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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE COMPLETION OF THE NORTH RIVER TUNNEL.

March 11, 1904, must ever be memorable in the history of this city as marking the completion of the first tunnel to give access from Manhattan to the neighboring shores of New Jersey. The event was signalized by the passage beneath the North River, dry-shod, of President William G. McAdoo, of the New York & New Jersey Railroad Company, and a party of invited guests. Although it will take another year to clean up the work, build the approaches and put in the finishing touches, the long-looked-for and much-delayed North River Tunnel is at last an established fact. Great credit is due Engineer Charles M. Jacob and his staff for the way in which a difficult and discredited work has been brought to an unusually successful termination, the junction being effected with mathematic exactness.

With the breaking away by the workmen's tools of the last screen of material, there is marked the practical consummation of an engineering work which has been in progress intermittently for about a quarter of a century. The scheme was originally planned in 1874. The first English company that took hold of the project had carried the tunnel about 2,000 feet beneath the bed of the North River when they met their first serious difficulty in a blowout, which resulted in the death of twenty men who were working at the heading. Three years after this the company failed; and after a period of seven years, during which nothing was done upon the scheme, another company took hold of the work, only to meet with failure. The present New York and New Jersey Company took up the work in 1901, when 3,895 feet of tunnel had been completed from the New Jersey side; and in spite of some very complicated problems presented by a ledge of rock which was encountered not far from the New York side, and a blowout which occurred at this point and occasioned considerable delay, the work has been prosecuted without interruption. The second tunnel, which parallels the one that has just been completed and lies a little to the south of it, is being excavated with a more modern and greatly improved shield, which is enabling the work to be prosecuted with greater rapidity. Already it has been pushed forward about 1,500 feet beneath the river, and the rate of progress per day is steadily increasing as the work is carried forward. The indications are that some time in the spring or early summer of 1905, it will be possible to run cars between Manhattan and New Jersey.

In this connection mention should be made of the fact that the contract for the excavation of the Pennsylvania Railroad tunnel beneath the North River has recently been let to the O'Rourke Engineering and Construction Company and that for the tunnels beneath the East River to S. Pearson & Son, of London. The contract provides for the completion of the tunnels in two years, with the stipulation that the time limit may be modified if any labor troubles occur during the progress of the work.

DIRECT-CURRENT TRACTION ON THE NEW YORK CENTRAL.

Unquestionably the most important step that has yet been taken in the application of electric traction to steam railroads was the recent closing of the important contract of the New York Central Railroad for the first large installment of its electrical equipment. The company have recognized for several years that the time was approaching when this important change would have to be seriously considered; but it was not until two years ago, when the Park Avenue tunnel disaster occurred, that the necessity for immediately taking this work in hand became apparent. It is well understood by those who are familiar with the state of the art of electrical traction, that, because of the transition stage through which it is passing, the present time is somewhat inopportune for undertaking so costly a work, and one upon which the future extensions of electrical equipment must be based. We refer to the development of alternating-current electric traction, which has been making of late such rapid strides, particularly in the hands of European engineers. Within a year or two the new systems that have been installed or are now being built, will have given sufficient data to determine the strong and weak points of the alternating current when used in this class of work, and the alternating-current motor will have settled down to something like its best and permanent form. It was urgent, however, that the change of motive power should be made at once, and therefore a choice had to be made between the well-tried direct-current system, as used almost exclusively on American electric roads, and the new alternating-current system, which undoubtedly gives promise of being in some respects superior to the older method. In the course of a recent interview of our Editor with one of the officials of the New York Central Railroad Company, the considerations which determined the decision in favor of the direct current were outlined as follows:

The first consideration was the fact that the New York Central suburban system must be considered as forming a section of the general suburban transit facilities of Greater New York, and that any radical change in its motive power must be considered with a view to possibilities of interchange of cars with intersecting or contiguous lines. Thus, the question of an interchange of the company's trains with those of the subway system has been seriously suggested from time to time, and as the subway is being equipped with the direct current, the adoption of the alternating-current system would have shut it out from any such interchange as might have seemed desirable. Then, again, there was the necessity for very prompt action in abolishing steam from the Park Avenue tunnel, a point on which the railroad has committed itself in distinct pledges to the New York public. At the same time, the decision to use the direct current for the first installment is not intended to control the action of the company with regard to any further extensions that may be made. Any other division of the line will be judged by the local conditions. The division of the New York Central lines affected by the present contracts will include the terminal at 42d Street, and the Hudson River and Harlem lines as far as Croton and White Plains. These two points are considered to be the limits of the suburban traffic, and on these divisions the suburban trains will be operated by motor cars on the multiple unit system, as used on the elevated railroads. Through trains will be brought into and out of New York by heavy electric locomotives, each weighing 85 tons, and capable of pulling a 500-ton train on the level at a constant speed of 75 miles an hour. If in the future the company should determine to electrify another stretch of the road, say, from Croton to Albany or from White Plains to Pittsfield, with the alternating-current system, it would merely be necessary to change from a direct current to an alternating current at these points.

There were other minor considerations which led to the choice of the direct current, but the most important consideration was the fact that the electrical apparatus and equipment when it came to be discarded, would find a more ready sale if it were of the direct than if it were of the alternating-current type. It was considered that because alternating-current traction is comparatively in its infancy, the improvements that would be made, and made probably in rapid succession, would soon render the present type of motor more or less obsolete; and when the improved apparatus and equipment were put in, it would be far more difficult to find a sale for discarded alternating-current electrical equipment than it would if it were of the direct-current type, the latter having settled down to certain standard forms that always have a good second-hand market value.

THE MOTIVE POWER FOR HIGH-PRESSURE FIRE SERVICE.

Stirred by the succession of great conflagrations which culminated with the destruction by fire of the greater part of the business section of Baltimore, New York has at last awakened to its own danger and Mayor McClellan has taken action which promises speedily to provide both Manhattan and Brooklyn with a system of high-pressure salt-water fire pipes such as were recommended years ago by former Chief Bonner of the fire department and by the New York Board of Fire Underwriters.

Of the general merits of such a system little need be said. The only criticism offered at the public meeting before the Mayor was that salt water was liable to do more damage to goods than would fresh water, and former Mayor Schieren of Brooklyn suggested therefore that the proposed new system draw its water supply from the present sources of fresh water. Part of this argument was offset by the admitted superiority of salt water as a fire extinguisher, and the rest was disposed of by the fact that neither Manhattan nor Brooklyn has a drop of fresh water to spare for any purpose.

The necessity for a high-pressure system of pipes, separate and distinct from the ordinary distributing system, was acknowledged by all the speakers. That such a system is not only a crying necessity for the whole of Manhattan below 42d Street and for the river front and drygoods district of Brooklyn in order to avert fire danger, but that its installation would be an actual source of economy, was demonstrated.

In Philadelphia, where a similar system has just been completed, the fire premiums on $200,000,000 worth of risk have already been reduced 15 cents per $100 and a further reduction of 10 cents is promised. This reduction alone means a return of nearly 10 per cent per annum on the whole cost of the plant, leaving out of consideration the saving made possible in the general operation of the fire department.

The power plant at Philadelphia is equal in effect to forty fire engines. Where its six-hose hydrants stand, there is no need to maintain engines. Only hose and hose-carriages are needed. In New York a question has been raised as to the character of engines which should be used for driving the fire pumps. Philadelphia settled that question after a careful inquiry by adopting a battery of Westinghouse gas engines.

Three power systems would naturally suggest themselves, viz., steam, gas, and electricity. If the power stations were to be operated continuously or for any considerable portion of each day, there can be little doubt that steam would be the choice. But a fire-fighting station only operates when there are fires in the district. Steam plants must have boilers as well as engines, and for fire purposes a full head of steam must be kept up at all times. This means expense in attendance, fuel, and depreciation of boilers.

The Philadelphia danger zone is of like character to those in New York. It is estimated there that the pumping station will be called upon to do about 10 hours' work a month.

The first saving effected by the substitution of gas engines or electric motors for steam, is the elimination of the boilers and the space they occupy. This means much in the cost of land and buildings alone. Second is the saving in fuel and attendance. In Philadelphia, where eight 280-horse-power Westinghouse gas engines are installed, the engines made the following comparative figures:

	Steam Engines.	Gas Engines.
Number of engines......	3	8
Number of boilers......	8	
Cost of engines.......	$140,000	$150,000
Pumping capacity, 24 hours, gals.	15,000,000	16,000,000
Wages per month......	$650	$450
Cost of gas per month..		$392
Cost of coal per month..	$500	
Oil, waste, etc..........	$48	$48
Repairs	$85	$85
Total cost per month...	$1,283	$975

The saving in space and attendance would be common to both the gas-engine plant and an electric-motor plant. Each would be operated by one man to a station, and there is no question but that each could be so connected with its respective supply of gas or electricity as to do away with any practical danger of interruption through accidents to gas plants or central stations.

The use of electric motors would admit of the adoption of centrifugal pumps, which have some advantages. Gas engines cost about $40 a horse-power. Electric motors would cost considerably less. It is interesting, therefore, to consider the comparative merits of the two systems with the cost of installing and operating them.

Each stands ready to operate at full power the moment it is called upon, while consuming nothing while it waits.

Electric motors themselves would not cost more than about one-half as much as gas engines of equivalent power. This would seem at first to be a strong argument in their favor, but upon further consideration much of this advantage disappears. When switchboards have been added and direct connections made with two or more independent sources of power, the items of cost will mount pretty near to those for the gas-engine plant.

Cost of operation furnishes a further argument in favor of the gas engine. The Westinghouse gas engine is guaranteed to produce a brake horse-power with the consumption of 11,500 British thermal units. Street gas in New York gives from 650 B. T. U. upward per cubic foot. On this basis 17½ feet per hour would furnish 1 horse-power. In a recent 24-hour test run in Philadelphia with one of the engines, the con-