A NEW METHOD OF WET EXCAVATION.

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Draining, instead of emptying, an excavation.

How vacuum pumps and three hundred well points master the terrors of quicksand better than sump method.

Why ordinary wooden sheeting is sufficient, even though sand is unusually fluid and digging goes three feet below sheeting.

How the 30-foot excavation for a new $350,000 sewer at Gary, Ind., is kept dry, although 22 feet below water level.

Detailed costs of excavation, pumping, jetting well points, laying brick, shovelling and back-filling.

"The Magic City of Steel," Gary, Indiana, which represents an expenditure of $75,000,000, has attracted much attention in the world of engineering, owing to the magnitude of the work, the speed of construction and the methods adopted. With a population of fifteen thousand, Gary is scarcely two years old; yet it has above ten miles of paved streets, twenty miles of gas mains, an electric light plant, full telegraph and telephone service, both local and long distance, and now an elaborate system of sewers, about twenty miles in length, is nearing completion. The sewer system will cost about $350,000, and about half of this contract was let to Green & Sons Company, contractors, of Chicago, Ill.

This article deals with the methods and costs of the contractor in overcoming the difficulties of quicksand, which will flow in from a radius of fifteen feet when an excavation one foot in depth is left unconfined. This sand, when dry, is so impalpable that it is ankle deep. So low is the land, also, as compared with Lake Michigan, that in many places there are surface ponds three and four feet in depth.

The Vacuum Pump Method.

In designating the arrangement of the apparatus the front or foremost end of the sewer trench will be the end being excavated, while the words "first," "second" and "third" pumps will serve to designate their relative position in reference to the front end of the sewer trench.

It will be seen from the illustration that the first vacuum pump (an Emerson No. 3, with 5-inch suction and 4-inch discharge) has to do with draining the excavation immediately adjacent to the scraper bucket excavator. Its suction pipe is connected with a horizontal 4-inch pipe as shown. The 2-inch well points are three feet long, and are connected with 2-inch pipes 13 feet long, which are jetted in a double row near the centre of the trench. This arrangement is made so as to allow the sheeting to be driven on either side. The pump draws water from:—

132 2-inch well points sunk 16 feet below.

1 4-inch well point sunk 16 feet straight below the pump.

1 4-inch suction pipe, with strainer, placed on the front end of the horizontal pipe line, and draining surface water.

Pump Suspension.

The pumps are all hung by chain falls from "A" frames, the first "A" frame being mounted on rollers to facilitate its being moved forward as the excavation progresses. The sheeting prevents the others being so mounted.

Pipe Connections.

The 4-inch horizontal suction pipe mentioned in connection with pump No. 1 is made up of six sections and joined by flanges. As the work progresses 22 feet the rear section is removed and placed in front, and so on. Gate valves at frequent intervals make it possible to do this without shutting down; thus the pump can remain in one position, even though the excavation has been carried forward about 6 x 22, or approximately 120 feet.

The vertical pipes leading down to the well points have ells at the top and a four-foot length of hard, wire-lined rubber suction hose makes the connection to the 4-inch main pipe. Each 22-foot length of this latter pipe has eleven cross valves, with two bushings each, to accommodate the rubber connection.

Sheeting now Driven.

After the draining has been carried on for a couple of hours in the first of the six sections attached to the first pump, 2 x 8 x 12 in. sheeting is driven by mauls on both sides of the sixth section. Then excavation is started by six shovellers, and is carried down about six feet more. It is at this level that the well points attached to pumps No. 2 and No. 3 are jetted down another 16 feet, so that they penetrate below the bottom of the lowest excavation and six feet below the bottom of the sheeting. The entire trench was dry sand, comparatively, and would stand ½ to 1, although if wet it would not stand better than 15 to 1.

Different Arrangement for Other Pumps.

The second and third Emerson pumps have their suction pipes, as the electrical engineer would say, "operating in parallel"; that is, they are both drawing water from the same piping system. The suction pipe of each draws water from:—

One 4-inch suction hose straight below the pump.

One 4-inch rubber hose leading to the right.

One 4-inch rubber hose leading to the left.

This arrangement is accomplished by means of a four-way connection in the suction of each pump, about one foot below the pump. The two 4-inch rubber hose, branching

Bird's Eye View of Gary Sewer, Showing Pumping Plant, Trench, Clamshell, Backfilling and New Steel Plant in Far Distance.

off horizontally from the four-way connection, and at right angles to the trench, are only long enough to connect through a tee with 2-inch iron pipes, also horizontal, which extend along the sides of the trench, just inside the sheeting. It is to these latter pipes that the 1¼-inch well points are connected, and jetted down as close to the sheeting as possible so that the excavation can go on without hindrance.

Shifting the Vacuum along the Trench.

Again gate valves at frequent intervals allow of considerable flexibility, so that the pumping can be made stronger in any part of the excavation where specially large quantities of water may be encountered. Thus, the entire combined capacities of the second and third pumps can be concentrated on those well points in the wettest part of the work by closing the gate valves and shutting the vacuum from other points in the trench. This would, of course, be impossible were an ordinary "sump" used. Had the sump method been employed as the work progressed, new sumps would have to be dug, sheeted, and additional pumps hung at considerable expense. The "distributed suction" idea at Gary makes the pumping more efficient than in the old sump method, because the water is only drained from the