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Contents of this Issue

Chicago Elevated Railways to be Assessed as Steam Roads

A controversy which has been going on for some time as to whether the elevated railways of Chicago should be assessed in the same manner as steam railroads of the State by the State Board of Equalization or by the Cook County Board of Review has finally been decided by the Supreme Court of Illinois. The court holds that, since these roads were organized under the steam railroad act rather than under the street railway laws, they should be assessed by the State rather than by the local body.

Different Methods and Results

Our friends across the border may be slow and unprogressive as some of their critics claim—we do not think so ourselves—but the people of Canada, as a rule, and their officials of all grades, retain a wholesome, old-fashioned respect for law and order, and insist upon its observance at all times. The manner in which the rioting, intimidation and destruction of property during the strike of the street railway employees at Toronto were suppressed, should serve as a lesson to the municipal officers in this country, who are often inclined to be lenient with such law-breakers through fear of the political antagonism engendered by putting down this element with a firm hand. Had the Providence and Pawtucket strike been handled like the Toronto strike, a speedy settlement would have been effected, and most of the trouble would have been avoided.

Electric Franchise Asked for a Chicago Steam Road

A significant move has been made by the Chicago, Milwaukee & St. Paul Railway in asking the Chicago City Council for a franchise giving it the right to use electricity or compressed air as motive power on its suburban line from Evanston. This ordinance was introduced in the council on the evening of June 18 and was referred to the committee on local transportation. The grant is asked for twenty years, beginning with 1903. For a number of years there has been much talk of an arrangement between the Northwestern Elevated Railway and the Chicago, Milwaukee & St. Paul Railway whereby trains from Evanston on the latter road may be run into town over the Northwestern Elevated tracks. However, the suburbanites who depend upon this road for transportation are now clamoring for relief, and they are urging their claims before the council and the Mayor with much vigor and persistence.

Forfeiture of Franchises

The question of abandonment of a street railway route is discussed in an opinion by Corporation Council Rives, who has investigated the subject for the benefit of the borough presidents of New York. Frequently companies find in remodeling their systems that certain lines are neither profitable nor necessary, but that they may be of great value later, and consequently they do not wish to relinquish their franchises. In order to retain their rights the companies continue a few cars, even though they be operated at considerable loss. Briefly, Mr. Rives declares that this is not enough, and that where the company does not furnish regular and frequent service the franchise is forfeited and the municipality is justified in causing the removal of the tracks from the street.

To Enlarge the Chicago Union Elevated Loop

It is a matter for serious reflection that a city district without surface or elevated railway service is mighty anxious to get it, but after it has once been established in the neighborhood, and the locality has been built up as a result of the incoming of the local transportation systems, there is a tremendous opposition to any changes or extensions. These thoughts are suggested by the situation in Chicago. As the capacity of the Union Elevated loop around the downtown district of Chicago is beginning to reach its limit in number of trains that can be accommodated, there is talk of extensions. One scheme proposed is to cut the loop in two by building a line across Monroe Street from Fifth Avenue to Wabash Avenue. Some property owners on Monroe Street favor it, but others are opposed and promise all sorts of dreadful things if an attempt is made to build the line.

The other plan is to make Polk Street the southern side of the loop, two long blocks further south than the present line, which is on Van Buren Street. Now, Polk Street forms the "seamy edge" of the downtown district, and while the expansion of the business district is undoubtedly in that direction, the "seamy" characteristics are still very prominent. The Polk Street real estate holders are falling over themselves to get the loop, and are forming an association to further the movement to secure the loop extension, as they realize that the adoption of their plan would mean an immediate advancement of values greater than would come through the natural development in many years. A further extension to Twelfth Street is also advocated, and this is probably the wiser course, although it is looking far ahead. When the union loop was originally built city officials and business men did not fully recognize what an important factor it was destined to become in the city transportation system. Now that it has become apparent, ample provision should be made.

Single Phase Motors for Heavy Railroad Service

The most important event of the Institute meeting at Great Barrington last week was the announcement made by Bion J. Arnold that he had perfected a system of electric railroading employing a single-phase motor, a system which was at once recognized as an innovation of far reaching signifigance, and one that seems destined to prove an important factor in the application of electricity to the service now performed exclusively by steam lines. Mr. Arnold outlined the principle and application of his invention in his address before the Institute, and we are enabled to present on another page of this issue a brief resume of his work in this field.

It is proposed to use a single-phase motor in which the element commonly known as the stator will be made so as to revolve, as will also the usual rotor. By this means the synchronous relation may be maintained between the stator and rotor, while at the same time either of these elements may have any desired speed between zero and maximum. Compressed air engines and air storage are important features of the combination, one engine being connected with the stator and the other with the rotor in the opposite direction. The motor is always connected to line, and thus either the rotor or stator, or both, will be always in motion. When the car is at rest the stator runs at synchronous speed and compresses air for storage. When it is desired to start the car the stator-compressor engine is throttled, and to maintain the synchronous relation between the stator and rotor, it follows that the latter will begin to rotate and to propel the car. As the stator engine is gradually throttled the rotor speed increases correspondingly, until, finally, when the stator is brought to rest, the rotor will have attained synchronous speed. Should a higher speed than that corresponding to synchronism be desired the stator may be revolved in the same direction as the rotor, and, if in starting a higher torque than that of the motor itself is required, the engine of the rotor may be utilized. The details for regulating the equipment have been thoroughly worked out and comprise many interesting features of control, giving a great flexibility to the system, such as has heretofore been wanting in all alternating motor equipments for this class of work. Another important feature of Mr. Arnold's plan is the fact that the system practically provides for a self-contained unit, as it is possible to operate the car for a considerable distance by means of the compressed air engines without depending upon any other source of power. This feature will doubtless prove very useful in operating long interurban lines that pass through cities and towns where it is impossible or undesirable to depend upon the usual method of current supply, or where permission to erect overhead wires could not be obtained.

We are pleased to note that the new system will have a practical application very shortly on a sixty-mile Western road now being built. This should at once determine the practicability of the plan in so far as engineering details are concerned, and if it meet the expectations of its friends the development of electricity in its application to long-distance heavy service railroading will have made a mighty advance.

Data Needed on Rural Trolley Lines

There is need for more complete reliable figures on the possible freight and passenger business obtainable from rural communities by an electric road built primarily to serve such a district. Our article on the freight business of the Chicago, Harvard & Geneva Lake Railway in the issue of June 7 gave the results in a single instance, although in this case the freight business was a secondary matter as compared with through passenger travel. Before general conclusions can be reached figures should be obtained from a number of rural communities. As pointed out by Dr. Louis Bell in an article in the Street Railway Journal of March 1, 1902, on "The Function of Small Roads," there are many places in the United States where it would be possible to build cheaply designed electric lines which, although not of heavy enough construction for severe traffic, would be sufficient to serve a sparsely settled territory admirably and which could be made to pay because of the low investment. The trend of electric railway building has undoubtedly been toward larger and more costly roads rather than in the other direction, but it is well not to lose sight of the possibilities of the small roads. It should be a matter of the greatest interest and importance not only to those directly interested in the street railway business, but to rural communities in general, to know just how far electric railway operation on the small scale mentioned can be carried into country districts with profit. That question has been settled so far as steam road operation is concerned, and it has been generally assumed among engineers that for a very small traffic through agricultural regions steam roads can be made to pay where an electric road could not. While this is undoubtedly true in some cases, there are certainly plenty of others where there is at least room for experiment whether a profitable electric road could not be constructed along the most economical lines, giving a tolerably frequent service and obtaining power from neighboring electric light stations, possibly with the aid of a storage battery. It is a question yet to be answered whether a rural electric railway of this kind would not create a traffic between a rural community and its nearest large town which could not by any means be obtained by a steam road, with its necessarily infrequent service over the same route. To give such a service, present ideas as to proper construction and operation would have to be revolutionized and both first cost and operating expense would have to be scaled down to the lowest point, but this need not necessarily be bad engineering for such a proposition, because very light traffic justifies very economical methods in operation and construction.

The experience of the independent telephone industry may shed some light on this subject. In that business farmers' telephone lines have been constructed and maintained by the users themselves where formerly it was thought that telephone service was impracticable. The construction is cheap in many cases, to be sure, and the farmers do much of the work of construction and maintenance themselves. The lines are not as reliable as the magnificent long-distance circuits of the large telephone companies, but they serve very well their purpose of furnishing the farmers a means of communication with town. May it not be that before long we will see electric roads serving similar rural communities and built with the co-operation of the farmers themselves? There should, of course, be some level-headed electric railway man to supervise such an enterprise. Under his direction a large part of the work of grading and track laying could be done by farmers interested in the construction of the road who could be given stock in the company in exchange for their services, leaving only the purchase of material for outside capital to take care of, and in many cases a large part of this latter sum would be subscribed by business men and shippers in the principal town terminus, who would also be interested in the construction of such a road. From the local support which would thus be obtained, and with a level-headed business man and engineer at the head of affairs in an advisory capacity, there would be a good chance for success if the population served was at all sufficient to

support a road. The value of the farm land within reach of such a road could not fail to be greatly increased on account of the connection with town, and this, too, ought to prove a powerful influence in encouraging the building of such roads. However, as said before, there is need of more light on the question of how much business can be obtained from a rural territory before any predictions can be made as to how far such building will be carried on.

Louisiana Passes a "Jim Crow" Bill

Following the example of Virginia, the Louisiana Legislature on June 21 passed the "Jim Crow" bill affecting street railway companies of the State. This measure is known as the Wilson separate-car bill and requires the street railway companies to provide separate cars or separate accommodations on their cars for negroes. The bill passed the Senate with only one dissenting vote. The law had already passed the House, and the street railway companies have signified their willingness to comply with its provisions.

New York Central's Terminal Plans

Mr. Arnold's Institute paper describing the investigation conducted by him for the New York Central Railroad Company, with a view to changing the motive power at the terminus in this city, is a valuable contribution on the availability of electricity for heavy railroad work. It is true that the question was merely one of the substitution of electricity for steam upon the terminal system, which is entirely different both in scope and character from undertaking the complete equipment of a steam railroad system; but in this case, at least, the problem was much more intricate than would be one of ordinary railroading and was much more unfavorable than would be the larger one of the introduction of a complete electric railway system. The conditions were about as unfavorable for electricity as any that could be found within the scope of railroad engineering, and in addition to this the conservative attitude of Mr. Arnold throughout this investigation precluded the possibility of any advantage being given to electricity in comparison with steam; on the contrary, it may be safely said that the opponents of electric traction could not ask for a more severe and exacting ordeal than that to which Mr. Arnold subjected the electrical equipment during the comparative tests. In the face of these facts it is really surprising, and, of course, highly gratifying, that electricity was able to show any economical advantage whatever over steam; yet Mr. Arnold's report, taking into consideration all the operating expenses and fixed charges, shows a slight saving amounting to 2 per cent of the total cost per locomotive mile in favor of the electric system. Under the circumstances it is only reasonable to expect that much more favorable results will be obtained in actual commercial operation than those recorded in this investigation, for it is admitted that no such combination of unfavorable circumstances as those under which the electrical tests were made would be found in any modern railroad system. We should not lose sight of the fact either that it was not the aim of the company nor of its engineer to select the cheapest method for this work, but rather to determine the best practical plan for eliminating the dangers attending the employment of steam locomotives which considerations of public safety required to be abandoned.

The problem, therefore, that confronted Mr. Arnold was how best to accomplish this change. The investigation embraced the entire question of the substitution of electricity for steam locomotives, and the cost of the several methods was worked out for all the conditions which it was deemed would materially affect the result and which ought to be considered. The tabulated results of these investigations cover the cost of operating the proposed system in twelve different ways, beginning with the plan of establishing a single direct-current power station at the center of the system and near the tracks with no storage batteries whatever and employing a 600-volt working conductor. Several modifications of this system, an alternating-current plan, a combination of alternating-current and direct-current power stations and an arrangement of batteries on locomotives charged from working conductors, were all considered and finally discarded for one which provided for the establishment of a power station for generating alternating and direct current at the Harlem River near one end of the line, with a sub-station near the other end, and batteries in both stations. The last-mentioned system is about 10 per cent less economical than the simple 600-volt distribution provided for in the first plan, but it has a greater factor of safety and is entirely practical in every particular, whereas the first plan called for a power station at a point where it would probably be difficult to establish and maintain it. Taking everything into consideration, there is no doubt that the recommendations of Mr. Arnold in favor of the last plan will be generally approved by those who are experienced in this line and especially familiar with the exacting requirements of this service.

We have only attempted to touch incidentally upon some of the important features which are very thoroughly covered in Mr. Arnold's paper, and we recommend a careful study of the report as presented elsewhere in this issue to all who are interested in this subject.

Burning Oil in Power Plants

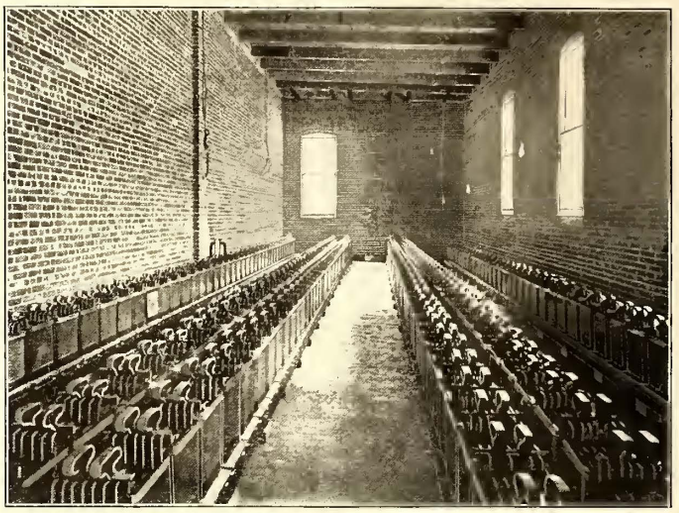
Those who have had the most experience with fuel oil are generally conservative in their claims, even though they may be consistent advocates of it, for they recognize that there are many features about an installation for this purpose that require constant attention. Many investigators are misled by the apparent simplicity of the equipment. It is easy enough to convert a furnace from coal to oil, but it is just as easy to return to the old method, and those whose expectations have been raised too high are liable to do this if they accept the statement of "oil boomers" and intrust the plant to inexperienced hands at the start. To secure satisfactory results it is necessary to exercise considerable care, first of all, in the designing and building of the plant and then in properly operating it. An essential feature is that the oil must flow to the burners at a steady pressure, otherwise the fires will be put out, and besides the annoyance and loss resulting from this there is great danger of explosion. Experience has shown that when the flow of oil at the burners is unsteady the strain is likely to blow the flame out or more oil will come through the burner than can be properly atomized and the fire will smoke badly, filling the tubes with a soot that is harder to remove than that produced by coal. Moreover, the oil that is not atomized will flow away and be lost. There is always a liability, too, that the oil that runs into the pit at such times may cause a serious explosion. This is recognized by the best authorities on the subject, and they are trying to impress it upon others who are less experienced, and, possibly because of this fact, more radical in their views. In one electrical plant which was installed by experienced engineers and discussed at a recent convention the boilers were provided with peep-holes in the back to enable the attendant to see the condition of his fire. Care was taken to watch the fires very closely, and in case they went out for any reason to shut off the oil immediately, as the gas from the oil, combined with air in certain proportions, was found to be very explosive. It was pointed out that cases of this kind have been known where explosions occurred which took the damper up the chimney and blew out the front of the boiler. Yet we are frequently told that absolutely no attention is required for oil-burning apparatus and that the simplicity of the arrangement makes it possible for anyone to equip a plant of this kind. Such a policy is bound to react, and the consequences cannot be evaded where it is persisted in. As long as the oil men withhold important information of this kind they cannot hope to enjoy the confidence of the men responsible for the successful operation of important power plants.

Mineola, Hempstead and Freeport Traction Company

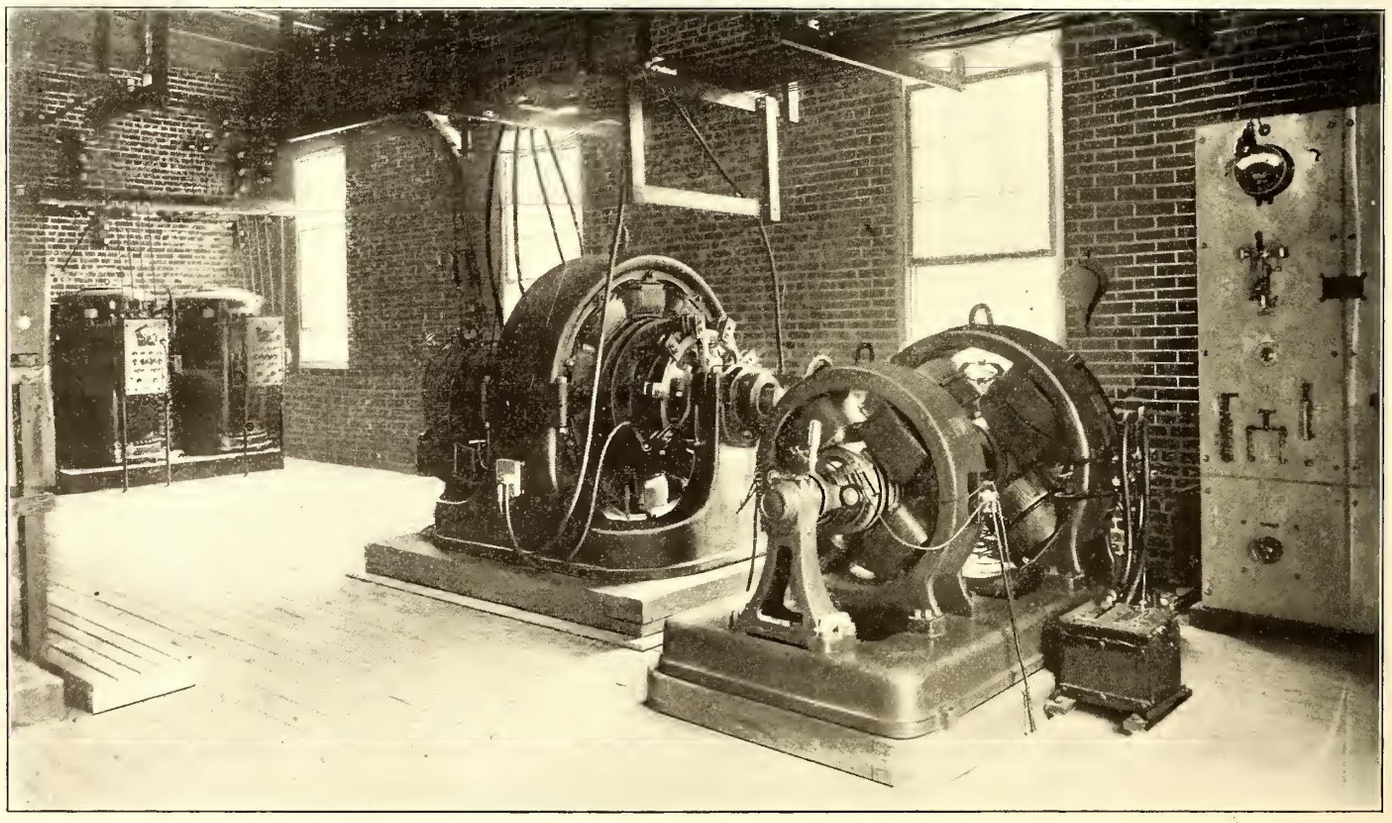
About a month ago the Mineola, Hempstead & Freeport Traction Company opened its system of traction lines on Long Island, and already the original estimates of traffic have been greatly exceeded. The promoters of the road met with considerable opposition, both from residents in the section affected and from the steam railroad lines serving the district. But the electric road won, and it has now constructed between Mineola and Hempstead, and between Freeport and Hempstead one of the best-equipped short interurban lines in the country. Extensive additions are already under way in the shape of a 10-mile connection between Hempstead and Jamaica, where the track is now being laid. The present route of the road, which is about 8½ miles in length, follows the country turnpikes and roads, but some of the contemplated extensions may be built on the company's own right of way. The part of the system which is completed runs from Mineola on the north, through Garden City to Hempstead, a distance of about 3 miles, and from Hempstead south to the town of Freeport, through which it passes to the southern boundary. The accompanying map shows in heavy lines the section now being operated, and in dotted lines the connection between Hempstead and Jamaica; the portion between Hempstead and Queens being nearly completed, and that between Queens and Jamaica having been tentatively decided upon.

This section of country is extremely level, so that there are practically no grades of any importance on the entire system. The track construction consists of yellow pine ties, 2 ft., center to center, on which are laid 7-in. tram-head girder rails, weighing 80 lbs. per yard. The rails are cut in 60-ft. lengths, and are supported by rail braces, making the track work thoroughly reliable. The rails are connected by ordinary fish-plates, and protected bonds are used.

The overhead material is furnished by the Ohio Brass Company, and consists of a double trolley wire supported both by span wires and side pole and brackets; 000 grooved trolley wire is used. The double trolley wire gives sufficient feeder capacity for the Mineola branch, but for the Freeport branch there is a single 0000 feed wire to a point about half-way between Hempstead and Freeport. An interesting feature of the overhead construction is the method of crossing steam railroad tracks. In order to lessen the danger of a car being stalled on a grade crossing, the State Board of Railroad Commissioners approved the overhead trough construction shown in the accompanying engraving. This consists of a sheet-copper inverted trough, backed by iron brackets, through the tops of which pass the bolts for the two lines of trolley ears. The entire trough, which is insulated by the type of span insulators shown in the cut, is alive, and should the trolley wheel jump from the wire while in the vicinity of the railroad tracks, the current will not be interrupted and the car can be taken safely across. Another interesting feature of the overhead work is an overhead switch, by means of which the two trolley wires are brought together at a Y, which makes the trolley pole take the correct wire without attention from the motorman. This switch is placed a few rods from the angle of the Y. On one side of the switch the two trolley wires are separated to the standard distance, and on the other they are brought close together or a single wire is used. The switch has a spring tongue, and a trolley wheel approaching the switch from the Y will be thrown by this tongue to the right-hand wire, but when going in the opposite direction the tongue is forced over and the wheel passes the switch to the single wire beyond. At the angles of the Y ordinary overhead switches are used. These spring-tongue switches are manufactured by A. F. Bartlett, of Saginaw, Mich.



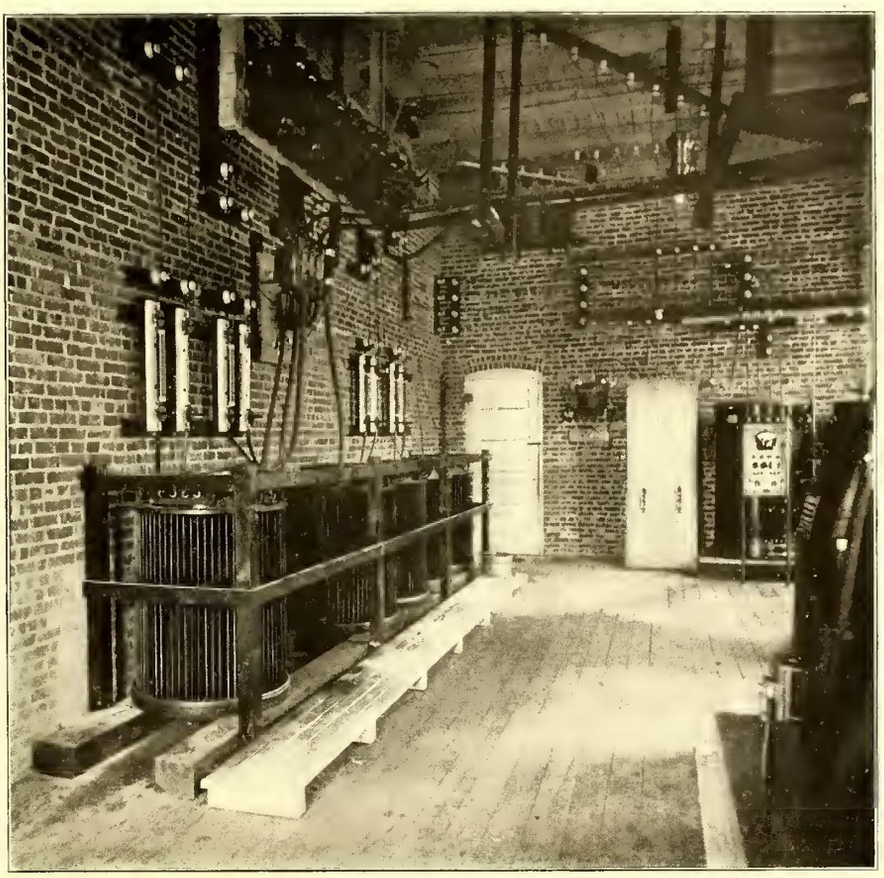
STORAGE BATTERY AUXILIARY



ROTARY CONVERTER AND BOOSTER IN HEMPSTEAD SUB-STATION

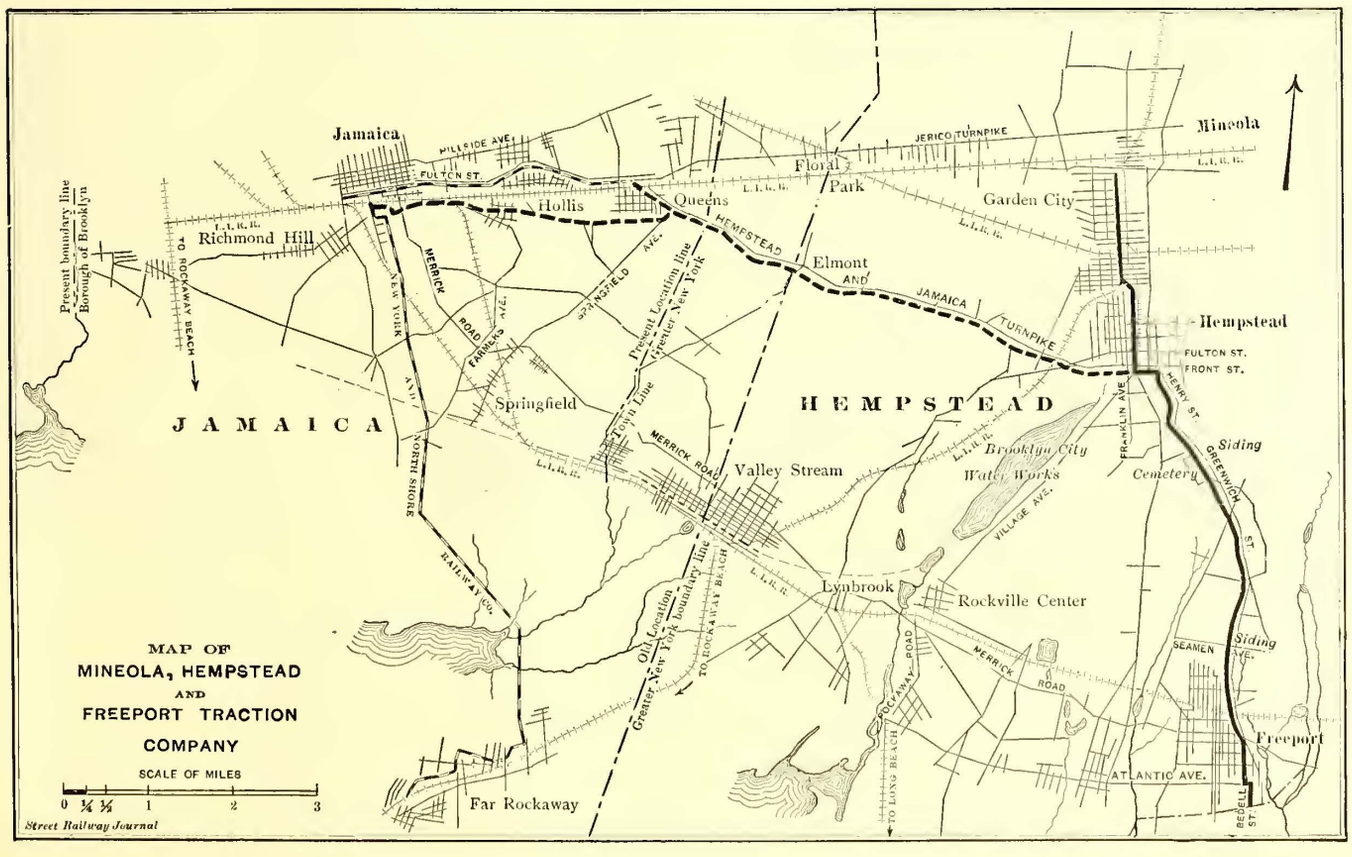
The power for the line is supplied by a sub-station at Hempstead, which receives alternating current from the Roslyn Light & Power Company's plant at Roslyn. This plant was originally built for supplying a few of the handsome private residences which abound in this locality, but its territory has been greatly extended and it furnishes light and power for a number of adjoining towns.

The sub-station used by the railway also contains transformers for both constant current and constant voltage, supply circuits used for street arc and residential incandescent lighting respectively. The transmission is three-phase at 6600 volts and 60 cycles. Three-phase, stationary, step-down transformers in the sub-station reduce this voltage directly to the requirements of the rotary converters. At present there is but one Westinghouse rotary of 200 kw capacity, but an additional unit will probably soon be installed. This plant is another example of the successful operation of rotary converters on 60-cycle circuits. The rotary is started by means of a Type C Westinghouse induction motor, mounted at one end of the shaft. The line voltage at the sub-station is 550 volts, and uniform load on the rotary converter is assured by the use of a storage battery and booster. The storage battery is placed in a room immediately behind the converter room and contains 270 cells of chloride accumulators of thirteen Type F plates, made by the Electric Storage Battery Company, of Philadelphia. These cells are mounted on insulated sand trays, resting on the usual type of battery racks, and the lead straps which form the connection are brazed together. There is no room for more plates in the cells, and, as seen by the accompanying view of the interior of the battery room, there is no accommodation for more cells on the floor, but the capacity may be doubled by a second series immediately over those now in use. The battery is capable of discharging on full charge at the rate of 120 amps. The booster which regulates the charge and discharge of the battery is a motor generator built by the Western Electric Company, and is situated near the rotary converter, as shown in one of the views. The output of the booster is 300 amps, at 60 volts. The switchboards are of blue Vermont marble equipped with the usual apparatus for a station of this kind, most of which was furnished by the Westinghouse Electric & Manufacturing Company.



TRANSFORMER EQUIPMENT

The consulting engineer for the Roslyn Electric Light Company is C. O. Mailloux, of New York. Mr. Mailloux has recently contracted with Westinghouse, Church, Kerr & Company for two 400-hp Westinghouse steam turbines for installation in this plant. It will be some months, however, before they will be delivered, but temporary engines and generators are being put in, and as soon as they are running the rotary sub-station of the Mineola, Hempstead & Freeport Traction Company can be considerably increased in capacity, probably by the addition as a second 200-kw machine. Included in the sub-station building is a well-equipped repair shop, where the cars may be inspected and motors and trucks attended to if out of



order. The room is well lighted and ventilated and is equipped with drill-press, lathe, grindstone and other tools, driven by a line shaft belted to an induction motor operated on the lighting circuit. The power for the machine shop is therefore entirely distinct from the railway circuit, and the shop can be run after the rotary has been shut down, either in case of accident to the rotary or its auxiliary apparatus, or while the car service is suspended during the night. The sloping character of the ground has given an opportunity for constructing a track pit of somewhat novel design. The tracks entering the shop are about 4 ft. above the floor. They run along the side of the wall, and the rail nearest the center of the room is supported by a wooden stringer resting on brick piers. When a car is in the house, therefore, access can be had to it from underneath with considerable ease. The master mechanic has designed a simple and efficient hoist for lowering the motors into the pit, and handling other heavy work. This hoist consists of an ordinary lifting jack supporting a platform, the whole being placed on a small four-wheeled truck which can be moved around with ease under the car and out between the piers. The plot of ground upon which the sub-station is built is of considerable extent, and ample provision has therefore been made for future additions to the plant.

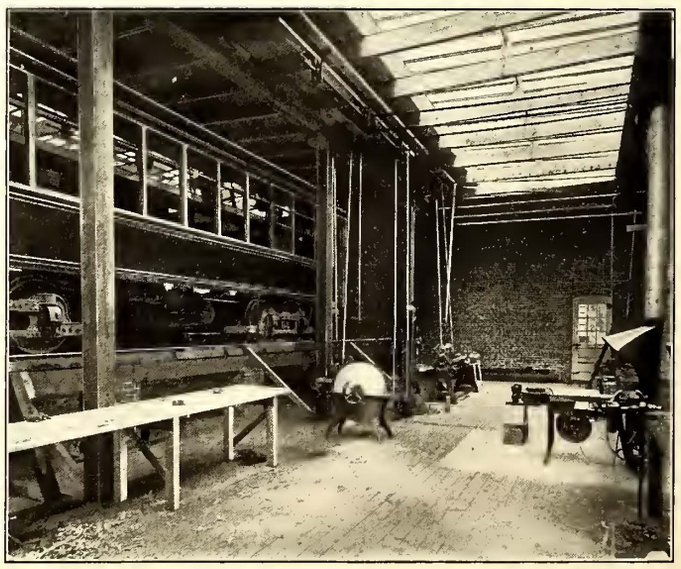
FIRST CAR OPERATED OVER THE ROAD

The rolling stock at present consists of four handsome double-truck cars, built by the Wason Manufacturing Company, of Springfield, Mass. The trucks for these cars were furnished by the Peckham Manufacturing Company, of New York, and are specially adapted to high-speed interurban service. The car equipment is soon to be doubled by an increase of four cars of the same type made by the John Stephenson Company, of Elizabeth, N. J. The cars seat forty-four passengers, the arrangement of the seats being similar to that adopted by the Worcester (Mass.) Consolidated road. The seats at each end are longitudinal and hold four passengers each, and in the center of the car there are cross seats of the walk-over pattern. The seats were made by the Heywood Bros. & Wakefield Company, of Wakefield, Mass., and are covered with red plush, with polished grab handles at the corners of the backs of the cross seats.

There are but few turnouts necessary, on account of the shortness of the road; at each turnout, however, telephones are installed so that the position of the cars are at all times known to the superintendent. A switchboard is to be placed in the main office at Hempstead, and as the road is increased in size a most complete system will be installed. The telephone apparatus is furnished by the Garl Electric Company, of Akron, Ohio. At all grade crossings where the electric lines cross steam roads there are placed safety derailing switches made by the New York Switch & Crossing Company. These derailing switches are operated electrically from boxes on the other side of the track, so that the conductor must cross the track in order to set the switch for the advance of his car. In this way it is absolutely certain that the car stops before reaching the railroad crossing, and the conductor is compelled to place himself in a position where he has a full view of the steam track and cannot fail to observe approaching trains. The switch-boxes are opened by a key carried by the conductor.

The schedule now being operated has a 40-minute headway, but this is increased on holidays and other times of especially heavy traffic. The road is considerably handicapped from lack of power, and until the extensions in the stations referred to have been completed it will be impossible greatly to increase the service. However, the company is giving its patrons a very satisfactory schedule at present, and the towns served are very well pleased with their new traction system. The road was built by the Cleveland Construction Company, of Akron, Ohio. The president of the road, John E. Ensign, was formerly a resident of Cleveland, and it has been under his direction that the road has been constructed.

INTERIOR OF CAR



REPAIR SHOP WITH CAR IN POSITION FOR INSPECTION

The electrician and master mechanic, C. P. Orth, is an old Cleveland Construction Company man. Frank E. Bradley, formerly with the Albany & Hudson road, has had entire charge of track construction.

New Traction Project at Buenos Ayres

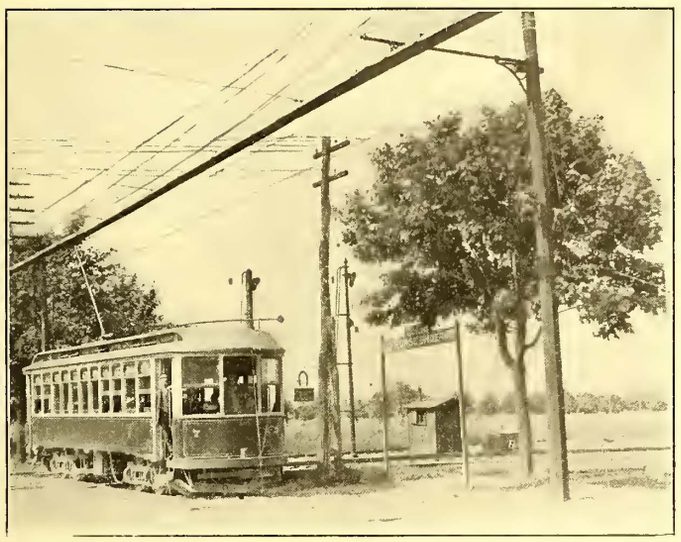
Varela Cuneo & Company, of Buenos Ayres, Argentine Republic, are expected to decide by July 31 as to the construction of a new electric traction system from Rivadana, located on the outskirts of Buenos Ayres, going to the Tigre and passing through all the northern suburbs.

Chicago Subway Projects

The first definite proposition to build subways for street railway lines in the downtown district of Chicago that has yet been offered was made by ex-Mayor Washburne and William A. Alexander, of the George A. Fuller Company, at the meeting of the Chicago City Council June 18, when an ordinance was introduced by Alderman Menwigen, accompanied by the following argument addressed to the Mayor and council by Messrs. Washburne and Alexander:

The greatest municipal evil is the congestion of public utilities in that portion of the south division of the city of Chicago which lies north of Twelfth Street.

The greatest need of the city of Chicago is money. Had the city of Chicago the necessary money it would relieve this congestion by building tunnels underneath the city's streets, and require all electric light wires, gas pipes, sewer pipes, water pipes, telephone lines, and street railroad tracks to be laid therein, and would charge therefor a rental or fee that would not only pay the interest on the money invested and create a sinking fund, but would furnish the city with revenue to meet its constantly increasing necessities. But the city of Chicago has not and cannot raise the money so to do, for the



OVERHEAD CONSTRUCTION, SHOWING INVERTED TROUGH AT RAILROAD CROSSING

constitution of this State prohibits any municipality from becoming indebted in any manner, or for any purpose to an amount, including existing indebtedness, in the aggregate exceeding 5 per centum on the value of the taxable property therein, to be ascertained by the last assessment for State and county taxes previous to the incurring of such indebtedness.

The ordinance which we offer you does not interfere with the adoption of the constitutional amendment, and does not preclude the city from deriving the benefit thereof; but on the contrary is an incentive to, and directly promotes the same, and in the interim, by the enterprise of private citizens, gives the city of Chicago that which the city would do were it financially and legally able to do so.

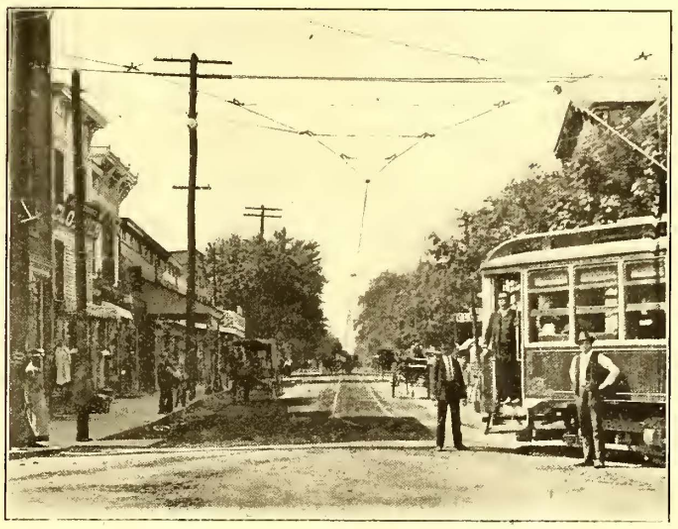
Within the time reasonably necessary to secure uses of the subway the city of Chicago will be in receipt of 3 per cent of the gross receipts obtained by the owners of such system for the use thereof. Within five years thereafter the city of Chicago shall receive annually 5 per cent of such gross receipts. Within fifteen years from the date of the acceptance of the ordinance the city of Chicago will have the right to acquire all the rights of their owners in said subways, tunnels, and underground conduits, upon paying the owners thereof the original cost of said work and the extensions, and 10 per cent thereon for builders' profit. Every ten years thereafter the city of Chicago has the like privilege.

The ordinance as presented gives these two gentlemen and their successors the right to use the subway for transportation of passengers, packages, mails, baggage, freight and for conduit for heat and electric current, and gives the right to sublet space within the conduits. It provides that no part of the subway shall be laid more than 26 ft. below the surface of the street except for going under the Chicago River; all plans to be approved by the commissioner of public works. It is agreed that the applicants should reconstruct and rebuild the water and sewer systems within the district bounded by the river on the north and west, Twelfth Street on the south and the lake on the east. This is practically the entire downtown district of Chicago. The promoters agree to have at least 5 miles of the subway completed within four years upon the acceptance of the ordinance. The compensation to the city for the first ten years is to be 3 per cent of the gross receipts and 5 per cent after that. The city has the right to purchase the subways at any time after fifteen years by paying the actual cost of construction of such subways from the beginning until the time when the transfer is made, plus 10 per cent. The gentlemen applying for the ordinance claim to have $40,000,000 at command for the construction of this system of subways.

The Illinois Telephone & Telegraph Company is at the present time building a deep tunnel in the same district, through which it proposes to run telephone cables and also to carry mail and freight. In view of the possible desire of the city to build or allow to be built a subway close to the street surface B. J. Arnold, the city's expert engineer, recently appointed to investigate local transportation problems, was asked to make a report on whether there would be any interference between the Illinois Telephone & Telegraph Company's tunnels and any subways that might be built for street railway purposes. Mr. Arnold said in part:

If a single story, curb to curb, subway, with grade crossings, should ultimately be found to be advisable, the tunnels of the Illinois Telephone & Telegraph Company are low enough not to interfere. If it should be decided that the grade crossings must be eliminated in the future subway, there would be points where the subway would interfere with the tunnels.

Since action on the ordinance is being urged by the company on the ground that it may not be delayed in its construction work, and since it is impracticable to locate the points of interscction of the future subways and the tunnels, the only way to protect the interests of the city is to provide in it for depressing or elevating the tunnels of the Illinois Telephone & Telegraph Company at such points as may eventually be found necessary for the proper construction of the future subway or subways.



VIEW OF TROLLEY LINE, SHOWING OVERHEAD SWITCH WITH TONGUE IN DISTANCE

The cost of whatever changes may be made necessary should be divided between the company and the municipality, or such company as the municipality may hereafter authorize to build a subway.

The Illinois Telephone & Telegraph Company is asking for a revision of some of its ordinances, hence the question arose as to whether its tunnels were deep enough not to interfere with other possible underground work.

Efforts to Extend the Chicago Union Elevated Loop

Property owners having real estate located south of the present Union Elevated loop of Chicago met at the Grand Pacific Hotel in that city June 17 and formed an association to secure an extension of the Union Elevated loop as far south as either Twelfth Street or Polk Street. The following resolutions were adopted:

Whereas, The elevated loop at present located is utterly inadequate to meet the requirements of the people of this city and also seriously retards the growth and development of its business portion.

Whereas, These objections can be removed only by a material enlargement of the loop and the removal several blocks southward of that part of the loop which is now in Van Buren Street,

Resolved by this meeting, That a committee of seven owners of real estate located in the south division, south of Van Buren Street and north of Twelfth, be appointed by the chairman with full power and authority to investigate, agitate and take such measures as in their judgment shall meet the emergency; and,

Resolved, That the committee be given power to change and enlarge its membership and to appoint such experts and assistants as it may deem appropriate. Said committee, however, to have no power to incur any expense except to the extent that may hereafter be agreed upon in writing by the various property owners.

Chicago's business district which is bounded by the loop is constantly crowding the business center farther south, and the extension of the loop southward would appear to be the most natural solution of the problem.

Electro-Pneumatic Railway System*

BY BION J. ARNOLD

During the last three years I have earnestly advocated the use of the alternating-current motor for certain classes of railway work, and have often been asked by my friends why I believed so thoroughly in the alternating-current motor, and have been questioned rather closely at times for particulars regarding a certain system which I have been working upon.

I wish to state that long before I had any fixed ideas as to a system of my own, a study of the railway question from an engineering view partially convinced me of the necessity of the ultimate abandonment of the direct-current motor for heavy and long distance service, due to the low working voltage that it was necessarily limited to, the resulting heavy investment in transmission lines required and the many translations between the power station and the car when any great distance was involved.

An active connection with the development and construction of electric railways in this country impressed me with the correctness of my preconceived ideas to such an extent that they finally crystallized into a system of electric railway construction upon which I have been working for several years, and to which I have alluded from time to time without giving to those not interested with me any definite information regarding it, for reasons well known to those working upon new devices.

I have constructed 20 miles of road for this system, together with the necessary trucks and motor equipments, and as I am reasonably sure of the interest you will take in this system I feel warranted in presenting it to this Institute. The recent discussion between engineers in Europe and the United States on this question has added interest to the subject at present, and this is my reason for presenting a brief description of my system at this meeting. The principles underlying the system I advocate and which I call an electro-pneumatic system are as follows:

First.—A single-phase or multiphase motor mounted directly upon the car, designed for the average power required by the car and running continuously at a constant speed and a constant load, and therefore at maximum efficiency.

Second.—Instead of stopping and starting this motor and dissipating the energy through resistances, as is customary with all other systems known to me, I control the speed of the car by retarding or accelerating the rotor and stator of the motor by means of compressed air and in such a manner that I save a portion of the energy which is ordinarily dissipated through resistances and store it to assist in starting the car, helping over grades, for use in switching purposes and for operation of the brakes.

Third.—By this method of control I secure an infinite number of speeds from zero to the maximum speed of the car, which may or may not be at the synchronous speed of the motor, for with the air-controlling mechanism working compressing, the speeds below synchronism are maintained, and by reversing the direction of the air through the controller speeds above synchronism may be attained for reasonable distances.. This feature gives to the alternating-current motor the element absolutely essential for practical railway work, for it permits a car or train to ascend a grade at any speed with the motor working at its maximum efficiency and imparting its full power to the car. When descending the grade the motor may utilize its full power drawn from the line in compressing air or it may be used to compress air with the stored energy of the train, thereby acting as a brake.

Fourth.—By virtue of the air-storage feature each car becomes an independent unit and capable, in case of loss of current from the line, of running a reasonable distance without contact with the working conductor and without the aid of storage batteries. This feature will enable a car to work on a high-tension trolley wire or active conductor over private right of way and allow the active conductor to be stopped where the private right of way ceases and the car to proceed through a city or town on any tracks, whether electrically equipped or not, until it reaches the outskirts of the city or town, where it can take up the working conductor again on private right of way. This feature is also valuable in switching work, for each car being independent it can leave the main line track and operate over switches or sidings without complicating the yards with additional overhead or third-rail conductors, thus necessitating through-line conductors over main-line tracks only.

Fifth.—Since a single-phase motor can be used the motors can be supplied with current from a single overhead wire or third rail and with a single-rail return circuit, thus permitting the overhead constructions, or third-rail constructions, to conform to the standard of to-day, except that a much higher working voltage can be used provided the insulation is taken care of. Furthermore, in steam railway work this system, by virtue of its single-phase feature, will only require the use of one of the track rails for the return circuit, thus leaving the other rail for the use of the signal system, which, up to the present time, does not seem to have been satisfactorily solved without the use of one of the track rails.

Sixth.—Current may be taken from the working conductor at any voltage up to the limit of the insulation, and in case this voltage is high (I am building my line for 15,000 volts) a static transformer will be carried upon each car and the pressure reduced from the line voltage to the voltage of the motor, which in the case under construction is designed for 200 volts. Where it is unnecessary to utilize so high a line pressure the motor may be designed for the working voltage and the current fed directly from the working conductor into the motor, thus eliminating the static transformer. When a high-voltage working conductor and static transformer is used, and it is thought advisable to use a working conductor through cities or towns, this working conductor will be supplied with energy through a stationary transformer at each city limit, thus making the working conductor through the cities or towns safe.

Seventh.—By virtue of the speed of the motor and its constant load, either when the car is in motion or when it is standing still and the motor is compressing air, the variable load now customary in electric railway power plants is eliminated and the power station works at practically a constant load, thereby eliminating a large part of the investment at present necessary in power station and line construction. Furthermore, by virtue of the air-storage feature, each car, in the particular apparatus I have designed, is capable at any time when current is on the working conductor of delivering to the car wheels a much greater torque in proportion to the capacity of the motor than is possible with any electrical system known to-day.

I believe that by the adoption of this system the following results will be accomplished:

First.—The entire elimination of the present standard system of rotary converter sub-station plant, together with the maintenance thereon and the cost of the necessary attendants.

Second.—It would absorb and render available for useful work in starting, or otherwise, a large percentage of the energy store in the moving mass which under the present methods of operation is dissipated at the brake shoes.

Third.—A large reduction in the first cost of electrically equipping long-distance railways, thereby making it feasible, from an engineering and business standpoint, to equip many roads which cannot now be shown to be advisable, thus opening up the steam railroad field to the industry in which we are now engaged.

* Address delivered before the American Institute of Electrical Engineers at Great Barrington, Mass., June 19, 1902.

The Interurban Freight Question at Indianapolis

Indianapolis, admittedly regarded as possessing advantages calculated to make it one of the greatest interurban centers in the country, after having disposed of the question of terms for admitting the interurban lines to the city, is now considering the freight question, realizing that this subject must be properly disposed of before there can accrue to the community all of the benefits that should follow the operation of the interurban lines. Although the terminal franchises granted by the city to the interurban lines required the companies to establish a freight service and have freight stations within the city limits, the establishment of a limited freight service has already developed the fact that every business has certain and unalterable laws which are pretty sure to bring about unexpected complications and stubborn opposition by the resident public. Hauling merchandise in car lots at all hours through the city means the turning of numerous resident streets into railway lines, and the residents are entering an emphatic opposition and threatening to obtain relief through the courts. The plan of loading and unloading between 2 o'clock and 4 o'clock in the morning is also meeting with objection from the merchants and manufacturers. How to overcome these objections, some of which are justifiable, is the question that must be settled. The plan of having a loop for the interurban lines as the basis of a joint terminal system has been suggested.

But this is not the only question to be settled, for the Mayor and merchants differ in regard to the questions of interurban freight rates and the power of the city to regulate them. The Mayor doubts the city's power to regulate by schedule the price of hauling freight to points beyond the city's limits and earnestly believes a franchise with freight rates could not be enforced. On the other hand, the merchants insist that the city can provide a maximum figure and make it one of the conditions of the road being allowed to enter the city. A conference will be held, Wednes-

day, June 25, between the city authorities and all the representatives of the interurbans that are now running into the city, also those that are projected, for the purpose of considering the plan to establish a joint terminal station and agency and to consider the question of rates to be charged for freight traffic.

The plan most likely to be adopted is to have the Indianapolis Street Railway Company construct a belt line about the city. All the interurban cars would enter Indianapolis over the belt route, and this would lead to the establishment of a joint terminal passenger and freight station down town. President McGowan, of the Indianapolis Street Railway Company, is said to favor this plan, and says his company will build the terminal station. The steam roads, it is said, are likely to raise a legal question by asking the city authorities for a franchise to run cars over the Indianapolis Street Railway Company's tracks in order to gather freight. The steam roads, it is said, will endeavor to show by the State law, under which the Indianapolis Street Railway Company's franchise was awarded, and by the city ordinance granting the franchise, that there is no authority to carry freight on street car tracks. The franchise says the Indianapolis Street Railway Company or any interurban company using its tracks may haul freight over its lines without the consent of the Board of Public Works. The interurban lines will insist at the conference that the city should eliminate the special tax on interurban cars for entering the city, so the money can be used to pay rent for the union passenger and freight terminal which the local company proposes to build. President McGowan, of the Indianapolis Street Railway Company, has suggested that his company has the right to lease the cars of the interurban companies at the city limits and haul them over its tracks, on which it pays a tax of $35,000 a year, and thereby deprive the city of the tax collected from interurban cars. This plan would be opposed by the city, as it is in no mood to eliminate the tax. Thus it will be seen that the interurban freight question is a perplexing one, and several conferences may be required to arrange the matter amicably, if litigation dos not arise.

Electric Cars on Steam Railroads*

BY E. A. EVANS.

A paper was recently read by C. H. Davis before the Canadian Society of Civil Engineers on the competition of steam and electric parallels in which, among other conclusions, Mr. Davis took the ground that "steam railroads will in the near future handle their suburban and short-distance interurban passenger traffic and mail, express, baggage and local freight carried in suburban and interurban passenger trains by electric motive power, and this irrespective of whether operating expenses are affected favorably or unfavorably." In this conclusion the writer fully agrees, and proposes to show that to carry out this conclusion it is not even necessary to construct a parallel, but, on the contrary, that steam trains and electric cars can be safely operated upon the same track.

The writer, as manager of the Quebec Railway, Light & Power Company, part of which was formerly the Quebec, Montmorency & Charlevoix Railway, a steam road operating between the city of Quebec and Ste. Anne de Beaupré and St. Joachim, a distance of 30 miles, inaugurated a service of electric cars upon the same track and running between the usual steam railway trains. The scheme was generally considered a bold one, and it was not believed that it would meet with success. The results, however, as will presently be shown, have more than justified the innovation and the expenditure incurred.

The Quebec, Montmorency & Charlevoix Railway, as it was formerly called, after leaving Quebec passes along the flats comprising the north shore of the St. Lawrence. For 6 miles there is a continuous row of farmers' dwellings on both sides of the highway, which, however, is on the top of a cliff running parallel to the railway and at a distance varying from one-half to one mile from the track. At Montmorency the line runs through a small village the inhabitants of which are mostly operatives in a large cotton factory, and from here the line runs through the following parishes: L'Ange Gardien, population about 1400; Chateau Richer, population about 2000; Ste. Anne de Beaupré, population about 1500, and St. Joachim, population about 1000. Before the innovation of the electric system this community was served in the winter by two daily steam trains leaving Quebec at 8:50 a. m. and 5:15 p. m. and leaving Ste. Anne de Beaupré at 7:15 a. m. and 11:40 a. m., in the summer by four daily steam trains leaving Quebec at 7:30 a. m., 10 a. m., 5 p. m. and 6:15 p. m. and Ste. Anne de Beaupré at 5:45 a. m., 7:23 a. m., 11:50 a. m. and 4:10 p. m. There was also an additional steam train between Quebec and Montmorency leaving Quebec at 2 p. m. and returning at 3:45 p. m. Special trains, as required, were also put in service to convey the large numbers of pilgrims visiting the shrine of Ste. Anne de Beaupré.

The residents in the thickly inhabited portion on top of the cliff between Quebec and Montmorency, previously mentioned, did not patronize the railway, but traveled by omnibuses, of which there were eight or ten.

The year previous to the introduction of the electric cars, 1899, the steam trains carried 253,054 passengers, including about 41,500 pilgrims to Ste. Anne de Beaupré. This did not appear to the writer to be satisfactory, especially during the winter, when residents would take advantage of the good winter roads and drives rather than submit to the inconvenience of waiting at a railway station to catch a train. As a result, it was decided to electrically bond the existing track, put up an overhead trolley wire high enough to allow of brakemen traveling with safety on top of box and freight cars, put in an alternating-current direct-connected generator at the electric power station at Montmorency and operate electric cars between the steam trains. These cars were each equipped with four 50-hp motors and Westinghouse air brakes, operated by an independent motor, and were so geared as to be capable of running at a speed of 45 miles an hour, standard railway car wheels being used. The cost of this work for the 30 miles of track was as follows:

Electrically bonding existing track	$5,022
Overhead trolley, including poles, etc	68,804
Six large double-truck cars, seating capacity fifty-four, with motors, etc., complete	51,606
One 600-kw alternating-current direct-connected generator and water wheel and one 200-kw rotary transformer at Ste. Anne de Beaupré, including switchboards, etc	43,43
Total	$169,375

Upon its completion, in addition to the regular steam railway service, which was continued as before, cars were sent over the line between Quebec and Montmorency every hour between 6:30 a. m. and 9:30 p. m. and between Quebec and Ste. Anne de Beaupré about every three hours. The following comparative statement shows the result of the year's operation in 1901, from which it will be noted that there was an increase of 318,320 passengers carried and an increased revenue of $29,071.39, with an increased expenditure of $5,698.46. From June 30, 1901, to June 12, 1902, there has been a further increase of 86,392 passengers over the corresponding period of last year.

COMPARATIVE STATEMENT OF TICKETS SOLD AT DIFFERENT STATIONS

	1899—STEAM		1901—STEAM AND ELECTRIC	
	Passengers	Amount	Passengers	Amount
Quebec	108,103	$20,107.20	259,364	$33,976.70
Quebec Pilgrims	41,329	7,687.35	106,280	13 922.34
Hedleyville	2,431	452.30	4,759	623.45
Beauport	20,241	1,626.25	47,237	4,991.40
Montmorency	17,070	2,963 60	64,535	6,294.31
L'Ange Gardien	11 062	1,427.10	15,669	2,048 25
Chateau Richer	12,652	2,274.25	18,885	2,879.70
Ste. Anne	23,738	4,569.45	33,190	5,404.55
Beaupre	2,198	463.60	3,691	611.50
St. Joachim	2,920	563.00	10,557	1,596.62
Agencies	11,310	2,087.45	7,207	944.12
Totals	253,054	$44,221.55	571,374	$73,292 94

The omnibuses previously referred to have been withdrawn from business, notwithstanding the inconvenience of passengers having to walk up the cliff to get to the public road and their houses, and traffic has now so much increased that it has been found necessary to run cars every half hour between Quebec and Montmorency and about every hour between Quebec and Ste. Anne de Beaupré, although the steam trains are still run as formerly. On Sundays and holidays the resources of the company are fully taxed, and it has been found necessary to increase the rolling stock with cars having a seating capacity for 120 passengers, and in addition to the regular cars to run specials at from ten to fifteen minutes' interval. It has also been found absolutely necessary to construct a double track between Quebec and Montmorency.

The writer, as an old steam railway engineer, would like very much to enlarge upon the subject of suburban railways and the desirability of steam railway managers studying and taking up the subject, but enough has been said to show that it is advisable to leave the old groove and not allow other and independent street railways to compete for suburban traffic. It might perhaps be as well to mention that, notwithstanding the traffic mentioned, steam freight and special pilgrimages trains are being constantly handled and that no collision or any other accident has so far occurred.

* Read before the Canadian Electrical Association, Quebec, June 12, 1902.

Street Railway Development in New York State

The map presented herewith has recently been compiled and gives the existing and projected street railway lines in the Empire State. A glance at the map shows that while the increase of mileage during the past ten years, as given in the table below, has been over 1000 miles, the next few years will be an era in electric railroad building such as this State has not seen before. When the dotted lines which represent projected railways are changed to the solid lines that stand for roads completed and in operation the State will be traversed by a network of trolley lines aggregating over 4000 miles and capitalized at between $300,000,000 and $350,000,000.

During the past year some forty companies have been incorporated in this State to build over 600 miles of track through a suburban country, which, reckoned with the companies hitherto incorporated, but not yet doing business, brings the total of projected lines up to 1200 miles. The accompanying map shows not only the existing lines and their proposed extensions, but projected lines that have given indications of building in the near future. Besides these there are other companies formed and being organized which are sure to greatly increase these figures.

While the building of electric lines in this State has not kept pace with the growth in some of the New England and Western States, the following tabulation shows that great advances have been made during the last decade:

	1891.	1901
Miles of track operated	1,084	2,417
Capital stock	$90,321,983	$193,558,438
Assets	91,351,865	451,943,153
Liabilities	90,321,983	443,652,546
Gross earnings	20,153,973	43,068,405
Operating expenses	14,914,204	24,501,456
Cars, box and open of all kinds	6,000	12,000
Horses	27,138	6,084
Passengers carried	410,720,306	1,162,439,614
Number of employees	15,803	27,914

Although much has been said in the newspapers throughout the eastern section of the country concerning the feasibility and probability of a trunk line between New York City and Buffalo, such a project cannot be realized for some time to come. The map shows that at the present time one can travel from New York City as far north as Tarrytown. From Tarrytown there is no trolley line until Ossining is reached, where a small local road is in operation. Then comes a long stretch to Peekskill, where a line runs east about 5 miles to Mohegan. From the latter place to Fishkill there is no trolley. From Fishkill Landing to the village a line is in operation and in the near future will be connected with the road running along the Hudson River to Poughkeepsie. From the latter place to Hudson no existing or projected line is shown on the map. In other words, to connect up the missing links which now exist between Tarrytown and Hudson it would necessitate the building of some 90 miles of track catering to a population of something less than 170,000, including Tarrytown and Hudson, the termini. The prospects of a road from Poughkeepsie to Hudson, however, seem at present to be quite good.

At Hudson begins the longest trolley system in the State, extending through Albany, Troy, Waterford, Mechanicsville, Stillwater, Sandy Hill, Fort Edward, Glens Falls and Caldwell to Warrensburg, a distance of 105 miles. This is not only the longest line but the pleasantest trolley excursion route, for the road from Hudson runs through a semi-mountainous, pastoral country, affording a grand view of the Catskill Mountains on the left, while on the right the Berkshire Hills are plainly seen. There are also large tracts of highly cultivated farms, with many little villages located here and there. From Albany the line follows the banks of the upper Hudson for many miles to the foot of Lake George, acknowledged to be the most beautiful body of water in New York, if not in the United States. From Mechanicsville a line will shortly be in operation through Ballston Spa, Saratoga, to Saratoga Springs, the noted pleasure resort. From Saratoga the Hudson Valley Railway Company, which operates the line from Waterford to Warrensburg and to the Springs, will build in the near future a line to Schenectady and also from Saratoga to Glens Falls, although neither of these extensions will be built without strong opposition on the part of the Schenectady Railway Company, which claims to have the right to build from the latter place to Ballston Spa, and the North River Railway Company, which has been recently incorporated to build the line from Saratoga to Glens Falls.

The feature of the map which strikes the eye first is the almost unbroken sequence of constructed and projected lines connecting Hudson with Buffalo and almost reaching west as far as the Ohio State line. It is along the Mohawk Valley, the central and western portions of the State, that the greatest progress is being made. It certainly will not be long before the line reaches continuously from Hudson to Lake Erie.

Starting from Albany, where the Albany & Hudson line terminates, we find a line running west as far as Schenectady, a distance of 18 miles, one of the most successful railways in the country, demonstrating as it does the practicability of running trolley lines parallel with steam railroads. From Schenectady a line will be in operation running through Amsterdam and as far west as Fonda. From the latter place no attempt has been made to construct a line until Canajoharie is reached. From here the Mohawk River Traction Company will build a line running west through Fort Plain to the village of Neillston, there connecting with a proposed line to Little Falls, where it will join the system of the Utica & Mohawk Valley, which runs through Herkimer, Frankford and Utica to Rome, a distance of some 40 miles. Up to the present time no effort has been made to connect Rome with Oneida, but the Syracuse & Suburban Company has signified its intention of building an extension from Fayetteville to Oneida, thus giving the latter place a trolley connection with Syracuse.

From Syracuse to Buffalo great activity is displayed by the incorporation of several companies to build competing lines and the intention of existing roads to extend their systems far into the suburban country, a project which they would have considered a wildcat scheme not many years ago, but are compelled to work out to-day in order to keep others out of the field.

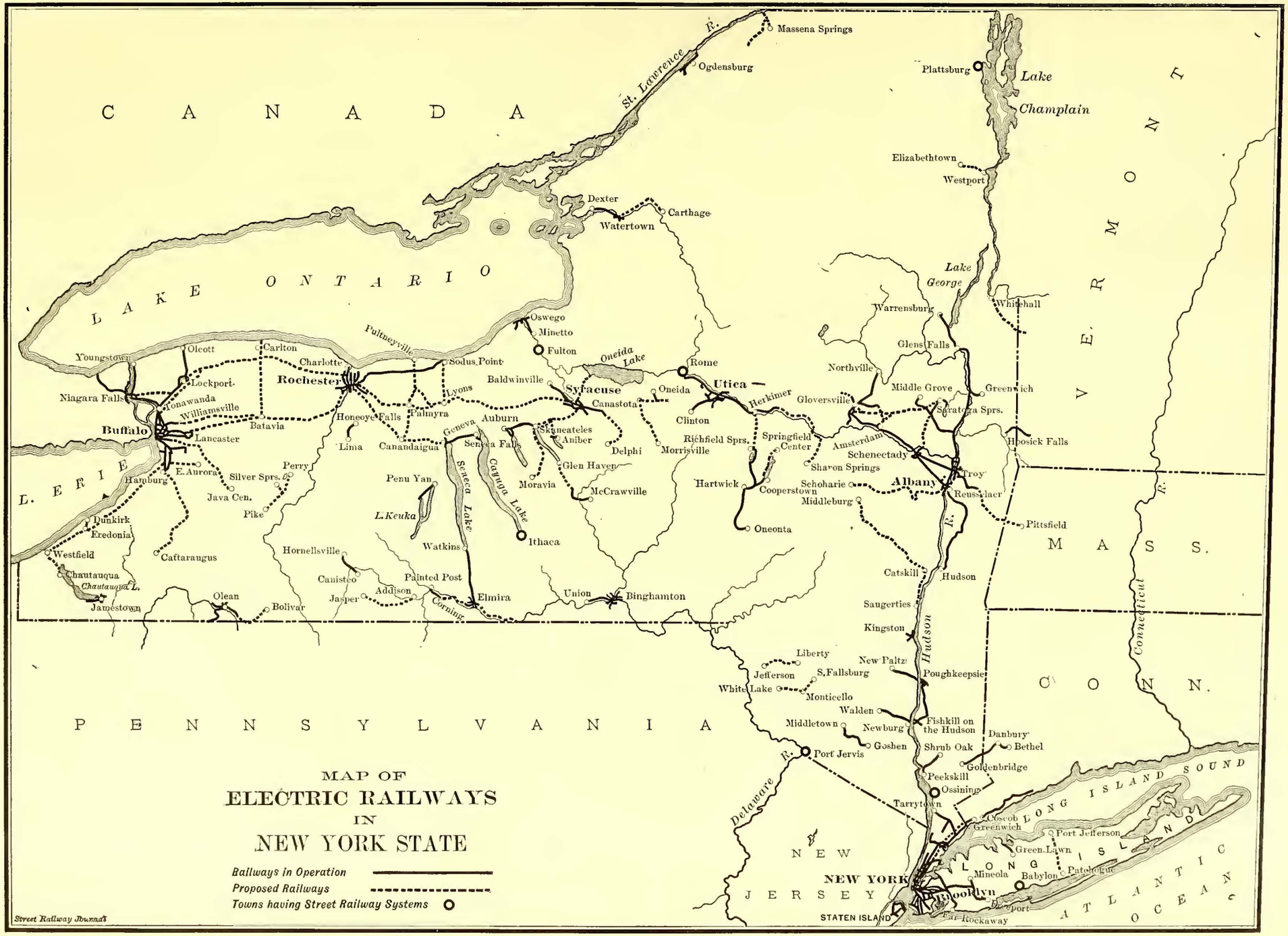
Returning to Syracuse and continuing along the trunk line west we find that there are two projected lines between this city and Rochester. The Rochester, Syracuse & Eastern Railway Company was incorporated last year to build a line connecting these two cities by a direct route, this company also purchasing the rights and franchises of the Fairport Electric, Macedon Electric, Palmyra Electric, Newark Electric and the Lyons Electric Street Railways, which were likewise incorporated during the year 1901. The distance between the two places over this route is about 110 miles. The other proposed line is via Skaneateles, Auburn, Waterloo, Geneva and Canandaigua to Rochester. With the exception of a small break between Auburn and Seneca Falls surveys have been made of the projected lines between these two cities.

From Rochester to Buffalo the position of the projected roads in this section suggest the formation of two trunk lines, for, while the Buffalo, Niagara Falls & Rochester Railway intends to build a line from Rochester to Buffalo and Niagara Falls, a greater portion of which will be along the historic Ridge Road, which was for many years the main artery of communication between Albany and Buffalo, at Hartford one line will run in a southerly direction to Buffalo and the other due west to Niagara Falls.

The Buffalo & Depew, a small road operating 7¼ miles between the two places, has filed in the office of the Secretary of State its intention to extend this line through Batavia, Leroy, Caledonia, Mumford and Scottsville to Rochester, paralleling the tracks of the New York Central and the Lehigh Valley. This proposed extension will necessitate the building of some 60 miles of track. The Buffalo & Williamsville Street Railway has also signified its intention of extending its line to Batavia.

From Buffalo west along the tracks of the Lake Shore and Pennsylvania Railroads, and following closely the shore at Lake Erie, indications point strongly to the building of an electric line for the Hamburg Street Railway, now operating a line from Buffalo to Hamburg. The evident intention is to extend this line through Bay View, Athol Springs and eventually to Silver Creek, where it will connect with the proposed line of the Lake Shore Traction Company, which was recently incorporated to build through Hanover, Sheridan, Fredonia, Pomfret, Brocton and Portland to Westfield.

So much for the "trunk lines." A number of projected branches may be found to be of little less importance. From Albany we have the projected line running out to Schoharie, which will in time be extended through Middleburg and Oak Hill to meet the Hudson again at Catskill. Another line from Albany and Troy will extend southeast to Pittsfield, Mass., there connecting with the Pittsfield and Berkshire systems, running south as far as the Connecticut line and north through Cheshire, Adams, North Adams, to Williamstown. As one goes further west the proposed line will be noticed running from Fort Plain to Sharon Springs, a popular summer resort. Another projected line will be built in the near future from Fort Plain through Springfield village to Cooperstown, with a branch line to Richfield Springs. This line will connect at the Springs and Cooperstown with the existing line of the Oneonta, Cooperstown & Richfield Springs Railway, which also proposes to build an extension from the Springs to the main trunk line at Herkimer. Following the trunk line west, several proposed branch lines running due north to the popular summer resorts along the shores of Lake Ontario will be seen.



MAP OF
ELECTRIC RAILWAYS
IN
NEW YORK STATE

Railways in Operation ——————
Proposed Railways - - - - - - - - - -
Towns having Street Railway Systems ○

Street Railway Journal

In addition to the lines mentioned, the Rochester & Sodus Bay is a very important one, running, as it does, between the two places mentioned, a distance of some 36 miles.

Buffalo has a very complete system of suburban lines. The lines of the International Traction Company run through Tonawanda and Lockport to the lake at Olcott, while another line follows the Niagara River to its mouth. On the south and east there are many projected lines.

In addition to the roads already referred to some mention should be made of the projected lines which, when completed, will be isolated for many years to come. The Liberty & Jeffersonville is now under construction. The Monticello, Fallsburg & White Lake, which proposes to build between the points mentioned, has obtained the necessary rights from the Board of Railroad Commissioners; the Mineola, Hempstead & Freeport has completed its line and is in operation; the Whitehall & Granville has let the contract for the construction of its line for some 20 miles in length, connecting Whitehall with Pawlet, Vt.; the Watertown & Carthage proposes to build about 20 miles of road between the two places, following closely the banks of the Black River. There are many other lines in this article not mentioned, but shown on the map, which will be in operation within another year.

The accompanying map was prepared by R. H. Derrah, who has recently been doing valuable work in this line for the authorities at Albany. At the rate the trunk lines are being formed it is safe to say that in the course of four years one will be able to start from Augusta, Maine, and use the trolley through the Pine Tree State, New Hampshire, Massachusetts, striking through Albany, Syracuse, Rochester, Buffalo, Cleveland, Toledo and Detroit to the northern portion of Michigan or westward to Chicago and other sections of Illinois and Indiana by one continuous grand trunk line. Or, again, one can follow this line from Maine as far west as Springfield, thence southward along the valley of the Connecticut and the shores of Long Island Sound, through the city of New York and the cities, towns and villages of New Jersey and Pennsylvania, to a point where it will join the trunk line referred to in the State of Ohio.

Defeat for the Three-cent Fare Lines in Cleveland

The 3-cent fare ordinance that Mayor Johnson, of Cleveland, had passed through the council a few months ago has met defeat at the hands of the Circuit Court by virtue of a decision rendered June 21. John B. Hoefgen, to whom the franchise was awarded, is perpetually enjoined from building the proposed railway in Cleveland. The decision of Judge Strimple dissolving the temporary injunction against the 3-cent fare people was overruled. The court held that the ordinance to construct a railway over three out of seventeen routes which the city advertised for was illegal for a number of reasons. The principal reason pointed out by the court was that in the original ordinance calling for bids all of the seventeen routes were regarded as one road comprising about 75 miles, but that in the ordinance granted only three routes were considered, comprising 13 miles. "It might have been possible," said Judge Caldwell, "that other bidders would have offered to carry passengers for less than Mr. Hoefgen on this 13-mile road when they would not care to bid on the whole 75 miles; yet they had no opportunity to bid on anything but the whole 75 miles."

The court said that the routes originally advertised for were changed in the franchise-granting ordinance. The change in one of the routes from Michigan Street to Champlain Street, the court held, was not permissible.

"At the time the routes were advertised for," said the court, "it was known that it would be almost impossible to secure the required number of consents on Canal Street and Michigan Street, and this may have prevented certain people from bidding who could not have known that the route would be changed later. The same argument holds true in the cases of other changes in the routes. There was absolutely no authority in law for the changes."

The court took exceptions to the municipal ownership and labor arbitration clauses in the ordinance, claiming that they were unreasonable provisions. The arbitration clause compelled the road to arbitrate with its employees and provided the manner of settling differences.

The injunction suit was brought in the name of William F. Raynolds, who is supposed to have been backed by the existing companies.

Mayor Johnson has announced in an interview that the case will not be appealed to the Supreme Court, but that a fresh start will be made to secure the low-fare roads. It will be necessary to receive new applications for routes, to advertise for bids and repeat all the work in order to avoid the errors the court has pointed out. Separate ordinances will be prepared for each route. Mayor Johnson claims that the consents of property owners will not have to be secured again.

Toronto Street Railway Strike

Employees of the Toronto Railway Company last week made a demand upon their employers for an advance in wages to 25 cents an hour, recognition of the union and the reinstatement of Business Agent McDonald, who had been dismissed. The company positively refused to grant the men's demands, but offered to pay from 17 cents to 21 cents. This concession was not sufficient to satisfy the leaders and a strike was declared on Saturday. The men were well organized, but the leaders were unable to control them, and as soon as the company began running cars the new men were assaulted, the windows in the cars were broken, and, when the new hands persisted in running the cars to the end of the line, the strikers boarded them, removed the motormen and conductors, derailed and in one instance overturned the cars and heaped indignities upon the passengers.

The first demonstration on the part of the mob convinced the civic authorities that they could not cope with the strikers and an appeal was immediately made to the military officials for assistance. The response was prompt and effective. Troops were immediately summoned, 750 mounted men from the Niagara camp, consisting of 250 of the Governor-General's body guard, 200 mounted rifles and 250 men of the First and Second Dragoons, left Niagara with their horses in three special trains at 10 o'clock Sunday and arrived at daylight on Monday. In addition, 300 of the Queen's Own, 300 Grenadiers and 200 Highlanders were ordered to parade at the armories, and 700 extra policemen were sworn in. These measures brought the strikers to their senses. Several rioters were arrested and every outbreak was promptly quelled. The cars were started out, and, protected by the troops, were run without molestation. On Monday afternoon the men agreed to compromise, as the result of the intermediation of the Board of Trade, and the 1400 cavalry and infantry, composed of regiments from the Niagara camp and the local militiamen, were dispersed. The agreement provided that the men shall receive 18 cents per hour for the first year and 20 cents thereafter. With regard to recognition of the union, it says: "The company will not interfere with the freedom of the railway employees to organize under any form of constitution, but the company declines to give recognition to the union or to receive a grievance committee from the union, but any employees who may have been suspended or dismissed, or who may have any other grievance, shall have the right of an appeal in person to the general manager and to bring with him such of his fellow-employees or other witnesses who may have any knowledge of the facts and circumstances of the case." At a meeting of the union Monday evening the agreement was unanimously ratified.

Trolley Trips Through Southern New England

For four years the publishers of the little book with the above title have been increasing the size and improving the artistic features therein, and the present edition, which has just been issued, is one of the handsomest productions in the way of a general trolley guide that has yet appeared. The text is embellished by a large number of excellent half-tones, and contains, besides the dry data as to routes, times, fares, etc., a very large amount of exceedingly interesting and well-written descriptive matter. The bright, yellow cover contains a unique design showing the improvements in transportation facilities which have occurred during the last century, the picture at the top illustrating the old stage coach and that at the bottom a modern interurban trolley car. The side trips from the principal cities in the district covered are given considerable space in the book, so that in any section the public can find, from a perusal of its pages, delightful and inexpensive outings, especially during the open-car season. The illustrations are exceptionally numerous, there being nearly 100 fine views of town and country. There are nine maps; four of them are used to show the trolley lines between New York and Boston, and include nearly the whole of the States of Massachusetts, Rhode Island and Connecticut; the remaining five show in detail the lines in and near Bridgeport, New Haven, Hartford, Springfield and Worcester. The tables give distances, fares and running time in concise form. It is printed on good paper, and, in short, the make-up is far ahead of what one would expect in a book of the kind. The publishers are White & Warner, of Hartford, Conn., and the price is the moderate sum of 10 cents.

Method of Ascertaining by Means of a Dynamometer Car the Power Required to Operate the Trains of the New York Central & Hudson River Railroad Between Mott Haven Junction and Grand Central Station, and the Relative Cost of Operation by Steam and Electricity*

BY BION J. ARNOLD.

In August, 1901, the writer was commissioned by the New York Central Railroad Company to study the conditions governing the operation of its trains between Mott Haven Junction and Grand Central Station, and to report upon the feasibility of operating them by electricity. This division consists of 5.3 miles of four track road forming the trunk line, or main artery over which the trains from the three divisions of the New York Central and the main line of the New York, New Haven & Hartford Railroads enter the city of New York. For 2.58 miles from Mott Haven Junction the tracks are carried on an elevated stone and steel structure; then for 2.04 miles through a tunnel underneath the street, emerging into an open cut .68 of a mile long, then terminating at the Grand Central Station in an intricate stub-end yard, having about 8 miles of switching tracks. Fig. 1 shows the map of this yard. Over this division are made nearly 600 train movements per day, as almost all trains entering the yard or station must be returned to Mott Haven Junction, owing to lack of sufficient storage tracks at the Grand Central terminus.

The annoyance to passengers due to the use of steam locomotives in the tunnel, caused the company to examine into the advisability of adopting electricity, and it is through the courtesy of W. J. Wilgus, chief engineer of the company under whose directions the investigation was made, that the writer is allowed to present to this institute the technical substance of this report.

All money values relating to total cost of installation, real estate, etc., and many other elements upon which the final recommendations of the report were based, together with many of the general recommendations and conclusions themselves, are

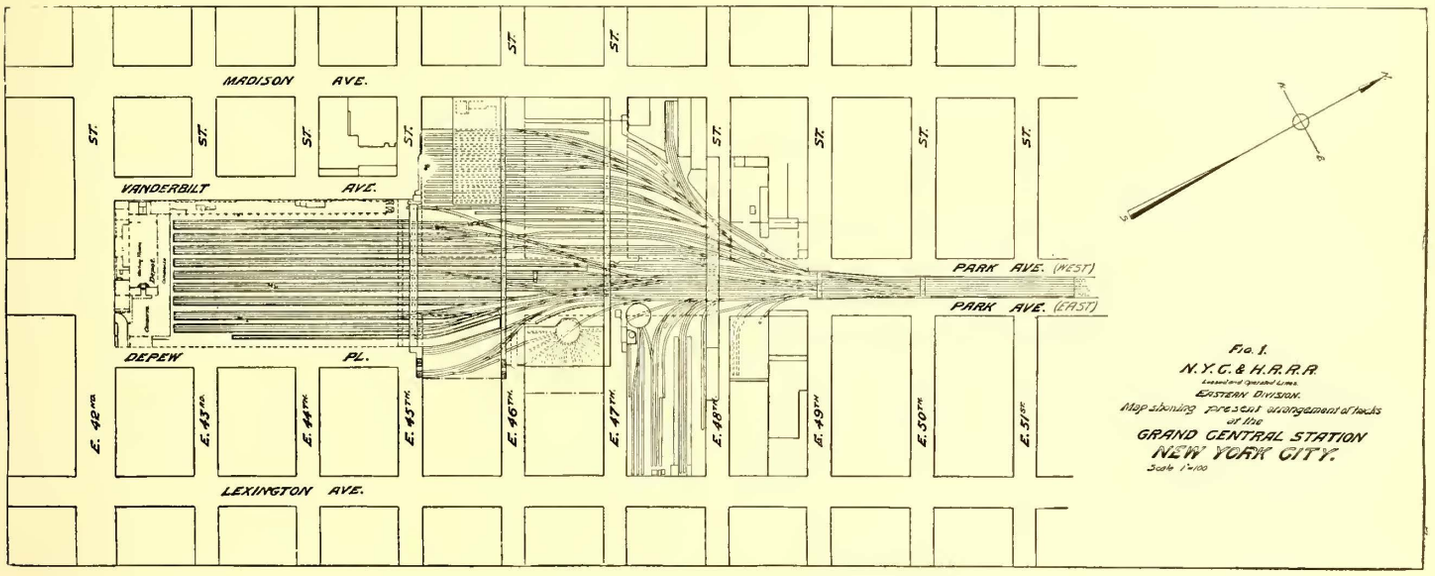


FIG 1.—NEW YORK CENTRAL TERMINAL YARD

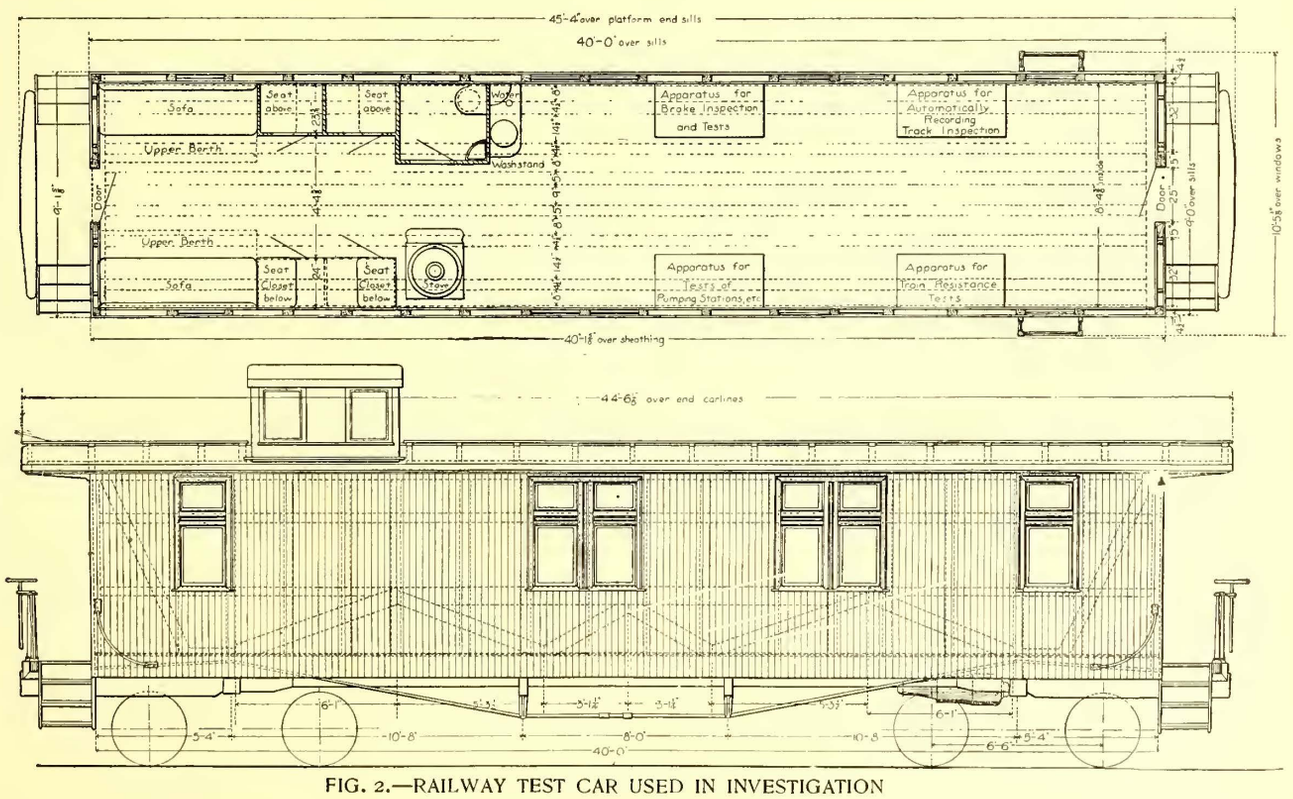


FIG. 2.—RAILWAY TEST CAR USED IN INVESTIGATION

* Read before the American Institute of Electrical Engineers, Great Barrington, Mass., June 19, 1902.

necessarily omitted from this paper, but it is believed that the data given is sufficiently complete to enable one to check the technical conclusions herein given.

Soon after taking up the work it became evident, on account of the number and weights of the trains to be handled and the numerous variable elements entering into the operating system, which would not adapt themselves conveniently to formulæ, that the most practical and satisfactory way of ascertaining the power required to propel the trains was to measure, by means of a dynamometer car, the "draw-bar pull" of a sufficient number of trains of various weights, to determine the average power required per train and from this compute the general load diagram.

A dynamometer car known as "Test Car No. 17," owned jointly by the Illinois Central Railway Company and the University of Illinois, was secured, and men thoroughly skilled in its use were employed to operate it. This car was coupled between the engine and the train in each case, and operated on trains running over the different divisions of the road, so that not

FIG. 3.—VIEW OF DYNAMOMETER CAR

less than four runs, two or more in each direction, were made for each class of train. Since the trains of all divisions, including those of the New York, New Haven & Hartford Railroad, run over the New York Central tracks between Mott Haven Junction and Grand Central Station, the records of the New York Central trains for this division will apply to trains of equal weight on the New York, New Haven & Hartford road, and were so considered in the calculations.

Description of Dynamometer Car.—In the dynamometer car employed, which is shown in Fig. 2 to Fig. 6, inclusive, the draw-bar is secured by means of a suitable rod to a piston head which fits closely in a cylinder filled with oil. The pull at the draw-bar thereby produces a pressure upon this oil which is transmitted through suitable piping to the recording device, consisting essentially of a Bourdon gage, which by means of a suitable arm and pen records upon paper, driven past it by gearing from the car axle, in such a manner that the height of the record from the base line is proportionate to the draw-bar pull. This base line, and time and position lines are produced by separate pens, the former recording every five seconds by means of clock-work, and the latter recording at mile posts, stations, etc., when an electric circuit is closed by hand. The other instruments in use on the car during these tests were a Boyer speed recorder, an anemometer for recording the relative velocity of the wind, and a weather vane showing the direction of the wind relative to the direction of travel of the car.

The dynamometer cylinders and a diagrammatic arrangement of the car are shown in Fig. 6. The cylinders are made of three castings held together by stud bolts not shown in the figure. The effective area of the largest cylinder is 60 sq. ins., of the intermediate cylinder 30 sq. ins., and of the smallest 5 sq. ins. It is intended that the working pressure of the oil in the cylinder should be from 300 to 1000 lbs. per square inch, and for this range of pressure the largest cylinder has sufficient capacity for the heaviest freight service, the intermediate cylinder would be used when working with a train of ordinary tonnage, and the smallest cylinder when working with a train of light tonnage. If it should become necessary all the cylinders could be coupled up in multiple, thus giving an effective piston area of 95 sq. ins.

The cylinders are reamed and the pistons and piston rods ground. The forward end of the gland is ground spherical and fits into a spherically ground seat in the stuffing box casting. This spherical seat is used to permit the three sleeves to align themselves properly on the rod. The pressure of the oil keeps the gland on its seat, and this oil is supplemented by the pressure of several helical springs placed between the rear end of the sleeve and the plate shown at the inner end of the stuffing box. The pistons will gradually move forward on account of leakage, but so slowly that the cylinders can be refilled from the pump at stops, or, if necessary, when the cylinders are under pressure. This design was resorted to in order to avoid the uncertainty concerning the frictional resistance incident to the use of the usual packed pistons and stuffing boxes.

In Fig. 5 is shown the table upon which are placed the dynamometer recording gage, the rolls for driving the paper chart and the Boyer speed recorder. The vertical shaft projecting through the floor under the middle of the table derives its motion from the car axle by means of worm and bevel gears. Its motion is transmitted by means of the gears shown, to the speed recorder and the paper driving apparatus. This consists of a pair of driving rolls, around which the paper passes, and supply and receiving rolls. The paper is drawn from the former and fed to the latter after running over the drum of the recorder.

DISCUSSION OF DYNAMOMETER RECORDS

Fig. 7 to Fig. 14, inclusive, show the dynamometer car records of eight different classes of trains which are in daily operation over some of the divisions of the road. On each record is shown graphically the following:

(1) The "draw-bar pull" of train shown in the irregular heavy line as recorded by the pen of the dynamometer cylinder, each inch of height from the base line being equivalent to 7428 lbs. of draw-bar pull exerted by the engine on the train, which is shown in outline on the record, the horizontal scale being 13.2 ins. to the mile.

(2) The speed of the train, as shown by the regular dotted line, each thirty-second of an inch of height representing a speed of 1 mile per hour.

(3) The profile of the road is shown at the bottom and the alignment at the top of each record, so that it is possible to calculate by formulæ the theoretical horse-power required to haul the train under the conditions of each case and after equating for grade and curvature, check the result by the curves here given.

It should be noted that the records do not include the power required to propel the locomotive nor the head-end resistance offered to it by the air, and that when the dynamometer car was running backward, the power to propel it is not represented in the record and its weight should not be taken into consideration as a part of the train. These factors were taken into account when determining the final load diagram.

The diagrams are arranged in the order of the train weights with the light trains first and a few trains have been introduced which do not operate over the particular division under consideration.

Fig. 7 represents a light suburban train running on the New York & Putnam Division from Putnam Junction to 155th Street.

Fig 8 represents a light suburban train of the Harlem Division

FIG. 4.—INTERIOR OF DYNAMOMETER CAR

which runs between Grand Central Station and Lake Mahopac.

Fig. 9 represents a suburban train which runs on the Harlem Division between Grand Central Station and White Plains.

Fig. 10 shows a moderate weight suburban train of the Harlem Division which runs between White Plains and Grand Central Station.

Fig. 11 represents a standard local through train on the Hud-

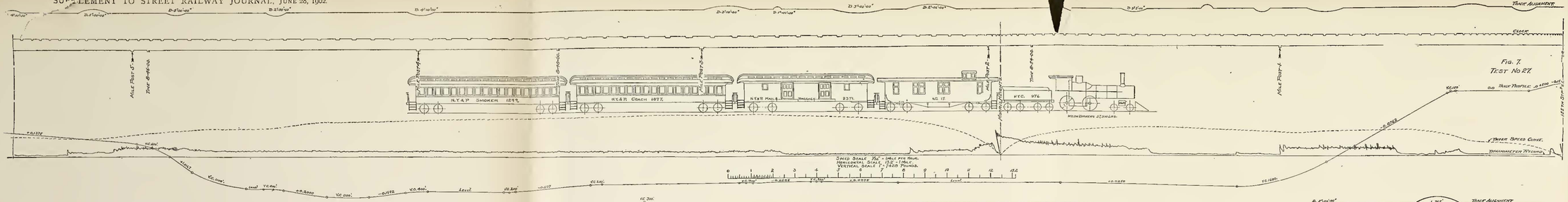


FIG. 7.—TEST NO. 27.

Putnam Junction to 155th St., Putnam Division.
Railway Test Car No. 17, November 5th, 1901
Passenger Train No. 2.
30 sq. in. cylinder in operation, test car backward
Engine 970 N. Y. C.

Weight of engine loaded	45.15 tons
Weight on drivers	28.65 "
Total Weight loaded engine and tender	80.15 "

Train as follows:

17	I. C.	Test Car	
2371	N. Y. & P.	Mail and Baggage,	48,200 lbs.
1877	"	Coach	17,700 "
1209	"	Smoker	50,000 "
			74.0 tons
		Passengers	8. "
			82.0 tons.

Weather.—Cool and cloudy at start, light rain, commenced at 7.30 and continued to end of test, temperature 40 F. Passenger and Anemometer records taken.
Rail good

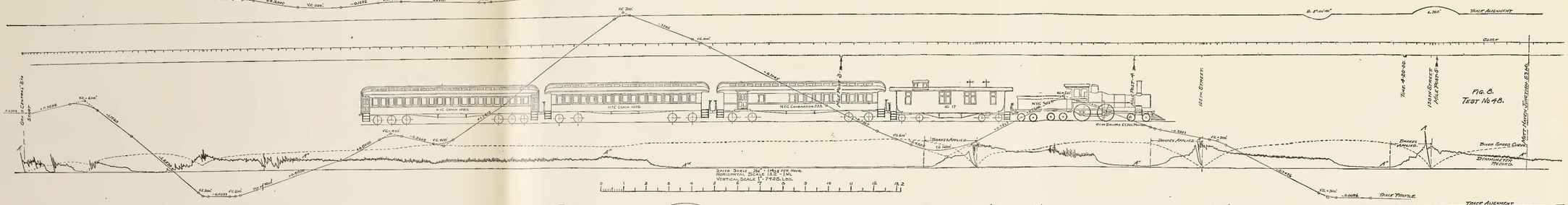


FIG. 8.—TEST NO. 48.

Grand Central Station to Lake Mahopac, Harlem Division.
Railway Test Car No. 17, November 14th, 1901.
Passenger Train No. 17.
30 sq. in. cylinder in operation, test car forward.
Engine 987 N. Y. C.

Weight loaded engine	49.25 tons
Weight on drivers	32.75 "
Total weight loaded engine and tender	84.6 "

Train as follows:

17	I. C.	Test Car	44,650 lbs.
283	N. Y. C.	Combination	59,600 "
1023	"	Coach	65,100 "
1087	"	"	86,500 "
			127.9 tons
		Passengers	9.4 "
		Total tonnage included in record	137.3 "

Weather.—Clear and dry, temperature 43 F.
Passenger and Anemometer records taken.
Rail good.

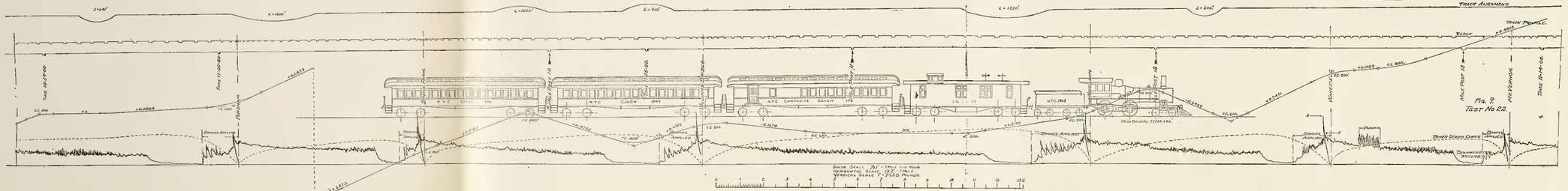


FIG. 9.—TEST NO. 22.

Grand Central Station to White Plains, Harlem Division.
Railway Test Car No. 17, November 21, 1901.
Passenger Train No. 111.
30 sq. in. cylinder in operation, test car forward.
Engine 1013 N. Y. C.

Weight of loaded engine	55. tons
Weight on drivers	38.5 "
Total weight loaded engine and tender	95.7 "

Train as follows:

17	I. C.	Test Car	44,650 lbs.
192	N. Y. C.	Combination	63,800 "
1049	"	Coach	84,340 "
840		"	57,960 "
			123.4 tons.
		Passengers	15. "
		Total tonnage included in record	140.4 "

Weather.—Fine, clear, temperature 61-68 F.
Wind very light, direction not noted.
Rail good.

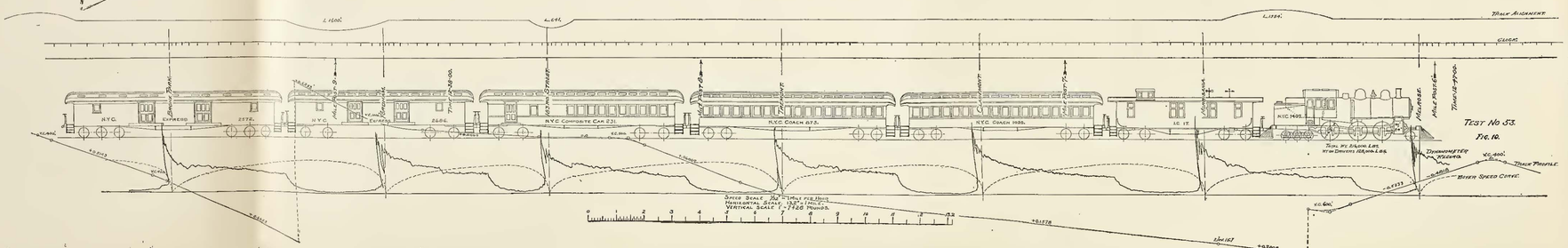


FIG. 10.—TEST NO. 53.

White Plains to Grand Central Station, Harlem Division
Railway Test Car No. 17, November 19th, 1901.
Passenger Train 190.
30 sq. in. cylinder in operation, test car forward.
Engine 1402 N. Y. C.

Total weight	108 tons.
Weight on drivers	64 "
Weight with tender	108 "

Train as follows:

17	I. C.	Test Car	44,650 lbs.
1020	N. Y. C.	Coach	65,500 "
873	"	"	60,900 "
231	"	Combination	60,300 "
2686	"	Express	54,300 "
2572	"	"	81,000 "
			183.3 tons.
		Passengers	36.6 "
		Total tonnage included in record	220.0 "

Weather.—Clear and dry, temperature 43 F.
Passenger and Anemometer records taken.
Rail good.

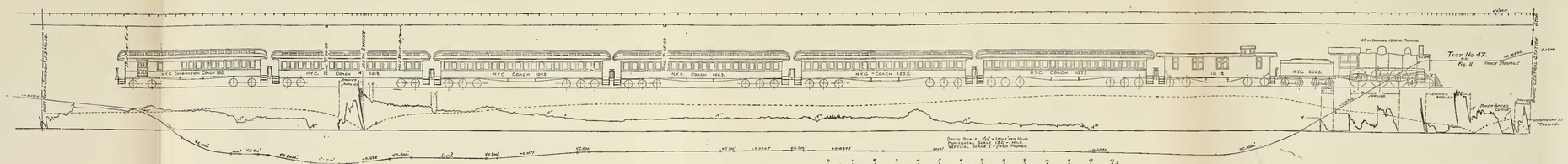


FIG. 11.—TEST NO. 47.

Poughkeepsie to Grand Central Station, Hudson Division.
Railway Test Car No. 17, November 13th, 1901.
Passenger Train No. 3.
20 sq. in. cylinder in operation, test car backward.
Engine 3023 N. Y. C.

Weight of loaded engine		87.5 tons.
Weight on drivers		67.15 "
Total weight with loaded engine and tender		143.6 "

Train as follows:

17	L. C.	Test Car	45,640 lbs.
1977	N. Y. C.	Coach	85,550 "
1523	"	"	81,800 "
1993	"	"	86,000 "
1602	"	"	90,600 "
3019	"	"	90,100 "
130	"	Combination	85,000 "
			224.6 tons.
		Passengers	33.3 "
Total tonnage included in record			267.8 "

Weather.—Fair and dry, temperature 42 to 59 F.
Passenger and Anemometer records taken.
Rail damp.

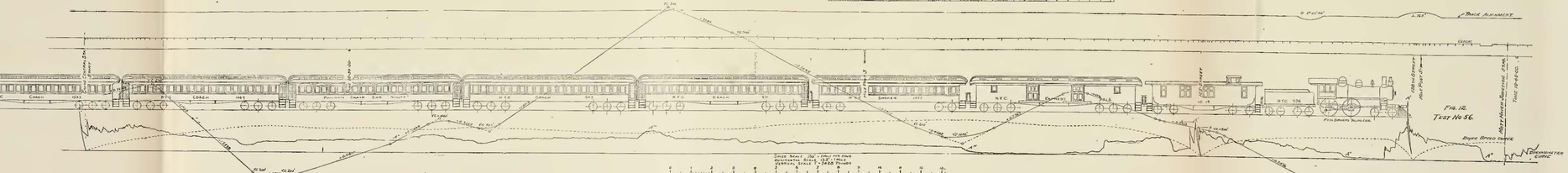


FIG. 12.—TEST NO. 56.

Grand Central Station to Schenectady, Hudson & Mohawk Divisions.
Railway Test Car 17, November 20th, 1901.
Passenger Train No. 7.
20 sq. in. cylinder in operation, test car running backward.
Engine 526 N. Y. C.

Weight of loaded engine		87.5 tons.
Weight on drivers		65.0 "
Total weight loaded engine and tender		141.1 "

Train as follows:

		Test Car	lbs.
6545	N. Y. C.	Express	77,800 "
1977	"	Smoker	85,500 "
521	"	Coach	85,300 "
941	"	"	92,000 "
"Ninita"		Pullman chair car	100,000 "
1993	N. Y. C.	Coach	84,400 "
1522	"	"	84,400 "
		Passengers	296.7 tons.
			11.8 "
Total tonnage included in record			311.5 "

Poughkeepsie:

1503	N. Y. C.	Coach.	Set Out.
220	"	Comb.	Taken Off.

Albany:

526	"	Engine.	Taken Off.
2013	"		Taken Off.
1503	"	Coach.	Set Out.
220	"	Comb.	Set Out.

Weather.—Clear, temperature 38 F.
Passenger and Anemometer records taken.
Rail good.
NOTE.—Calibration tests were made on the run between Albany and Schenectady.
NOTE.—When Dynamometer Car is running "forward" or "backward" its weight is or is not included in the Dynamometer record.

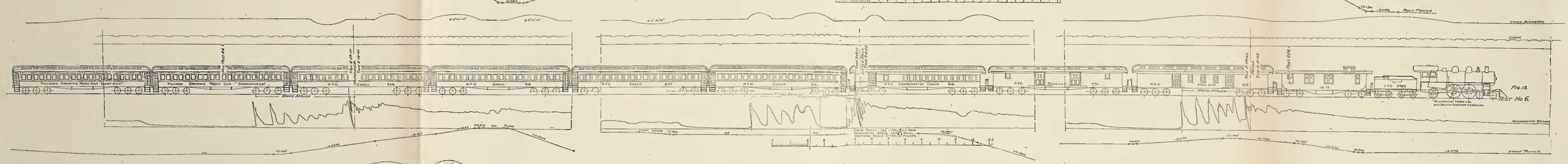


FIG. 13.—TEST NO. 6.

Syracuse to Albany, Mohawk Division
Railway Test Car No. 17, Oct. 25th, 1901
Passenger Train No. 14.
30 sq. in. cylinder in operation, test car backward.
Engine 526 N. Y. C.

Weight of loaded engine		88. tons.
Weight on drivers		67.4 "
Using traction harness		66.4 "
Total weight loaded engine and tender		144.5 "

Train as follows:

17	L. C.	Test Car	lbs.
215	N. Y. C.	Mail	86,300 "
770	"	Baggage	60,000 "
205	"	Combination	81,000 "
952	"	Coach	87,000 "
868	"	"	87,500 "
916	"	"	87,700 "
949	"	"	94,500 "
"Susquehanna"		Pullman Drawing Room Car	89,000 "
"Golfrey"	"	" " "	57,300 "
		Passengers	337.0 tons.
			17.0 "
Total tonnage included in record			334.0 "

Weather.—Clear.
Rail good.

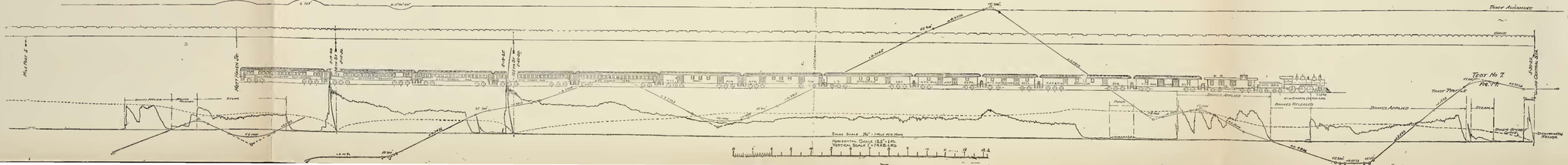


FIG. 14.—TEST NO. 7.

Chicago to New York.
Railway test Car No. 17, Hudson Division.
Passenger Train No. 28.
30 sq. in. cylinder in operation, test car running backward.
Engine 3124 N. Y. C.

Weight of loaded engine		87.6 tons.
Weight on drivers		67.15 "
Total weight loaded engine and tender		143.57 "

Train as follows

17	L. C.	Test Car	lbs.
2739	N. Y. C.	Baggage	59,000 "
302	C. C. C. & St. L.	Express	50,000 "
2771	N. Y. C.		44,500 "
2026	"	Baggage	52,500 "
585	"	"	59,100 "
2114	"	Mail	80,100 "
1986	"	Coach	70,000 "
960	"	"	94,800 "
928	"	"	97,900 "
"Navarre"		Pullman Sleeper	108,000 "
"Shenango"	"	"	97,000 "
		Passengers	434.45 tons.
			31.72 "
Total tonnage included in record			466.17 "

Weather.—Clear and cool, wind light, direction not noted.
Rail condition good.

son Division known as the Day Express, stopping at practically all stations.

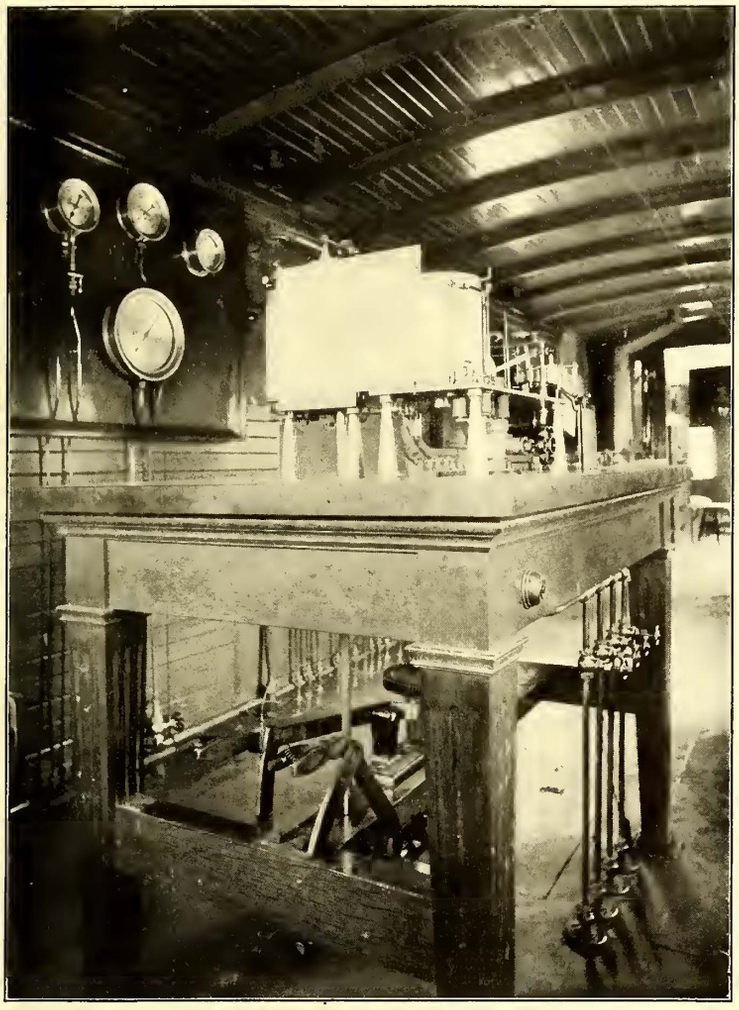


FIG. 5.—EQUIPMENT OF DYNAMOMETER CAR

Fig. 12 represents a through local train known as the Day Express, which stops at almost all stations.

Fig. 13 represents a through fast train between Buffalo and Albany, known as the New York & New England Express, which makes the fastest through time between Chicago and New York and Boston made by any train on the road. This record is introduced as an interesting example of the requirements of heavy through train service and as a part of the record taken on a through run from Chicago to New York, a distance of nearly 1000 miles.

The train was hauled by the latest type of New York Central passenger locomotive, which has hauled a train of sixteen cars, weighing, with the locomotive, over 900 tons, at a speed of 60 miles per hour, and maintained the schedule speed of over 45 miles per hour with the same train between New York and Albany. On the run from which Fig. 13 was taken the engine maintained for a considerable distance a speed of 63 miles per hour with ten cars, constituting, with the engine, a train weighing 494 tons, thus developing continuously 940 hp, assuming the ordinary allowance for head-end resistance due to wind or air pressure. At another time and with a heavier train this engine developed 1452 ihp at 63 miles per hour, 240 r. p. m., as shown by indicator cards.

Fig. 14 represents the record from Mott Haven Junction to Grand Central Station of a through heavy express train known as the New York & Boston Express, loaded heavily with express, mail and papers, but carrying few passengers.

It is thought that the records here introduced are sufficient in number and character to represent fairly well the several classes of duty required of the present steam locomotives, and what would be required from electric locomotives in case they should be adopted, as the problem submitted was to duplicate the present passenger train service between Mott Haven Junction and Grand Central Station, by using electric power instead of steam locomotives.

The questions of changes in the Grand Central terminal, or of the present method of train operation, or of handling the suburban trains on the division outside of Mott Haven Junction are not considered in this paper.

It appears that the braking effort per ton is not as high on certain types of locomotives as it is on coaches. This is due to the fact that not all the wheels of the locomotive are always braked, and those that are braked cannot be set to the skidding point with a fully loaded tender, for if they were they would then skid with a lightly loaded tender. Hence the draw-bar pull during retardation is often as great, or even greater, than it is during acceleration. An instance of this is seen in Fig. 12 at (b), where the maximum draw-bar pull due to the braking effort of the train on the locomotive is 11,950 lbs., while the maximum draw-bar pull exerted in starting the train at (c) is 9945 lbs. That is to say, in this particular run during the period over which all possible retardation is desired, the draw-bar pull instead of being zero, is 20 per cent greater than that available for acceleration. In Fig. 9, for the stop at Wakefield these figures become respectively 15,675 lbs., 9899 lbs. and 60 per cent. At all other stops on this record it is seen that the braking effort of the train is nearly equal to the maximum starting effort of the locomotive during acceleration.

The severe oscillation of the dynamometer pen on this record exhibits the irregular turning moment of the engine which is caused partly by unequal distribution of the steam in the cylinders, due to the lack of proper adjustment of the valve motion, and partly to the irregular turning moment of any two-cylinder engine of this type.

In Fig. 10, however, which is the record obtained from engine No. 1407—one of the latest suburban type engines on this road—

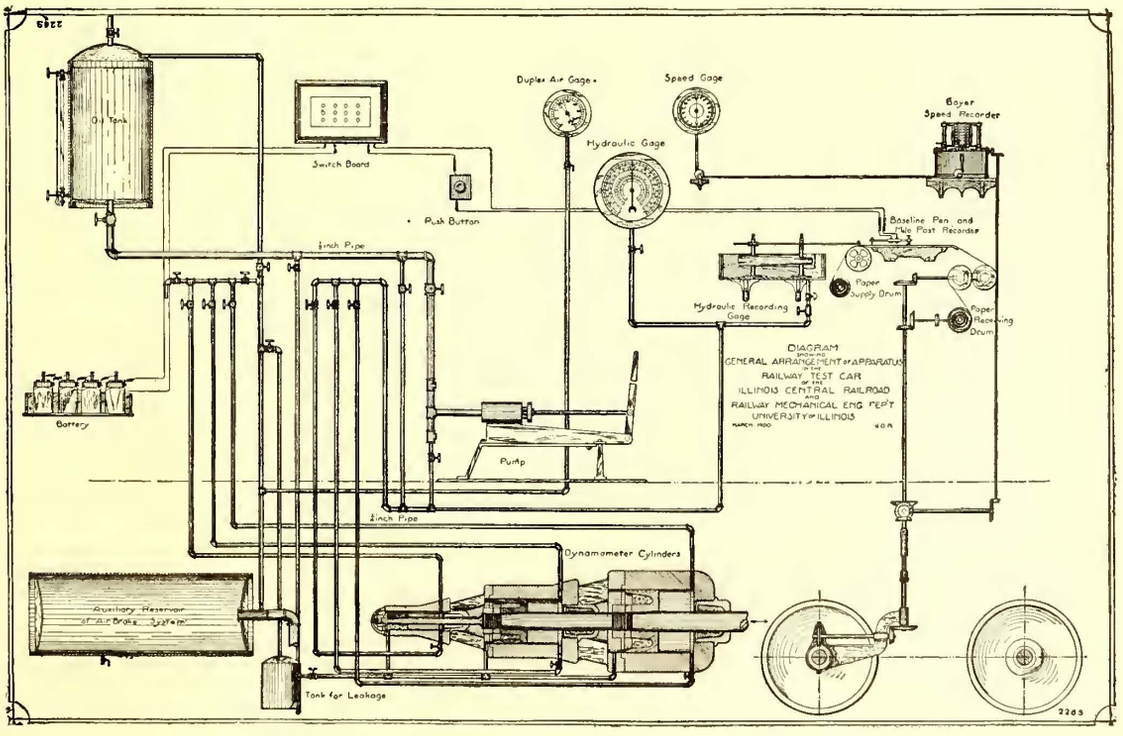


FIG. 6.—DIAGRAM OF EQUIPMENT OF DYNAMOMETER CAR

the smoothness of the record, and the perfect braking of the engine and train are noticeable.

Where these records are marked "pump," the dynamometer cylinder was being filled with oil from the hand pump provided for this purpose.

The various phases in the cycle of locomotive performance are

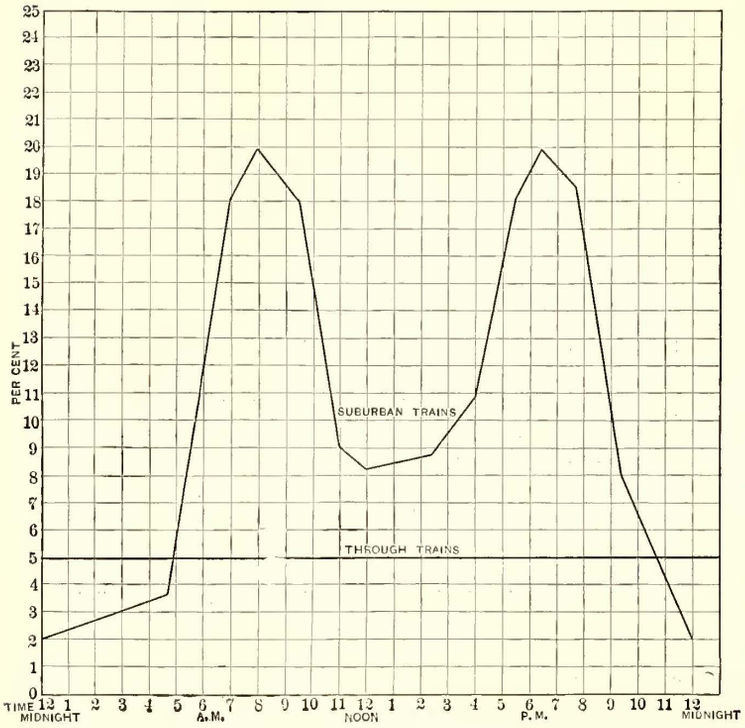


FIG. 15.—PERCENTAGE OF PASSENGER WEIGHT TO LIGHT TRAIN WEIGHTS, GRAND CENTRAL STATION TO MOTT HAVEN JUNCTION

clearly seen in the dynamometer records; thus, in Fig. 11, at (b) the engine was given steam, at (c) hooked up, and at (d) given more steam, at (e) again hooked up, and at (f) again given more steam; at A^5 steam was cut off and the train coasted to (g) where brakes were applied, released, and again applied at (h), etc.

ment, and finally a reduction of the draw-bar pull thus obtained to horse-power, and eventually to kilowatts. Owing to the fact that the maximum speeds on this division seldom exceed 35 miles per hour, and that the trains were never less than three cars in length—often reaching eleven cars in length—no correction was made for head end air resistance.

The successive steps were as follows:

(1) In order to determine the average draw-bar pull for any given period, the entire area under the dynamometer pen record was found by a planimeter and divided by the length of base of the interval from start to stop, the result being the average draw-bar pull. Thus, in Figs. 7 to 14 inclusive, which are characteristic dynamometer records, the areas A′, A″, etc., were found by a planimeter; by dividing any area thus found by the total length of its base between stops, the average height of the dynamometer records between stops is obtained. This average height, when multiplied by the constant of the instrument, represents the average draw-bar pull between these stops.

(2) From passenger records taken during dynamometer tests the curve shown in Fig. 15 was plotted, showing the ratio of the weight of the live load to the light weight of the train.

(3) Dividing the average pull in pounds by the total weight of the train the average pound per ton draw-bar pull over the run under consideration was obtained.* The average pounds per ton draw-bar pull thus obtained for each run is shown in Table 1. The means of the values set forth in Table 1 are shown in Table 2.

The average pounds per ton draw-bar pull (not tractive effort) for various lengths of run over the Mott Haven division are shown in Curve 1 of Fig. 16. Curves 2 and 3 show these values for longer runs, as obtained on the Harlem and Hudson divisions, respectively, and Curve 4, which is the mean of Curves 1, 2 and 3, shows very roughly what may be expected to obtain as the average value of the "pounds per ton" draw-bar pull under ordinary steam railroad conditions on a level and comparatively straight track with various weights and length of train (three to ten cars, 100 to 400 tons) and at an average speed of about 30 miles per hour.

The question of grade is here eliminated, for each point shown represents the average value of two runs on the same train, one north, the other south.

The number of variables entering into these values, such, for example, as the degree of skill of the engineer, the wind velocity, the condition of the track, agreement with schedule time, etc., make it impossible for any curve to pass through all its points,

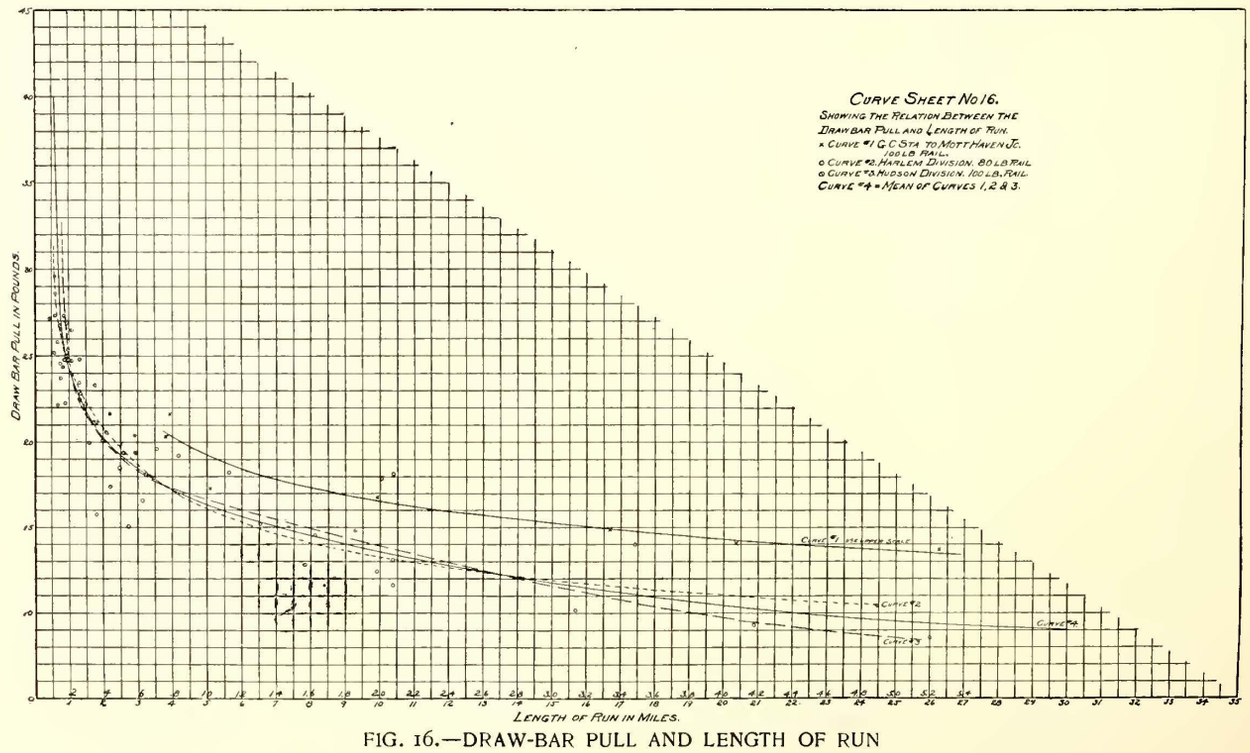


FIG. 16.—DRAW-BAR PULL AND LENGTH OF RUN

METHOD OF OBTAINING HORSE-POWER AT DRAW-BAR FROM DYNAMOMETER RECORDS.

This was obtained in general in the following manner: From actual dynamometer car tests the average draw-bar pull of the several trains over the various runs was determined, proper allowance made for increased train weight due to motor equip-

and therefore, as stated, these curves can only be taken as indicating the average value of a widely varying quantity.

(4) Fig. 17 shows a graphical method of obtaining the speed in miles per hour between any two stations when the time of run between these two stations is given. If the lower strip of this

* This data is being tabulated in convenient form, and will be presented next week.

diagram be cut off along the dotted line and placed horizontally at the left with any station on the ordinate at the given time the intersection of any other station with an oblique line gives the average speed between these stations. Thus, for example, if the run from Grand Central Station to Yonkers is made in forty-two minutes, by placing "Grand Central Station" on the ordinate at the left at forty-two minutes and running horizontally along the strip to "Yonkers" the oblique line here intersected shows the average speed to be 22 miles per hour; in the same manner, if the run from Grand Central Station to Mott Haven Junction is made in ten and one-quarter minutes the average speed is 30 miles per hour. Again, by placing "Spuyten Duyvil" on the ordinate at the left at twenty-eight minutes and following horizontally to "Hastings" the average speed between these two stations is seen to be 18 miles per hour.

(5) The weight of every train arriving or leaving the Grand Central Station on a given day was obtained and its average speed between stops determined from the above curves. Knowing, therefore, the average draw-bar pull in pounds required to haul a train, and the average speed at which this draw-bar pull was exerted, the horse-power at the draw-bar becomes

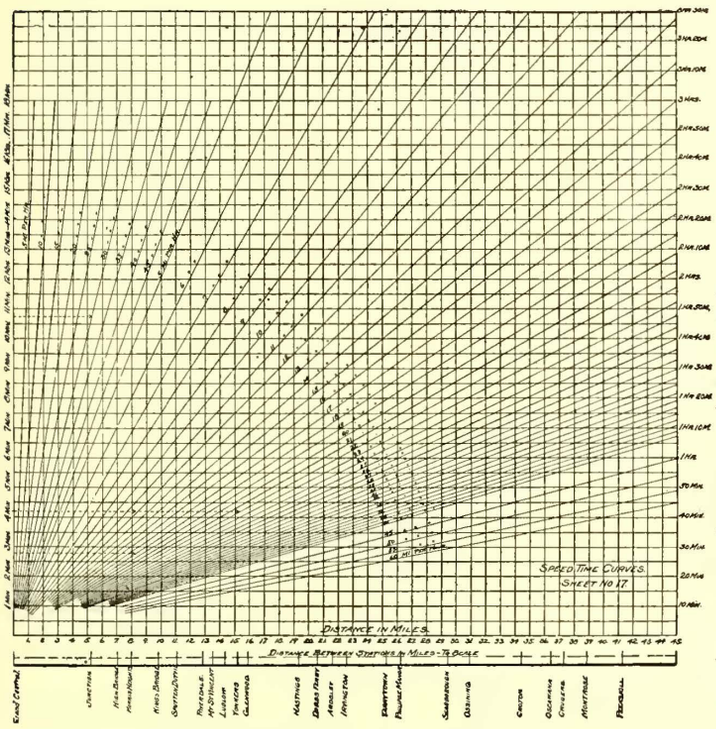


FIG. 17.—SPEED IN MILES PER HOUR

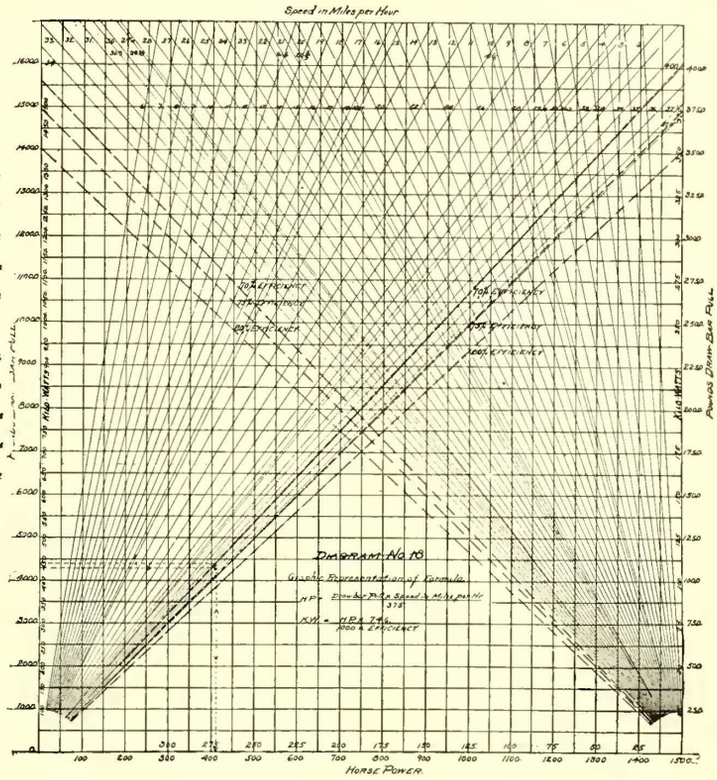


FIG. 18.—HORSE-POWER EXERTED AT DRAW-BAR

H. P. = foot pounds per minute/33,000.
= draw-bar pull × miles per hour × 5280/33,000 × 60.
= draw-bar pull × miles per hour/375.

This formula is represented graphically in Fig. 18, from which, knowing the draw-bar pull and speed, the horse-power or kilowatts corresponding thereto is determined. Thus, for example, if the draw-bar pull is 4300 lbs. at a speed of 36 miles per hour, to find the horse-power or kilowatts corresponding thereto at 4300 lbs. on the ordinate at the left of the figure, follow the dotted line to the right until it intersects the required speed curve, thence downward to the base line, thus obtaining 410 hp. If the efficiency of the motor is taken at 70 per cent, by following the ordinate at 410 hp vertically to the 70 per cent curve and thence to the left the kilowatt capacity required is found to be 440 kw, which is the power required to propel the train, exclusive of the locomotive and head-end resistance.

Now, referring to the first line of Table 3, which represents the results obtained by calculating the power required for the train service of Oct. 23, 1901, we have for the first train shown:

In Column 1, the division over which the train runs, namely, "N" (N. Y., N. H. & H.); in Column 2 the train number; in Column 3, light weight of train; in Column 4, weight of train loaded, which was obtained by reference to the curve in Fig. 15, showing the weight of passengers to be added to the light-train weight.

The first stop being at 125th Street, Columns 5, 6, 7 and 8 are blank, but show by arrow heads the direction of movement, thus → north, ← south.

In Column 9 is found the average speed obtained as above.

In Column 10 the pounds draw-bar pull from Table 2.

In Column 11 the product of "pounds per ton," times total tonnage of train.

In Column 12 the average horse-power required to haul a train, exclusive of the locomotive, from Grand Central Station to 125th Street; this value was obtained from Fig. 18 and is

$$5227 \times 32.8/475 = 458 \text{ hp.}$$

No stop being made at 138th Street, Columns 13, 14, 15 and 16 are blank.

In Column 17 the average speed from 125th Street to Junction is found as above.

In Column 18 average "pounds per ton" draw-bar pull over this run.

In Column 19 the average total draw-bar pull.

In Column 20 the average horse-power required at the draw-bar over this run.

The horse-power required for each scheduled train over each run was obtained in the same manner, and the results as taken from this table were plotted and are shown on train diagram sheets, Figs. 19, 20, 21 and 22.

METHOD OF OBTAINING DAILY LOAD DIAGRAM.

From a careful examination of the weights of all locomotives now in service on this division it was found that properly powered electric locomotives having a total weight of sixty-five tons each, all of which would be available for tractive effort, could satisfactorily perform the service of existing steam locomotives.

To each train horse-power curve, therefore, as plotted on Train Sheets, Figs. 19, 20, 21 and 22, is added the horse-power required to propel a 65-ton locomotive.

This horse-power was obtained in the same manner as that required to haul the train and was plotted separately on the train sheets; evidently the friction of an electric locomotive in pounds per ton is greater than an equivalent weight of train, but this difference was considered in selecting the proper locomotive efficiency.

The sum of the instantaneous values of these individual curves was then plotted as the irregular solid line Curve 1 in Figs. 19, 20, 21 and 22. The mean height of this curve is plotted as the straight-line Curve 2 on each sheet and represents the average horse-power required to propel all schedule trains and locomotives during the six hours covered by the sheet.

This average horse-power, when converted into kilowatts by means of the following formula (which is exhibited graphically in Fig. 18)

$$\text{kw} = \text{hp} \times 746/70\% \times 1000$$

where 1000 watts = 1 kw

746 watts = 1 electrical hp

and 70% = efficiency of locomotives

gives the average kilowatt input required at contact shoes of electric locomotives for the period covered by each sheet and appears as Curve 3.

Curve 4 represents the mean average kilowatt input at contact shoes (for line service only) throughout a period of twenty-four hours under the same conditions, and its height is the average height of Curve 3 in Figs. 19, 20, 21 and 22.

The switching, shop train and return engine service was found to represent such hourly demands as are shown in Curves 3 and 4 of Fig. 23.

The mean height of Curve 3 on Fig. 23 appears as Curve 5 in Figs. 19, 20, 21 and 22, and similarly the mean height of Curve 4 on Fig. 23 appears as Curve 6 on Figs. 19, 20, 21 and 22.

The sum of Curves 4, 5 and 6 on Sheets 19, 20, 21 and 22 is plotted as Curve 7 on those sheets, and therefore represents the average daily kilowatt input required at contact shoes of locomotive for all service.

Curve 1 of Fig. 23 is a condensed load diagram of the entire service, showing the hourly variation of the different classes of service as deduced from the curves in Figs. 19, 20, 21 and 22.

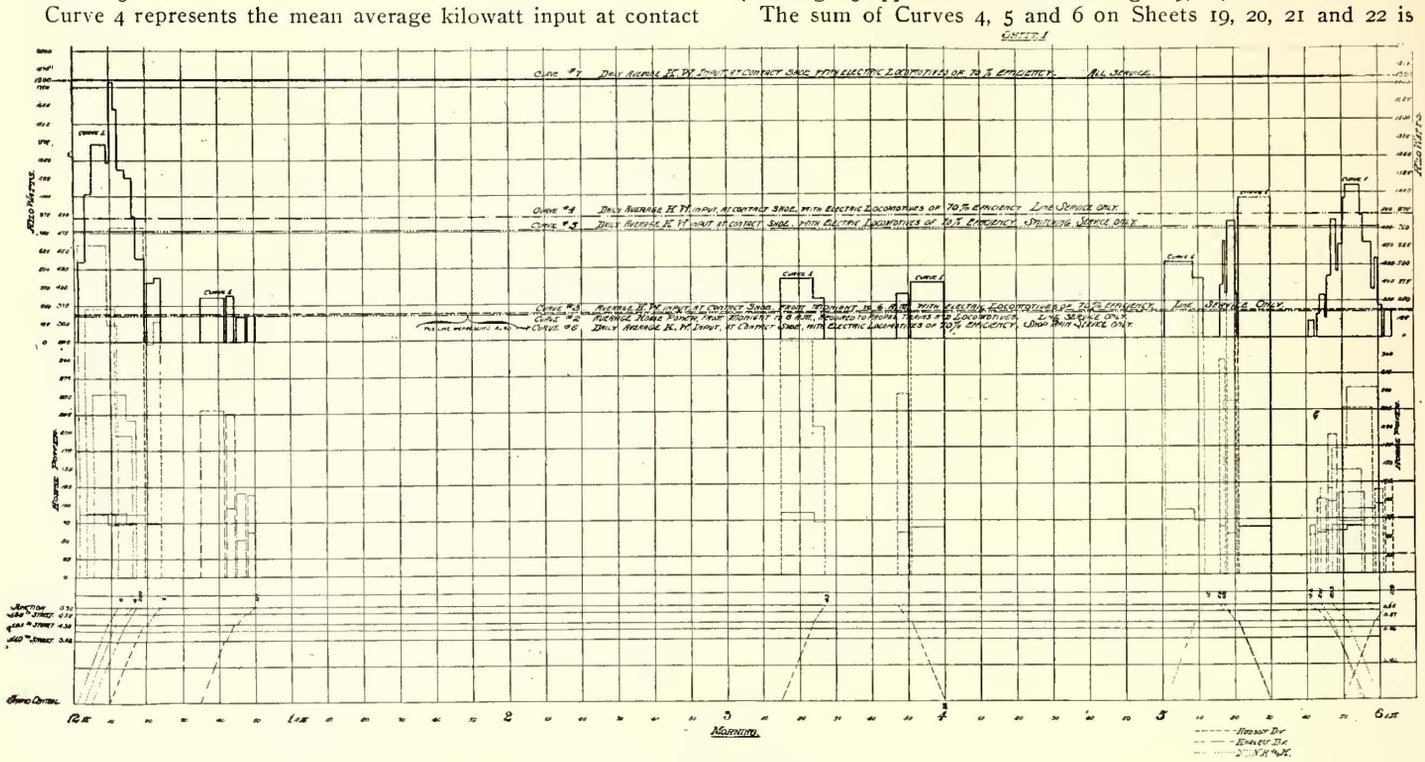


FIG. 19.—DAILY TRAIN SHEET

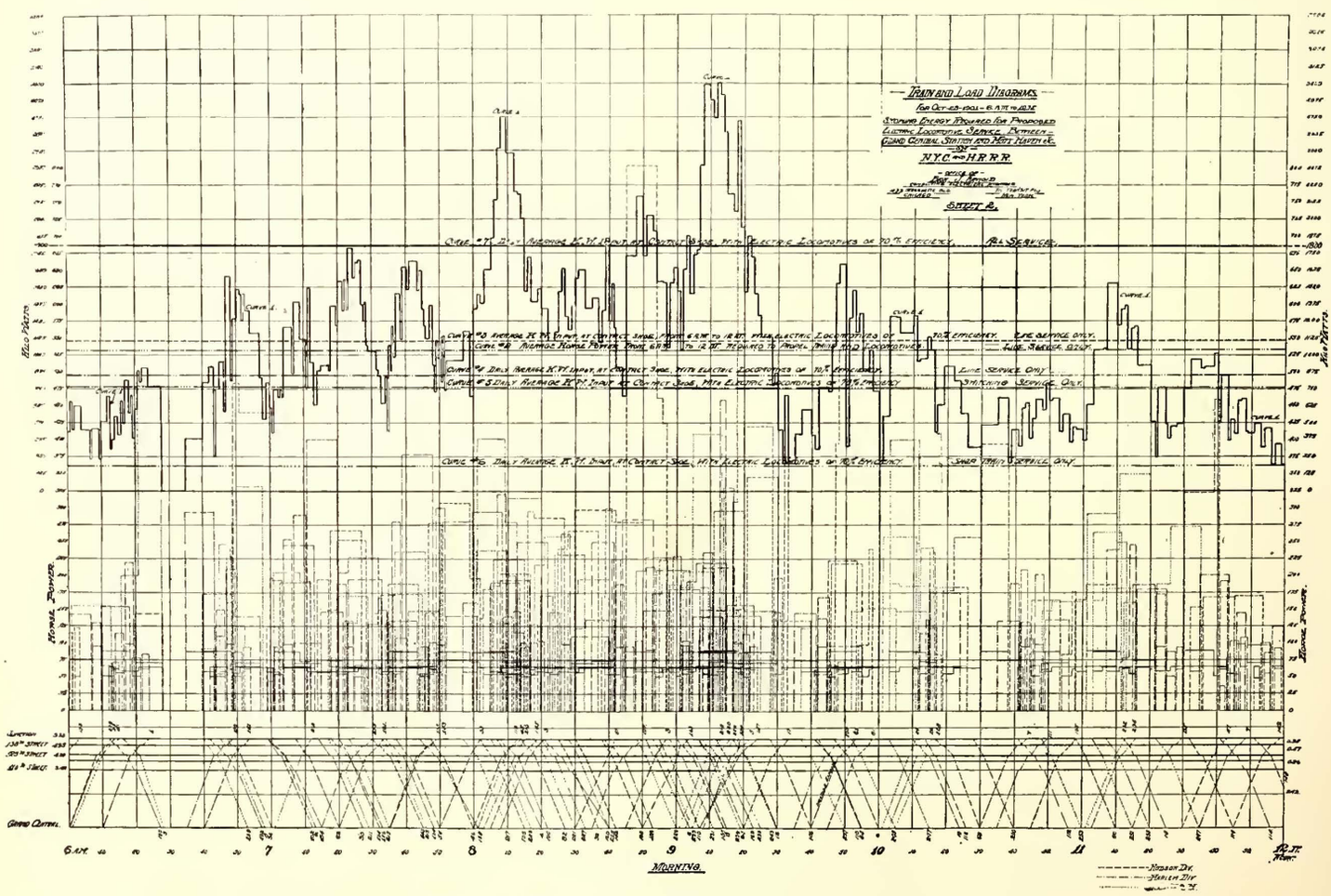


FIG. 20.—TRAIN SHEET AND LOAD DIAGRAM

From Curve 7 on these sheets it is seen that the daily average input required would be at the rate of 1800 kw, and therefore the total annual input required at the contact shoes of the locomotives for propulsion alone would be $(1800 \times 24 \times 365) = 15{,}768{,}000$

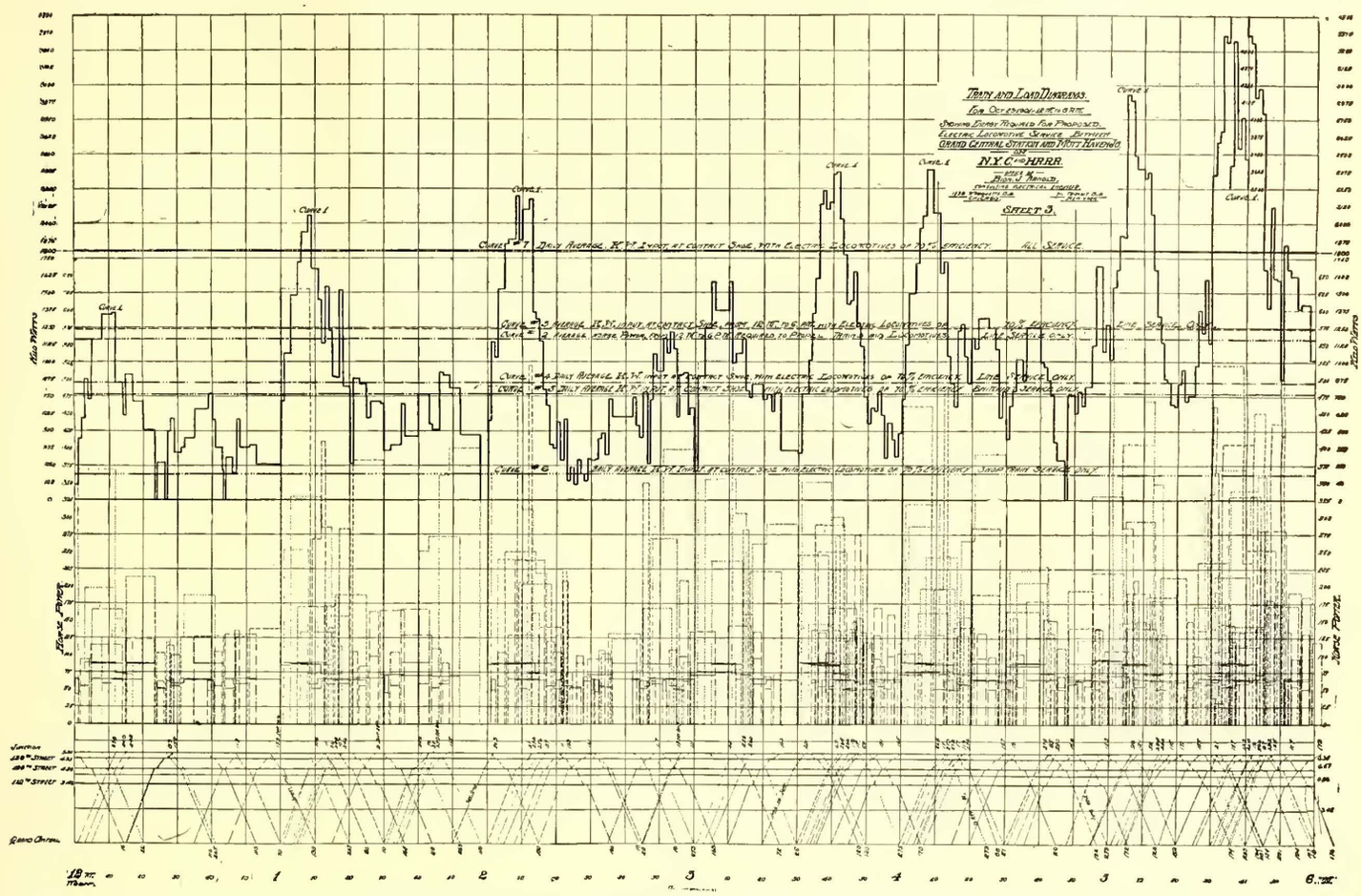


FIG. 21.—TRAIN AND LOAD DIAGRAMS FOR OCT. 23, 1901, SHOWING ENERGY REQUIRED FOR PROPOSED ELECTRIC LOCOMOTIVE SERVICE BETWEEN GRAND CENTRAL STATION AND MOTT HAVEN JUNCTION

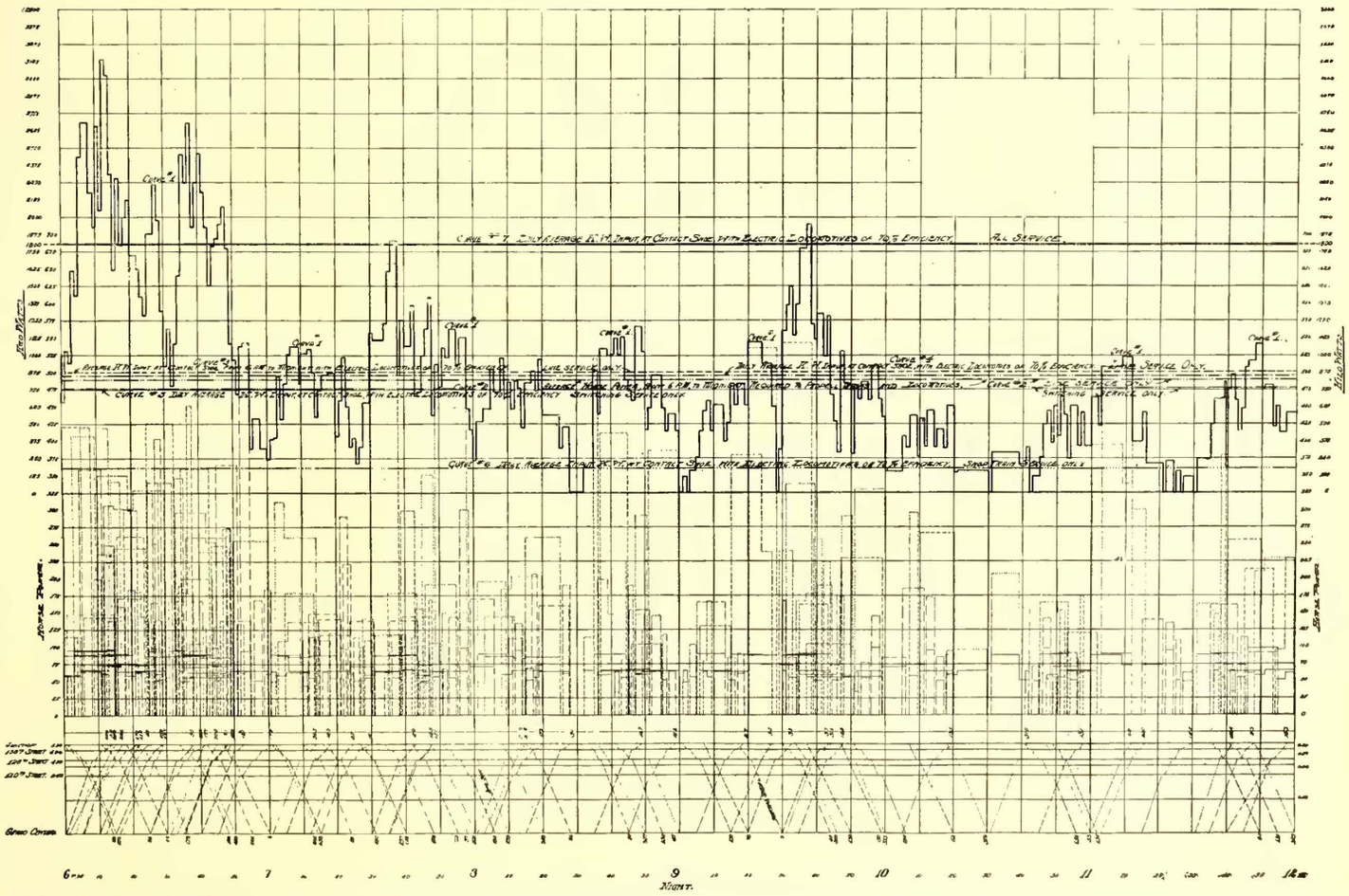


FIG. 22.—TRAIN AND LOAD DIAGRAMS FOR OCT. 25, 1901, SHOWING ENERGY REQUIRED FOR PROPOSED ELECTRIC LOCOMOTIVE SERVICE BETWEEN GRAND CENTRAL STATION AND MOTT HAVEN JUNCTION

kw-hours. From the total number of tons hauled yearly over this division, including passenger, shop trains and switching service, the ton miles per year were found to be 250,285,710. Hence the electrical energy required to haul a ton 1 mile over this division under the existing conditions would be

$$15{,}768{,}000{,}000/250{,}285{,}710 = 63 \text{ watt-hours per ton mile.}$$

With this figure as a basis, and the load factor as determined from the load diagram, the problem of determining the best method of producing, distributing and applying the power was considered.

CHOICE OF SYSTEM

While it is the writer's opinion that the alternating-current railway motor will yet prove to be the most efficient, all things considered, for long-distance railway work, it has not yet in his opinion demonstrated its ability to start under load as efficiently or to accelerate a train as rapidly as the direct-current motor. The line under immediate consideration was short, the trains numerous and rapid acceleration desirable, all of which are conditions favorable to the direct-current motor.

Furthermore, direct-current motors, with their necessary auxiliaries, have become fairly well standardized, and it is the only class of electric railway apparatus available from the manufacturers of the United States without involving experimental work and large development expense.

In view of these facts, and the probable necessity for rapid construction, the writer refrained from advising anything of an experimental nature, and therefore recommended the direct-current system in combination with the third rail for the main line and overhead construction for the yards, all of which have demonstrated fully their ability to meet the conditions imposed by railway operation so far as motive power is concerned, although there has not yet been an electric installation on any existing terminal that is as complex or into which anywhere near the number of heavy trains enter as on this section of road.

Had the length of road under consideration been considerably greater, and had it been thought possible to secure sufficient time to conduct experiments or invite demonstrations by manufacturers of alternating-current motor equipment this class of apparatus would have been more seriously considered.

DISCUSSIONS AND ANALYSIS OF PLANS OF ESTIMATES

In the preparation of estimates, twelve distinct plans of generation and distribution were considered and the results tabulated as shown in the accompanying table. All the estimates were computed upon the same basis so far as cost of fuel, labor and losses in transmission were concerned. The different headings in the table here shown are deduced from another table not here published, the columns of which were as follows:

Column A.—Total Cost of Entire Installation.—Erected complete, consisting of power house, transmission circuits, feeders, sub-stations, track construction chargeable to electrical equipment, overhead construction and electric locomotives.

Column B.—Total Operating Expenses per Annum.—Including wages in power house and sub-stations and on rolling stock, together with all coal, oil, water, waste, repairs, etc.

Column C.—Fixed Charges per Annum.—Including interest at 4 per cent on total investment and taxes at 2 per cent on buildings, sites, machinery and electric locomotives.

Column D.—Total Expense per Annum.—Made up of Column B plus Column C.

Column E.—Operating Expenses per Annum at Power House.—Including coal, water, oil, waste, etc., and repairs and wages.

Column F.—Operating Expenses per Annum at Contact Shoe.—Including coal, water, oil, waste, etc., and repairs and wages in power house; oil, waste, repairs and wages in sub-stations, and repairs (labor and material) on transmission lines.

Column G.—Total Expense per Annum Exclusive of Rolling Stock.—Including operating expenses per annum at contact shoe (as in preceding Column F) plus fixed charges as follows: Interest at 4 per cent on total investment (less cost of electric locomotives) and taxes at 2 per cent on buildings, sites and machinery.

Column I.—Total Locomotive Miles per Annum.—Determined from information furnished through the operating department.

The explanation of the columns in the table below is as follows:

Column H is:

$$\frac{\text{Column E (of table not published)}}{\text{Total kw-hours generated at P. H.}}$$

and represents the operating expenses per kw-hour at power house switchboard.

Column M is:

$$\frac{\text{Column F (of table not published)}}{\text{Total kw-hours delivered to contact shoe annually}}$$

and represents the operating expenses per kw-hour at contact shoe.

Column N is:

$$\frac{\text{Column G (of table not published)}}{\text{Total kw-hours delivered to motor terminals annually,}}$$

and represents the total cost per kw-hour delivered to motor terminals exclusive of fixed and operating charges on electric locomotives.

The cost per kw-hour at motor terminal differs from the cost per kw-hour at the contact shoe only when batteries are carried on the locomotives, in which event the cost per kw-hour at the motor terminals is increased over the cost per kw-hour at the contact shoe by the cost of energy lost in the batteries.

Column J is:

$$\frac{\text{Column B (of table not published)}}{\text{Column I}}$$ and represents the operating expenses per electric locomotive mile. The values in this column are directly comparable with values now obtained in the present steam locomotive service, except that the operating expenses for steam locomotives, as shown by the performance sheets of the motive power department, do not include any charge for water. From the best information available, the cost of water

Table of Estimates on Plans for Proposed Electrical Equipment of the N. Y. C. & H. R. R. R. Between Grand Central Station and Mott Haven Junction

Plan	Character of Stations, Etc.	E = Total kw hours at power house	F = Total kw hours at contact shoe	G = Total kw hours at motor terminals	$J = \frac{B}{I}$	$K = \frac{C}{I}$	$L = (J + K)$
1	Direct current power station at center of line and contiguous to tracks. 600 volt working conductor, no batteries	.447c	.60c	1.06 c	14.02c	6.58c	20.60c
2	Same as No. 1, with batteries in power house	.472	.66	1.37	14.65	6 71	21.36
3	Same as No. 1, with battery sub-station near Grand Central Station and Mott Haven Junction	.475	.668	1.20	14.7	7.25	21.95
4	Alternating current power station on river front near center of line, with rotary converter sub-stations near each end of line. 11,000 volt A. C. and 600 volt D. C.	.572	.715	1.287	15.2	7.58	22.78
5	Combined D. C. and A. C. power station at Harlem River near one end of line and one rotary converter sub-station near the other end of line. 11,000 volt A. C., 600 volt D. C., no batteries	.570	.666	1.19	14.7	7.18	21.88
6	Direct current feeders from Manhattan Railway sub-station located near center of line. Transmission from sub-station to working conductor, 600 volts D. C. energy to be purchased	2.5	2.650	2.748	34.61	2 89	37.53
7	Rotary converter sub-station at center of line. A. C. energy to be purchased from Manhattan sub-station and transmitted at 11,000 volts. Energy to cost ½ cent less per kw hour than D. C. energy delivered	2.5	2.336	2.508	31.50	4.23	35 73
8	Two rotary converter sub-stations, one near each end of line. A. C. current to be purchased from Manhattan sub-station near center of line	2.1	2.336	2.504	31.50	3.93	35.43
9	Combined A. C. and D. C. power station near Harlem River at end of line One sub-station near other end, and batteries carried on locomotives charged from working conductor	.519	.629	1.122	16.58	7.76	24.34
10	One rotary converter sub-staion near center of line, A. C. current purchased from Manhattan sub-station No. 7, batteries on locomotives charged from working conductor	2.12	2.4	2.502	34.40	4.08	38.48
11	Direct current feeders from Manhattan sub-station No. 7, near center of line. Batteries on locomotives charged from working conductors	2.5	2.738	2.742	37.81	2.51	40.32
12	Combined A. C. and D. C. power station at Harlem River near outer end of line. One sub-station near other end. Batteries in power station and sub-station. A. C. transmission 11,000 volts, D. C. conductors 600 volts	.55	.775	1.335	15.80	7.83	23.63

for the present service on this division is about .987 cent per locomotive mile, which amount added to the present cost as shown on the locomotive performance sheets, gives an amount which should be compared with the values in Column J.

Column K is:

$$\frac{\text{Column C (of table not published)}}{\text{Column I}}$$ and represents

the fixed charges per electric locomotive mile, and is here tabulated merely as a step in obtaining.

Column L (which is Column J plus Column K) and represents the total cost per electric locomotive mile.

While the results in Column L indicate that Plan No. 1 was the most advisable one to adopt, it was not seriously considered, for the reason that it necessitated locating the power station in a part of the city where its erection would probably have been prohibited by the city authorities, but it was here introduced for comparison as indicative of the economy to be gained by placing the power station at the theoretical center of distribution. The same objections apply to Plans 2 and 3.

Plans 4 and 5 bring out quite clearly the difference in the cost of operation between two sub-stations and one, both plans permitting the location of the power station on the river front.

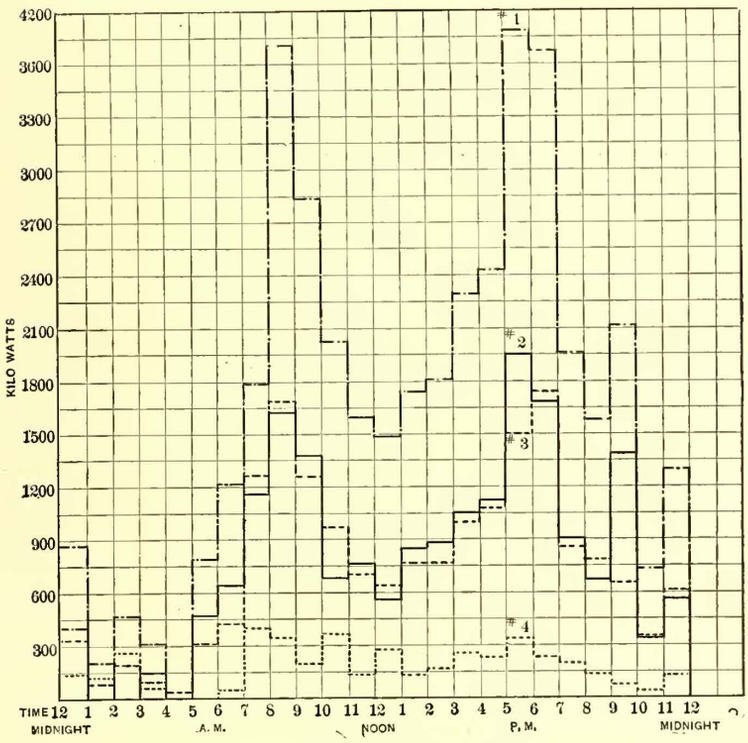


FIG. 23.—LOAD DIAGRAM

The difference in favor of Plan 5 is entirely due to the saving in labor of one sub-station.

Plans 6, 7 and 8 were studied with the object of ascertaining whether the purchase, instead of the generation of power, would offer a satisfactory solution of the problem.

The purchase of both direct-current and alternating-current energy was considered on the lowest basis that it was thought possible for any existing company to furnish it, and it was found that the direct-current energy would cost the railroad company ½ cent more per kw-hour than the alternating-current energy, in consequence of the interest, depreciation, maintenance, etc., of the transmission lines, rotary converters and other sub-station apparatus which would have to be furnished by the energy-producing company.

The prohibitive annual cost of these purchasing plans is at once observed by reference to Columns L and M, the plans only meriting consideration as representing a temporary arrangement that might be effected in order to allow rapid installation.

Owing to the more or less complex system of overhead or third-rail yard construction made necessary by the nature of the case and the advantages to be obtained by their elimination in the substitution of locomotives which could for switching service be self-contained, though normally supplied with energy from the working conductors, a study was made of electric locomotives carrying batteries.

The results of these studies made under several different assumptions are shown under Plans 9, 10 and 11. From Columns L and N it is evident that whatever may be gained by the elimination of the overhead construction is largely offset by the additional cost of operation, although it will be observed that the cost per locomotive mile of Plan 9 compares favorably with the cost of Plan 12.

Plan 12 differed only from Plan 5 in a slight reduction in the capacity of the converting apparatus in the power house and sub-stations and the substitution therefor of two storage batteries (one located in or near the power house and one in the sub-station), each of such capacity that it, together with only a portion of the main station and sub-station machinery, would be capable of taking over the entire load of the line for a short period of time in cases of emergency.

The additional first cost and the slight increase in annual expense (as compared with Plan 5), represented by a reserve station capacity of this nature, was thought to be of secondary importance only, in view of the increased reliability of operation thereby obtained. The increased cost of operation in this plan over that of Plan 5 is due to the fact that the battery maintenance was figured at 10 per cent per annum, which is considerable higher than is ordinarily assumed, and will probably be considered excessive by some.

A battery of this kind would not only serve as a reserve, but would prove of considerable value as a regulator of potential along the line, and, in addition, it would, notwithstanding its inherent losses, tend to reduce the power house operating costs by taking up the excessive load fluctuations of the system and permitting the load upon the engines to be maintained at or near their most efficient working capacity.

It was considered of the utmost importance in an installation of this magnitude that the number of interruptions of power simply be reduced to a minimum, that no device which could increase the safety and reliability of the plant should be omitted, and that the probability of future extensions of the electrical system should be considered. As best fulfilling the above conditions, therefore, Plan 12 was the one specifically recommended for adoption.

OPERATING EXPENSES.

A careful compilation of all the expenses entering into the operation of the present steam service was made, and the following comparative table of relative costs is believed to be correct, assuming that the present locomotives running between Mott Haven Junction and Grand Central Station should be abandoned and the service now performed by them duplicated by electric locomotives operated in accordance with Plan 12. It is assumed that the electric locomotives will be operated by the same class of men as those who now operate the steam locomotives and that they would receive the same rate of pay that they now receive.

This condition is not favorable to electric traction, as it is not ordinarily necessary to have two men to operate an electric motor, but in the writer's judgment it is not advisable to operate a service of this class under such exacting conditions without two men on each locomotive.

If the motor-car system should be adopted, as it probably would be were the electrical equipment extended beyond Mott Haven Junction, or if the forward guard or brakeman were allowed to take the place of the second man while passing through the tunnel and yards, a saving equivalent to his wages could thereby be effected.

With two men of the same skill as at present employed on the locomotives the figures are as follows:

	Steam.	Electricity.
Operating expenses per locomotive mile exclusive of fixed charges, but including water, labor, cost of cleaning and repairing tunnel and all other expenses of locomotive operation	23.05	15.80
Fixed charges per locomotive mile assuming that it now requires forty locomotives to perform the present service and that thirty-three electric locomotives could perform the same service	1.13	7.83
Total in cents	24.18	23.63

From these figures it appears that while there would be a slight annual saving in operating expenses in favor of electricity it is not sufficient to warrant its adoption on the grounds of economy in operation alone, although its adoption can be justified on other grounds.

These figures could be made more favorable to electricity were an optimistic view of many of its advantages taken, and the probability is that practical operation will show a somewhat greater gain than here indicated; but it has been deemed best by the writer to maintain a conservative view throughout the entire investigation.

It is, however, safe to conclude that the saving in operation expenses by the electric system would be sufficient to offset the increased fixed charges due to the additional investment made necessary by its adoption.

The dynamometer car was operated by Edward C. Schmidt, professor of railway mechanical engineering of the University of Illinois. He was assisted by J. J. Snodgrass and R. W. Lohmann. B. S. Harrison, Hugh Hazleton, R. W. Lohmann, J. J. Snodgrass, H. A. Strauss and A. S. Courtright assisted in the calculations and preparation of the report.

In connection with the investigation, a series of comparative acceleration tests of steam locomotives and electrical equipment were made at Schenectady, the results of which are set forth in another paper prepared by W. B. Potter and the writer, which is to be read at this meeting.

Subway Power Plant a Nuisance

The Court of Appeals of New York has declared that the builders of the subway in Manhattan had no legal right to erect sheds and workshops along the line of the tunnel against the wishes of abutting property owners. The decision was in the action brought by the proprietor of the Everett House, corner of Fourth Avenue and Seventeenth Street, fronting on Union Square, against Frederick Holbrook and others, sub-contractors under John B. McDonald, who is constructing the Rapid Transit Subway.

The Special Term refused to grant an order for an injunction restraining the continuance of certain worksheds erected by the tunnel contractors in front of the Everett House, on the ground that they are a nuisance and for the recovery of damages arising therefrom. The Appellate Division reversed the Special Term, and the Court of Appeals on June 11 sustained the Appellate Division and ordered judgment absolute in favor of the Everett House proprietor, with stipulation.

Under a permit from the Park Department the contractors erected buildings upon the paved place in front of the hotel, and placed therein boilers, forges, air compressors and machinery to furnish power and appliances for the prosecution of the work under their sub-contract, extending from Great Jones Street to Thirty-Second Street. These buildings occupy the space of 100 ft. x 120 ft. and are enclosed with board fences. The space is used to store tools and machinery. The power generated within the enclosure is compressed air, which is conducted along the work in pipe lines. The structure is so erected as to leave in front of plaintiff's hotel a paved carriage way 40 ft. wide. The opinion of the court, which was written by Judge Bartlett, holds that no authority is vested in the Rapid Transit Commissioners or the Park Commissioners to erect such structures as those of which complaint is made. These structures, it is pointed out, are not temporary, but rather permanent, as they are intended for the life of the contract, and, therefore, do not come within the provisions of the law of 1892, which grants temporary privileges to those engaged in public work of this description.

The plaintiff's main contention that the buildings and appliances which have been erected on the plaza in front of his hotel, some of which is part of Union Square, is a nuisance, unauthorized by law and not necessary to the execution of the work; that there is no reason for the generation of compressed air in a central plant, except that the contractors found it more convenient and economical; that if such necessities existed the structures should have been erected and maintained at a distance from the lines of the work and away from the residential and thickly settled parts of the city.

On this point the court says: "We are of opinion that the findings of the trial court established that these structures ought to have been placed elsewhere, or the power for the generation of compressed air subdivided into a number of small plants distributed along the line of the work." The finding in this connection that the aggregate damage produced thereby would not be lessened, and the loss which now falls upon the plaintiff would be cast upon others, is pronounced clearly inconsistent, with the finding that the plaintiff sustained damage of a special nature It is held to be a mere matter of conjecture, unsupported by evidence, what damages would be suffered by others if the plant were erected off the line of the work. It is evident that the plant could be located in sparsely settled districts near the river front, and not cause a tenth part of the damage that would arise in maintaining it at the point selected by those defendants, or in the heart of the residential portion of the city, like Fifth Avenue, Madison Avenue or other localities that might be named. Gas houses, electric light plants, power houses and large manufacturing establishments peculiar to city life are usually erected in the localities where the damages inflicted upon surrounding property are reduced to a minimum. The plaintiff doubtless must suffer the annoyance and injury from such acts as are reasonably necessary to the execution of work, but it is unjust and placing upon him an undue burden to permit the erection and maintenance of this plant in front of his hotel for the generation of compressed air, to be used along the entire line of the work undertaken by these contractors from Great Jones Street to Thirty-Second Street, and which may continue for a period of three years or more from its inception.

"The fact that the defendants are engaged in a public work is not accepted as defense to the charge that the structures in front of plaintiff's hotel are a nuisance. It is to be kept in mind that the construction of the Rapid Transit Railroad by these defendants is an important public work in which the citizens of the city of New York are deeply interested, and the courts should be careful to accord to them every legal right in a liberal spirit of construction, avoiding, if possible, placing in their way obstacles of any kind."

The court is careful to call attention to the fact that it is deciding this case upon its peculiar facts, and not laying down any general rule as to the conduct of this subway work. It is impossible to precisely regulate the damages so as to prevent greater loss to one abutting owner than another under apparently like circumstances. It is, therefore, held that these defendants ought not to be permitted to continue a condition of affairs that is rapidly reducing this plaintiff to bankruptcy, when the trial court has found in substance that the structures of which complaint is made are not necessary for the reasonable prosecution of the work. This case presents a situation of peculiar hardship, and the plaintiff ought to be adequately compensated in damages, or the defendants should be prevented by perpetual injunction from continuing the nuisance of which complaint is made.

An Estimate of the Cost of Municipal Ownership in San Francisco

The city engineer of San Francisco has completed an estimate of the cost of reconstructing and maintaining, under municipal ownership, the Geary Street, Park & Ocean Railroad, the franchises of which expire in a few months. In a report to the Board of Public Works the engineer submits several estimates on lines proposed but not included in a similar report made last year. These included several crosstown lines, the principal one being a route to run from the Presidio to the Potrero. Another embraces the extension of the present track from Tenth Avenue to the ocean and a line from C Street to Ocean Avenue in the Sunset district.

Excluding the proposed crosstown lines three main propositions are submitted with the estimated cost as follows: From the Park direct to the ferries along Geary Street, a distance of 4.9 miles, or an alternate location along Grant Avenue, Kearney and Pine Streets, $850,000; from Fulton Street along Tenth Avenue, Point Lobos Avenue and Geary Street to Market Street, a distance of 4.3 miles, $700,000, or an alternate location traversing Grant Avenue, Kearney and Bush and Pine Streets, $780,000.

The project embracing all the laterals and giving a complete municipal system is explained as follows: Main line, electric conduit system, 4.90 miles long, an extension to the ocean, overhead trolley, 2.35 miles long; extension on Nineteenth Avenue, overhead trolley, 3 miles long; crosstown line, overhead trolley, 5.80 miles long. The total cost of construction is estimated at $2,250,000, which would be increased by the loss of interest during construction, amounting probably to $78,750. Eliminating the lines from C Street to the ocean and from Nineteenth Avenue to the Sunset district, the cost would amount to $1,836,000.

If the municipal street railway system be restricted to a line from the ferries to the Park the location of a power house at the northern water front of the city would not be justified, the engineer says; but the economic location would then be about midway between the road terminals, or about the location of the present power house. This location has been assumed as a basis for the cost estimate. The building there to be erected will serve not only as a power house, but also as a car house.

An estimate of the cost of operation and maintenance of the line proposed from the Park direct to the ferries, without laterals, is shown as follows: Operation, per annum, $144.290; maintenance and deterioration account, $33,000; interest 3½ per cent of $850,000, the total cost, $29,750; a total of $207,040. This is on a basis of an eight-hour day and compensation at least $2.50 per day, or 31¼ cents an hour for conductors and motormen. With twenty cars in the service, of which two are supposed to be idle, one at each end of the line, the cost per car per mile would approximate 16 cents.

Metropolitan Railway Pension System

President Vreeland, of the Metropolitan Street Railway Company, has announced that the regulations governing the working of the pension department have been completed and will be put in operation July 1. An outline of this plan was published in the STREET RAILWAY JOURNAL of March 15, together with an expression of President Vreeland's views on the subject. The board of officers of the pension department, to serve during the first fiscal year and until their successors have been appointed, will consist of the following-named officers of the Metropolitan Street Railway Company: C. E. Warren, secretary and treasurer; H. A. Robinson, attorney; M. G. Starrett, chief engineer; Oren Root, Jr., assistant general manager; W. B. Reed, engineer maintenance of way; Thomas Millen, general master mechanic. Mr. Root will act as chairman of the board and Mr. Warren as secretary. Employees who consider themselves eligible for pensions and desiring to take advantage of this plan have been instructed to make application to their employing officers. These applications will be forwarded through the department head to the pension board, which will pass upon all matters pertaining to the pension system. It is announced that the decision of this board on all matters of this kind will be final. President Vreeland has issued a circular announcing these appointments and the following regulations which will govern the operation of the system:

I. A new department of the Metropolitan Street Railway Company, to be called the Pension Department, is hereby created for the following purposes, to wit:

(1.) To carry out the order of the President of the Metropolitan Street Railway Company requiring that all employees of that company who shall have attained the age of seventy years, and also such employees from sixty-five to sixty-nine years of age, both inclusive, as shall have been twenty-five years or more in the service of the company, and shall have become physically disqualified from continuing such service, shall be retired from service;

(2.) To make payments to such employees of such pension allowances as may be authorized from time to time by the pension board of the pension department.

II. The pension department shall be in charge of a pension board, who shall be appointed annually in the month of June by the president of the Metropolitan Street Railway Company, and shall serve for one year from the first day of July next succeeding, and until their successors are appointed. The pension board shall, subject to the approval of the president of the Metropolitan Street Railway Company, have authority to make and enforce rules and regulations for the care and protection of the department; to determine the eligibility of employees to receive pension allowances; to fix the amounts of such allowances, and to prescribe the conditions under which such allowances may be paid and under which they may be revoked. They shall make rules for their government not inconsistent with these regulations; and shall, from time to time, whenever required, make reports of their proceedings to the president of the Metropolitan Street Railway Company.

III. Of the employees who shall be retired from service there are two classes, as follows:

(a.) All employees who shall have attained the age of seventy years.

(b.) All employees from sixty-five to sixty-nine years of age, both inclusive, who shall have been continuously for twenty-five years or over in the service of the company, and who shall, in the opinion of the pension board, have become physically disqualified from continuing such service.

No employee whose maximum wages have exceeded $1,200 per annum, for a period of more than five (5) years, shall be eligible for retirement under these regulations.

No employee who enters the service of the company after the first day of July, 1902, shall be eligible for retirement for a pension allowance under these regulations, unless he shall have joined the Metropolitan Street Railway Association within five years after entering the service of the company, nor unless his membership in said association shall have been continuous thereafter up to the time of his retirement under these regulations. Any employee who shall be in the service of the company on the first day of July, 1902, and who shall at that time be a member of the Metropolitan Street Railway Association, or who shall become a member of said association on or before the first day of July, 1903, and whose membership in said association shall be continuous thereafter until his retirement under these regulations, shall be eligible for a pension allowance, as herein provided for. Any employee who shall be in the service of the company on the first day of July, 1902, and who shall then have attained the age of forty-five years, but shall not then be a member of the Metropolitan Street Railway Association, shall nevertheless be eligible for a pension allowance hereunder, provided he shall thereafter attain the age, and shall have served the company continuously for the period required by these regulations, and shall otherwise be eligible hereunder.

IV. In case any employee from sixty-five to sixty-nine years of age, inclusive, who has been continuously for twenty-five or more years in the service of the company, claims that he is physically disqualified for further service, he may make application for retirement to the pension board, who shall decide whether or not he shall be retired from the service. The decision of this board shall, in all cases, be final.

Employees making application for retirement, who are from sixty-five to sixty-nine years of age, both inclusive, shall submit to a physical examination by a physician or physicians appointed by the pension board.

V. In referring to the employees of the company, the expression "service" and "in the service" shall include employment upon or in connection with any of the railroads operated by the Metropolitan Street Railway Company, and the service of any such employee shall be considered as continuous from the date from which he has been continuously employed upon or in connection with such railways, whether prior or subsequent to their acquisition or operation by the Metropolitan Street Railway Company or its lessee.

VI. The pension allowances authorized by the president of the Metropolitan Street Railway Company to be paid are for the present fixed upon the following basis:

(a.) If service in the company's employment shall have been continuous for thirty-five (35) years or more, 40 per cent of the annual average wages for the ten years previous to retirement.

(b.) If the service has been continuous for thirty (30) and less than thirty-five (35) years, 30 per cent of the annual average wages for the ten years previous to retirement.

(c.) If the service has been continuous for twenty-five (25) and less than thirty (30) years, 25 per cent of the annual average wages for the ten years previous to retirement.

(d.) The same basis of payment to apply to those employees between the ages of sixty-five and sixty-nine years, both inclusive, who are retired at the discretion of the pension board.

(e.) Whenever at any time it may be found that the granting of pension allowances on the foregoing basis shall create total demands in excess of the sum of $50,000 per annum, which has been fixed by the president of the Metropolitan Street Railway Company as the total amount which will be expended in any one year by that company for pension allowances, and as often as such condition may arise, the Metropolitan Street Railway Company reserves the right to rearrange all pensions on a new basis, ratably reducing the pension allowances theretofore made or thereafter to be made, so as to bring the total of all pensions paid annually within such total amount of $50,000; and in such case, the order of the president of the Metropolitan Street Railway Company, in establishing such new basis, shall be absolutely final and binding upon the pension board and upon any and all beneficiaries under the pension system. Notice of such new basis shall be given before the beginning of the year in which it may be decided to put the same into effect.

VII. In computing service it shall be reckoned from the date of the entry into the service to the date when relieved, deduction of the actual time out of the service being then made, and any fractional part of a month in the final result being eliminated. If any employee who has resigned or been discharged from the service of the company should be re-employed, his service in the company shall, for the purpose of this pension department, be computed from the date at which he last re-enters the employ.

VIII. When pension allowances shall be authorized, pursuant to these regulations, they shall, unless and until revoked by the pension board, be paid monthly, commencing on the first day of the calendar month and terminating with the date of death. Any pension allowance may be revoked by the pension board for misconduct on the part of the beneficiary, of which misconduct the pension board shall be the sole judge.

IX. To the end that direct personal relations between the company and its retired employees may be preserved, and that such employees may continue to enjoy the benefits of the pension system, no assignment of pensions will be permitted or recognized.

X. Neither the action of the company in establishing a system of pensions, nor any other action now or hereafter taken by the company or by the pension board in the inauguration and operation of a pension system, shall be held or construed as giving to any officer, agent or employee of the company a right to be retained in its service or any legal right or claim to any pension allowance; and the company expressly reserves its right and privilege to discharge, at any time, any officer, agent or employee when the interests of the company in its judgment may require such discharge, without liability for any claim for pension or other allowance other than salary or wages due and unpaid.

XI. In payment of pension allowances, pay rolls showing the names of those to whom allowances have been made and the amount of such allowances shall be prepared at the close of each month by the secretary of the pension board, who shall certify as to their correctness, such pay rolls also being certified by the head of the department of the Metropolitan Street Railway Company, in whose department the men were before being relieved from duty, and the same shall be presented to the pension board to be approved by them for payment, who shall in turn send them to the president (of the Metropolitan Street Railway Company), for his approval, and after the approval of the president, payment shall be made to the employee, receiving his receipt, which shall be filed as a record in the office of the secretary of the pension board.

XII. The secretary of the pension board must keep himself advised of the whereabouts of former employees who have been relieved from the service, and promptly report to the pension board when any of them cease to be entitled to their pension allowance. When any such employee does not reside within the limits of Greater New York, such employee receiving a pension allowance, shall be required to forward every three months an affidavit to the secretary of the pension board, or oftener as may be required, setting forth that he is still entitled to the pension allowance.

XIII. The acceptance of a pension allowance, as stated in these regulations, shall not debar any such former employee from engaging in other business, but such person cannot re-enter the service of the company.

XIV. Whenever the words "Company" or "Metropolitan Street Railway Company" are used in these regulations, they shall be understood to include the Metropolitan Street Railway Company and its lessee.

A handsome souvenir of Spring Bank Park, London, Ont., has been issued by the local street railway company. London is a growing city, and the inhabitants are brought within easy distance of one of the finest parks in Canada by the London Street Railway, which operates commodious summer cars on the Spring Bank line at frequent intervals. Much care has been taken in the preparation of the book, both as to the matter contained, which is bright and readable, and in the artistic appearance of both the cover and pages.

Steam Road Suburbanites Clamor for Electric Traction

The full explanation of the ordinance recently presented before the Chicago City Council to allow the Chicago, Milwaukee & St. Paul Railroad Company to change the motive power on is suburban line from Chicago to Evanston to electricity is found in an interview with L. G. Kirkland, president of the North Shore Transportation League, in the Chicago Record-Herald of June 22. The residents living along the Chicago, Milwaukee & St. Paul in the suburban districts of Argyle Park, Edgewater, Rogers Park and Birchwood have formed an organization called the North Shore Transportation League for the purpose of securing better transportation to the business part of the city. That the gentlemen have done something more than talk about better transportation and are taking practical steps to secure it is shown by the interview with Mr. Kirkland, in which he says:

"The St. Paul road people tell us that if they could get an ordinance passed in the council allowing them to change their motive power on the Evanston division to electricity they would make arrangements to run from Evanston to Wilson Avenue on their present line, and for a right of way on the Northwestern Elevated tracks from that point down to the city and around the loop. So on last Wednesday evening we presented an ordinance to the council asking for that privilege for the St. Paul road. We also called upon the Mayor to ascertain what he would be willing to do toward helping us. Mayor Harrison is bent upon making every railroad franchise bring a revenue to the city. We explained to him that the road owned its right of way in fee simple, and the only thing it wanted was the privilege of changing its motive power to electricity—that is, to cross the intersecting streets with an overhead trolley. It is not a franchise the road is asking, and they do not propose to have a perpetual franchise."

The league has a petition prepared for presentation to the council when the ordinance comes up signed by over 1500 names, and all the organizations of the Twenty-fifth Ward have joined with the league to bring pressure on the council in favor of the passage of the ordinance.

The Question of Brakes at St. Louis

The matter of power brakes for the street cars of St. Louis is still hung up apparently between the companies and the public improvement board, which received the following letter from the St. Louis Transit Company June 20:

Board of Public Improvements, city: Gentlemen—I beg to acknowledge the receipt of your letter of the 10th inst., embodying a resolution of your honorable board calling the attention of the St. Louis Transit company to the provisions of ordinance No. 20,653, and inquiring whether it will submit plans and specifications of brakes it proposes to use upon cars, and if so, when.

I beg to submit that the transit company is now using brakes that have been in use for many years in this city with efficiency, and such as are in common and general use in nearly all the cities of the United States. Whether any other practical, efficient and approved brake exists, I am not informed. Several have elsewhere been tested and discarded. It is the policy of the company to adopt as speedily as may be consistent with a just concern for the safety of its passengers (to whom it is holden in the highest degree of care), the interests of the public and its own abilities, all tested and approved appliances that will inure to the safe and efficient operation of its cars.

It would not be prudent business management to equip all of its cars with experimental brakes, that is, brakes that had not stood the test of applied use for quite a period of time. There are many inventors in the field, and each one in the conceit of self-interest, urges his for adoption. I am advised that there is a patented mechanical brake in which a very considerable local interest is taken, and which may be urged upon the attention of your board. It would cost the transit company $400,000, to be expended within sixty days, to put this untried brake upon its cars. If it failed in practical use, your board could, under the ordinance which you cite, discredit it within sixty days, and impose another expenditure as great within another sixty days, and so on every sixty days in the year.

You observe from this that it is important that this company proceed, with the usual business caution, with tests and experiments, before submitting for the consideration of your honorable board any brake, which it could commend to its adoption. Yous truly, A. B. Du Pont,

Second vice-president St. Louis Transit Company.

Superintendent John Grant, of the St. Louis Transit Company, said in regard to the paragraph referring to a local brake: "I cannot say what brake is referred to in the letter. There is no plant in the country capable of equipping the St. Louis street cars with new brakes within sixty days. Besides, the brake has not been found as yet which meets all the requirements of the railroad company. We are making tests on our own cars of different patterns of brakes and are keeping watch of the tests in other cities, and when the brake is found that will do better service than those now in use it will be to the interest of the company to have them adopted as soon as possible."

Vice-President Du Pont said, when asked in regard to the letter: "I decline to state at present what brake I referred to in my letter. All I can say on that point is that there is a brake in which a good deal of St. Lous capital is interested. That is the one to which I referred to, and I believe it is the plan to force it upon us."

President Phillips, of the Board of Public Improvements, stated that he regarded the letter of Mr. Du Pont as stating the final decision of the Transit Company not to co-operate with the board in putting the ordinance into effect in this city. He said on that point that the matter would not end with the letter and that the Board of Public Improvements would not be turned from its purpose by the determination of the company. "Plans and specifications of power brakes have already been called for by the board," said Mr. Phillips, "and when these are received the committee will probably go East to inspect brakes in actual service." Continuing, Mr. Phillips said: "I know of but one local brake as likely to be the one referred to. That is a power brake invented by a well-known St. Louis man and backed by strong St. Louis capitalists. The promoters called our attention to this brake, but we told them that it would have to come to us from the Transit Company or the Suburban Company in the form of a suggestion or a recommendation before we could consider it. Our course is to treat the Transit Company fairly. We have given them all the leeway possible in the matter of a fender, and all our suggestions were framed so as to allow the company full latitude in adopting them, so that no manufacturer could take advantage of the company by exorbitant prices for some special device. It is also unfair to the board to intimate that there may be a change in the selection of a brake after sixty days and a second order for an expenditure of another $400,000 by discrediting the former brake."

He also says he will ask the city counselor to sustain him in his efforts to inforce the ordinance when it becomes effective. This looks as if a legal war between the city and the Transit Company is threatened over the power-brake ordinance.

Tunnel Contracts

The Pennsylvania Railroad tunnel contract was signed June 23 by the Rapid Transit Commission and it was at once forwarded to Philadelphia to be executed by the company's officials. Within three months the work of building the tunnel will be begun, if the aldermen do not delay it. President Cassatt thinks that it can be finished in three years.

Corporation Counsel Rives has not yet approved the form of contract for the Brooklyn tunnel.

Negotiations between the Rapid Transit Commission and the New York & New Jersey Railroad Company for determining the remuneration to be paid to the city for the terminal facilities desired by the company in Manhattan have been begun. The company succeeded to the rights of the old Hudson Tunnel Railroad Company and wants a terminal in the blocks bounded by Christopher, West Tenth, Greenwich and Hudson Streets, and permission to tunnel under the streets. Mr. Oakman, who is vice-president of the New York & New Jersey Railroad Company, is also a director of the Subway Construction Company. It is understood that the new company will be willing to make terms like those agreed to by the Pennsylvania Railroad Company and that the amount to be paid the city wihin the first twenty-five years of the life of the franchise will aggregate $300,000.

Power Plant Extension for the John Stephenson Company's Works

Work at the car-building establishment of the John Stephenson Company has been steadily increasing during the last year, and within the last few months it has been so rapid that considerable inconvenience has been experienced from a want of power. To remedy this condition, as the works are entirely without line shafting, an extra electric generating set is necessary. A contract has just been signed for a 300-kw General Electric generator and a 450-hp tandem compound engine. The cylinders are 20 ins. and 34 ins. in diameter and 28 in. stroke. The set is guaranteed for 50 per cent overload and will be installed at the earliest possible date.

"Where and How to Go" is the title of a small brochure issued by the Grand Rapids Railway Company for the purpose of showing that the city of Grand Rapids has, within its limits, or close at hand, some of the prettiest scenes in Michigan, and places of amusement and recreation not surpassed in similar localities anywhere in the Middle West.

Great Barrington Meeting of the American Institute of Electrical Engineers

The nineteenth annual convention of the American Institute of Electrical Engineers, held at Great Barrington, Mass., on June 17, 18, 19, 20 and 21, was the most successful gathering of the members that has ever occurred. The importance of the papers presented, the character and standing of the engineers who were able to attend and take part in the discussions, and the extremely pleasant social features which resulted from the active co-operation and cordial hospitality of the residents of the meeting place will make it a red-letter occasion in the history of the Institute for years to come. More than 250 members and their friends availed themselves of the opportunity of combining business with pleasure in the Berkshire Hills, and a much larger proportion than usual were ladies, who spent the time during the business sessions in taking a number of the beautiful drives which abound in this section. On the invitation of the Stanley Electric Manufacturing Company, through its president, Dr. F. A. C. Perrine, a trip by special train was made to Pittsfield, where a visit to the Stanley Works was made and the party entertained by Dr. and Mrs. Perrine at a lawn tea at their residence and later by the town of Pittsfield at "The Maplewood."

Among those present at the convention were the following: C. P. Steinmetz, B. J. Arnold, F. J. Sprague, W. B. Potter, S. T. Dodd and Mrs. Dodd, F. A. C. Perrine and Mrs. Perrine, A H. Armstrong and Mrs. Armstrong, C. C. Chesney and Mrs. Chesney, Elihu Thomson, E. H. Mullin and Mrs. Mullin, J. Wilkinson, L. Stieringer, Ralph W. Pope, Louis Duncan, J. D. Keiley, T. C. Martin and Mrs. Martin, J. M. Wakeman and Mrs. Wakeman, A. E. Kennelly, C. A. Lieb and Mrs. Lieb, C. B. Wisner, W. D. Weaver, W. C. Andrews, Calvert Townley, Carl Hering, William Maver, Jr., and Mrs. Maver, George F. Sever, T. E. Murray and Mrs. Murray, C. O. Mailloux and Mrs. Mailloux, William Stanley, W. H. Browne, A. V. Garratt and Mrs. Garratt, Joseph Sachs, E. G. Bernard, H. E. Heath, H. W. Buck, A. P. Jenks, J. F. Kelly and Mrs. Kelly, H. G. Reist, F. S. Pearson and Mrs Pearson, R. B. Owens, H. Ward Leonard and Mrs. Leonard, W. E. Goldsborough, W. J. Jenks and Mrs. Jenks, Lamar Lyndon, J. B. Entz, D. B. Rushmore, Samuel Sheldon, C. S. Bradley, F. B. Crocker and C. W. Holtzer. C. F. Scott, president-elect of the Institute, was unavoidably absent in Europe, but a long letter was read from him expressing his regret at not being able to be at the convention and his assurances that he would do all in his power to make the following year as successful as the one just passed over.

The most important paper at the convention was that by B. J. Arnold on his investigations of the power required to operate trains in connection with his work in perfecting the New York terminal arrangements of the New York Central & Hudson River Railroad, which is reprinted elsewhere in this issue. This was followed in the discussion by an outline of Mr. Arnold's new traction system using single-phase electrical currents and compressed-air auxiliary apparatus, which is also presented in this issue. The other railway papers read before the session on Thursday morning, which was set apart as a day for discussing traction problems, was also of exceptional merit, and the railway features of the meeting were therefore of great prominence.

Convention of the Canadian Electrical Association

The twelfth annual convention of this association was held in Quebec, Canada, on June 11, 12 and 13, and not only was the attendance the largest on record, but the papers read and the topics discussed made its importance far in advance of any that had preceded it. President P. G. Gossler, of Montreal, through whose untiring efforts the success of the meeting was largely due, delivered an interesting annual address dealing with the question of the early development of power transmission in Canada, the aims and hopes of the association, the subject of legislation both as to laws already passed and as to what appears to be the present tendency, the inspection of electrical installations, the expansion of the business of electrical companies and several other important subjects. A paper was read by A. B. Lambe, of Toronto, on the "Electrical Equipment of an Ordinary Street Car," in which he went very fully into all the details. While somewhat elementary in character, this paper was listened to with a great deal of interest, especially so on account of the exhibit of working apparatus which was courteously loaned him by the Quebec Railway, Light & Power Company to illustrate his remarks. Another subject of interest to street railway men was a paper by A. A. Dion on the "Use of Storage Batteries in Electric Distribution," in which he included railway plants among the other advantageous positions for the installation of accumulators. E. A. Evans, of Quebec, read a paper on electric suburban railways, which is reprinted elsewhere in this issue. During the convention a number of interesting excursions were made to power plants and other objects of interest about Quebec, and the social features, consisting of the annual banquet, concerts, etc., were exceptionally well managed.

A New Philadelphia Railway Supply Agency

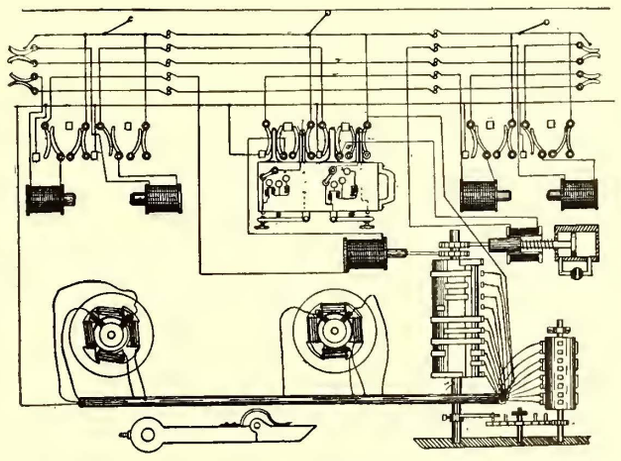
H. F. Sanville, who for a number of years has been connected with the Morris Electric Company, of New York, has opened an office for himself in the Girard Trust Building, Philadelphia. Mr. Sanville will deal in street railway supplies exclusively, and has already secured the agency for several well-known specialties and general lines. He will represent the Albert & J. M. Anderson Manufacturing Company, of Boston, Mass., and will be in a position to contract for trolley line material, switchboard apparatus and other electrical equipment materials manufactured by this well-known house. This agency will also be a branch office for Francis Granger, of New York, and all electric railway specialties handled by this New York concern will thus be represented in Philadelphia. These include the products of the Corning Brake Shoe Company, Ham Sand Box Company, R. Bliss Manufacturing Company, Lehigh Car Wheel & Axle Works, New Haven Car Register Company, Hipwood-Barrett Fender Company, Sterling Electrical Manufacturing Company and Trojan Trolley Tender Company. In adition Mr. Sanville will handle the products of the Waclark Wire Company.

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 JUNE 17, 1902

702,427. Electric Railway; J. C. Henry, Denver, Col. Application filed April 1, 1901. A multiple-unit control system in which the several controllers are moved step by step by solenoids, all of which are connected in series in a local circuit, the local circuit being controlled by a hand switch.



PATENT NO. 702,427

702,484. Car Fender; W. B. Rohmer, Bay St. Louis, Miss. Application filed Nov. 30, 1901. Relates to the means for tripping a catch-member of the fender so that the latter will be quickly and easily operated by coming in contact with an obstruction and will be immediately moved out of the way as soon as it has performed its function.

702,522. Railway Switch; W. C. Wood, New York, N. Y. Application filed Dec. 16, 1901. Means whereby the pin which forms the axis of the switch tongue is held in its proper position.

702,545. Railway Switch; S. A. Douglas, Leavenworth, and M. Alcorn, Leavenworth County, Kan. Application filed Dec. 10, 1901. Details.

702,564. Car Truck; H. R. Keithley, Buffalo, N. Y. Application filed Jan. 20, 1902. A truck embodying the distinctive features of both the diamond and pedestal types of trucks..

702,565. Railway Car Truck; H. R. Keithley, Buffalo, N. Y. Application filed April 11, 1902. A modification of the preceding patent.

702,579. Compound Truss Rail; E. T. Morlan, Pittsburgh, Pa. Application filed Oct. 23, 1901. A compound truss rail consisting of base and head members, each having webs which overlap and are bolted together.

702,593. Safety Device for Railway Points or Switches; S. Rogozea, Brussels, Belgium. Application filed March 18, 1902. The car wheel closes and locks the switch immediately before passing over it.

702,644. Car Wheel; M. P. Gerbing, Wentworth, Mo. Application filed Jan. 31, 1902. The wheel has a groove in the angle between the tread and flange which prevents cutting away the corner of the rail.

702,701. Car Bolster; H. C. Buhoup, Chicago, Ill. Application filed March 14, 1902. The center bearing consists of two hemispherical sockets in which a ball is confined.

702,744. Railway Replacing Frog; A. Pursley, St. Paul, Minn. Application filed July 30, 1901. A frog provided with grooves adapted to conduct the car wheel from the ground to the rail.

702,745. Automatic Switch-Throwing Device; J. N. Quinn, Cincinnati, Ohio. Application filed March 8, 1902. Details.

702,818. Bolster; E. W. Palmquist, East St. Louis, Ill. Application filed March 8, 1902. The upper and lower cords are connected by a web, a king-bolt opening extends through the upper cord and the upper part of the web and terminates in a cross-passage which provides for access to the lower end of the king-bolt.

702,890. Brake Shoe; A. L. Streeter, Chicago, Ill. Application filed Jan. 27, 1902. Wires extend from end to end of the shoe at the back to prevent pieces from falling in case the shoe breaks.

702,896. Hide-Bearing for Railway Cars; C. H. Williams, Jr., Chicago, Ill. Application filed Feb. 12, 1902. The balls furnishing the side bearing are aranged to turn on other smaller balls beneath them.

PERSONAL MENTION

MR. F B ROCKWELL will assume the duties of general manager of the Syracuse, Lakeside & Baldwinsville Railway, of Syracuse, N. Y., on July 1.

MR. RAPHAEL SEMMES, of Mobile, has been elected general manager of the Mobile Street Railway, of Mobile, Ala., to succeed Mr. R. F. Scott, who will become superintendent of the company.

MR. JAMES ROWLAND BIBBINS has resigned as assistant electrical engineer of the Detroit United Railway to accept a position in the Westinghouse Company's publishing department. Mr. Bibbins will be located in New York.

MR. C. C. BURDICK has been appointed superintendent of the St. Paul lines of the Twin-City Rapid Transit Company, of Minneapolis, Minn., to succeed Mr. D. S. Smith, who has become general superintendent of the Brooklyn Rapid Transit Company.

MR. M. V. MORSE, a prominent merchant of Omaha, Neb., has been elected secretary of the Omaha Street Railway Company, of Omaha, Neb. Until the election of Mr. Morse as secretary of the company the duties of secretary had been combined with those of general manager.

MR. THOMAS GANNON, for the past three years division superintendent of the Weymouth & Braintree branch of the Old Colony Street Railway, of Boston, Mass., has resigned to become division superintendent of the Mansfield & Walpole division of the Blue Hill Street Railway Company, of Boston.

MR. JOHN A. WALKER, vice-president, treasurer and general managers of the Joseph Dixon Crucible Company, of Jersey City, N. J., sailed for Europe on June 17. Mr. Walker will spend most of the time at the company's London branch and in business visits to the various Dixon agencies on the continent.

MR. C. W. GEARHART, who has had charge of the elevated cars of the Brooklyn Rapid Transit Company on the bridge, has resigned to accept a position in Boston, and his place is to be taken by Superintendent E. F. Rives, who has heretofore acted as superintendent of the associated lines on the bridge. The latter's title hereafter will be superintendent of the bridge division, the elevated and surface lines being combined and placed under his charge.

MR. T. G. HANSEN, until recently general superintendent of the system of the Northern Ohio Traction Company, sails for England June 25 to become traffic manager for one of the leading properties of the British Electric Traction Company, of London, which operates traction lines in a number of English cities. Mr. Hansen's first street railway work was as a gripman on one of the Chicago cable roads. Later he became an inspector, and four years ago went to Cleveland as division superintendent of the Cleveland Electric Railway. Several months ago he was appointed general superintendent of the Northern Ohio Traction Company. Mr. W. H. Douglas, heretofore division superintendent of the Northern Ohio Traction Company, has been appointed general superintendent of the company, to succeed Mr. T G. Hansen. Mr. Douglas has been under General Manager Currie at Toronto, Canada; Lima, Ohio, and Detroit, Mich. He was superintendent of the Canton-Massillon Railway while it was controlled by the Northern Ohio Traction Company.

T. G. HANSEN

MR. E. W. DAVIS, formerly prominent in street railway affairs in Western Pennsylvania, died at El Paso, Tex., a few days ago. Mr. Davis was born in Pottsville, Pa., forty-three years ago and was reared in that place. After receiving a common school education he studied civil engineering and soon thereafter superintended the construction of street railway lines in Pittsburgh and Philadelphia. Shortly before the Consolidated Traction Company, of Pittsburgh, absorbed the older concern Mr. Davis resigned his position with the road, of which he had been made superintendent. Later he constructed the Versailles line at Pittsburgh and some years ago made all arrangements for building a road between Canonsburg and McDonald.

MR. CHARLES T. CHILD, technical editor of the Electrical Review, New York, died at the home of his father-in-law, Rev. John R. Cushing, in Gleasondale, Mass., on Monday, June 23. Mr. Child had been in poor health for a number of weeks but his illness had not assumed a serious aspect until a few days before his death when it was announced that he was suffering from a severe attack of typhoid fever. Mr. Childs was a pioneer in the street railway field, having been connected with Mr. Frank J. Sprague in the installation of the original Richmond line, and has taken an active part in many electrical undertakings. He is best known, however, from his ability as a writer, his connection with many technical papers having kept him for many years before the electrical profession and made him a prominent figure in recent electrical development. He was a linguist of exceptional qualifications, a graduate of Johns Hopkins University and a special student in physics and mathematics under the late Professor Henry Howland. In 1892 he took charge of the United States Astrophysical Observatory of the Smithsonian Institution, and many of the elaborate researches of Professor L. B. Langley were undertaken under his supervision. Mr. Child was a man of great cordiality, and endeared himself not only to a large circle of intimate friends, but to his extensive acquaintance throughout the electrical profession of the world, having a happy combination of pleasing personal characteristics which enabled him to make friends readily and to command the respect and affection of all those with whom he was closely associated. Mr. Child was thirty-five years old and leaves a widow and three small children.

C. T. CHILD

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, June 25, 1902.

Contrary to the experience of recent years the surplus bank reserve has not decreased during the first three weeks of June. It stands now a trifle higher than it did at the outset of the month. As a result, in place of the abnormally low figure of three weeks ago, the present surplus does not compare unfavorably with the average of the last few years. We pointed out in this column last week that if precedent is followed the reserve may be expected to increase pretty steadily during July and the first half of August. The only obstacle to such expansion lies in the possibility of a renewal of gold exports, which is suggested by the advance in our exchange market during the last ten days, and by the sharp decline in the European exchanges. Rates now are nearly in the position where gold could be shipped to France at a profit. The condition has partly been brought about by the preparations for the partial conversion of the French government debt, which has occasioned a general hardening of foreign discounts, and has helped to depress sterling exchanges at Paris and Berlin. But the rise in sterling at New York is more directly due to remittances of interest and dividends upon American securities held abroad, and these remittances will cease of course after the turn of the half year. Consequently it is not easy to tell as yet whether the current movement of exchange is anything more than temporary in character, and whether if gold were to go out any considerable quantity would be shipped. The course of the money market during the next month or so, it will be seen, is more or less intimately connected with the settlement of these questions. Other factors in the situation remain practically the same as they have been described in previous articles. Currency continues to flow inward in seasonable volume from the interior centers, and suffices to more than offset what the Treasury is drawing out through surplus revenue collections. The principal demand for loans, as reflected by the large increase in that item in last Saturday's bank statement, arises from the customary preparations for the first of july settlements. Borrowing for syndicate enterprises and for the ordinary speculative operations is at a minimum—which, everything considered, is by no means an unwelcome feature of the situation.

Money on call is easy at 3 per cent. Time loans are made freely at 4¼ per cent for sixty days on good collateral, and 4½ per cent for the longer periods.

The Stock Market

The upward movement which started a week ago on the Stock Exchange has made notable progress in some directions, while in others it has seemingly been checked. A quiet investment demand, normally incident to the semi-annual corporation disbursements, is observable in the bond department, but it has not cut much of a figure in stocks. The principal stimulus to the stock market has come from the various cliques of professional operators engaged in the manipulation of their specialties. In this category the movement in the so-called Gould properties—Wabash and the Southwestern railroad properties more particularly—has been the most important. The strength of these stocks is partially due to the good crop prospects in the Southwest, and partially to the plans which have long been rumored for a great railway system under the leadership of the Missouri Pacific. It is safe to say, however, that this scheme will not reach its maturity until some decision has been rendered in the Northern Securities litigation. The rest of the railway list, including such favorites as St. Paul, Union Pacific and Reading, have had occasional bursts of activity accompanied by rising prices. But their movement has been far less uniform and their tendency more uncertain than the Gould shares. The coal strike undoubtedly continues a repressive factor, but its influence is not felt to anything like the extent it was three weeks ago. Wall Street commonly takes the view that the chances of the miners have been weakened by the failure of the strike in the West Virginia soft coal mines, and it is inclined to look forward to an early termination of the struggle. It is a matter of doubt in the minds of many whether the call for a general convention on the seventeenth of next month is not a bluff on the part of the union leaders, and it is still more doubtful whether such an assemblage would declare for a general strike. The crops have suffered something of a set-back from excessive rains and low temperatures during the week, but no really serious damage has been done. The outlook here, as in the general business situation, continues favorable.

The local traction stocks have done little more than follow the fluctuations of the general market. Good buying is noticeable in Manhattan, but the stock is only taken as offered, and there is no bidding for it. On the contrary the indications are that the people who are buying the shares do not care to see higher prices yet awhile. The earnings are reported to be even better than the average for the March quarter, and even the conservative officials of the company are talking 7 per cent to be earned for the calendar year. That the stock will eventually sell a good deal higher is what the best judges believe. The pool in Brooklyn Rapid Transit, after a period of quiescence, are apparently ready to take the aggressive again. On the other hand the life has all gone out of the recent incipient boom in Metropolitan shares.

Philadelphia

The stock of the new Philadelphia Rapid Transit Company, which has leased the Union Traction, was traded in for the first time during the past week. A total of 600,000 shares has been listed, the par value being $50, and $5 only being paid in. This small installment accounts for the low quotation for the issue, which opened at 9⅜, and subsequently fell to 8⅞. Dealings have been comparatively active in the shares, but this circumstance has not lessened the interest in Union Traction, which has been dealt in in very fair volume during the week. Evidences of continued absorption of a good character were very plain, and the stock rose easily from 43½ to 44, but the buyers did not seem inclined to force the price above this level. Speculative sentiment in Union Traction is undergoing the same sort of revolution that it is in the Metropolitan Street Railway stock of New York. The reasoning in both cases is that the lessee company will retain all the benefits of its present earnings and absorb beside most of the extra strength contributed by the newly-created concern. A sensational feature of the week's trading was the bidding up of Indianapolis Street Railway stock 13 points to 76¼ before any offerings were attracted. At that figure 100 shares changed hands. Other stock sales comprised American Railways at 45¾, Fairmount Park Transportation at 22 and 22½, Philadelphia Traction at 98½, United Traction of Pittsburgh, preferred, at 51, Easton Electric at 19½, and Railways General at 4¾. In bonds the week's transactions included Citizens' Passenger of Indianapolis 5s at 110½, People's Passenger 4s at 106½, Consolidated of New Jersey 5s at 109⅞ and 109¾, Electric People's Traction 4s at 98⅞ to 100, and Indianapolis Railway 4s at 88⅝.

Chicago

Despite the fact that earnings on all the elevated lines continue largely in excess of last year, the stocks of the various companies have all gone lower during the past week. Lake Street has shown particular weakness, touching 10¾, which is 5 points lower than the high figure of the rise six weeks ago, and the lowest the stock has sold this season. The selling apparently represents liquidation by speculators who bought some time ago, on the talk that control of the property was to be acquired by an outside interest. Now there is some discussion of another reorganization. The other elevated shares have declined on light trading, Metropolitan common getting down to 38½, Northwestern common to 36, and South Side to 112. Chicago Union Traction holds steady but inactive around 18, and nothing has been done in the other traction shares. The Illinois Supreme Court has decided that the elevated roads are to be assessed henceforth by the State Board of Equalization and not by local assessors. The impression is that this will result in less radical methods of taxation, but there seems no real reason why the decision should be important to the companies. The residents of the North Shore have petitioned the City Council to allow the St. Paul Railroad to electrify its Evanston branch and send its cars over the Northwestern Elevated. Considerable interest is taken in the decision, which has been referred to the committee on transportation.

Other Traction Securities

Scarcely anything is to be said of the Boston market for traction shares during the week. Massachusetts Electric common is off three-quarters of a point to 43, but the dealings were too small to have any significance. West End preferred, "ex" the quarterly dividend of 2 per cent, sold at 114¼. In Baltimore the strength of the United Railway issues continues, the common getting back to 16, the general 4s rising to 97, and the incomes to 69¾. This is the highest price the last-named have touched this season, if the recent 2 per cent coupon were added to the price. Other Baltimore transactions include Lexington Railway 5s at 104, Charleston Consolidated Electric 5s at 98, Knoxville Railway 5s at 100, Norfolk Railway 5s at 114, Norfolk Railway & Lighting 5s at 96, City & Suburban (Washington) 5s at 98¼, Atlanta Street Railway 5s at 108¼, and Neport News and Old Point 4s at 96¾. North Jersey Traction

issues are a shade higher at 83¼ for the bonds and 28½ for the stock. Rochester Railway preferred continues strong at 102½. Dealings have begun in the new stock of the New Orleans Railways Company, sales of which are reported at 10¾. New Orleans City Railroad shares are firm at 34¼ for the common and 112½ for the preferred. No change is reported in either Columbus or Louisville traction securities. The feature of the New York curb was the sensational advance in the new San Francisco Street Railway bonds from 92 to 101. According to the story considerable sales have been made against the subscription privileges, which, including the right to subscribe to a certain proportion of common and preferred stock as well as the bonds, were relatively cheap by comparison with the market price of the bonds. It appears that out of a total of $20,000,000 of the bonds $5,000,000 only were actually issued, while the remainder are tied up by an option, and are not, therefore, available for delivery. This leaves the position one where a large short interest exists, with only a very narrow supply obtainable for covering, and the price has been bid up on the theory that a virtual corner exists. Naturally those who bought the subscription rights and sold the bonds in good faith that the entire amount would be issued are exceedingly indignant against the banking syndicate which have promoted the "deal." At this writing the outcome of the situation is by no means clear.

It was another active week on the Cleveland Stock Exchange. Toledo Railways & Light was again the feature, sales amounting to 4105 shares. The opening sale was made at 30¾, and during the week the stock advanced to 32, but later dropped to 30. Sales of Detroit United amounted to 540 shares at a decline from 79½ to 78, ex-dividend at latter figure. Northern Ohio Traction common made a strong showing, closing at 43½, a gain of 5½ points over the high figure of the previous week. It sold at 40 to 43 during the week, closing strong at the high mark. Two blocks of the preferred went at 86, 2 points up. Six lots of Cleveland, Elyria & Western sold at 70; last sales of this stock were close to 80. Four hundred shares of Elgin, Aurora & Southern sold at 43 and 44½, the former the closing figure. Western Ohio Railway receipts are in strong demand but few are for sale. Two lots went at 22½ to 23¾, a gain of 2¼ over last week. There was considerable bidding on Cleveland Electric, but sales amounted only to 187 shares at 85, gain of 3 over last sales. Repeated rumors are again heard to the effect that the consolidation of the two big city systems is soon to be consummated. President Andrews, of the company, admits that Senator Hanna, who is at the head of the other company, now has the matter under advisement and does not deny that matters are favorable for the speedy carrying out of the plan. Monday Cleveland Electric sold at 84 for a small lot. Western Ohio receipts advanced to 23¾ and 100 Detroit United sold at 77¾.

Security Quotations

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

	Closing Bid June 17	June 24
American Railways Company	45½	45¼
Boston Elevated	166	a166
Brooklyn R. T.	67	66⅝
Chicago City	206	205
Chicago Union Tr. (common)	18	17½
Chicago Union Tr. (preferred)	54	53
Cleveland & Eastern	31	31
Cleveland Electric	81½	85
Columbus (common)	52½	52½
Columbus (preferred)	107¼	107¼
Consolidated Traction of N. J.	69½	69½
Consolidated Traction of N. J. 5s	112⅛	112⅛
Detroit United	78⅞	79⅛
Electric People's Traction (Philadelphia) 4s	99	99¼
Elgin, Aurora & Southern	44	43
Indianapolis Street Railway 4s	88½	88⅝
Lake Street Elevated	11¾	10½
Manhattan Railway	131	130⅞
Massachusetts Elec. Cos. (common)	43¾	43
Massachusetts Elec. Cos. (preferred)	98	a98
Metropolitan Elevated, Chicago (common)	38	38
Metropolitan Elevated, Chicago	90	89½
Metropolitan Street	151⅛	148
New Orleans (common)	34	34¼
New Orleans (preferred)	111½	112½
North American	121	121
Northern Ohio Traction (common)	37½	43
Northern Ohio Traction (preferred)	84	86
North Jersey	28¼	28½
Northwestern Elevated, Chicago (common)	37	34
Northwestern Elevated, Chicago (preferred)	84½	80
Philadelphia Traction	98¾	98½
St. Louis Transit Co. (common)	30¾	30¾
South Side Elevated (Chicago)	112	109
Southern Ohio Traction	67¼	67¼
Third Avenue	130	130
Toledo Railway & Light	29⅞	30
Twin City, Minneapolis (common)	119	119
United Railways, St. Louis (preferred)	83¾	83½
United Railways, St. Louis, 4s	87⅜	87¼
Union Traction (Philadelphia)	43¼	43¼
Western Ohio Railway	20½	22¾

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

Iron and Steel

Extreme scarcity of raw material continues to hamper all branches of the iron trade. A number of furnaces have had to shut down in the anthracite coal regions, and still others in the Ohio Valley, owing to the scarcity of fuel caused by the miners' strike. This condition has led to some placing of contracts by timid consumers as far ahead as 1903, while in the steel trade it has stimulated importations from abroad.. According to the Iron Age reports from Chicago, additional sales of steel rails have been made during the week for delivery in 1903. Quotations are as follows: Bessemer pig iron, $21.50; steel billets, $33; steel rails, $28; girder rails, $33.

Metal

Quotations for the leading metals are as follows: Copper, 12 to 12 7-16 cents; tin, 28⅜ to 28½ cents; lead, 4⅛ cents, and spelter 4⅞ cents.

BIRMINGHAM, ALA.—The directors of the Birmingham Railway, Light & Power Company have declared a regular semi-annual dividend of 3 per cent on the preferred stock, of which there is an issue of $1,500,000.

MACON, GA.—The Railways & Light Company of America is reported to be negotiating for the purchase of the Macon Consolidated Street Railroad Company and the Macon Electric Light & Railway Company.

MOLINE, ILL.—The stockholders of the Moline, East Moline & Watertown Railway have voted to increase the capital stock of the company from $25,000 to $125,000, the additional stock to pay for the construction of the road to East Moline.

BURLINGTON, IA.—Mason, Lewis & Company, of Chicago and Boston, offer, at 101.50 and interest, $500,000 Burlington Railway & Light Company first mortgage 5 per cent gold bonds. The bonds dated July 1, 1897, maturing Oct. 1, 1917. Their retirement is optional after July 1, 1902, at 105 and interest. The interest is payable April 1 and Oct. 1.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company is arranging to absorb by consolidation the Milford, Holliston & Framingham Street Railway Company. The capital stock of the Milford & Uxbridge Company is to be increased from $100,000 to $352,000, the new stock to be exchanged dollar for dollar for the shares of the Milford, Holliston & Framingham Street Railway Company.

NORTH ADAMS, MASS.—A controlling interest in the Hoosac Valley Electric Railway has been purchased by a syndicate, the members of which are stockholders of the Pittsfield Street Railway. It is generally expected that a consolidation of the properties will be affected. In that event there will be a continuous route from Pittsfield to Adams, Nortb Adams and Williamstown.

MARSHALL, MICH.—The Jackson & Battle Creek Traction Company, building an electric railway between Jackson and Battle Creek, has given a mortgage for $750,000 to the Morton Trust Company, of New York. It runs for thirty years from July 1, 1902, and bears interest at 5 per cent, payable semi-annually.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company reports earnings as follows:

April	1902	1901
Gross earnings	$263,243	$232,244
Operating expenses	131,388	111,741
Earnings from operation	$131,855	$120,503
Charges and preferred dividends	76,017	74,168
Net earnings	$55,838	$46,335
From Jan. 1 to April 30		
Gross earnings	$1,059,565	$926,312
Operating expenses	512,040	449,324
Earnings from operation	$547,525	$476,988
Charges and preferred dividends	304,067	286,461
Net earnings	$243,458	$190,527

ALBANY, N. Y.—It is reported that plans are being matured for combining into one large system the United Traction & Electric Company, of Albany and Troy; the Hudson Valley Railway, which has a system connecting with Lake George; the Albany & Hudson Railway, and the Albany & Schenectady Railway. Anthony N. Brady and his associates in the United Traction & Electric Company are said to be arranging the deal.

DOLGEVILLE, N. Y.—The Little Falls & Dolgeville Railroad will be sold at public auction on July 24. There are many reports as to the prospective purchaser of the property, but the one looked upon as most likely to materialize is that the Herkimer County Light & Power Company, which now owns the Dolgeville electric lighting plant, will buy the property.

JERSEY CITY, N. J.—The directors of United Traction & Electric Company of New Jersey have declared the regular quarterly dividend of 1 per cent, payable July 1.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

April	1902	1901
Gross receipts	$1,041,706	$989,993
Expenses, including taxes	705,011	658,282
Net receipts	$336,695	$331,711
Ten months ending April 30		
Gross receipts	$10,468,072	$9,844,597
Expenses, including taxes	7,489,909	6,522,732
Net receipts	$2,978,162	$3,321,865

ROCHESTER, N. Y.—N. W. Halsey & Company, of New York, are offering for subscription a limited amount of the first consolidated 5 per cent bonds of the Rochester Railway Company, maturing in 1930.

NEW YORK, N. Y.—Kuhn, Loeb & Company, of New York, received on June 25 subscriptions at 97½ for $11,000,000 of Metropolitan Street Railway Company's 4 per cent refunding 100-year gold mortgage bonds. These bonds are part of a recently authorized issue of $65,000,000, of which $54,000,000 are reserved to retire outstanding bonds of other issues of the Metropolitan Street Railway Company, and of its subsidiary companies. The refunding mortgage securing this issue is the only obligation of the Metropolitan Street Railway Company covering all its lines and leases, and therefore the only lien which embraces the entire system as now constituted. The issue is limited to $65,000,000. Among the properties mortgaged are the franchises, railroads, equipment, leases, real estate and other property of the company, and also 14,000 shares Broadway and Seventh Avenue Railroad Company stock, 4,000 shares Forty-Second Street and Grand Street Ferry Railroad Company stock, 3000 shares Central Park, North and East River Railroad Company stock and 9900 shares Thirty-Fourth Street and Crosstown Railway Company stock. The outstanding capital stock of the company is $52,000,000, and it has paid since January, 1899, regular dividends of 7 per cent upon its outstanding share capital. Dividends at the same rate have been guaranteed by the Interurban Street Railway Company, to which the system has been leased. The subscription lists will be closed at 3 p. m. on the same day that they are opened, and payment for the bonds is to be made on July 8, when they will be ready for delivery.

NEW YORK, N. Y.—The North American Company, which controls the Milwaukee Electric Railway & Light Company and various electric railway and lighting properties through the country, reports earnings as follows for the fiscal year ended May 31, 1902:

Salaries, legal expenses, net rentals and other expenses	$47,713
Taxes	5,773
Reduction of good will	1,000,000
Balance to undivided profits	1,049,702
Total expenditures	$2,103,188
Balance unrealized profit account as of May 31, 1901, transferred to income account	$1,547,446
Interest received and accrued	136,169
Dividends	67,761
Commissions, profits and compensations for services	351,812
Total receipts	$2,103,188

On account of the reorganization last year, a comparison of income accounts is not feasible. President Wetmore, of the company, in presenting the report to the stockholders, said in part: "In the last annual statement a balance of $1,547,446 was carried in 'unrealized profit account.' During the past year a sufficient amount of securities was sold to warrant the closing of this account and the transfer of the balance to income account, which, together with other profits in the year, makes a credit balance of $2,103,188. Out of this sum $1,000,000 has been appropriated in reduction of the good-will account, and the final balance constitutes a fund available for payments of dividends. Valuations have been made on a conservative basis. The company has no bonds, notes or money obligations whatever. In the last annual report the purchase of the Gas, Electric & Water Companies in Covington, Newport, Dayton, Ludlow and Bellevue, and their consolidation into the Union Light, Heat & Power Company, in which your company has control, was announced. Since then a consolidation has been effected with the Cincinnati, Covington & Newport Light & Traction Railway Company, and the North American has received preferred and common shares in the new company, viz., Cincinnati, Covington & Newport Light & Traction Company. The earnings, both gross and net, are rapidly increasing, the property is efficiently managed, the preferred shares are already on a dividend basis, and it seems assured that a surplus will be earned from the outset which will warrant dividends on the common. The North American retains ownership of the Milwaukee Electric Railway & Light Company, and the development of its earning capacity during the year has been even greater than expected. During the past year your company has acquired other interests and is planning for their development, but negotiations are not yet so far advanced to admit explanation of at this time. The company is in possession of cash and quick resources which enable it to avail of the opportunities now offering in the electrical field which have never seemed more abundant or of greater promise than at present."

CLEVELAND, OHIO.—The Cleveland, Painesville & Ashtabula Railway Company, which was purchased from the Everett-Moore Syndicate by Messrs. Holcomb and Lattimer, has been fully organized and financed. The company is capitalized at $750,000, and will be bonded for the same amount, this being on a basis of $25,000 per mile for the 30 miles between Painesville and Ashtabula. The officers of the company are: Luther Allen, president; W. J. Hayes, vice-president; Joseph R. Kraus, secretary-treasurer. The company owns the lighting plant and franchise in Geneva, and a private right of way has been secured touching Geneva, Madison and Unionville. The road will connect the Cleveland, Painesville & Eastern with the system now being built between Conneaut and Erie, Pa., with projected roads to Buffalo. Traffic arrangements have been completed with the Cleveland, Painesville & Eastern whereby cars of both companies will be operated through from the Public Square, Cleveland, to Ashtabula.

CANTON, OHIO.—Directors of the Canton-Massillon Railway Company and the Canton-Akron Railway Company have voted favorably on the proposition to consolidate the properties under the title of the Canton-Akron Railway Company. The capital stock of the company has been increased to $1,600,000 to make the merger. Both properties are owned by Tucker, Anthony & Company, of Boston.

COLUMBUS, OHIO.—It is announced that A. E. Appleyard, acting for Tucker, Anthony & Company, of Boston, has purchased the Newark & Granville Street Railway, which includes the Newark city lines formerly owned by the Newark Consolidated Street Railway, and the interurban line to Granville, in all, 13 miles of track. The road will be consolidated with the Columbus, Buckeye Lake & Newark Traction Company, owned by Tucker, Anthony & Company.

CLEVELAND, OHIO.—On page 731 of the STREET RAILWAY JOURNAL for June 7, under the head of companies having gross receipts for 1901 of between $500,000 and $100,000, the Southern Ohio Traction Company's gross receipts were given as $140,542 for 1900, and $154,787 for 1901. The figures thus given are the net receipts for the respective years, the true statement for these years showing:

	1900	1901
Gross receipts	$294,907	$337,741
Operating expenses	154,365	182,954
Net earnings	$140,542	$154,787

OTTAWA, ONT.—The Hull Electric Railway, operating between Ottawa and Aylmed, has passed into the hands of the Ottawa, Northern & Western Railway, or, more properly, of the Canadian Pacific Railway, which recently concluded the purchase of that system. The purchase price is said to have been between $700,000 and $800,000.

HUNTINGTON, W. VA.—The Pennsylvania Railroad Company is reported to have bought the Camden Interstate Railway for the Chesapeake & Ohio Railroad. The reported purchase price is $2,000,000.

PITTSBURGH, PA.—The Philadelphia Company reports earnings as follows:

May	1902	1901
Gross receipts	$1,123,411	$987,984
Expenses and taxes	613,731	531,130
Net earnings	$509,680	$456,854
Gross income	$588,605	$474,323
Gross income	$588,605	$575,323
Deductions	76,941	34,648
Balance	$511,664	$439,675
Charges	323,163	264,007
Surplus for five months	$188,501	$175,668
Gross receipts	$5,773,616	$5,104,305
Expenses and taxes	2,970,826	2,573,453
Net earnings	$2,802,790	$2,530,852
Other income	772,663	309,702
Gross income	$3,575,453	$2,840,554
Deductions	377,599	184,652
Balance	$3,197,854	$2,655,902
Charges	1,744,275	1,320,536
Surplus	$1,453,579	$1,335,366

MONTREAL, QUE.—The Montreal Street Railway Company reports earnings as follows:

April	1902	1901
Gross receipts	$152,524	$144,131
Operating expenses	83,850	93,272
Earnings from operation	$68,674	$50,859
Receipts from other sources	1,865	662
Gross income	$70,539	$51,521
Fixed charges and interest on loans	15,848	9,288
Net earnings	$54,691	$42,233
Oct. 1 to April		
Gross receipts	$1,067,406	$1,008,232
Operating expenses	679,457	652,921
Earnings from operation	$387,949	$355,311
Receipts from other sources	11,704	4,585
Gross income	$399,653	$359,896
Fixed charges and interest on loans	106,234	64,363
Net earnings	$293,419	$295,533

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., May '02	60,747	33,911	26,836	12,957	13,879
	1 " " '01	48,505	28,301	20,204	11,382	8,821
	5 " " '02	251,306	148,773	102,533	------	------
	5 " " '01	210,746	132,335	78,441	------	------
	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., May '02	131,371	90,393	40,977	23,476	17,501
	1 " " '01	73,725	60,993	12,730	19,901	†7,170
	11 " " '02	1,347,142	928,159	418,983	239,299	179,684
	11 " " '01	1,214,749	836,460	378,289	219,334	158,955
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., Apl. '02	1,041,706	*705,011	336,696	------	------
	1 " " '01	989,994	*658,282	331,711	------	------
	10 " " 02	10,468,072	*7489910	2,978,162	------	------
	10 " " '01	9,844,598	*6522733	3,321,865	------	------
	12 " June '01	12,135,559	*7216008	4,919,551	4,341,748	577,803
	12 " " '00	11,768,550	*7106373	4,662,177	4,135,405	526,772
BUFFALO, N. Y.						
International Tr. Co.	1 m., Feb. '02	230,744	132,920	97,824	94,276	3,548
	1 " " '01	235,021	118,273	116,748	84,411	32,338
	8 " " '02	3,519,491	1,664,285	1,855,206	789,124	1,066,081
	8 " " '01	1,998,050	972,319	1,025,731	641,057	384,674
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., May '02	16,441	7,353	9,088	------	------
	1 " " '01	14,167	5,594	8,573	------	------
	5 " " '02	61,189	30,956	30,234	------	------
	5 " " '01	48,209	28,207	20,001	------	------
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	------	------
	12 " " '00	757,954	378,661	379,293	------	------
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., 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., May '02	25,045	13,311	11,735	------	------
	1 " " '01	20,707	11,141	9,566	------	------
	5 " " '02	103,194	64,702	38,492	------	------
	5 " " '01	84,791	54,523	30,267	------	------
	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., May '02	17,128	9,039	8,088	------	------
	1 " " '01	13,498	6,583	6,915	------	------
	5 " " '02	61,810	35,180	26,630	------	------
	5 " " '01	49,700	28,193	21,507	------	------
	12 " Dec. '01	164,971	* 87,102	77,869	72,500	5,369
	12 " " '00	141,112	* 89,592	71,520	72,500	† 980
DENVER, COL.						
Denver City Tramway Co.	1 m., Apl. '02	124,516	66,535	57,983	32,865	26,119
	1 " " '01	116,357	62,806	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., May '02	292,415	161,336	131,079	67,752	63,327
	1 " " '01	243,447	138,304	105,142	57,360	47,782
	5 " " '02	1,307,822	747,710	560,112	327,907	232,205
	5 " " '01	1,122,312	635,934	486,377	286,785	199,592
	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., May '02	44,475	20,288	24,187	9,745	14,442
	1 " " '01	37,205	19,628	17,576	9,158	8,418
	5 " " '02	196,910	110,278	86,632	48,189	38,443
	5 " " '01	169,074	99,527	69,547	45,577	23,969
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., May '02	35,115	20,343	14,773	8,333	6,439
	1 " " '01	29,616	16,097	13,519	8,333	5,186
	12 " " '02	379,252	216,017	163,235	100,000	63 235
	13 " " '01	330,578	208,823	121,755	100,000	21,755
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., May '02	12,234	7,886	4,348	2,410	1,938
	1 " " '01	10,003	6,818	3,185	2,079	1,107
	5 " " '02	51,421	34,609	16,812	11,306	5,507
	5 " " '01	46,195	31,954	14,241	9,886	4,355
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m. May '02	218,633	103.835	114,797	65,638	49,159
	1 " " '01	192,667	94,503	98,163	61,380	36,783
	5 " " '02	1,052,179	505,111	547,068	323,539	223,529
	5 " " '01	921,349	492,033	429,316	302,544	126,772
	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., May '02	178,408	86,780	91,628	18,672	72,955
	1 " " '01	161,283	90,766	70,518	11 633	58,885
	8 " " '02	1,257,518	766,238	491,280	124,907	366,373
	8 " " '01	1,174,099	743,687	430,412	75,995	354,417
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	2,682,132	2 444,091
	12 " " '00	9,950,735	5,195,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., 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 '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
	12 " " '00	14,437,134	6,631,254	7,805,880	4,445,720	3,360,160
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m., Mar. '02	3,994	2,411	1,584	1,146	438
	9 " " '01	3,835	2,043	1,794	1,187	604
	9 " " '02	41,735	21 611	20,124	12,343	7,781
	9 " " '01	39,270	19,276	19,994	11,068	8,925
PHILADELPHIA, PA.						
American Railways	1 m., May '02	97,701	------	------	------	------
	1 " " '01	73,406	------	------	------	------
	11 " " '02	908,356	------	------	------	------
	11 " " '01	764,560	------	------	------	------
RICHMOND, VA.						
Richmond Trac. Co.	1 m., Sept. '01	20,991	15,669	5,322	3,196	2,126
	1 " " '00	20,727	10,770	9,957	3.843	6,115
	12 " " '01	218,569	139,542	79,027	38,618	40,410
	12 " " '00	203,057	108,198	94,859	37,608	57,250
ROCHESTER, N. Y.						
Rochester Ry.	1 m., May '02	88,164	47,772	40,391	24,749	15,642
	1 " " '01	81,016	47,471	33,545	24 185	9,360
	5 " " '02	438,506	241,196	197,311	123,854	73,457
	5 " " '01	409,848	261,259	148,590	120,453	28,137
SCHENECTADY, N. Y.						
Schenectady Ry. Co.	3 m., Dec. '01	84,061	46,949	37,112	13,454	23,658
	3 " " '00	30,876	14,517	16,359	6,087	10,272
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Apl. '02	56,008	31,349	24,659	19,025	5,634
	1 " " '01	52,416	28,470	23,946	18,683	5,263
	10 " " '02	574,652	316,908	257,744	190,196	67,548
	10 " " '01	512,389	280,907	231,482	186,288	45,194
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Mar. '02	111,174	53.151	58,024	37,833	20,189
	1 " " '01	98,749	46,047	52,701	24,271	28,431
	3 " " '02	325,238	163,442	161,796	113,494	48,302
	3 " " '01	288,960	141,628	147.333	72,813	74,520
	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
W. NEW BRIGHTON, S. I.						
Staten Island Ry.	3 m., Mar. '02	38,189	46,906	† 8.717	8,778	†17,495
	3 " " '01	35,897	38,288	† 2,391	8,217	†10,608