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NEW YORK WATER SUPPLY.

We present herewith a bird's eye view, showing the routes of the old and new aqueducts supplying New York with water, and giving the principal landmarks from the Croton watershed to the city. The picture clearly presents the course of the Croton River, the location of Muscoot, Croton, and the proposed Quaker Bridge dams, and in the dotted line shows the line of the old aqueduct and in the full black line shows the course of the new aqueduct. The old aqueduct, it will be observed, follows down the southern bank of Croton River to the Hudson, and then down the bank of that stream to High Bridge, where it enters the city. This course was adopted to avoid the high ground a more direct and shorter line would have encountered, and enabled the engineers to build almost the entire distance at the level of the ground, thereby saving the great expense of tunnel and deep cut work.

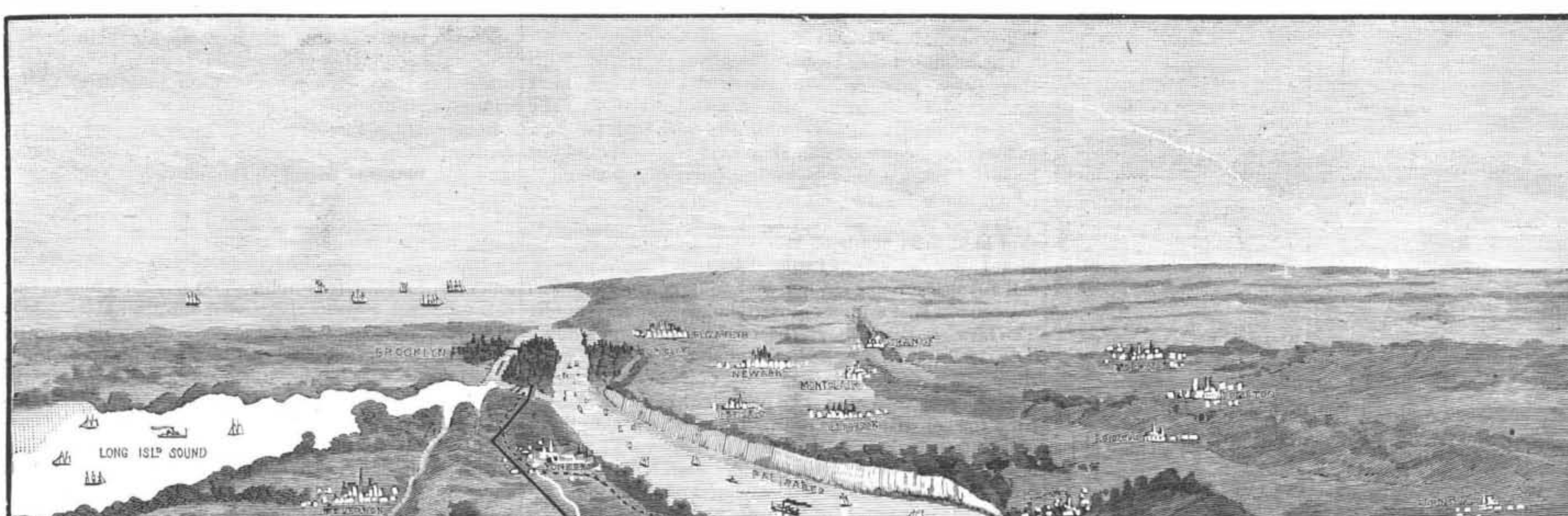
The new aqueduct passes in an almost straight line from Croton dam, where the main gate house for admitting water from either of the reservoirs at either of several depths will be located, to the Harlem, under the bed of which it will pass. Of the total length of thirty and three-quarter miles, twenty-five is through gneiss rock of different degrees of hardness, marble being found at the Harlem and at shaft 13. Between Croton Lake and the river are some twenty-nine shafts, the deepest of which is three hundred and fifty feet, which are, as far as possible, located in the valleys, the tunnel in many instances passing under hills much exceeding in height the depth of the adjoining shafts. From the bottom of each shaft the two headings are extended. This method permits of rapid work, as it multiplies the points of attack. Almost the entire aqueduct is thus tunneled through solid rock, and it is safe to assume that it will prove as durable as the hills through which it passes.

Quaker Bridge dam, located at the right in the picture, will be the most massive structure of its kind in the world. It will be situated between the hills through which the Croton flows. The great dam will be 1,500 feet long at the top and 22½ feet wide; will be 216 feet thick at the base, and from its top to the bottom of the V-shaped valley it will measure 277 feet.

It is not the intention to permit the water to flow over the dam, the contour of the country being such as to form, between the hills at one end of the dam, a natural by-pass, through which, when the reservoir is full, all the surplus water finds its way. There will thus be three dams across the Croton River. Muscoot, the upper one, now forms a pond of 2,500,000,000 gallons capacity, to which Crotom dam, the top of which is about on a level with the bottom of the other, will add 2,000,000,000 gallons. The great Quaker Bridge dam will constitute a reservoir, the water in which will be level with that inclosed by the Muscoot, and will, consequently, submerge Croton dam. This will add 20,760,000,000 gallons to the supply, at a level higher than that of the Croton dam reservoir. The aggregate capacity of the three reservoirs will be a little over 30,000,000,000 gallons, sufficient to insure an ample supply during the dry season for many years to come.

The gate house, through which the water will pass to the aqueduct, will be located in a niche cut out of the solid rock of the hill at the southern end of Croton dam. This gate house will be connected with the reservoirs at several levels, so that water can be drawn from either at the desired level, according to the condition of the water in each. There will be an independent communication between the Muscoot and Quaker dam reservoirs, so that, should it become necessary, the water can be drawn off from the middle reservoir and the latter cleaned. Provision is also made for emptying the lower reservoir, if that should ever be required. It will be observed that the ponds are practically independent of each other, although they have a common outlet.

(*Continued on page* 358.)



BIRD'S EYE VIEW OF THE ROUTES OF THE NEW YORK CITY AQUEDUCT.

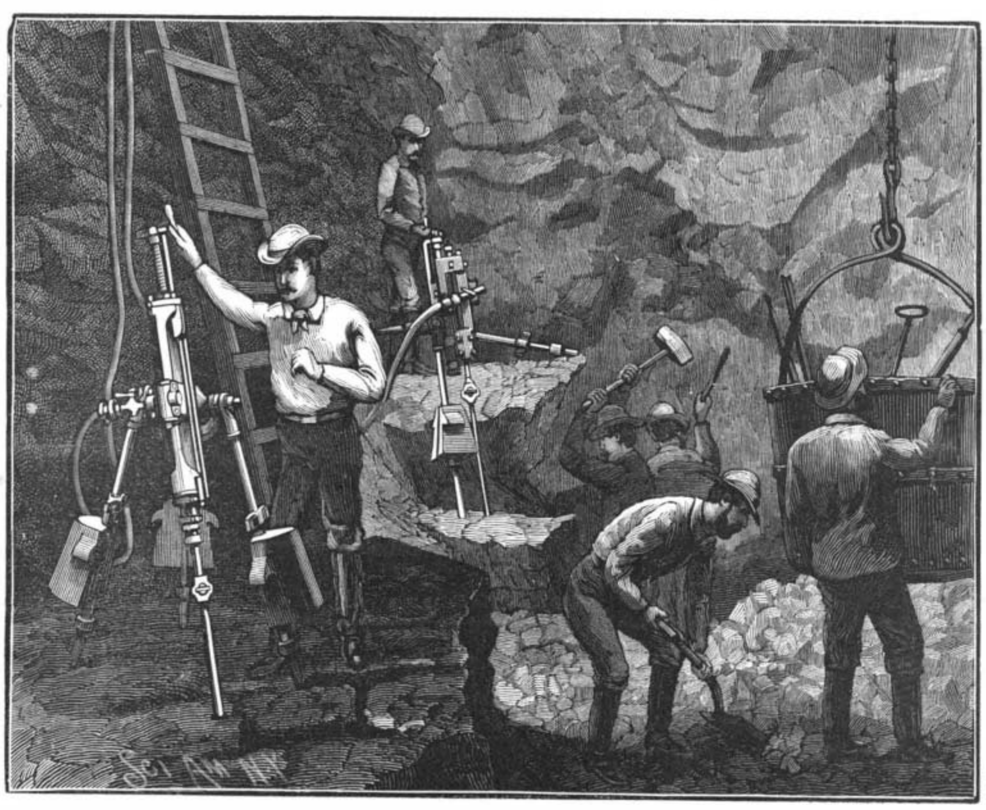
NEW YORK WATER SUPPLY.

(Continued from first page.)

The aqueduct is the shape of a horseshoe in section, and has a sectional area of 155½ square feet. When filled to within 7-10 of a foot from its top, it will deliver 318,000,000 gallons per day, or three and a third times the present daily consumption of 95,000,000 gallons.

The grade of the aqueduct from Croton Lake to shaft 20 is 7-10 of a foot to the mile. At Gould's Swamp, near Tarrytown, the aqueduct encountered soft material, upon which no reliance could be placed, and through which it would have been a difficult matter to build the tunnel. It was therefore decided to drop a short section 70 feet, in order to secure a firm bed in solid rock. At shaft 20, the aqueduct descends 115 feet on a grade of 10 per cent. From the bottom of this incline to the bank of the Harlem, the usual grade of 7-10 of a foot to the mile is maintained.

We now reach the most interesting point on the aqueduct proper—where it dips and passes under the Harlem River. The bed of the river is composed of sand and gravel at the eastern side, and mud at the western side; below these is hard rock, which assumes the form, immediately under the mud, of a deep and narrow valley or gorge. It was at first thought that the aqueduct, in order to clear this low spot and make the crossing in solid rock, would only have to be sunk 150 feet below the river water level. To reach shaft 24, on the eastern bank of the river, the aqueduct descends on a grade of 15 in the 100; according to the first plan, that portion under the river to vertical shaft 25, on the opposite bank, was to be 2 in the 100. From the bottom of shaft 25 it was proposed to extend a test drift toward the gorge, and in that way ascertain its depth and the character of the material directly beneath it. This was done, and drill holes were made in the heading of the test drift. These showed that the gorge extended below that level, and that it was not possible to carry out the original intentions. Shaft 25 was then extended about 100 feet deeper. Should solid material be found at this depth, the aqueduct will be built under the river, and the steep section from the other shore extended to meet it.

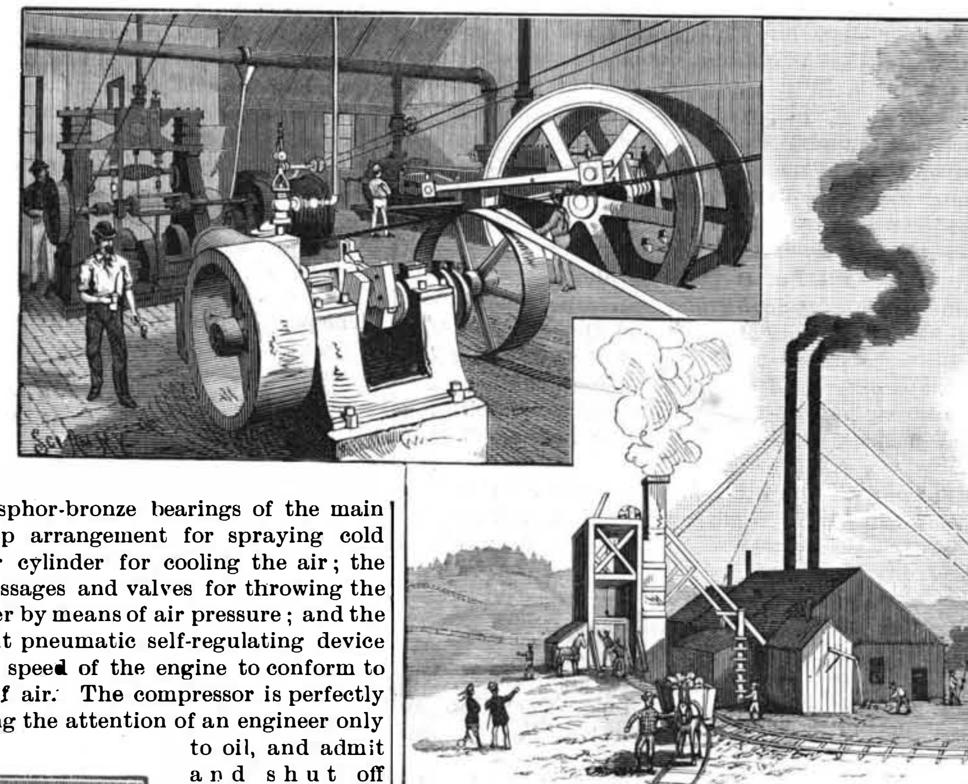


THE INGERSOLL DRILLS AT WORK IN THE AQUEDUCT.

From the Harlem, the aqueduct passes under Tenth Avenue to the distributing gate house at 135th Street.

The manner of prosecuting the work is illustrated by the engravings upon this page, which show the plant at the top of the shaft and the method of sinking the shaft and driving the heading. Our views were selected partly to show the Ingersoll air compressors and rock drills, as these machines are extensively used along the entire line, and have invariably given the greatest satisfaction. The shaft or well leading from the ground surface to the grade line of the tunnel is sunk in the usual mining way. By means of the well known "Eclipse" drills, holes are sunk to a depth of three or four feet in the bottom, being so distributed as to cover the whole section. The holes are then filled with explosives, tamped, and discharged by electricity. As the shaft progresses, the hoisting machinery is brought into operation, and the men and material are raised and lowered by the cage. When the bottom has been reached, the two tunnels are started in opposite directions, to meet the two others coming toward them from the adjoining shafts, and each heading is then independent of the other, and is worked by its own gangs. When one heading has been drilled and the holes charged, the men retire to a safe distance and the charge is fired. Fans at the surface are then set in operation, to remove as quickly as possible the gases resulting from the explosion, as they affect the health of the men.

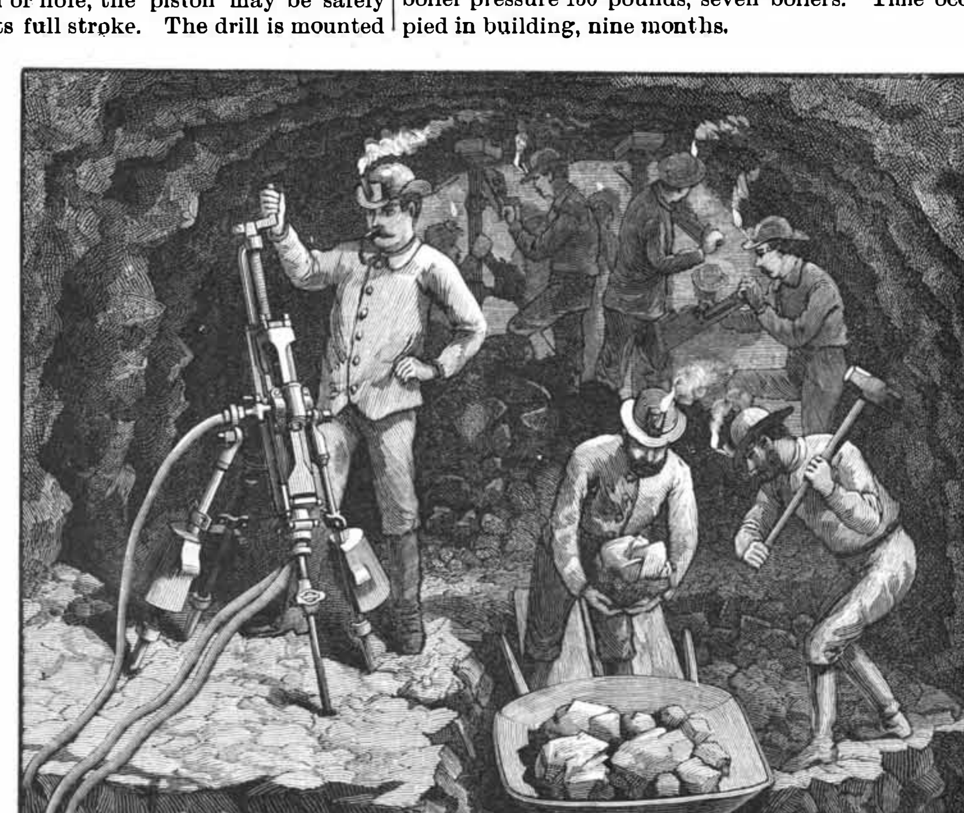
The Ingersoll air compressors and rock drills are well known and appreciated wherever mining operations are prosecuted. Their "Straight Line" compressors are built on the most approved plan. The most essential features in the construction of this machine are in the improved cylindrical inlet and outlet air valves; in the simple and quick manner of adjusting the phosphor-bronze bearings of the main shaft; in the pump arrangement for spraying cold water into the air cylinder for cooling the air; the arrangement of passages and valves for throwing the engine off the center by means of air pressure; and the simple and efficient pneumatic self-regulating device for controlling the speed of the engine to conform to the consumption of air. The compressor is perfectly automatic, requiring the attention of an engineer only to oil, and admit and shut off steam. It is because of these points, which we have only mentioned, that the Ingersoll compressors are so well received.



INGERSOLL BOILER HOUSE AND ENGINE ROOM.

The "Eclipse" drill can be operated by either steam or compressed air. It has an independent steam-thrown valve, shifted by the steam or air used, and there is, in consequence, no rocker arm or tappet liable to break and damage the cylinder. In drills of the same size all the parts are interchangeable. The stroke can be varied from one to seven inches; and as both cylinder heads are protected on the inside by elastic cushions, which receive the blow of the piston when the bit suddenly cuts into an open seam or hole, the piston may be safely allowed to run at its full stroke. The drill is mounted upon an adjustable tripod constructed to permit drilling at any desired angle.

Regarding the efficiency of the Ingersoll drills, and the ease and rapidity with which they may be handled, we may state that the best weekly and monthly records of completed work on the new aqueduct, 83 feet (full section of tunnel) and 265½ feet (full section of tunnel), respectively, have been made with these drills, the material passed through being hard granitic gneiss. They are used on the Croton dam section of the aqueduct exclusively, and also from shafts 0 to 11, from shafts 22 to 24, the section under the Harlem River, and at the gate house at 135th Street. They are also used at shafts 12 A, 12 B, 14, 18, 18½, 19, 20, and 21.



INGERSOLL DRILLS AT A HEADING.

The entire aqueduct from the gate house at Croton dam to the one at 135th St. is now under way, the total contract price, including the two gate houses, being $14,000,000. The estimated cost of Quaker Bridge dam is $6,000,000, making the aggregate cost of the improvement $20,000,000. The old aqueduct cost $12,500,000.

The Hammond Type Writer.

This is one of the very best machines in the market. It is just now having a successful introduction in England, and attracts much attention in the American Exhibition, London.

Among other advantages claimed for the Hammond machine are that it is compact in form and portable, weighing only 15 pounds; that the action is simple, and the machine easily worked by reason of the accessibility of the keyboard and the disposition of the keys, and that the paper is not horizontal, but vertical, and is therefore easily read by the operator as he works. The alignment is very perfect and the impressions are uniform. The type quadrants can be removed and replaced by others bearing a different type if desired. The paper being slipped into a hollow cylinder, a very long rule may be used, and as the carriage ends are opened, the paper may be of any width.

A Remarkable Steamer.

The new British steamer Ormuz lately made the voyage from Adelaide, Australia, to Liverpool, a distance of 11,000 miles, in 27 days, being an average of 17 miles an hour. Coal consumption, only 110 tons per diem. The ship is 465 feet long, 52 feet beam, 37 feet depth, 10,500 tons displacement loaded, 8,500 horse power, boiler pressure 150 pounds, seven boilers. Time occupied in building, nine months.