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COMPETITIVE SYSTEMS OF TRACTION IN NEW YORK CITY.

There is probably no city in the world where so good an opportunity is presented for a comparative test of the merits of the various systems of street traction as that which is offered on the lines of the Metropolitan Traction Company, New York. In addition to its world renowned Broadway cable line, which carries by far the heaviest traffic of any cable road in existence, the company operates some miles of electric underground trolley road on Lenox Avenue, upon which also it is running experimentally some compressed air motors built on the Hoadley patents. The fierce competition between the surface and elevated roads of the city is favorable to an unbiased judgment of results; for it is safe to say that after complying with the restrictions of the law, that system which proves to be the most economical and effective will be finally adopted.

In a recent interview with President Vreeland, of the Metropolitan Company, we were given certain facts regarding the situation which are timely and significant. The policy of the company in building the cable road on Broadway, and its later extension on Lexington Avenue, and also the proposed underground trolley lines on Eighth and Sixth Avenues, has been determined by the exigencies of an ever increasing and overburdened traffic. So rapid has been the growth of travel in New York City that there has never been a time when it has not exceeded the capacity of the company's roads. Extensions and improvements have been made under the spur of pressing necessity, and the company has never been able to afford the time necessary for any lengthy experimental work of its own to determine the best form of traction. In all contemplated improvements it has had to choose the best system in sight at the time. This was the case when the cable was chosen for Broadway, and it is the same pressing necessity that causes the company to put in the costly underground trolley on forty-three miles of its lines on Eighth and Madison Avenues, before its experimental work with the compressed air motors is completed.

With regard to the cable road, the company is satisfied that in spite of the high state of efficiency to which electric traction has been brought and its superior economy under average conditions the cable is the best form of traction for the exceptionally heavy traffic on Broadway. The fact that electricity is replacing the cable in San Francisco and elsewhere, and showing a higher comparative economy, proves the case only for such conditions as obtain on these lines, where the volume of travel is moderate and the headway between cars is measured by minutes. The Broadway cable road, however, is operated under conditions that find no parallel in any city of the world. The average headway between cars is twenty seconds, and during the "rush" hours it is as small as ten seconds. Add to this that the bulk of the travel on the busiest portions of the line is local, necessitating frequent stops, and one has some idea of the enormous demand that is put upon the power house, and the value of having at command the great reservoir of momentum which is provided by the cable and its miles of moving cars. The problem of transportation on a line where the headway is measured by seconds instead of by minutes resolves itself largely into one of celerity in starting and stopping, and the management and engineers of the Broadway line are satisfied that this is more efficiently solved by the existing cable than it could be by any form of electric traction.

That the company considers this efficiency to hold good only where the burden of traffic is abnormally heavy is proved by its intention to equip the parallel lines on Eighth and Madison Avenues electrically. These lines are at present operated by horse cars, and the change is being made chiefly with a view of relieving the congestion on Broadway, and incidentally to provide a better service on these lines. The change will affect forty-three miles of road. The Eighth Avenue line will extend from One Hundred and Fifty-third Street to Fifty-ninth and thence by way of Sixth Avenue to a terminus at the lower end of the city. The Madison Avenue line will extend from One Hundred and Thirty-eighth Street to the Post Office by way of Fourth Avenue, the Bowery and Center Street. The construction and equipment will be similar to that which is used on the Lenox Avenue line, an illustrated description which was given in the SCIENTIFIC AMERICAN of February 22, 1896. Power for the Madison Avenue line will be furnished from the Twenty-fifth Street power house, in which will be erected four 850 kilowatt generators, driven by direct connected engines of 1,300 horse power. At the One Hundred and Forty-sixth Street station three 850 kilowatt generators will be added to the two 400 kilowatt generators which are already in place.

With reference to the experiments in compressed air traction which the company is carrying out on Lenox Avenue, we are informed that electricity was not chosen for the new lines because of any unfavorable results which had attended these trials, but simply because the experiments had not extended over a sufficient period to allow any reliable data to be tabulated. The results have so far been satisfactory, and two more motors will soon be added to the equipment. The company still has over one hundred miles of horse car lines which have yet to be changed to some form of mechanical traction, and if the compressed air motors fulfill their present promise after a sufficiently lengthy trial, they will probably in time be placed on a portion of these lines.

WELDED RAIL JOINTS.

There is certainly no part of the roadbed of steam railroads that has received more careful attention of late years than the rail joints. Time was when these were the most neglected portion of the track, and two small strips of iron, loosely bolted to the web of the rail, were considered to be a sufficient reinforcement. So long as the ends of the rail were held fairly well in line, the roadmaster was satisfied. The idea of attempting to restore the whole strength of the rail does not seem to have been seriously entertained, and as a consequence the rail ends soon became permanently bent under the incessant pounding of the traffic, and every joint became a hollow spot, lying more or less below the track level. To-day, however, the engineer has changed all that. By designing the joints on scientific principles, giving them a section adapted to the strains which they have to endure, it has been possible to produce a length of track whose vertical stiffness and strength are continuous, the joints displaying these qualities as fully as the body of the rail itself.

Such, at least, is the condition of first-class modern track when it is first laid. Laboratory tests have shown that some of the modern joints possess even greater rigidity than the rail itself, at least under the conditions of test where the load is applied as a static pressure, and has no dynamic effect. Conditions of service, however, are so entirely different that it can easily be understood that the results fall far below those which are obtained in the testing machine. The loads, represented by the weight of the train concentrated on the wheels, come upon the joints with the dynamic effect of a blow, the bending effect of which is far greater than would be due to the quiet load. The tendency of this pounding is to loosen the fastenings and allow movement and wear of the parts, with the ultimate result that no amount of screwing up will take out the "sag," and keep the joint up to level. Although it is true that by increasing the weight of rails and fastenings these difficulties are reduced, yet in the best of track the joints still remain the chief source of care and expense.

In view of this fact, it is natural that engineers should be directing their energies to the design of a continuous joint, in which there shall be no break in the metal. Such a joint would at once get rid of the defects of all "fished" or spliced joints—always provided, of course, that the welded joint shall be perfectly sound.

Of late years the production of better rail joints has been greatly stimulated by the rapid development of electric traction, and this for two reasons: First, the destruction of joints was increased by the heavy pounding of rigidly supported motors (a difficulty which the partial supporting of the motors on springs has merely reduced, but has not removed); and secondly, the desire to secure the greatest possible electrical conductivity has directed attention to welded joints.

The first efforts to secure a continuous metallic joint were made by electrical welding, and this was followed by what is known as cast welding. In the first case a powerful electric current is passed through the ends of the rails and pieces of iron, known as chucks, which take the place of the fishplates. When the metal has been raised to a welding heat, heavy pressure is brought against the side plates and they are welded to the rails, the flow of metal filling in the space between the rail ends and forming a butt weld. It is claimed, and justly so, that a perfectly welded joint is stronger than the body of the rail. In cast welding, molten cast iron is run into a mould which incloses the abutting rail ends, which are thereby heated (or are supposed to be) to the welding point, so that the resulting joint is solid and continuous.

Mr. W. K. Bowen, superintendent of the Chicago City Road, has recently given some data in a paper before the convention of the American Street Railway Association, at St. Louis, which promise well for this style of joint. He stated that, of the 17,000 cast welded joints made on his road in 1895, only 154 were lost, and these breakages were due to flaws in the metal. Comparative tests have shown the joint to be "far stronger than the rail itself." The joints are made as follows: After the rail ends have been scraped or filed off so as to present a bright surface, a cast iron mould is placed around the joint, the fit being made so snug as to prevent the escape of any metal from the mould.

The metal is then poured in, and the outer part of the casting, being chilled by the mould, sets first, forming a crust which retains the molten metal. As this crust contracts faster than the interior, the latter is forced up against the rails and a more perfect contact is insured.

Although the first object of electrical engineers in