IX. HEATERS AND DRYERS

The apparatus in this section has been divided into two categories, as follows:

A. DRYERS

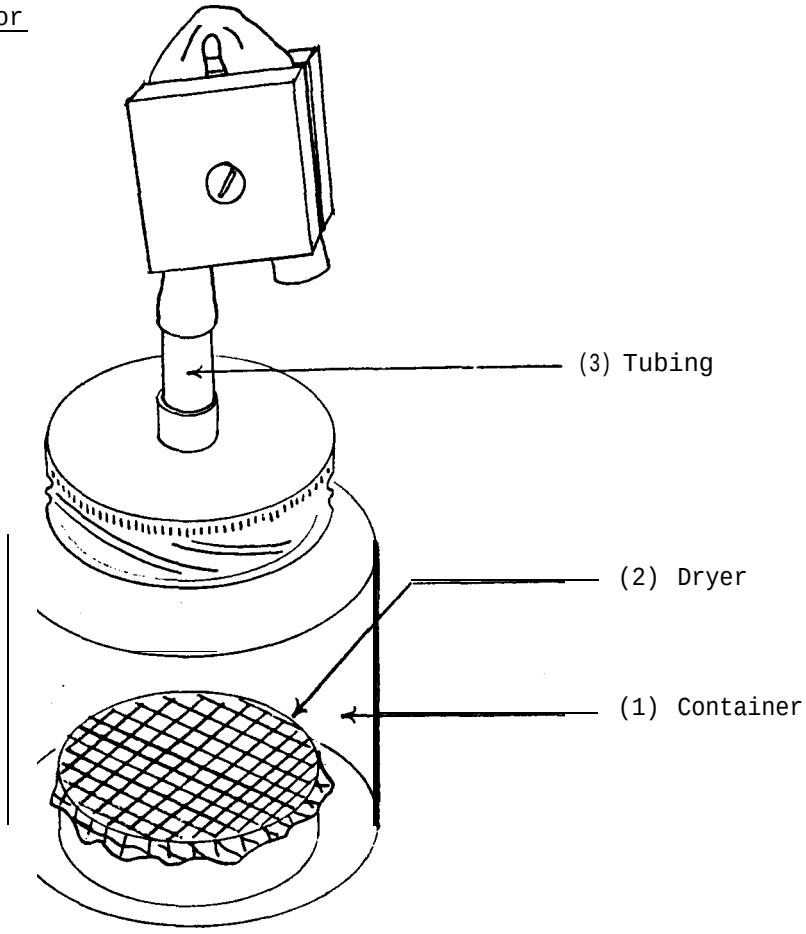
Dryers are devices used to remove the moisture content from chemical compounds.

B. HEATER

This is a device that is intended to produce a heat intense enough to incinerate precipitates.

A. DRYERS

A1. Dessicator



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Container	1	Glass Jar (A)	Capacity 200 ml or more
	1	Lid (B)	To fit jar (A)
(2) Dryer	1	Small Tin Can (C)	To fit inside jar (A)
	1	Wire Mesh (D)	To cover tin can (C)
		Calcium Chloride or Silica Gel (E)	--
(3) Tubing	1	Rubber Tubing (F)	1 cm diameter, 15 cm long
	1	Glass Tube (G)	0.7 cm diameter, 5 cm long
	1	Screw Clamp or Pinch Clamp (H)	(IV/A4 or A5).

b. Construction

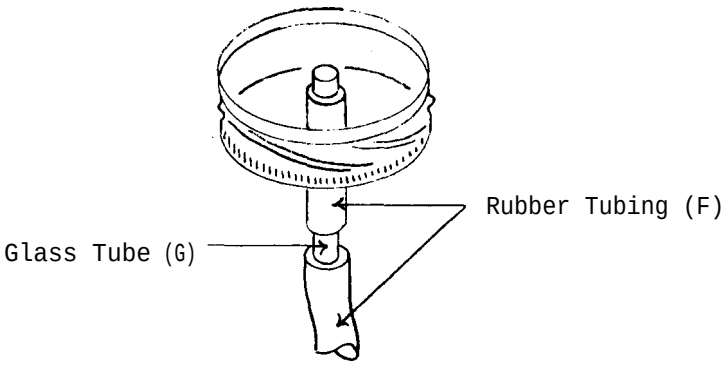
(1) Container

Select a jar (A) with a screw top (B) and a very wide mouth. Cut a hole slightly less than 1.0 cm in diameter in the center of the jar lid (B).

(2) Dryer

Take a short tin can (C) which fits easily into the jar, or cut a taller can to a height of 2 - 3 cm.

Place a drying agent, such as calcium chloride ($CaCl_2$) pellets or silica gel (C) in the can. Cover the can with wire mesh (D) and set it in the bottom of the jar (A).

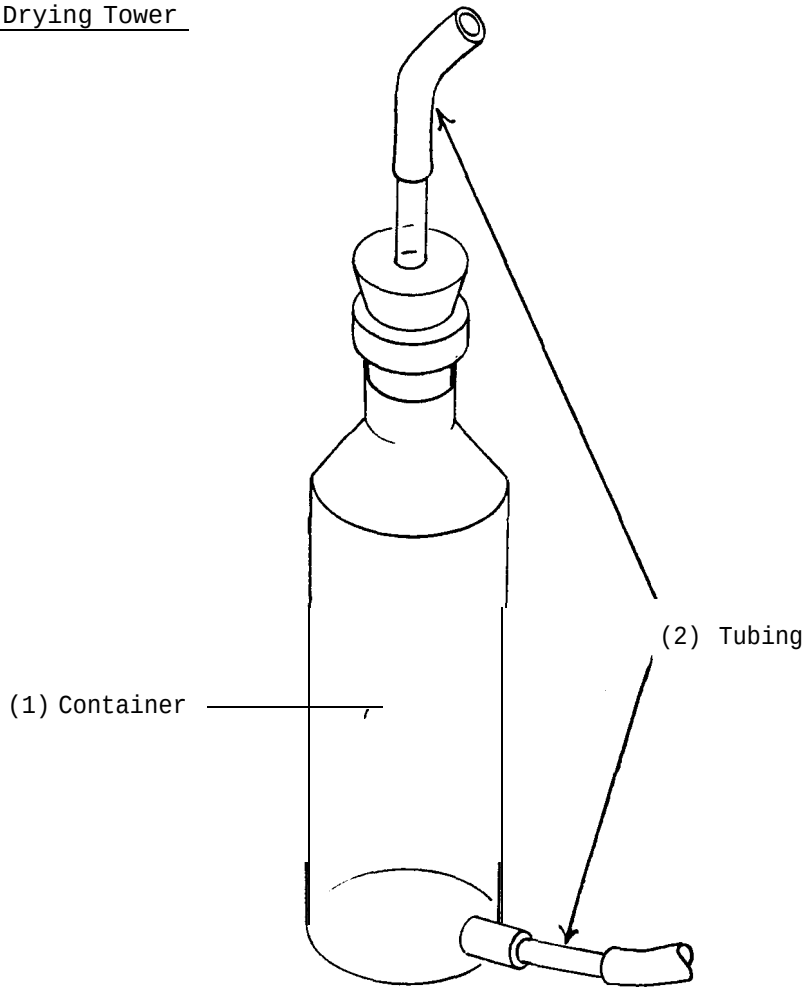


Cut a section of about 3 cm from the piece of rubber tubing (F). Insert one end of the glass tube (G) all the way into this short piece of rubber tubing. Insert the other end of the glass tube (G) into the longer section of rubber tubing. Push the shorter piece of rubber tubing, with the glass tube inside, into the hole in the top of the jar lid (B). Seal the tubing into the hole in the jar with cement, if necessary, to make an airtight seam. Seal the long rubber tube with a pinch clamp (IV/A4) or screw clamp (IV/A5).

C.Notes

(i) Powders or substances to be kept free of moisture are placed in containers inside the dessicator, and the top is sealed. The rubber and glass tube arrangement permits a partial vacuum to be formed in the dessicator if it is used in conjunction with a vacuum pump.

A2, Drying Tower



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Container	1	Glass Bottle (A)	Capacity approximately 300-400 ml
	1	l-Hole Stopper (B)	To fit bottle (A)
(2) Tubing	3	Rubber Tubing (C)	1 cm diameter, 5 cm long
	2	Glass Tubing (D)	0.7 cm diameter, 5 cm long

b. Construction

(1) Container

Drill a hole just slightly smaller than 1.0 cm in the side of the bottle (A) near the bottom (I/E2). Fit the bottle (A) with a one-hole cork or rubber stopper (B).

(2) Tubing

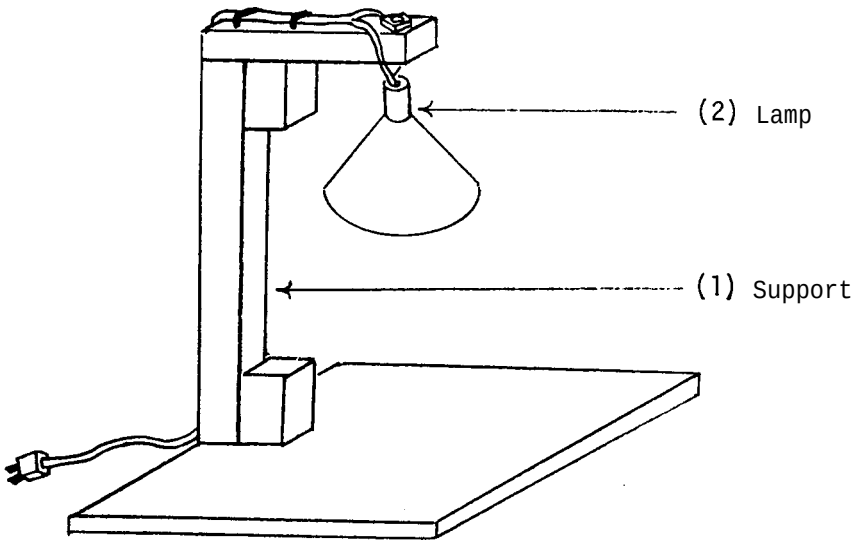
Insert one of the pieces of glass tubing (D) into the one-hole stopper, and push a piece of rubber tubing (C) on to the other end of the glass tube.

Insert one piece of rubber tubing (C) into the hole in the bottle (A), and cement it in place to make an airtight seal. Push the second piece of glass tubing (D) into the rubber tubing (C), and connect the last piece of rubber tubing (C) to the glass tube (D).

c. Notes

(1) This apparatus is used in removing moisture from gases. For example, moisture can be eliminated from H_2, O_2, N_2, Cl_2, and SO_2 by filling the drying tower with calcium chloride or other drying agent and connecting it by means of the tubing connections at top and bottom, between the gas generator and collecting device. As the gas passes through the drying tower, moisture is absorbed by the drying agent.

A3. Electric Lamp Dryer

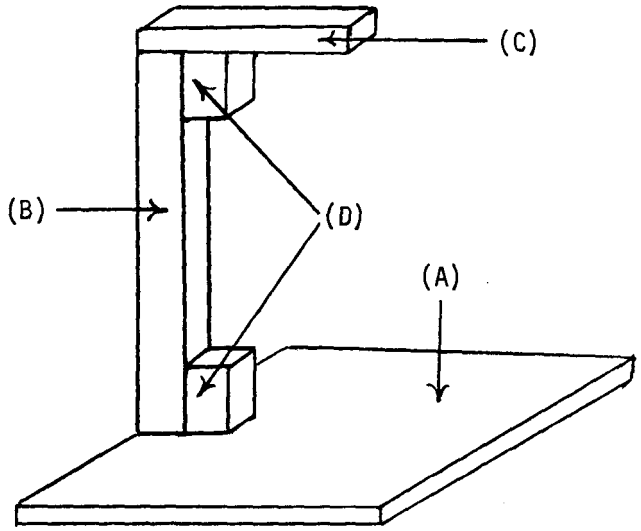


a. Materials Required

Components'	Qu	Items Required	Dimensions
(1) Support	1	Wood (A)	30 cm x 30 cm x 1 cm
	1	Wood (B)	1 cm x 2 cm x 32 cm
	1	Wood (C)	1 cm x 2 cm x 18 cm
	2	Wood (D)	4 cm x 4 cm x 2 cm
(2) Lamp	1	Lamp Socket (E)	--
	1	Insulated Electrical Cord and Plug (F)	--
	1	Incandescent Bulb (G)	100 watts
	4	Large Staples or Thin Nails (H)	--
	1	Bolt (I)	Approximately 0.8 cm x 3 cm
	1	Nut (J)	To fit bolt (I)
	1	Wire Mesh (K)	20 cm x 20 cm
	1	Thin Wire (L)	15 cm
	1	Aluminum Foil (M)	20 cm x 20 cm

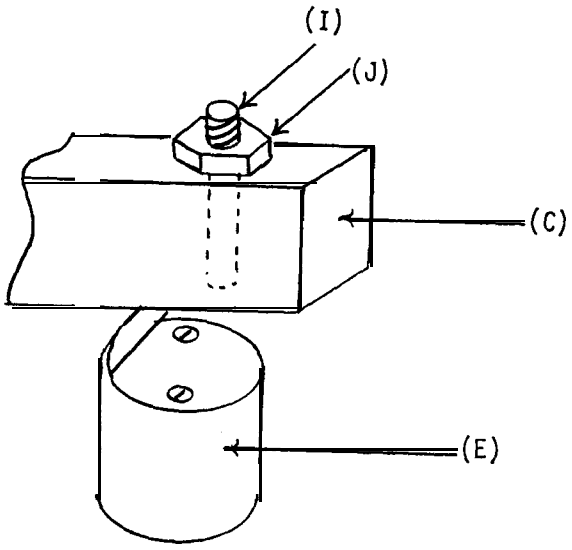
b. Construction

(1) Support



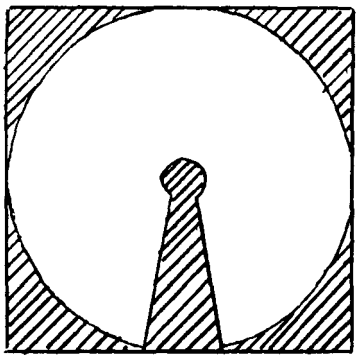
Construct the support as illustrated. Use glue and screws to secure the parts (A), (B), (C) and (D) to one another.

(2) Lamp

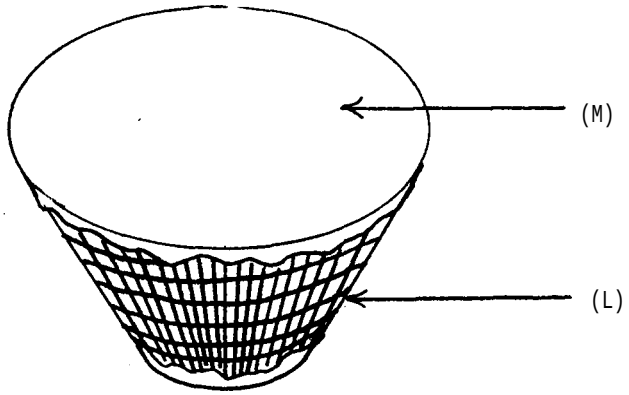


Secure the lamp socket (E) to the top horizontal bar (C) with the nut (J) and bolt (I).

Attach the electrical cord, with plug attached (F), to the socket (E). Run the wire along the top bar (C) and down the back of the vertical support (B). Secure the cord in position with large staples (H), bent nails, or tape.



From the wire mesh (K), cut a circle. Cut out and remove the shaded portion as shown. cut a similar but slightly larger shape from the aluminum foil (M). Curve the wire mesh (K) into a cone with an open end that will fit over the base of the incandescent bulb (G), and secure the cut edges together by threading the thin wire (L) in and out of the wire mesh.



Cover the inside of the wire mesh cone (K) with the foil (M), shiny side to the inside of the cone. Secure the foil reflector (M) to the wire mesh (L) by bending the foil edges around the wire mesh cone.

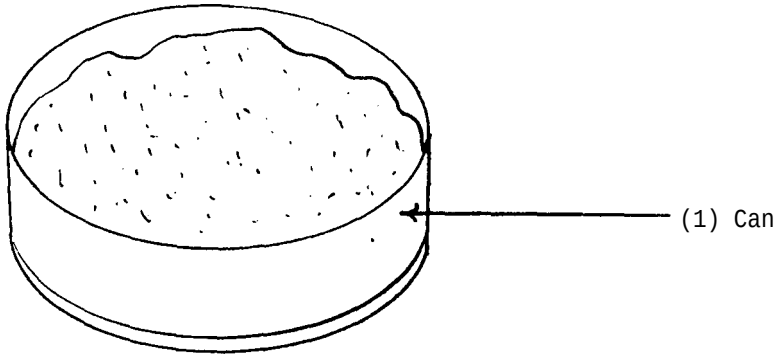
Slip the small end of the reflector over the neck of the bulb (E) and screw the bulb into the socket (E).

c. Notes

(i) The light provides a heat source for drying precipitates which are placed in shallow containers, watch glasses (V/A5) or petri dishes (V/A6).

(ii) Experimentation in the use of the dryer might include varying the size of the reflector, distance of the bulb from the material, wattage of bulb and number of bulbs used.

A4. Sand Bath



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Can	1	Large Tin Can (A)	15-20 cm diameter
	--	Sand (B)	--

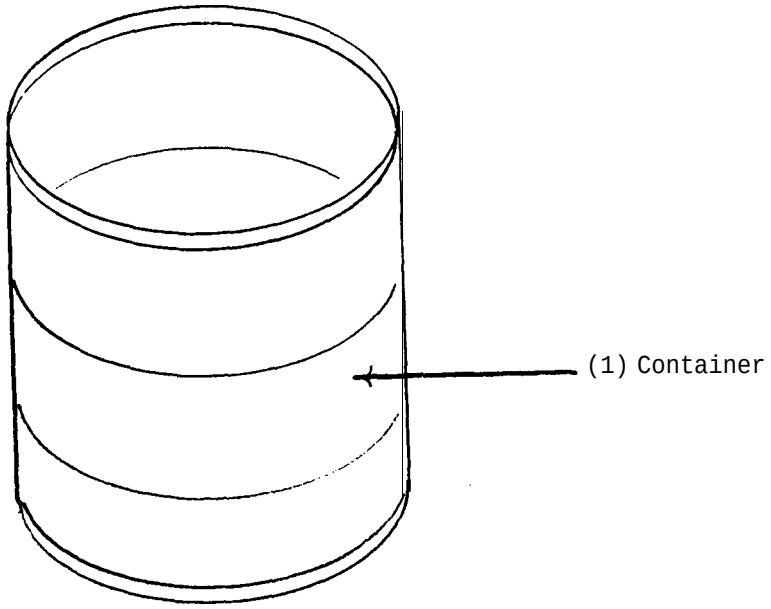
b. Construction

(1)Can — Use a large, shallow tin can (A) as a container, or cut a larger can to a height of about 5 cm. Fill the container with sand (B).

C. Notes

(1) Solutions or precipitates that must be evaporated or dried slowly may be placed in shallow containers, watch glasses, or petri dishes which are rested on the sand, The sand bath is then rested on a tripod (IV/B3), heating stand (IV/B4) or other suitable support and slowly heated with an alcohol or gas burner.

A5. Water or Steam Bath



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Container	1	Tin Can (A)	Capacity approximately 150-300 ml

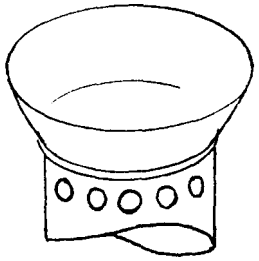
b. Construction

(1) Container — Use an empty, clean tin can (A) for the container. Fill it about 2/3 full of water.

C. Notes

(i) Use of the water bath is a safe way to heat materials that must not, for technical or safety reasons, be heated above about 100'C. Test tubes containing material to be heated are placed in the water bath. The water bath is rested on asuitable support and heated with an alcohol or gas burner. Materials heated in the test tubes will be heated to a temperature not higher than the boiling point of the water.

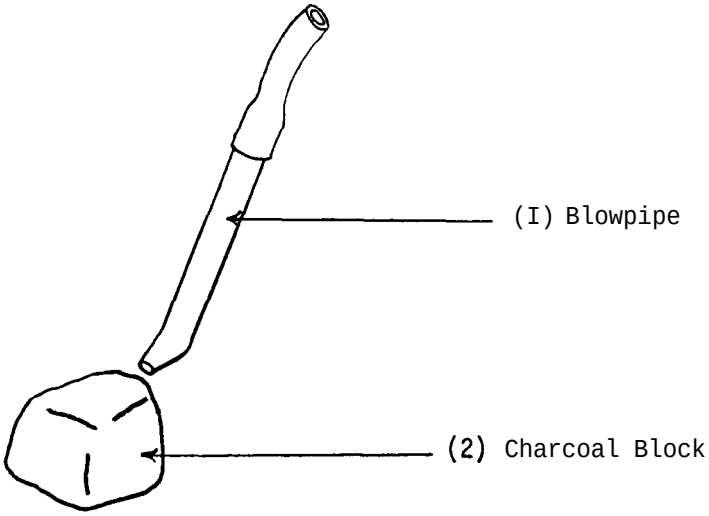
(ii) The water bath may be converted to a steam bath by the addition of a row of holes punched or drilled around the can near the top. The can is filled about 1/3 full of water, and a petri dish (V/A6) or watch glass (V/A5) containing material to be heated is rested on top.



The steam bath is rested on a suitable support and heated; as the water boils, the steam will heat the material in the petri dish or watch glass and will be able to escape through the holes in the top of the can.

B. HEATER

B1. Blowpipe for Charcoal Block



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Blowpipe	1	Rubber Tubing (A)	Approximately 1.0 cm diameter, 10 cm long
	1	Glass Tubing (B)	Approximately 0.7 cm diameter, 20 cm long
(2) Charcoal Block	1	Charcoal Block (C)	--

b. Construction

(1) Blowpipe

Heat the glass tubing (B) near one end and bend it slightly as shown. Then heat it again, just past the bend, in order to draw it out to form a nozzle.

Fit the rubber tubing (A) over the other end of the glass tube (B).

(2) Charcoal Block

Use a lump of charcoal (C) as a heat source.

c. Notes

(i) This item is used to create a concentrated heat source by blowing through the blowpipe onto the charcoal ember.