and rock carried by the glaciers caused the river to be pushed eastward out of its normal channel and over the solid rock beyond. When borings were made for the aqueduct through this section of the city, it was found necessary to lay it at a depth of about 750 feet below the surface. Much of the rock through this section is decayed and unfit to form the walls of a high-pressure aqueduct which is being built to last for all time. The present channel of the East River, on the other hand, passes over solid rock, and is comparatively very shallow. Seven hundred and fifty feet is an enormous depth, second only to the great siphon under the Hudson River, which is 1,114 feet below the river surface. It so happens that the deepest shaft ever sunk in New York city equals the height of the tallest building in the world.

Arrived in Brooklyn, the aqueduct rises again to within two or three hundred feet of the surface, and is pushed as far as it is possible to carry it in solid rock and yet communicate with the surface. This limit was found to be at the junction of Flatbush and Third Avenues. Here it was necessary to go through 215 feet of overlying earth before coming to the rock. The caisson method had to be resorted to and the caisson was sunk over 100 feet below the water line before rock was reached. Considerable difficulty was here experienced in sinking the shaft to the rock, because it called for the use of pneumatic pressure that taxed the endurance of the workmen to the limit. From here on the water will be conducted through pipes laid in a trench of a moderate depth below the surface. From the foot of Seventy-ninth Street, Bay Ridge, the conduit will be run across the Narrows to Staten Island, through a pipe 36 inches in diameter, provided with flexible joints, and laid in a submarine trench. The details of this section of the work have not yet been given out. However, tests have been made to discover at what depth the pipe line under the water must be buried. It is evident that it must lie far enough below ground to prevent its being entangled with anchors from large vessels that may have to anchor in the Narrows. The matter has been thoroughly investigated, and practical tests have been made by dragging anchors of large size along the bottom. It has been determined that if the pipe line is buried at least eight feet under the bed, it will be entirely safe. On the Staten Island side a 48-inch pipe will carry the water on up the hill and through a tunnel into Silver Lake reservoir, 120 miles from the source in the Catskills.

The greatest interest in this city section of the aqueduct attaches naturally to that part which is being excavated through solid rock under the busy city. It is a surprising fact that a work of such magnitude can be carried on directly under our feet without inconveniencing us in the least. The only surface evidence of the deep rock tunneling is to be found at the various shafts which are located in parks, or public squares. The principal difficulty that presented itself at first was the question of storing explosives for a work of such great proportion. To keep the necessary explosives on the surface was to harbor constant menaces to the lives of the citizens. The matter was finally solved by placing the dynamite magazines far under the surface in the rock, and setting the doors to these magazines so they will automatically close in case of an explosion and trap the hot and poisonous fumes in the rock chamber, where they can do no harm to the workmen. The idea was borrowed from European practice, where mining operations are conducted close to and sometimes directly under large cities. Access to the dynamite chamber is had through a zigzag drift. At each turn of the drift a pocket is excavated, and the chamber itself is made of large capacity. In this chamber the dynamite is stored under a protecting roof to keep off any fragments of rocks that might fall when jarred by the "shooting" in the tunnel. At the entrance of the drift a very substantial concrete bulkhead is built, and in this is a low doorway. The door is of massive construction, built of I-beams, sixteen inches deep and spaced apart with oak beams twelve inches square. The door has beveled edges, so that it will seat itself snugly in the doorway. The door is always kept open at an angle of about 45 degrees. In the magazine a thousand pounds of dynamite may be kept at a time. Should this be exploded, the explosion wave would have to travel down the zigzag passage and would lose much of its force at each abrupt turn, finally striking the door with greatly diminished energy. The door would be slammed shut by the blast of air issuing from the drift and would then be held shut by the gases of the exploded dynamite. A magazine of this sort has been constructed near the foot of each shaft—not at the foot, however, for fear that in case of a mishap, it might block the escape of the men. The magazines have been tested by exploding a number of sticks of dynamite around the first bend in the drift, and in every case the door has closed just as expected.

The work through the rock is being pushed very rapidly; at some of the shafts between 800 and 1,000 pounds of dynamite have been used daily. Within the last year millions of pounds of dynamite have been exploded under the city, while most of New York was totally oblivious to the fact. Already a number of the tunnel sections have been "holed" through. To expedite the work, one contractor is using an interesting form of shoveling machine, built especially for this work, so that it may be taken down the comparatively narrow shaft and be assembled to work within the small diameter of eleven feet, which is the size of the tunnel at the particular point where this machine is now being used. The machine is controlled by a single operator, and does the work of six laborers.

Some of the work on the city pressure tunnel has been hurried so far that certain sections are now being lined with concrete. The forms used for this purpose are very interesting. They cover 120 feet altogether and are arranged in two sections, sixty feet of the lower half of the tunnel being concreted in an advance of sixty feet of the upper part. The first step is to lay the "invert," that is, a narrow segment of the lining running along the bottom of the tunnel. This, when completed, forms the track upon which the forms for the rest of the lining travel. The forms are mounted on trucks with wheels tapered to fit the curve of the invert. The forms for the lower half cylinder are practically the same as those for the upper half cylinder. After the lining has set, the sides of the upper form may be drawn in to free them from the concrete, by operating the turnbuckles A, and those of the lower forms by operating the turnbuckle B. Then jacks may be unscrewed to lower the upper section slightly freeing it completely from the concrete and jacks E may be screwed up to raise the bottom section slightly upon the truck. In this collapsed condition the forms may be drawn forward to complete the next section of tunnel. It is quite a different task, however, to lay the concrete into the upper form. Sections of the plating of the upper forms are removed and the concrete is shoveled in, adding the plates step by step as necessary, until finally the topmost plate is added when the concrete can be introduced only from the end of the form. It will be observed that small pieces of board are temporarily nailed against the edge of the forms and fitted up as neatly as possible against the rock above, so as to retain the concrete until it sets. As each section is completed, grouting holes are left in the top through which, when the lining is completed otherwise, grout will be forced under high pressure to fill up all cracks and crevices and make the lining perfectly sound.