIES SUBMITTED

The Chicago Union Traction Company has filed with the City Clerk formal acceptances of the ordinances passed by the City Council for trolleyizing its lines. It is stated that the work of placing the wires and poles for all of the West Side lines will begin at once. The first work will be done on the Blue Island Avenue line. General Manager John M. Roach has said that he expected to be able to comply with the ordinances which demand that the West Side lines shall be equipped for electric operation in sixty days from the time authority was given, and that the work on the North Side lines shall be completed within ninety days. The Chicago City Railway Company has not yet accepted the ordinances, but it is said that the cable cars will be off the South Side lines by Jan. 1. The Union Traction Company intends to equip its present cars for electric operation by wiring them and mounting them on new trucks. The Chicago City Railway, it is said, will obtain new cars, and it has contracts for fall delivery of fifty-five cars of its latest type. It is further intended to change the present cable power houses to rotary converter sub-stations. Regarding the changes, President Mitten is quoted as having said:

"My idea is to put on practically new cars. We can utilize some of the present car bodies, but not a great many, and then only the best ones. The company must make its new service in Cottage Grove Avenue equal to that in Indiana Avenue and Wentworth Avenue. As things are now traffic is deserting Cottage Grove Avenue and going to Indiana Avenue, and we can put all the cars in the latter street the tracks will carry, and not be able to take care of the people. If, however, we had as good service in Cottage Grove then the traffic would distribute itself and there would not be the trouble."

The long expected figures of the values of the tangible property of the Union Traction Company and the Chicago City Railway have been presented to the City Council. The values fixed by the company are much in excess of the estimates made by Bion J. Arnold in 1902, which are as follows:

Values as submitted by railway companies:

Union Traction	$27,401,218
Chicago City Railway	20,103,936
Total	$47,505,154

Values fixed in 1902 by Engineer Bion J. Arnold, based on the cost of reproducing lines:

Union Traction	$22,214,635
Chicago City Railway	17,172,424
Total	$39,387,059

Fixed by Mr. Arnold in 1902 as value for electric railway purposes:

Union Traction	$14,937,088
Chicago City Railway	11,747,818
Total	$26,684,906

W. W. Gurley, general counsel for the Chicago Union Traction Company, in presenting the figures for that corporation, said:

"This amount has been arrived at by determining the cost at current prices of reproducing the property in question and deducting therefrom the amount of money that would be required to place the present property in a condition as good as new, for the purposes of operation as a street car system, using the motive power which is now being used in the respective streets.

"The above amount does not include any estimate on work yet to be performed, either in the way of paving streets, reconstruction of tunnels, electrifying or equipping lines of railway or in procuring new or modified cars.

"We assume that all items expended hereafter in the improvement of the property will be taken into consideration as a part of the expense of the proposed rehabilitation or will be added to the value of our present tangible property.

"For lack of time we have not been able to determine the value of the unexpired franchises and rights of the various companies interested in the traction systems. If, as has been stated at previous meetings of your committee, the city is to appoint experts to verify these valuations, we stand ready to appear before those experts and inform them fully as to the separate items of property and the valuations thereof."

President Mitten, in his statement of the Chicago City Railway Company's estimates, said:

"The value of the tangible property of this company, as represented by our schedules, to be considered in the event of our arriving at a settlement with the city upon an indeterminate license plan, is $20,103,935.89, and is based upon reproduction at current prices, less cost of bringing property at this date up to a condition operatively equal to new, and includes all of the new tracks constructed to date and the new cars now in service. The new paint shop and sub-stations now being constructed are omitted, but will necessarily be included as a part of the contemplated reconstruction, together with such additions as may be made prior to the actual transfer of the property.

"The valuation of unexpired franchises is not included, but will be submitted as soon as the work of preparing the same can be completed.

"If the city desires to appoint engineers to verify these values, the company's engineers will appear before them and supply the details upon which these values are based."

Mayor Dunne considers the estimates far in excess of what the lines are really worth. He says they are based on a wrong method of calculation, and that it is absurd to consider the actual value of the cable systems when they are so antiquated.

TRANSIT MATTERS IN NEW YORK

The New York, New Haven & Hartford Railroad Company has applied to the Rapid Transit Commission for a franchise for a four-track railroad to run from the terminus of its road at Woodlawn south to the tracks of the Harlem River & Portchester Railroad (owned by the New Haven line), thus affording an all-rail connection with Port Morris and doing away with the use of the New York Central's tracks. The application was referred to the board's committee on plan and scope.

The New York Central & Hudson River Railroad Company, in a letter to the Transit Commission, has signified its willingness to co-operate with the board in placing in a subway the present tracks on Tenth and Eleventh Avenues. Engineer Rice said that a plan was now under consideration for the placing of the tracks in a subway. He said that the chief engineer of the company and himself were in consultation already.

The New York Connecting Railroad Company has renewed its request for a franchise. The Board of Estimate had appointed a special committee to investigate the proposition, and its report was read. The committee wanted some light on the proposition as to route and to the amount of freight to be carried before passing judgment on the question. It was estimated that the cost of the road would be about $1,000,000 a mile. Another conference of the Board of Estimate and the committee of the Rapid Transit Board was finally ordered.

Corporation Counsel Delaney has submitted his opinion that the Interborough Rapid Transit Company had no franchise to construct a third track on the Third Avenue elevated structure. Geo. L. Rives, counsel for the Rapid Transit Board, to whom was referred the Corporation Counsel's opinion on the third track proposition, said that a grant from the board was necessary before the company could build such a track. Controller Metz said that if the third track would help transit facilities the application should be granted. On the suggestion of President Orr it was decided to hold a public hearing on the matter on June 28.

IMPORTANT LEGAL DECISION AFFECTING ELEVATED IN NEW YORK

The Court of Appeals, a few days ago, in an action brought in 1901 by the owner of property on Sixth Avenue, along the line of the Manhattan Elevated Railway, reversed the decision of the lower courts, and held that abutting property owners are barred by the statute of limitations from bringing actions for damages to easements through the operation of the railroad after twenty years from the commencement of operations. Judge Vann wrote the opinion. "The elevated roads south of the Harlem River were constructed and put in operation between June, 1878, and August, 1880, the company claiming that under the statute abutting owners became barred twenty years later, viz.: between June, 1898, and August, 1900. The court held that the fact that the company had settled with many property owners similarly situated, and in various tax petitions had admitted its liability for damages to abutting property owners was irrelevant, maintaining that there was no privity between the plaintiff and other owners. The counsel for the company estimates that the number of such claims still outstanding or unsettled is about 7500, and their aggregate value, based on judgments and voluntary settlements already made, would be from $6,000,000 to $8,000,000."

MAYOR JOHNSON ANNOUNCES PLANS OF THREE-CENT FARE COMPANY—OTHER DEVELOPMENTS

Having overcome the long series of legal entanglements which have held up the building of the so-called 3-cent fare system in Cleveland, Mayor Johnson, of Cleveland, has announced the plans of the company. He states that a leasing company representing the city will take over and operate the property of the Forest City Street Railway Company, the name of the low-fare company. The Municipal Traction Company, the proposed holding company, was incorporated at Columbus, Ohio, last week, with nominal capitalization of $10,000. The Forest City Street Railway Company at the same time increased its authorized capital stock from $250,000 to $2,000,000. Of this amount $700,000 will be issued at once, and the proceeds will be used by the Municipal Traction Company in the completion of the lines already started by the Forest City Company, the purchase of power house equipment, rolling stock, etc. The names of the five directors who will operate the municipal company, as announced by Mayor Johnson, are: A. B. DuPont, of Detroit, Mich., who has been associated with Mayor Johnson in a number of his traction ventures; Frederick C. Howe, a traction expert; Edward Weibenson, a prominent banker who is secretary of an Ohio interurban road; C. W. Stage, county solicitor and an associate of Mayor Johnson, and William Breif, a prominent business man.

In his statement Mayor Johnson says that while the Municipal Traction Company will be nominally a corporation for profit, its purpose will be to act rather as an intermediary between the public and the street railway company. The lease under which it will operate will define the amount of profit which can be earned by the company and guarantee the payment back to the public of any residue above this guaranteed dividend. The repayment to the public may take either the form of betterment and extension of the service or the purchase of the property by the city. The statement says:

"The issue of stock by the Forest City Railway Company and the lease of the property by the Municipal Traction Company is to be upon the following conditions:

"(1) Neither preferred stock nor bonds shall be issued by the Forest City Railway Company, nor shall its property be encumbered by mortgage in any way.

"(2) The issue of $700,000 of common stock shall be sold at 90 cents on the dollar, and shall be entitled to 6 per cent accumulative dividends at par.

"(3) All stock so sold and all stock already sold shall be subject to an option to purchase from the Municipal Traction Company by the city at $1.10 and accumulated dividends.

"(4) All present stockholders of the Forest City Railway Company shall subscribe to these terms, and none shall have the slightest advantage or preference over another.

"(5) All proceeds of the sale of the stock of the Forest City Railway Company shall be expended by the Municipal Traction Company in the construction and operation of the street railway system, and the vouchers for all expenditures shall be open for inspection by the city authorities or by the public at large. This publicity shall attach to any work which shall be done in the future or which has been done in the past, since the formation of the company.

"(6) At any time the city may be empowered by law, and may desire to do so, it shall be permitted to enter under the lease in place of the Municipal Traction Company and assume and exercise the option to purchase, operate and maintain the system of the Forest City Railway Company.

"(7) The Municipal Traction Company shall pay all operating expenses of the Forest City Railway Company, a reasonable charge for depreciation, the accumulative dividend of 6 per cent on the outstanding capital stock, the expenses of the Municipal Traction Company, and shall devote all surplus earnings to the betterment of the service, to exercise the opinion to retire the capital stock of the Forest City Railway Company, or the reduction of fares."

The statement continues in part:

"The property which the Forest City Railway Company will turn over to the leasing company will consist of 5 miles of track already constructed, and 9 miles under construction. Work is being pushed in the laying of track and pavement; cars are being purchased, and part of the road should be in operation in the fall. Extensions to all parts of the city will be sought without delay, and new construction will be pushed with all speed.

"The remaining $1,300,000 of the Forest City Company's stock will be issued and sold from time to time, and the proceeds applied to new construction. By reason of the expiration of the grants of the 5-cent fare company on Central Avenue, and the nearness of the expiration of franchises on other streets, as well as the wide field in this rapidly growing city for more and better street railway service, the growth and extension of the low-fare system will be rapid as construction work will accommodate.

"Every franchise grant made to the Forest City Company by the city shall be safeguarded in every conceivable way against any abuse, and all future grants will pass under the lease of the Municipal Traction Company."

The Forest City Company is doing some rapid construction work. On the Denison Avenue line, work is being pushed to Lorain Street, and last Saturday and Sunday the company built more than a mile of track along Marcelline, to dodge injunction suits. This track lies in the southeasterly portion of the city, across the river from the Denison Avenue line, and is about 4 miles from the center of the city. It is said that the low-fare company proposes to build a line along the southerly border of the city, in which event the Marcelline Avenue line might be of some value. The line could also be used to form part of an entrance for an interurban line building to the south.

Last week Mayor Johnson and Horace Andrews, president of the Cleveland Electric, held a conference, relative to the leasing of the old company to a company representing the city. It will be remembered that this was proposed some months ago, and Mayor Johnson practically offered to accept $85 per share for the property. At the meeting last week, Mayor Johnson said that in view of recent developments, he thought the value of Cleveland Electric had declined 10 points. This probably puts a quietus upon the acceptance by the company of any leasing plan, although the directors had expressed a willingness to consider such a plan, providing they received a fair proposition. The company received the report of Prof. Bemis, who was retained by the city to estimate the value of the company's property, while the city was given the report prepared by Secretary Davies upon the same subject. As has been intimated, the two reports are a long way apart by reason of the difference of opinion as to the values of existing franchises. Other meetings are to be held.

A new phase of the situation has been presented by the announcement that the Cleveland Electric Railway Company has received a proposition to lease the property to Eastern interests, who are represented in Cleveland by Henry Everett, formerly president of the company. President Andrews declines to disclose the identity of the new people, or to speak of their proposition, but he has denied that it is the so-called Widener-Elkins syndicate, which is securing numerous other traction properties in Ohio. It is also stated that the same syndicate is planning to acquire the Lake Shore Electric and other interurban lines radiating from Cleveland, with a view to making a huge system. The leasing of the property would carry with it the burden of concluding negotiations with the city for the final settlement of the franchise problem.

OUTING OF THE NEW ENGLAND STREET RAILWAY CLUB

The June outing of the New England Street Railway Club was planned for Thursday, June 28, at Salisbury Beach, and a most attractive itinerary had been arranged. The party was scheduled to leave Boston at 9:30 o'clock, in special cars over the Boston & Maine Railroad for Newburyport. Through the courtesy of the Haverhill & Amesbury Street Railway Company, L. E. Lynde, superintendent, planned to take the party in special cars from Newburyport to Salisbury Beach; from there to Black Rocks, and on the return journey to Newburyport. A first-class shore dinner was arranged to be served at Hotel Cushing.

STRIKE IN PENNSYLVANIA

The employees of the Lehigh Valley Transit Company, operating in the slate and cement regions of Lehigh County, Pa., and part of Northampton, with lines from Allentown run to Bethlehem, Nazareth, Slatington, Slatedale, Emaus, Macungie, Hellertown, Catasauqua, Coplay, Egypt, Northampton Siegfried, Allentown and Philadelphia, are on strike, and conditions throughout the territory affected have assumed a serious aspect. The militia has been called out. The trouble is over a question of the recognition of the union.

A BILL TO PREVENT MERGERS IN MASSACHUSETTS NOW

A drastic bill, designed to prevent foreign railroad corporations from purchasing Massachusetts street railway companies and forcing foreign companies to relinquish any such railways which they may control, was before the committee on rules of the House, Saturday, June 23, on the question of the admission of the measure for consideration. The measure was received from Attorney-General Dana Malone, who had been requested, under an order of Representative Weeks, of Everett, to point out what form of legislation would be necessary to prevent the purchase of street railway properties by railroads organized under a foreign charter. Especial interest was attached to the Attorney-General's bill, because its provisions have the sanction of Gov. Guild, who, it is stated, is anxious to have the matter considered before the adjournment of this General Court. The suggested restriction of foreign railroad corporations follows a defeat of the so-called "merger bill," to which reference was made in the Street Railway Journal last week. Gov. Guild congratulated the Legislature on the defeat of this measure. After a conference of various committee chairmen of the House, it was agreed that the Railroad bill and Governor's message should have a public hearing, and next Tuesday forenoon was assigned as the time for the opening of the hearing.

Chairman Cummings opened this hearing by reading the Governor's message. He said that the committee intended to hear everybody who had anything to offer. The committee wanted the advice of sound business men and sound lawyers, and would first hear those in favor of the enactment of such legislation. Representative Weeks, of Everett, called the attention of the committee to the bill, along these lines, that he had introduced House bill 1358. He also called attention to the fact that four-fifths of the members of the lower branch of the Legislature had gone on record that in their opinion such consolidation was adverse to good sound public policy. In response to a question by Committeeman Turtle, Mr. Weeks said the evil to which he referred was not so much a present one as the possibility of a future absolute control of all transportation lines in the State by one corporation. John C. Cobb, chairman of the legislative committee, Boston Merchants' Association, made a long speech, in which he said the board of directors of the Merchants' Association, at a meeting called for the purpose of considering the Governor's message, unanimously endorsed the position taken by the Governor, and instructed him, as their representative, to support the Governor's message. At the close of his speech, Mr. Cobb said he thought the question comes down to one of whether the State desires competition or monopoly. The Legislature has no authority to control the ownership of stock, but it has the right to say that no railroad shall have the right to control and operate both a railroad and a street railway in this State at the same time. If there was such a law the road would be very careful about owning street railway stock, even through New York parties.

Representative Luce, of Somerville, followed Mr. Cobb, and presented to the committee a bill which differs materially from that suggested by the Attorney-General. He said he did not present it with the idea that the bill suggested by the Attorney-General would not prove efficacious, but thought his own would give a better solution of the problem. He said he had heard many strictures on the bill suggested by the law officer of the Commonwealth, and upon investigation had found that his bill very closely follows the existing law, and if it is bad law then the codification bill recently enacted by the Legislature is also bad law.

The House adjourned to meet Wednesday afternoon at 4 o'clock, when it is expected that the committees on railroads and street railways will report an anti-merger bill. The bill will then be given its first reading and go into the orders of the day for Thursday.

Sealed proposals will be received at the office of W. W. Gurley, 914 Marquette Building, 204 Dearborn Street, Chicago, and be opened Thursday, July 5, 1906, by the receivers of the Chicago Union Traction Company, James H. Eckels and Marshall E. Sampsell, for lowering and making changes in Van Buren Street tunnel, under the south branch of the Chicago River. Other work to the tunnels also is to be done, in accordance with specifications on file with Engineer S. G. Artingstall, Postal Telegraph Building, Chicago.

OFFICIAL RETURNS CONFIRM DENVER ELECTION RESULTS

In the Street Railway Journal of May 26, brief mention was made of the result of the municipal election held in Denver May 15, which resulted in the settlement of a number of questions of great importance to the Denver City Tramway Company and other interests. Quite recently the official returns of the election were formally announced, confirming the original result, but changing the figures somewhat. A complete statement of the questions voted upon by the tax-paying electors and the decisions recorded follows:

The Union Pacific Railway Company, to lay tracks for steam road on Blake Street. This was defeated.

The Denver Terminal Company, to lay tracks on certain streets of the city for alleged suburban lines. This was defeated.

The Municipal Traction Company, for a street railway on various streets of Denver, and covering much of the territory now covered by the Denver City Tramway Company. This was defeated by a heavy vote.

The Northwestern Terminal Company, for tracks on various streets to let "The Moffat Road" into Denver. This was carried by a substantial majority.

The Denver Gas & Electric Company, now operating in the city, to lay gas pipes and erect poles to supply electricity. This was carried by a small vote.

The Denver City Tramway Company, for a franchise for a period of twenty years, covering the present lines, some of which would expire in about fourteen years, and some 80 miles of extensions, to be built at the rate of at least 10 miles per annum. The payment into the city treasury of $1,200,000, payable at the rate of $5,000 per month on the first day of each month during the life of the franchise, and to be used only in the improvement of streets, boulevards and parks, and to be in lieu of all license tax on cars. The sales of half-fare tickets for children over six and under twelve years of age by conductors at the rate of ten for 25 cents. Providing for free transfers to connecting lines, but not to lines reaching the vicinity of end of line to which transfers are given. Also the extension of certain viaducts of the city at the cost of the company, and the paving between and for 2 ft. on each side of the tracks of the company at the company's expense and keeping same in repair. Litigation pending between the city and the company as to its present grants and rights of way, etc., not affected by the franchise voted. This was carried by a majority of 185 votes.

Of the four daily papers three opposed the franchises. In the case of "The Post," which was behind the application of the company known as the Municipal Traction Company, it supported this one and opposed all the others. The "Denver Republican," on the other hand, supported all of the applications except those of the Denver Terminal and the Municipal Traction Companies.

SAN FRANCISCO RAILWAY NOTES

The work of reconstructing the Sutter Street car line in San Francisco is proceeding very satisfactorily. The southerly track has been completed from Market Street to Fillmore, and work is now being rushed on the other track, so the United Railroads ought to be able to start running cars as far as Fillmore before July 1. The Sutter Street Railway Company, which operated the horse cars on lower Market Street from the ferry to Sutter, has petitioned the Board of Supervisors for permission to use the overhead trolley. The tracks will be used in conjunction with those of the United Railroads. The company also agrees to furnish light along its line. But this offer seems superfluous, as the United Railroads had previously agreed to light the same blocks.

The railway company has laid a standard girder-rail track on Post Street for the two blocks between Leavenworth and Larkin Streets, under a temporary permit, primarily, it is stated, for the hauling of debris. It will serve the important purpose of affording a connection between the company's Post Street line and the cross-town line on Larkin and Polk Streets, and from the manner in which the track has been laid the suggestion has gone forth that the company aims to use it as a permanent link in its system of overhead trolley lines. This will probably be done, should the people want the track to remain.

According to Superintendent Harris, of the California Street Railway Company, the cable system of the company will be in operation by Aug. 1. At the start cars will probably be run on California Street only between Kearny Street and Presidio

Avenue. "This part of the track," says Mr. Harris, "is in excellent shape, with the exception of two small stretches of track at the Larkin and Palk Street crossings. Below Kearny Street the roadbed will require considerable repair and rebuilding. The earthquake did considerable damage to the track below Sansome Street. The slot is closed in places and the track is very uneven. Most of the damage, however, was caused by the fire. This is particularly true of the track on O'Farrell, Jones and Hyde Streets, where the heat was so intense that it warped the track and slot rails out of shape. It will take longer to get this portion of the road in shape for operation; so we have decided, as a starter, to get the California Street line running.

"Unfortunately, we lost all of our cars. We had fifty-two cars, but operated normally about thirty-nine or forty. To meet the immediate needs of the company, we are having twenty-five cars built at the Hammond shops, at Seventh and Berry Streets, and these will be ready in six weeks."

Superintendent Harris says that new cables will have to be installed before cars can be run on the California and Hyde Street lines. The cable suffered considerable from the fire, notwithstanding the fact that it was 18 ins. below the surface of the street. One of the curiosities of the conflagration is to be seen in the north slot of the California Street line close to the Hyde Street crossing. Here the cable was subjected to such intense heat from the flames of the adjoining buildings that at one place the wire strands completely melted.

The Kearny Street line is now in operation from the Southern Pacific Depot, at Third and Townsend, to North Beach, by way of Third, Kearny, Broadway and Powell Streets.

The United Railroads has resumed the operation of its sightseeing cars, three trips being made daily from the ferry. The route takes in the Cliff House, Affiliated Colleges and the Mission District.

The service on the Hayes Street line, commenced a few days ago, has been suspended temporarily until heavier rails can be laid to replace the light track that was found not to be sufficient to carry the heavy electric cars without derailment.

It is declared on reliable authority that the United Railroads have arranged to take over the Presidio & Ferries Railroad Company, more familiarly known as the Union Street line.

For the present the Union Street road will continue to be known as an independent line. It is seeking permits from the Supervisors on that basis. Before long, however, it is asserted that the road to the Presidio will become one of the proprietary lines of the United Railroads, or at least a friendly connection. The United Railroads will soon be found supplying the Union Street road with power, cars and transfer facilities, if it does not take the road over into its system.

The Union Street line has asked the Supervisors for permission to convert its road into an electric line and to erect poles and wires for the operation of electric cars. Its application has already been passed upon favorably by the street committee of the Board.

BOARD OF ESTIMATE OF NEW YORK ASKS FOR NEW SUBWAY PLANS

The Board of Estimate held a long session and disposed of a large amount of routine business Friday, June 22. On motion of President Coler, of Brooklyn, the board passed by unanimous vote a resolution asking the Rapid Transit Commission to proceed forthwith to prepare plans for an elaborate extension of the subway system to connect all boroughs. The resolution in full follows:

"Resolved, That, in accordance with Section 4 of the Rapid Transit law, as amended, the Board of Estimate and Apportionment, as the local authorities of the city of New York, hereby requests the Board of Rapid Transit Commissioners of said city to proceed forthwith to the consideration of a rapid transit subway system to serve the transportation needs of the city by a continuous system of connected routes in the boroughs of the Bronx, Manhattan, Brooklyn and Queens, with provision for a future extension line into the borough of Richmond; said rapid transit line to begin at a point in the borough of the Bronx, to be recommended by the president of said borough, to proceed thence to the borough of Manhattan, and along certain streets in said borough, to be recommended by the president of said borough, to connect with the Williamsburg Bridge, and crossing said bridge to proceed in the borough of Brooklyn through Broadway to Jamaica Avenue, and to connect also with the Manhattan Bridge, and crossing said bridge to proceed in the borough of Brooklyn by way of Flatbush Avenue, as extended, and Flatbush Avenue and Fourth Avenue to Fort Hamilton, with a spur connection at Fortieth Street for extension to Coney Island; and,

"Resolved, That the Board of Estimate and Apportionment recommends to the Rapid Transit Commission that the said rapid transit system be provided for in a contract or contracts which shall insure the operation of the entire system, as recommended, by one corporation, whether said corporation be a private corporation or the corporation of the city of New York."

THE CLAIM AGENTS' QUESTION BOX

The American Street and Interurban Claim Agents' Association is making this year its first attempt at a question box, and a call has been issued by Secretary B. B. Davis, of the association, with headquarters at 14 North High Street, Columbus, Ohio, for replies to a series of twenty-four questions, appended hereto. Answers are requested by Aug. 1, so that the classification and preparation for publication and distribution before the annual convention on Oct. 15, can be carried out so as to insure the best results. In replying to questions it is only necessary to answer by number, and not to repeat the question. Replies should all be signed. The queries for the box follow:

1. Is it good policy to settle personal-injury claims in which there is, according to the investigation, no liability, when it can be done along close lines, or shall we stand on these cases and settle only those which are close or for which we are clearly liable?
2. What steps are taken, and by whom, to collect damages for injury to cars on the street by vehicles, etc., owing to neglect or recklessness of drivers, or the breaking of glass by persons outside or inside of cars through no fault of the company?
3. What is the law in your particular State in a case where a pedestrian or teamster is struck by a car while crossing electric tracks; who testifies that he looked and listened and failed to see the car; where the conditions are such that he could not help seeing it, if he had looked, and where it would be self-evident from the surrounding circumstances that the man was committing perjury. Could he be convicted of perjury in your State if the jury find for the defendant in a damage case?
4. What is the best way to break up ambulance chasing?
5. What is the custom or practice in regard to calling upon injured persons, especially when there is no liability?
6. How can conductors and motormen be made to render reports of accidents seemingly trivial?
7. What qualifications should a claim agent possess to be successful?
8. Is it advisable to declare your identity to possible claimants in every accident which occurs, or not? If so, why? If not, why?
9. Is it advisable or a good policy to obtain medical examinations in all cases of injuries, and how soon after the accident?
10. What is the best method to adopt in the investigation and disposition of "blind or unreported cases?"
11. What is the best method of settling claims; by cash, check, or order on the treasurer?
12. Is it a good plan to discuss cases with attorneys after case has been placed in their hands?
13. What is the best plan to adopt when prominent physicians, who are inclined to be friendly, present a bill for double the amount charged in ordinary cases?
14. Is it better to interview an injured person before the investigation is made in order to get his or her statement first?
15. Should surface railway companies have a regularly employed physician?
16. Does sending a physician in minor cases aggravate the case and make it more difficult for settlement and more expensive?
17. Which is the better qualified, the operating, or claim department, for instructing train men in their duty in relation to accidents?
18. What is the best form of blank release to be used in settlement of cases, to safeguard it against future attacks?
19. What statistics relating to accidents should a claim department have, and of what value are they?
20. Of what value are photographs in the disposition of claims?
21. What is the best way to maintain harmonious relations between the claim and operating department?
22. What has been your experience in following up so-called permanently injured persons after their claims have been disposed of? Wouldn't it pay to keep them under observation?
23. What is the best plan in securing full details and protecting company's interests in accidents resulting in death?
24. What instruction should be given conductors and motormen regarding accidents when they first enter service? In what manner should instruction be given?

The Indianapolis, Crawfordsville & Western Traction Company has increased its capital stock from $2,000,000 to $3,000,000. The road is expected to be under construction, 45 miles, extending from the Industrial School for Girls, a State institution, west of Indianapolis, via Clearmont, Brownsburg, Pittsboro, Raintown, Lizton, Jamestown, New Ross, Mace to Crawfordsville. Track laying to begin July 1. The Marion Trust Company, of Indianapolis, is said to be handling the financial end of the operations. Edward Hawkins is president of the traction company. A mortgage for $3,000,000 was recently filed.

SCHOEPF SYNDICATE FORMS BIG COMPANY—AFTER DAYTON & TROY

The Indiana, Columbus & Eastern Railway Company, recently incorporated by the Schoepf syndicate to take over and operate a number of the properties of the syndicate, has filed papers with the Secretary of State of Ohio increasing its capital stock from $1,000,000 to $12,000,000. Of this amount 100,000 shares are common stock and 10,000 shares 5 per cent preferred. At the same time the Columbus, Newark & Zanesville Traction Company reduced its capital from $1,500,000 to $850,000, retiring its preferred stock. The capital stock of this company was then increased to $6,250,000, of which 49,000 shares are common and 5000 preferred. The explanation of these changes is that the Columbus, Newark & Zanesville Traction Company has absorbed the Columbus, Buckeye Lake & Newark Traction Company and the Zanesville Railway Light & Power Company, and their securities are retired by the new issues.

The Indiana, Columbus & Eastern will buy or lease and operate nearly all the Ohio lines of the Schoepf syndicate, including the lines above mentioned, which were acquired from Tucker-Anthony, the lines acquired from the Appleyard syndicate, the Dayton & Western, the Dayton & Northern, and that part of the Dayton & Muncie from Greenville to Union City, the Columbus & Lake Michigan Railway, the steam road operating from Lima to Defiance, and the lines under construction from Lima to Bellefontaine and from Lima to Toledo. The new capital will provide money to install additional power where needed, and to place the various properties in first-class shape for fast long-distance service.

Much interest attaches to the report that the syndicate is again seeking to acquire the Dayton & Troy Electric Railway. The syndicate tried some time ago to get this road, but the Clegg family, of Dayton, who own it, declined to sell except at a price which was deemed unsatisfactory to the Cincinnati syndicate. The Dayton & Western, owned by the Winters family, which was closely allied with the Clegg family, occupied a similar position with regard to that road, but the property was turned over to the big syndicate on a leasing arrangement. The report is that the Dayton & Troy may be acquired under a similar arrangement, which will leave the ownership as heretofore, but with the operation in connection with the big system. The peculiar importance attached to this particular situation is that the Dayton & Troy is in an alliance with the Western Ohio and the Toledo Urban & Interurban for handling through business between Dayton and Toledo. The syndicate tried some time ago to secure the last two roads, and upon failure to get them they decided to build a line from Lima to Toledo. This is now well under construction, so that for the through business between the two large cities it now has no need of the Toledo Urban & Interurban or the northern section of the Western Ohio between Lima and Findlay. To secure a direct connection for its new Lima-Toledo line it does need the Dayton & Troy. The syndicate owns the Dayton, Springfield & Urbana and the Urbana, Bellefontaine & Northern, and these in connection with a line which it is building from Lima to Bellefontaine will make a through line from Dayton to Lima and Toledo, but it is so indirect that well-informed traction people do not believe that the syndicate could, or would, attempt to compete for time with the more direct lines, hence the desire of the syndicate to secure these lines and the great interest which attaches to the outcome of the new negotiations for the Dayton & Troy.

THE NEW BRITAIN THIRD-RAIL LINE TO BE DISCONTINUED

In the Superior Court at Hartford, Conn., Corporation Counsel Hungerford, of New Britain, and Attorney Lucius F. Robinson, representing the New York, New Haven & Hartford Railroad Company, appeared before Judge Silas A. Robinson and submitted a form of judgment agreed upon in the suit to restrain the company from continuing to operate the New Britain third-rail line. By this judgment the third rail will be discontinued Aug. 1 of this year. The judgment is as follows:

"This action by complainant claiming an injunction against the operation by defendant of its railroad within the city of New Britain by means of a third rail charged with electricity and claiming other relief, came to this court on the first Tuesday of September, A. D. 1905, and thence to the present time. The defendant on the 2d day of November, 1905, filed its demurrer to the complaint. Upon the 28th day of March, 1906, upon motion of the plaintiff, the city of New Britain, the State of Connecticut was made a party plaintiff in this action, and upon motion of said plaintiff, the city of New Britain, allowed on the 28th day of March, 1906, the complaint was amended as appears by the amendment on file. Upon the 25th day of April, 1906, the defendant withdrew its demurrer to the complaint and filed notice of its intention to refuse to plead further in said action. The court thereupon having heard the plaintiff finds that the allegations of paragraphs one, two, three, four, five, six and eight of the complaint as amended are true, and the court further finds that the plaintiff's third prayer for relief ought to be granted, and that a permanent injunction should issue against the operation of the defendant's railroad within the limits of the city of New Britain in the manner set forth in the complaint.

"Whereupon it is adjudged that the defendant and its servants, agents and lessees be, and they are hereby, enjoined each under a penalty of $10,000 against the operation of the defendant's railroad within the limits of the city of New Britain on and after the 1st day of August, 1906, by means of the system of operation known as the third-rail system, that is, by means of a third rail charged with electricity, and it is adjudged that no party to this action recover any costs from any other party."

G. A. R. CAUSES HEAVY TRAFFIC IN OHIO

Traction lines in the vicinity of Dayton reaped a big harvest from the annual encampment of the Ohio Grand Army of the Republic, held in that city a few days ago. The steam roads declined to give the veterans the usual rate of 1 cent per mile, and would make no reduction from the 2 cents a mile rate now in force. As a result, the soldiers took the traction lines as far as possible, for they gave reduced rates and ran special cars from all points in the district. The Columbus, London & Springfield Railway had nearly 500 out of Columbus, and the Dayton, Springfield & Urbana, 300 out of Springfield. The Dayton & Troy—Western Ohio—Toledo Urban & Interurban limited service from Toledo to Dayton was taxed to its uttermost carrying capacity for two days. Double headers, and in some cases three sections, were run on each train. In addition there were several specials out of Toledo, five specials out of Findlay, six out of Lima, and so on all down the line. There were few delays and no accidents reported, and the tractions not only gathered in a fine lot of extra business, but secured an immense amount of advertising, as the newspapers all over the district commented upon the excellent service given by the electric lines.

TRAINS FROM LOS ANGELES TO THE COAST

Officials of the Pacific Electric Railway Company are planning to run trains of three coaches between Los Angeles, the seashore and other important interurban points. According to officials of the company the improvement is absolutely necessary. The trains will be made up of two motor coaches and a trailer. Each train will have a seating capacity of 150 persons. The trains will be through ones entirely. The company will provide individual coaches to take care of local demand. A test of the new train is now being made by Chief Electrician S. H. Anderson, and Mr. Huntington will be one of the party to make the trial trip. J. McMillan, general manager of the Pacific Electric, has been working on the scheme for months, and if a test proves successful, interurban electric trains will become important factors in Southern California transportation.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JUNE 19, 1906

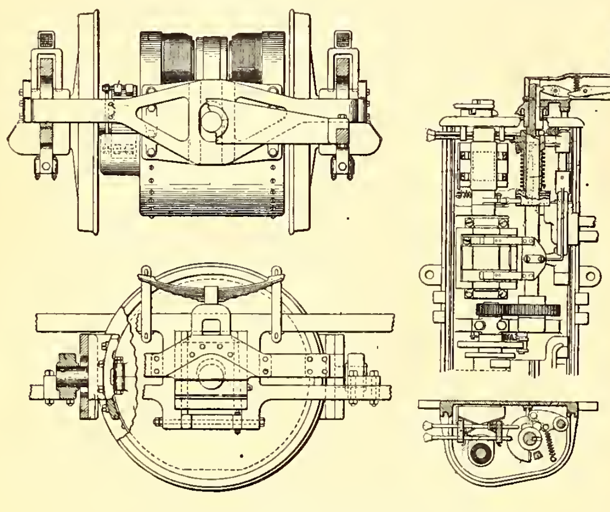
823,513. Safety System for Operating Railroads; William H. Dammond, Detroit, Mich. App. filed Feb. 17, 1905. Insulated sections incorporated in the track, which constitute receiving stations by which the messages are transmitted to the train from points along the road. Also actuates danger and caution signals in front of the train.

823,646. Signaling System; Jacob B. Struble, Wilkinsburg, Pa.

App. filed April 11, 1905. A signaling system for railways employing an alternating current as a motive power, and a rail of the track as a return for the alternating current in which a closed track circuit is employed, the usual current in which effects a suitable form of translating device, which device responds to the usual current in the track circuit in its noraml operation. The translating device in turn may control a circuit including an operating mechanism for a signal device comprised in a railway signal, or the translating device may directly operate the signal.

823,648. Railway Signaling; Louis H. Thullen, Edgewood, Pa. App. filed Feb. 5, 1904. A signal system for electric railways in which the motive power for the motors is alternating current with a return for the propulsion current through the rails. Had a source of direct current for energizing the rails of the block sections.

823,732. Safety Railway Switch Structure; Henry R. Luther, Newton, Mass. App. filed Sept. 1, 1905. Details of construction of a lock for the switch point, preventing the same from being jarred out of place by the wheel flanges passing over the heel of the switch point.



PATENTS NOS. 823,969 AND 823,992

823,992. Emergency Brake; Fred. B. Corey, Schenectady, N. Y. App. filed March 21, 1903. Mounted within the controller casing and operatively connected in the car-brake system is an emergency valve, which is adapted to apply the brakes in case the controller handle is released in any of its operative positions.

823,966. Brake Actuating Device; John Post, Philadelphia, Pa. App. filed Feb. 12, 1906. The brake-shoes are secured to the piston rods of steam cylinders, and a steam circulating system connects the cylinders with controller valves at each end of the car, which valves are in turn connected with a steam boiler.

823,968. Electric Locomotive; Edward D. Priest, Schenectady, N. Y. App. filed Jan. 28, 1905. Four pairs of wheels are provided on each of which is a direct-connected motor. The invention relates particularly to a form of suspension by which the weight is evenly distributed to all of the wheels.

823,969. Electric Locomotive; Edward D. Priest, Schenectady, N. Y. App. filed Jan. 28, 1905. Modification of the above, and relates particularly to a transverse suspension system for keeping the pole faces of the motor in parallel with the armature.

WARNING AGAINST ACCIDENT FAKIRS

Edward Fitzgerald, claim adjuster for the Cincinnati, Newport & Covington Traction & Light Company, has sent out a circular letter warning street railway companies against a party of accident fakirs that recently attempted to operate against his company. A woman with a child in her arms boarded a car late at night, and as she was slow in taking her seat the car started, and she was thrown against the seat and the child dashed to the floor. The woman's husband and a couple of friends were on the car when the "accident" took place. It appears that she was suffering from an old injury, and a doctor who was attending her was in the deal. Three suits were filed—one for injuries to the woman, one for injuries to the child, and one by the husband for loss of services of wife and child.

PERSONAL MENTION

MR. W. R. COOPER has been appointed editor of the "Electrician" (London) in place of Mr. F. C. Raphael, who retires June 30.

MR. A. M. HEWES, of Chicago, was elected a director of the Indianapolis, Crawfordsville & Western Traction Company at the special meeting of the board of directors June 19.

MR. NICOLAS LE GRAND has resigned as manager of the supply department of the St. Louis Car Company, and will engage in the general railway supply business in St. Louis.

MR. D. A. MUNGER has been appointed general traffic agent of the Pacific Electric Railway Company, and has entered upon his new duties. He is an Eastern man. The management of Alpine Tavern and of the Pacific Electric's traffic business at that end of the line is again in the hands of Mr. J. H. McGuire.

MR. W. H. WHITESIDE, president of the Allis-Chalmers Company, accompanied by his wife and daughter, sailed from New York for Liverpool, June 19, on the "Caronia." Mr. Whiteside and his family will visit various points of interest in England, Germany, Switzerland and France, spending most of their time on the Continent.

MR. R. W. KING, formerly manager of the Rapid Transit Company of Chattanooga, Tenn., has been elected manager of the Lookout Railway Company, of Chattanooga, which embraces the incline and the railway to top of the mountain, known as the Lookout Mountain & Lula Lake Railway. Mr. King is planning now completely to remodel and rebuild the line.

MR. A. D. SCHINDLER, formerly general manager of the Pacific Electric Railway Company, has opened a railway construction office in San Francisco. Associated with him are Mr. R. S. Masson, who, until June 1, was consulting electrical engineer of the Pacific Electric Railway Company, and Mr. Melville Dozier, once engineer of maintenance of way for the same corporation.

MR. HENRY E. HUNTINGTON has returned to Los Angeles from a six weeks' trip in the East, where he devoted most of his time to affairs of the Newport News Shipyard, in which he is interested. Mr. Huntington says that rails have been ordered for 125 miles of track for the Pacific Electric lines in Southern California, and the construction of these lines will begin in the fall. The first new construction work will be the line between Lake Avenue and Monrovia. The work of double-tracking the Redondo line will be continued until completed.

MR. GEORGE U. G. HOLMAN, of New York, who promoted and built the Levis County Railway, Quebec, Canada, is now associated with Mr. L. Knowles Perot, of Philadelphia, as electrical engineer of the Valley Forge system of railroads and railways. This syndicate will build and operate a third-rail private right-of-way-line between Philadelphia and Phœnixville, Pa., and has offices in the Land Title Building. Mr. Holman is also vice-president of the Public Service Investment Company, which is the holding company for eleven Pennsylvania corporations. He retains his New York office.

MR. D. H. LAVENBURG, of Toledo, has been appointed general manager of the Ohio Central Traction Company, with headquarters at Galion, Ohio, succeeding Mr. T. C. Cherry, resigned. Mr. Lavenburg has had a long and varied experience in steam and interurban railway work. For a number of years he was train despatcher on the Wheeling & Lake Erie Railway (steam). He became chief train despatcher of the Toledo, Fremont & Norwalk, now a part of the Lake Shore Electric Railway, and later was division superintendent of that line. Three years ago he went to Texas as superintendent of the Northern Texas Traction Company, and a year later he resigned to become general manager of the Toledo & Indiana, which position he held up to a few months ago, when the road changed hands.

MR. P. NEY WILSON has resigned his position as supervisor of the South Jersey division of the Public Service Corporation of New Jersey, and has accepted the position of engineer of permanent way and associate engineer of construction of the Para Tramways Company, of Para, Brazil. This is one of the lines now being constructed by the J. G. White Company, of New York, and Mr. Wilson will sail for London about July 20 to go over the plans of the Para road, and will soon after leave England for Brazil. Mr. Wilson has been supervisor of the Camden & Suburban Railway Company and its successor, the South Jersey division of the Public Service Corporation, for a period of nine years. In this capacity he has had charge of the track construction of the Camden lines and has made an excellent record.