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EDITORIAL NOTICE

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

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Contents of this Issue

The Proposed Equipment of the New York Central Tunnel

The announcement was made last week, within a week after the terrible disaster and loss of life in the tunnel of the New York Central Railroad, that the company had determined upon the equipment of its suburban trains with electricity, and that a second station for the reception of such trains would be built under the existing Grand Central Station at Forty-Second Street. It is well known that for the last six months certainly the company has been engaged on a study of the application of electricity to its suburban service, and it is understood that the official announcement was to have been made several days earlier than was done, but that it was delayed through the occurrence of the untoward accident. It is a remarkable coincidence that this signal demonstration of the inefficiency of steam as a motive power in tunnels should have occurred just at the time when the plans for electrical equipment were nearing completion. The testimony which has already been given at the coroner's inquest, however, indicates that immunity from similar accidents in the past has been more a matter of good fortune than anything else, because it has been shown that, owing to the obscuring of signal lights, trains have frequently run past a block in misty and stormy weather.

To many it has been explicable why electricity has not before been employed on this work. As we stated in our last issue, however, to those who have been in close touch with the applications of electric power to railway work; the lack of appreciation as to its possibilities among steam engineers and others who are non-electrical is hard to understand. We must remember that the application of electricity to traction work is of very recent growth, especially so far as high speed and heavy units are concerned, and that what the large railroad corporations have lost and are losing through the neglect to recognize the capabilities of electric power has been partially offset up to within a comparatively recent period by the advances which have been made in the art.

Having now made its decision, the New York Central Railroad will undoubtedly carry on the work of reconstruction as rapidly as possible, and from the proposed large issue of new stock evidently intends to spare no expense in providing an electric service which will fulfil the requirements so long needed. The company has been fortunate in securing for this work Mr. Bion J. Arnold, whose reputation as a designer, builder and engineer in railway work is of the highest, and whose experience in interurban and third-rail service, commencing with the intramural road at the Chicago World's Fair and continued on high-speed railways in the West, eminently fit him for the office which has been created for him of consulting electrical engineer. It is safe to say that no one more capable could have been found for the position.

While the statement has been made that the suburban service will be equipped with electricity, no announcement has been made as to whether motor cars or trains or locomotives will be used, and we understand that the engineers are engaged on a report on the subject which will soon be submitted to the managers of the road. Nor has there been any explanation as to what will be classed as suburban business, or how far out the electric lines will extend, but it is understood that whatever plans are adopted for this work will be made to comprise the service of the other two lines which use the Park Avenue terminal, viz., the Harlem Railroad and the New Haven road, as well as the Central Railroad proper. An undertaking of this kind, especially where it involves considerable underground construction and station reconstruction, will necessarily take a great deal of time, and it is useless to minimize the importance of the problems which will be met in this work. There is no exact precedent for the kind of installation which will be required in the New York problem, and it is not to be expected that the work can be carried on without many interruptions. The adoption of a separate terminal for the electric trains, as proposed, will undoubtedly, however, simplify the problem very much and will eliminate largely if not entirely the switch-yard problem, which would be a serious one in a terminal the size of the New York Central, if an attempt were made

to utilize for the electric cars the same terminal station as that used by the steam trains.

The Dangers of Electric Traction

Quite an unexpected turn was given last week to the discussion over the adoption of electric traction in the New York Central tunnel by the appearance last week in the New York *Times* of a brief, terse letter from George Westinghouse, in which that distinguished inventor and engineer cautioned against the assumption that electricity would bring in the millenium by curing all the present evils at once. The letter, which appears in this issue, not only attracted attention immediately, as do any of Mr. Westinghouse's utterances, but elicited a most vigorous outcry in the newspapers in support of or against what was taken to be his assertion that electricity would introduce greater perils than it would remove. The journal to which the famous letter was addressed, equally with many other people, all in good faith, read in the document, or into it, an attack on electric traction per se; and having done this found themselves very much perplexed, for the name of Westinghouse has long been prominently associated with the industrial development of electricity, and has also been allied with progressive ideas and inventions which make up so much of electrical history during the past fifteen years. After the publication of his first letter, Mr. Westinghouse came out with a second, defining his position, and seeking to remove whatever misconception might surround it in the minds of the public. That the misunderstanding of the object aimed at was general is undeniable, as evidenced not only by printed comment, but by numerous angry and animated retorts and comments, private as well as public, the most conspicuous in the latter category being, probably, the letter from Frank J. Sprague, which also appears in the interesting batch of data in our columns this week on the subject. The tendency to seek a motive or read between the lines is simply inevitable in the case of utterances of this kind, no matter whether it be President Roosevelt on the tariff, or Lord Rosebery on the Boer war; and in this instance everybody was thinking or talking about the plans of the New York Central and watching each deliverance from those who have any claim to be regarded as leaders of public opinion.

Elsewhere we have discussed the engineering aspects broadly of the New York Central situation, and now confine ourselves specifically to the interesting, and, indeed, extremely useful correspondence referred to above. Mr. Westinghouse has tried, and certainly succeeded, in putting in clear black and white what he believes to be an immediate necessity of the situation; and he reveals himself, as we can but conceive him to be, an ardent supporter of electric traction. Like another strong thinker and clear speaker, Mr. Chamberlain, he is evidently somewhat hurt that his remarks should be susceptible of being directed awry; but, after all, it is but opening up a further opportunity for statement, and for that discussion which, among men seeking the truth, always leads to the best results. Electricity, safest of all agents, is in some respects the most dangerous of them, and the list of disasters and casualties due to its careless use is a very long and sad one. In fact, the very ease with which it lends itself to manipulation is one of the provocatives to trouble, and the familiarity that breeds contempt is often enhanced by the manner in which manufactured lightning can be employed day in and day out for all useful purposes without harm, in spite of the fact that frequently less care is taken with it than an ordinary jet of water from a hydrant. In electric work this disregard of even the common requirements of safety is far more common and general than we like to see it, and whatever influence or ability this journal has at command is consistently and persistently directed against methods, appliances and men who risk by carelessness or parsimony the precious human lives committed to their care. We doubt, however, whether it is necessary to make the entire car non-combustible. Such a requirement seems an excess of caution, in view of the completeness with which all parts of the electric circuit can be fully protected against accidental contact with wood and other inflammable portions of the ordinary car. In the case of a rear-end collision, if the electric conductor is overhead or protected at the side of the track, a derailed electric car is certainly in less danger from fire than a steam train with its live coals in the engine firebox, and with its possibilities of ignition from individual lighting and heating apparatus in case they are used. Of course the use of non-combustible cars might prove advantageous in the case of such accident or collision, as preventing ignition of the wreck, but it should be remembered that any severe short-circuit would immediately open the breakers in the section or at the station. Rear-end collisions, however, should not occur under proper systems of signaling, and in tunnels certainly would be rendered much less remote of occurrence where electricity, instead of steam, was a motive power. It is said that a steam railroad train is almost the safest place, according to the law of averages, where a person can be, but as the possibilities of signaling and automatic blocking are even superior in the case of a high-speed electric train, the well-known remark about safety of steam railroad travel must be modified to give preference to that of electric railroading. Nevertheless the question of fireproof cars, as presented by Mr. Westinghouse, like any statement of opinion which he makes, is worthy of the most serious consideration on the part of both railway managers and car builders, and, we have no doubt that it will bear fruit in the exercise of even greater care in car construction. The terrible collision in the New York Central Tunnel has "called a halt" on steam, and has climaxed in the proposed change to electricity. We are quite confident that if, while the adoption is being made of the new power, Mr. Westinghouse can see it surrounded by every proper safeguard and precaution, he will be gratified with the sense of having performed a duty and of having achieved his purpose.

Our own columns bear witness to the fact that Mr. Westinghouse has before this raised his voice in behalf of safer cars, and in calling attention to the specific points in his second letter, we hasten to say that the sentiments there expressed are in reality not new to him. There may be differences of opinion as to the particular methods and appliances, but the fundamental principles advocated are right, and sound, and true, and if they are lived up to, not only will lives and property be saved now, but in the long run the advance of electric traction will be appreciably accelerated.

The Eternal Question of Taxation

One of the burdens which street railway companies can never rid themselves of is that of the continual attempts to increase their burdens, which legislatures, civic federations, citizens' associations, reformers and others who are trying to put the world right seek to put upon the already overburdened corporations. We have heard of decreases in gross receipts, of proceedings in insolvency and the appointments of receivers, but we have never heard of a body of citizens requesting that a street railway company's taxes should be decreased therefor, or of burdens once imposed that have been removed. This is an old and familiar story to railway companies, but is suggested again by two instances which have occurred during the last week in New York State. One is the summing up of the arguments by the attorneys for the New York City corporations on the constitutionality of the Ford franchise bill before Judge Robert Earle, who has been appointed referee in the application made by the corporations taxed under the special franchise acts for a review of the assessments placed on their special franchise by the State Board of Tax Commissioners. The arguments presented by these attorneys, especially by former Senator David B. Hill, who is chief attorney for the corporations, indicated that the tax was unconstitutional in that it took away from the local assessors the right to assess property within their boundaries, that it was impossible of intelligent execution, and that the method employed by the Tax Commission in making assessments was unlawful in that the full value of the property as determined by them was taken as the taxable value instead of a

percentage, as in all other assessments. Of course no decision by the referee has as yet been rendered, and it may be a considerable time before any such decision can be expected, so that the question whether franchises are property, and as so, taxable in New York, is still undecided.

The second instance, which recalls the fact that street railway companies are never free from a continual harassment is a letter recently addressed by D. Leroy Dresser, president of the Merchants' Association of New York City to Mayor Low, calling his attention to the franchises which the railways of that city are enjoying, and stating that in his opinion "no public franchise should hereafter be granted, except upon terms which shall assure to the people of this city a reasonable share of the earnings derived from the use of those franchises. The public burden would be very greatly lessened if proper and equitable use were made of this hitherto almost neglected source of public revenue."

This has a familiar sound, but as long as arguments of this kind are confined to general and indefinite statements, the person who makes them is on comparatively safe ground. It is a somewhat curious fact, however, that protests of this kind are not considered as sufficiently convincing unless they point a moral by some actual figures, and this is where the advocate of higher taxes gets beyond his depth. On this point Mr. Dresser's letter says: "Street railways, including both surface and elevated roads, now occupy nearly 600 miles of the city's streets. The ostensible capitalization of the corporations operating these lines is about $300,000,000. Their capitalized value, on the basis of recent sales and current rates of interest, is at least $500,000,000. A very large proportion of the actual capitalization, represented by stocks and bonds, is fictitious, and the difference between the actual investment of the corporations and the present salable value of the properties represents the proper earning powers of the franchises. The city receives nothing whatever from most of the franchises, and has never received more than $400,000 in any year."

Let us see what the report of the Railroad Commissioners for the State of New York has to say on this point. In the reports rendered by that commission the taxes proper are divided into three heads, "Taxes on the Property Used in the Operation of the Road," "Taxes on Earnings and Capital Stock," and "Taxes Other Than the Above." Part of these taxes are paid to the State authorities and part to the city authorities, and no separation is made in the report as to the division between these two governing bodies, but as far as the company is concerned, we do not see very much difference whether the tax is paid to the city or the State. The amount of taxes divided into the three divisions mentioned paid by the street railway companies in Manhattan Borough and Brooklyn Borough for the year ending June 30, 1900, the last report available, was as follows.

	Taxes on property used in operation of road	Taxes on earnings and capital stock	Taxes other than above
Manhattan Elevated	$65,921	$99,699	*$706,054
Metropolitan Street Railway	469,180	254,029	37,794
Third Avenue Railway	189,695	36,805	2,375
Other surface street railways in Manhattan	13,214	35,693	415
Total for Manhattan	$738,010	$426,226	$746,638
Brooklyn Rapid Transit	529,546	144,952	22,222
Coney Island & Brooklyn	23,715	17,149	1,065
Other surface street railways in B'klyn.	862	434	.....
Total for Brooklyn	$554,123	$162,535	$23,287
Total for Manhattan and B'klyn..	1,292,133	588,761	769,925

* Includes taxes on structure.

As will be seen, the total taxes paid, $2,650,821, are more than six and one-half times the maximum of $400,000 mentioned in the letter, and in these figures is not included any of the taxes paid by the railway companies in Richmond, Queens or Bronx Boroughs.

As we have pointed out before, however, the items charged as taxes in the annual reports of the companies by no means include all of the direct return made to the public for the use of streets. Under this heading should certainly be included the damages assessed against a company by property owners for injuries done to their property by the construction and operation of the road. As is well known, the Manhattan Elevated Railway Company, which is included in the category of the Merchants' Association among the street railways, has paid large sums by order of the court to property owners along its line who have suffered, or who have been considered to have suffered, by the operation of its trains and the existence of its structure. These damages are just as truly a payment to the public for the use of the streets as if they went directly into the city treasury. The amount is paid out by the railway company, and the only difference is that the persons in the community directly injured receive the recompense rather than those who are not directly affected. The same is true of the amounts paid for personal injuries by the railway companies, as in this case also the persons who are directly injured by the operation of the cars on the streets are recompensed by the companies. The property damages paid by the Manhattan Company during the three score or so of years of its existence have been enormous, but as the Merchants' Association confines itself to any one year, we will take the last year reported, that is the year ending June 30, 1900, and add these figures to those of the taxes proper. This is done in the following table, from which it will be seen that the total taxes paid now aggregate for that single year the enormous sum of $5,123,512, or considerably more than twelve times the greatest maximum mentioned by Mr. Dresser.

	Taxes	Injuries and damages (land or personal)	Total
Manhattan Railway	$871,674	$1,234,878	$2,106,552
Metropolitan	761,002	269,480	1,030,482
Third Avenue	228,876	66,630	295,506
Other surface lines in Manhattan	49,323	13,582	62,905
Total for Manhattan	$1,910,875	$1,584,570	$3,495,445
Brooklyn Rapid Transit	696,721	797,790	1,494,511
Coney Island & Brooklyn	41,929	89,400	131,329
Other surface railways in Brooklyn	1,296	931	2,227
Total for Brooklyn	$739,946	$888,121	$1,628,067
Total for Manhattan and B'klyn.	2,650,821	2,472,691	5,123,512

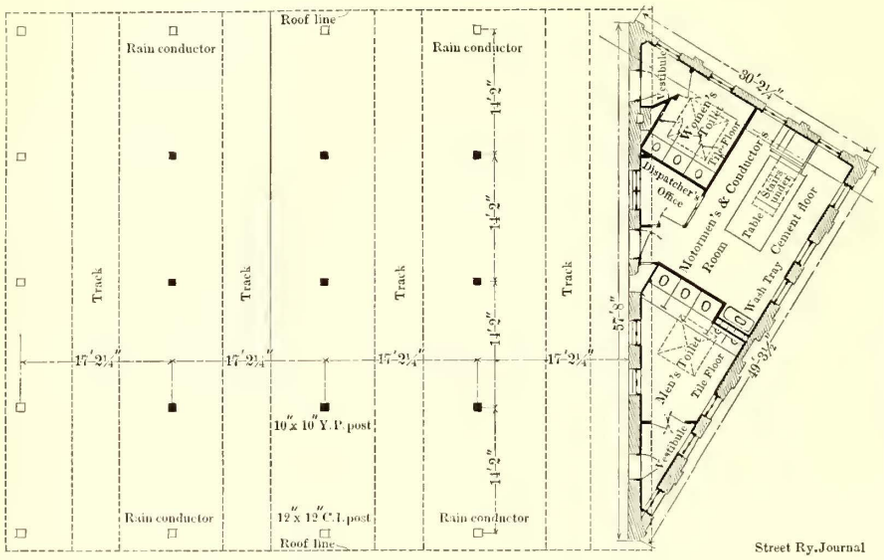
As the gross receipts from passengers carried during the same year by the companies in question amounted to only a little more than $40,000,000, the figures in the table above show that more than one-eighth, or more than 12½ per cent of all the receipts from passengers, was paid back for the use of the streets. We will not discuss here the extent of other returns made to the public in other than direct payment, such as the giving of transfers from one line to another, and in giving longer hauls for the same fare, but we should like to ask the president of the Merchants' Association if any of its members pays 12½ per cent of his gross receipts, or one-half, or one-quarter of this amount for taxes. Even the amount of payment demanded and paid by the railway companies under the name of "taxes" amounts to more than 6.6 per cent of the gross receipts from passengers. Do the merchants of New York pay as much as this on their annual sales of merchandise?

The Coming Convention of the Railroad Commissioners

The fourteenth annual convention of Railroad Commissioners, which will be held at Charleston, S. C., on Feb. 11, 1902, will possess considerable interest for street railway companies. As will be remembered, the Street Railway Accountants' Association of America was elected last year to honorary membership in this association, with the privilege of debate, and accorded a representation of three at all subsequent meetings of the association. The value of the work of the Street Railway Accountants' Association has also been attested to by the Railroad Commissioners, by the adoption by them of the standard classification of construction and operating accounts. At the Charleston convention, the Street Railway Accountants' Association will be represented by H. C. Mackay, of Milwaukee, Wis.; W. F. Ham, of Washington, D. C.; C. N. Duffy, of Chicago, Ill.

Attractive Passenger Waiting Pavilion

The artistic possibilities in the construction of a waiting-room for street railway passengers is illustrated in the pavilion shown on this page, which is one erected during the past year by the Union Traction Company of Philadelphia on a small triangle of ground bounded by Thirty-Third Street, Dauphin Street and Ridge Avenue.



PLAN OF WAITING PAVILION AT PHILADELPHIA

This location is directly opposite one of the main entrances to Fairmount Park, and at a point which the cars of a large number of lines pass or from which they start. It is also very convenient for the visitors to the park in summer, particularly the ladies and children who may sometimes be caught by a sudden shower and wish some shelter while wating for the proper car to take them home.

The structure, a plan view of which is also shown on this page, was built at a cost of about $7,000, not including the expense of plumbing and heating. As will be seen, it is of brick, with three waiting-rooms on the west side—one for men, one for women, and a small room for the inspector. In the open space are four tracks through which the cars run and where the passengers board them. The covering over this space is ceiled with yellow pine, varnished.

The Everett-Moore Situation

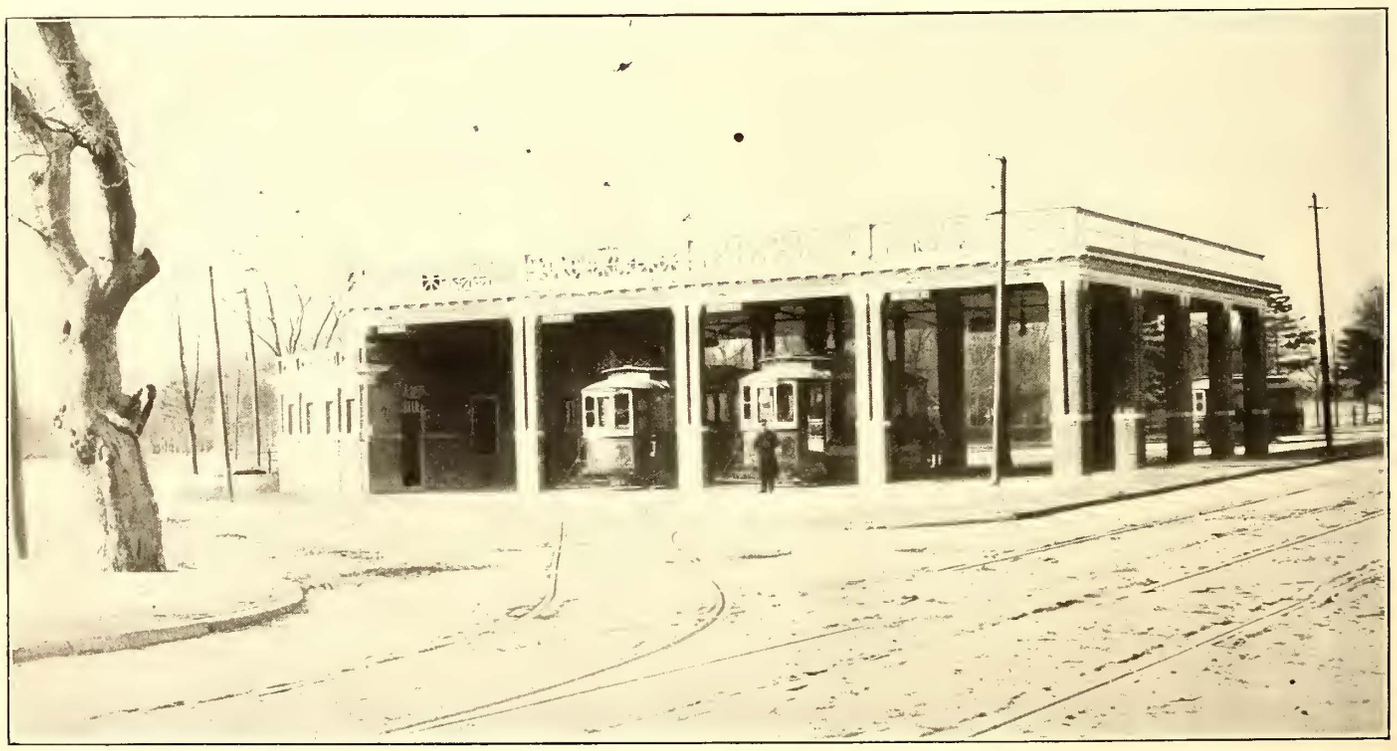
The bankers' committee in charge of the Everett-Moore syndicate's affairs report that conditions are growing more favorable every day. According to latest reports, out of $11,500,000 of credits, extensions have been granted by creditors representing more than $10,000,000. Engagements have been arranged with several of the few remaining creditors, and it is believed that their consents will be secured during the present week. It is stated that thus far only two creditors have demurred to signing the agreement. One of them telegraphed that he was satisfied, but that he could not reach his partner, and the other did not refuse to sign, but simply said he would wait and watch developments.

The Strang Construction Company, which secured the first receiver for the Detroit & Toledo Shore Line Railway, has withdrawn its application, and Receiver Allen F. Edwards, who was appointed through the efforts of Mr. Everett, is now in full charge of the property. The Strang Construction Company will complete the road as soon as possible.

The bankers' committee expects to dominate to a certain extent, in the affairs of all of the constituent companies controlled by the syndicate. Under its direction R. W. Judd has been appointed to succeed John Sherwin as treasurer of the Federal Telephone Company, the United States Telephone Company, the Cuyahoga Telephone Company, and the Reserve Construction Company. Representation will be arranged for on the boards of the various railway companies, this having already been accomplished in the cases of the Cleveland Electric Railway and the Northern Ohio Traction Company.

In accordance with a previously announced plan of disposing of certain properties not actually required to keep the main traction system intact, the bankers' committee has practically decided that it will be well for the syndicate to dispose of its interest in the London (Ontario) Street Railway. The property includes 28 miles of track in London, and the company is capitalized at $400,000, with the same amount in bonds. This property is making a fine showing, as will be seen by reference to the table on another page. Some time ago the syndicate was offered $180 a share for the property, but the offer was refused.

The Toledo & Monroe Railway, it is said, has been permitted to revert back to its former owners, Messrs. C. A. Black, J. H.



ATTRACTIVE WAITING PAVILION NEAR FAIRMOUNT PARK, PHILADELPHIA

Muckley and E. M. Fowler, of Detroit. Under the purchase plan for this road, the syndicate paid a certain amount in cash, and the road was turned over under a lease which expired Jan. 1, 1902, at which time the purchase of the road was to be completed, or the road turned back to the original owners. The cash deposit was forfeited and the earnings of the road, minus the operating expenses, turned over to the original owners. Jan. 1 a fifteen-days' extension to the agreement was made, but as the syndicate was unable to carry out its plan, the former owners took possession. It is understod that Manager Allen F. Edwards will be retained for the present, and the road operated as heretofore, but as an independent proposition. This property is not actually required in the system of the syndicate. In connection with the northern portion of the Detroit & Toledo Shore Line, it was the plan to use it as part of the through line between Toledo and Detroit; in fact, cars have been operated through for several weeks past. But as soon as the lower portion of the Shore Line is completed, the Toledo & Monroe would not be required.

It is stated that the bankers' commitee is taking steps toward the early termination of the receivership of the Lake Shore Electric Railway. Through service on this line has been inaugurated, and it will soon be yielding excellent returns.

Chairman Newcomb of the bankers' committee stated Monday that there was a possibility that the property of the Detroit United Railway might be offered for sale. He said: "The Detroit properties are in fine shape and a magnificent investment, and can be disposed of at absolutely fair and no upset price. Bidders on this property would be willing to pay what it is worth." The money received from this property would be used to meet obligation on telephone accounts. No definite action in regard to the sale of any properties will be taken until the committee becomes absolutely operative, that is, when every consent to the extension has been turned in.

At the suggestion of the bankers' committee in charge of Everett-Moore affairs, the Securities Company, of Cleveland, which was organized some months ago with $1,000,000 to finance the syndicate's projects, will wind up its affairs. The plan was to market many of the securities of the syndicate, besides doing a general trust business. Fred S. Borton was president, Charles W Wason, vice-president, and George H. Bender, secretary-treasurer of the company. Because of the determination to liquidate the company Mr. Borton was re-elected secretary of the Cleveland Electric Railway, and will resume his former position. C. H. Price, who became assistant secretary, will again become cashier, and the office of assistant secretary will be abolished.

The annual meeting of the stockholders of the Cleveland Electric Railway was held Nov. 15. The only change made in the officers and directors was the election of George H. S. Russell, a well-known banker, as treasurer in place of E. L. W. Moore, and the election of Calvery Morris as a director in place of Mr. Moore. The officers and directors are as follows: H. A. Everett, president; R. A. Harmon, vice-president; George S. Russell, treasurer; F. S. Borton, secretary. H. A. Everett, Charles L. Pack, R. A. Harman, Calvery Morris, Charles W. Wason, Horace E. Andrews, Myron T. Herrick, James Parmelee, John J. Stanley, directors. Messrs. Morris, Herrick and Russell are supposed to represent the bankers' committee in charge of affairs. The proposition to increase the capital stock of the company $1,000,000 was not considered, and therefore fails.

Improvements at Salt Lake City

On Aug. 1, 1901, control of the Salt Lake Rapid Transit Company, with its 31 miles of track, passed into the hands of the Salt Lake City Railway, giving the new concern 76½ miles of road, and the properties were consolidated as the Consolidated Railway & Power Company, with Charles L. Rood as president. The Consolidated Railway & Power Company now controls most of the street railway lines of Salt Lake, the sole exception being the West Side Rapid Transit, operating 12 miles of steam and electric line.

During the year the company has added to its equipment 2½ miles of track on Seventh East Street. To Culder's Park, on West Temple Street, half a mile has been built, and the track on Third South Street has been doubled. In all 5½ miles of track have been laid. The company is laying 72-lb. rails in the paved district of the city, and the double track on West Second South Street will be thus relaid as soon as the paving company completes its work. Plans for extensions to Bingham Junction and Bingham have been drawn, but the movement at present is not fully decided on. The company was intending also to build a $300,000 power plant on the west side during the coming year, but it was decided that the present sources of power could be sufficiently enlarged to meet all demands for some time to come. However, the company is prepared to take the steps when the exigencies of the situation demand it.

The Design and Construction of Fly-Wheels for Slow-Speed Engines for Electric Lighting and Traction Purposes *

BY A. MARSHALL DOWNIE, B. Sc.

In all mechanisms such as the steam engine, where reciprocating motion is transformed into rotary motion, the effort producing that rotation is bound to vary in amount, no matter how constant the force producing the reciprocatory motion; and a corresponding acceleration, positive or negative, occurs simultaneously with the change of effort. Further, in all systems where energy is utilized the demand is necessarily subject to fluctuations. In order that the system may be as efficient as possible it is important that the supply should as nearly as possible coincide with, or bear a direct ratio to, the demand. In the design of apparatus for the transformation of mechanical into electrical energy, the question of uniformity of speed in the prime mover is a vital one, and the fulfilment of the conditions above mentioned is subject to the proviso that the velocity of rotation must be kept as nearly as possible constant, or at least must only vary within certain defined limits. In order to realize these conditions fly-wheels and governors are employed, each having a special function to fulfil.

In the following remarks the design and application of fly-wheels to large slow-speed engines for electric lighting and traction will be briefly discussed.

In engines for driving electric generators, either for lighting or power, the need for speed regulation is perhaps greater than for any other class of work, and the fluctuations in the external load are greater and more sudden than in any other service, with one or two exceptions. The duty of the fly-wheel is to control the tendency to change of speed due to inequality in amount of internal effort in the engine, and the function of the governor is to limit the variation which arises from change in the amount of the external load. The scope of this paper is confined to the part undertaken by the fly-wheel.

An ordinary reciprocating engine performs one complete cycle of operations, so far as we are presently concerned, in two strokes of the piston, or one complete revolution of the crank pin. During that time the effort or pressure on the piston changes from a maximum at admission to a minimum at release, and again on the return stroke from a maximum at admission on the opposite side of the piston to a minimum at release on the same side. At the same time, the component of that effort, resolved tangentially to the crank-pin circle, varies in a somewhat similar manner; but this "crank-pin effort," as it is called, is modified by the finite length of the connecting rod and the inertia of the reciprocating and rotating parts of the engine. The effect of the finite length of the connecting rod is to produce the maximum effort on the crank pin, at a position on the crank-pin circle nearer the inner dead center than would be the case were the connecting rod of infinite length; and the change of effort is more rapid and less symmetrical throughout the revolution. The influence of the inertia of the reciprocating parts is important in all large engines where the moving parts have great mass and their actual velocity is considerable, although the number of revolutions in a given time may be small. The effect of inertia may be considered as a force acting in opposition to the steam pressure at the inner dead center, and in conjunction with it at the outer dead center.

A complete crank-effort diagram was shown for a compound vertical engine designed to develop 1650 ihp, the cylinders being 28 ins. and 58 ins. in diameter respectively, by 48 ins. stroke, with a steam pressure of 150 lbs. per sq. in., and a speed of 83 revolutions per minute. The cranks are at right angles, and the connecting rod is five cranks in length. The steam is superheated and the clearance space is small, so that the curve of expansion will not fall greatly below that obtained in an ideal indicator diagram. The indicator diagrams have been drawn for each cylinder in their relative positions, and the exhaust line of the high-pressure cylinder and the admission line of the low-pressure cylinder computed in the usual manner, having regard to the receiver volume.

The mass of the reciprocating parts supposed to be concentrated at the radius of the crank-pin circle, and moving with a velocity corresponding to the normal speed of 83 revolutions per minute, produces forces of 35,000 lbs. at the inner dead center, and 24,000 lbs. at the outer dead center for the high-pressure cylinder, and 40,000 and 28,000 lbs. respectively for the low-pressure cylinder. These were reduced to pressures per square inch of piston area and plotted to the same scale as the indicator diagrams are drawn. The combined effort due to both cylinders in their relative posi-

* Abstract of paper presented before the Institution of Engineers and Shipbuilders in Scotland, Oct. 29, 1901.

tion was determined and, for convenience, plotted on a straight line, equal in length to the circumference of the crank-pin circle as base. The area of the figure thus obtained (which was evidently the integral of the product of effort and space), gave the total work, and a straight line could be drawn indicating the mean effort. The line of actual effort cut the line of mean effort in 8 points. Between any consecutive two of these points the effort on the crank pin reaches a maximum or a minimum value, and the area included between the actual effort line and the mean effort line from one point to the next is called a fluctuation of energy. The largest of these areas, be it positive or negative, is called the *fluctuation of energy*, and the ratio of this quantity to the total work done in one revolution is called the *coefficient of fluctuation of energy*, and is denoted in what follows by the letter k.

conditions can be simply expressed as a mathematical formula involving the use of certain constants whose values will be given later.

If E be the total energy stored in a fly-wheel of weight W (supposed to be concentrated at the radius of gyration) when moving with a mean peripheral velocity of V_0 feet per second,

$\triangle$ E the fluctuation of fly-wheel energy or energy stored in the fly-wheel when changing from the minimum velocity V_1 through V_0 to the maximum V_2,

w the work done by the engine in one revolution, and

q the coefficient of speed variation allowable between the maximum and minimum limits:

Then

Table I.

Particulars Regarding Fly-Wheels for Lighting and Traction Engines.

Description of Engine	Description of Generator	Ihp of Engine	Output of Generator per Ehp	Total Weight of Fly-wheel and Rotor	Foot-tons of Energy at Normal Speed per Ehp	Probable Value of K	Corresponding Value of q	Remarks
Vertical 3-cylinder compound, by Messrs. E. P. Allis & Co. Cylinders 42 in. and $\frac{2}{60 \text{ in.}}$ × 60 in. stroke. 75 revolutions per minute.	Three-phase alternator, by Thomson-Houston Co.	4,000	2,500 kw 3,400 ehp	Fly-wheel 100 tons Rotor - 50 "	4	.035	$\frac{1}{600}$	As made for Glasgow Corporation Tramway Power Station.
Horizontal 4-cylinder tandem triple-expansion, by the Nurnberg Engineering Co. Cyls. 27½", 43½", and $\frac{2}{45\frac{1}{2}"}$ × 63" stroke. 72 revolutions per minute.	Three-phase alternator, by Helios E. C. Co.	2,800	1,700 kw 2,300 ehp	Fly-wheel generator 76 tons	3.5	.022	$\frac{1}{2,500}$	As exhibited at Paris, 1900, on lighting load.
Vertical side by side compound, by Nurnberg Engineering Co. Cylinders 30½ in., 49 in. and 71 in. × 43½ in. stroke. 84 revolutions per minute.	Three-phase alternator 850 kw, and direct current generator 750 kw, by Schuckert Co.	2,400	1,500 kw 2,000 ehp	Fly-wheel 40 tons A. C. Rotor 30 " C. C. " 26 "	3.5	.07	$\frac{1}{500}$	As exhibited at Paris, one-half on lighting and one-half on power.
Vertical 4-cylinder tandem triple expansion, by Borsig, Berlin. Cyls. 30 in., 46 in. and $\frac{2}{52 \text{ in.}}$ × 48 in. stroke. 90 revolutions. Cranks at 180°.	Three-phase Siemens and Halske generator.	2,500	1,600 kw 2,200 ehp	Fly-wheel 39 tons Rotor - 32 "	3.6	.1	$\frac{1}{380}$	As exhibited at Paris, 1900, on lighting load.
Vertical cross compound, by Societe Francais de Construction Mecanique. Cylinders 32 in. and 68 in. × 48 in. stroke. 75 revolutions per minute.	Three-phase alternator, by Thomson-Houston Co.	1,750	1,000 kw 1,450 ehp	Fly-wheel 69 tons Rotor - 24 "	4.5	.065	$\frac{1}{600}$	As exhibited at Paris, 1900, on lighting load, but intended ultimately for traction work.
Vertical side by side compound, by Societe Alsacienne de Construction Mecanique. Cyls. 33½ in. and 53½ in. × 48 in. stroke. 75 revolutions per minute.	Direct-current generator, by Thomson-Houston Co.	1,500	950 kw 1,250 ehp	Fly-wheel 30 tons Rotor - 19 "	2.4	.07	$\frac{1}{280}$	As exhibited at Paris, 1900, on lighting load.
Vertical side by side compound, by Messrs. D. Stewart & Co., Ltd. Cylinders 28 in. and 58 in. × 48 in. stroke. 84 revolutions per minute.	Three-phase alternator, by Oerlikon Co.	1,620	1,000 kw 1,340 ehp	Fly-wheel rotor 45 tons	2.8	.07	$\frac{1}{370}$	As being made for Dublin Corporation Electric Lighting.
Vertical cross-compound, by Messrs. D. Stewart & Co., Ltd. Cylinders 22 in. and 44 in. × 42 in. stroke. 90 revolutions per minute.	Three-phase alternator, by Thomson-Houston Co.	800	500 kw 650 ehp	Fly-wheel 33 tons Rotor - 10 "	4.5	.065	$\frac{1}{650}$	As made for Glasgow Corporation Power Station.

In considering the effect this fluctuation of effort has on the speed of the engine it was seen that at the beginning of the revolution the effort was less than the mean, but was increasing. Until the effort reaches the mean, energy is abstracted from the engine at a greater rate than it receives it, and the velocity of the moving parts will decrease. As soon as the effort exceeds the mean, energy is imparted to the moving parts at a greater rate than it is extracted therefrom, and their velocity will thus increase until the effort again reaches the mean, when the velocity will have reached a maximum value. During the time which elapses until the actual effort curve again cuts the mean line, the velocity again diminishes to a minimum at that point, and so on throughout the revolution. Each fluctuation of energy will have its corresponding change of speed in the engine, and the range of speed variation will depend on the mass in the moving parts and their capacity for storing energy. By far the largest mass in the moving system is that of the fly-wheel, and the problem to be solved in fly-wheel design is the determination of the dimensions and mass of a fly-wheel, such that it shall be able to store or give out an amount of energy equal to that represented by the area of the largest fluctuation of energy while changing in speed from one fixed limit to another, the limits being fixed beforehand by consideration of the class of work which the engine is designed to perform.

The question of the weight of the fly-wheel to fulfil certain

$$q = \frac{V_2 - V_1}{V_0} \qquad (1)$$

$$E = \frac{W V_0^2}{2g} \qquad (2)$$

$$\triangle E = \frac{W}{2g}\left(V_2^2 - V_1^2\right) = \frac{W}{2g}\left(V_2 + V_1\right)\left(V_2 - V_1\right)$$

$$\text{or} = \frac{W}{g} V_0 \left(V_2 - V_1\right) = 2\,E.q \qquad (3)$$

$$\text{but } \frac{\triangle E}{w} = k. \quad \therefore k = \frac{2E.q}{w}, \quad 2E = \frac{k\,w}{q} \quad \frac{W V_0^2}{g} = \frac{k\,w}{q}$$

$$\text{and } \frac{W}{g} = \frac{kw}{q\ V_0^2} \qquad (4)$$

From which it will be seen that the mass of the fly-wheel is directly proportional to the coefficient of fluctuation of energy and the horse-power, and inversely proportional to the coefficient of variation of velocity and the square of the speed. It would thus be economical of material to run the fly-wheel with a high peripheral velocity, but as the intensity of the stress in the material due to centrifugal force is independent of the cross-sectional area of the rim, and varies as the square of its linear velocity, the maximum safe speed of a fly-wheel is limited by the strength of the material composing it. In the majority of cases the material

is cast iron, and it is found that the safe tensile working stress is reached with a maximum peripheral velocity of about 100 feet per second, which would correspond to about from 80 to 90 feet per second on the mean circumference, the maximum stress due to centrifugal force then being about 1000 lbs. per sq. in.

The value of the coefficient q depends on the service to which the engine is put, and sometimes on the practice of the makers of the plant. For ordinary lighting loads with continuous current plants the coefficient q generally varies from $\frac{1}{100}$ to $\frac{1}{200}$. For alternators in parallel on lighting loads, q varies from $\frac{1}{200}$ to $\frac{1}{300}$, and for traction work the value is anything from $\frac{1}{100}$ to $\frac{1}{500}$, or even more. For example, Messrs. Sulzer Frères say $\frac{1}{200}$ for lighting and $\frac{1}{250}$ for traction. Continental makers in general do not ask for such great regularity as American and British makers, as may be seen from a comparison given in Table I. The fly-wheels in American traction engines give values of from $\frac{1}{45}$ to $\frac{1}{65}$ and the writer knows of a recent case in which a British firm of electrical engineers required a regularity of $\frac{1}{500}$ for alternators on a lighting load.

The quantity or ratio q is sometimes expressed differently in connection with electrical work as a certain number of "electrical degrees" of variation per impulse. This method is very largely adopted in America, and, the writer believes, was first used by the General Electric Company of New York, but the two methods of expression, although different in form, are identical in substance, as the following explanation will show.

In a multipolar generator having p pairs of poles, the number of degrees described by each pair of poles in one cycle is 360, so that the total number of electrical degrees described is $p \times 360$ per revolution. In a compound engine, such as we have under consideration, the number of impulses per revolution is four, so that the number of degrees described in one impulse is $\frac{p \times 360}{4}$

If ϕ is put for the permissible total variation expressed in degrees we have a ratio $S = \frac{\phi}{90\,p}$ which should correspond with "q" as given above.

A common value for ϕ is 6°, a 3° increase or lag from the mean, and this in a 60-pole generator would give a value of $S = \frac{6}{90 \times 30}$ or $\frac{1}{450}$, a result which agrees closely with q as adopted in good American practice.

The coefficient of fluctuation of energy is perhaps the most important factor in fly-wheel design, and the most difficult to determine, and it is mainly for this purpose that crank-effort diagrams must be constructed.

Tables II. and III. give numerical results for fluctuation of energy and fluctuation of effort, deduced from the diagrams made from the engines.

Passing to the question of the actual design and construction of the fly-wheel, it will be well to consider the nature and distribution of the stresses in its various parts when in motion under working conditions.

Fly-wheels, as generally made, consist of rim, arms and boss, and these are either all cast in one or made of separate pieces and jointed together according to the size of the wheel, and the service to which it is to be put.

The stress in the rim is made of a tensile stress normal to the radial cross-section, due to centrifugal force, and a compressive stress at the inner side of the rim with a tensile stress at the outer side, due to the bending moment produced by the pressure of centrifugal force on the part of the rim between any two consecutive arms, being, in fact, analogous to the stress produced at the mid-section of a beam fixed at each end and loaded uniformly. On the whole, the net stress is a tensile one, increasing in intensity from the inner edge of the rim outward.

As has been remarked before, the "hoop" tension, due to centrifugal force, is independent of the cross-section of the rim, and depends only on the specific gravity of the material composing it and its linear velocity. The determination of the stress in this case is analogous to the similar calculation of the stress on a longitudinal joint in a boiler, if for the steam pressure we substitute a force-pressure $= \frac{wv^2}{gr}$, where w is the weight of the unit length of the rim of unit thickness.

In cast iron, weighing 450 lbs. to the cubic foot, the stress per square inch due to centrifugal tension, in pounds, is equal to $\frac{v^2}{10}$, where v is the velocity of the rim in feet per second. As regards the stresses set up by bending, the portion of the rim extending from one arm to the next may be considered as a beam fixed at both ends, and loaded uniformly with $W = \frac{vw^2}{gr}$ lbs. per foot of length, where w is the weight of rim per foot. Under these conditions there will be a point of contrary flexure at one quarter of the span from each arm, where the bending moment = O, and the maximum bending moment will be at the center, and will be equal to $\frac{Wl^2}{12}$, if the fixing at the arms be perfectly rigid. But the fixing can hardly be considered as quite rigid, owing to the arm being a more or less flexible column, and its attachment to the rim being at the under side only, so that it may be considered as something between a rigid fixing and a simple support. In the latter case the maximum bending moment would be $\frac{Wl^2}{8}$, therefore the actual denominator may be taken as something between 8 and 12.

TABLE II.

FLUCTUATION OF ENERGY

Values of K Supposing				Length of Connecting Rod	Remarks
One Crank	Two Cranks at Right Angles	Two Cranks at 180°	Three Cranks at 120°		
.0152	.01055		.00325	Infinite	Uniform pressure on piston
.1245	.0314		.0084	Six cranks	Inertia neglected
1.12	.0600	.16	.025	Five cranks	Actual diagram Inertia included
.1358	.0418		.0115	Four cranks	Uniform pressure
	.108			Not given	H.M.S. Nelson. Cotterill p. 229

TABLE III.

FLUCTUATION OF CRANK EFFORT

Ratio to Mean for	One Crank	Two Cranks at Right Angles	Two Cranks at 180°	Three Cranks at 120° t.e.	Length of Connecting Rod	Remarks
Maximum	1.57	1.112		1.047	Infinite	Uniform pressure on piston
Minimum	0	.785		.907		Inertia neglected
Maximum	1.62	1.32		1.077	Four Cranks	Uniform pressure on piston
Minimum	0	.785		.794		Inertia neglected
Maximum	2.09	1.415	1.62	1.179	Five Cranks	Actual diagram
Minimum	0	.594	0	.738		Inertia included
Maximum		1.52			Not given	H.M.S. Nelson
Minimum		.6				Cotterill p. 229

This expression would hold good for a fly-wheel with a jointless rim. In large and heavy fly-wheels, however, such as those under consideration, joints are necessary for convenience of casting, handling, and erecting. If the joint be made midway between the arms, and we consider it as lacking in rigidity compared with the solid rim, each portion of the rim, as an extreme case, may be considered as a cantilever fixed at each arm, and the maximum bending moment will then be at its junction with the arm, and will have a value $\frac{Wl^2}{8}$. If the joint be at the arm, then, with the same assumptions as before, the segment of the rim will be under the same conditions as a beam supported at both ends, the maximum bending moment being at the center and equal to $\frac{Wl^2}{8}$ as before.

The joint is generally placed midway between the arms, but it would certainly be advantageous in designing a fly-wheel, as in designing a built girder, to put the joint at the point of contrary flexure, where the bending moment is zero, *i. e.*, at a point about one-quarter of the span from one end. This should present no difficulty from the point of view of construction, machining, and erection. No doubt if we assume, as before, that the rim at the joint is lacking in rigidity, the placing of the joint as last mentioned would have the effect of increasing the maximum stress due to bending, to an amount $= 9\,\frac{Wl^2}{32}$ but it would remove the point

at which such stress occurs to a position where the rim is quite solid, and therefore more able to resist the stress; in any case the joint would have a certain amount of rigidity, and thus prevent the stress reaching the value indicated.

The stresses in the arms are principally tensile, and due to the centrifugal force of their own mass and the proportion of the centrifugal force in the rim transmitted to them. There is also the shearing stress at their junction with the hub, arising from the transmission of the force producing positive or negative acceleration between shaft and rim, and a bending moment due to the same cause.

If F be the centrifugal force tending to separate one-half of the rim from the other, and n the number of arms, it can be shown that the portion of this force borne by each arm, if the rim joints are so made that the whole stress comes upon the arms, will be $\frac{\pi}{n}$ F, and this necessitates a cross section in each arm of from one-half to three-quarters of that in the rim to resist this force alone. Such a contingency, however, should never arise in practice, as the rim should be rigid enough to take most of the stress due to its own centrifugal force. The combined cross-sectional area of the arms in well-designed wheels of the type under consideration, is generally from two to three times the cross section of the rim. The strength of the arms as beams fixed at the inner end and loaded at the outer end with the force required to produce an acccleration, positive or negative, in the mass of one segment, while changing the velocity through the limits specified in the time elapsing between two consecutive points of coincidence of the actual and mean crank-effort lines (*e. g.* in Fig. 1 one-eighth of one revolution or .09 second) should also be considered, and this together with the resistance to shearing by the same load should not tax the material above one-eighth of its ultimate strength.

The fixing of the arms to the hub is usually by means of bolts or cotters, and their strength in double shear should be equal to that of the arm in shear or tension, whichever is greater.

Several forms of rim joints are in general use for fly-wheels, and among the principal may be mentioned the following: (1) Flanged and bolted, (2) dowel-plate and cotters, (3) arrow-headed bolts, (4) links and lugs.

The following points regarding the construction of these different forms of joints are worthy of note:

(1) In the flanged and bolted joints, the bolts should be as near the rim as possible, consistently with getting a deep flange. The bolts should be carefully fitted at each end and cleared in the center, so that the stress on them should be tensile rather than shearing. They should all be initially stressed by screwing up if possible to the same amount.

(2) The accurate machining and fitting of the dowel-plate and cotter joint is most important. It should, of course, be so designed that the strength of the cast iron, cotters, and portion of the dowel-plate, in shear, is equal to the strength of the portion of the dowel-plate in tension. The accuracy with which the initial stress in this form of joint can be adjusted is an important feature in its favor.

(3) The arrow-headed bolt joint is a shrunk joint, and is open to the objection that the initial stress on the bolts due to shrinking-in is a more or less unknown quantity, and the ulitmate strength therefore indeterminate. The points to be attended to in its construction are, accurate machining between the checks on bolts and rim, and provision for clearance at the center, for the same reason as noted in (1).

(4) The 'link and lug" joint is also a shrunk one, and subject to the same objection as (3) on that score. If made with the lub projecting, as shown on the illustration, it has the advantage that the section of the rim is not diminished at the joint. The increase of weight, however, which such a form necessitates, is a good reason for removing the position of the joint nearer one arm.

Much light has been thrown on the relative strengths of solid rims and various forms of joints by some interesting experiments by Prof. C. H. Benjamin, related in the Proceedings of the American Institution of Mechanical Engineers, Nov. 29, 1898. In these experiments small fly-wheels of from 15 ins. to 24 ins. diameter, some of which had solid rims and others jointed, as in (1) and (4), were tested to destruction. The solid-rimmed wheels almost invariably gave way midway between the arms, at a speed slightly below that at which the calculated centrifugal tension would be equal to the ultimate tensile strength of the material as proved in a testing machine.

For example, the cast iron used had an ultimate tensile strength of 19,000 lbs. per sq. inch, corresponding to a speed of 450 feet per second, and the solid wheel failed at 428 feet per second. The wheel with flanged and bolted joints (1) failed when the tensile stress was only about one-fourth of that of the solid rim, although the joint was evidently well proportioned, as the failure in one case arose from the flange breaking, and in the other from fracture of the bolts both occurring at about the same limit. The link joint (4) had a strength slightly over two-thirds of that of the solid, and was thus greatly superior to the flanged joint. The non-reduction of cross section should also give this joint superiority over the dowel-plate and arrow-head bolt joints, as in both these cases the cross section is reduced by about one-fourth. The reason why the link joint is not so strong as the solid rim is probably owing to the weight of the lugs and links adding to the bending moment, due to centrifugal force at the point where the rim is weakest to resist this, and of course the initial stress due to shrinking adds another element of weakness. It would be interesting to know what additional strength would be obtained by making such a joint nearer one arm, as it would naturally reduce the maximum stress at the mid-section of the rim. It is worthy of note, however, that the stress produced by the bending moment at the rim cannot be great, as one of the above experiments consisted in testing to destruction several fly-wheels with alternate arms missed out, and they were able to reach almost to the same speed limits as those with all the arms left in.

In some recent cases, principally in America, and notably in the engines for the Metropolitan Street Railway Company, of New York, fly-wheels with riveted steel-plate rims have been successfully used, and run at much higher speeds than would be safe with cast iron.

From the above facts some general conclusions may be drawn:

(1) A good average value for the energy necessary to be stored in fly-wheels for electric lighting purposes is 2.9 foot-tons per electric horse-power, and in traction plant 4 foot-tons.

(2) Cast-iron fly-wheels should, where practicable, have solid rims, but when jointed, the best form is the "link and lug" type where such can be adopted without inconvenience, and the next best is the dowel-plate and cotter. Flanged and bolted joints should be avoided, and the best place for a joint is near one arm.

(3) Solid-rimmed cast-iron fly-wheels may be run at a peripheral velocity of 100 feet per second, with the certain knowledge that the "factor of safety" is not under 12, and link-jointed wheels may also be run at that speed, and have a certain factor of safety of 8. A lower factor of safety should not be used, and flange-jointed wheels should not be run above 70 to 75 feet per second. Built steel wheels may be run up to 130 feet per second.

(4) Arms should be joined to rims with large fillets, and their fixing to the hub should be carefully fitted.

(5) The best material of its kind should be used in construction, and homogeneity should be insured as far as practicable by having test bars cast and proved from each segment.

Proposed Electric Construction in Melbourne

The construction and equipment with electric power of a number of suburban lines in the vicinity of Melbourne, Australia, formed the subject of an interesting discussion before the legislative body of that city lately, and a committee has been appointed to investigate the subject. A number of persons have already testified to the decreased expense and the increased earnings possible by electricity, as well as the possibility of the utilization of water power for supplying the necessary power. It was shown that a force of 2,000 hp was available at Digts' Falls, on the Yarra, close to Melbourne, while other powers at a greater distance were also available. The estimates of the chief mechanical engineer of the railroad department show that the St. Kilda line, which will probably be the first to be equipped, could be changed from steam to electricity at a cost of £65,375. The committee strongly recommended the equipment of this line, but a preliminary essential was considered to be that the services of a competent electric railway manager from Great Britain or America, one who had had the necessary practical experience in the initiation and control of similar undertakings, be secured.

Syracuse, it might be said, can claim the right to be ranked with "Car Town," San Francisco, and St. Louis in the novel use of discarded street cars. A number of the antiquated species, formerly drawn by mules, are to be found in that city, they being used as coal offices, quick lunch rooms and children's playhouses.

Comments on the Electrical Equipment of the New York Central Tunnel

The recent disaster in the New York Central tunnel on Park Avenue, and the announcement made last week that the company would equip its suburban trains with electric motors, and construct an addition to its terminal facilities under its present station for such electric trains, have naturally created a great deal of comment in electrical and railway circles. Some of the most interesting interviews and communications to the New York daily papers as to the possible dangers from electricity which have appeared during the past week are published below.

(From the New York Times for Jan. 16, 1902.)

ELECTRICITY'S DANGERS.

PITTSBURG, Jan. 11, 1902.

To the Editor of the New York *Times*:

It may prove useful at this moment to direct the attention of the press to certain features incident to the use of electricity for the operation of trains or cars.

From the comments which have already been made in regard to the accident which is now uppermost in our minds, it seems to be assumed that such accident would in all probability not have occured if the colliding trains had been propelled by electricity, and also the absence of steam would have lessened the risk to the occupants of the telescoped cars.

As a matter of fact, with an electrically operated train the risk of accident will, juding by experience, be increased rather than diminished because of the presence of the heavy electrical machinery which it is proposed to attach to several cars of each train. Already there have been many serious collisions with great loss of life between electric cars, while there have been numerous cases in New York and other places in which cars have been quickly destroyed by fires which have resulted from some derangement of the electrical apparatus or circuits, and in some instances so quickly that passengers have had scarcely time to escape to the street.

It should be borne in mind that the electric energy required to operate a heavy train is sufficient to melt a considerable bar of iron, or to start a dangerous fire, if anything goes wrong upon a car of ordinary combustible construction, much more readily than the car stove, the use of which has been abolished by law. Therefore, if a collision were to occur between two electrically fitted trains, each having several combustible cars thereof, fitted with electrical apparatus and carrying electrical circuits throughout, there could be an accident of so serious a character as to start an agitation having for its purpose the abolition of the use of electricity altogether, or at least to compel the railway companies to abandon the use of combustible cars fitted with electric motors.

The destruction by fire of a car or train upon a street or upon a level is one thing, but such an occurrence upon an elevated railway or in a tunnel can have consequences the contemplation of which should lead to wise regulations governing the construction and use of electrically propelled trains, and thereby insure to the public the rapid development of electric traction.

In Liverpool, during the past month, an electric train, while running in a short tunnel, was set on fire by the electric current and totally destroyed, with considerable loss of life.

GEORGE WESTINGHOUSE.

(From the New York Times for Jan. 17, 1902.)

MR. WESTINGHOUSE'S LETTER.

NEW YORK, Jan. 16, 1902.

To the Editor of the New York *Times:*

I am a little surprised at your editorial article in reply to the letter of Mr. George Westinghouse. You suggest that if Mr. Rockefeller should write to you discouraging the use of refined petroleum because of its fire risks, or if Mr. Carnegie should discourage the use of steel instead of iron, you would not be disposed to look upon such letters as having much value as contributions to technical literature. If Mr. Rockefeller should detect a considerable tendency to specify, say on shipboard, the use of petroleum that would flash at 100 degrees, of if Mr. Carnegie should find a number of railroads specifying rail steel high in phosphorus and sulphur, either one of these gentlemen would be apt to take pains to call attention to such dangerous practices. This is precisely what Mr. Westinghouse has undertaken to do, through your columns, with regard to electricity as a means of conveying power to the driving wheels.

If you were to set an intelligent young man to make an investigation, going back over three years, into the number of cars that have been set on fire by electric current, I venture to say that you would be surprised at the result of the inquiry. You could easily get track of at least half a dozen cases where cars have been burned to the trucks. The fact that "the train in the Liverpool Tunnel employed the open switch" (if it be a fact) is of little consequence in this discussion. There are twenty ways by which cars might be set on fire by the electric current.

Mr. Westinghouse is the last man in the world to say a word to discourage the use of electricity for traction, and his letter to you (as I read it) was not designed to be discouraging. On the contrary, it was, I have no doubt, intended as the warning of a man of vast experience and observation. Coupled with Mr. Westinghouse's brilliant imagination and astounding fertility of invention is an underlying conservatism of judgment which has been one of the elements of his success. H. G. PROUT.

(From the New York Times for Jan. 18, 1902.)

MR. SPRAGUE ANSWERS MR. WESTINGHOUSE.

NEW YORK, Jan. 17, 1902.

To the Editor of the New York *Times:*

Your editorial in yesterday's issue, deservedly rebuking Mr. Westinghouse for his pessimistic and ill-advised letter, is in error in stating that it will be read with consternation, or even with surprise, by electrical engineers, notwithstanding Mr. Prout's indorsement.

Mr. Westinghouse has a habit, which I fear is almost chronic, of tendering advice to those contemplating advanced methods in electrical transportation to do nothing, unless it be to wait until his particular plans have materialized. Because of his prominence and much good work in the engineering world, over-much importance may be attached to his dictum on electrical subjects, in the advanced arts of which Mr. Westinghouse, however, is less apt a student and less qualified a judge than he is in the matter of air brakes.

An unhappy accident in the New York Central tunnel has, because of its appalling consequences, appealed most strongly to popular feeling and prejudice. It is not my present purpose to discuss the causes of this accident, to try the apportionment of blame, or to point out what I may think are the proper remedies, but Mr. Westinghouse's comments are properly subjects for criticism and correction. His letter dated Jan. 11, some four days before the apparently premature announcement of tentative plans, which, it is reasonable to assume, have for some time been and still are under serious consideration by the railway company.

I have, in common with many others, definite ideas as to what may be accomplished for the betterment of the existing state of things, formulated with knowledge of many well recognized responsibilities and difficulties. Appreciation of the serious character of any problem is not, however, excuse for shirking its solution, not sufficient warrant for men whose word may be given undue weight, committing themselves to unwise alarmist comments, which may act to delay needed improvements.

Although the official announcement of the company's plans, as far as described, detail no specific method of electrical operation, Mr. Westinghouse assumes that it is proposed to move all trains by motors attached to "several cars of each train." The plan thus indefinitely referred to is what is now known as the "multiple-unit system," was first introduced by me on the South Side Elevated of Chicago, four years ago, and is now the generally accepted method of train operation for certain classes of service. It is a method of train control and operation by means of which locomotives or cars, each equipped with motors and controllers individual to these motors, can be aggregated at will, with or without other cars unequipped with motors, into train combinations of any length, and controllable from any desired point.

The system has found in Mr. Westinghouse a persistent opponent, although obliged by the advance of transportation methods to yield it some measure of approval, and he takes the present opportunity to first assume what the railway company itself is not yet ready to announce, and then condemn its possible adoption by criticisms based on false promises, and supported by misleading statements. That the multiple-unit system, already indorsed by 300,000 horse-power of equipment within four years, is an essential in any general solution of many railway problems of to-day goes without saying, but it is equally certain that modified or alternative plans must be applied to other problems.

Mr. Westinghouse declares that already there have been many serious collisions on electric cars, with great loss of life. It would have been more to the point if he had explained that almost invariably these have been single cars on single-track roads, where no adequate signals were in operation, or where they were ignored. Where there have been collisions between trains on electrically operated elevated roads, the cause has been fog and absence or disregard of signals, and the loss of life has been a

minimum. In no case has such a collision caused a conflagration; this last, when it has occurred, having been on account of defective work. There is less reason why fires should occur on well-equipped multiple-unit operated trains than on single cars in the streets, for it is undeniably true that much greater care has, at least in some cases, been exercised to create fire and foolproof apparatus.

The statement is also gravely advanced that the amount of current necessary to operate a train would melt a large bar of iron. So, too, would the amount of current necessary to light an ordinary building, but an essential of the multiple-unit system is the localization on any motor car of controlling apparatus individual to its motors, and limited in current to their capacity. No controlling device in this system carries the entire current of the train; heavy currents are especially prohibited, being carried from one car to another, and the controlling currents are less than those in an ordinary lamp circuit.

Ignorance and carelessness of motormen is largely discounted, in that the current input in each motor equipment is, where the system is properly installed, automatically limited to absolutely safe amounts. Where derangement of a circuit occurs, causing an abnormal increase of current, safety devices of reliable character provide against its continuance.

Mr. Westinghouse makes reference to an accident, the first of its kind on that road, although in operation for eleven years, which recently occurred on the tunnel section of the Liverpool Overhead Railway. This equipment had the very objection which the multiple-unit system was designed to avoid, in that main currents were carried from the regulating apparatus at the head of the train to motors at the rear end. Whatever the actual cause of trouble, the presence of creosoted wood in the tunnel largely contributed to the serious character of the disaster.

Evidently Mr. Westinghouse is apprehensive that the multiple-unit system may be found advantageous in some proposed equipment on the New York Central, but it is safe to assume that any well-matured plans will not be stopped because of objection from a manifestly interested source, and that if it be satisfactorily demonstrated to the railway company that electrical operation will prove advantageous it will be adopted, whatever the system or cost.

Frank J. Sprague.

(From the New York Sun for Jan. 18, 1902.)

Interviews with Mr. Yerkes and Mr. Westinghouse on Fireproof Cars.

Charles T. Yerkes, who will equip and operate the new underground electric railway in London, believes that one of the chief factors in the solution of electric traction is the use of fireproof cars. Such cars have never yet been used for passenger service. It will be interesting, therefore, to Americans to learn that Mr. Yerkes has practically invented such a car, with which his London road will be equipped. When Mr. Yerkes was asked yesterday to tell the *Sun* about these cars, he said:

"When the London underground electric road is ready for business it will be equipped with absolutely fireproof cars. These cars will make impossible a repetition on our line of the recent accident in Liverpool, in which several persons were burned to death. The use of the cars will reduce to a minimum the possibility of the wrecking of cars, in ordinary collisions, such as occurred last week in the Park Avenue tunnel."

George Westinghouse, president of the Westinghouse Electric & Manufacturing Company, said yesterday, in advocating the use of fireproof cars on roads operated by electricity:

"The operation by electricity of heavy trains, being in a sense a new art, the majority of railway managers and the public in general have not yet had impressed upon their minds anything but the possible advantages which would follow the substitution of electric for steam traction; nothing, therefore, could be more natural to them than to favorably consider the numerous proposals of inventors and manufacturers for the application of motors and accessories to existing combustible cars, and to less favorably consider plans involving a more costly construction of cars, and such an application of electrical apparatus as would tend to reduce the chances for accident from fire to a minimum.

"Besides increased comfort due to the avoidance of smoke and cinders, a very important reason favoring the use of electricity is the ability to attain higher speed, and thereby save valuable time to travelers. Higher speeds, however, involve greater risks, since it takes four times the distance within which to stop a train when running at fifty miles an hour as is required with one running at twenty-five miles an hour.

" I believe electricity can be safely utilized for the operation of suburban and interurban trains, and that this use will be rapidly extended in all parts of the world. It is not against the true interests of electrical industries to call attention to this subject in a manner which will lead to the safe use of their products; nothing could more seriously interfere with such development of electric traction than a serious loss of life due to such an application of the apparatus as would lead to the destruction of a train by fire. Cars can and should be constructed, and electrical apparatus applied in such a manner, as to avoid the risks referred to."

Mr. Westinghouse added that one way to avoid the possibility of accident on electrically operated railways was by the use of fireproof cars.

(From the New York Evening Post for Jan. 14, 1902.)

Views of President Hall.

President John M. Hall, of the New York, New Haven and Hartford Railroad Company, asked by the *Evening Post* correspondent for his views on the possibility of avoiding dangers and inconveniences in the operation of the Fourth Avenue tunnel, makes, in substance, the following statement:

"I have grave doubts as to the possibilty in practice of adopting electricity to the operation of the tunnel. The motor engines needed will have to be many in number, very powerful, and very costly, but apart from such considerations will be the extreme difficulty of using them interchangeably with steam above the tunnel. We have estimated that to make the transfer from the motor to steam engines, readjust brakes, and get started again will require not less than ten minutes for each train—a delay certain to be very vexatious for passengers. The electric motors, too, are constantly getting out of order. Electricity will also require an engine yard of large size, which will have to be located, as we think, a number of miles above the Harlem. This whole matter of interchanging steam with electricity above the tunnel meets in many ways obstacles which seem to me almost insuperable.

"The discussion of remedies for the present operation of the tunnel all appear to come back in the final analysis to one, namely, the opening of the tunnel to the air and reverting to the old conditions above the Grand Central Depot before that structure was built. In those days the trains ran in the open through the rock cuts and over the embankments. Later, owing largely to the demands of propertyholders, the Harlem Company built the present tunnel, at that time called an 'improvement.' The way to make a genuine improvement now and solve the whole problem is to open the roof and let light and air in, whether the property owners complain or not. Would such an open-air system be worse than that of the elevated roads in the streets and avenues of New York today?

"The immense and increasing traffic through the tunnel must be admitted as a fact, and will be large whether the tunnel is opened or not. There are, however, ways of relieving it in part. One plan is that which has been under consideration by the New York Central Company of a new station for suburban passengers near the Harlem, and connection with the Rapid Transit system and the elevated lines. As to the New Haven Company, we must, in the main, probably use the Grand Central Depot for years to come. We have no large property on the Harlem, and our Harlem branch is necessarily given up almost entirely to freight traffic. However, we hope, after a time, to make such an arrangement with the Rapid Transit system and elevated roads as will relieve the tunnel of part of our suburban traffic. But express trains must continue to run indefinitely to the Grand Central.

"Our contract with the New York Central, as modified a few years ago, limits our responsibility as regards maintenance of track, signals and similar matters to the terminal below Fifty-Second Street, and as to that responsibility we merely bear a part of the cost. Our engines, in running through the tunnel, either use coke to diminish smoke, or are anthracite burning. The recent disaster, as it seems to me, was clearly due to the carelessness or inexperience of the engineer, which seems to me quite unaccountable. Failing to see the signals he should have stopped the train. Such a case happened awhile ago on one of our trains in the tunnel, when the engineer, not seeing the signal, stopped the train and did not proceed until he received the signal of safety."

(From the New York Evening Post for Jan. 17, 1902.)

Interview with Mr. Gotshall.

W. C. Gotshall, president of the New York and Portchester Railroad Company, to-day took exceptions to the statement regarding the safety of an electric equipment for railroads, made by George Westinghouse in a letter to the *Times* of Jan. 16. Mr. Gotshall said that he could not comprehend the meaning of it, in view of the fact that at present electric trains, requiring enormous power, are operating in London, in Paris, in Chicago, and in Boston. Continuing, Mr. Gotshall said:

"There is absolutely nothing in connection with the operation of an electric train of a dangerous nature, when the operating system is designed and installed under the supervision of com-

petent and experienced men. It is unfortunate that the Liverpool accident should be held up to the public as a practical horrible example, in the manner in which Mr. Westinghouse has done. The causes of that accident are well known, and would not occur again. Attention is called to the fact that the Liverpool system was installed some years ago.

"Referring to the matter of safety appliances for the purpose of stopping trains, I would say, that the Boston Elevated, among others, is now operating an automatic safety block-signal system of the tripper type, the operation of which is such that when the block is closed the track tripper is in a vertical position, in which position it is impossible for a car to get on to the next block without having its brakes instantly and violently set. Reference is made to the fact that there have been no accidents on the Boston elevated system, notwithstanding the fact that these blocks average about 800 feet in length, and that the service during the commercial hours is on a three-minute headway. These signals have never yet failed, and their operation is such that should the operator of the car fall dead at his post, the train would be brought to a dead stop on its attempting to enter a closed block. The tripper system is of such nature that its application is possible to steam cars as well as electric.

"Referring to the matter of the possibility of short-circuits, there have been very serious short-circuits, so far as the passage of an enormous current is concerned, upon a number of occasions, on the Boston elevated and on the Paris underground. It is now well known that the application of a circuit breaker to a car should not be made. The proper thing to use is a fuse, and a non-arcing fuse. Should an open fuse be used—that is, a fuse with the entire metal exposed—there is the possibility of igniting the woodwork of the car. At the present time no modern engineer would think of using an open fuse, in view of the high state of perfection to which non-arcing fuses have now been brought. These non-arcing fuses snap with nothing more than the instantaneous emission of a small quantity of smoke. These fuses are now in use on the Boston elevated, on the Paris underground, on the Central London Underground Two-Penny Road, and have always operated satisfactorily since their installation.

(From the New York Times for Jan. 19, 1902.)

MR. WESTINGHOUSE'S VIEWS.

NEW YORK, Jan. 18, 1902.

To the Editor of the New York *Times:*

Permit me to thank you for the prominence you have given to my letter of the 11th and the discussions thereon.

Your editorial of to-day invites more discussion of this subject, and possibly further criticism in the line of the unexpected interpretation of my letter.

The controlling paragraph of my letter, to which I again invite your attention, and that of railway managers who have the first responsibility to the public, and of electrical engineers, is as follows:

"The destruction by fire of a car or train upon a street or upon a level is one thing, but such an occurrence upon an elevated railway or in a tunnel can have consequences the contemplation of which should lead to wise regulations governing the construction and use of electrically propelled trains, and thereby insure to the public the rapid development of electric traction."

From questions which have been asked, it is evident that the word "combustible," which obviously should be read into this from the preceding paragraph, has been quite overlooked.

No one can have a stronger belief than I entertain of the advantages to be derived from the use of electricity in the operation of trains. A lifelong experience, however, in connection with safety appliances upon railways has caused me to view the subject from quite a different standpoint from that usually taken, especially by inventors and promotors, and in some cases by manufacturers of electrical apparatus, who evidently dislike to emphasize the dangers attending the application of so much electrical machinery beneath the ordinary combustible cars now generally in use, and the utilization of which has been contemplated in order to keep down the total cost of installation.

I believe a further useful purpose will be served by particularizing some of the dangers to be guarded against in the fitting of trains with electrical apparatus:

1. A great advantage of electric traction is the possibility of a much higher speed. This, however, while not extending the vision of the engineer in charge of the apparatus, will require a greater distance within which to stop the train.

2. When many tons of electrical apparatus are distributed beneath several cars of a train, and of necessity more or less loosely supported, and between which and the rails and roadbed there is but a small clearance, it is evident that much greater precautions will have to be taken than is ordinarily the case with the running gear of the present steam cars, derangements in which have often been the cause of accident.

3. Electrical apparatus supported beneath the car can develop by means of a short-circuit heat energy sufficient to instantly ignite cars of wood construction, and this has occurred repeatedly, notwithstanding the presence of safety appliances intended to guard against such occurrences.

4. When a total wreck results from an accident, and experience has shown that accidents are inevitable whatever the mode of propulsion, the debris scattered over the "live" and other rails would render useless the ordinary circuit controlling devices which may be located upon the cars. This emphasizes the importance of a non-combustible construction of cars.

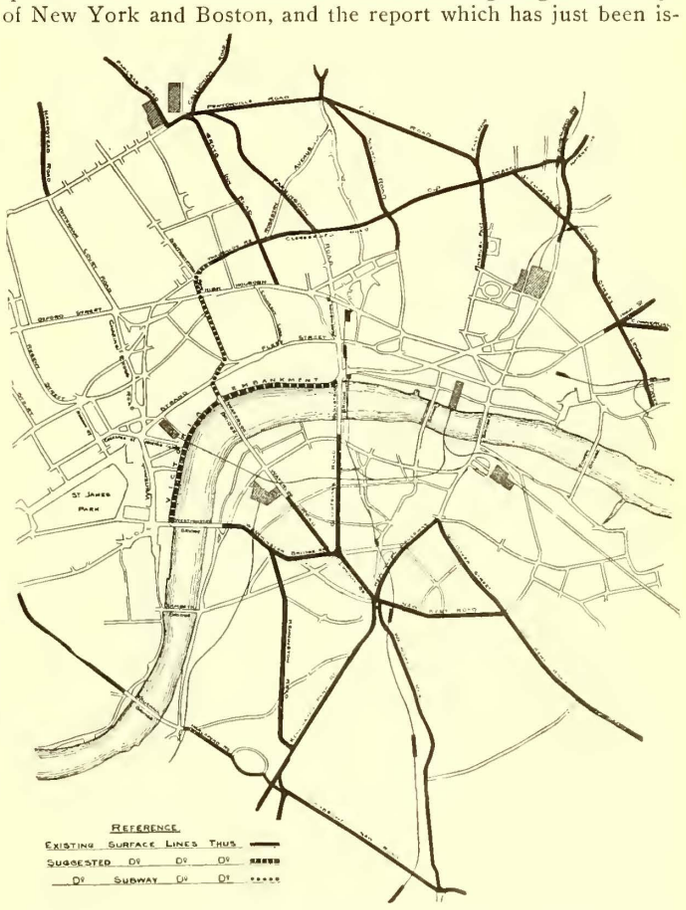
The public announcement that Mr. Yerkes, who has had so many years of experience in matters of this kind, proposes to construct his cars for the underground railways in London of non-combustible material, is a corroboration of the views I sought to bring to the attention of the public through your columns.

I am not disturbed by personal criticisms based upon a misapprehension of my motives, which are entirely in the interest of the public, and not in the slightest degree governed by my personal interests. It may be to my credit to render a public service.

GEORGE WESTINGHOUSE.

Subway Plans in London

A report on the installation of tramway subways on the lines of the London County Council has just been rendered by Alfred Baker, tramways manager, and John H. Rider, electric engineer for the County Council. These gentlemen, it will be remembered, spent a number of weeks last summer in investigating the subways of New York and Boston, and the report which has just been issued, is the result of their tour of investigation. The report, which is very fully illustrated to show the completed work in Boston, and that under construction in New York, gives full particulars of the financial and technical history of the two undertakings. It states that the committee were greatly impressed by the dryness and airiness of the subway, the air being extremely good and fresh. The number of cars run in each direction in the Boston subway is given as about 150 per hour, or 4000 in each direction per day of sixteen hours. The committee also states that it believes that the problem in London will never be satisfac-



MAP SHOWING LONDON COUNTY COUNCIL TRAMWAYS AND PROPOSED SUBWAYS

torily solved until the tramways north and south of the river Thames are linked together, and a plan is presented, reproduced herewith, showing the proposed extensions under the city and along the river of the subway. Estimating a four-track subway to cost one-third more than a two-track subway, the cost of the Boston subway is given in the report at about £425,000 per mile for a two-track subway, and the New York subway at about £350,000 per mile for a two-track subway. The latter figure, they say, may be considered as a rough guide for a large portion of the proposed subway work in London, which is given at about £282,000, which, however, does not include the sum for the proposed vault cellars and further vested interests, or the addition of pipe galleries to the subway. The report includes an addendum by J. Allen Baker, chairman of the County Council and vice-president of the highways committee, strongly urging the construction of the subway suggested in the report prepared.

London Letter

(From Our Regular Correspondent.)

The Board of Trade has now reached a definite decision in favor of the direct-current system as to the best type of electric traction to be adopted on the Metropolitan and District Railways, and the daily press is unanimous in approving the opinion as given by the umpire of the arbitrators, the Hon. Alfred Lyttleton. In view of all the evidence that was brought before the arbitrators, and which was pretty fully reported last month, it is difficult to see what other decision could be arrived at, as it is the opinion of most engineers that, in the present undeveloped state of polyphase traction, it would have been too much in the nature of an experiment to introduce the high voltage, three-phase system, with overhead conductors in the old underground tunnels. The service would have been too exacting, and the complications too many, and that Londoners in general approve of the decision is amply evidenced by the sharp rise both in Metropolitan and District securities. Polyphase traction will undoubtedly play a large part in the future of electric railways, but the Board of Trade of London has wisely decided that the underground railway was not the proper place to develop it. Thus ends one of the most curious and involved cases of modern times, and it is now to be earnestly hoped that the two railways will hasten with all despatch to place their contracts and at once commence the work of conversion. I have hinted more than once in this column that the two railways would soon regain much of their lost prestige and business, so soon as they got rid of the sulphurous fumes and the begrimed tunnels, stations and rolling stock, and I have no reason to doubt that with the advent of electric traction on their system, the two companies would soon surpass their best records. They have one great advantage over the tubes that cannot be overlooked, and that is that they are near the surface, there being many who still object to the lifts and to traveling on the average about 75 feet in the bowels of the earth. Severer competition is threatened, however, as there are a number of schemes for deep, level tubes to be put forward in the coming parliamentary session, some of which will parallel the old lines, and thereby get some of their traffic, so that it behooves all concerned to move now as quickly as possible.

Since writing the above it is reassuring to find that the Metropolitan Company, which advocated the polyphase system, has already held a meeting of directors, and accepted the decision of the Board of Trade, so that no further dispute seems likely. It is also to be sincerely hoped that speedy arrangements will be made with the other great steam railway companies which have running powers over the Metropolitan and District lines so that their trains may be electrified also. Just how this will be accomplished does not yet appear, but though the subject is a complicated one, the difficulties can be readily overcome if the engineers of the companies will agree on a common method.

The Heywood magistrates recently gave an important decision in a case affecting the payment of tramway fares. On Sept. 18 a man was summoned for traveling on a local tramcar without paying his fare, and counsel in his behalf pleaded that he gave his name and address and promised to pay the fare later, as he had no money in his possession then. There was, it was urged, no intention to defraud, and the defendant was like a man traveling on the railway without a ticket, but who gave his name and address.

It was announced that in view of the importance of the case to the public and the tramway company, the magistrates had taken great trouble to arrive at a decision. The conflicting cases quoted by counsel had been gone into, and the magistrates had arrived at the decision that though no fraud was intended, a breach of the company's by-law, which was of a reasonable character, had been committed, and defendant would be fined 2s. 6d. and ordinary court costs. Special costs would not be allowed, on the ground that this point of law had not been raised previously.

With regard to the power house for the District Railway Company it was announced some time ago that the whole of this equipment had gone to the British Westinghouse Company, and this is now confirmed. It is now also stated on the best authority that steam turbines will be used instead of engines of the ordinary reciprocating type. As the generaters are to be 5000 kw capacity, it will be at once seen that the experiment of using steam turbines will be a most interesting one, no turbines approaching that size having ever been constructed. It is stated that recent tests have proven that steam turbines will compare favorably in economy of steam consumption with the best types of compound condensing engines. The great power house at Chelsea which will be thus equipped is doubtless intended to supply others of Mr. Yerkes' electric schemes, and it would appear as if we were on the eve in England of most important electric developments in railway work. Meantime the Metropolitan Company have issued their specifications for their power house, and there appears to be a general impression abroad that Ganz & Company, of Budapest, will succeed in carrying off this contract, which will reward them in some part for the magnificent fight which they put up for the whole electrification of the underground railway. Though nothing definite has yet been given out, it would appear that the great steam railways who have running powers over the underground lines are already making preparation to equip such of their trains as require to run in the Inner Circle, so that the entering edge of the wedge of electric traction as applied to railway work in England will soon have been made, and who is prepared to say just where it will stop.

The Edinburgh Tramways Company has created a mild sensation in the Scottish capital by commencing the regular running of cars on Sunday in the city. It is understood that the number of cars runing will not be so large as on week days, but much will depend on the amount of patronage offered by the public. In Glasgow, when the Corporation was taken to task for running Sunday cars, the promise was made that there would be only a modified service. Very soon, however, the service accommodated itself to the desires of the public, who overcrowded the cars, and led to others being put on the various routes.

Such undoubtedly will also be the result of the Edinburgh innovation, and in the meantime it is interesting to note that the men do not appear to have any objection to the extra day's work as long as they get extra pay.

The Rothesay Tramways Company will shortly commence operations in connection with the conversion of the line to the electric system. It is anticipated that all the work of laying the new rails and fitting the electric power plant will be completed during the winter and early spring months, and that this much-needed improvement will be completed against the opening of the coming season. For several summers the resources of the company have been taxed to the utmost to manipulate the ever-increasing traffic between Rothesay and Port Bannatyne by means of horse haulage, and the introduction of electric traction will be welcomed. The company now proposes to apply for Parliamentary powers to develop their line at both ends. When these two extensions are carried into effect the company will have a through system extending upward of seven miles, which passes through much that is interesting in Bute scenery.

At a recent meeting of the Ipswich Town Council the Parliamentary Bill Committee reported that they had received the award of Sir Frederick Bramwell, Bart., with reference to the purchase of the tramways, under which the sum to be paid by the Corporation to the company for the whole of their undertaking was £17,552. The company at once gave notice to the Town Clerk that they should cease running the trams after the 1st inst. The committee therefore arranged to take possession on that day, and to take over the whole of the company's staff except the secretary, and run cars as the company had done until the wishes of the Council could be ascertained.

The town of Kirkcaldy, in Scotland, is to have electric tramways, and the following contracts have been awarded: British Insulated Wire Company (Ltd.), Prescot, for the overhead construction, amounting to £3,487; the Improved Glow Lamp Company, London, for the are lamp posts, £453, and Cox Walkers (Ltd.), Darlington, for the switchboard and motor generators, £2,746.

At the monthly meeting of Perth Town Council last month the resolution of the Council in Committee agreeing to acquire the Perth district tramways undertaking by arbitration was carried. Mr. Hawtayne, engineer for the Corporation, reported that the expenditure of acquiring the undertaking would be from £40,000 to £50,000. So far as he could gage public opinion it was that the Corporation should have control of the scheme.

At a meeting of Ayr Town Council it was resolved to proceed with the extension of the electric tramways to the Burns Monument, a mile and three-quarters additional, at the estimated cost of £16,000, and the folowing contracts were accepted—D. Murray, Glasgow, permanent way, £7,611; Lorain Steel Company, London, rails and appurtenances, £2,577; Lowdon Bros. & Company, Dundee, overhead equipment, £1,820; Callander & Company, London, cables, £1,292; Hurst, Nelson & Company, Motherwell, five cars at about £600 each. The contractors have agreed to finish their various contracts by April 1.

Birmingham is going to make an attempt to follow London's example, a local leading firm of solicitors having signified that a London syndicate has empowered them to apply to Parliament for powers to construct a number of underground tubes for that city.

A town's meting of the ratepayers and burgesses of Leicester was recently held at the Municipal Buildings for the purpose of passing a resolution sanctioning the promotion of the Tramways Bill in Parliament. The motion to promote the bill, which will involve the expenditure of £650,000 in the next few years, was unanimously carried.

The purchase of the tramways has finally been decided by the Darlington Town Council, and the Tramways Committee are now considering the question of proceeding for powers for £100,000 to carry out the new electrical system. The whole of this money will not be required at once, but it is thought desirable to cover future requirements.

The Romford Urban District Council is applying for powers to construct an electric tramway from the Ilford boundary to Romford. The Metropolitan Tramway now runs to Manor Park, while the East Ham Electric Tramway continues therefrom to Ilford. The latter District Council have decided to construct an electric tramway to Chadwell Heath, so that Romford's proposal will tend to further open up the old market town and bring it in direct tramway communication with the East End of London. A. C. S.

Large Power Station for Manchester

Great interest is being taken in the large electric tramway and lighting station which is now under construction in Manchester, England, and which when completed, will be one of the finest electrical generating stations in the United Kingdom, if not in the world. There will be six cross-compound engines of 3000 ihp, each direct coupled to three-phase generators generating current at 6500 volts. The engines are being built by Messrs. Yates & Thom, of Blackburn, and all of the electrical equipment is being supplied by the Electrical Company, of London, which will use the apparatus of the Allgemeine Elektricitäts Gesellschaft, of Berlin.

The engines are supplied with steam at 160 lbs. per square in., and can work either condensing or non-condensing. The condensing pant is of the barometric type, each engine being provided with electrically driven condensing plant, capable of dealing with the maximum amount of steam used by the engines when working under full load. The condensers are worked by continuous current motors, the power for which, and also for the necessary motors required for driving fans, coal carriers, etc., being supplied by three auxiliary generating sets, each of 230 kw capacity. Each of these sets consists of a high-speed Willans engine, direct coupled to a continuous current shunt wound generator, generating current at 230 volts. The excitation of the three-phase generators is taken off the auxiliary plant bus-bars at starting up, and afterward from two motor generators, each of 75 kw capacity, consisting of an induction motor, driving a continuous current generator. Each of these motor generators is capable of supplying the full excitation current for three of the main generators. The main generators themselves are of the revolving field type.

The sub-station plant comprises thiry motor generators each of 250 kw capacity, eighteen of which will be used for traction and twelve for lighting purposes, and further, ten balancers.

These motor generators will be erected at ten sub-stations.

The traction motor generators consist of synchronous motors, driving compound wound, continuous current gencrators, developing current at 500 volts to 550 volts. These sets are provided with direct coupled exciters. In case of need these sets can also be used as shunt wound generators, supplying current at 400 volts for lighting purposes.

The lighting motor generators consist of synchronous three-phase motors of the same type as for the traction sets, direct coupled to shunt wound, continuous current generators. These continuous current generators are provided with patent equalizers, by means of which the three-wire system is balanced.

Besides these equalizers, each sub-station is provided with a balancer consisting of three-phase induction motor, direct coupled at either end to a continuous current generator of 125 kw capacity, each generating current at 220 volts.

The switchboards in the generating and sub-stations are arranged so that the traction and lighting generators can be quite distinct; at the same time, every provision is made so that any main generator can be used for traction or lighting; any cables can be used for traction or lighting, and in case of need, the traction and lighting can be supplied by one and the same generator through the same cables.

Great care has been bestowed on the design of the high-pressure boards to insure the safety of the switchboard attendants. With the exception of static voltmeters for testing the condition of the insulation, all the instruments on the front of the board are supplied with current at low pressure through switchboard transformers, current transformers, etc. The meters are worked through relays. All high-tension parts are well protected at the back of the board; the insulated handles of the switches protrude through slits in the marble panels.

All high-tension instruments are of the Electrical Company's own make.

Provision is made in all the sub-stations for extending the boards, both high and low tension, for additional motor generators. The low tension boards are designed to take up as small a space as possible, and at the same time to be easily attended.

The main ammeters are of the edgewise type, with back illumination of Messrs. Evershed & Vignoles make, which firm also supplies the illuminated dial voltmeters.

The recording instruments are of Messrs. Elliot Bros.' well-known make. The remaining instruments and the boards will be manufactured by the electrical company.

The station as above described is already being extended by the addition of two 6000 ihp engines and generators, and the sub-stations by forty motor generators, each of 150 kw capacity. This work is also being carried out by the Electrical Company of London.

Changes in the Personnel of the Manhattan Railway Company

The official opening of the Manhattan Railway as an electrically operated system, which occurred two weeks ago, has been followed by a number of changes of considerable importance in the company's officers and staff. Such radical improvements in the mechanical equipment of a road would naturally be followed by certain changes in the personnel of the company, and no exception to this rule has been made in the Manhattan road. Hugh Hazleton, who has been assistant electrical engineer under W. E. Baker, has been made electrical engineer of the company. Mr. Baker, who has held the position of electrical engineer and general superintendent, will have charge of the operating department. M. M. Dorlan, who has been associated with Mr. Baker in his office at 32 Park Place, has been appointed supply agent, vice Ashbel Green, who retired from that position about two months since to go into other business. The office at 32 Park Place has been abolished, all downtown business of the company being transacted at the main office at 195 Broadway, and Mr. Hazleton having his office in the main power station. H. G. Stott, who has been in charge of the work at the new Seventy-Fourth Street power station, and also of the distribution and sub-station work, retains the position of superintendent of motive power, with full charge of the steam and electrical plant at Seventy-Fourth Street. He will be assisted on the steam engineering side by R. D. Tomlinson, until recently assistant engineer of the Ninety-Sixth Street power station of the Metropolitan Street Railway Company. L. B. Stillwell will remain as consulting engineer of the Manhattan Elevated Railway, as well as of the Rapid Transit Subway Construction Company.

Annual Report of the Lake Street Elevated

The annual meeting of the Lake Street Elevated Railroad, of Chicago, was held Jan. 14. The annual report for the year ending Dec. 31, 1901, was presented, and showed a surplus of $6,204 after the payment of taxes and interest on the debenture and first mortgage bonds and the floating debt. This compares with a surplus of $4,752 in 1900, and $3,640 in 1899. The road carried 15,394,036 passengers during the year, or an average of 42,175 per day. In 1900 the total number of passengers carried was 14,617,343, and the daily average 40,048. The company's earnings from operation were $767,795.68, and earnings from other sources $18,666.53. Operating expenses were $388,799, leaving the net

earnings $397,663. The percentage of operating expenses to gross earnings was 49.43, as against 49.95 in 1900. The charges for the year 1901 showed an increase over those for 1900, due to important improvements made during the year.

In the annual report of the president to the stockholders Mr. Knight reviewed the changes in the management and ownership druing the year and made a statement of the improvements on the property. About $70,000 has been spent to establish an express train service for the patrons of the road in the outlying districts, but the opposition of some of the town boards has made it impossible to start this service as yet. The company lost about $15,000 in the revenue it formerly drew from the Harlem race track business on account of the service put in there by the Illinois Central. The by-laws of the company were revised and the annual meeting day was changed to the last Thursday in January. W. W. Miller, of New York, and J. C. Hutchins and Frank Hedley were re-elected directors, and the elections to the board when the property changed hands were confirmed by the stockholders. The report for the year follows:

	1901	1900
Gross	$786,462	$757,954
Operating expenses	388,799	378,661
Net earnings	$397,663	$379,293
Charges:		
Taxes	14,857	13,650
Interest 1st-mtg. bonds	17,262	22,115
Interest debentures	218,355	201,955
Interest floating debt	56,248	37,756
Loop rental	76,970	97,887
Suburban rental	6,000	97,887
Mileage tax reserve	1,767	1,178
Total	$391,459	$374,541
Surplus for year	6,204	4,752
Per cent operating expenses to gross income	49.43	49.95

Street Railway Patents

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

UNITED STATES PATENTS ISSUED JAN. 13, 1902.

690,922. Three-way Railway Switch; W. F. Bossert, Utica, N. Y. App. filed Sept. 20, 1901. Two movable points in each rail are connected with independent slides, and these, in turn, with links attached to the opposite side of a disk, so that when rotating the disk a half-turn one pair of points will be closed and the other open.

690,967. Composite Car Wheel; M. G. Keeran, Bloomington, Ill. App. filed April 24, 1901. A flanged plate having a solid metal hub and wood and metal sections which form the tread extending to the hub.

690,988. Paving Brick for Track Paving and Fastening Purposes; W. H. Nelson, Washington, D. C. App. filed Jan. 17, 1901. A brick constructed to evenly fit the sides of a track rail and also co-operate with the fastenings thereof to thus obviate the tendency of such fastenings to loosen under the vibrations incident to travel.

691,008. Device for Operating Street Railway Switches; W. E. Schilling, Laporte, Ind., and O. M. Ridgway, Kansas City, Mo. App. filed April 25, 1901. A vertical staff fixed in the car platform and having a switch throwing cam at its lower end, and a handle at its upper end.

691,010. Automatic Railway Switch; C. Schwartz, Quincy Township, and W. H. Drittler, Hancock, Mich. App. filed Aug. 27, 1901. Means for locking the switch rails against hand operation, and means for automatically operating the switch rail by a passing train when in such locked condition.

691,086. Elevated Railroad; J. N. Valley, Jersey City, N. J. App. filed April 3, 1901. Structural details of an elevated roadway intended to suspend a car from overhead tracks.

691,095. Brake Beam; J. H. Baker, Allegheny, Pa. App. filed Aug. 17, 1901. A brake beam is strengthened by a tension member whose ends are connected with the beam, and whose middle portion is separated therefrom by a truss. Nuts at the end of the tension member enable the tension to be changed.

691,096. Brake Beam; J. H. Baker, Allegheny, Pa. App. filed Oct. 21, 1901. A modification of the preceding patent, in which the tension member is in two parts linked together at the middle point, where the truss is applied.

691,201. Car Brake; H. S. Stier, St. Louis, Mo. App. filed Oct. 23, 1901. Details.

691,236. Trolley Pole Base; J. D. Bucklay and E. H. Phinney, Brunswick, Me. App. filed April 22, 1901. A hood enclosing the pivoted end of a trolley pole, and its spring is mounted on roller bearings to turn on a table fixed to the car.

691,263. Trolley Fender; H. W. Ham, Lansingburg, N. Y. App. filed April 8, 1901. Details of a spring drum arrangement for controlling the cord.

691,264. Trolley Tender; H. W. Ham, Lansingburg, N. Y. App. filed June 13, 1901. Another arrangement for a similar purpose.

691,275. Trolley Pole Controlling Device for Cars or Vehicles; W. H. Kilbourn, Greenfield, Mass. App. filed April 10, 1901. The trolley cord leads over a weighted pulley placed on an incline, so that when the pole lifts its upward movement will be retarded by the weight of the pulley.

691,313. Bounding Pin and Method of Making Same; C. A. Holdridge, Chicago, Ill. App. filed Nov. 18, 1901. A hollow conical pin intended to fit over the end of the bond, is made in two semi-conical parts.

691,315. Car Fender; E. W. Jeter, Atlanta, Ga. App. filed April 27, 1901. Details.

PERSONAL MENTION

MR. R. W. BLACKWELL, of R. W. Blackwell & Co., of London, reached New York last week on a short business trip.

MR. H. R. GOSHORN, formerly claim agent for the Consolidated Traction Company, of Pittsburgh, Pa., has been appointed claim agent of the Union Traction Company, of Philadelphia.

MR. C. A. BUCH, general manager of the Altoona & Logan Valley Electric Railway Company, resigned his position at the annual meeting of his company on Jan. 13. The office of vice-president was created at this meeting and will be held by Mr. H. J. Crowley.

MR. PATRICK MANION, who has been in the treasurer's office of the Transit Company since its formation, has been appointed paymaster by the company, to succeed F. J. Duffy, who has become associated with the Richmond Traction Company, of Richmond, Va.

MR. R. D. TOMLINSON, who recently resigned from the Metropolitan Street Railway Company to accept a position with the Manhattan Railway Company, was connected with the former company as assistant engineer of the Ninety-sixth Street power station, and not chief engineer as mentioned in last week's issue.

MR. F. A. LAWSON, formerly agent for J. G. Brill Company, resigned from that company on Jan. 1, and Mr. Frank L. Brown has been appointed in his stead. Mr. Brown was formerly agent of the Shelby Steel Tool Company, and his office will be in San Francisco. He is well known in street railway circles, and we extend to him our best wishes for his success.

MR. CHAS. S. DRUMMOND has returned to Europe after a stay of some five weeks in the United States and British Columbia. Mr. Drummond is one of the prominent directors of the British Electric Traction Company, and the purpose of his visit to this side of the water was to inspect the properties of his company, which controls the leading electric traction systems of Vancouver and Nelson, B. C.

MR. JOHN PARKER ILLSLEY, at one time prominently identified with the operation of street railways in Scranton and Brooklyn, and who, for a number of years, was connected with railroad operation in the West, died at his home at New Brighton, S. I., N. Y., Jan. 15. For thirty years Mr. Illsley was connected with the firm of E. W. Clarke & Company, Philadelphia bankers, as consulting engineer. He was president of the construction company that built the Ohio River Railroad, recently sold to the Baltimore & Ohio Railroad Company, and after that he became interested in street railroading. Mr. Illsley was seventy-seven years old.

MR. B. A. MAPLEDORAM, superintendent and purchasing agent of the Suburban Rapid Transit Street Railway Company, of Pittsburgh, who retires from the company Feb. 1, was recently presented with a handsome diamond stud and a watch fob and charm by the employees of the company. Mr. Mapledoram is a civil engineer of wide experience on railway construction, and had complete charge of the reconstruction of the Suburban, with which road he has been connected for over three years. Previous to this position he was in the employ of the Consolidated Traction Company, of Pittsburgh, and had charge of all its track work. Before that time Mr. Mapledoram was connected with a railway construction concern of Johnstown. He was tendered a position with the Pittsburgh Railways Company, the consolidation, but declined. Mr. Mapledoram, however, has not fully matured his plans for the future.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Jan. 22, 1902.

The money market is following out the line of development which it commonly does at this season of the year. Under the influence of the redeposit of funds by interior institutions and large disbursements of the National Treausury for pensions, reserves of the local banks are expanding rapidly, the accumulation of funds exceeds the demand from borrowers, and rates for money are declining in consequence. There can be no uncertainty regarding the course of the market for another month at least. Shipments of gold to Europe have not been as large as expected, and with the abrupt relaxation which has occurred at the foreign centers, sterling exchange has fallen well below the shipping point, and a continuation of the movement is no longer probable. Added to this the suspension of speculative activity in the stock market has restricted the demand for new accommodation to the various syndicates which have not yet completed their several undertakings and are in need of temporary assistance from banking capital. Borrowing for these purposes is not going on, however, on anything like the scale it was a year ago, when enormous issues of new securities to take over railroad purchases were being financed. For these reasons, therefore, there is certain to be a constantly increasing supply of lendable funds during the immediate future, which will keep money quotations down to a purely nominal basis. The position of the foreign exchange is especially noteworthy in view of the common anticipation a month ago that a larger amount of foreign loans made in this country during the summer and fall would mature in January and would have to be taken up. Either Europe, on account of its own easier conditions, has not insisted on the liquidation of these credits, or what is more likely, the surprisingly well-maintained trade balance in our favor has kept down these obligations to a smaller total than had been generally supposed. At all events the American money situation is clearly more favorable now than it has been at any period in the last twelve months. Call loans are made freely on the Stock Exchange at 3½ per cent, while 4 to 4¼ per cent is asked for all time loans maturing within six months.

The Stock Market

The general stock market has fallen into a state of stagnancy which is disheartening to the bright hopes of the speculative contingent a month ago. Various reasons are given why the active buying movement which had been so confidently expected did not materialize. Some people attach the chief importance to the disappointing showing of the United States Steel Corporation for the last quarter of 1901, published early in the month; others to the uncertainty about the outcome of the litigation pending in the Northern Securities Company, and others to the entirely unlooked-for issue of debenture bonds by the Atchison directors. But while these circumstances, both singly and collectively, have unquestionably operated against a better market, the main explanation for the reactionary tendency of the share list lies without any doubt in the cautious temper of the outside public, which is referable far less to any recent occurrences than to their previous conviction that any speculation for the rise starting from the current high range of prices would be dangerous and possibly disastrous. There is still no cause to doubt that the control of the outstanding security supply is lodged in the hands of the strong speculative interests, and that these interests are committed forcibly to the side of improvement. But the public has come to view even this strong technical position with suspicion, and to assume that any rise henceforth would merely be for the purpose of lightening loads which have grown uncomfortably heavy. The situation in brief is that of a market where the wells of speculative enthusiasm have run dry, and where nothing save the continuance of favorable outside factors in the shape of active trade and phenomenal railway earnings prevent a serious break. That any collapse of the sort is impending is, however, altogether unlikely. Stocks of railroad and industrial corporations which were unduly inflated in the era of speculative extravagance a year ago are simply seeking their normal investment level, and in most cases this can hardly be said to be far distant from the quotations now prevailing.

The local traction group have held distinctly better than the rest of the market during the past week. A good deal of interest has been attracted to the hearings on the State franchise tax at Albany, but the slight grounds for believing that the constitutionality of the tax will be denied do not afford any substantial reason for the strength displayed by the stocks. The advance in Metropolitan is plausibly accounted for by the belief that a new issue of the shares is soon to be made which will carry with them valuable subscription rights to the present holders. Manhattan is being picked up quietly but steadily on all concessions by people who are confident in the future of the property and do not believe that its prospective increase in earning power has yet been discounted. The firmness in Brooklyn Rapid Transit appears to be merely sympathetic with the strength of the other members of the group.

Philadelphia

The feature of the Philadelphia traction market continues to be the heavy buying of Union Traction shares. From 33¾ a week ago, the stock rose to 35½ yesterday, with dealings larger than they have been for a long time past. The regular directors' meeting on Monday of this week was awaited with unusual interest, in view of the rumors which had been persistently circulated that a $5 assessment call would be made on the stock. No action was taken on this matter, however, and the favorable inferences which were drawn in consequence appeared to furnish the main inspiration for the rise in the market. Philadelphia Traction, the leased line stock, was sympathetically strong, moving up from 97¼ to 97¾. On sales of 500 shares Railways Company General dropped a half point to 4. American Railways was steady around 44½. Consolidated Traction of New Jersey sold in fractional lots at 68, and a single sale of Consolidated Traction of Pittsburgh, preferred, was reported at 64¼. Sales of bonds comprised Electric People's Traction 4s at 98⅜ to 99, People's Passenger 4s, ex-interest, at 105½, Indianapolis 4s at 86 to 86½, Consolidated of New Jersey 5s at 110¼, United Railways of Pittsburgh 5s at 116, and Easton Consolidated Electric 5s at 105¼.

Chicago

The entire market for Chicago traction securities has taken on a stronger tone during the past week. Dealings have continued light in many issues, not footing up a hundred shares. But the drift of prices has almost unexceptionally been in the direction of improvement. Union Traction common, which sold last Wednesday as low as 10, recovered to 10½, and the preferred held firmly at 47. City Railway rose on what looked to be investment purchases, from 188 to 190. West Chicago was rather heavier than the rest, around 90⅛. Among the elevated stocks South Side sold rather freely in full lots at 105, and later small amounts were bought as high as 107. A single sale of a hundred shares of Northwestern Elevated common was reported at 38. Metropolitan Elevated common on several scattered transactions sold from 40 down to 39⅛, and a few large sales were made in the preferred at 90¾ and 90½. Lake Street was firm at 10¾, after selling at one time as high as 11¼. An official of the road in an interview with our correspondent said: "We are working to a good end, and I think the less said about the property, until we have accomplished our designs, the better. I wish to state, however, that the company is fully as able to meet its increased taxes as the other companies." The remarkable earnings statements of the other elevated lines for December have already been published, but it is worth while noting that the Metropolitan showed a gain of $106,000 over December, 1900, and of more than 100 per cent over the period in 1897, while, as compared with the previous year, the earnings of the Northwestern increased 17.8 per cent, and of the South Side 8.6 per cent. This brilliant record is the best explanation for the rising quotations in the market.

Other Traction Securities

There have been no dealings worth noting this week in the New York curb market for traction specialties. In Boston the Massachusetts Electric issues were particularly strong and active. The common sold up to 35, reacting later to 34, and the preferred rose to 92½, losing only half a point in the subsequent dealings. There was no specific news, apart from the good earnings of the system, to account for the buying. Fractional lots of Boston Elevated sold at 166 and 167, and the West End shares were unchanged at 94½ for the common, and 114 for the preferred. In Baltimore the more favorable sentiment of a week ago regarding the United Railway securitites continues. The failure of the scheme for a rival company caused a rally in the stock to 14¾ and in the income bonds to 68¼. These prices have been maintained during the week. Other Baltimore transactions include Lexington Railway 5s at 102½, Norfolk Railway 5s at 109½ up to 110½, and United Railways of Baltimore 4s at 95½. The latest

sales of the St. Louis Street Railway issues reported from the Western markets were made at 32½ to 33 for the common, and 85½ for the preferred. At the close of last week small lots of New Orleans City Railroad new certificates were sold at 30¼ for the common, and 105 for the preferred. Latest reports of this company's net earnings are unfavorable, showing decrease from last year. No dealings of note occurred in any of the other markets of the West and South. From all quarters comes the information that business in securities, both speculative and investment, is next to nothing. Business on the Cleveland Stock Exchange the latter part of last week was marked by further weakness on the part of the Everett-Moore traction securities. Detroit United sold Saturday at the lowest price yet reached, 58¾ Fifty shares of Northern Ohio Traction common sold at 30, 12½ points below the last sale. The latter stock is not being pressed for sale, however, and only a small block was unloaded at the figure named. Cleveland Electric Railway continues steady at 70, 300 shares going at this figure Monday. Repeated rumors that the bankers' committee is considering a proposition to sell Detroit United stock to Detroit and Chicago parties at a figure between 55 and 60 caused increased activity of this stock yesterday. One hundred shares sold at 58, 100 at 57¾, 100 trust certificates at 57¾, 150 shares at 57½ and 350 shares at 57¼.

Security Quotations

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

	1902 Closing Bid Jan. 14	Jan. 21
American Railways Company	44¼	44
Boston Elevated	167	166
Brooklyn R. T.	63⅜	65½
Chicago City	187	190
Chicago Union Tr. (common)	10⅛	10½
Chicago Union Tr. (preferred)	47	47¼
Cleveland City	112	a112
Cleveland & Eastern	31	a30
Cleveland Electric	70	70½
Columbus (common)	39	39
Columbus (preferred)	90	90
Consolidated Traction of N. J.	67	67
Consolidated Traction of N. J. 5s	109	109
Consolidated Traction of Pittsburgh (common)	22½	23
Consolidated Traction of Pittsburgh (preferred)	..	64¼
Detroit United	60	57¾
Detroit United Certificates	61½	57
Electric-People's Traction (Philadelphia) 4s	98¼	98⅜
Elgin, Aurora & Southern	37	a37
Indianapolis Street Railway	46	46
Indianapolis Street Railway 4s	87½	87½
Lake Street Elevated	10¾	10½
Louisville (common)	..	..
Louisville (preferred)	..	..
Manhattan Ry.	136½	135⅝
Massachusetts Elec. Cos. (common)	34	34
Massachusetts Elec. Cos. (preferred)	91½	91½
Metropolitan Elevated, Chicago (common)	40½	39⅛
Metropolitan Elevated, Chicago	90¼	90¼
Metropolitan Street	160¼	167⅝
New Orleans (common)	28½	30¼
New Orleans (preferred)	104½	105
North American	90	88
Northern Ohio Traction (common)	42½	a30
Northern Ohio Traction (preferred)	88¼	..
North Jersey	22	22
Northwestern Elevated, Chicago (common)	37¼	38
Northwestern Elevated, Chicago (preferred)	86	86
Philadelphia Traction	97¼	97½
Rochester (common)	42	42
St. Louis Transit Co. (common)	33¼	32
South Side Elevated (Chicago)	a107½	105
Syracuse (common)	21	21
Syracuse (preferred)	52	61
Third Ave.	121¼	123
Twin City, Minneapolis (common)	109	108½
United Railways, St. Louis (preferred)	86	85
United Railways, St. Louis, 4s	89¼	89
Union Traction (Philadelphia)	34⅛	35⅜

* Ex-dividend (a) Asked.

Iron and Steel

The latest statistics of production and consumption indicate no change from the favorable conditions in the iron industry. According to the *Iron Age*, the weekly output of the pig-iron furnaces at the opening of January was 291,992 tons, and yet in face of this enormous tonnage, stocks on hand had not increased during December. In fact, had it not been for the deficiency in transportation facilities which hindered the delivery against orders, there would have been a decrease in reserve supplies last month. The striking feature outside of this strong position is the increasing competition, especially on the part of German and English steel and steel rail makers. Over half of a 105,000-ton order for rails by the Mexican National Railroad, placed this week, went to German concerns, and it is stated that English interests may get a good part of the remaining half. That we should be importing steel, whereas, up to a year ago, we were large exporters, is an astonishing change in the situation; yet it is explained, not by weakness or inflated prices in the American market, but simply by the inability, temporarily, of American production to cope with the home demand.

Quotations are $16.50 per ton for Bessemer pig, $27.50 for steel billets, and $28 for steel rails.

Metals.

Quotations are as follows: Copper, lake, 11⅛ cents; tin, 23¾ cents; lead, 4 cents; and spelter, 4.35 cents.

WASHINGTON, D. C.—Pursuant to the agreement for the reorganization of the Washington Traction & Electric Company, a call has been made upon the depositing stockholders under said agreement for the payments required from such depositing stockholders in order to purchase stock of the new company. Such payments are to be made to the United States Mortgage & Trust Company, New York City, for the account of the committee, at the rate of $3 per share of stock deposited on Feb. 3, 1902; $3 for each such share on March 17, 1902, and $3 for each such share on May 1, 1902, making a total payment of $9 for each share of stock deposited, for which the depositing stockholders will be entitled to receive voting trust certificates for shares of the preferred and common stock of the new company at the rate of $9 in preferred stock and $30 in common stock for each $9 paid.

AMHERST, MASS.—The stockholders of the Amherst & Sunderland Street Railway Company have voted to adopt the suggestion of the Railroad Commissioners regarding the proposed issue of bonds, and will refund a previous issue of $21,500 and consolidate with it $30,000 of floating indebtedness in a new issue of $51,500. The application of the company is now before the Railroad Commissioners.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company has declared a regular semi-annual dividend of 2 per cent on the common stock, payable Feb. 15. The policy in regard to dividends on the common stock in future will be to make them quarterly instead of semi-annual.

CLEVELAND, OHIO.—The Eastern Ohio Traction Company will be the title of a new corporation formed by the combination of the Cleveland & Eastern, Cleveland & Chagrin Falls and Chagrin Falls & Eastern Railways. The capital stock is fixed at $2,500,000.

CLEVELAND, OHIO.—The Cleveland, Elyria & Western Railway Company has declared a quarterly dividend of ¾ of 1 per cent.

MANSFIELD, OHIO.—The Citizens' Street Railway has filed a mortgage for $400,000 in favor of the Cleveland Trust Company. The mortgage is to cover bonds to the same amount issued for the purpose of building the Mansfield-Shelby line (already completed), for making improvements to the present system and for refunding outstanding bonds. The issue is payable April 1, 1923, and bears interest at 5 per cent.

AKRON, OHIO.—The Northern Ohio Traction Company, one of the Everett-Moore properties, has made the following comparative statement of its business for 1900 and 1901. Gross earnings for 1900, $513,724; 1901, $617,010; operating expenses, $317,475 and $350,844; net earnings, $196,249 and $366,166; surplus for stock, $86,858 and $130,000.

JOHNSTOWN, PA.—Application has been made for the appointment of a receiver for the Johnstown Passenger Railway Company. The suit is filed by a minority stockholder, and is the result of an effort of new interests to increase the capital of the company from $800,000 to $2,000,000. The applicant prays for an injunction restraining the officers or directors from disposing of any more of the new stock.

TITUSVILLE, PA.—It is reported that the property of the Titusville Electric Traction Company has been purchased in the interest of persons identified with the Crawford County Electric Street Railway Company, recently incorporated. It is said that the plan is to extend the lines to Meadville.

TORONTO, ONT.—The annual meeting of the Toronto Railway Company was held a few days ago. The most important event was the retirement of F. Wanklyn and C. E. L. Porteous as directors and the election of Frederick Nicholls and H. M. Pellatt, of Toronto, as their successors. The gross earnings amounted to $1,661,017.50, as compared with $1,501,001.28 of the previous year, showing an increase of $160,016.22 in the company's business during the year. The percentage of operating expenses to earnings was 51.6 per cent, as compared with 51 per cent for the previous year, and the total expenditure on capital account during the year amounted to $331,743.97. During the year the company paid to the city of Toronto, under the terms of the franchise, the sum of $226,453, as compared with $204,383.81 last year, and in addition thereto the company paid the provincial tax levied under the Revenue Act. The operating expenses showed an increase of $81,631.28 over the previous year, and the net earnings were $78,384.94 more than the previous year. The passengers carried were 39,848,087, or 3,786,220 more than in 1900. There were 13,750,038 transfers given, which shows an increase of 1,179,334 over the preceding year. A comparison of the statements of 1901 and 1900 follows:

	1901	1900
Gross earnings	$1,661,017.50	$1,501,001
Operating expenses	857,612.10	775,980
Net earnings	803,405.40	725,020
Passengers carried	39,848,087	36,061,867
Transfers	13,750,038	12,570,704

TABLE OF OPERATING STATISTICS

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

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., Dec. '01	53,384	*30,968	22,516	13,259	9,257
	1 " " '00	38,395	*22,089	16,306	5,148	11,158
	9 " " '01	462,800	263,361	199,439	98,973	100,466
	9 " " '00	387,972	241,782	146,190	109,786	36,404
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	513,725	*317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., Dec. '01	125,315	89,888	35,427	21,373	14,055
	1 " " '00	118,235	81,121	37 114	19,901	17,213
	6 " " '01	751,363	498,413	252,950	123,017	129,933
	6 " " '00	713,763	474,083	239,680	119,830	119,850
AUGUSTA, GA.						
Augusta Ry.& Elec.Co.	1 m., Oct. '01	18,031	10,012	8,019	------	------
	1 " " '00	15,772	9,668	6,104	------	------
	10 " " '91	169,950	102,279	67,671	------	------
	10 " " '00	157,049	91,785	65,264	------	------
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Dec. '01	18,240	7,310	10,930	------	------
	1 " " '00	16,633	7,201	9,432	------	------
	6 " " '01	113,390	55,932	57,459	30,890	26,569
	6 " " '00	100,222	49,453	50,769	28,626	22,143
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept.'01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept.'01	5,778,133	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., Nov. '01	997,813	*730,840	266,973	------	------
	1 " " '00	942,018	*627,959	314,059	------	------
	5 " " '01	5,498,520	*3762359	1,736,161	------	------
	5 " " '00	5,159,930	*3229484	1,930,446	------	------
	12 " June '01	12,135,559	*7216008	4,919,551	4,341,748	577,803
	12 " " '00	11,768,550	*7106373	4,662,177	4,135,405	526,772
BUFFALO, N. Y.						
International Tr. Co.	1 m., Nov. '01	283,710	174,195	109,515	93,399	16,116
	1 " " '00	239,439	124,599	114,841	80,941	33,900
	5 " " '01	2,761,503	1,203,882	1,557,621	501,533	1,056,088
	5 " " '00	1,271,327	593,798	677,529	405,492	272,038
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Nov. '01	12,041	5,804	6,237	------	------
	1 " " '00	9,781	5,604	4,177	------	------
	11 " " '01	159,453	68,234	91,218	------	------
	11 " " '00	131,065	53,940	77,125	------	------
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	------	------
	12 " " '00	757,954	378,661	379,293	------	------
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., Dec. '01	4,306	* 2,420	1,886	1,380	506
	1 " " '00	4,040	* 2,477	1,563	1,417	146
	12 " " '01	47,976	*32,002	15,974	13,023	2,951
	12 " " '00	49,646	*33,272	16,374	13,294	3,080
Cleveland & Eastern	1 m., Dec. '01	7,473	*3,565	3,908	3,545	363
	1 " " '00	5,171	*3,731	1,440	3,232	†1,792
	12 " " '01	90,390	52,022	38,368	43,678	†4,310
	12 " " '00	62,893	36,672	26,221	36,148	†9,927
Cleveland El. Ry. Co.	1 m., Dec. '01	199,688	107,770	91,918	21,705	70,213
	1 " " '00	185,455	101,437	84,018	19,475	64 543
	12 " " '01	2,296,898	1,265,953	1,030,945	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., Dec. '01	19.406	11,098	8,309	7,770	538
	1 " " '00	16,023	9,401	6,622	3,228	3,395
	12 " " '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,698	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Dec. '01	11,920	*6,681	5,239	6,042	†803
	1 " " '00	9,926	*7,084	2,842	6,042	†3,960
	12 " " '01	164,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*89,592	71,520	72,500	†980
DENVER, COL.						
Denver City Tramway Co.	1 m., Nov. '01	118,863	64,838	54,024	32,437	21,588
	1 " " '00	109,768	60,858	48,911	31,607	17,303
	11 " " '01	1,374,784	750,850	623,934	350,749	273,185
	11 " " '00	1,187,728	664,007	523,721	343,229	180,501
DETROIT, MICH.						
Detroit & Port Huron Shore Line	1 m., Nov. '01	27,979	17,447	10,532	9,466	1,066
	1 " " '00	25,039	16,921	8,118	9,692	------
	11 " " '01	355,195	206,052	149,143	106,163	42,980
	11 " " '00	262,800	151,503	111,297	71,623	39,674
Detroit United Ry.	1 m., Dec. '01	271,441	*153,404	118,037	61,781	56,756
	1 " " '00	239,321	*129,101	110,220	57,120	53,100
	12 " " '01	2,919,171	*1596765	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Rapid Ry.	1 m., Dec. '01	30,984	* 17,678	13,306	9,692	3,614
	1 " " '00	27,873	* 18,735	9,138	9,692	† 554
	12 " " '01	386,624	* 223,730	162,894	116,300	46,954
	12 " " '00	290,678	* 170,237	120,436	81,315	39,121
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Dec. '01	40,541	25,042	15,499	9,219	6,287
	1 " " '00	37,211	23,239	13,973	8,929	5,044
	12 " " '01	453,704	251,315	202,389	109,967	92,422
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Dec. '01	17,779	12,421	10,550	1,871	------
	1 " " '00	26,439	18,122	8,317	------	------
	6 " " '01	193,723	98,181	95,542	63,300	32,242
	6 " " '00	163,630	103,644	59,986	------	------
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Dec. '01	25,309	14,781	10,528	7,500	3,028
	1 " " '00	24,744	14,339	10,405	7,500	2,905
	12 " " '01	337,741	182,954	154,787	90,000	64,787
	12 " " '00	294,907	154,465	140,542	90,000	50,542
LONDON, ONT.						
London St. Ry. Co.	1 m., Dec. '01	12,947	6,280	6,667	1,859	4,808
	1 " " '00	11,043	5,324	5,719	1,682	4,037
	12 " " '01	141,846	84,557	57,289	23,835	33,454
	12 " " '00	119,109	78,501	40,608	21,624	18,985
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt.	1 m., Dec. '01	243,927	105,659	138,267	67,162	71,105
	1 " " '00	209,887	97,987	111,900	69,742	42,158
	12 " " '01	2,442,342	1,185,534	1,256,808	755,139	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	824,665	266,247
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Nov. '01	268,517	114,444	154,072	58,350	95,722
	1 " " '00	239,713	109,477	130,235	51,965	78,270
	11 " " '01	2,879,635	1,301,345	1.578,289	619,787	958,502
	11 " " '00	2,582,536	1,199,984	1,382,551	577,622	804,929
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Dec. '01	158,196	105,607	52,589	15,185	37,404
	1 " " '00	148,637	96,736	51,901	9,220	42,681
	3 " " '01	479,169	287,307	191,862	44,536	147.326
	3 " " '00	455,530	278,805	176,724	28,018	148,707
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Sept. '01	2,284,565	1,312,130	972,434	632,350	340,084
	3 " " '00	2,081,964	1,236,711	845,253	626,925	218,328
	12 " " '01	10,455,872	5,328,649	5,127,223	2,682,132	2,444,091
	12 " " '00	9,950,735	5,195,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., Sept. '01	3,750,285	1,563,260	2,187,025	1,148,714	1,038,311
	3 " " '00	3,608,306	1,555,036	2,053,270	1,128,985	924,285
	12 " June '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
	12 " " '01	14,437,134	6,631,254	7,805,880	4,445,720	3,360,160
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m., Nov. '01	4,200	2,044	2,156	1,146	1,010
	1 " " '00	3,934	2,392	1,541	1,597	------
	5 " " '01	25,876	11.077	14,799	7,160	7,640
	5 " " '00	23,837	11,005	12,852	7,276	5,555
PITTSBURG, PA.						
Consolidated Traction	1 m., Nov. '01	296,588	126,215	170.373	88,792	81,581
	1 " " '00	263,540	106,588	156,952	89,526	67,426
	8 " " '01	2,344 887	1,004,710	1,340,178	718,118	622,060
	8 " " '00	2,194,256	904,171	1,290,085	709,897	580,188
PHILADELPHIA, PA.						
American Railways	1 m., Dec. '01	82,270	------	------	------	------
	1 " " '00	68 201	------	------	------	------
	6 " " '01	501,217	------	------	------	------
	6 " " '00	441,226	------	------	------	------
RICHMOND, VA.						
Richmond Trac. Co.	1 m , Sept. '01	20,991	15,669	5,322	3,196	2,126
	1 " " '00	20,727	10,770	9,957	3.843	6,115
	12 " " '01	218,569	139,542	79,027	38,618	40,410
	12 " " '00	203,057	108,198	94,859	37,608	57,250
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Nov. '01	85,925	44,963	40,962	25,062	15,900
	1 " " '00	82,225	48,997	33,228	24,229	8,999
	5 " " '01	428,781	232,399	196,382	124,846	71,536
	5 " " '00	405,918	244,182	161,736	120,760	40,975
SCRANTON, PA.						
Scranton Ry. Co.	1 m., Oct. '01	2,638	29,300	adf26661	------	------
	1 " " '00	48,781	34,787	13,993	------	------
	10 " " '01	507,989	295,079	212,910	------	------
	10 " " '00	504,852	298,122	206,730	------	------
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Dec. '01	63,471	34,374	29,097	19,025	10,072
	1 " " '00	58,365	31,122	27,243	18,606	8,636
	6 " " '01	346,670	188,286	158,384	114,096	44,288
	6 " " '00	304,930	166,236	138,693	111,754	26,939
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Dec. '01	126,379	*63,632	62,747	37,813	24,934
	1 " " '00	111,847	*53,435	58,412	34,271	24,141
	12 " " '01	1,311,084	* 636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	* 616,945	565,572	409,051	156,521
W. NEW BRIGHTON, S. I.						
Staten Island El	1 m., Dec. '01	15,080	11,916	3,163	8,559	df.+5,396
	1 " " '00	13,177	11,237	1,940	8,333	†6,394
	6 " " '01	125,977	88,229	37,749	52,774	†15,025
	6 " " '00	120,277	76,395	43,882	52,348	† 8,466

NEWS OF THE WEEK

CONSTRUCTION NOTES

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company, as previously stated, has many improvements in contemplation, and is now doing considerable work. The Bessemer line is being relaid with 70-lb. steel, as well as the old Powderly line from Powderly to Bessemer. This is in all 20 miles of track. The East Lake line, 7 miles long, is also being relaid with 70-lb. rail. When this is complete there will be a line put on from Bessemer to East Lake, 20 miles, which will be operated like a trunk line. The company is double tracking for five blocks on Twenty-First Street, the new rail being 70 lbs. and the old being replaced with the same weight. New rolling stock has also been bought. The company is doubling the capacity of the electric light in Birmingham, and a new plant is being put in at Bessemer. The cost of the power station improvement alone will aggregate about $450,000. The capacity of the gas plant is also to be increased and the mains extended, at a cost of $100,000. The total outlay will be about $1,600,000.

ENSLEY, ALA.—The Steel Cities Railway Company has been reorganized, and the construction of the road is practically assured. A line from Birmingham to Ensley is to be built, one from Ensley to an undetermined point, and one from Ensley to Brookside. The first line will be 6 miles long, the second 8, and the third 6. It is given out as a certainty almost that the Birmingham-Ensley line will be built within a short time, if not the others. The directors of the company are: J. W. Minor, of Ensley; J. B. Stagg, Pratt City; R. R. Zell, S. E. Thompson, J. R. Adams, of Birmingham. The estimated cost of constructing the line is said to be $750,000.

GADSDEN, ALA.—The Gadsden, Alabama City & Attalla Railroad has been granted franchises for the construction of a number of lines here.

SAN FRANCISCO, CAL.—The North Shore Railroad Company has been incorporated by the Colgate-Martin syndicate as the successor of the North Pacific Cost Railroad, which recently passed into the control of the syndicate. As previously stated, the road will be rebuilt and equipped with electricity. The plan is to convert it into a standard-gage line, double tracking it in addition. The capital stock of the company is $6,000,000, of which $90,000 has been subscribed.

VALLEJO, CAL.—The Council has adopted an ordinance granting J. W. Hartzell and H. F. Hartzell a franchise for the construction of an electric railway here.

OAKLAND, CAL.—The Oakland Transit Company plans the connection of its local lines with Point Richmond; also the extension of the San Pablo Avenue line from West Berkeley to the Santa Fe terminal. The acquisition of the McDonald-Henshaw franchise, which gives the company the right to build from the Alameda County line to Point Richmond, make possible the building of a line over this route at once.

REDLANDS, CAL.—The Redlands Street Railway Company is laying out a 40-acre park on San Bernardino Avenue. The company will extend its lines west on San Bernardino Avenue to the city limits. The company has recently completed a branch of 2½ miles to the County Club. Two Brill cars modeled after the standard Metropolitan car have recently been added to the company's equipment.

SAN JOSE, CAL.—Satisfactory progress is being made with the electrification of the Alum Rock Railway, now owned by the San Jose & Santa Clara Railway. The road is about 7½ miles long. The company is building a storage-battery station. All the contracts for material have been awarded.

ROME, GA.—The City Electric Railway Company proposes to extend its lines from Mobley to Lindale, a distance of about 3 miles. The plan of the company is to remove its power house to Mobley.

BELLEVILLE, ILL.—The St. Louis & Belleville Electric Railway Company will shortly begin building an addition to its power house.

CHICAGO, ILL.—One of the important questions that will be considered at the annual meeting of the Northwestern Elevated Railroad, to be held Jan. 29, is the extension of the system to Ravenswood. The company, by its issue of bonds, has sufficient money on hand to finance this improvement, it is believed, without raising more funds.

ALTON, ILL.—The annual meeting of the stockholders of the Alton Railway & Illuminating Company, of Alton, was held Jan. 13. Joseph A. Porter was again elected president and treasurer of the company. Many extensions of the system will be made this year. The first improvement will be the construction of a line to East Alton.

WINCHESTER, IND.—The Dayton & Northern Traction Company has accepted the franchise recently tendered in this city, and which provides that the work of building a line from Columbus, Ohio, to Indianapolis, by way of this city, shall begin during the present year and be completed within a period of two years. However, the company expects to complete the work this year if material can be obtained. The work will be divided in three sections and prosecuted simultaneously. The company is now operating from Dayton to Greenville, Ohio.

DANVILLE, IND.—The Hendricks County Commissioners have granted a franchise to C. F. Smith, president of the Martinsville Company, to build an electric railway between Plainfield and Danville. A $5,000 bond was filed to complete the line this year. Mr. Smith has asked for franchises through Marion and Morgan Counties. A branch of this line will be run between the Union Stock Yards at Indianapolis to Plainfield, and another from Mooresville to Plainfield. The power house at Mooresville is expected to furnish power to the Danville system, as well as the Martinsville line.

LAPORTE, IND.—The Chicago & South Shore Electric Railway Company has been organized to construct an electric railway between this city and Michigan City, and ultimately to Chicago. W. C. Burns, of Chicago; J. J. Burns, Charles Burns and G. K. Ripley, of Goshen; C. H. Holmes, of Green Bay, Wis.; Lemuel Darrough and E. F. Michael, of Laporte, are interested in the project.

RICHMOND, IND.—The City Council has granted a franchise to the Hamilton, Eaton & Richmond Traction Company. Work to begin by July, and the line must be completed within a year. The Eastern Indiana Company has also been granted a franchise. This company will build to Portland and other points north. The petitions have been before the Council for some time.

FRANKLIN, IND.—The Commissioners have granted a franchise to the Indianapolis, Nashville & Southern Transit Company to build a line through the western part of Johnson County.

GOSHEN, IND.—The Northern Indiana Traction Company announces that the construction of the Goshen-Angolia electric line will be begun at once.

WASHINGTON, IND.—Surveys are now being made for an extensive electric railway system to connect Evansville, Princeton, Vincennes, Petersburg, Washington and other places. Illinois and Indiana capital is said to be behind the project, and two companies are reported to have been organized to carry the project to completion.

BALTIMORE, MD.—The first branch of the City Council has adopted the report of the committee on city passenger railways, advising against the granting of a franchise to the Maryland Electric Railway Company. The Maryland Electric Railway Company is backed mainly by Philadelphians, and its efforts to secure franchises have agitated the city for some months past. If the franchises had been obtained the company would have become a competitor of the United Railways & Electric Company, now operating all the lines in the city.

COVINGTON, KY.—An electric railway is planned to be constructed from Covington through Ludlow, Bromley and Constance to Petersburg and Split Rock, where it is proposed to establish a summer resort. From Petersburrg the main line is to run through Hebron, Burlington, Erlanger and Alexandria, and from there back into Covington. This will make practically a belt line of two counties. The territory embraced by this proposed line is largely given over to farming.

MAYNARD, MASS.—The Maynard, Acton & Lowell Street Railway Company, during the next six months, expects to build between 14 and 20 miles of new line. The company will also build an addition to its car house, and expects to purchase 1000 hp in boilers and generators. Open and closed cars will also be purchased.

JACKSON, MICH.—The Hawks-Angus syndicate has its franchises and right of way practically all secured for the proposed line from Jackson to Coldwater, and work will be begun on the line in the spring.

SAGINAW, MICH.—It is stated that all the franchises have been secured for the proposed electric railway to connect Saginaw and St. Johns, extending through St. Charles. The road will connect with the Lansing, St. Johns & St. Louis Railway. G. W. Emerich, of Saginaw, is the principal promoter.

LANSING, MICH.—The Gordon Traction Company is securing right of way and franchises for its proposed road from Battle Creek to Lansing. It is claimed the road will be built during the coming season.

LANSING, MICH.—The Michigan Suburban Railroad Company has been incorporated under the laws of the State of Michigan, for the purpose of operating the railway from Lansing to St. Johns, recently built by the Lansing, St. Johns & St. Louis Railway Company. This road was built for an electric line, but will be operated temporarily, at least, by steam, and the organization of this company under the general railroad law was made necessary in order to make satisfactory contracts with the connecting steam roads.

ST. LOUIS, MO.—One hundred new cars have been ordered by the St. Louis Transit Company for the Broadway line. They will be completed by May 1, by which time the new power house on Salisbury Street will have been finished and sufficient power provided to operate the increased number of cars. The new cars are all for summer service. The seating capacity of the cars will be sixty persons. They are being built in St. Louis.

ST. JOSEPH, MO.—The construction of the Kansas City & St. Joseph Electric Railway, the preliminary arrangements for which have been made, is to be begun in the early spring. The new road is to extend between Kansas City and St. Joseph, a distance of 54 miles, and a bridge is to be built across the Missouri River at Kansas City. Connections will be made with the lines of the Metropolitan Street Railway Company of Kansas City.

ST. LOUIS, MO.—The St. Louis, Hillsboro & Southern Railway Company has filed with the County Court at Clayton a petition for a franchise for a road to run south through St. Louis County, Jefferson County and "other counties in the State," without fixing a definite terminus.

ST. LOUIS, MO.—An extension of the franchise of the St. Louis, Fenton & Southwestern Railroad, which expired Jan. 1, 1902, has been granted until Jan. 1, 1903, provided $500 is paid into the county treasury before July 1, 1902.

BUTTE, MONT.—The Butte Electric Railway Company has purchased 15 acres of land adjoining Columbia Gardens, its park, and will erect thereon a grandstand and bleachers, laying out the land for outdoor sports.

HADDONFIELD, N. J.—The Five-Mile Beach Electric Railway Company has been incorporated for the purpose of constructing an electric railway on the Five-Mile Beach, in Cape May County, as well as other sections of the State. The authorized capital of the new company is $200,000, and the amount with which it begins business is $25,000. The incorporators of the company are: Henry D. Moore, Frederick Sutton, William G. Moore and J. Fithian Tatem, of Haddonfield.