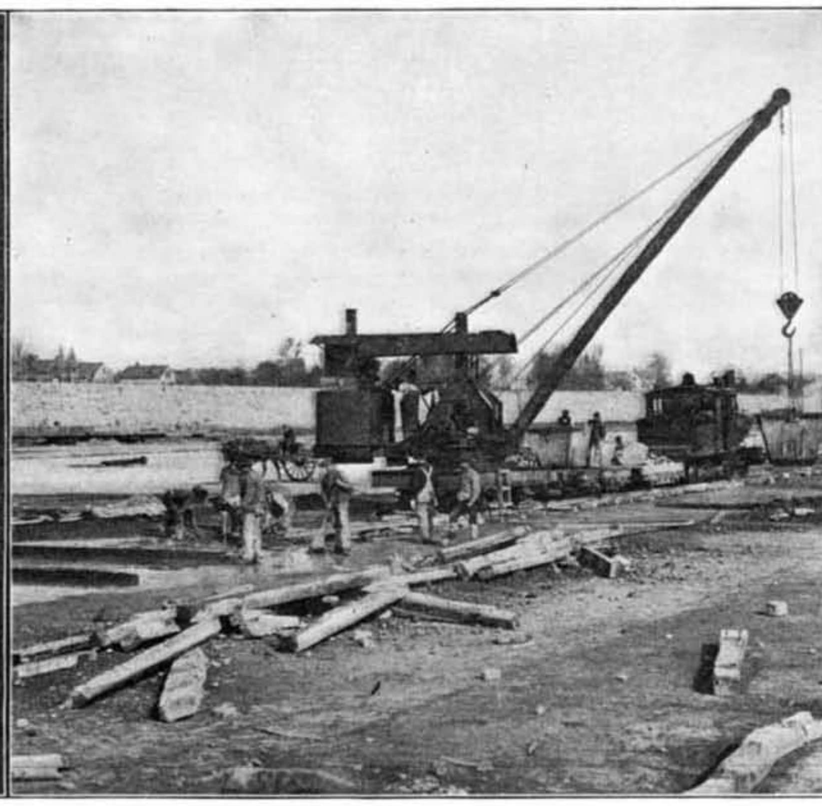
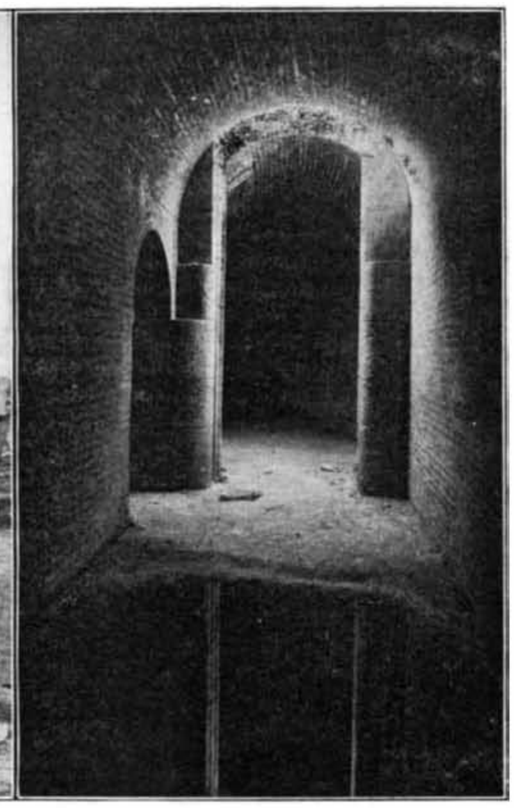
COMPLETING THE JEROME PARK RESERVOIR.

Nature has provided a magnificent supply of pure water in the annual rainfall of the watershed of the Croton River, and when the city authorities were considering, some sixty years ago, the question of providing a larger water supply, they selected this locality for the construction of a new reservoir. If we bear in mind how much smaller New York was in the decade 1830 to 1840, when the new work was undertaken, than it is to-day, we shall appreciate the forethought and enterprise which led the authorities to build a costly reservoir fully forty miles north from the city and lead the waters across the intervening distance in a solid masonry conduit. The Croton aqueduct, or, as it is now called, the old aqueduct, is a familiar landscape feature to travelers over the old Albany post road, and the unbroken service which it has rendered for more than half a century testifies to the excellent quality of the work. The maximum safe capacity of the aqueduct is 75,000,000 gallons in twenty-four hours.

The Gate at End of Chamber Leads to Reservoir.



Laying the Concrete Floor in the Reservoir.



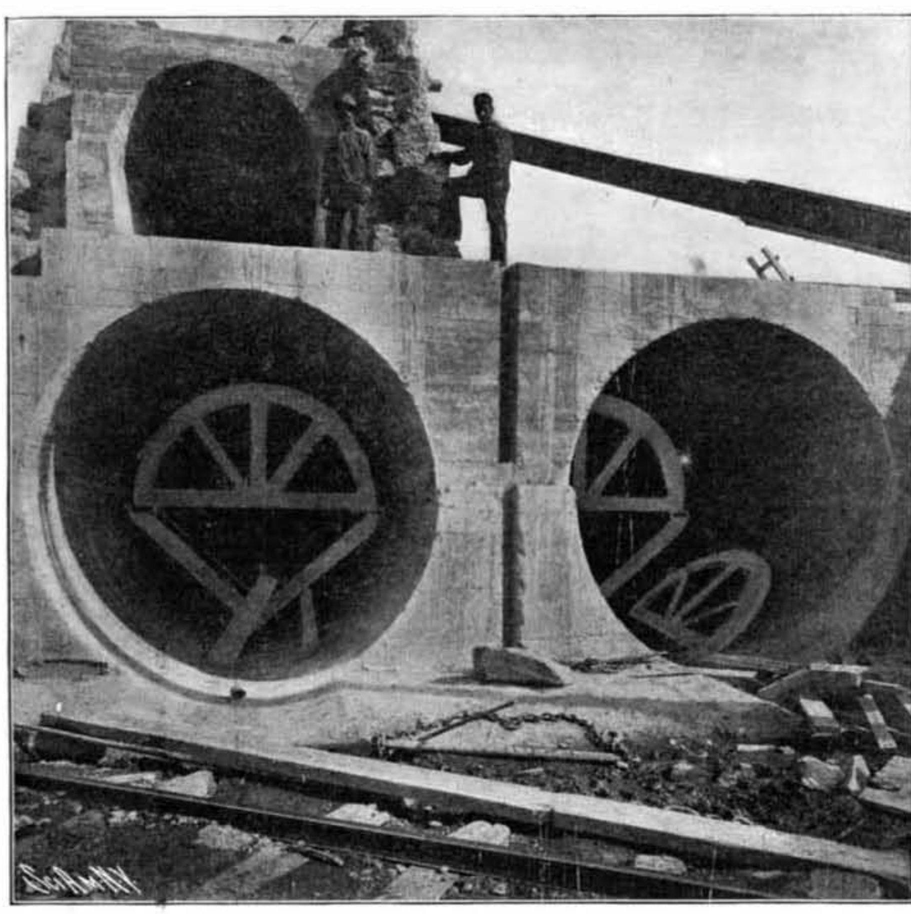
Where the Aqueduct Enters Gatehouse No. 5.

In 1890 the new aqueduct, with a capacity of 300,000,000 gallons per day, was completed. This structure, unlike the old one, which was built almost entirely upon the side hill and above ground, was constructed as far as possible in tunnel, and was carried, as far as practicable, in a straight line from Croton reservoir to the Harlem River. Both aqueducts discharge directly into a terminal gatehouse, situated at 135th Street and Amsterdam Avenue, from which the water is led by twelve 48-inch pipes into the city mains and into the Central Park reservoirs. The latter have a capacity of a billion gallons of water, or sufficient for five days' supply of the city. As a matter of fact, however, the high-water level of these reservoirs is only 115 feet above the sea, and before they can be entirely exhausted, the pressure fails and the remaining water ceases to be available on the higher floors of the city buildings.

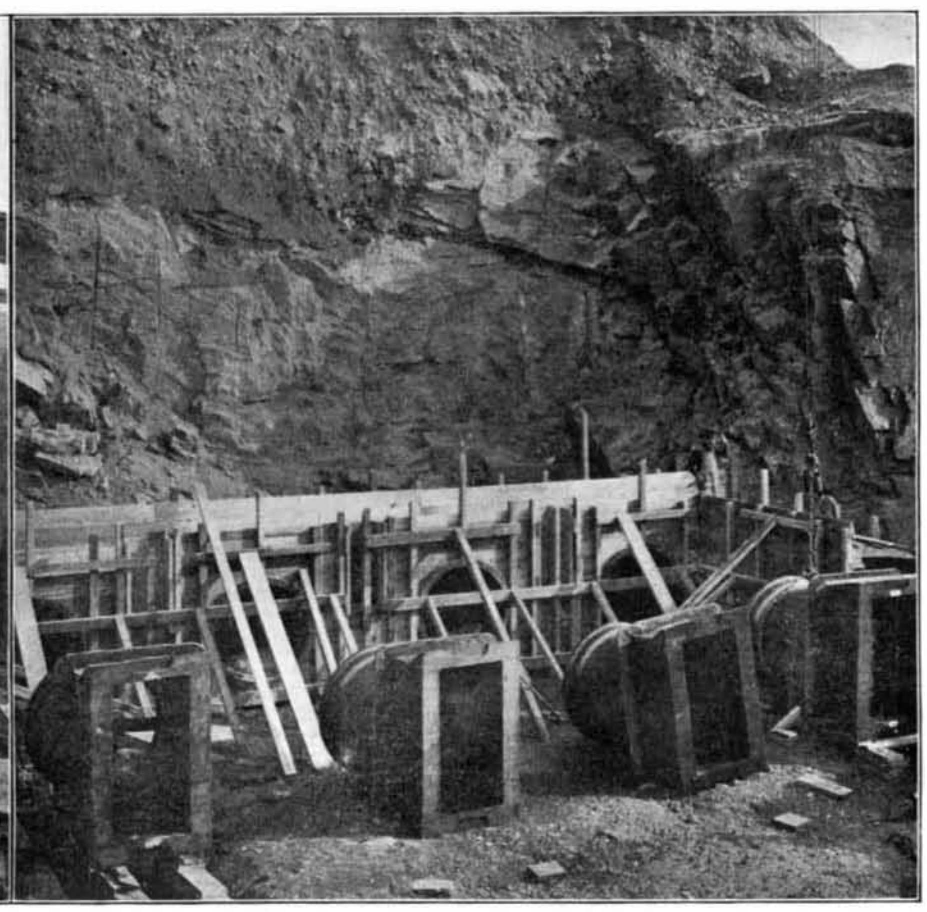
For this reason the actual supply is limited to three and a half or four days, and in the event of a failure in the Croton reservoir, or of the two aqueducts above mentioned, the city would be brought within measurable distance of a water famine. Although such a contingency as the failure of both aqueducts or of the reservoir is remote, the aqueduct commissioners determined, some ten years ago, to enlarge the reservoir capacity at the city end of the line by constructing an additional storage basin which would have about double the capacity of those in Central Park. This would give the city a reserve of three billions of gallons, or about fourteen days' supply. Work was started in 1896, and the westerly basin will be completed and in service by the close of the present year.

The site chosen for the reservoir lies on the high ridge of land which runs in a general north-and-south direction between the New York and Putnam and the Harlem railroads, and judged from the engineer's point of view, it is well adapted to the purpose. It forms a general depression on the summit of the ridge, and Nature has helped to lessen the labor of digging out and embanking this huge artificial basin, the depth of which is 26½ feet and its area 239 acres, by surrounding it for half the total distance with rising ground. The other half of the distance has been shut in by an embankment and retaining wall. The original design called for a core-wall embankment around the greater part of the perimeter of the reservoir; but as the work proceeded, the character of the ground underlying the foundations proved to be so unsatisfactory that it was decided to substitute a solid masonry retaining-wall along the westerly and easterly sides of the reservoir. As the inner face of this wall is nearly perpendicular, it followed that the area of the bottom of the reservoir was greatly increased, the additional area being that contained between the line of the toe of the earth slope, as designed, and the line of the inside foot of the perpendicular wall. The enlargement amounted to about 10 acres.

In spite of the natural basin that existed at the reservoir site, the amount of excavation has been enormous. No part where the natural surface was less than 16 feet above the proposed bottom, which is 29 feet below the crest of the retaining wall, and 31½ feet below the top of the finished embankment. The total amount of excavation is about 7,200,000 yards, and as the excavated material occupies more space than



Section of Dividing Wall Containing the Old (Upper) and New (Lower) Aqueducts.



Laying the Reducing Pipes at Gatehouse No. 5.

COMPLETING JEROME PARK RESERVOIR.

the material before excavation, some 11,000,000 cubic yards have been blasted out and excavated, the larger part being carried to the Sound, some six miles away, and dumped on the low land or tide flats. Some of the material, however, was used in filling in property and streets of the Bronx; and a part was deposited for filling in Van Cortlandt Park. All of this work but about 10 per cent has been completed.

Both the old and the new aqueducts pass through the reservoir site on their way to the city, the former at the ground level, the latter some 100 feet below the surface. As the bottom of the reservoir lies below the old aqueduct base or foundation, it has been necessary to remove the latter structure altogether and rebuild it; this has been done. At a point about a mile to the north of the reservoir the new aqueduct is at the ground level, and it is here that it is depressed and carried in a tunnel to the deep level above mentioned, at which it is carried under the Harlem River. At about the center of the reservoir a vertical shaft, known as Shaft 21, rises from this aqueduct to the bottom of the reservoir. At the point to the north above mentioned, where the change of grade occurs in the new aqueduct, a deflecting gate chamber is being put in and a surface branch aqueduct is being built, which branch runs parallel with the old aqueduct, until the northern end of the reservoir is reached. Here the two aqueducts are continued in one compact masonry structure, known as Gatehouse No. 7, where the flow can be discharged into either the east or west basin or continued south through the masonry division wall. This division wall is built upon the solid rock and runs through the reservoir from north to south, dividing it into two approximately equal and entirely separate basins, the top of the structure being at elevation 136.5 and level with the top of the embankment, or 5 feet above the maximum high-water level in the reservoirs.

At the center of its length, and opposite the Shaft 21 leading down to the new aqueduct, a large main gatehouse (No. 5) has been built, from which a short conduit leads across to connect through this shaft with the new aqueduct below ground. To the south of the main gatehouse two conduit aqueducts are continued at bottom elevation 107, for distributing the supply, each conduit being 11 feet in diameter. The old aqueduct is carried above these at its former elevation. At a point 1,500 feet to the south of the gatehouse one distributing conduit leads into the western and the other into the eastern half of the reservoir. By this arrangement six separate systems of distribution of the water are secured. Water also can be discharged into the east reservoir from the old aqueduct at Gatehouse No. 6, or may be taken thereat. The reservoir may be filled or the water distributed directly from either the old or the new surface aqueducts, or from the subterranean aqueduct through Shaft 21, the operations being all controlled at the main gatehouses, Nos. 5, 6, and 7.

Six lines of 48-inch pipe radiate from the main central gatehouse, No. 5, two of which leave the reservoir at Van Cortlandt Avenue Gatehouse No. 2 to the northwest, two at Sedgwick Avenue Gatehouse No. 3 to the west, and two at Jerome Avenue Gatehouse No. 4 to the southeast, one of which leads to a high-service pumping station; also two 48-inch pipes will lead away south to Manhattan, from Gatehouse No. 6 at Kingsbridge Road. A gatehouse has been built at each point of exit. The main gatehouse connections are so arranged that these pipes may be supplied with water from either basin of the reservoir or directly from either the old or new aqueduct. The 48-inch pipes, with the aid of the new pumping stations, will serve the annexed district to the north of the Harlem River, and it is also proposed to carry a double line of 48-inch pipes south across the Harlem River to connect directly with the city mains on Manhattan Island. This would give an independent source of supply in case of any accident to the present aqueducts where they cross the Harlem River. It has also been arranged to take off four lines of 48-inch pipes east and west from Gatehouse No. 7, north end, connecting with the city system, should the reservoirs require cleaning, etc.

It is the determination of the Aqueduct Commission to finish the westerly half first, and put it immediately in service. The final work of concreting the bottom was begun in 1904, and 30.25 acres were laid in that year. On March 27, 1905, work was again started on a scale that would insure its completion by the following Thanksgiving, or before the frost set in. By April 27, between three and four acres had been laid, with only half the concreting plant installed. It was estimated that twelve mixers would be sufficient to complete the work in the year; but the contractors have ordered sixteen, and nine of them are at work. It is hoped to exceed the estimated output of concrete by 20 per cent, and carry the total per day up to 3,000 square yards, or seven-tenths of an acre. The task is a truly gigantic one, as 101.25 acres have to be covered with concrete 6 inches in thickness, which means that a total of 1,750,000 cubic feet must be mixed, carried to the site and carefully tamped and surfaced. It will take at least a year more to complete the easterly basin. We are indebted to Mr. J. Waldo Smith, the chief engineer of the Aqueduct Commission, and to Mr. F. S. Cook, division engineer in charge of the construction of this work, for courtesies extended during the preparation of this article.

THE AUXETOPHONE FOR REINFORCING GRAMOPHONE SOUNDS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Some time ago we drew attention in the SCIENTIFIC AMERICAN to the ingenious invention that had been devised by the Hon. C. A. Parsons, inventor of the steam turbine, and Mr. Horace Short, by the employment of which the reproductive sounds of phonographs and similar machines could be appreciably reinforced. At that time the invention was in a purely experimental stage. In the interval, however, the inventors have been perfecting it so as to be a commercial and practical attachment to talking machines. In this direction they have now succeeded, and recently an interesting demonstration of its practicability was given in connection with a gramophone.

In this device, which is called the auxetophone, the usual diaphragm of glass or mica in the producer is replaced by a small valve, which controls the admission of compressed air to the trumpet. The air is supplied from a small pump or bellows contained in the pedestal supporting the instrument at a pressure of about two pounds to a square inch. The valve, though of small size, consists of a fine comb of aluminium or magnalium, and the teeth of this comb just cover the gaps in a corresponding comb of brass, through which the air tries to escape from the compressed-air chamber connected with the supply tube.


THE PARSONS AUXETOPHONE.

The little magnalium valve, which is very light, is hinged on steel springs, so that when its teeth are slightly lifted from the brass comb or valve seat, the air is allowed to escape at both sides of each tooth in very large quantities up through the two combs and into the trumpet. When, however, the two combs approach closely and almost touch, the escape of air is checked and almost ceases.

It will thus be noticed that the slightest movement of the magnalium valve on its supporting springs greatly varies the admission of air into the trumpet; and being connected to the needle of the gramophone, the motion of the valve corresponds exactly to the motion imparted to it by the record, and also to the original wave of sound as recorded by the recording instrument when the record was made.

The auxetophone reproducer may therefore be called an air relay, for by its use the gramophone record has only to work a valve of special construction, which controls the power of the compressed air. It is therefore of much greater power and volume than the diaphragm reproducer hitherto used, while it has the additional feature of enforcing the harmonics, which gives increased fullness of tone.

The reason of this remarkable change in tone is somewhat complex to explain, but the velocity of motion of the valve causes, or corresponds to, acceleration of the velocity of air in the trumpet, and that acceleration in the motion of the valve corresponds to double acceleration of the air in the trumpet. When this is worked out mathematically, it is found that the air wave provided in the trumpet is the differential of the wave on the record; in other words, the harmonics are reinforced, or a richness is imparted to the sound. Another feature of the auxetophone is an ingenious little "viscous connection," as it is called, introduced between the needle and the valve, which adds to the softness of the tone, and its action may be compared to the effect of the moisture in the throat of the singer, or the effect of age and playing in mellowing and loosening the fibers in the wood of the violin.

The auxetophone is a very powerful reinforcer, and on a calm day may be heard distinctly for two or three miles, and speech may be followed in every word from two to five hundred yards at least. The device has been acquired by the Gramophone Company, of London. It is intended, as soon as a few adjustments and simplifications have been made to coincide with public requirements, to install auxetophones upon transatlantic liners for the amusement of passengers.

MOVING PLATFORM SUBWAY FOR NEW YORK CITY.

Toward the close of November last year, there appeared before the Board of Rapid Transit Railroad Commissioners of this city several leading railroad officials and engineers, with a proposal to build a moving platform subway below Thirty-fourth Street between First and Ninth Avenues in this city. The sponsors of the new scheme are men of broad experience and high technical qualifications, as will be seen when we mention that they included Mr. Stuyvesant Fish, president of the Illinois Central Railroad, Gen. Eugene Griffin, first vice-president of the General Electric Company, and Mr. Louis B. Stillwell, the electrical engineer of the Interborough Rapid Transit Company; and in the record of their testimony, given before the Rapid Transit Commission, the proposed moving platform is indorsed with a unanimity which is a guarantee that, so far as the mechanical and commercial aspects of the scheme are concerned, it is thoroughly practicable. The proposal was to build a continuous moving platform across Manhattan Island, under 34th Street, with a loop at each end, both the easterly-moving and westerly-moving sections of the platform to be contained within a single tunnel. The platform was to be built in four sections: First an auxiliary section, to be stationary during the greater part of the time, and operated only during the midnight hours, and three moving sections, traveling at the respective speeds of three, six and nine miles per hour, the fastest section to be provided with cross seats throughout its entire length. The company stated, before the Rapid Transit Commission, that the platform would have a capacity for delivering at a given point forty-eight thousand seated passengers per hour, and it was stated that an arrangement would be made with the present Subway Company for a transfer of passengers.

Subsequently to the presentation of the scheme, the Metropolitan Street Railway Company, which controls all the street railways in New York city, and intends to be one of the most active bidders for the construction of further subways, argued strongly against the giving over of such an important thoroughfare as Thirty-fourth Street to a moving platform, and offered to build a subway system which would include Thirty-fourth Street as an important link therein. The matter was thoroughly argued before the Rapid Transit Commission, and that body decided at its last meeting to reserve Thirty-fourth Street for a four-track subway, not necessarily as a part of the Metropolitan scheme, but for whatever company might be the successful bidder for a subway system that included the Thirty-fourth Street subway as part of it. At the same time, it was intimated to the promoters of the moving platform subway that if they were willing to consider some other important cross-town street, such as Twenty-third Street, the Rapid Transit Commission would be ready to entertain a proposal.

In coming to this conclusion six out of seven members of the Rapid Transit Commission that were present voted against the installation of the moving platform on Thirty-fourth Street, the objections being directed, not against the moving platform as such, but against its appropriation of a thoroughfare which, because of its contiguity to the new Pennsylvania Railroad station, would form the most important cross-town link in the future complex system of subway transportation in New York. We cannot but think that, all things considered, the decision of the Commission was a wise one, and that the first level below the street surface on Thirty-fourth Street should certainly be reserved for a system of transportation identical with that under which the greater part of the future subway system will be operated. At the same time, there is unquestionably a great future for the moving platform. Its enormous capacity, which is far