

fenced in. This land the Commissioners propose planting with trees.

The work of collecting springs consists of a concrete chamber, 4 ft. by 3 ft., built in the most suitable position. From this chamber open-jointed pipes are laid, following the springs into the side of the hill and in other directions where smaller springs could be obtained. These branches were laid to an average depth of 6 ft. and covered with 1 ft. of washed gravel, and trench refilled with the excavated material. A weir was built in the chamber, so that the flow can be measured periodically to see if the flow decreases or otherwise. From the weir chamber a cement jointed pipe is laid to main conduit, the connection being made by building a concrete chamber 3 ft. by 3 ft. All chambers are covered with reinforced concrete slabs, with manholes where necessary. It will be gathered from the preceding description that the springs are, as far as practicable, protected in every possible way from the risk of contamination, the water not being exposed until it reaches the valve-house at the reservoir.

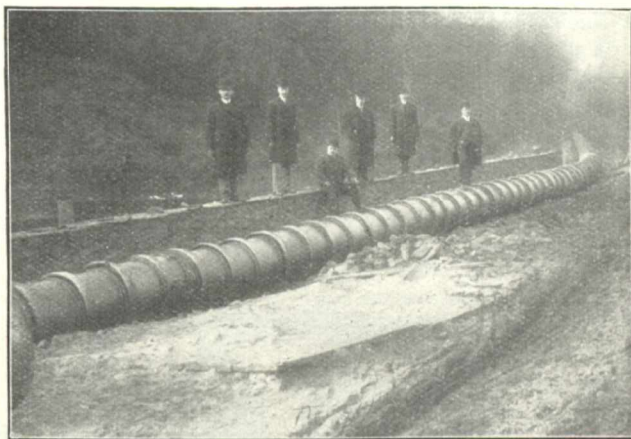
The main conduit consists of a 24-inch diameter vitrified pipe, laid to a grade of 1 in 1,000, the average depth of pipe being 5 feet 6 inches.

Nothing of especial interest occurred in the work. The usual methods of pipe-laying were employed as in sewer

water is met with in the excavation, as was the case in places where the conduit was laid.

The conduit in its course cityward crosses under the C.P.R., and also under the river. No difficulty was experienced at either place. In the latter the water in the river was about four feet deep, and the customary way of damming off half the river, pumping, excavating and laying pipe for that distance, then turning the flow of water over the pipe already laid and laying the next part was followed successfully.

Pipes under the river were of cast-iron, owing to the greater head that they were subjected to. They were laid



**Pipe Line and Retaining Wall.**

as an inverted syphon, a concrete chamber with air vent being built at either end.

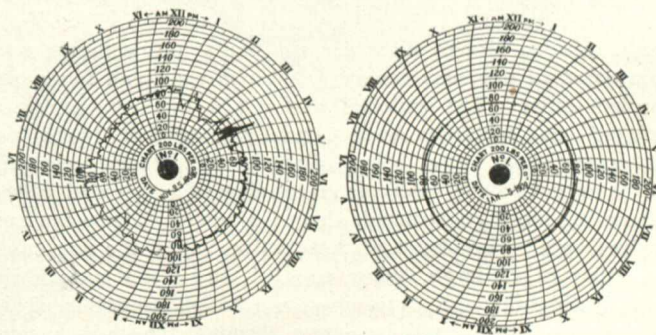
The construction of the concrete storage reservoir presented some rather unusual difficulties, owing to the fact that the site was in part of the open reservoir then used by the city, and that the supply could not be interfered with whilst work was in progress.

To overcome this difficulty the engineers decided to lay a 14-inch cast-iron pipe, with lead joints, in the bottom of the old reservoir, the level of which was three feet lower than the floor level of the new reservoir. Pipes were jointed together on trestle work and lowered eight feet into place



**Pipe Line during construction.**

construction, with the exception, perhaps, of the manner of making joints, which was specified briefly as follows: Strands of yarn to be cut eight inches longer than circumference of the pipe, yarn to be well soaked in cement grout and thoroughly caulked into joints; no strands of yarn to overlap in same place. The joint to be filled in this manner and finished off with the usual fillet of cement. The fact that one section of this conduit is laid as an inverted syphon for a distance of 1,800 feet under a five-foot head, and is watertight, shows that this system of making joints is very satisfactory. Great care, however, should be exercised, and, in the opinion of the writer, an inspector should be on the ground to see each joint made, as it is almost impossible to get the work done properly without constant supervision, especially where



**Pressure record discs.**

by means of chain blocks, the blocks being spaced about twelve feet apart. In this manner 200 feet of pipe were successfully laid. Dams were then built, water pumped out, and excavation and grading done. Several springs or leakages from the old reservoir were met with, and diverted to pumps by means of open-jointed tile. In adopting this method no difficulty was encountered in the laying of concrete. One pulsometer pump and one duplex pump was sufficient to keep excavation dry during the progress of work. The dimensions of the reservoir and details of same are shown on the accompanying plan. The capacity is about 500,000 imperial gallons. Depth of water is usually eight feet, but can be