CHAPTER 2

EXPERIMENTAL TECHNIQUES

2.1 Description of the apparatus.

Fig 1 and 2 show the main details of the test rig. A cylindrical steel tank A, 8 inches diameter by 8 inches long, functions as a generator-absorber. It contains about two third full of NH_3-NaSCN solution. Another cylindrical steel tank B, 6 inches diameter by 8 inches long, functions as the condenser-evaporator. Tank A and B are connected to each other by a 3/4 inch high pressure rubber hose (c). Ammonia can be charged into the system through a charging valve D.

2.2 Instrumentation.

Both the generator and the condenser have thermometers well fitted at the side wall about 5 inches from the bottom for measuring temperature. The generator-absorber pressure can be measured by a Burdon tube pressure gage fitted at the outlet of the tank.

Mass transfer of the ammonia during regeneration and absorption is determined by placing tank A and B on each side of a balancing beam mounted on a steel knife edge as shown in fig. 2.

2.3 Experimental methods.

2.3.1 Determination of the amount of NH_3 condensed during regeneration.

The generator was charged with solution of 50% NH_3 concentration. It was then placed on top of an electric heater which was situated in a steel drum. The drum was finally filled with granulated vermiculite insulator in order to minimized the heat lost. The condenser was immersed in a pail of water. The drum containing the generator and the pail containing the condenser were then placed on each end of the balanced beam placed on a steel knife edge. Additional weights were placed on the necessary side until the beam was balanced. The generator pressure and temperature and the condenser temperature were recorded. The heater was then turned on and its power input was recorded. Every 5 minutes interval the beam was balanced and the necessary readings of weight, pressure and temperature were taken. The heating continued for 2 hours.

The above procedure was repeated 3 more times for the solution of 54.5, 56.0 and 58.5% NH_3 concentration respectively.

2.3.2 Absorption process study.

After regeneration was completed, the condenser was taken out of the water pail and put into an insulated box contains water of known temperature and weight. That is, the condenser was now ready to act as an evaporator and had already been put into a calorimeter. The generator was immersed into a pail of water so that it would function as an absorber.

Two methods of absorption were studied. The first one was done by allowing the system to standstill. All the necessary data

were taken at 5 minute intervals during the first half hour and then at 20 minute intervals until the process was completed. The second method was done by shaking the absorber 10 times each at 5 minute intervals. (The pressure and temperature change of the solutions were found to be negligible after shaking the vessel more than 10 times) All the data were taken just before shaking and one minute after shaking.

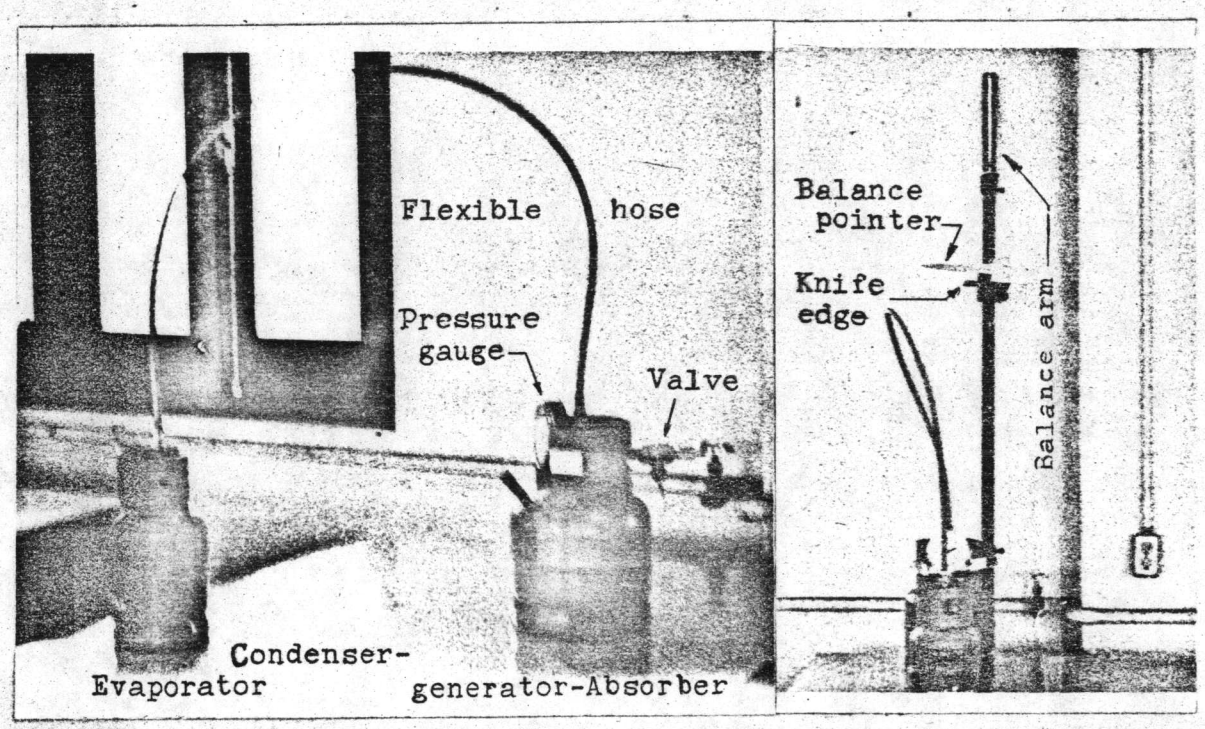

Fig. 1 The test rig.

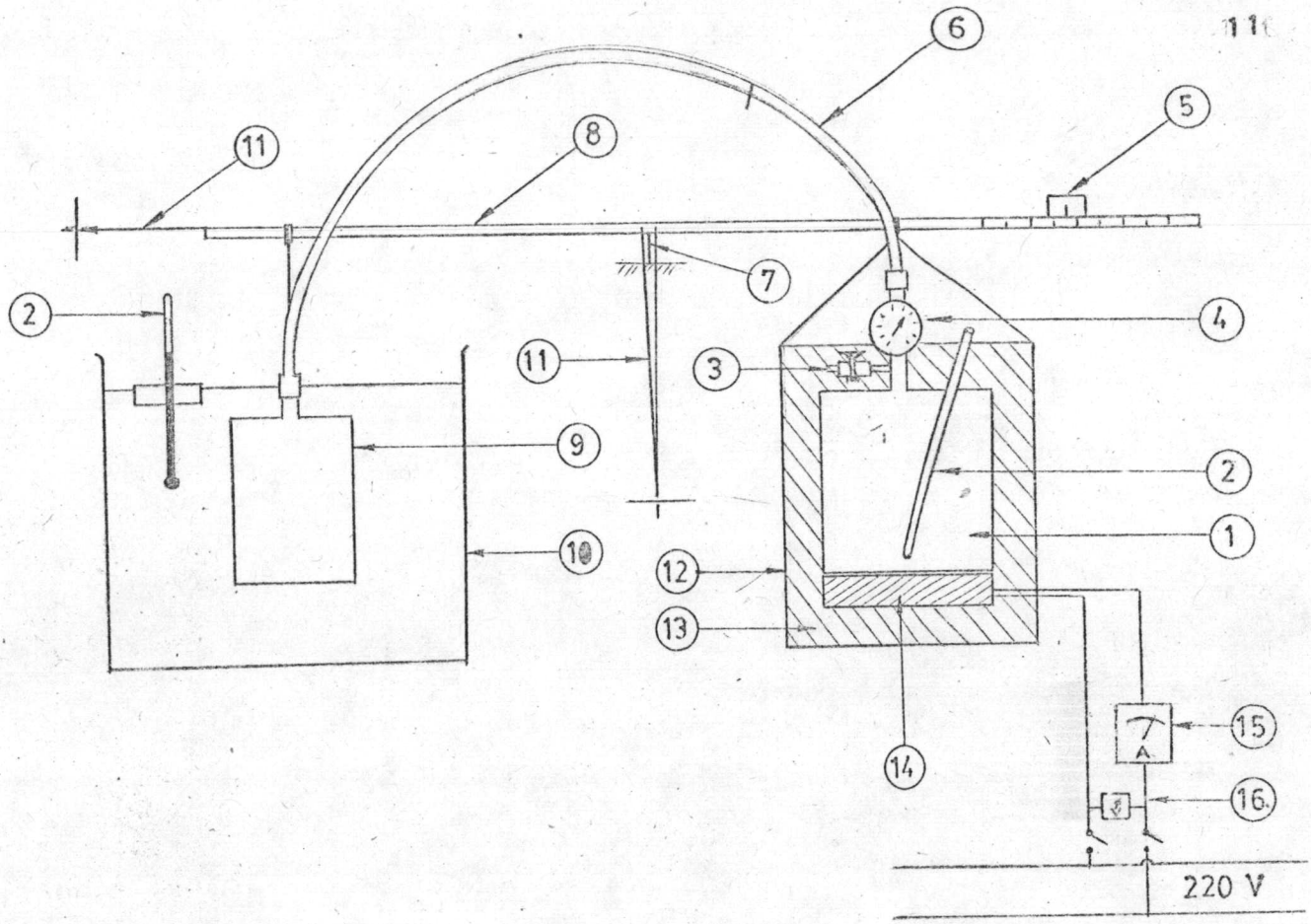

Fig 2 Schematic diagram of the test rig.

1 Generator-Absorber
2 Thermometer
3 Ammonia charging valve
4 Pressure gauge
5 Jockey weight
6 Flexible hose
7 Knife edge
8 Balance arm
9 Condenser-Evaporator
10 Cooling water tank
11 Balance pointer
12 Insulated jacket
13 Insulator(vermiculite)
14 Electric heater
15 Ammeter
16 Volt meter

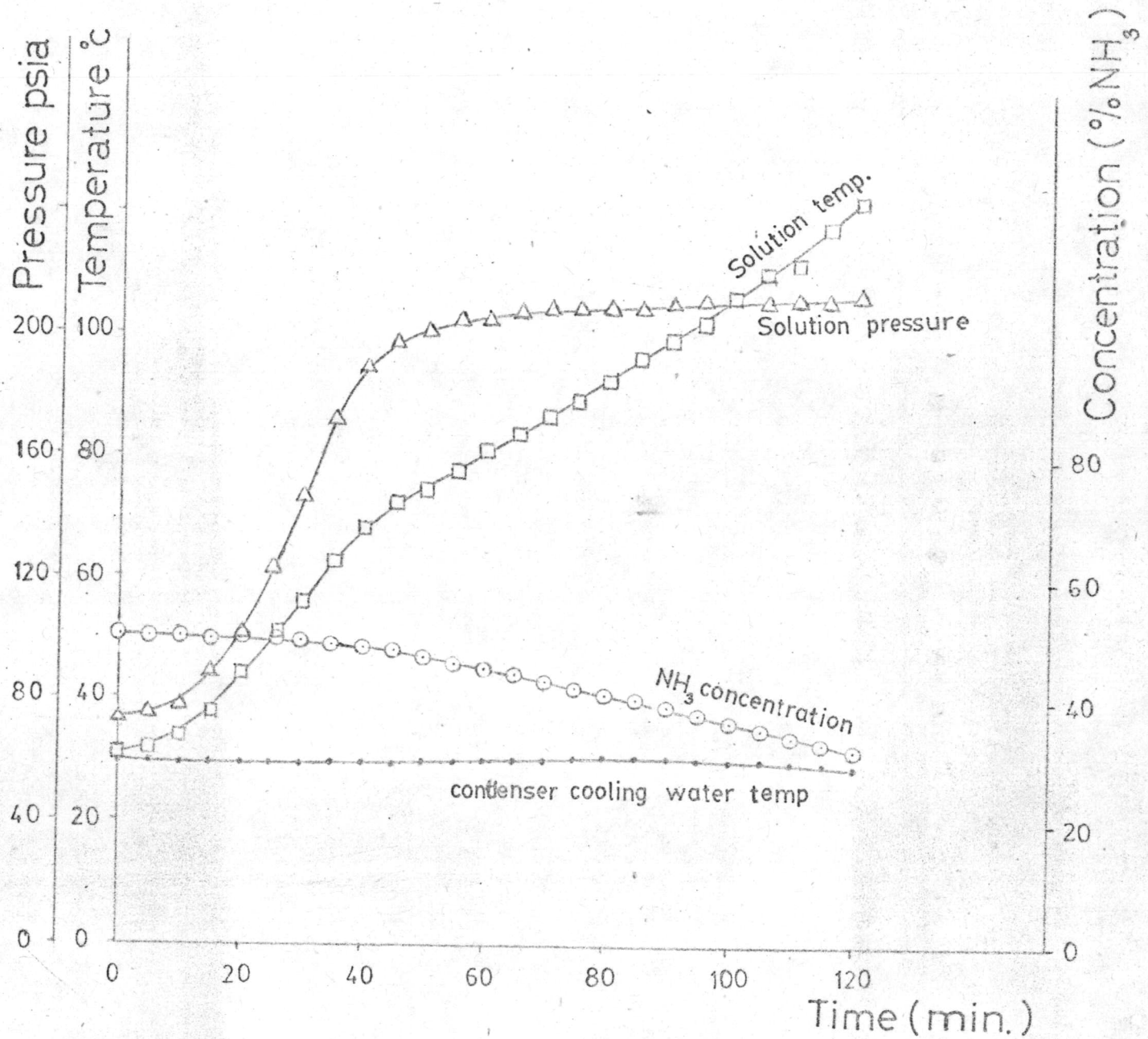

Fig. 3 Result at 50% concentration

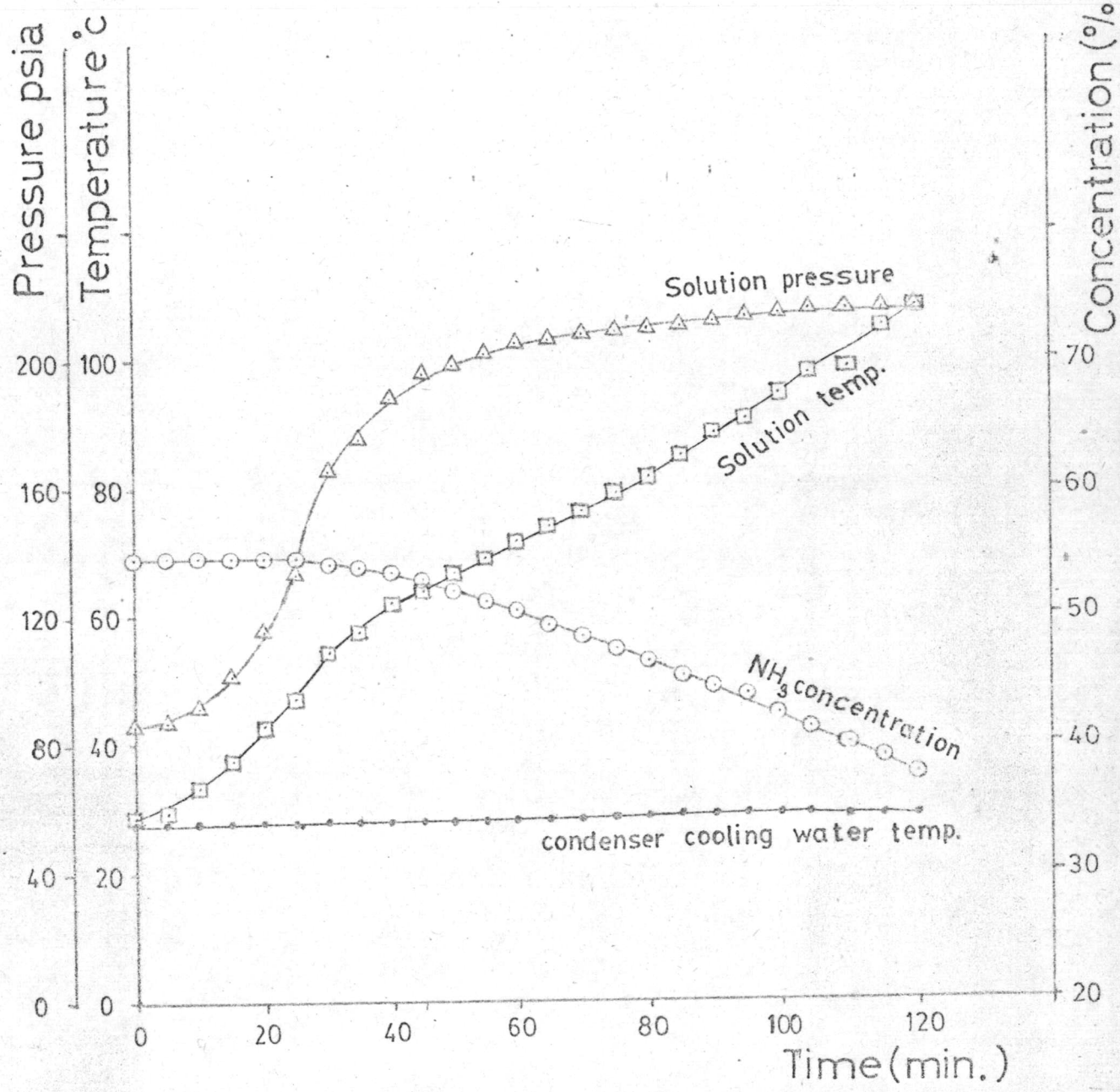

Fig. 4 Result at 54 55 % NH_3 concentration

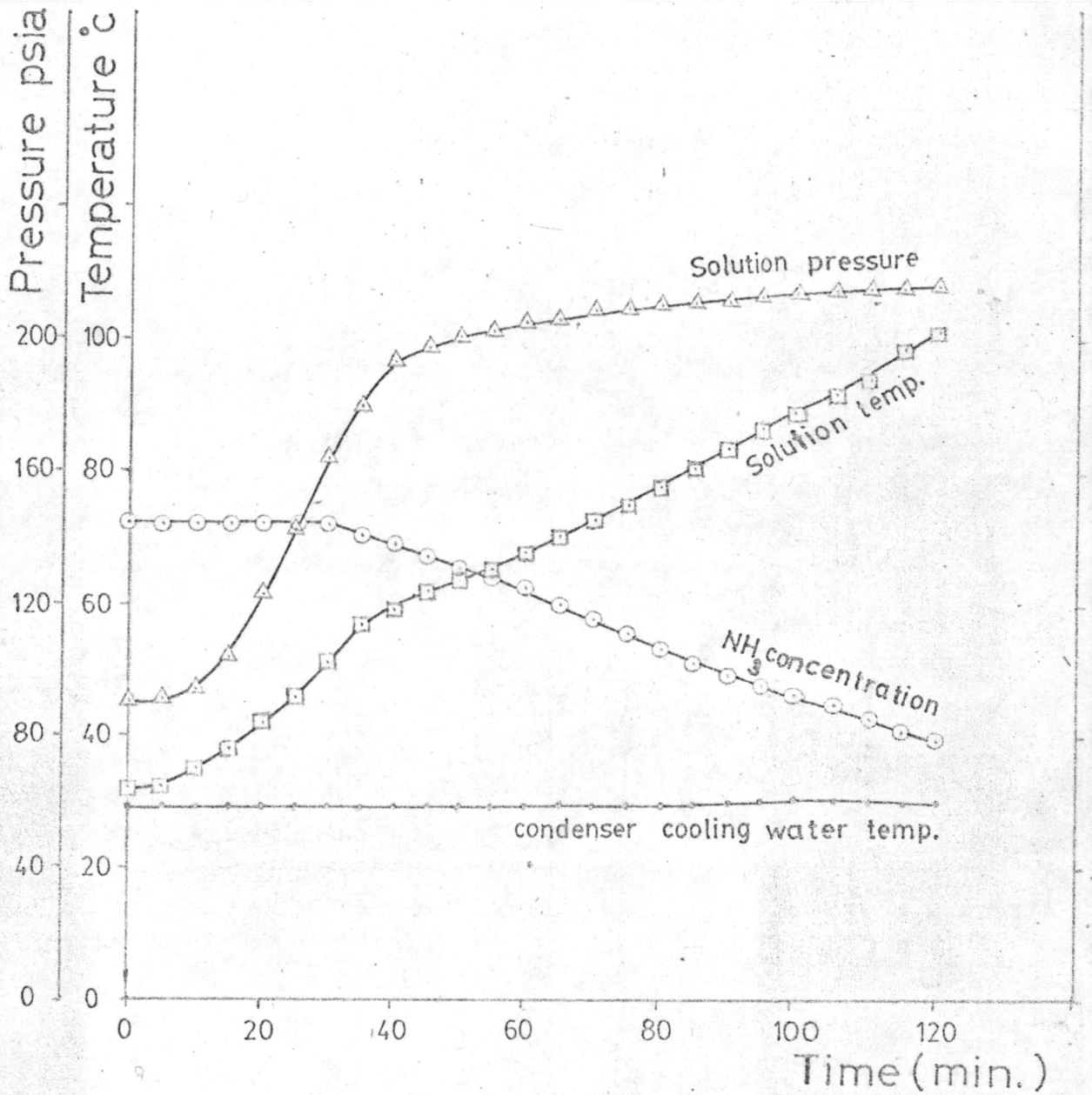

Fig.5 Result at 56% NH_3 concentration

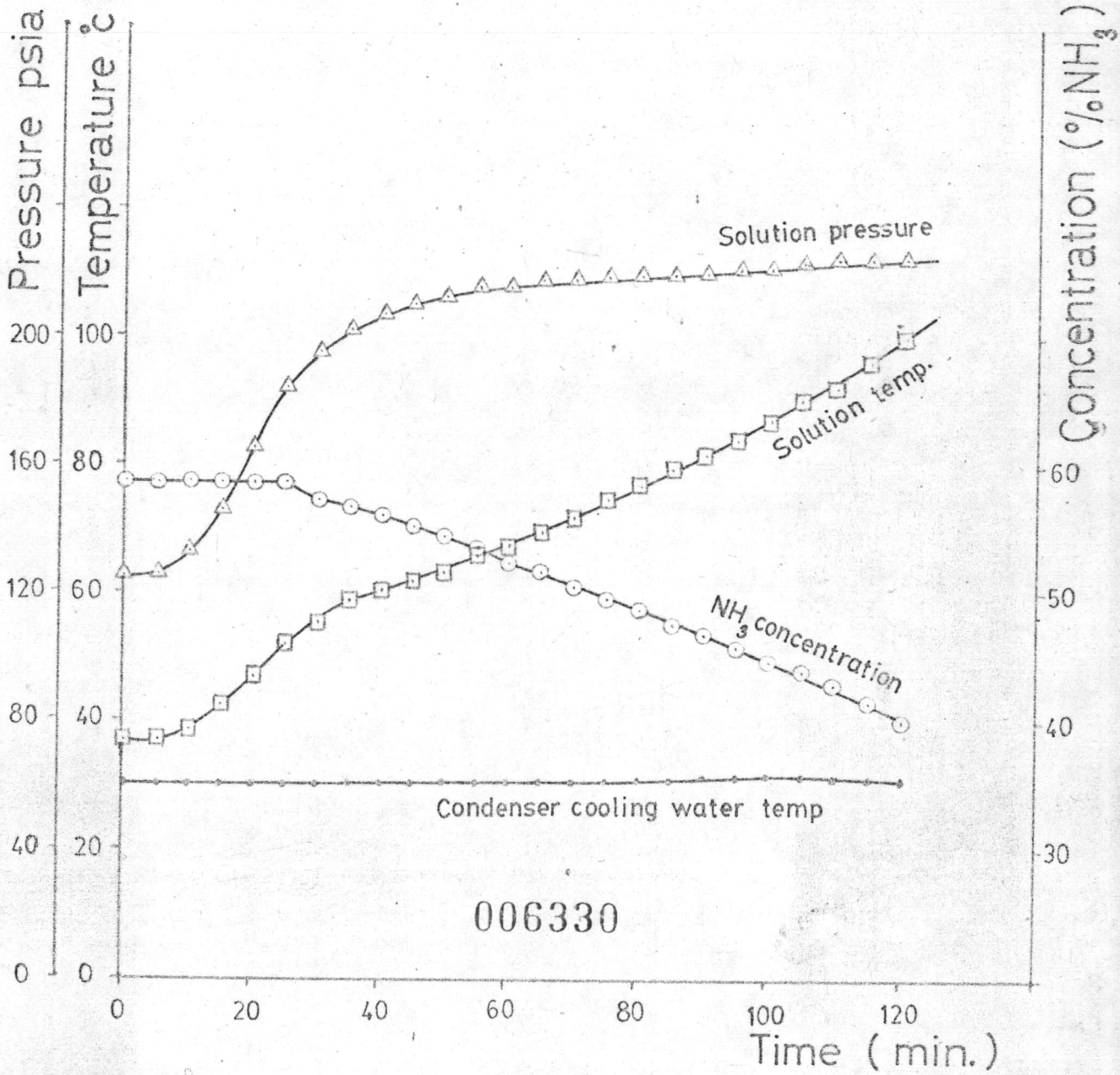

Fig.6 Result at 58.5 %NH_3 concentration

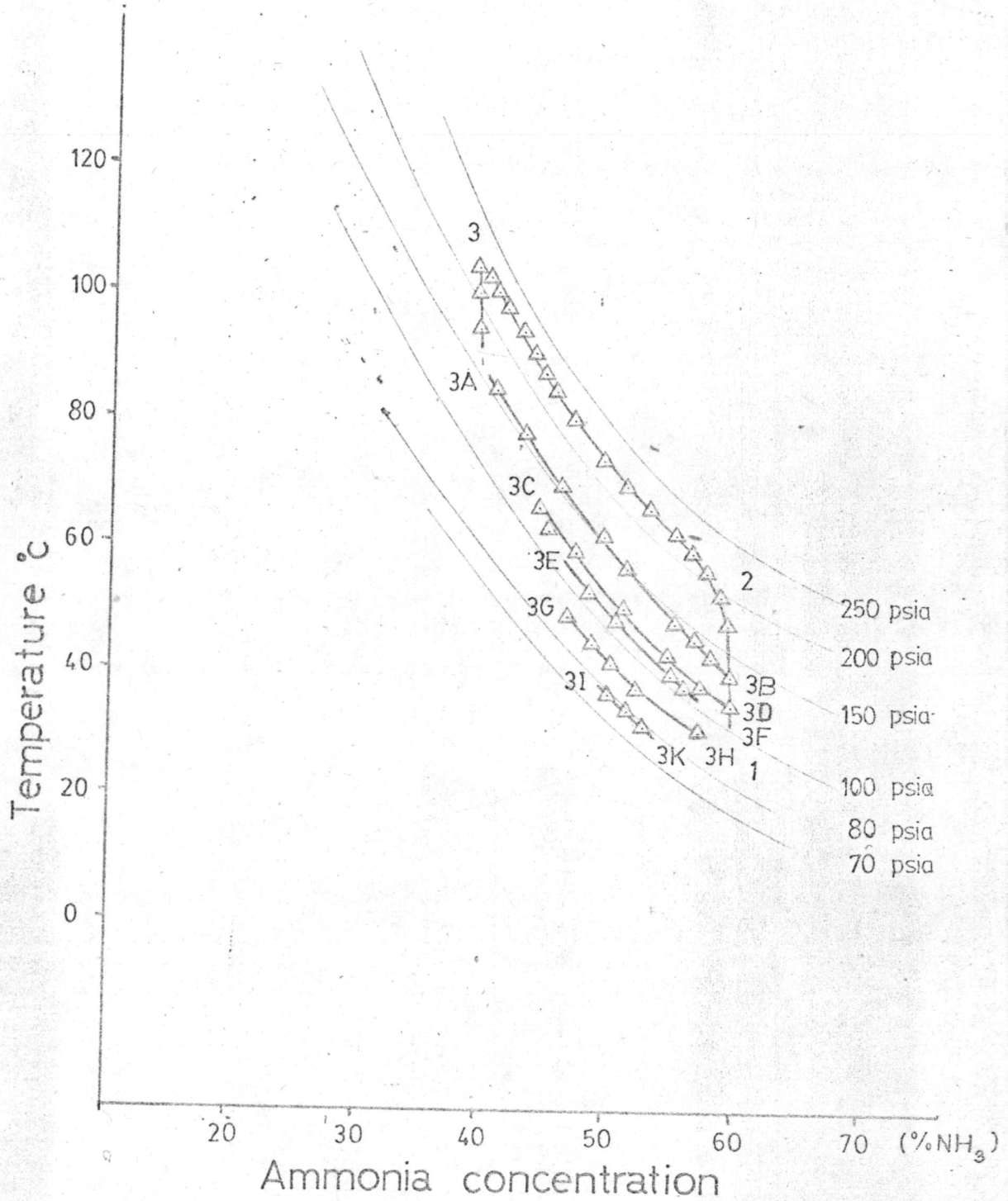

Fig.7 Actual cycle (58.5% NH_3 concentration)
(shaking at maximum concentration)

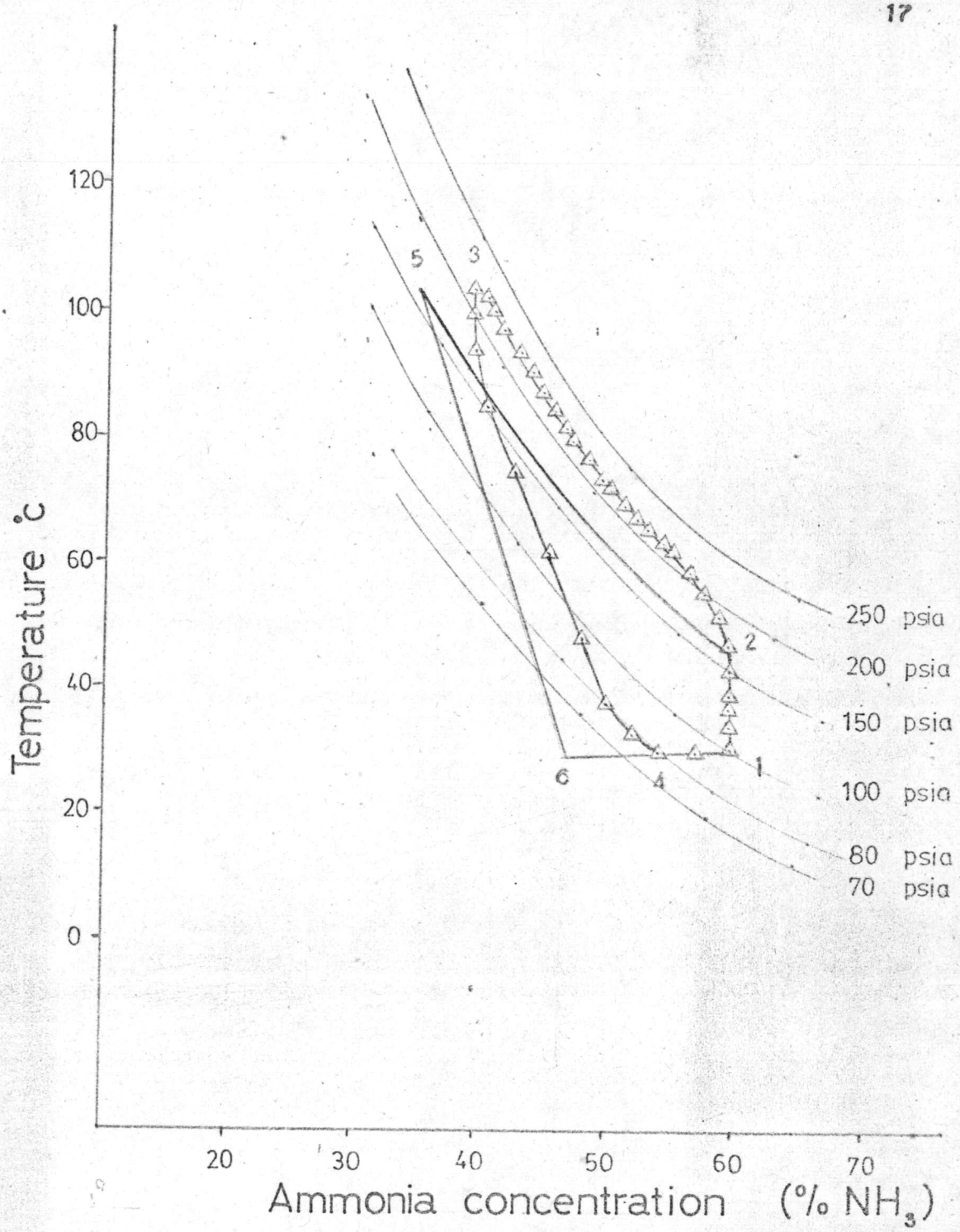

Fig.8 Actual cycle (58.5 % NH_3 concentration)

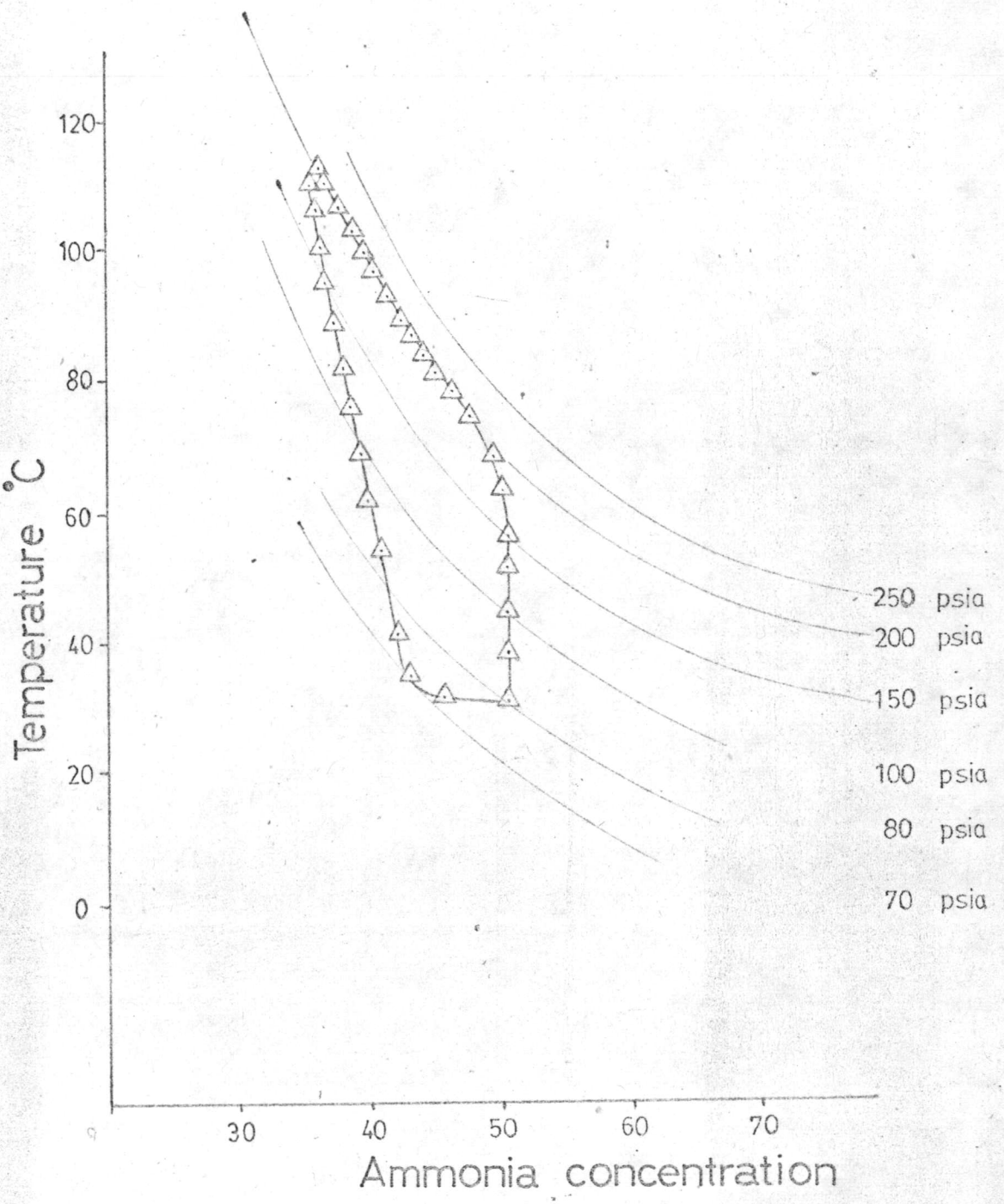

Fig.9 Actual cycle (50% NH_3 concentration)

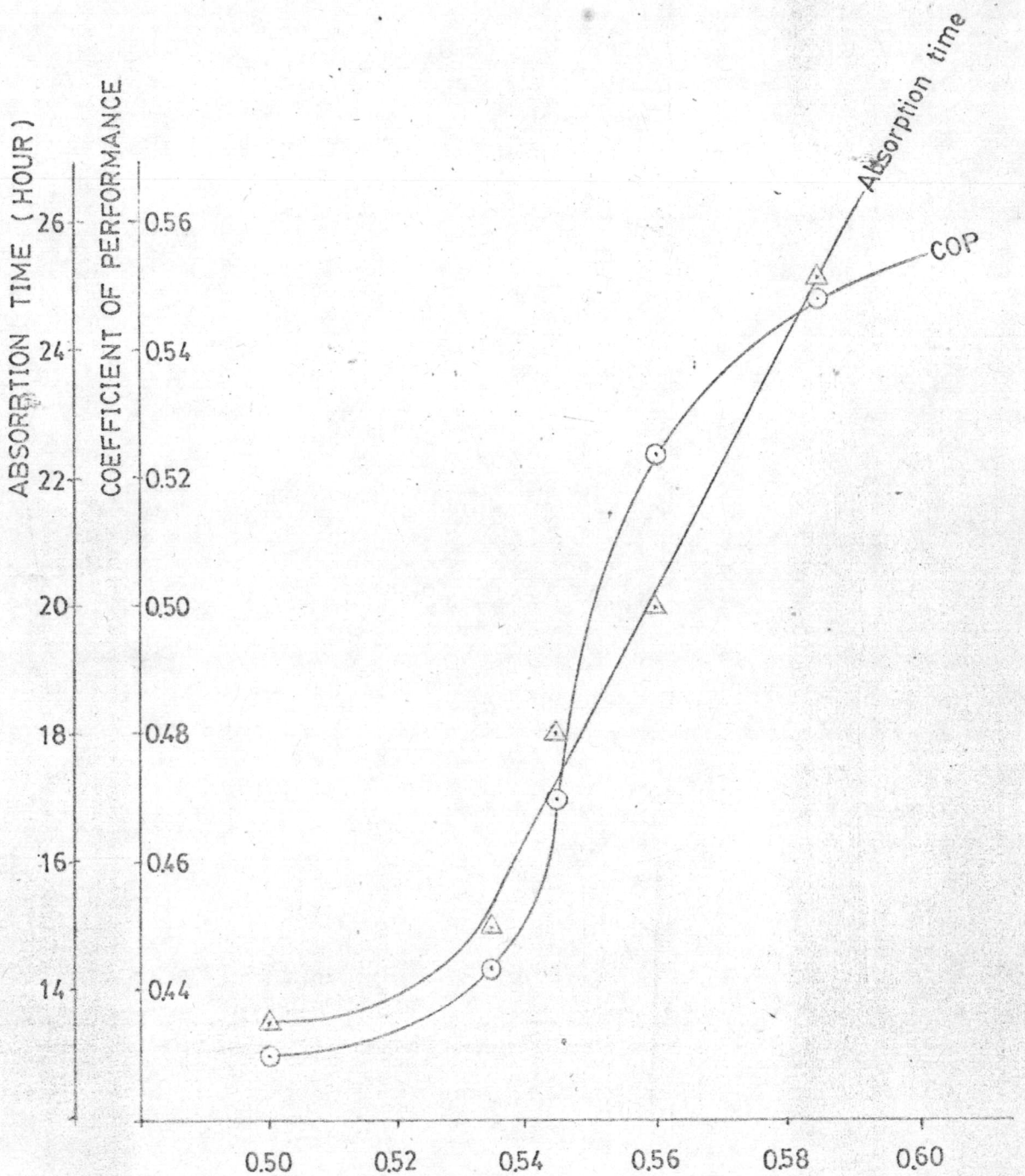

Fig. 10 Absorption time and COP vs Ammonia concentration