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Contents of this Issue

Opening of a Large Interurban Road

The Ohio River Electric Railway & Power Company opened its new line in Southern Ohio on Wednesday, Nov. 14. This new road runs from Racine to Middleport, a distance of more than 12 miles, passing through the towns of Syracuse, Minersville and Pomeroy. It is expected that there will be a large freight business in addition to the regular passenger service, and electric locomotives are included in the equipment.

Chicago City Railway to Retire Bonds

It is announced that the Chicago City Railway Company will retire its bonds which expire July, 1901, by issuing new stock. There are $4,619,500 in bonds outstanding, and they bear interest at the rate of 4½ per cent. The new stock is to be offered at par to present stockholders. The company has issued $500,000 new stock this year, making the present total $13,500,000. There is still $500,000 of stock authorized, but not issued. A new issue of $5,000,000 will be authorized in all probability when the bonds are retired. This will bring the total capital stock up to $19,000,000.

No Changes in St. Louis

The St. Louis *Star* recently contained the surprising announcement that President Edward Whitaker, of the St. Louis Transit Company, and George W. Baumhoff, general manager of the company, were to resign. It was announced that Capt. Robert McCulloch, of Chicago, formerly of St. Louis, was to return to St. Louis as successor to Mr. Baumhoff, and that Murray Carleton, the present vice-president of the St. Louis Transit Company, was to succeed Mr. Whitaker. Our St. Louis correspondent, who was communicated with as soon as this news was received, telegraphs us that Mr. Whitaker emphatically denies that either he or Mr. Baumhoff have resigned or will resign.

Norfolk Houses Destroyed by Fire

The car house of the Norfolk Railway & Lighting Company was destroyed by fire, Nov. 11, together with fifty cars. The fire was discovered at 1 a. m., after the cars had all been turned in for the night. There were sixty-one cars in the house at the time the fire was discovered, but by heroic efforts eleven of these were saved. The loss is estimated at $150,000. The fire has crippled service in the city, and there will be no relief until cars can be obtained from other cities. The company has already begun the work of securing new cars, and expects to resume regular operations in a few days. The origin of the fire is unknown.

Lynn & Boston to Increase Its Capital

The Massachusetts Railroad Commissioners have just issued an order approving an issue of 10,160 shares of additional capital stock by the Lynn & Boston Railroad Company, of Lynn, in addition to its present outstanding capital of $2,271,000. The value of the shares, to be offered proportionately to stockholders, is $130 per share. The order is on the petition of the company that it may issue $1,500,000 additional capital. In approving the new issue of stock the board recommends that the company continue to limit its dividends to 6 per cent per annum, until the impairment of capital shall have been made good, and requires that the existing contract providing for the issue of coupon notes to the value of $310,000 shall be canceled. It orders that, of the increase granted, $124,000 shall be used to the refunding at par value of outstanding bonds issued Oct. 9, 1894, amounting to $161,200. The Board also orders that $607,000 shall be applied to the payment and funding at par value of outstanding coupon notes amounting at par value to $789,100; that $54,000 shall be applied to the necessary cost of the purchase of additional rolling stock; that $138,000 shall be applied to the necessary cost of improvements in the power station at Salem, and $29,000 to the necessary cost of improvements in the power station at Wakefield; that $21,000 shall be applied to the necessary cost of the Essex Falls transmission line, and $14,000 to the necessary cost of equipment for the sub-station at Essex Falls, and that $29,000 shall be applied to the necessary cost of the new building and equipment of sub-station at Gloucester, and any excess in the proceeds of said stock over and above the amounts required for the purposes aforesaid shall be applied to the payment for permanent improvements and additions to the street railway property.

Chattanooga Purchase and Improvements

The Rapid Transit Company, of Chattanooga, Tenn., has just purchased the property of the Chattanooga & Lookout Mountain Railroad, Lookout Point Incline Company and Lookout Incline & Lulu Lake Railway, and has announced that important improvements are to be made in its system. The properties purchased were mainly owned by J. T. Crass. The purchase price is not announced. The improvements to be made in the system include extensions, additions to power station, and the general reconstruction of the property just acquired. The lines of the Rapid Transit Company will be extended to the top of Lookout Mountain, a line will be around Lulu Lake on the mountain, and a loop will be built at East Lake, and cars run directly from the city to all points, including the top of the mountain. The Sherman Heights line will be extended to Boyce Station, and a loop will be built around East Lake. The power station equipment will be more than doubled, and, when all these improvements are completed, there will be a network of lines touching every suburban point.

Details of the Birmingham Consolidation

The details of the Birmingham, Ala., consolidation, which was concluded Oct. 17, 1900, and which has been previously noted in the Street Railway Journal, have been made public. The consolidated companies are the Birmingham Railway & Electric Company, Birmingham Traction Company and the Birmingham, Powderly & Bessemer Railway Company, and the official title of the consolidation is the Birmingham Railway, Light & Power Company. The capital stock of the company is $1,500,000, divided in 15,000 shares, of a par value of $100. It has been decided to issue bonds to the amount of $3,500,000. They will be fifty-year bonds, of the denomination of $1,000, and bear interest at the rate of 5 per cent. They are to be payable in gold, and to be a first lien on the property of the company now owned or hereafter acquired. Of the stock of the consolidated company, 10,000 shares are to be held in the treasury for further use; 5000 shares are to be delivered to the stockholders of the Birmingham Traction Company, and 500 bonds are to be delivered to the bondholders of said company; 100 bonds are to be delivered to the bondholders of the Birmingham, Powderly & Bessemer Railway Company and the outstanding bonds of the last named two companies are to be delivered to the consolidated company and canceled. The remaining bonds of the consolidated company are to be left in its treasury for the purpose of acquiring other property, or making further consolidations with other companies.

First Annual Meeting of the J. C., H. & P. Ry. Co.

The first annual meeting of the Jersey City, Hoboken & Paterson Railway Company, of Hoboken, N. J., was held Nov. 5. The company is a most important one in New Jersey, and is a consolidation, November, 1899, of practically all the electric railways in Northern New Jersey, which were not already under the control of the North Jersey Street Railway Company. This latter company is also controlled by the same interests. The Jersey City, Hoboken & Paterson Railway Company is a union of the North Hudson County Street Railway Company, Paterson Street Railway Company, Paterson Central Electric Railway Company, Saddle River Traction Company, Palisades Railroad Company, White Line Traction Company, Paterson, Passaic & Rutherford Electric Railway Company, Jersey City, Hoboken & Rutherford Electric Railway Company and Paterson Horse Railway Company.

The report of the company for the year, it is said, shows a surplus of $100,000. At the meeting of the company many new directors entered the directorate. The old directors who were re-elected are: David Young, John F. Shanley, William C. Shanley, A. P. Hexamer, Edward L. Young, Gen. B. W. Spencer. The new directors who have just been elected are: Dennis McLaughlin, E. F. C. Young, William B. Gourley, Randal Morgan, Gen. William C. Heppenheimer, Chandler W. Riker, Charles A. Sterling, John R. Lee, J. E. Hulshizer.

Municipal Ownership Discussed at Chicago

At a banquet of the Merchants' Club, of Chicago, held Nov. 10, municipal ownership of public utilities was discussed, and papers were presented by Professor Edmund J. James, of the University of Chicago, and Colonel E. R. Bliss. Both the speakers urged against municipal ownership. Professor James fears that municipalization will greatly increase what he terms the "functionary class"—those who would strive to obtain a position under the municipality, and then become inactive and remain dormant—and the large increase in political patronage.

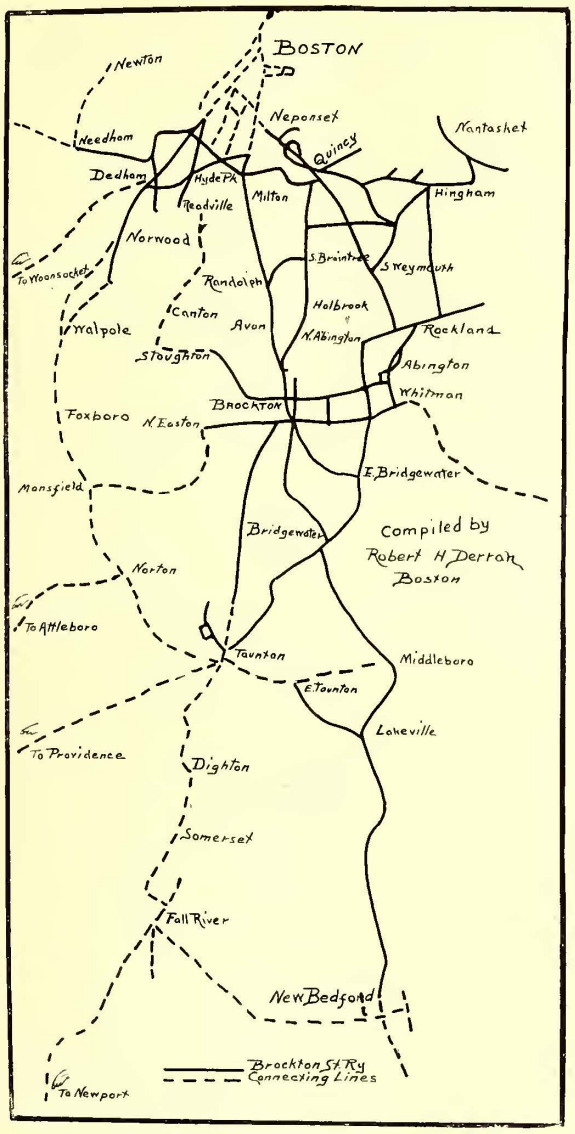
Professor James said, in part: "Private management is, on the whole, more efficient, and operates under favorable conditions at a lower cost of production, and leaves, therefore, possibly a larger margin of profit for the community. This, in spite of the fact that individual instances may be found of very capable public management; in spite of the fact that municipalities may be able to borrow money at lower rates of interest than private corporations; in spite of the alleged fact that public employees have a keener sense of loyalty to the community than private employees to the company; in spite of the fact that with every passing year the efficiency of the municipality as a business agent is increasing. Another reason in my mind for rejecting municipal ownership as a general and satisfactory solution at present is that such a solution would end in increasing enormously the functionary class in our society—the class which, instead of depending upon its own right arm and good cause for getting on in the world, depends on getting a place at the public crib, where, protected by the conservatism of public employment, it may lead a life, if not of ease, at least of inertia, lack of initiative, and lack of strenuous effort. This objection holds especially against a permanent civil service—the absolutely essential condition of reasonable efficiency in public, as in private, employment."

Colonel Bliss said, in part: "The policy of municipal ownership does not attempt to destroy monopoly, but to create perpetual monopoly. Its advocates propose that the city shall monopolize all these utilities, taking them out of the hands of private corporations in order to secure for the public the full measure of all possible benefits to be derived from them. They present this as a business proposition in no wise related to socialism. As proof of this they quote Lord Salisbury, who, when once accused of tending toward socialism, replied that it was simply a question of business, and that each age, and each people, and each country must decide for itself as to what work it would do as an owner and what work it would let out to private corporations. This statement assumes that the question is still an open one. It does not involve the taking over of large property interests already established and in successful operation under private management, or the assumption by the municipality of a large amount of indebtedness in the form of capital already invested in these public utilities. It is well known that at that time the conditions existing in Great Britain and in the countries of continental Europe were vastly different from the conditions now existing in the United States. Nowhere in Europe was there a system of urban transportation worthy of the name of street railway, and gas and water supplies were totally inadequate. Investors hesitated, and investments were correspondingly slow in the development of public utilities, and in many instances investors, appalled by the gigantic demands made by the rapid growth of many of the European cities, absolutely refused to assume the risk. It was, therefore, true that in its application there it was a question of business rather than of socialism. If Chicago to-day was without a complete system of street railways, without an ample supply of gas, and without an efficient telephone and electric lighting service, the question then at issue might be as Lord Salisbury stated it; but when the question arises regarding industries that have been developed by private corporations, are owned by them, are in successful operation under their management, and in the main meet all public requirements, in the logical sequence of events, Lord Salisbury's statement must be reversed. Under such conditions, each age and each people, and each country must decide for itself what work shall continue to be done by private enterprise and what work shall be let out to political corporations. Municipal ownership, under existing conditions in this country, does not mean the wiping out of monopoly; it means the destruction of private property, for the purpose of enabling a municipal corporation to enlarge its functions and render an industrial service previously rendered by a private corporation."

The Brockton Street Railway

Since the beginning of the year twenty-two street railway companies to the north and south of Boston, controlled by the Massachusetts Electric Companies, but operated independently, have been merged into two companies, viz.: The Lynn & Boston Railroad Company and the Brockton Street Railway Company. The Lynn & Boston, on the north side, has purchased the stock of ten

companies, viz: Reading & Lowell, Woburn & Reading, Wakefield & Stoneham, Mystic Valley, Salem & Wakefield, Gloucester, Essex & Beverly, Gloucester, Gloucester & Rockport, and the Rockport Street Railway. A full account of this consolidation was given in the STREET RAILWAY JOURNAL for March 24, 1900. The Brockton Street Railway Company, on the south side, has absorbed eleven independent lines, viz.: Needham & Boston, West Roxbury & Roslindale, Norfolk Central, Norfolk Suburban, Bos-



BROCKTON STREET RAILWAY AND CONNECTING LINES

ton, Milton & Brockton, Quincy & Boston, Brockton & Bridgewater, Brockton & East Bridgewater, Taunton & Brockton, and New Bedford, Middleboro & Brockton Street Railways.

At the beginning of the year the Brockton Street Railway Company operated only 47 miles of track, connecting Brockton with a few suburban towns within a radius of 6 miles from the center of Brockton, but it has gradually extended its lines in all directions by purchasing the system of the adjoining companies until to-day, as will be seen by the accompanying map, it connects with the Boston Elevated Railway Company at four different points, besides reaching about every point of any importance along the South Shore and the Old Colony districts. One line, starting from Milton Lower Mills and extending southward to New Bedford, is the longest street railway line under one management in this section of the country. The company now operates cars in Dedham, Needham, Norwood, Walpole, Hyde Park, Milton, Quincy, Weymouth, Hingham, Nantasket, Braintree, Randolph, Holbrook, Avon, Rockland, Abington, Whitman, Brockton, Stoughton, Easton, Bridgewater, West Bridgewater, East Bridgewater, Rayham, Taunton, Middleboro, Lakeville and New Bedford, and less than two years ago the lines were operated by seventeen different companies.. The most recent additions to this system have been the lines of the South Shore & Boston Street Railway and the West Roxbury & Roslindale Street Railway.

It is surprising to note the changes that have taken place in Eastern Massachusetts since the Massachusetts Electric Companies obtained a controlling interest in thirty-three companies. By consolidation these thirty-three companies have dwindled down to eight, one in Rhode Island, one in New Hampshire, and the other six in Massachusetts. The most recent consolidations have been the Taunton Street Railway with the Globe, Lowell & Suburban with the Lowell, Lawrence & Haverhill, South Shore & Boston and West Roxbury & Roslindale with the Brockton Street Railway Company.

The capital stock of the Brockton Street Railway Company, prior to the purchase of the West Roxbury & Roslindale and the South Shore & Boston, was $2,312,400. This has been increased since the consolidation to some $3,500,000, and the company has obtained authority from the Railroad Commissioners for the right to issue $400,000 additional stock for the purpose of paying the floating indebtedness of the company.

Horace B. Rogers has full charge of the entire Brockton system.

To Test a Massachusetts Street Railway Law

The city of Worcester, Mass., is determined to have the courts decide the respective rights and liabilities of the cities, towns and street railway companies under the law passed by the Legislature in 1898, which provides for the removal of snow, and has brought suit against the Worcester Consolidated Street Railway Company to enforce payment of bills amounting to some $12,400, being the expense incurred by the city during the past two years in removing snow from the tracks and streets.

Prior to 1898 the street railway companies paid into the State Treasury a franchise or corporate tax apportioned according to the market value of the company's stock, less the local taxes on real estate paid direct to the different cities and towns by the companies. This corporation or franchise tax was paid to the different cities and towns in which the holders of stock resided, and, in addition to this tax, the street railway companies were obliged to keep the streets in which their tracks were located in good repair, and to remove snow and ice therefrom. The removal of snow and ice from the tracks to the traveled way, by the companies has been a source of contention since the very first. On many occasions have the street railway employees and the employees of the cities and towns been in conflict in the streets over the removal of the snow. This state of affairs continued until 1897, when Governor Wolcott recommended the appointment of a committee by the Legislature to investigate the subject of the relations between street railway and municipal corporations. In its report to the next Legislature (1898) this committee recommended that the different municipalities should have full control of the public ways, and be held responsible for their condition. For various reasons it was agreed that no set rule could be established as to the compensation to be paid to the different cities and towns by the street railways for the removal of snow and ice from the streets in which they operated cars, and a bill was finally presented to the Legislature, which, it was thought, would end the controversy. This bill provided that the corporation or franchise tax should be apportioned according to the market value of a company's stock, and that the amounts so collected should be paid by the State Treasurer to the different cities and towns where street railways were operated in proportion to the length of single track, instead of paying it to cities and towns in which the stockholders resided, as heretofore, for in many cases the stock was held in cities and towns where no road existed. In addition to this, and the real estate taxes, it was provided that the companies should be obliged to pay into the treasuries of the different cities and towns in which they operated cars an "excise tax," based on the gross receipts. Companies whose gross income per miles of track were less than $4,000 were taxed 1 per cent on the gross receipts; those more than $4,000 and less than $7,000, 2 per cent; those more than $7,000 and less than $14,000, 2¼ per cent; those more than $14,000 and less than $21,000, 2½ per cent; those more than $21,000 and less than $28,000, 2¾ per cent; those reaching $28,000 or more, 3 per cent.

The taxes paid to the different cities and towns by the street railway companies, directly and indirectly, through the State Treasurer, were to be applied toward the construction, repair and maintenance of public ways, and the removal of snow therefrom, entirely relieving the street railways from the removal of snow, or of any responsibility in keeping any portion of the streets, road or bridges through or over which they operate cars, in repair, except as required in their location grants and where they were obliged to remove the surface of the street in repairing or renewing tracks.

The interpretation of the act by the City of Worcester and the Worcester Consolidated Street Railway Company differs materi-

ally, and the courts are sought as a last resort. President Dewey, of the company, has written the following letter to the City Solicitor in reply to the city's demand for payment on account of expense incurred in removing snow from the streets during the past two years:

Worcester, Mass., Oct. 20, 1900.

A. P. Rugg, Esq., City Solicitor, Worcester, Mass.:

Dear Sir—In regard to the bills of the City of Worcester against the Worcester Consolidated Street Railway Company, of which you have sent me a memorandum, I do not find, upon investigation, that there is any obligation on the part of the company with reference to the bills numbered 2413 and 2491 for work done on Pleasant Street and Southbridge Street. The bills numbered 2028, 2179, 2366, 2369, 2370 and 2417, amounting to about forty-four hundred and twenty dollars ($4,420), are for work and material used in the repair and maintenance of public ways, and this company is advised and believes that it is relieved from any liability for such bills by the provisions of chapter 578 of the acts of 1898, even if there was any legal obligation therefor previous to the passage of that law. That act passed by the Legislature in 1898 provides for an excise tax to be paid by the street railway company, and to be "applied toward the construction, repair and maintenance of the public ways, and the removal of snow therefrom," and the company does not think that the Legislature intended that it should contribute by the payment of this tax for the repairs and maintenance of the highways, and in addition thereto still continue to pay for such repairs and maintenance as it had previously done.

As you are well aware, the various questions that have arisen under the street railway law of 1898 have never been passed upon by the courts, and the respective rights and liabilities of the cities and towns and street railway companies under that law have not yet been determined. You are also aware that lawyers differ as to the interpretation of various provisions of that law, and the street railway company, having been advised that it is not liable for the bills presented by the city, must decline to pay the same, and it does not seem reasonable that it should be expected to do otherwise until the matter has been adjudicated by the courts.

In this connection I desire to call attention to the fact that during the two years that the street railway law of 1898 has been in force the city of Worcester has received about twenty-seven thousand dollars ($27,000) as an excise tax, provided for by that law, to be "applied toward the construction, repairs and maintenance of the public ways and the removal of snow therefrom." According to the bills rendered this company, the city has during the past two years expended about forty-four hundred dollars ($4,400) for repairs and maintenance of highways which it claims this company should pay by reason of certain conditions in its franchises; it also claims to have expended about eight thousand dollars ($8,000) in the removal of snow.

Assuming that this company had been required to pay the entire cost of removing snow from the streets where its tracks are laid, which was never required, nor, so far as I know, ever suggested before the law of 1898 was passed, and assuming that but for that law it would have paid the several bills mentioned, amounting to about forty-four hundred dollars ($4,400), the toal cost to this company for repairs and maintenance of highways and removal of snow would have been about thirteen thousand four hundred dollars ($13,400), whereas it has paid to the city of Worcester by virtue of said law of 1898, to be devoted to the same purposes, about twenty-seven thousand dollars ($27,000), or twice as much as it would otherwise have been called upon to pay.

On the other hand, assuming that the city has expended eight thousand dollars ($8,000) for the removal of snow, and fails to recover from the street railway company the sum of about forty-four hundred dollars ($4,400) which the company claims it is relieved from paying by reason of the provisions of the law of 1898, the city will still receive from the company the sum of twenty-seven thousand dollars ($27,000) or about thirteen thousand six hundred dollars ($13,600) more than it would have received if the law of 1898 had not been enacted.

In consequence of the street railway law of 1898 the city also receives each year the tax upon the capital stock of the company which previously belonged to the Commonwealth, and which amounts to about fourteen thousand dollars ($14,000) a year, so that the city treasury has been further enriched to that extent by reason of this law, which is claimed by some to be most unfair and unjust to the city and its interests.

As the city will receive for the past two years a profit of at least thirteen thousand five hundred dollars ($13,500) from the excise tax, and about twenty-eight thousand dollars ($28,000) from the corporation tax, or tax upon the capital stock of the company, making a total of about forty-one thousand five hundred dollars ($41,500), which it would not otherwise have received, it would certainly seem as though it had derived some material benefit from the law.

Yours truly, Francis H. Dewey,
President of Worcester Consolidated Street Railway Company.

An unsuccessful attempt was made last year to have the law repealed. The act provides that after three years from October, 1898, the cities and towns may petition the Railroad Commissioners for a revision, and that the Commissioners shall, after determining the average cost for the work done by the different cities and towns for construction, repairs and maintenance of the streets and public ways, and the average annual payments made by the different companies, determine the percentage of the gross receipts that shall be paid to the different cities and towns annually, the proportion to be fixed at a rate equal to the annual cost incurred by the different cities and towns during the preceding three years.

The city of Worcester will receive this year (1900) $16,657.09 in the way of an excise tax from the various street railway companies, with the exception of the Worcester & Webster Street Railway, which has not as yet filed a report. The amount to be paid by the several companies follows:

Worcester Consolidated Street Railway	$14,882,09
Worcester & Suburban Street Railway Company	1,688.18
Worcester & Clinton Street Railway Company	78.32
Worcester & Marlboro Street Railway Company	8.50
Total	$16,657.09

The Electric Conduit Railway—Its Development and Construction*

BY F. G. CUDWORTH

The history of the development of the electric conduit railway is but a repetition of the successes and failures that have marked the development of every branch of electrical science, and its present high state of efficiency stands as a monument to the untiring energy and perseverance of the electrical workers of the last quarter of the nineteenth century.

Commercially speaking, electrical traction dates back scarcely fifteen years. It was introduced into the United States in an experimental railway at the Chicago exposition in 1883, four years after it appeared at Berlin.

In the fall of 1884 there was opened to the public at Cleveland, Ohio, 1½ miles of underground slotted conduit road. This was probably the first attempt to operate, on a commercial scale, any form of street railway, by electric traction, in the United States. It was certainly the first attempt at slotted conduit construction in this country, and while this attempt may not be safely styled a complete success, it was by no means a failure, being operated for nearly two years. The service was not sufficiently satisfactory to warrant its continuance.

In the Cleveland construction the Bentley-Knight Company used a wooden conduit, placed midway between the rails, the conductor bars being supported in very much the same way as in our more recent construction. Their motor was hung from the car body midway between the two car axles, and was connected to the axles by wire cables. This was, perhaps, the weakest point of the Bentley-Knight construction. While they realized one of the essential features of the motor problem, they did not at that time grasp the importance of the other, viz., that of positive gearing.

Late in 1884 there was witnessed the erection of the first practical overhead copper trolley wire in the United States, by J. C. Henry at Kansas City; 1885, 1886 and 1887 saw rapid advancement made in both line and motor construction. Early in the latter year Sprague commenced the construction of overhead trolley lines at Richmond, Va.; St. Joseph, Mo., and Wilmington, Del. But it was not until 1888 that the commercial street railway was in practical operation in the United States. In this year several roads began to operate and to carry passengers on schedule time.

Among the most successful lines were the Sprague road, at Richmond, Va.; the Thomson-Houston system, at Washington, D. C., and a conduit road installed by Bentley & Knight at Allegheny City.

That the early workers upon the problem of electric traction realized that the only feasible method of operating cars electrically was by some means of underground propulsion is proved by the repeated attempt, both in this country and abroad, to construct a successful conduit system.

It was recognized from the outset that this system must be much more costly; nevertheless, the urgency was felt to warrant the outlay, and numerous and expensive attempts were made to construct a conduit suitable for the successful and economical operation of cars. There is little doubt that this problem would have been successfully solved at this time, had not Sprague early in 1888 demonstrated the entire practicability of the overhead trolley, and thus offered a much cheaper substitute.

During 1888 and 1889 Bentley & Knight were making for the West End Street Railway Company, of Boston, the most pretentious efforts to solve the underground problem ever undertaken. The West End Company at that time was the largest street railway in the world, not only in miles of track but in number of cars operated.

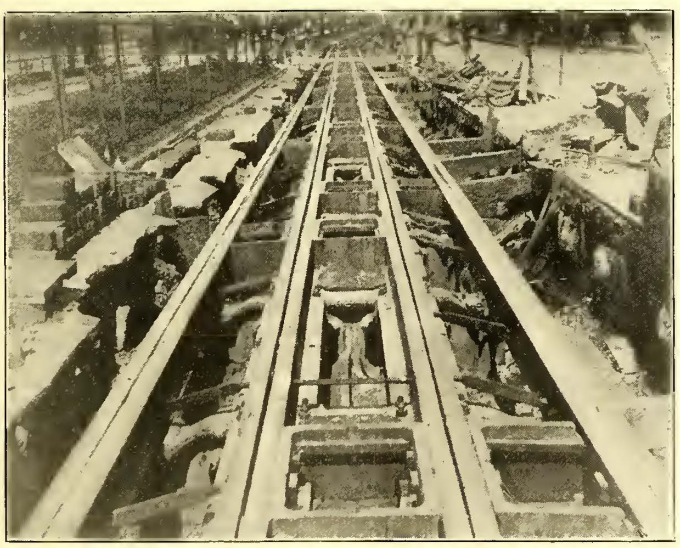
The signal failure of this experiment, after almost six months of attempted operation, during which time the system met with daily, almost hourly, breakdowns and delays, convinced the officials of the West End Company, and the public in general, that the underground conduit road could not be successfully operated, and led to the equipment of the entire West End system with the overhead trolley. This failure of the West End Company to con-

*Paper read at Brooklyn Engineers' Club, Oct. 11, 1900.

struct a successful conduit road practically stopped all further experiments along the line of underground construction, and gave a great impetus to the overhead trolley. The pronounced success of this latter system as a means of urban transit led to its rapid introduction into nearly every city in the United States, and the history of the development of the overhead trolley to its present high state of efficiency within the short space of ten years is without a parallel in the annals of the world's engineering.

It is safe to say that, had it not been for the stubborn and persistent refusal of the municipal authorities of New York City to consider any form of electric traction which contemplated the use of overhead wires, we should have had few experiments in the line of underground construction after the disastrous failure on the West End road. As it was, the officials of the Metropolitan Street Railway Company were compelled to seek for some system of traction equal, if not superior, to the overhead trolley. They turned their attention to the cable as the most desirable substitute. Plans were prepared, and in 1889 construction commenced. Yet on Jan. 1, 1893, the entire railway system of New York City, with the exception of a cable line on 125th Street and Amsterdam Avenue, was operated by horse-power, although the spring of this year saw the Broadway cable line from Fifty-Ninth Street to the Battery (10.2 miles) put in operation. Construction was continued, and in 1895 15 miles of additional cable lines on Columbus, Ninth and Lexington Avenues were opened. During this period of cable construction the company's engineers had not been idle. It was more and more evident that in spite of the improvements in the cable it would not do for a system as large as that now operating on Manhattan Island. Its gigantic power plants and street vaults, many of these containing sheave wheels a score of feet in diameter, could only be built and operated at a tremendous expense. It was recognized that the enormous cost of cable construction would alone limit its extension, and the directors of the Metropolitan Street Railway Company cast about for some other form of mechanical traction which would equal, and if possible be an improvement on, the overhead trolley.

The growth of electric traction abroad had not been characterized by that which had marked its development in America. Consequently the extension of the overhead trolley had been slow, and, owing to extended prejudice against overhead wire in general, engineers had spent considerable time in perfecting the underground system. At about the time of the Bentley-Knight

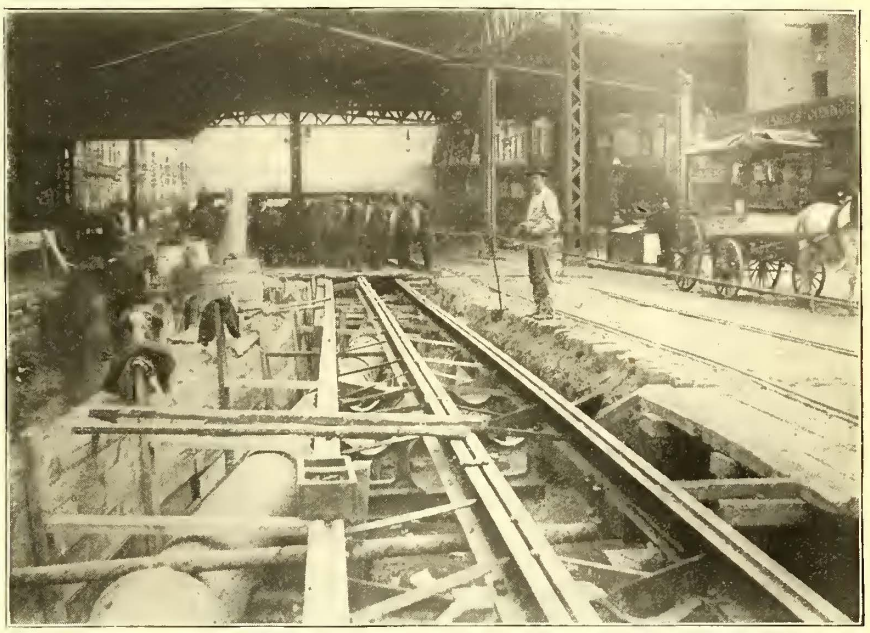


DOUBLE CONDUIT LINE ON THE BOULEVARD

failure on the West End system in Boston, a conduit road was constructed in Buda-Pest, Hungary, by the Siemens-Halske Company, and, as it was constructed in a very substantial manner, it is not strange that it proved a success from the start. The Buda-Pest road is built with the slot adjacent to the tram rail and not in the center of the track, as with the cable and conduit roads constructed in this country. In this case the slot serves not only for the plow but also as a groove for the wheel flange, consequently it is made much wider, and is, in the Buda-Pest system, 1⅛ ins. wide.

In this country many light road wagons have tires only ¾ in. wide, consequently the slot is limited to a maximum width of ¾ in., and cannot be used as a wheel groove, as the flange requires a greater width. Again, in the design of "special" work, where there is a complication of frogs, switches, turnouts, the center slot renders the design less complicated, and is to be preferred.

In 1892 William C. Whitney, one of the controlling spirits of



SOME OF THE OBSTRUCTIONS ENCOUNTERED.

the Metropolitan Street Railway Company, offered a reward of $50,000 for a system of mechanical traction suitable for the 190 miles of road then controlled by this company in New York City. It was proposed, in order to have the sanction of the State, and that the disposal of this princely reward might be entirely free from prejudice, to place in the hands of the State Board of Railroad Commissioners both the investigation of the plans submitted and the final award. The board decided, however, that it had no power to determine the matter, consequently the applicants began to forward their schemes to the railway officials, who were, in an exceedingly short time, completely swamped by the multitude received, nearly all of which were of an impracticable nature. It was clearly seen that if any advance was to be made the company must go into investigations on its own account. It was felt that the company could afford to spend a large sum in conducting experiments necessary to develop a system. The problem that confronted it was not only the development of an entirely new system, but with the reconstruction of some 200 miles of lines, so interwoven and united that one system must be adopted for the larger proportion.

That this was no easy problem was realized from the start; to install a system that would ultimately prove a failure and have to be abandoned, would mean the loss of the entire sum expended; consequently it was decided to send the company's engineer abroad, not only to investigate the Buda-Pest conduit system, but all kinds of mechanical traction there in use on the continent. After a detailed examination of the workings of the Buda-Pest conduit road, and a careful study of the drainage conditions, as compared with those of New York City, the engineer reported that he considered the underground electric conduit system which had been in operation in Buda-Pest for several years entirely superior to all others examined by him, and recommended its adoption, with modifications, by the company. He had examined, among other systems, hot water, compressed air, gas motor and storage battery. The Metropolitan Company proposed at this time to construct some 5 miles of cable road in the northern part of the city on Lenox Avenue. In accordance with the report of its engineer, however, the company decided to equip this line, experimentally, with the electric conduit system, conforming the construction as nearly as possible to its standard cable work, so that in case of the failure of the experiment the road could be changed to cable at a minimum expense. A contract was entered into with the General Electric Company, of New York, by which the electrical equipment was to be installed, and the road turned over to the railway company to operate for one year. If at the

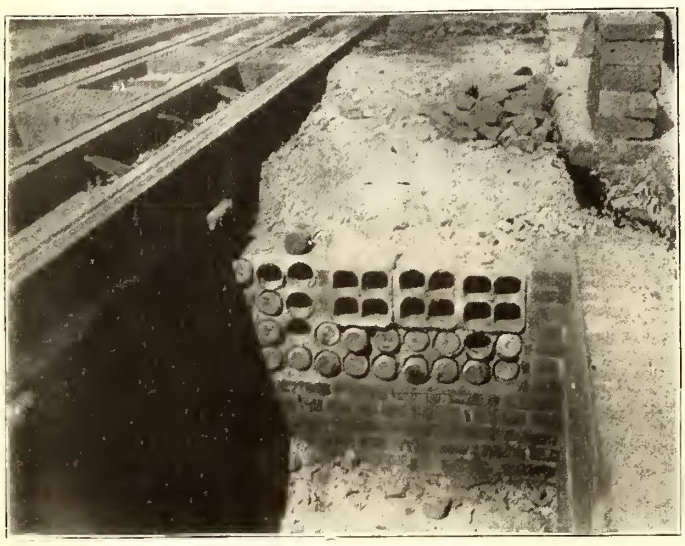
end of that time the road proved unsatisfactory, the electric company was to remove the equipment without cost to the railway.

Construction was commenced in September, 1894; the first car was operated April 1, 1895, and the Railroad Commissioners officially inspected the road during the same month.

This is, in brief, the history of the first attempt at operating an underground conduit street railway in New York City, and the success that marked the early operation of the Lenox Avenue road was most pronounced, and the difficulties attending its operation much less than those usually encountered in operating an overhead trolley road.

In the first two years of operation of the Lenox Avenue road there developed a few mechanical faults which had to be corrected, but there has been no serious interruption of the service, although the road has been in continuous operation twenty-four hours a day. Snow has given much less trouble than was expected, and it is the writer's opinion that the conduit system can be operated under all climatic conditions with no more difficulties than will be met with in running any form of mechanically operated road.

From this successful experiment the growth of the conduit system in New York City has been extremely rapid. It has been improved step by step. As weaknesses have developed under the strain of operation they have been removed and improved in the later construction, until the present standard, now in use by the



MANHOLE AND CONDUITS

Metropolitan Street Railway Company, for all slotted conduit work, is as near perfection as it is possible to carry a piece of mechanism.

The design has been criticized as being too heavy, and in the case of the Third Avenue system, which has lately completed its electrical equipment, it has been modified in a very marked degree. Radical changes have been introduced in the method of track construction, which time alone shall justify or condemn.

The tendency of the Metropolitan construction has been toward a firm, unyielding roadbed, while that adopted by the Third Avenue road has been the opposite. The latter company in its new construction returned to the old form of a longitudinal stringer beneath the "tram" rail, and, in the reconstruction of its old cable lines, the company placed a stiff spring beneath the rail-base to give elasticity to the road. This would appear to be a step backward, if we are to draw conclusions from the earlier experiments along the line of underground conduit developments, as the failure of these earlier experiments are all traceable to mechanical weaknesses.

It is a comparatively easy matter to construct a track for a steam or overhead trolley road, but when it becomes necessary to construct a longitudinal slot, the edge of which overhangs the supports, and to maintain this slot at a uniform width under all conditions of temperature and traffic, the problem becomes somewhat complicated.

Many of the common kinds of paving material, granite, wood, etc., expand to a considerable extent under different climatic conditions, and with a slot in the street the tendency is to expand in the direction of the slot. Consequently it is necessary to construct the slot sufficiently strong to withstand this expansion. This has been provided for in the more recent construction by using a comparatively heavy yoke. It will be seen that this expansion is a very serious matter, as the shank of the plow is 3/8 in. thick, and the slot itself is only 3/4 in., leaving a clearance of 3-16 in. between plow and slot rail. Besides this, the slot rail is subjected to a heavy strain from loaded trucks passing over it, consequently the rail and yoke must be proportioned to meet these excessive strains without being deflected or closed up, and the foundations necessary to support these yokes must be of a most substantial character.

The construction of special work where one or more lines cross is in itself a complicated piece of mechanism, but when that design must be made to withstand the strain of a loaded truck carrying from 40 tons to 60 tons, it presents a very difficult problem in mechanical engineering.

Taking up the main features of track construction, we will describe a section of standard track work, giving the method of construction as adopted in New York City. The yokes are placed 5 ft. apart, center to center, every third yoke being a so-called "box yoke." This is a cast-iron yoke, considerably heavier than the ordinary yoke, and arranged to receive the insulators for supporting the conductor bars. The foundations are, in all cases, of concrete, usually 6 ins. deep under the base of the yoke, and tamped in around it in the same manner that ballast is used in steam railroad work. Actual construction is carried forward in the following manner:

From a "base line," previously established on the sidewalk, the center of the track is staked out, and the excavation carried down to sub-grade. Forms are now placed in the excavations so that concrete can be laid for the foundation of the yokes. The concrete is deposited along the line of each track, usually some 6 ins. wider than the base of the yoke, and where the feeder ducts are laid at the same elevation as the bottom of the yokes it is made wide enough to receive them. The iron is now placed in the trench, the rails bolted to the yokes, and the track brought to the proper line and grade by means of wooden blocks and wedges. Concrete is now rammed around the base of the yokes and brought up between the yokes as far as the bottom of the conduit. The track is now ready for the sheet-iron lining. While the conduit itself is of concrete, it is made by placing sheet-iron forms between the yokes and ramming concrete against them; these forms are afterward removed, leaving a continuous tube of concrete. Earth back-filling is now brought up to within 15 ins. of the street surface, and the entire space between tracks, and for a distance of 2 ft. on the outside of the rails, is covered with a 6-in. layer of concrete. This forms the foundation for block paving, and in the case of asphalt, this concrete is brought up to within 3 ins. of the surface. Feeder ducts are usually laid along the outside of the rails in connection with the track work. There are no special numbers of these tubes, enough being put down to supply the present traffic, and to provide as far as possible for future growth. Manholes are built about every 400 ft. to allow connection being made with the feeder cables and conductor bars. These manholes are generally about 5 ft. wide and 4 ft. deep, and are long enough to permit of repairs being made to the cables, and for a new one to be drawn in without removing the street pavement, otherwise than to take off the cast-iron cover at the street surface.

The conduit itself is connected with cleaning manholes at intervals of from 95 ft. to 125 ft. These are for the purpose of draining the conduit, and to allow the removal of all accumulations of dirt, etc. They differ from the feeder manholes in that they extend from outside to outside of tram rails only, the entrance being between tracks. Each is connected to the nearest sewer with a 6-in. drain pipe; in fact, the best method is to connect all manholes, both feeder and cleaning, with the sewer, and provide each with a fair sized sump hole, from which a trapped drain leads to the sewer.

It was the practice, in the early conduit construction, to place these cleaning manholes 200 ft. or more apart, but it was found that the rapid accumulation of mud, which made it necessary to clean the conduit at least once a month in summer and oftener during the winter months, was so large that difficulty was experienced pushing the same to the manholes. This was especially the case with snow, which, finding its way into the conduit, became softened from the difference in temperature, and in a number of cases packed hard enough to break the plow before it was pushed to the manhole.

Different methods are used in cleaning the conduit, both horse and hand scrapers being used to drag the mud to the manholes, where it is removed and carted away. Recently an electric cleaning car has been developed, which is proving very successful.

In the electrical operation of the road the current is taken from the cable to a T-shaped conductor bar. These bars are in 30-ft. lengths, supported at each box yoke every 15-ft. by a heavy bottle-shaped insulator. The bars are placed in the conduit 6 ins. apart, face to face.

The contact is made by means of a plow. This consists of a

steel shank attached to the truck of the car, and extending down into the conduit. It carries at the lower end two steel springs, to which are fixed cast-iron shoes, shaped a good deal like a large spoon bowl. These shoes slide along the conductor bars and take the current from the bar to the shoe; from the shoes insulated copper wires lead to the motor. The path of the current is from the positive bar to the cast-iron shoe; thence along the insulated wire to the motor, through the motor to the wire on the opposite side of the plow to the negative shoe and negative conductor bar.

To facilitate the operation, the bars are divided into sections, usually 1 mile in length. These sections receive the current direct from the power station independent of all other sections on the road, and as both incoming and outgoing feeders are provided with independent switches at the power station, it is possible, in case of trouble on the line, to cut off any particular section without interfering with the cars on any other portion of the road. Another important fact in connection with this sectional arrangement of feeders, in the operation of a conduit road, which does not appear in overhead trolley operation, is that as both sides of the circuit are insulated from the ground, in the conduit system, leakage, when it does occur, must arise on one side or the other of the circuit, consequently this sectional arrangement of both conductor bars and feeders makes it possible to correct all trouble from grounds, and renders the interruption of traffic through the grounding of conductor bars impossible. With the positive and negative feeders connected with double-throw switches, it is a very easy matter to reverse the polarity of the conductor bars in any one section by simply throwing the feeder switches from one terminal to the other. For example: If a ground occurs on a positive bar in any one section, no trouble will arise unless another ground occurs on the negative side; in fact, several grounds might occur on the positive side without causing any trouble in operation. But let a positive and negative ground occur at the same time, even if a mile apart, there will doubtless be a serious loss of current, and probably an interruption in the service of the line. In such a case the engineer at the power station reverses the polarity of the bars on one of the grounded sections by throwing over the switches. The positive side is made negative, and the flow of current is immediately stopped, as both grounds are flung on to the same side of the circuit. In this way the only trouble that can seriously affect the operation of the underground system is guarded against.

The voltage adopted on the conduit lines is now the same as the standard for the overhead trolley—from 500 volts to 550 volts. The weight of rail used has been steadily increasing until at present it has exceeded that used by steam roads. Weights in 1898 were as follows:

Kinds of rail.	Length	Wt. pc.	Wt. ft. of Tr.	Wt. per. yd.
Tram	30 ft.	1070 lbs.	71 1-3 lbs.	107 lbs.
Slot	30 ft.	570 lbs.	38 lbs.	57 lbs.
Conductor bar	30 ft.	210 lbs.	14 lbs.	21 lbs.
Regular yoke		415 lbs.		
Box yoke		611 lbs.		

Trams, 9-in. girder; slot, 7-in Z-bar.

The standard for 1900 is a 60-ft. girder, weighing 109 lbs. per yard, while that adopted for the reconstruction of the Broadway cable is a 7-in. girder, weighing 107 lbs. per yard. This latter is connected by probably the heaviest and strongest fish-plate ever used in a surface road.

The Third Avenue road in its reconstruction work adopted a 60-ft. tram rail of the girder section. On the Third Avenue line, where the old cable conduit was utilized for the electric equipment, the old yoke limited the rail used to a 7-in. girder, having a 4-in. base. Accordingly a rail of that dimension of the standard New York section, weighing 104 lbs. per yard, and in 60-ft. lengths, has been used with the Falk cast-welded joint. The percentage of carbon in the new rail is 0.6 per cent.

The Metropolitan Company, during the present season, adopted the cast-weld joint for the first time, using it on the old rails of the Lexington Avenue cable line. This rail was a 7-in. girder badly out of line, and in some cases very much worn. The joint has stiffened the rail a considerable extent, and has made a marked difference in the ease of riding, but as to its prolonging the life of the old rail sufficiently to warrant the expense of the joint, is, in the writer's opinion, doubtful.

The cost of the cast joint is $4.25. This includes cleaning the rail with the sand blast, and furnishing all material necessary to properly weld the same. The cost of excavating and relaying pavement around joint was about $2.70, making the total cost of joint in the neighborhood of $7. This, at the present market price of steel rails ($26) is a little more than half the cost of replacing with a new rail.

Feeder ducts in use in New York City consist of three different designs. The McRoy, earthen tile in clusters of four each—3¾ ins., inside diameter, 6 ft. long. These were laid with three styles of joints. The first method was to use three pieces of burlap, two pieces being wrapped around the joint dry, the third being dipped in hot tar and placed around the other two. The second method used the same amount of burlap, cement being used in place of the tar on the last wrap. In the third method a dry wrap was used. In this the burlap is put on dry, being held in place by wires or narrow strips of sheet iron.

The National duct is of sheet iron, cement lined, 3¾ ins. diameter, in 6-ft. lengths. It has male and female joint, and is laid in cement mortar.

The Camp duct is an earthen tile, 18 ins. long, 3¼ ins. diameter, and is laid in cement mortar without special wrap.

As regards the cost of underground conduit construction, it is almost impossible to give an intelligent answer, owing entirely to the local conditions. This is especially true in New York City where account must be taken not only of numerous sub-surface obstructions, such as pipes, drains, sewers, etc., that must be taken up and relaid, but entire streets in a large number of cases have to be repaved. All this, combined with the extremely high price of special work, tends to bring the average cost per mile of single track to about $90,000, including feeders. Outside of New York City, where there are less stringent rules relating to the relaying of old pavement, and where there are less sub-surface obstructions, the underground electric conduit system can be installed for $35,000 to $50,000 per mile of single track.

The actual cost per mile of single track in the New York construction has been as high as $150,000, while special work at intersections has cost much higher; that at Twenty-Third Street and Sixth Avenue costing $59,650; Canal Street and West Broadway, $48,869; one double crossover and two double-track turnouts at Thirty-Fourth Street and East River, $95,333.97.

The Annual Meeting and Report of the Manhattan Railway Company

The annual meeting of the stockholders of the Manhattan Railway Company, of New York, was held Nov. 14. The old officers were re-elected as follows: George J. Gould, president; Alfred Skitt, vice-president; D. W. McWilliams, secretary and treasurer. No changes were made in the directorate, and the outgoing members of the executive and expense committees were returned.

The annual report of the operation of the company for the year ending Sept. 30 was presented at the meeting; it is appended, a comparison being made with last year's statement:

	1899	1900
Gross receipts	$9,325,111	$9,950.735
Operating expenses	5,286,182	5,195.312
Earnings from operation	$4,038,929	$4,755,422
Deductions from earnings:		
Interest on bonds	$1,889,680	$1,816,309
Taxes	827,608	872,335
Interest and taxes	2,717,289	2,688,644
Net income	$1,321,640	$2,066,778
Previous surplus	4,401,207	4,162,847
Total net income	$5,723,847	$6,229,626
*Dividends	1,560,000	1,920,000
Surplus	$4,162,847	$4,309,626

*Four per cent on $48,000,000 in 1900; 2 per cent on $30,000,000 and 2 per cent on $48,000,000 in 1899.

The number of passengers carried is given as 183,788,851 in 1900, as against 177,204,588 in 1899. This is an increase of 6,584,293, or an average of over 503,000 a day. The percentage of operating expenses to gross receipts, excluding all taxes, was 52.21 per cent for 1900, as against 56.69 per cent in 1899. The percentage of operating expenses to gross receipts, including all taxes, was 60.98 per cent in 1900, as against 65.56 per cent in 1899.

At the meeting of the company President Gould said: "The annual report to the stockholders shows the satisfactory growth and results of the company's business for the year ending Sept. 30. The electrical installation is making excellent progress. The heaviest work at the main power station at East Seventy-Fourth Street is completed, and the superstructure is being rapidly erected in anticipation of the first arrivals of machinery, due for delivery next month. The first electric train is completely equipped, and, through the courtesy of the officials of the Metropolitan Street

Railway in furnishing us with the necessary power, it will be put in operation on our Second Avenue line without delay. The company's general improvements and enlargement of facilities other than the change of motive power will begin to produce results in the very near future. The first stretch of the Fordham extension beyond Tremont will be ready for trains in a few days, giving entrance to the new yards on One Hundred and Eightieth Street, with a capacity for 325 cars. The new line from this point to Fordham will be finished early in January. Our plans contemplate the extension of express service from Eighty-Fourth Street to One Hundred and Twenty-Ninth Street, on the Third Avenue line, materially shortening the running time of express trains between Harlem and the lower part of the city. This improvement we expect to put into effect within the next thirty days. Generally, I may say that the outlook for the Manhattan system is most encouraging."

Annual Meeting of the Montreal Street Railway Company

The annual meeting of the Montreal Street Railway Company was held at Montreal, Que., Nov. 7. The annual statement of the company's affairs showed an increase in gross receipts of over $109,129 over 1899, and an increase in earnings from operation of $29,153. The number of passengers carried in 1900 was 43,362,262, an increase of 3,175,749 over 1899. Dividends, amounting to 10 per cent, have been paid during the year, totaling the sum of $512,500, and leaving a surplus of $134,746 over the year's operations. The operating expenses show an increase of 1.11 per cent, as compared with last year, due mainly to the more frequent and extended car service demanded by the city, and other increases, including that of wages of employees. The company's rolling stock has been increased during the year by the addition of fifty-six closed motor cars, forty-five open motor cars, seven supply cars, eighty trucks, and the electrical equipments for the cars have been increased by 128 motors and eighty-three controllers. There are at present six extra long closed motor cars, mounted on double trucks, under construction, making in all twenty-five cars of this new type. During the past year the company has paid taxes amounting to $168,679.

The operating report of the company for the year ending Sept. 30, 1900, is given herewith, and a comparison is made with the report for the year ending Sept. 30, 1899:

	1899	1900
Gross receipts	$1,660,776	$1,769,905
Operating expenses	912,949	992,925
Earnings from operation	$747,827	$776,980

The general balance sheets show:

ASSETS

Cost of road and equipment	$5,718,209
Real estate and buildings	1,557,785
Stores	48,256
Accounts receivable	43,397
Cash on hand	178,317
Cash on deposit with City of Montreal	25,000
Total	$7,570,964

LIABILITIES

Capital stock	$5,497,055
Bonds	973,333
Mortgages	6,035
Accounts and wages payable	69,588
Accrued fixed charges	90,231
Employees' securities	7,118
Unclaimed dividends	1,957
Unredeemed tickets	16,942
Suspense accounts	49,053
Dividend payable Nov. 2, 1900	135,000
Contingent account	164,333
Surplus	560,319
Total	$7,570,964

"In the Public Eye"

One of the Cleveland daily papers contains the following item about a well known street railway manager:

"Ira A. McCormick, general manager of the Big Consolidated, has done several things to bring him into the public eye of late. The first was when he broke all precedents by having signs placed across Euclid Avenue, telling people where to go to get cars for the East end, the avenue being minus cars on account of the Erie Street sewer. That a street railway company should take the trouble to tell the public anything was an innovation with a big I. A day or two later McCormick put placards in the cars instructing women how to get off the cars with least risk of falling. Innovation No. 2.

"Thursday, McCormick reached the pinnacle of fame by running open cars on Cedar Avenue during the snow storm. He got in the public eye for keeps by that stroke of genius.

"McCormick is a railroad man from the ground up, and that is saying a good deal, for he stands 6 ft. 3 ins. without his boots. He is built in proportion and commands attention wherever he is.

"The employees of the company like McCormick, and he's on friendly terms with all of them. He's a 'mixer,' and a prominent club man, but withal devoted to his family and home. He drives a fine pair of horses."

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

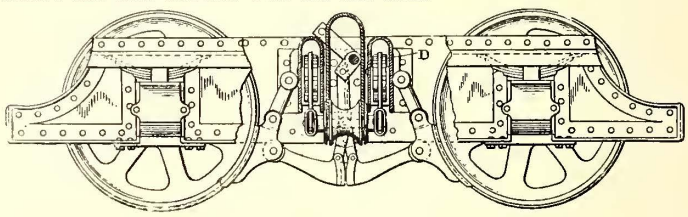
STREET RAILWAY PATENTS ISSUED NOV. 6, 1900

661,045. Mountain Locomotive; G. S. Fouts, San Francisco, Cal. App. filed Nov. 15, 1899. The construction is such that the pull or push of the load is exerted automatically to maintain the pressure of certain friction wheels, and to increase the pressure as the grade increases, whether in ascending or descending.

661,054. Railroad Switch; D. Isard, Camden, N. J. App. filed July 28, 1900. The switch point is held in either of its two positions by spring pressure.

661,077. Street Car Turntable; O. G. Rieske, Dayton, Ohio. App. filed July 22, 1899. The car standing on the turntable engages frictionally with wheels on the table, which are geared to a circular rack, when the power is turned on through the car, the car wheels drive the gearing of the table, and so rotate the latter.

661,123. Rail-Joint; W. W. Gillespie, Milwaukee, Wis. App. filed May 23, 1900. The invention relates to the construction of a sleeve, which is adapted to be placed around the rail-joint, and to be secured thereto by molten metal, which is poured into the sleeve and into contact with the rail ends.



PATENT NO. 661,432

661,305. Working Device for Railways with Automatic Correction of the Axles; J. De Buigne, Vienna, Austria. App. filed Dec. 30, 1897. The wheels are mounted loosely on the axle, and are movable independently of each other; each wheel has an outer flange instead of an inner flange, and means are provided for imparting rotary motion to each wheel independently of the other.

661,432. Car Truck and Brake; D. B. Van Dorn, Cleveland, Ohio. App. filed March 17, 1900. A car truck having its sides formed of single flat steel plates and edgings of angle-iron riveted upon the outside of said plates along their top and bottom and smooth plain inner surfaces.

661,442. Railway Car; J. A. Kratz, Baltimore, Md. App. filed March 22, 1900. By means of a system of levers one side step or running-board can be lifted while the other is lowered.

661,453. Railway Car Step; J. A. Kratz, Baltimore, Md. App. filed April 21, 1900. A modification of the preceding patent.

PERSONAL MENTION

MR. J. B. POTTER, the recently appointed superintendent for the Webster & Dudley Street Railway, of Webster, Mass., has just entered on his new duties.

MR. CLARENCE P. KING, president of the Pottsville Union Traction Company, of Pottsville, Pa., has removed his Philadelphia headquarters from 721 Walnut Street to the Real Estate Trust Building.

MR. C. S. M'MAHAN, Western representative of the Street Railway Journal, with headquarters at Chicago, has resigned that position, and with Mr. W. R. C. Smith, formerly of the *American Electrician*, have purchased the *Engineer*, of Cleveland, with which they will in the future be connected. Mr. McMahan and his associate have our best wishes in the new field in which they are engaged.

MR. W. E. HARRINGTON, general manager of the Camden & Suburban Railway Company, will sever his connection with the