IV. SUPPORTS, STANDS, AND HOLDERS

A. HOLDERS

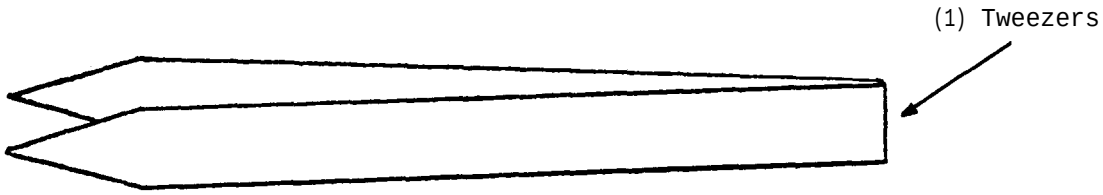
Holders are classified as small, portable, hand-held devices used to support other pieces of apparatus.

B. SUPPORTS AND STANDS

These devices are used to hold items stationery for relatively long periods of time.

A. HOLDERS

Al. Tweezers (Forceps)



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Tweezers	1	Forceps	BIOL/II/A4

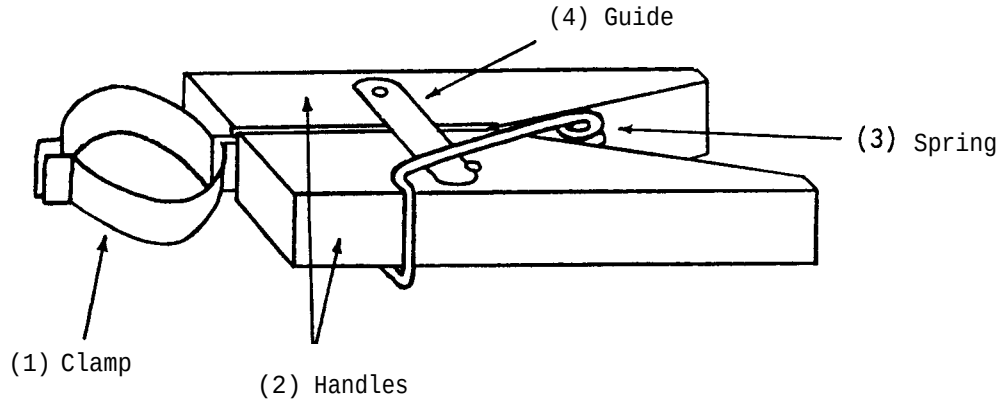
b. Construction

(1) Tweezers — See BIOL/II/A4 for construction details.

C. Notes

(i) Uses of forceps in chemistry operations include the handling of small items or radioactive materials.

A2. Multi-Purpose Design Holder

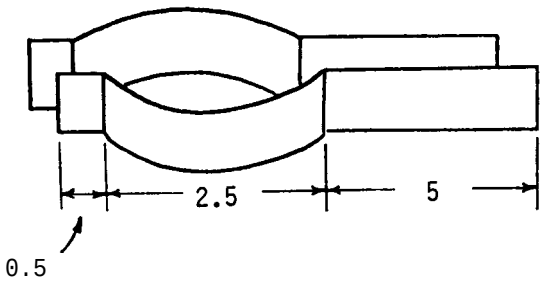


a. Materials Required

Components	Qu	Items Required	Dimensions.
(1) Clamp	2	Metal Strapping (A)	B cm x 1.5 cm
(2) Handles	1	Wood Block (B)	2cmx 4 cm x 15 cm
	4	Nails (C)	0.5 cm thick x 1 cm long
(3) Spring	1	Heavy Iron Wire (coat hanger) (D)	Approximately 30 cm long
(4) Guide	2	Metal Strapping (E)	1.5 cm x 3.5 cm
	4	Nails (F)	0.5 cm thick x 1 cm long

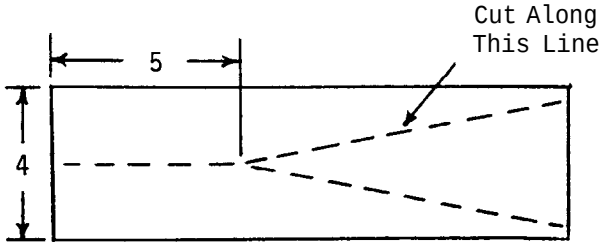
b. Construction

(1) Clamp

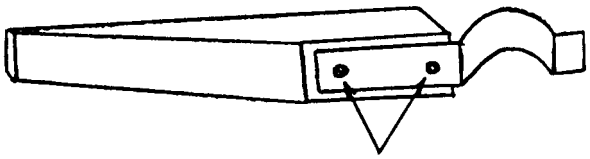


Bend the two pieces of metal strapping (A) as indicated.

(2) Handles

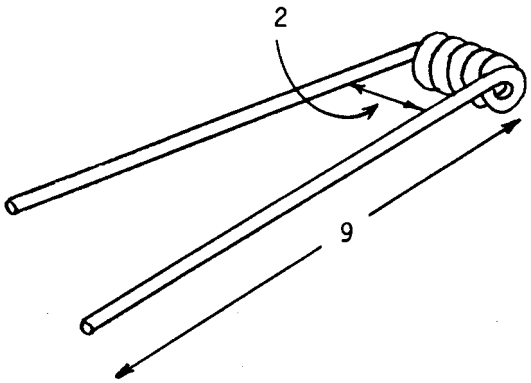


With a pencil and ruler, section the wood block (B) as shown. Cut two wedges and discard the triangular portions as waste.

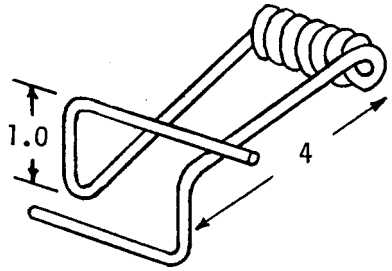


Nails (C)

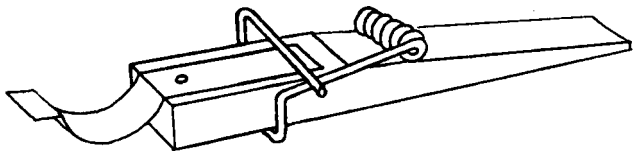
Fasten one strapping clamp to the short end of each of the handles with the nails (C).



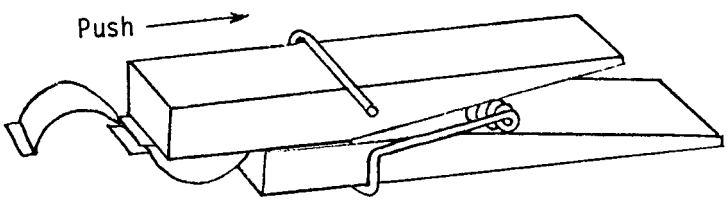
Clamp a pencil or stick of about 0.8 cm diameter in a vise, Starting at the center of the wire (D), coil the wire around the pencil. Make at least six turns, or a coil that extends beyond the width of the wood block (2 cm) by one wire-thickness on each side, Leave at least 9 cm of straight wire at each end of the spring.



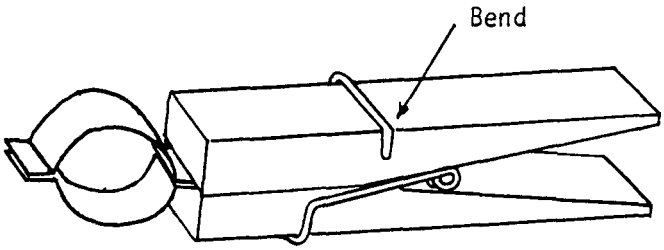
Approximately 4 cm from the spring, make a 90' bend in each straight section of wire, as shown. One cm from each of the first bends, make a second 90' bend.



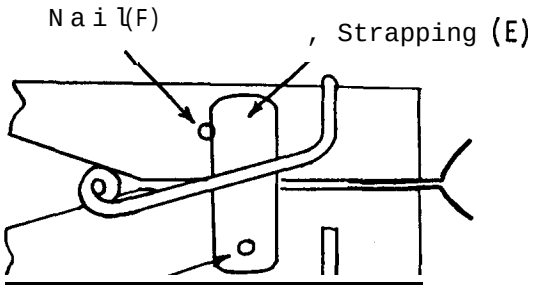
Slide the spring on to one of the handles as shown.



Slide the second handle into place.



Trim excess wire to within 1.5 cm of the edge of the handle. Bend this remaining wire around handles to hold the spring in place.



Top View

Lay the holder on its side. Slide one small piece of strapping under the spring as shown. Secure the strapping in place on one handle with one nail. Nail a second guiding nail into the other handle just at the edge of the strapping. Turn the holder over and repeat with another small piece of strapping. These guides keep the handles from twisting out of alignment.

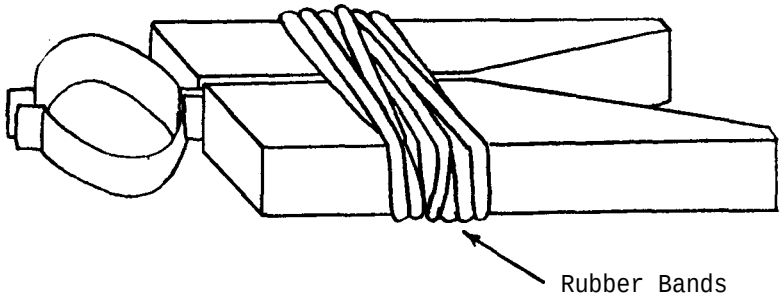
C.Notes

(i) This design is based on the spring-type clothespin. If one isavailable, it will be a helpful construction guide.

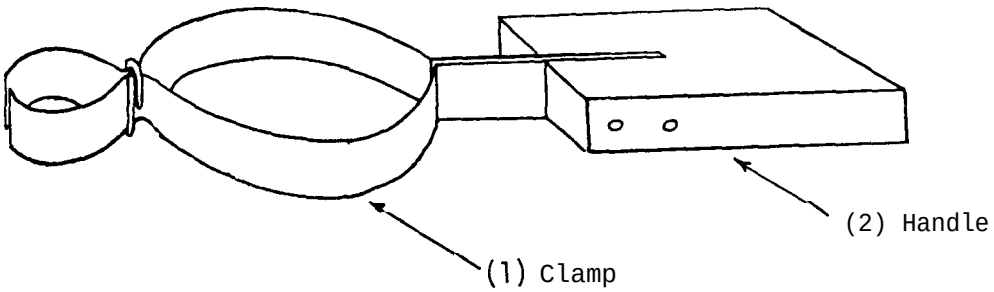
(ii) Squeezing the handles together will cause the clamp to open and close.

(iii) The sizes of the components used in this item will vary with the use to be made of the holder. The clamp and handle can be reduced in size for use with test tubes, or enlarged for use with large flasks.

(iv) For a simpler version of this design, three or four strong rubber bands provide the spring action. Cut the handles and attach the clamps as described. Then place the two handles together as indicated in the diagram. Wrap the rubber bands around the top part of the handles to draw them together. The chief problem with using rubber bands is that they will deteriorate and must be replaced from time to time.



A3. Test Tube Holder

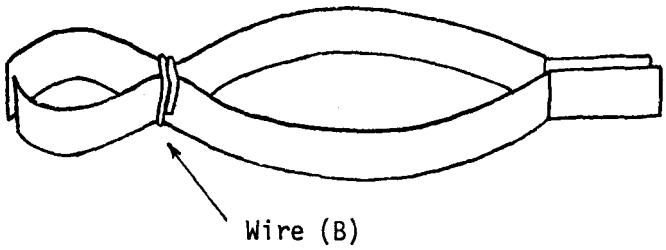


a. Material Required

Components	Qu	Items Required	Dimensions
(1) Clamp	2	Metal Strapping (A)	20 cm long
	1	Thin Wire (B)	Approximately 0.1 cm thick, 4-5 cm long
(2) Handle	1	Wood Block (C)	Approximately 10 cm x 3 cm x 2 cm

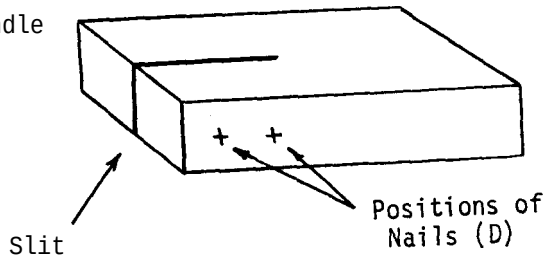
b. Construction

(1) Clamp



Bend two loops in each piece of strapping (A) as shown. Fit the smaller loops to the test tubes to be used. Wrap a small piece of wire (B) around the two pieces of strapping at the point where they curve inward, just behind the front loops, to hold the pieces together.

(2) Handle



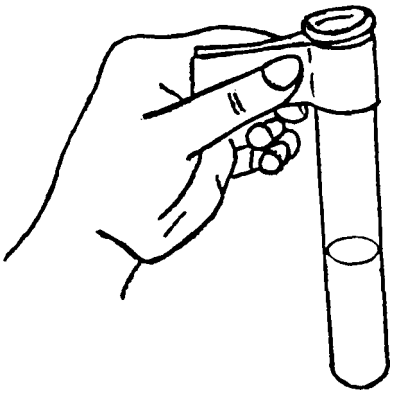
Cut a slit about halfway down the center of the block (C). Insert the flat portions of the strapping clamps into the slit. Secure the clamp to the handle with two nails.

c, Notes

(i) To open this clamp, squeeze together the large loop between the handle and the wire. Release the loop to close the clamp.

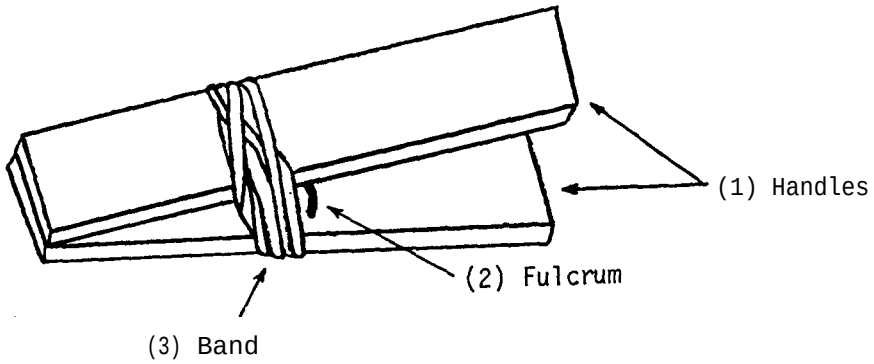
(ii) This design is best suited for small, light-weight test tubes.

(iii) A quick and convenient holder for handling hot test tubes can be made with a piece of paper measuring approximately 15 cm x 8 cm. The paper is folded into



thirds, lengthwise, to form a strip. This strip can be wrapped around a test tube near the top. then grasped tightly, next to the test tube.

A4. Wooden Pinch Clamp



a. Materials Required

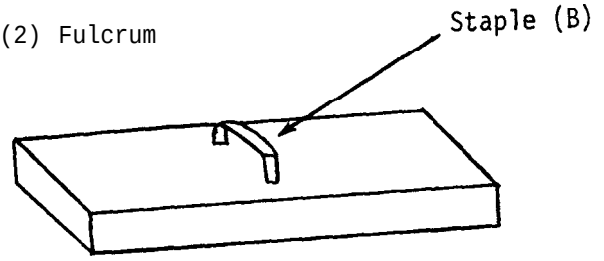
Components	Qu	Items Required	Dimensions
(1) Handles	2	Wooden Strips (A)	2 cm x 8 cm x 0.5 cm
(2) Fulcrum	1	Metal Staple or Tack (B)	1 cm wide
(3) Band	2	Rubber Bands (C)	0.5 cm x 9 cm

b. Construction

(1) Handles

Sand any splinters or rough edges from the wood strips (A).

(2) Fulcrum



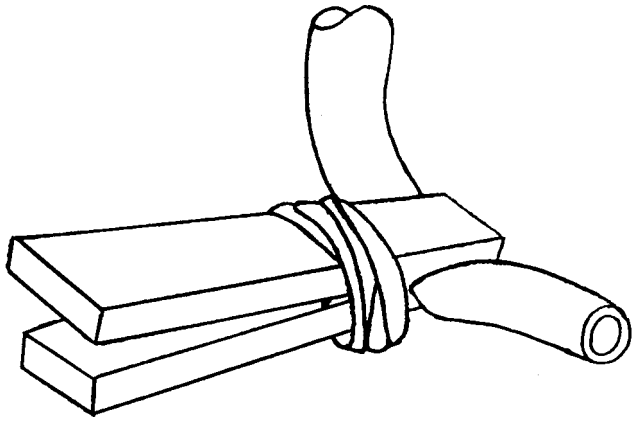
Drive the staple (B) or tack into the middle of one of the handles. Allow about 0.5 cm of the staple or tack to protrude from the wood.

(3) Band

Place the handles together with the fulcrum between them. Wrap the two rubber bands (C) tightly around the handles at a point just in front of the fulcrum.

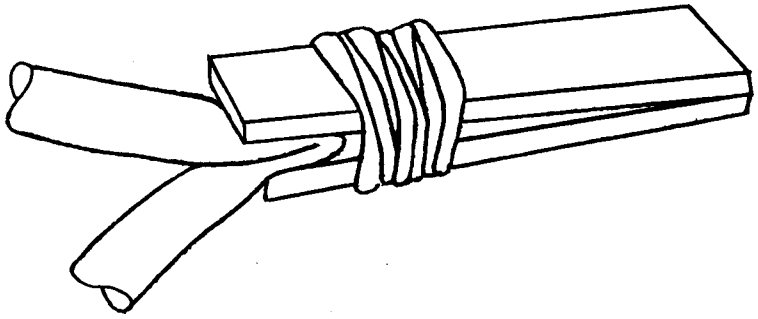
C.Notes

(i) If the rubber bands are sufficiently tight, it should be possible to



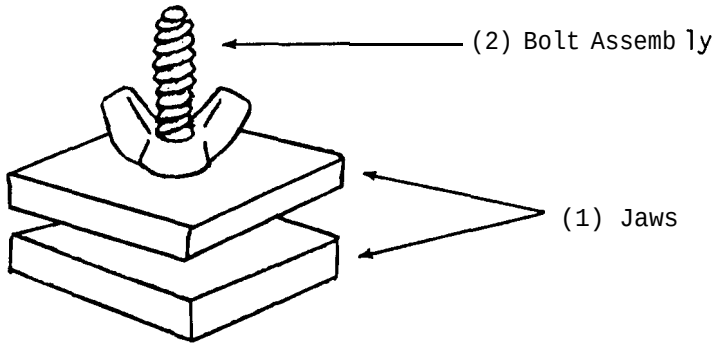
completely close off the flow of a liquid such as water through 1 cm wide rubber tubing,

(ii) To completely close off plastic tubing and heavier rubber tubing, it will be necessary to bend the tubing back upon itself and secure the clamp at the bend.



(iii) If pinch-typeclothespinsare available, they may be substituted for this clamp. However, it will be necessary to bend rubber tubing as well as plastic tubing back upon itself, as in the above illustration, in order to completely close the tubing with a clothespin clamp.

A5. Wooden Screw Clamp



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Jaws	2	Wood (A)	3.5 cm x 3.5 cm x 0.7 cm
(2) Bolt Assembly	1	Bolt (B)	0.5 cm diameter, approximately 4-5 cm long
	1	Wing Nut (C)	To fit bolt (B)

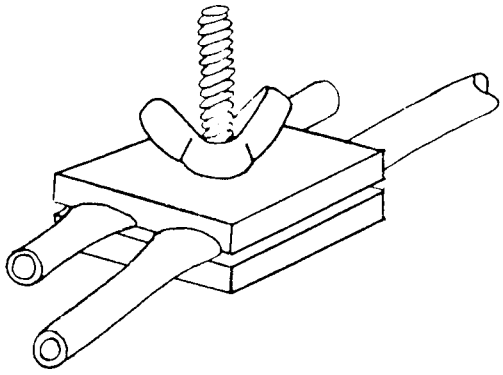
b. Construction

(1) Jaws — Sand the wood squares (A) to remove rough edges and splinters. Drill a hole 0.6 cm in diameter in the center of each square.

(2) Bolt Assembly — Insert the bolt (B) through the hole in each square and check to see that the holes are just large enough to permit the bolt to slide through easily. Screw the wing nut (C) in place on the bolt.

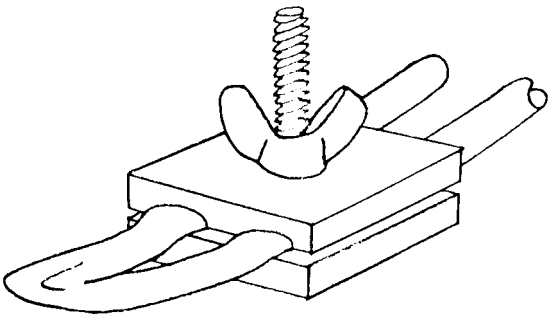
C.Notes

(i) To use this clamp with rubber tubing, a short (approximately 4 cm long) section of tubing of the same type as that in use is cut. The tubing in use is



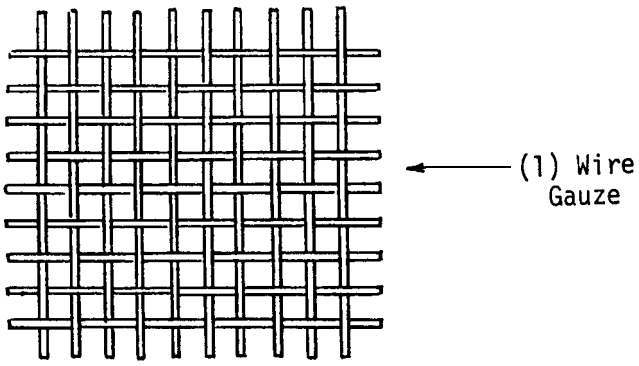
passed through the jaws on one side, as close to the bolt as possible. The short section of tubing is passed through the jaws on the opposite side to balance the force of the clamp. By turning the wing nut to tighten the clamp, the flow of a liquid or gas through rubber tubing can be controlled or shut off completely.

(ii) The flow rate of a liquid or gas through plastic tubing can be controlled in the same way, but the stiffness of plastic tubing makes it difficult to close the tubing completely. To close plastic tubing, it is necessary to bend the tubing back on itself, passing each section of the tubing through the clamp and tightening the wing nut as much as possible.



B. SUPPORTS AND STANDS

B1. Wire Gauze



a. Materials Required

Components	Qu	Items Required	Dimensions
(1)Wire Gauze	1	Wire Mesh (A)	Approximately 10 cm x 10 cm of heavy guage wire

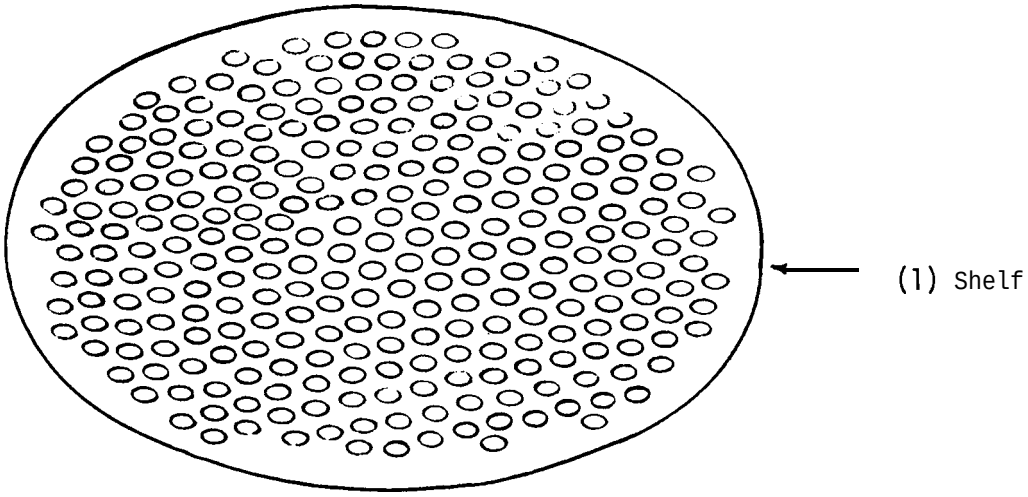
b, Construction

(1) Wire Gauze — Cut the wire mesh (A) to a size approximately 10 cm x 10 cm. Trim off sharp ends.

c. Notes

(i) This item is generally used in conjunction with the tripods and ring stand described in the sections that follow. The wire screen is placed on the tripod, heating stand, or ring to support a flask or beaker. A burner may be placed beneath the stand to heat the contents of the container.

B2. Heating Shelf



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Shelf	1	Tin Can Top or Bottom (A)	10 cm diameter or larger

b. Construction

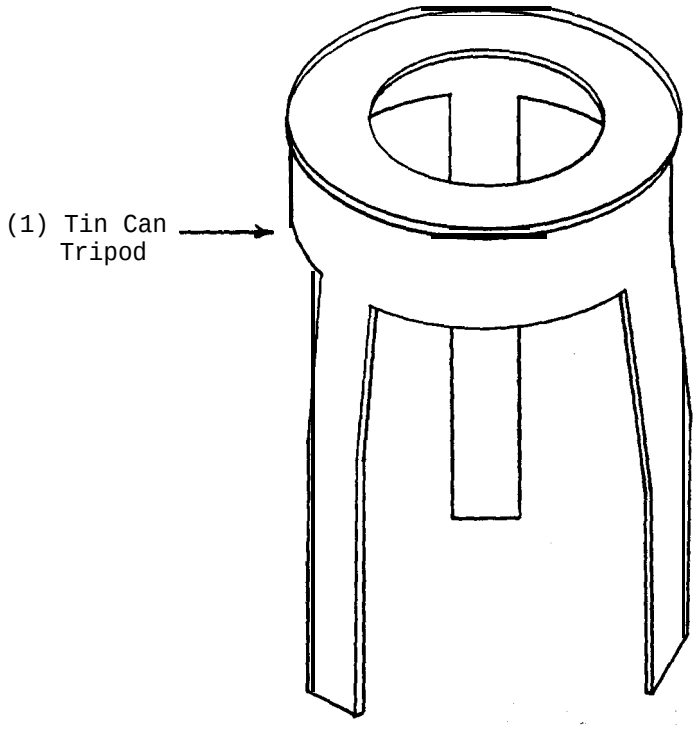
(1) Shelf — Remove the top (A) or bottom from a tin can. Punch many holes in it with a large nail.

c.Notes

(i) This item is used in the same way as the wire gauze (IV/Bl); that is, to support a flask, beaker, or other container upon a tripod or similar support.

(ii) This is also a useful item to keep hot glass from contacting the tabletop.

B3. (1) Tripod (Tin Can)

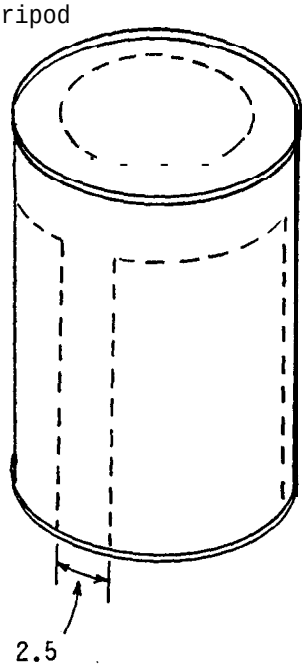


a. Material Required

Components	Qu	Items Required	Dimensions
(1) Tin Can Tripod	1	Tin Can (A)	Approximately 8 cm diameter, 12 cm high

b. Construction

(1) Tin Can Tripod

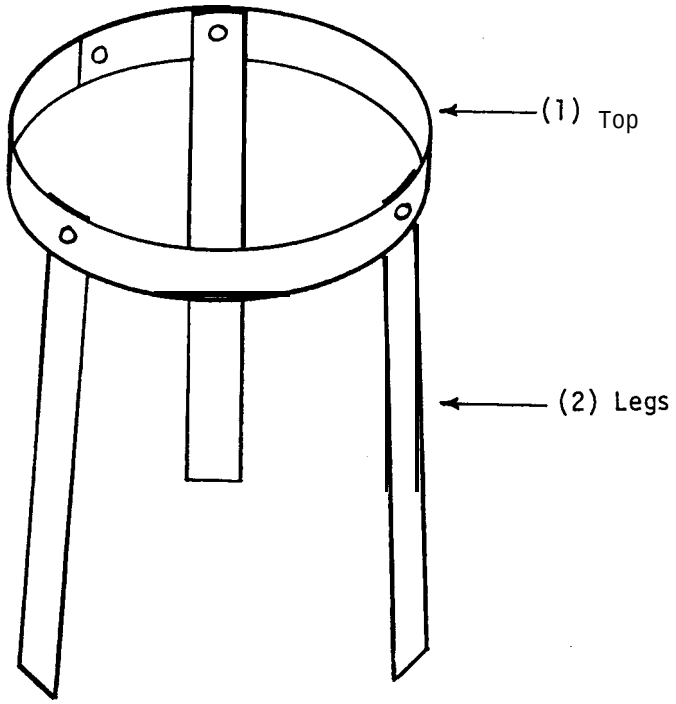


Cut a circle about 5 cm diameter from the bottom of the can (A). Mark the position for three legs, evenly spaced around the can. Allow a ring of about 1.5 cm at the top of the tripod before marking the legs. Allow approximately 2.5 cm for the width of each leg. Then cut along the marked lines to produce the three legs. With pliers, bend in the outside edge of each leg slightly to provide extra support.

C.Notes

(i) This tripod is simple to make, but it must be used with caution because of sharp edges and instability. It is suitable for supporting lightweight items, such as a funnel.

B3 (2). Tripod (Strappings)



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Top	1	Metal Strapping (A)	1.5 cm x 42 cm
(2) Legs	3	Metal Strapping (B)	1.5 cm x 34 cm

b. Construction

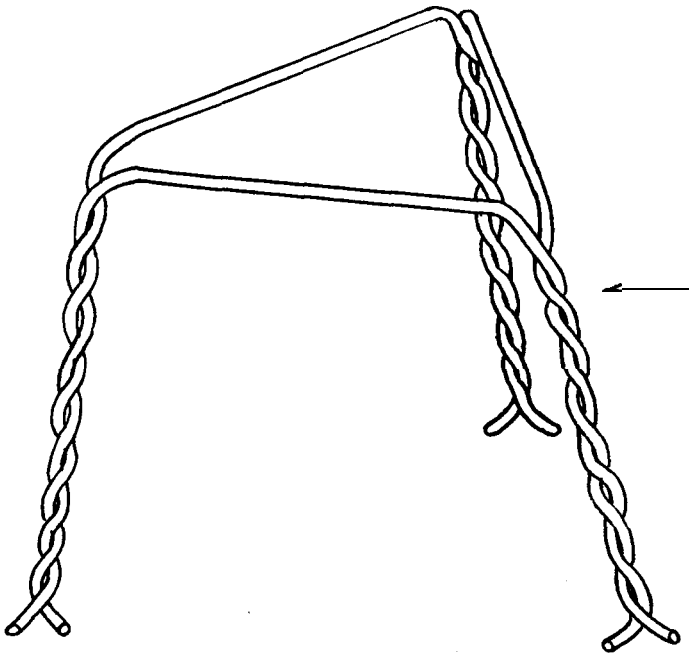
(1) Top — Bend the section of strapping (A) into a circle and secure the ends with a metal rivet.

(2) Legs — Fold each of the three sections of strapping (B) in half and pinch the fold closed. Secure the open ends of each leg to the top with metal rivets.

C.Notes

(i) The dimensions given produce a tripod that is useful for most applications, but this tripod can also be made larger or smaller by varying the length of the strapping used.

B3 (3). Tripod (Wire)



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Wire Tripod	3	Heavy Wire	0.2 cm diameter, 40 cm long

b. Construction

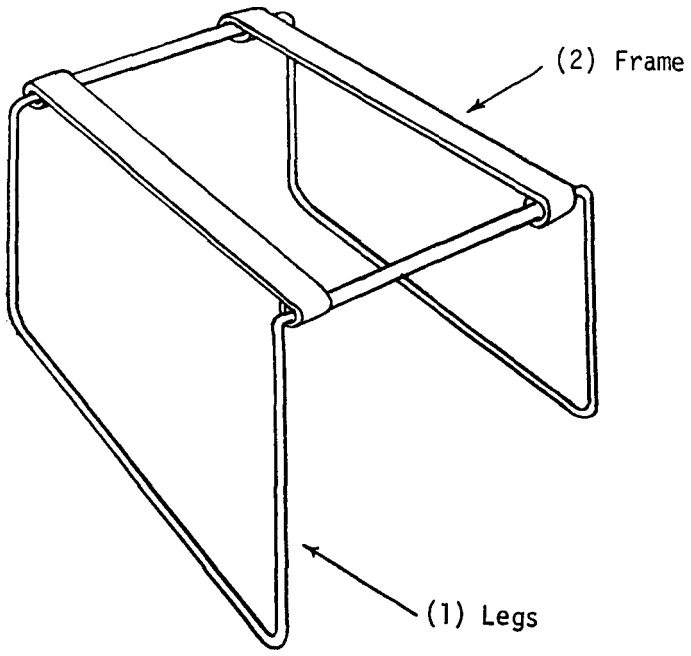
(1) Wire Tripod

Twist together the ends of two pieces of wire (A) for approximately 15 cm to form one leg. Twist the free ends of these two pieces together with each end of the third piece of wire. Make each twisted leg 15 cm long. Bend the legs down to form a tripod with a level top, as illustrated.

C.Notes

(1) This size tripod is useful for most applications, but it may also be made larger or smaller by varying the length of the wire used.

B4. Collapsible Heating Stand



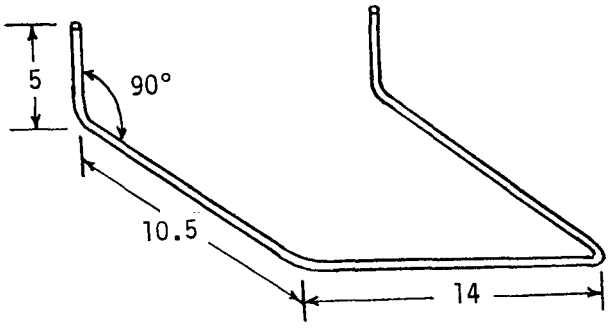
a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Legs	2	Thick Wire (A)	0.4 cm diameter, 45 cm long
(2) Frame	2	Metal Sheeting (B)	10 cm x 3 cm
	2	Metal Strapping (C)	1.5 cm x 16 cm

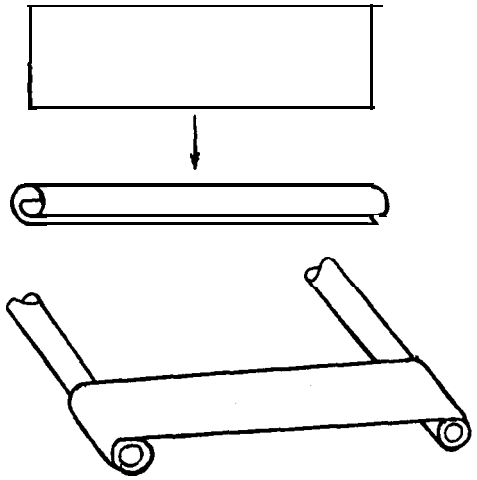
b. Construction

(1) Legs

Bend the two pieces of heavy wire (A) to the shape indicated.



(2) Frame



Strapping

Roll each of the rectangular pieces of metal sheeting (B) into long tubes that just fit around the legs.

Roll 3 cm at each end of the metal strapping pieces (C) around each end of the tubes.

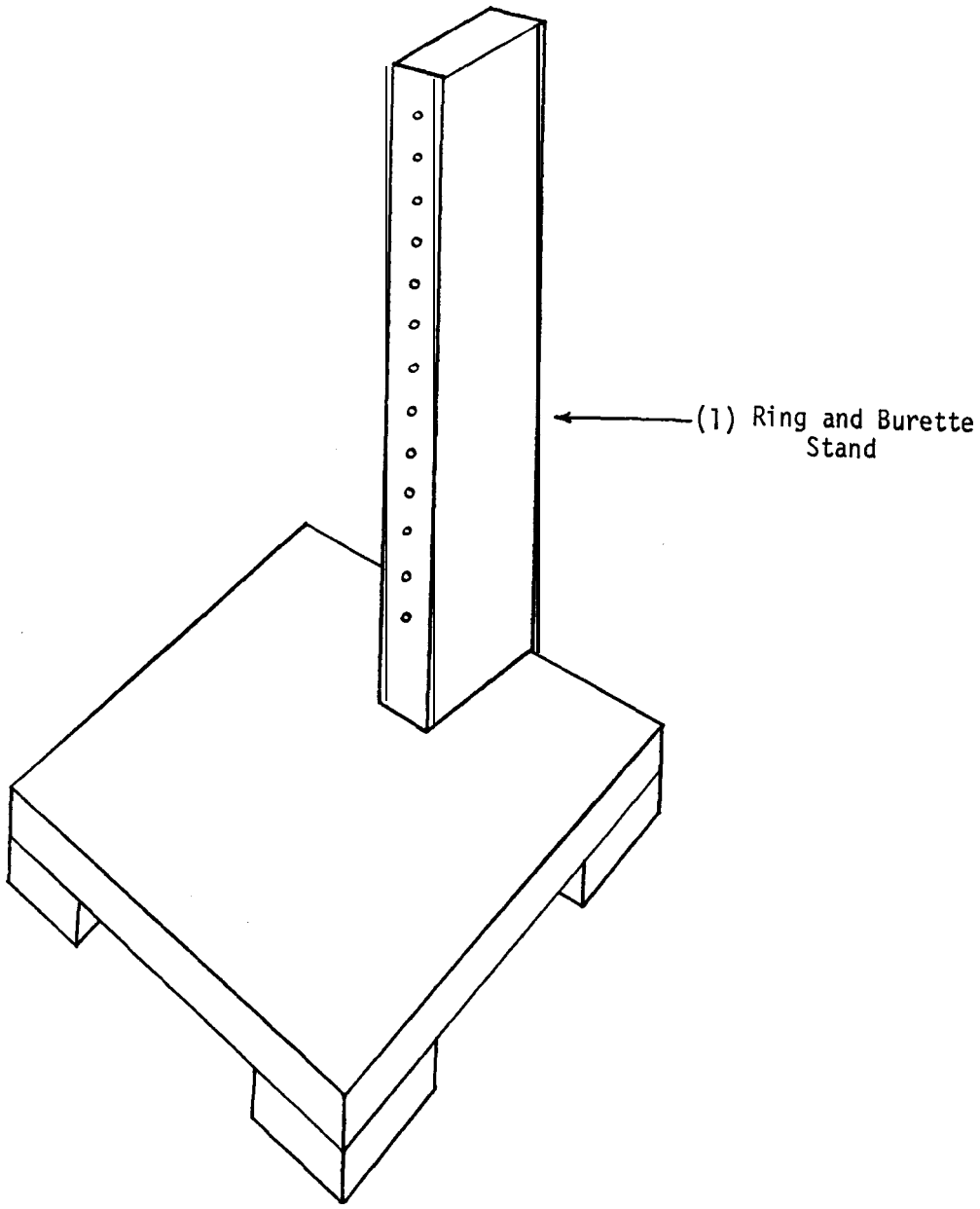
Insert the free ends of the legs (A) into the ends of the tubing (B) to complete this stand.

C. Notes

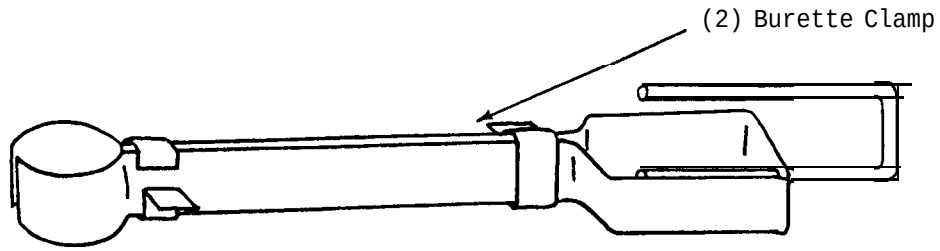
(i) Like the tripods, this stand is generally used with wire gauze (IV/Bl) or heating shelf (IV/B2).

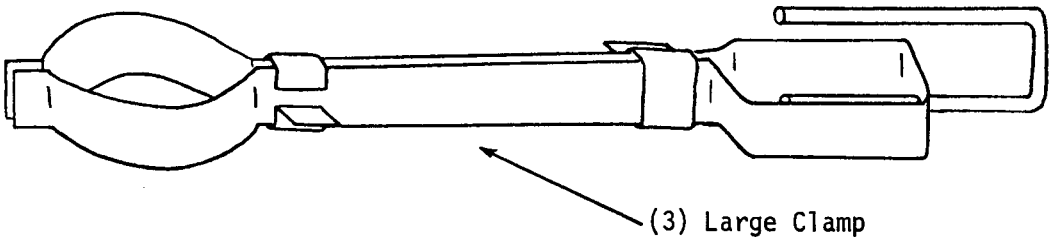
(ii) When this stand is not in use, the legs may be removed for ease in storing.

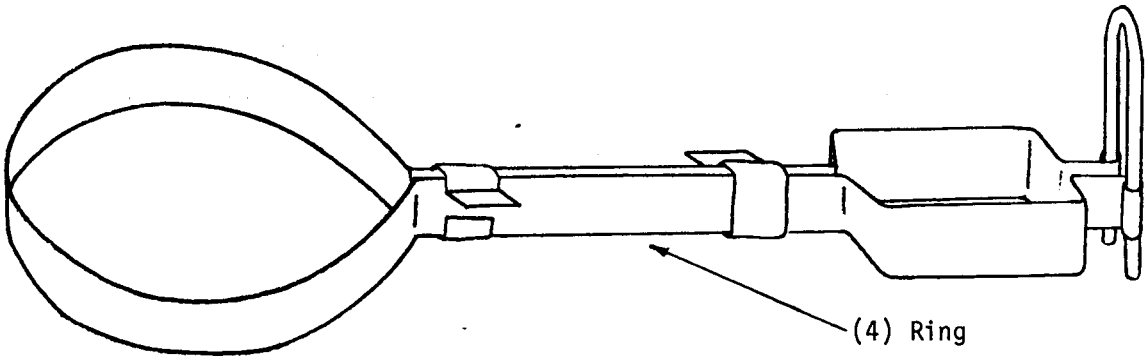
B5. Ring and Burette Stand with Attachments*

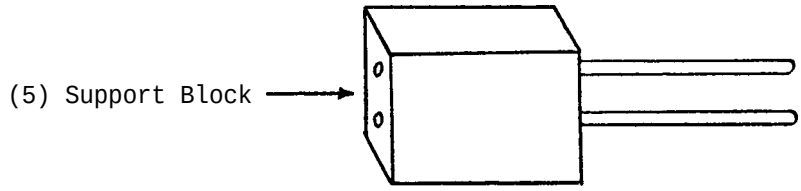


*Adapted from C. S. Rao (Editor), Science Teachers' Handbook, (Hyderabad, India: American Peace Corps, 1968), pp 144-146.









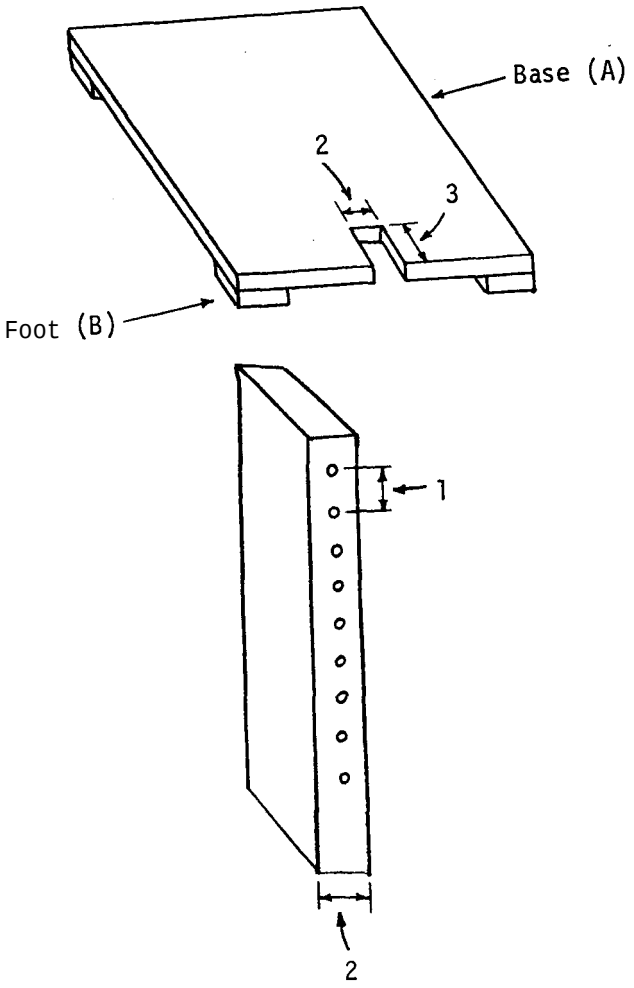
a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Ring and Burette Stand	1	Wood Block (A)	14 cm x 18 cm x 2 cm
	4	Wood Block (B)	2 cm x 4 cm x 1.5 cm
	1	Wood Block (C)	3 cm x 2 cm x 40 cm

(2) Burette Clamp	1	Metal Strapping (D)	1.5 cm x 27 cm
	2	Metal Strapping (E)	1.5 cm x 5 cm
	1	Heavy Wire (F)	0.2 cm diameter, 10-12 cm long
(3) Large Clamp	1	Metal Strapping (G)	1.5 cm x 35 cm
	2	Metal Strapping (H)	1.5 cm x 5 cm
	1	Heavy Wire (I)	0.2 cm diameter, 10-12 cm long
(4) Ring	1	Metal Strapping (J)	1.5 cm x 50-60 cm
	2	Metal Strapping (K)	1.5 cm x 5 cm
	1	Heavy Wire (L)	0.2 cm diameter, 10 cm long
(5) Support Block	1	Wood Block (M)	5 cm x 2 cm x 4 cm
	2	Nails (N)	0.35 cm diameter, 8 cm long

b. Construction

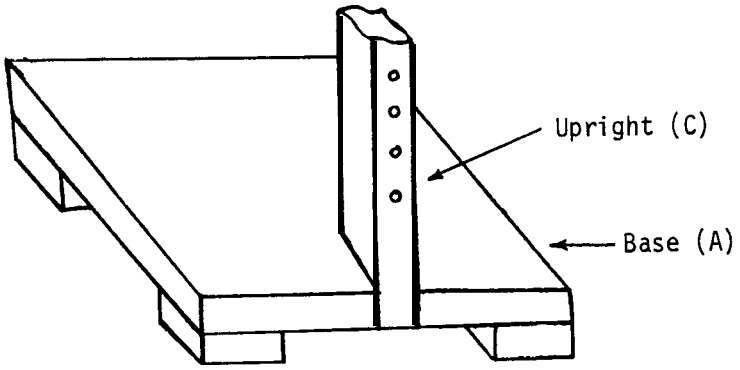
(1) Ring and Burette Stand



Sand all the wood blocks to remove splinters and rough edges. Nail a small wood block (B) to each corner of the flat block (A) to make feet.

In the center of one of the short sides of the base (A) cut a rectangular notch 3 cm long x 2 cm wide.

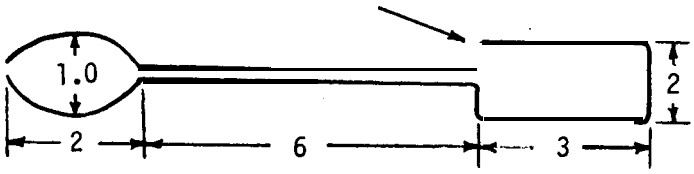
Drill 0.6 - 0.7 cm holes at 1 cm intervals all the way through the long block (C) as shown.



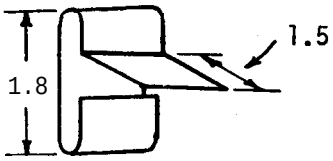
Fit this block into the rectangular notch in the base (A) and nail it in place to form the upright.

(2) Burette Clamp

Stand Attachment

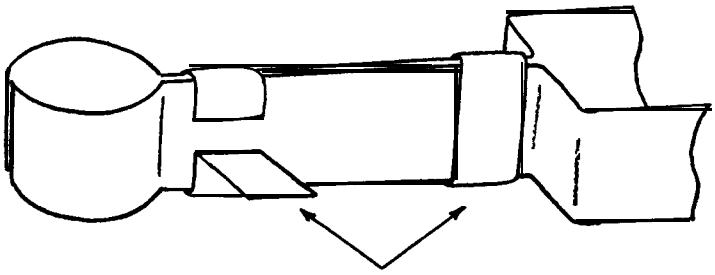


Bend the piece of metal strapping (D) as shown. Adjust the stand attachment section so that it will fit securely around the upright of the stand, yet be able to slide up or down along the upright.



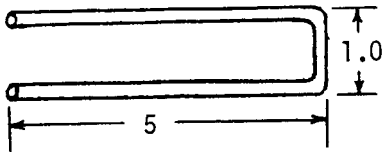
Bend two small pieces of strapping (E) as indicated to form tightening clips. Fit them around the straight section of the burette clamp to hold the clamp tightly closed.

Tightening Clip (E)

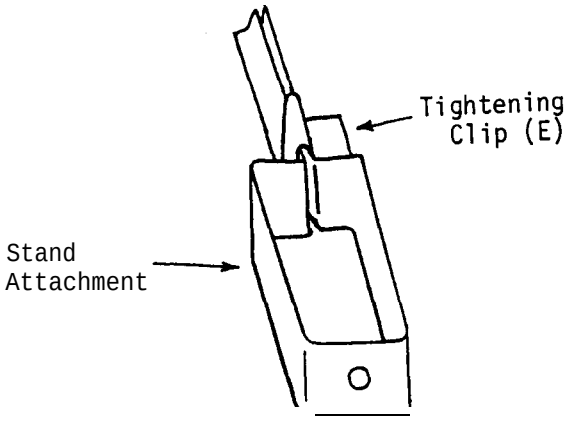


Tightening Clip (E)

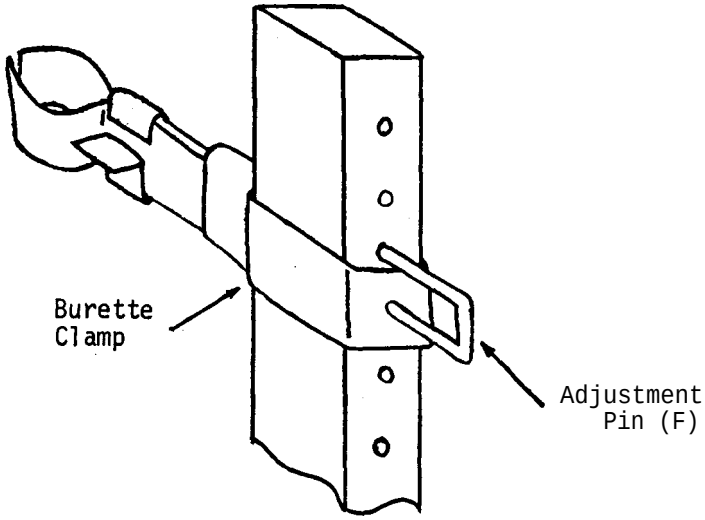
Adjustment Pin (F)



Bend a 10 - 12 cm piece of heavy wire (F) as indicated to make an adjustment pin. Adjust the width between the legs to match the holes drilled in the upright.

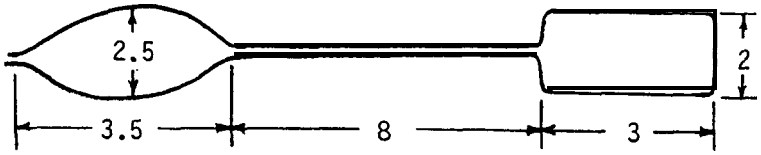


Drill a hole approximately 0.4 cm diameter in the burette clamp as shown.

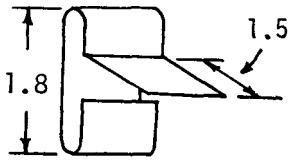


To position the burette clamp on the stand, slide the rectangular section of the clamp along the upright to the desired height, with the clamp facing the base of the stand. Align the hole in the burette clamp with a hole in the upright. Insert one of the legs of the adjustment pin through the burette clamp and into the upright. Insert the other leg of the pin into the next higher hole of the upright.

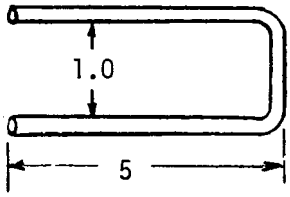
(3) Large Clamp



Bend the piece of strapping (G) in the same general shape as the burette clamp, but slightly larger.



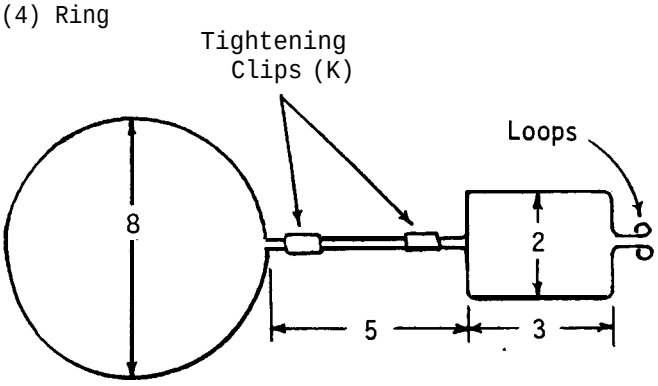
Construct two tightening clips (H) just as with the burette clamp. Position the clips on the clamp to hold it closed.



Construct an adjustment pin from a piece of heavy wire (I). Follow the procedure given for the burette clamp,

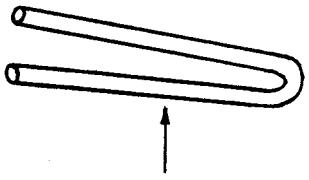
Drill a hole in the large clamp for the adjustment pin, as described for the burette clamp.

(4) Ring

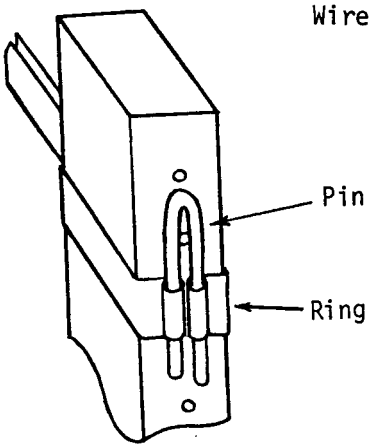


Bend the piece of metal strapping (J) into the shape shown. Bend the ends of the strapping into loops approximately 0.4 cm diameter.

Make two tightening clips according to the directions given with the burette clamp from the strapping (K). Secure them in the positions shown.

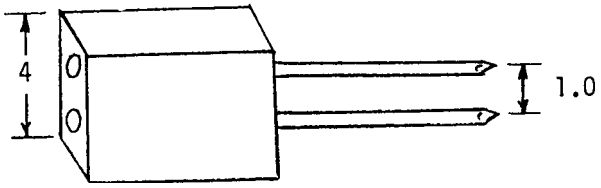


Construct a pin to hold the end loops together by bending the length of heavy wire (L) in half.

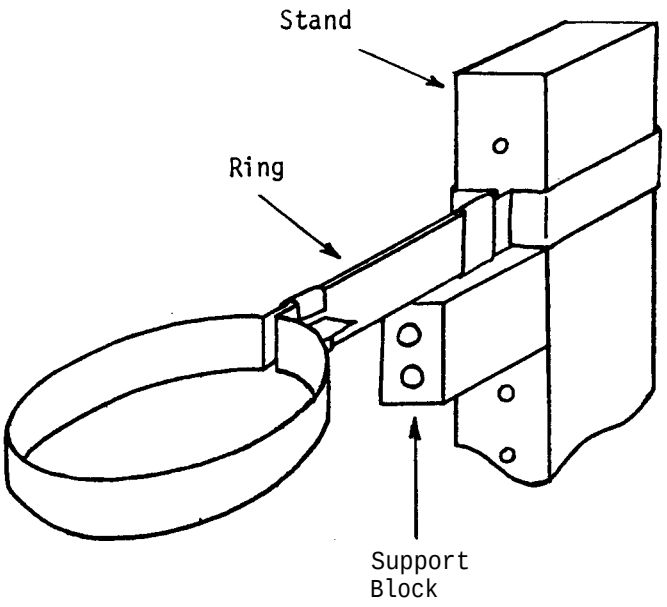


To position the ring on the stand, slide the rectangular section of the ring along with the upright to the desired height, with the clamp facing the base of the stand. Push the pin through the end loops.

(5) Support Block



Drive two nails (N) all the way into a small block of wood (M) 1 cm apart.



Position the support block to prevent the front of the ring from leaning forward under the weight of materials placed on it. Insert the two prongs of the support block into the two holes in the upright just below the ring.

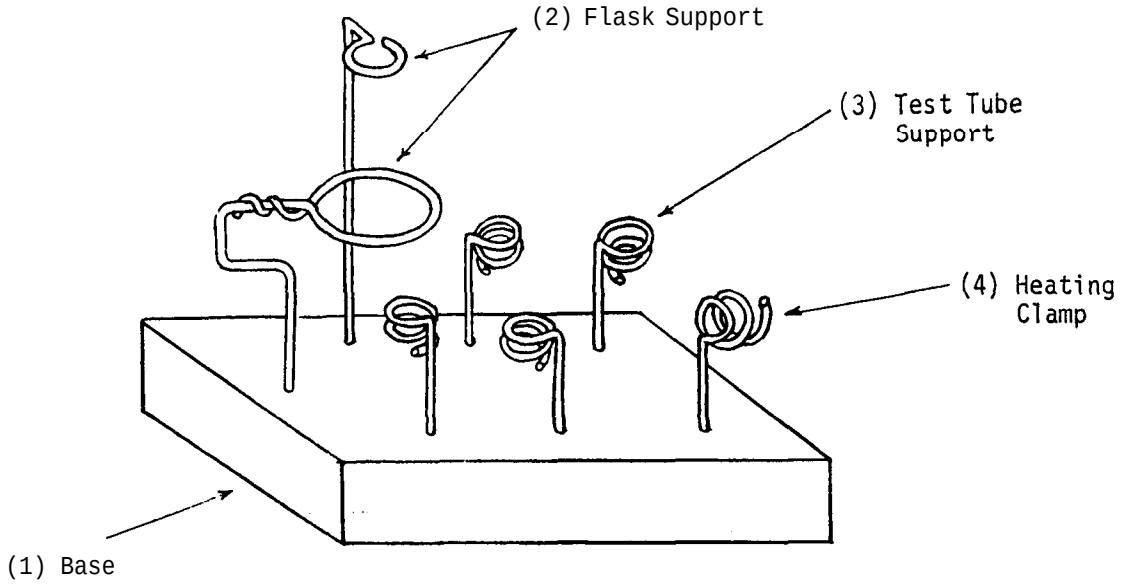
C.Notes

(i) To loosen the burette clamp or large clamp, slide the tightening clips toward each other. To tighten, slide the clips away from each other.

(ii) Although the burette clamp and large clamp have adjustment pins to hold them in place, they are much more stable when the support block is pushed into theupright iammediately beneath the clamp. This prevents the burette clamp or large clamp from leaning forward.

(iii) The ring will safely support masses up to about 1 kilogram. It can support round-bottomed containers or flat-bottomed containers with a diameter slightly larger than that of the ring. To support smaller containers, a wire gauze (IV/Bl) or heating shelf (IV/B2) may be placed on the ring. For large conatiners, a more stable support, such as one of the tripods (IV/B3) or the collapsible heating stand (IV/B4) is recommended.

B6. Multipurpose Stand

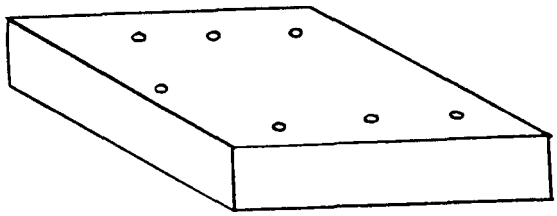


a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Base	1	Wood (A)	9 cm x 4 cm x 18 cm
(2) Flask Support	1	Heavy Wire (coat hanger) (B)	0.2 cm diameter, 35 cm long
	1	Heavy Wire (coat hanger) (C)	0.2 cm diameter, 40 cm long
(3) Test Tube Support	4	Heavy Wire (coat hanger) (D)	0.2 cm diameter, 15-20 cm long
(4) Heating Clamp	1	Heavy Wire (coat hanger) (E)	0.2 cm diameter, 20 cm long

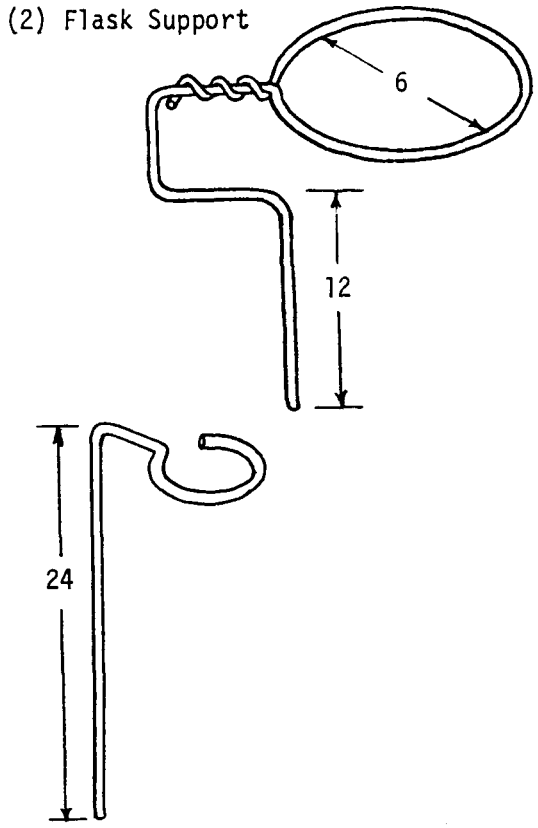
b. Construction

(1) Base



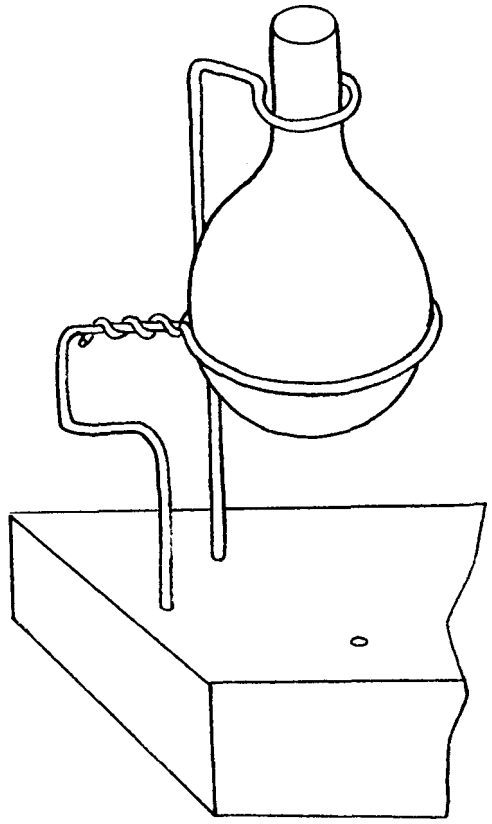
Drill seven holes approximately 0.2 cm in diameter into the wood block (A) as shown. If a larger block is used, or if more attachments are desired, drill more holes,

(2) Flask Support



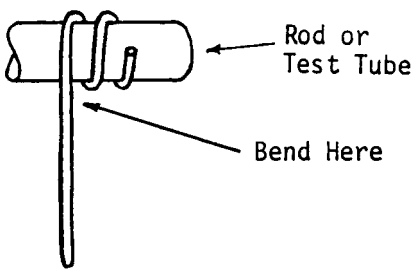
Bend the piece of heavy wire (C) as shown to form the base of the flask support. Make the circular loop about 6 cm in diameter.

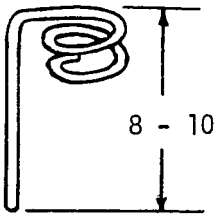
Bend the shorter piece of heavy wire (B) into a loop to form a support for the neck of a flask or light-bulb flask (IV/Al), Make the open loop about 4 cm in diameter.



Insert the two sections of the support into adjacent holes in the base. Adjust them so that they will support a flask or light-bulb flask as illustrated.

(3) Test Tube Support

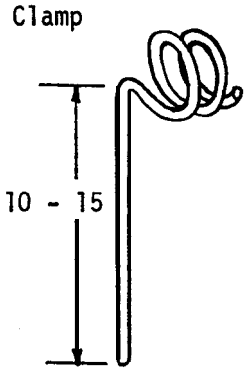




Use pliers to bend each of the pieces of heavy wire (D) around a wooden rod or test tube of the desired diameter (2 cm for example). Follow the steps illustrated.

Insert the supports into holes in the base.

(4) Heating Clamp

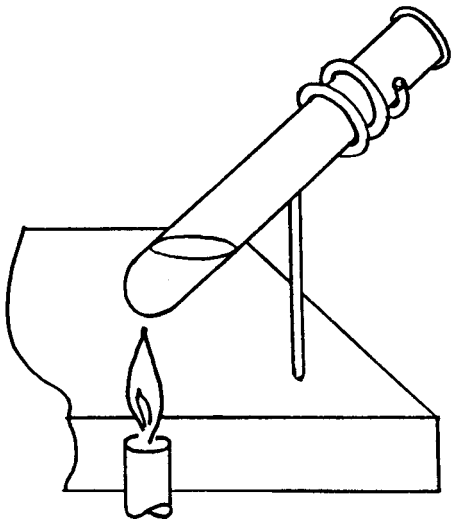


Bend the piece of heavy wire (E) into loop just as for the test tube support shown above. However, tilt the loop at an angle, rather than vertically as was done for the test tube supports. Insert the heating clamp into one of the holes in the base.

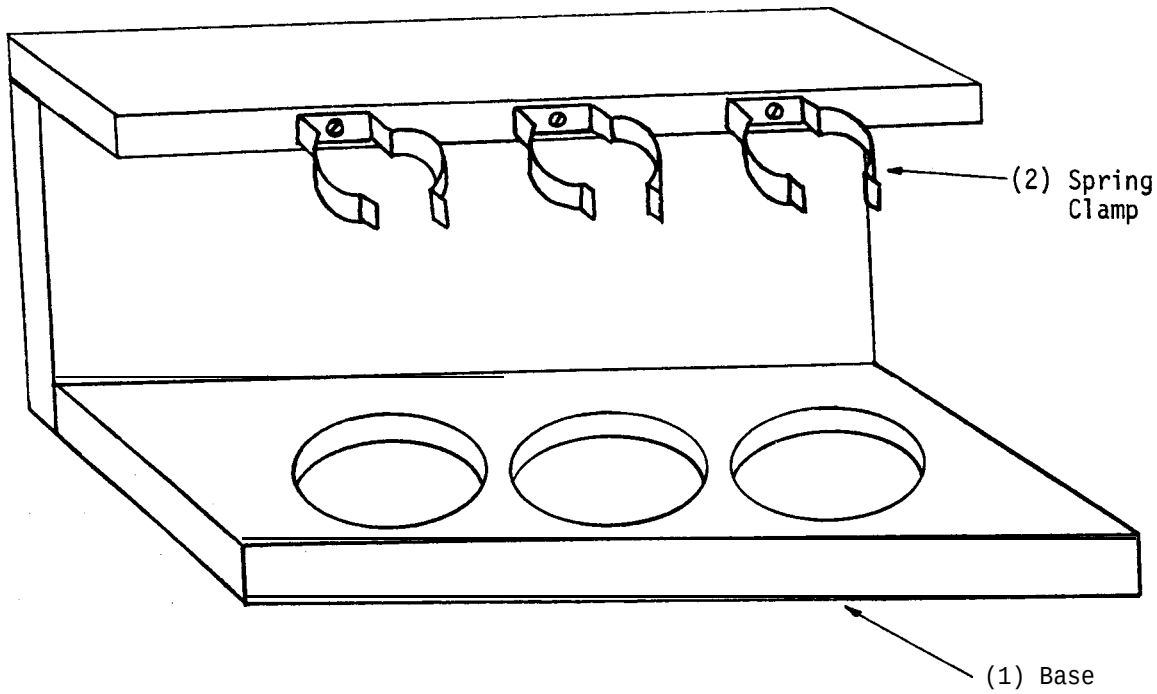
C.Notes

(i) Sizes and number of the supports constructed, as well as the size of the base, may be varied to suit individual needs.

(ii) The heating clamp is used to hold a test tube at an angle while its contents are heated. Supporting the test tube at an angle presents a greater area to be heated. As a safety measure, it allows the mouth of the test tube to be pointed away from everyone in the vicinity.



B7. Rack for Light-Bulb Glassware

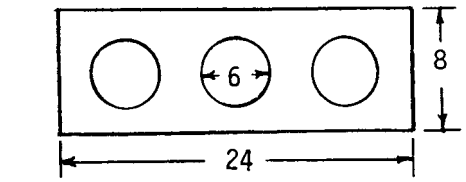


a. Materials Required

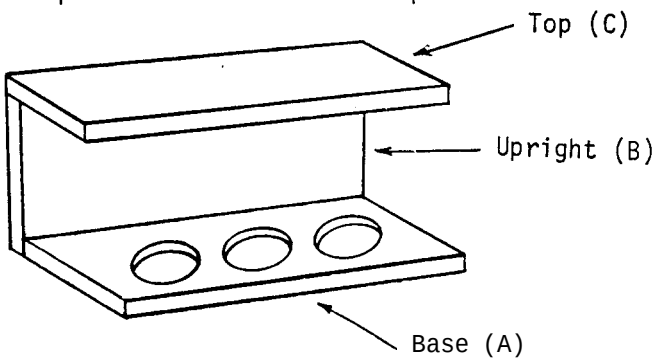
Components	Qu	Items Required	Dimensions
(1) Base	1	Wood (A)	8 cm x 24 cm x 2 cm
	1	Wood (B)	9 cm x 24 cm x 2 cm
	1	Wood (C)	4 cm x 24 cm x 2 cm
(2) Spring Clamp	3	Metal Strapping (D)	1 cm x 14 cm

b. Construction

(1) Base

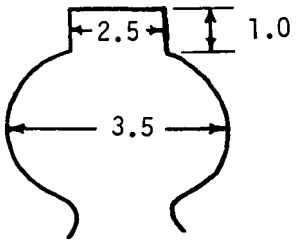


Drill or cut three circular holes, 6 cm in diameter in the large piece of wood (A). Allow about 1.5cm between holes.



Attach top (C) and upright (B) with glue and screws as shown,

(2) Spring Clamp

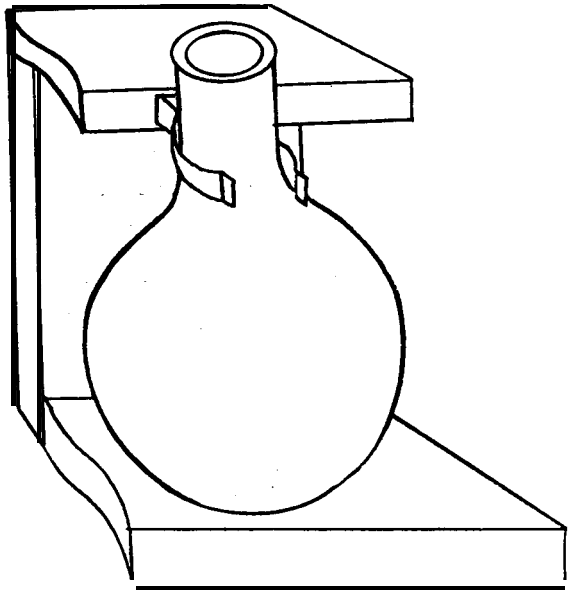


Drill a hole approximately 0.5 cm diameter in the center of each of the pieces of metal strapping (D). Bend each piece of metal strapping into the shape shown.

Center each clamp over each hole in the base. Secure each clamp to the top (horizontally) piece of the base with a screw.

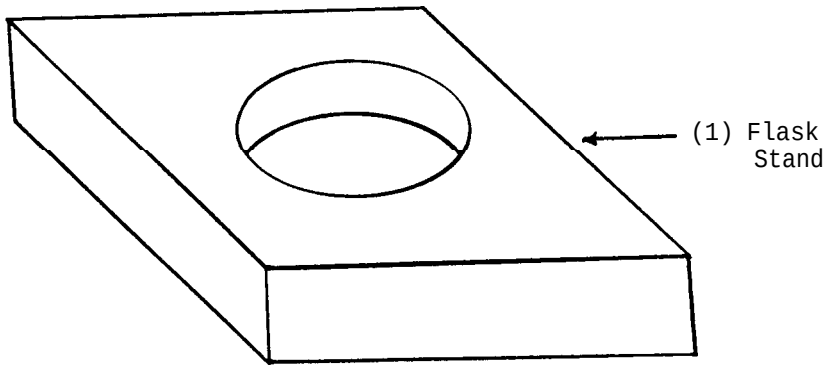
C. Notes

(i) The spring clamp holds the neck of a light-bulb flask securely, while the hole in the base supports the round bottom of the flask.



(ii) This design may be modified to accommodate more flasks, or flasks of different sizes.

B8. Stand for Light-Bulb Glassware



a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Flask Stand	1	Wood Block (A)	9 cm x 9 cm x 4 cm

b. Construction

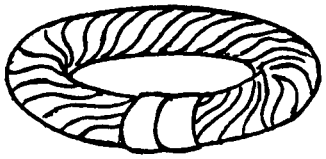
(1) Flask Stand

Drill or cut a circular hole through the center of the block (A). Adjust the diameter of the hole to the size of the light-bulb flask used:

6 cm diameter hole for bulbs from 60 to 200 watts. 7 cm diameter hole for larger bulbs.

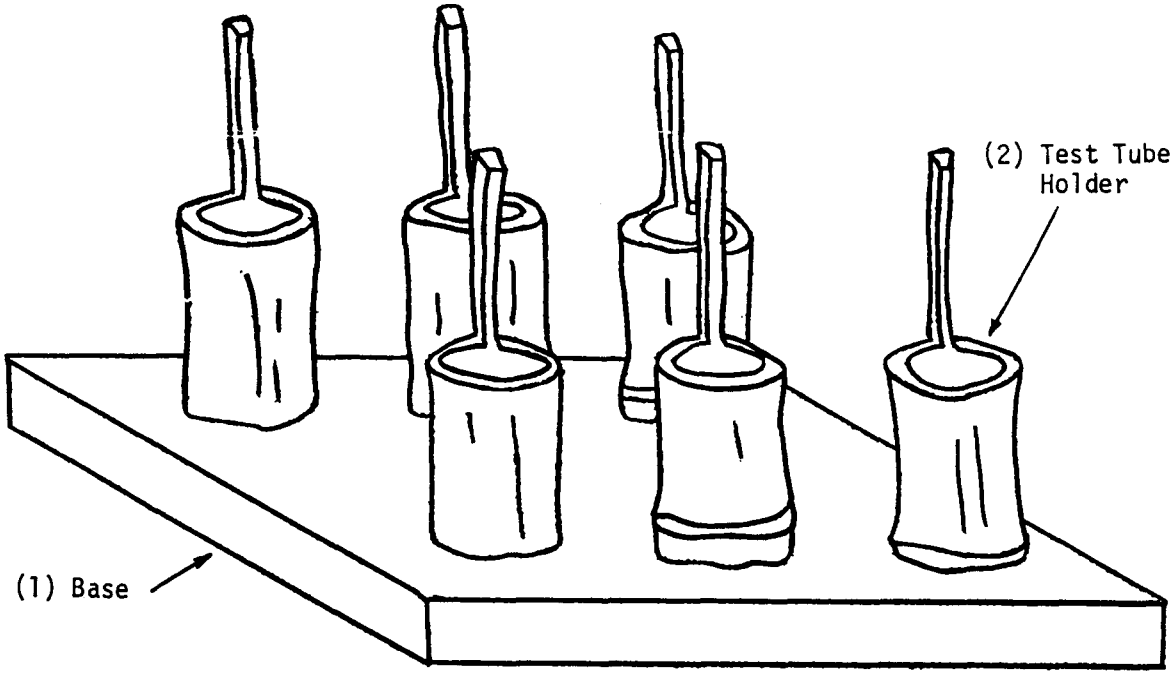
c. Notes

(i) Another stand for a single piece of light-bulb, or any round-bottomed glassware, can be made with a piece of heavy rope approximately 3 cm in diameter.



The rope is cut to a length slightly shorter than the maximum circumference of the flask, and the ends of the rope are taped or spliced together to form a ring.

B9. Bamboo Test Tube Rack



a. Materials Required

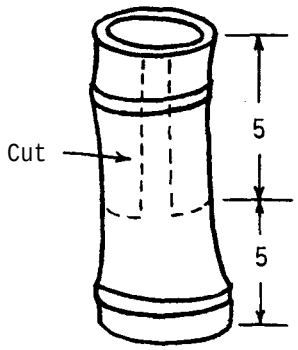
Components	Qu	Items Required	Dimensions
(1) Base	1	Wood Block (A)	1 cmx 7 cmxl8 cm
(2) Test Tube Holder	6	Bamboo Sections (B)	Approximately 2.5 cm outside diameter, 10 cm long

b. Construction

(1) Base

Sand the wood block (A) to remove splinters and rough edges.

(2) Test Tube Holder



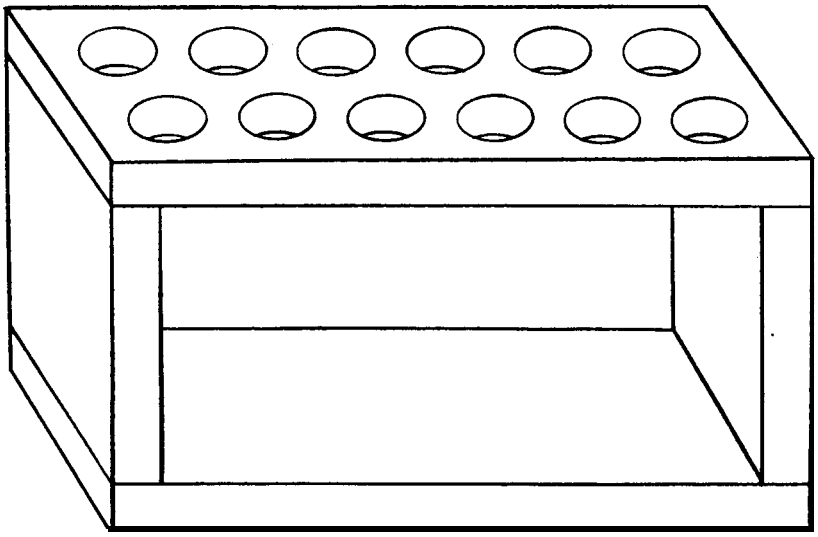
Select bamboo sections (B) with thick walls (at least 0.2 cm). Cut away approximately half the length of each bamboo section, but leave one upright piece as shown. Cement these cylinders to the base.

C.Notes

(i) The upright section remaining on each bamboo cylinder is used to support test tubes upside down for drying.

(ii) The size of the base may be varied to accommodate a convenient number of bamboo cylinders. The diameter of the bamboo cylinders may be varied to suit the size of the test tubes used.

Bl0. Wooden Test Tube Rack



(1) Test Tube Rack

a. Materials Required

Components	Qu	Items Required	Dimensions
(1) Test Tube Rack	2	Wood (A)	8 cm x 20 cm x 1 cm
	2	Wood (B)	8 cm x 12 cm x 2 cm

b. Construction

(1) Test Tube Rack

Drill 12 holes, 2.2 cm in diameter at evenly spaced intervals in one of the larger pieces of wood (A) to form the top of the rack.

Secure the sides (B) to the top (A) as shown, with nails or cement. Secure the bottom (A) in place with nails or cement.

C.Notes

(i) For larger or smaller test tubes, the dimensions may be varied.