Chapter III

Materials and Methods

As an experimental aeration medel, the pilot oxidation ditch located near the Department of Sanitary Engineering, Chulalongkorn University was used in this study.

Figure I shows its dimensions of approximately 4.00 $m.^2$ surface area and 0.60 m. depth.

According to the operational method shown in Figure 5, an "ELEPON" Sumersible Dewatering Pump Model A 250 produced by Elepon Corporation Osaka, Japan was set up at the bottom of the ditch as located in the said figure.

The discharge pipe of 1 5/8 inches inside diameter was used. To the discharge effluence or exit, a 90 degree bend was connected, in order to change the down direction of flow to more or less horizontal plane for the purpose of obtaining circulation of water in the ditch and good distribution of air bubbles.

Actually in all sets of experiment, the discharge varies a little bit due to changes in the voltage of power supply, the elevation head of the located diffuser and its characteristics.

Three types of diffuser were investigated. The diffuser type I is classified as the ordinary perforated-pipe diffuser and five pieces were established with different diameters and different number of holes drilled. Details of these five pieces named Duffuser No. 1, 2, 3, 4 and 5 are shown in Figure 2.

The diffuser type II or the Pitot type differs from the type one by the addition of Pitot tubes installed as shown in Figure 3. Two pieces were made and called Diffuser No. 6 and 7.

Diffuser No. 8 and 9 of the type III or the Venturi type are shown in Figure 4.

A "FUJI" Watt-Hour Meter produced by Fuji Electric Company, Japan was used for the measurement of power consumption. It is so constructed that for the power supply of one kilowatt-hour, the wheel inside will rotate 2000 revolutions. So the power in watt is determined by:

$$W \text{ (watts)} = 1800 \times \text{revolutions/sec.}$$

A "DELTA" Scientific Oxygen Meter Model 75 produced by Delta Scientific Corporation, Lindenhurst, New York 11757 was applied to the determination of dissolved oxygen.

Tap water was used as an absorbing substance in this type of determining aeration equipment performance under the non-steady state aeration of a deoxygenated water as suggested by Eckenfelder and Ford (1968).

Typical procedure of each experiment is as following:-

1. Set up all equipments according to the required conditions under the method of operation shown in Figure 5.

2. Deoxygenate the water by adding sodium sulphite of about 7.88 mg/l per 1 mg/l of dissolved oxygen and only 0.10 mg/l of cobolt chloride as suggested by Jones, Day & Converse (1969).

3. Close all holes of the diffuser by using a piece of tape, then thoroughly mix the ditch contents by operating the pump until the dissolved oxygen remains at zero.

4. Start aerating by removal of the used tape.

5. Record the temperature and power consumption.

6. Determine dessolved oxygen of water at appropriate time intervals. Take at least five values before 90% saturated is reached. (Eckenfelder, 1966).

Perior to the determination of dissolved oxygen by using a "Delta" oxygen meter in each set of experiment, the meter probe is immersed in water at about 5 cm. under water surface. Care must be taken in making sure that, before each reading:-

1. The probe is absolutely clean and sensitive.
2. The temperature indicated on oxygen meter dail guage is adjusted to that of the determined water.
3. The probe is continuously shaken at least 1 minute before any reading is taken.

Variation in the amount of air supply is obtained by the change in elevation head of diffuser location.

A bubble formation for this aeration system is shown in Figure A.

The discharge efficiency of the used pump is shown in Figure B.

The values of C_s shown in Appendix A were taken from new values of oxygen saturation recommended by the American Society of Civil Engineering (Eckenfelder, 1966).

Fig. 1 AERATION MODEL

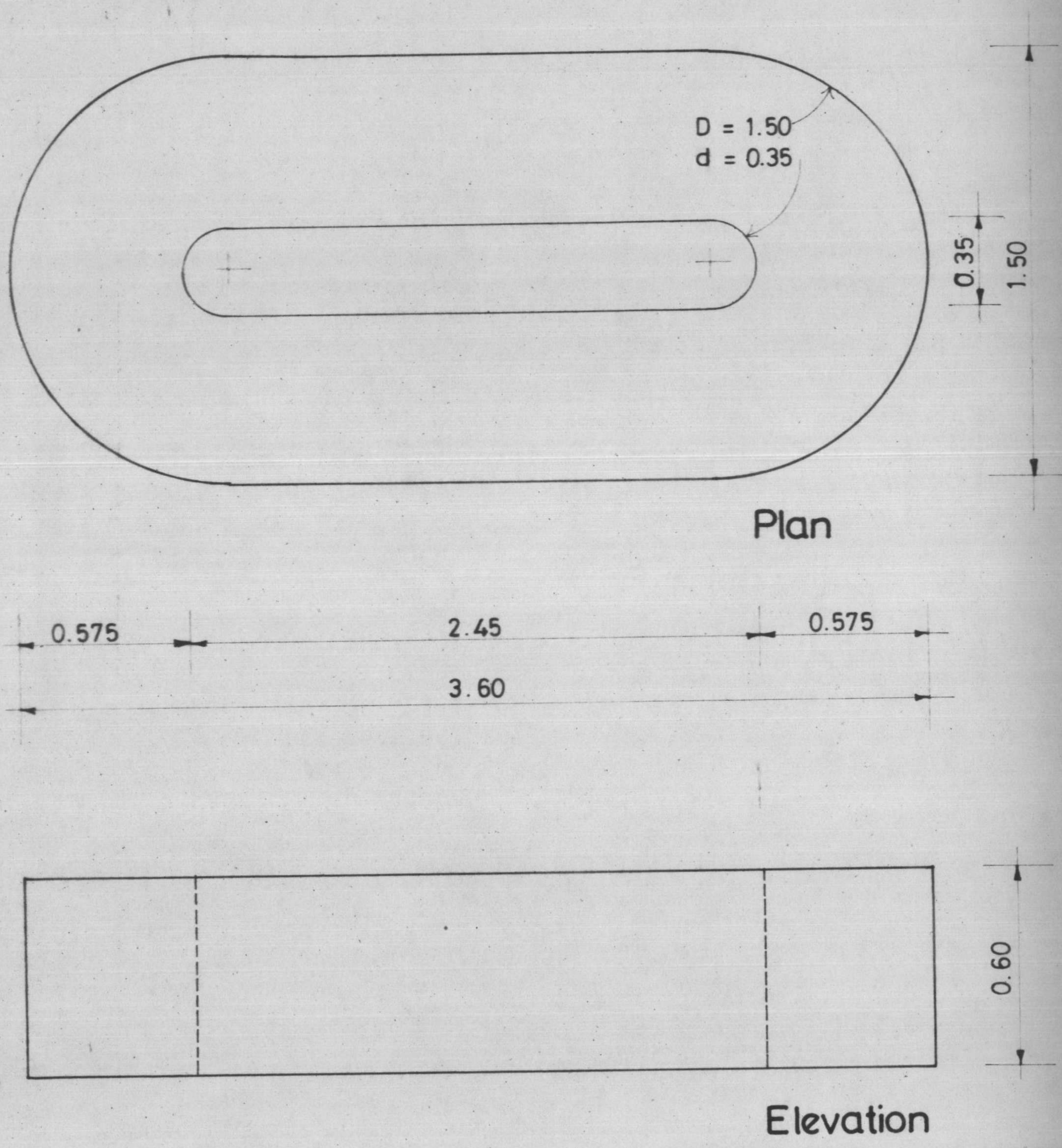
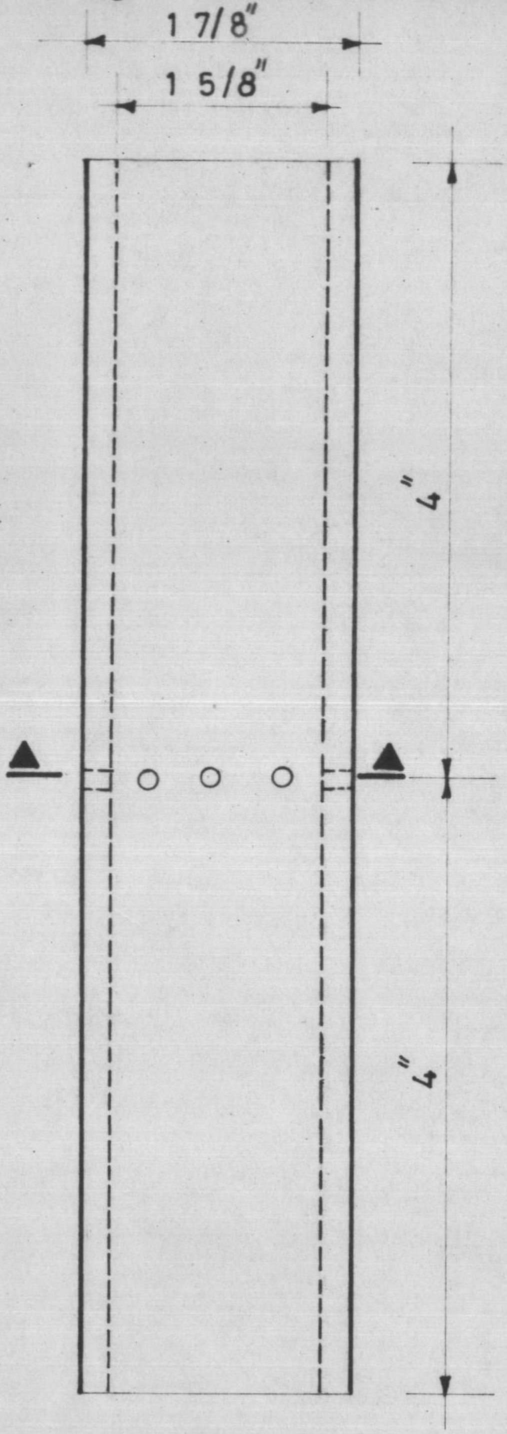
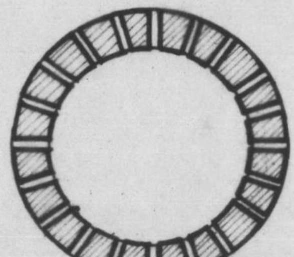
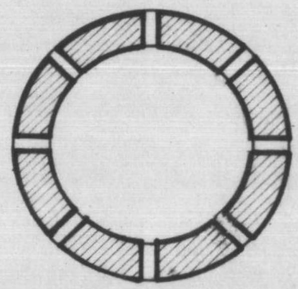


Fig. 2 DETAILS OF DIFFUSERS TYPE I

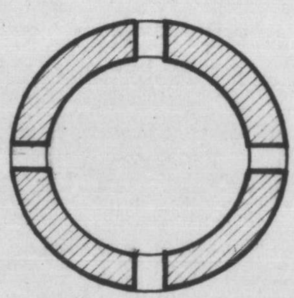




Diffuser No. 1 - 20 holes each 5/64" Ø
Diffuser No. 2 - 20 holes each 5/64" Ø



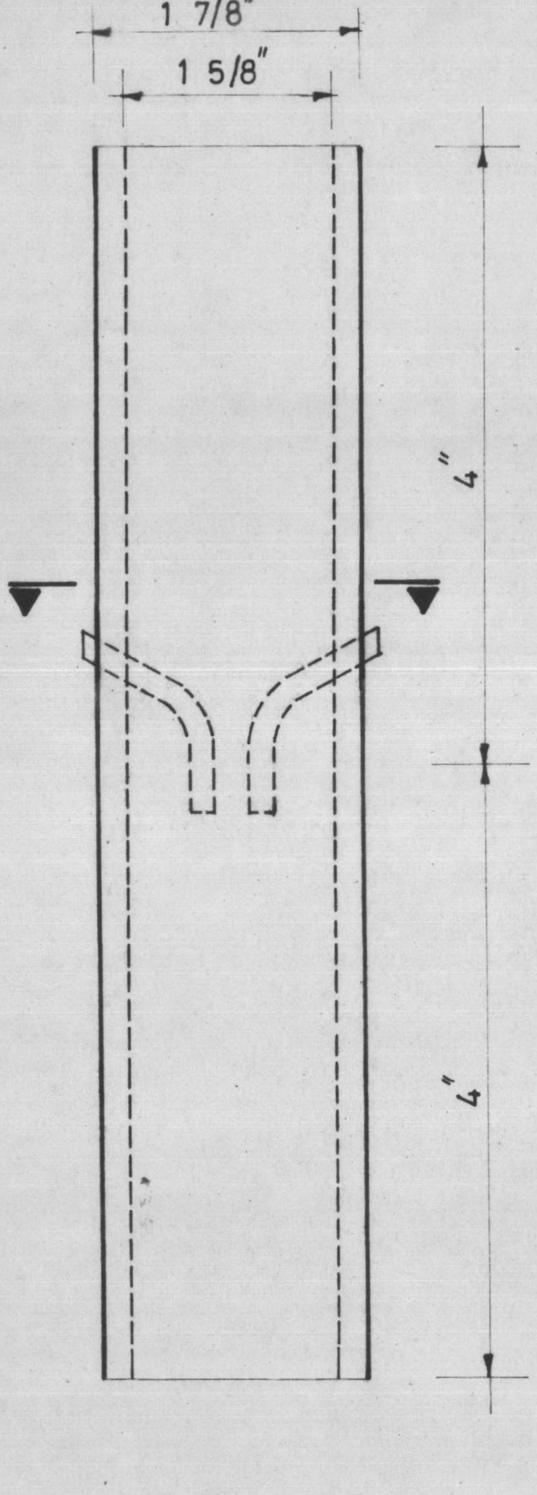
Diffuser No.-3 - 8 holes each 1/8" Ø
Diffuser No.-4 - 8 holes each 1/8" Ø

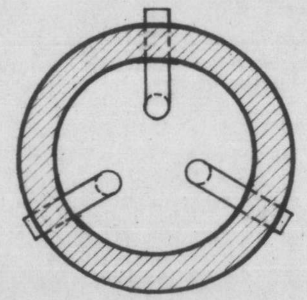


Diffuser No. -5 - 4 holes each 1/4" Ø

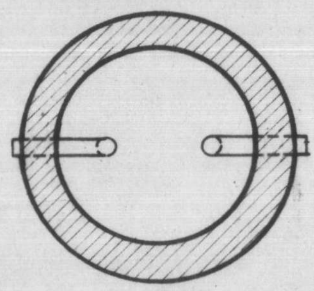
Note : Only diffusers No.1 and No.3 , the holes were drilled at 45° to the center line of flow.

Fig. 3 DETAILS OF DIFFUSERS TYPE II



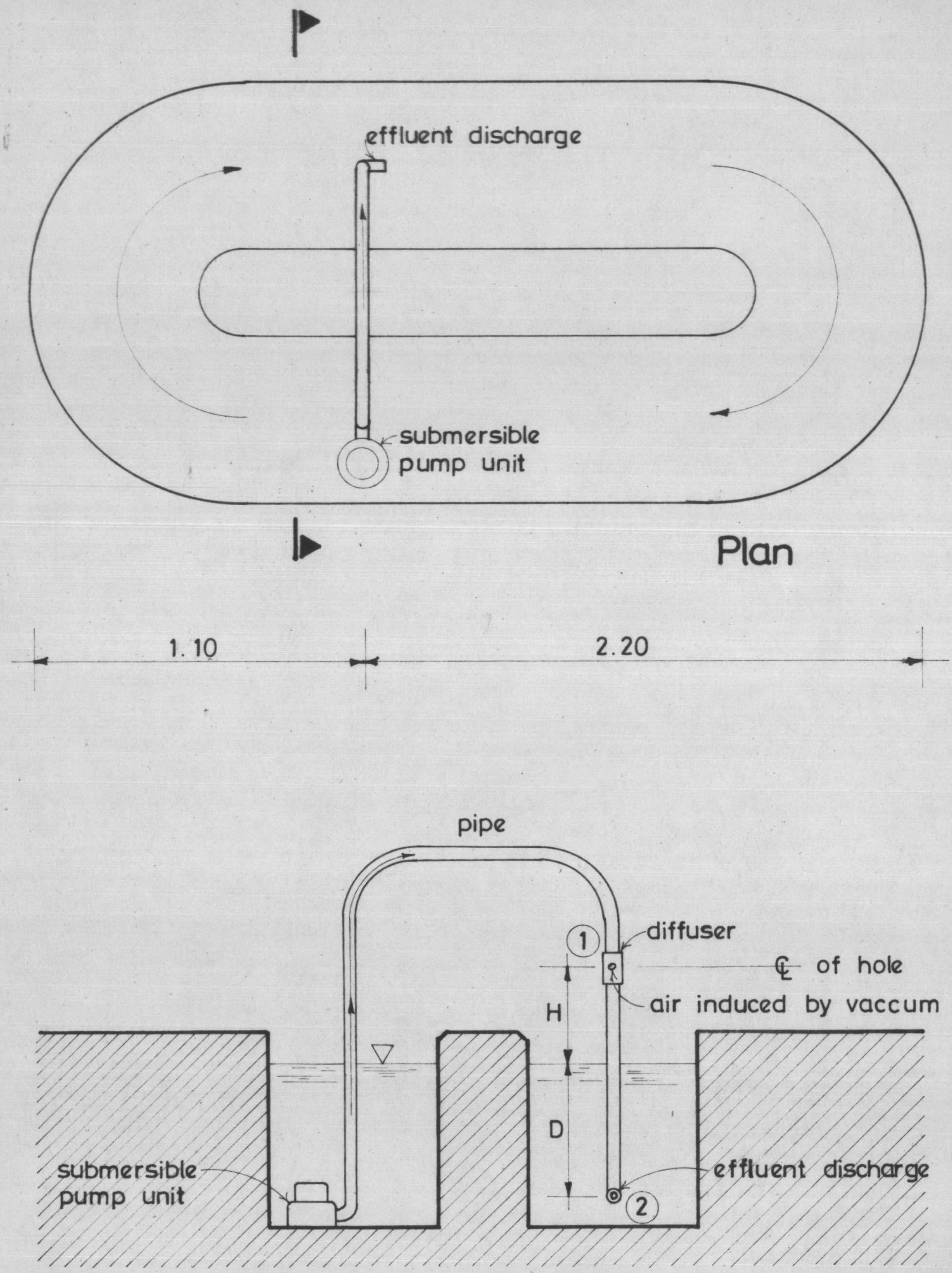


Diffuser No. 6 consist of 3 pilot tubes each 1/8" Ø



Diffuser No. 7 consist of 2 pilot tubes each 7/32" Ø

Fig. 5 METHOD OF OPERATION



H denoted elevation head of the diffuser.

D denoted immersion depth of effluent discharge.

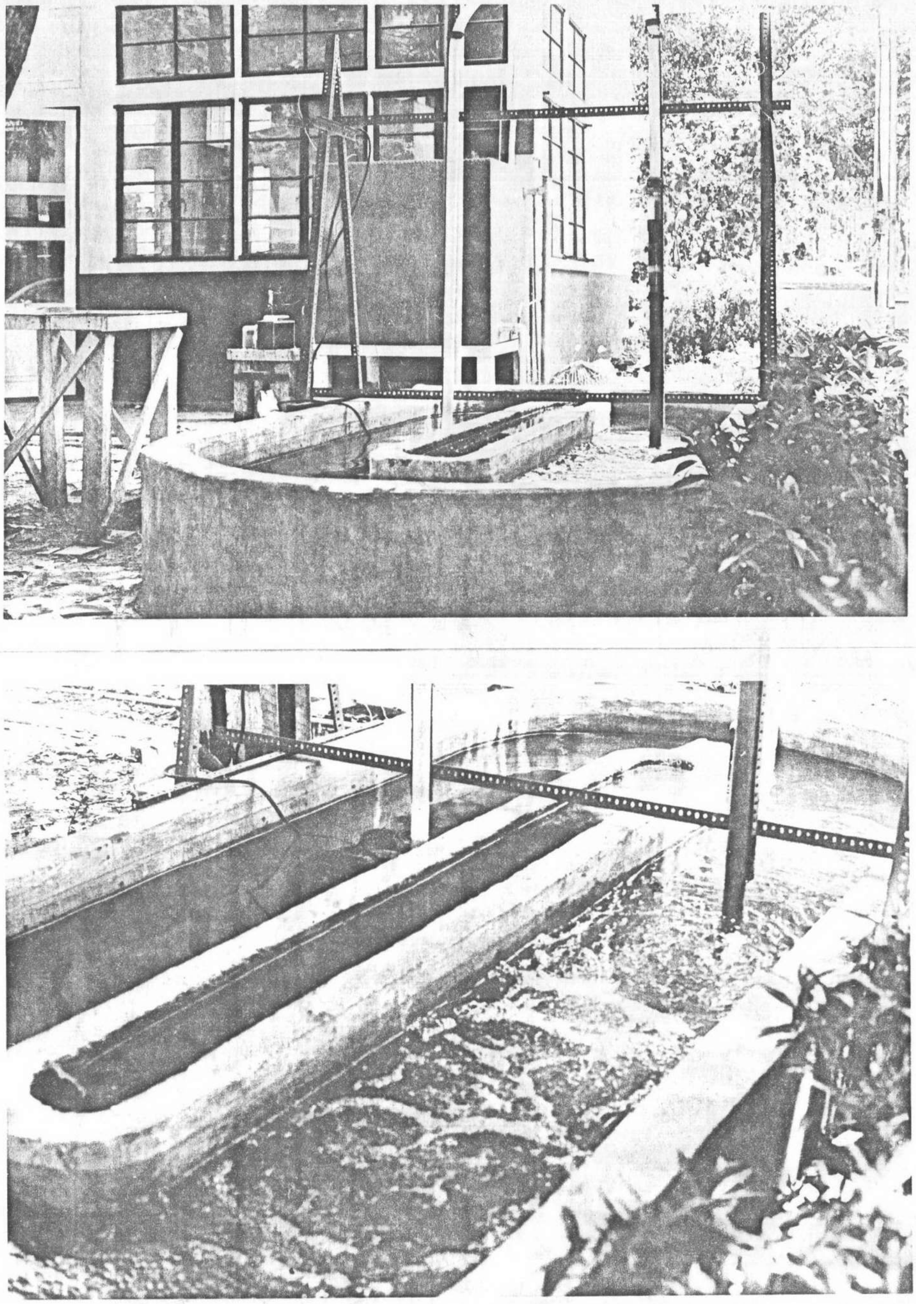


Figure A A bubble formation by Diffuser No. 9

Fig. B PUMP CHARACTERISTIC