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EDITORIAL NOTICE

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

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

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The Situation at Catlettsburg

Judging from the newspaper accounts of the strike of the Camden Interstate Street Railway Company's employees, the "victory" of the union resulted from intimidation and violence on the part of the strikers and their sympathizers. Rioting and bloodshed were reported at Huntington, Ironton, Catlettsburg and Ashland, but these disturbances failed to awaken the authorities to a realization of their duties. The press dispatches, during this lawlessness, said: "The city officials are making little or no effort to keep order. Sheriff Walton was appealed to for assistance, but said that city authorities should first make an effort to keep the peace." All of this trouble grew out of the refusal of the company to recognize the union, and the conduct of the men during the strike shows that there are very good reasons why the union should not be recognized aside from any question of company policy. It is a sad commentary upon any community that such an organization is not only tolerated but encouraged.

The Trackless Trolley Car.

Our readers are familiar, through several articles which have appeared in this paper, with the device known as the "trackless trolley," and which is employed in Europe to some extent where the amount of traffic is not sufficient to justify the expense of laying the ordinary track construction. Up to this time there have been no systems of the trackless trolley kind installed in this country, but it is just reported that F. G. Tilton and G. F. Stiles, two Lowell capitalists, will build a line of this kind between Franklin and Franklin Falls, N. H. A 20-hp omnibus has been ordered, capable of carrying thirty-two passengers and freight, and this car will be run by overhead wires on a macadam road. It is nowhere claimed that this system is as cheap to operate as the ordinary trolley system, or is in any respect more desirable than the latter, except that by it the expense of laying a track is avoided. The records of power consumption on the roads installed abroad indicate that about twice as much power is required on a good road to operate an omnibus of this kind as would be needed to propel a trolley car of about the same size. It is needless to say, however, that one chief essential for success is that the highway be a good one, and sufficiently broad to accommodate the traffic.

* * *

The average electric railway manager very often finds himself confronted with a situation where a certain amount of traffic could be secured by the construction of a short spur to his main track, but where there is considerable doubt whether enough passengers can be secured, certainly at first, to put the line on a paying basis. We ourselves can call to mind a number of instances of this kind, in some of which the local manager has actually taken into serious contemplation the operation of an automobile car, either steam or electric. Again, there may be places where the right to lay tracks either cannot be obtained or else will only be given under such burdensome restrictions that it will not be profitable. To both of these cases the trackless trolley seems particularly adapted. If the future should show that the traffic is not sufficient to justify the road, the expense of installation has been very slight, while, on the other hand, if the traffic should grow, the ordinary track can be laid and used with the same overhead wires, while the trolley omnibus can be relegated to another branch, where it can develop another traffic territory. Still another instance where this system, if it is practical, can be used is in a small town where there is no trolley system and where current to operate the line can be purchased from a local lighting company.

* * *

Two systems of this kind are employed abroad. In one the trolley is of ordinary under-running type and the two poles carried on the bus are similar to those on a car, except that they are longer and are swiveled both at the base and at the harp, so that a certain amount of variation in running is possible. In the other system the trolley runs on top of the wire, as in the old early Van de Poele system, and is connected to the omnibus by two flexible wires. The advantage of the latter method is, of course, that of a greater range in movement for the bus, depending on the length of the connecting cable. The former plan, on the other hand, permits an overhead construction exactly similar to that of the ordinary trolley car, except that two wires are used. For this reason the line can be converted very easily, so far as the overhead equipment is concerned, from a trackless to that of the ordinary track sort. The announcements published of the Franklin line do not indicate which system is to be employed in that city, but we hope when the line is in operation to present some details of it.

* * *

We have already referred to the absolute necessity of having a good road to run over, if the trackless trolley is to be even a fair success. We do not know the condition of the particular highway upon which it is stated the trial is to be made, but we could wish for better roads than the experimenters are likely to find in that part of the country. A combination of sand, stones and bad construction faithfully describes the ordinary New England highway, and on top of this everybody insists on using narrow tires, so as to insure the maximum tractive effort. Even the roads that exist are narrow, as well as bad, and a line of ordinary automobile trucks would encounter many difficulties. We can imagine a trackless trolley car performing fairly well on Continental or American roads of the better class, but the average American road is quite another story. Putting out of consideration the annoyance of the double trolley, under even the most favorable conditions, the power required on ordinary roadbeds and grades is considerable, and the mere difficulty of dodging other vehicles, simple enough with a common automobile, is formidable when the trolley connections are taken into account.

* * *

The average denizen of the rural districts has little enough love for automobiles at their best, and when trying to pass a trackless trolley car with a heavily loaded hayrack we fear his language would be more picturesque than polite. However, let the experimenters try it on—they have our best wishes for success—and if they can din the gospel of good roads into the unbelieving ears of the rural heathen we will pass around the missionary box for them. Even on city streets the automobile truck has thus far had a strenuous time of it, and while it doubtless has a great future, its present is full of griefs. The advent of a thoroughly successful kerosene burner or kerosene explosive engine, would clear up the difficulties wonderfully, and when the storage battery has really arrived perhaps the horse will shake his harness for good and all. A French breeder has been experimenting of late years on the development of horses of stature suitable for household pets. He has, we are informed, already brought the full-grown equine to the modest dimensions of a setter dog, and if both he and the automobile fulfil their hoped-for destinies, we may see the elect lounging back in their touring cars with their horses in their laps. But for the present we will pin our faith to the trolley car when we wish to get there on time.

The Street Railway in American Cities

It has been the usual custom for American cities, in the matter of railroad franchises, to wait until somebody wanted to do something, and then the city has been content to say yes or no. It has long been my contention that a city ought to be able to say what it wanted to have done and then to ascertain what somebody would do it for; in other words, that the city should be able to take the initiative.—From Mayor Low's Weekly Talk.

This statement shows a lack of appreciation of conditions that obtain in American cities, and it is hard to accept it as the expression of a student of municipal organization. Had the policy here advocated been followed, the present development of city transportation facilities and the consequent improvement of living conditions resulting therefrom, which are now universally enjoyed in this country, would be unknown. It is only necessary to bear in mind the financial condition of the average American city, the numerous demands that are made upon its resources, and the present status of public works entrusted to its care, to realize the wisdom and good fortune of the cities that have adopted the policy of entrusting the street railway business to private corporations.

We should not lose sight of the fact that the street railway companies have done a great public service in developing transportation facilities, not the least important feature of which has been the opening up of residential districts outside of the crowded business centres, thus relieving the congestion of these quarters and enabling all classes to secure homes in localities where better living conditions could be obtained.

The street railway companies have not waited for the demands of traffic; they have opened up new territory and led the way for the settlement of new districts. It is no exaggeration to say that they have been pioneers of civilization in the highest sense of the term. They have given the people the means of getting away from the crowded thoroughfares, and in many instances have been compelled to operate their roads, for long terms, at considerable loss, relying entirely upon the future for a fair compensation for this outlay. The investment represented in these roads has been very great, much more than any city could devote to similar work under even more favorable conditions. To-day there are comparatively few cities in this country that are in position to engage in enterprises of this kind, and it is doubtful if there are any that have funds at their disposal that could be spared for the period that must, of necessity, expire before the investment could become profitable.

This distinctive American policy has resulted in a higher development of electric railways in this country than in any other part of the world, which, of itself, is sufficient justification, even if there were not many other good reasons for it.

The Sky-Scraping Coal Bill

At the present rate of increase in the price of even soft coal, the time is soon coming when the motor power department of the electric road must take counsel with itself wherewith it shall stoke the boilers. Coal has been on the up-grade for some years, but the last two seasons are ominous. It really seems as if the coal monopoly, for such it practically is, proposed to "educate" the dear public to pay for its coal by the pound. It is hard enough on large electric railway systems that have terminal facilities of their own, and order coal by the ship load. But the burden falls with double severity on the small road that has, of necessity, a poor load factor and probably a rather uneconomical station to boot. In such cases, the cost of fuel, even at the former reasonable prices, was a serious item in the year's expenditures, and now the case is much worse; the more so as the outlook for improvement is not promising. It, therefore, behooves all hands to look out for means of relief.

Anything that will improve station efficiency means lower coal bills, and, consequently, it is desirable to overhaul the station equipment with a critical eye. Perhaps it did not pay to condense three or four years ago, but the balance turns the other way now, and the sooner that new compound engine is ordered the better. Then, too, how about that water-tube boiler that you have talked about since summer before last? Would it not be good policy to order it about to-morrow morning? And, while you are about it, you had better consult with the makers and see that the furnace is planned especially for the use of cheap fuel. Then, too, you have been nosing about and considering storage batteries for a year or two—hadn't you better quit thinking it over and do something? Your load factor is bad enough to demand it, surely, and every month the coal bill gives you a bad quarter of an hour. Batteries cost good money, too, but they do not pull on your bank account quite so hard as the coal pile does, and once in, they will save a handsome percentage on the investment. If worst comes to worst, the time may soon come when it will pay to investigate the merits of producer gas and gas engines. It is a hard state of things when one has to turn away from the steam engine, but unless the back of the coal monopoly is broken, and that promptly, something must be done to improve the utilization of the fuel one is able to buy. It is now quite certain that by the skilful use of producer gas one can get the horsepower-hour on the equivalent of little more than a pound of coal, and it is high time that the question were seriously considered. Electric power transmission should see a boom coming, too, and every water power that is available should be turned to immediate account. The comic paragrapher has pictured the magnate of the next generation wearing a sizeable chunk of anthracite in his shirt-front, but the joke is getting, even now, altogether too grim for enjoyment. The coal supply is far from exhausted, but the patience of the consumer is, and it is time to take the matter in hand and to push it to a final settlement.

The Convention of the International Tramway Association.

Electric railway progress in the United States has been so rapid, and we have been accustomed to such a great extent to look upon American railway practice as standard throughout the world, that American railway managers have, as a rule, taken comparatively little interest in the meetings of the foreign tramway associations. Another reason for this fact has undoubtedly been that it is the general impression that operating conditions are so different abroad that little practical value can be secured by a study of foreign electric railway conditions. In some respects both of these statements are true, although, when we consider them carefully, the arguments neutralize each other, because if American apparatus is used extensively abroad the experience of others with it will often be of as much value as if the apparatus were being employed in this country. As a matter of fact, Europe possesses a number of very active street railway associations at which topics are often discussed which are of interest to Americans, and while local conditions have caused a difference in certain operating methods there is nowhere near the diversity of practice between tramways abroad and in America as exist between the steam railroads in the two continents. The fact that electric railway development has occurred at a time when the interchange of ideas by the technical press and in other ways has been so general, together with the extensive development of electric railways in this country, have had the effect that the principles of American electric railway practice are pretty well understood, and to a large extent followed abroad. The result is that any new improvement which is made here in any important feature of electric railroading is known in Europe almost as soon as it has received publication in this country, and is considered on its merits even if it is not adopted.

Nor can Americans claim that they have nothing to learn in electric railway engineering from the companies across the water. From the opening of the early Siemens & Halske railway at Gross-Lichterfelde, in 1881, there has been an interchange of ideas between the two continents in which America has profited in many ways. Among the examples which we may cite of this truth is the underground slot conduit which was developed in Budapest before it was applied in this country, although American conditions required a considerable modification of the Hungarian model. The carbon brush and the storage battery for power stations, one now considered an essential and the other as an important adjunct in many cases to railway operation, were employed abroad before they were in this country, while the rotary converter was originated abroad though developed and perfected in this country, so that its general use is now distinctively American. Even at the present time we have an instance of the same thing in underground tube railways, and the use of three-phase motors for railway work. While the three-phase roads abroad may yet be considered in the experimental stage, the fact remains that lines of this kind are in regular operation, and have been for some time, while there are no instances of the direct application of three-phase motors to railway work in this country.

The largest and most important foreign street railway association is the International Tramway Union, which was established some fifteen years ago, and which now holds biennial meetings in the different capitals of Europe. The meeting this year, held in London, was the first ever conducted in an English-speaking country, and in this issue we publish a report of the first part of the meeting. The second part will appear in an early issue.

The membership of the International Street Railway Association is made up largely of Continental managers, and three languages, English, French and German, were used in the meetings in London, a digest of the remarks of each speaker being translated into the other two languages for the benefit of those who did not understand the language which the speaker used. We will not attempt here to make any analysis of the different papers or discussions, as the report is complete in itself. It is interesting to note, however, that many of the topics are the same as those which often come up for debate on this side of the Atlantic, a fact which indicates the community of interest in tramway matters in all parts of the world.

The New York State Street Railway Convention.

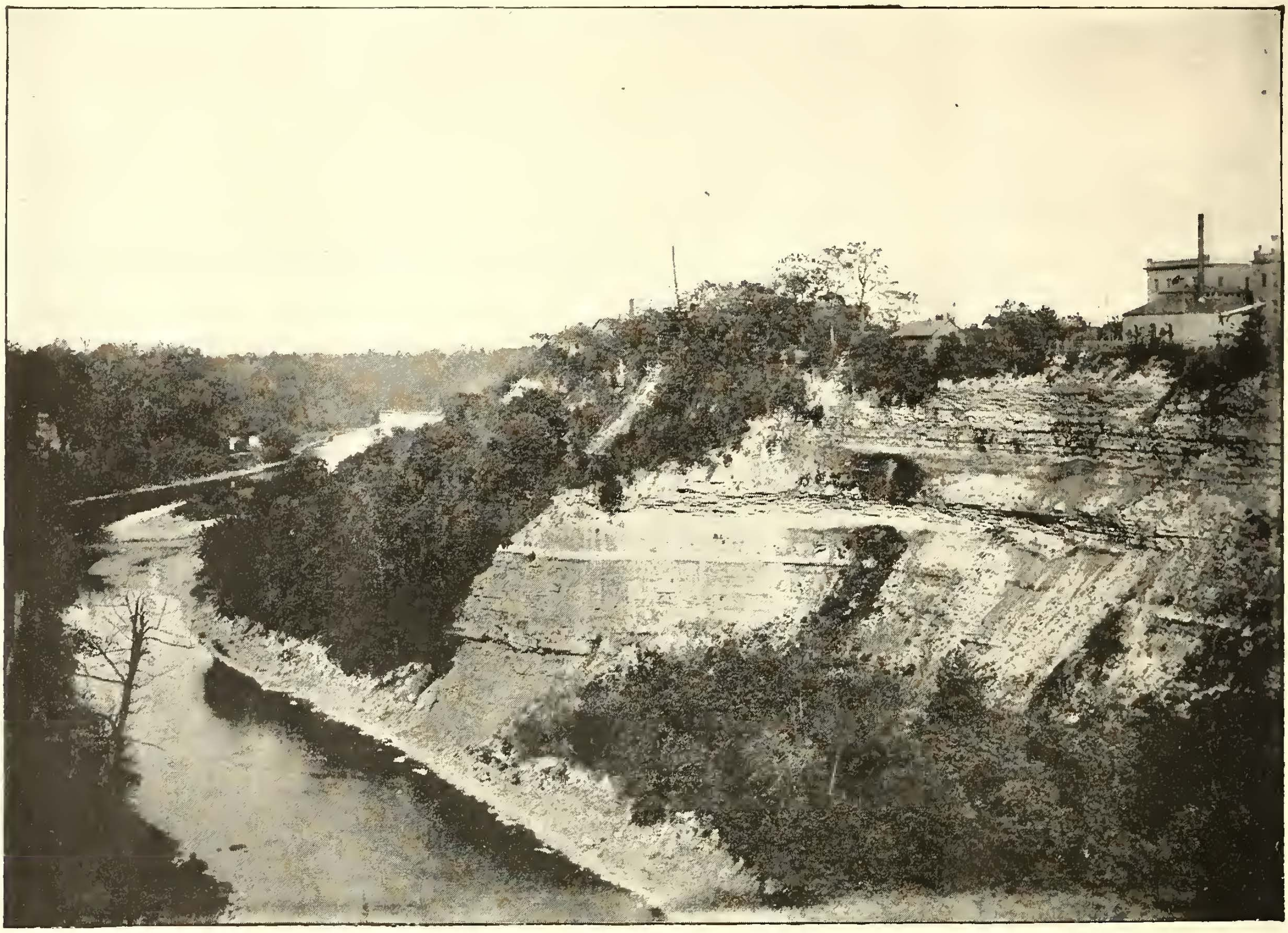
The convention of the New York State Street Railway Association is always looked upon as one of the most important events of street railway interest of the year, and the meeting which will take place next month promises to be one of the most interesting in the history of the association.

The date fixed for the meeting is Sept. 9-10, and the convention will be held at Fort William Henry Hotel, Lake George. The place selected for the meeting is a most attractive one during September, and the management of the association hopes that there will be a large attendance. There is another reason why the convention this year should possess unusual interest. The entire district in New York State north of Albany and bounded, in fact, by Utica on the west, the State line on the east, and Lake George on the north, has during the last two or three years undergone an enormous development of its electric railway facilities. The roads built have been of the high-speed type, and have been carried through this rich farming and popular summer resort region in many directions, so that as an interurban center this portion of the State almost, if it does not quite, rival the older and better known interurban electric railway districts of the Middle Western States. Recent consolidations have brought this system largely under one management, and it is now possible to travel from Albany to Lake George and beyond, entirely by electric road. The method of operating this vast system of electric railways will naturally be of extreme interest to a visiting railway manager, and we have no doubt but that facilities for an inspection of some of the most interesting features of this line will be afforded those who attend the convention next month.

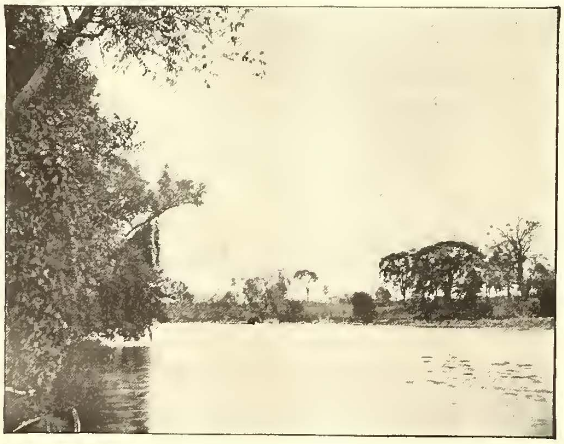
The New York State Association certainly deserves a great deal of credit and congratulation for its successful history and the important work in advancing the interests of street railways which it has accomplished since its foundation. We have on several occasions in the past expressed our high opinion of the work of the association and the ability which has been displayed in directing the work and aims of this body by its able president, G. Tracy Rogers, and the executive committees who have co-operated with him in carrying out the work of the association. The papers presented at the annual m etings have always been of the highest class, and the association has been fortunate in securing the active and hearty co-operation of the leading railway managers in the State, whose presence and discussions on the topics presented have been of the greatest value. It is with no idea of depreciating the street railway associations of other States to call attention in this way to the work accomplished by the New York State Association and to point to it as an example of what can be accomplished by united action and the expenditure of a little time for the common good. We know that many companies, who always make a point of sending representatives to the convention of the American Street Railway Association, neglect the meetings of the association of their own State, presumably on the theory that being small, it is not worth the time and consideration which would have to be given it. The State associations, however, have their peculiar province, and some things which they can do cannot be accomplished or even undertaken by a national body.

Rochester's Parks and Pleasure Resorts

The development of the park system in Rochester and the establishment of the summer resorts along the lake and bay in that vicinity may be said to date from the introduction of the electric railway system, and to be due, in large part, to the extension of the trolley lines, not only within the city, but to all points of interest along the lake within a convenient distance. Fifteen years ago the people of Rochester were dependent upon two small plots of ground in the heart of the city for recreation purposes; namely, Jones Square and Brown Square, with an occasional outing at Falls Field or Maple Grove. Now, however, they have one of the finest systems of parks in the country—probably the most complete of any city of its size in the world—comprising, in addition to eleven small squares or interior parks of ten acres and less, about 630 acres in three plots, all of which are easily and quickly reached over the lines of the Rochester Railway Company. The original cost of the land for these pleasure grounds aggregated about $300,000, and during the last ten years, while the park plan has been developing, about half a million dollars has been expended for maintenance and improvement. The three principal parks in the city are Seneca Park, which lies on both sides of the Genesee River in the northern part of the town; Genesee Valley Park, similarly situated along the upper river and on the southern border of the city, and Highland Park, which contains the reservoir of the city's water system.



GENESEE CANYON, BELOW LOWER FALLS, SENECA PARK, SHOWING ANCIENT SILURIAN (NIAGARA) STRATA



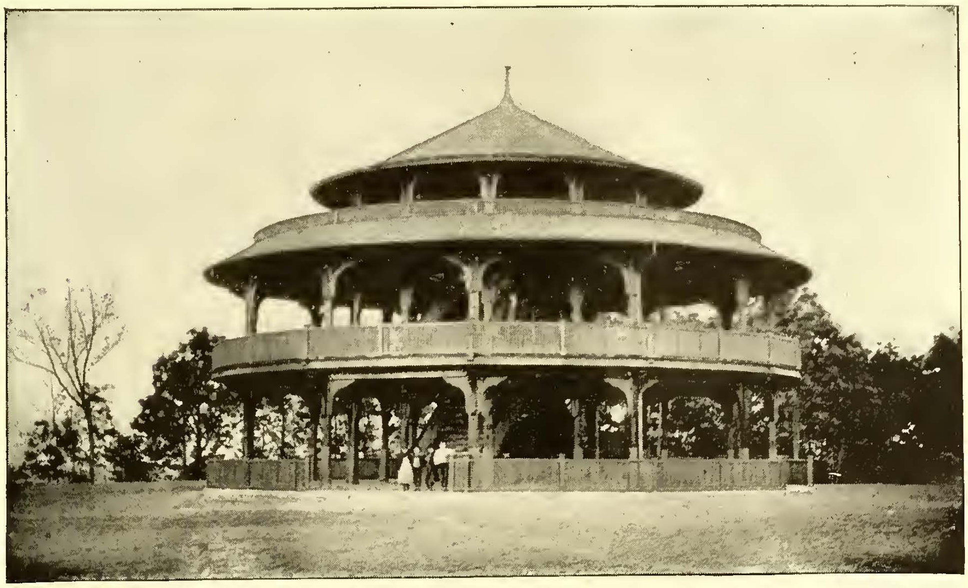
ON THE RIVER, GENESEE VALLEY PARK

LAKE IN SENECA PARK

The waterside resorts which are reached by the Rochester Railway Company and its connecting lines include Ontario Beach, Summerville and Windsor Beach, Manitou Beach, Sea Breeze, Glen Haven and Sodus Bay. All of the waterside resorts lie to the north of the city; Manitou, which is several miles up the lake, being the farthest western point, and Sodus, forty miles east of Rochester, marking the other extreme. The other points dot the lake front between these outposts. They are all reached directly by trolley lines from Rochester which connect with the local system and enter the city over the Rochester Railway lines.

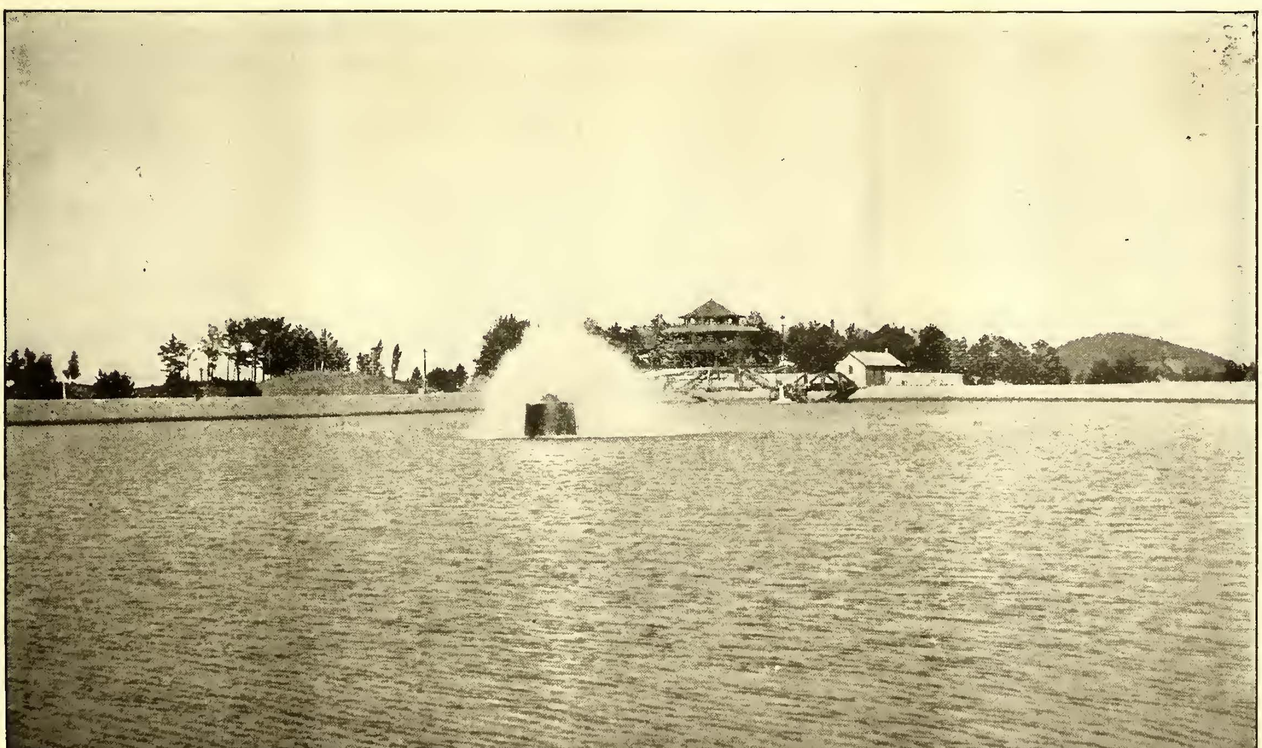
The system of the Rochester Railway Company covers all parts of the city very thoroughly, and comprises 105 miles of track over which 185 motor cars and forty trail cars are operated. The lines are laid out so that all routes lead to the business center of the city, from which the cars for the pleasure resorts and parks start, thus enabling patrons in all parts of the town to make direct connections with any of these points. The company has arranged trips taking in several points of interest, and combining not only trolley rides through interesting parts of the city and attractive rural scenes, but also lake trips or a ride on Irondequoit Bay, which is a very picturesque spot and a favorite resort for fishermen and canoeists. A forty-mile trolley ride through a beautiful country to Sodus Bay is offered those who enjoy rural scenes and long trolley rides.

While the lake resorts are available only a comparatively short time every year, the parks are visited at all seasons, especially in the fall and spring, when they are particularly beautiful and attractive to all lovers of nature.



CHILDREN'S PAVILION, HIGHLAND PARK

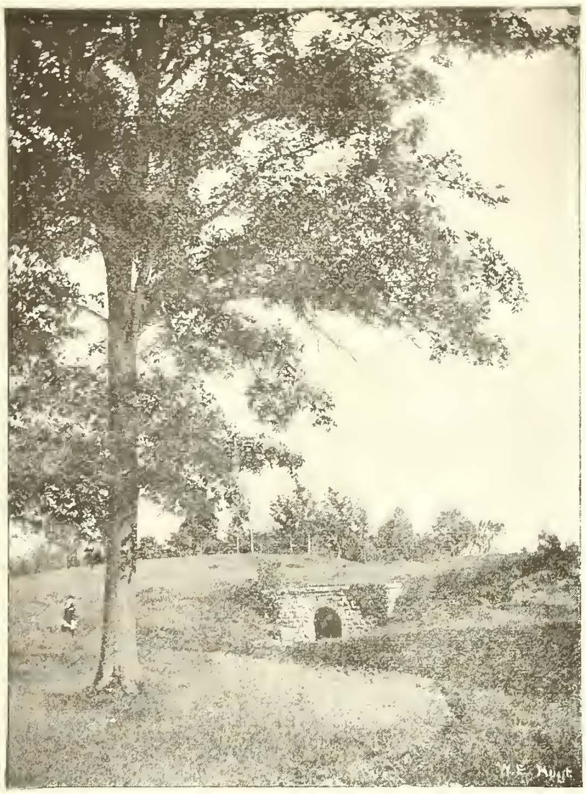
Seneca Park comprises 212 acres, 141 acres of which are on the east side of the river and 71 acres on the west side, and it contains a long section of the cañon of the Genesee, which rises over 200 ft. from the water level and is densely covered with the native forest growth. One of the most attractive features of this park is a charmingly picturesque lake of five acres, fed by natural springs, and encircled by promenades and driveways. This park also contains a large dancing pavilion and buildings for the zoological collection. Among the natural beauties of this site is a series of terraces and plateaus and a very complete collection of shrubs, trees and flowering plants.



FOUNTAIN IN MT. HOPE RESERVOIR, HIGHLAND PARK

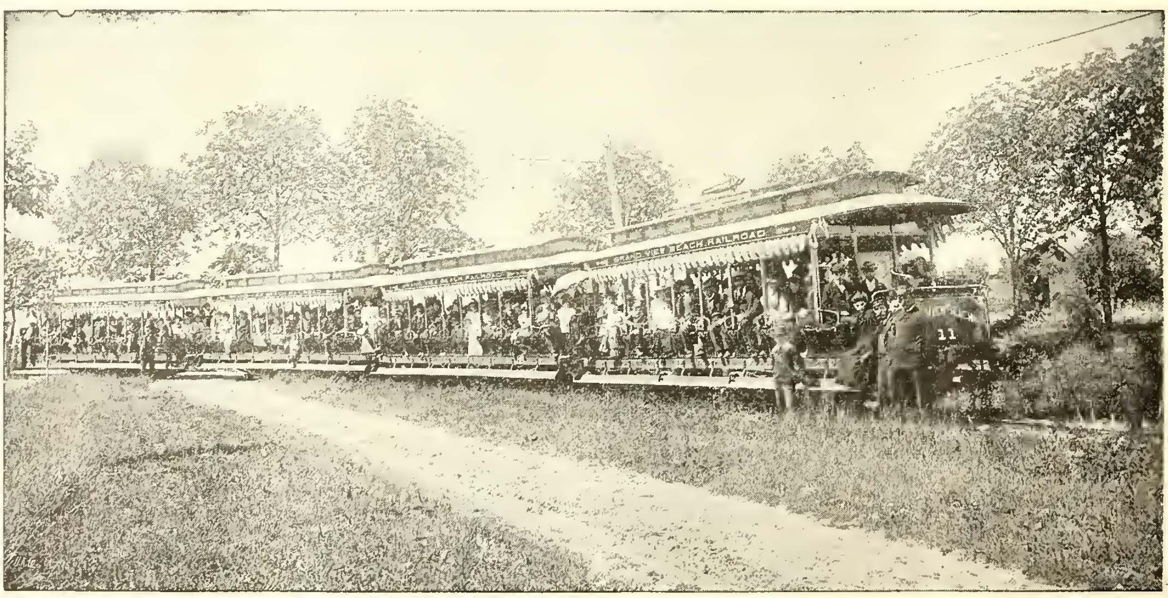
Genesee Valley Park, on the other hand, comprises a broad expanse of meadow, cool and shady woodlands, and placid stretches of river, which are very tempting to those who desire to indulge in outdoor sports or in recreative pursuits. This park comprises 340 acres. The land is practically a level tract, and possesses many elements of beauty, furnishing a rare example of the possibilities of landscape gardening in a location possessing many natural advantages. This park, too, is divided by the Genesee River, whose placid waters wind gracefully between the shady banks, affording an ideal place for boating and canoeing. There are golf links, base ball and athletic grounds, and a fine bicycle track. In summer, concerts are frequently given by popular bands.

Highland Park is the smallest of the three principal resorts, and comprises only 60 acres, but it is one of the most attractive spots, as it contains the waterworks reservoir, in which is a fountain projecting water to the height of 100 ft., and there is also an elaborate floral display. From the eminence in this park an unobstructed view to the south reveals a landscape of extraordinary beauty, and on all sides are beds of flowers and clumps of blooming foliage. To the north, the city stretches out, and beyond can be seen, on a clear day, the waters of Lake Ontario. The plan to use the reservoir site for park purposes was proposed by Ellwanger & Barry who were at one time interested in the old street railway company which operated the horse car lines in Rochester for many years. They offered to donate twenty



SCENE IN GENESEE VALLEY PARK

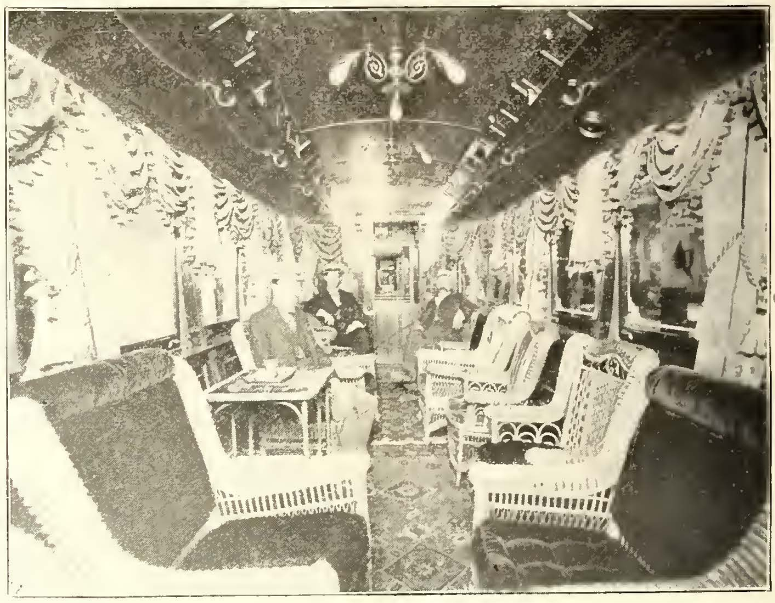
acres to help out the project. This generous offer was accepted, and now the park includes part of a moraine extending from the river to a point several miles east, the south slope of which has been developed to make of the park an arboretum. Here are over 1100 species and varieties of the 1800 sorts indigenous to this latitude. Such a sight as this slope during the flowering



TROLLEY PARTY VISITING LAKE RESORTS

season cannot be found elsewhere in this country, and the troops of bright, laughing children frolicking on the banks—for this is a "children's park"—lend additional grace and beauty to the scene. However, the children are not the only admirers of this collection, for it attracts horticulturists from all parts of the world. The north slope is devoted to evergreens, of which there are numerous varieties, beneath whose spreading branches are arranged long rows of picnic tables and settees. In 1890 Messrs. Ellwanger & Barry constructed a beautiful pavilion for the children, circular in form, three stories in height, 62 ft. in diameter and 46 ft. to the apex. This has proved a great attraction.

There are many additional points of interest in the city that are not included in the official park system, although some of them lie along the park route, and are much admired and visited by residents and strangers. Most important of all are the Falls of the Genesee. The upper falls are situated in the heart of the city; to the south of Platt Street bridge, which spans the gorge at the height of 200 ft. From here a splendid view may be had. The falls are 85 ft. high, and it was over this precipice that the famous Sam Patch made his last and fatal leap in 1829, before



PRIVATE CAR OF THE ROCHESTER RAILWAY COMPANY

thousands of spectators. The middle falls are 26 ft. high. The lower falls may be viewed to advantage from the Driving Park Avenue bridge. They are 96 ft. high and present a most imposing spectacle. To the north is the cañon of the Genesee. Driving Park Avenue bridge spans the Genesee cañon at a height of 212 ft. The bridge is 990 ft. long, and is the third longest single span bridge in the world. All of these points of interest, like the city parks, are located on the lines of the street railway company.

The city is particularly fortunate in its location, which enables it to enjoy many attractive summer resorts on Lake Ontario, Irondequoit Bay and Sodus Bay; all reached by trolley cars operated in conjunction with the local service.

The ride to Ontario Beach by trolley occupies about three-quarters of an hour. The first part of the journey is through

State Street, one of the city's chief business thoroughfares. At Lyell Avenue an oblique turn is made into Lake Avenue, and from this point to the Ridge Road is a succession of handsome residences and well-kept lawns. Beyond the city limits the route continues over the Charlotte Boulevard through a picturesque section. On the left is Kodak Park. Farther along on the boulevard the car passes St. Bernard's Seminary and Holy Sepulchre Cemetery. About two minutes' ride beyond this is Riverside Station, opposite which is Riverside Cemetery. After this comes Charlotte Village and then Ontario Beach. The entire route is lined with magnificent shade trees, which help to make the ride cool and refreshing on the hot summer days. The ride is also free from dust and dirt, as the streets and boulevards over which the cars run are constantly sprinkled.

Ontario Beach, on the shores of Lake Ontario, about 7½ miles north of Rochester, is the most popular lake resort in the State. It offers attractions usually found at the great seacoast resorts. During the season concerts are given afternoon and evening by bands of national reputation, and free vaudeville shows are continually going on in the pavilions, as well as spectacular outdoor attractions for entertainment.

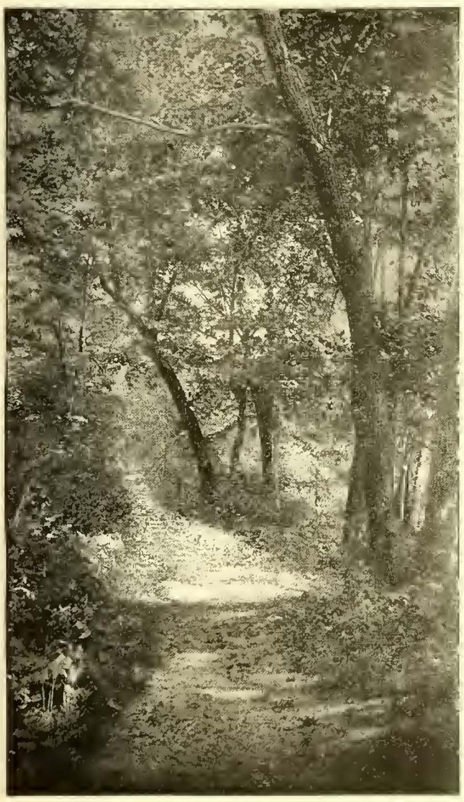
From Ontario Beach to the west runs a trolley line along the shore to Manitou, which is a favorite resort for picnickers, fishermen and family outings. This is owned by the Rochester, Charlotte & Manitou Railroad Company, and is a very popular route. It works in conjunction with the Rochester Railway Company.

Summerville, on the opposite side of the river from Charlotte, is a popular resort, and offers as attractions a splendid electric fountain, the Paul Boyton chutes, and a bathing beach. Adjoining Summerville are Windsor Beach and the White City, comprising a community of summer campers, whose long rows of tents present a very pretty spectacle. The ride to Windsor Beach and Summerville from the city is through a beautiful section of country, and follows the course of the river along the east side.

THE WHITE CITY AT WINDSOR BEACH, LAKE ONTARIO

Many visitors take the Windsor Beach car from Rochester, cross the river by ferry, and return over the Charlotte line, or reverse the order, and thus get a trip on each side of the city.

Sea Breeze is the suggestive name of a popular resort at the point where Irondequoit Bay connects with the lake. It has been laid out in very attractive manner by landscape gardeners, and as it possesses many natural advantages, it draws many pleasure seekers. The Rochester & Irondequoit Railway Company, which is leased by the Rochester Railway Company, operates a direct line to this point, from which steamers can be taken on Irondequoit Bay to Newport, Glen Haven and other points, or on Lake Ontario to Ontario Beach.



OLD PATHWAY IN SENECA PARK

LIGHTHOUSE, SODUS POINT

Glen Haven, one of the latest resorts in the neighborhood of Rochester, is situated in a charming glen at the head of Irondequoit Bay, on the line of the Rochester & Sodus Bay Railway.

It possesses many attractions, and has splendid accommodations for excursions and picnics, being surrounded by delightful groves on all sides. It has the advantage of being nearer to Rochester than any other of the summer resorts, the trip taking only thirty minutes' ride from the center of the city.

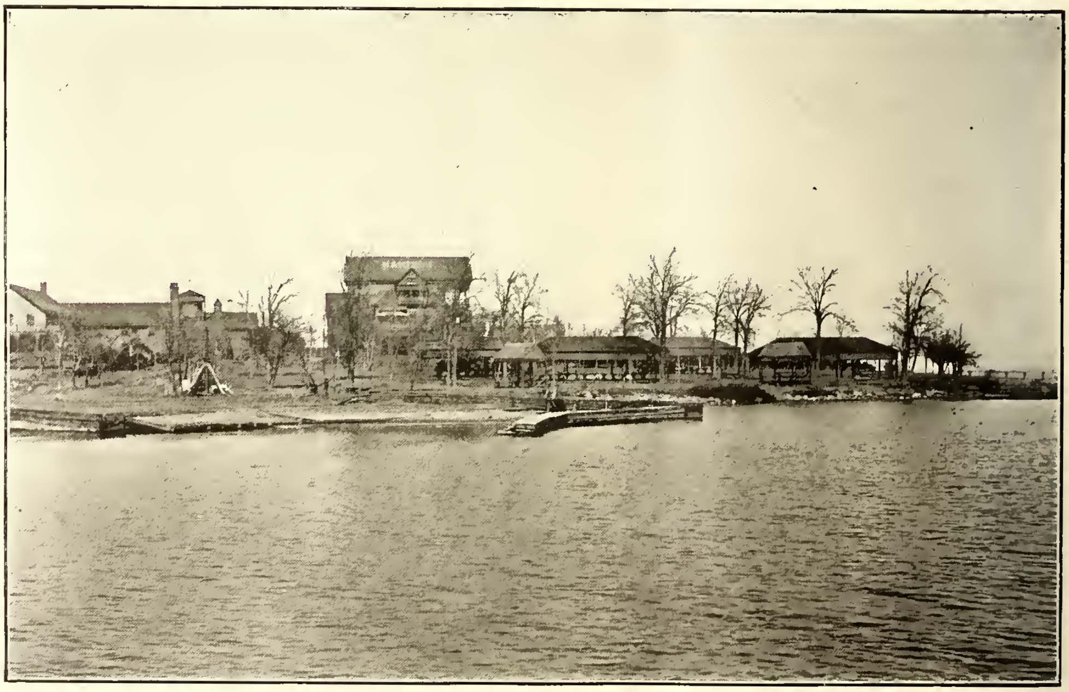
SUMMERVILLE, AT THE MOUTH OF THE GENESEE RIVER

Sodus Bay, which, of all the resorts reached by trolley lines from Rochester, is the farthest, is likewise one of the most attractive, as it affords many advantages which cannot be found elsewhere. It is acknowledged to be the finest harbor on Lake Ontario, and is protected by a splendid breakwater, built by the Government. The shores and islands abound with attractions and beautiful scenery, and accommodation for picnics and excursions are offered on every hand. A ride to Sodus Bay on a "Royal Blue Line" car of the Rochester & Sodus Bay Railway Company, which is now controlled by the Rochester Railway Company, is one of the most enjoyable "trolley trips" possible to find anywhere. The line passes through a fine residential section as far as the Glen Haven depot, and then makes a turn to the left, and passes through the outskirts of the city. Just beyond the city the line runs through a most picturesque glen, and emerging from this enters Glen Haven. Here a turn to the right brings the car through the bluffs. Irondequoit Bay presents itself to view for over a mile. Leaving the bay and the main power station of the company, the route leads through the Dugway, winding in and out among the hills. This part of the ride contains some of the finest landscape scenes to be found on the line. The track has been built for a considerable distance along the Webster Road and the Ridge Road, which was at one time the shore of Lake Ontario. The first point of importance is the village of West Webster, then three miles beyond is Webster, a prosperous and thriving village of about 1200 people. Through a beautiful farming section the line runs to Union Hill, a few miles beyond which is Fruitland, and then Ontario Center and Ontario. The landscape is ever changing; the road is lined with splendid orchards, and in springtime, when the trees are in blossom, the sight is most inspiring. The next town is Williamson, two miles beyond is East Williamson, and five miles further Sodus—the most important town on the line, with a population of 1800 persons. After leaving Sodus the line parallels the Rome, Watertown & Ogdensburg Railway as far as Wallington, where it passes under that road and turns to the north. About three miles beyond Wallington is Margaretta Grove, a favorite resort for picnickers. After this a few minutes' ride lands the traveler at his destination in the historic village of Sodus Point. It is expected that this road will eventually become one of the most important parts of the system of the Rochester Railway Company, as the freight and express service during the winter and the pleasure traffic in the summer months have been rapidly developing since the opening of the line. Sodus has proved a very attractive resort for Rochesterians.

At all points reached by the trolley lines along the lake the railway company has contributed generously toward furnishing attractions and entertainments, and this liberality has resulted in largely increasing the patronage of these resorts and the revenue of the street railway company.

Buenos Ayres Horse Road to be Converted

The Buenos Ayres Grand National Tramways Company, Ltd., a British concern which operates about 50 miles of horse tramways, employing nearly 300 cars, in the city of Buenos Ayres, Argentine Republic, is about to be equipped with electricity, according to private advices just received from South America. J. Hamden Wall, the general manager of the company, is now on his way to London for the purpose of conferring with his directors on the subject. The consulting engineers of the company are Sir George Bruce & White, of London. The company's head offices are at 6 Eastcheap, London, E. C.



MANITOU BEACH, ON LAKE ONTARIO

Plotting Speed-Time Curves—III

BY C. O. MAILLOUX

Modified Curves.—Fig. 11 is reproduced for the purpose of illustrating the modifications produced in the acceleration curve and the distance-curve by various changes in service conditions. The lower "*A*" curve is the same as the solid line curve in Fig 7. The lower "*B*" curve shows the change in the form of the acceleration curve produced by the addition of a trailer-car to the motor car. It bears a relation to the curve *A* similar to that of a curve for a down grade of relatively high percentage, this relation being obvious from the analytical principles previously set forth. The lower curve, *C*, shows the acceleration which would be obtained if the motors remained connected in series throughout the acceleration cycle. The curves *Fa*, *Fb*, *Fc*, etc., are the corresponding distance curves. In the case of both acceleration and distance curves the upper line of each pair is that which corresponds to the next higher gearing ratio. It should be noted that while the maximum speed attainable is higher with an increased gearing ratio, yet the initial acceleration is smaller. The two acceleration curves and

Sec. I. Such a run curve, however, only applies when the track actually is, or is assumed to be, straight and level. When it is desired to make proper allowance for track curves and grades, the process of producing the run curve is no longer as simple.

Fig. 12 shows a "service" run curve in which the speed line is modified by grades only. It represents express service run No. 7, running north, on the New York & Port Chester Railroad.

Fig. 13 shows a "service" run curve in which the speed line is modified both by grades and track curves. It represents express service run No. 11, running south, on the same line.

The latter curve has been specially selected as an interesting practical example of speed-time curve plotting, embodying substantially all the features and complications which are usually met with in the plotting of such curves.

These two service-run curves form part of a large series of such curves prepared for the aforesaid company during the last year, under the joint direction of Mr. W. C. Gotshall, president of the company, and the writer, to serve as the basis and also as the corroboration of technical evidence regarding the engineering features and merits of the project of the company, as presented in the hearing before the New York State Railroad Commission; and they are here reproduced, together with some of the corre-

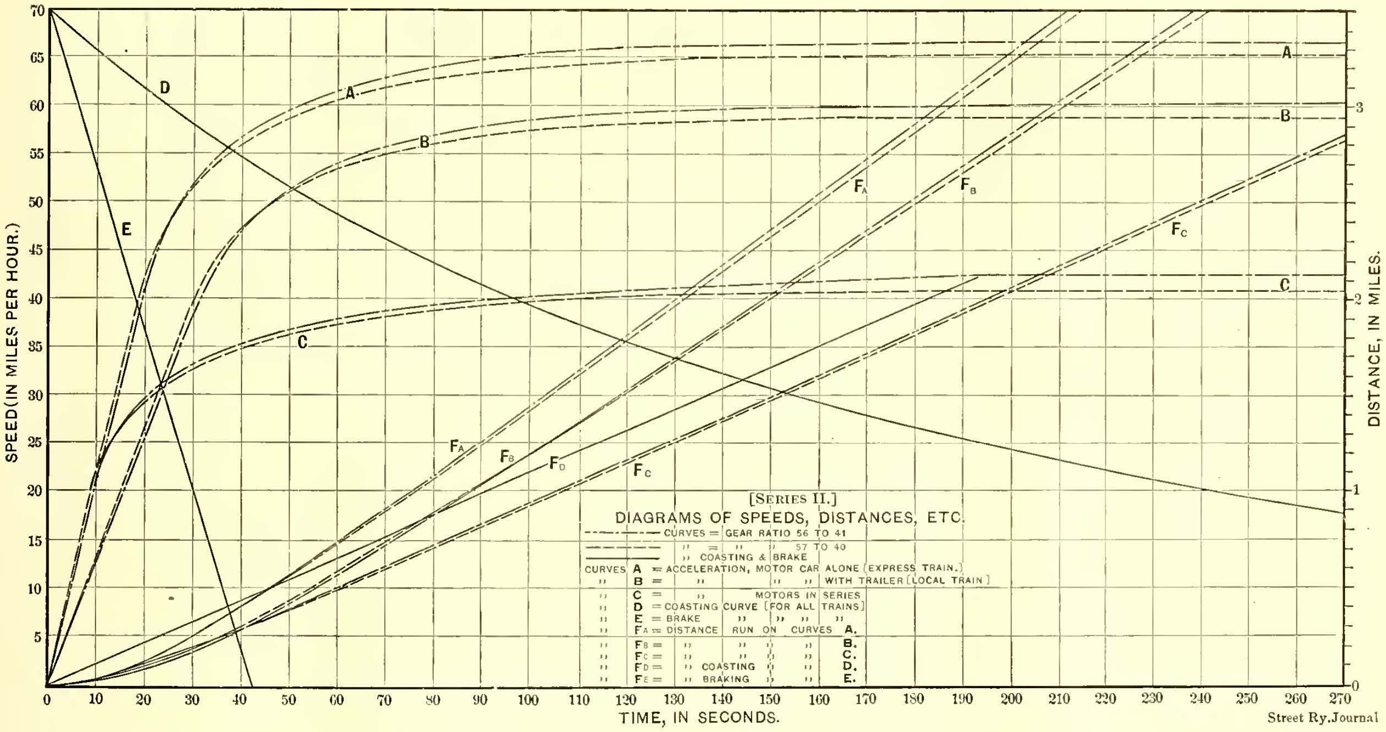


FIG. 11

the two distance curves cross in the figure at a point near the bend or "knee" in the curve. This characteristic of the two curves is the reason why the higher gearing ratio would be selected when the lengths of run are relatively great, whereas the lower gearing ratio would be selected when the lengths of run and the time allowable for acceleration are relatively short.

Run Curves.—The process of plotting a "run" curve consists in selecting and in bringing together properly certain determinate portions of acceleration curves, drifting curves and braking curves, constituting its component parts.

The operation of selecting and plotting the portions of component curves aforesaid naturally involves a more or less comprehensive study of all the basic data, the peculiar features and the specific conditions of the case, as well as the determination of their influence and effects by reference to the principles of analysis and synthesis previously considered; and it also requires the practical application of methods of plotting such as hereinbefore described. The operation of bringing together and of combining the component curves involves the utilization of the distance-time curve as a gage of the distance and time intervals corresponding to each distinct portion of curve; and it requires some knowledge of drafting room methods.

In a conventional run curve of the simplest form, such as shown in Fig. 4, there are only three component parts (A, B, C), which are easily combined together in the manner already explained in

NOTE.—The first instalment of this paper appeared in the STREET RAILWAY JOURNAL July 5, and the second part July 26, and contained Figs. 1 to 10, inclusive.

sponding subsidiary curves, by permission of Mr. Gotshall. The writer further takes this occasion to acknowledge many valuable ideas and suggestions kindly given by Mr. Gotshall, and gladly utilized in the preparation of this paper.

Tables I and II give the line data which are the basic data by reference to which these two run curves were prepared. These data were taken or calculated from the profile maps, location maps and field notes of the preliminary surveys made of the entire line. The first column gives the reference letters by means of which the corresponding portion of the run curve in the figure may be identified. Column II gives the lengths of the corresponding portions of the total run in fractions of a mile. Columns III and IV give the percentages of up-grade and down-grade, respectively. Column V gives the track curvature, stated in track "degrees," the word "tangent" being synonymous with "zero degrees" (0°), and being used to designate *straight* portions of track, all in accordance with the established practice in civil engineering. Column VI gives the track curvature expressed in equivalent percentage of grade. In Column VII the "net equivalent grade" values are given, these values being the same as the grade values given in Column III, for all portions on which there are no track curves, and being equal to the algebraical sum of the values given in Columns III and VI for all portions of the run on which track curves occur.

It will be noted that in the tables the total length of run is subdivided into as many portions as there are changes in track gradient or in track curvature, each portion being tabulated separately in a distinct line. Each of the lines in the tables corresponds to at least one "component" portion of the run curve.

TABLE I.—LINE DATA FOR EXPRESS SERVICE RUN NO. 7 (NORTH) NEW YORK & PORT CHESTER RAILROAD CO.

I. Portion No. (Fig. 12)	II. Length Miles	Per Cent of Grade III. Up	IV. Down	Track Curvature V. Degrees	VI. Equival't Grade*	VII. Net Equivalent Grade
0 to A	.107	----	0.900	4°	+0.180	−0.720%
A to B	.347	----	"	Tangent	------	−0.900%
B to C	.521	0.364	----	"	------	+0.364%
C to E	.567	----	0.433	"	------	−0.433%
E to G	.183	0.122	----	"	------	+0.122%
G to H	.065	"	----	2°	+0.090	+0.212%
H to I	.063	"	----	Tangent	------	+0.122%
	1.853	----	----	----	------	------

TABLE II.—LINE DATA FOR EXPRESS SERVICE RUN NO. 11 (SOUTH) NEW YORK & PORT CHESTER RAILROAD CO.

I. Portion No. (Fig. 13)	II. Length (Miles)	Per Cent of Grade III. Up	IV. Down	Track Curvature V.	VI. Equival't Grade*	VII. Net Equivalent Grade
0 to A	.306	0.283	----	Tangent	------	+0.283%
A to B	.113	"	----	1° 30′	+ .068	+0.351%
B to E	.374	"	----	Tangent	------	+0,283%
E to H	.208	"	----	7° 10′	+0.323	+0.606%
H to I	.135	"	----	Tangent	------	+0.283%
I to J	.189	Level	----	"	------	------
J to M	.189	1.300	----	"	------	+1.300%
M to N	.111	Level	----	"	------	------
	1,625	----	----	----	------	------

*By equation (XIII), taking b = 0.9

Some of them may correspond, as will be seen later, to two or more such component portions. Thus, while the total distance for run No. 7, amounting to 1.853 miles, in Table I, is sub-divided into seven distinct portions, each tabulated in a distinct line, it will be found that the corresponding run curve (Fig 12) is made up of nine "component" portions of run. In like manner the eight distinct portions of the run (No. 11) tabulated in Table II, correspond to fourteen "component" portions of run in Fig. 13.

The manner in which the aforesaid line "characteristics" influence the form of the speed-time curve has already been fully considered. In plotting a run curve we need, it is obvious, to consider, in addition to these line data, the other forces concerned in acceleration. If we use the "chart" method, previously described, we will need a "Chart of Coefficients," on which will be drawn the proper curves analagous to M and N, giving, respectively, the gross and net motor accelerations as functions of the speed, and also the curve R, giving the equivalent acceleration due to train resistance. The "corrected" speed curve and the tractive-effort curve marked "C", in Fig. 5, constitute the motor characteristics, by reference to which the curve of gross acceleration coefficients (M), shown in Fig. 9, was prepared. This curve (M) is substantially the same as was used in plotting the set of acceleration curves corresponding to various gradients shown in Fig. 7 and the service-run curves shown in Figs. 12 and 13.

It is proper to state that the straight portion of this curve M is based upon the assumption that the mean value of the current during the early stages of acceleration will be exactly 400 amps. per motor, corresponding to a maximum initial tractive effort of 2644 lbs. per motor, as indicated by the corrected curve of tractive efforts (C) in Fig. 5.

The track curves occurring during a given run are the first features requiring attention. If the track curves occur at the beginning or at the end of the run they usually impose no limitations on the speed. When they occur at midway points on the run they will impose limitations unless they are of relatively small degree. Run No. 11 furnishes an instance of this kind, as will be seen later.

Service Run No. 7—(Fig. 12), begins with a portion, 0.107 mile in length, having a track curve of 4 degs. and a down-grade of 0.90 per cent. The data in Column VI giving the "equivalent grade," and in Column VII giving the "net grade," show that the advantage of the down-grade is partly offset by the increase in the train resistance due to the track curve, the resultant effect being the same as if the track were straight and had a down-grade of only 0.72 per cent. instead of 0.90 per cent. The first portion (O-A) of the service-run curve in Fig. 12 will, therefore, be the same as the first portion of an acceleration curve, such as would be obtained on a straight track having a down-grade of 0.72 per cent. The net acceleration coefficients for this portion of the curve may, it is obvious, be readily obtained from the "Chart of Coefficients" (Fig. 9), and the corresponding time values can then be obtained by reference to the "Chart of Reciprocals" (Fig. 10) in the manner already fully explained.

The process of determining the co-ordinate points for the portion of curve to be plotted has already been described fully in the previous pages, and, therefore, need not be detailed further. The co-ordinates of the curve having been determined and the curve itself having been plotted and drawn, the next step is to ascertain the exact point at which the first portion (O-A) terminates. This is done by means of the distance curve, in the manner already fully explained, and also illustrated by reference to Fig. 4 in the foregoing reference to the "distance-time curve." The time point at which the ordinate of the distance-curve, when measured by the scale of distance, indicates a distance of 0.107 mile, represents the time point at which the first portion of the run-curve (O-A) should terminate. A vertical ordinate line is usually drawn from the terminal point A after it has been thus determined. The end of the first portion of the run (A) corresponds to a speed of 41.8 m. p. h., and a time interval of 19 seconds from the time of starting.

The second portion of the run has, according to Table I, a length of 0.347 mile, with the same down-grade (— 0.90 per cent), but without any curve. It begins at the speed point A (= 41.8 m. p. h.) and ends at the point B (= 59.6 m. p. h.). The co-ordinates for this portion of the curve are to be determined in substantially the same way as for the first portion of the curve, with the exception that the time values for all speed points higher than 41.8 m. p. h. are the only ones which need to be determined. After the curve has been plotted and drawn to a certain length

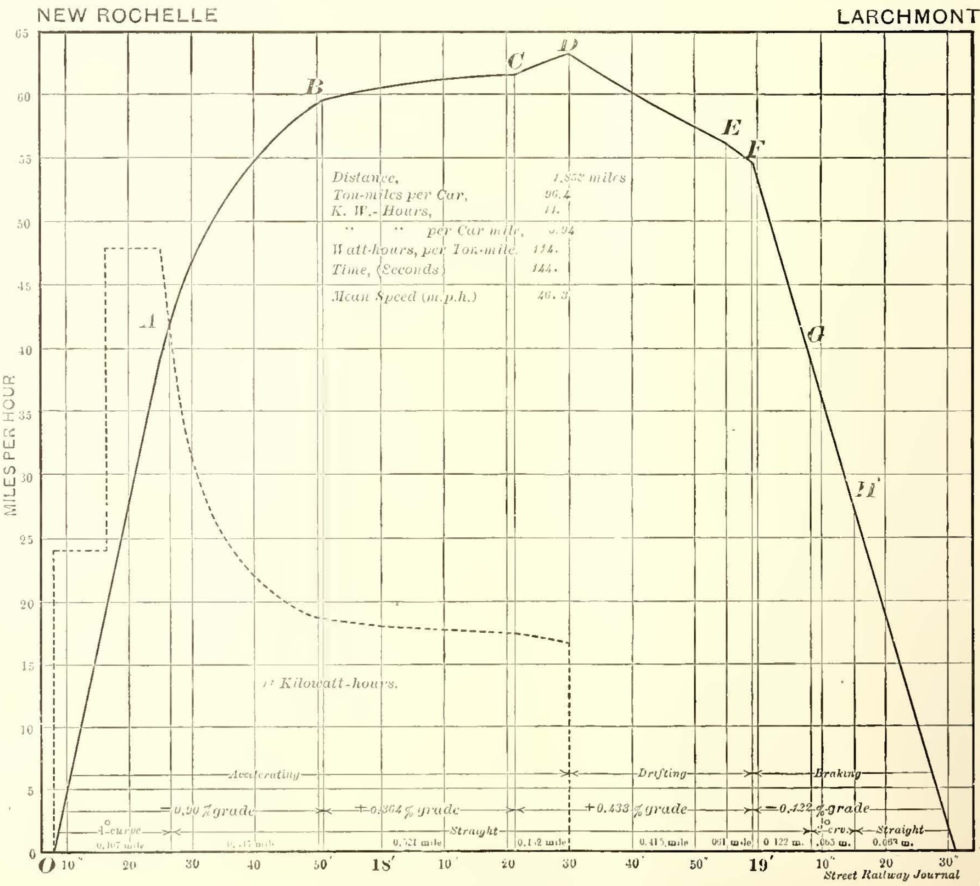


FIG 12

the point B, at which it should be cut off, is determined by reference to the corresponding distance-curve. The third portion of the curve, as shown in Table I, is 0.521 mile in length, straight, and on an up-grade of 0.364 per cent. The co-ordinates for this portion of the curve are determined and plotted, and the terminal point (C = 61.7 m. p. h.) is determined in the same manner as before. The relative flatness of this portion of the curve is both the result and the indication of the effect of the up-grade, the relative gain in speed being, as should be expected, much less on an up-grade than on a down-grade.

As the three portions of run-curve thus far considered cover a little over one-half of the total distance, it becomes necessary, in proceeding to plot the next portion, to anticipate and to determine two things: First, the point at which the electric power is to be shut off and at which the train will begin to coast; and, second, the point at which the brakes will be applied. Both points are determined somewhat arbitrarily, and vary greatly in different cases. It may be said that both are related to, and depend upon, the time allowed for making the run, or, in other words, the schedule speed required. The sooner the electric power is shut off, the smaller, it is obvious, will be the amount of electric energy consumed during the run. The effect of cutting off the electric power early is to increase the length of time during which the train must drift or coast, and also to lower the speed at which the brakes must be applied, in order to cover the same given total length of run. When economy is an important consideration it is obviously desirable that the amount of coasting should be greatly increased, and that the braking should begin at as low a speed as possible, for, the greater the amount of speed reduction obtained by drifting or coasting, and the lower the speed at which the brakes are applied, the smaller the momentum of the car at the time of braking, and, consequently, the smaller the amount of energy dissipated by friction during the operation of braking. When time is an important consideration, however, as in the case of a rapid transit or express line, it becomes necessary to sacrifice economy in order to gain time. In such cases we must shorten considerably the period of time during which the train will coast, and we must begin the operation of braking at a much higher speed. It may be desirable in fact to reduce the period of braking until it is virtually eliminated, the brakes being practically put on at the same instant that the power is shut off. A run-curve made under those conditions will be the curve corresponding to the *minimum time of run* for that particular case, although it will not be the curve of *minimum energy consumption*. It is desirable, even when the quickest time is to be made, to still make allowance for a certain period of coasting between the time that the power is shut off and the time that the brakes are applied. This gives the motorman a certain margin, for, if running behind, he can keep the current on a little longer and reduce, or eliminate, the period of coasting, while if running ahead, he can cut off the power earlier, and increase the period of coasting. In the service run under consideration (Fig. 12) the acceleration is continued on entering the fourth portion of the run (*C* to *E*) until the point *D*, distant 0.152 mile from the point *C*, has been attained. At the point *D* (= 63.3 m. p. h.) the current is shut off and the train begins to drift. In this particular case it was decided to let the coasting continue until the speed became reduced to 55 m. p. h., at which point (*F*) the operation of braking is to begin. The fixing of the braking point has the effect of also fixing the point *D*, at which the current is to be cut off. This is due to the fixed relation between the form of a speed-time curve and the area enclosed by it, and also to the fact that this area, as pointed out in Appendix A, is equal to and serves to measure the distance covered by the train in the corresponding time interval.

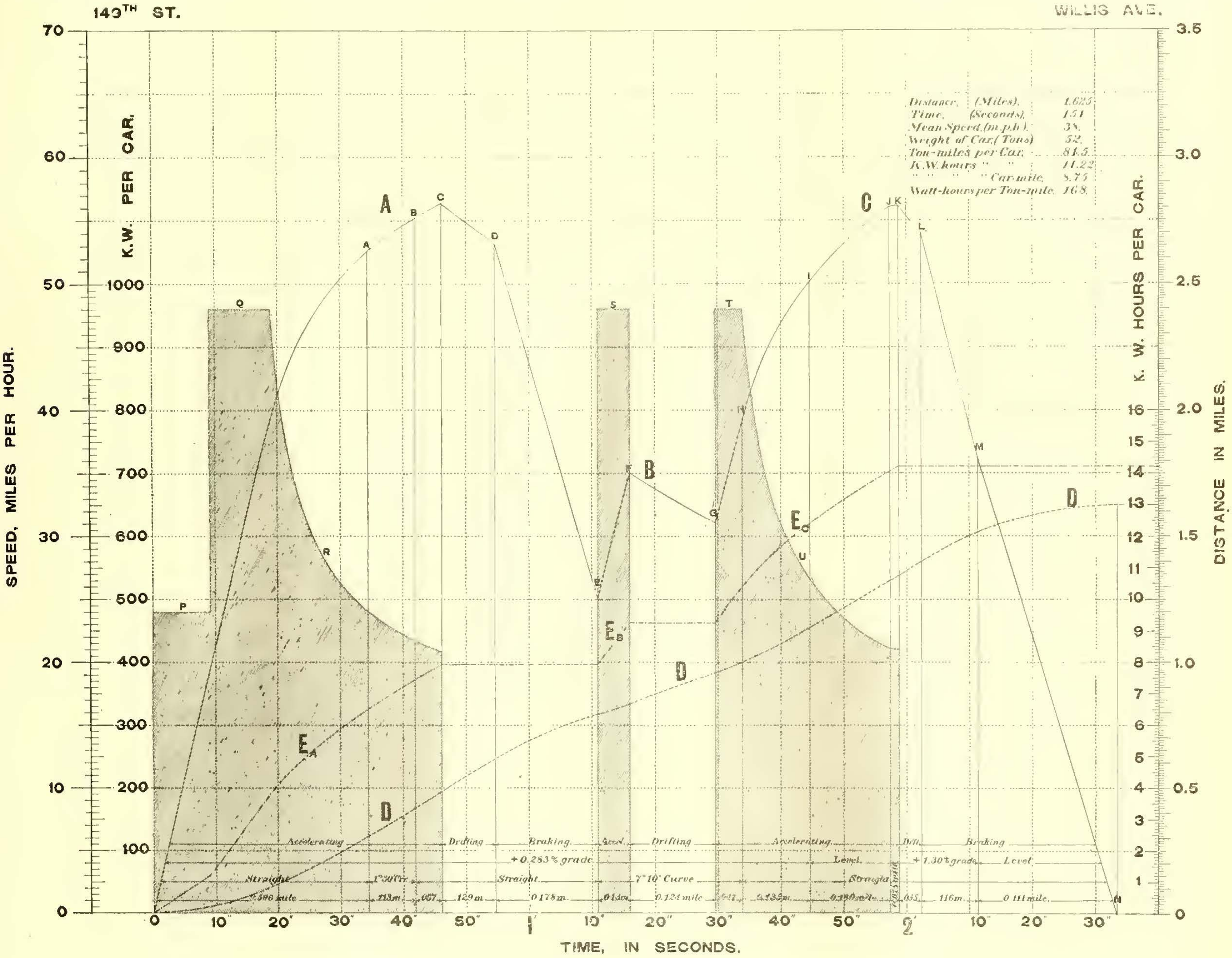


FIG. 13

The fourth portion (*C* to *E*) of the run tabulated in Table I will, therefore, correspond to two "component" curves, one being an acceleration curve (*C-D*) and the other a drifting curve (*D-E*). The acceleration curve is to be determined and to be plotted in the manner indicated for the preceding portions. As the point *D* is not known and has to be determined, it will be necessary to plot the curve to some arbitrary length, such as may be deemed sufficient for the purpose. If too long the excess can be erased; if too short, it will have to be lengthened.

The point *D*, at which the drifting begins, cannot be determined until we ascertain how much distance will be covered by the train while braking from the speed of 55 m. p. h., which, as already stated, was fixed as the point at which the operation of braking is to begin. It will be necessary, therefore, to determine and even to plot out the braking curve before plotting the drifting curve itself.

In plotting the braking curve we have to work backwards, so to speak, for we must, of necessity, begin with the last portion. According to Table I the last portion of the run is straight, on a + 0.122 per cent grade, and is .063 mile in length. We need to determine, first, the speed at which the train would be running at the time of entering this portion; second, the time consumed in running through this portion. This case corresponds exactly with the first brake-curve problem discussed in Appendix D. The equations (*e*) and (*f*) therein obtained for the speed and time values will exactly apply in this case. The speed will be:

$$y = \sqrt{7200\ k\ s} \qquad (e)$$

and the time will be:

$$x = \frac{y}{k} = \sqrt{\frac{7200\ k\ s}{k}} \qquad (f)$$

in which

y = the initial braking speed for that portion of the run.
x = the time interval for that portion of the run.
k = the net or resultant retardation coefficient.
s = the length of the corresponding portion in miles.
= .063 mile, in this case.

The value of the retardation coefficient, k, when calculated by the formula given in equation (X), will be found in this case to be:

$$k = 1.647 + (0.01098 \times 0.122 \times 20) = 1.674$$

Substituting the proper values in equation (*e*) we have:

$$y = \sqrt{7200 \times 1.674 \times .063} = 27.6 \text{ m. p. h.}$$

(which is the speed at the point H); and the time, by equation (*f*), will be:

$$x = \frac{27.6}{1.674} = 16.5 \text{ seconds.}$$

We next proceed to determine the co-ordinates for the portion of run ($G\ H$) immediately preceding the last portion.

The case corresponds exactly with Problem 2 in Appendix D. The initial speed (at the point G) will be:

$$Y = \sqrt{7200\ K\ s + a^2} \qquad (1)$$

where

Y = the entering or initial speed.
a = the leaving or final speed.
s = the distance,
k = the net coefficient of retardation.

The final speed (a) will obviously be the same as the initial speed y (= 27.6 m. p. h.) for the last portion of the run.

The distance from Table I is

$$s = .065 \text{ mile.}$$

The net retardation coefficient for the "equivalent" grade given in Table I, Column VII, will, by equation (X), be .

$$k = 1.647 + (.212 \times .20 \times 0.01098)$$
$$= 1.694$$

Substituting these values in equation (1) we will have:

$$Y = \sqrt{7200 \times 1.694 \times .065 + 759.3}$$
$$= \sqrt{792.7 + 759.3} = 39.4 \text{ m. p. h.}$$

(which is the speed at the point G).

The time interval corresponding to this portion of the run will be:

$$x = \frac{Y - a}{k} \qquad (i)$$

$$= \frac{39.4 - 27.6}{1.694} = 6.97 \text{ seconds,}$$

or, practically, 7 seconds.

The speed at the point G being only 39.4 m. p. h., as already seen, it follows that the braking must have begun before the train enters upon the portion $G\ H$. The next step, therefore, is to determine how much of the portion ($E\ G$) preceding the portion $G\ H$ will be covered by a train when braking a long enough time to reduce the speed from 55 m. p. h. to 39.4 m. p. h. This case corresponds exactly with problem 3 in Appendix D. The formula for the distance traveled is

$$s = \frac{Y^2 - a^2}{7200\ k} \qquad (m)$$

where

Y = the initial braking speed.
a = the final braking speed.
k = the net retardation coefficient.
s = the distance traveled while braking from speed "Y" to speed "a."

The net equivalent grade (Column VII) being the same for this portion as for the last portion ($H\ I$), the net retardation coefficient will also be the same, or $k = 1.674$.

Substituting values in equation (m) we have:

$$s = \frac{55^2 - 39.4^2}{7200\ x\ 1.674} = .122 \text{ mile}$$

which is the length of that part of the portion of run $E\ G$.

This, as we find from Table I, is not the whole of the portion of run $E\ G$, which is 0.183 mile long. The difference, which is

$$0.183 - 0.122 = 0.061 \text{ mile,}$$

represents distance covered by the train *before* the braking begins, or, in other words, while the train is still drifting. Hence the portion of run $E\ G$ must be represented in the run curve by two "component" curves, one ($E\ F$) being a drifting curve and the other ($F\ G$) being a braking curve. The time interval corresponding to the portion $F\ G$ is calculated in the same manner as for the portion $G\ H$ by means of formula (i). Its value is

$$x = \frac{55 - 39.4}{1.674} = 9.3 \text{ seconds}$$

The next step is to plot a portion of drifting curve from which the portion $E\ F$ may be cut off. This can be done by the chart method, using the curve Q on the chart of coefficients. We may begin plotting from a slightly higher speed, say 57 m.p.h. or 58 m.p.h., and plot the curve downward with positively increasing time values, in the usual way, until the speed line comes down to 55 m.p.h.—where the drifting ceases.

We may, however, plot the drifting curve in the opposite direction or "backwards," as it were, starting from the lower speed limit (55 m.p.h.), and continuing upward and backward until the length of the portion plotted is sufficient to represent a little more than the distance required to be covered. With a little practice, it is as easy, by the chart method to plot a curve "backward," as it is to plot it "forward." This is one of the incidental features and advantages of the method. The *modus operandi,* when plotting barckward, is, in reality, exactly the same, but the *order* is reversed. In plotting a drifting curve "forward," the retardation coefficient values would be taken from the chart of coefficients in the order of descending speed values, or from right to left, and the summated values would be reckoned and plotted in the right-hand direction, like positive abscissae. In plotting "backward," we merely reverse this order; the retardation coefficients are taken from the chart of coefficients in the order of ascending speed values, and the summated time values are to be reckoned and plotted in the left-hand direction, as if they were negative abscissae.

The curve having been plotted (on a separate sheet), the next step is to determine the "entering" point (E), at which it should be cut off. This is to be done, as in the case of the three portions of acceleration curve (O to C), by reference to the distance curve corresponding to this drifting curve. The initial or entering speed (at the point E) is found to be 56.4 m.p.h.

We now come to the final and somewhat difficult operation of making the "joint" or connection between what might be termed the "acceleration end" and the "retardation end" of the run curve. This joint occurs, as already seen, at a point D, on the portion $C\ E$, which point is, itself, to be located. It is necessary in this case to operate from both ends of the portion of run $C\ E$. For this purpose we need an acceleration curve suitable for the beginning of this portion, and a drifting curve suitable for the end thereof. Suppose we plot, in accordance with the data given in Table I, for the portion $C\ E$, on separate sheets of tracing paper or of tracing cloth, two distinct speed-time curves—one being an *acceleration* curve whose "beginning" or lowest speed point is the same as the speed at the point C (= 59.6 m.p.h.)—the other being a *drifting* curve, whose "end" or lowest speed point is the same as the speed at the point E, (= 56.4 m.p.h.); and suppose the distance curve for each speed-time curve to be also drawn on the same sheet therewith. If the two sheets be placed in correct ordinate relation with a straight line serving as the axis of x for both curves, the acceleration curve being placed at the left and the drifting curve at the right, and if they be then moved toward each other until they become partially superposed, the upper ends of the two curves will eventually come in contact; and if the sheets continue to move toward each other, the point of intersection between the two speed-time curves will gradually become lower until it corresponds exactly with the right speed point D, at which point the motion should stop. When the two curves are in this relation, they will precisely represent the portion of the run $C\ D\ E$ shown in Fig. 12, and it will be found by reference to the distance curves, that the aggregate distance corresponding to the two component curves $C\ D$ and $D\ E$ will be exactly 0.567 mile, as given in Table I. It is evident that if the curves were made to intersect at a point higher than the point D, the aggregate area, and, consequently, the aggregate distance covered by the two curves, would be greater, whereas, if the curves were moved closer together, thereby bringing the point of intersection below the point D, the area enclosed, and, consequently, the distance covered, would be smaller. The point D, is, therefore, the only one which meets the condition. It will be found that the acceleration portion, $C\ D$, ends when a speed of 63.3 m.p.h. has been attained, and a distance of 0.152 mile has been covered, the rest of the distance (0.415 mile), being covered while drifting from this speed to the entering speed at the point E, (56.4 m.p.h).

The component curves $C\ D$ and $D\ E$ having been determined, they can now be plotted on the same sheet as the preceding portions of the run curve. The portion $E\ F$, plotted on a separate sheet, may now be transferred to the same sheet. The portions of braking curve, $F\ G$, $G\ H$ and $H\ I$, being straight lines, can be readily plotted by reference to the data calculated in the manner previously indicated. Thus, the point G corresponds to a speed of 39.4 m.p.h. and a distance of 9.3 seconds from the ordinate of the point F. In like manner, the point H corresponds to a speed of 27.6 F. In like manner, the point H corresponds to a speed of 27.6 m.p.h., and a distance of 7 seconds from the ordinate of the point G. The terminal point I occurs at a time distance of 16.5 seconds from the ordinate of the point H.

Service Run No. 11 (Fig. 13).—A glance at the curve shows that it has two "notches" and three "crests," A, B, C, indicating three distinctive acceleration cycles. The acceleration in the first cycle lasts from the time of starting until the speed point C (56.35 m. p. h.) is attained, after which the train drifts as far as the point D (53.2 m. p. h.), and then brakes as far as the point E (25 m. p. h.), where the second cycle begins. The acceleration in the second cycle continues until the speed has risen to the point F (35 m. p. h.), after which the train drifts to the speed point G (31.1 m. p. h.), where the third cycle begins, with acceleration continued to the speed point K (56.2 m. p. h.), followed by drifting to the point L (54 m. p. h.), at which point the final braking begins, being continued to the end of the run (N).

The striking difference in outline between this run curve and the run curve shown in Fig. 12, is due to the restriction imposed upon the speed by a track curve of relatively short radius (7° 10'), which occurs in the portion $E\ H$, about midway, in this particular run. It will be found by reference to the line data in Table II, that there are two track curves in this run. The first track curve (1° 30') occurring in the portion $A\ B$ and tabulated in the second line in Table II, does not impose any limitations on the speed, such track curves being considered safe at any speeds below 60 m.p.h. In the case of the second track curve (7° 10'), however, it is necessary to restrict the speed considerably. It was decided in this particular case that the speed on entering this particular track curve ought not to exceed 25 m. p. h., and that the speed ought not to exceed 35 m.p.h. while running on the curve, excepting toward the end, where it would be allowable to allow the speed to rise as high as 40 m. p. h. while running out of the track curve. This restriction, it will be readily seen, accounts for the notch at the point E, as well as for the crests $B\ C$, in the run curve. This case is an interesting illustration of the important modifying effect produced on the service-run curve by a track curve of relatively small radius occurring at a midway point in the run. The track curve is, in this case, the primary cause for the two supplemental accelerations required in this particular service run, each of which involves an application of electrical energy to the train, and, consequently, occasions a material increase in the energy consumption required for the run, as will be found later on plotting the energy in-put curves.

When the service run has but a single cycle, as in Fig. 12, the plotting must of necessity begin with the very first portion. When it has several acceleration cycles, as in this case, if the speed value at the beginning of the second or third cycle is determined, or arbitrarily fixed, it is possible to begin the process of plotting at one of these cycles. Thus, in this particular case, the speed being restricted and set to 25 m. p. h. at the point E, corresponding to the point at which the train enters the sharp track curve, it would be possible to begin the process of plotting the run curve from the point E instead of from the point O. Advantage may be taken of this fact when it is desired to do work quickly, and to apportion it among as many persons as possible. In this case we shall follow the usual practice and assume that the curve is to be plotted by beginning at the very first portion ($O\ A$).

The operation of plotting the run curves is susceptible of being still further simplified, especially when the run curves are plotted and drawn on a relatively large scale, by a "method of interpolation," which the writer has used considerably, with success and satisfaction. The method is specially useful when the number of run curves to be made is large. For the purpose of giving an example illustrating the nature and practical use of the method, it will be assumed to be the method used in plotting the service-run curve shown in Fig. 13.

New York's Transportation Needs

Mayor Low's weekly letter, July 31, discussed the transportation facilities of New York and the improvements and extensions which, in his estimation, would be required to secure the unification of the several boroughs that will be necessary to carry out the spirit of the enactment which made possible the greater city. These requirements are considered under three general headings, namely: Inter-borough communication between Manhattan Island and Long Island, communication with Manhattan Island from the north, and the improvement of the city's commercial facilities in connection with the development of the water front of Manhattan Island. These features of the letter which relate particularly to intramural service are reprinted herewith:

When the Brooklyn Bridge was designed it was intended, from the railroad point of view, to be a bridge with shuttle trains passing to and fro upon it. In the process of time it has become a railroad thoroughfare—wholly so as to trolley cars, partly so as to the bridge railroad proper. One need not be a prophet to be able to foresee that its destiny is to become, from this point of view, wholly a thoroughfare. Two conclusions flow from this situation: First, that the suspended structure of the Brooklyn Bridge should be rebuilt as soon as possible to adapt it to the largest possible use as a railroad thoroughfare; second, that all the other East River bridges must be treated as railroad thoroughfares—that is to say, they must not only arrive, they must lead somewhere.

These conclusions may be briefly amplified. There are certainly very few, if any, railroad bridges in the country twenty years old that have not been rebuilt, at least once, in that interval, and, in some instances, twice, to adapt them to the demands of modern use. The towers of the Brooklyn Bridge and the cables and anchorages of it are equal to any demands that may be made upon them, but the suspended structure cannot do any more than it is doing now. Were this suspended structure to be rebuilt to comply with modern conditions, six car trains could be run instead of four car trains; in other words, the train capacity of the bridge would be increased 50 per cent. I believe this work can go forward without interfering with the use of the bridge. It ought to be planned for at once, and put under contract as early as possible. The estimated cost is $2,000,000. With this work completed we should have a modern railroad bridge instead of one twenty years old.

But, as I stated, a railroad thoroughfare not only ought to arrive; it ought to lead somewhere. Now, where in Manhattan should those East River bridges lead? The Brooklyn Bridge incontestably ought to lead south to the financial districts and across the city to the Hudson River ferries, and also north via Center Street and other streets to the Williamsburg Bridge. This would enable it to place Brooklyn in touch with a large district of Manhattan and with the New Jersey ferries. The southern connection can wait, but I think it will come. In the meanwhile the northern connection is immediately important, because it will not only increase the value of the Brooklyn Bridge, but it will also bring the Williamsburg Bridge (which ought to be open by Oct., 1903,) in touch with the City Hall, thus making that bridge, in its turn, a railroad thoroughfare. The same connection will, of course, unite the two bridges, and it seems to me possible, should it be thought desirable, that if the southern connection should one day be built for the Brooklyn Bridge trains from the Williamsburg Bridge could also make use of it.

The Manhattan Bridge runs from a point near the junction of Fulton Street and Flatbush Avenue, in Brooklyn, to the neighborhood of Canal Street and the Bowery. The railroad of this bridge ought to be carried across the city in such a way as to give contact with the West Side elevated roads, as well as with those upon the East Side.

The Blackwell's Island Bridge should be brought into immediate communication with the City Hall.

The connection between the Brooklyn Bridge and the Williamsburg Bridge, if the detailed studies show it to be practicable should be made underground, as proposed by Mr. Parsons in his recent report. The railroad outlet for the Manhattan Bridge must be either underground or by elevated road, as further study may dictate; for Canal Street is a broad thoroughfare, entirely given up to business. So far as the Blackwell's Island Bridge is concerned, this bridge terminates at Second Avenue, so that it could easily be connected with the Second Avenue railroad, and that road should be brought to the City Hall. It is clear that the natural agent for using the Blackwell's Island Bridge as a railroad thoroughfare is the Manhattan Railroad Company, and the natural agent for using as railroad thoroughfares the Brooklyn Bridge, the Williamsburg Bridge and the Manhattan Bridge, is the

Brooklyn Rapid Transit Company. So also is this latter company the natural agent for using the second Brooklyn tunnel, which ought to be located, as far as possible, to meet its views; provided, always, that these two companies will do their part in developing this thoroughfare traffic. They can hardly be expected to pay full interest on these costly bridges, for the bridges serve other purposes than that of railroad thoroughfares; but it ought not to be impossible to reach an equitable adjustment of the sum to be paid for the use of the bridges, and these companies ought to pay, as the subway company does, for the cost of the connecting links; that is to say, the travel that uses the bridges ought to pay its way, precisely as the travel does that uses the subways.

It may seem strange to some that I have said so much about the Brooklyn Bridge without alluding to the unseemly and dangerous crowding of the trolley cars. I am not indifferent to this crowding; but the fact is that it is an incident of conditions that cannot be removed by temporary treatment. Only such a comprehensive treatment of the subject as I have outlined will do away with the present crowding at the Manhattan end of the Brooklyn Bridge. I think it is true that a moving platform would carry double the number of people of the present bridge railroad; but it would be reverting to the old idea of the bridge as a thing complete in itself instead of as a railroad thoroughfare. Neither do I think it good judgment, if it can be avoided, to abandon, even temporarily, a single fare between the boroughs. I am quite confident that the moving platform should not be resorted to, except in cases of necessity or except in response to a popular demand. The part of wisdom, I am sure, is to go ahead with the plans for permanent relief as soon as possible. If I am asked what, then, is to happen next winter, when the dangerous and unseemly crowding again appears, I can only say that this must be overcome, as far as practicable, by suitable regulation, unless still further study should show that additional trolley loops can be installed without interfering with the bridge railroad platform. If no new loops can be made, the Rapid Transit Company must be called upon to remove some of the many lines that now use the bridge, so as to reduce the overcrowding. Thus far no practicable plan has been brought to my attention.

The key of this situation, so far as it is an unsolved problem, is the New York Central & Hudson River Railroad. It is a fortunate thing that no legislation affecting the Grand Central Station was had last winter, for legislation hurriedly prepared and passed under pressure of a feeling of panic can seldom be sufficiently matured to deal wisely with such a problem. When the Legislature was in session the New York Central Company was under the impression that it could not undertake to change the motive power of its through traffic from steam to electricity for many years to come. It advocated then plans for a change of power for its suburban traffic which called for a loop under Madison Avenue and various other streets.

Since the adjournment of the Legislature I have kept in close touch with this question, and I am now authorized by the president of the New York Central Railroad to say that his road is ready to enter into a stipulation with the city, if the city will approve the changes which they now wish to make at the Grand Central Station, to substitute electricity for steam, not only for their suburban, but also for their through traffic, and that they will sign a contract for the erection of power houses adequate for both of these purposes immediately after the approval by the city of their terminal plans. Nor is this all that has been gained by a more careful study of the problem.

In response to my suggestion that there ought to be some point or points in the Borough of the Bronx at which passengers could change from their suburban and through trains to the subway and to the various elevated roads running south, the company has given me its assurance that the city can command its most earnest and energetic co-operation in developing such a center, or centers, as may be deemed best, north of the Harlem River. This attitude on the part of the company seems to make it probable, though, perhaps, not entirely certain, that it will not be necessary to carry any loop under Madison Avenue; thus relieving the former of one of its most serious objections.

In other words, all that the railroad company asks of the city now is to be permitted to throw the western roadway of Park Avenue, below Fifty-Sixth Street, into the approach to its yard; and to close certain portions of the cross streets that will be wholly enclosed within its yard as the company proposes to enlarge it. The railroad company has bought substantially all of the property affected by these changes and proposes to give to the city a new roadway for Park Avenue, adjacent to its present one and of equal width, and to pay the city for all the streets that may be closed in connection with its yard. This matter will be brought before the proper boards for action in September.

The city has ample power, under the charter, to do a large part of what is asked. If more power is necessary to complete the work, that can be had next winter by enlarging the powers of the city, instead of the railroad. This will avoid the difficulty of passing a general law to deal with a very special situation. The railroad company must, of course, get legislative authority to change its motive power from steam to electricity, but there is no doubt that this authority can be had for the asking. A law should also be passed, which was overlooked last winter, compelling the New York, New Haven & Hartford Railroad to make the same change, so far as it continues to use the Grand Central Depot.

In this connection I have stipulated that an arrangement shall be made at the same time which shall provide definitely for the removal of every grade crossing now maintained by the New York Central Company within the limits of the city.

The matter of the Grand Central Depot being disposed of, every effort should be made to develop, north of the Harlem, one or more union stations to serve the needs of the traveling public. It is one of the greatest merits of Mr. Parsons' plan for carrying the railroad of the Brooklyn Bridge underground that it makes, near the City Hall, a union depot for bridge trains, for the subway and for the elevated roads of the East Side. If a similar common center were developed north of the Harlem I think it will be apparent how greatly the convenience of the traveling public would be subserved, only in the north I should hope that the conditions will make it possible to bring to one or another of these points not only the elevated roads of the East Side, but those of the West Side as well. It is not easy to accomplish this at the City Hall, where the conditions are so much more rigid, but north of the Harlem it ought to be entirely possible. I am confident that if the various railroad companies concerned will co-operate with the city this result can be brought about in the near future.

The East Side subway, already being planned for, should, of course, be carried to completion as early as possible; and neither should the Jerome Avenue extension, already approved by the Rapid Transit Commission, be forgotten.

It does not seem necessary to discuss at length the desirability of carrying the existing subway on Broadway from Forty-Second Street down to the Battery. That is a development that must come in the not distant future. I only wish to express one thought, at the present time, in connection with it; and that is that pipe galleries shall be provided for on such an ample scale that the surface of Broadway, after this work is completed, will never have to be disturbed again, in any future that can be foreseen to-day. This seems to me to be almost an essential condition for permitting this work to be done.

The improvements already made by the Dock Department and those that are about to be begun provide not only for a large number of modern piers, but also for an exterior street 250 ft. in width. This street is already completed, with unimportant breaks, from Cortland Street to Gansevoort Market, and it will soon be completed as far as Thirty-Eighth Street. This street is wide enough to permit of the erection, without disadvantage to anybody, of an elevated railroad having a spur, if desired, running down every pier. Such an elevated railroad might easily be carried from the lower part of the island up to a point where it reaches the right of way of the New York Central & Hudson River Railroad, at Thirtieth Street.

If the Pennsylvania tunnel franchise should be granted it would not be difficult to make a connection between the Pennsylvania system and this exterior road. The result would be a railroad directly connecting every pier upon the West Side of Manhattan Island with the New York Central and the Pennsylvania Railroad systems.

Settlement of Chicago Labor Troubles

When employees of the Chicago City Railway Company recently perfected their organization they submitted certain demands to the officers of the company, which the officials refused to grant. The local division of the Amalgamated Association of Street Railway Employees discussed the matter until an agreement was entered into whereby the points of difference were to be held in abeyance pending a consideration of the questions involved by three arbitrators. The motormen and conductors on the trolley lines demanded 28 cents an hour, in lieu of 21 cents, and pointed to the fact that the cable operators on the Cottage Grove Avenue line were receiving 30 cents an hour, and those on the State Street system 28 cents. A compromise was reached whereby the rate of wages was raised to 24 cents per hour, beginning 60 days from the period of instruction.

Meeting of the International Tramway Union

The International Tramway Union, the official title of which is the Union Internationale Permanente de Tramways, held its eleventh meeting at London June 30 to July 4. This association was organized some seventeen years ago, and since that time has held a series of eleven congresses in various European capitals, viz.: Berlin, 1886; Vienna, 1887; Brussels, 1888; Milan, 1889; Amsterdam, 1890; Hamburg, 1891; Buda-Pesth, 1893; Cologne, 1894; Stockholm, 1896; Geneva, 1898; and Paris, 1900. The recent meetings have been held every two years, instead of every year, as with the American Street Railway Association. The Union numbers among its members representatives from tramway companies and others interested in electric traction from practically every European country, but up to within recently its greatest membership has been from the Continental countries in Western Europe, viz.: France, Germany, Belgium, Holland, Switzerland, Austria and Italy. The congress held in London last month was the first ever conducted on English soil, and was upon the invitation of the Tramways & Light Railways Association of Great Britain. There was a large and representative attendance, the number of delegates from countries outside of England being more than 140. The meetings were very successful, both from the standpoint of attendance and results secured, and through the hospitality of the hosts, the Tramways & Light Railways Association, the social features of the convention were very enjoyable. The meetings were held at Berner's Hall, in Agricultural Hall, Islington, and in connection with them was a very large exhibit of electric railway apparatus of all kinds in which most of the prominent English manufacturing firms and many American companies participated. Several other tramway meetings were held in the same building during the continuation of the exhibit, such as that of the Association of Municipal Tramway Managers of Great Britain, and that of the Incorporated Municipal Electrical Association, composed of many municipal electrical engineers and superintendents resident in Great Britain, so that the sessions were well representative of all the tramway interests of Europe.

The congress of the International Tramways Union was, of course, the one in which the principal interest centered. The arrangements which had been made for entertaining the congress were most complete and reflected the highest credit upon Mr. R. H. Scotter, chairman of the Entertainment Committee; Mr. Ernest Benedict, the secretary of the Tramways & Light Railways Association; the Entertainment Committee as a whole, and all who contributed to the comfort and entertainment of the delegates during their stay in London. The coronation festivities which were to have occurred the week before the meeting of the association, and other incidents, including the unfortunate illness of the King, which could not have been foreseen when the date of the meeting was selected, threatened at one time to interfere with the success of the meeting, and added greatly to the labor of the hosts of the Union. The fact, however, that all the arrangements, as planned, were carried out most successfully is a most striking testimonial to the energy and ability of the gentlemen composing the local committee. Even the complications introduced by the use of three different languages by the speakers were successfully overcome. Hitherto, in the meetings of the Union, while the official language has been French, the proceedings have been conducted in both French and German. This year English was also introduced, and all of the papers presented to the congress were translated and printed in English, ready for distribution to the delegates before the opening of the convention. This fact, together with the careful translation into English of an abstract of the speeches made in German and French by the different delegates, added greatly to the ease with which the American and English members were able to follow the discussions.

In the issue of Aug. 2 an account was published of the meetings of the two English Associations. The space available this week will not permit the publication of an abstract of the entire proceedings of the International Union. A portion, therefore, is given this week, and the rest will be published in an early issue.

MONDAY, JUNE 30

The official opening of the congress and of the exhibition occurred at 12 o'clock on June 30, when the delegates to the meeting of the International Union were cordially welcomed to London by the Right Hon. Gerald Balfour, M. P., president of the Board of Trade. The chairman of the meeting was Sir Charles Rivers Wilson, president of the British Electric Traction Company, who, after a few words of welcome, introduced Mr. Balfour. Replies to the speech of the latter were made by Mr. Janssen, president of the International Union, and Mr. Scotter, chairman of the congress committee of the International Tramways & Light Railways Association, after which the delegates adjourned to a sumptuous lunch provided by the members of the tramways committee. After lunch the delegates entered brakes and visited the principal objects of interest in the city of London, including the Guildhall, Tower Bridge and Mansion House. In the evening a reception was tendered the Union at the Institution of Mechanical Engineers at Storey's Gate, St. James' Park. The guests were received by Sir C. Rivers and Lady Wilson, President Janssen and Mr. and Mrs. Scotter and were entertained by music from the Viennese band, and by a biograph exhibition. Among the views thrown on the screen during this part of the entertainment were several representing the opening of the road of the London United Tramways Company.

TUESDAY, JULY 1

The sessions at Berner's Hall were opened at 9.30 a. m. by President Janssen.

The president said that at the opening of the meeting of the congress in London he wished to thank the various governments who had been kind enough to honor them by sending representatives, and he cordially welcomed the various representatives who had accepted the invitation to be present. They were particularly honored to see among them so many men distinguished in the industry in which they were interested. Their presence was greatly appreciated, and he trusted that as the result of the deliberations of the congress, those who had gathered together would carry away a great mass of useful information and data. Proceeding, Mr. Janssen deplored the death of several of their prominent members who had passed away since they met in Paris, and he also referred to the honors which had been conferred on several of their members. Mr. Nonnenberg had given up the position of secretary-general of the union, which he had filled to the great appreciation of the committee, and Mr. Janssen paid a very high tribute to the talent and devotion the late secretary had shown in carrying out the duties of the office. Alluding to the organization and working of the union, he said their aim was to make the union of the greatest possible service to the members in many ways. There were branches in each country, and they were making arrangements for the collection of accurate and complete information from the various branches, which would be of the utmost use to those who were engaged in the tramway industry. He thought they were all agreed that this was a most desirable step to take, for there was no doubt that tramway work was developing at a great pace. Each one of them had something to learn from his neighbor, and they were fortunate enough to be engaged in an industry in which they could all furnish one another with useful information. In many industries and trades there were secrets which could not be divulged, but, fortunately, that was not the case with the tramway industry, and, as he had said, every one could probably be of assistance to some one else. To this end, therefore, they had established a general secretariat of the International Union, and from his office all members could obtain the information which was collated, technical or otherwise, which might be of use to them in the working of tramways and light railways. (Applause.) All such information would be gladly placed at the disposal of any member, but he would ask them to bear in mind that any service of this kind should be reciprocated, and they should all be ready on their part to furnish any information to the office which was required. It was also most important that all the data should be collated on a uniform basis, so that useful and accurate comparisons could be made. What this basis should be they would have to settle. Another important function of the international secretary would be to collect information as to the legislation in different countries affecting them, and that would be most valuable to the members. They would also collect together various legal decisions affecting the industry. In conclusion, Mr. Janssen made a strong appeal to those present to co-operate in giving all the assistance possible to the office, so that the undertaking might be made a great success.

Sir Charles Rivers Wilson, G. C. M. G., C. B., then took the chair. He said that it was with a good deal of shame that he had to acknowledge that although this was the twelfth congress it was the first held in this country. He felt that it was not the fault of the union, neither was it the fault of the British tramway industry. In his opinion the fault lay elsewhere. He felt that the British prided themselves on this being a land of liberty, but he thought that liberty might be abused, and in his opinion liberty in this direction had been abused, and had been used to oppose the advance of the industries in which those present were particularly interested in. To the foreign members present he wished to say how delighted he was to see them, and thought that the effect of the congress would be decidedly helpful with the government. The effect produced on Mr. Balfour, who honored them by opening the exhibition, would, he thought, be very helpful in helping on the interests which they all had at heart. In conclusion, he said he trusted that the kindly and friendly intercourse which had been going on between members of the congress since their arrival would continue, and that firm friendships of different nationalities would be one of the outcomes of the congress. (Cheers.)

Mr. Lavalard, of Paris, then read a paper on "Transfers." An abstract of this paper follows:

TRANSFERS

In Paris, a considerable time before the creation of tramways, transfer tickets were used upon the omnibuses.

This regulation dated from 1834. It was devised by the old Entreprise Générale des Omnibus, under the management of MM. Moreau-Charlonet et Feuillant at the suggestion of a shareholder. At that time the public transportation service in Paris was conducted by thirteen companies, having different names, such as the Entreprise Générale des Omnibus, Constantines, Favorites, Hirondelles, Batignolaises, Gazelles, Béarnaises, etc. The first transfers were established between the lines of the boulevards and those of the Barrière du Trône (which is a continuation of the former, starting from the Bastille), by the Entreprise Générale des Omnibus.

The system, having given good results, was successively applied to the other lines of the same society, and to the lines of the other companies we have named, and, finally, it was adopted not only for the lines belonging to one company, but for those of different companies.

While, in the year 1861, out of 76,000,000 passengers, more than 12,000,000 were passengers with transfer tickets; in 1901, the Compagnie des Omnibus alone distributed 87,664,358 transfer tickets out of 266,935,912 passengers carried. This figure was made up of 85,699,234 tickets for inside places—that is to say, those issued without extra charge—of which only 38,543,200 were utilized, or 45 per cent, and of 1,945,124 outside tickets; that is to say, those for which a supplement of 15 centimes was paid, of which 1,810,490, or 93 per cent were utilized. Uniting the two classes, interior and outside, we have: Of 87,644,358 transfer tickets issued, 40,353,690 utilized, or 46 per cent. There is one remark to be made. It is that the passenger almost always utilized the transfer tickets for which he had paid, as is proved from the preceding figures. We must point out that, with the transfer tickets, passengers can, for 30 centimes, travel enormous distances from north to south and from east to west in Paris. Speaking generally, all the omnibus and tramway companies exchange transfers along their lines, with the lines of a considerable number of other companies. It cannot be denied that at certain hours of the day those traveling on transfer tickets are exposed to long delays while waiting their turn on the most frequented lines, but even on these lines the cars follow each other rapidly, and, in truth, the very lowness of the fare often gives patience to the passenger.

But when Paris extended, the transfer tickets issued without supplementary charge within the line of the fortifications, have remained unchanged, up to this day.

Fraud has often to be feared, certainly it has often been practiced, but by issuing different colored tickets, and, above all, by noting the hour of their issues, its extent has been much diminished.

It is not without interest to see how the American tramway managers have treated this question of transfer tickets.

We find, in the number for October, 1901, of the STREET RAILWAY JOURNAL, published in New York, a very complete article on the subject appears from the pen of Mr. Oren Root, Jr., assistant manager of the Metropolitan Street Railway Company of New York. In it he states that the transfer system, adopted and in use for ten years, has increased the receipts and the profits of the company, more than any other improvement, without excepting the use of electricity as a motive power.

We shall now examine the replies which we have received from eighteen companies on the question of transfers:

Sixteen use the transfer system and admit the result to be more or less favorable.

Two only do not make use of it, the first the Société d'Entreprise de Travaux of Liege, which does not consider it useful; the second the Great Tramway Company of Berlin, which states that its tariff is too low, and that, moreover, its commutation tickets facilitate the transfer of regular patrons.

Of the sixteen companies using the transfer system, some consider it a necessary evil, while the others, on the contrary, recognize the fact that it has augmented the receipts, and is useful to the companies on that account, while it is very advantageous to the public.

Many companies allow two changes of cars, but many claim that this facilitates fraud, and permit only one change; with the exception of the tramway companies of Aix-la-Chapelle, of Strassburg, and of Barmen-Elberfeld which make one extra charge for several changes.

Thirteen companies issue transfer tickets without extra charge, and, in general, use the same tickets, so as to diminish the working expenses.

Two companies only, those of Hanover and Brussels, make a supplementary charge on issuing a different ticket which serves for the second car.

The charge of 15 pfennigs, instead of 10, the price of an ordinary ticket, in Hanover, is intended to check the over-loading which occurred in certain parts of the town, where the lines intersect, and to encourage the journeys by transfer over relatively long distances.

The object in Brussels is to allow passengers to take two short journeys over different sections for each of which the passenger would not pay anew the maximum fare, but for which he is willing to pay a slightly increased single fare. The same reasons are given by the Electric Tramways of Barmen-Elberfeld. This company has attached to its reply an extract from the report of M. de Pirch to the general meeting of the directors of German tramways and light railways, in 1899. At that meeting, forty-six companies which had established the transfer system acknowledged that the system is useful.

The sample tickets which were sent to us by the tramway companies, which have replied to the questions sent out, and those we have ourselves collected on our numerous voyages, are almost identical; that is to say, they indicate: First, the point of departure; second, the place where the passenger must exchange from one line to another; third, the date of the month, or the day of the week; and, finally, the hour of departure, which serves to regulate the duration of the validity of the transfer ticket.

In many companies the colors of the tickets vary, giving certain indications. With some exceptions, transfer tickets are only issued within certain boundaries in all the towns, and an additional charge is made for the suburban districts.

Summing up all the documents we have consulted, we find:

1st. The transfer system is to be recommended and has, in general, increased the traffic, and, almost always, the receipts, for it attracts passengers, above all when it is gratuitous.

2d. It is most advantageous for the passenger, since it enables him to make two fairly long trips; and it is this which justifies the imposition of a small extra charge.

It permits him also to travel over two small sections of lines which intersect.

3d. Free transfers need hardly be given, except on very short lines; they facilitate checking, as with it the same ticket can be used for the two cars. And, as we have already said, passengers should not object to a slight additional charge, for a long journey, on two lines which cross.

4th. Transfers should only be allowed onto a line not parallel with the original line. The issue of transfers for several changes is productive of fraud.

5th. As far as possible the transfers should only be allowed at junctions, or crossings.

6th. The marking of day, date and hour, is an excellent practice, above all, on the first ticket issued. Change in the color of the paper is also very important, above all when it indicates the direction of the journey.

7th. It is indispensable to limit the transfers, above all, the free transfers, to the interior of towns or to localities, very close to them unless under special conditions affecting several companies. For suburban districts there should always be an extra charge.

8th. If possible, suppress the transfer service on days of crowded traffic, such as Sundays and holidays.

9th. The transfer system increases the staff and the material to a certain degree. As far as regards the staff, its increase is not great when the transfers are gratuitous and on the first ticket issued. The checking of tickets at junctions and crossings necessitates a new staff, which we think could be dispensed with when the payment of an additional fare is made for an additional ticket giving access to the second car. In the first transfer systems the checking was effected at the offices of the crossing places. This is no longer done.

As regards the rolling stock, the transfer system increases in traffic, and this may be undesirable on a line with horse traction, owing to excessive over-loading. But with mechanical traction, which allows of trailer cars, every one admits that the transfer system is an advantage for the public which always finds room, and for the company, which, without extra expense, can increase both its traffic and its receipts.

10th. As regards transfers between neighboring and different companies I must refer you to the deliberations which took place at the meeting of this association in 1887, and with reference to the division of the receipts.

Mr. Grialou, of Lyons, in discussing the paper, said he agreed with the conclusions given by the author. Transfer tickets were usually imposed upon companies by law, and therefore it was no question as to whether a charge should be made for them or not, as they were generally made obligatory. The question was—How were they to be issued, and what was the best method of insuring a correct use of them. The system was open to two abuses—first, on the part of the public, and, secondly, by the employees of the company. A passenger would get into a car, ask for a transfer ticket, and then get out and do a little shopping on the way, instead of going directly to the car, as they should. By this means this ticket was converted into a "stop over", instead of a transfer ticket. The employees of the company were also tempted by the existence, of these transfer tickets to use them fraudulently, and he cited cases in Lyons where considerable trouble had arisen with them. He had found it an excellent precaution in Lyons to put a mechanical register on the car and every time a passenger got into a car he was registered. The company had found that this system had been very successful in stopping the abuse of transfers by conductors. The introduction of the mechanical register had increased the company's receipts between 5 per cent and 6 per cent. He particularly desired that the question should be again discussed at the next meeting.

Mr. Gustave Koehler, of Berlin, and Mr. Lavalard also discussed the question, after which Mr. Röhl, of Hamburg, said he would like to propose that a commission should be formed to consider this extremely important matter. Every country and every town was different, and a congress should not come to a hasty conclusion. Therefore, he proposed that a commission should be formed to report to the next congress.

The proposition was carried.

The next paper presented was on "A Proposed Basis for Estimating the Power of Motors," and was read by Dr. G. Rasch, professor of the Polytechnical School of Aix-la-Chapelle. Dr. Rasch's paper is published in abstract below:

MR. JOHANNES RÖHL
of Hamburg

MR. LÉON JANSSEN
of Brussels
(President)

MR. H. GÉRON
of Cologne

MR. E. A. ZIFFER
of Vienna

MR. E. J. LAVALARD
of Paris

MR. JULES KESSELS
of Brussels

MR. F. NONNENBERG
of Brussels
(Treasurer)

MR. GEORGES BROCA
of Paris

MR. P. T'SERSTEVENS
of Brussels
(Secretary)

OFFICERS AND EXECUTIVE COMMITTEE OF THE INTERNATIONAL TRAMWAY UNION

THE RATING OF MOTORS AND GENERATORS

The regulations of the German Institute of Electrical Engineers define as the normal power of a traction motor that which in the test room can be obtained for one hour without causing the temperature to rise above the admissible limits. During these tests the covers, lids, etc., usually closed in service must not be removed, opened or modified in any essential manner, nor is it permissible to replace artificially the current of air created by the displacement of the car. The writer is of the opinion, however, that even under these conditions a trial of one hour is insufficient, as a traction motor, even though loaded on an average below the normal, is in use for fourteen or sixteen hours a day. The length of the trial should take into consideration the special conditions of the car service for which the motor is destined. It is in this connection that M. Maximilian Müller has examined the question in the Electrotechnische Zeitschrift. This article develops very interesting considerations on the subject of the duration of trials which are to be advised for traction motors. We have attempted to condense the results of this study into the following formula:

$$x = \frac{t\ T1}{t + 28\ (T - T1)}$$

in which x stands for the required duration of the trial, T the time during which the car is out of the depot, and $T1$ the time during which the motor is working; T—$T1$ stands, consequently, for the time during which the motor is not subjected to the electric current, t stands for the heating of the motor, that is to say, the excess of its temperature over that of the atmosphere. The foregoing formula contemplates a cooling of 28 degs. C an hour, during its period of rest.

We shall apply this formula to an example; the motor works during 7.3 hours. With a permissible temperature increase to 70 degs. C we obtain:

$$x = \frac{70 \times 7.3}{70 + 28\ (14 - 7.3)} = 2$$

or a duration of two hours, during which it would be desirable to run the motor under full load.

But while retaining a trial of the duration of an hour, the German regulations preserve the advantage of defining precisely what is meant by the normal rating of a motor, without which no clear signification could be given to the word overload. Concerning overload trials the German regulations prescribe that the admissible limits of temperature cannot, equally, be exceeded; it follows then that overloads can only be carried during relatively short periods. Without taking traction motors into special consideration, the German regulations prescribe in a general way an overload of 25 per cent during half an hour for generators, motors, rotary converters and transformers.

Concerning the permissible rise in temperature the German regulations say:

As a general rule, and as the temperature of the atmosphere does not exceed 35 degs. C., the admissible limits for the rise in temperature will be as follows:

For cotton insulations, 50 degs. C.

For paper insulations, 60 degs. C.

For insulations in mica, amiante or other similar preparations, 80 degs. C.

For stationary coils—as for example the magnet coils—the admissible limits of temperature may be allowed an increase of 10 degs. C.

The regulations add that for traction motors the foregoing limits may be 20 degs. C higher if the trial is made in a test room. This greater latitude in favour of traction motors has without doubt been made to allow for the better ventilation in ordinary working on a car than in the test room.

It seems at first irrational to allow of a greater limit of heating for stationary windings than for rotary windings, the more so as the ventilation of the latter is superior to that of the former. This raising of the limit is nevertheless only apparent for, according to the German regulations, the rise of temperature for stationary windings is to be determined by the increase of the electrical resistance, while for the movable parts of the machine, it is to be obtained directly by the thermometer.

It is a singular thing that in none of the communications which have been received in reply to the question is mention made of that difference in the methods of trial which we have indicated; we may then consider that the different companies agree on this point with the German regulations.

A body submitted to the action of a current, as, for example, an induction coil, is not heated in a uniform manner, and, consequently, does not possess a uniform temperature; the temperature on the outside is less than in the interior. The lowest of these temperatures, that on the outside, can be determined by the thermometer. On the other hand, an average temperature can be obtained by calculation from the increase in electrical resistance. These two methods of measuring are liable to give results differing as much as 60 degs. C.

The limit of heating of 60 degs. which would be applicable according to what has been said, to fixed windings with cotton insulation, for example, has probably been determined according to the investigations made by M. Dettmar and published in the Elektrotechnische Zeitschrift for the year 1900, pp. 727 et seq. This author arrived at the following results for conductors covered with cotton: A temperature of 95 degs. C may be considered as perfectly admissible for stationary windings; on the contrary, for the rotating coils this temperature of 95 degs. C should be regarded as an extreme one, and is not to be allowed in a well-adjusted machine. Besides, as an atmospheric temperature of 35 degs. C. is in no way extraordinary, it results in the case of a cotton insulation that a limit of 60 degs. C. overheating is permissible.

Among the replies which were made to the question of 1900, the opinion is found that motors should be able to support with safety temperatures of from 75 degs. to 80 degs. C.; it would seem unreasonable from this to fix the temperature limit, that is, the excess of the temperature of the motor over the temperature of the atmosphere, to 50 degs. or 55 degs. C.

In addition to the power of the motor, the purchaser has equal interest in being informed as to its torque and speed. We are of the opinion that it would be convenient to characterize a motor by the two following factors:

M = torque in kilogrammes, and N = turns per minute of the axle of the motor.

These two factors are related in the following manner to the power, w, of the motor given in watts:

$$w = \frac{2\ \pi\ 9.81}{60}\ M\ N = 1.028\ M.\ N.$$

or, assuming an efficiency of 95 per cent, W, the input of the motor, could be indicated as follows:

$$W = \frac{w}{0.95} = 1.08\ M.\ N.$$

This formula is within 5 per cent, which is sufficiently accurate.

If then, a motor was thus designated, say by two numbers, for example, 20/550, it would be understood to be a motor which under a normal load produces a torque of 20 kilogrammeters and attains a speed of 550 r. p. m.

The energy received by the motor would be then, $1.08 \times 20 \times 550 = 11.900$ watts, which at a pressure of 600 volts, will represent a current of 20 amps.

It is further to be remarked that in the preceding formula the torque represents not the useful torque, but rather a torque somewhat higher than that. The torque indicated above would be sufficient, nevertheless, to rate the motor, and if guarantees can be asked from the contractor, nothing prevents these referring to efficiency.

In conclusion I make the following suggestion: The determination of the rating of a motor shall remain as fixed by the rules of the German Institute of Electrical Engineers. These define without ambiguity what should be understood by half load, and by 50 per cent overload. The manufacturer would have to fill in the following table:

	Half Load	Normal Load	Overload of 50 Per Cent.
Power of the current in amp.			
Torque in kilogrammeters.			
Number of revolutions per minute.			
Efficiency			

It hardly appears necessary to us to specify the special basis to adopt for the rating of generators. We strongly recommend for adoption the principles laid down by the German Institute of Electrical Engineers.

Mr. Mackloskie, of Brussels, in discussing this paper, said he thought the union ought to accept the report of Dr. Rasch, who proposed that they should take up the method of rating recommended by the German Institute of Electrical Engineers. In fact, he believed they were the only standard which had been formulated up to the present time, and he thought the union could not do anything better than accept them.

Mr. Pedriali, of Brussels, suggested that as the German society had already adopted a standard method of rating, the meeting should adopt this standard, and that the engineers of the railway companies in the union should use them in their specifications.

Dr. Rasch observed that the German specifications, as they now stand, are not sufficiently detailed for tramway work, and he therefore proposed that the association should take the question up further, and add to the clauses in reference to tramway work.

Mr. Max Von Leber, government representative from Austria, remarked that the conditions were so different in the various systems of electric traction in various towns, and on account of the various laws and regulations, that it seemed impossible, in short, to frame a separate rule by which that standardization might be carried out.

Mr. Scotter said he might point out that at the present time they had in England a standardization committee, sitting under Sir William Preece, who was a member of the reception committee of the congress, and the whole question was coming up sooner or later for discussion. They would be most happy—he only spoke unofficially, but he felt sure they would be most happy—to receive that discussion, and to attempt to help the members of the union, and he hoped the members of the union would help them in England to arrive at something like what one might call a universal standard in these matters.

Mr. F. W. Egger said the Americans had a good deal more experience of tramway work than the Germans, and the German conditions did not come up to the conditions and particulars which the American makers supplied with their machines. He would like to propose that the American methods of testing, and so forth, be adopted in preference to the German, and also that the question of sparking and overload should receive more attention than it had done up to now.

Dr. Rasch said although in the short resume he had given of his paper he did not refer to sparking, yet it was dealt with in the paper. One of the difficulties concerning it was that they could not make accurate measurements of it.

Mr. d'Hoop impressed upon the congress the necessity of something being done very quickly in the matter. Work was going on in different countries, and different specifications were being issued, and the longer it went on the more difficult it would be to unify them in the end. He hoped, therefore, that every effort would be made to press the matter forward.

Mr. Scotter said that, on behalf of his association, if it met with the approval of the congress, he would see that the paper and the discussion thereon should be placed before Sir William Preece's committee at the earliest possible moment.

This course was agreed to.

Mr. Scotter then announced that the members would lunch by invitation of the Mayor of Islington, and would afterward visit the Islington municipal electrical works, as well as the works of the Great Northern and City Railway Station at Old Street. In the evening a conversazione would be given by the President and Mrs. Swinburne for the Council of the Institution of Electrical Engineers at the Natural History Museum.

The congress then adjourned.

The Islington power station, which is used exclusively for lighting purposes, is equipped with eight Lancashire boilers, and ten Babcock & Wilcox water tube boilers. There are ten Adamson compound engines, three of which are of 1000 hp, direct-coupled to 2000-volt Ferranti & Fowler dynamos, and one Scott engine and Crompton dynamo. The output during 1900 was 2,324,057 kw-hours.

The City & Great Northern Railway, which was described fully in a recent issue of the STREET RAILWAY JOURNAL, is designed to run from Moorgate Street, city, to Finsbury Park, a distance of about 3½ miles—the bulk of which is in tunnel. The tunnel will be 16 ft. in diameter. There will be five stations, including the two terminals. The cars will be 49 ft. 6 ins. x 9 ft. 4 ins., and will comply with the Great Northern Railway gage, so that ordinary railway carriage can be used if necessary. Both of these installations were visited by a large number of delegates.

The evening reception, or conversazione tendered to the union at the Natural History Museum by the Institution of Electrical Engineers was very largely attended, and the handsome building looked especially brilliant with its tasteful decorations. The attendants, who included most of the delegates to the international congress, as well as many of the most prominent electrical engineers in England, were received by President and Mrs. Swinburne, and were afterwards entertained by a handsome collation, as well as by music from two orchestras. At 11 o'clock "God Save the King" was played, and all those present heartily joined in singing the words of that well-known hymn. The courtesy of the institute in postponing its conversazione in order to hold it during the week of the congress, so that an invitation to attend could be extended to the members of the union, was heartily appreciated.

WEDNESDAY, JULY 2

The members of the union met at Berner's Hall at 9.30, when the chair was taken by Colonel Boughey, C. S. I., one of His Majesty's Commissioners of Light Railways.

Mr. Ch. Thonet, of Liege, read a paper on "Central Stations." This paper is published in abstract below:

POWER STATIONS

As a rule, the steam engines used are compound-tandem; above 1000 hp they are generally cross-compound, in order to bring the dynamo between both cylinders. In some stations, for very high power units, triple-expansion engines are used, notably in Berlin and Paris. Laval steam turbines are also operated in Paris, Holland and Germany, but we have no information concerning these.

The engines are usually worked condensing; the condensers being of the jet type allowing of a vacuum of 65 to 70 cm.

The speed ranges from 52 to 150 and even 235 r. p. m. with the Mackintosh, Willans, etc., engines. The steam pressure lies between 7.5 and 10 kg per sq. cm.

The daily cost of maintenance per car km for the steam engines, comprising the salaries of the operating staff, ranges from: Fr. 0.004 to fr. 0.008; that is, fr. 0.006 or ½ pfennig on an average.

The steam consumption per horsehour varies greatly. At the guarantee tests, the consumptions range between 5.8 and 8.2 kg per ihp and for compound condensing engines; while in ordinary working conditions it is from 6.5 to 8.8 kg.

When reckoned per effective hp, these figures are: 6.7 and 9.45 kg.

The consumption in coal attained in a guarantee test differs widely from that obtained in ordinary working conditions.

These are some data furnished by the principal companies operating condensing, with tandem-compound steam engines of 300 to 700 hp and when good ordinary coal was burned:

	At the Guarantee Tests				Under Ordinary Working Conditions		
	kgs	kgs	kgs	kgs	kgs	kgs	kgs
Per ihp-hour....	0.770	0.616	—	1.31	0.865	0.745	—
Per ehp-hour....	0.928	—	—	1.46	1.01	—	—
Per kw-hour.....	1.270	1.06	1.300	2.0	1.38	1.94	1.70

We can accept, as a true average for the coal consumption under ordinary working conditions, the data given by the Tramways Bruxellois for their 450 and 750 hp engines; these are:

At the guarantee tests: 1.300 kg per kw-hour.

In ordinary service: 1.700 kg per kw-hour.

The cost in coal per kw-hour ranges from fr. 0.4 to fr. 0.089, and per car km from 3 centimes to 7.5 centimes.

The total consumption in lubricants varies from:

Fr. 0.003 to fr. 0.010 per kw-hour; that is, 3.9 gr. to 7 gr.

Fr. 0.0012 to fr. 0.009 per car km; that is, 2.5 gr. to 5 gr.

The efficiency of the steam engines varies from 80 to 90 per cent, being 85 per cent as a mean.

Several companies call attention to the influence of varying load on the efficiency and consumption of steam engines. Thus, with a load 45 per cent, the normal one, the coal consumption was found to reach 1.850 kg per kw-hour; this consumption was only 1.700 kg, when the load reached 60 per cent. It is, therefore, of advantage, when operating small systems on which the load is apt to vary widely, to adopt regulating storage batteries.

Gas Engines

No other company than the General Contracting Company, of which the writer is manager, having given information on the working of central stations with producer gas, we are obliged to keep to the information which we possess on the working of our plant in Barcelona and Andrès (Spain). Producer gas installations are in operation in Lausanne, Zurich, Orléans, Poitiers, Reims, Cassel (France), Barcelona-Tibidabo, etc.

The gas engines put up at the Barcelona central station are of the Crossley, four-period type. They are operated by producer or mixed gases. There are, at present, two 165 hp and one 300 hp engines. Their speed is 180 r. p. m. The gas is produced in a gasogene with rotating hearth, of the Fichet and Heurtey system.

The steam necessary for the production of mixed gas which has to be injected into the furnace of the producer, is obtained from a small vertical boiler. At present Messrs. Fichet and Heurtey have replaced the steam by a blast of hot air obtained through the use of a fan.

The coal employed is anthracite, possessing 8000 calories, and from 3 per cent to 5 per cent cinders at a maximum. The price is generally about the same as that of ordinary Cardiff, although now it has risen to 10 per cent or 15 per cent above that.

The mixed gas contains: 50 per cent azot, Az; 20 per cent hydrogen, H; 20 per cent carbon-monoxide, CO; 5 per cent to 7 per cent carbon dioxide, CO^2; 2 per cent to 3 per cent hydrocarbons.

The calorific power ranges from 1200 to 1300 calories.

The cooling of the gas on leaving the producer is obtained by means of a series of vertical tubes, through which the gas is sent; the warming of the blast air necessary for the producer furnace is obtained at the same time. In order to be purified, the gas is then sent through a tower filled with coke, on which water is continually showered; it also goes through cases filled with sawdust and oxide of iron; this purifying substance is regenerated monthly by being exposed to the open air.

The maintenance expenses of the gas engines are not higher than those for steam engines, excepting the lubrication, which requires great care and materials of good quality.

On the other hand, fewer men are necessary for the handling of the producers than for that of the boilers and an ordinary helper is sufficient instead of experienced stokers. In Lausanne, Barcelona, etc., the maintenance cost for the gas engines and producers reaches, on an average, fr. 0.0025 to fr. 0.006 per kw-hour; they can be estimated at ½ centime per kw-hour.

The coal consumptions in 1902 have been:

	At the Guarantee Test kgs	Under Ordinary Working Conditions kgs
Per eff. hp	0.600	0.625
Per car km	——	0.900
Per kw-hour	——	1.000

The price of coal in 1900 was 62 pesetas; that is, 47 francs a ton; at present the price is 48 pesetas, or 36 francs. (It is to be noted that the tramway line is, throughout, on a grade and that in 1901 the consumption per car km reached 900 watts.) At present, the average consumption of screened anthracite is 850 gr. per kw-hour, or 750 gr. per car km, the number of watts per car km having been reduced to 750 on an average.

The cylinder oil used costs fr. 0.85 per kg.

The engine oil used costs fr. 0.45 per kg.

The average consumption in 1901 reached:

Per eff. hp	fr. 0.009 or	14 grammes
Per kw-hour	fr. 0.013 or	20 "
Per car km	fr. 0.011 or	17 "

At present, this consumption has been reduced by 25 per cent, because the oil is recovered, and after being filtered, is used for the greasing of the cars.

The water consumption for cooling the engines is very slight; 25 litres per chp-hour on an average, while that for washing and purifying purposes does not exceed 10 litres; the water consumption for steam engines being generally as high as 250 litres per horse. The total cost for the production of one kw-hour with coal worth 62 pesetas aggregated, in Barcelona, fr. 0,10; with coal worth 48 pesetas the cost of one kw-hour is fr. 0.08; with coal worth 30 pesetas the cost of one kw-hour is fr 0.06.

We think it useful to mention the highly interesting contribution on the matter of M. Witz, engineer, professor at the science department in Lille, of which the title is: "Comparison between the Efficiency of Steam and Gas Engines," and which has been published in the L'Eclairage Electrique, of Paris, Nos. 1 and 2, on January4 and 11, 1902. This article points out the superiority of the gas motor, giving data obtained from tests most scientifically and seriously carried out. The conclusions are as follows:

The thermic efficiency of the gas producer is slightly superior to that of the boiler; the efficiency of the gas engine being much higher than that of the steam engine. The coal consumption per ihp hour, even for the smallest plants equipped with gas producers and engines, is far from being as high as that reached by the largest steam plants using steam superheaters.

If it be understood that for thermic machines the duty of which is to do work by the transformation of heat, the most rational basis of comparison and the most reliable, is that which is derived from the comparison of the respective ratios of transformation of the calories into kilogrammeters, we must acknowledge that the steam apparatus is inferior to those operated by gas.

Generators

Most companies use continuous-current, shunt, compound, or over-compounded 550-volt generators. The smaller generators are belt driven, the larger ones being direct driven. A few companies use three-phase, high-pressure currents with transforming sub-stations; in Marseilles, for instance, the current is generated by 1100-kw alternators at a pressure of 5500 volts. The voltage is lowered in the sub-stations to 340 volts three-phase through the aid of stationary transformers; it is then converted into 550-volt, direct current through means of rotary converters. Very little maintenance is required by the generators.

Information relative to the cost of maintenance of the central steam plant, exclusive of buildings, has only been given by some companies. With the Brussels Tramways it is fr. 0.0028; with the Liége Tramways it is 0.014 (on account of multitubular boilers.)

The oil consumption for the generators, per kw-hour, is about gr. 0.15 to gr. 0.10. The mean efficiency varies from 90 per cent to 93 per cent at full load.

Few companies use storage batteries for lighting purposes. Some companies operate booster dynamos to automatically compensate for the loss in pressure on the feeders used for the loading of the storage batteries housed in two stations situated at unequal distances from the main power station (Compagnie Générale des Omnibus de Paris, Usine de Montreuil).

In Barcelona the central gas power station operates a booster dynamo allowing of the storage battery to be loaded and helping it at times. Such is also the case at the Leipzig, Nuremberg, and Compagnie Générale des Omnibus de Paris tramways (Usine de Billancourt).

Cost of Erection of Steam Stations

The first cost of erection of the station varies with the value of land, according to the towns and location chosen or imposed by the municipalities and also with the machines, according to their size and to local conditions.

With regard to steam power stations, we will mention the information given by the Nuremberg Tramways, whose plant comprises eight 79-kw machines and four 335-kw machines; that is, a total of 1972 kw. The first cost has been:

310,000 fr. for land and buildings;
868,000 fr. for boilers, engines and dynamos.

Total 1,178,000 fr., which shows that the cost of erection per kw for land and buildings alone was 157 francs, and that for the boilers, engines, dynamos, etc., 440 francs. The total cost of erection of the power station reached, thus, 597 francs per kw of the whole installation. This is a very favorable figure and one seldom attained.

We can also mention the Liege Tramways; a small station was built outside the town in 1893 for the operation of a tramway line 6 kw in length. The station comprises two machines and dynamos of 48 kw each; that is, 96 kw available power, with a battery of 160 amp.-hours capacity.

The total cost of installation, including land and buildings, reached 84,000 francs; that is, 875 francs per kw available. This figure, which is very low, considering it is for a small and very complete plant, deserves mentioning.

The Hanover Tramways, which operate several power stations, state that the cost of these, exclusive of land and buildings, reached 3,640,522 marks; that is, 845 francs per kw available.

Finally, at the Brussels Tramways, where the power of the central station aggregates 1450 kw, divided between six units, the cost of land and building has reached 275 francs per kw available, and that for the erection of boilers, engines, dynamos, etc., 690 francs; this brings the total cost of erection per kw available to 965 francs.

Although this figure is higher than the former ones, it really represents the mean cost of such installations. When considering a central station of mean power, the cost of erection per kw available must be estimated at 1000 francs.

For larger power stations, the advantage resulting from location outside the towns and that from the installation of greater units, allows, in general, of this cost being reduced to 700 francs per kw available.

Cost of Erection of Gas Power Stations

The information given under the first question by the Liège General Contracting Company, with reference to the Barcelona-San Andrès Tramway power station, states that there are 440 kw available for traction purpose, a very small portion of which being derived for the purpose of lighting the station and the car houses. The cost of erection comprising land, station, car houses, shops, storeroom, buildings, etc., has reached 525 francs per kw. It must be considered that very large property has been purchased to provide for the installation and centralization of the station, depots and line necessities.

The erection of the gas producers, engines, puffer batteries of 450 amp-hours, gasometers, shops, etc., cost 437,000 francs; that is, 1000 francs per kw available. The total expense per kw available reached, in Barcelona, 1525 francs. This plant was erected in 1900, during which year the materials were most expensive. It is quite certain that the prices are now lower by 25 per cent, and that the expense for the installation of producer gas appliances would not exceed 700 or 800 francs per kw available.

We have recently had the occasion to study the installation of a small station for a tramway line 9 km long; we give hereafter the prices referring, respectively, to steam and gas plant.

Erection of two gas engines of 250 hp or 185 kw each; that is, 370 kw, as a whole, with gas producers, purifiers, gasometers, dynamos and water mains; total cost being 225,000 francs or 608 francs per available kw. With steam engines, including the water mains, the cost reached 165,000 frs.; that is, 445 francs per kw available. In this case the installation of the water mains was very expensive, on account of the long distance from the station to the canal.

Water Power Stations

No answers having been received from the companies who work their stations by water power, we can give no exact information on the subject; besides, we have reasons to believe that the prime cost per kw available is not less than 1000 francs, and can even be twice as high as this, according to local difficulties and to the length of the water mains, etc. It should be necessary to get information from those countries where these water power stations are in operation.

Various tramway companies purchase the current from outside companies; but this, generally, at a high price. These are some of the prices paid by kw-hour: Fr. 0.13 at the Christiania Tramways; fr. 0.135 at the Zurich Tramways; fr. 0.17 at the Havre Tramways; fr. 0.20 at the Municipal Liege Tramways.

A gas power station has offered, in this last town, to supply the current at a cost of fr. 0.10 per kw-hour. The water power stations supply the current at a cost varying from fr. 0.05 to fr. 0.08 kw-hour.

Cost of Operation Per Kilowatt-Hour

We have condensed into this table the information given by some companies:

Brussels Tramways.	Francs.
Salaries and wages	0,0114
Coal consumption (22 fr. a ton)	0,0400
Lubricant consumption and lighting	0,0060
Maintenance and repair of boilers, engines and dynamos	0,0028
Maintenance of buildings	0,0013
Taxes, rents, etc	0,9090
Total	0,0705

That is: 7 centimes per kw-hour.

Frederiksberg Tramways.	Pfennigs.
Salaries and wages	5,99
Consumption:	
Coal (at 22,47 marks a ton)	7,06
Maintenance and renewal	0,97
Sundry expenses	1,90
Total	15,92

That is: 19,8 centimes per kw-hour.

Hanover Tramways.	Pfennigs.
Wages	0,789
Consumption:	
Coal at 20,80 and 12,42 marks a ton	3,477
Lubricants	0,181
Sundry materials	0,026
Maintenance	0,098
Miscellaneous	0,158
Total	4,729

That is: 5,8 centimes per kw-hour.

Liege Tramways.	Francs.
Salaries and wages	0,027
Consumption in coal (worth 21 francs a ton)	0,091
Maintenance and repair to buildings	0,002
" " boilers	0,011
" of engines and dynamos	0,003
" of storage battery	0,005
Cost per kw-hour	0,139

N. B. This figure includes half the wages paid to the operating fireman and refers to the year 1901 when the coal was worth 50 per cent more than at present.

The cost of one kw-hour has now been reduced to between 10 and 11 centimes (the engines are non-condensing).

Nuremberg-Furth Tramways.	Francs.
Wages	0,0988
Fuel and Oil Consumption:	
Coal at 25 marks a ton } Lignite at 12 marks a ton }	0,0610
Maintenance and miscellaneous	0,0025
Total cost for one kw	0,0722

In adding to this, the managing expenses = fr. 0,0077, the total cost reaches 8 centimes per kw-hour.

Barcelona-San-Andrès Tramways.	
Producer Gas Power Station:	Francs.
Salaries and wages	0,022
Coal (45.00 francs a ton)	0,046
Lubricants and water	0,007
Maintenance (producers, engines and dynamos)	0,004
" of the storage batteries	0,010
Total	0,089

That is: 8.9 centimes per kw-hour.

N. B. The plant has been provided to deliver an output double its present output; consequently, the engines and storage batteries having only half their load, their efficiency is not so high as at Lausanne, Orléans, etc.

Lausanne Tramways.	
Producer Gas Power Station. Years 1899-1900):	Francs.
Salaries and wages	0,0182
Coal consumption (34.00 francs a ton)	0,0324
Lubricant and water consumption	0,0054
Maintenance (producers, engines and dynamos)	0,0027
" of storage battery	0,0070
Total	0,066

That is: 6,6 centimes per kw-hour.

Orléans Tramways.	
Producer Gas Power Station. (Years 1899-1900):	Francs.
Salaries and wages	0,019
Coal consumption (32.00 francs a ton)	0,030
Lubricant and water consumption	0,005
Maintenance (producers, engines and dynamos)	0,003
" of storage battery	0,005
Total	0,062

That is: 6,2 centimes per kw-hour.

Nancy Tramways. (Years 1899-1900):	Francs.
Salaries and wages	0,024
Coal consumption (18,00 francs a ton)	0,039
Lubricant and water consumption	0,005
Maintenance	0,003
Total	0,071

That is: 7,1 centimes per kw-hour.

Great Leipzig Tramways.	Pfennigs.
Salaries and wages	0,9
Coal consumption (lignite, marks 5,2 a ton)	2,0
Lubricant and water consumption	0,6
Maintenance	0,4
Total	4,0

Total cost 4,0 pfennig, that is 5 centimes.

In addition to this, 1,04 pfennig per kw-hour are provided for sinking fund.

Marseilles Tramways.	
(Formerly Saint-Louis power station.)	Francs.
Salaries and wages	0,013
Coal consumption (half coal worth fr. 29.50 and half lignite worth fr. 17.00 a ton)	0,059
Consumption { water 0,0006 } { lubricant 0,0059 }	0,006
Maintenance	0,002
Total	0,080

That is: 8 centimes per kw-hour.

We have received no information on the operation of the large Marseilles power station; but we can say that the cost of one kw-hour ranges there from 5 to 6 centimes.

Hamburg Tramways (in 1899).	Pfennigs.
Salaries and wages	3,5
Coal consumption (19,22 marks a ton)	8,1
Consumption { lubricant 1,6 } { water 0,8 }	2,4
Total	14,0

The maintenance expenses are included in wages.

That is: 18,05 centimes per kw-hour.

Neuilly Tramways.	Francs.
Salaries and wages	0,0261
Coal consumption	0,0312
Consumption { lubricant 0,063 } { water 0,014 }	0,0077
Maintenance	0,0040
Total	0,0690

That is: 6,9 centimes per kw-hour.

Verviers Tramways.	Francs.
Salaries and wages	0,026
Coal consumption (17,35 francs a ton)	0,035
Lubricant and water consumption	0,005
Maintenance	0,003
Total	0,069

That is: 6,9 centimes per kw-hour.

With reference to the information derived from the different tramway companies, we come to the conclusion that the cost of one kw-hour, including wages of all kinds, coal lubricant and water consumption, maintenance and repairs to boilers, engines and dynamos and also the maintenance of the storage battery necessary with producer gas plants, ranges between the following limits:

For important power stations, operating 1000-hp engines and above, the price of coal lying between 15 and 20 francs a ton, the cost will range between 4 and 6 centimes per kw-hour.

For medium size power stations, operating engines from 300 to 600-hp capacity, the price of coal lying between 15 and 20 francs a ton, the cost will range between 6 and 8 centimes per kw-hour.

For small power stations operating engines from 100 to 200-hp capacity, the price of coal lying between 15 and 20 francs a ton, the cost will range between 8 and 10 centimes per kw-hour.

For producer gas power stations, operating engines from 150 to 200-hp capacity, the price of coal lying between 30 and 40 francs a ton, the cost will range between 5 and 7 centimes per kw-hour.

If the price of the coal be reduced to 15 or 20 francs a ton, the cost will range between 4 and 6 centimes per kw-hour.

The chairman said it only remained for them to thank Mr. Thonet very sincerely for his very able and careful paper, and for the new and interesting facts he had brought out. It was a paper full of details and statistics which hardly lent itself for discussion, and he thought, therefore, it only remained for him, in the name of the members, to thank Mr. Thonet for the paper. (Applause.)

The chairman then said the second subject to be dealt with that morning was the conditions under which tramways may be laid on roads, by Mr. Albert Janssen, the general secretary and director of the Brussels Tramways. The conditions with which Mr. Janssen dealt were especially with regard to the payments made for tramway concessions. Mr. Janssen, in his paper, proposed that the union should adopt resolutions expressing its sentiment that all franchise payments should be a percentage of the net profits of the tramway enterprise, or else should be based upon the excess between the gross receipts and a certain set sum made up from the car kilometers run and a price agreed upon between the authorities and the company as a fair allowance for the expenses per car-kilometer. In this way the city and company would be in a sense partners in any profits which might be made by the enterprise.

Mr. Röhl, of Hamburg, proposed that the congress adopt the conclusions as they stood in Mr. Janssen's paper, except the last one, which he proposed should be cut out. If they agreed to that conclusion it would enable the authorities to force the companies to increase the number of car miles without any advantage to the company. It might happen that the company would not be able to work the increased car miles economically, and therefore it would not be fair that it should be forced by the authorities in the matter. He thought that participation should be based upon the net profits only.

Mr. Lavalard remarked that he agreed with the objections which Mr. Rohl had brought against the last conclusion of Mr. Janssen, and he hoped it would be omitted from the resolutions.

The discussion was continued by Mr. Koehler and Mr. Grialou, who pointed out that the conditions suggested in the paper by Mr. Albert Janssen would suit neither France nor Prussia. In those countries the companies had to keep a certain portion of the road in repair and make certain other returns, and they considered these preferable to a system of percentage on the net profits. The question as to the net profits was a very difficult one to determine, and it gave the authorities an opportunity of inspecting and reviewing the books of the company, a proceeding which was objectionable.

Mr. Leon Janssen remarked that the arrangement between the company and the municipality was really a partnership, and it must therefore be a question of give-and-take on both sides. The municipality supplied the streets, and the company supplied the capital, and it was not right that the municipality should receive anything except the net profits—that was after payment of all working expenses and a fair rate of interest on the shares.

Mr. Albert Janssen said the reserve should also be taken into account, and if after that had been provided for, there remained 1, 2, or 3 per cent over, it should be equitably divided between the municipality and the company.

Eventually the congress adopted the conclusions in the paper with the exception of the last paragraph.

The chairman said he was sure they all wished to thank Mr. Albert Janssen for his paper. (Hear, hear.) It had been a very interesting paper, and, as it seemed by the discussion, on a very thorny subject. He would now ask Mr. Scotter, who was well known to them all, to read his paper.

Mr. Scotter then read a paper in which he briefly reviewed the history of the light railway movement in Great Britain. He stated the length of time required to obtain a franchise in that country and several other countries, and in conclusion recommended united action in developing light railways, between the government, local authorities and private capital. He instanced the National Light Railway system of Belgium as a successful example of this method. In conclusion he urged the compilation of statistics on municipal trading, advantages of uniformity of gage, length of time of concession, and certain other subjects, which data can be used in enlightening the authorities on these important subjects, and in obtaining intelligent legislation.

Mr. Addyman, of Leeds, described some of the difficulties encountered in England in obtaining concessions for tramways and light railways, and urged the importance of the subject in Great Britain.

Mr. Schendweiler said, that, while appreciating fully the enormous trouble that Mr. Scotter must have taken in collecting the information which he had placed before them, he would point out that in referring to Prussia he had unwittingly made a little slip as to the years for which concessions were granted. As a matter of fact, concessions existed in which there was no time limit, and the government had power to force a municipality to allow a tramway to pass through a town.

Mr. L. Janssen thanked Mr. Scotter for his paper, and said that the council of the union would deal with the matter and appoint a committee of gentlemen representing the various countries to collect information.

Mr. A. Trautweiler, chief engineer of the Strassburg Company, then read a paper on "The Arrangement of Car Houses." This recommended the concentration of cars in car houses of not smaller than 100 to 150 cars capacity.

The chairman, in the name of the congress, thanked Mr. Trautweiler for his valuable paper.

The chairman said he was sure that he might thank Mr. Ziffer in the name of all present for the extremely valuable paper with which he had favored them. It was a most interesting contribution, and would form the subject of very careful consideration at home, though it was hardly one that lent itself to discussion at the moment. In conclusion, he thanked the foreign delegates for their presence, and said they were deeply indebted to the various governments for allowing their representatives to come and take part in the work of that congress.

On the motion of Mr. L. Janssen, a hearty vote of thanks was accorded the chairman for presiding, and the congress adjourned until Thursday morning at 9.30.

(To be Continued.)

New York Central's Plans

Supplementing Mayor Low's weekly talk on the transportation problem, the New York Central management has given out some additional information regarding the company's plans for the change of motive power and enlargement of its terminal facilities. It is proposed, within two years, to have in operation a great electric traction system at an expense of $10,500,000 for its installation, and an additional cost of $4,000,000 for changes to be made in the yards from Forty-Ninth Street to Fifty-Sixth Street along Park Avenue; the abolishment of steam as a motive power on its lines within a distance of thirty miles from New York, and the probable erection of a great three-deck passenger station above the Harlem River for the sole use of suburban traffic. W. C. Brown, third vice-president of the railroad company, said that the company is proceeding on the basis that the necessary legislation may be had and that the work will be pushed rapidly forward to completion.

"Then the smoke and steam in the Park Avenue Tunnel will be a thing of the past," said Mr. Brown, "and whether the new proposed 'clearing house' station to be built in the Bronx or the loop under the Grand Central Station be constructed, trains will move with greater frequency and without delay.

"Through trains will be hauled by electric locomotives to Croton Landing on the main line and White Plains on the Harlem Railroad, and with a delay of not more than a minute the change will be made to steam locomotives. Practically, no time will be lost. On suburban trains the motors will be attached directly to the cars.

"Power stations will be built and machinery installed to generate 100,000 hp, which will be necessary to maintain the train service. Two or more such plants will be located at favorable points along the lines of the railroads. The 'third-rail' will be used to convey the electrical energy, and only in a few instances in the yards will it be necessary to install an overhead system.

"Steam will be abolished everywhere, and about the yards even switching will be done with electrical power. The tunnel will be lighted by electricity and all stations within the radius of the electric traction.

Mr. Brown would not state where the great Union Station in the Bronx was to be located.

"In regard to the abolition of the grade crossings in New York," he said, "the company is willing to act in conjunction with the city. These crossings are eleven in number. Several hundred thousand dollars would be required to remove them, but they are dangerous as they exist."

William J. Wilgus, chief engineer of the New York Central Railroad, said that the time used in the change of power by the road would be largely consumed by the erection of the power plants.

"We have made extensive experiments," said Chief Engineer Wilgus, "and will adopt no type of electrical locomotive now in use, but will build from new plans, combining the latest improvements known.

"They will be of sufficient size and power to move the heaviest trains now in operation. Although it has not yet been decided, it is probable that the motor cars for suburban trains will be of our present type of passenger car and of equal size."

The Storm Block Signal System

The Storm block signal system is now being introduced on a number of electric roads, and, since it solves some of the perplexing questions in connection with block signals for electric roads in a very simple manner, a description of the equipment recently placed on a section of single track for the Grand Rapids Railway Company may be of value.

The system is such that the passage of any number of cars into a block at once is so recorded, the signals displayed at the entrance to a block cannot show clear until all the cars that have passed into a block have passed out of it. The circuits of the system are shown in the diagram, Fig. 1. The operation of the signal is as follows. Suppose a train enters a block from the turnout at the right of the diagram. As it enters its trolley wheel makes a momentary contact between the trolley wire and a contact clip alongside the wire. Mounted on the trolley wire at this point and supporting the contact clip is a box containing the signal setting and clearing apparatus, *A*, at the other end of the block is exactly similar apparatus, *B*. This box on the trolley wire is shown in Fig. 3, which was taken from the installation in the Grand Rapids Railway. The trolley wheel of a car passing into a block at *A* establishes a circuit which energizes the coil marked set magnet. This set magnet (in a manner which will be explained later) establishes a circuit from the trolley wire through the contact drum in the instrument at *A* into incandescent lamp No. 1 of the signal box, *C*, then to the group of four incandescent lamps, numbered 7, in signal box, *D*, at the opposite end of the block, and thence to the ground. Any car approaching the entrance at the block at *B* would, therefore, see a group of four lamps lighted in the signal box, *D*, while any car following the one which had entered at *A* would see one lamp in the top part of the signal box, *C*. Supposing now the car has proceeded through the single-track block, coming again to the double track or passing switch at the left of the diagram. Its trolley wheel passes under a contact clip on the right-hand track which momentarily establishes a contact through the clearing magnet in the instrument at *B* and also in the instrument at *A*, both these magnets being parallel between the contact clips at the ends of the block and ground. This has the effect of rotating the contact drum at *A* so as to open the signal circuit previously established through lamps 1 and 7 at the two signal boxes. In series with each regular signal lamp or group of lamps is a relay which will throw in another lamp or lamps, in case any lamp in the circuit burns out. For example, suppose lamp 1 should burn out, the current would then fail to pass through the relay magnet just below it in the diagram, and the armature not being attached would make contact so that current would flow through lamp 2 instead of lamp 1. The signal circuits now having been explained, it remains only to take up the details of the contact drum and the signal setting and clearing magnets in the instruments *A* and *B*.

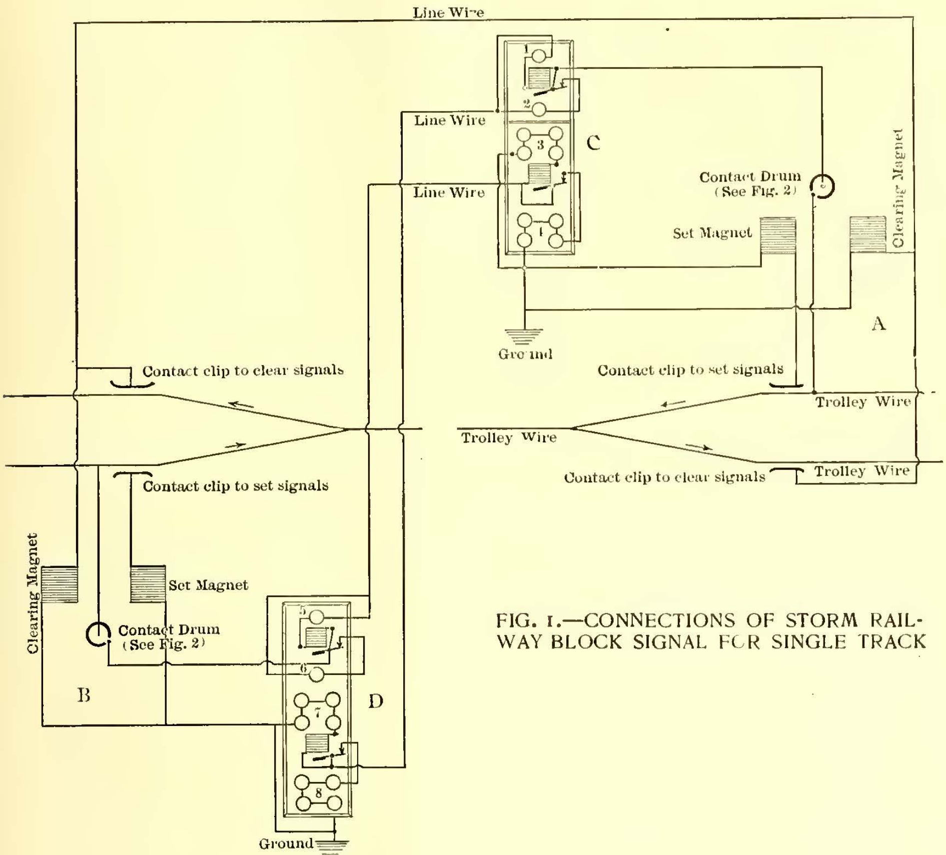


FIG. 1.—CONNECTIONS OF STORM RAILWAY BLOCK SIGNAL FOR SINGLE TRACK

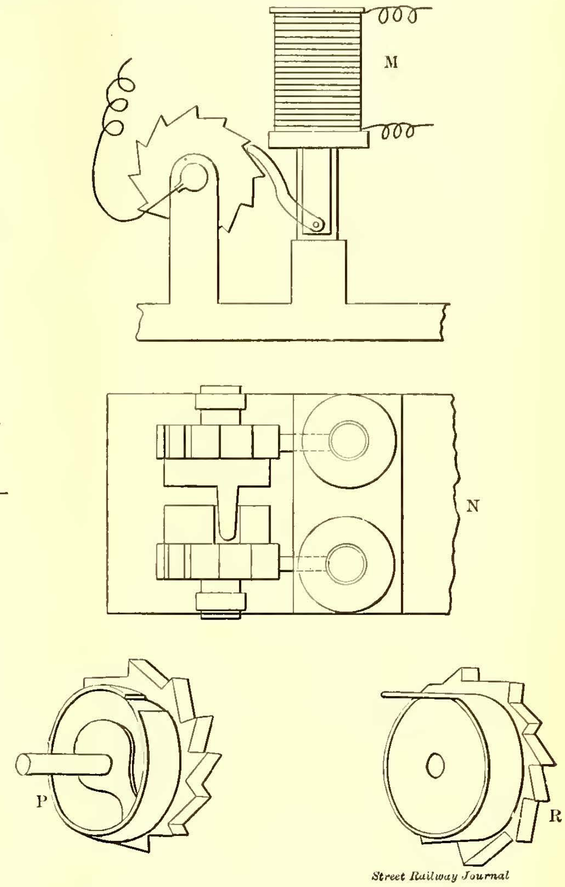


FIG. 2.—DETAILS OF SETTING AND CLEARING DEVICE

FIG 3.—STORM SIGNAL ON GRAND RAPIDS RAILWAY

The setting and clearing magnets are mounted side by side. Each one actuates a contact cylinder of its own by means of a ratchet and pawl, which is shown in *M*, Fig. 2, which is a side view, and by *N*, which is a top view showing the two magnets side by side. *P* and *R*, Fig. 2, are the contact drums. Electrical connection for the signal circuit is made through the hubs of the drums *P* and *R*. It will be noted that one of these drums has a contact ring around its entire circumference, except at one point. The other drum, *R*, has a finger which extends over and makes contact on the circumference of *P*, both of these drums being mounted on the same shaft. When this finger is over the point where the contact ring on *P* is omitted, the signal circuit is open. At all other positions which the two drums may take relative to each other the signal circuit is closed by the bearing of the contact finger of *R* on the contact ring of *P*. When there is no car in the block the contact finger of *R* rests on the open circuit position of the ring of *P*. When a car enters the block the signal setting magnet is energized for an instant. The signal setting magnet is energized, and by means of the pawl, the ratchet wheel and contact drum *P* is moved along one notch, so that the finger of *R* establishes contact, making the circuit complete through the signals. When the car reaches the other end of the block the clearing magnet rotates the drum, *R*, one notch in the same direction that *P* was rotated by the setting magnet, and the circuit is again opened. If several cars had entered the block, drum *P* would have been rotated as many notches as there were cars passing the signal instrument. Before the signals can be cleared, therefore, the drum, *R*, must be rotated an equal number of notches. In other words, this instrument counts the number of trolley wheels passing under the instrument, and will not open the circuit to clear the signals until an equal number of trolley wheels have passed out of the block. The signal setting and clearing magnets are normally out of circuit, being energized only at the instant a trolley wheel passed under. This insures practical freedom from burnouts caused by lightning. The whole apparatus is very simple. As will be seen from the diagram, three line wires between signals are required. This signal is made by the Storm Railway Signal Company at Waterloo, Ia.

New Home of James B. Clow & Sons Company

James B. Clow & Sons Company is now settled in its substantial and convenient new building, at Franklin and Harrison Streets, Chicago. This company has for many years been carrying on its large business in steam and sanitary pipe fittings at a warehouse on Lake Street. The new building is even more accessible to Chicago customers, and has in addition railroad and water shipping facilities, as the building fronts on the river just north of Harrison Street Bridge. This building is a thoroughly fireproof, seven-story, steel-frame structure, having 17,800 sq. ft. of floor space. The ground dimensions are 110 ft. x 190 ft. One of the notable things about this company's new home is the splendid brass foundry in which crude oil is used for fuel. The brass furnace is made under patents of the Hawley Down Draft Furnace Company. The furnace is closed, and the oil flame is blown down against the brass in the bottom of the ladle. The products of combustion pass out through a nozzle, which is turned while the brass is being melted so as to bring it under a hood. When the brass is poured the oil supply is shut off temporarily, and the ladle tipped so as to pour from the exhaust nozzle. This apparatus being closed is almost entirely free from the intense radiated heat of an ordinary brass furnace, and the foundry is a very cool and comfortable place, as compared to the average brass foundry. This furnace has a capacity of 600 lbs. of brass per hour, and 180 flasks are filled three time per day in ordinary day work. It is here that the smaller sizes of valves made by this company are turned out as well as fittings for sanitary plumbing. The top floor has also a machine shop, divided into a number of sections, each of which is confined to one special line of work. The light is excellent on this entire floor. The roof is of the saw-tooth pattern with windows entirely on the north slant. Below the brass foundry and machine shop are floors for storage and assembly purposes until the second floor is reached. Here are the general offices, show rooms and city sales departments. In the basement and the yard, adjoining it on the river, are the heavy steam pipe and fittings and the pipe-cutting machinery. This company is said to have the largest stock of cast-iron fittings to be found in Chicago. The yard adjoining the building, which is on the river front and is served by a switch track from the Chicago Great Western Railroad, has a crane for handling material. Cars unload directly into the basement, where goods are taken by any of the numerous freight elevators, or can be unloaded into the yard Power for the entire building is furnished by motors, located in the different departments, so that there is a minimum loss in belting and shafting. Along with moving into its new quarters it has adopted new systems of bookkeeping and filing, based on the card index and loose-leaf ledger plans, and a very efficient system is being worked out along this line.

Climax Stock Guard

In the description of the cattle guard of the Climax Stock Guard Company, which was illustrated in the STREET RAILWAY JOURNAL, July 19, the dimensions should have been given as 24 ins. long, 8½ ins. wide and 4¼ ins. high. The company announces that the device is receiving very favorable consideration among interurban and suburban railway managers.

New Rule in Regard to Disagreements

Disputes having arisen at different times between passengers and conductors over tickets issued on the lines of the North Jersey Street Railway Company, E. H. Hibbs, auditor of the company, has put in effect a system by which much of the trouble will be avoided. He has issued to conductors printed cards containing on one side the following:

"The rules of the company governing the acceptance of tickets by conductors are uniform and must not be deviated from. In cases where controversy arises between passengers and conductors, conductors will collect fares and refer passengers to this office for adjustment.

"In order to cause passengers as little trouble as possible, the cashiers at Newark, 315 Market Street,
"Elizabeth, Broad Street,
"Jersey City, ferry terminal,
may also be applied to adjust grievances on their respective divisions."

On the other side of the slip is the following blank, to be filled out by the conductor and handed to the passenger who thinks he has a grievance:

Date ....Time ....
Kind of ticket ....
Why refused ....
Conductor ....
Line ....

Mr. Hibbs, in a recent interview, said: "The company desires to adjust all differences with as little inconvenience as possible to its patrons, and believes the new system will be approved by the public. We have certain rules by which our men must abide, and it will simplify things very much for them to refer disputes to headquarters."

Cleveland's Three-Cent Fare Ordinances

The latest development in the 3-cent fare controversy in Cleveland is the dissolution of the temporary injunction granted a few weeks ago restraining the City Council from doing business until the new code bill could be formulated. The injunction was secured at the instance of Judge Boynton, a taxpayer, and was brought by Attorney-General Sheets to prevent the granting of franchises to a proposed 3-cent-fare railroad. Eleven ordinances establishing low-fare routes have passed the Council. The city clerk has advertised for bids for them and they will be opened on Aug. 25. The ordinance which formed the basis of the injunction proceedings was signed by the Mayor, together with ten others, shortly after its passage, and sent to the official paper and published.

To remove one of the reasons assigned by Judge Boynton for beginning the suit for injunction against the members of the City Council, Mayor Johnson erased his name from the ordinance and sent it to the city clerk's office together with a veto message, in which he gave the following reasons for his action:

I learn by the newspapers that Judge W. W. Boynton, who filed suit and secured an injunction restraining the City Council from acting on certain matters of legislation, gives as his reason for bringing the suit that the property owners on his section of East Madison Avenue are strongly opposed to a 3-cent fare street railway on that street. Rather than see the entire movement for 3-cent fares delayed I am in favor of not only vetoing this ordinance, but doing everything that can be done to prevent the building of a 3-cent fare railway in that thoroughfare until a new form of government is established. I recommend that the Council take this view.

The opinion among the Councilmen is that the Mayor has exceeded his authority, and that he had no right to erase his signature of approval of the ordinance. Director of Law Beacom, however, held that the Mayor had the right to do so, as final publication of the ordinance had not yet been made.

Power Brakes for St. Louis Street Cars

The committee appointed by the president's department of the Board of Public Improvements to investigate the practicability of power brakes for street railway cars adopted a report, July 26, which was later presented at the meeting of the Board.

The committee recommends the approval by the Board of the Christensen compressed air brake, with either motor or axle-driven air compressor pump; the Standard (Westinghouse) compressed air brake, with either motor or axle-driven air compressor pump; the Westinghouse electro magnetic track and wheel brake, and the Neal hydraulic brake.

The report contains descriptions and plans of the brakes recommended, and states that stops by the brakes, made by experienced motormen, are without discomfort to passengers, except in case of emergency. The brakes never fail, it is stated, if kept properly inspected and maintained in good order and operated by trained motormen.

Yerkes' Plans in London Successful

At a meeting held July 30 the Parliamentary committee on the proposed tube railways in London decided to make a report giving the Yerkes underground railway interests the right of way for the completion of its entire system. The Morgan Company's bills to authorize the paralleling of the main portion of Yerkes' routes have been put over until next session.

The contest between the Morgan and Speyer-Yerkes interests affects connecting links in the London underground system. The Speyer-Yerkes franchises cover lines already in operation within the city; the Morgan group controls outside transportation lines. The agreement made by Charles T. Yerkes, Speyer Bros. and the Old Colony Trust Company last Spring was to register their new company to be known as the Underground Electric Railway, Ltd., with a capital of £5,000,000, for the purpose of electrifying the District Railway and building four other lines—the Brompton & Piccadilly, the Great Northern & Strand, the Charing Cross, Euston & Hampstead and the Baker Street & Waterloo Railway. The estimated cost of construction of the new lines is £15,000,000.

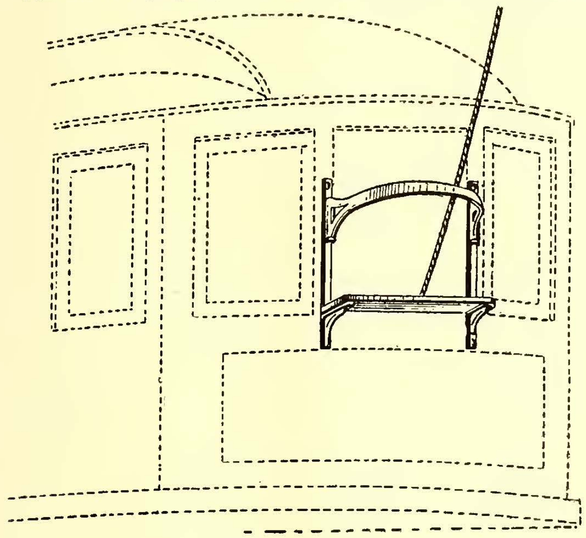
Street Railway Patents

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

UNITED STATES PATENTS ISSUED JULY 29, 1902

705,583. Electric Signal; Arthur J. Haycox, Mansfield, Ohio. App. filed April 10, 1902. One terminal of a signal lamp is connected with the trolley wire, the other leading through a manually operated switch, to the return circuit, whereby the signal can be operated at pleasure.

705,611. Adjustable Brake Head; Gilbert P. Ritter, Chicago, Ill. App. filed May 15, 1902. The brake head has a journal opening, and a grip tongue coincident therewith engages the end of the beam whereby adjustments may be made to accommodate the various heights at which the beam is hung.



PATENT NO. 705,705

705,705. Safety Attachment For Trolley Car Vestibules; Susie E. Pressler, Toledo, Ohio. App. filed May 5, 1902. Rearwardly extending brackets against which the motorman may lean when adjusting the trolley wheel to the wire to avoid falling backward.

705,783. Street Car Fender; Ole Olesen, St. Louis, Mo. App. filed Aug. 7, 1901. A canvas apron is connected to a jackstay fixed to a skeleton frame.

705,798. Trolley; W. L. Von Hardenburg, Brooklyn, N. Y. App. filed June 22, 1901. A spiral groove on each side of the wheel conducts the wire back to the tread whenever it becomes displaced.

705,848. Electric Railway; Charles J. Kintner, New York, N. Y. App. filed Oct. 29, 1900. Renewed Feb. 28, 1902. A series of rotary tubular switches inclosing a current feeder are turned by the car engaging with a spiral groove therein.

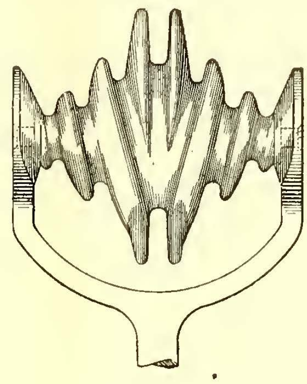
705,814. Fender or Guard for Tramway Cars; John Bauer, New York, N. Y. App. filed March 19, 1902. A V-shaped fender located beneath the car platform.

705,825. Trolley Head and Wheel; W. A. E. Davis, Toledo, Ohio. App. filed Dec. 18, 1901. Overhanging side-plates to prevent the wheel from leaving the wire.

705,882. Trolley; Thomas W. Sutton, Pittsburgh, Pa. App. filed May 7, 1902. Fingers which prevent the wheel from leaving the wire can be moved readily to detach the wheel.

705,886. Car Fender; John W. Wehmeyer, St. Louis, Mo. App. filed Feb. 24, 1902. Details.

705,918. Car Fender; Charles Giblin, Cleveland, Ohio. App. filed Aug. 12, 1901. A fender having sideboards, and a tilting bottom.



PATENT NO. 705,798

705,927. Brake-Shoe Adjuster; Edwin M. Herr, Pittsburgh, Pa. App. filed Dec. 7, 1901. A track brake provided with means for automatically adjusting the shoe support when the shoe wears down to a certain point.

PERSONAL MENTION

MR. ARTHUR HOLLAND, who has been acting president of the United Railroads of San Francisco, has been appointed president of the company.

MR. HOWARD PORTER, for some time assistant superintendent of the Cincinnati Traction Company, has become superintendent of the street railway at Paducah, Ky.

MR. M. J. LOFTUS, JR., for some time superintendent of the Newark & Granville Electric Railway, has resigned to become general manager of the Indianapolis & Martinsville Rapid Transit Company.

MR. O. E. OLESON, for six years chief engineer of the power plant of the Toledo Railways & Light Company, has resigned to accept a similar position with the Rapid Transit Company, of Minneapolis.

MR. EDWARD SPELLMAN, of Cleveland, has been appointed superintendent of the Ohio Central Traction Company's lines, which are the property of the Pomeroy-Mandelbaum Syndicate, of Cleveland.

MR. RICHARD EMORY, formerly vice-president and general manager of the Nashville Railway, and recently assistant to the general manager of the Milwaukee Electric Railway & Light Company, has recently accepted a position with the Appleyard Syndicate, of Boston, as manager of a part of its Ohio properties. Mr. Emory will have his headquarters at Columbus.

MR. R. T. GUNN, superintendent of the Norfolk Railway & Light Company's system, has been appointed superintendent of all of the Norfolk, Portsmouth & Newport News Company's lines with terminals in this city. Mr. H. R. Palmer has been appointed superintendent of the power plant of the company in Norfolk, as well as that in Berkley. Mr. G. A. Hatch will act as superintendent of the Berkley Street Railway, as well as the Atlantic Terminal line.

MR. F. A. ESTEP, president of the R. D. Nuttall Company, of Pittsburgh, Pa., recently returned to New York after an extended trip abroad in the interests of his company. Mr. Estep attended the exhibition of tramways supplies, held in London during July, in connection with the convention of the International Tramway Association, at which he had an exhibit, and also made a trip on the Continent, where the Nuttall Company has enjoyed an extensive business.

UNITED STATES SENATOR HANNA was presented a handsome cane by the employees of the Cleveland City Railway Company, of which he is president, on August 4. About 800 employees of the company gathered at a public hall to which Senator Hanna had been summoned, and the presentation was then made. In acknowledging the gift, Senator Hanna expressed his sincere thanks to his employees for their gift, and incidentally spoke on the relations that he hopes to see soon established between capital and labor.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Aug. 6, 1902.

So far as the immediate condition of the money market is concerned, everything is satisfactory to borrowers. Call money continues to loan in abundance on the Stock Exchange at 2¾ per cent. Time money is firmer, especially for the distant periods, yet even time loans can be made on good collateral at 4¾ per cent for the six months from now to February. Local bank reserves are lower than they were two weeks ago, partly because of heavy gold exports to Europe, and partly in consequence of renewed loan expansion. The gold shipments are apparently over for the present, however, rates of exchange at Paris and Berlin, to which the recent consignments have been made, having recovered well above the gold import level. As for the movement of loans, this is not something that can be so easily predicted. The quieting down of speculation on the Stock Exchange, however, is rather a fair indication that no further increase of importance will occur during the immediate future. In contrast to these easy present conditions, the outlook a month or so ahead is not so reassuring. Treasury expenditures, which ran heavily in excess of receipts during the first two weeks of July, have fallen off greatly, as had been expected. Last year there were very large surpluses from now on, ranging from $6,000,000 in August to over $10,000,000 in October. The abolition of the war internal revenue taxes makes it probable that the surplus this year will be considerably smaller, but the reduction does not promise to be great enough to make the treasury a debtor instead of a creditor in the money market. In a few weeks' time, moreover, the autumn currency demands will begin, and local cash holdings will be rapidly depleted by country bank withdrawals. All this is to occur, moreover, with New York surplus reserve at the exceptionally low figure of $13,000,000.

The Stock Market

The customary quiet of midsummer has once more settled down upon the Stock Exchange. The brief outburst of speculative activity in July raised the general price average substantially, but otherwise it has left conditions practically as it found them. There has been no important distribution of stocks in the hands of the outside public. Holdings remain concentrated to an unusual extent with the larger speculative and financial interests, and this element, although suspending its efforts to advance prices, seems inclined to check any tendency toward decline. The outside situation meanwhile continues highly favorable. Progress of the crops is altogether satisfactory, and an extremely heavy yield of the staple products seems to be more than ever assured. Reports from the various industries are also uniformly encouraging, and although the end of the coal strike is not yet clearly visible, events appear to be shaping themselves toward a gradual break-up of the miners' resistance. As a logical reflection of the prosperity, present and prospective, railroad earnings keep on piling up increases over the totals of the previous year. The question uppermost in the minds of serious investors is, however, whether the rapid advance which has taken place during the last four months has not gone as far as it is safe to go, for the time being, toward discounting the favorable outside conditions. This question is answered now quite unanimously in the affirmative. As a further incentive to caution there is the uncertain outlook already described in the money market. Even the boldest of the speculative fraternity have come to realize the wisdom of going slow until the solution of the autumn money problem can be more clearly seen. The Rock Island proposals for heavy increase in capitalization are a more recent development, which have cooled the enthusiasm of speculative buyers. Altogether, while sentiment, as a rule, is not pessimistic, it is extremely cautious, and the reflection of it is likely to be seen for the present in a dull and hesitating market, such as we have had during the past week.

Among the local traction stocks interest has centered chiefly in Manhattan Elevated. The course of the stock in the recent trading has strengthened the view frequently expressed in these articles, and held by intelligent observers that the shares have been quietly but steadily absorbed for some time past with the purpose of holding for considerably higher prices. Talk of a lease of the property to the New York Central on a 6 or 7 per cent guarantee has been revived by the plans of the Central management, announced last week, for extending its terminal facilities and substituting electricity for steam in its local service. But there appears to be no good reason as yet for placing much faith in these stories. The Manhattan's exceedingly good show of present earnings, with the prospect of further expansion under full electrical equipment, are logical reasons enough for the recent accumulation of the stock. There is little feature to the recent dealings in either Brooklyn Rapid Transit or Metropolitan. Attempts to stimulate outside buying of Metropolitan Securities have so far not met with much success.

Philadelphia

The feature of the traction movement in Philadelphia has been the heavy buying of the new Rapid Transit Company shares and of Union Traction, the leased line issue. Rapid Transit, which was first quoted a month ago at 9, and which sold two weeks ago at 11½, rose steadily in the remaining interval to 13⅞, while Union Traction went up from 44⅞ to 47⅛—a new high record for that stock. It is claimed that the present Union Traction Company is earning enough to pay the guarantee on its stock, and leave a balance of $300,000 (on the basis of the last year's earnings) for Rapid Transit stock. The negotiations for purchase of outlying suburban lines have furnished an additional incentive, and as a part of the general movement Fairmount Park Transportation shares have risen 5 points, from 22 to 27, on unusually large dealings. Apart from possible legitimate causes for the advance, it should be noted that only a small proportion of either Union Traction or Philadelphia Rapid Transit stocks are held by the outside public. If the syndicate which carried through the consolidation deal were desirous of making a market for the new securities it would be easy for them to engineer just such a rise as has occurred. Other Philadelphia sales during the fortnight comprise Philadelphia Traction, at a slight advance, to 99⅞, American Railways, which rose a point and a half to 47¾, and later reacted to 47, Railways General at 4¾, Easton Electric at 19⅞, and Rochester Railway common, 200 shares of which sold at 66½.

Chicago

Chicago elevated shares have, as a rule, been strong and fairly active in the recent trading, partly on heavy traffic receipts and partly on discussion of future financial plans. Northwestern Elevated common, in which scarcely any dealings have occurred during the last few months, was exceptionally strong, rising nearly 2 points to 37. This advance was connected with the visit of a New York banking representative, when plans for improving and extending the system were considered, and it also reflected the increase of 15½ per cent reported in July earnings over the month last year. Metropolitan earnings for the same period increased 23½ per cent, and even Lake Street showed a gain of 10 per cent. Metropolitan shares were strong on this showing, the common getting up to 39½ and the preferred to 92½. Lake Street, however, on the uncertainty regarding the terms of the impending reorganization, continued heavy, selling down from 10 to 9⅜. Among the surface line securities, City Railway rose rapidly on the buying of fractional lots from 205 to 220. Chicago Union Traction was firmer for the preferred shares, at 50, but lower for the common, which declined from 16⅝ to 15¼.

Other Traction Securities

The two weeks have been exceedingly quiet in the Boston traction stocks. On light trading Massachusetts Electric declined to 40⅜, then recovered to 41, while the preferred held steady at 98. Boston Elevated sold in a few lots, between 164 and 166, West End common between 94½ and 96, and the preferred at 114. In Baltimore excitement subsided in the Nashville Street Railway securities, but they were steady and somewhat higher, the recovery extending to 5⅞ for the stock, and 73½ for the trust certificates. United Railways of Baltimore common, after an advance to 16⅞ fell back to 16. The general 4 per cents went to 97¾, and back to 97¼, while the incomes remained about stationary, at 70¼. Anacostia & Potomac 5s, on unfavorable rumors concerning the company's financial position, dropped sharply from 103 to 99¾, but later recovered to 103½. Other Baltimore sales comprise Lexington Railway 5s, at 104; Charleston Consolidated Railways, between 93¾ and 94¾; Norfolk Railway & Lighting 5s, at 95¼; City & Suburban (Baltimore) 5s, at 102½; Atlanta Railway 5s, at 106, and City & Suburban (Washington) 5s, at 102 and 102½. The feature of the Louisville traction market was a sharp advance in Louisville Street Railway common, five shares of which sold at 141, against a quotation of 126 bid two weeks ago. Trading in New Orleans securities has been quiet at a slight reaction to 16, for the common and 56¼ for the preferred. Toledo Railway & Light is also dull but strong around 34.

Last week was one of the most active on record for the Cleveland Stock Exchange. Tractions held the center of the stage, and nearly 10,000 shares changed hands during the week. The strong bull movement which started two weeks ago has continued, and nearly everything on the board advanced. Cincinnati, Dayton & Toledo lead the activity, with sales of 3186 shares. It opened Monday at 23 and advanced to 27 during the week; closing sale was at 26¼. Detroit United followed with sales numbering 2742 shares, which were brought into the market at an advance from 84 to 87½. It is the general opinion that this stock will continue to advance to about the 90 mark unless New York should withdraw its support; a contingency which is not feared. Toledo Railways came in for 850 shares, on an advance to 34½. News of a million dollar tax suit against the company has since caused it to sag somewhat. Northern Ohio continues its steady advance. It started at 40½ for the common and closed at 45, over 700 shares selling. Southern Ohio continues to advance with the new Cincinnati, Dayton & Toledo, which supersedes it. Five hundred of the shares still out changed hands, at from 71½ to 73⅜. Lake Shore Electric is showing remarkable strength in view of the fact that the proposition has not yet been financed. It opened at 14½ and advanced to 17⅞; sales 437 shares. Cleveland Electric continues strong at 85, 125 shares selling, with plenty of bids for more. Syracuse Rapid Transit sold for 349 shares, at 70 for the preferred, 2 points higher than last previous. Western Ohio continues firm at 25 and 25½. Sales numbered 365 shares. Monday, 100 Lake Shore common advanced to 18½, the highest yet. Northern Ohio sold for 45 for 100 shares, and Cleveland Electric advanced to 86 for 100 shares. Two hundred Cincinnati, Dayton & Toledo sold at 26, a drop of 1 point from last sales.

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 July 22	Closing Bid Aug. 5
American Railways Company	46¼	47
Boston Elevated	165	164
Brooklyn R. T.	71	69
Chicago City	210	215
Chicago Union Tr. (common)	16¾	15½
Chicago Union Tr. (preferred)	52	50
Cleveland Electric	82½	86¼
Columbus (common)	52	52
Columbus (preferred)	108	107¼
Consolidated Traction of N. J.	69½	69½
Consolidated Traction of N. J. 5s	110½	110½
Detroit United	79¾	85⅝
Electric People's Traction (Philadelphia) 4s	99¾	99½
Elgin, Aurora & Southern	41½	43
Indianapolis Street Railway 4s	87¾	87¾
Lake Street Elevated	10¼	9½
Manhattan Railway	136½	136⅛
Massachusetts Elec. Cos. (common)	42	41
Massachusetts Elec. Cos. (preferred)	97½	97¾
Metropolitan Elevated, Chicago (common)	38	39
Metropolitan Elevated, Chicago	92	91½
Metropolitan Street	150¾	149
North American	126	123½
Northern Ohio Traction (common)	39¾	44½
Northern Ohio Traction (preferred)	89	89
North Jersey	30½	30½
Northwestern Elevated, Chicago (common)	35	37
Northwestern Elevated, Chicago (preferred)	80	84
Philadelphia Rapid Transit	11¼	13¾
Philadelphia Traction	99¾	99⅝
St. Louis Transit Co. (common)	31	31½
South Side Elevated (Chicago)	110	110
Southern Ohio Traction	..	72
Syracuse Rapid Transit	..	27¾
Syracuse Rapid Transit (preferred)	65	76
Third Avenue	132½	132
Toledo Railway & Light	30¾	30
Twin City, Minneapolis (common)	121½	123½
United Railways, St. Louis (preferred)	84	83½
United Railways, St. Louis, 4s	87¼	87¼
Union Traction (Philadelphia)	44⅞	47
Western Ohio Railway	..	25¼
New Orleans Railways (common)	17¼	16
New Orleans Railways (preferred)	56	56¼

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

With the exception of billets, where the conditions are distinctly easier, demand continues to run far ahead of production in the leading branches of the iron trade. In basic pig iron the bulk of the orders now being taken are on contracts running well into next year. For prompt delivery fancy premiums have to be paid. The Eastern foundry interests are coming to depend more and more upon imports of the foreign material. Meanwhile it is estimated that 1,200,000 tons of steel rails are already booked for next year's delivery, and an additional 400,000 tons will be carried over from this year's. Quotations are $21.75 for Bessemer pig, $33 for steel billets and $28 for steel rails.

Metal

Quotations for the leading metals are as follows: Copper, 11.90 cents; tin, 28 cents; lead, 4⅛ cents; spelter, 5⅜ cents.

MACON, GA.—Tucker, Anthony & Company, of Boston, have sold the Macon Consolidated Street Railway Company and the Metropolitan Street Railway Company, both of Macon, Ga., to Nashville and Savannah parties. These properties have been controlled in Boston since 1894. The Macon Consolidated Company controls the Metropolitan Company. It has $350,000 bonds and $500,000 stock, and the system comprises about 20 miles of road. It is understood that purchase price for a controlling interest was in the neighborhood of $500,000.

CHICAGO, ILL.—Metropolitan Elevated directors have declared a semi-annual preferred dividend of 1½ per cent, payable Aug. 30. Books close Aug. 16 and reopen Aug. 30.

BOSTON, MASS.—The treasurer of the West End Street Railway Company received proposals July 23 for $300,000 West End Street Railway 4 per cent bonds dated Aug. 1, 1900, and maturing Aug. 1, 1915. This issue is to refund a matured issue of $300,000 Highland Street Railway Company 5 per cent bonds. The award was made to Lee, Higginson & Company at better than 104. Bids ranged down to 103, and were eleven in number.

BOSTON, MASS.—At a special meeting of the stockholders, held July 25, it was unanimously voted to authorize an increase in the capital stock of the Boston Elevated Railway Company from $10,000,000 par value to $15,000,000 par value, and an increase in the number of shares from 100,000, par value $100, to 150,000, par value $100, the proceeds to be applied to defraying the cost of construction and equipment of the road, with expenses incidental thereto, and to paying the indebtedness already contracted for that purpose. Gen. Bancroft said he was unable to state accurately how much money the road would require for these purposes, but to complete what had already been undertaken by the company would take somewhere between $3,000,000 and $4,000,000. Only stockholders of record will be allowed to subscribe for the new capital stock.

BOSTON, MASS.—Judge Colt of the United States Circuit Court on July 28 authorized William Odlin, receiver, to sell the property of the Stoughton & Randolph Street Railway Company. The road is 8.2 miles long. The villages in Stoughton and Randolph form its termini.

NASHVILLE, TENN.—The Nashville Railway bondholders' committee recently issued a statement from which we take the following facts and figures:

Capital stock (authorized $6,500,000) outstanding		$5,470,000
First consolidated mortgage 5 per cent bonds authorized		6,500,000
Held by trustee to redeem underlying bonds	$2,549,000	
Held in treasury for future requirements	1,651,000	
Outstanding in hands of public	2,300,000	6,500,000
Receiver's certificates		$500,000
Gross earnings for six months ended Dec. 31, 1901		$391,456

The earnings of the company for six months ended June 30th show a good increase over same months in 1901. The comparison by months from January to May inclusive, June not yet to hand, is as follows:

GROSS EARNINGS NASHVILLE RAILWAY, JANUARY TO MAY, 1902, INCLUSIVE

	1901	1902
January	$57,944.73	$63,230.64
February	50,928.90	56,583.11
March	59,084.89	65,773.04
April	59,109.15	65,225.87
May	63,509.10	76,860.63

Hambleton & Company, of Baltimore, in commenting on these figures, say:

"The company, we estimate, earned in gross for the year ended June 30, 1902.		$900,000
"Estimating the operating expenses at 55 per cent		495,000
"Estimated net earnings		$405,000
"Interest on underlying bonds	$146,020	
"Interest on receiver's certificates	30,000	
"Taxes (abnormally large)	78,716	
"Interest on $2,300,000 consolidated mortgage 5s	115,000	
		369.736
"Estimated surplus		$35,264

"We do not see why these estimates should not be realized. The money received from the sale of receiver's certificates is being spent in betterments and improvements, which, when completed, will add largely to the earning capacity of the property. The attitude of the city authorities is said to be friendly, and a reduction of taxes and the granting of new privileges are assured. It looks as if the Nashville Railway Company will soon be out of its difficulties."

TABLE OF OPERATING STATISTICS

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

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., June '02	67,631	36,589	31,041	14,121	17,021
	1 " " '01	58,191	32,123	26,069	13,056	15,946
	6 " " '02	318,937	185,362	133.575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	* 350,845	266,166	136,162	130,004
	12 " " '00	513,725	* 317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., July '02	140,209	89,013	51,197	23,866	27,331
	1 " " '01	134,370	79,638	54,732	------	------
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,075	------	------
	1 " " '01	15,678	9,341	6,337	------	------
	10 " " '02	187,658	103,986	83,672	------	------
	10 " " '01	169,756	94,355	75,401	------	------
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept.'01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept.'01	5,778,133	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., June '02	1,165,288	* 732,152	433,136	------	------
	1 " " '01	1,181,023	* 732,740	448,283	------	------
	12 " " '02	12,789,705	*8952214	3,837,490	------	------
	12 " " '01	12,101,198	*7970635	4,130,563	------	------
BUFFALO, N. Y.						
International Tr. Co.	1 m., May '02	264,184	146,787	117,398	97,330	20,068
	1 " " '01	291,666	161,077	130,589	92,020	38,569
CHARLESTON, S. C.	1 " " '00	209,309	115,487	93,823	78,250	15,572
Charleston Consol'ted Ry. Gas & El. Co.	6 m., May '02	399,572	208,325	191,248	75,826	115,422
	6 " " '01	245,745	159,425	86,320	76,714	9,607
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., June '02	17,750	7,065	10,685	------	------
	1 " " '01	17,253	6,195	11,057	------	------
	6 " " '02	78,940	38,021	40,919	------	------
	6 " " '01	65,461	34,403	31,058	------	------
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	------	------
	12 " " '00	757,954	378,661	379,293	------	------
Union Traction Co.	12 m., June '02	7,942,468	4,570,719	3,371,749	3,619,277	† 247,528
	12 " " '01	8,158,809	3,942,194	4,216,615	4,058,040	158,575
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	------	------
	1 " " '01	2,435	3,016	† 581	------	------
	12 " Dec. '01	47,976	* 32,002	15,974	13,023	2,951
	12 " " '00	49,646	* 33,272	16,374	13,294	3,080
Cleveland & Eastern	1 m., Feb. '02	4,916	3,616	1,300	------	------
	1 " " '01	3,525	4,037	† 512	------	------
	12 " Dec. '01	90,390	52,022	38,368	43,678	† 4,310
	12 " " '00	62,893	36,672	26,221	36,148	† 9,927
Cleveland El. Ry. Co.	1 m., May '02	217,563	------	------	------	------
	1 " " '01	187,049	------	------	------	------
	5 " " '02	962,890	------	------	------	------
	5 " " '01	854,594	------	------	------	------
	12 " Dec. '01	2,296,898	1,265,953	1,030,945	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., June '02	25,198	13,026	12,172	------	------
	1 " " '01	22,236	9,736	12,501	------	------
	6 " " '02	128,392	77,728	50,664	------	------
	6 " " '01	107,027	64,259	42,768	------	------
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,698	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., June '02	17,747	9,520	8,227	------	------
	1 " " '01	15,748	8,035	7,714	------	------
	6 " " '02	79,557	44,670	34,857	------	------
	6 " " '01	65,449	36,228	29,221	------	------
	12 " Dec. '01	164,971	* 87,102	77,869	72,500	5,369
	12 " " '00	141,112	* 89,592	71,520	72,500	† 980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.	1 m., June '02	77,545	* 42,671	34,875	15,614	19,261
	1 " " '01	72,201	* 42,147	30,054	15,746	14,308
	6 " " '02	422,150	*247,877	174,273	93,025	81,248
	6 " " '01	384,638	*235,852	148,786	94,105	54,681
DENVER, COL.						
Denver City Tramway Co.	1 m., Apl. '02	124,516	66,533	57,983	32,865	26,119
	1 " " '01	116,357	62,866	53,490	31,304	22,186
	4 " " '02	481,348	261,118	220,230	131,259	88,972
	4 " " '01	435,297	236,915	198,382	125,622	72,759
	12 " Dec. '01	1,507,293	818,321	688,965	383,180	305,785
	12 " " '00	1,302,290	722,458	579,839	374,291	205,548
DETROIT, MICH.						
Detroit United Ry.	1 m., June '02	291,470	* 159,333	132,137	------	------
	1 " " '01	260,109	* 139,412	120,697	------	------
	6 " " '02	1,600,675	* 907,044	693,631	395,739	297,892
	6 " " '01	1,384,181	* 775,347	608,834	345,119	263,715
	12 " Dec. '01	2,919,171	*1596765	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " '01	28,877	18,062	10,816	9,692	1,124
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., June '02	48,497	22,136	26,361	9,655	16,705
	1 " " '01	39,265	20,076	19,189	9,188	10,001
	6 " " '02	245,406	132,418	112,992	57,844	55,148
	6 " " '01	208,339	119,603	88,736	54,765	33,970
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., June '02	33,874	20,148	13,726	8,333	5,393
	1 " " '01	32,614	17,659	14,956	8,333	6,622
	6 " " '02	186,457	115,525	70,931	50,000	20,931
	6 " " '01	167,648	102,924	64,724	50,000	14,723
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co.	1 m., June '02	20,714	9,909	10,805	------	------
	1 " " '01	16,257	8,999	7,388	------	------
	6 " " '02	111,972	60,838	51,134	------	------
	6 " " '01	80,340	51,464	28,876	------	------
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,529	7,500	5,029
	1 " " '01	23,530	14,405	9,125	7,500	1,625
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	303,704	166,757	136,946	90,000	46,946
LONDON, ONT.						
London St. Ry. Co.	1 m., June '02	13,643	8,558	5,084	2,287	2,797
	1 " " '01	13,917	7,997	5,920	2,046	3,874
	6 " " '02	65,064	43,167	21,897	13,593	8,304
	6 " " '01	60,112	39,951	20,161	11,932	8,229
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m. June '02	222,450	107,193	115,257	66,015	49,242
	1 " " '01	202,416	94,430	107,986	62,780	45,207
	6 " " '02	1,274,629	612,304	662,325	389,554	272,771
	6 " " '01	1,123,765	586,463	537,302	365,323	171,978
	12 " Dec., '01	2,442,342	1,185,534	1,256,808	755,139	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	824,665	266,247
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., May '02	296,991	136,964	160,028	58,733	101,294
	1 " " '01	251,946	114,340	137,605	56,633	80,971
	5 " " '02	1,356,556	649,003	707,553	292,800	414,752
	5 " " '01	1,178,257	563,664	614,593	273,093	341,498
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., June '02	187,662	80,655	107,007	19,391	87,615
	1 " " '01	180,926	97,782	83,144	14,272	68,871
	9 " " '02	1,445,180	846.893	598,287	144,299	453,989
	9 " " '01	1,355,026	841,469	573,557	90,268	423,288
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Dec. '01	3,038,435	1,404,971	1,633,465	753,135	880,329
	3 " " '00	2,728,598	1,340,696	1,387,902	749.857	638,045
	12 " Sept. 01	10,455,872	5,328,649	5,127,223	2,683,132	2,444,091
	12 " " '00	9,950,735	5,195,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786,030	1,699,649	2,086,381	1,138,467	947,914
	12 " June '02	15,866,641	7,385,883	8,480,758	4,815,421	3,665,337
	12 " " '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y.						
Olean St. Ry. Co.	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PHILADELPHIA, PA.	1 m., May '02	97,701	------	------	------	------
American Railways	1 " " '01	73,406	------	------	------	------
	11 " " '02	908,356	------	------	------	------
	11 " " '01	764,560	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry.	1 m., June '02	89,236	46,809	42,426	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26.704	12,709
	6 " " '02	527,742	288,005	239,737	148,608	91,130
	6 " " '01	495,226	306,966	188,259	147,157	41,102
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., June '02	60,863	34,780	26,064	19,025	7,039
	1 " " '01	56,952	30,942	26,010	18,947	7,063
	12 " " '02	693,284	384,265	309,019	228,246	80,773
	12 " " '01	621,299	340,830	280,469	223,918	56,550
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., June '02	122,682	65,143	57,539	37,854	19,685
	1 " " '01	112,900	53,923	58,978	24,271	34,707
	6 " " '02	671,284	352,382	318,902	227,033	91,869
	6 " " '01	598,928	303,402	295,526	145,625	149,901
	12 " Dec. '01	1,311,084	* 636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	* 616,945	565,572	409,051	156,521
NEW BRIGHTON, S. I.						
Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	† 3,986
	3 " " '01	56,936	35,600	22,336	25,000	† 2,663