The filters and intake pipe were constructed by the Thor Iron Works, ; the cast iron pipe was supplied by Canada Iron Foundries, Limited; valves and operating tables, Glenfield & Kennedy, Limited; venturi meters, Builders' Iron Foundry; structural steel, Dominion Bridge Co.; steel sash, A. B. Ormsby & Co.; skylight, Henry Hope & Sons.

The filter house is the largest building of the plant, being 277 ft. x 123 ft. The bottom of the floor is 9 feet below high-water mark, and is within 25 feet of the lagoon at Toronto Island, which made excavation work difficult. In fact, the whole island is a water-logged sand bar, the highest point on the site of the works being only 4½ feet above the level of the water when construction began.

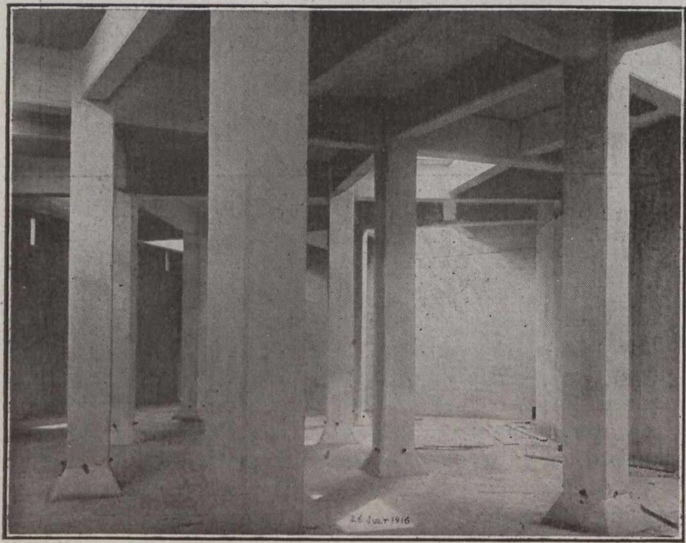

Fig. 12.—Interior of Coal Storage Portion of Coal-Chemical Building.

Excavation work was done with a Marion revolving shovel and an Industrial locomotive crane. On account of the fine running sand, all excavations that went much below water level were difficult and expensive.

A concrete foundation slab, or raft, 2 feet 6 inches thick was laid for the filter house.

Wash-back Water Tank.—The wash-back water tank is of steel and has a capacity of 200,000 Imperial gallons of sterilized, filtered water at a level of 60 feet above the ground, or 45 feet above the surface level of the water in the filters. The area of each filter to be washed is such that the maximum rate of discharge from this tank amounts to 31.4 million Imperial gallons per day, and for this purpose a 36-inch outlet pipe has been provided. Half of the water is discharged at a gradually increasing rate in ten minutes and the remainder at the maximum rate in five minutes, and this tank will probably be emptied about once a day. It is anticipated that on the average each filter will be back-washed once in ten days. A steam connection is provided to the tank to prevent freezing in winter time. The tank was constructed by the Canadian Chicago Bridge and Iron Works. The backwashing is accomplished by reversing the flow through the collector system when the loss of head in the filter becomes so high that the normal rate of filtration cannot be obtained.

Wharf.—The only access to the plant is by water and a wharf has been built along the western side of the plant. A typical section of the wharf is shown in Fig. 4. A concrete wall rests on two lines of timber piles and a further row of piles placed inland has provided foundation for the building wall. The face of the wall and the front rows of timber piles are protected by steel sheet piling and a timber runner is placed along the front of the wall to take the shock of the moving craft. In this way loaded scows transporting materials and railway freight cars can be brought right up alongside of the works. The wharf has the additional advantage of protecting the foundations of the various buildings along the western front of the plant. The sub-contractor who built the wharf was David Arnot, Toronto.

Sand-washing System.—In order better to illustrate the sand-washing arrangement, a typical section through the axis of a single unit gravity filter is illustrated in Fig. 13, while the actual details of one of the sand washers of the Toronto plant are shown in Fig. 14. The filter sand consists of two portions of precisely the same material with no physical boundary between them other than that produced by causing the upper portion slowly and almost imperceptibly to drift over the lower portion and across the paths of the filtering water. The sand has a maximum size of 1.2 mm., 60 per cent. less than .7 mm. and 10 per cent. less than 3.5 mm., and is rounded, water-worn, hard material. Around the periphery of the filter is a passage or system of ports down which the drifting sand passes.

The raw water which has previously been coagulated enters the filter partly by a standpipe at the centre of the unit and partly through a by-pass entering above the sand in the filter.

Within the sand washer the raw water pipe is provided with a restriction in every way similar to the tube of a venturi meter, and the drifting sand collected in the sand washer is inducted into the raw water at the narrowest part of the restriction, and this sand passes up the standpipe with the water, and is delivered with it above the top of the sand pyramid there, forming a volcano-like cone which continually drifts away and is continually being replaced, leaving a rounded topped object of stationary sand resting upon the collecting system. This stationary sand accomplishes the final filtration. The effective area of this stationary sand is more than twice the plan area of the unit and economizes the plan area of the filters. While probing the sand in a filter when in operation, the drifting sand will be found to be spongy and buoyant, whereas the surface of the stationary sand is found to be very hard packed and cannot be readily penetrated.

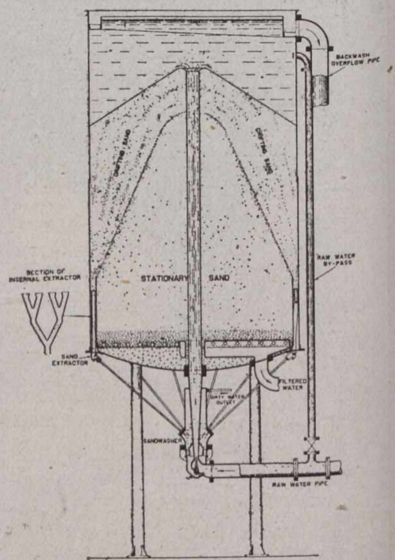

Fig. 13.—Section Through Single Filter, Showing Piping to Sand-washer. Each Filter in the Toronto Plant is Composed of 30 Such Separate Units.

The drifting sand passes down around the boundary of the stationary sand to a slot at an elevation of 2 feet 2 inches above the surface of the underdrain gravel, and ultimately passes through converging ports to a system of outlets or extractors and thence by pipes to the sand washer, in which the sand falls to the bottom through a current of raw water and is picked up by the inductor and the dirty