III EXPERIMENTAL INVESTIGATION

Since it was not convenient to use raw water from any natural sources, synthetic raw water was used throughtout the whole experiments. It was prepared by mixing tap water with fine clay powder. During the experiment, raw water was kept in a storage tank, capacity of 1.44 cu.m. as a source of raw supply. The tank was equipped with an airblower to ensure adequate dispersion of suspension and to prevent the setting of clay particles. By varying dosage of clay powder, it was able to obtain any degree of turbidity in the synthetic raw water. The feed was taken directly from the tank by mean of centrifugal pump. Flow measurement was made by a rotameter. A by-pass arrangement was used to by pass any excess flow (other than required to be used in the tube settling unit) to the storage tank. Turbidity of synthetic raw water used in this study varied from 55 to 65 FTU. Standard Jar Tests were carried out to find the optimum dosage of the alum and it was found that the optimum dosage was 50 mg/l. Due to the limited capacities of the storage tank and flocculation unit the maximum flow from the flocculation tank was fixed at 2.64 gpm. (10 lpm.). Thus, at high overflowrate (4.5 and 6 gpm/sq.ft.) only a half of the area of the tube settler was used and the other half was blocked by perspex sheet.

Samplings were taken at every 20 minutes period after half an hour of operation. Each run lasted for about two hours.

Analysis of water samples was done immediately after their collection. Turbidity was measured using a Hach Chemical Company Turbidimeter Model 1860A. This turbidimeter can be used over a wide range of turbidity

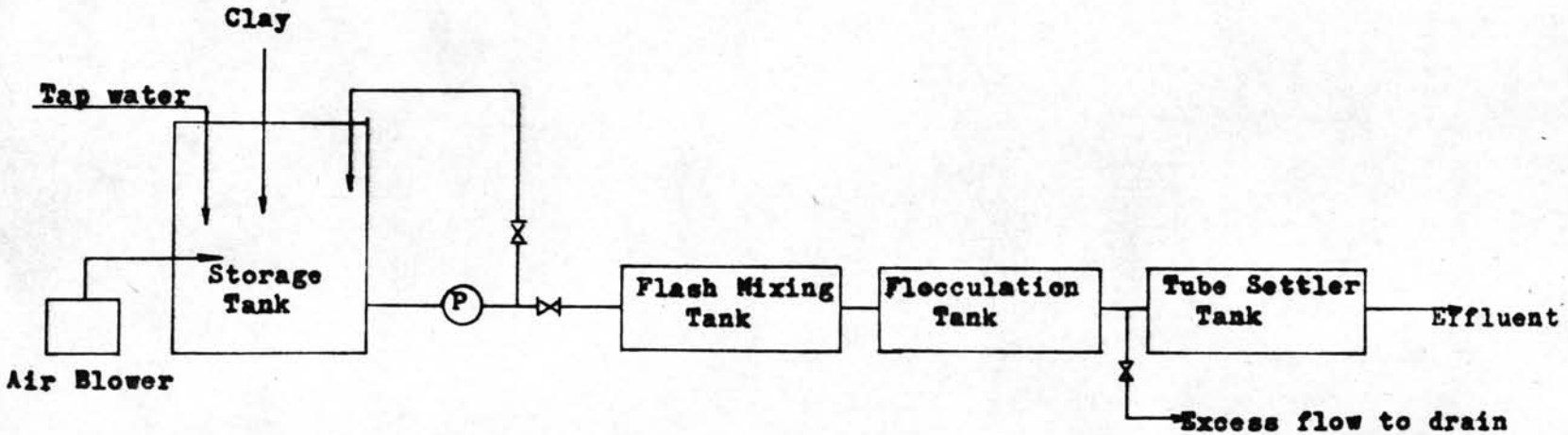

Fig 17 Flow Diagram of the Pilot Plant

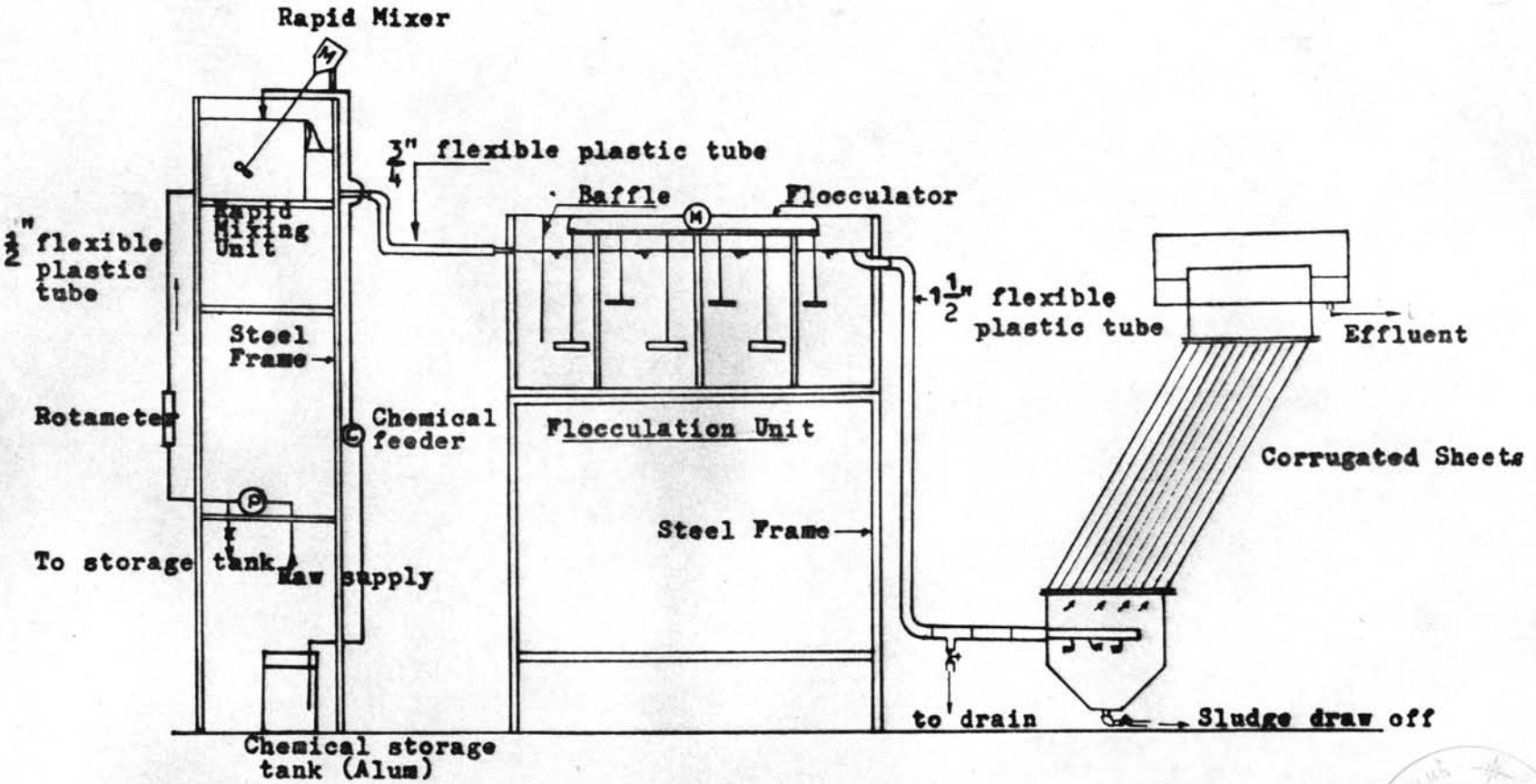

Fig 18 Layout of Pilot Plant

from 0.01 to 500 FTU. pH was measured by Beckman Zerometic pH meter.

Description of Pilot-Plant

The schematic diagram of the experimental scale plant used is shown in Fig.17 and 18, the system consists of a rapid mixing unit, a flocculation unit with mechanical mixing and a settling unit. Flow measurement for a settling unit was done by using graduate cylindrical and stop watch.

Settling Unit

The settling unit was made of 6 mm. perspex sheet. The horizontal surface area of this unit was 0.880 sq.ft., the inclined length of the tube was 3 ft. At bottom of the inclined tube a 0.5 in. wide perspex sheet was projected from the walls for support the tube module made from corrugated sheet. The inlet zone of the tube settler was connected to the flocculation chamber with a 1½ in diameter pipe. The inlet pipe was bent downwards to minimize the disturbance of the inlet faces of the tubes. All dimensions of the settling unit were shown in Fig 20.

The length of the tube modules made from galvanized steel and asbestos cement corrugated sheet, were varied for three levels of 1 ft., 2 ft. and 3 ft. General view and arrangement of corrugated sheets as tube settlers are shown in Fig 21 and 22. The sludge was removed manually by opening thesludge outlet value after the sludge had reached a certain level.

Flocculation Chamber

The flocculation tank was made of asbestos cement sheet 4 mm. thicks. The dimension was 1.20 mm. lenght, 0.40 m. in width and 0.50 m. in height.

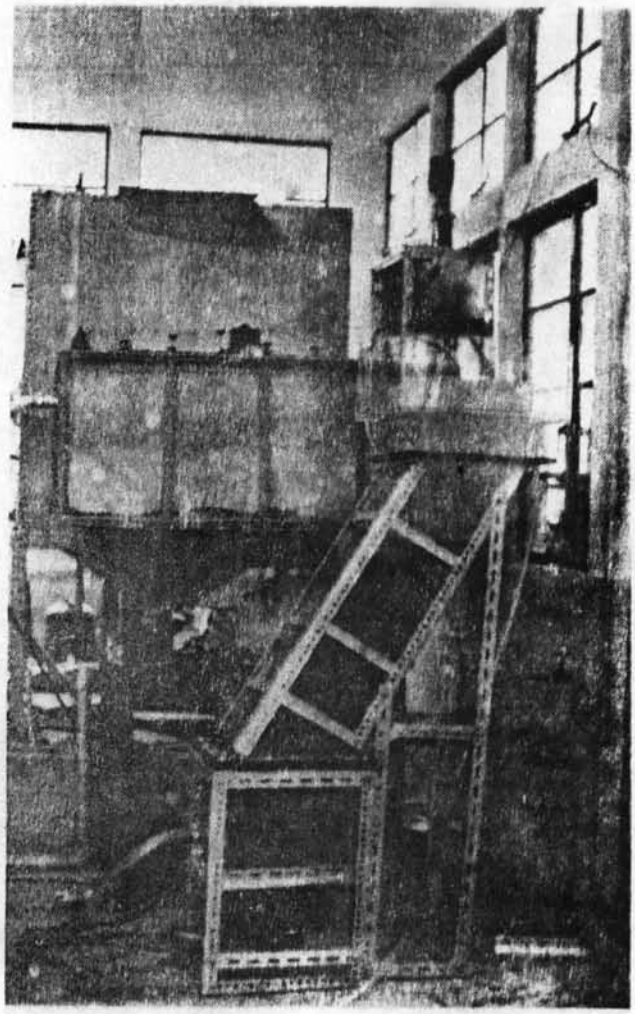

Fig. 19 General View of Pilot Plant.

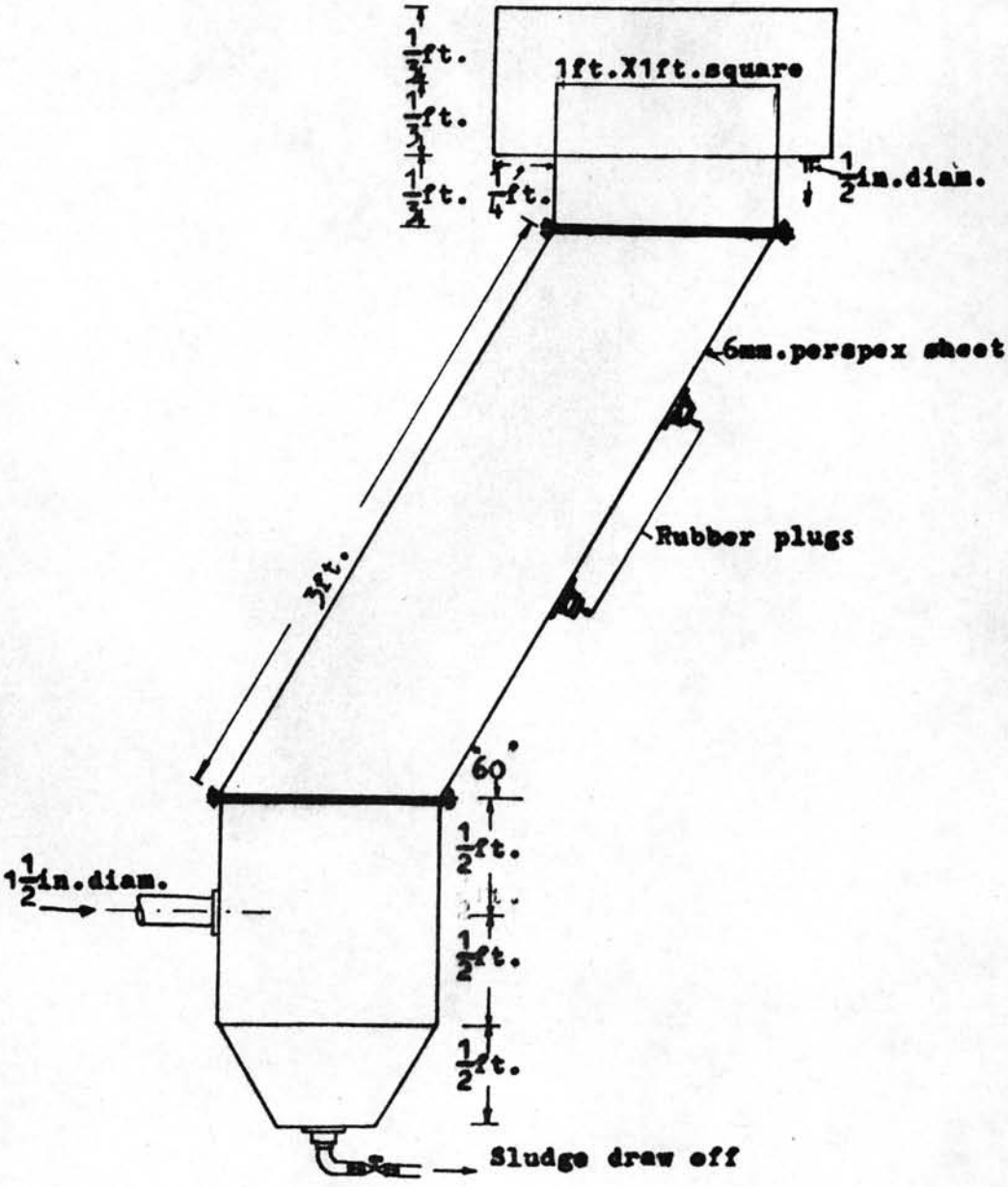

Fig 20 Diagrammatic Sketch of Settling Unit

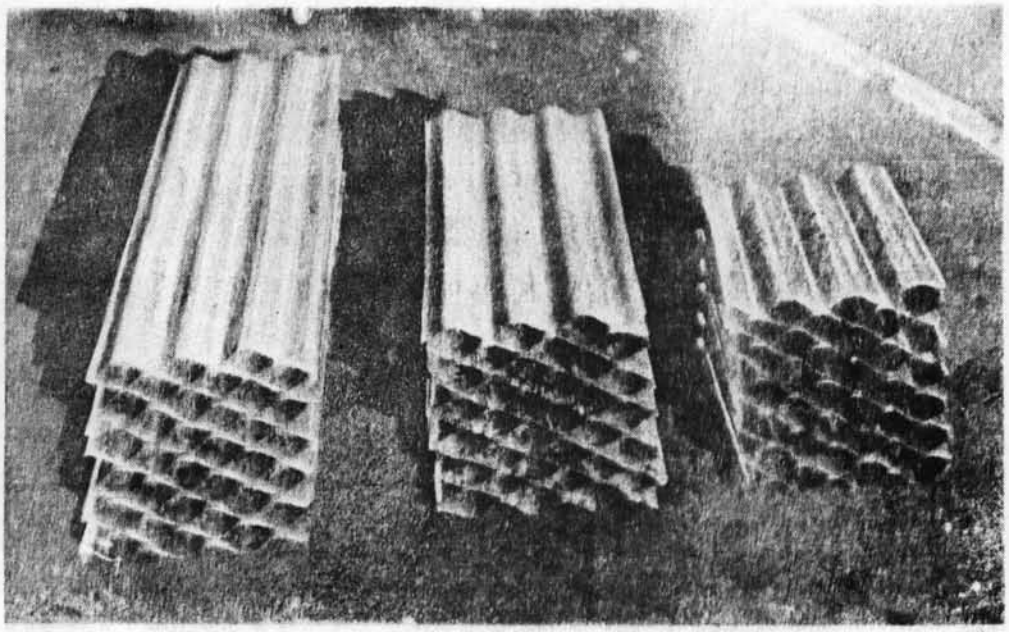

Fig. 21 General View of Tube Settler using Corrugated Sheets.

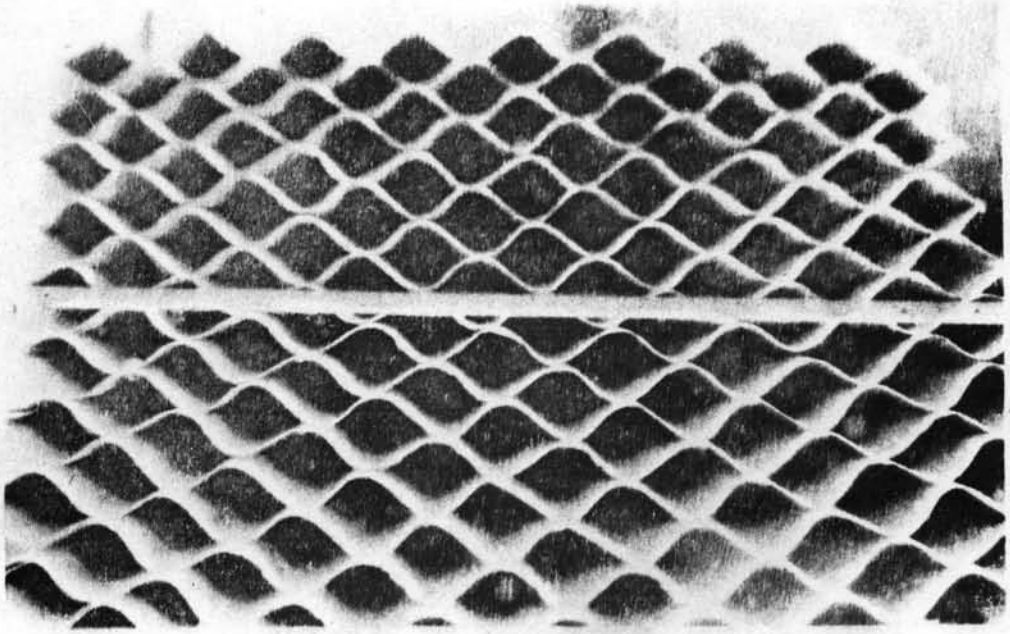

Fig. 22 Arrangement of Corrugated Sheets as Tube Settler.

Flocculating speed was about 40 rpm. The detention time in the floocula-tion, chamber was kept at 20 min.

Mixing Tank

Raw water was pumped to the rapid mixing unit. Alum solution (50 percent) was used as primary coagulant during this work and added to the rapid mixing unit by mean of chemical feeding pump (diaphramtype). Mechanical stirrer was used for flash mixing and the detention time was kept constant at 1 minute.

Experimental Design

In this study two types of tube materials were used, one was galva-nized steel coorugated sheet with amplitude of 1 cm. and 2 cm. and another was asbestos cement corrugated sheet with amplitude of 2.5 cm. These materials were used as the tube settlers for self cleansing of accumulated sludge. The independent variables to be, studied were as follow:-

1. Three levels of tube length studied were 1 ft., 2 ft. and 3 ft.

2. Tube sizes were varied according to the amplitudes of the corru-gated sheets, at the level of 1 cm. and 2 cm. for galvanized steel and 2.5 cm. for asbestos cement corrugated sheet.

3. The overflow rates were varied at 1, 2, 3, 4.5 and 6.0 gpm./sq.ft. of the tank surface area

A dependent variable which was measured to evaluate the settling performance was turbidity.