





however, to see any benefit in any of these proposed changes, while certain disadvantages are apparent in each. The first suggestion is to improve the car service on the lines east of Madison Avenue and west of Broadway to attract travel from the latter thoroughfare. The trouble with this, in our opinion, is that the Third Avenue line is now carrying as many passengers as it can handle, while the Second Avenue line, besides being inconvenient of access in the northern and central parts of the city, has now reached the practical limit of its carrying capacity as far as its present downtown terminal on Center Street is concerned. This street and Third Avenue constitute practically the only available routes below Canal Street on the East Side in downtown New York. Nor is any relief to be expected from the Sixth Avenue line below Canal Street so long as the present traffic congestion on West Broadway is allowed to continue. Mr. Vreeland, in discussing this matter at the last hearing, said that when a Sixth Avenue car went below Fourth Street the company practically said good-by to it until they saw it again, as the delays were so frequent on that line that it was uncertain when the car would return.

The proposed change at Thirty-Fourth Street, that of running the Broadway cars up Sixth Avenue from that point and down Sixth Avenue below that point, and the extension of the Broadway route east and west on Fifty-Ninth Street, also seem illusive. The latter plan is made practically prohibitive by the present number of cars on Fifty-Ninth Street, which is an extremely narrow thoroughfare, especially between Fifth Avenue and Madison Avenue. On the other hand, the present demand for a through line on Broadway, the natural artery of the city, is perhaps nowhere so strong as in the center of the business or theater district at Thirty-Fourth Street. It seems evident, therefore, that however desirable would be the elimination of the present triangular crossing at Thirty-Fourth Street the number of passengers who would insist on a transfer at that point, if the new plan were to come into effect, would nullify all benefits derived from the elimination of the crossing. The truth of the matter is that the travel above and below Thirty-Fourth Street on both Broadway and Sixth Avenue follows naturally those avenues, due, possibly, to the fact that there has been a through street car line on Sixth Avenue for forty years and on Upper Broadway for nearly the same length of time. Business conditions and locations have become largely fixed by these facts, and the greatest amount of inconvenience would result from any such radical change in routing cars, in this case as in many others. Taking up the final recommendation in regard to routing cars, no practical advantage would seem to result either from the suggestions to turn the Lexington Avenue cars into Fourth Avenue at Fourteenth Street, as that line is also crowded at that point, and the Twenty-Third Street and Madison Avenue crossing would be as troublesome as it was before.

### Proposed Changes in Operating Methods

We have already in a previous issue discussed the proposed regulations on the subject of transfers and vestibules, but there are one or two other suggestions made in the direction of operating practice which are, if anything, more absurd than the plan of enclosing the motorman in a vestibule under the abnormally crowded conditions which exist on New York streets or of giving transfers at every point, which would throw more travel on the lines like the Broadway lines, which are congested at present. One of these is the proposition to have two conductors on every car during the rush hours and on all of the long cars at all hours. A plan of this kind, we believe, is not only unnecessary, but would tend to be productive of serious

accidents. The entire theory of street railway operation depends upon the control of the car by one man, and we believe that with two conductors on a car, even if a strict division of their duties was formulated, there would be a division of responsibility that could not but have disastrous results.

Experience has shown this to be the case, because while no street railway company, so far as we know, has ever regularly attempted the operation of cars with two conductors, a number of bad accidents have occurred through the voluntary assistance of an employee who happened to be riding on a car and who has attempted to assist the conductor, but has given the signal to start at the wrong time. The result is that many railway companies have found it necessary to pass a rule requiring all employees riding on cars, but not regularly engaged in operating the car, to remain inside of the car and not to touch the bell under any consideration. In this way only can the possibility of a question as to a division of responsibility for the operation of the car be eliminated.

### The Regulation of Traffic

The demand for police regulation of trucking and traffic on the streets through which the lines are operated is, we believe, the most desirable suggestion made by the association, and with the removal of obstructions of all kinds from the public portions of the streets will do more than anything else to improve the service conditions in New York. Such regulation, however, to be effective must be efficient and should have the hearty co-operation of the city magistrates if any good is to be expected from it. The farcical administration of rules of this kind by which every complaint is dismissed, as has been the case during the past two years, makes a regulation of this nature worse than useless. The entire responsibility for the regulation of street traffic should, in our opinion, be vested in the police commission, or other active head of the police force, who should be held accountable for all street obstructions and whose duty it should be to see that the streets are made passable for all street traffic.

### Sanitation and Standing in Open Cars

The two final recommendations made by the association relate to the sanitary condition of the cars and the present practice of permitting passengers to stand between seats in open cars. The latter has certain grounds of reason, but until the nature of the average American citizen, who insists on riding on the first car which comes along, is changed, we think that there would be difficulty about enforcing a regulation of this kind. The New York companies have so far been successful in keeping passengers in open cars off the running board, although this practice is permitted in most cities; but to keep them off the cars altogether when they want to ride is an entirely different proposition.

The practicability of the suggestions made on the sanitary condition of the cars have not yet been disclosed. We believe that all railway men will be greatly interested in any recommendations of this character made by the association, but we sincerely trust that such as require any material modifications from recognized principles of car construction will be submitted to some car builder or other expert as to the practicability of the reform suggested before they are presented to the Railroad Commission. Contrary to what might appear at first sight, a street car, as well as a steam car, is one of the hardest structures to ventilate properly, and a careful study of the entire subject of the best methods of securing proper ventilation and cleanliness in cars would be most valuable if the remedies proposed are along practical lines.



## Growth of Chicago Traffic

That portion of the Arnold report on the Chicago transportation problem which is summarized in this issue contains much valuable data upon the growth of the traffic, and is particularly interesting as indicating the requirements that will have to be anticipated and the service that must be provided for not only in the immediate future, but for a long period, if permanent relief is to be afforded. The growth of population and traffic in Chicago is taken up in a very scientific way, with an effort to determine what the future probable growth of Chicago will be for fifty years. Curves are obtained and averaged from several of the largest cities of the world, showing growth of population, and a "law of decrease of the rate of population increase" is derived from these curves and applied to Chicago, but the author of the report is forced to admit that it is not safe to assume any definite figures as to the growth of the city, even by the application of this law, which is useful mainly in determining between what limits the population would probably land in fifty years. As to variation from year to year, it is shown that business conditions have a greater influence on the traffic than growth of population for two or three-year periods. The report makes a general outline of a new reorganized street railway system for the city of Chicago under one management. Two plans for subway terminals in the downtown districts are submitted. It is not considered possible to put all street railway tracks underground in the downtown district, because sufficient terminal capacities cannot in that way be provided for all time. A system of high and low level subways, if installed at once, would put off the necessity of tracks on the surface in the business district to a large extent for several years. One subway plan provides for both high and low level subways and terminal loops on the surface ultimately. The other subway plan is for a system of high-level subways only, in connection with which surface terminals would be used from the first.

Throughout the entire discussion of the different subway plans the author has carefully considered the practical working of each plan so far as it will affect the possibility of misuse of transfers, and the double-level subway plan is particularly recommended as avoiding all danger of possible fraud against the companies from this cause. The discussion on this subject by the author will be given more fully in the third instalment of the synopsis of the report, which will be published in our next issue. But the fact that this feature was so carefully considered is an excellent testimonial to the care taken by Mr. Arnold and the experts associated with him in the preparation of the report to give full weight to practical operating conditions.

The electric conduit system is considered feasible for Chicago without remodeling the present sewer systems. The flooding of the cable conduits at present is ascribed to insufficient connection between the cable conduits and the sewers and the clogging up of what few connections there are. The construction of most of the Chicago cable track and conduit is not heavy enough to permit of its being changed to an electric conduit system over which 25-ton electric cars could be operated. The danger from electrolysis with good construction is considered as largely overcome and not as serious as it was ten years ago, and where track has been laid in recent years in Chicago the difficulties from electrolysis are thought to be overcome to as great an extent as modern practice demands.

The present congestion on the Union Elevated loop is shown to be due to lack of length of the station platforms, which can be easily remedied. The ultimate capacity of the loop would

depend on the junction points where trains enter and leave the loop. After the junction point capacity has been reached, separate stub-end terminals for each road can be provided. Operation of elevated trains through from one side of the city to the other would do away with the problem of loop congestion entirely.

In considering the matter of rails, which is a subject in which operating men all over the country are interested, a grooved rail is recommended, somewhat similar to that used in New York and on which the groove is so shaped that the flange can force the dirt out of the groove instead of packing it into the groove. This is, however, suggested only for such streets as are well paved and regularly cleaned. Chicago has so many miles of dirty, poorly paved streets that it has been considered that the present girder rail should be retained because of the danger that the grooved rail would become clogged. The report, however, makes no secret of the fact that one reason the girder rail is recommended for outlying streets is because it affords a smooth track for wagons where the paving is not good. The T-rail is very highly spoken of in the report, the construction at Minneapolis and St. Paul being cited especially as favorable to the maintenance of pavements, which is quite contrary to the ideas of many of those not posted on T-rail in paved streets. It is stated that there are many streets in Chicago where track construction of this type could be installed with the assurance that it would give satisfactory results to all concerned. The use of a concrete beam under each rail, with tie rods for maintaining gage and using no ties, is referred to as the most substantial modern construction.

As to the price estimates, it is impossible to go into detail in a brief comment of this kind. The figures appear to be conservative and will serve to quiet the many claims made by agitators unfamiliar with technical matters as to the low cost of modern street railway construction. The high grade of talent employed in the preparation of these estimates leaves little room to question their approximate accuracy. It must be a satisfaction to the officials of Chicago street railway companies, who have been criticised as to their statements of the cost of electric railway conduits, to have their statements on costs of modern construction more than borne out by Mr. Arnold and his assistants.

The report would be exceedingly valuable alone for the unbiased figures which it puts into the hands of the street railway companies of this country as to the cost of electric railway construction. It has been a too frequent cry in connection with proposed 3-cent-fare lines and similar misdirected municipal agitation that the cost of construction is far below what it is represented to be by street railway men. While no one familiar with actual conditions would for one moment urge that stock watering has never been indulged in in connection with American street railway enterprises, the very fact that it has taken place in numerous instances has tended to keep in the public mind an idea that the cost of construction of electric roads is much below what it really is. The estimates, of course, do not take into account the great amount that has actually been spent in construction and scrap heaps on the Chicago roads. It deals entirely with the cost of construction to-day, and it is well that figures of this kind be made public in such a report as this. The city of Chicago and Mr. Arnold are both to be congratulated on this work as a whole. While it is not yet certain that the recommendations will be adopted exactly as they stand, there has now been given by the report a groundwork for something in the way of a thoroughly harmonious, modern and efficient system of surface transportation in Chicago.



**THE PASSENGER TRAFFIC PROBLEM OF GREATER NEW YORK—II**

BY W. W. WHEATLY

The extent and variety of the interruptions to which the traffic of the surface lines of Manhattan are subjected daily can hardly be fully appreciated from casual observation. One cannot diffuse himself over the entire city and know what is going on at all points. But the manager upon whose desk are laid the reports of the detentions of greater magnitude becomes thoroughly saturated with them. Some general statements are herewith given which, without going into details, are intended to give a correct idea of the serious nature of the ordinary detentions which interfere with the regularity of the service. These statements clearly indicate the difficulty of surface-line

TABLE NO. VIII.

Summary of blocks on lines of Metropolitan Street Railway Dec. 1 to 18, inclusive, caused entirely by vehicles or horses, or the contractors of the subway. No account made of any delay less than five minutes, of which there was an average of seventy-five daily:

Daily				Total			
Date	No.	Min.	Av.	Date	No.	Min.	Av.
Dec. 1.....	26	447	17.	Dec. 12.....	26	578	22.
2.....	29	385	13.	13.....	14	358	25.
3.....	9	105	12.	14.....	35	464	13.
4.....	15	284	19.	15.....	33	719	21.
5.....	42	520	12.	16.....	15	373	25.
6.....	56	742	13.	17.....	19	361	24.
7.....	4	55	13.	18.....	24	591	24.
8.....	20	294	14.				
9.....	23	578	25.	Total.....	434	7949	...
10.....	17	375	22.	Av. per day..	24	441	18.3
11.....	27	720	26.				

the trouble to inform themselves concerning it do not realize its extent. The photograph shown herewith, from which the



HERALD SQUARE, WHERE 1069 CARS PASS ON SURFACE LINES IN AN HOUR

operation. Table No. 8 is a summary for eighteen days (Dec. 1 to Dec. 18, 1902), inclusive, of all delays exceeding five minutes. The delays of less than five minutes, of which there are no less than seventy-five daily, have not been taken into account. None of the reported delays were caused by failures of equipment or power or by anything which could be controlled by the management. They are all attributed to vehicles or horses or to the obstructions for which the contractors of the rapid-transit subway are responsible. The summary of these detentions shows that there was an average of twenty-four reported delays each day, aggregating 441 minutes, or 18.3 minutes for each reported delay.

The interruptions to car traffic from vehicles crossing the tracks at street intersections is something that is little appreciated by the general public. Railway men who have not taken

illustration of Broadway from Eighteenth Street to Twenty-Third Street was made, was secured from The Commercial-Advertiser, of New York. The congested condition of the great retail shopping district shown in the photograph is fairly representative of the conditions that obtain there every day, making the rapid movement of surface cars utterly impracticable at the present time.

As further illustrative of this condition, Table No. IX. is presented, showing the number of vehicles passing certain busy street intersections during one hour on December 27. It was taken after the Christmas shopping season was over, in order to show practically normal conditions. A busy place for vehicle traffic, in corroboration of the photograph referred to, was found at the triangle on the corner of Broadway, Fifth Avenue and Twenty-Third Street, where 1910 vehicles crossed



the surface tracks in the one hour from 11 a. m. to 12 noon. These figures explain in a large measure the congestion in the

TABLE NO. IX.

Statement of vehicles crossing tracks of Metropolitan Street Railway in one hour at different street intersections Dec. 27, 1902:

Tally taken at	Time	
	3 to 4 p. m.	4 to 5 p. m.
Fulton Street and Broadway.....	1,030	820
Canal Street and Broadway.....	1,090	1,020
Thirty-Fourth Street and Broadway.....	1,150	1,080
Grand Central Depot.....	600	640
Thirty-Fourth Street and Seventh Avenue..	500	480
Canal Street and West Broadway.....	1,250	1,020
Forty-Second Street and Sixth Avenue...	730	760

Broadway, Twenty-Third Street and Fifth Avenue, from 11 a. m. to 12 noon: Broadway, 637; Fifth Avenue, 558; Twenty-Third Street, 715; total, 1,910.

narrow part of Broadway, from Eighteenth to Twenty-Third Streets. Canal Street and West Broadway comes next, with 1250 vehicles in the hour 3 p. m. to 4 p. m., which is explained by the fact that Canal Street is the only broad thoroughfare for vehicles going across town for many blocks on either side. The junction of Thirty-Fourth Street and Broadway passed 1150 vehicles in the one hour, 3 p. m. to 4 p. m., which, in consideration of the triangular track crossing of the Sixth Avenue, Broadway and Thirty-Fourth Street crosstown lines, makes it probably the busiest junction point in this or any other city.

For the purpose of showing a comparison between different cities of the traffic per mile of track and per car mile, Table No. X. is presented. It will be noticed that the figures are for the surface lines alone, except in Brooklyn and Boston, where the elevated railway figures cannot be separated from the surface lines. These figures indicate as clearly as can be done the relative density of traffic in the large cities of the country.

THE ADDITIONAL FACILITIES AUTHORIZED OR PROPOSED

An officer of our national government recently said to the committee of Congress on naval affairs: "The time to become warlike is when you are making estimates." Likewise it may be said the time to become earnest in securing adequate and comprehensive transportation facilities is several years before

they are needed. Had the people of New York fifteen years ago exhibited the awakened public spirit now so plainly manifest and insisted then upon a commencement of actual work on the necessary additional bridges, tunnels and subways the traffic congestion now so apparent everywhere would not have reached the acute stage. The important lesson to be learned is that, in the prosecution of all works of great magnitude, time is an element which must be reckoned with. There are one or two things in the present outlook that are forcing themselves upon our attention. One of them is that the greater part of the additional transit facilities authorized or projected and from which the greater amount of relief is expected will not be completed until the year 1907 or 1908, and in the meantime the population to be served is forging ahead by leaps and bounds. But the most striking idea which a look ahead brings into prominence is the probability that each one of the additional



BROADWAY, LOOKING NORTH FROM EIGHTEENTH STREET

transit facilities now planned for the north and south traffic on Manhattan Island will be hardly sufficient for giving adequate accommodation by the time of completion, and that if the future is to be provided with a comprehensive and complete

TABLE No. X  
SHOWING COMPARATIVE TRAFFIC PER MILE OF TRACK AND PER CAR MILE IN VARIOUS CITIES

	Year Ending	Miles of Track	Car Miles	Gross Receipts	Population per Mile of Track	Gross Receipts per Mile of Track	Gross Rec'pts per Car Mile Cents	Car Miles per Mile of Track
Manhattan surface lines . . .	June 30, 1901 ..	299.62	59,092,853	\$19,769,920	6,174	\$65,983	33.29	197,293
Chicago .....	Dec. 31, 1901 ..	518.11	61,120,635	13,337,736	3,927	25,784	21.82	118,000
Boston* .....	Sept. 30, 1901 ..	408.34	43,824,879	10,869,495	1,373	26,618	24.82	107,324
Brooklyn* .....	June 30, 1901 ..	575.72	56,588,465	13,655,085	2,026	23,718	24.11	98,257
Philadelphia .....	June 30, 1901 ..	457.37	57,534,235	13,431,680	2,829	29,586	23.35	125.82
Baltimore .....	Dec. 31, 1901 ..	353.00	.....	4,718,295	1,441	13,366	.....	.....
Washington .....	Dec. 31, 1901 ..	188.00	.....	2,852,549	1,161	15,173	.....	.....

\* Elevated traffic included, owing to impossibility of separating figures.



transportation system worthy of the greatest city on earth the plans and estimates must be made now and executed as promptly as possible.

There is given herewith a statement of the additional facilities already authorized and upon which work has already commenced or is about to commence.

STATEMENT OF ADDITIONAL TRANSIT FACILITIES AUTHORIZED AND THEIR PROBABLE COST

Description	Estimated Cost
1. New East River Bridge No. 2, from Delancy Street, Manhattan, to Broadway (Williamsburgh), Brooklyn; now under construction. Completion expected January, 1904. ....	\$20,000,000
2. Rapid Transit Subway, from City Hall, Manhattan, to Spuyten Duyvil and Bronx Park; now under construction. Completion expected January, 1904. ....	36,500,000
3. New York and New Jersey Tunnel, from Jersey City and Hoboken to Morton Street, Manhattan; to be used by trolley cars; now under construction. Completion expected January, 1904. ....	10,000,000
4. Atlantic Avenue improvement (new subway and elevated), in Brooklyn, for Long Island Railroad, to connect with tunnel to New York and Rapid Transit Subway. Completion expected January, 1905. ....	3,000,000
5. Extension of Rapid Transit Subway from City Hall, Manhattan, under Broadway to Bowling Green, thence by tunnel to Atlantic and Flatbush Avenues, Brooklyn, to a connection with Long Island Railroad; construction just commenced. Completion expected in 1906. ....	10,000,000
6. New East River Bridge (No. 3), from Canal and Forsyth Streets, Manhattan, to Willoughby Street, Brooklyn; construction just commenced. Completion expected in 1907. ....	19,500,000
7. New East River Bridge (No. 4), from Fifty-Ninth Street, Manhattan, over Blackwell's Island, to Long Island City (Ravenswood); contract to be given out very soon. Completion expected in 1908. ....	12,500,000
8. Pennsylvania-Long Island Railroad Tunnel, from Harrison, N. J., under Hudson River, Manhattan Island and East River, to Long Island City, with great passenger station at Seventh Avenue and Thirty-Third Street, Manhattan; construction to begin very soon. Completion expected in 1908. ....	50,000,000
Total cost. ....	\$161,500,000

ADDITIONAL FACILITIES CONTEMPLATED AND PARTIALLY PLEDGED AND THEIR PROBABLE COST

Description	Estimated Cost
1. Second East River Tunnel, from near Maiden Lane, Manhattan (connecting with the new bridges and rapid transit subway), to a point near the City Hall, Brooklyn; likely to be used by the trains of Brooklyn Rapid Transit Company. Could be completed within three or four years. ....	\$6,000,000
2. East Side Branch Rapid Transit Subway, from Harlem River or beyond, running south under Lexington Avenue to a connection with main line of subway at Forty-Second Street. Could be completed within three or four years. ....	10,000,000
3. New York Central subway and terminal improvements under Park Avenue, from a connection with the Rapid Transit Subway northward from Grand Central Station, at Forty-Second Street. Will probably operate a through train service with the municipal subway from City Hall, Manhattan, to suburban points on Hudson and Harlem Divisions. Could be completed within four or five years. ....	25,000,000
4. Broadway Branch Rapid Transit Subway from a connection with West Side Subway at Forty-Second and Broadway, running southward under Broadway to the Battery. (It was at one time proposed to join it to the main subway at Union Square, which would have been rather short-sighted). Could be completed within four or five years. ....	10,000,000
Total. ....	\$51,000,000

There is also a statement of the additional facilities contemplated and to which the municipal authorities are already partially pledged. It will be noticed that each statement shows the probable time of completion and the estimated cost of the work. The magnitude of these undertakings is indicated by the estimated cost of \$161,500,000 for the work already authorized and \$51,000,000 for the work likely to be authorized in the near future. To bring them into greater prominence, the proposed additional facilities are also shown herewith on a map from which the existing lines have been left off. Particular attention is directed to the enormous increase of transportation facilities laterally, especially toward Long Island. In his recent annual message to the Board of Aldermen the Mayor, Mr. Low, said: "With the completion of these bridges and tunnels, say within the next five years, there will be thirty railroad tracks between Manhattan and the boroughs of Brooklyn and Queens where now there are but four." There is no information available just now as to how many tracks there will be between Manhattan and New Jersey upon the completion of the two tunnels recently authorized, but there will probably be not less than four nor more than six, where now there are none. We may therefore count upon an increase of thirty to thirty-two tracks for the east and west traffic, upon which the carrying capacity may be roughly estimated at 350,000 people per hour in one direction, and it might be worked up to a much higher maximum eventually. What these increased facilities mean to Brooklyn and to nearby Long Island and New Jersey suburbs may be indicated by reference to the statement in last week's issue, showing that at present the maximum number of people who come to Manhattan in the rush hour from Long Island and Staten Island by bridge and ferries is only 64,000, and the number from New Jersey by ferries is 32,000, making a total of 96,000 per hour.

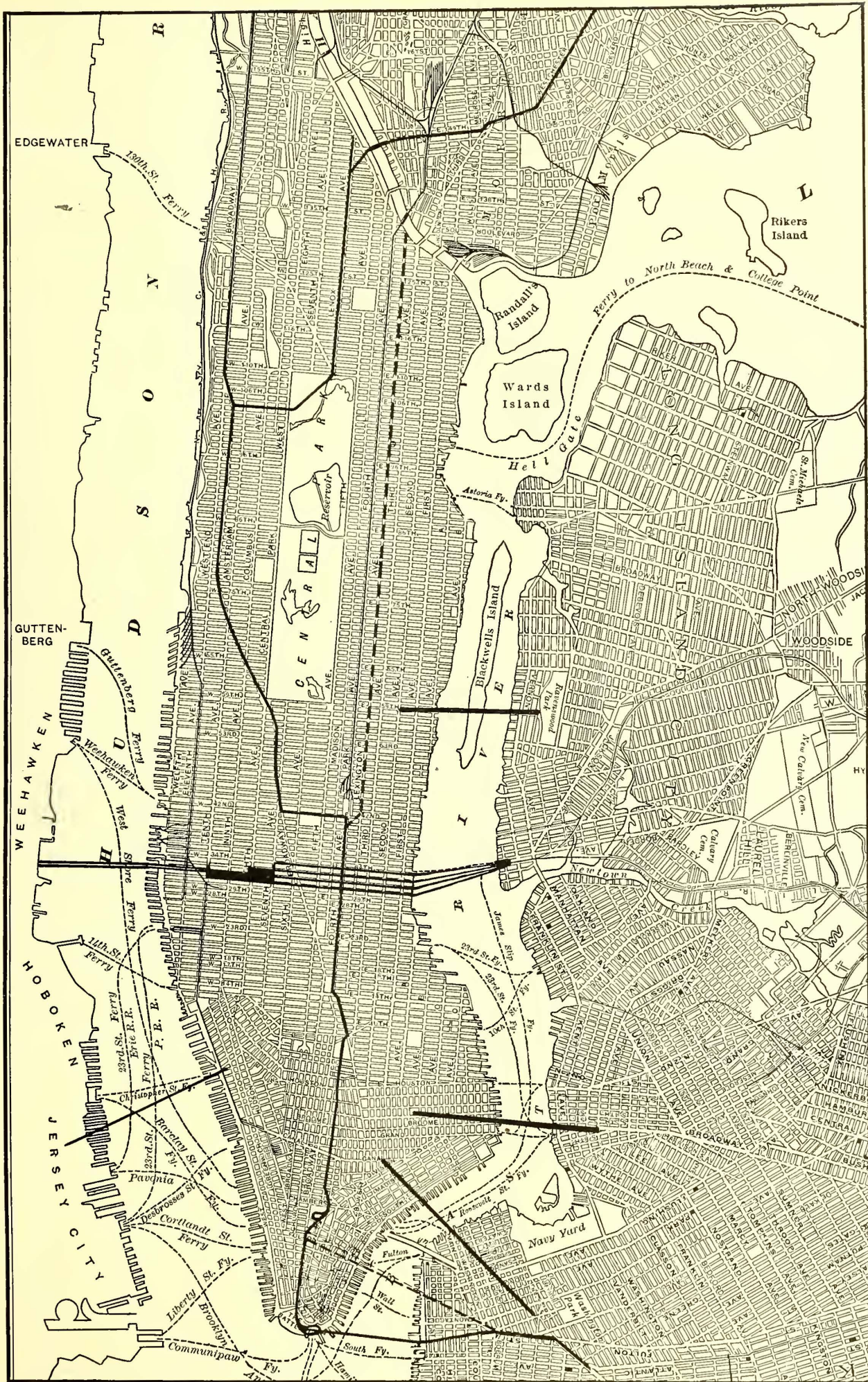
The completion, one by one, of these tremendous undertakings will mark the beginning of a transition period in the transportation problem of New York City and its suburbs. The partial removal of the river barriers on both sides of Manhattan Island will give a wonderful impetus to rapid through transit to the suburban districts. If the signs of the times may be read correctly they point to an immediate overflow, increasing with the succeeding years, of the hundreds of thousands of people who now are unwillingly crowded into the tenements and flat houses of Manhattan. It is plain to be seen that the boroughs of Brooklyn and Queens, and, in fact, all of the nearby Long Island suburbs, are going to be the centers of the most active development and rapid growth, because they are to be in the line of least resistance. The writer makes no predictions, but desires to state that many well-informed men who have devoted much time to the study of this question are of the opinion that within a very few years the center of population of New York City will be transferred from Manhattan Island to Long Island.

It is perhaps wisely ordained that the full benefit of all the additional transit facilities is not to be realized at one time. Commencing with 1904, it is promised that we shall have the completion of the subway for the north and south travel, East River bridge No. 2 for the Brooklyn travel and the New York and New Jersey tunnel for the New Jersey travel. It has for some time been generally recognized as a foregone conclusion that the completion of these improvements in 1904 will have been discounted in advance by the increase in population and the number of passengers seeking transportation. From the moment these new transit additions commence to operate it is certain there will be more people who want to ride than they can comfortably carry. It is now our purpose to consider the additional facilities as briefly as possible and to show their relation to one another and to the existing lines on Manhattan Island.

MUNICIPAL SUBWAY AND ITS TRAFFIC CONNECTIONS

To speak of this important work in the singular number, as is now generally done, indicates that, in public opinion, it is





MAP SHOWING NEW YORK'S NEW TRANSPORTATION FACILITIES

(Solid lines show routes authorized, dotted show additional lines to which the city is partially pledged.)



associated with the single tunnel from City Hall, Manhattan, to 104th Street and the two branches, one to Spuyten Duyvil and one to Bronx Park. The Spuyten Duyvil branch is to have two tracks from Spuyten Duyvil to 137th Street and three tracks from 137th Street to 104th Street. The Bronx Park branch is to have three tracks from Bronx Park to Jackson Avenue and two tracks from Jackson Avenue to 104th Street. The traffic from these two branches converges at 104th Street and is to be carried to the City Hall on four tracks. This is the subway as it will be opened to the public about the beginning of 1904.

Ever since the subway became an assured fact the public

safety of operation may be estimated with considerable accuracy. Any transportation expert will bear witness that trains running at 30 miles to 35 miles per hour cannot with safety be operated on a shorter interval than two to two and a half minutes, and only that is possible with the most perfect safety appliances and the best trained employees. It is understood that safety and speed are the essential elements in the subway operation, and these two essentials are not to be sacrificed. It is probable, however, that with the frequent stops and shorter interval the local trains will not be able to reach such high maximum speeds as the express trains. Thirty trains an hour on the express tracks and fifty trains an hour on the local



OBSTRUCTIONS AT TWENTY-THIRD STREET AND FOURTH AVENUE

has felt that the time of relief from the overcrowded traffic conditions in New York was near at hand. By what means the public reached that belief it probably could not tell; and it would not be worth while to inquire were it not for the fact that when the public expects much and gets little its criticism is not always intelligently directed. The maximum capacity of this completed subway is to be computed upon the basis of four tracks, two for local and two for express trains. No matter how many tracks are provided north of 104th Street nor how many additional subways are joined to this one above Fourteenth Street (Union Square) its maximum capacity will be fixed by the number of tracks on the downtown section, where the density of traffic is greatest. The maximum traffic capacity of such a high-speed road having in view absolute

tracks may be said to be the average maximum train capacity of the road. With eight cars on each express and six cars on each local train, as is now proposed, there will be a car capacity of 540 cars per hour. The seating capacity of each car being fifty-two persons, it appears that the subway can carry 28,000 seated passengers per hour. If there is to be the usual overcrowded condition of the cars, each reader may figure for himself the probable number that will be able to find standing room. Eighty people (fifty-two seated and twenty-eight standing) to each car is considered a good average. Figured on this basis, the carrying capacity of the four tracks may be estimated at 43,000 people per hour in one direction.

In the article in last week's issue dealing with present traffic conditions it was shown that the north and south elevated and



surface roads bring to and carry away from the business district in one hour a total of 142,000 people. Every one who rides is familiar with the overcrowding during rush hours and can estimate the relative proportions of those who stand and those who obtain seats. The relief to the present facilities by the carrying of 43,000 people per hour in the subway will depend upon the proportion of the 142,000 people to be carried that are tributary to the subway. In this connection the figures of the Manhattan elevated roads may be of some assistance. On Monday, May 25, 1896, the station ticket sales on the elevated lines were 626,000, of which 336,200 was down traffic and 289,800 was up traffic. Of the down traffic, 161,000, or 48 per cent, used the West Side lines and 175,200, or 52 per cent, used the East Side lines. The distribution of the up

conditions have not materially changed. It may, however, be possible that figures for December, 1902, which are not now available, would show a slightly larger proportion of increase on the East Side than on the West Side lines. It is probably not far from the truth to assume that 52 per cent of the elevated traffic is on the East Side and 48 per cent on the West Side lines. The distribution on the surface lines, as shown by Table No. VI. in last week's issue, indicates that 52 per cent of the traffic is on the West Side and 48 per cent on the East Side lines.

Assuming at present 142,000 people an hour to be moved north and south, it is probably as near as can be estimated to say that it is pretty evenly divided between the east and west sides of the city. That branch of the subway which runs to



TRUCKS CROSSING BROADWAY AT CANAL STREET

traffic between the East Side and West Side lines was about the same. Of the 336,200 down traffic, 59 per cent came from north of Sixtieth Street, and of the 289,800 up traffic, 77 per cent came from south of Twenty-Second Street.

On Monday, Dec. 17, 1900, which was a busy day on the elevated, the ticket sales amounted to 701,811 tickets, of which 361,488, or 51 per cent, were on the West Side and 340,323, or 49 per cent, on the East Side lines. The maximum hour on this day was 7 a. m. to 8 a. m., when a total of 91,208 passengers were handled in both directions, as follows:

West Side Lines		East Side Lines	
Sixth Avenue.....	34,515	Third Avenue .....	36,196
Ninth Avenue.....	5,978	Second Avenue.....	14,519
Total .....	40,493	Total .....	50,715

Except for the increase of traffic it may be assumed that the

Bronx Park, it will be remembered, taps the territory now tributary to the East Side elevated and surface lines and will draw slightly, but not heavily, from them. The main line of the subway again taps the East Side traffic at all points below Forty-Second Street and will in this section draw considerable traffic from the East Side lines. In a general way, however, it is believed that it will draw principally from the West Side traffic. Out of the 142,000 people per hour to be carried it is probable that one-half are tributary at some point to the subway and will want to use it when opened next year for business. The relief to the existing lines by the carrying of 43,000 people per hour on subway trains will fall principally upon the West Side elevated and surface lines and in a lesser degree upon the East Side lines. It will undoubtedly be noticeable in a temporary diminution of the unseemly crowding, but the effect will not be long lived. With this subway working to its



full capacity all lines will soon be crowded as badly as ever, and the complaints of overcrowding on the north and south lines will probably continue.

But the Mayor, Mr. Low, in his recent annual message to the Board of Aldermen, said: "With the completion of the subway system for Manhattan and the Bronx upon the lines indicated the facilities for traveling north and south, already great, will be at least doubled." The Mayor evidently did not refer to a single subway with only four tracks, nor yet to an additional subway with four more tracks the length of the island. Two subways with four tracks each will be able to carry about 86,000 people per hour in one direction, but that is not double the present facilities. Perhaps the Mayor was considering the Manhattan elevated alone when he said the present facilities would be doubled, but it must not be forgotten that at present the surface lines are doing considerable of the long-haul traffic which the elevated cannot carry. The present carrying capacity of all the north and south lines reaching the shopping and business districts is about 142,000 passengers per hour. A third subway, with four additional tracks, which has not yet been proposed, would bring the subway capacity up to about 129,000 per hour, and, as will be seen, the present carrying capacity would not then be doubled. The addition of sufficient subway tracks to double the present facilities is desirable. Such a provision promptly executed will not be realized any too soon.

A map is shown herewith upon which the additional facilities already authorized are indicated by black lines, and the additional facilities to which the city is partially pledged are indicated by dotted lines, with the exception of the proposed Broadway subway, which, owing to lack of detail concerning it, is omitted.

The proposed East Side branch from Harlem River running south under Lexington Avenue is planned to join the main subway at Forty-Second Street, and this branch, it is understood, will have three tracks part of the way and two tracks the balance of the way. It may also cross the Harlem River and go northward under Jerome Avenue through the heart of the borough of the Bronx. It may be depended upon to bring a very heavy traffic into the main subway at Forty-Second Street.

The traffic from the new Portchester road (four tracks), which will be of no inconsiderable volume and will be capable of great expansion, will be delivered to one or the other of the branches of the subway near Harlem River. There is a probability also that the Portchester trains may run through the subway to the lower end of Manhattan Island.

It is proposed to equip for electric operation the Hudson division of the New York Central Railroad as far north as Croton, 34 miles, and the Harlem division as far north as White Plains, 22 miles. The most important and far-reaching part of the plan as it affects the local transportation problem is the proposal to run the electric suburban trains through the subway to the City Hall, Manhattan. Whether the trains run through or not, the traffic delivered to the subway will undoubtedly be great and will have to be cared for.

The Pennsylvania-Long Island Railroad tunnel, with its mammoth passenger station near Seventh Avenue and Thirty-Third Street, is destined to focus at that point an enormous volume of traffic. The completion of this great work is bound to exercise a remarkable influence upon the currents of traffic north and south on Manhattan Island. The already enormous traffic of the Pennsylvania-Long Island and Lehigh Valley roads is now distributed along the shores of Manhattan by ferries. Within five years, when the tunnel is completed, that traffic, greatly increased, will be concentrated at a central point in the city and will be thrown upon the already overcrowded north and south lines for distribution.

The Blackwell's Island bridge will land its traffic at some point on Fifty-Ninth Street east of Park Avenue, and the

East Side north and south lines will there take up the task of distribution. This bridge will open up for development the entire borough of Queens, and its traffic will undoubtedly experience a remarkably rapid growth.

The New York and New Jersey tunnel will probably be used by the surface car lines of Jersey City and Hoboken to land their passengers in New York, and it may also serve the passenger traffic of the Erie and the Lackawanna Railroads. Its New York terminal will be at Christopher Street, 1½ miles from the City Hall. The one thing that seems to be certain is that its mighty throng of Jerseyites will be dumped upon the southbound lines in the morning and upon the northbound lines at night at the height of the rush hour.

The disposition of the traffic reaching Manhattan over the Williamsburg bridge (No. 2) and over the Manhattan bridge (No. 3) will not become quite such a troublesome factor as the other traffic streams, provided that the much-talked-of plans are carried out of making each of these bridges not only a highway leading to Manhattan, but continuing by elevated or subway in the direction which the majority wish to go. It is believed that 70 per cent to 80 per cent of the people who come over these bridges in the rush hours will want to be taken southward toward the City Hall—Wall Street district. This traffic should by all means be handled without a break and without being thrown upon any of the existing elevated or surface lines or the subway.

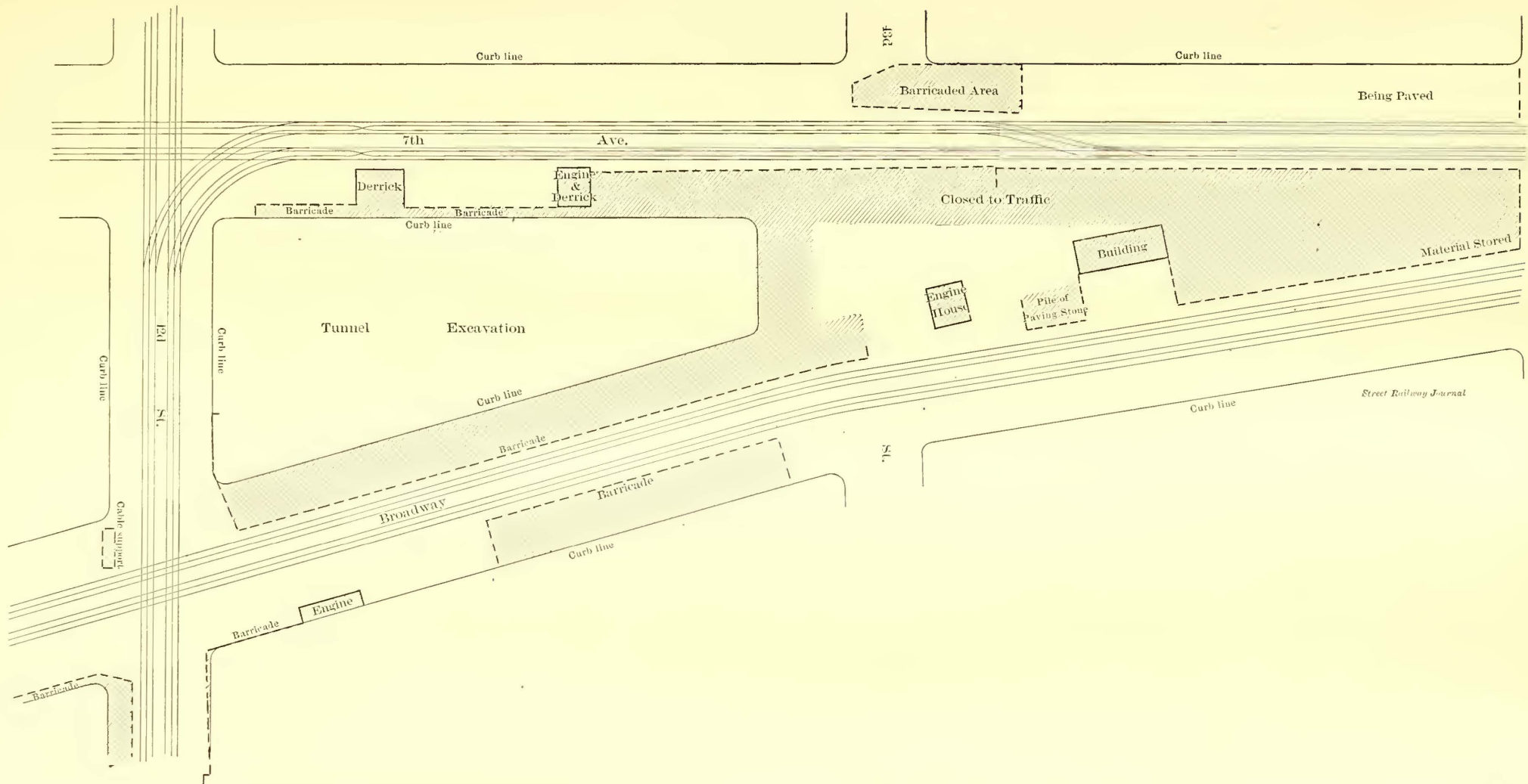
The brief mention of the tremendous additions certain to be made within a few years to the north and south traffic indicates that the plans as at present announced for taking care of it are inadequate. The subway now nearing completion and the one proposed by the Mayor to run from Forty-Second Street under Broadway to the Battery appear to be the only provisions contemplated. These two subways, with eight tracks, are needed now (to-day) to take proper care of the existing north and south traffic and to allow for its expansion until additional subways can be constructed. It is just as certain as anything can be that at the end of five years, when all the additional transit facilities herein outlined commence to pour their swarms of people upon the north and south lines for distribution, not less than five north and south subways, with twenty tracks, will be needed. Unless they are provided the growth of the northern portion of the city, and the city's northern suburbs, will be retarded and the traffic congestion will become terrific.

The building and development of more transportation lines north of Forty-Second Street or in the Bronx will not relieve, but will make the situation worse. The additional facilities are needed on the lower end of Manhattan Island, and it is there they must be provided if adequate relief is to be experienced. The provision for adding twenty-six additional tracks over or under the East River toward Long Island is an example of doing things upon a scale commensurate with the greatness and importance of the problem to be solved. When we place alongside of that splendid provision the four additional subway tracks already authorized and the four more promised the contrast is striking. When we remember that the twenty-six additional tracks toward Long Island are being provided for a traffic which now amounts to only 64,000 per hour, or 25 per cent of the total rush-hour traffic to the business district, and that the four additional subway tracks nearing completion and the four others suggested are to provide for a traffic which now amounts to 142,000 per hour, or 56 per cent of the total rush-hour traffic to the business district, the relative proportions of these provisions seem to be quite out of order. Unless this glaring inequality is promptly corrected there can be no question where the population will be forced to go within the few years following the completion of the twenty-six additional tracks over the East River; and it may not perhaps be an unmixed evil to have the center of population on Long Island.

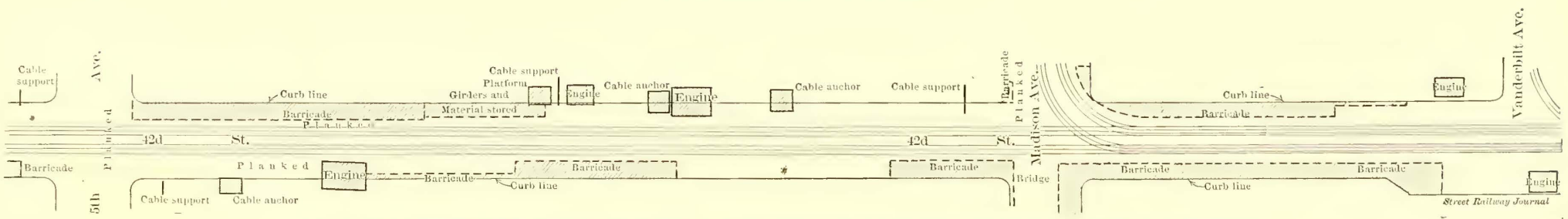








PLAN OF BROADWAY AND SEVENTH AVENUE, BETWEEN FORTY-SECOND AND FORTY-FOURTH STREETS, WHERE SUBWAY OPERATIONS LEAVE SCARCELY ENOUGH ROOM FOR STREET RAILWAY TRACKS



PLAN OF FORTY-SECOND STREET, SHOWING CAR TRACKS AND OBSTRUCTIONS DUE TO SUBWAY OPERATIONS



The physical conditions are such as to almost prohibit the construction of more elevated structures on the lower end of Manhattan Island; and public opinion being arrayed against their further extension, it is probable that future transit development must go underground. There is a limit to the number of north and south subways that can be placed under the lower end of Manhattan, but that limit will not be reached for many years to come.

An arrangement of transportation lines, which may be said to be almost ideal, should embody the following essential features:

1. Such an arrangement of tracks, stations, terminals and train service as will make an entire separation of the local, or short-haul traffic, from the through, or long-haul, traffic.

2. Such an arrangement of lines and tracks that the several lines of traffic do not cross one another at grade or come into conflict at any point.

3. The avoidance of large terminals where heavy concentrations of traffic (as at the New York terminal of the present Brooklyn bridge) bring the streams of people together either inside or outside the terminal and render operation dangerous and difficult.

4. The connection of the adjacent bridges, tunnels and subways with one another in such a manner that there may be a circulating system of train service where the conditions render it desirable. The subway on Manhattan Island (as an illustration) should be so planned that there may be a belt line rapid-transit service starting from the Battery, running up the East Side as far as, say Fifty-Ninth Street, thence across Fifty-Ninth Street to a West Side subway, thence down the West Side to the Battery. Such a circulating system would serve an enormous traffic on both sides of the city and in both directions.

5. Handling the long-distance traffic from the boroughs of Brooklyn, Queens, Bronx and from New Jersey on fast express trains and delivering it in the business district of Manhattan at or near the point of destination without change of cars.

6. Where change of cars is necessary for any considerable volume of traffic to so arrange matters that the local Manhattan lines may handle it in the direction contrary to their heavy traffic movement morning and night, thus having a tendency to preserve a well-balanced traffic.

There is probably no other city of first-class importance in the world where the stranger arriving at its outer gates by rail is compelled to submit to so much annoyance and inconvenience in reaching his city destination as in New York. While the ferries have proven in many ways excellent distributors of traffic along the shores of Manhattan Island, they are in every sense of the word disagreeable and out of date. Since the Pennsylvania, Lehigh Valley and Long Island Railroads are to enjoy, with the New York Central and the New York, New Haven & Hartford roads, the privilege of landing their passengers in the heart of the city, it seems quite probable that the other large roads on the New Jersey shore will soon be seeking similar advantages. The Central Railroad of New Jersey, the Philadelphia & Reading, the Erie, the Delaware, Lackawanna & Western, the West Shore and the Ontario & Western will probably not care to suffer the handicap of the ferry transfer while their strongest competitors are bidding for business in the heart of Manhattan. Each one of these roads has a suburban passenger service of more or less importance for the benefit of New York commuters. Each road is trying to build up the suburbs along its lines by offering increasing accommodations in rapid transit to its commuter traffic. Recent developments make it more than probable that it will not be long until several or all of them will be seeking admittance to Manhattan by tunnel.

Mention of these probable additional tunnels is made in order

to show the importance and the necessity at this time of the adoption of a carefully prepared general plan of subway development for Manhattan. Such a plan should be made upon a broad and comprehensive basis having in view the future growth and transportation necessities of the city for many years to come. It should take into consideration the fact that there is an ultimate limit to the development of additional north and south lines on the lower end of Manhattan Island, and that the future additional lateral tunnels should be brought into the city in such locations that their traffic, when thrown upon the north and south lines for distribution, may be handled by them in the direction contrary to their existing heavy flow of traffic.

In the issue of next week attention will be given in greater detail to the increased facilities reaching toward Long Island and to their probable future influence upon the traffic in the boroughs of Brooklyn and Queens.

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### REPORT OF THE MASSACHUSETTS RAILROAD COMMISSION

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A remarkably interesting report was submitted to the Massachusetts Legislature by the State Board of Railroad Commissioners on January 14. In addition to the usual complete data upon the financial showing and traffic of the steam and electric roads of the State there is embodied in the report a discussion of the questions of suburban fares, electric equipment of railroads and power brakes. The suburban fare question touches the electric railway vitally in its competition with the steam road, and the commission's views upon the matter throw considerable additional light upon passenger service in and about Boston.

An extended inquiry into fares upon railroads outside of Massachusetts show that, however unequal and unscientific may be the present arrangement in and about Boston, as a whole the suburban fares of that territory are among the lowest of such rates to be found anywhere. The consolidations which have taken place render no excuse for the variations in rates which exist reasonable.

In considering workmen's trains, the board calls attention to the distinction existing between workmen's cars or trains, restricted in use to a limited class of wage-earners, and cheap morning and evening trains open to any one wishing to travel at certain hours. The workman's car or train, in the narrow and restricted sense, is a well-established feature of railroad and railway service in foreign countries, but is less known and less favored in this country. It is the outgrowth of social conditions characteristic of great centers of population, where the necessities of large numbers of ill-paid workmen are thought to demand transportation cheap enough to enable them to travel between their homes and places of employment, and where class distinctions, with restricted privileges and graded accommodations, are a matter of course. When railroads are owned by the State the theory that the public owes a duty to a class in the community which can best be discharged by furnishing cheap transportation is one which can readily be carried out without reference to cost. Whatever the burden, it is borne logically as an item of government expense. In no case have the necessities of the poor demanded more consideration than in and about London; but while workmen's trains, with their restricted privileges, poor accommodations and limited liability on the part of the companies, have long been an established feature of English railway service, there has been a marked tendency in late years to improve the accommodations, liberalize the restrictions and so lessen the distinctions between this and a general cheap morning and evening service. Special privileges are usually granted to the railways in the way of franchise grants or exemptions from expense and limitations upon liability in return for the cheap fare.



The Central London Railway, which stands as an example of a modern type of electric underground road, and the Great Eastern Railway, one of the most important of English steam railroads, among others, operate cheap morning and evening trains under their respective charters. But, independent of this legislative agreement, the experience of these companies furnishes a profitable study of the results of dealing with a large traffic at low rates upon business principles. The history of the Great Eastern bears specially upon this point. Taking up the problem at first as a compulsory requirement under the terms of its charter, the management developed an extraordinary suburban business, as a part of which it increased the cheap morning and evening trains much beyond the number required by law. The company, complying with its obligation to provide homes elsewhere in place of those in the city uprooted by the construction of the railroad, seized the opportunity to create and maintain traffic by encouraging the building of suburban homes generally for the poorer people who found daily occupation in London. Thus the contribution of the company in low fares for the morning and evening hours was more than made good through the consequent travel at other hours at higher rates and through the general increase in all kinds of business. In handling the enormous passenger traffic at the Liverpool Street Station of this road, said to be greater than that of any other station upon any other railroad in the world, the compartment car and the construction of stations with floors upon the same level as that of the cars add greatly to the facility with which trains can be loaded and unloaded. These conditions were, however, not influenced by severe street railway competition.

Class discriminations in the use of trains, with rates so low as to prevent a reasonable return to stockholders, upon the theory that such concession is due to a particular portion of the traveling public, is contrary to the spirit of American institutions. This would be true whether the companies were called upon to bear the burden or whether the rest of the traveling public were to bear it through the payment of higher fares to compensate the companies for what they lose in the lower. In the one case it would be an unjust discrimination and in the other an unlawful interference with private property. Whatever may be thought of those who uphold such service elsewhere, there are in Massachusetts no conditions to warrant a plea that the public health or morals call for transportation for any class at a cost inconsistent with a fair profit to the carrier. Aside from any legal question, compulsory legislation of this kind is contrary to the independent spirit abroad in the land. The poorest among us who are honest with themselves and their neighbors have a just pride in demanding as much as is given to others and the same pride in asking for no more. The workingman of other countries must ride in the third-class compartment and in some cases in special and yet poorer cars; with us, grades of accommodation are unknown to suburban service. Indeed, the attempt to compare our parlor coaches in use upon long-distance journeys with the first-class compartment of foreign railways is generally made only in a constrained effort to find some basis upon which there may be an approach to favorable comparison in respect to cost of travel.

The question of cheap morning and evening trains in Massachusetts is a business problem to be solved by business principles and not one of enforced contribution to public charity, either from the railroads or from the more prosperous part of the community to the less prosperous.

The only claim to be urged for a cheap morning and evening service is that the regularity with which certain persons ride daily at fixed hours affords the carrier the most favorable conditions for economical operation, and therefore entitles those who so travel to the lowest fares which are consistent with a profitable business. In determining the justice of such claim the inquiry is into reasonable accommodations and rea-

sonable fares for a given traffic. This is the same inquiry which the board is from time to time making under its general jurisdiction upon the application of individuals and communities.

Referring to the question of electric equipment of railroads, the board states that the progress made in the application of electric power upon street railways is a matter of common knowledge. The electric car moving over level ways, up and down steep grades, through tunnels and over elevated structures, has become so familiar that the horse car, pegging along the streets and toiling up the hills in no pretense of consideration for the comfort of passengers, is almost forgotten.

The successful adaptation of electricity to transportation has not been confined to one form of use. Speed, comfort and convenience have been secured with the trolley, the third rail, the electric locomotive and the storage battery. Whether we journey through Central London, the Paris or the Berlin subway, above the streets of Elberfeld upon its novel suspension railway; in the electric locomotive upon the Orleans railway, or over the new electric railroad from Milan, or enjoy upon our own roads the boon of rapid transit with freedom from smoke and dirt of coal, we see everywhere the proof that inventive genius and the spirit of enterprise have found opportunity and capital for the development of the electric current as a carrier of mankind not in one State or one country, but in many under all forms of government and irrespective of the nature of railway ownership or control. If the State has been readier at times than private capitalists to take risks in experimental enterprises it is equally true that the keen insight and shrewd business judgment of private capitalists have been quick to appreciate whatever advanced methods hold out promise of sure returns.

Experiment and practical test have demonstrated the fact that roads can be built and trains run over them with electric power at a speed which will equal, if not exceed, that of the steam railroad. The fast expresses between Calais and Paris, or between New York and the West, could easily be rivaled, if not excelled, upon an electric railroad. The reason that the steam road has not yet generally given way to the electric railroad, and (according to the commission) is not likely to in the immediate future, is due in part to the difficulty in solving problems of a physical character, but in a greater measure to that experienced in overcoming commercial barriers in the expense of installation and maintenance of the plant.

"In dealing with the entire railroad system, we have," says the commission, "the frequent and infrequent passenger and freight service, the light and the heavy train load, the short and the long-distance haul, the traffic with many and the traffic with few stops and the complicated freight and passenger terminals. It is evident that these conditions present serious questions affecting both safety and expense in considering an electric equipment."

The use of a single motor, carrying its own fuel, distinguishes steam transportation, while the peculiar feature of the electric system is the fact that the power is generated at one or more central stations and transmitted for considerable distances. The principal economy in the use of electricity is in the opportunity to generate power in large units under the most favorable conditions; its waste is in distribution at expense and loss. The greatest electrical economy is secured when the load upon the line consists of a large number of small units—small trains at short distances apart. As the development of the passenger business through increased frequency of the short-distance service, has been in this direction, while the development of the freight business through the increase in weight and decrease in the number of trains has been in the direction of the least electrical economy, it is clear that the most favorable field for the introduction of electricity is in the passenger traffic.

It is almost wholly within this field that the possibilities of an electric service upon railroads are exhibited in this and other



countries with varying degrees of success. The service is found upon certain branch or suburban lines where increased facilities for transportation, combined with reduction of fare, have brought a large increase in the volume of traffic. Whether a given enterprise has proved profitable is often a difficult matter to determine, but it is safe to lay down the general rule that a field for the development of a very much larger traffic with frequent train service has been shown to be essential to satisfactory results.

One of the first railroads to electrically equip a part of its lines was the New York, New Haven & Hartford, which, in 1895, so equipped the Nantasket Beach branch, adopting the trolley system, though subsequently in extending the equipment for a short distance on the main line of the South Shore branch it used the third rail. The result of the more frequent service, combined with the lower fares, was at first a large increase in business, but more recently the traffic has fallen off to such an extent that the company claims, and apparently with reason, that this branch is unprofitable. This company, in 1901, equipped with the overhead trolley the line from Providence to Fall River, a distance of 20 miles. The fare was reduced from 50 cents to 20 cents and the number of trains very much increased. Although the service is not wholly satisfactory the enterprise has resulted in a great increase of traffic and in apparent financial success. The same company has also electrically equipped with the third rail the line between Hartford and New Britain and the branch from Stamford to New Canaan with good results.

In 1895 the Pennsylvania Railroad Company equipped with the overhead trolley a branch of its road in New Jersey between East Burlington and Mt. Holly, a distance of 7 miles. Light traffic was the difficulty which later caused the giving up of electric operation on this branch.

In Illinois, the Aurora, Elgin & Chicago Railway, about 30 miles of which have been finished with double-track construction and third rail, and in Ohio the Lake Shore Electric Railway, between Cleveland and Toledo, equipped with the overhead trolley, present very many of the ordinary features of a railroad service. While passenger traffic is the principal business, the carriage of express matter and freight to a limited extent is undertaken on both of these systems.

The trolley system has been introduced into Canada within a few years upon the Quebec, Montmorency & Charlevoix Railroad, which extends from Quebec to St. Anne de Beaupre, a distance of about 30 miles. Business was greatly increased by the frequent trains, and the results generally seem to have been favorable. The use of the electric locomotive in the operation of the tunnel at Baltimore and in other places has conclusively shown that under certain circumstances electric power can be very advantageously used in connection with freight traffic. Underground railways and tunnels can obviously be best operated by the use of electricity. In England, steps have been taken to change from steam to electricity upon underground railroads; but the only English steam road, in the ordinary sense of the word, which has undertaken to electrify any portion of its line is the Northeastern, which contemplates such a change upon some of its suburban lines in the neighborhood of Newcastle.

Electricity as a motive power upon steam railroads has been introduced in France, Belgium and Holland and in other parts of Europe for short-distance runs on connecting roads. The short line of railroad between Antwerp and Cappelen has been operated for about two years with storage-battery cars; but here, as in Germany and other places in Europe, such cars have failed to meet expectations.

Under governmental direction, interesting experiments have been made in Germany for high-speed runs between Berlin and Zossen, and a very high speed has been attained; but the condition of the roadbed was found so unsuitable for such speed that the tests were discontinued to await the construction of a

more substantial roadbed. Much is expected from the enterprise of the Italian people, aided by the government, looking to the conduct of both freight and passenger business under steam railroad conditions between Milan and Gallarati.

On every hand it is apparent that agencies are at work to develop the application of electricity so as to permit more and more its substitution for steam in the general operation of railroads. No incitement to pushing forward these undertakings can be more effective than the stimulus of self-interest on the part of those anxious to install the electric in the place of the steam plant, and on the part of those eager in the handling of transportation to make use of every real advance in methods. It is idle to suppose that the end can be hastened by legislation in the effort to compel capital to follow experiment more closely than business prudence dictates.

We reserve for our next issue the substance of the board's report on fenders, power brakes and general statistics.

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### NATIONAL CONVENTION ON MUNICIPAL OWNERSHIP AND PUBLIC FRANCHISES

Some time ago the committee on city affairs of the Reform Club, of New York, decided to take preliminary steps toward holding a convention of authorities on municipal topics to discuss the subjects of municipal ownership and the treatment of public franchises. Different gentlemen were approached on the subject and several agreed to present addresses on the subject. The convention will be held in New York at the rooms of the Reform Club, on Fifth Avenue, toward the end of February, and will probably extend over two days. The exact date has not yet been decided upon, but will be announced in these columns.

Addresses have already been promised by the Hon. Robert P. Porter on "The Recent History of Municipalization in Europe;" by the one or two gentlemen on the board of the School of Commerce, of New York, on "The Recent History of the Municipalization in the States;" by Frederick Howe, of Cleveland, on "Taxation of Franchise Values," and by Lieutenant James B. Cahoon on "Municipal Ownership of Gas and Electric Lighting Plants." Other speakers are expected to address the convention, and their names will be given later.

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### INTERNATIONAL LOOP AT DETROIT

The tourist public is familiar with the international belt line at Niagara, which affords such an unexcelled opportunity for seeing the beauties of Niagara Falls and gorge from both the American and Canadian sides. Another international trolley loop is under construction at Detroit, which will be second only to that at Niagara in attractiveness. The Detroit United Railway Company has for some time controlled the Sandwich, Windsor & Amherstburg Railway, located across the Detroit River from Detroit. The present tracks of the latter extend from Windsor to a point down the Detroit River toward Lake Erie, called Ojibwa, 5.75 miles from Windsor. The company is now extending the line from Ojibwa to Amherstburg along the river bank, 11.75 miles more, making 17½ miles. This line runs through some of the quaintest and most historic country adjacent to Detroit, the suburb of Amherstburg itself dating nearly as far back as the settlement of Detroit. On the American side, the Detroit United Railway already has its interurban line to Wyandotte and Trenton. The international loop will be composed of the Wyandotte division on the American side of the river from Detroit to Trenton and the Sandwich, Windsor & Amherstburg on the Canadian side of the river, the two lines being connected by ferry from Detroit to Windsor, and vice versa; also from Amherstburg to Trenton, and vice versa. The river is one of Detroit's greatest attractions. This new international loop follows this attraction, and the double ferry will by no means be a drawback to pleasure seekers.



**THE COOPER-HEWITT STATIC CONVERTER**

Telegraphic advices from London this week announce the first public exhibition by George Westinghouse of the new

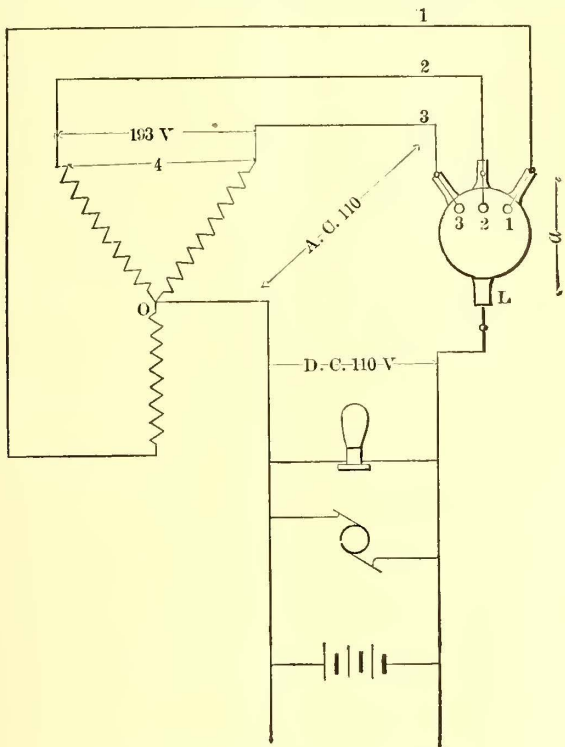


FIG. 1.—DIAGRAM OF CIRCUITS

trode of the converter and the other side to the neutral point of the Y-winding. The working circuit is shown to contain an incandescent lamp, a direct-current motor and a storage battery. The fourth electrode on the top is only used in starting up, when it is connected for a very short period to a circuit including a "choke" or "kicking" coil. When used with a Cooper-Hewitt mercury-vapor tube a higher voltage than the normal running voltage is usually required; this voltage is supplied from the auxiliary circuit during the very short period necessary to produce the proper condition in the tube to start up the discharge from the normal circuit. Very shortly after the converter is in circuit it attains a normal temperature at which it will operate indefinitely. The amount of heat to be dissipated at the converter is a direct function of the drop of about 14 volts, and the dimensions of a converter can be quite accurately fixed to dissipate the heat incident to a given maximum load.

A striking peculiarity of the system is the fact that the drop in voltage between the upper electrodes and the mercury electrode is constant at approximately 14 volts at all loads on the converter. That is to say, this drop remains the same whether the current passing is 1/2 amp. or 90 amps. At present this drop is about 14 volts, but late experiments have indicated a possibility of reducing this considerably, even to as low as 6 volts. Assuming the former figure, the efficiency of the present apparatus can be simply determined. The converter illustrated in the diagram has been operated at a voltage as high as 1800, in which case the efficiency passes 99 per cent, while at 600 volts it would be about 95 per cent. It follows from the above that the voltage delivered to the working circuit is constant whatever the load on that circuit, and measurements have shown this to be actually the case. Experiments indicate that the converter in its present form is capable of handling com-

Cooper-Hewitt static converter, of which more or less definite rumors have been current among electrical engineers for several months past. No details of operation, however, have yet been made public, so that particulars of the operation of the converter, as given below, will be of particular interest. Briefly, the system, which has been developed by Peter Cooper Hewitt, of New York, is one for the conversion of alternating into direct current, the central feature of which consists in the utilization of peculiar properties of electrodes sealed in a receptacle containing vapor at a certain degree of attenuation. Under this condition the electrodes act as electric valves, permitting passage to one portion of the alternating wave and suppressing another portion. The remarkable feature of the system is the extreme simplicity of the apparatus. A converter for 200 lamps, for example, is little larger than a 100-cp incandescent lamp, is even more simple in construction than the latter and weighs but a few pounds. Merely as an interesting comparison, it may be observed that a rotary converter of the same capacity would weigh in the neighborhood of 700 lbs. Although developed for use in connection with mercury-vapor lamps, the system is also equally applicable to conversion for power circuits.

mercially voltages up to 3000, and that with further improvements the range may be extended to 10,000 volts. Up to the present stage only glass receptacles have been used, but the principle admits of the use of steel shells, in which case the

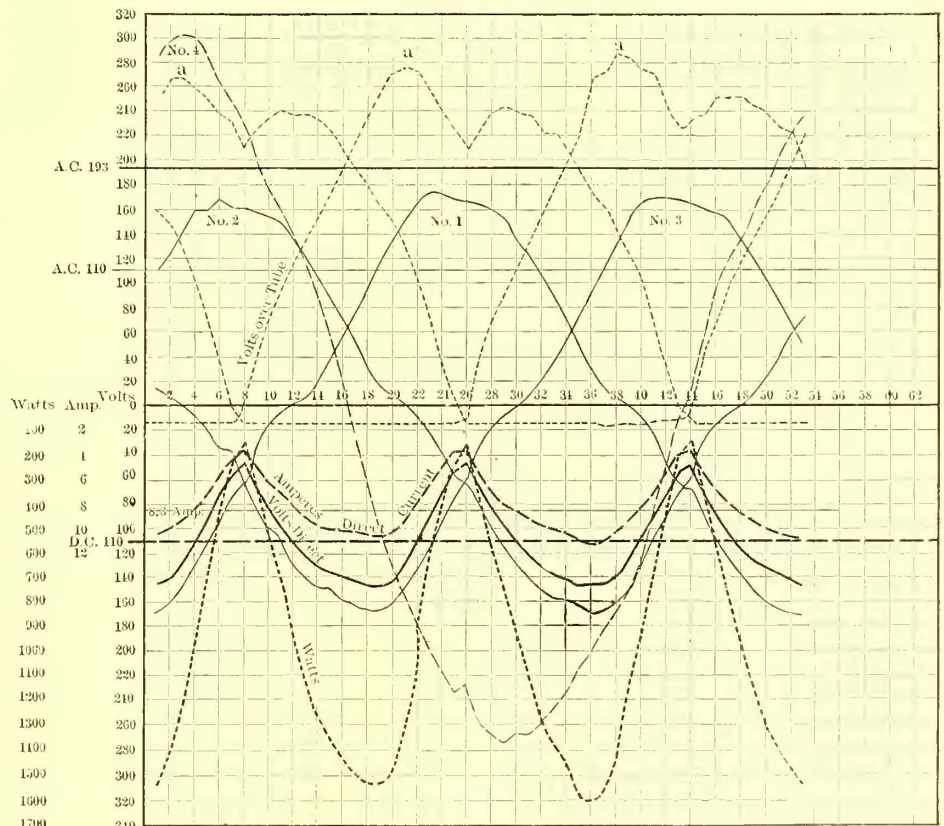


FIG. 2.—CHARACTERISTICS OF THREE-PHASE CURRENTS

Fig. 1 is diagram of the circuits; 1, 2 and 3 are the circuits of a Y-wound, three-phase generator, the leads of which connect to the static converter electrodes, 1, 2 and 3. One side of the working circuit is connected to the lower or mercury elec-



shell would form the negative electrode, the positive electrodes entering through insulating material, such as glass or porcelain.

Figs. 2 and 3 are curves plotted from data taken with a converter in regular operation, the data being applied to rectangular co-ordinates in Fig. 2 and to polar co-ordinates in Fig. 3. The curves 1, 2 and 3 represent the waves of the e. m. f. generated in the three Y-windings of the generator. Curve 3 is the e. m. f. wave corresponding to the generator terminals of windings 2 and 3, the other corresponding curves of the outer three-phase circuit not being laid down; a, a, a are the three e. m. f.

was 110, the delta voltage at the terminals of the machine and the upper electrodes 193, and that of the pulsating direct current 110. In this, as in all other tests, the drop between the upper and lower electrodes was approximately 14 volts.

It will be noted that the curve in the working circuit corresponds to a direct pulsating current. If more than three phases were delivered to the converter the working e. m. f. would, of course, have less difference between its maximum and minimum value—that is, the current would more nearly approach a continuous current. In this respect the action of the converter may be compared with that of a commutator, a three-phase converter corresponding to a three-part accumulator, a six-phase converter to a six-part commutator, etc. It has been found that a pulsating current is most efficient in charging storage batteries, and for this purpose the converter in its present simple form is directly applicable.

### FORD FRANCHISE TAX LAW

Governor Odell, in his annual message, discussed the franchise tax law, which is now under consideration in the Supreme Court of the State, and plainly indicated that he disapproved the principle upon which this law was based. He said:

Under the operation of the franchise tax law it was sought to impose upon all those using streets and highways a greater tax for the privileges thus accorded. There is a great misconception, however, as to the results produced. A single corporation in the boroughs of Manhattan and the Bronx has seven-sixteenths of the total valuation of such properties in these two boroughs. This corporation is paying as much tax as many great railroad systems. By provisions of the law it is entitled to deductions because of car licenses and percentages paid to the city—at least so the law was interpreted until a recent decision of the court in a case in Buffalo, which held that such tax should not be deducted. The increase in receipts under this law upon the one hundred and sixty-seven millions of franchise valuations in Manhattan and the Bronx, after making all allowances for the tangible properties in the streets, and the deductions order by the courts of one-third of the total assessment are \$430,000 of the new revenue. If this same

proportion were carried out, therefore, in the city of New York it would mean an added revenue to the local treasury of \$860,000. The State has accorded to every locality the power to enter into contracts for all franchises which may be granted, and it seemed to me at the time of the enactment of this measure that ample provision was possessed by the cities properly to guard and protect their interests and that to surrender, therefore, what should belong to the State to the municipalities—that is, franchise rights—was unnecessarily giving away powers which should belong to and which are inherent in the State.

With corporations, as with individuals, we should be fair, and while perhaps these corporations had not been paying the proportion which they should, still, whatever is of value for a franchise should be paid for to the State, because it creates the corporation; while for the use of the streets there should be a direct contract between the company seeking such privileges and the municipality affected. I am of the opinion also that under the present law those who might desire to use the powers possessed for taxing purposes could do so to the great disadvantage of almost any corporation, or with resultant unfairness to the municipalities affected. It seems to me, therefore, that the only safe and conservative way of assessing such corporations is upon their earning capacity.

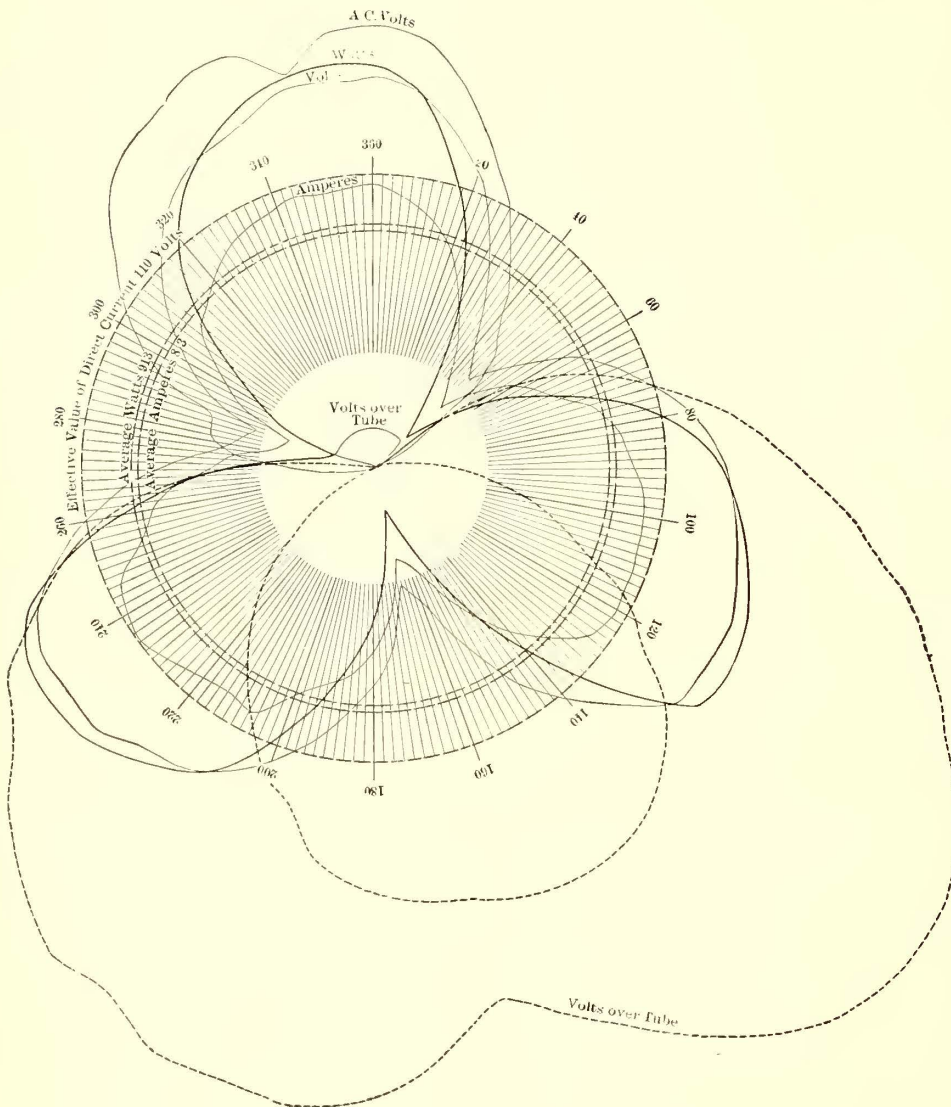


FIG. 3.—VOLTAGE, CURRENT AND WATT CURVES, POLAR CO-ORDINATES

waves corresponding to measurements taken across the converter. The e. m. f. curve of the working circuit is shown in heavy line, the corresponding current and watt curves being shown in dotted and broken line, respectively. The same explanation will apply to the polar curves.

The form of the curves a, a, a indicates very clearly the electric valve action of the electrodes in suppressing one portion of the alternating-current wave. This action is visually apparent at a very low frequency, when the succession of impulses from the several upper to the lower electrode can be followed by observing the vapor streams. It is interesting to note that the mass of mercury forming the lower electrode has a motion of rotation, the angular velocity of which varies with the frequency.

By reference to the curves it will be seen that the effective voltage of the pulsating current corresponds exactly to that generated in the sections of the Y-winding of the generator. In the machine used in these particular tests, the latter voltage



**ENGINEERING AND OPERATING FEATURES OF THE CHICAGO TRANSPORTATION PROBLEM—II**

The abstract of the report by B. J. Arnold to the local transportation committee of the Chicago City Council is continued from last issue, which discussed Parts I. and II. In the present article, Parts III., IV. and V. are considered.

Part III. is devoted to the growth of population and development of the transportation business in Chicago, a comparison of its population growth with that in other cities and a discussion of probable future increase. The financial results obtained in operation are analyzed. To show the city's growth and the development of the transportation business the following tables are submitted.

The tables and diagrams on transportation results do not include the business of the Chicago Consolidated Traction Company. As the business of the company is partly derived from the territory outside the city limits, any figures that might have been secured would not have been applicable to the present calculations, and it was decided to leave them out of the tables and make approximations as to the business done by that company within the city limits in the deductions and conclusions to be drawn from these statistics.

Table No. 1 shows the population from the incorporation of the city to the last census, taken in 1900 by the Board of Education.

TABLE NO. 1

Population of City of Chicago from Its Incorporation, 1837 to 1900			
1837.....	4,170	1868.....	252,054
1840.....	4,479	1870.....	306,605
1843.....	7,580	1872.....	367,396
1845.....	12,088	1874.....	325,408
1846.....	14,169	1876.....	407,661
1847.....	16,859	1878.....	436,731
1848.....	20,023	1880.....	491,516
1849.....	23,047	1882.....	560,693
1850.....	29,963	1884.....	629,985
1853.....	59,130	1886.....	703,817
1855.....	80,000	1888.....	802,651
1856.....	84,113	1890.....	1,208,669
1860.....	109,206	1892.....	1,438,010
1862.....	138,186	1894.....	1,567,657
1864.....	169,353	1896.....	1,616,635
1865.....	178,492	1898.....	1,851,588
1866.....	200,418	1900.....	2,007,695

Table No. 2, which is not shown here, gives the population for twenty years from 1880 to 1900 in periods of two years, by divisions, showing the percentage of increase between each census, by divisions and as a whole. The ten years from 1880 to 1899 cover the period of extensive annexation, especially to the South Division. The ten years from 1890 to 1900 show an increase from natural growth of 65.3 per cent, or an average of 6.53 per cent per annum, not compounded, and 5.5 per cent compounded, the largest increase being in the South Division. The federal census shows this increase to be an average of 5.44 per cent per annum, not compounded, and 5.35 per cent compounded. The six years from 1894 to 1900 show an increase of 28 per cent, an average, not compounded, of 4.66 per cent per year, or 4.29 per cent per year compounded and largely in the West Division. The two years from April, 1898, to April, 1900, show an increase of 8.44 per cent, or an average of 4.22 per cent per annum, not compounded, and 3 per cent compounded.

Table No. 3 gives the average single-track mileage of surface lines in each division, and as a whole for each year from 1892 to 1901, showing the increase year by year to meet the demands of the increase in population. In this mileage is included only the trackage of the Chicago City Railway Company and the Union Traction Company.

TABLE NO. 3

Track Mileage Each Year from 1892 to 1901—Surface Lines

Year	So. Div.	No. Div.	W. Div.	Total
1892.....	150.21	93.45	182.90	426.56
1893.....	152.33	93.45	197.10	442.88
1894.....	161.62	93.45	197.90	452.97
1895.....	162.37	93.45	199.00	454.82
1896.....	184.22	93.45	203.40	481.07
1897.....	189.72	93.45	203.40	486.57
1898.....	196.85	94.08	207.30	498.23
1899.....	205.48	94.08	207.30	506.86
1900.....	209.82	94.08	207.30	511.20
1901.....	214.77	94.14	209.20	518.11

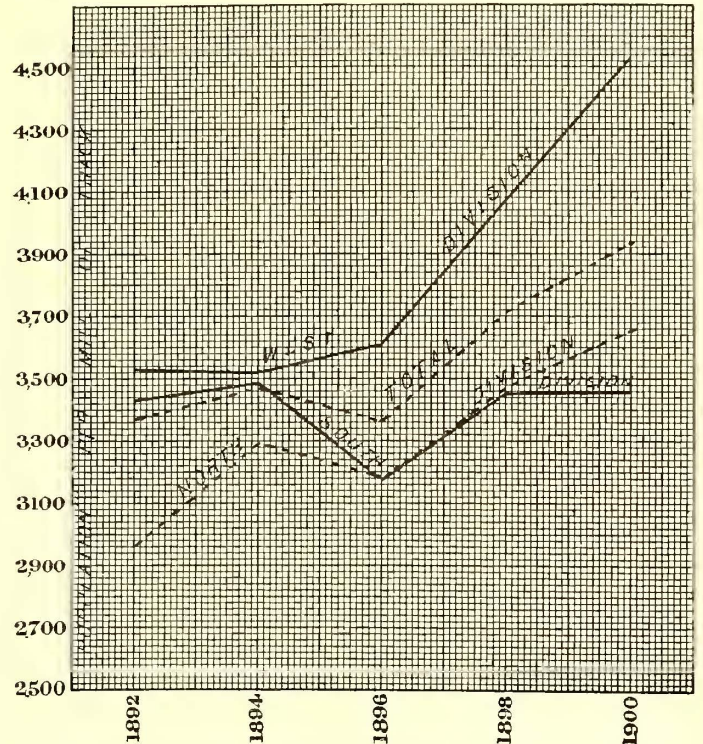


FIG. 1.—DIAGRAM OF TABLE NO. 4. POPULATION PER MILE OF TRACK, BY DIVISIONS, OF THE CHICAGO CITY RAILWAY AND CHICAGO UNION TRACTION COMPANY'S LINES

Table No. 4, not given but shown graphically in Fig. 1, gives the population per mile of surface track and shows 1000 more to the mile in the West Division than the South. The North Division is also in excess of the South.

Table No. 5 gives the revenue passengers carried per year from 1892 to 1901 by the surface lines in divisions. It is interesting to note how the effects of "boom" and depressed times, and competition of elevated lines can be traced in the opera-

TABLE NO. 5

Revenue Passengers Carried Per Year, 1892 to 1901—Surface Lines

Year	So. Div.	No. Div.	W. Div.	Total
1892.....	88,018,861	50,419,457	94,518,474	232,956,792
1893.....	120,596,270	60,311,673	107,053,461	287,961,404
1894.....	84,794,987	49,571,463	85,287,302	219,653,752
1895.....	88,806,461	53,887,428	85,100,643	227,794,532
1896.....	95,238,915	56,523,620	79,072,902	230,835,437
1897.....	95,621,112	56,354,147	78,594,930	230,570,189
1898.....	95,992,114	58,422,070	80,600,505	235,014,689
1899.....	103,253,300	61,047,316	86,233,880	250,534,496
1900.....	110,843,202	57,468,053	89,817,809	258,129,064
1901.....	117,127,732	55,026,732	94,681,270	266,835,734

tions of the surface transportation business. The returns of 1893 show the benefits derived from the World's Fair; 1894 and 1895 show the depressed times following the fair and the advent of elevated competition on the South Side; 1895 and 1896 demonstrate the effects of elevated competition in the West Division as well as the loss entailed from labor troubles



during that period; 1900 and 1901 indicate the operation of the elevated in the North Division. As there has been no disturbing element introduced in the South Division since the labor difficulties of 1896 and 1897 a steady increase in business is noted, resulting in an increase in 1901 of nearly thirty million passengers over those carried in 1892.

As is shown in Table 3 and the discussion of Table 9, the increase in mileage in the North and West Divisions, exclusive of about 28 miles, has not been built by the Union Traction Company, and, consequently, the normal increase in receipts which would naturally accrue to new mileage has not accrued to the Union Traction Company, but has accrued to the Chicago Consolidated Traction Company, which has built the increased mileage that now exists in the North and West Divisions over that of 1892, exclusive of the 28 miles built by the Union Traction Company. While the statement that the increase in the last ten years in the North Division is only five million passengers, and that the West Division has only just regained its losses since 1892, is true as to the lines of the Union Traction Company, it is not true when applied to all of the surface transportation facilities of the North and West Divisions.

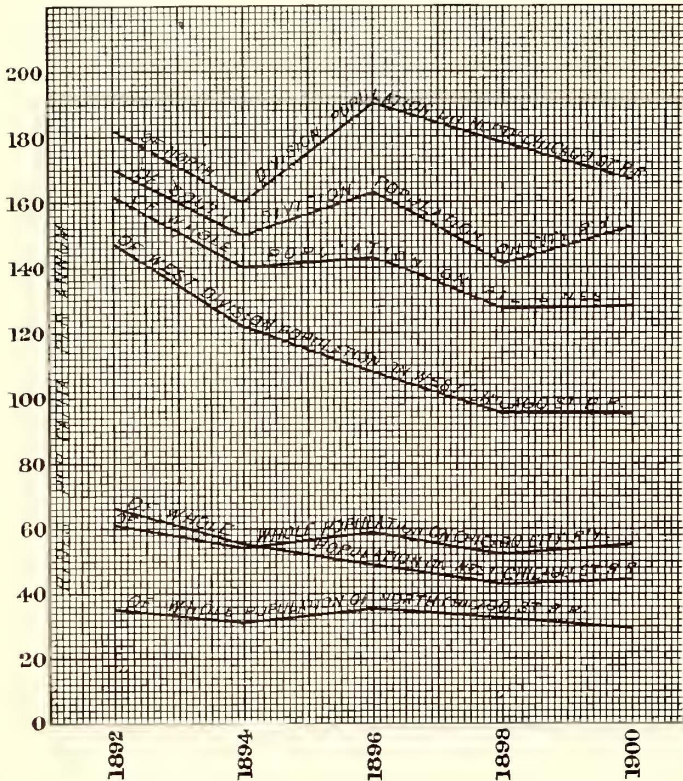


FIG. 2.—DIAGRAM OF TABLE NO. 6. RIDES PER CAPITA PER ANNUM ON CHICAGO CITY RAILWAY AND UNION TRACTION COMPANY'S LINES

The elevated competition in the South Division has not been as serious as in the other divisions, nor is it of as recent date, and, consequently, it is natural that the increase in the North and West Divisions, even including the increase that has accrued to the additional mileage of the Chicago Consolidated Traction Company, has not been as great as in the South Division, but it is believed that the time has arrived when the surface lines have overcome the effect of the competition of the elevated lines and that in the future the percentage of increase will be as great in the North and West Divisions as in the South Division.

Table No. 6, not here given but shown graphically in Fig. 2, gives the rides per capita per annum of the population of each division on the lines of the divisional systems; the rides per capita of the whole population on each divisional system and the rides per capita of the whole population on the whole mileage.

This table shows that, although the population has increased 39 per cent in the last eight years, the rides per capita have decreased from 162 to 128, the largest falling off being in the West Division. This is due to elevated competition and the fact that the increase in population has largely settled in remote outlying districts, using other means of transportation. The figures also show that the residents of the West Division do not ride in proportion to the population of either of the other divisions.

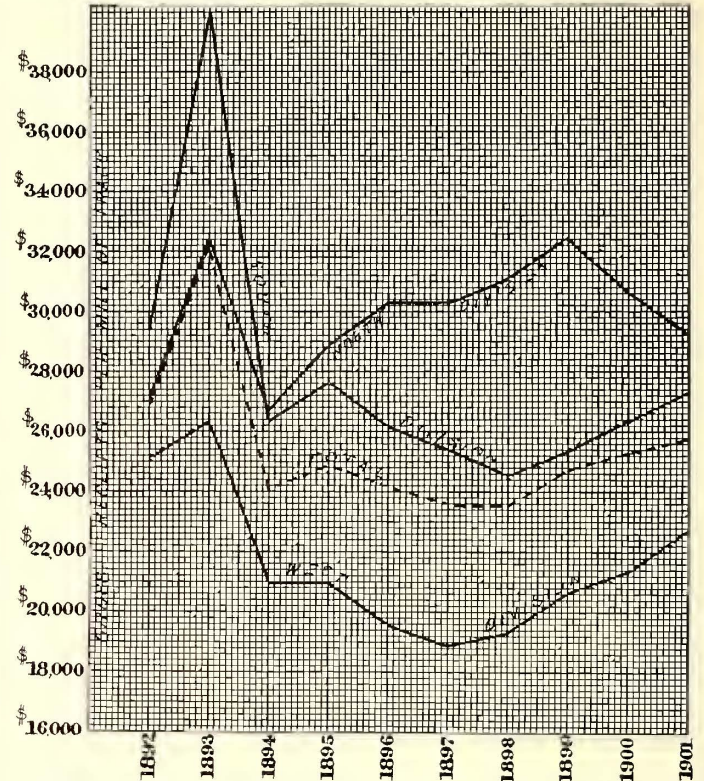


FIG. 3.—DIAGRAM OF TABLE NO. 9. GROSS RECEIPTS PER MILE OF TRACK PER YEAR OF CHICAGO CITY RAILWAY AND CHICAGO UNION TRACTION COMPANY

Table No. 7 gives the passengers carried per mile of track, demonstrating the same point as Table 6.

TABLE NO. 7

Passengers Carried Per Mile of Track—Surface Lines

Year.	So. Div.	No. Div.	W. Div.	Average
1892.....	585,972	539,533	516,777	546,129
1893.....	791,677	645,389	543,143	650,202
1894.....	524,656	530,459	430,962	484,919
1895.....	546,939	576,644	427,641	500,845
1896.....	516,984	604,854	388,755	479,838
1897.....	504,012	603,040	386,405	473,868
1898.....	487,640	620,983	388,810	471,700
1899.....	502,500	648,887	416,000	494,287
1900.....	528,277	610,842	433,274	504,947
1901.....	545,363	555,043	452,587	515,017

Table No. 9, not here given but shown graphically in Fig. 3, gives the gross receipts per mile of track per year for the last ten years in divisions. The track mileage in all three divisions has increased during the last ten years about 92 miles. Of this, 64 miles is in the South Division, less than 1 mile in the North Division and 26 miles in the West Division.

The small increase in mileage in the North and West Divisions by the Union Traction Company and its subsidiary companies is due to the fact that the Chicago Consolidated Traction Company has built some 90 miles within the two divisions during the last ten years which were used to serve the increasing population.

While nearly all the increased receipts of the whole city during the last ten years is shown to be in the South Division,



owing to the increase in mileage, the receipts per mile have decreased about \$2,000.

Table No. 10, given below, gives the car miles operated per year by divisions for the last ten years.

TABLE NO. 10

Car-Miles Operated Per Year, 1892 to 1901—Surface Lines

Year	So. Div.	No. Div.	W. Div.	Total
1892.....	20,820,710	8,547,791	15,582,142	44,950,643
1893.....	26,304,090	9,224,173	16,813,135	52,341,398
1894.....	21,047,410	8,793,587	15,671,500	45,512,497
1895.....	21,941,900	9,697,326	16,820,525	48,459,751
1896.....	24,552,900	10,590,036	15,703,761	50,846,697
1897.....	24,378,000	10,644,270	15,478,263	50,500,533
1898.....	24,385,300	10,916,737	16,066,454	51,368,491
1899.....	26,371,000	11,189,758	16,618,244	54,179,002
1900.....	29,232,360	12,343,787	19,328,434	60,904,581
1901.....	30,643,250	11,372,043	19,105,342	61,120,635

system is compelled to run more mileage to secure its business than either of the other divisions. This is due to the elongated shape of the territory, with consequent long routes and the settlement of the population at points farther removed from the business center than in the other divisions. It will be noted that more mileage has been run in the North and West Divisions since the acquisition of those systems by the Union Traction Company, which means that a more liberal service has been given. The constantly decreasing receipts per

Table No. 11, not here given but shown graphically in Fig. 4, gives the car miles operated per mile of track per year in divisions for the last ten years.

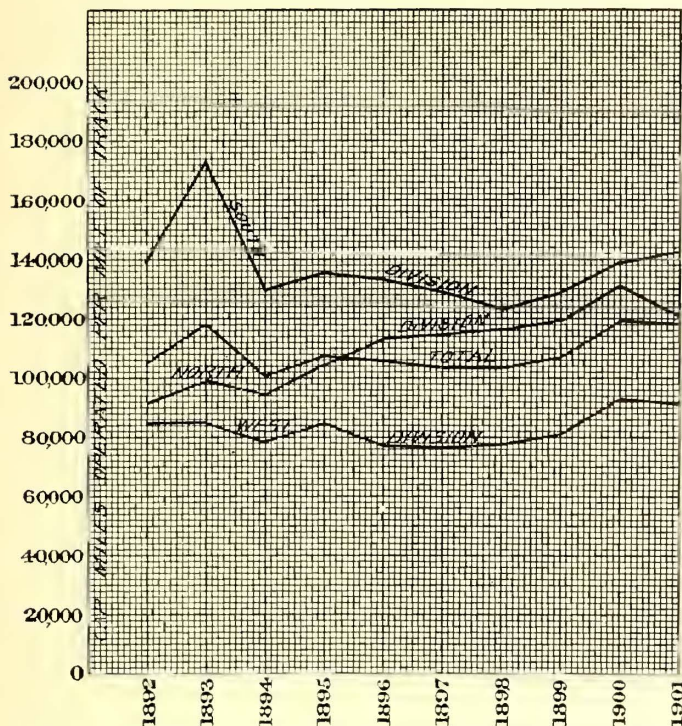


FIG. 4.—DIAGRAM OF TABLE NO. 11. CAR-MILES PER MILE OF TRACK PER ANNUM ON CHICAGO CITY RAILWAY AND UNION TRACTION COMPANY'S LINES

Table No. 12 gives the gross receipts per mile operated per year in divisions for the last ten years.

TABLE NO. 12

Gross Receipts Per Mile Operated Per Year—Surface Lines

Year	So. Div.	No. Div.	W. Div.	Total
	Repts. Per Mile Cents	Repts. Per Mile Cents	Repts. Per Mile Cents	Repts. Per Mile Cents
1892.....	21.13	29.50	29.43	25.60
1893.....	23.04	32.68	30.90	27.27
1894.....	20.26	28.19	26.43	23.92
1895.....	20.40	27.78	24.71	23.38
1896.....	19.58	26.69	25.30	22.83
1897.....	19.76	26.48	24.86	22.74
1898.....	19.82	26.76	24.76	22.84
1899.....	19.69	27.26	25.76	23.12
1900.....	18.96	23.30	23.21	21.19
1901.....	19.11	24.19	24.76	21.82

These last three tables demonstrate that the South Division

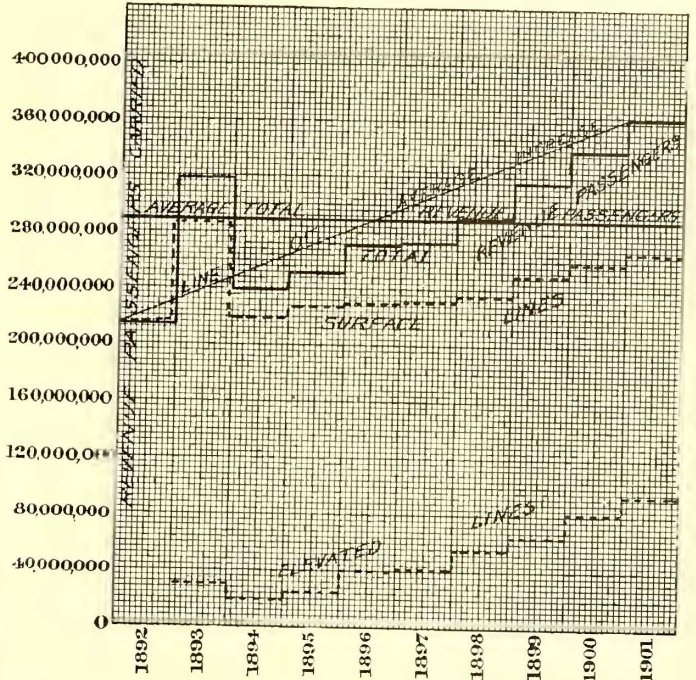


FIG. 5.—DIAGRAM A, OF TABLE NO. 14. REVENUE PASSENGERS CARRIED PER YEAR, 1892-1901—SURFACE AND ELEVATED LINES

mile run, as shown in Table 12, demonstrate that a more liberal policy in the furnishing of accommodations has been adopted each year, and the increase in receipts per mile run in the North and West Divisions over the South Division is mainly attributable to the fact of there being a more dense population adjacent to the business center requiring shorter hauls.

Table 13 gives the revenue passengers carried per year by the elevated lines.

TABLE NO. 13

Revenue Passengers Carried Per Year 1892 to 1901—Elevated Lines

Year	So. Div.	No. Div.	W. Div.	Total
1892.....	In Construction		In Construction	
1893.....	30,055,560		"	30,055,560
1894.....	13,587,855	In Construction	6,000,000	19,587,855
1895.....	14,217,845	"	9,936,450	24,154,295
1896.....	13,405,355	"	26,363,907	39,769,262
1897.....	13,331,625	"	28,236,528	41,568,153
1898.....	18,898,605	"	36,306,408	55,205,013
1899.....	22,628,175	"	42,166,559	64,794,734
1900.....	24,990,820	10,185,141	46,109,290	81,285,251
1901.....	26,320,150	20,327,005	48,960,994	95,608,149

Table 14, not given but shown graphically in Fig. 5, gives the revenue passengers carried per year from 1892 to 1901 on the surface and elevated lines combined and the percentage of increase each year. This more satisfactorily shows the steady and uniform increase in the total transportation business each year, combining, as it does, the competing systems. During the nine years from 1892 to 1901 the total increase has been 55.58 per cent over what the gross receipts were for the year 1892, or an average of 6.18 per cent per annum, not compounded, or 5 per cent per annum compounded. The surface



lines carried during 1901 73.62 per cent of the total passengers carried and the elevated lines 26.38 per cent. As the elevated lines have about settled down to their normal business they should only be credited with a share of the increase in the future equal to the proportion of their business to the total business. On this basis, and assuming that the increase in the future will be at the same rate as that in the past, the surface lines should be credited with 4.55 per cent of the increase and the elevated with 1.63 per cent, respectively, if figured not compounded, or 3.68 per cent and 1.32 per cent, respectively, if figured compounded.

Tables and curves are given in the report which show the percentage of increase of population and passenger earnings on surface and elevated lines from 1892 to 1900. The population increased nearly 9 per cent between 1892 and 1894, while the riding increased less than 3 per cent. Between 1896 and 1898, covering the period of labor troubles, the population increased about 14½ per cent and the riding only 7¼ per cent. Between 1898 and 1900 the population increased 8½ per cent and the passengers carried nearly 17 per cent. These figures would tend to demonstrate that prosperous and depressed times affect the transportation business more than increase in population does.

DEDUCTIONS

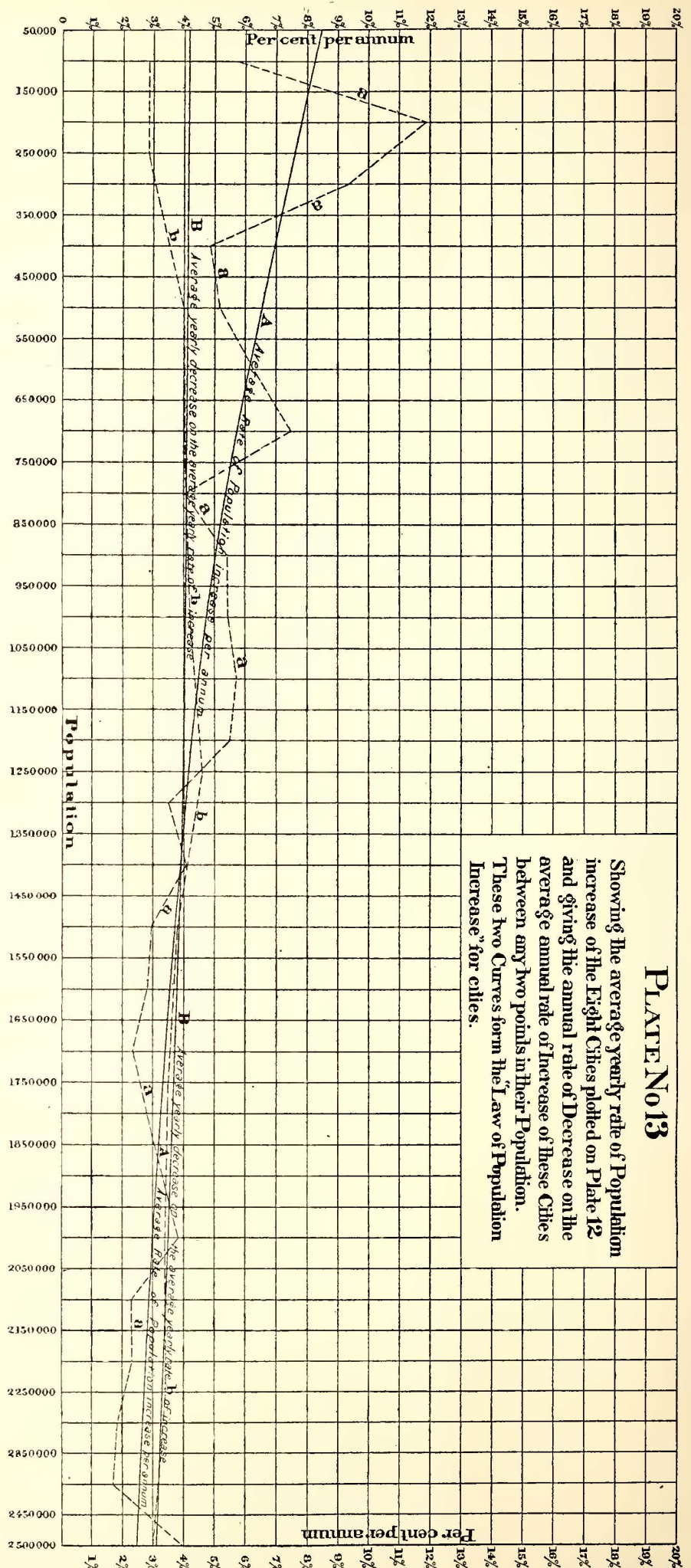
The deductions to be drawn from this information are:

First—That the normal increase in population up to and including 1892 was at the rate of about 11.2 per cent per annum compounded, and that since and up to 1901 the increase has dropped to less than 5 per cent per annum, although the figures for 1901 and estimated figures for 1902 bring the average for this last year up to 7.7 per cent.

Second—That the elevated competition, labor disturbances and depressions in the industrial world at the several periods during the last ten years and the earnings of the mileage built by the Chicago Consolidated Traction Company have practically offset any benefits which might have accrued to the surface lines of the Union Traction Company in the North and West Divisions from increase in population—its gross receipts during the last year being approximately equal to what they were in 1892.

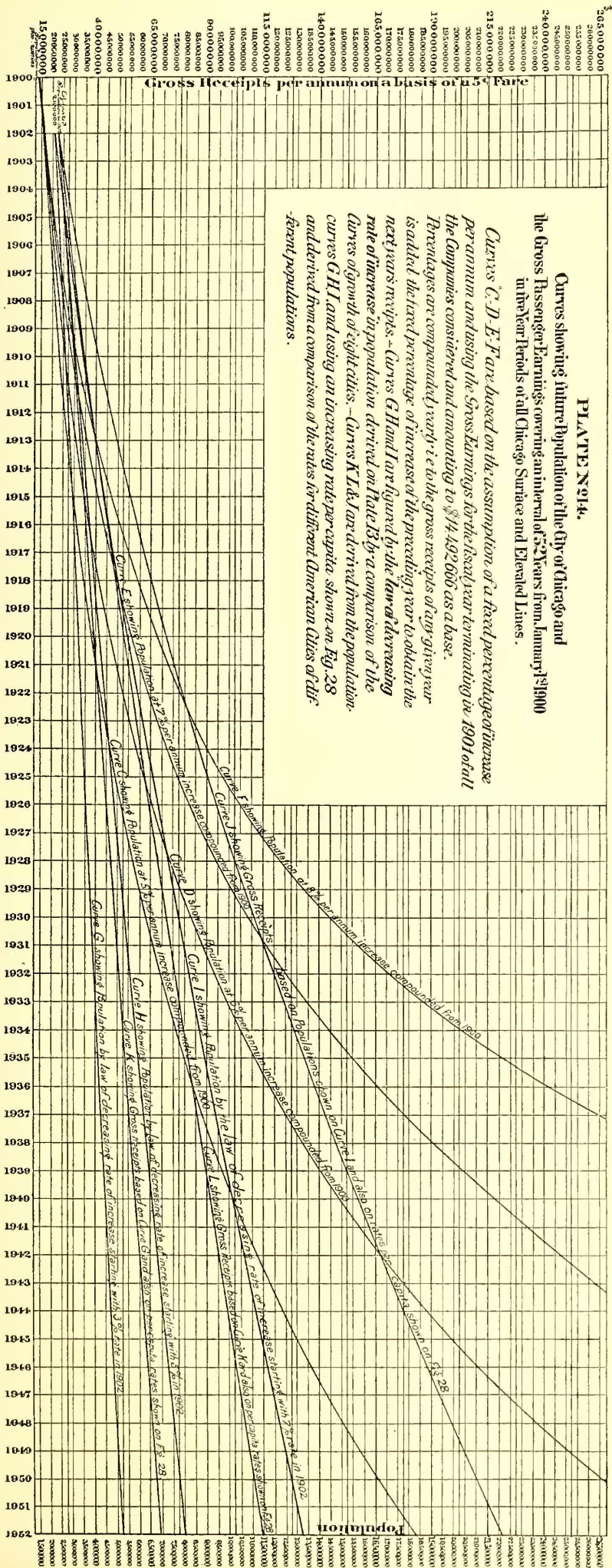
Third—That the Chicago City Railway Company in the South Division has met all competition and depression and shows an increase of passengers carried during the year of 1901 of thirty million passengers over the number carried during the year of 1892, or about 34 per cent increase in nine years.

Fourth—That in a city the size of Chicago the increase in population per year, as recorded since 1862, does not seem to have as much influence in increasing earnings of



**PLATE No 13**  
 Showing the average yearly rate of Population increase of the Eight Cities plotted on Plate 12 and giving the annual rate of Decrease on the average annual rate of Increase of these Cities between any two points in their Population. These two Curves form the "Law of Population Increase" for cities.





the transportation business as do depressed times in decreasing them or prosperous times in augmenting them.

POPULATION INCREASE IN OTHER CITIES

In order to arrive at a basis on which to estimate the future growth of Chicago and the future gross earnings and requirements of the street railway lines in Chicago figures were obtained and curves plotted from the leading cities of the world.

It was found that Chicago has increased in population at a much more rapid rate than any other large city, but it cannot be hoped that it will permanently maintain its present rate of increase.

The increase in the population of London from 1800 to 1860 was at an average of 1.8 per cent per annum; from 1861 to 1891 at 1.22 per cent per annum; from 1891 to 1901 at 1.55 per cent per annum.

Paris, between 1800 and 1900, increased 1.675 per cent per annum.

Berlin, from 1861 to 1900, increased 3.225 per cent per annum, or the highest rate of any European city.

Philadelphia, between 1800 and 1900, increased 3.5 per cent per annum.

New York, for the same period, increased 3.6 per cent per annum.

The territory now constituting Greater New York, between 1800 and 1880, increased 4.06 per cent per annum. The same territory between 1870 and 1900 increased 2.8 per cent per annum, or for the century, 1800 to 1900, the increase was 3.9 per cent per annum.

On Plate 13, Curve A, is given the average rate of annual increase of population of all the cities considered for different periods of time. This shows that the average rate of increase for all these cities is a gradually decreasing one. Curve B represents this gradual rate of decrease of the average rate of increase and forms the basis of a law which is made use of a little later.

Plate 14 shows Curves C to L inclusive, which represent the increase in population of the city of Chicago for a period of fifty-two years from 1900, under different assumed rates of increase figured from the foregoing law. If the national and local conditions governing Chicago should average in the future as they have in the past it is fair to suppose that the law of decreasing rate of yearly increase derived from the average curve of other cities would hold and that the population in 1952 would be 13,250,000. This is starting with 7 per cent increase for 1902. Taking 3 per cent as a basis upon which to apply the law instead of 7 per cent, a curve is obtained conforming to the average growth of the European cities considered. This growth shows the population of Chicago in 1952 as 5,250,000. The two curves, I and G, Plate 14, of population increase as determined according to the law of decrease in population increase, represent the limits between which the growth in population of Chicago should vary. The probable average growth of any city cannot be determined with any degree of safety except within certain limits. This is well illustrated in the case of Philadelphia. Prior to 1861 any law applied to its growth at that time would have shown a rapid increase in population, whereas the growth dropped in five years from 33 per cent per annum to 9.7 per cent and in another five years to 2.9 per cent.

PROBABLE FUTURE GROSS RECEIPTS

In order to approximate the gross receipts for the



future of the surface and elevated lines, the receipts per capita of seventy-four cities of the United States of different population, including St. Paul, Minneapolis, St. Louis, Boston and

From Tables 16 and 17 it will be seen that the Chicago City Railway Company operates its cable lines for 2 cents a car mile less than its electric service, while it costs the Union Traction

Company about 2 cents a car mile more than its electric service. This is due largely to the fact that in the South Division about 45 per cent of the total business is done on the cable lines, requiring only three power plants. In the North and West Divisions only 34½ per cent of the total business is done on the cable, requiring eight extensive power plants for the operation of the cable system. While a change from cable to electric power in the South Division would not apparently save money in operation, the increase which could be obtained in speed and the more elastic methods of routing that could be adopted would be of material benefit to the company as well as the public.

In the North and West Divisions, had the cable lines been electric during their last fiscal year, the company would have saved over 2 cents a mile on all car mileage operated by cable, or about \$225,000 for the two divisions.

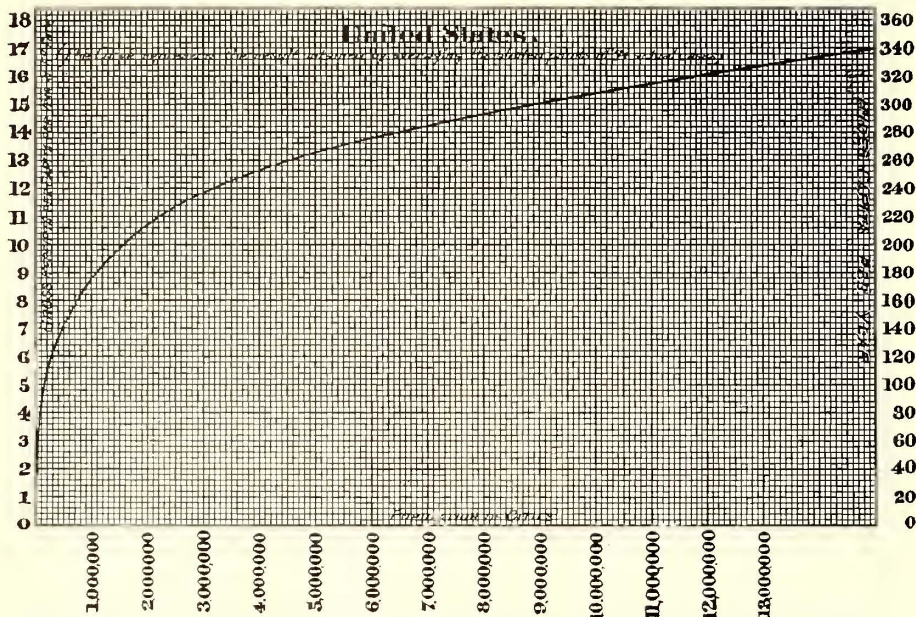


FIG. 6.—CURVE OF COEFFICIENT OF RIDES AND GROSS RECEIPTS PER CAPITA IN CITIES OF THE UNITED STATES

New York, were compiled. The curve in Fig. 6 was then plotted, showing the relation of traffic and gross receipts per annum per capita of population. According to this curve, for a city of 750,000 inhabitants the gross receipts should be about \$8 per capita per year; for a city of 2,000,000 it should be \$10.60 per capita, and for a city of 4,500,000 it should be \$13 per capita. Applying these figures to the Curves I and G of population increase (Plate 14), the total gross receipts for 1952 should be \$222,500,000 on the 7 per cent increase basis and \$70,000,000 on the 3 per cent increase basis. The probability is that an average curve, as shown on Curve K, Plate 14, would approximate the actual growth of the future. Curve L represents the probable gross receipts for this rate of increase.

From the above it is reasonably clear to the author that the true rate of increase, and consequently the true rate upon which to base future earnings of the street railways of Chicago, is a varying one, for, while it may hold at the rate of 5 per cent or 6 per cent per annum for some time to come, it cannot be held at this rate permanently and must gradually decrease, contrary to the generally accepted opinion on this subject. The compounding feature, which must be taken into account in every correct analysis of the subject, is frequently left out of the account. Operating expenses might be slightly decreased with the increase of population, but as this varies with the quality of service demanded it cannot be predetermined and must be assumed at some fixed percentage of the gross receipts for comparison. Mr. Arnold cannot see his way clear to recommend the assumption of any fixed percentage of increase in gross receipts for any great length of time, but has endeavored to give as complete analysis of the subject as practicable to form the basis for intelligent discussion. If a money compensation is to be required by the city for franchises the only just basis of compensation should be a percentage of the gross receipts of each of the companies, payable annually. No definite amount of compensation independent of the gross receipts can be justly fixed in advance.

OPERATING AND FINANCIAL STATISTICS

Because of the lack of uniformity in methods of accounting only the figures of the present companies for one year ended Jan. 3, 1902, are given. Tables 16 and 17 give statements in condensed form of the Chicago City Railway Company and the Chicago Union Traction Company.

TABLE NO. 16  
Statements of Operations—Chicago City Railway Company  
Year Ending Dec. 31, 1901

Items	Electric	Cable	Horse	Total
Maintenance of Way and Equipment .	\$278,385.25	\$262,381.18	\$945.58	\$541,712.01
Power Production . . . .	199,540.75	150,850.70		350,391.45
Conducting Transportation ..	1,688,428.40	1,025,081.64	26,541.57	2,740,051.61
Cost of Operating . . . .	2,166,354.40	1,438,313.52	27,487.15	3,632,155.07
Receipts from Passengers .	3,647,135.61	2,188,588.15	20,662.85	5,856,386.61
Net Earnings from Operation of Cars.	1,480,781.21	750,274.63	*6,824.30	2,224,231.54
Miles Run . . . .	16,727,540	13,809,620	106,090	30,643,250
Passengers Carried . . .	73,403,433	44,041,678	418,879	117,863,990
				Average
Receipts per Mile . . . . .	21 8-10c	15 8-10c	19 5-10c	19 1-10c
Operating Cost per Mile . . . .	12 95-100c	10 41-100c	25 90-100c	11 85-100c
Percentage of Operating Expenses to Gross Receipts . . . . .	59 40-100%	65 72-100%	133%	62 02-100%
Per Cent of Total—				
Miles Run . . . .	54 59-100%	45 06-100%	35-100%	100%
Passenger Receipts . . . .	62 28-100%	37 37-100%	35-100%	100%

\* Loss.

TABLE NO. 17  
Statement of Operations—Chicago Union Traction Co. Year Ending June 30, 1902

Items	Electric	Cable	Total
Maintenance of Way and Equipment . . . . .	\$610,054.57	\$480,842.03	\$1,090,896.60
Power Production . . . . .	322,104.95	239,973.59	562,078.54
Conducting Transportation	1,868,035.14	1,049,709.15	2,917,744.29
Cost of Operating . . . . .	2,800,194.66	1,770,524.77	4,570,719.43
Receipts from Passengers.	4,923,089.41	2,856,971.74	7,801,075.78
		21,004.73*	



Items	Electric	Cable	Total
Net Earnings from Operation of Cars.....	2,122,894.75	1,107,451.70	3,230,356.35
Miles Run .....	20,018,334	10,619,779	30,732,951
Passengers Carried .....	98,562,555	57,154,184	156,136,898
Receipts per Mile.....	24 59-100c	26 90-100c	25 38-100c
Operating Cost per Mile..	13 98-100c	16 52-100c	14-87-100c
Percentage of Operating Expenses to Per Cent of Total Gross Receipts...	56 87-100%	61 52-100%	58 59-100%
Miles Run .....	65 13-100%	34 55-100%	100%
Passenger Receipts .....	63 10-100%	36 62-100%	100%

\* Horse.

Table No. 18 gives a further statement of the finances of the two companies for the same period.

Items	Chicago City Ry. Co.	Chicago U. T. Co.	Combined
Net Earnings from Operation of Cars, per Tables 16 and 17 .....	\$2,224,231.54	\$3,230,356.35	\$5,454,587.89
Income from Other Sources .....	43,884.68		43,884.68
Chartered Cars .....		4,264.65	
U. S. Mail .....		19,779.35	
Advertising .....		33,525.00	
Rents, Land & Buildings..		49,703.06	
Rents, Tracks and Terminals .....		10,000.00	
Interest on Deposits and Loans .....		9,786.67	
Miscellaneous .....		14,335.97	141,393.80
	\$2,268,116.22	\$3,371,750.15	\$5,639,866.37
DEDUCTIONS			
Depreciation .....	\$180,000.00		
Interest on Bonded Indebtedness, Now Retired	103,938.75		
General Taxes .....	237,018.00		
Dividend 9 per cent on \$18,000,000 Capital Stock	1,620,000.00		2,140,956.75
Taxes .....		\$614,416.93	
Interest on Loans .....		117,784.20	
Premiums on Bonds Purchased .....		2,397.04	
Bond Interest .....		1,250,740.00	
Rentals on Stocks.....		1,633,939.66	3,619,277.83
Surplus .....	127,159.47		
Deficit .....		247,527.68	120,368.21

PAYMENTS TO THE CITY

Complying with the provisions of certain ordinances under which it is operating the Chicago City Railway Company pays annually for paving, sprinkling, heating and license fees \$216,537, or nearly 1 per cent of the total gross receipts of the company from all sources. This amount is practically a fixed charge, but does not include taxes. The Chicago Union Traction Company pays annually \$187,799.06 for similar items, or slightly over one-half of 1 per cent of the gross receipts of the company from all sources. There are also other items covering repairs to pavements, bridges, viaducts and subscriptions to track elevation and viaduct construction, but these are not fixed annual charges and hence are not enumerated.

CAPITALIZATION

The total capitalization of the Chicago City Railway Company is represented by its capital stock of \$18,000,000, on which it is paying at the present time 9 per cent annual dividends, or \$1,620,000. The Chicago Union Traction Company, on its West Side system, has assumed mortgages and guaran-

teed dividends on capital stock in outlying companies to the amount of \$33,682,300, upon which the annual interest is \$2,179,895. The North Side system stock and bonds to outlying companies amounts to \$16,220,000, with an annual fixed charge of \$1,464,980. The total underlying securities of the Chicago Union Traction Company are, therefore, \$49,902,300, with annual fixed charges of \$3,644,875. Added to this is \$12,000,000 in 5 per cent accumulative preferred stock of the Chicago Union Traction Company and \$20,000,000 common stock. The total liabilities of the Chicago Union Traction Company are, therefore, \$81,902,300, with annual fixed charges of \$4,244,875. Deductions from this bring the net total capitalization from the Union Traction system, not including the Consolidated system, which it owns, down to \$75,097,100, on which the fixed charge, including bond interest, guaranteed stock dividends and dividends on preferred stock, but not dividends on common stock, amounting to \$3,482,560.

THROUGH ROUTES, UNIVERSAL TRANSFERS AND THE ONE-CITY, ONE-FARE QUESTION

Part IV. takes up the questions of the best routing of cars and universal transfers over the entire city. There seems to be a sentiment in favor of securing for Chicago in the adjustment of the transportation question one fare within the limits of the territory served by the companies at present affected by the franchises. Although this is the sentiment, no one seems to have devised any practical way to accomplish it. Some favor having cars of one company use the tracks of other companies, giving through service between divisions without change of cars; others favor the unrestricted change of transfers to accomplish the same end, and still others think that nothing but the consolidation of management on some basis would accomplish the result. In steam railroad operation, one company frequently utilizes the trackage of another for the purpose of perfecting more desirable routes. In such cases it is an easy matter to account for the business done, because the stations are fixed and all traffic is subject to the supervision of the conceding company. In street railway operation it is not so easy. Several proposed plans are briefly discussed in the report. The great desirability of transportation by through routes from one division to another is recognized, and it is considered that this can be done in an equitable manner, provided the committee should see fit to require it after considering it in connection with other subject matter of the report.

One method of accomplishing this, and a comparatively simple one, would be to equip each car with two cash-fare registers, one register to be used to record all fares originating north of any fixed line in the business district, say Monroe Street. South of this point the use of the first register would be discontinued by locking it, or otherwise, and the other register brought into use. It is believed that this principle could be applied in such a manner as fully to meet all conditions. If this plan should not be satisfactory to the companies they would probably soon agree upon some other method of accomplishing the object, if conditions made it necessary.

UNIVERSAL TRANSFERS

Universal transfers to accomplish the desired end of one fare within the city limits would be equitable to both companies if the average length of riding in the two territories were the same. The average length of the present routes on the Chicago City Railway Company is 10.37 miles. Those of the Union Traction Company average 7.69 miles. The possible average ride for all passengers hauled by the City Railway Company on transfers issued by the Union Traction Company would be 2.68 miles longer than on the Union Traction Company's lines. The population of North and West Divisions is in excess of the South Division, which is occupied by the Chicago City Railway; consequently the initial travel would be greater from the lines of the Union Traction Company, but



this would be equalized by the cash fare received from the South Side lines on the return trip. The method of settlement between the two companies would be to pay 5 cents cash for each transfer presented by one company in excess of the transfers presented by the other. This method of operation, while feasible and equitable as between companies, would be unsatisfactory to the public in operation because of the large number of loops converging at one point down town, creating a large number of grade crossings at loops and materially diminishing the terminal capacity of the downtown district. The holder of a transfer from one line to another in the business center would be compelled to walk from one to four blocks. Of course, it is true at the present time, under the double-fare system, that passengers desiring to utilize both systems must walk certain distances in changing from one system to another, but this disadvantage should be eliminated in the future.

#### JOINT USE OF TRACKS

Each company should give up its present tracks in the business district and accept new grants on a plan best suited for the accommodation of the passengers from each division.

#### IS THE ONE-FARE IDEA FEASIBLE?

Could a company afford to conduct the transportation business of Chicago on the basis of one fare within the city limits in the territory now occupied by the two principal companies? In the absence of a practical demonstration any answer to this question must be considered as a matter of opinion. The extreme distance served by the two present companies is about 17 miles from north to south. One fare would not be feasible if every passenger traveled all this distance, or even half this distance. However, the dense population of the city is located north of Fifty-Fifth Street, east of California Avenue and south of Diversey Boulevard. Within these boundaries the large percentage of the traffic is by the surface lines. Outside of these boundaries the population seeks other more rapid means of transportation to the business center. The extreme distance north and south within these boundaries is only 10 miles, a less distance than it is possible to ride at present on either company's lines for one fare. The present fare would not be sufficient if it were not that only a small proportion of the passengers avail themselves of the extreme privileges allowed. It is considered that the same would be true if the privileges were extended to the entire territory embraced by the lines of the two companies and that the extra short-haul travel between divisions that would be induced by the extension of these privileges would compensate for the loss of double fares between divisions. The fact must be recognized that about 80 per cent of the whole present travel for all divisions on the surface lines is to and from the business center, and the privilege of one fare between divisions would not appreciably alter this fact. The operating expenses would not be materially increased in proportion to the gross receipts, because the same total number of cars that are in operation now would do the same amount of business as they do now, but differently distributed.

As will be shown in Part V of this report, which outlines a consolidated plan of operation, practically the same service as is being given at the present time can be given with 200 cars less because of the increased speed obtained by the change of the cable lines to electric and the greater facilities of operating by through routes as against the present divisional operation. To this can be added the saving in superintendence and in the maintenance of only one organization. It is my opinion, after a careful canvass of the matter, that a unified company could afford to furnish transportation facilities to the entire territory embraced by the lines of the Chicago City Railway Company, the Chicago Union Traction Company and the Chicago Consolidated Traction Company within the city limits for a single fare, and that companies operating under divisional owner-

ship or management could guarantee the same privilege if properly protected against the fraudulent use of transfers, but at a slightly increased expense over that of a unified company.

#### SUGGESTIONS FOR UNIFIED STREET RAILWAY SYSTEMS IN CHICAGO

Part V of the report contains recommendations for a general plan of surface transportation under consolidated management, including the subways required, routes recommended, number of cars and headway of cars, schedule of streets and estimates of cost to produce such a system, with estimates of the earnings to be derived. As previously pointed out, it is considered that the unification of management must be precedent to any really satisfactory and permanent solution of the problem.

#### SUBWAYS UNDER UNIFIED MANAGEMENT

If subways were built for the accommodation of cars under the present plan, with no grade crossings, the subway system would consist of a number of small loops disconnected and entering from each division. With such a system of subways installed the realization of an ideal system of interdivisional transportation would be indefinitely postponed.

The desire for subways in Chicago has arisen because of the congestion in the streets in the business district. If subways are built they should reduce congestion to a minimum and render the most service to the public with a view to the future good of the city. The congested area is about twice as long north and south as it is broad east and west. Entrance to this area from the south is narrowed by the course of the river. Logically, subways designed to avoid or decrease congestion should pass the long way of the congested district. Following this course of reasoning, the recommendations, given in detail later, are for north and south subways between Fourteenth Street and Indiana Street, and in one plan, which will be outlined later on, are connections to two tunnels at present leading to the West Division.

#### GENERAL PLAN OF UNIFIED OPERATION

The north and south tracks of the three divisions, including those west of the river, should be connected and through north and south lines of cars should be operated on each street, these lines to be designated the "trunk system." Upon the east and west tracks of the three divisions, through east and west lines of cars should be operated on each street, these lines to be designated the "cross-town system." Upon the diagonal avenues radiating from the business center there should be operated lines of cars between the northeast and southwest and between the southeast and northwest divisions of the city through the business center, designated the "avenue system." As the business center is the objective point of a large portion of the travel, especially morning and night, whatever service is found necessary to augment the service already set forth should be operated as at present from divisions to the business center and return. To serve local travel in the business district and transfer passengers between railroad depots there should be a local downtown route which should receive and issue transfers to and from all lines entering the business district. With a sufficient number of cars of proper design, properly routed and operated under adequate headway under this general plan, the citizens of Chicago would have a system of transportation that would only be excelled in cities where elevated, underground and surface systems exist under one control and are all used to equalize time and distance within the city limits. The problem submitted for report covers only a rearrangement of surface transportation without regard to the elevated system.

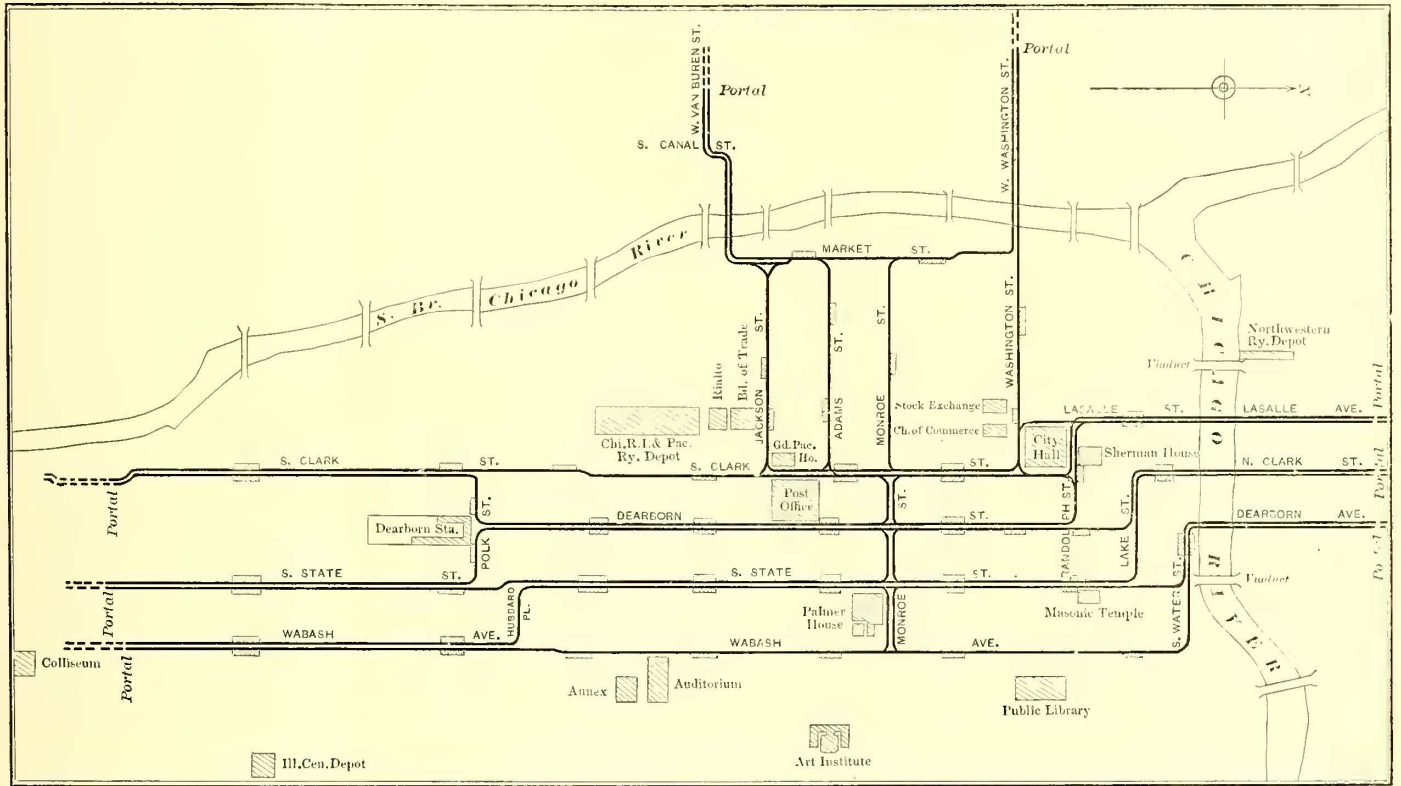
#### SUBWAY RATES

Conforming to the fundamental principle that transportation should be conducted so as to give the through traffic the right of way or route in the channel of least resistance, and recog-

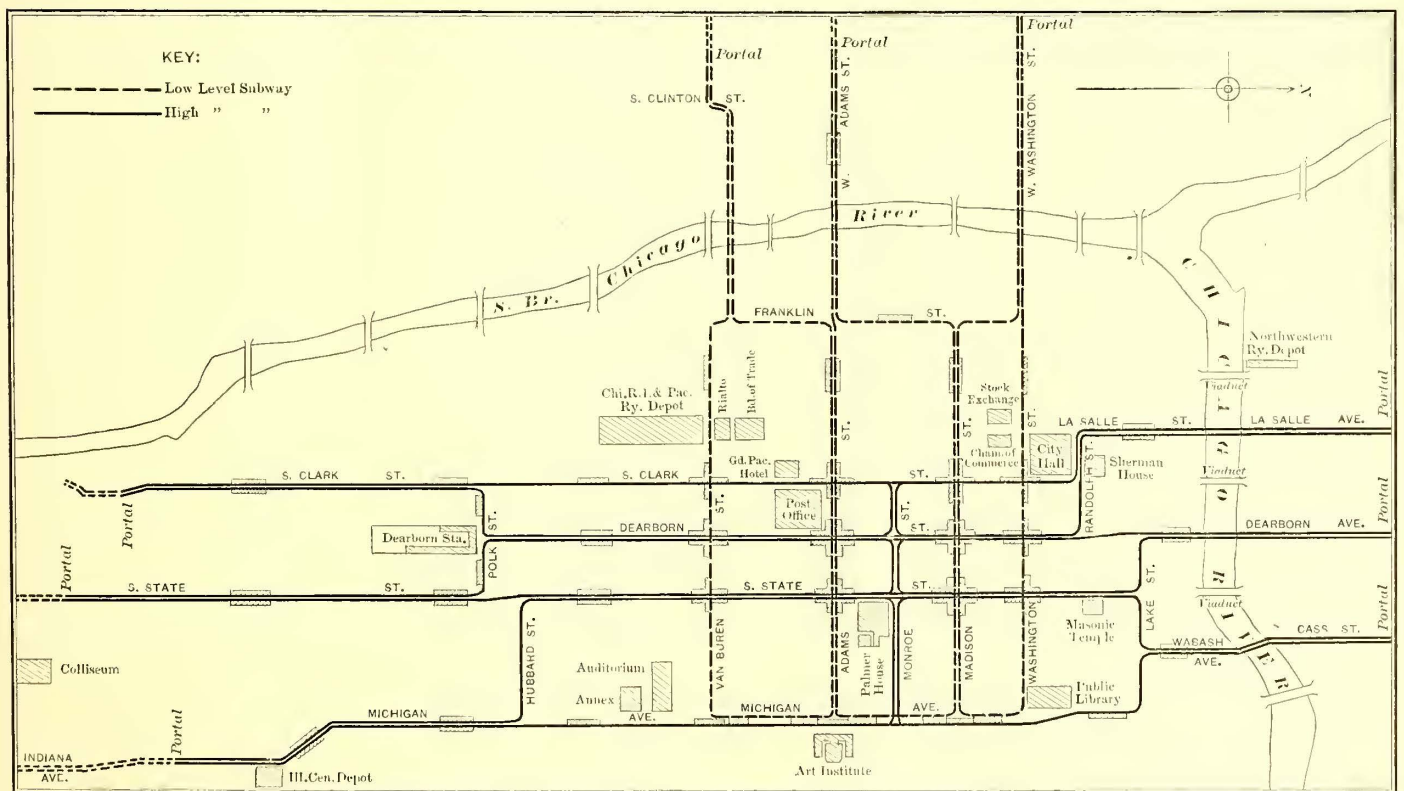


nizing that a large portion of the through traffic will be conducted between the North and South Divisions contiguous to the lake shore and over the "avenue lines" through the business center, the subway system of Chicago should consist of

outed to the tracks leading to the most western subway, as quite a proportion of the traffic from the westerly portion of the South Division and from the West Division terminating in the business center will naturally be brought in over the



MAP NO. 11, SHOWING SUBWAY PLAN NO. 1



MAP NO. 10, SHOWING SUGGESTED SURFACE LOOPS IN CONNECTION WITH SUBWAY PLAN NO. 1, AND RECOMMENDED AS A SURFACE DISTRIBUTION SYSTEM, IN CONNECTION WITH ALL PLANS

subways between Fourteenth Street and Indiana Street under the north and south streets best adapted to serve the north and south through traffic, with east and west connections (see Subway Plan I on Map 11) from the most westerly subway to the two terminals leading to the western division. The "avenue" through traffic from the North and South Divisions should be

"avenue" lines and from lines leading into the avenues. Two subway loops for the joint use of this traffic, terminating in the business center, should be constructed, using the most westerly north and south subway for the east side of each loop. All other cars from the West Division and from the westerly portion of the South Division would be brought into the busi-



ness district over the bridges and returned via surface loops (see Map 10) over cross-connecting subways, as shown on the map. By this plan the following results would be obtained:

First—The greatest possible capacity of the limited area of the business district would be utilized for terminal facilities.

Second—All through traffic via the business center would be taken through the congested district underground, saving time to the passenger and relieving the congestion in this district.

Third—All subways would be on a high level without grade crossings, thus cheapening the construction and not interfering with existing low-level improvements.

Fourth—All river tunnel approaches within the business center would be closed.

Fifth—As all traffic from the North and South Divisions would be underground, if Surface Plan No. 1 (Map 10) were used, grade crossings of surface loops would be eliminated, except those incident to the operation of the local distributing system.

#### SURFACE TRACKS IN CONNECTION WITH SUBWAYS

Many have an idea that a subway system in the business district of Chicago will do away with all surface tracks. While this would be desirable, it is impracticable to devise sufficient terminal capacity in the limited number of streets embraced in the business district and avoid grade crossings without adopting a high and low level subway system, as hereinafter discussed. Whatever additional terminal facilities not afforded by the subway are required in the plan under discussion, which is Subway Plan No. 1 (Map 11), in combination with Surface Plan No. 1 (Map 10), must be arranged on the surface. As the number of highways entering the business center from the south and available for street car operation is limited to three, and as the number entering from the north is limited to four, and as the natural trend of through traffic is in a northerly and southerly direction parallel to the water front, it is necessary to locate the subway for the accommodation principally of the North and South Divisions. (The report then enters into a discussion of the particular routes suggested.) By this arrangement of surface loops all tracks except those at street intersections would be eliminated from La Salle and Washington Streets. It would be possible to bridge the river at La Salle Street by the abandonment of the tunnel and give a boulevard entrance into and through the business center by connecting with Jackson Boulevard and on Washington Street to Michigan Avenue. The route of the business center system is then discussed.

Map No. 9 is of the new proposed complete railway system for the entire city, with the headway and distribution of cars indicated for the time of maximum traffic. This map is contained on the large inset sheet which accompanies this issue.

#### LOOP CAPACITIES

Fifteen loops is the maximum capacity of the present highway entrances to the business district. It was shown in Part II. how many passengers must be moved from the business district in one hour. On the fifteen loops provided in Plan No. 1 the present traffic from each division could be taken care of and an ultimate capacity of about three times the present needs provided for, assuming that cars were operated on ten-seconds headway over each loop and that sixty people were carried per car. This would take care of 324,000 per hour, corresponding to a population of 5,000,000.

#### UNIVERSAL TRANSFER SYSTEM

A system of transfers similar to that in use by the Metropolitan Street Railway in New York is advocated and described at length. (This system was fully discussed and its operation explained by Oren Root, Jr., assistant general manager of the Metropolitan Street Railway Company of New York, in the STREET RAILWAY JOURNAL for Oct. 5, 1901.)

#### COSTS AND GROSS RECEIPTS

Later in the report is given a detailed estimate of the cost of a street railway system for the entire city, except the extreme southerly portion. This estimate includes all essential streets operated on by the four companies now in the territory, and also some new trackage (see Map 9). The terminal trackage in the business center would be as on Maps 10 and 11. The estimate includes 21.07 miles of conduit road. As the estimate is given in detail later, only a few main points are given here.

The plant for power production would be of a high-tension type, with sub-stations for transformation of the current to suitable voltage for the working conductors, the latest and best practice in vogue for such a system.

The cars would be of the closed, double-truck type, with reversible back cross seats, seating fifty-two passengers, equipped with power brakes and adequate motor capacity; and as this type is eminently suitable for summer operation, only one equipment would be necessary.

As the proper location for barns in which to house and from which to operate the cars would be at the extreme outlying ends of the several lines, the cost of real estate would be materially lessened. As the power house site for an economical distribution of current should be centrally located and contiguous to an ample supply of water and fuel, dock property near the business center, with adequate steam road connections, should be provided. The sub-stations would only require ordinary residence lots, located from 2 to 6 miles from the power house.

It is believed that the several amounts named for cost of real estate, while conservative, are ample to acquire suitable property, and the prices on rolling stock and equipment are the ruling prices at the present time.

This Cost Estimate No. 1 shows as a total cost to produce an ideal system of street railways, as previously described in this part, exclusive of the subway proper ready for operation, \$69,800,000.

The track mileage embraced in this estimate is 220 miles in excess of the present mileage of the Chicago City Railway Company and the Chicago Union Traction Company combined, which is sufficient to include the present mileage in the city limits of the Chicago Consolidated Traction Company and the Chicago General Railway Company.

The gross earnings of the present companies should be materially increased in the operation of this completed system.

Such a system, built in the best manner known to the art and on lines calculated for the most economical results in operation, should show marked decrease in operating expenses from the expenses of the present companies; but basing the calculations on the last annual reports of the Chicago City Railway Company and the Chicago Union Traction Company and such information as has been available regarding the returns of the Chicago Consolidated Traction Company and Chicago General Railway Company, the results shown in the following table would be obtained.

In the gross receipts from passengers and from other sources is included the proportion of the receipts of the Chicago Consolidated Traction Company that the mileage of the company within the city limits bears to the total mileage owned by the company, which is 70 per cent. The information on which the total gross receipts is based was derived from testimony of the auditor deduced in the case of the City vs. The Union and Consolidated Companies relative to transfers.

Estimate of operation for one year of system above outlined, costing (exclusive of the subway system proper) \$69,800,000, based on the past performances for one year of the Chicago City Railway Company, the Chicago Union Traction Company, the Chicago Consolidated Traction Company and the Chicago General Railway Company:



GROSS RECEIPTS FROM ALL SOURCES	
From Passengers .....	\$14,492,666.20
From Other Sources .....	270,472.78
	\$14,763,138.98
Operating Expenses 60 per cent of Passenger Receipts .....	8,695,599.72
Net Earnings from Operation.....	\$6,067,539.26
Taxes as Paid in the Past.....	943,283.28
Net Earnings per Annum to be Ap- plied to Interest on Bonds and Stock, Maintenance of Property, and to be set aside for Sinking Fund to Renew the Property, and or all other Purposes Incumbent Upon the Property .....	\$5,124,255.98

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### MASSACHUSETTS STREET RAILWAY PETITIONS

It is a matter of remark in connection with Massachusetts street railway projects that many promoters go before the Railroad Commission for a hearing before they have complied with well-defined and simple requirements which have been published far and wide through the State as the rules of procedure before the Commission. The result is that these propositions are thus brought to the notice of the public prematurely, witnesses are summoned at considerable expense and trouble, and the time of the Commission is wasted without in the least advancing the projects submitted.

One case in point recently resulted in the summary dismissal of the petition by the Commissioners, who were obliged virtually to tell the promoters to begin all over again. It was in regard to the petition of the Holbrook, Weymouth & Nantasket Street Railway Company, and approval was asked of locations granted by the local authorities in Holbrook and Weymouth, two small towns in the southeastern district of the State. Edward F. Draper represented the company. His difficulty was that he had disregarded the rule of the Board requiring the filing with such petitions of plans of the locations, showing the position of the tracks in the streets or highways, the position of sidings and other details. Mr. Draper told the Commissioners that the local authorities had granted him his locations "in accordance with plans to be filed" after the company should be ready to proceed with the construction. No plan had actually been prepared, for the local authorities had followed the description of the route by referring to an old set of plans which had been drawn some time previously, when another company had petitioned unsuccessfully for similar locations.

Chairman Jackson stopped the proceedings when this situation developed, and although the Board was at first inclined to go on with the hearing except so far as plans were actually required to understand what was being stated, it was finally concluded that the matter could not profitably continue in default of plans showing exactly what the route was to be. The chairman also pointed out that the petitioners had proposed and obtained a location on the basis of using 56-lb. rails, whereas a published rule of the Board requires nothing less than 60-lb. rails; and, moreover, the local franchises evidently granted a location crossing tracks of the New York, New Haven & Hartford Railroad, which was a condition which the Board now disapproves on principle.

When the petitioner explained that he "didn't know that the conditions of the franchise entered into the matter at this stage," the chairman replied:

"Everything enters into it. You ask us as a Board to approve of certain locations on the ground of public convenience and necessity. Considerations of public safety enter into these proceedings, and in order to pass on the questions we have to take into consideration the terms on which the locations were granted, and we must know just where the tracks are intended to be laid in the streets. As your matter stands before us now, it is as if the local boards had not yet completed the work

which, under the law, they must attend to before we can pass on it."

The petitioner announced his willingness to have an adjournment until he should be able to file plans, but the Board preferred to dismiss the petition without prejudice. Mr. Draper declared that he would at once prepare plans and present them with a new petition. It appeared after the hearing that fresh difficulties had arisen on account of the fact that the petitioned had filed with the Board the original papers instead of copies from the local authorities of the towns in which it was proposed to operate, and the Board, under its customary procedure, had closed the case, leaving the originals a part of its official record and therefore not subject to the petitioner's further use.

The entire difficulty, which resulted in the hold-up of this petition, appears to have been of a kind that could have been avoided by compliance with the Commission's published rules, printed in newspapers and street railway publications some months ago. These, briefly summarized, call for:

- (1) Plan of locations, showing place of tracks in highway, turnouts, trolley poles, grades and street lines, presented at time of applying for approval of locations.
- (2) Sixty-pound rails.
- (3) Ties, 7 ft. x 6 ins. x 6 ins., 2 ft. apart.
- (4) Drained roadbed, with 18 ins. ballast below rails.
- (5) Railway to have a clearance of at least 4 ft. 6 ins., and to avoid crossing the highway in which it is laid.
- (6) Roadway outside railway to be wide enough to accommodate other travel.
- (7) Necessary crossings of highway in which road is laid to be guarded by special regulations.

The plan of the Holbrook, Weymouth & Nantasket road is interesting chiefly because it aims to give a through route across Norfolk County, to reach the Nantasket Beach Reservation, a matter which has been agitated for three years. The locations for which approval was asked are as follows: Beginning at the town boundary between Holbrook and Randolph, running through Union Street, Holbrook, to the Holbrook Railroad station; thence to Holbrook Center, thence to the South Weymouth Railroad station in Weymouth; then for about 200 yds. over the tracks of the Old Colony Street Railway Company to reach Columbian Square in South Weymouth, where connection for Nantasket may be made. Locations from local authorities were granted in Holbrook on Sept. 8, 1902, and in Weymouth on Nov. 3, 1902. The proposed railway is to be about 5 miles long, in the direct line of travel between Holbrook and Weymouth, and following the old Post Road connecting these places with the city of Brockton.

Bentley W. Warren, representing the Old Colony Street Railway Company, told the Commissioners that he should oppose the granting of the locations on the ground that the proposed road was not needed by the public, and on the ground that it was against the policy of the Board in regard to companies which could not show a reasonable hope of operation at a profit.

Named as directors in the Holbrook Company are Edward F. Draper, John W. Porter, Charles W. Lincoln, George B. French and Edward C. Jenney. The Holbrook location was granted on condition that the road be in operation within eighteen months from Sept. 8, 1902.

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It has just been announced in Pittsburg that arrangements have been made for consolidating the Pittsburg, McKeesport & Connellsville Street Railway and the Pittsburg, McKeesport & Greensburg Street Railway Company. However, there is no official confirmation of the statement. The Pittsburg, McKeesport & Connellsville Railway Company is now completing an extensive system of lines in the coke region. The Pittsburg, McKeesport & Greensburg Railway Company is a consolidation of the Westmoreland Railway Company and the Greensburg & Hemphill Electric Light & Railway Company.



## SUBURBAN CARS IN BOSTON

Within a week or two it is expected that cars of the Boston suburban electric companies will begin running into Boston over the surface tracks of the Boston Elevated. The delay in the matter is largely a question of details, as the agreements have been signed which cover the business phases of the problem. All the cars of the Boston suburban companies which are to run into the city are equipped with air brakes, and as none of the surface cars of the Boston Elevated are so provided, and, further, as the Boston Elevated crews are to handle the foreign cars on their lines, a number of them have been run for the last few weeks over the Allston and Brighton lines, so that the elevated employecs may familiarize themselves with the power brake operation. Another reason for delay is the difficulty in arranging the local schedules of the suburban people to fit in with the operation of their cars on the crowded lines in Boston. On the suburban lines, cars can be kept fairly close to schedule time, as there are few, if any, obstructions; but as soon as the cars get in town, where they have to cope with the blockades of other cars and wagon traffic, they are likely to lose time in such a way as to throw the out-of-town schedules out of adjustment. This is not a serious matter as far as the Newton Boulevard is concerned, as this is double-tracked; but on single-tracked lines it is necessary to keep the cars practically on schedule time in order properly to meet at turnouts.

The Commonwealth Avenue line plans to begin running its boulevard cars from Norumbega Park into the Park Street subway station within a few days. This will be the first outside line to be brought in. Up to the present time its terminus has been at Lake Street, near Chestnut Hill Reservoir, where its passengers were brought in town by Boston Elevated cars, either by way of Beacon Street, Brookline village and Huntington Avenue or Commonwealth Avenue and Brighton Avenue. Tracks of either company come to a dead end under the wooden shelter forming the station at Lake Street, but within a couple of weeks loop tracks have been constructed around this shelter so that an unbroken line of rails for both inward and outward tracks now extends between Norumbega Park and the subway in Boston.

When this line is started the Commonwealth Avenue employees will bring the cars as far as Lake Street, where the conductor and motorman in the Boston Elevated employ will displace them and run the cars and collect fares in and out of town to the Lake Street station again, where the suburban crew will once more take charge and conduct the cars to their terminal point. Two fares will be collected for the entire run, one by each company, and the transfer system of both suburban and electric companies will remain in force exactly as it is at present. The suburban company has just purchased forty-four new double-truck cars of the same size as is used by the Boston Elevated for this subway service. Another order for fifty-six cars has been placed for the through route in summer, and these will be of the same length as the winter cars. On account of the sharp loop at Park Street subway station the long fifteen-bench open cars which have been run between Lake Street and Norumbega Park in recent years could not be run into Boston, their width and distance between centers of trucks making it out of the question for them to attempt the loop.

Within a short time after the Norumbega Park cars begin running into the subway the Newton company will begin sending in its cars from Waltham, by way of Watertown Square, North Beacon Street, Brighton Avenue and Commonwealth Avenue—almost a straight line from the starting point in town—as far as the corner of Beacon Street and Massachusetts Avenue. The Boston Elevated has inaugurated a new transfer station at this point which is of great service to passengers for

Cambridge, Newton and the cross-town Massachusetts Avenue lines running to Roxbury and the South End. These lines place Waltham and practically all the Newtons within the range of a 10-cent fare and single car to Boston trip to any point on the Boston Elevated system. An illustration of the variety of service which can be availed of in Boston and its suburbs for a total fare of 11 cents is found in the trip from the Newton Lower Falls terminus of the suburban lines to East Boston, a distance of about 14 miles. Leaving Newton Lower Falls, the first transfer is made at the corner of Washington Street and Commonwealth Avenue, near the Woodland Park Hotel in Auburndale, whence the new through line to Park Street subway will carry the passenger into the heart of Boston, at which point transfer is made to an Atlantic circuit elevated train. At Battery Street Station the passenger leaves the elevated road and crosses the harbor on the East Boston ferry at a toll of 1 cent and then continues his ride on transfer to the Boston Elevated surface cars in East Boston to his objective point. Three cars, an elevated train and a ferryboat are involved in this journey, which provides the passenger in its course with every form of electric transit now operated on tracks—surface, suburban and city, subway, elevated, and, in addition, steamboat. The same variety can be obtained for 6 cents on the shorter run to East Boston from Newton. About an hour and a half is occupied in the longer trip. After these lines have been brought into the subway it is probable that the Newton Highlands cars will be run into the city.

## OIL AS FUEL IN CALIFORNIA

The extent to which crude oil has come into use for steam generation in all parts of California is surprising to those who have not given especial attention to the subject. The annual capacity of the productive oil wells in the State at the close of 1901 was approximately 16,000,000 barrels, and practically every new factory built is arranged for the employment of this material as fuel. The railroads are, however, of course the chief consumers of crude petroleum, and the saving which the Southern Pacific Railroad has effected through the change from coal to crude oil is estimated at \$100,000 per month.

This corporation is building storage tanks all along its lines for the supply of its locomotives. The storage tanks at West Oakland and Melrose have a combined capacity of 17,430,000 gallons. Locomotives are now being supplied with new tenders which carry oil and water exclusively and possess a running capacity of 300 miles at high rate of speed. Oil and water supply stations are being established at distances varying from 200 miles to 300 miles apart to accommodate the new conditions. Nearly 200 locomotives belonging to the Southern Pacific alone are now equipped with oil-burning furnaces, resulting in an estimated saving in the cost of operation over those consuming coal of about \$16 per 100 miles. Coal burning has been practically abolished on the San Joaquin division of the company's roads. The Santa Fe Railroad Company is operating all of its Western roads with oil-burning locomotives.

## CHICAGO TRANSPORTATION MATTERS

The local transportation committee of the Chicago City Council will meet on Wednesday, January 21, to consider in detail the report submitted by Bion T. Arnold on the "Engineering and Operating Features of the Chicago Transportation Problem." Representatives of the traction companies operating in Chicago and other interests affected by the proposed plans will be given an opportunity to present their views for the consideration of the aldermanic committee. It is probable that a plan will be arranged for the discussion of the report in detail and securing the views of the operating companies on the several features embodied in the recommendations.



## NEW YORK TRANSPORTATION PROBLEMS

The investigation into the transportation service of New York which the Board of Railroad Commissioners is making was completed, so far as the public hearings were concerned, with the Brooklyn meeting last week, but the experts for the board and the Merchants' Association have continued their work, and it is expected that they will present the results of their examinations at the conference with the railway officials next week.

The Manhattan Company on Monday was granted two weeks' additional time in which to adopt the directions issued by the commissioners for the improvement of the elevated service, and the company's representatives have given assurance that the additional facilities for immediate relief will be furnished at that time. This includes the addition of 100 new cars each month for three months and the operation of additional cars during the non-rush hours, but, of course, the third track cannot be extended as directed without much preliminary work and special authorization by the city and property owners.

## OPENING OF THE BOURNEMOUTH TRAMWAYS

The Bournemouth electric tramway system in England was put in operation December 19. The line is particularly interesting from the fact that it is equipped with the trolley system in the suburbs of the city and the side-slot conduit system in the center of the city and is the only road equipped with the side-slot conduit in Great Britain. The contractors were J. G. White & Company, of London.

## NEW YORK CENTRAL ENGINEERING COMMISSION

The announcement was made last week that the New York Central management and the city officials of New York had agreed upon the general terms of the plans for the terminal improvements at the Grand Central Station in New York and the substitution of electricity as the motive power in the Park Avenue tunnel and on the suburban service of that system. This will enable the company to proceed at once with the formulation of its plans, and it is understood that immediate steps will be taken to do this.

The engineering problems involved in this scheme will be submitted to a board, or commission, organized especially for this purpose and consisting of two representatives of the New York Central and three independent consulting engineers who have been selected because of their special experience in transportation matters. The commission will comprise W. J. Wilgus, chief engineer of the New York Central, who will act as chairman; A. M. Waitt, superintendent of motive power on that system; B. J. Arnold, who conducted the preliminary investigation and made an exhaustive report upon the electrification of the tunnel, switching and suburban service of the Central; Frank J. Sprague, who has been retained in an advisory capacity for some time, and George Gibbs, who is now engaged on the subway system and the Pennsylvania tunnel project. Although no official announcement has been made, it is understood that the commission will pass upon all plans presented for the solution of the difficult problems involved.

## ENGLISH & AUTO-MOTOR CARS

Two auto cars are being built at York, England, to run on the Northeastern Railway between Hartlepool and West Hartlepool. They will be 53 ft. long and will provide seating accommodations for fifty-two passengers. At one end of the car there will be a Napier petrol engine of 85 b. hp., with four cylinders; the engine will drive a dynamo which will supply current to two motors underneath the engine compartment.

The body of the car will be much lighter than ordinarily, approximating closely to the street type. The car is described as a street saloon, with an engine compartment at one end and a conductor's compartment at the other. The car will be fitted with electric brakes and illuminated by electric light, and it is expected it will be ready for service early this year.

## STIRRING UP FREIGHT TRAFFIC AT ROCKFORD

As has been previously remarked in these columns, Rockford, Ill., is becoming an important interurban center, and is, in fact, the most important interurban center in Northern Illinois at the present time. The Rockford & Interurban Railway Company controls the city lines in Rockford and the interurban to Belvidere, about 20 miles east. The same company will build west to Freeport the coming season. The Rockford, Beloit & Janesville Railroad Company, a separate company, also recently began operating over the entire length of its line. Since July 1 of the present year the Rockford & Interurban Railway Company has had on its staff a general passenger and express agent in the person of J. H. Groneman, who has been very energetic in advertising the interurban freight business, as well as presenting the attractive side of the company's lines to passengers. The express car between Rockford and Belvidere now makes two or three trips daily. The company is now handling between 180 and 200 machine covers a day for a wood working company in Rockford, shipped to a sewing-machine factory at Belvidere. In November it carried 26 tons of meat from Rockford to Belvidere, or an average of 1 ton per day. The perishable fruit business is also large. From 18 cans to 30 cans of milk are handled daily, milk and butter comprising the general cargo into Rockford from Belvidere and way stations. Mr. Groneman has published some attractive advertising literature, including desk calendars with half-tone engravings of electric railway views or characteristic electric railway scenes, such as the entrance to the interurban freight depot at Rockford. This freight depot is adjoining the passenger waiting room at the principal transfer point in Rockford. Mr. Groneman's business card is a novel idea, as well as a striking one, and yet in good taste. The background is a half-tone engraving in brown ink, of a scene along the interurban line, including an interurban car. Mr. Groneman's name and business are printed in black ink over this half-tone engraving.

## ANNUAL STATEMENTS OF THE STREET RAILWAY COMPANIES IN MASSACHUSETTS

In the issue of Jan. 3 a table was published of the principal figures contained in the annual reports of the street railway companies in New York State for the year ending June 30, 1901. Through the courtesy of the Railroad Commissioners of Massachusetts a representative of this paper has been permitted to make a transcript of similar figures for the street railway companies in that State from the report of the Commission, which has not yet been published. The tables are for the year ending Sept. 30, 1902, and show capital stock and funded debt, gross and net earnings, operating expenses, dividends paid in, amount and per cent on capital, and surplus or deficit for the year.

The total number of companies reporting amounted to sixty-four, of which twenty-seven show a deficit, and thirty-seven a surplus as a result of the year's business and the payment of dividends, if any dividends were paid. Thirty-eight out of the sixty-four did not pay any dividends. Of those which paid dividends eight paid 8 per cent, eight paid 6 per cent, four paid 5 per cent and six different rates less than 5 per cent. All of the companies given in the table are operating companies with the exception of the Massachusetts Electric Companies. The figures of this latter company are included in the table, however, owing to the interest felt in its operation by investors at large:



FINANCIAL REPORTS OF THE OPERATING STREET RAILWAYS OF THE STATE OF MASSACHUSETTS, FOR THE YEAR ENDING SEPT. 30, 1902.

NAME	ON SEPT. 30, 1902		YEAR ENDING SEPT. 30, 1902					Surplus for Year
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividend Paid		
						Amount	PerCent	
\$	\$	\$	\$	\$	\$		\$	
Amherst & Sunderland.....	93,000	51,500	21,418	14,656	2,989	2,020	4	1,753
Athol & Orange.....	74,500	60,000	37,298	23,760	5,046	5,960	8	2,532
Blue Hill.....	150,000	.....	25,133	25,262	7,266	.....	..	def. 7,393
Boston Elevated.....	10,000,000	.....	11,321,030	7,862,571	2,836,560	600,000	6	21,899
Boston & Northern.....	6,143,000	8,027,000	3,499,075	2,113,462	883,588	367,380	6	134,646
Bristol County.....	200,000	200,000	53,114	38,092	15,292	.....	..	def. 270
Brockton & Plymouth.....	295,000	270,000	90,333	58,939	24,996	.....	..	6,398
Citizens' Electric (Newburyport).....	240,000	210,000	92,390	54,831	17,349	.....	..	20,210
Commonwealth Avenue.....	292,000	75,000	81,315	63,804	12,712	13,140	4½	def. 8,340
Concord, Maynard & Hudson.....	175,000	165,000	47,008	35,070	5,752	.....	..	6,187
Conway.....	35,950	60,903	8,471	5,744	3,163	.....	..	def. 437
College City & Edgartown Traction Co.....	60,000	.....	4,183	4,473	147	.....	..	def. 437
Dartmouth & Westport.....	150,000	90,000	132,991	96,383	14,150	12,000	8	10,458
East Taunton.....	110,000	45,000	35,334	21,263	4,382	5,500	5	4,188
Easton.....	.....	.....	.....	.....	.....	.....	.....	.....
Framingham Union.....	30,000	47,000	37,736	21,963	6,248	1,500	5	8,024
Fitchburg & Leominster.....	350,000	300,000	201,247	121,272	52,687	210,000	6	6,289
Gardiner, Westminister & Fitchburg.....	185,000	150,900	56,106	44,420	15,011	.....	..	def. 3,325
Georgetown, Rowley & Ipswich.....	180,000	180,000	40,514	24,254	12,228	.....	..	4,032
Greenfield & Turner's Falls.....	115,500	88,000	51,617	31,110	8,095	4,620	4	7,792
Hampshire & Worcester.....	75,000	60,000	21,552	14,479	5,490	.....	..	1,583
Haverhill & Amesbury.....	150,000	490,000	113,175	72,062	40,893	.....	..	220
Haverhill, Georgetown & Danvers.....	60,000	35,000	28,459	21,214	4,585	.....	..	2,659
Holyoke.....	700,000	335,000	336,853	223,328	55,368	56,000	8	2,157
Hoosac Valley.....	200,000	100,000	116,111	83,010	22,645	12,000	6	def. 1,544
Interstate.....	380,000	150,000	148,299	109,586	11,569	.....	..	27,144
Lawrence & Reading.....	222,000	.....	41,228	40,899	11,220	.....	..	def. 10,890
Lexington & Boston.....	525,000	350,000	145,093	100,979	23,337	15,063	1¼	5,714
Linwood.....	12,000	.....	9,252	8,440	379	.....	..	433
Lowell & Boston.....	90,000	90,000	15,402	23,131	7,457	.....	..	def. 15,185
Marlboro.....	80,000	80,000	64,559	47,015	20,421	.....	..	def. 2,877
Marlboro & Westborough.....	160,000	160,000	31,725	26,618	15,141	.....	..	def. 10,034
Massachusetts Electric Co.....	31,725,500	2,700,000	6,090,168	3,827,372	1,391,239	a 676,390	4	195,167
Medfield & Medway.....	100,000	100,000	23,136	20,261	7,749	.....	..	def. 4,874
Middleboro, Wareham & Buzzard's Bay.....	150,000	150,000	45,170	36,399	3,891	.....	..	4,880
Middletown & Danvers.....	32,000	.....	15,716	13,923	250	.....	..	1,543
Milford, Attleboro & Woonsocket.....	315,000	250,000	75,461	52,070	17,806	10,000	4	def. 4,415
Milford & Uxbridge.....	352,000	315,000	142,380	100,013	31,736	15,120	66	def. 4,290
Natick & Cochituate.....	100,000	.....	79,751	64,965	6,348	8,000	8	438
New Bedford & Onset.....	500,000	280,000	69,254	51,849	21,149	.....	..	def. 3,744
Newton & Boston.....	200,000	200,000	70,793	78,717	19,550	.....	..	def. 27,474
Newton Street.....	315,000	250,000	134,300	95,205	17,884	18,900	6	2,311
Norfolk & Bristol.....	200,000	.....	39,436	33,974	9,125	.....	..	def. 3,665
Norfolk Western.....	100,000	100,000	24,431	21,160	9,673	.....	..	def. 6,403
Northampton.....	300,000	225,000	144,846	97,523	26,815	24,000	8	def. 3,492
Northampton & Amherst.....	180,000	160,000	51,891	44,114	10,100	.....	..	def. 2,323
Norton & Taunton.....	297,000	296,000	46,512	37,192	17,727	.....	..	def. 8,407
Norwood, Canton & Sharon.....	62,500	.....	8,824	17,859	8,113	.....	..	def. 17,148
Old Colony Street Ry. Co.....	5,777,700	4,669,000	2,385,915	1,454,215	582,735	288,885	5	60,080
Pittsfield.....	200,000	55,000	111,697	77,817	16,346	7,800	6	9,735
Plymouth & Sandwich.....	36,800	.....	6,414	4,778	1,050	.....	..	586
Providence & Fall River.....	165,000	165,000	36,147	29,609	11,223	.....	..	def. 4,685
Shelburn Falls & Colrain.....	50,000	50,000	14,333	9,900	3,635	.....	..	798
Southbridge & Sturbridge.....	60,000	60,000	33,532	23,105	5,583	.....	..	4,843
South Middlesex.....	100,000	100,000	70,405	59,869	22,381	.....	..	def. 11,845
Springfield.....	1,958,400	100,000	844,665	594,637	88,089	156,672	8	5,268
Springfield & Eastern.....	370,000	330,000	102,788	63,738	38,265	.....	..	786
Templeton.....	50,000	.....	40,578	33,820	20,882	.....	..	def. 14,124
Union (New Bedford).....	600,000	400,000	326,125	201,784	55,388	48,000	8	20,952
Warren, Brookfield & Spencer.....	150,000	125,000	61,595	40,139	14,081	.....	..	7,376
Webster & Dudley.....	50,000	30,000	30,439	20,380	5,716	.....	..	4,343
Wellesley & Boston.....	115,000	.....	62,825	49,624	4,498	9,200	8	def. 498
Worcester & Blackstone.....	60,000	.....	55,811	37,193	8,561	.....	..	10,956
Worcester Consolidated.....	3,550,000	1,203,000	1,220,256	762,569	279,885	177,500	5	302
Worcester & Webster.....	150,000	150,000	61,437	51,536	27,022	.....	..	def. 17,121
Woronoco.....	200,000	75,000	64,489	44,820	8,322	9,000	6	2,349

a 4 per cent. on preferred stock. 66 per cent. on capital stock of Milford, Holliston and Framingham St. Ry. Co.



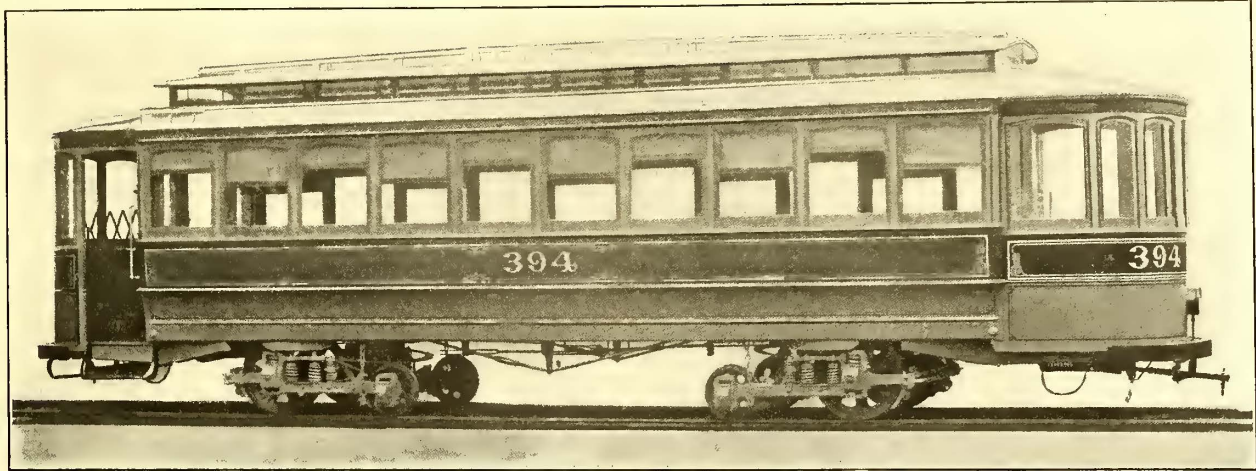
**NEW CARS FOR COLUMBUS, OHIO**

The Columbus Railway Company has just put in service twenty closed cars of the type illustrated herewith. They were built by the J. G. Brill Company, of Philadelphia, and are just like ten other cars which the same company built for Columbus two years ago, and which have proved very popular.

The length over end panels is 28 ft. 8½ ins.; over vestibules, 38 ft. 7 ins.; width over sill plates, 6 ft. 11 ins.; over belt-rails,

hopper and closed weight-box are entirely free from the guides or stay-rods, and consequently no rocking of the hopper takes place during the discharge of the machine to cause friction and unnecessary wear on the knife edges and invalidate the accuracy of the weighings.

The scales occupy less room in height than any other machines of similar capacities. The machines are adapted to the weighing of many different materials and are made in many sizes, with hopper capacities running as high as 6 tons, and



ONE OF THE NEW CARS FOR COLUMBUS

7 ft. 11¼ ins. The platforms are 4 ft. 6 ins. from end-panels to wainscoting of vestibules. The vestibules are sheathed with sheet steel, and are protected with patented angle-iron bumpers. Patented folding gates are provided at the entries. The slide sills have ½-in. x 7-in. steel plates, and the platform supports are reinforced with heavy plates. The seats are longitudinal. The interiors are finished in cherry, with ceilings of bird's-eye maple. The cars are mounted on "Eureka" maximum-traction trucks.

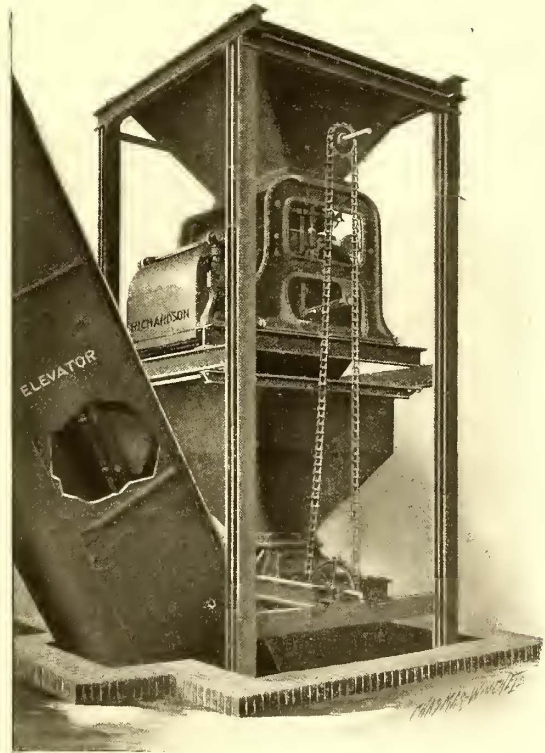
The car carries a novelty on its roof in the form of a braced trolley board. The usual plank is trussed by two straight steel rods, which bring all the weight and strain of the pole at the ends of the car instead of on the entire deck, as is the usual practice.

**AUTOMATIC SCALES FOR POWER PLANTS**

The accompanying cut illustrates an automatic scale in use in a large power station at Bristol, England, where it serves to check the coal as it enters the plant. These scales are also frequently used to weigh and register the coal as it goes to the automatic stokers.

The material to be weighed is supplied from a hopper or bin above the scales and is admitted into the weigh-hopper by means of a swinging cut-off which, at the beginning of the operation, is open. When the charge is nearly completed the cut-off, actuated by the increased weight of the weigh-hopper, partially closes and reduces the stream of material to a mere dribble. When an exact balance is reached the cut-off completely closes, stopping the flow, and in doing so throws up a lever, which sets in motion the mechanism which opens the bottom of the hopper, and as soon as the charge has been dumped closes and locks it again. In closing the bottom of the hopper the dumping mechanism again strikes the lever, throwing it down and thereby causing the cut-off to open and allow a new charge to flow into the weigh-hopper. The movement is a very simple one, the only power required being the momentum of the falling material. It is claimed that an absolute balance is secured of every weighing. A long-armed beam is employed, swinging entirely free of any of the working parts of the machine, thus insuring frictionless movement. The weigh-

they have been found especially accurate in the weighing of materials in large charges.



AUTOMATIC SCALES FOR WEIGHING COAL

The scales are put on the American market by the Richardson Scale Company, of New York.

A general shortening of schedules on the lines of the Metropolitan Street Railway Company, of Kansas City, Mo., has been made possible because of the new policy adopted by the company of inducing passengers to step lively and of taking on only such passengers as are at the designated stopping places.



## WORKS OF A BROOKLYN RAILWAY SUPPLY COMPANY

The accompanying illustrations give a very good idea of a number of rooms in the new factory of the Columbia Machine Works & Malleable Iron Company, of Brooklyn, N. Y. This company has recently greatly enlarged its business, and it has now manufacturing facilities which enable it to turn out large and small work of the highest quality. The company makes a specialty of electric railway supplies, and some of the features of the trade which are supplied are new and refilled commutators, drop-forged copper bars for commutator and other purposes, armature windings for all types of generators and mo-



MACHINE SHOP

tors, trolley wheels, fuse boxes, bearings, car trimmings, miscellaneous drop-forging work, canopy and power house switches, adjustable brake and controller handles, etc. The works contain also excellent facilities for nickel plating and



WINDING ROOM

pattern making, and the brass and iron foundries are fully equipped for doing all kinds of casting work.

On the second floor is the machine shop for small work, size of floor 200x40, and contains lathes, drill presses, screw machines, etc., in great variety. Along the side of the room there is a line of twelve lathes, which is supplemented by other machines of the same kind distributed elsewhere in convenient positions. There are five screw machines. Next to the machine shop is the polishing and dipping room, where the nickel-plate baths, buffers, etc., are installed. On the first floor of the

factory is the machine shop for heavy work, forge and stock-room, where the heavy ironwork is taken care of. One of the punch presses in this department will take iron an inch thick, and several steam hammers of large size are also found here. Two or three special hammers are placed near the center of the room and are used for making drop-forged commutator bars, as well as for other drop-forged work. The other work on the iron castings is also done on this floor, and at present there are eight machines at work continuously on bearings alone, one of the specialties of the company being cast-iron bearings with or without babbitt filling. The commutator department is one of the busiest in the shops, facilities being at hand for turning out the finest quality of both large and small work. At present a large generator commutator is being made for the Coney Island & Brooklyn Railway and another generator commutator for the New York & North Shore Railway. Among the tools of special interest in the machine shop and forge room are a large Jones & Lamson screw machine and a Pratt & Whitney die sinker.

The winding department is at the top of the building. As seen from the illustration, a number of winding machines are kept busy. These machines are all made by the company, as are also the special forms for winding coils of various types. A large number of standard forms are constantly kept in readi-



BRASS FOUNDRY

ness, so that an order for any ordinary kind of motor can be quickly filled. Special forms, however, can be made in a short time if necessity requires it. The drying oven has been placed in this department, heated with steam pipes, in which armature coils can be thoroughly baked before shipment. An interesting machine has recently been installed for recovering old field windings. This is a triple-spindle winding machine which will cover an old field winding with a layer of double cotton. Burned-out field coils sent to the works are unwound, the wire is stripped of its insulation, thoroughly cleaned and then passed through the rewinder, where it is recovered and made as good as new. The wire is then wound into field coils in the same manner as if new wire was actually used, and a hydraulic press is employed for shaping the coil after it is formed. The coil is then returned to the railway company at very little cost for the work. Adjoining the winding room is the pattern room, where ten men are employed in making patterns for the foundries. This department contains a wood lathe, planer, rip saw, band saw and other machine tools for wood working. It is under the direction of an experienced patternmaker, and much care has been given to this most important department of a machine shop.

A large amount of work is done in the brass foundry, where



six furnaces are kept running all the time. The company is about erecting a Schwartz oil-burning furnace which will have a capacity of 400 lbs. of metal per hour, and will, it is hoped, increase the facilities sufficiently to enable this department to keep up with its work. In the iron foundry, which adjoins the brass foundry, is a 3-ton per hour cupola, and at present this department is turning out 6 tons of iron castings per day. A large core oven has been built in an adjoining room and a small oven, with revolving shelves, so that access could be had to all of its shelf room by the opening of a single small door, is placed in a corner of the foundry. Both of these ovens are heated by coal fires. The cleaning room contains the usual equipment of tumbling barrels, emery wheels, etc., for finishing up the rough castings. The foundries are in a separate wooden building, built with its walls some three feet from the walls of the main building. It is the intention later to enclose this wooden building in a brick structure, after which the wooden walls may be removed. A separate building 65 ft. x 25 ft. is used exclusively for storing patterns.

The company has its own power plant, consisting of one 100-hp and one 75-hp fire-tube boilers, made by Smith Brothers, of Brooklyn, and a single-cylinder Harris-Corliss 125-hp engine. An interesting feature of the power plant is the manner of driving the shafting in the foundry. The belt which drives the main machine shop is brought up from the lower side of the engine fly-wheel and passes over the idler, whose shaft is near the top of the fly-wheel. This brings a large amount of pressure on the idler and drives it with considerable force. The second pulley is put on the shaft of the idler, and this drives the belt in connection with the shaft of the foundry. Adjoining the engine room is the electric lighting plant of the works. The shops are heated by exhaust

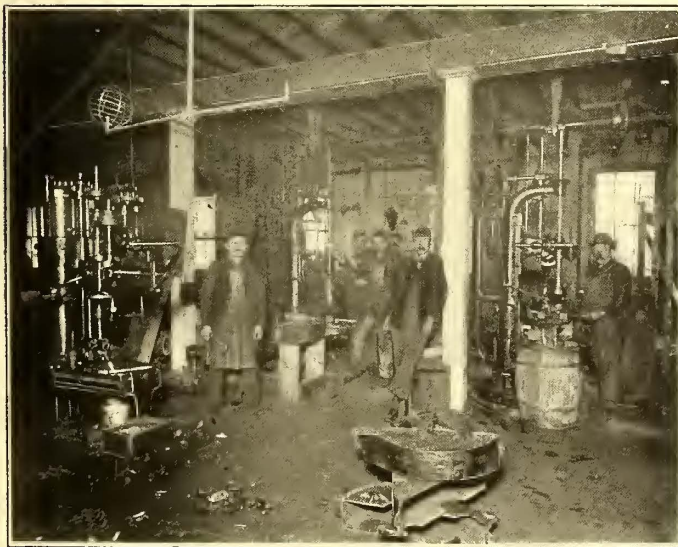
iron was formerly entirely unfitted, and the works constantly fill a large number of orders for this material.

The Columbia Machine Works & Malleable Iron Company employs at present about 165 men, of which ninety are in the



PATTERN SHOP

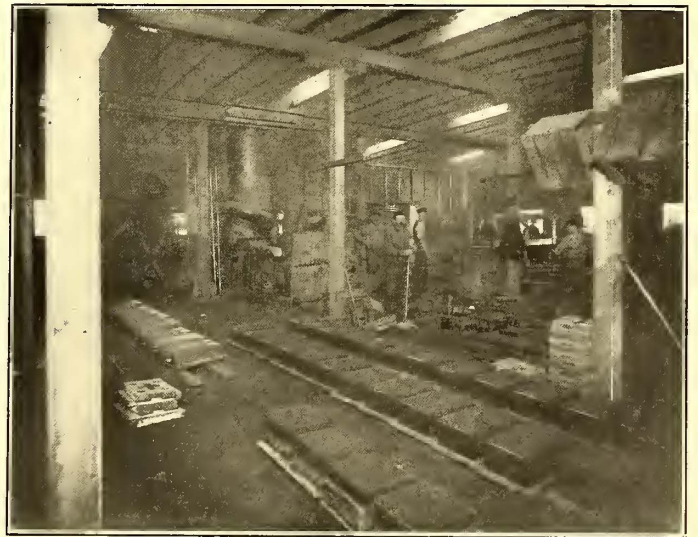
machine shop alone and twenty in the winding department. A large amount of work is at present being completed for the Manhattan Railway Company, of New York. This includes 3200 pneumatic brush attachments for the elevated cars for cleaning ice and sleet from the third rail and a great number of forgings for brake gearing on the new cars.



BLACKSMITH SHOP

steam, a complete system of piping having been recently installed.

The stock room of the company contains a few specialties which it tries to have ready for immediate orders. It is impossible, however, to keep more than a small stock on hand with the present facilities of the works, as orders are now being filled which are keeping all the machines up to their maximum capacity. One of the specialties, however, which are kept in stock are malleable iron controller handles, which have been found very satisfactory on a number of roads where considerable trouble has been experienced in the theft of their brass controller handles. The works do a large business in malleable castings of all kinds and sizes. The shop is at present congested with a large number of this class of castings for gear cases. Malleable castings are becoming more and more popular for a number of classes of work for which cast-



IRON FOUNDRY WITH CUPOLA

The president and treasurer of the company, J. G. Buehler, has had many years of experience in machine shop practice, especially as it relates to street railway work. He is ably seconded by James Grady, the vice-president and general manager. The other officers of the company are Christian Buehler, secretary; W. R. Kerschner, second vice-president, and R. D. Kane, assistant secretary.

### ◆◆◆ INCREASED WAGES ON ROCHESTER LINES

General Manager Nicholl, of the Rochester Railway Company, has announced an advance in the wages of conductors and motormen on the company's lines according to the following scale:

Less than six months, 17 cents per hour. Six months and less than one year, 18½ cents per hour. One year and over, 20 cents per hour.



## FINANCIAL INTELLIGENCE

### The Money Market

WALL STREET, Jan. 14, 1903.

The movement of the money market toward a lower level has continued during the past week. Time loans, which up to ten days ago commanded 6 per cent, are now made quite freely at  $5\frac{3}{4}$ , and this includes all periods from one to six months. The demand for mercantile paper at lower figures has correspondingly quickened. Call money meanwhile, in spite of an active demand on the Stock Exchange, is liberally supplied at an average of 4 per cent. The causes for this general decline in rates were pointed out in this article a week ago. They have all been confirmed by the developments of the last seven days. Briefly enumerated, they are (1) the normal increase in this month's government expenditures, which, for the time being, have overbalanced a heavy customs and internal revenue; (2) the rapid return flow of currency drawn westward during the autumn for the purpose of "moving the crops"; (3) active competition in lending, with the New York Clearing House banks, by institutions outside that organization, and (4) the usual relaxation of the foreign money markets, which has tended to postpone the anticipated resumption of gold exports. Accompanying the decline in money rates, local bank reserves have risen rapidly, the surplus above legal requirements standing now at more than \$14,000,000. This, to be sure, is not up to the average of the season, but it is larger than the banks held at this date a year ago. The question as to how long these favorable conditions are likely to last, must take into account at least three circumstances in which the present situation differs from preceding years. One of these is the great enlargement of the import trade, swelling customs receipts to abnormal proportions; another is the unusual industrial activity of the country, which tends to retain in the interior a part of the capital ordinarily available for re-deposit at New York, and finally there is the fact that we still have a large indebtedness in the foreign markets, which our excess of merchandise exports will not suffice to liquidate, and which, therefore, must sooner or later be settled by shipment of gold. That the beginning of these shipments is not far distant may be concluded from this week's sharp rise in the sterling exchange market. Altogether the outlook for money continuing indefinitely as easy as it is now is, to say the least, dubious.

### The Stock Market

The stock market, after another few days of excited trading, has quieted down perceptibly, with a general reaction in prices. This tendency is regarded as natural and even necessary, in view of the rapidity of the previous advance. There is nothing in the general situation to frighten holders of stock, as candid observers unanimously agree; but inasmuch as a large part of the recent buying has come from speculators who proposed to sell again at higher figures, it was to be expected that the market would fall back when these operators attempted to secure their profits. Regarding the immediate future, opinion is a good deal divided, some critics maintaining that the advance has gone far enough, and that there ought to be a considerable interval of comparative dullness, with sagging prices, while other critics believe that after a brief set back the market will resume its upward course. Everything depends, of course, upon how far the pools and syndicates that bought stocks at the low prices of December have succeeded in their efforts to "unload" at a profit. If they were able to get rid of the greater part of their holdings, they may be willing to wait for lower prices before taking them back; if they are still carrying more than they care to, then manipulation for the rise may be renewed at any time. These are technical questions which the average outsider is not prepared to pass upon. The only certain thing is that the market at the moment is free from the uncertainties which disturbed it so seriously a month ago. Moreover, the temper of the financial community is generally optimistic.

Manhattan Elevated shares have been one of the conspicuous exceptions to the general downward tendency. They have risen again partly on pool buying and partly on purchases of a more genuine character which have been influenced by the idea that the stock will be put on a 7 per cent dividend basis sooner than expected. All well-informed observers agree that the floating supply of Manhattan stock is exceedingly small. Brooklyn Rapid Transit has held comparatively strong, but it has looked rather

as if the pool were willing to distribute some of their holdings at present prices. Metropolitan has been dull, with irregular and unimportant fluctuations.

### Philadelphia

Scarcely any trading worth mentioning has occurred among the street railway stocks in Philadelphia during the week. The pool in Rapid Transit shares appears to be resting on its oars, contenting itself with holding the price steady between  $17\frac{1}{2}$  and  $17\frac{7}{8}$ . Little stock has changed hands. Union Traction likewise has merely remained stationary around 47, and practically all the sales reported in Philadelphia Traction have been made at  $98\frac{1}{2}$ . In American Railways scarcely more than a hundred shares have been dealt in altogether, between  $51\frac{1}{2}$  and 52. Railways General has been firm at an advance from  $4\frac{1}{2}$  to 5, and Consolidated Traction of New Jersey has sold up from 66 to  $66\frac{3}{4}$ . The only other transaction recorded was in Easton Electric at  $20\frac{1}{4}$ .

### Chicago

The presence in Chicago of certain prominent representatives of the Eastern interest in the Union Traction Company, started the rumors of an impending consolidation among the surface lines going again. If the incident has any such significance, the inferences concerning the matter have at least been drawn too hastily. Nothing more definite regarding the visit of these officials is given out than that they desired to look over the Chicago field and get in touch with the sentiment of local street railway men as to the prospects for extending the franchise, and kindred matters. The sharp rise in the stock market probably will turn out to have been premature. Nevertheless Union Traction common was bid up sharply from 15 to 17, the preferred from  $45\frac{1}{2}$  to 50, City Railway from 208 to 220, West Chicago from  $89\frac{1}{2}$  to 92, and North Chicago from 165 to 175. It was noteworthy that the supply of stocks offered for sale during this quick advance was inconsiderable. Expectation that the directors of the Metropolitan Elevated will declare the full 5 per cent dividends on the preferred stock for this year, has led to some buying of the shares at an advance from  $89\frac{1}{2}$  to 90. The common stock, however, after rising to  $39\frac{1}{2}$  fell back suddenly to 38. Denials of disturbing rumors concerning the outlook for the Lake Street Elevated have been followed by some improvement in the shares, the price rallying from  $7\frac{3}{4}$  to  $8\frac{1}{2}$ . Northwestern Elevated issues have been strong, the preferred selling at 76 and the common from 32 to  $33\frac{1}{2}$ . South Side has also been firm at  $108\frac{3}{4}$  and 109.

### Other Traction Securities

Realizing sales on a moderate scale have been in evidence during the week in Boston. Massachusetts Electric common after selling at  $37\frac{1}{2}$  declined to  $36\frac{1}{2}$ , while the preferred dropped back from 96 to  $94\frac{1}{2}$ . At the same time Boston Elevated sold down from 154 to  $152\frac{1}{2}$ . The West End shares were little changed, the preferred selling between  $111\frac{1}{2}$  and  $111\frac{7}{8}$  and the common between 94 and 95. The week in Baltimore has been extremely dull and unimportant so far as the traction specialties are concerned. Sales are reported of United Railways stock at 14 and  $13\frac{3}{4}$ , the income bonds at  $67\frac{1}{2}$  and  $67\frac{3}{4}$  and the general 4s at  $95\frac{1}{2}$  and 95; also Anacostia and Potomac 5s at 100, Baltimore Traction 5s at  $116\frac{1}{4}$ , City and Suburban (Baltimore) 5s at 113 and 112, Pittsburg Traction 5s at 116, Nashville Railway 5s at  $105\frac{1}{2}$  and Nashville second incomes at  $34\frac{1}{4}$ . On the New York curb about 1000 shares of the new Interborough Rapid Transit stock (50 per cent paid) have been dealt in between 117 and  $117\frac{1}{2}$ . The full-paid stock of the same company at the same time sold at  $115\frac{1}{2}$ . New Orleans Street Railway common has been exceptionally active at an advance from  $15\frac{3}{8}$  to  $15\frac{1}{2}$ , while the preferred is up to 50. Scattering sales are reported in Washington Electric common at 17, the preferred from  $50\frac{3}{4}$  down to 50, United Railways of St. Louis preferred at  $80\frac{3}{8}$ , American Elevated at  $3\frac{1}{4}$ , American Light & Traction preferred at  $95\frac{7}{8}$ ; and in bonds, New Orleans  $4\frac{1}{2}$ s at 82, United Railways of St. Louis 4s, between  $84\frac{3}{4}$  and  $84\frac{1}{4}$ , St. Louis Transit 5s at 95. Brooklyn Rapid Transit 4s at  $82\frac{1}{2}$ , and San Francisco subscription privileges at 48 and 47. Sales in traction on the Cleveland exchange last week numbered about 1000 shares, which is a decided improvement on recent previous weeks. Interest centered on Northern receipts and Miami & Erie Canal. Sales on the Northern Ohio Traction common ran from  $66\frac{1}{2}$  to 70, the price increasing with each sale.



Preferred receipts representing 150 shares sold at 92¾ and 93. Sales in the canal stock were 267 shares, the prices advancing from 30 to 33¼. Recent favorable reports relative to this project are increasing the demand, and a bull movement is looked for. Lake Shore Electric common advanced from 14 to 15 on small sales. Other sales were of minor importance: Ten Aurora, Elgin & Chicago preferred at 91, fifty Cleveland Electric at 84⅞, a slight decline; thirty Elgin, Aurora & Southern at 53, an advance of 1½; fifty of Springfield & Xenia at 16 and 35, Western Ohio receipts at 25¼ to 25½. Monday of this week opened strong on tractions. Three hundred Northern Ohio Traction common receipts sold at 70 and 100 of the new Northern Ohio Traction & Light common stock went at 20½; much interest is centered in this new stock. Four fifty-share lots of Lake Shore Electric preferred sold at 51, and 100 Cincinnati, Dayton & Toledo at 38¾. There was a demand for Western Ohio bonds, and \$15,000 sold at 80 and 80¼. Miami & Erie Canal advanced to 33½ for small lots. The entire board looks stronger, and a general improvement is looked for. There has been considerable trading in the "right" to subscribe to the new \$400,000 of the Cleveland City Railway which will be put out at par to subscribers. Blocks of these rights have been sold at from 5 to 6¼ by parties who have not the money to subscribe to the new issue.

**Security Quotations**

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

	Closing Bid	
	Jan. 6	Jan. 13
American Railways Company.....	51¾	51½
Aurora, Elgin & Chicago.....	40	a38
Boston Elevated .....	153½	152½
Brooklyn R. T. ....	69¾	68½
Chicago City .....	208	215
Chicago Union Tr. (common).....	147½	16½
Chicago Union Tr. (preferred) .....	46	50
Cleveland Electric .....	84	85
Columbus (common) .....	65	63
Columbus (preferred) .....	104½	104
Consolidated Traction of N. J. ....	69	66
Consolidated Traction of N. J. 5s.....	107	106¾
Detroit United .....	86	87
Electric People's Traction (Philadelphia) 4s.....	98¾	98¼
Elgin, Aurora & Southern .....	48¾	51½
Indianapolis Street Railway 4s.....	—	—
Lake Shore Electric .....	13½	14¾
Lake Street Elevated .....	8	8¾
Manhattan Railway .....	150	154
Massachusetts Elec. Cos. (common).....	36½	36½
Massachusetts Elec. Cos. (preferred).....	95	94½
Metropolitan Elevated, Chicago (common).....	37½	37
Metropolitan Elevated, Chicago (preferred).....	88	88
Metropolitan Street .....	142	141½
New Orleans Railways (common).....	15	15¼
New Orleans Railways (preferred) .....	46½	49½
North American .....	117½	117
Northern Ohio Traction (common).....	a70	66
Northern Ohio Traction (preferred) .....	88	—
North Jersey .....	—	—
Northwestern Elevated, Chicago (common).....	31¾	33
Philadelphia Rapid Transit.....	17¾	17½
Philadelphia Traction .....	98	98¼
St. Louis Transit (common) .....	28	28¾
South Side Elevated (Chicago).....	a109	108½
Syracuse Rapid Transit .....	a31¾	a31
Syracuse Rapid Transit (preferred) .....	76	a80
Third Avenue .....	127½	a128
Toledo Railway & Light .....	33¾	36¾
Twin City, Minneapolis (common).....	119½	118½
United Railways, St. Louis (preferred).....	80	80¼
United Railways, St. Louis, 4s.....	84¾	84¼
Union Traction (Philadelphia) .....	46¾	46¾
Western Ohio Receipts .....	25	27

a Asked. b Last sale.

**Iron and Steel**

Nothing deserving particular mention has happened in the iron trade during the week. It is the "off" season in all lines, and the dullness now prevailing is to be expected. In some ways this is even fortunate for the stability of the situation, because if producers were not given more time to catch up with back orders we might have a temporary rise in prices, which later on would have to be followed by a corresponding decline. Already some hardening of quotations is discernible in foundry pig iron. Improvement is

noted in some branches of the industry, particularly sheets, bars and merchant-pipe, which were suffering from over-production and price-cutting a short while ago. Quotations are nominally unchanged on the basis of \$21.75 to \$22 for Bessemer iron, \$29 to \$30 for Bessemer steel, and \$28 for steel rails.

**Metals**

Quotations for the leading metals are as follows: Copper 12¾ cents, tin 28 cents, lead 4⅞ cents, and spelter 4¾ cents.

**GROWTH OF BRITISH WESTINGHOUSE COMPANY**

The directors of the British Westinghouse Electric & Manufacturing Company, Ltd., of London, England, have recently issued their third annual report, showing a material increase in growth of the company's business and indicating an industrial reawakening in England. Heretofore, orders have been executed at Pittsburg, but now that the company's works at Trafford Park, Manchester, England, are practically completed and about 3000 men employed, manufacturing operations have begun and all orders will hereafter be executed there.

A construction department has been organized to carry out building and general construction work, thus enabling the company to undertake the complete installation of large railway, power and lighting plants. This department will be under the management of James C. Stewart, of the engineering firm of James C. Stewart & Company.

Many important contracts have been obtained by the British Westinghouse Company during the last year, including those with the Metropolitan District Railway Company, the Metropolitan Railway Company, the Clyde Valley Electrical Power Company, the London United Tramways Company, Ltd., the Bath Tramways Company, Ltd., Exeter Corporation, Newcastle Corporation, and the Swansea Corporation.

The erection and equipment of the works at Trafford Park have absorbed the bulk of the available capital of the company, comprising, approximately, \$8,750,000, of which \$5,000,000 are in 6 per cent preference shares, and \$3,750,000 in ordinary shares. The extensive business in hand, as well as the new business in prospect—all of which is to be executed at the company's works—will require additional funds for material, labor, and working capital generally. The directors, therefore, propose to create an additional 200,000 6 per cent preference shares of, approximately, \$25 each, one-half of which is to be issued immediately, believing that the use of such additional capital will result in a higher percentage of profits to the company.

**FOR STATE ELECTRICAL LABORATORY IN NEW YORK**

The commission appointed last spring by Governor Odell, of New York, to inquire into the necessity for establishing a State Electrical Laboratory in connection with the Union College in Schenectady has completed its report and recommends an appropriation of \$275,000 for buildings and electrical equipments. The object of the laboratory is to provide authoritative information on questions of electrical science and an official standard for electrical measuring instruments and apparatus, and standards for electric wiring of buildings for the protection of municipalities and the general public in the use of electrical energy. The commissioners are: State Engineer Edward A. Bond, Charles Steinmetz and Harold W. Buck.

**BANQUET TO EMPLOYEES OF THE ST. LOUIS CAR COMPANY**

The St. Louis Car Company, of St. Louis, Mo., gave a banquet to the heads of the various departments and officers on the evening of December 27, in one of the rooms that are used as a dining hall for the officers, and where they have lunch every day, as the works of the company are situated too far from the business section for the officers to leave their duties for dinner. The banquet hall was very handsomely decorated for this special occasion. Mr. Vogal was the toastmaster. Each of the officers made remarks on the successful year that had passed and the good fellowship that existed between the officers and the workmen and the superintendents. The spread was quite sumptuous, and was kept up until a late hour. The St. Louis Transit Company, whose cars, made by the St. Louis Car Company, pass within a block or two of the works, furnished three special cars to take the merry crowd home. About seventy-five persons were present, among them several invited guests from the city, and several who were in the city on business with the company.



## A PROGRESSIVE CORRESPONDENCE SCHOOL

The American School of Correspondence, which recently became allied with the Armour Institute of Chicago, has greatly extended its scope, and it is now prepared to carry on much larger work than formerly. It is expected as a result that the results will be even more satisfactory than heretofore, and that many more students may be cared for. The courses are being constantly improved and extended, always, however, keeping within the well-defined field that such a school can properly occupy. At the same time Armour Institute is improving its facilities and is adding to its already excellent equipment. The new steam laboratory is now about ready for operation. The additions include a \$5,000 cross-compound Corliss engine, with a reheater receiver. This machine was built by the Allis-Chalmers Company. A 400-ft. Wheeler surface condenser will be connected with the experimental engine. A small, high-speed, cross-compound experimental engine has already been installed. This, with the present equipment of 1500-hp boilers, a 75-hp Russel engine, belted to a generator, and a 300-hp Ball & Wood engine, directly connected to a generator, will make the Armour Institute laboratory rank with the best in the country. The instruction courses of the Correspondence School and the reference library issued by that institution are attracting a great deal of attention among educators, and much favorable comment by the engineering fraternity.

The latest catalogue issued by this school contains a partial list of those who have completed the prescribed course of instruction. Of course it is impossible to present a complete list of those who have received the benefits of this instruction, as a large number would complete their term while the list was in course of preparation, but it is an interesting compilation and marks the first attempt of this kind to be made by any school of this character. The introductory to the catalogue states the aims and purposes of the school and calls attention to the many improvements that have lately been made with a view to placing the institution on an educational rather than on a commercial basis. The announcement is also made that the services of Prof. F. B. Crocker, of Columbia University, have been secured for the advisory board, and that he has also consented to prepare some of the electrical papers.

Among the late publications of the American School of Correspondence is a text book on Perspective Drawing which is claimed to be one of the best works on this subject that has ever been placed before correspondence students. This book was prepared by Prof. W. H. Lawrence, associate professor of the department of architecture at the Massachusetts Institute of Technology. Prof. Lawrence is a recognized authority on this subject, and the book will be found of considerable interest to all who are engaged in this study.

## ANOTHER TUNNEL BETWEEN NEW JERSEY AND LONG ISLAND

It is stated that the Union Terminal Company, which was incorporated nearly a year ago, and which has since been engaged in obtaining the necessary consents of property owners, will soon apply to the Rapid Transit Commission of New York for a franchise for a tunnel to connect New Jersey and Brooklyn.

The plans call for the laying under the North River of eight single-track steel tubes, which are to be carried to a point near the Bushwick Avenue station of the Long Island Railroad in Brooklyn. On the New Jersey side the tunnel will have a terminus near the Hackensack River in the southerly part of Hoboken, whence spurs will connect with the Erie and Lackawanna Railroads. Connection will also be made with the electric railway lines in Hudson County. The company is capitalized at \$40,000,000, much of which it is claimed has been paid in. The directors of the company are: Francis H. Leggett, Edward E. Palmer, of Morristown, N. J.; Appleton D. Palmer, of New York; Kenneth L. McLaren, of Jersey City; Roy Stone and Maurice L. Muhleman, of New York; Joseph A. Duffy, of Long Branch, N. J.

## MICHIGAN ELECTRIC COMPANY'S ANNUAL DINNER

The second annual banquet given by the Michigan Electric Company to its employees was held at Hotel Cadillac, Detroit, on January 3. It was attended by fifty employees, who were afterward entertained by the company at a theater party. The evening proved a most enjoyable one, and a great deal of good-feeling was displayed between employees and officers.

## INCREASE IN PAY AT MILWAUKEE

Through a general notice signed by General Manager J. I. Beggs, of the company, the employees of the Milwaukee Electric Railway & Light Company were informed Jan. 8 that their wages are to be increased, the increase dating from Jan. 1. In his statement to the employees Mr. Beggs says that he had purposed to make the announcement before the holiday season, but that he was prevented from so doing because of a serious accident which he suffered on Dec. 7, confining him to his bed and home for several weeks. The increase is 1 cent per hour, making the scale of wages as follows: 19 cents per hour for the first year, 20 cents per hour for the second year, 21 cents per hour for the third year, 22 cents per hour for the fourth year and thereafter. The official statement says, in part:

"This increase, like the increases taking effect June 1, 1900, and June 1, 1902 (aggregating over 15 per cent), is entirely voluntary, and is an evidence of our appreciation of your faithful service and endeavor to merit the commendation and good will of the public that we serve, to do which we are largely dependent upon your courtesy, patience and constant watchfulness in the performance of your duties. Unlike the steam roads, who can increase their rates of freight to make good increased cost of operation, we cannot increase the price of our service, but, on the contrary, are constantly lengthening the distance that can be ridden for a single fare, and providing more expensive construction and equipment; therefore the only way we can hope to obtain any return for the increased pay granted to our employees is by obtaining from them more intelligent, faithful and enthusiastic service, which I bespeak from every employee of the company."

## ELECTRIC RAILWAY SECURITIES

The recommendations as to the purchase of interurban railway securities published in the STREET RAILWAY JOURNAL for Dec. 27, and credited to a prominent banking house in Chicago were originally formulated by Knight, Donnelly & Company, of that city, and were printed in "Pit and Post," published by that firm. Omission of proper credit in these columns was due to the fact that the abstract which was quoted in these columns did not specifically mention the source of its information.

## THE PITTSBURG, McKEESPORT & CONNELLSVILLE RAILWAY

The Pittsburg, McKeesport & Connellsville Railway Company is rapidly connecting up its entire system in the coke region of Pennsylvania. The line between Scottdale and Mount Pleasant is practically completed, and all that is needed to complete the line between Scottdale and Connellsville is a steel viaduct over the Pennsylvania and Baltimore & Ohio tracks, which will be ready before spring. Between Connellsville and Uniontown less than 5 miles of line remain to be built. As soon as the coke region system is completed work will be commenced on the connection of the line with that part of the system now in operation in and about McKeesport. This line will be about 20 miles long, and will extend from the present terminal at Buena Vista to Connellsville, via Broad Ford. From the latter point a line will also be built to Scottdale. The company expects to have its new power house, east of Connellsville, in partial operation by Feb. 1. Three-phase transmission will be employed, about a dozen sub-stations being employed for distribution. The company has recently completed the purchase of the Dawson Electric Company, which has a plant of 300 hp. A contract will be awarded in a few days for the extension of its Leisenring Division to Vanderbilt, and thence to Dawson. The extension will really be a spur of the line now running from Connellsville through New Haven. It will be a little over 3 miles long.

## FROM TOLEDO TO CHICAGO

The plan of the Toledo & Western Railway syndicate for eventually connecting Toledo and Chicago by electric railway has assumed tangible form, through the announcement made by Hon. C. M. Stone, of the successful financing of the Garret, Auburn & Northern Railway, and the Chicago & Indiana Air Line. These roads are being promoted by interests which are closely allied with the Toledo & Western Railway, and in connection with the Indiana Railway, an independent line will form the desired connection. The lines will cover the territory as follows: Toledo & Western, Toledo to Pioneer; Garret, Auburn & Northern, Pioneer to Goshen; Indiana Railway, Goshen to South Bend; Chicago & Indi-



ana Railway, South Bend to Chicago. It is announced that contracts for material for both the roads above-mentioned will be placed at once, and that grading will start as soon as the weather permits. The new lines will be built on wide private right of way and will be equipped equal to the well-known high standard of the Toledo & Western Railway. Eventually the lines will be consolidated. The Toledo & Western syndicate is headed by Luther Allen and Judge C. M. Stone, of Cleveland, and F. R. Seagrave and J. R. Seagrave, of Toledo.

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### TOPICS OF THE WEEK

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Comptroller Grout, of New York, has asked for bids for \$7,000,000 gold bonds, 3½ per cent, for public improvements now authorized by the municipality. Of this issue \$2,000,000 will be issued for rapid transit improvements.

It is gratifying to learn that the New York Central management and the municipal authorities have partially reached an agreement upon the plans for the improvements of the terminal facilities in New York, which will permit of the introduction of electric service in the Park Avenue tunnel and the suburban lines entering the Grand Central Station.

The Cleveland Electric Railway Company is placing gongs on the rear platforms of a number of its cars. The gong is operated by the motorman, and warns passengers stepping from the car that another car is approaching from the opposite direction. The gong has a continuous ring, different from the ordinary gong on the front platform. It is believed the device will save many accidents.

A novel suit is that brought against the Springfield Street Railway Company of Springfield, Mass., by a man and his wife, for damage to the plaintiffs' house and discomfort to the occupants caused by the vibration from the machinery in the defendant's power house, and from the blowing of coal on the plaintiffs' premises from the defendant's coal pile.

The Rapid Transit Commissioners have assurances from Chief Engineer Parsons that the subway work is progressing at a rate that will insure a much earlier completion of the system than has heretofore been expected. Trial cars will be run over the route, Mr. Parsons said, in June or July, by which time the work of construction will probably be finished. This would leave four months for the installation of the equipment, most of which is now ready for delivery.

An official of the Philadelphia Rapid Transit Company is quoted as saying that "the rolling stock of the contemplated electric railway on the boulevard to Torresdale will be the finest of any electric line in the world. There will be observation and parlor cars of the most commodious type. Travel on the line will be a luxury. There will be observation stations along the route, towers with elevators, refreshment booths, and many other attractions. In fact, it is our plan to make the boulevard, as far as the trolley line is concerned, a 10-mile park."

At the twenty-sixth annual dinner of the Hotel Men's Association of New York, held at Delmonico's a few days ago, Simeon Ford, in the course of a speech, said: "I am glad the women have taken up the transportation problem. They are going to compel the traction companies to provide each female woman with a seat, hot and cold water, and electric curling irons. It makes a man's blood boil to think that his wife, after a hard day's shopping, is compelled to ride home in a car seated in some other fellow's lap, or that she should be jostled by rude workingmen, who have the nerve to ride home from work when such excellent walking facilities are provided."

In a recent interview in the New York World, Charles T. Yerkes said:

"Combinations have been made during the last few years which are wrong in principle and which could not have existed but for the unusual prosperity. By reason of trust organizations I have in many cases been forced to pay 50 per cent, frequently 20 per cent and 30 per cent advance. For this reason I shall buy all my material in England. I am not a calamity howler, but the inevitable

is apparent to every shrewd observer. There will be no sudden crash, but there will be a gradual decline in prices of trust products, and when they have dropped as far as they can they will have to begin to squeeze water out of their stocks and forego the large dividends they are now paying. American steel has risen 40 per cent in price in the past few years, and is rapidly becoming a drug in the market abroad."

The announcement that the Buffalo & Depew Electric Railway would use the lines of the Rochester Railway Company, entering that city has called forth a lament from the vigilant Mayor of the Flower City, who deplores the inability of the municipal administration to hold up the newcomers. The Rochester Company has encouraged the building of suburban roads, and has made favorable terms with those desiring admission to the city over its tracks, realizing that the best interests of the city and the company would thereby be served. This arrangement has not only brought nearby towns into closer business relations with the Rochester merchants, but it has afforded the people living along the routes traversed by the suburban cars much better service than could otherwise be provided. The Rochester Railway Company is obliged to pay an additional \$5 for each car running over the city lines, and additional taxation for additional percentage of increase in business. Moreover, if increased traffic requires more frequent paving operations the local company is compelled to stand the expense. It seems, under the circumstances, as if the Mayor had little reason to complain.

In view of the present discussion of street railway management in Chicago, the utterances of Judge Carter, of that city, upon municipal ownership and the dangers arising from political control of such important undertakings will be of especial interest at this time. In public address the distinguished jurist said: "Municipal ownership of water, light and sewerage is one thing, municipal ownership of street railways quite another. The former enter, or ought to enter, every street, and they each require comparatively a small number of men to manage them. Street railways only run through some streets, and require a host to operate and manage them. If the city owns the railways there is the question of competition between streets and the question of which party or boss shall control the army of operators. If municipal ownership is to come there is a financial difficulty. How to pay for the railways is a question I have never seen adequately answered. Yet, the financial question is the initial one that confronts us if we resolve on municipal ownership. I think every sensible man who has studied the question believes in renewing the companies' franchises, with the privilege of the city's taking them over after a period of five, ten or fifteen years if the city chooses."

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### STRIKE AT WATERBURY

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The lines of the Connecticut Railway & Lighting Company at Waterbury, Conn., and those extending to Naugatuck, Waterbury and Oakville are tied up by a strike of the employees, declared Jan. 10, because the company refused to grant certain demands made by the men. Among these demands are: The recognition of the union, reinstatement of the men who were discharged for incompetency, a ten-hour day at 22½ cents per hour for regular and extra men, and the compulsion of membership in the union of all employes of the company.

The reply which the railway company made to these demands was brief and pointed. After stating that the demands could not be granted the reply says that men not reporting for work at 3 p. m., Jan. 12, would be considered as having left the service of the company, and would only be re-employed as new men. So far as is known none of the men reported for duty. A storm hindered the company from carrying out its plan of resuming service at once with new men, as Waterbury and the surrounding country felt the effects of a disagreeable sleet and snow storm on Sunday.

Monday and Tuesday were spent in preparing the line, and on Wednesday morning the announcement was made that the operation of cars would begin that afternoon. As a precautionary move the city authorities were notified that adequate protection would be expected if any attempt should be made by the strikers or their sympathizers to interfere with the running of cars. The snowplows that were sent out by the company on Sunday in an effort to keep the road open were stoned, but no riotous demonstrations are reported as having occurred on Monday or Tuesday. The company has secured a force of men sufficient to resume operations on regular schedule, and is determined not to meet the demands of its former employees.



## THE SITUATION IN CHICAGO

It is stated in Chicago that within two or three weeks the Union Traction Company will tender to the Council an ordinance for franchise extension, the terms of which will be so liberal that the ordinance will pass. It is understood that among other concessions to the city will be consolidation with the Chicago City Railway and universal transfers on the company's lines, eventual consolidation of the elevated roads and one fare everywhere, expenditures of \$25,000,000 in the improvement and betterment of the surface service, and compensation to the city on a liberal basis.

## STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED JAN. 6, 1903

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

717,542. Trolley Harp; F. J. Caswell and C. N. Wood, Woodville, Mass. App. filed Feb. 10, 1902. Details.

717,570. Cable or Wire Shield for Suspended Cable Track Roads; H. M. Harding, Englewood, N. J. App. filed April 19, 1901. A tilting shield at the point of suspension prevents sagging of the wire.

717,583. Trolley Pole and Stand Therefor; W. H. Kilbourn, Greenfield, Mass. App. filed March 13, 1902. Relates to means for preventing the upward movement of the pole in case the trolley leaves the wire.

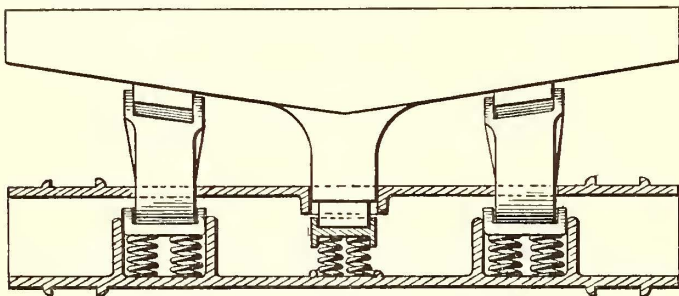
717,603. Railway Car Truck; J. F. O'Conner, Easton, Pa. App. filed April 23, 1902. Relates to the construction of a pivoted jaw in which the journal box is mounted and adapted to be horizontally removed therefrom in the direction of the rails through the opening formed by swinging upward said jaw.

717,620. Brake-Shoe; D. Rawstron, Harvey and H. Rawstrom, Chicago, Ill. App. filed March 31, 1902. A special design of hard metal insert.

717,632. Pinch Bar; M. A. Sheldon, Detroit, Mich. App. filed Sept. 13, 1902. Details.

717,689. Automatic Street Railway Switch; J. R. Klippelt, H. W. Jeffers and W. D. Bradford, Pittsburg, Pa. App. filed Feb. 5, 1902. Two operating levers between the track rails, in line with each other, one to open and the other to close the switch, and actuated by a trolley extending from the bottom of the car.

717,723. Car Seat Mechanism; H. Tesseyman, Dayton, Ohio. App. filed June 20, 1902. Relates to means for shifting the back of the seat from one side to the other and adjusting it at various inclinations.



PATENT NO. 717,781

717,728. Street Railway Curve; A. C. Wells, Whittier, Cal. App. filed April 7, 1902. The flange of the wheel contacts with balls in a ball race on the inner side of the inner rail of the track to reduce the noise and friction incident to the car turning a curve of the track.

717,742. Self-Locking Loose Wheel for Cars, &c.; C. J. Gustafson, Sequatchie, Tenn. App. filed April 7, 1902. Consists of a self-locking and self-lubricating hub cap and oil reservoir, which is inseparable from the axle when in service.

717,780. Car Truck; J. Timms, Columbus, Ohio. App. filed May 8, 1902. Dispenses with the truck bolster and supports the body transom directly on springs through the medium of side bearings.

717,781. Car Truck; J. Timms, Columbus, Ohio. App. filed May 8, 1902. See preceding patent.

717,821. Trolley for Electric Cars; W. A. Daggett, Vineland, N. J. App. filed April 22, 1902. Relates to the construction of a spring-mounted harp.

718,024. Trolley; J. T. Rice, Hot Springs, Ark. App. filed March 20, 1902. Two poles controlled by one spring.

718,025. Car Fender; J. B. Robidon, St. Louis, Mo. App. filed May 14, 1902. Means whereby the fender can be easily lowered by the pressure of the foot of the motorman and can also be removed and placed at either end of the car.

## PERSONAL MENTION

MR. T. C. CHERRY, superintendent of the Lorain Street Railway, of Lorain, Ohio, was recently presented with a fine leather Morris chair by employees of the company.

MR. H. C. WARREN, who has had extended experience in steam railroad operation, has been appointed general manager of the Toledo & Indiana Railway, of Toledo, Ohio.

GENERAL WILLIAM A. BANCROFT, president of the Boston Elevated Railway, of Boston, is the author of an interesting article on the Future of the Electric Railway in the current issue of "Wisdom."

MR. WILLIAM SUTTON, who was the president of the old American Car Company before that company was bought by the J. G. Brill Company, is now occupying the position of supervisor of the St. Louis Car Company.

MR. ROBERT O. CARNAHAN, for many years superintendent of the Staten Island Electric Railroad, has been made general transportation superintendent of both the Richmond Light & Railroad and Midland Railroad Companies.

MR. E. M. STEVENS, who has been connected with the Westinghouse Electric & Manufacturing Company, has been appointed general superintendent of the Cincinnati, Georgetown & Portsmouth Railway, of Cincinnati, Ohio, which has recently been placed in operation.

MR. CHARLES UPDYKE, formerly manager of the Toledo & Monroe Railway, has been made superintendent of the Cleveland-Norwalk Division of the Lake Shore Electric Railway, succeeding Mr. H. M. Smith, who has been transferred to another position on the Everett-Moore system.

MR. H. H. VREELAND has denied the report that he was to go to London to manage one of the underground railway systems in that city. The report was current about six months ago, and met emphatic denial from Mr. Vreeland. A second revival of the story occurred last week, but, according to Mr. Vreeland, he does not intend to change his residence from New York to London.

MR. RALPH LEE CRUMP, M. Am. Soc. C. E., has recently opened his offices in Kansas City, Mo. He will devote his efforts to general consulting work relating to the following branches: Steam and electric railways, lighting plants, water works and gas plants and water-power development. Until recently Mr. Crump has been in charge of important railway work for the New York engineers, Ford, Bacon & Davis.

MR. F. M. ZIMMERMAN has resigned as general manager of the Elgin, Aurora & Southern Traction Company, of Aurora, Ill., and will be succeeded by Mr. Edwin C. Faber, formerly general superintendent of the Cleveland Electric Railway, but lately with the General Electric Company. Mr. Zimmerman has been general superintendent of the Elgin, Aurora & Southern Traction Company since its organization, about two years ago.

MR. WILLIAM T. VAN BRUNT, retiring manager of the St. Joseph Light, Heat & Power Company, of St. Joseph, Mo., was tendered a banquet at the Metropole Hotel Jan. 12 by leading citizens and business men, as an evidence of appreciation of his good work for the rebuilding of St. Joseph. Covers were laid for about 200, and the affair was the most elaborate attempted in recent years. Among the guests from other points were Mr. Frederick Strauss, representing Seligman Company, of New York; Messrs. C. M. and Herbert Clark, of Philadelphia; Mr. George L. Esterbrook and Mr. Dwight S. Harding, of New York, and Mr. L. S. Swift, Mr. J. P. Lyman and Mr. A. H. Veeder, of Chicago.

MR. W. S. DIMMOCK, who assumed the management of the Tacoma Railway & Power Company, of Tacoma, Wash., a few months ago, has been placed in charge of the Tacoma & Seattle Interurban Railway as general manager of the company. The general offices of the interurban will now be in Tacoma, consisting of the general purchasing agent, assistant treasurer for the system, claim agent, chief engineers, attorneys and the general manager. The superintendent will, of course, remain at Kent. Mr. Dimmock, it will be recalled, was formerly general manager of the Richmond Passenger & Power Company, of Richmond, Va., and before that was general manager of the Omaha & Council Bluffs Railway & Bridge Company, and the Omaha, Council Bluffs & Suburban Railway Company. Previous to his connection with the electric railway industry Mr. Dimmock was prominently identified with several of the large trunk line railroads.