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Do Electric Roads Pay?

The recent failure of two or three associated interurban lines in Ohio and certain remarks in the annual report of the Massachusetts Board of Railroad Commissioners, which is published in abstract in this issue, have led to a number of pessimistic utterances in the daily press and elsewhere as to the financial condition of electric railway companies. The Ohio event is generally recognized as being due to local conditions, but the broad statements made by the Massachusetts Commission have naturally attracted much wider attention, and, we are sorry to say, have been given more consideration than the actual facts properly deserve. Broadly recited, the charges are as follows: That of seventy-four operating companies, thirty failed to earn expenses and fixed charges, twenty-five companies paid dividends, of which number only fourteen earned them during the year, while five companies were actually in the hands of receivers. In addition, it was stated that very few roads made proper provision for depreciation, and that very many were virtually living from hand to mouth. Now, if these accusations are to be taken strictly at their face value, they would imply that the electric railways of Massachusetts are in a very bad way indeed and that the business is a very precarious one. The bare facts as stated can probably be substantiated, since the commissioners have access to the figures, but that they mean what many interpreters of this report would have us understand by them, we beg leave to doubt. To begin with, last year was conspicuously a lean year in the street railway business, owing to very unusually heavy expenses during the winter and light receipts during the summer. Some roads suffered more than others, but the difference from the average of a series of years was in many cases quite enough to make many a conservative board of directors think twice before declaring a dividend. The mere cost of removing snow, to which we alluded in a recent editorial, was abnormal enough to cause serious loss, and the cool summer was equally bad.

The commissioners state further in their report that in previous years many electric railways were recklessly built in a spasm of frantic promotion, and they are now paying the penalty of their temerity, and that roads were constructed which did not meet any public necessity, and upon which the receipts fell off as soon as the novelty wore away. Looking forward, they see either one of the following results: (a) the acceptance of an unsatisfactory service as better than nothing; (b) an increase of fares; or (c) abandonment of the railway. As regards the first count, nobody knows better than street railway men that an unsatisfactory service is the road to ruin. In some cases railways have, in overmuch enthusiasm, started out in interurban work at unremunerative rates of fare, which should be corrected whenever possible, which is rather seldom, for three nickels beat a dime, and when fares go up traffic usually goes down. Nevertheless, it is a cause of congratulation that this important subject is to be taken up by the Massachusetts Board, and if a satisfactory conclusion can be worked out in any particular case, we believe that such a result will be reached by this body. Finally, it is quite clear that no road is going to be abandoned. Some may fail and be sold out at a price that will enable the new owner to make them pay, but that is their misfortune, and in such case the service will often be improved.

In our opinion, the conditions described, when combined with the weather and temperature of the past twelve months, form a sufficient explanation for the Massachusetts situation. We do not believe that the street railway business in that State, or anywhere else for that matter, is half so bad as the statistics for the past year, when judged by themselves, would imply. There are occasionally roads which have been unwisely built, improperly capitalized and injudiciously administered. Let the

Massachusetts Commissioners, as well as those in other States, give such roads a helping hand if they can, and let them work out their own salvation. If the companies have to reorganize, let them do their own financiering as seems necessary. A good year ahead will help out many a struggling road and lighten the burden imposed last year. Certain it is that roads will not be abandoned, and more will be built every year in response to genuine needs. We are keenly alive to the mischief that over-capitalization and over-promotion have done in the past, and have steadily raised a warning voice against it. But both bring their own punishment, and at worst lead to reorganization on a more conservative basis and more caution in the future. Broadly, however, electric roads have been made to pay, even in some very unpromising places, and we believe that those in Massachusetts will prove to be no exception to the rule. Here's hoping for bigger receipts in the new year!

The Indiana Electric Railway Association

The Indiana Electric Railway Association, which held its first regular convention last week, might have followed the example of its sister association in Ohio and chosen the name "Interurban Railway Association," so large a percentage of the mileage in Indana is interurban. Indiana men are feeling strongly the necessity of frequent gatherings for the next year or two for the purpose of scttling many questions pertaining to interchange of traffic and traffic agrecments. It was proposed at onc time to unite the associations of Indiana and Ohio, so closely are thc two States being joincd by their interurban connections; nevertheless, we think thc decision to keep thc two State's associations separate for the present is a wise one as long as such frequent meetings as once a month are proposed. The larger an association and the less acquainted its members are with each other, the less is the freedom of discussion, and there will be less formality about the State association meetings than there would be in a bi-State association meeting. The questions brought up at the first meeting of the Indiana Association, as can be seen by the report and by editorial discussion elsewhere, were mainly engineering subjects, but it is probable that questions of policy and traffic will take an equal, if not greater, share of the association's time in the future. The facility with which the recent Indiana convention drifted into the discussion of questions of policy and traffic, and the number of questions raised by such discussion, show how necessary it is to thrash out some of these things among interurban companies. As was fitting, the Indiana Association held its first meeting in the magnificent new interurban terminal station, of which Indianapolis can well be proud. This station, which is by far the most important of its kind in the country, is one of the strongest testimonials with which we are acquainted to the importance of the interurban electric railway to the world of to-day. The association's membership is distributed well among men of all departments of the Indiana companies. The election of Charles L. Henry to the presidency of this association was a fitting recognition of the important part Mr. Henry has played in the interurban railway development of this distinctly interurban railway State, Mr. Henry having been the organizer of the Union Traction Company of Indiana, which was, and (with its recent additions) still is, the largest interurban railway company in the country, and being now engaged in another important interurban railway enterprise, the Indianapolis & Cincinnati Traction Company, the new single-phase railway, whose important work is referred to on the opposite page.

The Preservation of Ties

In his paper before the Indiana Electric Railway Association last week, Thomas B. McMath, civil engineer of the Indianapolis Traction & Terminal Company, considers the subject from two standpoints, as shown by his paper which is published elsewhere in this issue. He considers first the possibility of increasing the life of timber ties by the creosoting process, and second, concrete beam construction, which partly does away with timber ties. Although creosoted ties have not been used to any great extent in street railway track construction, the increasing cost of timber is causing us to draw nearer and nearer to the time when processes for increasing the life of timber will be of more value. According to the case as made out by Mr. McMath, we are now about at the point where the use of creosoted timber is commercially feasible and advisable. Mr. McMath's remarks about concrete stringer construction are especially interesting because of his experience with concrete stringer construction in Indianapolis, where track construction of this kind was employed several years ago. This method was abandoned later, but is now being taken up again, and some of thc streets approaching thc new Interurban Terminal Building have had construction of this kind laid in them. The peculiarity of thc latest concrete stringer construction, described in Mr. McMath's paper, is that the track is held down by anchor bolts and plates imbedded in concrete, with the idea of preventing the springing up of the rails, which seems to have been troublesome in previous concrete stringer work.

Railway Power Statistics in Indiana

The paper giving statistics on the cost of electric railway power production and transmission in the State of Indiana, as presented to the convention of the Indiana Electric Railway Association last week, is conceded by all who have read it to be a valuable contribution to our knowledge of power production, because it includes so great a per cent of the electric railway mileage of that State and because of the intelligent analysis Mr. Richey has given to the matter. There are several rather startling things about the figures Mr. Richey presents. Perhaps the most striking is that he should have been able to get figures on the cost of power from 85 per cent of the electric railway mileage in the State. This indicates that Indiana railway managers are wide awake on the power subject, and that there is not the ignorance on this subject which prevailed in some quarters, and which was the regular thing a few years ago. Another interesting feature is the statement that but 20 per cent of the railway power generated in the State outside of the city of Indianapolis is represented by the output of direct-current generators. This shows how large a percentage of the electric railway power of the State is supplied to interurban lines covering considerable territory and calling for alternating-current transmission. Another surprise is the low average cost of power at the power station bus-bars for the stations reporting—i. e., about ¾ cent per kw-hour. This low figure, however, is accounted for by the fact that two-thirds of the electric railway power of the State is generated in two large and economical power stations, namely, that of the Indiana Union Traction Company, at Anderson, and that of the Indianapolis Traction & Terminal Company, supplying all the city lines in Indianapolis. Even eliminating these large power stations, however, and taking the uneconomical balance, the cost of power on the remaining roads is rather lower than the majority of electric railway engineers would have surmised, being a trifle over 1 cent per kw-hour. These, however, are

only a few of the interesting figures given in Mr. Richey's analysis, which is worth study, as it is a good indication of what is actually being done in the way of economical power generation for electric railways to-day. Coal is comparatively cheap in Indiana, but with the aid of the other figures given by Mr. Richey, any engineer can figure the probable effect of variations in price of fuel. The cost of labor reported is exceedingly low, even for the station reporting the highest cost, namely, .331 cent. This would indicate that all of the stations reporting must have been of fairly good size, and also that electric railways generally have reached sizes of units and sizes of stations which do not leave much room for cutting down labor cost. This fact was also indicated by figures from the Boston railway power stations, upon which we commented in our issue of Sept. 10, 1904.

Other Important Events in Indiana

A number of other things are happening in Indiana these days which make it a center of interest for electric railway men all over the country. Of most general and national interest probably is the starting of the Indianapolis & Cincinnati Traction Company's line, equipped with single-phase alternating-current motors. This will be the first road to try out the Westinghouse single-phase alternating-current railway motor on a large scale in every-day service. It is an important road aside from the fact that it is equipped with single-phase motors, and this fact adds still more to the interest attaching to its use of single-phase motors. Another event of great local importance to electric railway men of Indiana and the neighboring States was the inauguration of a limited parlor buffet car service between Indianapolis, Ind., and Dayton, Ohio, to be known as the "Interstate Limited."

The Indianapolis & Cincinnati Traction Company's single-phase road is now operated in the city of Rushville, and by the time this paper reaches its readers will very likely have in commercial service several miles of interurban line. Besides the question of the performance of the single-phase railway motor, various problems in high-tension trolley conductors will be thrashed out on this road. The voltage of the trolley wire being 3300, the engineers of this undertaking have taken great pains to prevent any accidents from the breaking of the high-tension trolley. The catenary form of construction has been adopted. The trolley wire is supported from the catenary every 10 ft., so that should the trolley wire break the loose end could not reach the ground or be within reach of a person standing on the ground. The catenary construction, of course, makes possible the use of a center-bearing high-tension insulator. There has been plenty of opportunity for the exercise of ingenuity in working out plans for this radically new type of overhead trolley construction. Then there is another new feature, the bow trolley, which is to be tried for the first time in this country on high-speed interurban work. It is agreed by most engineers that given the possibility of using a single-phase alternating-current supply at high tension, the next logical step is the use of some form of trolley which will give no trouble from leaving the wires at high speed, and which should have sufficient contact area for the comparatively small current required at high voltages. The wear will probably be great on the bow form of trolley at high speeds, and the pressure in order to keep this wear within reasonable bounds must be light. It is not expected that a successful form of bow trolley will be evolved without considerable experiment, but as one engineer remarked, there is plenty of opportunity to beat the present average trolley wheel on heavy high-speed service. Taken altogether, the work on this Indianapolis & Cincinnati line is of great importance to the interurban electric railway work of the future, and justifies the interest manifested in it all over the country, although, to be sure, with the large number of contracts for single-phase alternating-current motor equipments now under way, the Indianapolis & Cincinnati line will not long have the distinction of being the only purely single-phase electric railway in regular service in the country.

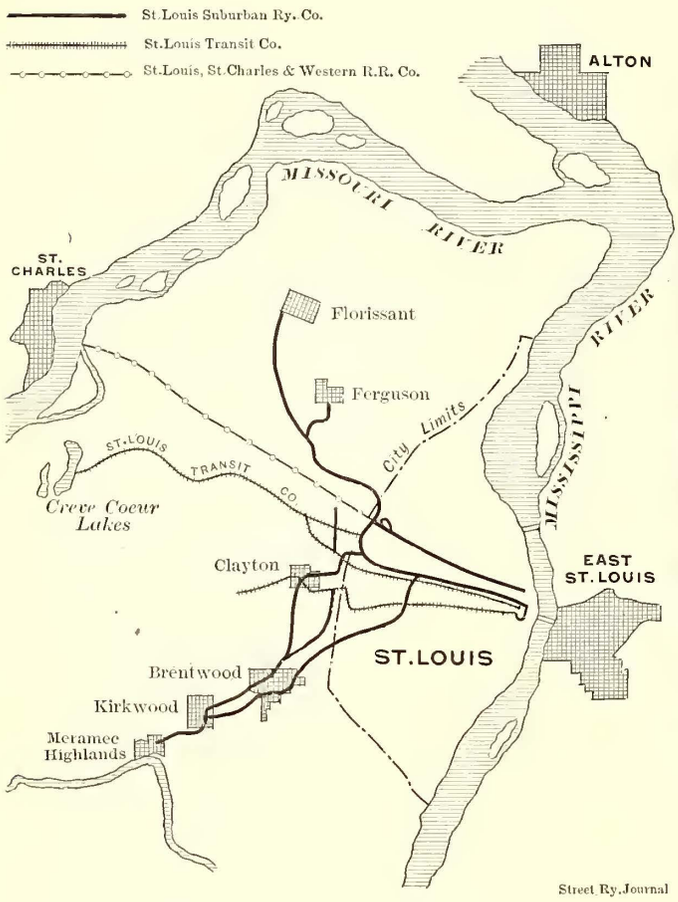
The "Interstate Limited," operating from the center of one State well over into an adjoining State, giving parlor buffet car service, is the first installation of this extent attempted by interurban roads, although shorter "limited" runs are being made, and may in future years be regarded as an event of considerable historical importance. Interurban railway companies have heretofore generally followed the practice of keeping their own cars on their own tracks, although on the route over which the "Interstate Limited" is to operate through car arrangements have been in vogue for some time for certain portions of the route. The "limited" feature of this service has been fairly well tried out and found profitable on other interurban lines. The buffet car service is an experiment, but there are many good reasons for thinking that it will prove profitable. The fact that these three companies have been able to agree on a traffic arrangement for through cars is encouraging, and shows that interurban managers are gradually realizing the point for which we have been contending for some time as to the increasing necessity of through traffic arrangements, or at least through connections at terminal points. Further particulars of this and other limited services will be found in an early issue.

Curves at the Foot of Grades

One of the most exasperating things in the layout of an interurban road is frequently the apparent necessity of locating sharp curves at the foot of long grades. Perhaps we should not say that this is necessary, because, with a sufficient expenditure, curves so located can frequently be eliminated and the curvature placed at some other less undesirable point. It nevertheless can be taken as an indication of the eternal "cussedness" of things that usually the very place it is hardest to avoid sharp curves is near the foot of long grades. The engineer of a company that is building an interurban line to operate rather than to sell, and who has in mind an investment which will not be endangered by the accidents which are sure to occur at some time where sharp curves are located at the bottom of grades, will use every possible means to avoid such curves. Where a curve is not a "blind curve"—that is, where the motormen coming from each direction can see a long distance beyond the curve—the curve adds practically no element of danger unless it is of such short radius that it cannot be taken at the speed likely to be attained by a car going down grade. Of course, there are locations which can truly be called mountain conditions, where grades and curves are the regular thing and where car speeds are correspondingly slow. On such roads sharp curves are not as dangerous as on the prairie roads, which occasionally take a dip into a river or creek bottom, with bluffs and cuts to shut off the view around curves. On the prairie road, high speed is the regular rule, and motormen being used to high-speed running, are less likely to run slow at dangerous points.

THE ST. LOUIS & SUBURBAN RAILWAY AND WORLD'S FAIR TRAFFIC

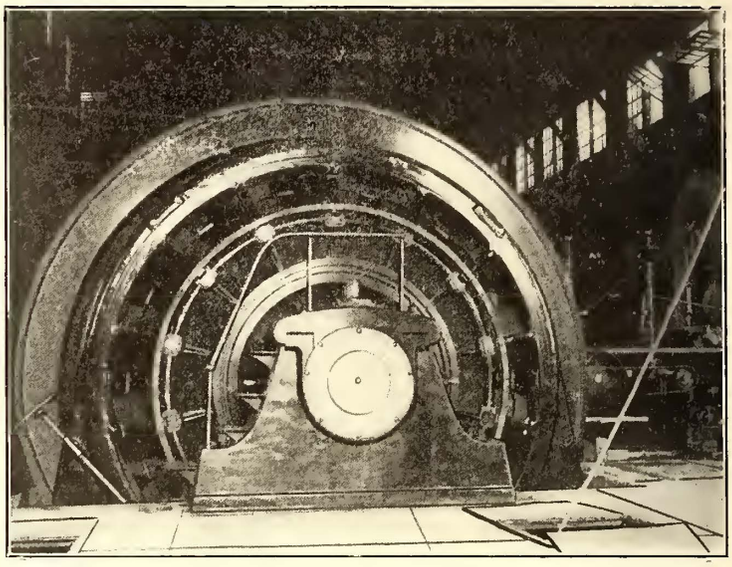
One of the important factors in the local transportation problem at the Louisiana Purchase Exposition the past season was the St. Louis & Suburban Railway. Although this company operates approximately only about one-tenth as many cars as the St. Louis Transit Company, it is a road which had much to do with transportation to and from the Exposition because of its location. A considerable proportion of the track is over a private right of way, which is due to the fact that part of it was originally a steam railroad operating west from the neighborhood of Vanderventer Avenue to Florissant. The downtown end of the line, which enters the business part of the city on Locust Street, was the first cable road to be constructed in St. Louis. The entire line was eventually changed to electric traction.



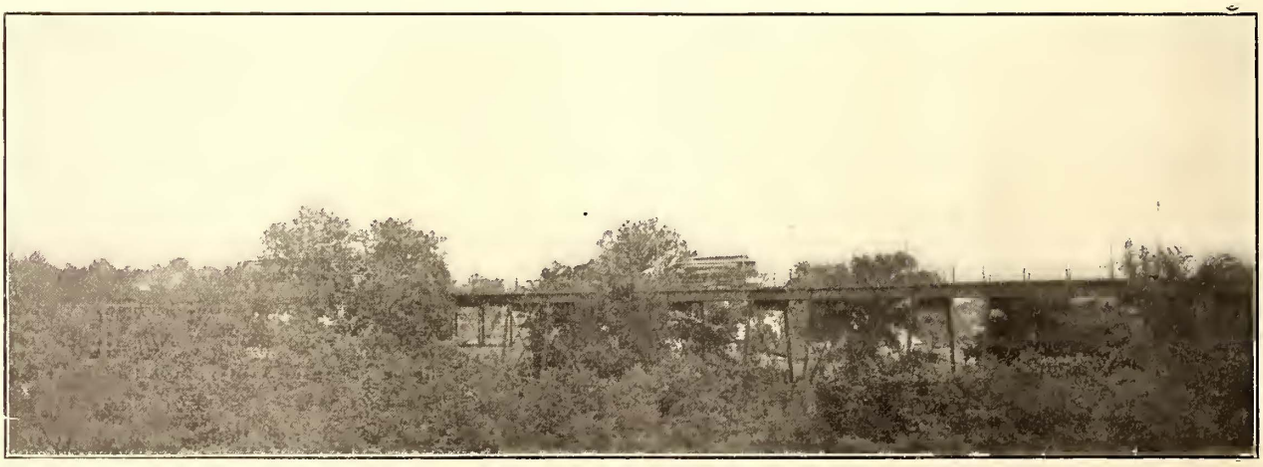
MAP OF SUBURBAN ELECTRIC LINES, ST. LOUIS

An opportunity is afforded, now that the Exposition has closed for some months, of reviewing the status of this line, which afforded the most direct route to the Fair grounds from certain sections of the city. During the Exposition so much attention was given to the Fair and to the larger system of the St. Louis Transit Company that little or nothing was printed of the system of the St. Louis & Suburban Railway Company.

One of the accompanying engravings shows a typical view along the company's private right of way. Heavy standard T-rails are used and the track is rock ballasted. Stopping platforms are placed at every street intersection. Operation over this private right of way being free from the dirt, dust and interruptions of a street, the highest class of service could be given consistent with stops on signal every block. The accompanying map shows all of the suburban lines radiating from St. Louis, and it will be noticed that the greater part of the mileage outside of the city limits is controlled by the St. Louis & Suburban Railway Company. The company maintained two loops at the World's Fair grounds, one at the Lindell or main entrance and one at the Skinker Road entrance. Cars were operated from the downtown loop to these two loops in addition to giving regular service over the suburban lines to Ferguson, Florissant and Meramec Highlands. The company owns about 195 cars. In handling World's Fair crowds, from 100 to 134 cars were operated.

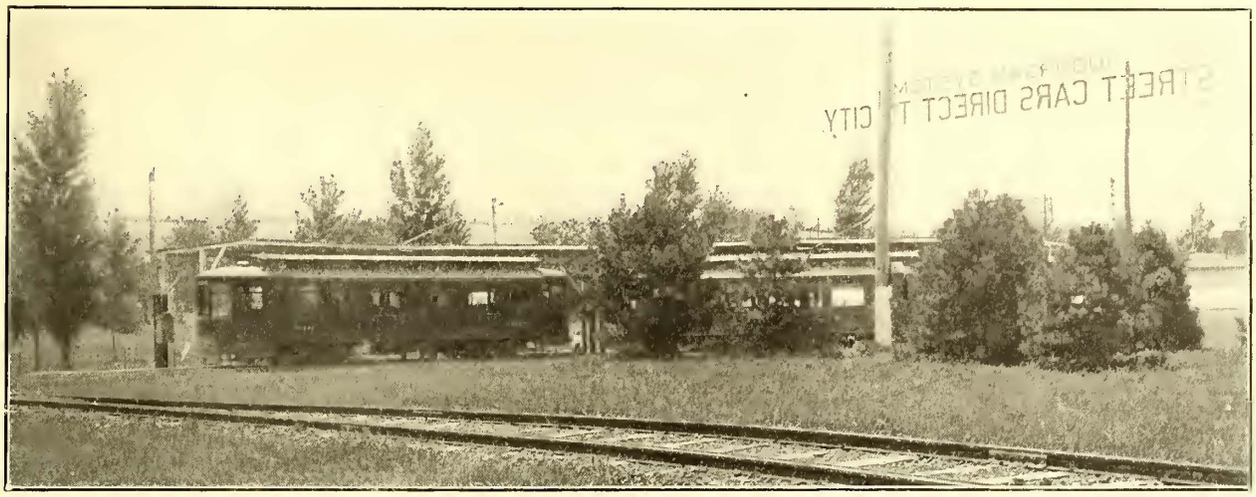


ONE OF THE NEW ALLIS-CHALMERS UNITS IN THE SUBURBAN POWER STATION



ST. LOUIS & SUBURBAN—EDGEBROOK VIADUCT

This company had a loop the nearest to the main entrance of the Exposition of any of the street railway loops. A view of this loop from the inside accompanies this article. This

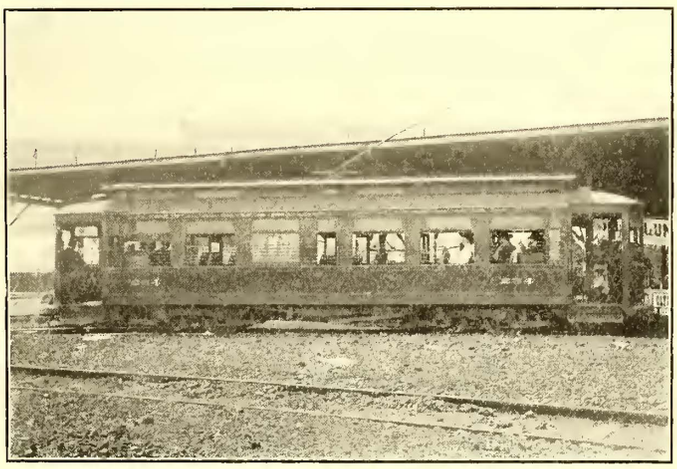


ST. LOUIS & SUBURBAN LOOP AT MAIN ENTRANCE TO THE EXPOSITION

method of operation was radically different from that of the other street railway loops at the Fair grounds, in that passengers were not allowed inside the loop except on the cars. In one corner of the loop was a roofed-over space, where passengers congregated and waited for the cars. The cars discharged passengers at an exit gate and then moved along to the loading gates. Cars were stopped so that front and back platforms were directly opposite these loading gates, and passengers stepped directly into the cars as they passed through the gates, so that there was no danger of crowds collecting inside the loop and getting injured in attempting to board moving cars. The arrangement was one which worked very smoothly. The electric sign over this loop which greeted the Exposition visitor as he went out of the main exit through the Fair grounds is shown in one of the engravings.

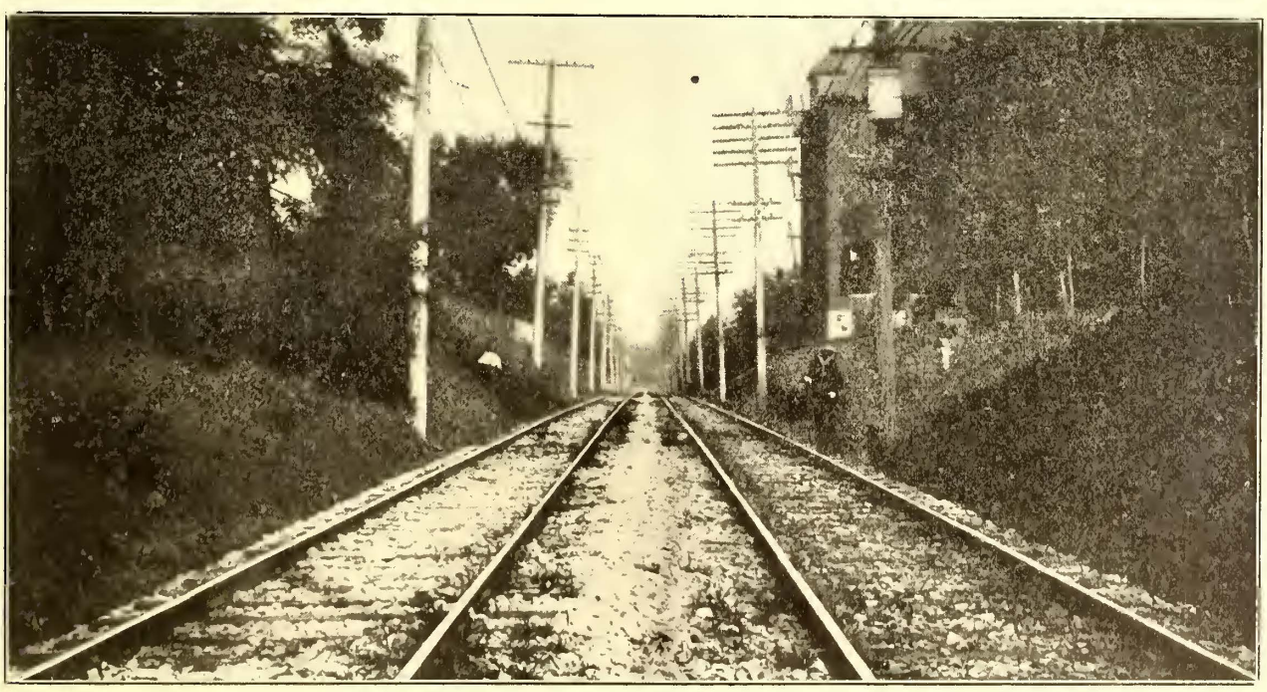
This company's standard cars are of a construction which has been frequently described in these columns. One of these cars is illustrated here. It has a seating capacity of fifty-two passengers. The body is 32 ft. long, and the length over all, 42 ft. It is mounted on St. Louis No. 47 short-wheel base truck, and has the patented steel-channel bottom, in which the strength is placed in the side sills, so that plenty of room is left for the swiveling of the trucks between the wheels, and the car body can be placed low. All cars have arc headlights.

Just before the Exposition, the company rebuilt its car house at DeHodiamont, which had been destroyed by fire. The new car house, a front view of which is shown, is practically fireproof. It has eleven entrance tracks and a capacity of 100 cars.



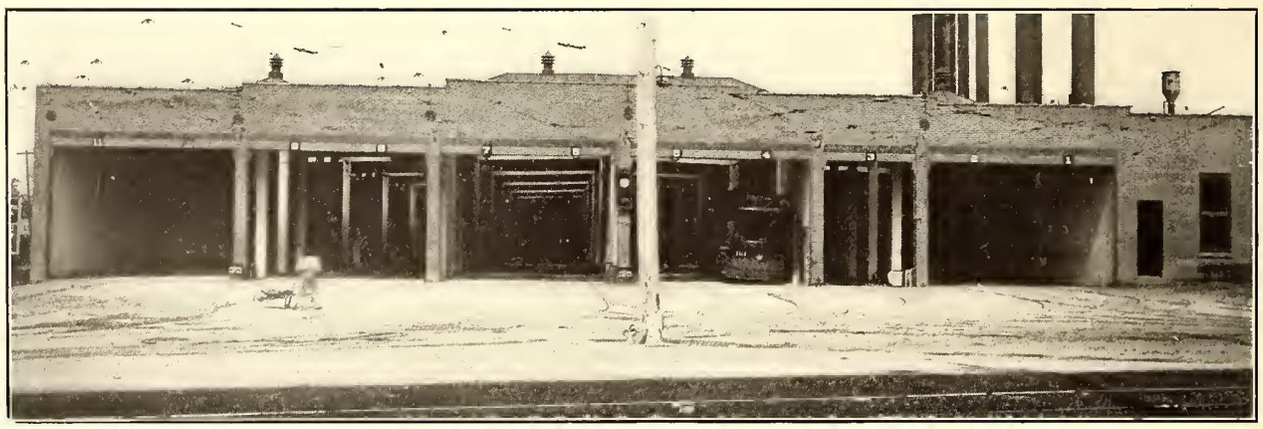
ONE OF THE ST. LOUIS & SUBURBAN STANDARD CARS

The power house, also at DeHodiamont, is one which was built early in the history of electric traction, and which has been added to and reconstructed from time to time, so that

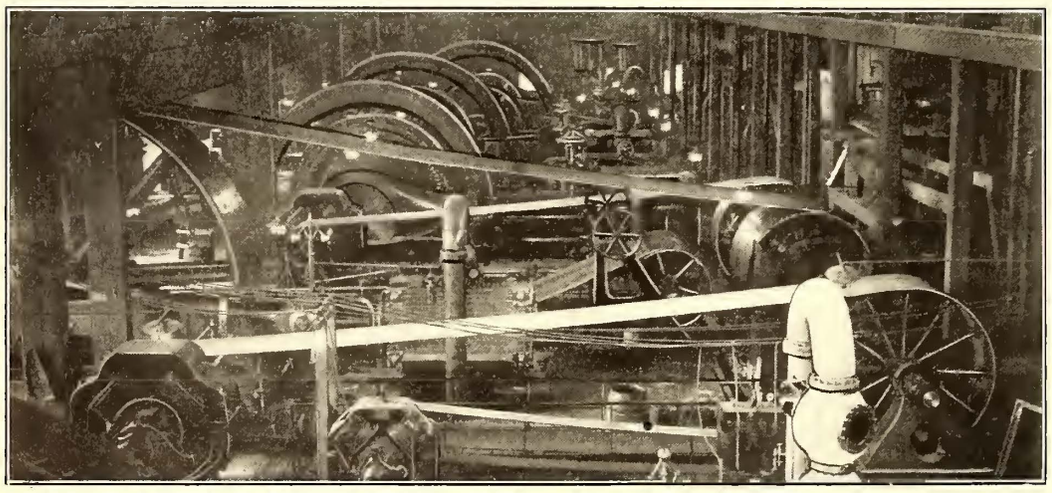


ST. LOUIS & SUBURBAN RAILWAY PRIVATE RIGHT OF WAY, WEST FROM TAYLOR AVENUE

a part of it is now well up to date. The latest addition consists of two GE 1200-kw 6600-volt alternating-current generators driven by Allis-Chalmers cross-compound Reynolds-Corliss engines. The engine room of this station is an interesting historical study, as in it can be found some of the earliest apparatus used in electric traction, and also some of the latest. The boilers and piping underwent a thorough reconstruction just previous to the World's Fair. The company has two substations to which 6600-volt alternating current is transmitted—one to supply the downtown end of the line and the other at Brentwood for the lines extending southwest. The system is under the management of John Mahoney, general superintendent, the president being J. S. Walsh, of St. Louis. These gentlemen are sharing with the St. Louis Transit Company management the many congratulations that have been offered to the street railway officials of St. Louis on the way the World's Fair crowds were transported during 1904.



ST. LOUIS & SUBURBAN NEW STORAGE SHEDS AT DE HODIAMONT



INTERIOR OF THE DE HODIAMONT STATION OF THE ST. LOUIS & SUBURBAN

A record of the traffic on the Brooklyn Bridge for the last twelve months, kept by Bridge Commissioner Best, shows that about 36,000 passengers now cross the bridge in the bridge trains in a single rush hour at night; this means that the cars, which seat about forty people, actually carry about three times that number during this one rush hour, from 5:30 to 6:30 p. m. In 1890 careful estimates were made of the probable future travel on the bridge, and the number of passengers now carried in the busiest hour of the day is 40 per cent greater than the maximum capacity then believed to be practicable with the length of train and number of trains now run, and it was estimated that the number of passengers now carried would not be reached until 1920.

EXPERIENCE WITH STORAGE AIR BRAKES AT ST. LOUIS

The storage air brake system has been in operation on most of the cars of the United Railways Company, of St. Louis, since before the opening of the World's Fair. This being the first large street railway to be equipped with the storage air brake system, considerable interest attaches to the performance of the storage air apparatus in actual service. It was thought by some that the compressing stations might be a source of trouble in cold weather, as they are expected to run without an attendant on duty all the time. No trouble has been experienced on this score. An attendant visits each station every two hours. The heat liberated by the compression of the air is not sufficient to heat the compressing station in the cold weather and stoves have been put in the stations, which are looked after by the attendant on his regular visits.

Almost the only difficulty experienced so far in the practical operation of the system is that the reducing valves on the cars have sometimes frozen up. The main storage tanks under a car carry air at 300-lb. pressure. Air is fed through a reducing valve to the service reservoir from which the brakes are operated. The latter reservoir is kept at 45-lb. pressure. If the reducing valve is frozen it may result in allowing an abnormal pressure in the small service reservoir and the blowing of the pop valve in this reservoir. A frozen reducing valve can be thawed out by burning a newspaper or something similar under the valve. On one line the reducing valves have been taken from under the car and put inside the car under a seat. This does away with the trouble.

Another improvement made has been in the introduction of blow-off cocks on both the high and low-pressure storage tanks on the car, by which the water can be blown out. The original plans called for these cocks, but in the hurry of equipping the cars before the opening of the World's Fair, the blow-off cocks were omitted in most cases and plugs were inserted. It is the intention to remove these plugs and put in blow-off cocks on all the cars, which will make it possible to drain off the moisture several times a day, if necessary. As with any compressed air apparatus, the most trouble from freezing comes when warm, moist weather is followed by a cold wave.

THE STEEL-TIRED WHEEL IN STREET RAILWAY SERVICE

BY NORMAN McD. CRAWFORD
General Manager, Hartford Street Railway Company

It is the growing opinion of street railway engineers that something stronger than the chilled cast-iron wheel should be used under cars operating on interurban lines, especially those operating under high-speed conditions and upon tracks that are not any too smooth or straight. Troubles from broken flanges with cast-iron wheels have been found to increase very materially when used under heavy cars operating under these conditions, and much interest is directed toward an economical solution of this difficulty. The steel-tired wheel affords the desired remedy and is being introduced in street railway service in many places, in spite of its supposed higher cost, and its use is expected by many to grow soon to such proportions that the chilled cast-iron wheel will be in the minority.

About four years ago the Hartford Street Railway Company decided to introduce steel-tired wheels upon the heavy double-truck cars used upon some of its principal suburban lines which are operated at high-speed schedules upon tracks having the combined disadvantages of sharp curves and heavy grades. It was realized that in case of a broken flange there was imminent danger, in many places, of a bad accident, resulting in precipitating the car down steep embankments, and the steel-tired wheel was introduced as a matter of precaution in view of the past troubles with broken flanges upon cast-iron wheels. The unquestionable sense of security obtained in the use of the steel-tired wheel, which cannot be had with the chilled cast-iron wheel, made the use of the former seem desirable at any cost, but the results of its introduction have been so far beyond expectations, not only as to safety, but also as to serviceability and economy, that steel-tired wheels are now being used upon many of the city cars of the Hartford Company, as well as its suburban lines. It will be of interest to those having to do with wheel problems to learn that the experience gained by the Hartford Company is such as to indicate that the use of the steel-tired wheel is attended by even less cost than is the case with the chilled-iron wheel.

The first cars equipped with steel-tired wheels were a lot of fourteen double-truck closed cars, nine of which were used in suburban service and the other five in city service; these cars were equipped Oct. 15, 1900, as shown in the accompanying table. The table shows the remarkable results which attended their use upon these cars. Cars No. 450 to 454 are operated over 200 miles per day upon the Rainbow suburban line, embracing a 28-mile round trip. These wheels had made mileages ranging between 100,000 miles and 200,000 miles each, in the time indicated upon the table. Their tires have, in many cases, required several turnings, but will permit several more before the tire requires to be removed from the wheel.

In October, 1901, eleven more double-truck closed cars were similarly equipped, which showed mileages ranging from 70,000 miles to 97,000 miles each at the time these records were taken. The last cars equipped with steel-tired wheels are four double-truck open cars, which were changed in May, 1902. These have similarly shown excellent results in service, as indicated in the accompanying table. Car No. 306 of this lot is now being operated 196 miles per day upon the New Britain interurban line, showing up to April 30, 1904, a total mileage of 39,942 miles. In all, thirty double-truck cars are now equipped with steel-tired wheels, making a total of 240 steel tires in service upon the Hartford lines.

Data as to how many turnings have been given the various tires are unfortunately not at hand, although it can be said that cars No. 402 to 408 have not required turning up to June 1, due to the minimized wear resulting from the long wheel base trucks upon which they are used.

The important feature of superiority of the steel-tired wheel over the cast-iron wheel is in the strength and stability of its flange. The chilled cast-iron wheel is very liable to chip at the flange, especially under the conditions of street railway service, with the frequent and heavy braking effects imposed upon the car wheels. Unequal heating is developed throughout the tread and flange of the wheel, and particularly is this dangerous with the cast-iron wheel when used in the wet and slushy season of

STEEL-TIRED WHEEL RECORD—HARTFORD STREET RAILWAY COMPANY

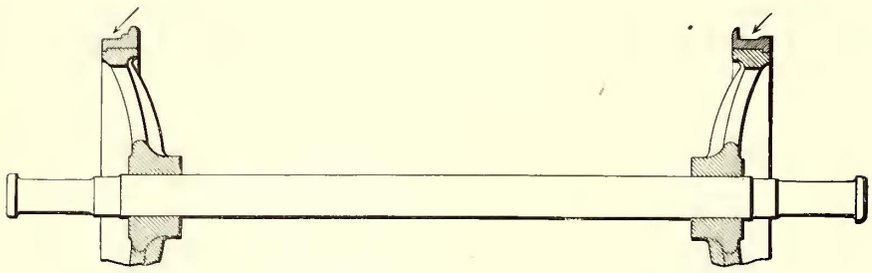
Car No.	Date Equipped	Mileage up to June 1st	Class of Service	Type of Car	Truck Wheel Base	Remarks
402	Oct. 15, '00	12,054	Sub'n, extra	Closed	5' 9"	These tires had not required truing up at time of this record
404	"	42,710	"	"	"	
406	"	100,282	Suburban	"	"	
408	"	64,015	"	"	"	
450	"	105,495	"	"	4 ft.	Each of these 5 cars oper 200 miles per day upon the Rainbow line, a 28 mile r'nd trip with numerous hills and sharp curves
451	"	105,032	"	"	"	
452	"	110,296	"	"	"	
453	"	197,005	"	"	"	
454	"	104,999	"	"	"	
455	"	66,982	City	"	"	
456	"	83,061	"	"	"	
457	"	88,914	"	"	"	
458	"	64,451	"	"	"	Note.—All tires on wheels used upon the short wheel-base-trucks (4 ft.) had been turned up once or more times up to the latest date shown
459	"	89,699	"	"	"	
462	Oct. 4, '01	82,872	"	"	"	
464	" 6 "	88,835	"	"	"	
465	" 7 "	91,160	"	"	"	
466	" 6 "	97,416	"	"	"	
467	" 7 "	98,595	"	"	"	
468	" 7 "	70,575	"	"	"	
469	" 13 "	93,125	"	"	"	
470	" 19 "	86,063	"	"	"	
471	" 24 "	92,059	"	"	"	
472	" 25 "	96,992	"	"	"	
474	" 27 "	89,532	"	"	"	
302	May 17, '02	7,385	Sub'n extra	Open	"	
304	" 21 "	11,171	"	"	"	
306	" 17 "	39,942	Suburban	"	"	Car No. 306 oper 196 miles per day upon the New Britain interurban line
308	" 24 "	28,204	"	"	"	

the spring; in case of sudden heavy braking, with the resulting overheating of the flange, it is almost inevitable that unequal shrinkage strains should be set up as the flange meets the water or snow in the groove of the rail, and many breakages have been traced to this cause. Another danger that is met in the use of the cast-iron wheel through city streets is that of chipping the flange when passing through irregularly-worn special work; this latter trouble is unavoidable, but must be contended with in street railway service. Furthermore, there are the other well-known difficulties which are met in the manufacture of chilled-iron wheels which always involve the feature of uncertainty as to what may be expected from them. The result of these difficulties has been found by the Hartford Street Railway Company to be such that the cast-iron wheel can be depended upon for only one season, after which it is the custom there to renew them as a matter of safety.

These troubles are almost entirely avoided by the use of the steel-tired wheel. No chipping of the flange may be expected from sudden contacts with special work, or with the unequal heating effects of braking. They are capable of standing much more severe service upon curves, and, furthermore, are not so subject to the difficulty of "flatting," which is unavoidable with the cast-iron wheel; if the steel tire becomes flat by prolonged skidding, the flatness tends to roll out by the rolling action of the wheel upon the track. The unquestionably serious trouble met in the cast-iron wheel of unevenness of chill, which is thought to be, and unquestionably is, most favorable to the production of flats, is, of course, entirely absent in the steel tire.

A difficulty met in the use of the steel tire is the more rapid wear of flanges, but it has been found by the experience at Hartford that even this can be avoided by proper truck proportions. In this connection it is important to note that the experience at Hartford has been that the abnormal wear upon

flanges is present only upon trucks whose wheel base is shorter than the gage of the track. It will be noticed from the accompanying table that two sizes of truck are used, those having a 4-ft. wheel base and a few having a 5¾-ft. wheel base. It was readily observed that the flange wear is very perceptibly less upon the tires used with the trucks having the long wheel base than upon the others. It was furthermore noted that upon short wheel base trucks the excessive flange wear took place upon two wheels located at diagonally opposite corners of the



SKETCH TO INDICATE TENDENCY TO SIDE WEAR WITH SHORT WHEEL-BASE TRUCKS

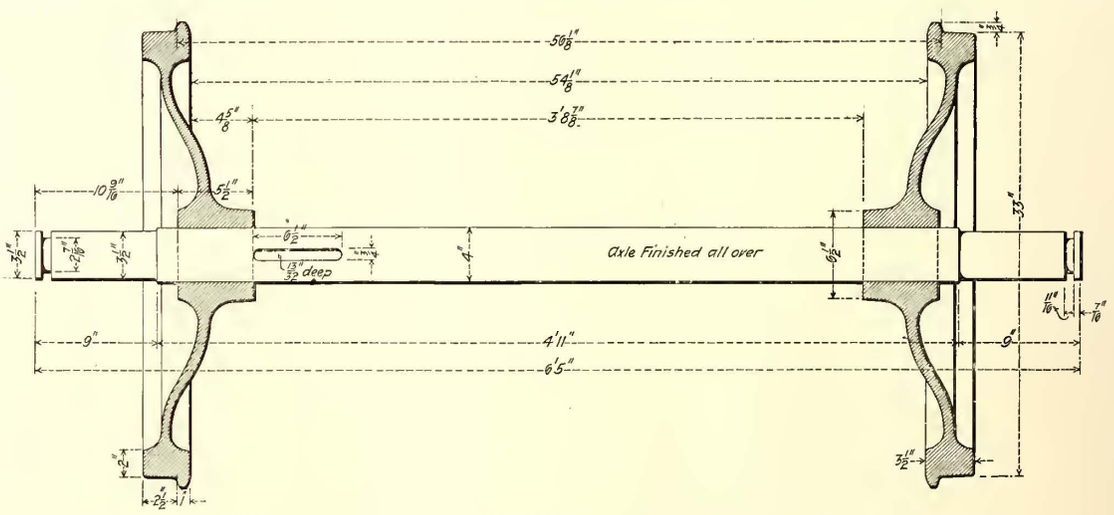
truck. This indicates a tendency toward a sidewise action of the truck, which is undoubtedly due to the wheel base length being shorter than the gage of the track; the action of a truck of such proportions may be likened to that of a single pair of wheels operated in a truck, which would, it is evident, have a tendency to turn sidewise in passing curves.

Another interesting fact was noted, in the case of the trucks with short wheel bases, that as the diagonally opposite wheels begin to wear thin at the flanges there is a tendency of a double wear upon the other sets of wheels which tends to crowd the thin flange even more tightly against the rail; the result of this action is indicated graphically in the accompanying sketch. No tendency of this kind whatever has been observed upon the trucks having a wheel base longer than the gage of the track, which is a strong indication that much of the difficulties met in the operation of steel-tired wheels rests in the proper proportioning of the truck. The Hartford Company expects to equip some of its single-truck cars having 6-ft. wheel bases with steel tires in order to ascertain if the still longer wheel base will further reduce its tendency to diagonal wear.

It is to be noted in this connection that steel-tired wheels have been operated at Hartford for mileages as high as 100,000 miles before turning. Our experience, however, would indicate that it is not advisable to allow the tires to wear to this extent, as in such case too much material must be cut off in truing the wheel tread up to the standard templet. We have also found that if the wheels are allowed to make only from 40,000 miles to 50,000 miles and are then turned up in the lathe, the cost of truing will be minimized, as the least possible amount of metal will have to be removed in order to strengthen the flange. This is the present practice, and with it much satisfaction is being experienced. About three truings are possible with the size of tire now used, which makes the total available mileage from each tire approximate 200,000 miles.

The most interesting phase of the problem of using steel-tired wheels is that of the cost, which is generally supposed to be higher than that attending the use of chilled wheels. The chilled cast-iron wheel as used at Hartford costs from $5 to $7 per wheel, according to the weight and nature of the service in which it is used; the total mileage that may be expected from the chilled wheels, however, is not over 30,000 miles, which, at an average cost of $6 per wheel, makes its cost amount to 20 cents for every thousand miles of service. A new steel tire, as used at Hartford, costs $12 each, but with the three truings after each 50,000 miles of service, will make the net cost $3 per 50,000 miles, or 6 cents per 1000 miles; adding to this a reasonable shop cost of $1 per wheel for the original application of the tire to the center, which also applies to each truing-up operation in the lathe, the gross cost per 50,000 miles is brought up to $4. Even this, however, only increases the gross cost per 1000 miles to 8 cents, which is very much less than half of that resulting from the use of the chilled cast-iron wheel.

The contention that the steel-tired wheel is outclassed by its first cost of from $30 to $40, is manifestly erroneously taken, as the center of the steel-tired wheel does not require renewing and should be considered as a permanent feature of the truck. Worn tires may be removed from it and replaced by new ones almost indefinitely. It is only fair to assume that the cost of the center should be charged up to the truck investment and only the renewable feature, the tire, be considered in comparison with the cast-iron wheel. The center is practically indestructible if made sufficiently strong for the service in the first place, and serves as a permanent investment. The only additional cost to be considered is that of removing a worn tire and replacing it by a new one, but this is easily covered in the above-mentioned allowance of $4 per tire per 50,000 miles, for this operation, and each of the three turnings in the lathe. Even if the expense of handling in the lathe and machining were double the above allowed amount, it may be seen that the cost of operating the steel tires would even then be far below that of using the chilled cast-iron wheel.



DETAILS OF NEW SOLID ROLLED AND FORGED STEEL WHEELS AS USED AT HARTFORD

The Hartford Company has recently introduced several of the new type of solid forged and rolled-steel wheels into service under some of its double-truck interurban cars in order to make a trial of this interesting departure in wheel building. This solid steel wheel has many advantages to offer over the steel-tired wheel, not only as to first cost, but also as to general simplicity and equal strength with less weight. On account of the very thorough and effective methods of forging and rolling in manufacture, it is thought that a maximum of density is

secured in the rim which will result in even longer wear than is secured from the tires upon the steel-tired wheels. While these new wheels have not been in service long enough as yet to allow of intelligent comparison of their performance with the various types of steel-tired wheels, still they promise to prove very economical and very satisfactory results are expected.

The lower drawing on page 108 presents the principal details of the new solid steel wheels as applied to the standard axle of the Hartford Street Railway Company, ready for use. Special attention should be called to the lightness of the web as compared with that of a chilled-iron or steel-tired wheel, although from the nature of the construction it is said to be very much stronger. These wheels were furnished by the Standard Steel Works, Philadelphia, Pa.

FIGHTING SLEET ON THE AURORA, ELGIN & CHICAGO RAILWAY

One of the most serious problems with which the management of a third-rail electric road is compelled to deal is that of the removal of, or prevention of the formation of, sleet. This is more serious on lines through the open country, where the schedule does not require cars at intervals frequent enough to prevent the sleet forming again, after it is once removed. In such a case, about the only means of avoiding frequent tie-ups of the line, is to place on the rail some solution with a very low freezing point, which will not only melt the ice already formed, but will prevent the formation of additional sleet. After thorough and satisfactory tests last winter, the Aurora, Elgin & Chicago Railway has adopted this method. A solution of calcium chloride, which does not have the corroding effects of common salt solution, is employed. In fitting up the necessary apparatus for distributing the liquid over the rail, the fact has been kept constantly in mind that effective fighting of sleet necessitates it being attacked as soon as it begins to form, and the apparatus is therefore so arranged that it can

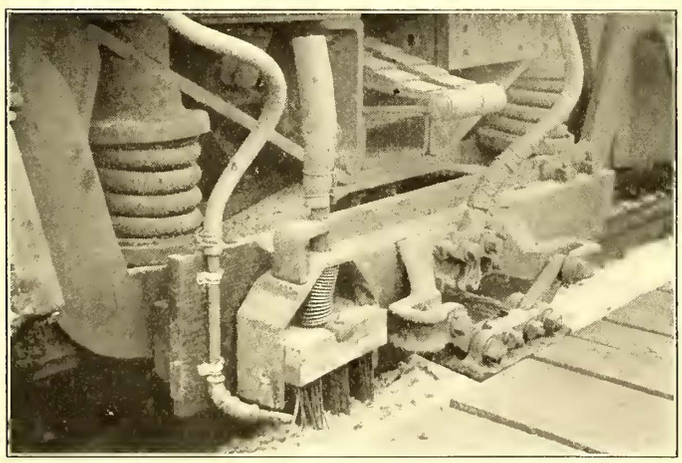


FIG. 1.—PIPE CARRYING SOLUTION TO THE RAIL

be put into service on very short notice. Another point aimed at was that the fighting of sleet should interfere as little as possible with the regular schedule.

The method of throwing the liquid on the rail is shown in Fig. 1. The small pipe shown in the illustration is connected to a rubber hose leading to the motorman's cab. Through this the solution is lead to the rail a few inches in front of the steel sleet brush. This brush, passing immediately afterward, spreads the solution uniformly over the film of ice before it has had time to run over the side of the rail. Each car is equipped with four such pipes, one in front of each of the four shoes, so that no matter on which track or in which direction the car may be traveling, one of the pipes may be put in service. The hose to which the pipes are attached are connected to the discharge pipes of a 40-gal can placed in the cab, and containing the solution of calcium chloride. As the solution is a conductor, it is necessary to ground the pipe on the truck frame to prevent the can in the cab becoming charged and becoming dangerous to the operators. This results, of course, in a current from the

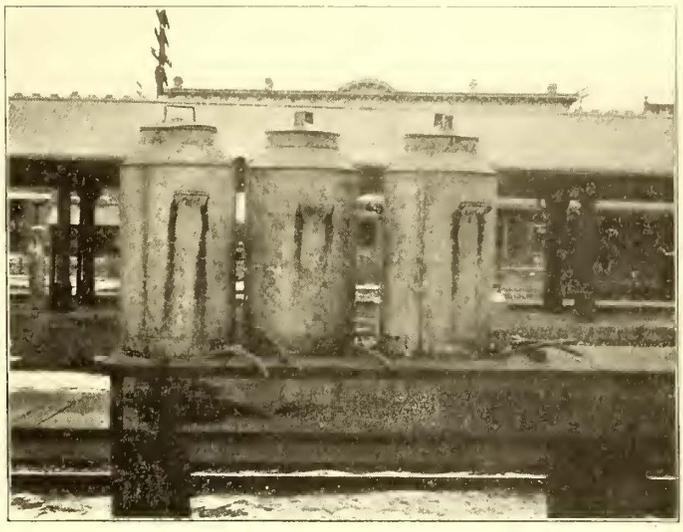


FIG. 2.—PLATFORM AND CANS AT WHEATON

third rail to the truck by way of the stream of liquid, but the conductivity of the stream is not great enough to cause an excessive current.

That they may be placed in service quickly, the cans filled with the solution are distributed at several points along the road on platforms, one of which is shown in Fig. 2. In case of a sudden sleet storm, the several cars running on a regular schedule pick up the cans from the nearest platform, place them in the cab and connect them by means of the rubber hose to the pipes leading to the rail. When a can becomes empty it may be filled, without removing it from the cab, at one of the several stations similar to that at Wheaton, shown in Fig. 3. Several barrels are placed on a trestle sufficiently high to insure the cans being filled quickly. The end of the long hose, which may be seen in the engraving, leading from the barrels, is inserted in the can in the cab of the car.

The cans are originally filled at the shops from the large mixing tank shown in Fig. 4. In this tank the caustic chloride of calcium is mixed with warm water in the proportion of about 38 lbs. of the chemical to 1 cu. ft., or about 7½ gals. of warm water. The proper density of the mixture is obtained by the use of a hydrometer, the reading of which should show a specific gravity of from 1200 to 1250.

When running at full speed, the full flow from the ¼-in. pipe is thrown on the rail. On slowing down or at stops, the operator in the cab governs the flow to correspond with the speed by means of a globe valve in the discharge pipe of the can. About one gallon of solution is used per mile. This amount is sufficient to spread well over the top of the rail, yet is not enough to run down over the sides to be wasted or possibly to injure the bonds. The corroding effect of calcium chloride on the copper is somewhat in dispute, but by so distributing the solution that it does not reach the bond, any danger is, of course, avoided. In case of a very thin coating of sleet, the immediate effect of the liquid is to dissolve the ice so the contact is made direct with the rail. With thicker formations, however, the sleet is not melted at once, but it is rendered a conductor by the permeation of the fluid, and is so loosened that it is scraped off the rail after one or two sleet brushes have passed over it.

As long as any of the liquid remains on the rail, the formation of new ice is prevented, but it has been found that after

about two hours, the effect of the passage of the shoes and brushes over the rail is to carry most of the solution off, and in case of a continued storm, another treatment is necessary.

As the expense of fitting each car with the necessary apparatus is very small, practically all of the motor cars have been so equipped. This prevents any delay in getting the apparatus in operation, as might occur if the front car of a train was not equipped. E. F. Gould, electrical engineer of the system, states that the apparatus was thoroughly tested last winter, and that the schedule was interfered with very little, although several serious sleet storms prevailed. The sleet is always attacked when it first begins to form. This is especially the case if the storm occurs early in the morning when no cars are being run over the line. At such a time cars are equipped with the cans at the barns and are kept in operation continuously as long as the storm continues. The expense of installing the apparatus, as may be seen, is comparatively small. After once installed, about the only additional expense is that of supplying the calcium chloride. As one gallon of the solution, containing 7½ lbs. of the chemical, is necessary per mile of treatment, the cost per mile at the usual market price of one dollar per 100 lbs. for the calcium chloride is only 7½ cents. This expense is negligibly small compared with the benefits obtained.

FIG. 3.—ELEVATED BARRELS AT WHEATON FOR FILLING TANKS IN CARS

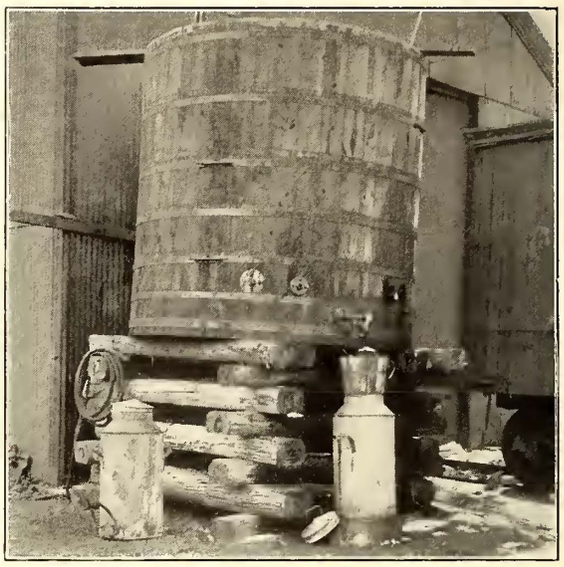


FIG. 4.—MIXING TANK FOR CALCIUM CHLORIDE AT THE CAR HOUSE

THE STRENGTH OF TIMBER TREATED WITH PRESERVATIVES

With the increasing use of timber, preserved in one way or another against decay and fire, it is important to determine the effect which the preserving process has upon the strength of the preserved timber. Many engineers believe that creosoted timber is more brittle and less capable of withstanding strains than the same timber before being treated with creosote.

This question was made the subject of a careful study during the St. Louis Exposition by the Government Bureau of Forestry, under the direction of Doctors von Schrenk and Hatt, of the Bureau of Forestry, and it was found that such reduction in strength as resulted was due entirely to the steaming process required in the seasoning, and that it was very nearly in direct proportion to the length of time that any given steam pressure was applied. Thus, the diminution of strength was found to be 25 per cent after a pressure of 20 lbs. was applied for ten hours to green loblolly pine, and 10 per cent when a pressure of 20 lbs. was applied for four hours. This diminution of strength increased very rapidly when the pressure rose above 20 lbs., and amounted to about 25 per cent when a pressure of 50 lbs. was applied for four hours.

With relation to the effect of preservatives themselves, it may be said that the treatment with zinc chloride does not seem to further reduce the strength of timber beyond the effect of the steaming process. This might have been expected when it is considered that the strength of the zinc chloride solution ordinarily used does not exceed 2½ per cent. The strength of timber that had been treated with the 2½ per cent solution of zinc chloride after having been steamed four hours at 20 lbs. pressure was the same as that of timber which had been steamed without the subsequent application of zinc chloride. The same statement may be made of timber treated with an 8½ per cent solution of zinc chloride. It may be that subsequently the crystallization of the zinc chloride will weaken the wood fiber. This remains to be determined.

The effect of the creosote appears to be the same as that of an equal amount of water in weakening the fiber. That is to say, the strength of creosoted timber is that of green timber. The difference is that while green timber gains strength upon seasoning, the creosote oil remains in the wood, and, it appears from analysis of a pile thirty-five years old, that the oil remains in a liquid condition. Consequently, comparison between seasoned timber and creosoted timber will always result to the disadvantage of the latter as far as its strength is concerned. In the case of creosoted wood, it also remains to determine what changes in the wood fiber take place through lapse of time in the presence of creosote oil.

The preservative fluids investigated included only croesote and zinc chloride.

It is expected that a bulletin will be issued upon the results of these investigations when the tests are completed. This bulletin will also contain the results of the investigations to determine the best methods of preserving wood so that the maximum impregnation may be obtained with the least expenditure of oil per cubic foot of timber.

Provided the City Councils of Minneapolis and St. Paul make appropriations sufficient to repay the company for the expenditure entailed, the Twin City Rapid Transit Company, operating in and between these cities, will build two flat cars for the transportation of fire apparatus from one city to the other. One car will be kept in each city, and in thirty-five minutes after request has been made from either place for assistance, the apparatus would be ready for service in the other city. The value of this proposal to the cities concerned is inestimable.

STEAM-TURBINE POWER PLANT OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD AT WARREN, R. I.

A steam-turbine electric generating plant that is noteworthy from the directness of the steam lines and the absence of a multiplicity of pipes has been added to the power station at Warren, R. I., of the Fall River branch of the New York, New Haven & Hartford Railroad. It is substantial evidence of the rapid growth of the electric service instituted by that company, for in the brief period since 1900, when electric transportation was introduced between Providence and Fall River and Bristol, the company has, for the second time, found it necessary, owing to increased traffic conditions, to make additions to its power equipment.

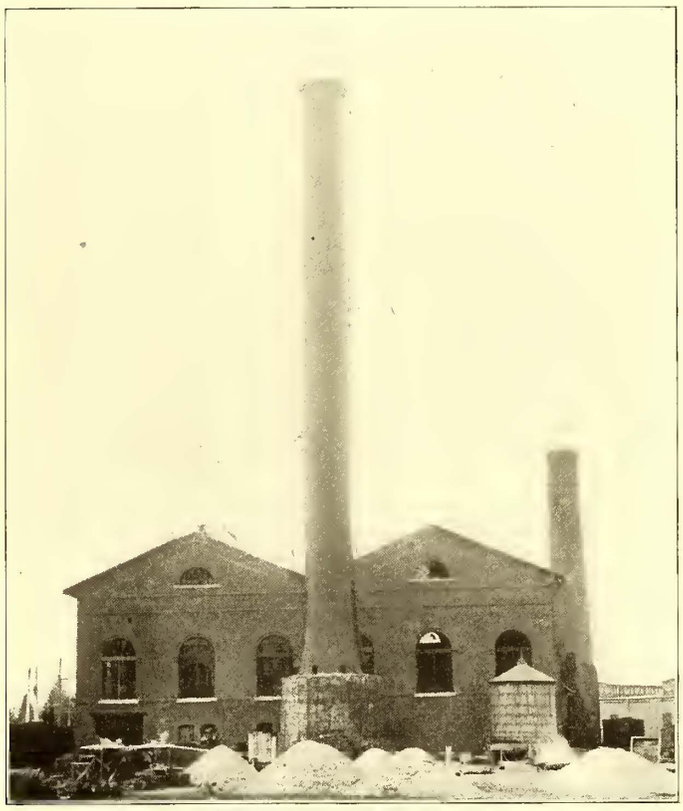
Warren is situated somewhat centrally with respect to the termini, the distances from the power station to Providence, Bristol and Fall River being 10 miles, 4 miles and 9 miles, respectively. Until this latest provision for additional power was made, direct current only was delivered from the plant, at 650 volts, and in connection with its transmission over the relatively long distance to the points of heavy demand, storage battery stations were maintained, one at East Providence and the other at Brayton, Mass., near Fall River. The direct-current machinery consisted largely of two 800-kw direct-connected steam-engine units.

To provide for the additional power for which, as stated, a need had developed, a contract was made with Westinghouse, Church, Kerr & Company, of New York. It was decided to employ alternators giving current directly at 13,200 volts, using Westinghouse-Parsons steam turbines for driving the alternators, to erect rotary sub-stations adjoining the storage battery plants and to connect the direct-current with the alternating-current system by means of a rotary converter in the power house, arranged to remain floating on the line, so that either system could assist the other according to the distribution of the load. The direct-current plant is, of course, planned to supply mainly the sections of the railway nearer the power station, so that the alternating-current machinery may be drawn upon when the load in that vicinity is unusually high, and vice versa, the direct current part of the station may, through the converter, serve the distant points. It is noteworthy that both the sub-stations and the power house building extension, which have accordingly been built, are of fireproof construction throughout, with brick walls, concrete floors and steel roof frames, the last carrying, in the case of the power station addition, a roof of Ludowici tiles, and in the case of the sub-stations, roofs of reinforced concrete.

The power station addition is practically 100 ft. in length and conforms to the general lines of the old building. It is divided into a boiler room, one story in height, housing the boilers and steam lines, and an engine room, two stories in height, containing on the second, or main floor, the steam turbines and electric generating apparatus, and on the basement floor the condensing apparatus, electric cables and transformers. Along the outer wall of the boiler room is a coal bunker, which is a continuation of that along the older section of the wall. Coal cars are run on an elevated track over the bunker, and the coal delivered from them into it passes by gravity through openings in the bottom of the building wall along the firing space in front of the boilers.

In the boiler room there are four Babcock & Wilcox water-tube boilers of 400-hp capacity each, arranged in two batteries, with space for a third battery. The boilers are connected with two mains, one of which supplies steam to the turbines, and the second, or auxiliary, steam main carries steam to the boiler feed-pumps, air pumps and an exciter engine. With this system of piping any derangement of the steam connections to the auxiliary apparatus in the station will not interfere with the operation of the steam turbines. The normal operating pressure is 150 lbs., and all the boilers are arranged for the installation of superheating apparatus when desired.

The products of combustion are carried through a brick duct immediately back of the boilers, leaving enough space below the duct for the blow-off connections. The top of the duct is flat and is built of brick, supported by T-bars spanning the duct. The smoke stack is outside the building, and is of the self-supporting steel class, 130 ft. high and 9 ft. in inside diameter. It was built by the Coatesville Boiler Works, of Coatesville, Pa., and rests on a masonry base 20 ft. high, through which the smoke duct reaches the steel shaft. The effective height of the chimney is 148 ft. above the grates. The base is octagonal in



POWER STATION AT WARREN

form, and is built of concrete, with outside and inside brick walls, which were made to serve as forms for the concrete filling.

The water for the boilers is handled by two 12-in. x 7-in. x 12-in. Warren duplex horizontal outside packed pumps, which receive their supply either from the city mains or from a deep well located on the premises. They deliver ordinarily through a feed-water heater, which receives the exhaust from the pumps, condensers and exciter engines, but the heater may, of course, be by-passed when desired. It is of the closed type, with single steam connection, and was built by the Goubert Manufacturing Company. It is placed horizontally overhead between the two batteries of the boilers, and alongside it is the outboard exhaust for the excess steam from the auxiliaries.

The leading characteristics of the piping work have already been mentioned. Each end of the main steam header is closed with an elbow pointing downward and fitted with a blank flange to form a drainage pocket; and the high-pressure lines are all drained by means of the Holly system. The connection from each boiler is, as usual, provided with two valves, and one of these, over the boiler, is a Pearson automatic non-return stop valve. The auxiliary header, however, is carried in the engine house basement, and is supplied from opposite ends of the present auxiliary steam main that extends across the front of the boilers. The two connections for this purpose, 4 ins. in diameter, are joined at the station partition wall by a connec-

tion from the main steam header, so that the auxiliary header may also receive steam from the main source.

The generator room contains two 750-kw turbo-alternators, with space for a third unit of the same size. They operate at 1500 r. p. m., giving an alternating-current output at 13,200 volts, as stated, and they are guaranteed to develop an electrical hp-hour on about 16 lbs. of steam when exhausting into a vacuum of 26 ins. They are also rated with a capacity to carry 100 per cent overload. As usual with this type of generating unit, no foundation bolts have been employed, the machines simply resting on a concrete base.

Each turbine is connected to an independent condensing plant, with the usual arrangements for operating either condensing or non-condensing. Each condensing unit consists of a Warren vertical twin air pump and jet condenser located adjacent to the turbine, but on the engine house basement floor, there being an open hatchway over each machine, so that the operating attendant has a full view of all the apparatus. The condensing plant is supplied with sea water from the Warren River, and an intake well has been built outside the building for the suction ends of the injection pipes of both the old and the new parts of the station. It was first intended to lead the water from the river to the well through a flume, but an intake bay is now being dredged to bring the water to the well through a short canal. Entrance to the latter will take place through a 4-ft. x 4-ft. opening fitted with removable screens formed of maple frames and No. 8 galvanized iron wire on a ½-in. mesh.

The rotary converter is of the capacity of one of the turbo-generators, or 750 kw. The transformers used with it are located in the basement. The new equipment includes a motor-driven exciter, as well as a steam-driven exciter. Both are of 50-kw capacity at 125 volts, and the engine of the latter is a 9-in. and 15-in. x 9-in. Westinghouse compound engine.

The switchboard is of blue Tennessee marble, supported on a steel frame. High-tension switches are of the oil-bath type, and all uninsulated parts of the switchboard connections carrying high-pressure current are enclosed in the usual fireproof compartments, reducing the danger to the attendants. Cables and wires otherwise are run on insulated supports on the basement ceiling, leaving the engine room floor unobstructed.

Each of the sub-stations will contain triplicate units of 300 kw each, including both static transformers and rotary converters for supplying 500-volt direct current to the trolley lines. One, two or three of the converters can be placed in operation as required. The same care has been shown in arranging the electric apparatus and circuits in these stations as in the power station. In conclusion, it may be said that the station stands as an instance of rapid construction, the excavations for the stack foundations, which were first undertaken, not being started until Aug. 15, 1904, and the first turbine being turned over by Dec. 21. The first sub-station was started Dec. 28.

The Trenton Street Railway, of Trenton, N. J., has applied to the City Council for relief from the abuse of transfer privileges extended to passengers. It is expected that the company will require all transfers to be issued through a transfer agent at the corner of State and Broad Streets, for persons transferring at that point. The city of Trenton is peculiarly laid out, and while the lines run at right angles at State and Broad Streets, they again parallel at others. The Stanton Street cars (running on State Street) parallel the South Broad Street cars for many blocks in the southern part of the city; the Wilbur cars parallel the North Broad Street cars in East Trenton. The Hamilton Avenue cars meet the Wilbur cars at East State Street and Olden Avenue. The East Trenton cars are paralleled in East Trenton by the Brunswick Avenue and Princeton cars (running at right angles at State and Broad Streets), and the Prospect Street and Pennington Avenue cars are but a short distance apart in the northern part of the city.

TESTS OF THE NEW YORK CENTRAL ELECTRIC LOCOMOTIVE

Since the preliminary test conducted by the New York Central & Hudson River Railroad Company with its experimental electric locomotive on the Schenectady-Hoffmans section of its line, near Schenectady, N. Y., and described in the Street Railway Journal for Nov. 19, a series of tests has been commenced to determine whether the locomotive meets the requirements of the specifications. These tests are now under way. Later it is proposed to conduct certain other tests on draw-bar pull, using the dynagraph car of the New York Central Railroad Company.

PROGRAMME OF TESTS

The programme adopted for the tests at the experimental track follows:

These tests are to be of eight kinds, viz.: (A) Adjusting resistances; (B) heat tests; (C) friction tests; (D) acceleration, traction and commutation tests; (E) speed tests; (F) accidental condition tests; (G) special tests; (H) service tests.

A.—ADJUSTING RESISTANCES

Acceleration curves will be taken with amperes plotted to time, and the resistances will be adjusted until a smooth curve is obtained.

B.—HEAT TESTS

The weights of trains, including the locomotive, should be 400 tons, 435 tons and 550 tons (2000 lbs. each ton); coaches will be weighed and proper combinations will be figured out to secure the exact weights of trains mentioned.

All controlling apparatus will be adjusted to take an average accelerating current while on resistance of 830 amps. per motor.

Ammeters will be placed in the circuit of each motor to see that all field coils are properly connected. All armatures should take approximately the same current when in multiple. A record of these amperes will be made and reported for inspection before the definite test is started.

The heat-run test at full voltage and full acceleration current will serve to give the whole locomotive a test, approximating the operating conditions in service. The temperature rise of armature, fields, commutators and all controlling apparatus will be taken. Thus a complete test will be gotten on commutation and general mechanical and electrical operation. The heat tests, approximating, as they will, service conditions, will therefore be the most important of all.

TESTS WITH A 550-TON TRAIN

The contract requires that a train of 550 tons total be handled from Forty-Second Street to Croton in one hour; there will then be a layover of twenty minutes; the return to Forty-Second Street with the 550-ton train must then be made in one hour, one stop being made in each straight trip. The motors will start at approximately the temperature of the surrounding air, and their rise in temperature will be measured by the thermometer, after the round trip. To approximate these conditions, the test on the experimental track will be made as follows:

Distance, 5½ miles.
Voltage at sub-station under all loads, 666 to 575.
Total weight of train, 550 tons.
Average accelerating current per motor, 830 amps.
Run going west to be made with motors accelerating at 830 amps., up into full multiple.
Run going east to be made with two motors in series for 1 mile, at which point the locomotive will be turned into full multiple.
At each end of straight trip, the locomotive will be shifted to the other end of train.
Run West:
Time, power on, 6 minutes 50 seconds.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 8 minutes 30 seconds.

Run East:
Time, power on, 7 minutes and 20 seconds.
Coasting, 50 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 9 minutes.

Two round trips will be made, with time consumed as follows:

	Minutes
Two round trips, train in motion, 17½ minutes	35
Time in motion, locomotive shiftings, 2 minutes each	6
Extra time allowed for coupling, 2 minutes each	6
Total	47
Time shifting locomotive once	4
Layover	29
Repeat above two round trips	47
Total time of test	127

At the end of the above run, the temperatures of the armature, field and controlling apparatus, as measured by their resistance and by the thermometer, will be taken.

TESTS WITH A 435-TON TRAIN

The contract requires that a train of 435 tons be handled from Forty-Second Street to Croton in forty-four minutes; there will then be a layover of sixty minutes at Croton. The return to Forty-Second Street must then be made in forty-four minutes with 435-ton train, then a layover of sixty minutes at Forty-Second Street. The locomotive must be prepared to keep up this service continuously.

To approximate these conditions, the test on the experimental track will be made as follows:

Distance, 5½ miles.
Voltage at sub-station under all loads, 666 to 575
Total weight of train, including locomotive, 435 tons.
Run going west, with motors in full multiple.
Run going east, two motors will be used in series for 1 mile and then the motors will be turned into multiple.
Run West:
Time, power on, 6 minutes and 20 seconds.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 7 minutes and 30 seconds.
Run East:
Time, power on, 7 minutes.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 8 minutes and 30 seconds.

Two round trips will be made, with time consumed as follows:

	Minutes
Two round trips train in motion, 16 minutes each	32
Time in motion, locomotive shifting 2 minutes each	6
Extra time allowed for coupling, etc., 2 minutes each	6
Total time	44
Shifting locomotive once	4
Layover	56
Total time of cycle	104

The foregoing will be repeated with a complete cycle every 104 minutes for twelve hours, or until continuous temperature rises are reached. A standard thermal characteristic test will be made, taking temperatures by thermometer, and by resistance during each layover and plotting them in a curve. At the end of the complete test, all temperatures by thermometer and resistance will be taken carefully, as in ordinary thermal characteristic runs.

TESTS WITH A 400-TON TRAIN

The contract requires that a train of 400 tons total weight be handled from Forty-Second Street to Croton in one hour, making three stops, and with a layover at each end of straight trip of sixty minutes; this cycle to be operated continuously.

To approximate these conditions, the tests on the experimental track will be as follows:

Distance, 5½ miles.
Voltage at sub-station under all loads, 666 to 575.
Total train weight, 400 tons.
Run west with motors in multiple.
Run east with motors in series for 1 mile and then in multiple.
Run West:
Time, power on, 6 minutes and 10 seconds.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 7 minutes and 30 seconds.
Run East:
Time, power on, 6 minutes and 50 seconds.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 8 minutes and 30 seconds.

Two and one-half round trips will be made, with time consumed as follows:

	Minutes
Average time train in motion, 2½ round trips	40
Shifting locomotive in motion, 2 minutes each	8
Extra time allowed for coupling, etc., 2 minutes each	8
Total time	56
Shifting locomotive once	4
Layover	60
Total time of cycle	120

The foregoing will be repeated with a complete cycle every two hours for twelve hours, or until continuous temperature rises are reached. A standard thermal characteristic test will be made, taking temperatures by thermometers, and by resistance during each layover and plotting them in curves. At the end of the complete test, all temperatures by thermometer and resistance will be taken carefully, as in ordinary thermal characteristic runs.

A coasting test will also be made with the locomotive pulling a 550-ton train, with the brushes removed and fields excited, at the approximate free running current value, in order to determine the effect of the magnetism upon the bearings.

In addition to the foregoing contract tests, other thermal characteristic runs will be made so as to complete a thorough thermal test of this locomotive equipment.

Distance, 5½ miles.
Acceleration per motor, 820 amps.
Minimum weight of train, 200 tons, including locomotive.
Maximum weight of train, 700 tons including locomotive.
Voltage at sub-station, 666 to 575.

There will be a sufficient number of tests, including the contract tests, to determine the degree rise per watt loss for as great a range of distribution of losses as would be gotten by operation with a 200-ton train minimum to a 700-ton train maximum. These will be as follows:

Run west to be made in full multiple.
Run east, 1 mile in series and then in multiple.
Time power on and coasting in each case to be determined by trial as in ordinary thermal characteristic runs.
With the lighter trains the layovers should be as small as consistent with operation during the test.
With the heavy trains a layover of approximately one-half the total time should be allowed.

All of these special runs, as well as the contract runs, will be calculated for losses as shown in thermal characteristic tests, and a report will be prepared therefrom.

C.—FRICTION TESTS

After getting the friction of the locomotive and train fairly constant and of average value, a series of friction test runs will be conducted. These runs will be made by allowing the train to coast in both directions over a portion of the track where the grades and curvatures are known, but a section of track will be selected having as long, straight and level portions as possible. Trains of 200 tons to 700 tons will be used. The locomotive will also be used alone. The average speed during coasting will be as low as 25 m.p.h., and also as high as possible. At least eight or ten good records will be obtained with average speeds within the above range. From the record of speeds to time thus obtained, the friction of various trains at various speeds will be determined.

From the heat-run records, the speed, amperes and volts can be gotten for various instants, and therefrom a speed or torque curve plotted to amperes will be deduced. In connection with the torque curves and the records of speed to time, the friction during acceleration at various speeds can be calculated and compared with the frictions determined from the coasting tests.

D.—ACCELERATION, TRACTION AND COMMUTATION TESTS

Acceleration, traction and commutation tests under control of the limit switch will be made as follows:

The controller will be adjusted to take varying average currents during acceleration on resistance of 600 amps., 800 amps., 1000 amps. and 1200 amps. per motor. Care will be taken to determine the slipping point of the wheels, and several tests with the proper current per motor will be made at or near this point.

Tests will be made with trains from 200 tons to 700 tons, also with the locomotive alone. The commutation of the motors and the general operation of the control will be noted and recorded. A record of amperes, volts and speed to time will also be taken. These tests will be taken at or near the substation, so as to get practically 600 volts across the motors.

The traction tests will be made with and without sand, and notes will be taken as to which wheels slip, with memoranda of weather conditions and conditions of rail.

E.—SPEED TESTS

Speed tests will be conducted with the locomotive pulling trains of from 200 tons to 700 tons weight to ascertain the maximum speed the locomotive can make when hauling these trains. The locomotive will also be tested running light and its maximum speed will be determined. The voltage at the substation may vary from the pressure previously given while these tests are being conducted, and if it does vary, allowances will be made and speed curves plotted to show what speeds the locomotive will make when supplied with a working pressure of 600 volts at the locomotive.

F.—ACCIDENTAL CONDITION TESTS

These tests are to be conducted to ascertain the hauling ca-

N. Y. C. & H. R. R. R. Electrical Department. Eq'p't Data Sheet No.

APPARATUS UNDER TEST

TESTS NUMBERS ..... Date 190

EQUIPMENT:

- Number of Motors
- Armature Numbers
- Frame Numbers
- Type of Motors
- Field Specifications
- Armature Specifications
- Gear Reduction
- Size of Wheels
- Weight on a Driving Axle
- Total Wt. Loco. or Motor Car
- Total Effective Wt. Loco. or Motor Car

REMARKS:

The Term Train, unless otherwise stated, includes Locomotive.

Temperatures taken by the resistance method will be followed by the letter "R."

Trailers,										Total
Weight Each										
Effect. Tons Ea.										
Length, Ft.										
Total Cross-Sect. to Rail, Sq. Ft.										

BLANK 1, FOR APPARATUS UNDER TEST

N. Y. C. & H. R. R. R. Electrical Department. Test No. Eq'p't Data Sheet No.

STARTING RESISTANCES

Date 190

NOTCH	STEP	TOTAL	REMARKS

UPPER PART OF BLANK 2, FOR STARTING RESISTANCES

N. Y. C. & H. R. R. R. Electrical Department. Test No. Eq'p't Data Sheet No.

LOG OF RUN

Date 190

No. of Run												
No. of Cars Used												
Weight of Train												
Length of Train												
Distance Run												
Direction of Run												
Duration of Run												
Time: Motors, Series-Series												
Time: Motors, Series-Multiple												
Time: Accel'g on Resis.												
Time: Power on												
Time: Coasting												
Time: Brakes on												
Distance: Motors, Series-Series												
Distance: Motors, Series-Multiple												
Distance: Accel'g on Resis.												
Distance: Power on												
Distance: Coasting												
Distance: Brakes on												
Accel. Motors, Series-Series												
Accel. Motors, Series Multiple												
Accel. Motors, Multiple												
Speed: Maximum												
Speed: Mean												
Energy: Train												
Energy: Pumps, L'ts, &c.												
Energy: Motors												
Energy: Total by Sta. Wattmeter												
Current: Maximum												
Current: Mean												
Current: Accel'g per Motor												
Volts: Maximum												
Volts: Minimum												
Volts: Mean												
Track: Condition												
Track: Grade												
Track: Curvature												
Wind Vel. & Direction												
Train Resis. per Ton: Coasting												
Train Resis. per Ton: Braking												
Accel'g Force, per Ton												

BLANK 3, LOG OF RUN

N. Y. C. & H. R. R. R. Electrical Department. Test No. Eq'p't Data Sheet No.

LOG OF HEAT RUN I

Time Sheet

Date 190

SCHEDULE	Time of Run H.	M.	S.	Elapsed Time Accn.	Current On	SCHEDULE	Time of Run H.	M.	S.	Elapsed Time Accn.	Current On
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					

UPPER PART OF BLANK 4, LOG OF HEAT RUN I.

pacity of the locomotive and how it will operate under various accidental conditions, of which the following are examples:

(1) One motor cut out of service, due either to loss of armature or field coil.

(2) Two motors cut out of service for similar reasons.

(3) Controller difficulties, such as one reverser failing to throw.

(4) Air Brake Failures—Tests will be made to indicate how

N. Y. C. & H. R. R.R. Electrical Department. Test No.____ Eq'p't Data Sheet No.____

LOG OF HEAT RUN II

READINGS RECORDED AT INTERVALS OF____ Date____ 190

Instrument No. / Corr. Factors							TEMPERATURES					
Motor No.____ Time	Volts Arm.	Amps. Arm.	Partial Res. Arm.	Volts Field	Amps. Field	Res. Field	Arm. by Res.	Field by Res.	Spool	Spool	Frame	Air Temp.
Motor No.____ Time												

No. of Comm. Segments____ No. Between Current Leads____ No. Between Volt Leads____

Ratio Total Resistance/Partial Resistance, (1) From Test____ (2) From Calculation____

Resistances	Number	Resistance	Number	Resistance	Number	Resistance	Number	Resistance
Armature 25° C.								
Armature Hot								
Field 25° C.								
Field Hot								

BLANK 5, LOG OF HEAT RUN II.

N.Y.C.&H.R.R.R. Electrical Department. Test No.____ Eq'p't Data Sheet No.____

LOG OF HEAT RUN III.

Date____ 190

FINAL TEMPERATURES Taken at____

MOTOR	No. 1	No. 2		No. 1	No. 2
Frame			Arm. Core Surface		
Spool			Arm. Conductors		
Spool			Commutator		

AIR TEMPERATURE At end of run____ °C.

Remarks, Weather Conditions, etc.:

UPPER PART OF BLANK 6, LOG OF HEAT RUN III.

N. Y. C. & H. R. R.R. Electrical Department. Test No.____ Eq'p't Data Sheet No.____

RESISTANCE MEASUREMENTS

Date____ 190

Time____ Air Temperature____

Arm. No.	Volts	Amps.	Resis.	Temp.	Field No.	Volts	Amps.	Resis.	Temp.

UPPER PART OF BLANK 7, FOR RESISTANCE MEASUREMENTS

N. Y. C. & H. R. R.R. Electrical Department. Test No.____ Eq'p't Data Sheet No.____

SUMMARY OF HEAT TESTS

Date____ 190

FOR APPARATUS UNDER TEST SEE SHEET No.____

SCHEDULE: Speed____ m. p. h., including____ stops of____ seconds each, for____ feet distance. Power on____ secs. Started every____ secs. Coasting____ secs. Braking____ secs. Standing____ secs. per run. Time occupied in taking resistances____ mins. per hr. Power on____ min. per hr.

ACCELERATION: Accelerating current called for____ amps. Mean accelerating current from test____ amps. Time of acceleration on resistance____ secs.

VOLTAGE: Voltage called for____, Mean voltage on motor just before power is cut off____. Mean voltage during speed curve running____

CURRENT: Mean current, while power is on____ amps. Root mean square current, while power is on____ amps. Current just before cutting off power____ amps. Free running current____ amps.

SPEED: Maximum____ m. p. h. Mean, while running____ m. p. h. Mean, including stops____ m. p. h. Free running speed____ m. p. h.

FINAL TEMPERATURE RISE BY THERMOMETERS

MOTOR	No.	No.	No.	No.
Frame				
Spool No. 1				
Spool No. 2				
Armature Core				
Arm. Conductors				
Commutator				

LOSSES:	WATTS MEAN LOSSES WITH POWER ON		
Armature No.			Mean
C^2R Armature			
Core Loss			
Total Arm. Loss			
C^2R Field			
Total Loss			

Ratio of Distribution = ____

Mean loss during run = ____ = ____ Watts

REMARKS:

Tested by	Date of Test	Test approved by

BLANK 8, SUMMARY OF HEAT RUNS

N. Y. C & H R. R.R. Electrical Department. Test No.____ Eq'p't Data Sheet No.____

TRAIN RESISTANCES

Date____ 190

TRAIN RESISTANCE BY COASTING

No. of Locomo's or Motor Cars	
No. of Trailers	
Weight of Train	
Effective Tons per Train	
Length of Train	
Coasting Speed { Beginning / End	
Time Coasting	
Direction of Wind	
Velocity of Wind	
Grade + or −	
Curvature	
Average Speed	
Retard m. p. h. p. s.	
Retard lbs. per Ton Tr. Wt.	
" due to Wind	
" " " Grade	
" " " Curv.	
" " " Friction	

TRAIN RESISTANCE BY FREE RUNNING

No. of Locomo's or Motor Cars	
No. of Trailers	
Weight of Train	
Length of Train	
Free constant Speed	
No. of Motors used	
Voltage on Motors	
Amps. per Motor	
Direction of Wind	
Velocity of Wind	
Grade + or −	
Curvature	
Total Friction per Ton	
Retard. due to Wind	
" " " Grade	
" " " Curv.	
" " " Friction	

BLANK 9, TRAIN RESISTANCES

the locomotive can be used as a brake to stop a train in case of a failure of the air brakes to work.

G.—SPECIAL TESTS

In order to ascertain whether or not certain changes in design may be advisable, tests will be made to ascertain what the effects would be in case changes were made, of which the following are examples:

(1) With brush holders mounted on supports attached to the yoke over the journal boxes, and also with the brush holders bolted directly to the magnetic frames.

(2) Tests with various types of third-rail and overhead current collecting devices on the locomotive.

(3) Fuse tests to determine the proper size and action when blown.

(4) Effect of magnetism in the motors upon metallic substances between or near the rails of the track.

(5) Competition tests with trains hauled by modern Atlantic and Pacific types of steam locomotives, including acceleration, speed and friction tests.

(6) What will happen if an armature is cut out, but has short-circuited coils.

(7) General operation of locomotive to be noted. This will include reliability of operation, riding qualities of locomotive, ease of taking curves, utility of motor screens under varying weather conditions of rain and snow, the action of various auxiliary devices, etc.

(8) Test for flashing over, when braking heavy currents.

(9) Tests under various conditions of snow, sleet, ice and rain, noting effect on shoes. Experiments to be made with various forms of snow-plows for cleaning the third rail, with and without protection; also with various methods of cleaning sleet and ice from the third rail; also heating tests of third rail for melting ice.

(10) Tests to be made with worn driving boxes. For these tests the boxes will be turned out to correspond to a worn journal.

H.—SERVICE TESTS

Service tests will be conducted of approximately 50,000 miles, of which the mileage made in performing the above tests shall constitute a part, to ascertain the results both on the locomotive and track. The 50,000 miles will be made up approximately as follows:

Preliminary running	500
Casual running	100
Heat test running	800
Other test running	4,100
Service mileage	44,500
Total	50,000

The service mileage will be made as follows:

(1) Eight hours running per day.

(2) Number of single trips per day, 68.

(3) Miles per day, 403.

(4) Days required for mileage test, 112.

In the 6 miles there are six frogs and one railroad crossing. Ten trips each day will be made through the passing sidings to get the wear and tear of going through the switches.

Before starting the mileage runs, a representative of the railroad company, to be appointed by the motive power department, will follow the tests, with the object of suggesting improvements to facilitate the handling of the locomotive, as well as to note mechanical defects.

RECORD BLANKS

A complete set of record blanks has been prepared by the Electrical Commission of the New York Central & Hudson River Railroad Company for systematically collecting and studying the test records. In using these blanks, all final records will be made out in duplicate and signed by regularly appointed representatives of the railroad company and the General Electric Company, and a copy of each official test will be furnished to each company. In view of the importance and novel character of these tests, reduced fac similes of the different forms employed are presented on the two preceding pages, showing the headings under which the entries will be made. The originals are all uniform in size, being 13½ ins. long and 7¾ ins. wide. There are nine forms, as follows:

(1) Apparatus under test;
(2) Starting resistances;
(3) Log of run;
(4) Log of heat run I. (time sheet);
(5) Log of heat run II.;
(6) Log of heat run III.;
(7) Resistance measurements;
(8) Summary of heat tests;
(9) Train resistances.

In addition to these reports, a progress report is to be submitted each week to the New York Central Electrical Commission, showing the results of the tests made during the previous week.

ANNUAL REPORT OF NEW YORK BOARD OF RAILROAD COMMISSIONERS

The Board of Railroad Commissioners of New York State has just rendered its annual report to the Legislature. In reference to elevated railroads, the report states that the total number of passengers carried on the Manhattan Railway during the year ending June 30, 1904, was 286,634,195; in 1903 it was 246,587,022, an increase in 1904 of 40,047,173. The average carried per day in 1904 (365 days) was 785,299; in 1903, 675,581. The Brooklyn statistics are included under surface railways. During the year the Brooklyn elevated roads killed 3 passengers and injured 48; the Manhattan killed 11 and injured 7. The board is still considering the question of the protection of the electric third rail in the operation of the elevated railroads in New York City.

The total gross earnings from operation of the surface street railway companies were $51,964,744.99, which is an increase of $2,989,996.22 over 1903. The operating expenses were $31,397,622.73, which is an increase of $3,137,901.45 over 1903. The percentage of dividends to capital stock is 3.71; in 1903 it was 3.66, an increase of .05 per cent. The total number of passengers carried (including "transfers") was 1,341,766,931; the total number carried in 1903 was 1,267,563,057; 74,203,874 more being carried in 1904 than in 1903. The miles operated increased 99.95 miles, but some of this was not operated during the entire year. The number of passengers carried in the boroughs of the Bronx and Manhattan, New York City (including "transfers"), was 618,760,058; an increase of 6,051,787 compared with 1903. The number of "transfers" in these boroughs increased 8,671,514. The number of passengers carried in the borough of Brooklyn (including "transfers"), including those carried in the borough of Queens by the Brooklyn roads and those carried in the borough of Queens by the Long Island Electric and the New York & Queens County (borough of Queens roads) railways, was 410,709,977, an increase of 30,957,755 over 1903. The number of "transfers" in these boroughs increased 4,714,503. The average carried per day (365 days) in these boroughs was 1,125,233.

Following will be found a table giving percentages of operating expenses to gross earnings for all the companies for the year ending June 30:

	1903.	1904.
Maintenance of way and structures	3.99	4.39
Maintenance of equipment	5.94	7.23
Operation of power plant	9.42	9.32
Operation of cars	28.13	28.30
General expenses	10.22	11.18
	57.70	60.42

The percentages of subdivisions of operating expenses to total operating expenses were as follows:

	1903.	1904.
Maintenance of way and structures	6.92	7.27
Maintenance of equipment	10.29	11.96
Operation of power plant	16.33	15.44
Operation of cars	48.74	46.83
General expenses	17.72	18.50
	100	100

The following table gives statistics relative to the operation of some of the more important companies in the State:

Street Surface Railway (principal companies) Receipts and Expenditures per passenger and cost of operating per car mile for year ending June 30, 1904

OPERATED WHOLLY OR IN PART BY MECHANICAL TRACTION

NAME OF ROAD	Number of passengers carried including transfers	Total car mileage	*Based upon Gross Earnings from Operation and Operating Expenses		*Based upon Receipts from all Sources and Total Expenditures, Including Fixed Charges		Per Car Mile		
			Average earnings per passenger	Average cost of operation per passenger	Average receipts per passenger	Average expenses per passenger	*Gross earnings	*Operating expenses	*Total expenses, including fixed charges
			Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Albany and Hudson	1,335,115	712,602	14.18	9.35	17.44	15.47	26.57	17.53	28.98
Auburn and Syracuse	2,737,954	904,822	8.72	5.84	8.77	8.19	26.39	17.66	24.77
Brooklyn Heights†	327,323,843	53,891,975	4.16	2.48	4.24	3.85	25.24	15.04	23.38
Binghamton	5,916,960	1,210,622	4.06	2.21	4.08	3.53	19.76	10.81	17.24
Central Crosstown (N. Y. City)‡§	15,969,152	1,426,824	2.56	1.69	2.73	2.36	30.59	18.93	26.47
Coney Island and Brooklyn	39,459,197	6,391,140	4.17	2.70	4.18	3.39	25.72	16.71	20.98
Crosstown Street (Buffalo)	16,404,286	2,614,577	3.30	1.99	3.33	3.05	20.73	12.48	19.14
Dry Dock East, Broadway and Battery (N. Y. City)	12,834,140	1,863,000	3.94	3.14	3.99	4.32	27.12	21.64	29.76
Geneva, Waterloo, Seneca Falls, and C. L.	1,708,859	437,984	4.57	2.93	4 59	4.15	17.85	11.43	16.21
Forty-second St. M. and St. N. Ave.(N.Y.City)§	20,355,905	3,232,145	4.13	2.89	4.61	4.85	26.04	18.24	30.53
Hudson Valley	5,717,679	2,265,130	8.13	6.56	8.55	11.19	20.54	16.55	27.36
International (Buffalo)	82,965,876	15,153,937	4.18	2.53	4.39	3.49	22.90	13.80	19.08
Jamestown	4,934,893	797,864	3.00	1.99	3.04	2.71	18.58	12.30	16.75
Kingston Consolidated	2,639,516	493,599	4.66	2.75	4.68	4.27	24.92	14 72	22.82
New York City¶	433,114,493	45,383,254	3.49	1.84	3.64	3.90	33.34	17.55	37.23
New York and Long Island	924,849	377,410	6.46	5.54	6.52	5.69	15.82	13.66	15.82
New York and Queens Co.	15,680,571	3,092,412	4.16	2.35	4.22	3.60	21.09	11.90	18.27
Rochester	47,338,639	6,138,030	3.14	1.79	3.19	2.55	24.23	13 86	19.70
Schenectady	10,102,677	2,755,036	6.48	4.91	8.21	6.81	23.77	18.04	24.98
Syracuse and Suburban	1,603,045	438,492	5.21	3.24	5.24	5.09	19.05	11.84	18.60
Syracuse Rapid Transit	21,451,500	3,869,887	3.89	2.28	3.91	3.42	21.57	12.67	18.97
Third Avenue (N. Y. City)**	45,867,289	6,336,829	3.92	2.07	5.25	5.22	28.37	14 99	37.78
United Traction (Albany and Troy)	33,454,182	8,297,632	5.05	3.29	5.09	4.22	20.37	13.28	17.01
Utica and Mohawk Valley	14,002,520	3,394,271	5.18	3.52	5.20	4.72	21.36	14.52	19.47
Union (N. Y. City)	48,766,028	7,670,457	2.65	2.03	2.68	2.58	16.86	12.93	16.29

*Includes earnings and expenses of freight, express, mail and all other business. †Includes all lines operated by Brooklyn Heights not making separate reports. ‡For nine months. §Includes portion operated by horses. ¶Includes all lines operated by New York City not making separate reports and also includes lines operated by horses. **For ten months

The following is a table of accidents occurring on street surface railways during the year ending June 30, 1904, as reported to the board in separate accident reports and as classified in its own office:

Table of Accidents on street surface railroads reported by separate reports to the Board of Railroad Commissioners, classified as to causes, for the year ending June 30, 1904.

CAUSE OF ACCIDENT	1904								1903							
	PASSENGERS		EMPLOYEES		OTHERS		TOTAL		PASSENGERS		EMPLOYEES		OTHERS		TOTAL	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
Fell from car in motion	7	26	4	9	3	9	14	44	6	15	3	4	...	2	9	21
Getting on or off cars in motion	12	156	2	...	5	54	19	210	10	130	1	...	10	77	21	207
Walking or being on track	1	1	10	4	94	161	105	166	...	...	5	3	82	166	87	169
Putting head or arms out of windows, or missiles thrown in windows	...	1	...	...	...	...	...	...	2	...	...	...	...	...	...	2
Crossing tracks at street crossings	...	...	...	...	42	114	42	114	...	...	...	...	28	108	28	108
Derailments:																
Running at too high rate of speed	...	...	...	...	...	...	...	...	13	40	1	1	...	...	14	41
From obstruction on track	...	...	...	...	...	...	...	...	...	7	...	...	...	...	...	7
From unknown causes	...	34	1	2	...	...	1	36	2	54	...	2	2	1	4	57
Defective track	...	9	...	...	...	...	...	9	...	...	...	...	...	...	...	...
Collisions:																
Head on, by neglect of orders or signal	1	62	...	10	...	...	1	72	2	53	...	...	...	...	2	53
Rear, by neglect of orders or signal	...	110	...	10	...	1	...	121	...	44	3	20	...	...	3	64
By misplaced switch	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...
At grade crossings of railroad	...	5	...	...	...	...	...	5	...	7	...	...	...	...	...	7
Other causes	3	62	11	36	...	2	14	100	2	36	8	18	1	2	11	56
	24	466	28	71	144	341	196	878	35	388	22	48	123	356	180	792
From causes beyond their own control	1	223	2	23	...	2	3	248	17	224	5	24	1	1	23	249
By their own misconduct or incaution	23	241	26	48	143	336	192	625	17	161	16	24	113	346	146	531
Reported as caused by intoxication	...	2	...	...	1	3	1	5	1	3	...	...	9	9	10	12
Indeterminable as to want of caution or otherwise	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...
	24	466	28	71	144	341	196	878	35	388	22	48	123	356	180	792

The average number of persons, including officials, employed during the year ending June 30, 1904, on all the street surface railroads of the State (including horse railroads) was 32,646; in 1903, 30,028. The aggregate amount of salaries and wages paid them during the year was $19,812,227.43; in 1903, $17,841,895.49. The companies owned and operated on June 30, 1904, 5253 electric motor or cable box cars; 4136 electric motor or cable open cars; 659 electric motor combination box and open cars; 30 electric motor combination passenger and baggage cars; 10 electric motor mail cars; 428 electric motor express, freight and other cars; 376 electric motor snow-plows, sweepers and sprinklers, the total being 10,892; for the year ending June 30, 1903, the total was 10,364. Sixteen thousand and seventy-two fenders were reported in 1904 as in use on these cars. Some of these fenders are transferred from one end of the car to the other at terminals, and some f the devices reported as fenders are wheel-guards. Two thousand and twenty-six other cars (being cars operated by horses, and box, open, freight, express, service cars and snow-plows not equipped with motors) were also owned and operated on June 30, 1904.

The number of tons of freight reported as carried on the

street surface railroads of the State during the year ending June 30, 1904, was 633,674.

On some of the roads separate express companies operate, and in some of these cases the amount carried is not reported.

REPORT OF ELECTRICAL EXPERT

The electrical expert of the board reports generally on the physical condition of street surface railroads as follows:

The improvements in the physical conditions of electric railroads in this State, mentioned in the last report to the board on that subject, have been continued during the past year. This is especially true of the suburban and interurban roads. There are, however, some exceptions, and a few of the older and less important roads are not in proper condition. On some of these there is quite an excursion traffic during the summer season, and the safety of this traffic requires that these roads should be improved.

The board has made recommendations which, if complied with, would result in the necessary improvements. In some instances, the financial conditions of the companies are such that they have been unable to comply with all of the recommendations. In these cases, frequent inspections of the roads have been made, and compliance with the more important recommendations, affecting the immediate safety of operation insisted upon, and, in most instances, have been complied with.

The improvement in the construction of cars, noted in the last report, has been continued during the past year, and all of the new cars added to the suburban service in the State are of modern construction and properly provide for the comfort and convenience of passengers. As a result of the board's action, there has been a marked improvement in the maintenance of cars on nearly all of the city as well as suburban railroads; more attention has been given to the matter of caring for cars, including painting, varnishing and cleaning.

The increase in the use of power brakes on electric cars has been continued during the past year, and all of the additions to the rolling stock on interurban lines have been equipped with some form of power brake, and a number of cars on city lines have been so equipped.

The question of the danger of high-voltage transmission lines, located on street and highways, was the subject of investigation by a committee of the State Street Railway Association. This committee made a number of tests on a line especially constructed for that purpose. Your electrical expert took part in these tests. This committee presented a report to the association at its convention held in Utica, September, 1904. This report was to the effect that, under certain conditions, wooden poles supporting wires carrying high-voltage currents might become dangerous to persons coming in contact with them. They also suggested a practical and inexpensive method of preventing these possible dangers, but, even with pole lines equipped as suggested by the committee, they should not be placed on streets or highways where it is possible to avoid doing so.

One of the most serious defects in electric railroad operation, not only in this State, but throughout the country, exists in the methods of train despatching. This important matter was the subject of consideration by a committee of the State Street Railway Association. This committee has not completed a report on this subject. A uniform method of train despatching on interurban railroads must be adopted, to insure safety of operation.

During the past year, several accidents have occurred, which were caused by operating two or more cars in one train with one motor car, the others being trailers coupled to the motor car and to each other with draw-bar couplings. These trains are usually used for excursion purposes, and in most cases without a sufficient number of employees on them to insure control on heavy grades. Where traffic demands the operation of cars in trains, they should be equipped with modern couplings and air brakes, controlled by the motorman on the head car.

THE BOARD'S RECOMMENDATIONS

The board renews to railroad managers its general recommendations made in its annual reports for several years, as to the operation of street surface railroads, especially in the following particulars:

First—Every street car which crosses a steam railroad at grade shall be equipped with a red flag for use during the day and a red lantern for use at night. When approaching such crossings, the car shall come to a full stop at least 30 ft. from the crossing, and shall not proceed until the conductor has gone upon the steam railroad, carrying the flag or lantern, and after ascertaining that the way is clear, given the proper signal for the car to proceed. The board also recommends that at all grade crossings by overhead trolley railroads of steam railroads, a V-shaped trough of metal be constructed over the trolley wire or wires to insure the motor retaining the current while the crossing is being made.

Second—That where two or more street car lines cross, or where they merge, an agreement shall be made as to which line shall have the right of way. The car that has not the right of way shall come to a full stop before crossing the tracks of the other line, or entering on the joint track, and the car which has the right of way shall slow down before crossing the tracks of the other line, or entering on the joint track.

Third—That cars passing in opposite directions shall not meet on street crossings.

Fourth—That the speed of cars be reduced to the minimum on all curves where the view is obstructed.

Fifth—That passengers be prohibited from riding on the running boards or side steps of open cars.

Sixth—That passengers be not permitted to stand on the front platform of open cars, and that only as many passengers be permitted on such platforms as can be conveniently seated. In the case of open cars that have no seats on the front platforms, passengers shall not be permitted to ride on the platform, and the side gates shall at all times be kept closed. Under no circumstances should passengers be permitted to ride on the front platforms of closed cars.

These recommendations have been quite generally adopted by the companies. Beginning in January last, in New York City, the plan of stopping street surface railroad cars at intersecting streets, with the front platform at the crosswalk first reached, was tried, but afterward abandoned. The recommendation of this board as to providing oil tail-lights on cars operated on suburban lines has been quite generally adopted.

Attention is called to statements contained in this volume of investigations of complaints against street surface railroads.

The members of the Salt Lake Street Railway Mutual Aid Association, at its last meeting, elected the following officers and directors for the ensuing year: O. P. Arnold, Jr., president; George Manning, vice-president; J. R. Mathews, secretary; A. M. Rust, treasurer; Joseph J. Coles, T. C. Nuttal, E. H. Arnold, M. W. Wagstaff, J. M. Lindsey, directors; Walter Calder, J. G. Williams, George Eldredge, auditors; Dr. C. M. Benedict, physician. The reports of the secretary and treasurer show the association to be in a thriving condition, financially and otherwise. It now has a membership of 340, over 100 having joined during the past few months. Arrangement has been made with one of the retail drug stores of the city by which members of the association will get prescriptions compounded and drugs and medicines at special rates. It is expected that an arrangement will be made with one of the hospitals to care for the members of the association in the event of sickness or accident, at a reasonable rate.

ANNUAL REPORT OF THE MASSACHUSETTS BOARD OF RAILROAD COMMISSIONERS

The annual report of the Railroad Commissioners of the State of Massachusetts has just been published. The statistics presented are for the year ending Sept. 30, 1904, and the commissioners say that the total miles of main track (including trackage rights) operated in the State is 2,654.479, an increase of 33.517 over the previous year. The remarks on the general condition of the street railway properties of the State follow:

STREET RAILWAY CONDITIONS

The street railway returns of the year are suggestive. Of seventy-four operating companies, thirty failed to earn expenses and fixed charges; twenty-five paid dividends; of the twenty-five which paid dividends, fourteen earned them during the year. Five companies, as stated above, have been in the hands of receivers. Very few companies, beside keeping their railways in good repair, reserved for depreciation what prudent management would require. Generally present necessities only have been met, the future, with its inevitable expense of replacement and reconstruction, being allowed to look out for itself. The board prepares a yearly list of companies, which appear from their returns to have properly earned and paid a dividend of at least 5 per cent for the five years immediately preceding. Thirteen companies were found to be entitled to a place upon the list submitted in January, 1903; the list of January, 1904, contained the names of twelve companies; that submitted this year contains the names of ten companies.

Attention has been repeatedly called to the unusual expenses consequent upon the severity of last winter's weather and to the loss of receipts in the summer owing to the coolness of the season. But it is not safe to count upon mild winters and warm summers in this part of the country, and while it is agreed that the past year was an extraordinary one, it is plain that the weather did not drive five companies into insolvency and others perilously near it. The evil is more radical. In the early days of the change from horse to electric railway, promotion ran wild, with the idea that immense profits were to be realized in the extension of the old and in the construction of new railways as electric roads in any and every direction; that where no business was in sight, it would appear under the creative magic of the electric car. The test of this opinion, necessarily a test of years in which novelty disappears, is now practically complete. Experience has shown that with the more expensive roadbed and equipment, the heavier rail and larger cars, there has not been the corresponding and expected development of permanent business. Operating cost, too, in heating cars and in repair and renewal of plant, has proved larger than was expected. With the new accommodation and the nearer approach to railroad conditions, has come the increased demand of the public for expenditures in the interest of safety and comfort which had not been counted upon, as for example, in construction of double track, instalment of signal systems and establishment of waiting rooms. Hurried along by the natural enthusiasm for the new type of railway with its many most attractive features, capital, sometimes deliberately misled, has been invested in undertakings for which there was no sufficient demand, and which are now represented by roads run, not only without return upon the investment, but at an actual loss of capital. In such cases the future promises as possible events: the acceptance of an unsatisfactory service as better than nothing; an increase in fares, or the abandonment of the railway. It is a source of gratification that under our restrictive laws, while capital has taken its own risk as to the earning capacity of these enterprises, in no case has there been an issue of stock or bonds in excess of the fair cost of the railway property, to act as a contributing factor to the existing troubles.

Upon some railways fares have been raised, and with encouraging results, but this action is usually unpopular, and is often taken at the risk of lessening the volume of business. It is, moreover, at times complicated by agreements made between companies and town officials when locations and privileges in the streets were granted. If, however, this is the remedy, it is better that it be applied than that the public lose the benefits which the railways bring.

Another incident of the present situation has been the enforcement upon certain systems of a seemingly arbitrary distinction between the long and the short distance ride, to the provocation of the through traveler, who is loath to admit that there is any justification for it. The zone system has never been favored in this State. Instead there has been adopted the 5-cent fare within city and town limits, in some cases between centers of adjoining towns. As new grants of location have been sought, the 5-cent fare has been made good for greater and greater distances, frequently through the use of transfer checks. This low fare promotes a better distribution of population in large communities, and is conveniently paid and collected, while the company has been enabled to reap a profit in the frequency with which cars have been filled and refilled with persons taking short rides. In one notable and exceptional instance this fare covers five cities, which were deemed to be so closely connected as to make practically one continuous community, and so to give the company the advantage of continually changing patronage from point to point. The attempt, however, upon interurban lines to maintain these local concessions, and at the same time to establish a sort of mileage basis for through travel, with arbitrary fare limits, has naturally led to frequent complaints from those who think they are unjustly denied privileges which are given to others. The companies, as well as the traveling public, would be benefited by the establishment of a more satisfactory system of fares upon these railways. Much study has been and is being given to the matter, but as yet the problem remains unsolved.

ASSETS AND LIABILITIES

The gross assets of the companies on Sept. 30, 1904, were $140,843,739.79, an increase of $1,979,525. The gross liabilities at the same date, including capital stock, were $136,049,485.24, an increase of $2,928,075. That is, the aggregate surplus of the companies was reduced by $948,550.

DIVIDENDS

The total amount of dividends declared the last year was $3,214,496.24, a decrease of $371,752 over the preceding year. One company paid 11 per cent; one paid 10 per cent; five paid 8 per cent; one paid 8 per cent on preferred and 7 per cent on common; one paid 7.22 per cent; one paid 7.20 per cent; one paid 7 per cent; ten paid 6 per cent; one paid 5.5 per cent; six paid 5 per cent; two paid 4 per cent; one paid 3.75 per cent; two paid 3 per cent; one paid 2.5 per cent; one paid 2 per cent; one paid 1.5 per cent; two paid 1 per cent; sixty-four companies declared no dividend.

COST AND CAPITAL INVESTMENT PER MILE

The total capital investment (capital stock and net debt) of the street railway companies of the State advanced the last year from $122,666,365 to $129,494,748, an increase of $6,828,383.

The average cost of the street railways of the State, per mile of main track (including the cost, but not the length of side track), as it stood on the books of the companies Sept. 30, 1904, was $27,025.14 for construction; $10,176.73 for equipment, and $13,105.68 for lands, buildings (including power plants) and other permanent property, making a total average cost of $50,307.55 per mile of main track.

INCOME AND EXPENDITURES

The total income of the companies from all sources, for the year ending Sept. 30, 1904, was $27,759,334.51, and the total ex-

penditures (including dividends) were $27,975,717.19, making a net loss of $216,382.68 to be deducted from the surplus of previous years.

The items of total expenditure, with the increase in each item over the previous year, are shown in the following table:

TOTAL EXPENDITURES, 1903 AND 1904

Expenditures.	1903.	1904.	Increase.
Expenses of operation	$17,519,367	$18,397,291	$877,924
Interest on debt and loans	2,350,391	2,670,989	320,598
Taxes	1,725,312	1,761,083	35,771
Rentals of leased railways	1,394,283	1,486,385	92,102
Other charges on income	435,382	445,473	10,091
Dividends paid	3,586,248	3,214,496	*371,752
Total expenditures	$27,010,983	$27,975,717	$964,734
Surplus for the year	16,668	†216,383	*233,051

* Decrease. † Deficit.

The gross earnings and expenses of operation the last year are classified and compared with those of the previous year, in the following table:

GROSS EARNINGS AND EXPENSES OF OPERATION, 1903 AND 1904

Earnings and Expenses.	1903.	1904.	Increase.
Revenue from passengers	$24,921,452	$25,619,597	$698,145
from mails and merchandise	82,837	93,344	10,507
from tolls, advertising, etc.	536,522	494,306	*42,216
Gross earnings from operation	$25,540,811	$26,207,247	$666,436
Operating expenses	17,519,367	18,397,291	877,924
Net earnings from operation	$8,021,444	$7,809,956	*$211,488

* Decrease.

VOLUME OF TRAFFIC

The total number of passengers carried during the last year on the railways of the 102 companies making returns to the board was 520,056,511, an increase of 15,394,268 passengers over the previous year.

The total number of miles run by street cars was 107,897,456, an increase of 390,644 miles over the previous year.

The following table gives for each of the last ten years the average gross earnings, operating expenses and net earnings from operation, per car-mile run and per passenger carried, thus showing more in detail the changes from year to year in the earnings, cost and net results of operation:

GROSS AND NET EARNINGS FROM OPERATION PER CAR-MILE RUN AND PER PASSENGER CARRIED, 1895-1904

Years.	Average per Car Mile.			Average per Passenger.		
	Gross Earnings.	Expenses of Operation.	Net Earnings.	Gross Earnings.	Expenses of Operation.	Net Earnings.
	Cents	Cents	Cents	Cents	Cents	Cents
1895	30.20	20.82	9.38	5.07	3.50	1.57
1896	27.69	19.70	7.99	5.08	3.61	1.47
1897	25.68	17.71	7.97	5.12	3.53	1.59
1898	24.80	17.11	7.69	5.11	3.52	1.59
1899	24.74	16.87	7.87	5.09	3.47	1.62
1900	24.46	16.10	8.36	5.06	3.33	1.73
1901	23.40	15.66	7.74	5.02	3.36	1.66
1902	23.42	15.87	7.55	5.05	3.42	1.63
1903	23.76	16.30	7.46	5.06	3.47	1.59
1904	24.29	17.05	7.24	5.04	3.54	1.50

STREET RAILWAY ACCIDENTS

The whole number of persons injured in connection with street railway operation, as reported by the companies for the year ending Sept. 30, 1904, was 5078, of whom 92 received fatal injuries and 4986 injuries not fatal. The number of passengers injured was 3372, of whom 21 were injured fatally. The injuries to employees were 161 in all, 5 of which were fatal. The number of injuries to travelers and others on the street was 1545, of which 66 were fatal.

Altogether, there appear to have been injured, fatally and otherwise, 804 more passengers, and 300 more travelers and other persons—in all 1104 more—the last than the preceding year.

THE QUESTION BOX

In the last issue of this paper the first portion of a series of questions, forming the "Question Box" of the Street Railway Journal, was published. The topics covered were: A, General; B, employees; C, parks and pleasure resorts; D, the express and freight service; E, the master mechanic's department. The following questions relate to F, steam engineering; G, the engine room; H, the line department; I, the track department.

For the benefit of those who did not see the previous number, it might be stated that the Street Railway Journal has decided to institute a question box on topics connected with street railway construction and operation. The questions were published in this and the last issues of this paper. Copies of these questions have also been mailed to a number of companies. Replies are requested, however, from any or all of the readers of this paper who have opinions to offer. The name of the contributor will be withheld from publication in any case where a request to this effect is made. In replying, it is not necessary to repeat the questions, the key numbers are sufficient. Answers are requested in detail and with reasons, as "yes" and "no" are of slight value. Progress is made by each person giving to the other the benefit of his experience, and the co-operation of all is requested in this general exchange of information.

F. STEAM ENGINEERING.

F 1.—What is the standard method of rating boilers?

F 2.—When computing the overload capacity of a boiler plant, what percentage above rated capacity is it safe to rely on?

F 3.—With reference to the relation between average and peak loads on an electric railway power station, what is the best size and what the best arrangement of boiler units?

F 4.—What is the best method, all things considered, of supporting a boiler?

F 5.—What kind of brick have you found best for boiler settings?

F 6.—In setting boilers, is it advisable to leave air spaces in the division and side walls?

F 7.—How do you locate breaks in boiler setting?

F 8.—What do you do to reduce air leakage in the brick work settings of boilers?

F 9.—Without mentioning trade names, can you give any suggestions on best way of securing good boiler steam pressure regulation on railway loads?

F 10.—Is it possible to secure regulation of boiler steam pressure to within 2 per cent. or 3 per cent. of normal, under railway load conditions?

F 11.—Do you blow-off your boilers at regular intervals? If so, how frequently?

F 12.—Describe what you consider to be the proper method of blowing down a boiler.

F 13.—How should the blow-off pipes of a boiler be protected?

F 14.—What is a practical method of keeping a boiler in service when a leak develops in the tubes, either fire-tube or water-tube?

F 15.—How frequently should boilers be thoroughly inspected?

F 16.—How frequently should boilers be thoroughly cleaned?

F 17.—Have you discovered any schemes for simplifying the work of cleaning boilers? Please describe any of the little things which make the work easier. For instance, when necessary for a man to go inside the boiler, what kind of a light does he take with him?

F 18.—Are you in favor of taking out boiler insurance? Why?

F 19.—On what basis is boiler insurance usually determined? What premium do you pay?

F 20.—What is a cheap and simple method of determining amount of feed water used in boilers at a small or medium size plant?

F 21.—Where feed water is taken from city mains on meter basis, what is a fair charge for the water?

F 22.—Where two sources are available ,is it preferable to take feed water from city water mains or from open supply, as a pond or stream?

F 23.—Can a satisfactory "home-made" device be devised for automatically indicating high and low water in the boilers?

F 24.—What advantage or economy is obtained by the use of automatic boiler-feed devices?

F 25.—If you know of any satisfactory "home-made" automatic boiler-feeder devices, please give description, cost and sketch.

F 26.—Please state your experience with automatic boiler-feeding devices, and give information and suggestions as to conditions under which a device of this kind can be used to advantage. What is the direct advantage and economy secured by an automatic boiler-feeding device?

F 27.—What ingredients in feed water cause scale formation in the boilers? What are the neutralizers in each case?

F 28.—How can the engineer of a small power station, without consulting a chemist, determine the scale-forming ingredients of the feed water he is using, with a view of injecting neutralizing chemicals?

F 29.—Is it practicable to use soda ash for purifying boiler feed water? What are the objections? Under what conditions should soda ash be used, and in what quantities?

F 30.—Under what conditions can kerosene be used to advantage in boilers? What are the objections to the use of kerosene?

F 31.—Will zinc placed in a steam boiler prevent scale or corrosion? Under what conditions of feed water impurity should zinc be used?

F 32.—What is the best method of feeding purifying compounds into a boiler?

F 33.—What portions of all the piping in the boiler room should be of brass?

F 34.—What are the relative merits and what the relative cost of iron and brass for hot feed water piping?

F 35.—Do you know of any novel or unusual arrangement of valves or piping on boiler feed lines that has resulted in better regulation or other advantage in feeding water to boilers? If so, please give detailed description, with sketch if possible.

F 36.—The proposition is advanced that in striving for flexibility in operation of steam plant, we have overdone the matter of putting all steam pipes in duplicate and coupling them up to the engines and boilers by an interminable number of valves so that all manner of permutations and combinations might be made between the engines and boilers. What do you think about it?

F 37.—How long after the engine has been stopped should the air pump vacuum endure? In actual practice, how long does it endure?

F 38.—How do you test vacuum enclosing pipes and vessels for leakage?

F 39.—What is the minimum head of hot-water supply above pump suction for reliable pumping service?

F 40.—What is the best method of guarding against possible shortage of condensing water supply?

F 41.—Can superheating be applied to existing electric railway power houses? What changes in piping, valves, engines, etc., are necessary? What advantages will follow? Cite instances.

F 42.—What is the limit in size of station in which superheating can be used with economy?

F 43.—Do you recommend separately fired or boiler contained superheaters for moderate size plants?

F 44.—What do you do with the ashes from your boiler plant?

F 45.—What is the comparative economy, including operation and maintenance, of automatic stokers and hand firing?

F 46.—What is the smallest size of boiler plant, or minimum coal consumption, which warrants the use of automatic stokers?

F 47.—What is a quick and sufficiently accurate method of determining the comparative values of different grades and kinds of coal for boiler firing purposes?

F 48.—In a small or medium size station what is the best method of determining amount of coal consumed? Give details.

F. 49.—What should be done to prevent coal storage bins from taking fire by spontaneous combustion?

F 50.—An engineer of a small power station requests suggestions on reducing cost of handling coal from cars to boilers. He does not believe size of plant warrants chain bucket conveyors. Can you give him any pointers or "wrinkles" on reducing this cost?

F 51.—On your road, what is the cost of boiler room labor per ton of coal fired, including handling ashes. (State whether hand firing or automatic stoking is used.)

F 52.—How many tons of coal should a fireman and passer handle per day?

F 53.—Is it easier for the fireman to handle coal from the floor with a long-handled shovel or from a charging car with a short-handled shovel?

F 54.—What schemes are there for inducing firemen to take greater interest in their work? Give details and results secured.

F 55.—What is the smallest size station in which coal and ash conveyor systems can be installed profitably—first investment and running cost considered? Give details.

F 56.—An electric railway power house is located in a lumber mill district, where sawdust and mill scrap are very cheap. The engineer believes he can run his station entirely on this fuel and stop using coal. Can he do it? What changes will he have to make in his grates and fire boxes? What about obtaining better draft? Can anyone furnish data on electric railway power houses using wood for fuel?

F 57.—Can the efficiency of an ordinary hand-fired boiler be increased by the use of a fire-brick coking arch over the grates? Give results of experience.

F 58.—Have you ever used a fire-brick wall at the back of the furnace? Into what form did you build the brick and what were the results secured? Please send sketches.

F 59.—For what uses, if any, do you employ compressed air in the boiler room? What has been your experience with the air lift for raising water from wells?

F 60.—What is a cheap and simple method of testing flue gases in a small or medium size plant?

F 61.—After an engineer has secured an analysis of the flue gases, how should he use the data obtained in determining and increasing the efficiency of his boilers?

F 62.—If the boiler is working at good efficiency, what should be the temperature of the flue gases as they leave the boiler?

F 63.—What is the rule for determining size of flue for a given plant?

F 64.—What are some of the ways by which intensity of draft can be secured, exclusive of mechanical blower?

F 65.—Have you ever tried injecting a jet of steam under boilers to raise steam pressure at times of heavy demands? Give details of arrangement and result secured.

F 66.—In a small or medium size plant, what is the best method of increasing boiler capacity during heavy peak loads? Give details and results obtained.

F 67.—An engineer of a medium size plant has been urged to put in mechanical draft. Wanted, information and suggestions as to what to do and how to do it.

F 68.—When does it become profitable to put in forced or induced draft in a small or medium size plant?

F 69.—What is the standard of measurement in expressing draft of chimney? On what is the standard based?

F 70.—What is a simple method of determining roughly the draft of a chimney, where absolute accuracy is not required?

F 71.—Given a proposed power plant, how is the height and cross section of chimney determined?

F 72.—What are the relative advantages and disadvantages of self-supporting steel stacks and brick chimneys? What are the relative costs?

F 73.—Information is requested concerning foundations for chimneys. What is the best kind of foundation?

G. THE ENGINE ROOM

G 1.—Discussion is invited pertaining to comparisons of the various systems of power generation and distribution now available for electric railway purposes.

G 2.—What are your ideas, based on experience, regarding the use of several small generating units in place of one or two large units? Give details, cost and results secured.

G 3.—Is it possible to run a commercial lighting or power load from generating units that are supplying current for railway purposes? How can it be done? What is the best method of regulation in such case to prevent fluctuations in the lighting or power circuit?

G 4.—To what various uses do you employ compressed air in the engine room?

G 5.—How do you obtain compressed air for the various uses about the power house. At what pressure do you use the air?

G 6.—Please state in detail what trouble you have had with lightning at your power house. Then please state in full what steps you have taken to prevent damage from lightning.

G 7.—Do you know of any satisfactory schemes whereby all employees of a power plant can participate in a bonus when station is operated at especially good economy? Give details and results obtained.

G 8.—A young engineer, who has yet to win his spurs, has been given charge of the power house on a 20-car road. He has been asked by the manager to carry out a general efficiency test of the entire station. He wants suggestions from some of the older heads as to some of the things he should and should not do in carrying out these tests. He wants to know how to dispose his available forces so as to obtain the data without taking on additional help. If your manager should ask you to make tests and report on just what each department of the power house was doing and could do, how would you go about it to get the information? This is a matter especially worthy of discussion. Suggestions are particularly requested.

G 9.—To what extent have gas engines been used on electric railway loads, and what have been the results secured with gas-engine-driven units? Information and data relative to this application of the gas engine are especially requested.

H. THE LINE DEPARTMENT.

H 1.—Please state in detail what trouble you have had with lightning on any part of the transmission or distribution system. Then, please state in full, what steps you have taken to prevent damage from lightning.

H 2.—What special trouble, if any, have you had with lightning on high-tension transmission lines, and what precautions do you take to protect the high-tension line and high-tension apparatus?

H 3.—What is the most efficient method of protecting high-tension lines from contact with trees?

H 4.—What is the best form of cradle or other device for catching broken high-tension lines at highway crossings, or where the lines cross over or under other wires?

H 5.—Should iron trolley poles be painted? Please give reason for your answer.

H 6.—Should wooden trolley poles be painted? Please give reasons for your answer.

H 7.—Without giving trade names, what is the nature of the paint you prefer for painting trolley poles?

H 8.—What is the best way to paint trolley poles? Give sketch or photograph and description of apparatus used; also detailed cost of doing the work.

H 9.—What is the best way to raise and set trolley poles? Give sketch or photographs and description of method. also detailed cost of doing the work.

H 10.—What are the relative costs of various kinds of woods available for trolley poles? What are their relative length of life?

H 11.—What is the most efficient method of jointing copper feeder cables?

H 12.—What is the most efficient method of tapping trolley wire to feeders?

H 13.—What is the most efficient method of preventing short circuits by reason of low-tension feeders coming in contact with trees?

H 14.—Do you prefer a mechanical or soldered clip?

H 15.—It has been suggested that sleet can be prevented from forming on the trolley wire by greasing the wire. Have you ever tried it? With what results?

H 16.—What is the best method of overcoming trouble caused by sleet on the trolley wire?

H 17.—When you receive a report from a car crew that a trolley wheel has jumped the wire, what action is taken?

H 18.—Please describe the essential features of your "hurry-up" service for repairing breaks in overhead construction.

H 19.—What are the relative advantages and disadvantages of the tower wagon and the tower car for making repairs in overhead construction? Do you prefer the wagon or the car?

H 20.—Have automobile tower wagons for repair purposes been used to any extent? What advantages do they possess over horse-drawn wagons?

I. THE TRACK DEPARTMENT.

I 1.—In the construction of a suburban or interurban electric railway, what are the deciding factors in determining the weight and section of rail to be used? State what weight and section you prefer, and why.

I 2.—What is the best type of rail for city service in unimproved streets?

I 3.—What advantages, if any, does a 9-in. girder rail possess over a 7-in. girder?

I 4.—If the conditions require a girder rail, which type would you prefer, semi-groove, full-groove, tram, center-bearing or Trilby section? Please state your reasons in full for the preference.

I 5.—When laying tracks, what space should be left between the ends of the rails for construction and expansion?

I 6.—What are the determining factors in selecting ballast for a new suburban or interurban electric road?

I 7.—What is the best material for ballast on a suburban or interurban electric road?

I 8.—Please give comparative costs of ballasting track with different materials.

I 9.—What means, machines, devices, special rigged cars, etc., do you know of for expediting or cheapening the work of ballasting and laying track? Please give sketch or photograph and detailed description, including cost.

I 10.—How can good drainage be secured on suburban and interurban electric roads? Please answer this question in detail.

I 11.—How can good drainage be secured on city tracks? Please answer this question in detail.

I 12.—What is the best form of cover plate and design of openings for track drains, especially with reference to the prevention of horses' shoes getting caught in openings?

I 13.—What is the best way of keeping tracks to gage in unimproved streets? Give details.

I 14.—Have you had any experience with "creeping" rails, and how have you remedied this difficulty?

I 15.—Have you had any experience with "waves" developing in the top surface of rails? What is the cause of this phenomenon and how can it be remedied?

I 16.—Do you know of any electric road that has used crude oil on the roadbed to lay dust and kill weeds? What have been the results obtained?

I 17.—Is crude oil a satisfactory substitute for salt for preventing obstruction of switches and special work by ice and snow?

I 18.—Do you know of any satisfactory device to be attached to each car for cleaning the groove of girder rails? Please give description, with sketch or photograph.

I 19.—Is there any advantage in greasing curves?

I 20.—What are the relative costs of various kinds of woods available for ties? What are their relative length of life?

I 21.—Has any satisfactory substitute been found for wooden ties? What has been the experience with iron, steel, glass, concrete or other materials for ties?

I 22.—What has been the experience with concrete foundations under rails or roadbed? Please give details as to how concrete was laid, cost of canstruction and results secured.

I 23.—What methods are available for welding joints? Please give your experience with any of the methods of welding track, including detailed cost of doing the work, and the results secured.

I 24.—In sanding track, is it better to sand one rail or both? Why?

I 25.—When sanding track, is it better to sand from a special sand-car or to have sand on each car? Why?

I 26.—Is it a good idea to mix salt with the sand? Why?

I 27.—What can be done to overcome slippery rails, due to dead leaves on the track?

FIRST CONVENTION OF THE INDIANA ELECTRIC RAILWAY ASSOCIATION

The Indiana Electric Railway Association held its first annual meeting at Indianapolis, Jan. 12. At a preliminary meeting of Indiana electric railway men held in Indianapolis on Dec. 9, 1904, the Indiana Electric Railway Association was formed and a constitution and by-laws were adopted. The by-laws provide for an annual meeting the second Thursday in January of each year. Regular meetings are provided for the second Thursday of each month, subject to change by the executive committee. At the preliminary organization meeting, held Dec. 9, a committee of nominations and arrangements was appointed, consisting of A. L. Drum, general manager of the Indiana Union Traction Company, chairman; Paul H. White, manager of the Indianapols & Martinsville Rapid Transit Company; J. W. Chipman, general manager of the Indianapolis & Eastern Railway Company; Gardner F. Wells, manager of the Terre Haute Traction & Light Company, and C. C. Reynolds, general manager of the Indianapolis & Northwestern Traction Company.

The convention was held on the fifth floor of the new Traction and Terminal Building, which is the new building recently completed to serve as an interurban terminal and traction headquarters in Indianapolis.

The meeting was called to order by A. L. Drum, chairman of the committee on arrangements. He presented the nominations for officers on behalf of the committee. The following officers were nominated and afterward elected: President, Charles L. Henry, president and general manager, Indianapolis & Cincinnati Traction Company; vice-president, J. W. Chipman, general manager, Indianapolis & Eastern Traction Company; secretary, Paul H. White, general manager, Indianapolis & Martinsville Rapid Transit Company; executive member (one year), A. L. Drum, general manager, Indiana Union Traction company; executive member (two years), C. C. Reynolds, general manager, Indianapolis & Northwestern Traction Company; executive member (three years), Gardner F. Wells, general manager, Terre Haute Traction & Light Company; member finance committee, Charles Murdock, president, Fort Wayne & Wabash Valley Traction Company; member finance committee, W. G. Irvin, general manager, Indianapolis, Colum-

bus & Southern Traction Company. President Henry then took the chair.

A paper was presented by A. S. Richey, electrical engineer of the Indiana Union Traction Company, on the subject: "Cost of Electric Railway Power Production and Transmission in the State of Indiana." A very full abstract of this paper is printed elsewhere in this issue. The paper contains valuable statistics on the cost of power production for 85 per cent of electric railway mileage of the State from which he has collected statistics.

In the discussion of this paper, A. L. Drum emphasized the point brought out by Mr. Richey that frequently alternating-current transmission is employed where direct current would be better. He cited one case of a railway and light plant in a city where the change from an alternating-current distribution with 45 per cent loss was made to a direct-current underground distribution with 12 per cent loss, and the $15,000 saved on fuel paid the interest on the $300,000 invested in making the change to the underground system, and the requirements of the city for underground wires were complied with. He cited another amusing incident where a company having a 500-volt direct-current power distribution system in a city thought to save money by operating it as a three-wire system, with 1000 volts between the outer mains of the system, placing the motors on one side of the city, on one side of the three-wire system, and those on the other side of the city, on the opposite side of the three-wire system. Further calculation, however, revealed the fact that the only saving in copper would be from the power station to the center of distribution on the neutral main, and this point was only about 100 ft. from the power house, so that the only compensation the company would have had for improving the insulation to stand 1000 volts between the outer mains would be the saving in copper on 100 ft. of neutral main. He further called attention to the fact that direct-current feeder copper in the air sometimes appreciates in value, while the contrary is the case with rotary converters and sub-station apparatus. He had hung up copper on overhead lines costing 11 cents a pound and sold it later at 15 cents a pound. In the gas belt in Indiana, steam users had found that gas at 8 cents per 1000 cu. ft. was about equivalent to coal at $1.35 per ton.

L. J. Schlesinger, inquiring of Mr. Richey as to the reason for the greater efficiency of transmission on the new lines of the Indiana Union Traction Company, as cited in Mr. Richey's paper, asked whether Mr. Richey had made any tests on the rail-bonding on the older lines.

Mr. Richey replied that no doubt considerable of the greater loss on the older lines could be accounted for by inferior rail-bonding, as these lines included city track which had been down some time. The curves and grades were easier on the new division, and the sub-stations better located with reference to the loads.

President Henry called attention to the important part that cost of labor plays in the total cost. As had been intimated before in the discussion, wages could not be reduced. For this reason, if the cost of labor is to be reduced, the only way is to use appliances which will do away with as much labor as possible.

The convention then adjourned for lunch. After lunch, the Indianapolis Traction & Terminal Company took the members on a special car from the Terminal Building to its power house and shops on West Washington Street. The party returned to go into convention again at 2:30 p. m.

Thomas B. McMath, civil engineer of the Indianapolis Traction & Terminal Company, read a paper on "Track and Roadbed Construction and Maintenance," with particular reference to the life and chemical preservation of ties. This paper is published elsewhere in this issue. It takes up briefly the commercial economy of the creosoting process and concrete roadbed construction with and without ties in paved city streets.

Thomas Elliott, chief engineer of the Cincinnati Traction Company, was asked for his experience, and stated that some creosoted ties made in Cincinnati had been down eleven years and were apparently as good as new. Common pine ties could be furnished, including creosoting, for about 40 cents each, about half of which was cost of creosoting. Such ties would be as good or better than the best timbers untreated, costing no more. Some poles had also been creosoted. Such poles undoubtedly had a much better life than the untreated poles. Creosoted poles, however, were not as good insulators as untreated wood poles. It is sometimes necessary to respike creosoted ties. In this case the holes were left open without apparent detriment.

President Henry spoke of the difficulty of securing data on the life of treated timbers, because it takes so many years to make tests of any value. He had always taken the position that it did not pay to put in poor ties, and for this reason would never lay seconds or culls. The freight, handling and laying cost the same for the best ties as for the poor ones, and the poor ones would have to come up much sooner.

Leverett M. Clark, master mechanic of the Indianapolis & Northwestern Traction Company, then read a paper on the "Construction and Maintenance of Cars and Equipment." He outlined briefly various points which he considered should go into the specifications for high-speed interurban rolling stock. Among these points, he mentioned the necessity of great strength in the lower side frames, because they formed the foundation for the sides and roof, and also the necessity of strong draft rigging, especially if the cars are intended to operate in trains. He favored quarter-sawed oak finish in the smoking compartment, mahogony in the passenger, and ash in the baggage and rear vestibule. He recommended Pullman color for the exterior, extra storm sash for winter use, seats upholstered in leather in smoking compartment, and with plush for the passenger compartment. He favored steel-tired wheels, because of the greater factor of safety, quiet running and freedom from flattening. Solid axle gears were also recommended. The advantages of multiple-unit control were summarized. The capacity of air-brake storage reservoirs should be so proportioned that a full service application of brakes will cause a reduction of pressure of not more than 4 lbs. The capacity of compressors should be sufficient to supply all air required for the operation of brakes, whistles and sanders under normal conditions, and not operate in excess of 30 per cent of each hour that the car is in service. Ts, elbows and other sharp turns should be avoided whenever possible, as well as water pockets and leaks. The range of reservoir pressure should be from 12 lbs. to 15 lbs., the compressor being cut out at a point not exceeding 5 lbs. above the emergency brake-cylinder pressure.

The following system of inspection was outlined:

MAINTENANCE

After a car has been on the road twenty-four hours, or has run a given number of miles, say 200, it should be placed over a pit in car house and receive a thorough inspection by a car inspector, whose duty is not to repair, but to report the exact condition of every detail on an inspection card, which, when employed in connection with a motorman's defect card, should show the absolute condition of cars and their equipment at regular intervals. An O. K. should be placed opposite defects noted on the inspection card after having been repaired, and when entire car has been O. K'd. by foreman of repairs, the cards should be sent to the master mechanic's office, from which a record of body, truck, motor, controller and trolley troubles can be kept.

After a car has been thus inspected and repaired, it should be thoroughly cleaned inside and out. Trucks, wheels motors, compressors, etc., can be kept in good condition by frequent wiping with oily waste.

All bearings should be regularly lubricated with a good quality of oil of a consistency conforming to the season of year.

Long fibred wood mixed with Japanese fibre in the proportion of 5 to 1 forms a reliable and durable packing waste, we having

records of journal and motor armature bearings which have run over 80,000 miles on the original waste placed in boxes.

For gear lubrication, a graphite grease mixed with a cushion of ground cork or fibre is recommended.

The air brake equipment should receive intelligent attention.

Operating valves and compressor governors should be regularly cleaned and oiled once each month. Compressors should be inspected, cleaned, and if necessary, oiled at least once a week, brake cylinders every twelve months, and at all times the governors should be watched to know that the proper reservoir pressures are maintained, that the reservoir gages are correct, and all cut-out cocks, joints, etc., free from leaks. Chime whistles should be kept clean and in tune. Sanding devices should be kept in operative condition, and hot water heating systems given proper care to guard against deposits of sediment and leaks.

Gardner F. Wells inquired as to the advantages of the unusually long cars used by the Indianapolis & Northwestern. Mr. Clark replied that these cars, which were from 62 ft. to 66 ft. long, sometimes did away with the necessity of putting on extra cars at times of unusually heavy traffic, and that was the principal advantage.

In answer to another question, Mr. Clark described a method of cushioning the trolley base used on the Indianapolis & Northwestern. The trolley base is bolted to oak planks, which have rubber cushions between them and the car roof. The object of this was to do away with part of the rumbling and hammering sound made by the trolley pole when running at high speed.

H. L. Swartz said that he had tried this plan and found it worthless as a preventive of noise.

Some questions were asked regarding the best way of fighting sleet on the trolley wire, the day previous to the convention having been one when considerable trouble was experienced by Indiana roads.

Mr. Elliott described the plan successfully used at Grand Rapids, which consisted of fastening a chain in the groove of the trolley wheel, the chain being renewed as fast as it wore out.

A. L. Drum, talking of desirable improvements in cars, favored making the toilet rooms larger and putting in water tanks to supply water for flushing purposes and prevent them from getting foul.

Frank D. Norviel, taking up again Mr. Wells' question as to the advantages of long cars, such as his company (Indianapolis & Northwestern) uses, said that the Indianapolis & Northwestern sometimes took out of Indianapolis on a single trip, in the baggage compartment of its regular passenger cars, express matter the gross revenue from which would be as much as $15. This was made possible by the fact that the cars were long enough, so that there could be a baggage and express compartment at the front end, in addition to the usual lengths of passenger compartments. That, he considered, was the real reason for using such long cars. He also brought up the question of charging for passengers' baggage. He opposed this policy and favored the free checking of baggage, as the steam roads do. He said that the interurbans were losing traffic by not doing this, because passengers with baggage, in many cases, have to pay more for passenger fare and baggage between two given points in Indiana on interurban roads than they would have to pay on steam roads, where baggage is checked free. A comparatively small number of passengers have baggage anyway, and he thought the interurban companies could afford to carry the baggage of such passengers free rather than lose the traffic altogether. To do this, of course, it was necessary to have a baggage compartment on each car. He urged strongly arrangements between interurban companies in Indiana whereby through tickets could be purchased, thereby insuring traffic to interurbans which might otherwise take steam roads for part of the distance.

After the discussion was closed on this subject, President Henry called on Dr. Louis Duncan, who was a casual visitor to the convention, to address the convention on any subject he might choose. Dr. Duncan, in responding to the invitation, called attention to the great interest attaching to the single-phase system with which the Indianapolis & Cincinnati Traction Company is equippng its lines. He questioned whether too great things were not anticipated for the single-phase system. It involved a great deal of complicated apparatus on each car, all of which involves certain losses. He did not think alternating-current motors would replace direct-current motors on city lines, and alternating-current interurban motors which were obliged to operate over direct-current city lines would always be at a disadvantage. He apparently considered that the advantages of the single-phase railway motors would be the most pronounced on interurban lines with heavy traffic and on electrically equipped steam roads. He would be very glad to learn what results had been obtained in the operation of the Indianapolis & Cincinnati line so far.

President Henry, of the Indianapolis & Cincinnati Traction Company, in answering Dr. Duncan's last question, explained that his company as yet was operating only one car, and that within the city of Rushville, to conform to the terms of the franchises. In another week, he hoped to have a number of miles of interurban line in operation, and it would probably be thirty days before the entire line from Indianapolis to Rushville would be in operation. The system was, of course, in an experimental stage, and no doubt some changes would have to be made in various details. He invited any electric railway men who were interested to visit the road and see what was being done. As regards the merits of the single-phase system, he wished to put himself on record as one of those who believe that the time will come when electric interurban roads "will handle heavy freight and lots of it." He believed that the single-phase system would make this possible. He emphasized the importance of getting rid of the large volume of current which must be handled in heavy railway work at 500 volts pressure. The Indianapolis & Cincinnati cars would be equipped with two trolleys, one trolley being of the ordinary wheel type for use in the city of Indianapolis, and the other being a new form of bow trolley for use on the high-speed, high-tension line outside of the city. He expected that the bow trolley would take considerable experimenting to perfect, but that it would ultimately be worked out. Power is to be transmitted from the power station to sub-stations at 33,000 volts, and at the sub-stations, static transformers will step-down the pressure to 3300 volts, at which voltage it will be supplied direct to the trolley line. The transformers carried on each car reduce the voltage to 250, for use in the motors. The sub-stations are fireproof structures, containing only static transformers, and are designed to operate without attendance. The only automatic circuit breakers in connection with the transmission and distribution system are to be located at the power station.

The convention then adjourned. Arrangements for the next regular meeting, according to the constitution, are left to the executive committee. The idea is to have meetings held in various places in the State.

The association starts out with a membership of over sixty electric railway men of Indiana.

In his message to the Legislature, Gov. Johnson, of Minnesota, recommended that the electric lines of the State be placed under the control of the Railway and Warehouse Commission.

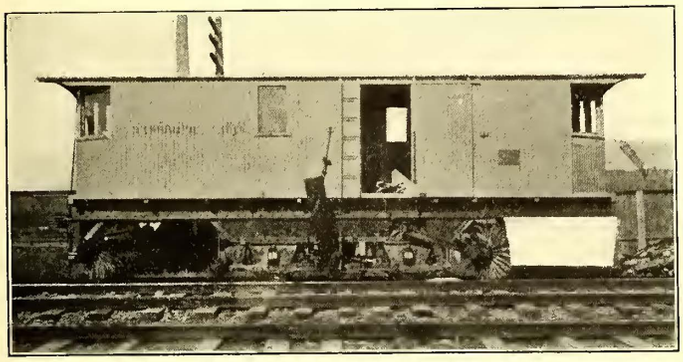
In order that perfect protection against fire may be provided, especially in case of a wreck, the San Francisco, Oakland & San Jose Railway Company, operating the "Key Route," has installed the patent Stemple fire extinguishers on all its cars. The extinguishers, which are the large brass Babcock pattern, are placed in the front of each car in the right-hand corner.

CORRESPONDENCE

THE REMOVAL OF SNOW

UTICA & MOHAWK VALLEY RAILWAY COMPANY
EDITORS STREET RAILWAY JOURNAL: Jan. 11, 1905.

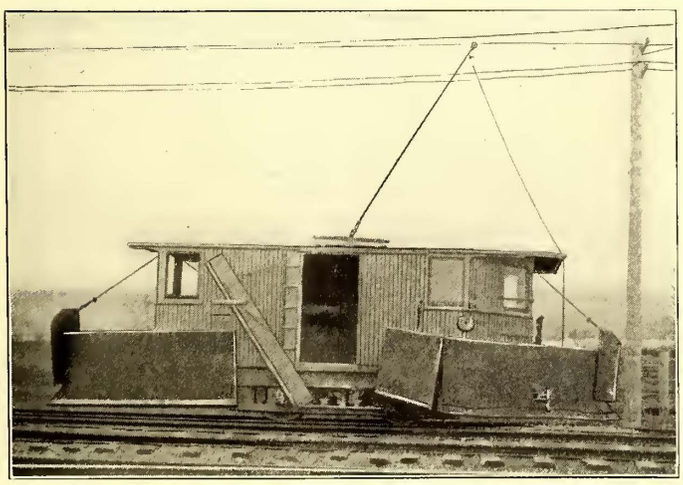
Your recent editorial on snow fighting, and Mr. Stewart's letter in your issue of Jan. 7, discuss a topic which is of great importance to all street railway companies in Northern latitudes. It is one to which the Utica & Mohawk Valley Railway has necessarily devoted considerable attention, and your request to us to give some particulars of our methods of caring



SINGLE-TRUCK SWEEPER

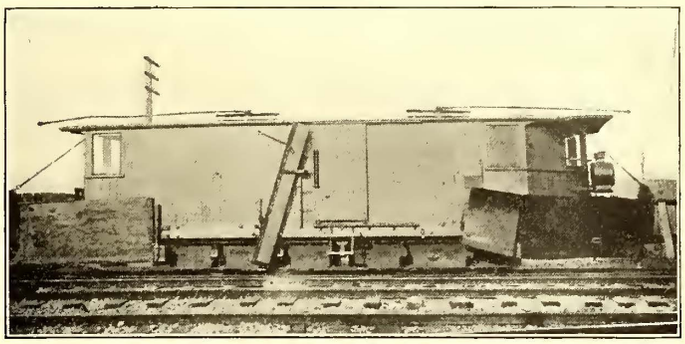
for snow in the upper Mohawk Valley is one with which I am glad to comply. Our snowfall during the winter is usually very heavy, and since between Utica and Little Falls we operate over our own right of way for a distance of practically 38 miles, the snow question is one of our most serious problems.

Our snow-fighting equipment consists of four types, viz.: scrapers, sweepers, shear and nose plows, and rotaries. Scrapers are carried on all cars, and we depend upon them for taking care of very light snows. Our sweeper equipment consists of two machines, which are used in the paved streets, and which take care of all snowfalls up to a depth of from 5 ins. to 6 ins. One of these is an old type of Lewis & Fowler sweeper, with motor-driven broom; the other is the latest type of Smith &



SINGLE-TRUCK SHEAR PLOW

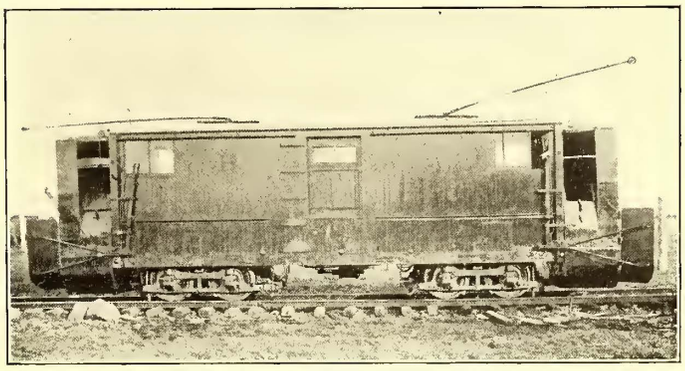
Wallace sweeper, with steel frame and motor-driven brooms. The advantage of the steel frame is, of course, that the plow keeps its shape better under the heavy work to which it is subjected, and we have found it extremely rigid. The brushes are adjustable in height and are raised or lowered, depending upon whether the snow is wet or light. This is a single-truck sweeper, with two motors for driving the sweeper and one motor for driving the brooms. Our third type of snow-fighting apparatus consists of the shear and nose plows. We have two double-truck, steel-frame shear plows; one single-truck, steel-frame shear plow, and one single-truck, steel-frame nose plow. The double-truck plows are fitted with four motors each, with air brakes and air mechanism for operating the wings and shears, and were supplied by Smith & Wallace. The single-truck plow is similarly equipped, except that it is fitted with two motors. Our fourth type of snow apparatus consists of two double-truck Ruggles rotary plows and one single-truck Ruggles plow. The double-truck plows are driven by four



DOUBLE-TRUCK SHEAR PLOW

motors, and has also two motors connected to the rotary shaft. The single-truck plow is equipped with half this number of motors—that is, two for moving the machine and one for operating the rotary shaft. All of our plows are also equipped with jacks, cables, chains, etc., so as to do wrecking business. We have found that this has been necessary owing to the great chances of their derailment. During the winter of 1902 we were obliged to have the rotaries out on the road only twice, but last year they were required frequently, and during the month of February they were in operation practically every night during the month.

In addition to the plows and sweepers mentioned, we make



DOUBLE-TRUCK ROTARY PLOW

extensive use of snow fences. These fences are collapsible, and are taken down in the summer and piled away, but are erected during the fall, on the westerly and southwesterly side of the track, which is the side of the prevailing winds. We use snow fences for every foot of our right of way that is exposed to drifts.

To every plow and sweeper owned by the company, double crews are assigned, one for day and one for night service. Each crew consists of a motorman, a conductor and three helpers, making five men in all. The motorman is placed in charge of the plow. As soon as snow begins to fall, whether it is by day or night, the motorman in charge of each plow or sweeper must communicate at once by telephone with the despatcher for instructions. He is not allowed any discretion in this matter, but is required to report for orders whether he is on his run or at his home. His instructions advise him at what time he is to report for duty, and in the meantime he notifies the men belonging to his crew and keeps in close touch with the main office. While on duty, the snow crews receive an advance of 20 per cent over their regular pay.

If the snow is too deep for the sweeper—that is, if it is 6 ins. or more, or if the indications point to a heavy snow—the nose or shear plows are put in operation, and, as a rule, within the city, are always followed by a sweeper, which cleans the snow off right down to the pavement. The rotaries are reserved for snow of 30 ins. in depth or more and for cutting through deep drifts. As a rule, they are used only in the country, but on one or two occasions have been employed in the city as well. At such times their baffle plates have to be so turned that the snow will not be thrown against the houses.

During the winter of 1903-04, the total expense charged to account 24, which is the cost of removing snow and ice, on the Utica & Mohawk system, amounted to $15,803, equivalent to $.0046 per car-mile. C. Loomis Allen.

NEW YORK & QUEENS COUNTY RAILWAY COMPANY

Long Island City, Jan. 16, 1905.

Editors Street Railway Journal:

I notice the subject of fighting snow is being discussed in your columns. Our method of caring for snow differs somewhat from that of a great many other companies, in that we place a great deal of dependence upon sweepers, and although we use shear plows, we operate the sweepers ahead of the plows. I think that this is logical, because a shear plow will sometimes get stalled in a heavy snow; while the sweeper will get through practically any drift, slowly, it is true, if the snow is deep, but if kept at work it will finally eat its way through. As, however, the sweepers remove the snow for a distance of only 6 ins. or so outside the outside rails, a shear plow is necessary, when the snow banks up, to push it back from the rails. Of course, for the very deepest snows, rotary plows are the most desirable, and during any one severe storm will pay the interest on the investment many times over.

I agree with the sentiment expressed in your editorial on snow fighting, that it is economy to have plenty of snow apparatus and to start in early with its use. If the snow is allowed to gain headway, it not only breaks up the schedule, but more power is required to remove it. In this latitude, it is advisable to have a sweeper to every 10 miles of track, and a sweeper to every 7 miles or 8 miles is better. There ought to be about the same number of shear plows. There is nothing which counts so much in the opinion of the public as the fact that a road is kept in operation when adjoining steam roads are snowed in, and we enjoyed this experience during the storm last week. When there is not enough power to operate all of the cars and plows, it is better to reduce the number of cars and substitute plows and sweepers, so as to keep the snow under control.

Another important point to bear in mind is that the service on the motors of the sweepers and rotary plows is continuous, and consequently is more severe than with ordinary car service. It is sometimes thought that because the snow apparatus is in use for short periods only, almost any controller or motor is good enough. Actually, only the best equipment should be used, as this is a part of the rolling stock which the management cannot afford to have break down. The rule applying to equipment also applies to the brooms. An extra supply of broom blocks, filled with the best rattan, should be kept on hand, as no sweeper will give good results with a half-filled broom, and if this latter precaution is not taken, the sweeper may have to be taken out of service at the most critical period of a storm. F. L. Fuller.

Since the Petaluma & Santa Rosa Electric Railroad has been in operation, the amount of freight to be handled has increased so much that the stern-wheel steamer "Gold" has been unable to carry it all, and the stern-wheel steamer "Sonoma" has been secured to run in conjunction with her between Petaluma and San Francisco. The "Sonoma" will continue in the service until a new steamer has been built to take her place.

COST OF ELECTRIC RAILWAY POWER PRODUCTION AND TRANSMISSION IN THE STATE OF INDIANA*

BY A. S. RICHEY

As the methods of conveying the energy from our coal pile to our car axles is the one thing which makes possible our business, and especially as the cost of this energy is one-fifth to one-quarter of our entire operating expense, it should be interesting to consider briefly the division of this cost into its components, together with a statement of the average costs per unit of the power used on the Indiana interurban roads.

A very comprehensive listing of the principal physical features of our electric railways was given in a paper entitled "Interurban Electric Railways of Indiana," presented by Robert P. Woods at a meeting of the Indiana Engineering Society, just a year ago.† The statistics as given in that paper stand practically correct to-day, when we add the 20 miles of the Indiana Northern Traction Company, now operating between Marion and Wabash. Supplementing Mr. Woods' paper as a source of information from which to draw the conclusions presented in this paper, we have written to officials of the various electric railways of the State, requesting car mileage and cost of power statistics. Nearly all of the roads have very kindly taken the pains to reply to our inquires in a very satisfactory manner, and it is due to their kindness in this regard that we are enabled to furnish some average figures on power costs.

We now have about 800 miles of interurban electric railways in the State, operating 100 cars regularly. These cars vary in size from the ordinary street car to the 60-ft. 35-ton car in use on the Indianapolis & Northwestern. The average weight of the 100 cars in regular daily operation is 25.61 tons, and their average scheduled speed is 20 m.p.h.

Twenty-four power stations furnish current to these cars, the combined station capacity (exclusive of the Indianapolis Traction & Terminal Company's station) being slightly over 20,000 kw, or an installed capacity in generators of about 200 kw for each interurban car operated and 25 kw for each track-mile operated. One-half of the twenty-four power stations generate and deliver to the cars direct current, while the other twelve generate alternating current, distributing to the cars as direct current through thirty-four sub-stations. The individual power station capacities vary from 200 kw to 6000 kw, and comprise units of nearly every standard rating from 65 kw to 1500 kw.

Assuming a power consumption of 100 watt-hours per ton-mile, we have an average total at our 100 interurban cars of about 5000 kw, using the average figures as given above of 25.61 tons as the weight of car and 20 m.p.h. as the schedule speed.

The average load factor of the power stations appears to be about 40 per cent of the installed capacity. Therefore the average output at power station bus-bars is over 8000 kw, which appears to indicate that the aggregate losses in overhead lines, rail return, sub-station apparatus, step-up transformers, etc., amounts to more than 3000 kw average, or an average efficiency from power station bus-bars to car motors of say 60 per cent. As the assumption of 100 watt-hours per ton-mile is probably high, this average efficiency of distribution, if in error, is to be considered higher rather than lower than the actual.

This loss of 40 per cent of the total power generated must be divided between the stations generating direct current and those generating and transmitting alternating current and converting to direct current through rotary converters at sub-stations. But 20 per cent of the railway power generated in

*A paper read before the first annual convention of the Indiana Electric Railway Association, at Indianapolis, Jan. 12, 1905.

† See Street Railway Journal, June 18, 1904.

the State outside of Indianapolis is the output of direct-current generators. Allowing 20 per cent for the transmission losses from the direct-current stations, leaves us an efficiency of about 55 per cent for the remaining 75 per cent of the generated power, which is the product of alternating-current stations. This efficiency is probably made up about as follows:

	Per Cent.
Efficiency of step-up transformers	.94
Efficiency of transmission lines	.97
Efficiency of step-down transformers	.93
Efficiency of rotary converters	.80
Efficiency of direct-current distribution	.80
Combined efficiency	.54

The figures given above as the efficiencies of transformers and rotary converters will, of course, not compare with the efficiencies guaranteed by manufacturers, as the guaranteed efficiencies are based on full load or nearly full load conditions, while the average load on rotary converter sub-stations in the service which is most general on our roads is hardly greater than 25 per cent of their rated capacities. This difference in distribution efficiency as between 80 per cent for the average direct-current station and 55 per cent for the average alternating-current station, is at first glance a surprising one, and helps many a company to spend a large proportion of the dollars saved by an economical power station. Without doubt, there is more than one railway in the State now operating an alternating-current generating plant with transmission lines and sub-stations that could have invested the same money in direct-current stations and trolley feeder, and be operating today with a less charge to cost per car-mile. On the other hand, there are several alternating-current generating stations in the State which are delivering power to the car axles, after paying the price for the losses, at a cost much less than that at which they could accomplish the same result from direct-current stations. The question of which system should be installed in a given case is one that should be carefully considered before a decision is made, as too often in the past few years has the alternating-current generating plant with rotary converter sub-stations been installed, seemingly because such an outfit was in style, when the much more simple system of direct-current stations with plenty of trolley feed-wire would have been much more economical.

For instance, let us briefly consider a given case as follows: Two cities of about 25,000 population each, situated 20 miles apart, each with a street railway system of say ten city cars. These two systems are owned by a company which is to construct an interurban road connecting the two, the plans contemplating new power equipment. The schedule will call for two regularly operated interurban cars and twenty city cars, and an installation of say 1000 kw capacity in power generating machinery. The location of an a. c. power station midway between the two towns, with a sub-station at each end and rotaries in the power station, will mean average transmission and conversion losses of about 45 per cent of the total power generated.

The location of a combination a. c.-d. c. plant at one end, with sub-stations at the other end and midway, will mean average transmission and conversion losses of about 35 per cent. With two d. c. stations, one at each end, and direct-current feeders on the interurban line, the same results will be attained with power losses of but 20 per cent; the first cost of the installation will be no greater, and the costs of generating the power would be but very little, if any, greater, provided, of course, that the facilities for obtaining coal and water are the same in the two towns. Assuming a generating cost of 10 per cent more in the two small stations than in the one larger one (which is high), we have the cost of power at the car from the d. c. stations averaging about 25 per cent lower than from the a. c. station at the middle location, and over 10 per cent lower than from an a. c.-d. c. station at one end of the line, without considering the additional labor at sub-stations which would be required with either of the a. c. stations.

If the given conditions be varied by the elimination of the city cars at one end of the line, leaving a load to be considered consisting of an interurban line of 20 miles in length, operating two regular cars on an hourly schedule, with a city system of ten small cars centering at one end of the interurban line, then one direct-current power station at or near the city car load probably will prove to be the most economical. In this case, of course, the trolley feeder must be increased greatly, and possibly a booster set will be required, but this additional investment will not reach the cost of transmission lines, sub-stations and sub-station apparatus, plus the capitalized cost of sub-station operation and losses.

However, when the proposed line is much to exceed 20 miles in length, especially if future extensions are very likely, and no great number of city cars is to be operated, economy begins to favor the alternating-current station with high-tension transmission and sub-stations, and as the length of line increases, and with it the number of cars to be operated and the total load on the station, it finally reaches a point where there is no question as between the one a. c. station and a number of small d. c. plants. With the construction of a power plant of several thousand kilowatts capacity, coal may be easily handled, and the many refinements conducive to economical operation may be introduced which are not possible or practicable in smaller stations. These points, together with the low cost per kw-hour for labor, which is possible with a large station, combine to reduce the initial cost of power to such a low figure that the seemingly low average efficiency of transmission and conversion, together with the cost of sub-station operation, may be met, and power still be delivered to cars many miles distant at a cost which will compare very favorably with direct-current distribution within much smaller possible areas.

In this discussion, no mention has been made of the purely alternating-current system, in which the car motors are designed for the use of alternating current, and for which the following claims are made: Reduction in first cost, by the elimination of the rotary converter and saving in trolley feeder; reduction in operating expenses, by doing away with constant sub-station attendance; an increase in efficiency by the reduction of trolley and feeder losses, reduction or elimination of rheostatic car starting losses and the complete elimination of rotary converter losses. As soon as the new alternating-current motor can demonstrate these points and prove to us that it is as well adapted to our purposes, as efficient, as reliable and as easy of maintenance as the direct-current series motor, we must seriously consider it in our future plans.

The operation of cars by this system has just been started on the Rushville division of the Indianapolis & Cincinnati Traction Company, and the operation of this line will be very closely watched by street railway engineers and managers until the success of the system has been fully demonstrated.

The replies which have been received to our letters of inquiry represent 85 per cent of the total installed generating capacity of the railway power stations of the State. These power stations generate an average of 5,845,450 kw-hours per month at an average total cost of $44,156.38, or .755 cent per kw-hour.

This average cost per kw-hour is divided as follows:

	Cent.
Fuel	0.526
Labor	0.158
Lubricants, waste and miscellaneous supplies	0.032
Repairs	0.039

The lowest total cost per kw-hour reported is 0.505 cent, while the highest is 2.024 cents. The lowest cost of fuel is 0.368 cent, the highest, 1.405 cents. The lowest cost of labor is 0.100 cent, the highest, 0.331 cent. The lowest cost of lubricants, waste and miscellaneous supplies is 0.015 cent, the high-

est, 0.086 cent. The lowest cost of repairs is 0.010 cent, the highest, 0.218 cent.

Deducting the output of the two most economical stations, representing two-thirds of the total output reported, the average cost of the balance of the power generated in the State is 1.021 cents per kw-hour.

The figures which have been given are on cost of power at power station switchboards. As six of the thirteen stations reporting are a. c. stations with transmission lines and sub-stations, these costs must be increased by the addition of sub-station operating expenses. With this addition, the total cost of power delivered to direct-current feeders is $47,500.01, or 0.964 cent per kw-hour, the lowest cost reported being 0.747 cent, and the highest being 2.024 cents.

The total amount of coal burned in all the stations reporting averages 532½ tons daily, 80 per cent of which is Indiana run of mine and slack. The average cost of all coal burned is $1.89 per ton. The average consumption of coal is 5.56 lbs. per kw-hour, the highest consumption reported being 10.7 lbs., and the lowest being 4.9 lbs. per kw-hour.

The power station capacity per interurban car operated averages, as has been stated, about 200 kw, the lowest being 150 kw, and the highest, 350 kw.

The roads reporting give a monthly car mileage of city cars of 1,122,060, and the interurban cars of 630,258 car-miles. The average power consumption is 1.48 kw-hours per car-mile for city cars and 5.18 kw-hours per car-mile for interurban cars. On this basis, the average cost of power per car-mile is 1.43 cents for city cars and 5 cents for interurban cars.

As illustrating the beneficial effect of the careful consideration of operating features in the engineering design and construction of a road, such as reducing curves and grades to the practical minimum, the careful location of sub-stations with respect to their loads, and an economical distribution of copper, some figures on the Indianapolis Northern division of the Indiana Union Traction Company, as compared with the balance of that system, may be of interest.

The Indianapolis Northern division consists of the lines from Indianapolis to Logansport, Kokomo to Peru, and Tipton to Elwood. This portion of the line is fed from the power station at Anderson, through 30,000-volt transmission lines, to six sub-stations, located 26 miles, 42 miles, 43 miles, 59 miles, 59 miles and 61 miles, respectively, from the power station the average distance of all rotary converters being over 46 miles from the generators.

The balance of the system is fed from the same power station through rotaries at the power station, and through 15,000-volt transmission lines to eight sub-stations, the average distance of all rotary converters on this old division being but 15 miles from the power station.

The entire alternating-current output of the station is measured by an integrating wattmeter on the generator switchboard, while a second wattmeter measures the input to the step-up transformers supplying current to the transmission lines feeding to the Indianapolis Northern sub-stations only.

Notwithstanding the fact that 12 per cent of the power used on the old divisions is delivered directly from the power station with no a. c. transformer or transmission losses whatever, and that the average distance from generator to rotary is 31 miles greater on the Indianapolis Northern division, the power station output to these new divisions is but 33 per cent of the total, while handling 42 per cent of the total car mileage. In other words, the power consumption per car-mile, including all losses from generator to car motor, on the new line is but two-thirds as much as on the old lines, even though the average transmission distance is three times as great. The class of cars in use on all divisions is the same, and the average schedule speed is slightly greater on the new lines than on the old.

TRACK AND ROADBED CONSTRUCTION AND MAINTENANCE WITH PARTICULAR REFERENCE TO THE LIFE AND CHEMICAL PRESERVATION OF TIES*

BY THOS. B. McMATH

As all present may know, the question of securing good ties is each year becoming more difficult, as timber becomes more scarce the quality offered in ties becomes poorer. Good white and burr oak ties are difficult to secure, and the attention of all railroads is called to the advisability of using treated timber. At present, the most satisfactory treatment for prevention of decay in timber is its impregnation with creosote; the additional life of treated timber fully justifies the expense, and it is possible to substitute a grade of timber utterly unsuited for ties, yet, which when treated, will show a life double that of the best untreated timber heretofore used.

Wood is composed of a great number of tubes firmly united and of varying sizes, the more open tubes being in what is commonly known as the sapwood; the older tubes are filled with various substances, as resin, gum, etc. The sapwood is the living part of the tree, the tubes allowing a free passage of water, while the heart wood, due to changes, no longer allow such free passage of water. Decay is caused by the entrance of living organisms, as insects, bacteria or fungi, and sapwood being more open, is the more readily attacked. The best conditions for their activities and growth exists in the presence of heat and moisture.

The treatment of timber consists in the introduction of substances poisonous to these destroying agents. It must penetrate all parts of the timber and must remain there permanently. Experiments have been made with the creosoting process for about forty years. Assuming that the results of the present creosoting will be as good as those obtained twenty years ago, we can assume that the life of a tie can be increased by treatment to twenty or twenty-five years.

Experiments have shown that the undesirable woods, such as red and black oak, owe their quick decay to the open and porous condition of their wood cells. Woods of this character are the ones in which the effect of treatment is greater, and their life compares very well with the life of the treated white and burr oak timbers.

On a visit to a Southern city, the writer was shown creosoted sap pine ties that had been in service on street railway track for more than fifteen years and were evidently good for nearly as much longer; also creosoted sap pine piles that were said to have been in position for about eighteen years and still were in a good state of preservation.

Sap pine is the poorest and cheapest grade of lumber in the South, on account of its open and porous nature, and is the most successfully treated. The writer was told that the treated ties cost in the vicinity of 40 cents, and treated sap pine poles could be secured for about $6 for a 30-ft. pole. He has written to parties for definite prices on these ties and poles delivered in Indianapolis, but has not as yet received a reply. Local creosoting works have quoted prices, but having an inflated idea of the value of their particular process, their prices correspond. I think, however, a good creosoted tie could be secured in Indianapolis for less than 65 cents, and that such a tie placed in track would last under ordinary conditions double the life of the ordinary white oak tie, especially white oak ties of the quality now obtainable. The life of a creosoted sap pine pole, considering its greater strength over cedar, is such as to strongly recommend its use.

The features in which track construction and maintenance in cities differ from ordinary steam and interurban railways are, first, the work must be such that no repair is necessary

*A paper read before the first convention of the Indiana Electric Railway Association, at Indianapolis, Jan. 12, 1905.

except at long intervals of time, and second, it must be such as to permit the ordinary types of street paving to be applied. Deep rail sections must be used in order that ties may be low enough to permit the paving of the tracks, instead of employing, as in railroad construction, the shallow rail and partly exposed ties. We use deep rails of from 6 ins. to 9 ins., laid on ties or without ties, in combination with concrete, the rails being laid on blocks in trenches which are filled with concrete, forming a beam under and around the rail, the rails being held in position by the concrete beam, with the aid of the street paving material. This type of construction has been in use for the past ten years.

In some cities this type of construction has been considered satisfactory, while in others it has been condemned. In Indianapolis we have several miles of track of 9-in. girder rail laid on concrete beam, with ties spaced 12 ft. apart, and paved with brick laid on a concrete base. This construction is inadequate for interurban traffic. The College Avenue line of this city was constructed with 7-in. T-rails, on ties spaced 2 ft. between centers, ballasted with natural cement concrete, which concrete extends from 6 ins. below the bottom of the tie to within 5 ins. of the top of the rail, the street surface being vitrified brick, with nose brick forming the flange groove adjoining the rail. This construction has proven entirely satisfactory for interurban traffic.

The tracks built last season and now used by the interurban cars on Ohio Street and Capitol Avenue, were built with 7-in. T-rails, on ties spaced 12 ft. apart, and resting on a concrete beam 24 ins. wide and 20 ins. in depth under each rail. Tie-plates were used at intervals of 4 ft., and securely held by anchor bolts extending through the concrete.

It is a deduction of the writer from experience in concrete beam work that track constructed in the old manner failed from lifting, and that such anchorage, in addition to holding the track in line and gage, would increase its stability by avoiding vertical movements. The use of the tie-plate between the ties permitted the suspension of the anchor bolts in their proper position during the process of concreting, the track having previously been brought to surface and line by tamping the ties. The concrete used was made of the best grade of Portland cement and had ample time to set.

The flange groove alongside of the rail was obtained by the use of a special nose block, much larger than the ordinary paving brick, this block being 5 ins. wide, 4½ ins. thick and 10 ins. long, the balance of the pavement being the ordinary paving brick. The special shape of this block permitted its being laid longitudinally directly upon a mortar bed on the concrete, strips of wood being used to fill the cavity under the head of the rail, to prevent the special nose brick from coming in contact with the rail and to reduce the rumble of the passing cars. These wooden strips also act as a semi-elastic material adjoining the rail, taking up the thrust due to the expansion of the pavement between the rails.

Brick pavements expand from temperature causes, and if rigidly held by the rail, the brick rises off the sand cushion to the detriment of the pavement, forming a sounding board which increases the noise.

The 7-in. T-rail now used in this city was especially designed for the heavy interurban car. All Shanghai rails previously rolled by the mills were too light in the web for such heavy loads, being designed for ordinary weights of city cars, and as city pavements required the rail to be 6 ins. in height or over, the webs in use were extended in height, but remained ⅜ in. in thickness.

As interurban cars use a 3-in. tread wheel, it was considered advisable that the head of the new rail should be 2⅜ ins., the web 9-16 ins. thick, the rail 7 ins. high and base 6 ins. wide. This rail weighs 91 lbs. to the yard. To the credit of those interested in the designing of this rail, it may be said that a subsequent design of rail, for similar conditions, made by a committee from the American Street Railway Association, is very similar, the main difference being that the committee made the head of their rail 3 ins. wide.

Perhaps the most trying feature of track maintenance in Indianapolis is the adjustments of gage on special work to fit it for wheels of all varieties. In this city are found all kinds of wheels, from ⅝-in. flange and 2-in. tread up to the M. C. B. with 1⅛-in. flange and 4-in. tread. If the guard rail on a curve is placed with the proper width of groove for the big flange, the ⅝-in. flange wheel can never touch the guard rail unless the wheel on the other end of the axle is riding with its flange on the rail. On the other hand, if the guard rail is set with reference to the little flange, the big flange will ride up on top of the guard rail.

We have made it a practice on curves where rolled guard sections are used to gage curves 4 ft. 8⅜ ins., and where we have been able to get this condition, we have had no derailment trouble, although the big wheels squeak and it takes power to send them around. Such places we keep well greased.

The outcome of this condition is that the interurban lines must be reasonable about their wheel flanges, and use a flange not over 1 in. deep x 1 5-16 ins. thick, so that guard rail sections can be used, and then, all wheels on city cars should be made to conform. The saving in special work renewals would pay for changing all the wheels in two years; the addition of ½ in. on the width of tread of city car wheels would immediately add 50 per cent to the life of every frog and switch in the track.

H. J. McGowan has taken an initial step in interurban railway development in erecting the terminal station and building, in which we now meet, and in which station enter interurban cars from all parts of the State of Indiana. Arrangements have been perfected by which through buffet parlor cars from Ohio will also enter this station. Indiana has taken the initiative in providing elegant and commodious accommodations for interurban railway patrons.

This association should therefore lead in the work of standardizing all equipment and secure the co-operation of other similar organizations in fixing such standards. Standard car-wheel flanges, width of tread, diameter of wheel and standard gage for pressing wheels should be adopted at the earliest possible moment, as cars of different lines are now frequently sent over connecting lines, and all city railroads over which interurban companies operate their cars are vitally interested. The difficulties arising from irregularities in any of the above-mentioned items cause the most disastrous results, and, until this is done, special work cannot be intelligently ordered.

SINGLE-PHASE, THREE-PHASE RAILWAY SYSTEM

A new system of power distribution for electric railway work has recently been patented by J. H. Hallberg, of New York, in which a single-phase synchronous or induction motor on the car or locomotive drives a three-phase generator, which in turn supplies current to three-phase motors on the axle. The system is claimed to be superior to that in which a d. c. electrically-driven generator is used on the car and d. c. on the axles, in that no commutators are employed. Changes in speed are secured by varying the frequency and amount of current in the three-phase circuit, and by the use of resistances in the secondaries of the motors. The exciter for the a. c. generator is mounted on one end of the motor-generator shaft, and a small single-phase self-starting motor on the other end of the shaft is used for bringing the motor members up to speed. Where low-voltage overhead wires can be installed, the inventor states that three-phase current can be collected for direct use by the motors.

OVERHEAD LINE APPLIANCES FOR SINGLE-PHASE ELECTRIC RAILWAYS

The development of the single-phase system naturally introduces the question of the necessity for better trolley line insulation than on low-voltage railways, and it is interesting to note that a number of the equipment companies have already taken up this important subject. Among them, the Electric Railway Equipment Company, of Cincinnati, has brought out a series of overhead appliances which have been designed by Elmer P. Morris, and which are illustrated in the accompanying diagrams. These are of a number of types, the first of which is illustrated in Fig. 1.

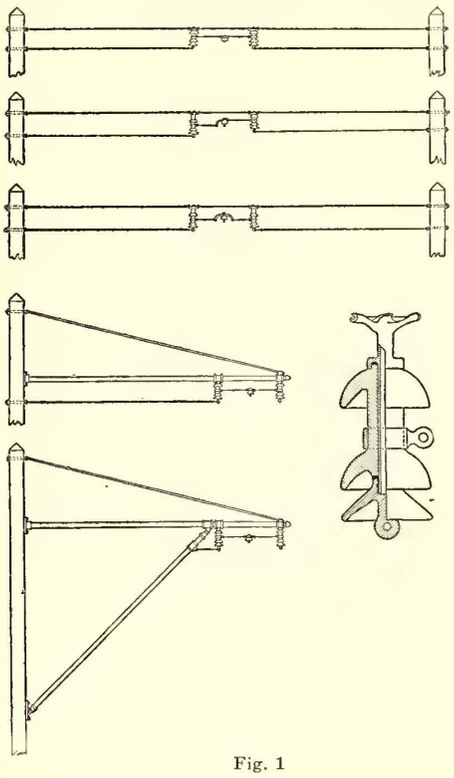


Fig. 1

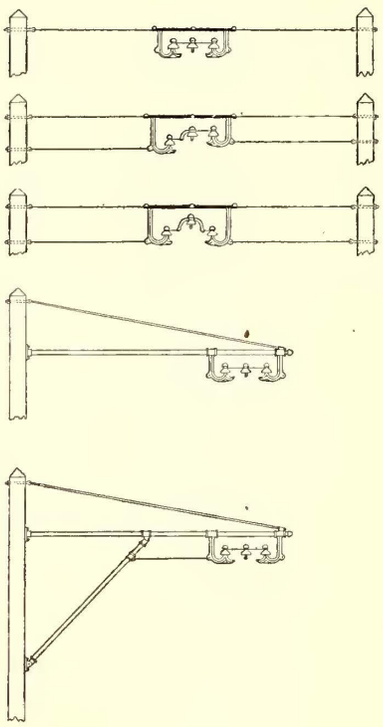


Fig. 2

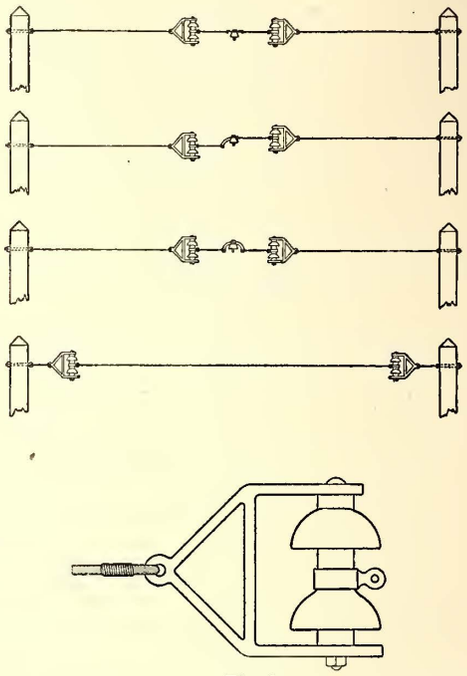


Fig. 3

FIGS. 1, 2 AND 3.—OVERHEAD INSULATORS FOR SINGLE-PHASE ROADS, SHOWING METHODS OF SUSPENSION

The insulator, as shown in the larger drawing in Fig. 1, is of the double petticoat type and of porcelain. This insulator is supported by an iron core, which has an iron upper cap, and is threaded at the bottom to carry a lower cap and eye. Rubber bushings are inserted between the caps and the porcelain to prevent the latter from cracking. A metal band with eye is placed around the middle shank of the porcelain, and this carries the regular hanger, which can be either of the ordinary type or an all-metal hanger. The other diagrams in Fig. 1 show, respectively, the method of using this insulator on straight line, single pull-off and double pull-off work, also two methods of bracket suspension. In span construction, the insulators can, of course, be placed any distance apart.

Fig. 2 illustrates a second style of overhead insulator, in which a double petticoated porcelain insulator of the ordinary form, carried on a wrought-iron support, is used. This support is provided with a shoe, as shown, so that there is no danger of the trolley breaking the insulator in case it should come off the wire. The methods of installing this insulator in span and bracket construction are also illustrated. In span construction a spacing bar or pipe is employed to keep the insulators apart.

A third system of single-phase insulation is illustrated in Fig. 3. This insulator is also of porcelain, with iron core, somewhat like that shown in Fig. 1, but it is held in a bracket, which equalizes the strain on both ends of the iron core.

Fig. 4 illustrates a novel form of auxiliary insulator for high-tension feeder lines, which has also recently been brought out by the same manufacturers along Mr. Morris' design. This insulator consists of a flat or semi-circular piece of porcelain with corrugations on its upper surface, and is designed to fit around the pin of an ordinary insulator. Its object is to catch the feeder wire in case of breakage of the insulator proper, so that the wire will not fall on the cross-arm or other support. To permit the installation of this insulator on lines already erected, it is made in two parts, which dovetail when in place.

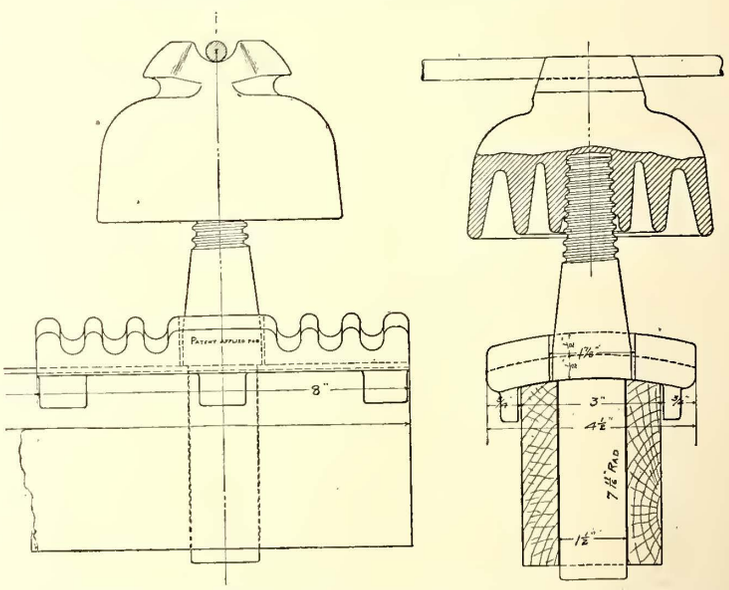


FIG. 4.—END ELEVATION AND SECTION OF AUXILIARY INSULATOR FOR HIGH-TENSION FEEDER LINES

The Old Colony Street Railway Company has increased the rate of fare on some of its lines. The fare from Brockton to New Bedford is 50 cents, as against 35 cents before Jan. 1, and the fare to Taunton from Brockton is 25 cents, as against 20 cents. General Manager Goff, of the company, says that street railways cannot be operated on a fare of less than 1½ cents a mile.

SOME RECENT VALVE DESIGNS

The Crane Company, the well-known valve manufacturer of Chicago, has recently brought out some new designs in renewable seat and disc globe and angle valves, suitable for working pressures up to 250 lbs. and tested to 700 lbs. pressure per square inch.

The renewable parts are of a hard and superior composition, made to last many times longer than those in the ordinary valves. They are especially suitable for any hard work where extreme pressure is used and where the wear and tear on the valve is most severe. By unscrewing the nut on bottom of the valve, which is shown in Fig. 1, all parts are accessible and removable from the top, thus making it convenient to substitute a new seat or new disc when required, or to replace any worn part. The disc being attached to the stem by a slot, is easily removed and replaced. The seat and disc can be removed and the two ground together if necessary.

In putting the valve together, the seat is replaced and the nut tightened on the bottom of the valve, which holds the seat in place; then the bonnet is screwed and the valve closed. The construction of these valves is such that they may be packed when open without steam escaping.

The renewable seats and wedge straightway valves are made with copper seats and hard metal wedge; they are suitable for working pressures up to 250 lbs., and are tested to 800 lbs. pressure per square inch. Soft metal rings or seats are furnished for water or air, when so specified.

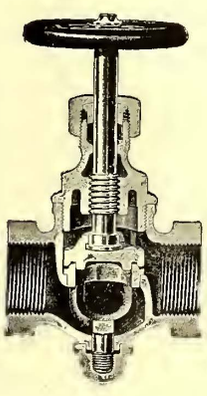


FIG. 1.—RENEWABLE SEAT OR DISC VALVE

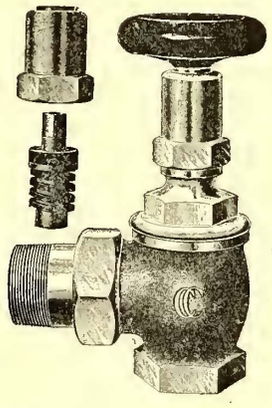


FIG. 2.—SELF-PACKING VALVE

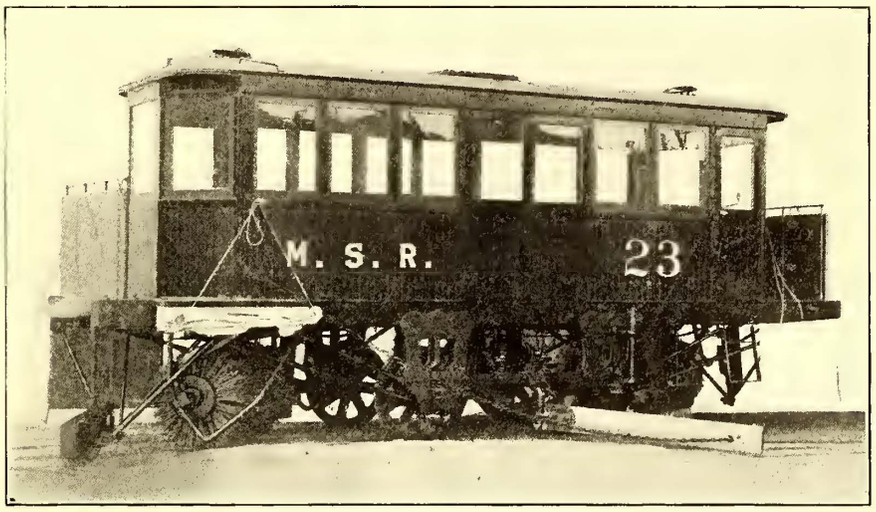
The "self-packing" globe and angle and radiator valves, shown in Fig. 2, are made with Jenkins disc and non-rising stem to supply the demand for valves embodying this very desirable self-packing feature. All users of radiator valves know that leaky stuffing boxes are a source of a great deal of annoyance, caused by the escape of steam and water, soiling the trimmings of valves, as well as the carpets, walls and ceilings.

Former attempts to produce a self-packing valve were unsuccessful, because the valves were made with two metallic parts, which, grinding together, would soon become leaky. In this self-packing valve a piece of vulcanized rubber is introduced between these two metallic parts, which makes a perfect seat. Should these valves become leaky, a new vulcanized rubber disc can readily be inserted. The application of this device when applied to globe and gate valves will be appreciated by all users of steam and water, as it obviates the constant attention of the engineer or other persons in charge of the plant in looking after leaky valves. The threads on the bonnet of these self-packing valves are the same size as those in the Jenkins disc valves, made by the Crane Company, and those wishing to replace the old style trimmings with this new self-packing device can do so without removing the valve.

SNOW SWEEPERS FOR THE MONTREAL STREET RAILWAY

The Montreal Street Railway Company has added to its snow-fighting equipment three new sweepers, like the one shown in the engraving, built by the J. G. Brill Company, which are similar to those furnished to the Metropolitan Street Railway Company, of New York, and other large cities. The Montreal Street Railway Company has used Brill sweepers for several years, and the details of this last order are practically a repetition of former ones. Under the experienced management, and because of the excellent equipment, the schedules are maintained without interruption throughout the winter, although no city railway system on the American continent has more to contend with as regards the removal of snow. The system includes about 120 miles of track and over 700 cars are operated.

This type of sweeper, which is known as the Brill Standard, has a single short broom at each end; these brooms are about three-quarters the length of long brooms used in other types, and, it is claimed, may be set at a more acute angle to the rails than is possible with long brooms, enabling the snow to be thrown clear of the rails and not piled up ahead. It is also stated that short brooms work and wear more evenly and are easier to handle, that they are capable of independent adjustment and can be made to conform to the curvature of the pavement between the rails, so that with one end set a little lower than the other, the rattan digs into the hollow of the rails and cleans them out thoroughly. Brush boards and wings, set at the same angle as the brooms, keep the rails on the side of the car not covered by the revolving broom, sufficiently free to prevent the stalling of the sweeper in deep snow, and the revolving broom at the rear cleans up what is left.

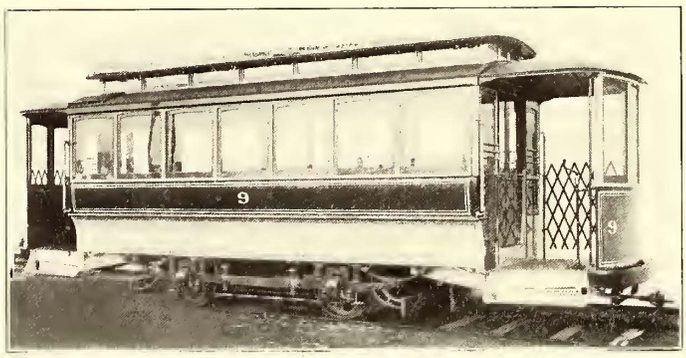


ONE OF THE NEW SNOW-SWEEPERS RECENTLY FURNISHED TO THE MONTREAL STREET RAILWAY COMPANY

The length of the body of these sweepers is 21 ft., and the width over the side sills, 7 ft. The side sills are 4¼ ins. x 8¾ ins., and the sill plates are 8 ins. x ½ in. The side sills extend 6 ins. beyond the dashers, for the purpose of supporting the iron pieces to which the shear boards are movably secured, and which extend 2 ft. 8 ins. outside the rail. The levelers at either side have a vertical adjustment, and the brush boards are arranged to fold up against their supports; besides the double doors at either side, single doors are provided at the diagonally opposite corners, and all doors are arranged to swing outwardly. Three motors are used, two for propulsion and one for the brooms. The cars are mounted on Brill gear trucks, with a wheel base of 7 ft. and 33 ins. diameter of wheels. The truck axles are 4 ins. in diameter, and the axles for the brooms, 3½ ins. The weight of each sweeper without motors is 14,000 lbs.

NEW EQUIPMENT FOR LEXINGTON, KY.

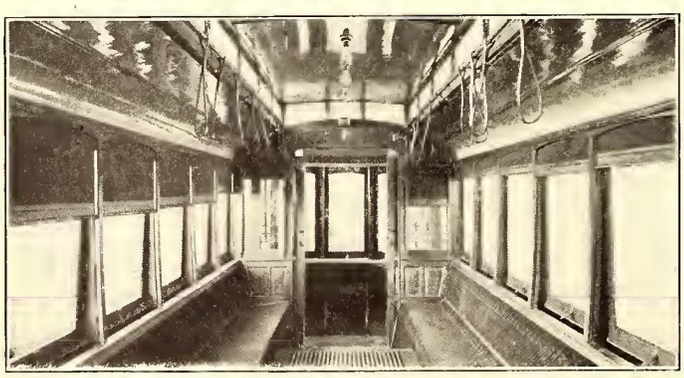
The American Car Company has recently furnished the Lexington Railway Company, of Lexington, Ky., several cars of the type shown. The Lexington Railway Company operates about 15 miles of lines in the city and vicinity, and is doing a prosperous business. Lexington is the chief railway center of



SINGLE-TRUCK CAR USED IN LEXINGTON, KY.

the northern section of Kentucky, and has several large educational institutions. It is in the heart of the celebrated blue grass country. There has been a large increase in population in recent years, and there are bright prospects of further rapid growth.

Each car measures 20 ft over the body and 29 ft. over the crown pieces. The width over sills, including the panels, is

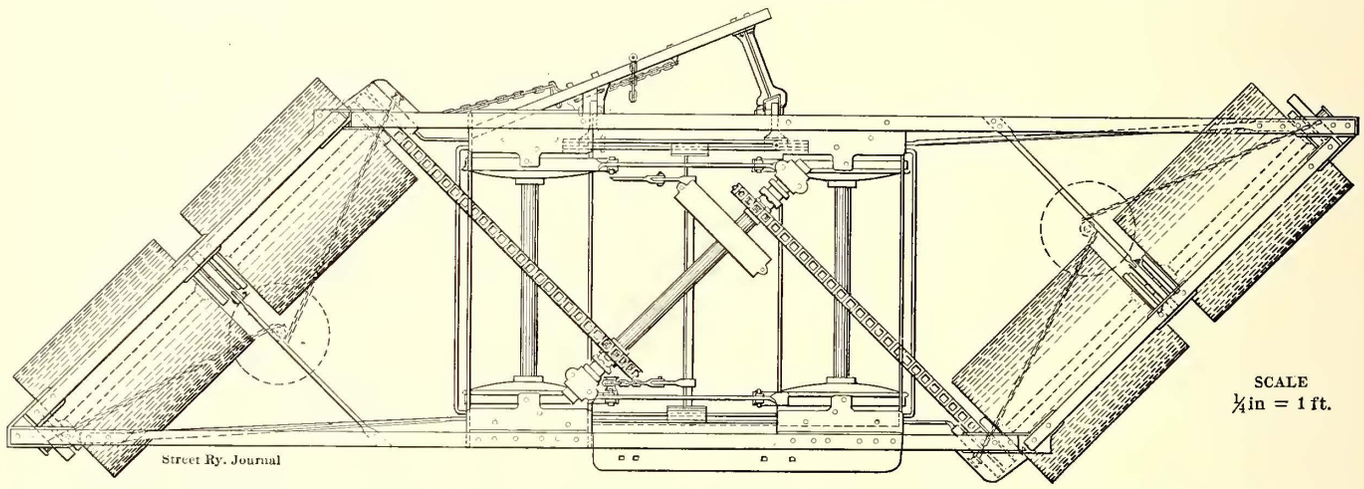


INTERIOR OF LEXINGTON CAR

6 ft. 3 ins., and over the posts at the belt, 7 ft. 5½ ins. The sweep of the posts is 8 ins. The distance between the centers of the posts is 2 ft. 9½ ins.; thickness of corner posts, 3¾ ins., and side posts, 1¾ ins. The side sills are 4 ins. x 7¾ ins., and the end sills are 4 ins. x 7 ins. The distance from the rail to he platform step is 15⅜ ins., and from the step to platform, 12 ins. The interior finish consists of cherry in natural color, with ceilings of maple. The windows are of polished plate, and the sashes are arranged to drop into the pockets. Wilton velvet carpet is used for the covering of the longitudinal seats. Instead of being nailed in the usual manner, the floors are screwed down. The central sash of the portable vestibules is arranged to slide to one side. The platform timbers are reinforced with angle iron and the construction is of an extra substantial character. Angle-iron bumpers, "Dedenda" gongs and "Dumpit" sand boxes of Brill manufacture are included among the furnishngs.

THE CONSTRUCTION OF McGUIRE-CUMMINGS SNOW SWEEPERS AND THEIR USE

In the STREET RAILWAY JOURNAL of Jan. 7, a communication was published by B. F. Stewart, calling attention to certain radical differences in the construction of various types of snow-sweepers. In that letter the fact was brought out that in the McGuire sweeper there is a revolving broom in advance of the truck the full width of the track, instead of only half the width as in older types. The accompanying plan of the frame work of the McGuire sweeper shows this construction better than it can be explained. The sweeper is constructed with a steel frame having diagonal ends, which carry the revolving brooms. The brooms are carried far enough in advance of the car platform so that when out on interurban track the snow curtains can be removed so as to throw snow entirely clear of the track, after the manner of a rotary plow. The revolving broom cleans clear down to the rail, which, of course, is more than can be done with a plow which must have a certain amount of clearance above the rail.



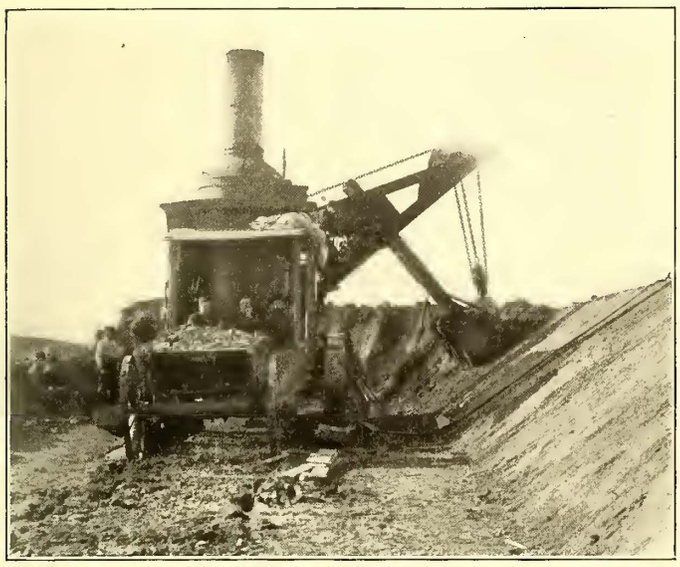
PLAN VIEW OF SWEEPER, SHOWING THE STEEL FRAME, WITH DIAGONAL ENDS, FOR CARRYING THE REVOLVING BROOMS

This change makes the plow efficacious on interurban lines, where it can clear drifts as deep as 4 ft., as in Joliet and Denver. Other large interurban railway companies which depend on this type of sweeper for the removal of snow are: The Elgin, Aurora & Southern; Toledo, Bowling Green & Southern; Chicago General; Ashtabula Rapid Transit; St. Louis & Suburban; Joliet & Plainfield.

General Manager Selvedge, of the Holland Palace Car Company, has been in Cleveland conferring with a number of prominent interurban managers relative to the practicability of installing parlor car service on some of the long connecting lines in which Cleveland people are interested. The Holland Company is building some magnificent 60-ft. parlor chair cars and is working out a number of long routes over which it believes such cars could be operated profitably. Nothing definite has been accomplished.

A STEAM SHOVEL FOR ELECTRIC RAILWAY GRADING

In the construction of electric interurban railways, the grading is frequently done by the slow process of employing horses and scrapers. Often, however, this could be accomplished more economically by the use of a steam shovel, but the extent of a single job of grading may not warrant the expense of purchasing a steam shovel of the size as ordinarily constructed,



VIEW SHOWING THE FINE SLOPE GIVEN BY STEAM SHOVEL

and these are, morcover, too heavy to be readily transported from one job to another.

The Vulcan Iron Works Company, of Toledo, Ohio, has designed a shovel that is peculiarly adapted to construction work on electric railways. This is the "Little Giant Traction Shovel," which weighs but 26 tons. It is well illustrated in the two accompanying illustrations, showing it in service on the Rockefeller extension of the Chicago & Milwaukee Electric Railway. A notable feature in one of the illustrations is the elegant bank and slope given to the cut by the machine.

The shovel is mounted on wheels with broad tires and is self-propelling. It is 10 ft. wide over all and 23 ft. long. The car itself stands 13 ft. high. The dipper has a clear lift above the ground of 8 ft. 6 ins., and will cut a bank 16 ft. high. One double engine hoists the dipper and another swings the crane. It will work in clay, sand, gravel, iron ore and similar materials, and is well adapted for use in brick yards, stone quarries, stripping coal fields, loading coal and other work of this nature, besides interurban grading.

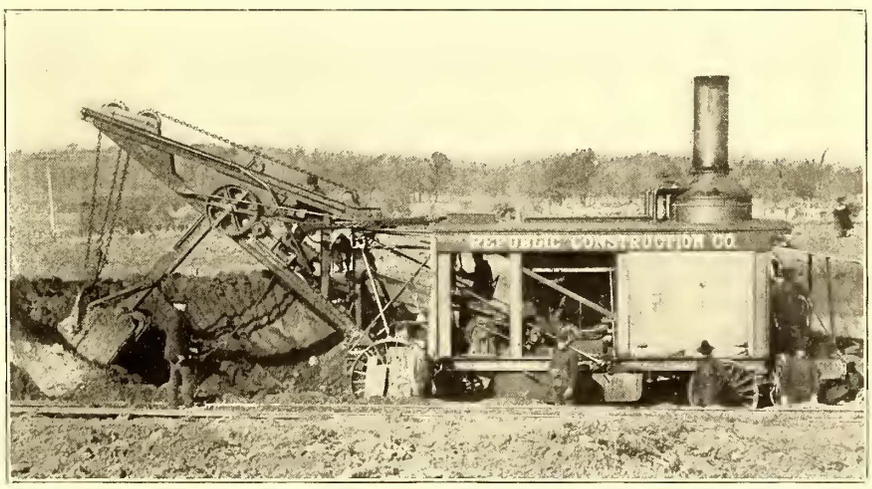
One great advantage of the machine is that it is of such a size that it can be hauled by teams when steam cannot be used, and when desired, it may be so constructed as to be readily taken apart for transportation on wagons to places not easily accessible. If the services require, it may be mounted on railroad trucks and carried on a track.

The expense of operation depends, of course, on the local conditions, varying sometimes from $50 per day on 1500 cu. yds. to $25 per day on 1500 cu. yds. The crew required to operate it usually consists of one engineer, one cranesman, one fireman and two pitmen, making a total of five.

A study of the conditions governing many jobs of grading will no doubt make it evident that this steam shovel can be employed to a greater advantage than the method requiring scrapers and teams.

TERMINAL FOR NEW JERSEY & PENNSYLVANIA TRACTION COMPANY IN TRENTON

The New Jersey & Pennsylvania Traction Company has purchased the Clark Building, at Warren and West Hanover Streets, Trenton, N. J., and will convert it into an up-to-date electric railway terminal. The building was formerly occupied by a large department store, and was partially destroyed by fire some months ago. The traction company purchased it at Sheriff's sale for $19,720, with assessments, which will bring the total price up to about $21,000. The building has a frontage of 60 ft. on Warren Street, one block from the City Hall, and within 100 yds. of the leading hotels, theaters and other electric railway terminals. It runs back about 170 ft. on West Hanover Street, joining the company's present office building and car house, which has frontage of 61 ft. on West Hanover Street, and 84 ft. on Chancery Street. The Clark Building was four stories high, and the fire destroyed the third and fourth floors and elevator shaft, the walls remaining practically intact. While no definite plans have as yet been decided upon for the new terminal, it is understood that the cars will be run direct into the remodeled building, so that passengers may enter the large waiting room (which will extend across the Warren Street front) without stepping out of doors. The company's offices will be located in the building, and the present car house will be utilized entirely for the repairing and storing of cars. It is probable that the present curves from the street will be done away with and that the cars will be backed into the car house from the new terminal, into which the cars will run. When the work is completed, the New Jersey & Pennsylvania Traction Company will have a terminal which could not be duplicated for $100,000 (including the present car house), and the only one of the kind in the State of New Jersey. It is located only a block from the terminus of the New York cars, and the New Jersey & Pennsylvania Traction Company operates cars to Princeton, N. J., and Newtown, Pa., and will soon be running to Newhope, Pa., and Lambertville, N. J. Another line will extend to Willow Grove, Philadelphia's famous pleasure resort, and the Morrisville (on the Newtown line) cars make direct connections with the Philadelphia, Bristol & Trenton cars, so that the new trolley terminal may be said to be the key to the traffic of the two States. The New Jersey & Pennsylvania Traction Company also has a storage house on North Willow Street, capable of holding all its cars, and owns the former offices, adjoining the house, so that it is in possession of a valuable lot of real estate within the city limits which could not be duplicated for the price, and which will rapidly increase in value.



STEAM SHOVEL IN OPERATION ON THE CHICAGO & MILWAUKEE ELECTRIC RAILWAY

FINANCIAL INTELLIGENCE

Wall Street, January 18, 1905.

The Money Market

Increasing ease developed in all branches of the money market this week, rates for all maturities being forced to the lowest point attained in months by the continued heavy offerings of funds by both local and out-of-town institutions. At the opening call money loaned at 2½ per cent, but subsequently the rate ran off to 1¾, which was the final figure. On time, the volume of business was extremely small, partly owing to the extreme ease in call money and partly to the entire lack of demand from stock commission houses. Sixty-day funds, which commanded 3 per cent a week ago, were obtainable during the present week at 2½ per cent, while four and five months' contracts were in moderate supply at 3 per cent. Six months' maturities were firmly held at 3¼ per cent, but a break in the rate to 3 per cent would not be at all surprising. Nine months' funds loaned at 3¼, and contracts for the balance of the year were offered at 3½ per cent. The movement of currency in this direction continues on an extremely large scale, and in addition, the local institutions continue to gain on their operations with the Sub-Treasury. The bank statement published last Saturday was better than generally expected, and showed clearly the vast accumulation of funds at this center. The increase in cash amounted to $15,348,900, while the surplus reserve increased $12,851,025, bringing the total up to $24,459,275, as against $12,851,025 in the previous week. The outflow of gold to Europe continues, and is likely to do so for an indefinite period. The local rates of exchange remain strong, while the rising tendency in Paris discounts, and the decline in the Paris cheque rate, indicates that the gold requirements at Paris have not yet been satisfied. As the movement is confined to gold bars entirely, it is not expected that the gold exports will assume large proportions, owing to the limited supply of assay office bars. At London and Berlin the discount rates were not materially changed from those ruling a week ago.

The Stock Market

Trading in the local securities market continued upon a comparatively small scale this week, and, although prices continued to show more or less irregularity, the movements were, for the most part, confined to narrow limits. The early dealings were accompanied by a generally higher range of prices, the principal features being the strength in the Pacific stocks, and in Northern Securities on the curb, which established a new high record at 147½. The advance in these shares gave rise to rumors of an amicable settlement of the Northern Securities dissolution plan, but subsequently these issues reacted sharply, on the announcement that the recent decision of the United States Circuit Court of Appeals would be appealed to the United States Supreme Court. In other parts of the list prices were advanced sharply, but toward the end a heavy realizing movement developed, which carried prices for most issues off sharply. Exceptionally strong features in the final dealings were Reading and Omaha, the latter advancing 19 points on an increase of ½ per cent in the semi-annaul dividend declaration, thus placing the stock on a 7 per cent basis. Notably weak features were Baltimore & Ohio, Illinois Central, Union & Southern Pacific and Amalgamated Copper. The money market displayed extraordinary ease throughout, rates for all maturities loaning at the lowest points attained since last November. The ease in money was reflected in an increased demand for high-grade bonds, the market for which was considerably more active and higher.

A noteworthy feature of the trading was the activity and strength in the local traction issues, practically all of them scoring sharp advances in sympathy with the upward movement in Interborough. The advance in these shares was accompanied by the usual crop of rumors of a "deal," but all of them were flatly denied by all interests. Brooklyn Rapid Transit was the feature of the group, the price scoring an extreme gain of 4⅝ points to 64⅞, but toward the close the price ran off to 63¾. Since Jan. 1, the earnings of the company have shown an increase of $5,000 per day, while from July 1 to Jan. 1, the gross earnings have increased $600,000, an average increase of $100,000 per month. Manhattan advanced to 169⅝, a net gain of 1⅝, while Metropolitan Street Railway and Metropolitan Securities advanced 1⅛ and 2 points to net, respectively.

Philadelphia

Increased activity developed in the market for local traction shares, and prices generally displayed strength. Interest centered largely in Philadelphia Rapid Transit and United Gas & Improvement. The first-named opened weak at 17⅞, owing to the rumored dissension among the local politicians, but subsequently it rose quite sharply to 19 on buying said to be for the New York interests. It is said that all the preliminary work incident to having the stock listed on the New York Stock Exchange, and that the new engraved certificates of stock will be finished the last of this week, when the instalment of $5 per share will be due, making the amount paid in $20. In all, about 15,000 shares were dealt in. Upward of 40,000 shares of United Gas & Improvement changed hands at prices ranging from 105½ to 109⅝, the final transaction being made at 109¼. The advance in this stock was based upon reports of a "melon-cutting" in the near future. Philadelphia Traction rose from 99½ to 100 and ended the week at 97⅞, while Fairmount Park Transportation advanced from 18¼ to 22. Philadelphia Company common moved between 41 and 42, while the preferred moved up from 46⅞ to 47. Union Traction sold in small amounts at from 58⅞ to 58⅝, and Consolidated Traction of New Jersey brought from 79⅝ to 80⅛. American Railways sold at 48 for about 400 shares.

Chicago

Local interests in touch with a large number of medium shareholders in Chicago City Railway express doubts at the syndicate's ability to secure a majority of the stock at $200. They maintain that from the fact that the Easterners are trying hard to obtain control, they may, at a later date, prove willing to pay even more for the property. A great many believe that the stock ought to be sold at least on a 4 per cent basis, which would make it worth $225.

Mr. Mitchell, president of the Illinois Trust and Savings Bank, says an effort will be made to bring the surface traction lines of Chicago under the control and management of one company. But that no further step in that direction will be made until the franchise matter has been satisfactorily disposed of. The control of the different roads is now so concentrated that the negotiations on behalf of the corporations can be conducted by one interest, and this should greatly simplify matters. All that the corporations want is that the municipal authorities show a fair spirit. The street railways wish only that which is fair.

The annual meeting of the Northwestern Elevated will be held January 25. It is expected the total surplus will show around $900,000 in the annual report.

The annual report of the South Side Elevated will be held on January 26. The annual report is expected to show a decrease in gross receipts of about $100,000.

Dealings in the traction stocks were rather quiet, there being a general disposition on the part of traders to await further developments in the local street railway situation, but prices, as a rule, held firm around those prevailing at the close of a week ago. Chicago City Railway opened at 194, and on profit-taking it ran off to 190. In the later transactions, however, the price advanced sharply to 198, and closing at 197¾. West Chicago sold at 60 for small amounts, but several hundred thousand dollars' worth of the Consolidated 5s changed hands at from 82 to 95½. North Chicago 5s sold at 95. Chicago Union Traction dropped from 12 to 9½, but later it advanced to 13, and closed at 12. Sales of the preferred were reported at 45. The Elevated stocks were strong on reports of the efforts making to merge all of the Elevated lines. It was further reported that the same interests that are interested in merging the surface lines, are behind the new deal. Metropolitan Elevated sold at 22, while the preferred moved up from 59½ to 61 and closed at 60⅞. Northwestern sold at 24½ and 24, and South Side brought 95.

Other Traction Securities

The feature of the Baltimore market was the activity in Norfolk Railway Light 5s, which sold at 91 to 91½ for about $25,000. United Railway issues were comparatively quiet, the first mortgage 4s selling at from 93 to 92, and the incomes at from 50 to 51½, and back again to 50½. The stock changed hands at 13 to 13½. Other transactions included Baltimore City Passenger 5s at 107, Macon Railway & Light 5s at 94½, Atlanta Street Railway bonds at 105½, Charleston Street Railway 5s at 105¼, and Charleston City Railway 5s at 93¾. The Boston market was ab-

solutely featureless. Boston Elevated was extremely quiet and fractionally lower, sales of small amounts being recorded at 157 and 157½. Massachusetts Electric common sold at 13½ and 14, while the preferred changed hands at from 58½ to 59½. West End common advanced from 94½ to 95½ on the exchange of odd lots, while a small lot of the preferred brought 113½. On the New York curb Interborough Rapid Transit continued the upward movement, the price making a new high record at 193 on comparatively small transactions. Toward the close, however, the support which was in evidence earlier in the week was apparently withdrawn, resulting in a reaction to 186, with a rally at the close to 188. About 25,000 shares of the stock were dealt in. The advance was based upon the large earnings of the company, which are said to be equal to 15 per cent on the stock, and to renewed reports of a "deal." The latter report was flatly denied. New Orleans Railways common was stronger, the price advancing from 3 to 4¼ on light purchases. North Jersey Street Railway 4s sold at 79½ for $25,000. Jersey City, Hoboken & Paterson 4s changed hands to the extent of $59,000 at prices ranging from 79 to 79½. Public Service Corporation issues were active and strong, 1000 shares of the stock selling at from 140 to 141, $50,000 of the certificates at from 73 to 73¼ and $100,000 of the 5 per cent notes at 97¼.

Cincinnati, Dayton & Toledo issues continue active in Cincinnati, in anticipation of the leasing plan soon to be announced. About a thousand shares of the stock sold at 23 to 24, and about $25,000 worth of the 5 per cent bonds at 85 to 85½. Cincinnati Street sold at the old price, 144. A block of $30,000 worth of Columbus Railway 5s sold at 91½. Cincinnati, Newport & Covington preferred sold at 91, and the common at 32, while a block of the 5 per cent consolidated bonds sold at 111½. Detroit United sold at 78½, Toledo Railway & Light at 23, and a round lot of Miami & Erie Canal stock at 1½.

Northern Ohio Traction continued active at Cleveland, and the price crossed 20, but failed to hold, and dropped back to 19½. Cleveland Electric Railway touched a new high figure of 80, but receded a trifle at the close. Western Ohio receipts dropped from 14 to 11⅛, but strengthened up to 12½, and are in good demand at that, with few offerings. A number of scattering sales of Northern Texas traction were made at 44¼. Cincinnati, Dayton & Toledo stock sold at 23¼. Muncie, Hartford & Fort Wayne was wanted at 41, but there were few offerings.

Security Quotations

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

	Jan. 11	Jan. 18
American Railways	47½	48
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	156½	157½
Brooklyn Rapid Transit	60¼	63¾
Chicago City	192	193
Chicago Union Traction (common)	12	11
Chicago Union Traction (preferred)	45¾	45
Cleveland Electric	74¼	a79
Consolidated Traction of New Jersey	78½	80½
Consolidated Traction of New Jersey 5s	108½	108½
Detroit United	77¾	77½
Interborough Rapid Transit	186	187
Lake Street Elevated	—	—
Manhattan Railway	167¾	169¼
Massachusetts Electric Cos. (common)	13½	13⅝
Massachusetts Electric Cos. (preferred)	58½	59½
Metropolitan Elevated, Chicago (common)	22	20½
Metropolitan Elevated, Chicago (preferred)	59	60
Metropolitan Street	115¾	116⅞
Metropolitan Securities	75	76¾
New Orleans Railways (common)	2¾	4
New Orleans Railways (preferred)	11	14
New Orleans Railways, 4½s	74½	76
North American	100¼	100½
Northern Ohio Traction & Light	17	—
Philadelphia Company (common)	24	18½
Philadelphia Rapid Transit	41	41¾
Philadelphia Traction	—	99¾
South Side Elevated (Chicago)	96	—
Third Avenue	127	127
Twin City, Minneapolis (common)	105¼	106¼
Union Traction (Philadelphia	58¾	58¾
West End (common)	95	95½
West End (preferred)	113	113

a Asked.

Iron and Steel

The "Iron Age" says the markets have been rather quiet in the past week, and there are some alarmists who show symptoms of uneasiness. The fact that we are producing and consuming so enormous a quantity for this season seems to inspire doubts as to the possibility of maintaining the pace. On the other hand the principal preoccupation of other conservative interests is that we may be in danger of a runaway market as the busy season approaches.

In spite of fact that United States Steel is turning nearly every wheel, the corporation is forced to pro rate shipments in the order in which specifications have been received, being unable to fill demands of all.

The event of the week has been the purchase on the part of the Steel Corporation of 25,000 tons of Bessemer pig at $15.50. A considerable tonnage of ore is being contracted for.

The steel rail market is quiet. Rail makers are confident and count on some heavy orders later on for the West and Southwest.

CHICAGO TRACTION MATTERS

A petition has been filed in the Circuit Court by Attorney Edward Roby as plaintiff, for an injunction restraining the city from passing the tentative ordinance for the Chicago City Railway, which the city proposes to submit to referendum in the spring. The petition also asks that the city be prevented from recognizing any right of the company to occupancy of the street. The basis of the petition is the claim that the legislative acts of 1859, 1861 and 1865, under which the Chicago City Railway Company has been operating, were never passed by the general assembly of the State and never became laws.

The petition, averring that the railway company at present has no rights, declares that the city, in granting any franchises to the company in return for the relinquishment of all unexpired rights, would in reality be giving the franchises without any consideration.

In its answer to the injunction bill, the city upholds the validity of the acts and asserts its rights to pass any ordinance.

PROPOSED CONSOLIDATION IN CHICAGO

Last week mention was made of the proposed consolidation of the Chicago City Railway Company with the Chicago Union Traction Company. It appears now that matters have not gone quite as far as the first reports would indicate. What has been done is to form a syndicate to purchase Chicago City Railway stock. The active men in this move are Marshall Field, John J. Mitchell and P. A. Valentine, of Chicago. J. P. Morgan & Company are syndicate managers. Hollins & Company, who are heavily interested in Chicago Union Traction, will participate in the underwriting. Messrs. Field, Armour and Valentine, in behalf of the syndicate, are advertising for Chicago City Railway stock, for which $200 per share is to be paid, provided sufficient stock to secure control of the company is pledged by March 31 next. These gentlemen are already heavily interested in the Chicago City Railway. P. A. Valentine represents the Armour interests.

DEVELOPMENTS IN APPLEYARD AFFAIRS

A number of developments have taken place in the affairs of the Appleyard lines of Ohio, which, as noted in the STREET RAILWAY JOURNAL of Jan. 14, have passed into the hands of receivers, and also in the affairs of the defunct German Bank of Buffalo, which Mr. Appleyard controlled and of which Richard Emory, formerly the Appleyard representative in Columbus, was president.

According to the Columbus "Press," Mr. Appleyard secured control of the German Bank of Buffalo, with deposits of $6,000,000, by an outlay of $29,999 in actual cash. He then is said to have secured from the bank loans aggregating $644,000.

Of the loans $207,000 was to the Central Market lines of Columbus, and to the Dayton, Springfield & Urbana Traction Company. The other loans were made largely on collateral, consisting of bonds of the Ohio Union Traction Company, which was formed to take over the Appleyard lines, but which, as far as can be learned, had not done so and therefore had no assets, so the "Press" says.

EXTENSION ORDINANCE OF THE NORTHWESTERN ELEVATED PASSED

At last the Ravenswood extension of the Northwestern Elevated Railroad in Chicago seems to be assured. The City Council of Chicago, on Jan. 16, passed the ordinance over the mayor's veto upon the recommendation of the mayor. An ordinance providing for this extension was originally passed last spring, but it was saddled with an objectionable amendment requiring half fare for children on the entire road. The company did not accept the ordinance. The citizens of that part of the city through which the extension is proposed, circulated petitions and urged upon the Council the passage of the ordinance because of the necessity for the road. A great sensation was made in the council at the time by one of the members, who charged that attempts had been made to bribe him to vote for the ordinance. This aroused great indignation in the Council. The matter was investigated by the committee of the Council and the grand jury, and the officers of the Northwestern Elevated Railroad Company asked that the ordinance be reconsidered and defeated if any taint of bribery could be proved in connection with it. The charges of bribery were found to be entirely without foundation, and the alderman making the charges was severely censured by the Council. Mayor Harrison felt obliged to veto the ordinance, but at the last meeting of the Council, recommended that, since the bribery charges were without foundation, the Council pass the ordinance over the veto, which was done.

THE FACTS OF THE HUNTINGTON DEAL IN CALIFORNIA

Final arrangements have been completed in a financial transaction involving approximately $2,000,000, for which amount Henry E. Huntington has acquired the minority interest of I. W. Hellman, C. E. de Guinne and Antone Borel in the Pacific Electric Railway Company and the Los Angeles Interurban Railway Company. Now Mr. Huntington owns an even half interest in these properties. The other half interest is possessed by E. H. Harriman of the Southern Pacific and his associates. The interest of Mr. Hellman and his associates amounted to about 15 per cent. Mr. Huntington's elaborate plans for the expansion of the electric railway systems outside of the city of Los Angeles to suburban and country points can now go on unhampered, inasmuch as he and Mr. Harriman are said to have a thorough understanding and are agreed on that point.

Mr. Hellman gives as his reason for selling that he is unable to spare from his banking business in Los Angeles and San Francisco the money necessary for present needs in the Huntington-Harriman plans for the development of Southern California. While Mr. Hellman and his associates have disposed of their interests in the Pacific Electric Railway Company, and the Los Angeles Interurban Railway Company, they will continue to own a minority interest in the Los Angeles Railway Company. This property, however, is absolutely controlled by Mr. Huntington, who owns 55 per cent of the stock; the remaining 45 per cent being divided into thirds and owned by Mr. Hellman, Mr. de Guinne and Mr. Borel.

The stock of the Los Angeles Railway Company is firm on the market at 105, though it has never paid any dividends, and it is not Mr. Huntington's policy that it shall for several years to come, his idea being to put the earnings into betterments until the system approaches what he considers to be perfection.

With Henry E. Huntington and E. H. Harriman each owning a half interest in the Pacific Electric Railway Company, and the Los Angeles Interurban Railway Company, extensive plans are maturing for future construction work on interurban lines. These plans, it is said, involve the expenditure of from $20,000,000 to $30,000,000, in addition to the vast sums already spent in Mr. Huntington's effort to give Los Angeles and the surrounding sections the best constructed and most thoroughly equipped system of interurban railways in the world. Each of the companies is capitalized at $10,000,000. Mr. Huntington is now in New York, and it is understood to be his purpose to dispose of the bonds of the Los Angeles Interurban Company while there.

The Hudson Companies, the construction concern which is to tunnel the North River, has elected as permanent directors, William C. McAdoo, John W. Simpson, Frederick B. Jennings, William C. Lane, Anthony N. Brady, Pliny Fisk, and William M. Barnum, and the following, who are also directors of the Interborough Company: Walter G. Oakman, Andrew Freedman, Gardiner M. Lane, Cornelius Vanderbilt, and William Barclay Parsons. Mr. Oakman is president.

THE RESULTS WITH THE INTRAMURAL ROAD AT ST. LOUIS

One of the most interesting of the final reports of World's Fair divisions is that of Manager Thomas Murphy of the Intramural Road, which was submitted recently through Director of Transportation Scullin to President Francis. It is shown that the road was one of the notable successes of the Exposition for the amount of revenue it brought in, its economy of operation and the absence of accidents. During the 177 days the road was operated 6,274,738 revenue passengers were carried. There were no dead-head passengers. On the Philippine extension, which was operated for 95 days, 58,305 passengers were carried from whom no fares were collected. Only one car was operated on this branch, and the cost of operation was $459.80. During the hours of heavy travel the cars were run in trains of two cars each on a three-minute schedule. The average speed maintained was twelve miles an hour, and the number of cars operated daily was sufficient to handle the travel, except on St. Louis Day. There were but two collisions between cars. Neither of these was serious, and no injuries resulted to passengers. A statement of earnings of the road shows:

Receipts from passengers	$627,473
Receipts from advertising	2,294
Gross earnings	$629,767
Operating expenses	60,995
Gross earnings less operating expenses	$568,772
Total number of passengers carried	6,274,738
Total number of days in operation	177
Total number of trips made	70,125

The Intramural road at Chicago was in operation 184 days. During that time 5,805,893 passengers were carried over the line. Its operating expenses were $91,653.30. The fare on the Intramural road at the Chicago fair was 5 cents. At the St. Louis Exposition the fare was 10 cents.

HEARING ON BROOKLYN TUNNEL PLANS

A hearing was given Thursday, Jan. 12, by the New York Rapid Transit Commissioners on the recommendations of Engineer Parsons for proposed transit facilities in Brooklyn. The original intention of the commission was to hear argument on all of the commissioners recommendations as made on Thursday, Dec. 29, which included the consideration of transit matters of concern to Manhattan and the Bronx. The delegation from Brooklyn, however, was so large, and the claim of that borough for consideration so important, that problems affecting that borough alone were considered. Mr. Parsons' plan, as outlined in the Street Railway Journal of Jan. 7, 1905, provided for a subway in Fourth Avenue, Brooklyn, out to Fort Hamilton, and for a line to run from the Battery, New York, across Governor's Island and Buttermilk Channel, along the shore of Fort Hamilton. These recommendations were purely tentative. Delegations from all parts of the borough were in attendance to argue for their particular plans.

The plan that seems best to conserve the interests of the majority was proposed by Lawrence Abrahams, who represents some ten civic organizations and boards of trade. Mr. Abraham's plan, in brief, provides for the construction of a line from the City Hall, Manhattan, under the river to Washington Street, Brooklyn, and thence to Court Street, Brooklyn, under the subway now being constructed, to Atlantic Avenue, to Fourth Avenue to Fort Hamilton, with a spur from Atlantic and Fourth Avenues connecting with the main line on Fulton Street at Fulton Street and Flatbush Avenue. Mr. Abraham proposes that the second tunnel shall be used exclusively for express trains (these trains to be the south-bound Manhattan local trains, which shall become express after leaving the bridge station, Manhattan), and the line now in course of construction for local service—the trains running through this route being the south-bound Manhattan express trains, which are to be transformed into locals after leaving the bridge station, Manhattan. By this scheme Brooklynites on their way to this borough at night, from north of Chambers Street, Manhattan, and those from the down-town section of that borough, around Wall Street, would be segregated, and there would be no overcrowding and none of the inconveniences that Mr. Abraham said he believes will be sure to follow the opening of the Brooklyn tunnel because of its being only a two-track line.

The hearing is being continued this week, so as to give the allied boards of trade of the eastern district a chance to agree on the proposition for a subway under Broadway in the eastern district.

MR. GOULD'S ELECTRIC PLANS IN THE SOUTH

Brief mention was made in the STREET RAILWAY JOURNAL of Jan. 7, of the plans of Frank J. Gould and his associates of building an extensive system of electric railways in the South. Since then it has been learned that application has been made in Virginia, by Henry M. Anderson, of the law firm of Munford, Hunton, Williams & Anderson, of Richmond, representing Mr. Gould, for a charter to build an electric railway from Richmond to Ashland, and thence through King William, King and Queen and Essex Counties to Tappahannock, Va., across the Tappahannock River, and thence through Northumberland and Lancaster Counties to Chesapeake Bay; also from Ashland through King William, King and Queen, Gloucester, Mathews and Middlesex Counties to Gloucester Point. This plan will require the building of about 150 miles of line, and perhaps more. As the proposed line will parallel the Richmond, Fredericksburg & Potomac Railroad, in which the State has an interest, the question of granting a charter will have to be passed upon by the Supreme Court, without the approval of which the corporation commission cannot grant a charter. A general objection to Mr. Gould's scheme was entered before the Supreme Court of Appeals in Virginia on Jan. 10, by the Attorney-General of the State. This is purely a technical objection, and no fear is entertained for the ultimate granting of the right to build.

Mr. Gould is president of the Virginia Passenger & Power Company, of Richmond, and Mr. Anderson is vice-president of the company. The proposed line is supposed to be connected and affiliated with the existing roads of the Passenger & Power Company

CLEVELAND CAR-HOUSES TO BE EQUIPPED WITH SPRINKLER SYSTEM

The General Fire Extinguisher Company, of Providence, R. I., has recently closed contracts, through its Cleveland office, for the equipment of the Lake View car shops and the Miles Avenue car house of the Cleveland Electric Railway Company, with the Grinnell automatic sprinkler system. Both plants are to have complete sprinkler equipments throughout all buildings, the Miles Avenue car house having, in addition to the usual arrangement of sprinklers, lower lines of sprinklers next to the car windows, for direct protection against fire which arise in the cars themselves.

The plant at the Lake View shops is to have a 50,000-gal. storage tank mounted upon a 75-ft. steel tower, which will be supplied by two 6-in. connections to city water mains upon two different streets. Several fire hydrants will be installed in the shop yard, to fight outside fires, while there will also be two Siamese steamer connections to the sprinkler delivery piping, for connecting fire engines in case of a fire which the elevated tank cannot take care of.

The system of the Miles Avenue car house will be supplied from two 35,000-gal. gravity tanks, each erected on a 75-ft. steel tower with independent 8-in. connections to the city water mains. This equipment includes, in addition to the sprinkler systems within the buildings, a hydrant in front of the car house for handling outside fires. An outside Siamese connection for fire engines is to be provided in this system also, to permit city fire engines to assist the elevated tanks in fighting a serious fire, if necessary.

DETAILS OF WASHINGTON, BALTIMORE & ANNAPOLIS REFINANCING

The details of the arrangements for the completion of the Washington, Baltimore & Annapolis Railway have been announced. The property has been taken over by a syndicate headed by George T. Bishop and John Sherwin, of Cleveland, who built the Northern Texas Traction Company's line. The new company will have a capital stock of $3,000,000, and will issue $2,000,000 first mortgage 5 per cent bonds and $1,000,000 second mortgage bonds. The Bishop-Sherwin syndicate will take the $2,000,000 first mortgage bonds and $2,000,000 of the stock at 95, the money to be used in completing the road. The subscribers to the old Washington, Baltimore & Annapolis underwriting will receive 50 per cent of the money they paid in in second mortgage bonds and 50 per cent in stock. The Washington, Berwyn & Laurel bondholders will receive 100 per cent of second mortgage bonds, and is understood that the steam road will receive 100 per cent second mortgage bonds and 125 per cent of common stock. The line from Washington to Baltimore will be double track on private right of way the entire distance, and it is stated that the running time between the two cities, 41 miles will be 50 minutes. The steam road owned by the company, which is to be electrified, is the only line between Washington and Annapolis. When completed there will be about 120 miles of track in the system.

ST. LOUIS TRANSIT EARNINGS

With gross earnings in December of $683,722, the United Railways Company falls but $49,577 short of fulfilling the prediction made early in the year of gross receipts of $10,000,000 for 1904. The December, 1904, earnings exceeded those of December, 1903, by $83,619. The gross earnings for the year amounted to $9,950,432. While the company has sources of revenue aside from its earnings by the operation of cars, it is not believed that the total gross revenue will amount to $10,000,000. It is estimated, based upon previous figures, that the cost of operation and taxes in 1904 will amount to $5,591,785, out of which must be paid interest on underlying liens, amounting to $754,400, and the interest on $28,292,000 first general mortgage bonds, amounting to $1,131,680. Thus a surplus will be left of about $2,332,285.

Based upon the statement of operation in 1904, 1903 and 1902 and 1901, it is estimated that the gross earnings for 1905, with other income, will amount to $8,384,872, and that the operating expenses and taxes will amount to $4,750,877, which, after payment of fixed charges, would leave a surplus of $1,697,915.

A statement of the earnings for 1904, by months, follows:

January	$565,098
February	563,257
March	645,481
April	710,368
May	837,872
June	925,387
July	984,644
August	1,014,776
September	1,051,452
October	1,095,842
November	875,524
December	683,722
Total	$9,950,423
Gross earnings in 1903	7,259,460
Gain of 1904 over 1903	$2,690,963
Gain of 1903 over 1902	873,242
Operating expenses and taxes in 1903	4,513,514
Estimated operating expenses and taxes in 1904	5,591,785
Estimated surplus after payment of fixed charges	2,232,285

ST. LOUIS PASSENGER STATISTICS

The "City Register," on Jan. 11 received the annual statement of trips made and passengers carried by the St. Louis Transit Company and the United Railways Company during the past year. An increase of 745,456 round trips was made, and 54,175,103 passengers were carried over 1903. Similar figures are not obtainable from the St. Louis & Suburban Railway, as the company has not filed statements of its traffic for two quarters. The statement of the Transit Company and the United Railways Company follows:

TRIPS MADE, 1904

First quarter	1,223,074
Second quarter	1,551,168
Third quarter	1,754,652
Fourth quarter	1,537,158
Total for 1904	6,066,052
Total for 1903	5,323,596
Increase, 1904	742,456

PASSENGERS CARRIED, 1904

First quarter	35,731,471
Second quarter	50,027,717
Third quarter	61,861,515
Fourth quarter	53,695,829
Total for 1904	201,316,532
Total for 1903	147,141,429
Increase, 1904	54,175,103

TRIPS COMPARED

Fourth quarter, 1904	1,537,158
Fourth quarter, 1903	1,308,274
Increase, 1904	228,884

TRAFFIC COMPARED

Fourth quarter, 1904	53,095,820
Fourth quarter, 1903	37,583,188
Increase, 1904	16,112,631

EQUIPMENT FOR LIMA ROAD

The General Electric Company will supply the equipment to be installed in the sub-station, and the car motors for the electric traction system to be built in Lima, the capital of Peru, to which reference was recently made in the Street Railway Journal.

A Peruvian syndicate has been formed for the purpose of electrically converting the existing mule tramways operated by the Ferrocarril Urbano de Lima. The system is about 20 miles long. Fifty open cars will be ordered in the first instance. They will be of the eight and ten bench type. The former will be equipped with double General Electric 25-hp. motors, while the others will have double General Electric 38-hp. motors.

Power to operate the new system will be derived from the hydro-electric plant of the Empresa Electrica de Santa Rosa, Limitada, located at Choosica, 35 miles from Lima. A 1200-kw sub-station will be built at Lima for the purpose of operating the new electric road.

ST. LOUIS & SUBURBAN TO ISSUE NEW STOCK

The majority stockholders of the St. Louis & Suburban Railway voted the $1,500,000 issue of new stock, at the annual meeting held Jan. 9. About four-fifths of the stock was represented at the meeting.

The deal is to be financed through a construction company and a local syndicate, which, it is said, have agreed to underwrite the issue. President Walsh and other directors declined to make public the name of the construction company or of the members of the underwriting syndicate. The officers were reticent about the plans, and would go no further than to state that an arrangement had been closed with the construction company to improve the property and take the entire 15,000 shares of new stock in payment. The construction company is insured a market for the stock by the underwriting syndicate. The figure at which the stock is to be underwritten is withheld. It was stated that there are about twenty members in the syndicate, but no names were given. All of the present directors are presumed to be members of the syndicate, together with several new stockholders.

The announcement was made that the meeting voted to increase the board of directors by eight new members, to be chosen at the option of the board. The former directors were re-elected, as follows: S. M. Kennard, Breckenridge Jones, Ben Altheimer, C. H. Huttig, H. I. Drummond, W. D. Orthwein, W. F. Nolker, Julius S. Walsh and C. Marquard Foster.

The improvements to be made to the property will cost in the neighborhood of $1,000,000. A double track will be laid along the divisions from Suburban Park to Florissant and Ferguson, from Clayton to Kirkwood, and from the branch line from Brentwood to West End Heights. About 15 miles of new track will be required. Another extensive improvement will be the laying of new track on the St. Louis & Meramec division from Sarah Street to Maplewood and Kirkwood. Several new steel bridges in the county also are contemplated. The improvement of the suburban right of way in the city from Vandeventer Avenue to De Hodiamont will probably come within the general scheme. The plans for this consist in making a sort of railroad parkway out of the alley through which the line runs by planting trees and lining it with gravel paths, terraces of grass and flower beds.

The par value of the new stock will be $100 a share. Several days ago it was stated that subscribers who compose the syndicate talked of had agreed to take the entire issue at $60 per share. Before the stock is finally disposed of, present stockholders will be given an opportunity to subscribe their pro rata at whatever figure has been agreed upon. Suburban stock has not been traded in for several months on the stock exchange. The present quotation is 64 asked and no bids.

The St. Louis & Meramec River Electric Railway Company also held its annual meeting Jan. 9 and re-elected the following board: Henry Semple Ames, president; E. H. Benoist, W. G. Lacky, J. H. Keebaugh, secretary, and William McC. Martin.

The construction company which is to take the contract for the improvements on the St. Louis & Suburban Railroad contemplated under the new issue of stock has been organized and has applied for a charter with a capital stock of $5,000. it has taken the name of the Florissant Construction, Real Estate & Investment Company. The incorporators of the company are: Henry Semple Ames, Warren G. Bartlett and Clarence Sharp. Mr. Ames is president of the St. Louis & Meramac Railway Company, whose line is part of the suburban system. The Florissant Company, it is announced, is to take over the 15,000 shares of new stock voted this week by the Suburban Company in payment for the construction work.

'BUS LINES IN CONNECTION WITH STREET RAILWAYS IN WASHINGTON

A statement made by Vice-President Harries, of the Washington Railway & Electric Company, during a hearing of the House Committee is of concern to street railway interests throughout these United States. Mr. Harries has said that the plan of his company is to operate 'busses as feeders to its street railway lines. Already the announcement has been made in these columns that 'bus service is to be given by the Schenectady Railway Company in reaching outlying districts that do not at present justify the expenditure that would be entailed by the building of branch lines of railway. The announcement from Washington is, however, the first to be made of plans to operate a regular service of this kind in connection with city lines whose business already is well established. Herein lies the significance of what Mr. Harries has said.

The plans are, of course, in embryo. So far as they have been made public it is apparent that two distinct lines will be operated. One of these lines is to be built across the city, starting at a point near North Capitol and N Streets; the other line will probably run north and south through Southeast Washington. The cross-town line is to run out N Street to New Jersey Avenue, to P Street, around Iowa and Dupont circles, and probably out Massachusetts Avenue. The Southwest line will commence at Eleventh and G Streets, southeast and go up Eleventh Street to Maryland Avenue, to Fifteenth and H Streets, northwest. Transfers are to be given from the 'busses to the street cars. The capacity of the coaches will be limited to 20 persons, so it is said.

NEW POWER HOUSE FOR SOUTH SIDE ELEVATED, CHICAGO

The construction of a new power plant has been determined upon by the South Side Elevated Railroad Company, of Chicago, and specifications regarding same are expected to be issued inside of the next sixty days. The capacity of the new station will be about 6000 hp. Sargent & Lundy, of Chicago, will be the consulting engineers in charge of the work.

NEW ZONE PLAN TO BE TESTED IN CLEVELAND

The Cleveland Council at its meeting Monday evening, Jan. 16, authorized the Cleveland Electric Railway to make a test of the zone plan. The company's proposition was embodied in a letter in part as follows:

"As the result of several conferences with Mayor Johnson, it has been suggested that the company should, by experiment, determine whether it could afford to carry passengers within a limited zone at a three-cent fare without transfers, and that such tests be made on portions of all the various lines of the company by operating three-cent fare additional cars on the east side lines as far as Wilson Avenue, on the south side lines as far as Clark Avenue and Pearl Street; on the west side lines as far as Gordon Avenue, and on the Wilson Avenue line during the experiment to be operated from Forest City Park to its northern terminus at a three-cent fare without transfers, or a five-cent fare with transfers, such special cars not to be operated during night hours of light travel, but for at least fourteen hours per day for six days in the week, and the company to maintain its present service at its present rate. While the company has already stated that it feels certain that it cannot afford to operate even with the limited zone at a three-cent fare without transfers, it is nevertheless willing to demonstrate the correctness of its views in that respect by an actual experiment along the lines suggested.

"The company has also been asked by your special committee to state what other experiments in operation at reduced rate of fare covering the entire city, it is ready to make, and in response we beg to state that we will, if desired by the city council, in addition to the test above described, make a further test of operation over the entire system at a four-cent cash fare without transfers, or a five-cent cash fare with the regular transfers, or the company will make an experiment as to the practicability of the operation of the entire system as six tickets for a quarter with transfers under such reasonable regulations as will prevent the abuse of that privilege experienced by the company in its previous test of this rate of fare."

The streets mentioned for the zone limits are about 2 miles from the center of the city to the east, south and west; the lake being to the north of the city, there are no lines in this direction. President Horace Andrews of the company states that the low-fare cars will be placed in operation as soon as switches can be laid for turning cars at the streets mentioned.

THE BALL OF THE BUFFALO ASSOCIATION

The fourth annual ball of the International Railway Employees' Association, composed of employees of the International Traction Company, of Buffalo, was held Tuesday evening, Jan. 10, at Convention Hall, Buffalo. Not only was it the largest and most successful affair yet given by the association, but it was one of the largest ever held in the hall. A conservative estimate places the attendance at more than 4000. The ceiling and walls of the hall were heavily draped in green and white bunting, united in a striking design. The boxes were arranged around the hall in a circular form, and were lined with rugs. The decorations consisted of holly ropes and hemlock wreaths, in which were hidden small electric light bulbs. On the stage was a handsome electric design, in the center of which was a brilliant electric sun, with the initials, I. R. E. A. on its face. Among the officials of the company in attendance at the ball were: President W. C. Ely, General Manager T. E. Mitten, Assistant to the President Van Horn Ely, Superintendent of Transportation C. A. Coons, General Passenger Agent J. E. Stephenson, Treasurer R. F. Rankine, Auditor H. M. Pease, and others.

The proceeds of the ball will be turned over to the sick and death benefit fund of the Employees' Association.

THE CHICAGO & INTERURBAN RAILWAY COMPANY

The Chicago & Interurban Railway Company, formerly the Blue Island, Riverdale & Hammond Railway, is now under construction at several points, the contract for the construction having been taken by the Western Electrical Supply Company, of St. Louis. This road is laid out to extend from One Hundrel and Nineteenth and Halsted Streets, in the town of West Pullman, south on and near Halsted Street to Harvey, and thence in a southeasterly direction to Thornton and Glenwood to Chicago Heights. Another line is to extend from Blue Island to Hammond, making use of the north and south line before mentioned for a short distance. The Western Electrical Supply Company has established a construction office at Harvey.

TECHNICAL LECTURES BEFORE THE BROOKLYN RAPID TRANSIT EMPLOYEES' BENEFIT ASSOCIATION

In conformity with arrangements made by Prof. Edward Taylor, instructor of the electrical class of the Brooklyn Rapid Transit Employees' Benefit Association, Prof. Sydney W. Ashe, of the Brooklyn Polytechnic Institute, delivered an illustrated lecture in the Auditorium at the Railroad Men's Building, 1 Jamaica Avenue, Brooklyn, N. Y., at 8:00 p. m. on Monday, Jan. 9, on the safety appliances of the New York Subway.

Prof. Ashe, who has made an especial study of the subway, had a large number of stereopticon views of its principal features, including the equipment, signals, etc. His talk was very interesting and also of great practical value to all employees, particularly the shopmen, electricians and trainmen.

On subsequent Monday evenings, practical lectures will be delivered by prominent electrical engineers, and the class will also be given a number of trips over the Brooklyn Rapid Transit System, visiting power houses, shops, etc. All employees are cordially invited to join the electrical class, to which no cost is attached. As the lectures for the remainder of the session will each be complete in themselves, omission to attend previous sessions will not detract from gaining the full benefit from the remaining lectures. On Monday evening, Jan. 16, Max Lowenthal, electrical engineer of the Prometheus Electric Company, delivered an address on the Niagara Falls power developments.

REPORTED SALE OF THE JOHN STEPHENSON COMPANY TO BRILL INTERESTS

Reports received from reliable sources, just as this paper is on the press, state that the control of the John Stephenson Company, of Elizabeth, N. J., has been purchased by interests connected with the J. G. Brill Company, of Philadelphia. This purchase was followed by a meeting held this week at which William H. Heulings, Jr., of Philadelphia, was elected president of the Stephenson Company, Samuel M. Curwen was elected vice-president, and James Rawle was elected treasurer.

ENGINEERS FOR THE UNITED ENGINEERING BUILDING

At the meeting of the conference committee on the United Engineering Building, held Jan. 7, Alfred R. Wolff was appointed consulting engineer for the heating and ventilation of both the United Engineering Building and the Engineers' Club, to be erected at Thirty-Ninth and Fortieth Streets, New York, under the Carnegie gift to engineering, of $1,500,000. C. O. Mailloux was elected as the consulting electrical engineer for the United Engineering Building, and the firm of Bates & Neilson were selected as consulting electrical engineers for the Engineer's Club. All these gentlemen are well known in connection with the execution of large work of the class named in New York and vicinity, in addition to which they are prominently identified with the organizations that will occupy the buildings in question.

ELECTRIC RAILWAY RESORTS IN CENTRAL NEW YORK

There is to be unusual activity along the line of new amusement parks and resorts in the vicinity of Syracuse in the coming summer, and several important new propositions will be carried out. The Syracuse & South Bay Railroad Company early in the summer will have completed a 10-mile double track electric road between Syracuse and Oneida Lake, a body of water 20 miles long and 6 miles wide. At South Bay, the terminus of the line, there is a large summer hotel owned by the railroad company, which also owns considerable land there.. A first-class amusement park is to be established on Norcross Point, not far from this hotel, while on Frenchman's Island, a short distance out in the lake, will be a popular picnic ground. At Lewis Point, Sylvan Beach, and other places along the lake, improved resort features are to be introduced. The electric railroad will unite with the steam railroads in the vicinity in developing the excursion business to the lake, organzing the Oneida Lake Steamboat Company, soon to be capitalized at $200,000, to operate a fleet of modern passenger and freight boats on the lake. The Syracuse & South Bay Railroad Company intends to use two electric locomotives to draw trains of ten cars to handle the excursion business.

The Auburn & Syracuse Electric Railroad Company has just bought two steamers on Skaneateles Lake, and is planning to build another one, the object being to develop the excursion business to this lake. The company has bought land in Skaneateles village for a park, and will establish another amusement resort further up the lake. The Syracuse syndicate, which controls the Auburn & Syracuse Electric, and the Rochester, Syracuse & Eastern Railroads, have just acquired control of the Syracuse, Lakeside & Baldwinsville Railway, and is planning to introduce new amusement features along this line this summer.

Another company proposes to spend about $125,000 in the establishment of "Fairyland," at the Onondaga Valley Park of the Syracuse Rapid Transit Company. The only remaining electric railroad in the vicinity of Syracuse is the Syracuse & Suburban, and this company, in addition to developing its Suburban Park at Edward Falls, will establish a new one at Fiddler's Green, near Jamesville.

REPORT OF THE AMERICAN RAILWAY MECHANICAL & ELECTRICAL ASSOCIATION

The official report of the St. Louis convention of the American Railway Mechanical & Electrical Association has been published, and is a volume of 165 pages, which is extremely creditable to both the association and its energetic secretary, Mr. Mower. The discussions at St. Louis were very instructive, and in the printed report they have been amplified by one or two diagrams which were not presented at St. Louis. There is a frontispiece of President Olds, and the cover, which is the official brown, bears a representation of the St. Louis pin.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JAN. 10, 1905.

779,404. Life Preserver for Railway Cars; Warren W. Annable, Grand Rapids, Mich. App. filed May 19, 1904. Comprises a series of spring fingers, vertically disposed, consisting of coils of spring wire provided with elastic coverings, and means for supporting the spring-fingers in front of the car.

779,405. Brake Mechanism for Railway Cars; Warren W. Annable, Grand Rapids, Mich. App. filed May 19, 1904. A brake

mechanism comprising, in combination with the wheels of a car-truck, independently-movable brake-shoes, a lever pivotally connected to each brake-shoe, rods connecting the levers at the respective sides of the truck, an equalizing-beam connected at its respective ends to the levers at the respective ends of the truck, and means for moving the equalizing-beam pivotally connected to the middle thereof.

779,410. Continuous-Rail Railway Crossing: Argyle Campbell, Chicago, Ill. App. filed Aug. 22, 1904. Consists of a movable member which can be moved to two different positions, in one position rendering one rail continuous, and in the other position rendering the second or intersecting rail continuous, while the opposite rail in each case is open.

779,441. Trolley Device; Henry O. Reese and Henry C. Weitzel, Baltimore, Md. App. filed June 10, 1904. Consists of a rocker carrying two trolley wheels and centrally pivoted at the upper end of the trolley arm, immediately above the shoulders formed near the pivot in position to catch the rocker in either of its positions, whereby to limit the rocking motion of the latter.

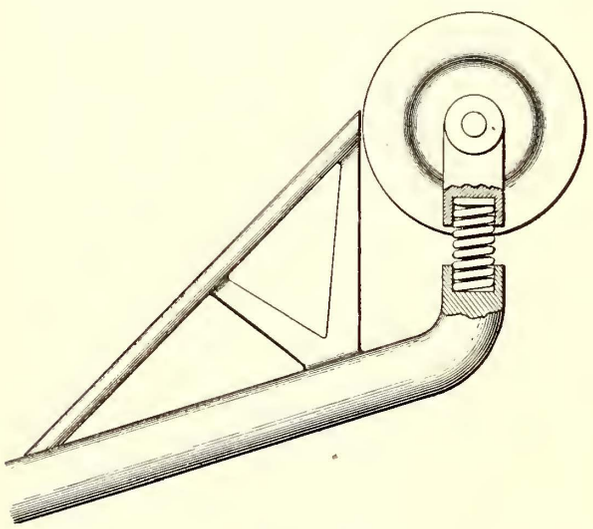
779,448. Life Guard for Electric Tram-cars or Other Road Vehicles; William A. Turner, Marple, and George A. W. Turner, Stockport, England. App. filed Oct. 7, 1904. The surface of the fender is caused, by a system of gearing, to travel in a direction opposite to that of the car, thereby facilitating the picking-up of any obstacle encountered.

779,470. Plate Fastening for Railway Track Structures; George M. Ervin, Johnstown, Pa. App. filed Dec. 5, 1903. Relates to the installation of wear plates at switches and crossings.

779,471. Railway Track Structure; George M. Ervin, Johnstown, Pa. App, filed Jan. 29, 1904. Relates to details of track construction.

779,475. System of Electrical Distribution for Electric Railways; Josef H. Hallberg, Cincinnati, O. App. filed Feb. 26, 1904. Comprises a source of alternating single-phase current means for converting said current into a continuously symmetrical polyphase current, and polyphase motors actuated by such polyphase current and adapted to give motion to the vehicles upon which they are located.

779,506. Slot Switch-Tongue and Slot Switch-Box Mechanism for Conduit Railway Construction; Henry C. Stiff, Johnstown, Pa.



PATENT NO. 779,850

App. filed Dec. 24, 1902. A slotted junction-piece having lateral recesses in the two upper portions of the conduit at opposite sides of the slot at the junction, ribs or bars connecting the upper and lower parts of the recessed portions, two slides with upwardly-extending notched portions arranged to work in the recesses and to extend through the openings between the ribs or bars, and means for operating the slides.

779,554. Trolley Bridge; Robert T. McCarroll, Columbus, O. App. filed June 4, 1904. A trolley bridge for car house doorways, in which steel rolling curtains are employed, comprising a pivoted bridge-piece which is adapted to close when the curtain is drawn up and thus bridge the opening in the trolley line through which the curtain passes.

779,557. Ticket Issuing and Recording Machine; John F. Ohmer and Elmer H. Bridenbaugh, Dayton, O. App. filed March 25, 1904. By this mechanism a single ticket or transfer may be issued at a time and a record made thereof, a printed record taken to show the number of transfers issued for any given period of time, each class of transfers separately registered, and the transfers perforated at different places as they are issued.

779,640. Suspension Device for Trolley Wires; Theophilus P. Chandler, Philadelphia, Pa. App. filed Oct. 7, 1904. Two gripping parts or plates, each having two oppositely arranged jaws adapted to extend partly around the wire on oppisite sides and jointly inclose it for more than half its circumference, the parts or plates being formed with a gap or clearance space between the jaws to receive the wire and allow it to come into the plans of the jaws.

779,654. Trolley Retriever; Emil J. Jonas, Hamlet, O. App. filed April 1, 1904. Pneumatic means for controlling the trolley pole.

779,739. Protective Device for Third Rails; John Ryna and Anthony C. Guntzer, New York, N. Y. App. filed Nov. 5, 1903. A protective housing for third rails.

779,774. Bracket Step for Street Cars, etc.; Robert Dunning, Winton Place, O. App. filed Nov. 14, 1904. A step for mounting to the roof of the car which also furnishes the means for the attachment of a handle to be used by passengers in getting on and off the car.

779,850. Trolley for Electric Railways; George C. Hohein, Norfolk, Va. App. filed Sept. 17, 1904. The trolley wheel is spring-mounted upon the harp in such a manner as to allow the wheel to move independently of the harp.

779,920. Track Switch for Electric Railways; George H. Fretts, Springfield, Mass. App. filed March 25, 1903. The switch is actuated by trolley current, and the motorman operates the same by either turning on or off the current to the car when passing under the contacts in the trolley wire controlling the switch.

PERSONAL MENTION

MR. GEORGE WILLIAM SMITH has resigned as president of the Frederick & Middletown Electric Railroad, of Frederick, Maryland.

MR. GEORGE J. KOBUSCH, president of the St. Louis Car Company, has been on a visit to New York for the past few days. He is stopping at the Hotel Imperial.

GOVERNOR MYRON T. HERRICK, of Ohio, has accepted an invitation to be the guest of honor and one of the speakers at the annual meeting and banquet of the Ohio Interurban Railway Association at Dayton, Jan. 26. Gov. Herrick is interested in several interurban and city properties in Ohio.

MR. ALBA HOUGHTON WARREN has been appointed local manager of the Brockton & Plymouth Street Railway Company, with headquarters at Plymouth, Mass. Previous to this appointment Mr. Warren was in operating charge of the Houghton County Street Railway Company, at Houghton, Mich. Both of these roads are controlled by Stone & Webster, of Boston.

MR. EDWARD LINDON PHILLIPS, president of the Hewes & Phillips Company, engine builders of Newark, died suddenly Saturday, Jan. 14, at his home, in Chatam, N. J., of apoplexy, at the age of fifty-four years. Mr. Phillips was born in Newark, and was a son of John L. Phillips, a well-known manufacturer of his day, who, after having his son educated in the public schools and Newark Academy, placed him in his own works and made him serve his time as an apprentice. The son was afterward graduated from Cornell, and when his father died, in 1886, he was made president of the company. He is survived by a widow and two daughters.

MR. EUGENE KLAPP has been appointed consulting engineer of the Brooklyn Rapid Transit Company. Mr. Klapp was graduated from the Columbia School of Mines in 1889, and shortly afterward was appointed chief engineer of the South Side Elevated Railway of Chicago. At the outbreak of the Spanish war, he was made a captain in a volunteer regiment of engineers, and at the conclusion of hostilities, he was selected as manager of the National Construction Company, which built the extensive drainage plant for New Orleans. When the New York Rapid Transit Commission began work on the subway, Mr. Klapp was for sometime engineer in charge of the fourth division of the work.

MR. GUY C. BARTON, first vice-president of the Omaha & Council Bluffs Railway Company, of Omaha, Neb., was elected president of the company to succeed the late Mr. Frank Murphy, at the annual meeting recently. Mr. G. W. Wattles was elected to succeed Mr. Barton as vice-president, and Mr. M. F. Hopkins, of Columbus, O., was selected for second vice-president. Mr. W. A. Smith was re-elected treasurer and general manager; Mr. F. A. Tucker as general superintendent, and Mr. R. A. Leussler as secretary. Mr. Frank Hamilton was elected to fill the vacancy in the board of directors. The present directors are Mr. Guy C. Barton, Mr. G. W. Wattles, Mr. N. V. Morse, Mr. W. A. Smith and Mr. Frank Hamilton, Omaha; Mr. C. R. Tyler, of Council Bluffs; Mr. Albert Strauss, of New York City; Mr. Randall Morgan, of Philadelphia, and Mr. Hugh J. McGowan, of Indianapolis.