CHAPTER III
EXPERIMENTAL METHOD

3.1 Materials preparation

The materials which are used to do the experiment of Foi-tong production have to be prepared and control their properties because they can effect the production process. This following work instruction concerns the preparation both for pre-test and post-test.

3.1.1 Egg emulsion preparation

There are two kind of eggs which should be used for do the experimentation. They are the poultry eggs. Duck eggs and hen egg in the ration of 80:20. Here can be used only the egg yolks, pure egg yolks. The mixture can be well prepared by weighting the egg yolk 80 % and the hen yolk 20 %. The most appropriately stored egg at room temperature for 4 day eggs. The spongy layer will be clean and dry with a cloth. After that the spongy layer was broken carefully, not to make the yolk break. The thick albumen will be taken off and the outer thin albumen will be kept. The yolks are pressed though a thin clean cotton cloth with the mesh of 400 meshes / inch approximately. The cloth will filter the egg emulsion and separate the vitelline membrance and germinal disc from the yolk (Carter, 1968). The egg emulsion was then mixed with an outer thin albumen of 18 % and 3 % of vegetable oil. (details in 3.1.3). At the last mixture was 0.1 % of a synthetic jasmine favor to suppressed the egg odor (in 3.1.4). The mixture was filtered again in order to make it homogeneous and should never be stirred strongly otherwise the mixture can get mixed with the air bubbles and lose its initial viscosity.

3.1.2. Preparation of syrup

Normal sugar for cooking foi-tong was found on the market. The favored sweetness of foi-tong is the foi-tong sugar was cooked in the syrup with 60 % concentration. It means that 100 gram of sugar was dissolved in the 60 gram of hot water. For this experimentation the syrup's physical properties were especially tested to electrical resistance. Therefore the syrup preparation was prepared two times. As

the first preparation , by selected 5 value concentration of the mixture, They were 50, 55, 60, 65, 70 % concentration syrup were kept in a separate beakers

Note: The sugar was made by MITRAPOL Co.Ltd.

3.1.3 Vegetable oil

There are many kinds of vegetable oil on the market. For this test the oil selected was Salad oil, Best food brand. This oil is very flavorful for the local need.

3.1.4 Synthetic Odor

For the experiment the synthetic jasmine flavor is selected. There are several kinds of synthetic odor, such as rose flavor, ilang-ilang flavor, fumigation candle (**Department of vocational education,1982**).

3.1.5 Drink water

The water used in the cooking process is different from place to place. Some recipes call for purified water, well water, distilled water. But, by inter-viewing some Foi-tong experts in U-thong and in Petchaburee provinces, the producers suggested normal drink water. Thus, for this experiment, the drinking water, POLARIS Brand was used.

3.2 **Experimental Equipment**

The study of all operational control factor was necessary to prepare some experimental equipment. There were two types of main equipment which have been especially designed and set up for this purpose:

3.2.1 Circular motion type

A circular motion type was an experimental equipment by which the rilling procedure is in circular motion. The Foi-tong string shaped in a circular shape. There were some including tools to prepared: such as *a vertical milling machine* it has speed range of 40-3000 rpm (stepless) , main spindle traverse: 0-200 mm. vertically. a set of collet chuck #16 mm. (for tightening the braket).*Circular motion equipment* consisted of:

1) Compression tube and spring force application
2) A PE-nozzle with 1 mm.hole diameter
3) Holding bracket
4) Plastic container for egg emulsion
5) PE-piston and rod

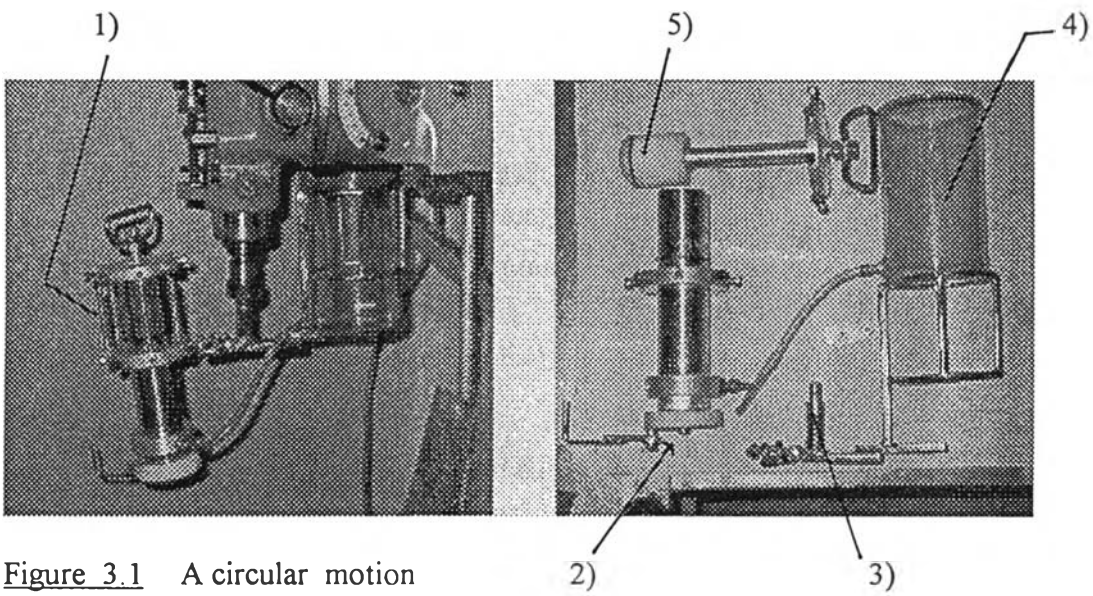

Figure 3.1 A circular motion

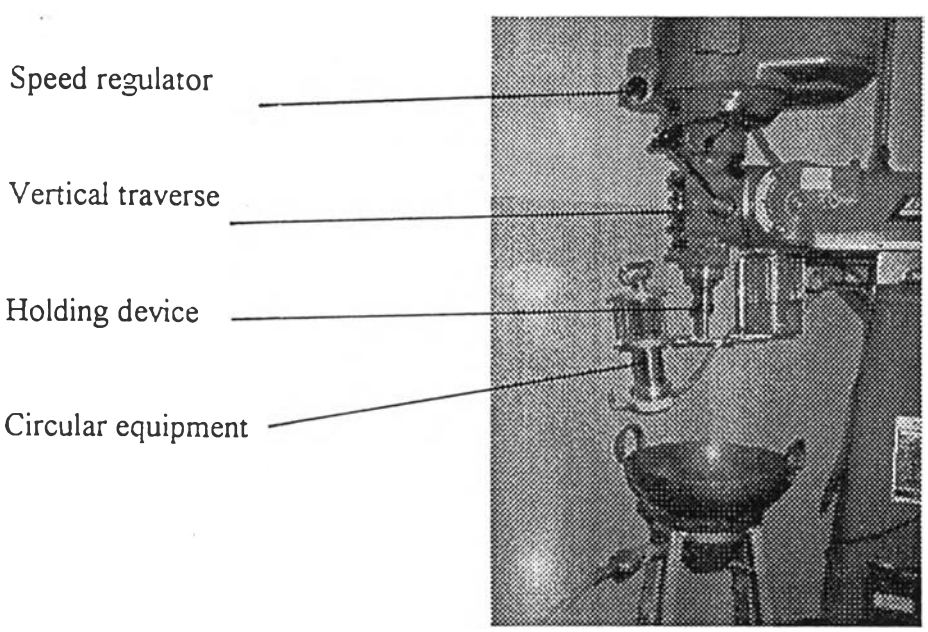

Figure 3.2 Installation of circular motion equipment with vertical milling machine

6) *A circular brass pan* with 40 cm. diameter. The pan made by brass sheet maintains temperature and the sugar slouch can slip from the brass surface more easily than the other material .

5) Flipper with 400 mesh/inch

6) *Weight*, Mettler Toledo.PB303

7) Refractometer

8) Thermocouple and temperature controller

9) Beaker, Pyrex : 0.3 , 0.5, 0.7 and 1 liter

10) Concentration controller (in chapter IV)

11) Data collection sheet (in appendix A)

3.2.2 Linear motion type

A linear motion type is a new design of Foi-tong apparatus. It was designed and set-up for studying the applied operational control factor which were the test result of the circular motion type. The main accessory of this equipment type;

1. *compression type*: pneumatic control
   stoke: 170 mm.
   compression: 0-4 bar, adjustable
   Stainless cylinder inside diameter 50 mm.
   PE- piston size : 50 dia. -0.02 , 40 mm. Piston length
   Rilling cup: Triangular shape 30 degree, with 46 of 1 mm. diameter through holes. As shown in Figure 3.3

2 .*Electrical stove* with temperature controller and thermocouple.

3. *Speed controller* for longitudinal movement, controllable speed range 0-400 rpm. 12 volt. DC motor with a spaket chain driving system.

4. *Two depots* prevent dropping of egg emulsion and heat protection.

5. Pneumatic control system

6 .Adjustable rilling height 0-300 mm.

7 . These following tools have been shared with the circular motion test.

7.1 temperature controller

7.2 Syrup concentration controller

7.3 Beaker, Pyrex:0.3 , 0.5 , 0.7, 1.0 liter.

7.4 Flipper with 400 mesh /inch

7.5 Weight, Mettler toledo PB303

7.6 Refractometer

8. Data collection sheet

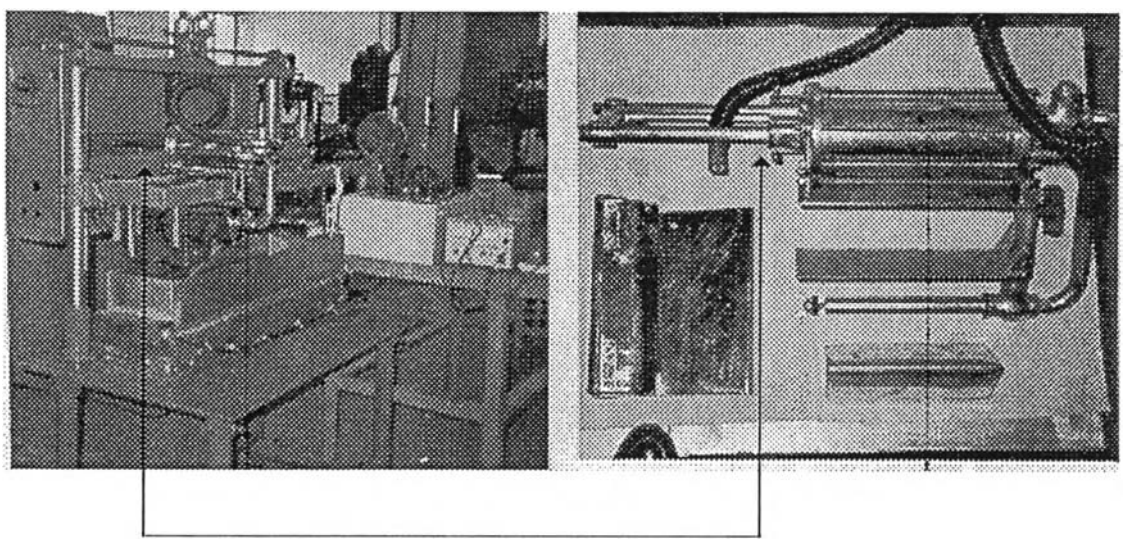

Figure 3.3 Linear motion type with a compression tube

3.3 Experiment Procedure

3.3.1 Circular motion equipment

The experiment procedure by using circular motion equipment followed this procedure step.

1. Swing over arm of the vertical milling machine 180 degree to the machine back.
2. Install the circular motion equipment by fixing its shaft end with the collet chuck

3. Chain low gear and try to move the vertical spindle to ensure that there is no part collision during turning of equipment.
4. Set a gas stove on its stand and move the set underneath the circular motion equipment.
5. Set a brass pan on the stove and bear in mind that there is no part collision against the pan.
6. Let the egg emulsion into compression tube by pulling the piston rod up wards. The egg emulsion will be sucked into the tube.
7. Check the spring displacement (in Figure 4.15 , p.50)
8. Set the rotation speed at the lowest speed the machine can perform.
9. Set the syrup pan under the rilling tube with the height 100 mm. approximately. Then move the vertical spindle to bring the nozzle to the position of 100 mm. above the syrup surface.
10. Install the transducers, thermometer and thermocouple at the pan rim for control temperature and main training the syrup level as well as its concentration.
11. Turn on the gas stove and regulate the value for a suitable flame, not too high or too low. After ten minutes the syrup will be boiled and produce some of scum which have to be taken away. Now, by eyes observation the cooking bubbles. The best condition is that the cooking bubbles are fine and dispersing covering all the syrup surface. Temperature at this stage around 103°C.
12. Open the nozzle stopper and turn on the main switch of milling machine. Be careful the equipment set is now swinging.
13. Adjust the rilling speed up to 50 rpm and stop the machine .
14. Close the nozzle stopper.
15. Take up the sampling product out from the pan and arrange it in order on the board. The rest in the syrup pan will be taken away.
16. To do the replication by repeating the procedure step 12-15, again three replications and collect the samplings.
17. Set the new operational control variable according to the statistical model set up.

3.3.2 Linear motion

Experimental procedure by the linear motion equipment is almost similar to the circular motion equipment. The different steps :

1. The rilling tube movement was linear instead of circle to maintain the same condition it needed a calculation as follow:

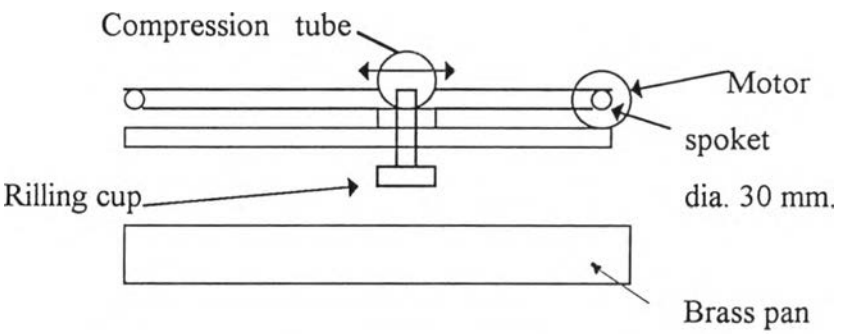

Figure 3.4 Rilling cup movement

Assumption

The circular motion speed by a traditional production is about 40 cm/s. The translation and circular motion should be the same speed, otherwise the egg emulsion string would be thin and cut off by the different speed. That means:

$\pi dn/1000*60$ [m/min] = 40 cm/s

where , d = 30 mm .

n = 254.65 rpm.

Result:

The motor has to rotate at n=254.65 rpm. In order to move the compression tube with velocity of 24 m/min (40 cm./ s.)

2. The linear motion equipment was controlled semi-automatically. The suction end compression performed by the electro-pneumatic sequencing. There was no human hand operation, except to turn on or turn off the machine.

3.4 **Foi-tong test method**

3.4.1 Diameter test

a) By collecting Foi-tong strings produced by the experimental equipment . The collecting data method was followed the model of statistical method, There were 135 number of tests (in Chapter V)

b) The string was separated in three pieces and each of them was measured the diameters in 10 intervals along it's length with the interval length 2 mm.

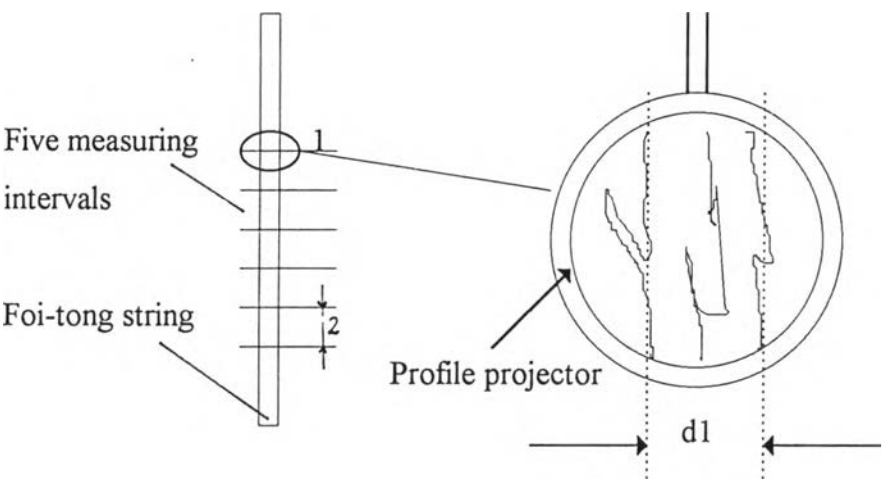

Figure 3.5 Measuring method of Foi-tong diameter

c) The measured diameters values were put in the SPSS statistical method and help analyze the effect of the factors .

3.4.2 Strength

The strength of Foi-tong string was measure in Kg / cm. It was the expansion under the limited tension force . By use of a tensile testing machine as shown in Figure D26 , Appendix D

3.4.3 Apply Statistical Analysis

The data were analyzed by statistic software called SPSS 7.5 for Windows, to run the analysis of variance (ANOVA)

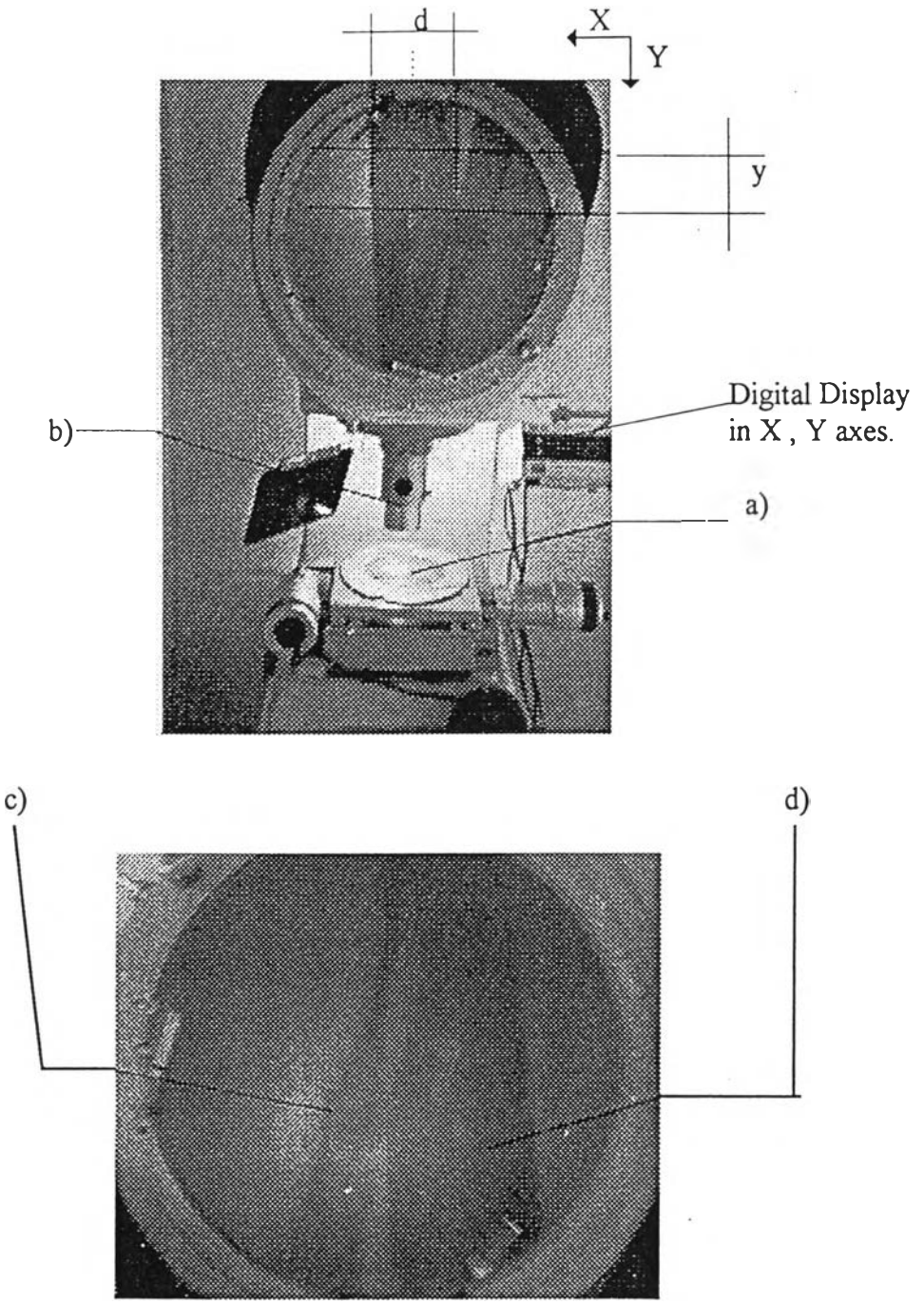

Figure 3.6 Measurement of Foi-tong string under microscopic magnification of 100 times. It showed the different shape between foi-tong string made by hand (using a banana leave cone) and by small machine (using a metal rilling cup)

a) Foi-tong sampling
b) 100 X - Objective lens
c) Foi-tong string made by hand
d) Foi-tong string made by small machine

Profile Projector : A profile projector is a light reflector with selected available magnification objectives between 10X to 200 X used in the measuring laboratoty of IE-Department, TU.

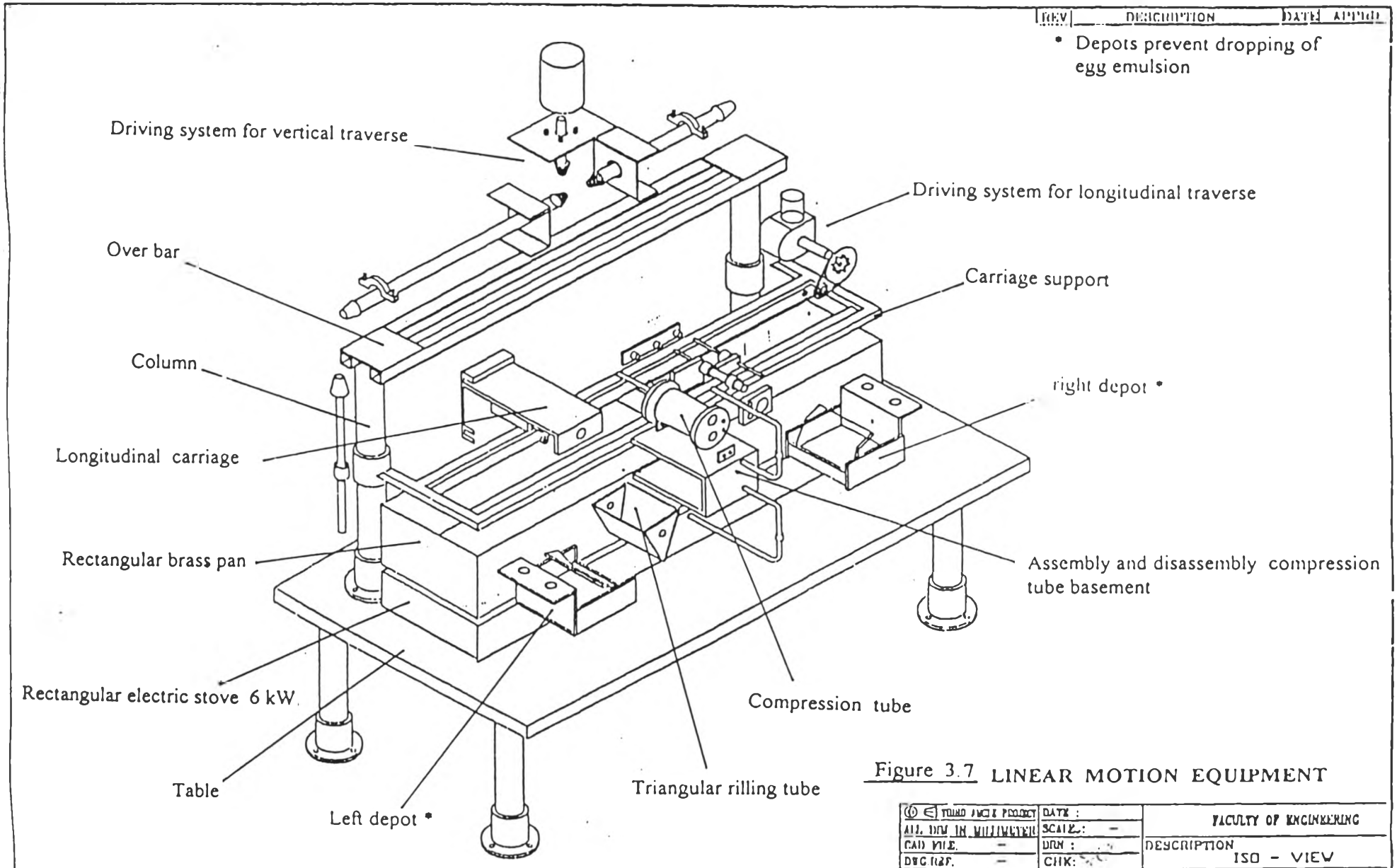

Figure 3.7 LINEAR MOTION EQUIPMENT

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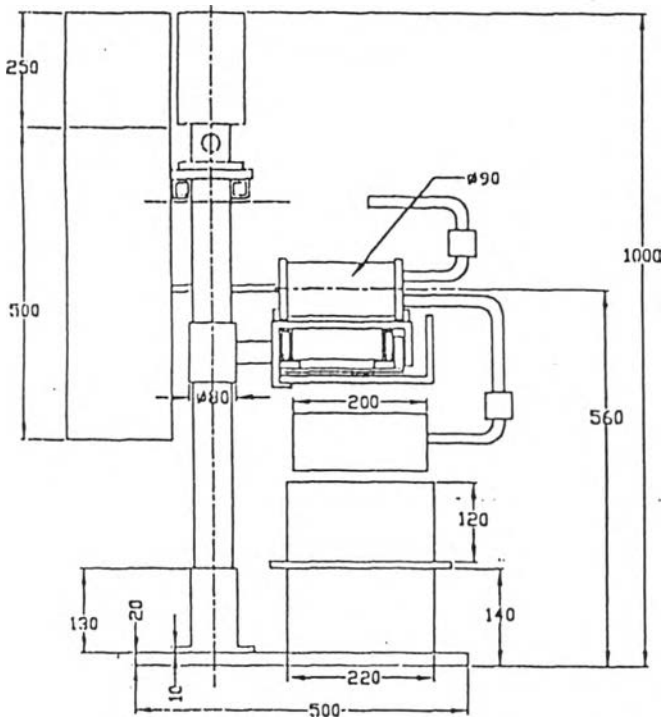

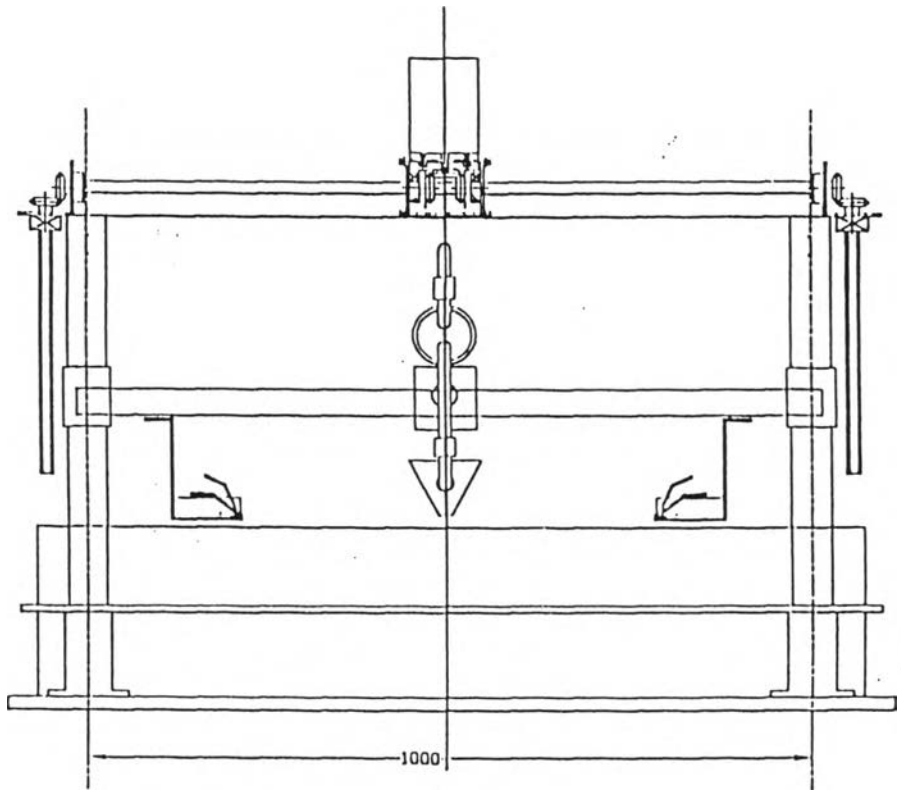

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