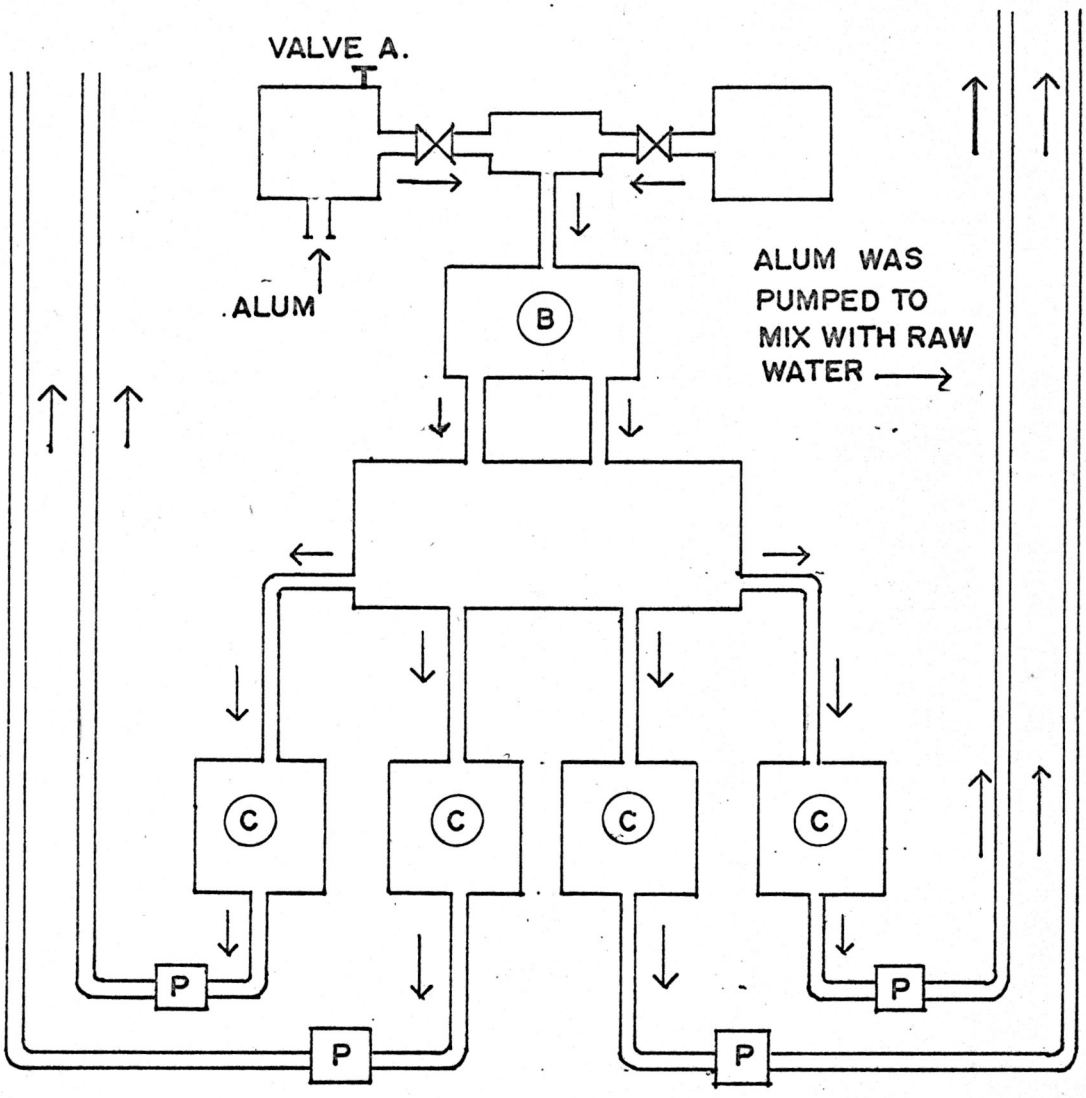
Chapter III

EXPERIMENTAL PROCEDURE

The experiments were performed with the full-scale accelator clarifier of Thonburi Water Treatment Plant. Raw water from Chaophya River was fed to the plant by means of electrical pump sets at Bangsue pumping station, 10.015 kilometers away from the plant, and also from Bangkok Noi-pumping station that receives water from Bangkok Noi canal which is a branch of Chaophya River, 0.8 km. away from the plant, through cast iron pipe 900 mm and 400 mm in diameter respectively, leading to the inlet tower. The prepared alum solution was injected to the raw water at the inlet tower by reagent pumps. Alum doses could be adjusted by control valve A of alum container as shown in Fig. 3.1, with stop watch to check the time that alum takes to fill the measure tank B in according to the dosage of alum which are determined by Jar test. From the measure tank B it was diluted with clear water, after that the diluted alum was pumped into the tower to mix with raw water. Raw water was flash mixed with alum in the inlet tower as shown in Fig. 3.2 and flow by gravity through cast iron pipe 700 mm in diameter to the four accelator clarifiers.

The accelator clarifier was 7.14 meters high and 26.20 meters in diameter with variable speed turbine on the top of the tank. The speed of the turbine could be varied from 0 to 6 rpm. Fig. 3.3 shows the flow diagram of Thonburi Water Treatment Plant. The effluent from the accelator clarifiers flow through effluent launders to the filters.



Valve A = to control alum doses.

Tank B = to measure alum doses

Tank C = to dilute alum with clear water.

P = Pump

Fig. 3.1 Alum Distributor

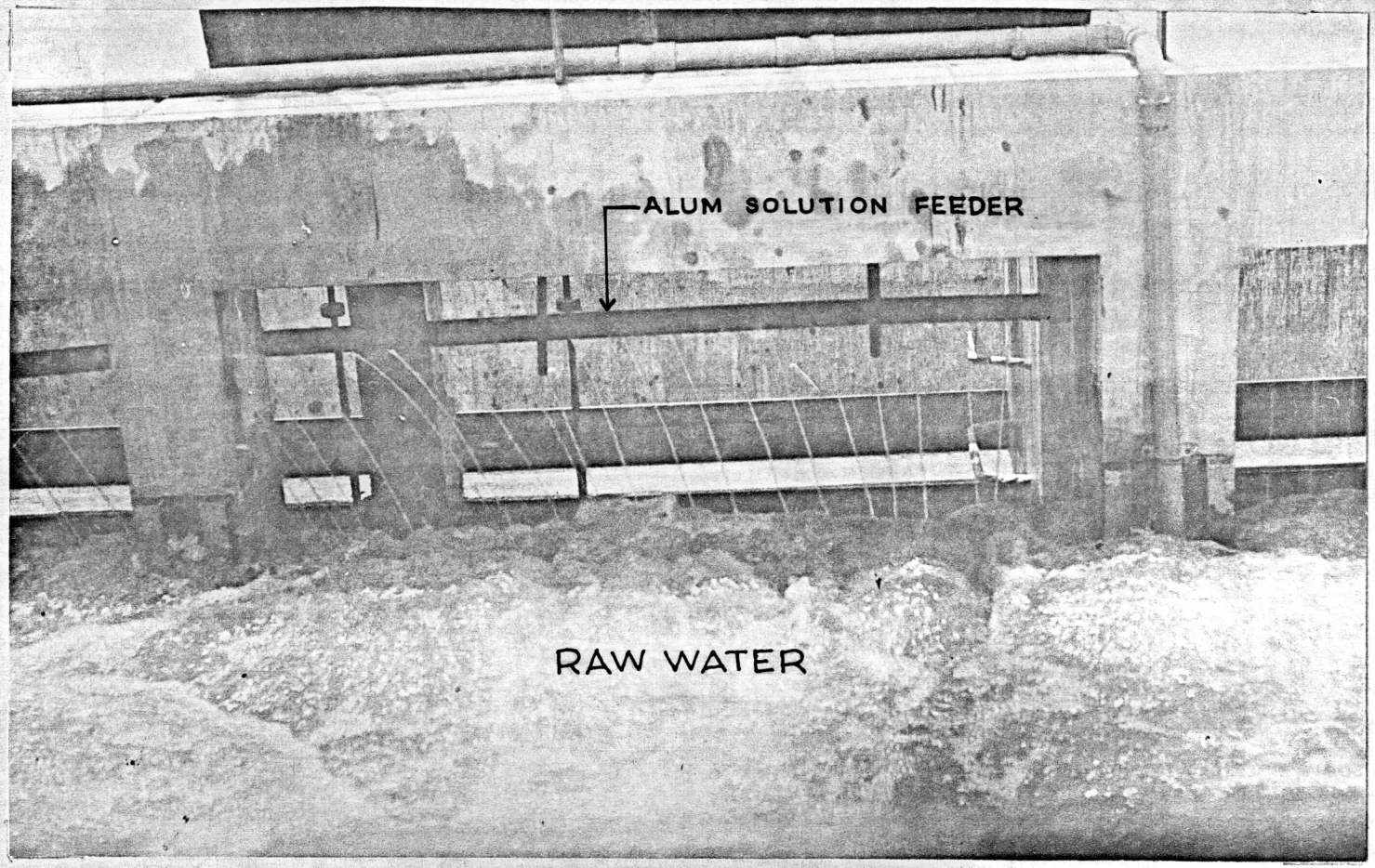
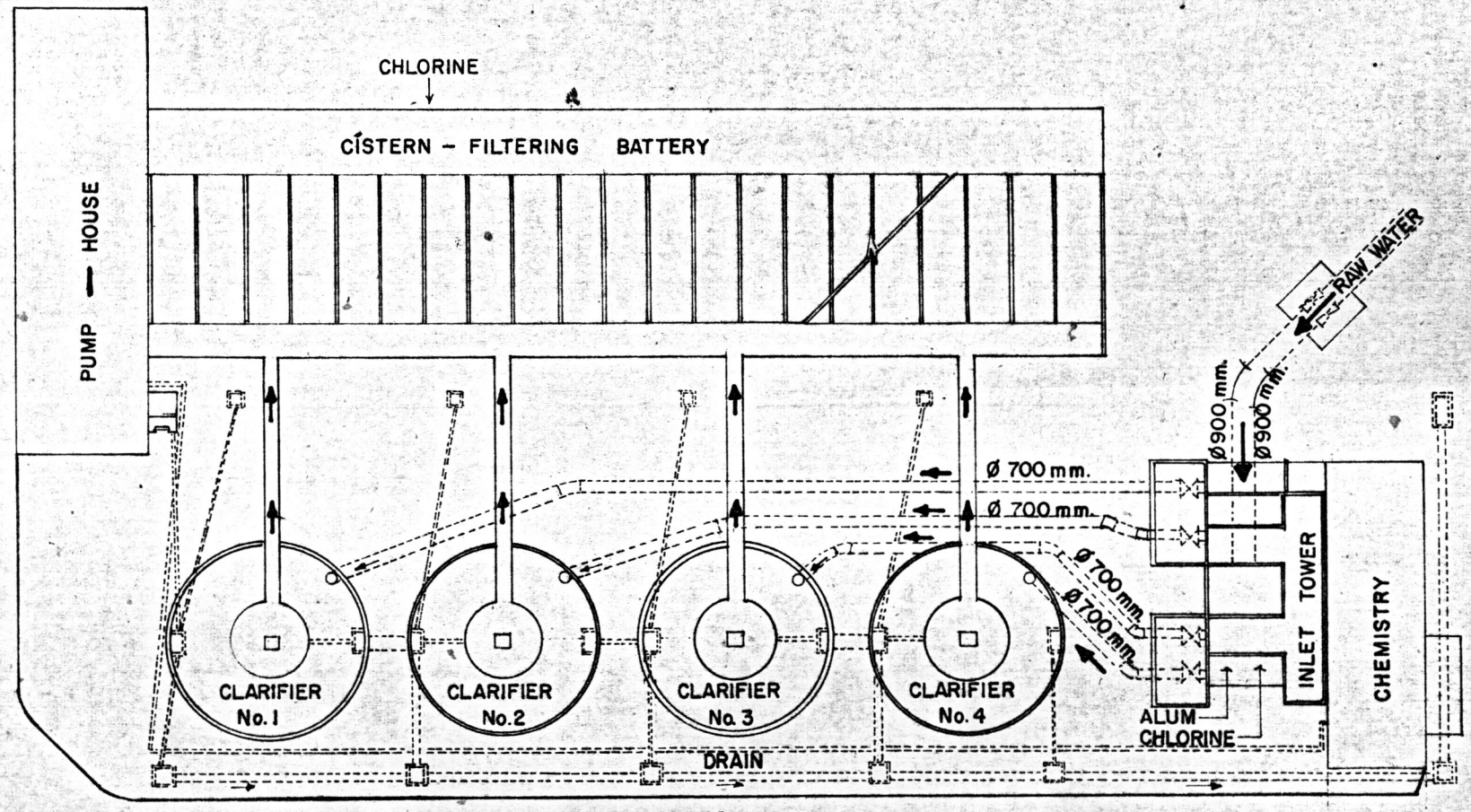


Fig. 3.2 Mixing Alum with Raw Water.

Fig. 3.3 The Flow Diagram of Thonburi Water Treatment Plant.



3.1 Starting the Accelator Clarifier

Before starting, check the injection circuit of the reagents and assure that the flow of the solutions to be distributed runs correctly. All the valves and traps of the accelator being opened, as well as the valves for sludge extraction, with the turbine in stop position, start the raw water pumps and the chemical feeder pumps and feed the accelator. Shut off the different valves of the clarifier in the same order as the raw water reaches each of these valves, naturally beginning with central drainage valve.

Start the turbine when it is submerged by about 25 centimeters of water, and adjust at the minimum speed after opening of the adjustable belt by about one-third. With the accelator filled up, shut the raw water inlet and stop the turbine and the chemical feeder pump. Open the cock valves of the hand control of sludge extraction in order to assure the well functioning of the automatic valves. Adjust the frequency of sludge extraction to obtain 15 seconds extraction every 5 minutes (See Fig. 3.4). After the above operations, shut off the automatic sludge extraction. Start the accelator and the reagent feeders entirely and adjust the discharge of raw water. Check the percentage of sludge in the central column after two hours running, the traps of the concentrators being kept open and the turbine running at the minimum speed.

For this, 1000 cubic centimeters of the water from the central column at about 30 centimeters depth was taken by means of a 1000 ml graduated cylinder.

The percentage of sludge can be determined by the height of

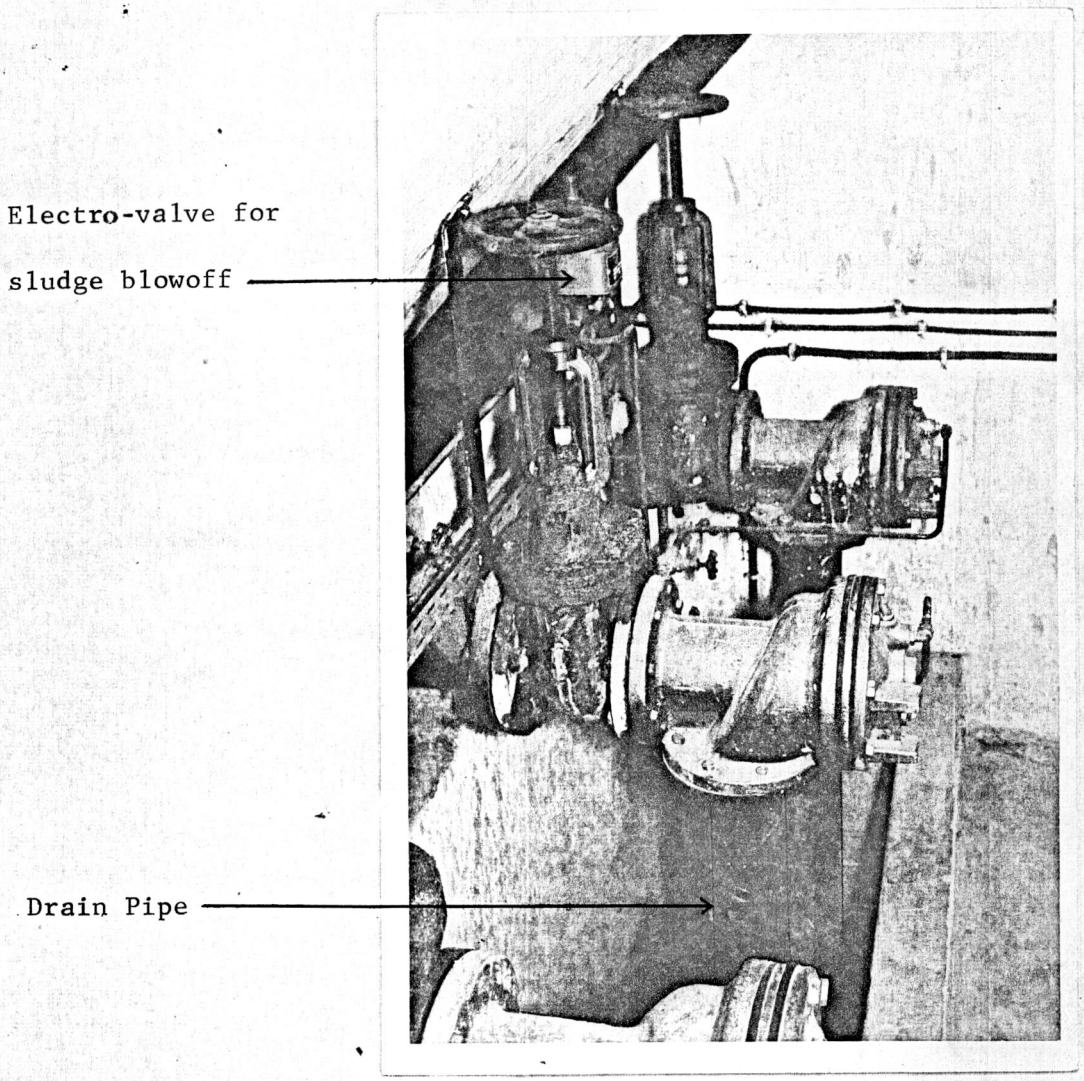


Fig. 3.4 Automatic Sludge Extraction

sludge concentrated and accumulated at the bottom of the graduated cylinder of 1000 cubic centimeters, and this after 5 minutes' time. Increase the speed of the turbine to 2 revolutions per minute for instance, and every half an hour measure the percentage of sludge contained in the central column. The value of sludge percentage should increase.

With a fixed speed of the turbine, the residual flocs after settlement in the graduated cylinder, is of important quantity. This proves that the optimum speed of the turbine has been over-passed, and that the speed has to be reduced in order to obtain a good settlement of the water sample from the central column with a minimum residual flocculation.

When the optimum speed is obtained the accelator running for a time, in order to stabilize the functioning.

Then the accelator in order to assure the good functioning, by checking the location of the sludge bed in the settlement zone.

The above checking can be done by means of a ballasted bottle of 1000 cubic centimeters capacity of which the neck will be blocked by means of a cork which can be removed when the bottle plunges to a definite depth in the accelator.

Immerge the bottle into the accelator at various definite depths, and each time measure the content of sludge in the various water samples.

If the sludge bed level is too high, slightly reduce the opening of the adjustable belt of the turbine and in the reverse case increase that opening.

Once the sludge level is stabilised, immerse the ballasted bottle

more and more deeply in order to check that there is no spot in the accelator with the sludge accumulation.

Due to the large capacity of the clarifier, it has to wait 2 to 3 hours at maximum discharge before repeating the above measurements after each adjustment.

Take each time the pH value of the clarified water obtained by settlement of water samples from the central column. This pH value should be equal to the one obtained for the clarified water sample during the flocculation tests in the laboratory.

All the above various operations being effected, start the sludge concentration in the following way:

Shut off the trap of one sludge concentrator.

Adjust the corresponding automatic sludge extraction to an opening time of 15 seconds every 10 minutes.

If the sludge content in the central column increases, start with a second sludge concentrator, etc., in order to obtain the sludge content in the central column equal to the sludge content previously found for the definition of the optimum revolution speed of the turbine.

If the sludge content decreases while using only one sludge concentrator, increase the intervals between the extractions.

In the case that, during the operation, **the** mud rises, correct in the following way according to the behaviour of the sludge increase:

a. The raising of sludge is uniform on the whole surface of the clarifier:

Check the dosage of the reagents and the raw water discharge.

Check the pH value of the clarified water obtained by settlement of the water sample taken from the central column. This pH value should be equal to the one obtained from the clarified water during the flocculation tests.

Make a flocculation test, in order to determine the revised dosage of the reagents in the case that the nature of raw water has changed.

b. If the sludge raising appears only at certain spots in form of clouds which raise and come to dispersion at the watersurface, take a watersample from the clarifier, at this spot and measure the pH value after settlement. To remedy this, increase the revolution speed of the turbine.

If the stopping of the installation is of a shorter time, it is preferable to keep the turbine running.

If the stopping time is prolonged, we can stop the turbine, In this case, at the time of re-starting, it is preferable to run the turbine half an hour before allowing the raw water to discharge into the clarifier, in order to avoid sludge raising. During that time, open the traps of the mud accumulators.

The traps of the sludge concentrator should be kept open when the drainage is not functioning.

3.2 Sludge Blowoff Rate

The sludge blowoff rate depends upon the rate of floc formation. It must be removed at the same rate as it is formed in order to maintain the required depth of sludge blanket. Because of the many variables involved in the rate of floc formation, so the effect of sludge blowoff rate were not studied.