



## CHAPTER IV

### EXPERIMENTAL EQUIPMENT

The equipment used for this research work is shown in Figure 4.1. It consists of two electric timers, four solenoid valves, an extraction column, two feed tanks and two feed pumps, and a collected tank for extracted phase. The details of each part of the equipment are as follows.

#### 4.1 The Extraction Column

The extraction column was 1.8 inches in diameter 39 inches high consisted of the following parts

##### 1. Sieve plates

The experimental was run by using extraction column composed of 5 sieve plates 6 inches apart. There are 55 holes, which diameter of  $\frac{3}{32}$  inch.

##### 2. Inlet and Outlet Sections

The inlet and outlet sections consist of water and methyl isobutyl ketone entering and water, methyl isobutyl ketone leaving.

#### 4.2 Electric Timers and Control Valves

Two electric times were used to control the cyclic operation of four solenoid valves. They are shown schematically in Figure 4.2.

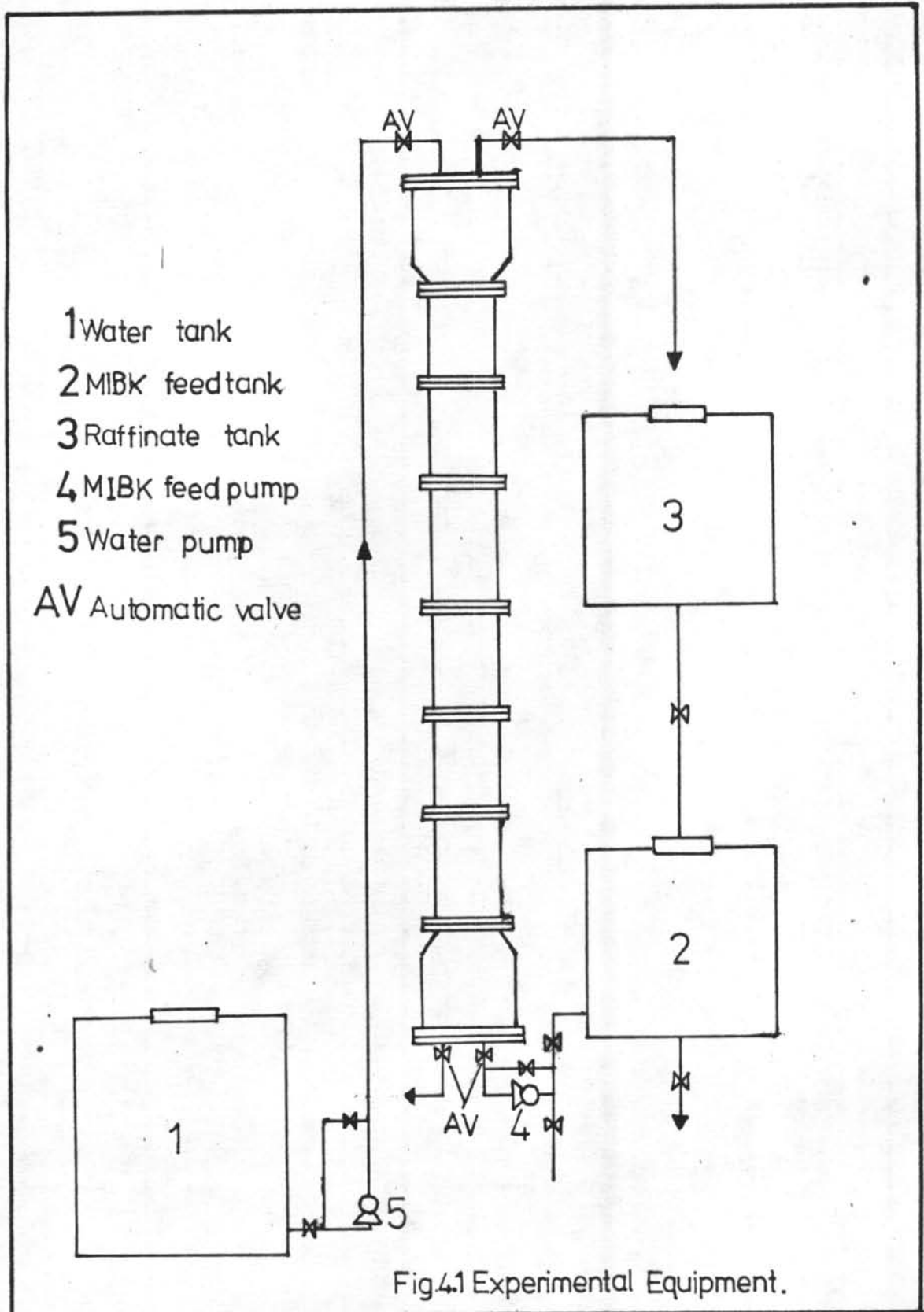


Fig.4.1 Experimental Equipment.

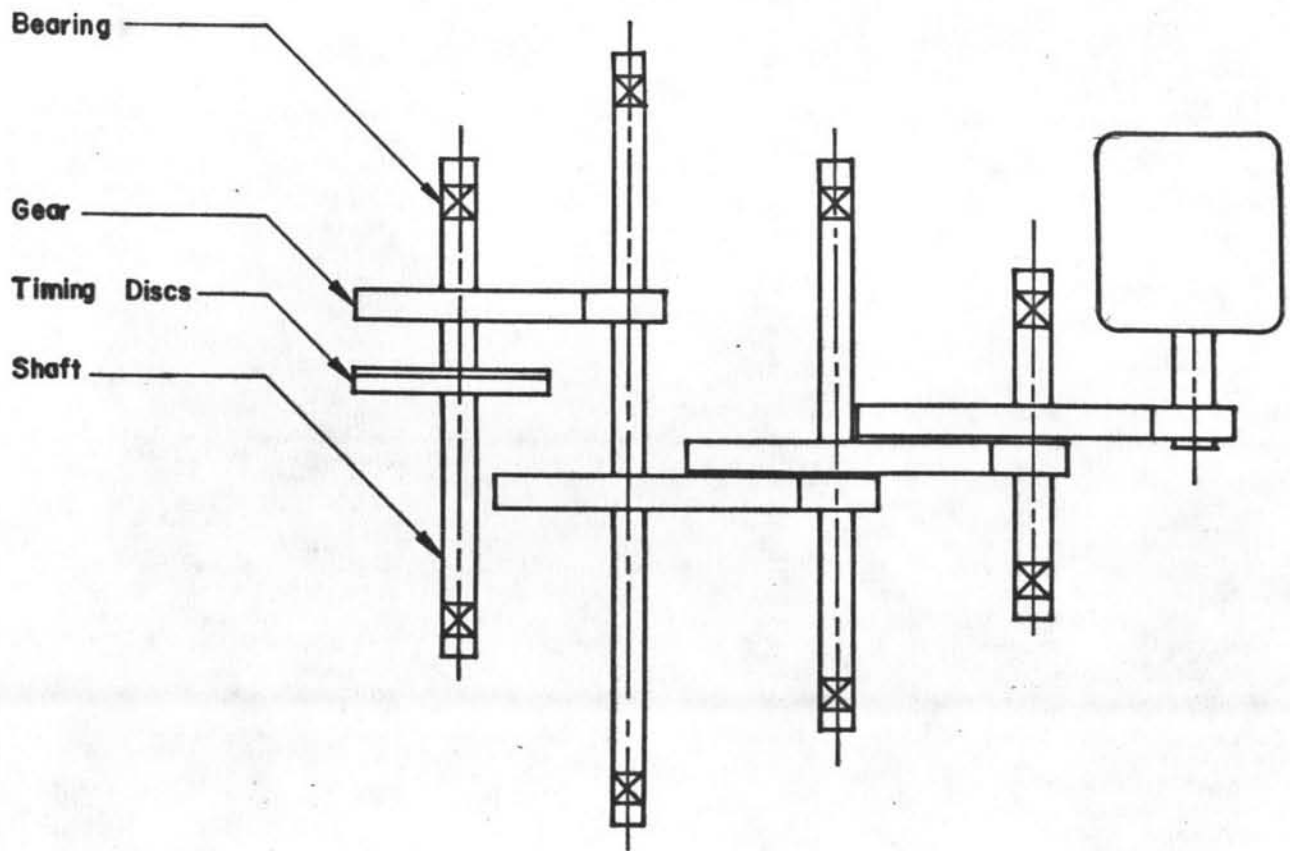


Fig 4.2 The electric timer

#### 4.3 Parts of the Electric Timers

1. A synchronous motor with an attached unit of reducing gears. The gears reduced the shaft speed of the motor from 1400 rpm to order of 5-10 rpm.

2. Two sets of timing discs, each having two disc, as shown in Figure 4.3. The diameter of one half of each disc was  $3\frac{1}{2}$  inches and of the other half was  $3\frac{1}{4}$  inches. Each pair of discs was fixed tightly together by a nut on the output shaft.

3. Two microswitch. Each consisted of a switch box, an attached contact arm with a rolling ball at its free end, and a switch button. The switch was fixed in a position, as shown in Figure 4.4, so that the rolling ball touched the part of  $3\frac{1}{2}$  inch. diameter, the circuit was closed, and as the rolling ball touched the part of  $3\frac{1}{4}$  inch. diameter, the circuit was open.

#### 4.4 Methods of Changing the Cycle Time and the Fraction Open

The cycle time could be varied by changing the gear ratios of the four gears used in the timer. In order to change the gears, the movable base of the device had to be adjusted, then fixed by nuts.

The fraction open could be changed by varying the relative position of the two parts of the discs as shown in Figure 4.4. In order to do this, the disc nut was merely loosened and any part of the discs was moved. After that, the disc nut had to be tightened again.

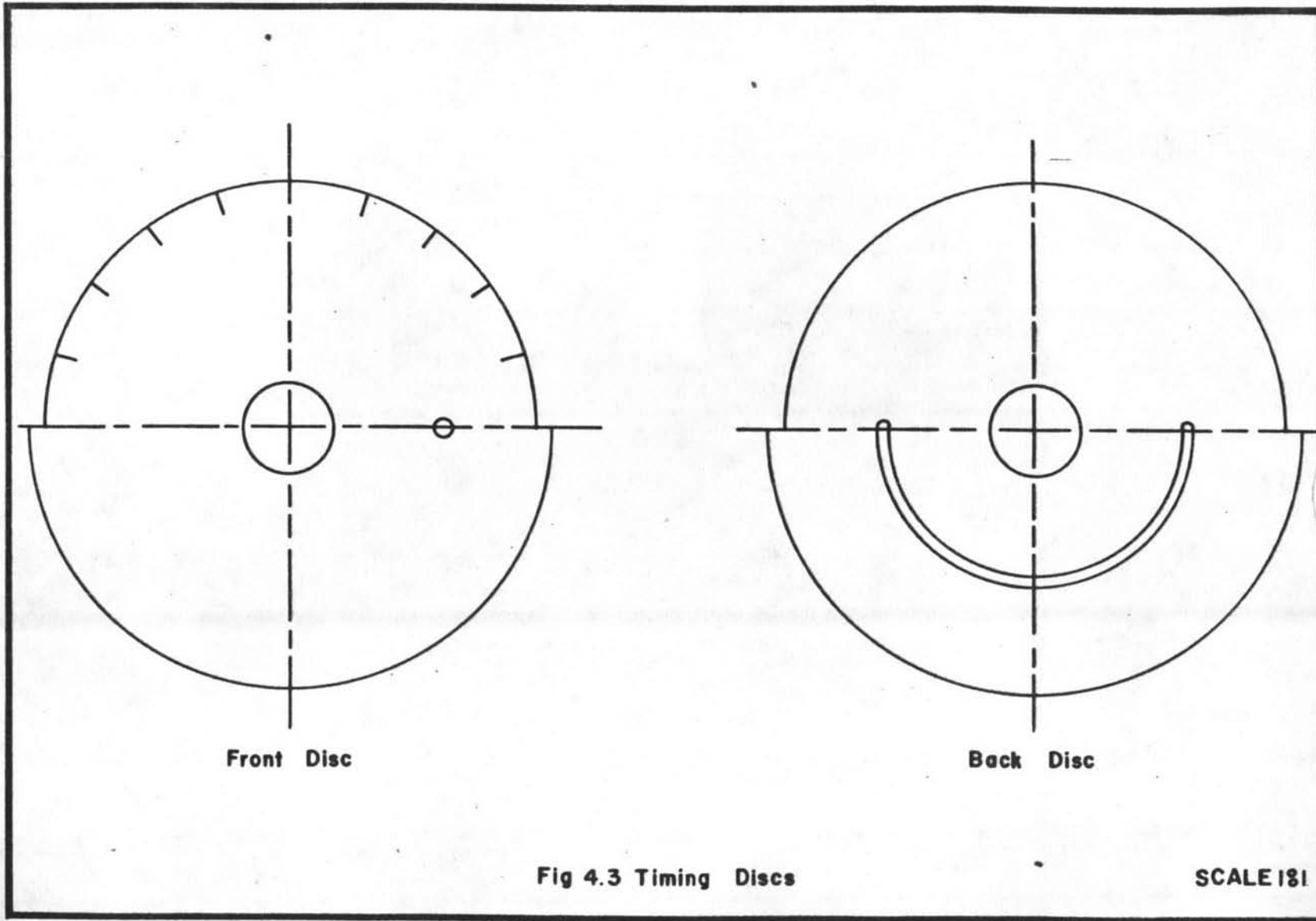


Fig 4.3 Timing Discs

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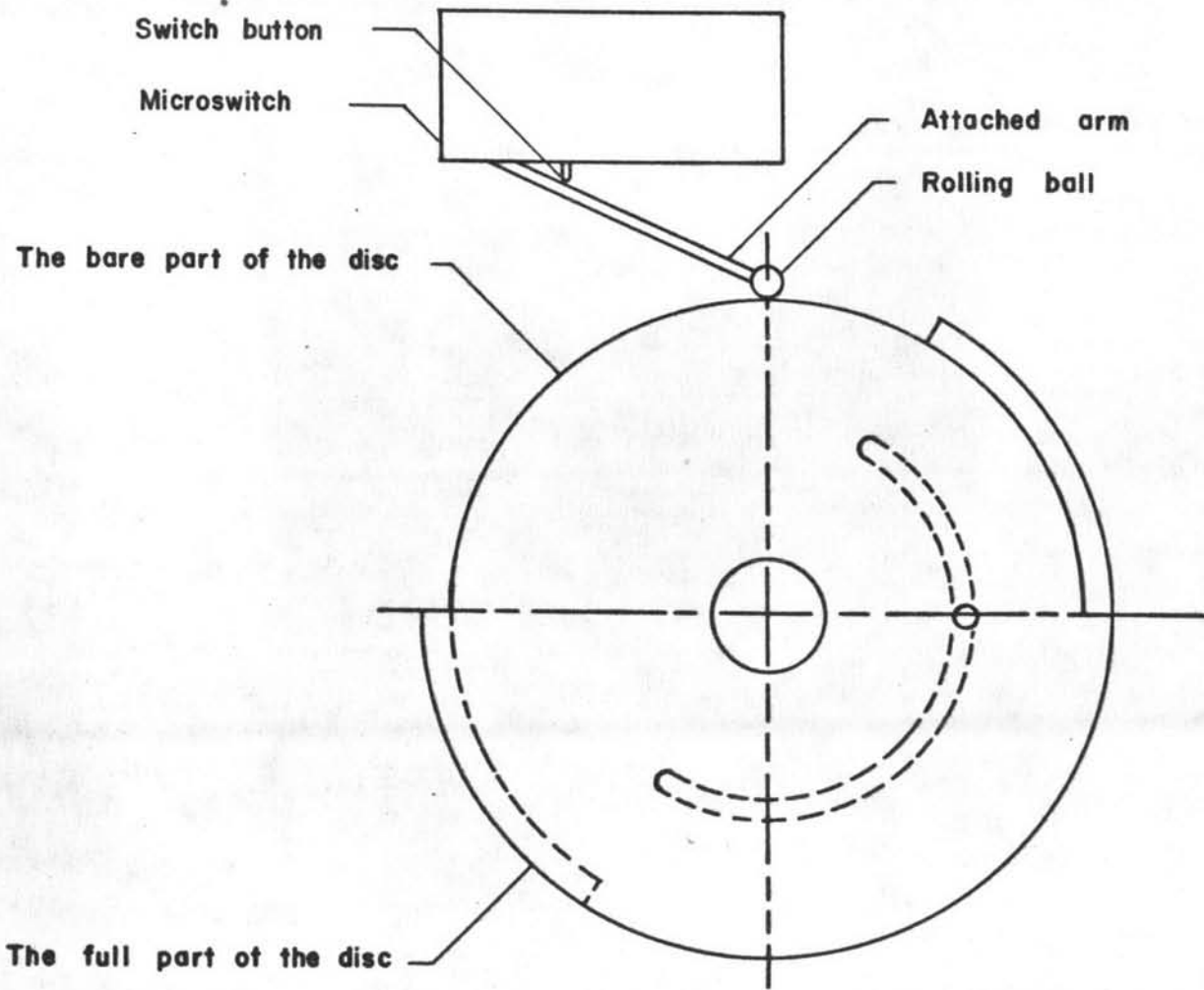


Fig 4.4 The Position of the Microswitch

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#### 4.5 Control Valves

Four solenoid valves, two were controlled by one of the two electric timers by being connected into the circuit of the corresponding microswitch, were installed on the entering and leaving lines of fluid flowing through the column. They were  $\frac{1}{2}$  inch valves using 220 volts alternating current. When the circuit was closed the valves were fully opened, and they were completely closed when the circuit was opened.

#### 4.6 Feed Tanks and Feed Pumps

Two square 24x24 inches and 20 inches high tanks were constructed from stainless steel sheet of 0.2 cm. thick, and they were used for feed tanks of M.I.B.K and water.

Two feed pumps were used. Both pumps had  $\frac{1}{2}$  H.P.