
CHAPTER 3

DEVELOPMENT OF EQUIPMENTS FOR RESEARCH

3.1 Development of Automatic Feeding and Lighting System

Intermittent lighting was applied to control the intermittent feeding (Buyse *et al.*, 1996) whereas, intermittent lighting was controlled by using the timer with light source. However, this practice was only possible in environment-controlled houses. Intermittent feeding under cold climatic condition was practiced to improve the efficiency of feed utilization, reduce mortality percentage due to ascites and prevent leg abnormalities. Whereas intermittent feeding in hot climate was expected to decrease body temperature and increase the efficiency of feed utilization along with lowering down the mortality caused by heat stress.

However, in the hot and humid areas, poultry birds were raised in conventional (open sided) poultry houses. In such houses controlling the feeding regimes under the effect of lighting was not possible. Under these circumstances mechanical feed lifting system was developed and applied for feed withdrawal as well as intermittent feeding regimes.

An iron stand was fabricated to which feeders were attached with a string. The feeders were hanged over the preinstalled pulleys at equal distances. One end of the main string was attached to a tension weight and the other end was attached with a lever (Fig. 3.1). An actuator (Fig 3.2) was installed with the lever in order to drive the feeders upwards and downwards. The limits of lifting up and down the feeders were fixed by fixing the upper (extended) and lower (retracting) limits of actuator.

Upper limit of the actuator was fixed by rotating the cam (present inside the control box of actuator) in clockwise direction (Fig. 3.2) until a “click” sound from the limit switch was heard. Whereas lower limit was fixed by using electric supply unit to retract the inner tube of actuator until motor stopped automatically.

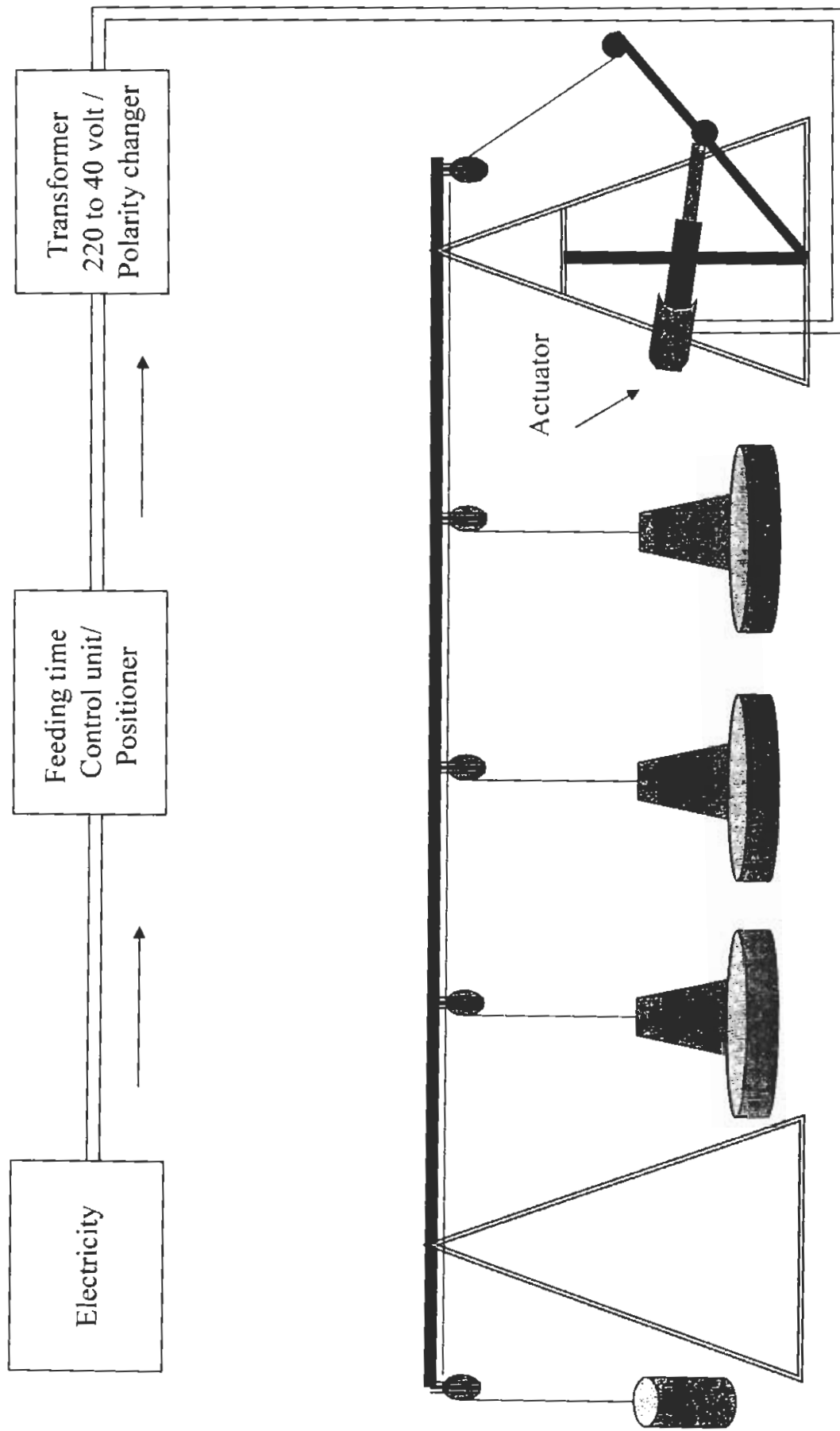


Fig. 3.1: Automatic feeding system for intermittent feeding

PARTS LIST FOR REGULAR ACTUATOR

ITEM	DESCRIPTION	USAGE	ITEM	DESCRIPTION	USAGE
1.	OUTER TUBE	1	23.	2mm GEAR SHAFT	2
2.	INNER TUBE	1	24.	GEAR B1	1
3.	SWIVEL HEAD	1	25.	GEAR B2	3
4.	X RING	1	26.	GEAR C1	1
5.	UPPER SEAL	1	27.	GASKET	1
6.	ACME SCREW	1	28.	CENTER HOUSING	1
7.	ACME NUT	1	29.	SCREW (FOR CENTER HOUSING)	4
8.	BALL BEARING	1	30.	LOWER CAM	1
9.	NUT/WASHER	1	31.	UPPER CAM	1
10.	NUT	2	32.	CAM SCREW	3
11.	H BLOCK	1	33.	TERMINAL STRIP	1
12.	LOWER SEAL	1	34.	LIMIT SWITCH	2
13.	BOLT	1	35.	DIODE	2
14.	MOTOR	1	36.	SCREW (FOR LIMIT SWITCH)	2
15.	UPPER HOUSING	1	37.	REED SENSOR	1
16.	UPPER BUSHING	1	38.	MAGNET	1
17.	OUTPUT GEAR	1	39.	WASHER	1
18.	INSERT	1	40.	SCREW (FOR MAGNET)	1
19.	1ST GEAR	1	41.	COVER	1
20.	2ND GEAR	1	42.	SCREW (FOR COVER)	1
21.	4mm GEAR SHAFT	2	43.	GROMMET	1
22.	CENTER BUSHING	1	44.	BRACKET	1

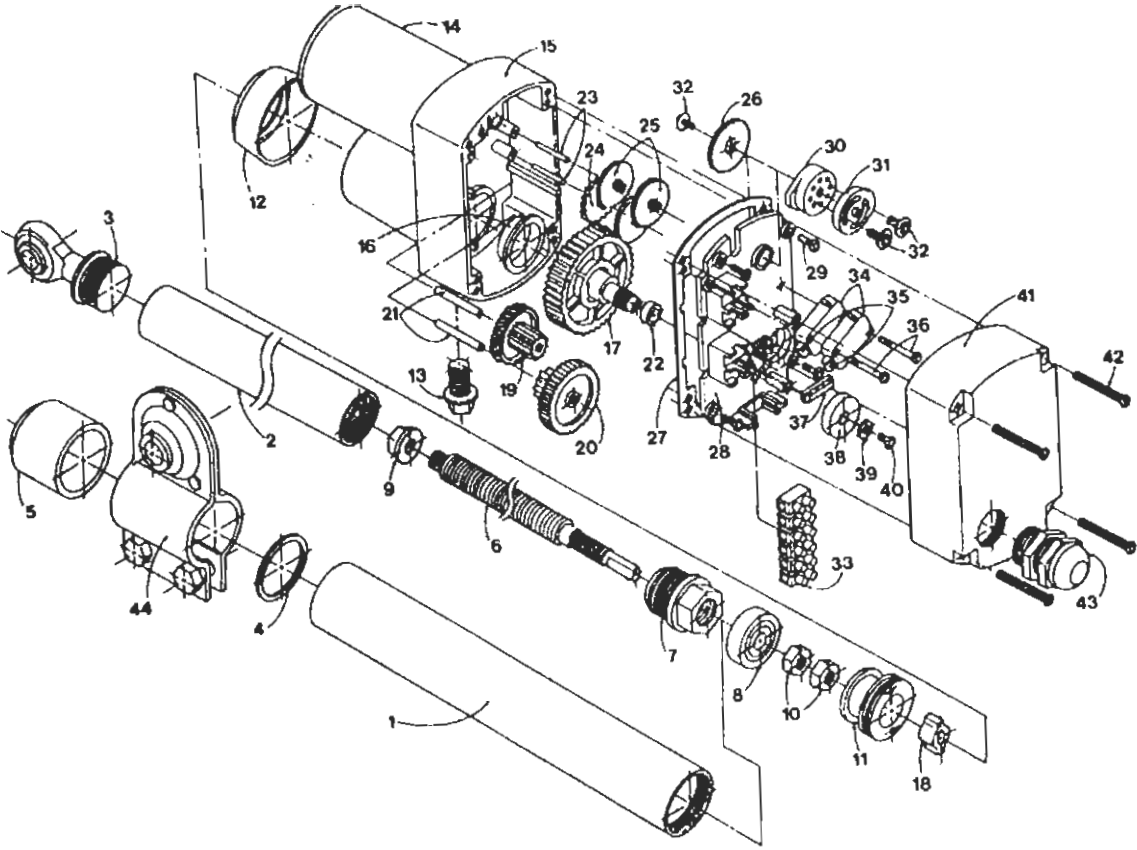


Fig. 3.2:

3.2. Development of Positioner

After the fabrication of mechanical feed lifting system a positioner was developed to manage the electric current in different polarities for a specific time. This equipment was used to run feeding system in order to provide feed according to a desired schedule.

The actuator attached with feed lifting system had the capacity to lift 128 kg weight using 40 volt direct current (DC). Provision of 40 volt current with (+, -) polarity had the ability to lift feeders upward and stop after taking them to upper limit. When (DC) current polarity in wires was changed (-, +) the actuator brought the feeders down to the birds level and stopped the feeders to the preset levels.

To change the polarity in the wires and hold the same polarity for a desired time an electric timer was used in the positioner. Its clock wheel rotated once in 24 hours. The wheel had 96 mechanical switches each having a time limit of 15 min. These switches were pushed inside making a groove, which in turn operated a micro switch to its ON or OFF position. Feeding time was programmed by pushing switches inside according to the required time. A transformer was used to provide 12 and 40 volt DC outputs at a time. Twelve volt DC current was used to set ON or OFF the two relays at the same time under the effect of micro switch of the timer, as shown in Fig. 3.3. Pressing the four mechanical switches down on to the timer dial and then left 12 switches unpressed in alternating sequence; one hour ON and 3 hour OFF sequence was fixed on the controlling dial. This ON and OFF sequence of micro switch of the timer was further used to control the availability of 12 volt DC current to the two relays.

Whereas the input of relays were fixed with 40 volt (DC) current and on the out put of relays jumpers were placed to connect both the relay points in such a way that an ON sequence from timer switch provided (+, -) polarity. While OFF sequence from the timer switch changed the polarity (-, +) at the out put points of relays as shown in Fig 3.3. Electric current of these two opposite polarities was sent to the actuator motor. This current rotated the motor in both,

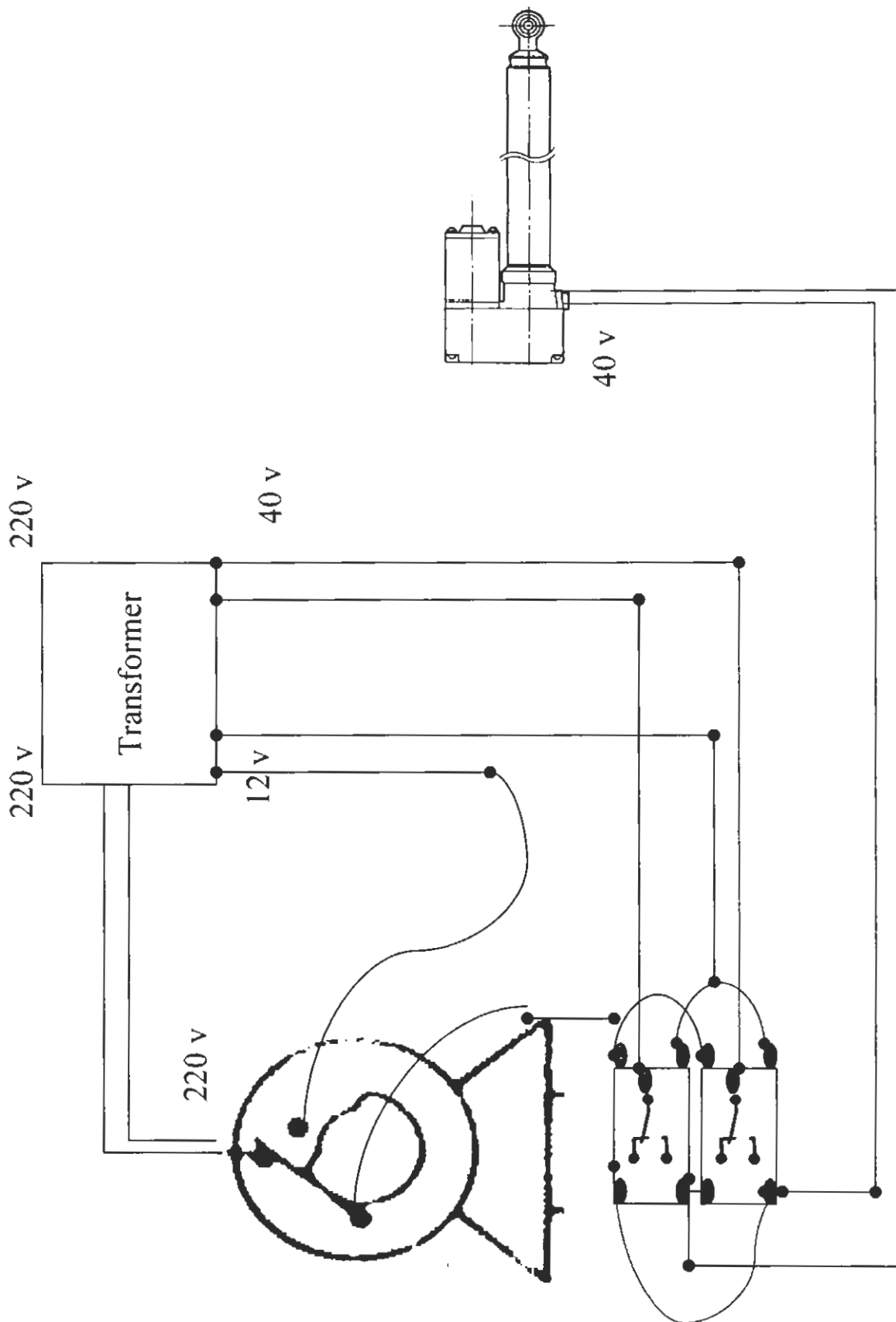


Fig. 3.3: Feeding Time Control Unit

clockwise and anti-clockwise direction depending upon the polarity of the current. Rotation of the motor moved the inner tube inside or outside of the shock further moving the feeders in downward or upward directions respectively. The limit switches in the motor controlled the movement of inner tube to its final limits for holding the feeders at a preset height. Feed withdrawal sequence was also developed by programming the feed restriction hours on the electric timer. Both intermittent feeding and feed withdrawal programs were applied with the help of automatic feeding systems so developed.

3.3. Light Operated Switch

Intermittent lighting is a mean to control intermittent feeding (Buyse, 1996). This indicated that darkness during night might affect the feeding schedules. In the current experiment automatic feed lifting system was used to maintain intermittent feeding pattern according to the scheduled. During the experimental period continuous lighting was required to assure that when feeder were lowered down to feed the birds, light must also be available to avoid interruption in feeding schedule due to darkness, especially during night.

Therefore a light operated switch (Fig. 3.4) was fabricated to be utilized in the development of lighting system in order to provide supplementation of artificial light during night/dark time, so that 24 hour uninterrupted light could be provided to the broilers both from natural as well as artificial sources.

3.4. Light Supplementation System

Light operated switch was used in the light supplementation process in conventional poultry house (Fig. 3.5). This switch detected the availability of sunlight and shutdown of electric supply to the electric bulbs. Therefore, when light intensity was below the recommended values it provided electric supply to the electric bulbs. Hence it supplemented the light from artificial light source till sunset in order to ensure the uninterrupted light availability.

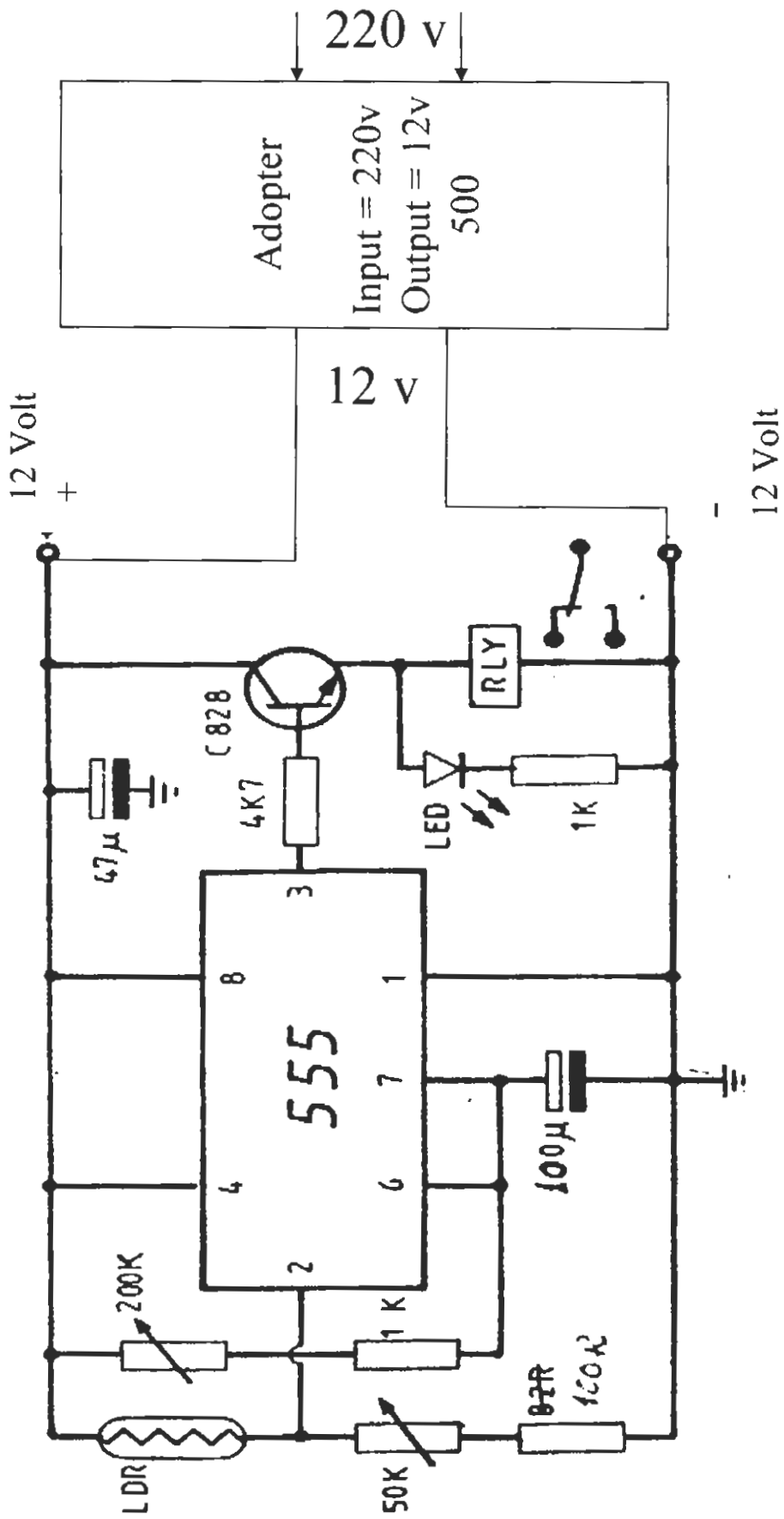


Fig. 3.4: Light Sensor

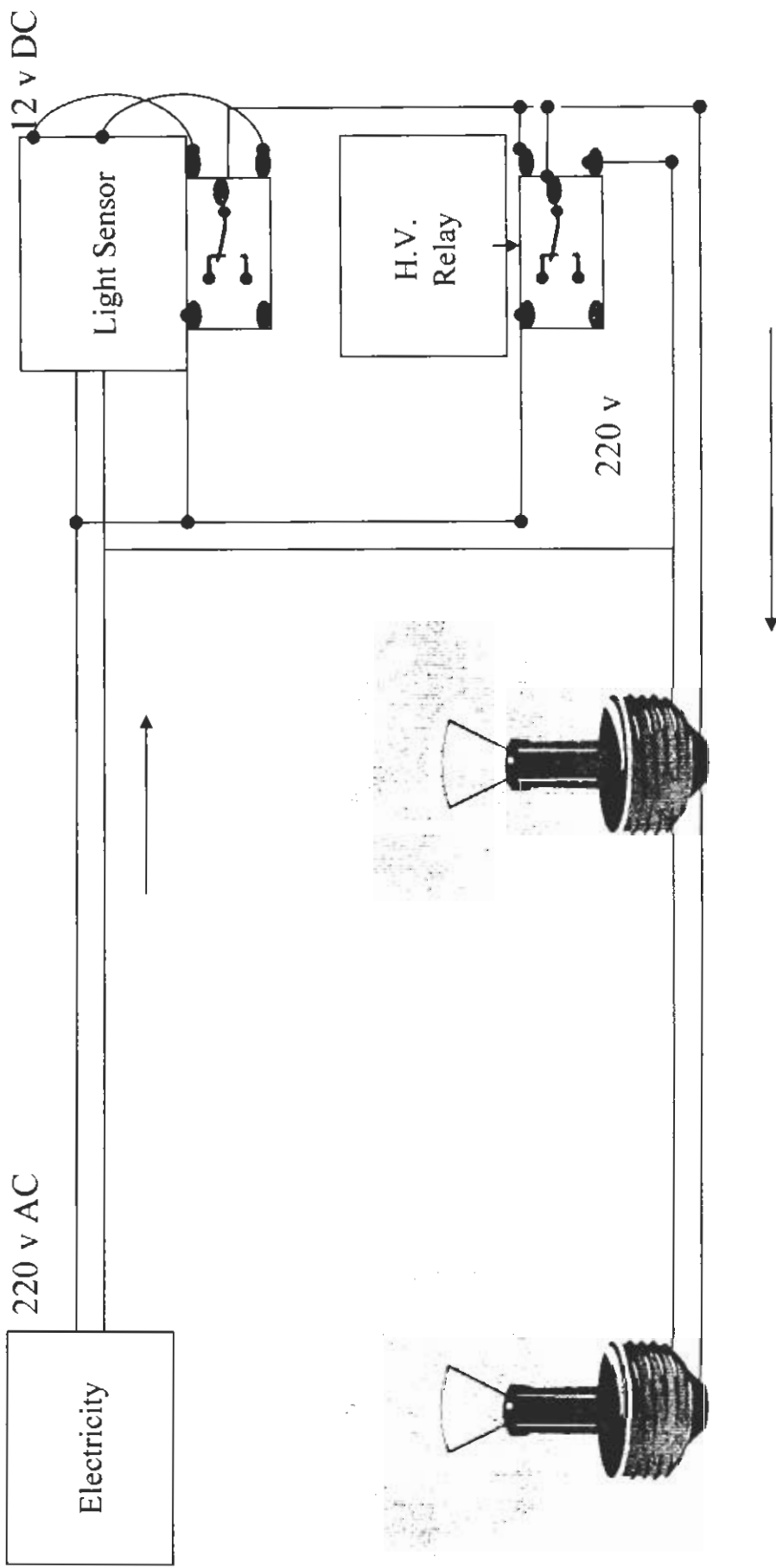


Fig. 3.5: Automatic Lighting System

3.5. Dark Hours Counter

Another light operated switch was connected to an electric clock for recording the time of total darkness in the shed due to failure of any lighting equipment during the experimental period. The switch cut down the electric supply to the clock in the presence of optimum light intensity (minimum light required for feeding). Whereas it switched on the clock by providing electricity when there was a failure of light equipments thus providing the information regarding period of darkness. This system provided a backup check on the light supplementation system (Fig 3.6).

3.6. Development of Water Measuring Equipment

Water measuring equipment for each pen was fabricated. In this system a three way out put nozzle was attached with a water tank. One supply line was attached with automatic waterer. Second output was used to drain the water out of tank whereas a glass water gauge was attached with the upper end of nozzle as shown in the diagrams (Fig. 3.7). Each point of glass water gauge was calibrated to represent one litter water capacity while the rest of water was measured by using measuring cylinder by draining the water from the lower end. This system helped to measure water intake for each experimental unit separately.

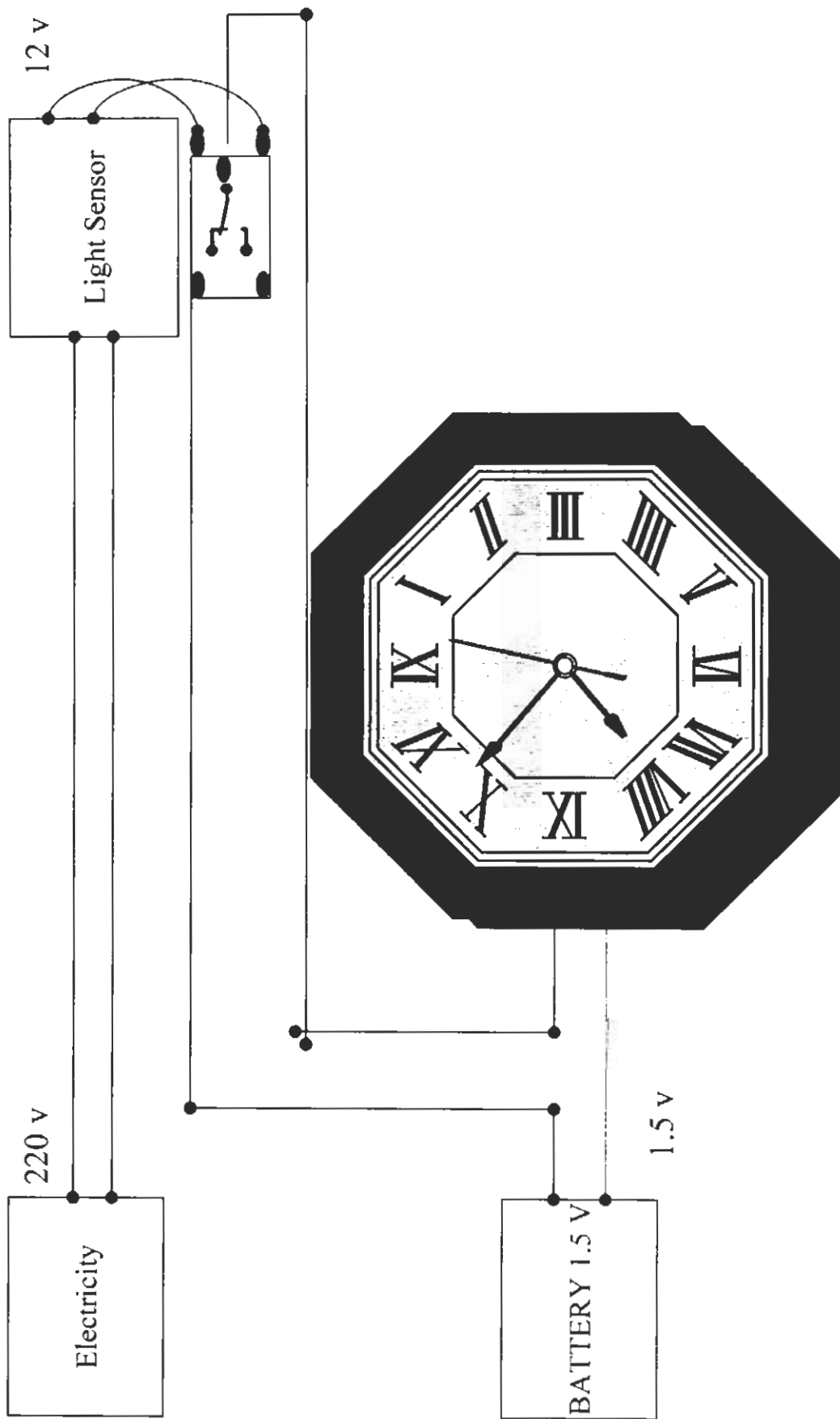


Fig. 3.6: Dark Hours Counter

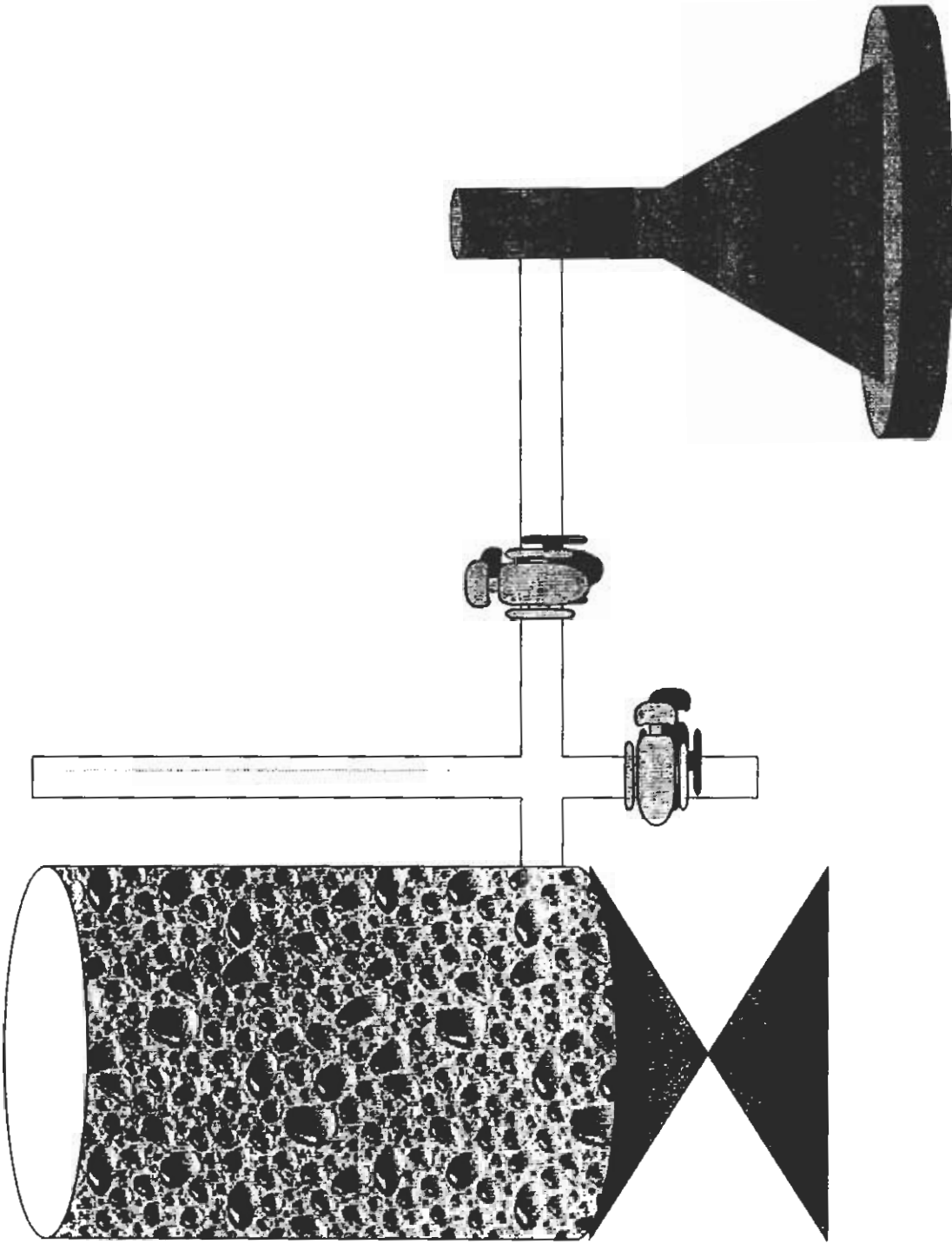


Fig. 3.7: Water Measuring Equipment