

IV. TERRESTRIAL COLLECTING APPARATUS

These items are designed for use in collecting land invertebrates, vertebrates, and plants. Instructions for killing, preserving, and storing these organisms can be found in a variety of books and journals.

A. INSECT COLLECTING APPARATUS

Insects are the most common, familiar organisms everywhere in the world. Items described in this section are used in collecting and treating them.

B. SOIL ORGANISM COLLECTING APPARATUS

These pieces of equipment enable students to discover the multitude and diversity of living things in the soil.

C. SMALL VERTEBRATE COLLECTING APPARATUS

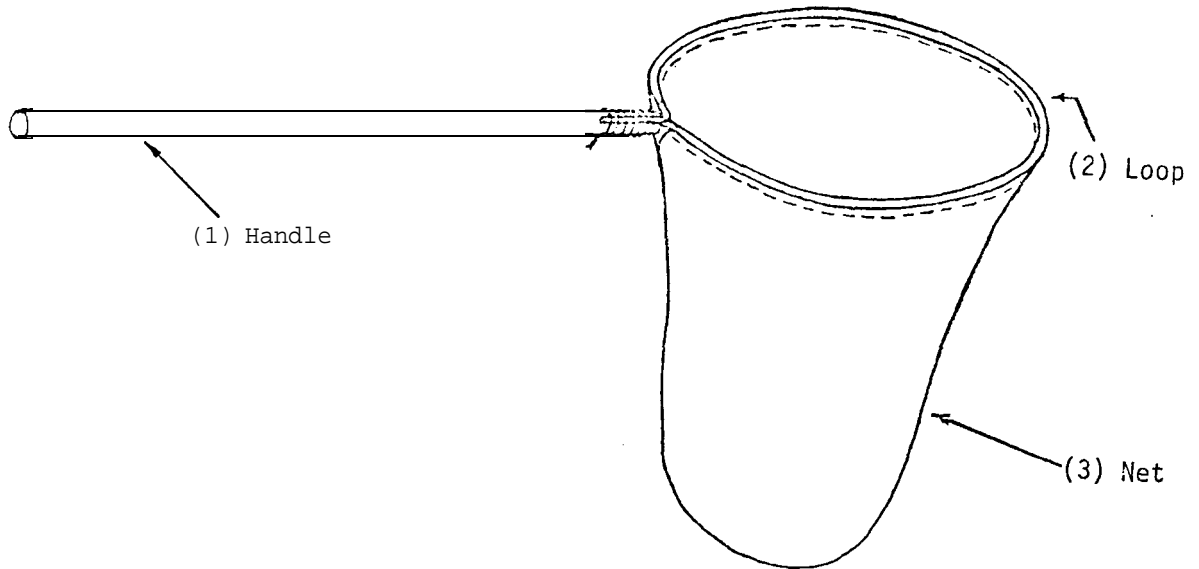
Small lizards, snakes, birds and mammals may be captured alive using these devices.

D. PLANT COLLECTING APPARATUS

The vasculum and plant presses in this section are used in collecting and preserving plant materials.

A. INSECT COLLECTING APPARATUS

A1. Butterfly Net

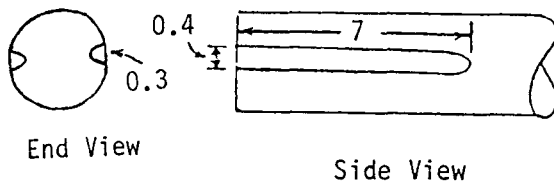


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Handle	1	Wood Dowel (A)	100 cm long, 2 cm diameter
(2) Loop	1	Heavy Wire (B)	115 cm long, 0.3 cm diameter
	1	Stiff Wire (C)	About 80-90 cm long, 0.1 cm diameter
(3) Net	1	Nylon Bag (D)	50 cm wide, 60 cm long

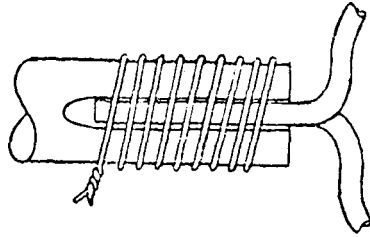
b. Construction

(1) Handle



The length of the dowel (A) from which the handle is made may be varied according to personal preference. Cut two grooves in one end of the handle, one opposite the other. Make these grooves about 7 cm long, 0.3 cm deep, and about 0.4 cm wide.

(2) Loop



Binding of Loop
to Handle

Form a loop 30 cm in diameter from the heavy wire (B). Leave about 7 cm of excess wire at each end which will fit into the grooves in the handle. Bend these 7 cm portions to 90° angles. Fit the wire ends into the grooves in the handle and bind them in place with the stiff wire (C).

(3) Net

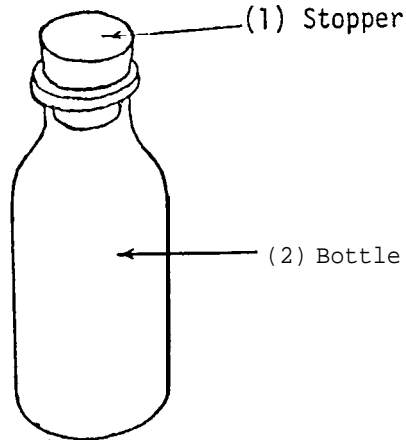
Select a finely meshed nylon laundry bag (D) or sew a net from a piece of nylon cloth or similar sturdy cloth with a relatively open weave. Whether a bag is used or a net sewn specifically for the butterfly net, make sure the opening of the net is 5 - 10 cm greater in circumference than that of the loop. Simply sew the open portion of the net around the loop with strong thread.

c. Notes

(i) Use the butterfly net to collect flying insects of all kinds. If it is sturdily made, it can also be swept through high grass to collect insects living in the grass. Consult a good source book for information on preserving, mounting, and storing collected insects.

(ii) The material used for the net must have a fine mesh through which insects cannot escape. At the same time, the mesh must be open enough to permit air to easily pass through it with little resistance. Parachute nylon is especially good for this purpose.

A2. Killing Jars



a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Stopper	1	Stopper (A)	To fit bottle
(2) Bottle	1	Glass Pill Bottle (B)	Approximately 10 cm long, 4 cm diameter

b. Construction

(1) Stopper

Select a cork or rubber stopper (A) which will effectively seal the bottle airtight.

(2) Bottle

Use a glass bottle (B) with a wide mouth.

c. Notes

(i) Killing bottles for insects can be made in several ways. Some are exceptionally dangerous and should only be used by the instructor. Be certain to label all jars as to their contents.

(ii) The following are methods of preparing killing jars:

(A) Cyanide Killing Jar - This is extremely dangerous and should only be used by the instructor. First, put a thin layer (0.5 cm) of potassium or sodium cyanide crystals in the bottom of the bottle. Cover this with a similar layer of fine sawdust or dry plaster of Paris. Finally, cover both layers with a layer of wet plaster of Paris. The jar is ready to use when the plaster hardens. Be sure to keep it tightly stoppered except to kill insects. Use only rubber stoppers.

(B) Ethyl Acetate Killing Jar - Put a thin (0.5 cm) layer of wet plaster of Paris in the bottom of the jar. When it has dried, put some ethyl acetate over the plaster and cover it with a small amount of tissue paper. This is also

especially dangerous and should be kept tightly stoppered.

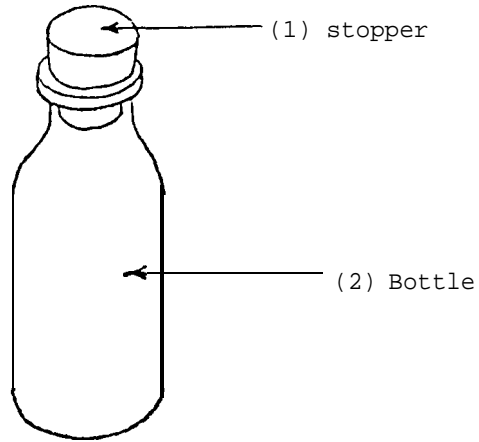
(C) Carbon Tetrachloride Killing Jar (1) - Pin a small piece of blotting paper or cotton to the bottom of the stopper. Saturate this with carbon tetrachloride just before putting the insects in the jar. This is a much safer jar for student use as the carbon tetrachloride quickly evaporates.

(D) Carbon Tetrachloride Killing Jar (2) - Use a one-hole stopper for the jar with a short piece of glass tubing extending through the hole. Plug one end of the tube with cotton. Place the insect in the jar, and replace the stopper. Then, carbon tetrachloride can be dripped through the tube onto the cotton plug where the fumes will kill the insect.

(E) Carbon Tetrachloride Killing Jar (3) - Place several rubber bands in the bottom of the jar and soak them overnight in carbon tetrachloride. Pour off the excess liquid and put a tight-fitting piece of blotting paper over the bands to keep them in place. This jar is relatively long lasting in its killing power.

(iii) The cork or rubber stoppers may absorb the toxic fumes from the jar so be sure to destroy them when the jars are discarded. Be absolutely certain that no fumes escape through the cork. It may be necessary to dip cork stoppers in melted paraffin wax to seal them completely.

A3. Relaxing Jar



a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Stopper	1	Cork Stopper (A)	To fit bottle
(2) Bottle	1	Glass Pill Bottle (B)	Approximately 10 cm long, 4 cm diameter

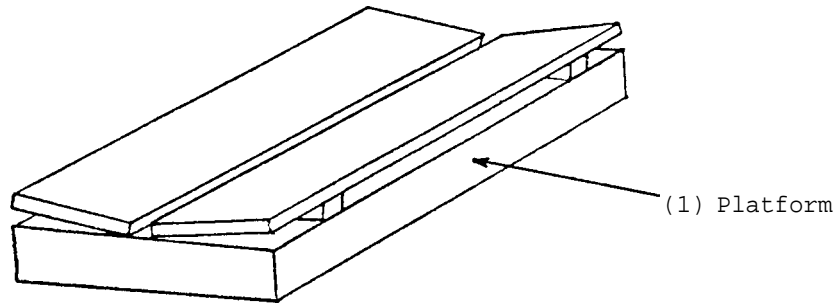
b. Construction

- | | |
|-------------|--|
| (1) Stopper | Select a cork or rubber stopper (A) which will effectively seal the bottle airtight. |
| (2) Bottle | Use a glass bottle (B) with a wide mouth. |

c. Notes

- (i) Relaxing bottles are used to make dead insects more flexible so that they can be manipulated into a desirable mounting position.
- (ii) The following is a method for preparing a relaxing jar: Place some moist sand in the bottom of the jar and add a few drops of carbolic acid to inhibit mold growth. Cover the sand with a piece of moist blotter paper. Leave the insects in the jar overnight to relax them.

A4. Insect Spreading Board

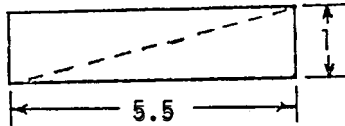


a. Materials Required

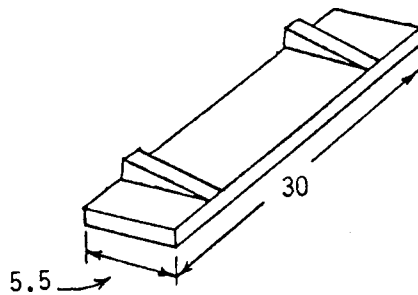
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Platform	1	Wood (A)	12 cm x 30 cm x 1.0 cm
	2	Wood (B)	5.5 cm x 30 cm x 0.5 cm
	2	Wood (C)	5.5 cm x 1 cm x 2 cm

b. Construction

(1) Platform



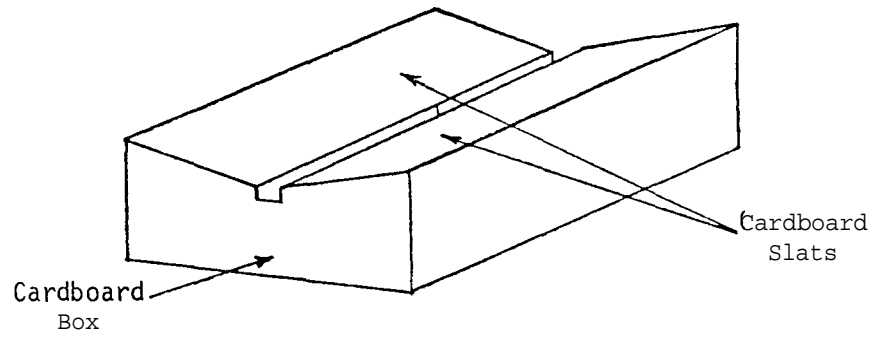
Cut the two small pieces of wood (C) in half diagonally, yielding four wedge-shaped pieces. Glue two of the wedges to the backs of each of the two slats (B). Turn the two slats over and glue them to the base (A). Leave a 1.0 cm gap between the two slats.



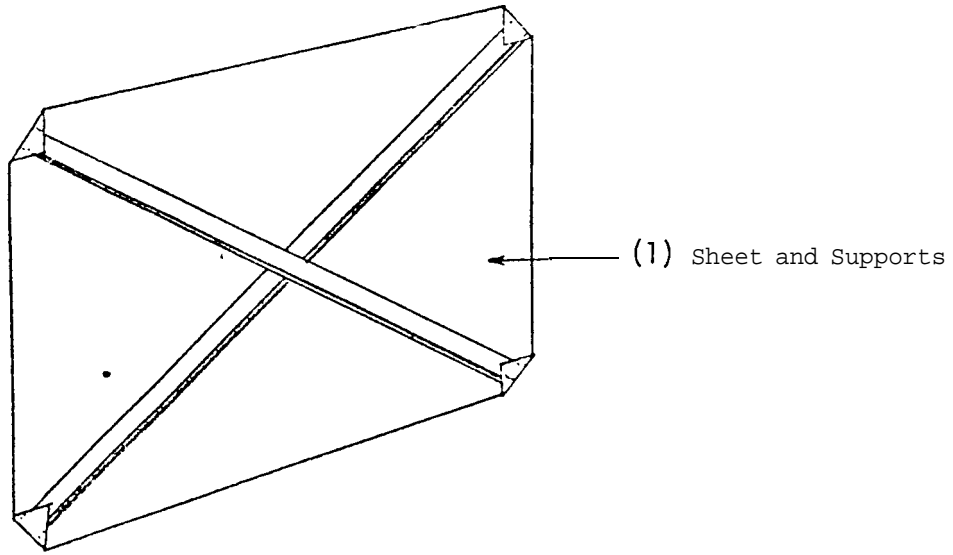
c. Notes

(i) Make the slats (B) from the softest wood available (e.g., balsa). Consult a good biological source book for details on preparing insects to be pinned and prepared on the spreading board.

(ii) A simple, inexpensive spreading board can be made from a cardboard box. Remove the top and cut the ends as shown in the illustration. Then glue two pieces of cardboard to the box to complete the spreading board.



A5. Beating Sheet *



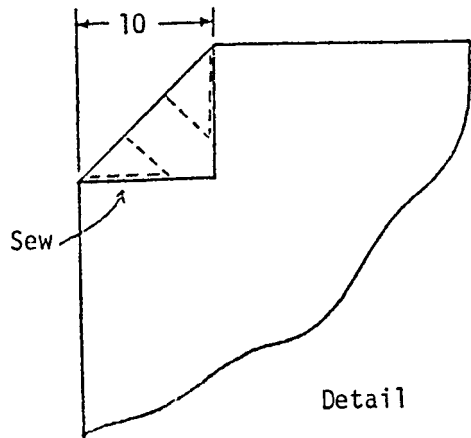
a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Sheet and Supports	1	Heavy Cloth (A)	100 cm x 100 cm
	2	Wooden Slats (B)	125 cm x 4 cm x 1.0 cm

b. Construction

(1) Sheet and Supports

Fold back about 10 cm of the heavy cloth (A) (muslin will work) at each corner and sew a pocket into each such that the tips of the wooden slats (B) will fit into them.



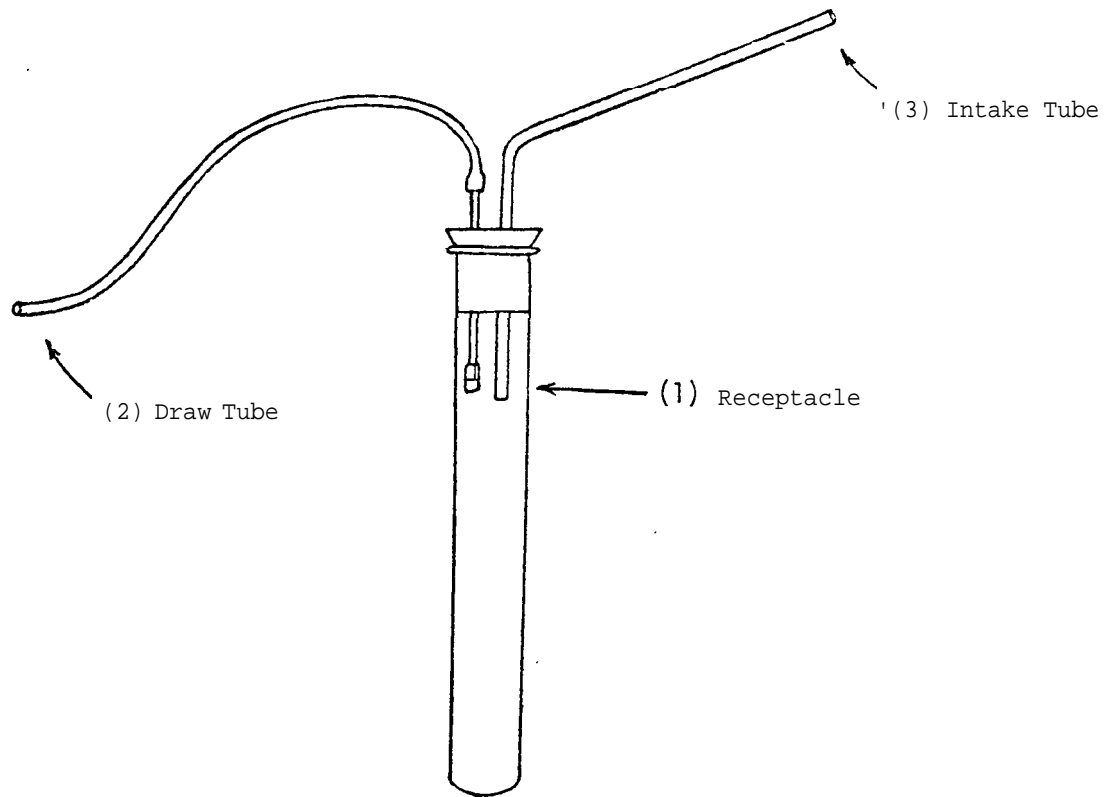
*Adapted from Jens W. Knudsen, Biological Techniques, (New York: Harper and Row, 1966), p 209.

c. Notes

(i) The sheet is held under shrubbery and insects are shaken off onto it where they can easily be captured.

(ii) Bamboo, wooden dowels, broom handles, etc. can be substituted for the wooden slats. In any case, the crosspieces can be removed after use to permit compact storage.

A6. Aspirator



a. Materials Required

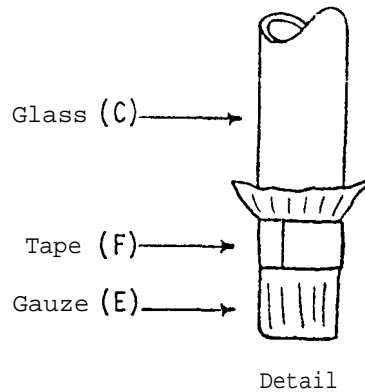
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Receptacle	1	Test Tube (A)	15 cm long, 1.6 cm inside diameter
	1	2-Hole Stopper (B)	To fit test tube
(2) Draw Tube	1	Glass Tube (C)	6 cm long, 0.2 cm inside diameter
	1	Rubber Tube (D)	35 cm long, 0.3 cm inside diameter
	1	Gauze (E)	1 cm x 2 cm
	1	Tape (F)	2 cm long
(3) Intake Tube	1	Glass Tubing (G)	16 cm long, 0.3 cm inside diameter

b. Construction

(1) Receptacle

Plug the end of the test tube (A) with a two-hole stopper (B).

(2) Draw Tube



Use the tape (F) to hold the gauze (E) in place over the end of the glass tube (C). Be certain air still flows freely through the end of the tube. Insert the end of the tube through one of the holes in the stopper. Attach the end of the rubber tube (D) to the glass tube (C).

(3) Intake Tube

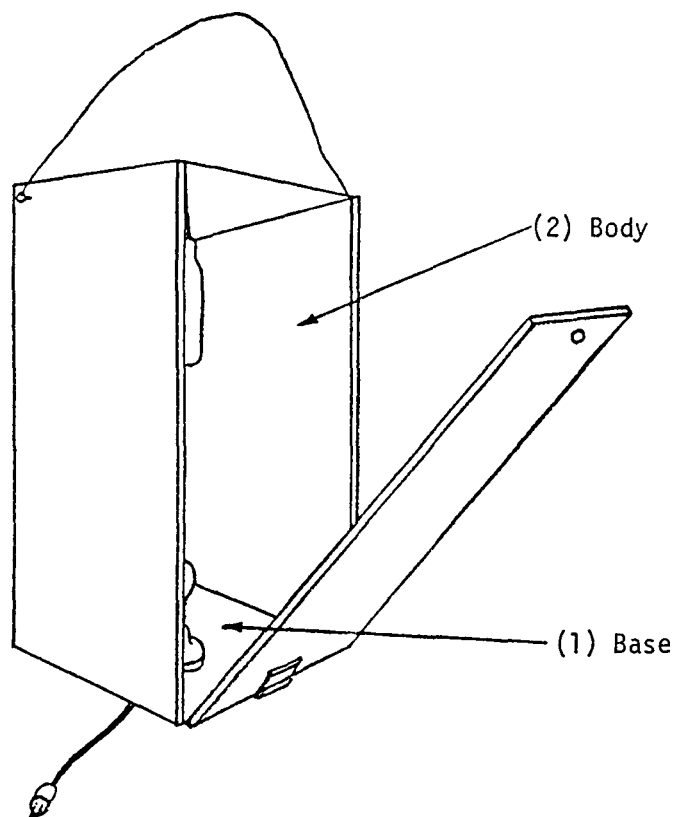
Bend the glass tube (G) to an 120° angle about 6 cm from one end, and insert this end into the remaining hole in the stopper.

c. Notes

(i) The aspirator is a useful instrument when collecting insects which are too small or too fragile to be collected by hand. To operate, place the draw tube between one's teeth and the intake tube near the insect to be collected. The collector then sucks in and the insect is captured. The gauze prevents the insect from entering the draw tube.

(ii) A glass bottle or vial may be used in place of a test tube, but in any case a tight-fitting stopper is required. The stopper may be either rubber or cork, and cotton may be used in place of the gauze.

A7. Night Flying Insect Collector



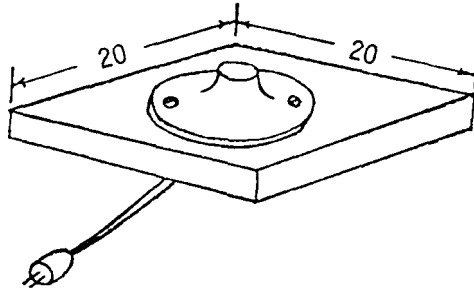
a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Base	1	Wood (A)	20 cm x 20 cm x 2 cm
	1	Electric Lightbulb Socket (Porcelain) (B)	12 cm diameter
	2	Electrical Wire (C)	50 cm long, 0.3 cm diameter
	1	Electrical Plug (D)	--
(2) Body	2	Wood (E)	22 cm x 50 cm x 1.0 cm
	2	Wood (F)	20 cm x 50 cm x 1.0 cm
	1	Hinge (G)	--
	4	Fine Wire Mesh (H)	20 cm x 17 cm
	1	Thick Rubber Band (I)	--
	1	Glass Container with Lip (J)	500 ml
	1	Light Bulb (K)	100 watts
	2	Screw Eyes (L)	2.5 cm long, 0.2 cm diameter
	1	Wire (M)	60 cm long, 0.1 cm diameter

1	Thin Sheet Metal (N)	10 cm x 10 cm
1	Wire (O)	10 cm long, 0.1 cm diameter
2	Wood Screws (P)	1 cm long

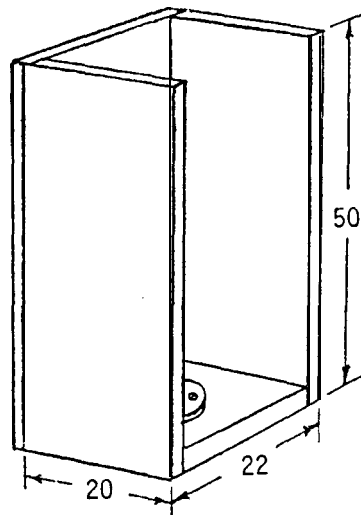
b. Construction

(1) Base

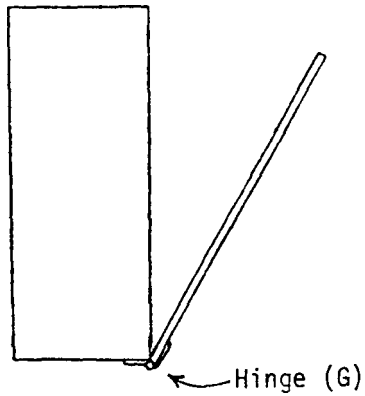


The electric light bulb socket (B) is centered on the base (A) and two holes are drilled through the base for the attachment of the electrical wires (C) to the terminals on the electric light socket. Attach the electrical wires to these terminals and extend them through the base. The socket is then screwed into place on the base using wood screws. Attach the electrical plug (D) to the wires to complete the base.

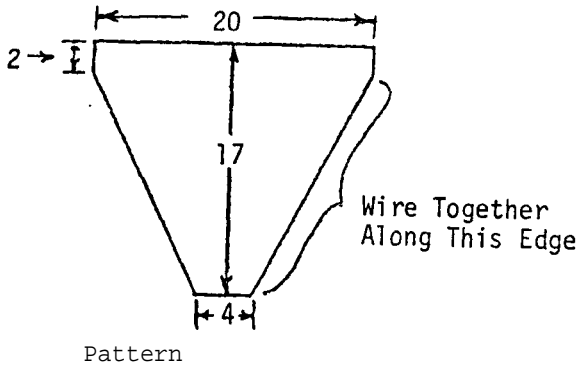
(2) Body



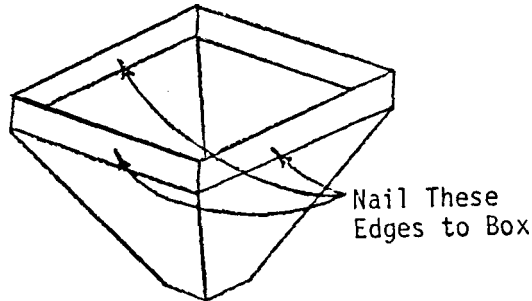
The two pieces of wood (F) are nailed into place on opposite sides of the base. One of the pieces of wood (E) is nailed onto the third side of the base where it overlaps the two ends of the sides already attached. It is then nailed to the other two sides. Take the last piece of wood (E) and attach the hinge (G) to the bottom of it and to the bottom of the base so that it forms a door which opens downward.



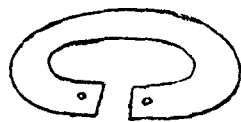
Side View



Pattern



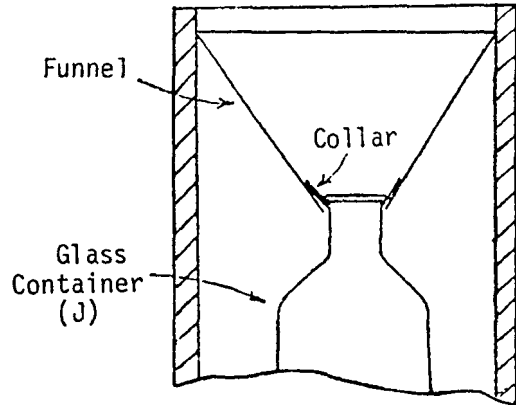
Completed Funnel



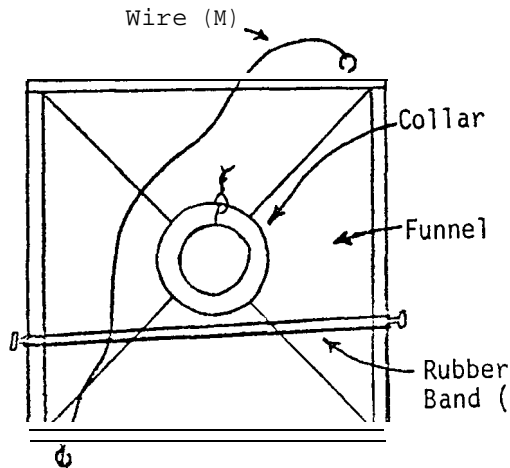
Collar

Take the four pieces of wire mesh (H) and cut them to the pattern shown, then wire them together along their edges to form a square funnel. The opening at the bottom of the funnel (4 cm square) should be the same width as the diameter of the neck of the collecting bottle (J) used. Nail three of the edges of the funnel along the top edges of the fixed sides of the trap. Of course, do not nail the fourth edge to the door or the door will not open.

Next, cut a collar from the piece of sheet metal (N) so that it will fit under the lip on the glass container (J). Cut this collar in such a way so that it



Side View



Top View

does not form a continuous circle, but instead has a break in it. Now, wrap the collar tightly around the neck of the glass container just under the lip. Pull the two free ends together and overlap them. Then punch a hole through the ends and place the piece of wire (O) through the holes and bend it so that it holds the collar tightly closed. The glass container can now be picked up by the collar without falling through it. Remove the collar, force the mouth of the glass container up through the bottom of the hole in the funnel, and replace the collar so that it holds the glass container in place.

Place two screws (P), one on the outside of the door about 2 cm down from the top, and the other in the same position on the side opposite the door. Then, close the door and stretch the rubber band (I) from one screw to the other over the top to hold the door closed. Finally, attach the two screw eyes (L) to opposite corners on the sides of the top and secure the wire (M) to them, and screw the light bulb (K) into the socket.

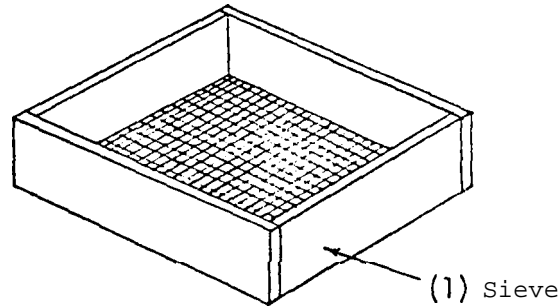
c. Notes

(i) To operate, simply hang the trap at night outside from a fixture (e.g., a tree limb), and attach the electrical wires to a power supply. Be sure to hang it in an area where there are a large number of night-flying insects. The light will attract the insects and they will fall into the glass container. When a sufficient number have become trapped in the container, place a wad of cotton soaked in carbon tetrachloride over the opening, thus killing the insects.

(ii) By placing two hinges on the side of the door, it can be opened to the side if so desired.

B. SOIL ORGANISM COLLECTING APPARATUS

B1. Soil Organism Sieve

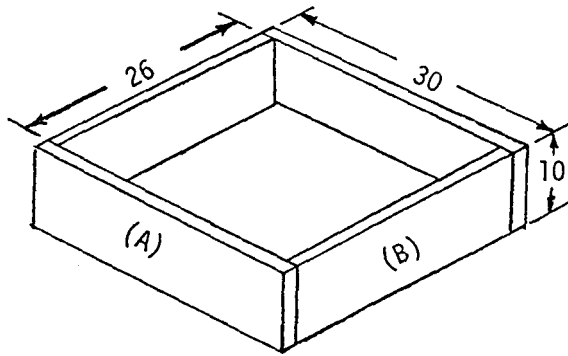


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Sieve	2	Wood (A)	30 cm x 10 cm x 2 cm
	2	Wood (B)	26 cm x 10 cm x 2 cm
	1	Wire Screen (C)	30 cm x 30 cm

b. Construction

(1) Sieve



Frame

Simply nail or screw the four wood boards (A,B) together to form a frame and nail the piece of screen (C) to the bottom of the frame.

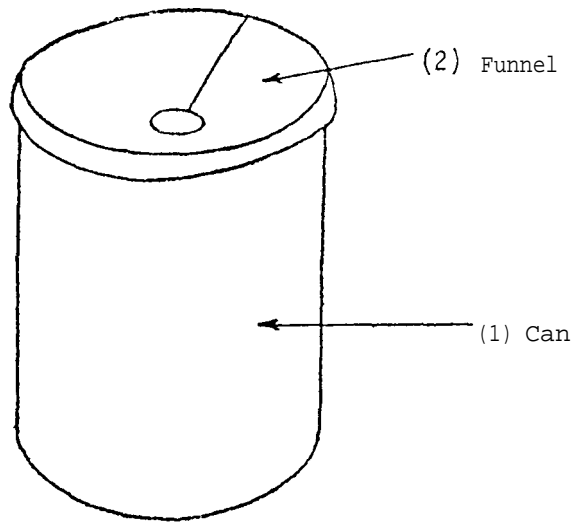
c. Notes

(i) Use the sieve to separate out soil organisms such as worms, grubs, etc., from the material in which they are living.

(ii) Carefully choose the size of wire mesh used in the sieve. A mesh or screen with too fine a weave will become clogged with soil and rendered useless. A relatively wide mesh will work well if the soil is coarse, allowing the organisms to fall through the mesh while holding back the soil.

(iii) A frame for the sieve can also be made by knocking out the bottom from an old drawer or wooden box.

52. Soil Insect Trap



a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Can	1	Tin Can (A)	0.5 liter capacity
(2) Funnel	1	Wire Mesh (B)	About 15 cm x 15 cm

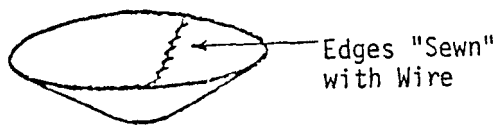
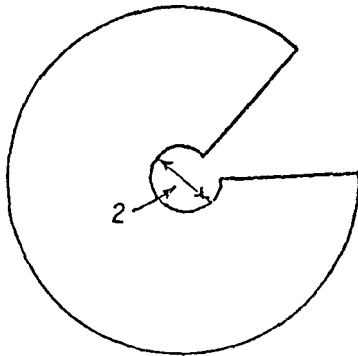
b. Construction

(1) Can

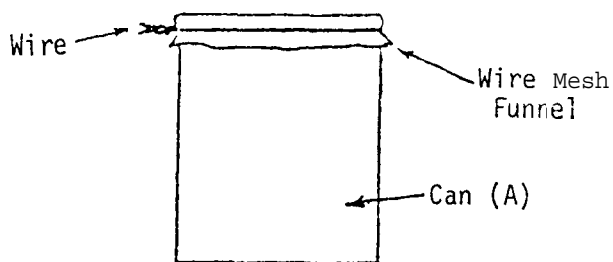
Remove one end from a tin can (A).

(2) Funnel

Cut a pattern for the funnel from the wire mesh (B). The outside diameter of the pattern should be approximately 2 cm wider than the diameter of the can (A) used.



Connect the two edges of the cutout portion of the pattern by "sewing" them together with wire. This will result in a cone with a hole at the apex. Complete the soil insect trap



Side View

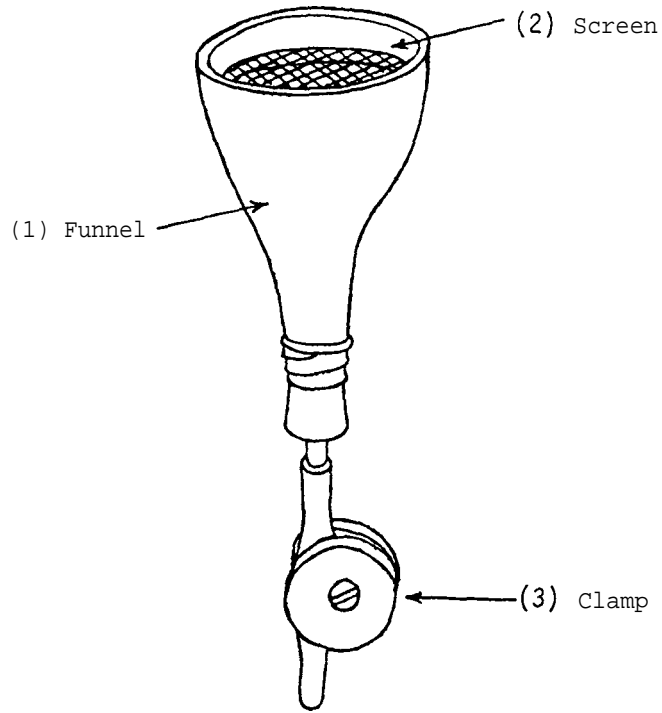
by inserting the funnel in the open end of the can and folding the excess wire mesh down around the outside of the can to hold it in place. If necessary, a piece of wire wrapped around the outside of the can and twisted tightly will help hold the funnel in place too.

c. Notes

(i) Place the trap in a hole in the ground so that the top edge of the trap is even with the soil level. Thus, small insects and other ground organisms crawling across the trap will fall through the hole in the funnel into the can. Check the can periodically for captured organisms.

(ii) The trap can be varied by making the funnel portion from aluminum foil, waxed paper, or other materials which are smooth and will help prevent the organisms from crawling out of the trap. Also, dusting the inside walls of the can with fine powder (e.g., talcum powder) will prevent organisms from crawling up the walls and out of the cage.

B3. Baermann Funnel

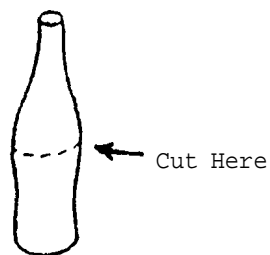


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Funnel	1	Glass Bottle (A)	About 7 cm diameter, 20 cm long
	1	Glass Tube (B)	5 cm long, 0.5 cm inside diameter
	1	1-Hole Stopper (C)	To fit bottle opening
	1	Rubber Tube (D)	12 cm long
(2) Screen	1	Fine Wire Mesh (E)	7 cm diameter
	1	Stiff Wire (F)	16 cm long, 0.3 cm diameter
(3) Clamp	1	Screw Clamp (G)	Chem/IV/A4

b. Construction

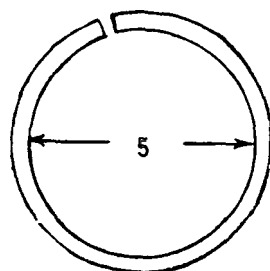
(1) Funnel



Soda Pop Bottle

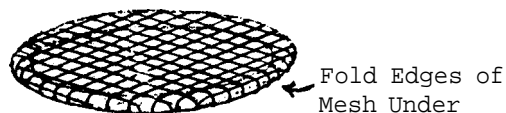
Cut the top of a glass soda pop bottle (A) off (See CHEM/I/F2 Force a short piece of glass tubing (B) through the one-hole stopper (C) and seal the opening with the stopper. Next, attach the rubber tube (D) to the glass tube.

(2) Screen



Ring

Make a ring slightly smaller in diameter (i.e., about 5 cm diameter) than the bottle with the stiff wire (F). Fold the edge of the circular piece of wire mesh (E) under the wire ring. The wire mesh will probably be stiff enough to hold itself in place without being wired to the ring.

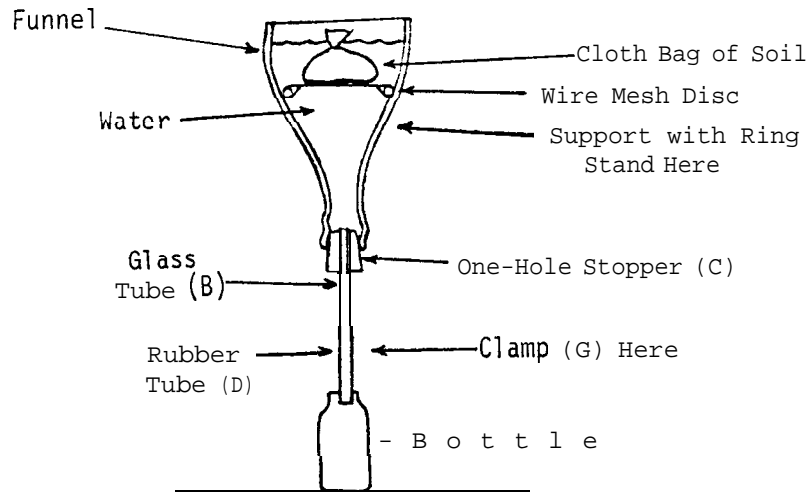


(3) Clamp

Use the clamp (G) to seal the rubber tube airtight.

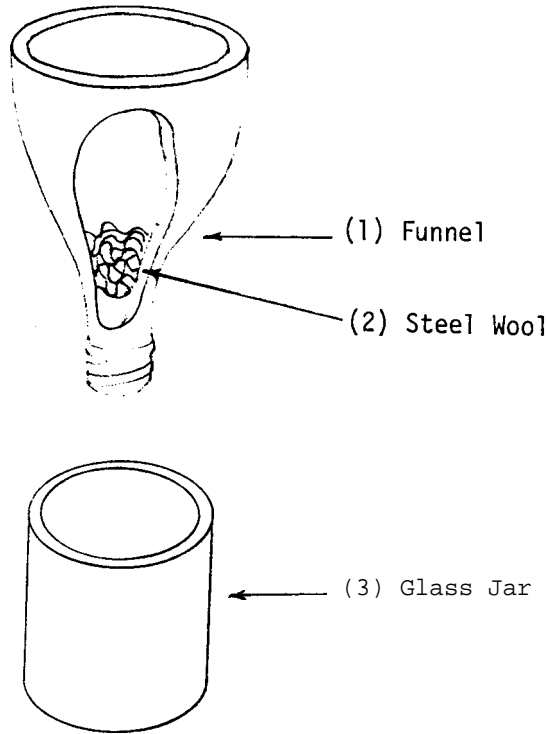
c. Notes

(i) The Baermann funnel is designed to extract soil nematodes from soil. To use it, it must be supported by a ring stand. Clamp off the tubing, and let the end of the tube extend into a small vial or bottle. Set the wire mesh disc into the funnel, put a small cloth bag of soil on the disc, and fill the apparatus with water. After an hour or so, release the clamp to collect a small sample of water which can be examined for soil nematodes. (See illustration on next page.)



(ii) If commercial funnels of the correct size are available and inexpensive, they can be substituted for the bottle funnel. Also, the end of the rubber tube can be sealed off with a pencil stub or piece of wooden dowel if a good clamp is not available.

B4. Berlese Funnel

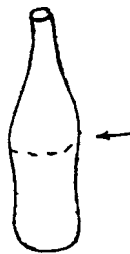


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Funnel	1	Glass Bottle (A)	About 7 cm diameter, 20 cm long
(2) Steel Wool	1	Steel Wool (B)	30 g
(3) Glass Jar	1	Glass Jar (C)	50 ml capacity

b. Construction

(1) Funnel



Cut Here

(2) Steel Wool

Cut the top of a soda pop bottle (A) off (See CHEM/I/F2 to make the funnel. Alternately, use a commercial glass or metal funnel, or make one using metal foil or heavy paper.

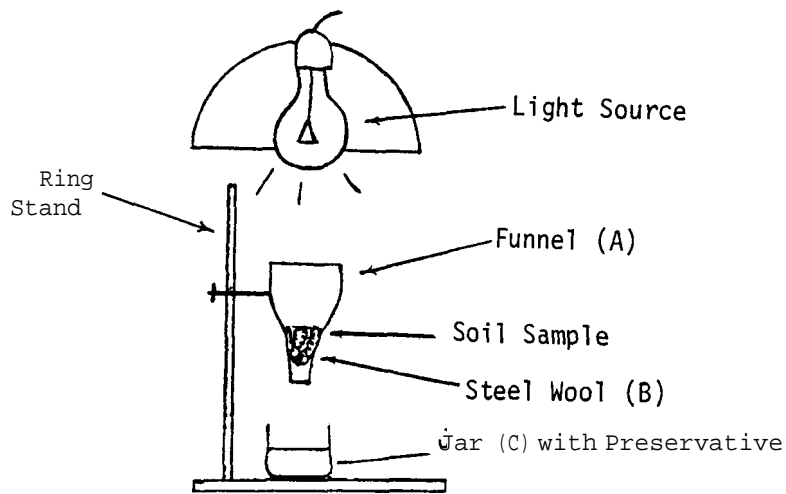
Place the steel wool (B) inside the funnel so that it blocks off the opening.

(3) Glass Jar

Fill the jar (C) about 1/2 full of alcohol or formalin and place it directly under the funnel.

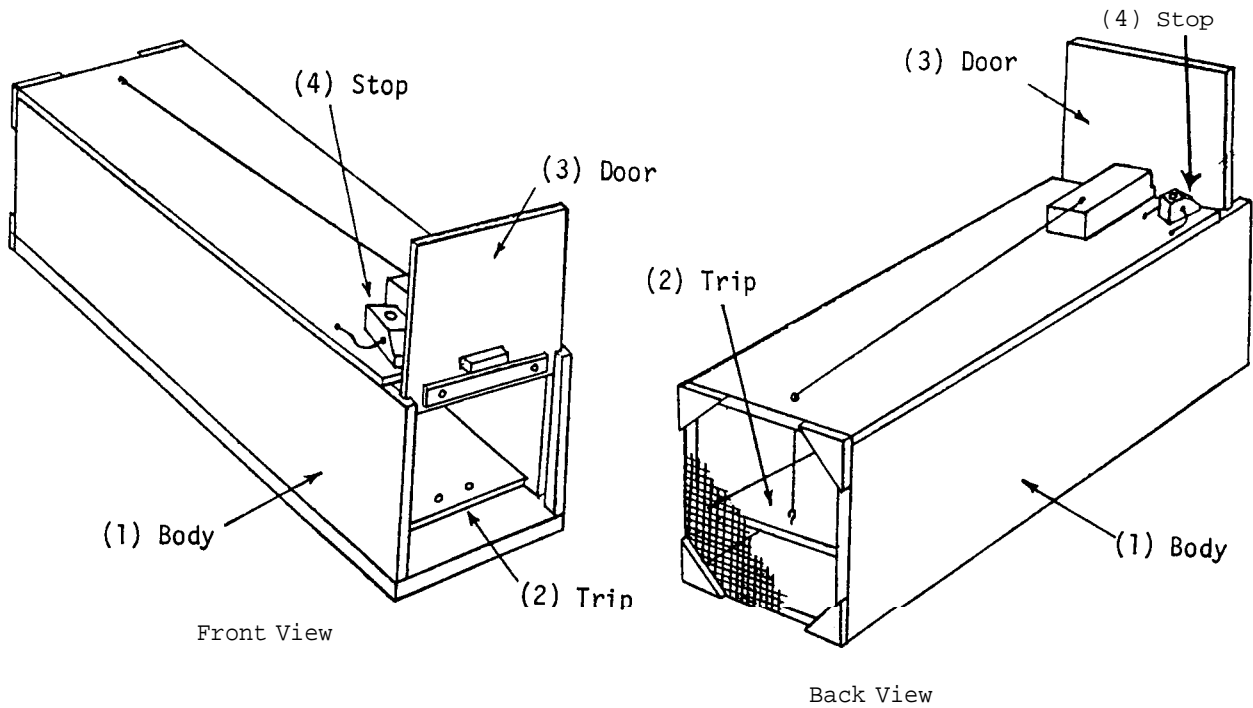
c. Notes

(i) To use the Berlese funnel, a ring stand and light source are needed. Support the funnel with the ring stand so that the neck of the funnel is directly over the glass jar. Place a 25 watt light directly above the funnel and close enough to the funnel that the heat from the bulb will warm the contents of the funnel. Place the soil sample in the funnel so that it rests on the steel wool. Pick out the larger soil organisms with forceps. The smaller organisms will be driven down by the light and heat of the bulb until they drop through the steel wool into the preservative in the jar. The apparatus should be left in place several days to insure that most of the organisms are collected.



C. SMALL VERTEBRATE COLLECTING APPARATUS

C1. Simple Box Trap



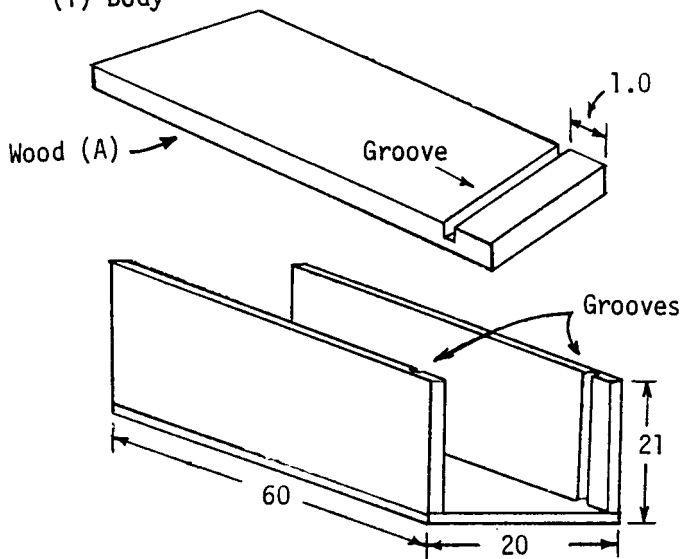
a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Body	3	Wood (A)	60 cm x 20 cm x 1.0 cm
	1	Wood (B)	58 cm x 20 cm x 1.0 cm
	2	Wood (C)	5 cm x 5 cm x 0.5 cm
	1	Wire Mesh (D)	20 cm x 22 cm
	(2) Trip	1	Wood (E)
(3) Door	1	Metal Hinge (F)	5 cm x 5 cm
	1	Eyed Screw (G)	2 cm long
	1	String (H)	85 cm
	1	Wood (I)	10 cm x 4 cm x 1.5 cm
	4	Round-headed Screws (J)	Approximately 1.0 cm long
	1	Construction Board (K)	19 cm x 20.5 cm x 0.25 cm
	1	Flat Metal (L)	15 cm x 1.5 cm x 0.5 cm

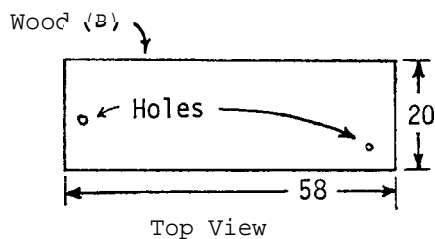
	2	Bolts (M)	1.25 cm long
	2	Nuts (N)	To fit bolts
(4) Stop	4	Tacks (O)	1.0 cm long
	1	String (P)	7 cm
	1	Rubber Band (Q)	--
	1	Wood (R)	6 cm x 2 cm x 2 cm
	1	Bolt (S)	5 cm long
	1	Nut (T)	To fit bolt

b. Construction

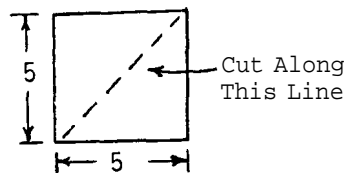
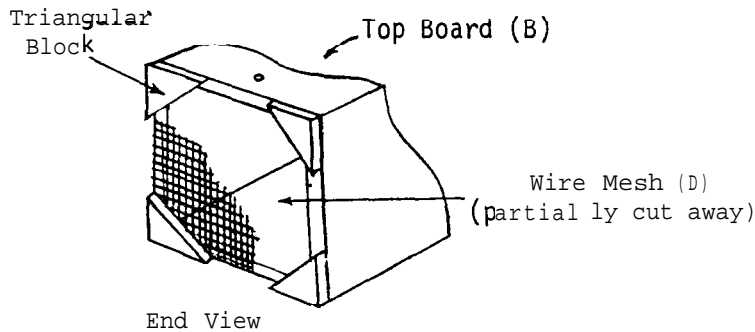
(1) Body



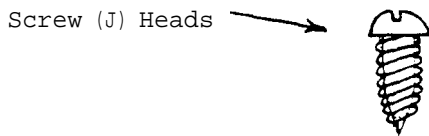
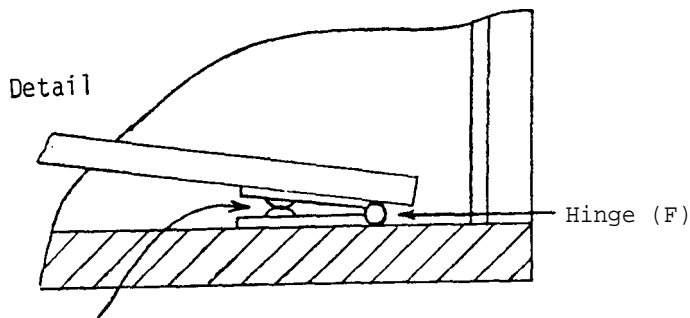
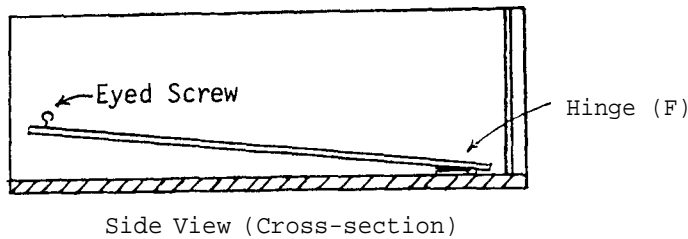
Begin the body by cutting a groove 0.3 cm wide and 0.5 cm deep parallel to the end of two of the pieces of wood (A). This groove is 1.0 cm from the end. Nail or screw these two boards to the third board (A).



In the corner of the board (B) to be used as the top, drill a hole 0.7 cm in diameter about 3 cm from each edge, and drill a hole about 0.5 cm in diameter through the other end of the top, 1.0 cm from the edge and centered. Set this board (B) aside until the trip (2) is completed.



(2) Trip

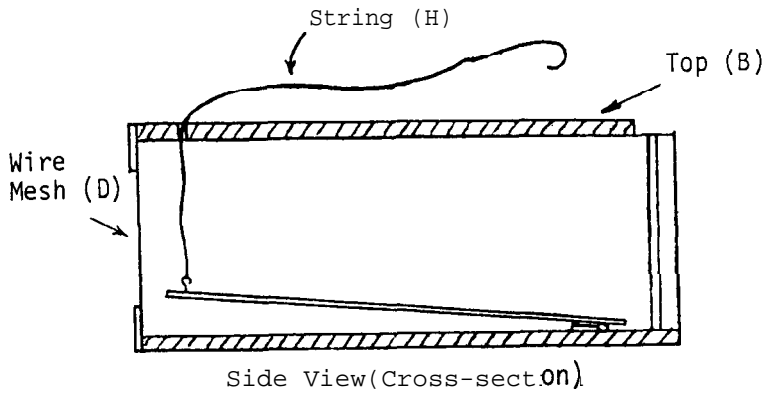


Seal off one end of the body by nailing the wire mesh (D) to it. Reinforce the corners with triangular pieces of wood gotten by cutting the wood pieces (C) in half diagonally. Again, do not seal the end until the trip (2) and top board (B) are in place.

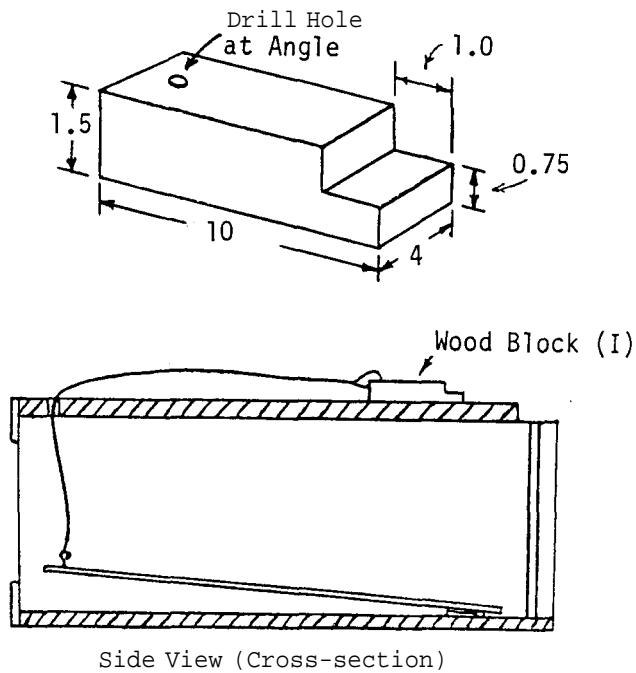
Screw the eyed screw (G) into one end of the wood (E) about 1.0 cm from the edge and centered. To the back of this board, fasten the hinge (F) which also should be about 1.0 cm from the edge and centered. Next, fasten the other half of the hinge to the bottom of the body so that the board is centered in the bottom of the body (i.e., it should be 2.5 cm from each end and 0.25 cm from each side of the body). Use round-headed screws (J) so that the hinge cannot close completely flat. In this way, the trip will be held up at a slight angle, which is needed in the design of this trap. Alternately, the length and tension of the trip string (N) can be adjusted to hold the trip in

the desired position without the necessity of using this type of hinge and screws.

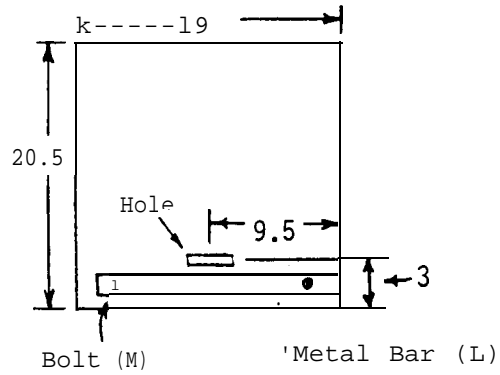
Now tie one end of the string to the eyed screw (G) in the trip (H). Run the other end of the string through the hole in the top board (B) of the body which may now be nailed or screwed into place. Also, the wire mesh (D) for the end of the body may be fastened in place after the top is finished.



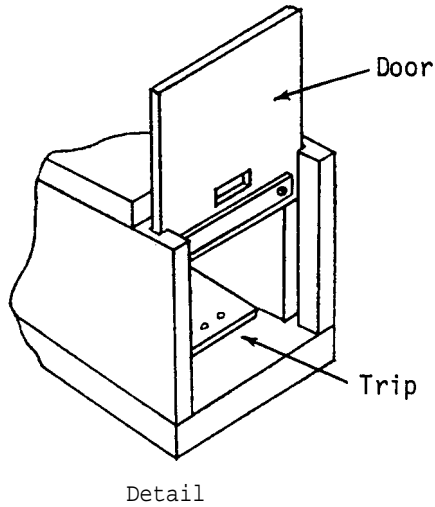
To complete the trip, cut a notch from the block of wood (I) and attach the free end of the string to the block by tying it through a hole drilled in the block.



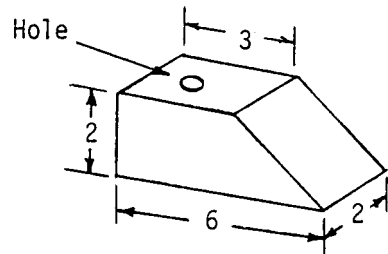
(3) Door



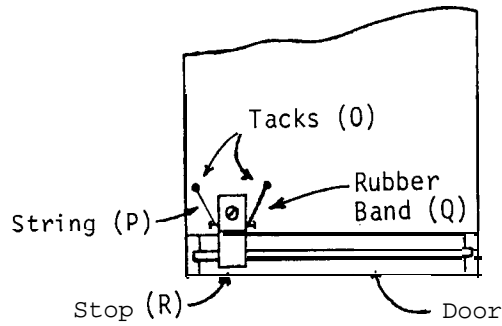
Cut a hole 4.25 x 1.0 cm in the construction board (K) 3 cm from the end of the board and centered. Next, using the nuts (N) and the bolts 90, bolt the flat metal bar (L) into position just under the hole. Holes will have to be drilled through the board for the bolt to go through. The door is now finished and should slide easily up and down in the notches in the sides of the body.



(4) Stop



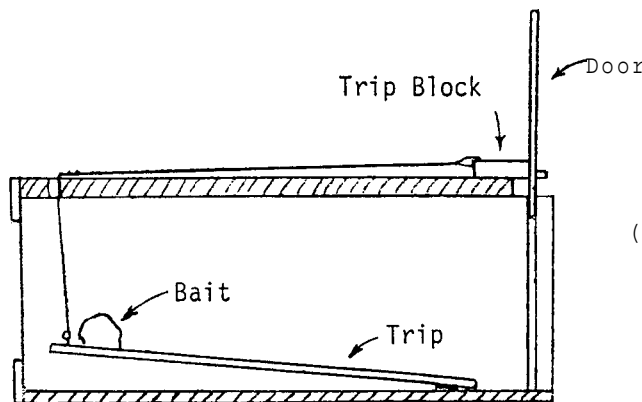
Cut the piece of wood (R) as shown and drill a hole in the wood slightly larger in diameter than the bolt (S) used.



Hammer a tack (O) into each side of the stop (R), and run a bolt (S) through the stop and the hole in the corner of the top. Screw the nut (T) loosely onto the bolt. Hammer two other tacks (O) into the top of the body, one to either side of the stop and slightly behind it. Finally, tie the piece of string (P) between the tack in the left side of the stop and the tack to the left in the top, and similarly attach the rubber band (Q) on the right side. Fix the tension in the rubber band so that the stop will be held out over the door when the door is closed, thus preventing the door from being raised after the trap has been sprung.

c. Notes

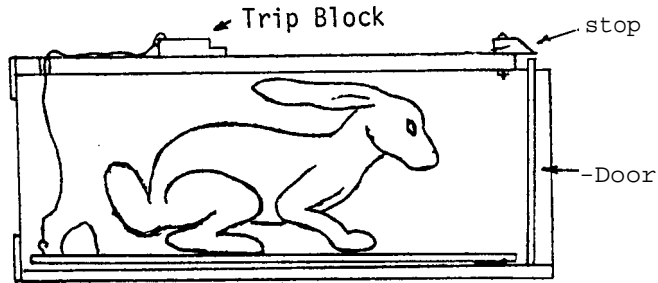
(i) To set the trap up, place it where small animals are likely to be found. Push the stop out of the way and put the door between the grooves in a raised position. Next, push the notched portion of the trip block through the hole in the door to hold the door up. Release the stop, allowing the rubber band to pull it against the door. At this point, the string attaching the trip block to the trip should be taut. Finally, place a suitable bait in the extreme rear of the cage on the trip.



Side View
(Cross-section)

Trap in "Set" Position

Because the round heads of the hinge screws hold the trip up at a slight angle, the animal entering the trap must move to the rear of the trap before the combination of its (the animal's) weight and leverage causes the rear of the trip to drop down, pulling the trip block back out of the hole in the door. The door then drops down in the grooves, the metal bar aiding in a faster drop. Finally, the stop is pulled out over the top of the door once the door is out of its way, and is held over the door because the rubber band pulls against the string.



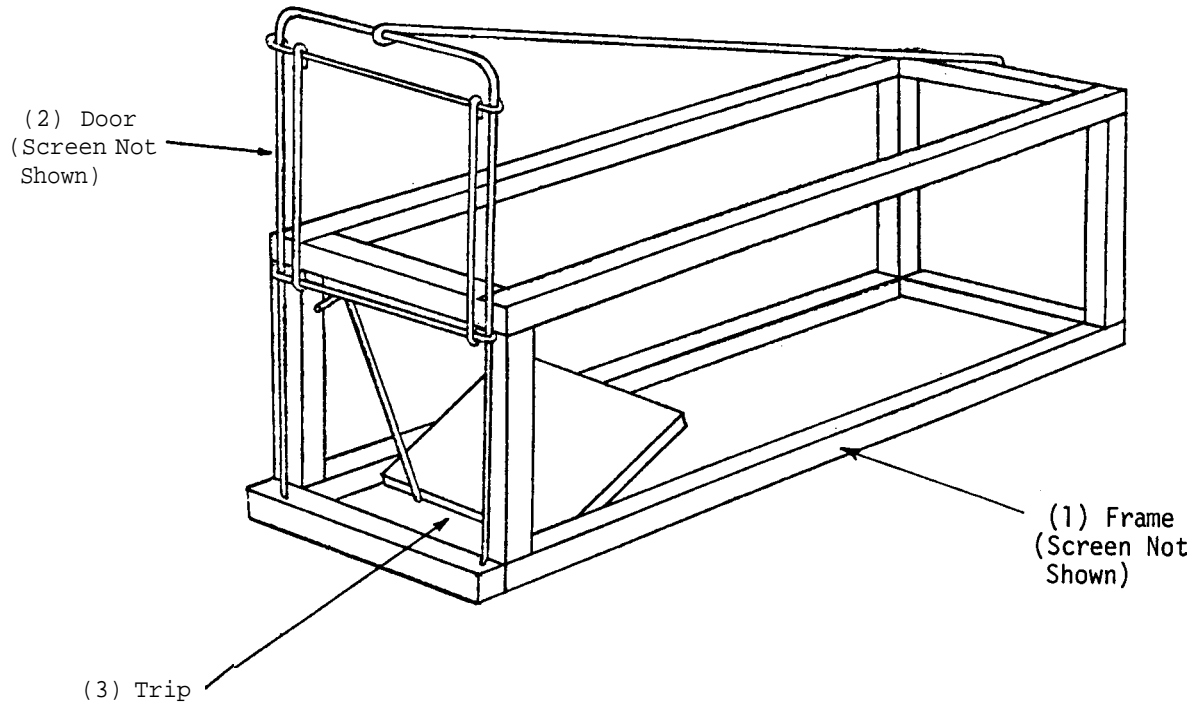
Side View
(Cross-section)

Trap in "Sprung"
Position

(ii) It may be desirable to modify the construction of this trap by making it with wire mesh sides as many animals are difficult to entice into enclosed spaces.

(iii) This design can be altered in many ways, especially with respect to proportion, dimensions, and materials used, including plywood or other thin but strong construction materials.

C2. Potter Bird Trap *



a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Frame	1	Wood (A)	24 cm x 2 cm x 2 cm
	4	Wood (B)	50 cm x 2 cm x 2 cm
	7	Wood (C)	20 cm x 2 cm x 2 cm
	4	Wire Screen (D)	23 cm x 49 cm
	1	Wire Screen (E)	23 cm x 23 cm
(2) Door	1	Stiff Wire (F)	125 cm long, 0.3 cm diameter
	1	Stiff Wire (G)	60 cm long, 0.3 cm diameter
	4	Stiff Wire (H)	27 cm long, 0.3 cm diameter
	1	Wire Screen (I)	22 cm x 22 cm
(3) Trip	1	"U" Tack (J)	1 cm long
	1	Stiff Wire (K)	25 cm long, 0.3 cm diameter

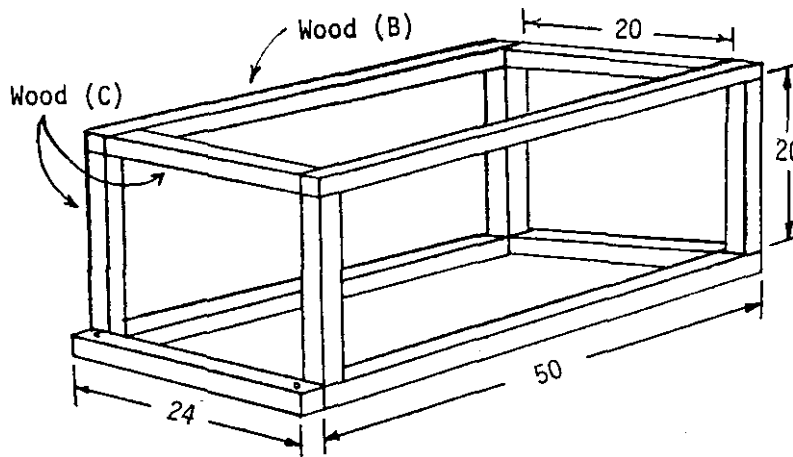
*Adapted from Nuffield Foundation, Teacher's Guide III: The Maintenance of Life, (England: Longmans/Penguin Books, 1966), p 201.

- 3 "U" Tacks (L)
- 1 Hood (M)

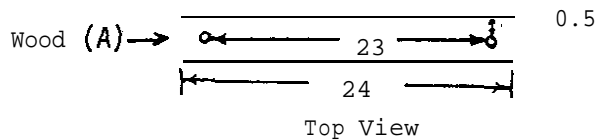
1 cm long
19 cm x 12 cm x 1.0 cm

b. Construction

(1) Frame

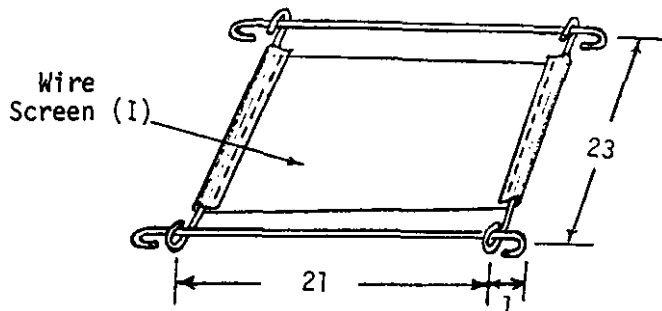


Nail and glue the basic framework together as shown. Begin by nailing one piece of wood (C) to the ends of two long pieces (B). Nail four of the remaining short pieces (C) to the U-shaped piece already made. Nail one in an upright position at each end of each long piece (B) to form the corners of the trap. Next, nail the two remaining pieces of both the short (C) and long (D) wood to the ends of the four upright pieces to complete the basic trap framework.

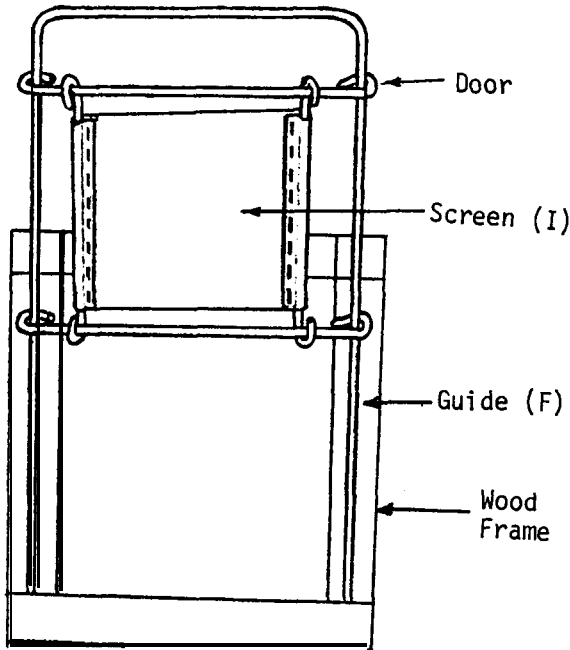
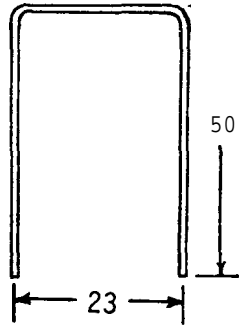


Drill holes the same diameter (0.3 cm) as the stiff wire (F) used for the door in the piece of wood (A) to act as "seats" for the door frame. Drill these holes 1.5 cm deep. Nail the four long pieces of screen (D) to the sides, bottom and top of the trap and nail the square piece (E) to the rear end to enclose all but the front of the trap in screening.

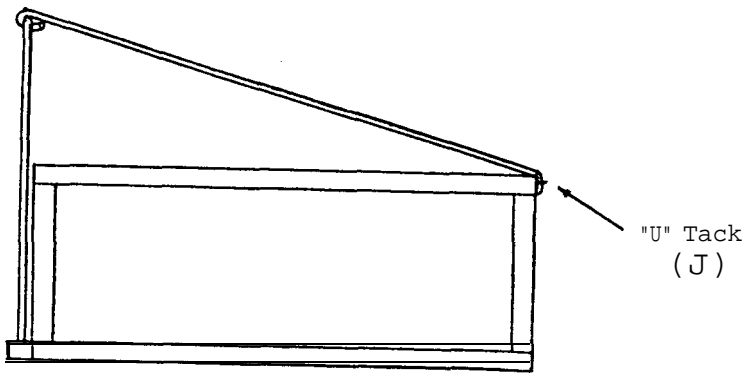
(2) Door



Bend the ends of two pieces of wire (H) over about 2 cm from each end. Bend the ends of the other two pieces (H) around the first two pieces to form a square framework. Fold two edges of the wire screen (I) around two sides of the frame



Front View



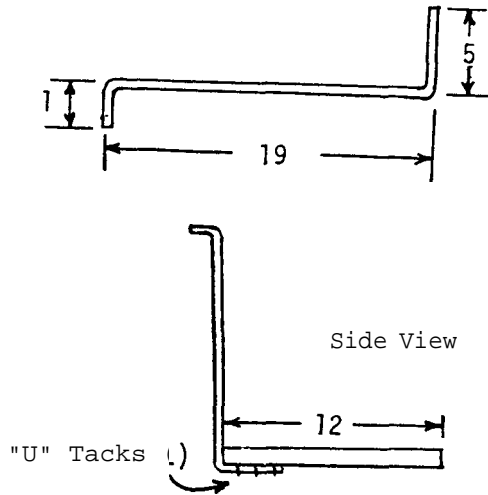
Side View

and "sew" the screen together with wire.

Bend the piece of wire (F) to a "U" shape. Slip the ends of this wire through the open ends of the wires in the door frame. The door should slide up and down easily with the U-shaped wire acting as a guide. Next, imbed the ends of the "U" into the holes in the front piece (A) of the wooden frame. They may be glued in place if necessary. When the door slides down the guide, it should effectively block the entrance of the trap with little or no gap.

Tack the end of the piece of wire (G) to the rear of the cage with a "U" tack (J) and bend it down until it touches the top of the door frame. Bend the remaining end around the wire (F) to help stabilize and support the door frame.

(3) Trip



Bend up 5 cm of the wire (K) to a right (90°) angle and bend 1.0 cm of the other end of the wire to a right angle in the opposite direction. Tack the wire to the wood (M) with the three "U" tacks (L) as near to one of the 12 cm edges as possible.

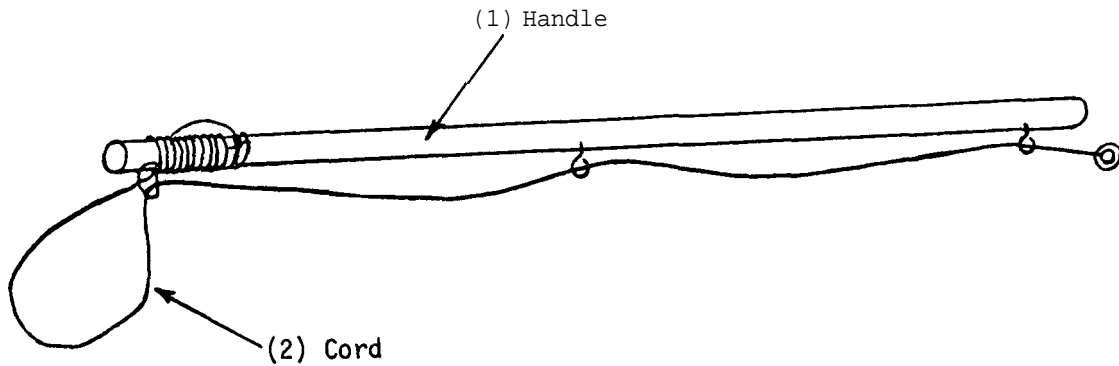
C. Notes

(i) To use the Potter bird trap, place it in a place where the desired type of bird is known to congregate. It may be necessary to anchor the trap in some manner in order to prevent it from being disturbed. The trap is set by pulling the sliding door all the way up and placing the trip inside the trap at such an angle that, when the door is lowered, the lower cross wire of the door rests on the bent portion of the trip wire. The slight pressure of the door on the trip should both hold the door up (and open) and keep the trip at a slight angle. Finally, bait the trap with a suitable attractant for the particular type of birds desired. A bird entering the trap for the bait will hop on the wooden part of the trip causing the wire to be pulled out from under the door which will drop down in place and trap the bird.

(ii) This trap, unlike others, doesn't require the hunter to hide in a blind waiting for a bird to enter.

(iii) The dimensions of this trap can be altered according to the size of the birds being trapped. Also, the trap may be baited in such a way as to attract other animals besides birds.

C3. Snare

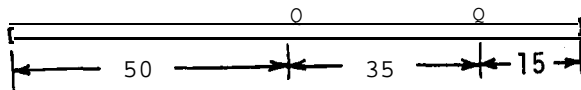


a. Materials Required

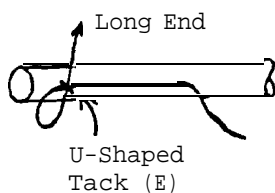
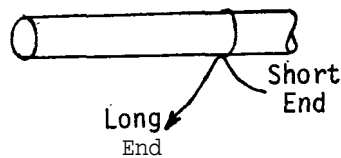
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Handle	1	Wooden Rod (A)	100 cm long, 2 cm diameter
	2	Eyed Screws (B)	1 cm diameter opening
(2) Cord	1	Insulated Copper Wire (C)	250 cm long, 0.3 cm diameter
	1	Washer (D)	3 cm diameter
	1	"U" Tack (E)	1 cm long

b. Construction

(1) Handle



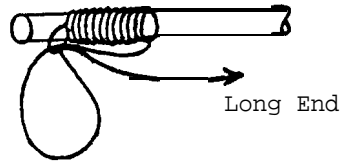
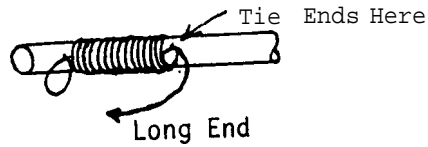
(2) Cord



Screw one eyed screw (B) 15 cm from the end of the wooden rod (A) and screw the second screw (B) 50 cm from the other end.

Tie the cord (C) securely to the rod at a point approximately 10 - 15 cm from the end. The short end should be at least 10 cm long as it will be used again to be tied to the long end.

Run the long end of the cord up to the end of the rod and form a loop. Hold the loop in place with a U-shaped tack (E).



At the end of the loop, begin wrapping the long end of the cord tightly around the rod until the short end has been reached. At that point, tie the long and short ends securely.

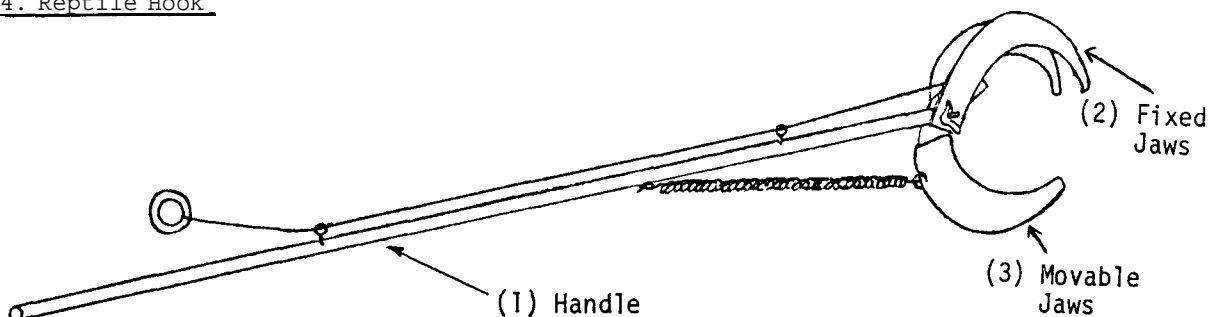
Extend the long end through the loop and then extend it back to form the snare. The long end is kept in position by extending the ends through the eyes on the rod. When the long end of the cord extends through the second eyed screw, tie the large metal washer (D) to it to make a pull ring.

c. Notes

(i) Use the snare to capture snakes, lizards, and other small animals which are difficult or dangerous to capture by hand. The loop must be placed over the animal's head, then pulled tight to hold it fast.

(ii) Bamboo or other materials may be used instead of wood for the rod. Rope can be used instead of insulated wire, but the wire is better since it is stiff and this helps keep the snare loop open instead of hanging limp.

C4. Reptile Hook

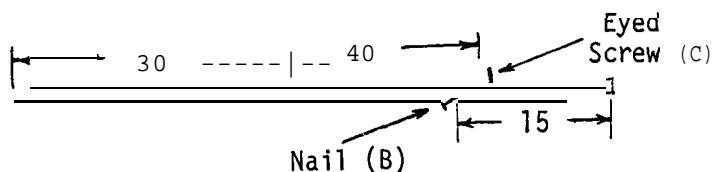


a. Materials Required

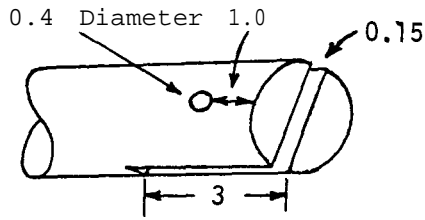
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Handle	1	Wooden Dowel (A)	100 cm long, 1.5 cm diameter
	1	Nail (B)	1.5 cm long, about 0.2 cm diameter
	2	Eyed Screws (C)	2 cm long, 1 cm diameter opening
	2	Tape (E)	About 50 cm
(2) Fixed Jaws	2	Sheet Metal (D)	10 cm x 6 cm x 0.1 cm
	2	Tape (E)	About 50 cm
(3) Movable Jaw	1	Sheet Metal (F)	10 cm x 9 cm x 0.1 cm
	1	Spring (G)	12 cm x 0.5 cm
	1	Steel Wire (H)	100 cm long
	1	Washer (I)	3 cm diameter
	1	Bolt (J)	0.4 cm diameter, 2.5 cm long
	1	Wing Nut (K)	0.4 cm internal diameter
	1	Tape (L)	About 50 cm
	1	Rubber Tubing (M)	7 cm long, 1.0 cm diameter

b. Construction

(1) Handle

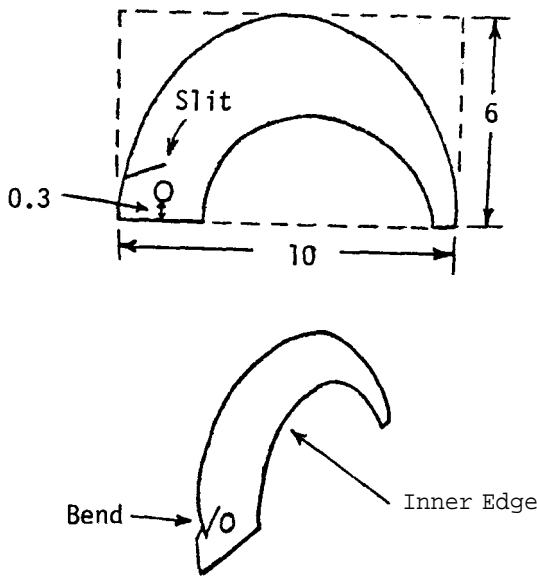


Screw the two eyed screws (C) into the wooden dowel (A) so that the opening of the "eye" faces the ends of the dowel. Hammer the nail (B) into the opposite side of the dowel at the angle indicated.



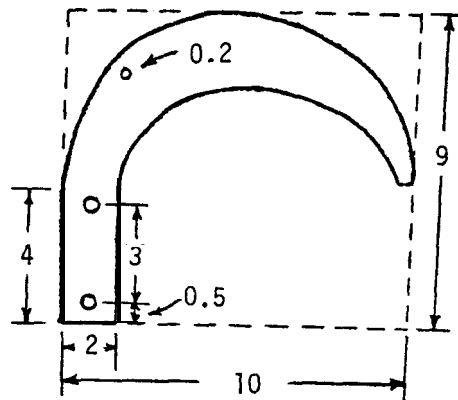
Cut a notch into the end of the dowel nearest the nail. This notch needs to be 3 cm deep and about 0.15 cm wide (i.e., slightly wider than the sheet metal (F) used for the movable jaw). Finally, drill a hole 0.4 cm in diameter 1 cm from the end, and perpendicular to the notch.

(2) Fixed Jaws

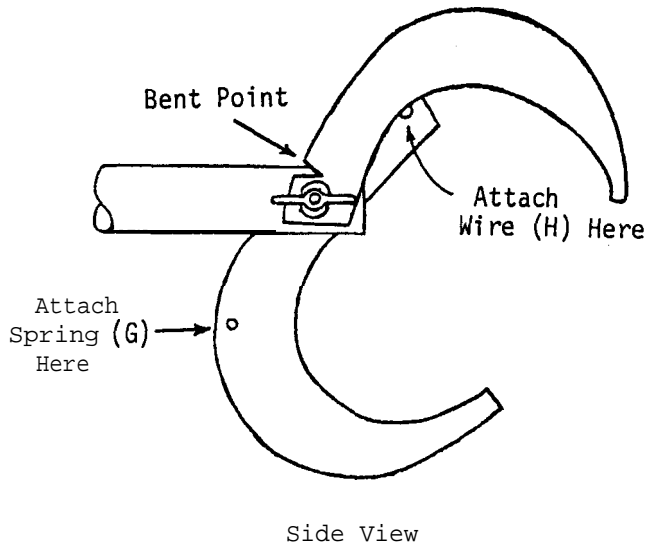
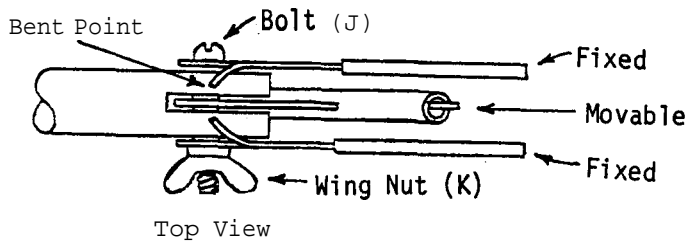
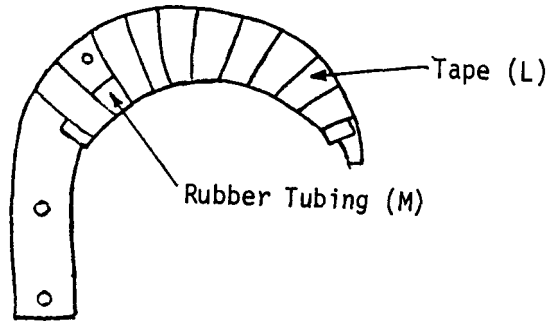
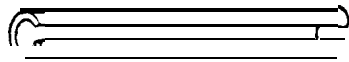


Cut the two fixed jaws to shape from the sheet metal (D). Drill or punch a hole 0.5 cm in diameter through the wide portion of each jaw, centered, and 0.3 cm from the flat edge. Cut a slit into each jaw about 0.7 cm long and in approximately the position indicated. Bend the resulting point of metal in on one jaw and out on the other (i.e., in opposite directions). To complete the jaws, cover at least the inner edge with tape (E), cloth, etc., to protect the animals being collected from cuts.

(3) Movable Jaw



The movable jaw, made from sheet metal (F), is identical in shape to the fixed jaws except that one arm is extended for 4 cm. Three holes must be drilled or punched in the jaw. The two lower holes need to be 0.5 cm in diameter while the third need only be about 0.2 cm in diameter. Pad the inner edge of the movable jaw by slitting one



side of a 7 cm long piece of rubber tubing (M), and slipping it over the edge of the jaw. Use tape (L) to hold the tubing in place. Alternatively, the jaw may simply be padded with cloth and tape or other materials.

Attach the jaws to the handle in this order: Run the bolt (J) through one fixed jaw, halfway through the handle, through the middle hole of the movable jaw, through the rest of the handle and through the second fixed jaw. Screw on the wing nut (K) to secure the whole assembly. Be certain that the "bent points" of the fixed jaws both point in, rather than out. Fix tension on the wing nut such that the jaws are not loose, but the movable jaw still can be freely moved. The "bent points" of the fixed jaws prevent them from rotating backwards about the bolt.

Next, attach the steel wire (H) to the upper hole of the movable jaw and run the free end through both eyed screws (C). Fasten the free end to the washer (I). Fasten one end of the spring (G) to the remaining hole in the

movable jaw, stretch out the spring, and fasten the free end to the nail (6). The movable jaw should be held wide open, and the reptile hook is ready for use. [Note: If a spring of the correct size and tension is not available, one can easily be made by winding steel wire (about 0.08 cm diameter) around a pencil or other cylindrical rod.]

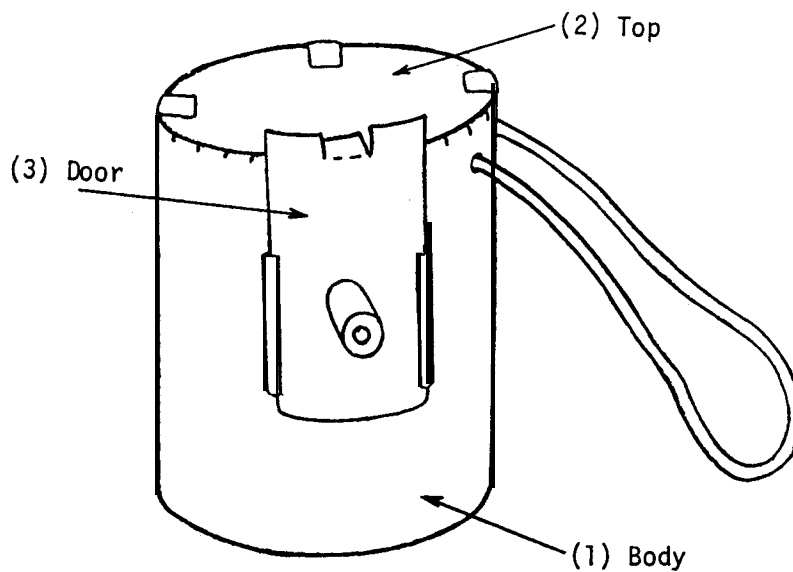
c. Notes

(i) Other materials such as bamboo, broom handles, etc., may be used for the handle. Also, a strong rubber band may be substituted for the spring.

(ii) If the sheet metal used for the jaws is sufficiently stiff and strong, only one fixed jaw may be required instead of two.

D. PLANT COLLECTING APPARATUS

D1. Vasculum

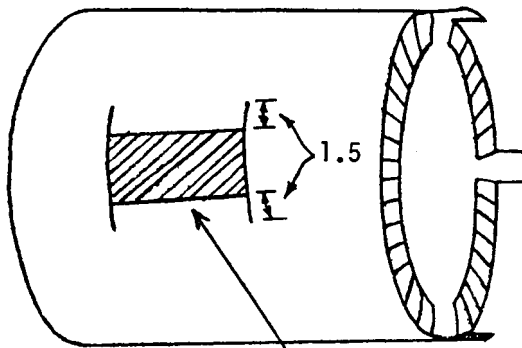
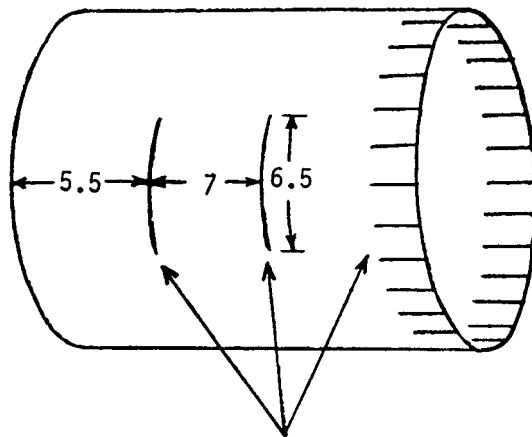


a. Materials Required

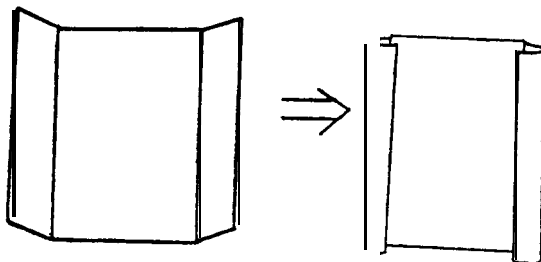
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Body	1	Tin Can (A)	4 liter capacity (about 18 cm long by 15 cm diameter) or larger
	1	Rope (B)	50 cm x 0.5 cm
(2) Top	1	Tin Sheet (C)	15 cm diameter, 0.05 cm thick
(3) Door	1	Tin Sheet (D)	14 cm x 8 cm x 0.05 cm
	1	Wood Dowel (E)	2.5 cm long, 2.5 cm diameter
	1	Nail (F)	3 cm long, 0.3 cm diameter

b. Construction

(1) Body



Remove Shaded Portion



Step 1

Step 2

Detail of
Door Guides

Use a hacksaw to make two slits in the side of the can (A). Each slit is 6.5 cm wide. The first slit is 5.5 cm from the bottom of the can, and the second slit is 7.0 cm from the first. Also, around the top edge (the top being the end which has been removed) make a series of slits approximately 2 cm deep and 2 cm apart.

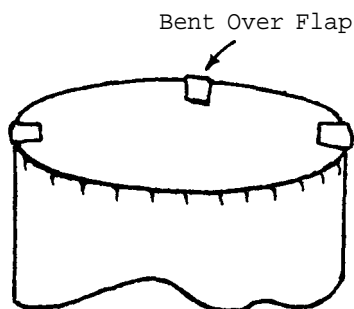
After these initial slits have been made, remove part of the can between the two slits leaving about 1.5 cm of metal to either side of the opening. Further, bend down all of the flaps made in the top edge of the can except for three, specifically those three which are 90°, 180°, and 270° from a point directly above the door.

To make the guides for the door, first bend the 1.5 cm flaps out until they touch the can, then double them over so that the door will slide between them without falling out. This second step is best done by holding the door in place and bending the flaps over it.

Finally, drill or punch two holes (about 1 cm diameter) in

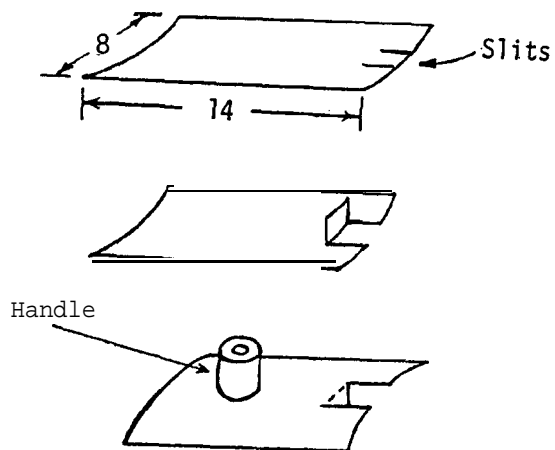
one side of the can. Pass an end of the rope (B) through each hole and knot the ends inside the can so that the rope cannot pull out.

(2) Top



Merely cut out a circular piece of tin sheet (C) the same size as the end of the can. Place this piece on top of the bent down flaps and bend down the remaining three flaps. The top should slide in and out easily.

(3) Door



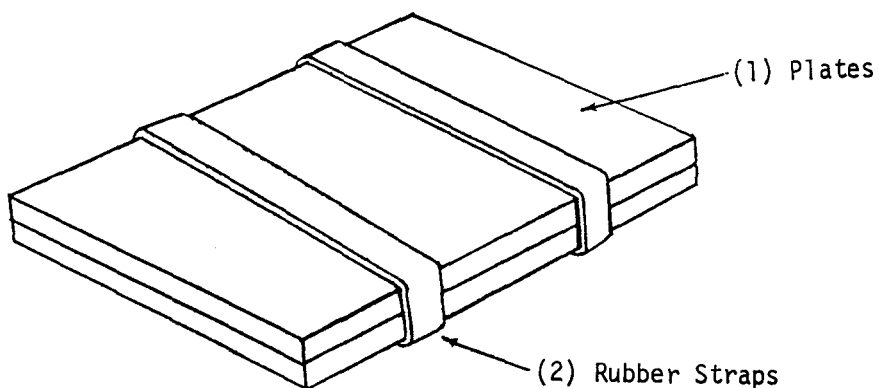
Roll the sheet metal (D) slightly until the slight curvature conforms to the side of the can. Make two slits 2 cm deep and 2 cm wide in one end, and bend the flap down. Make the door handle from the dowel (E) and nail (F). Simply drive the nail through the end of the dowel and through the door itself. Flatten the point of the nail like a rivet to hold the handle in place. When finished, the door should slide easily between the guides on the side of the can. The flap on the end of the door serves to help hold down the top as well as preventing the top from sliding out by accident.

c. Notes

(i) The vasculum is used to keep plant materials from excessively drying out when collecting in the field. Put the plants in the vasculum through the door when collecting, and remove them by removing the top.

(ii) If large tin cans with replacable lids are available, these will do nicely and will eliminate the need for cutting out the door and lid. Also, see VII/A2 (Sterilizer) for an alternate method of making the lid for a tin can of this type.

D2(1), Plant Press (Field Type)



a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Plates	2	Wood (or Plywood) (A)	25 cm x 20 cm x 1.0 cm
(2) Rubber Straps	2	Heavy Rubber Bands (B)	2.5 cm wide, 15 cm diameter

b. Construction

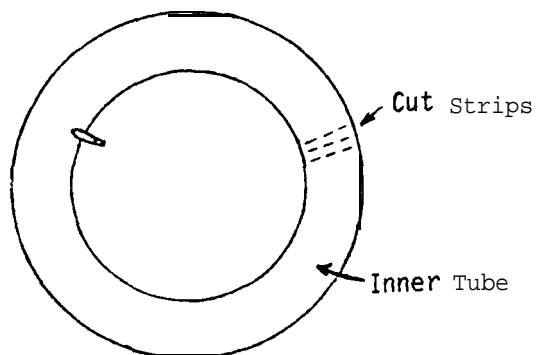
(1) Plates

Cut the wood (A) to size.

Smaller or larger sizes may be made according to personal preference.

(2) Rubber Straps

Cut the rubber straps (B) from old automobile tire inner tubes.



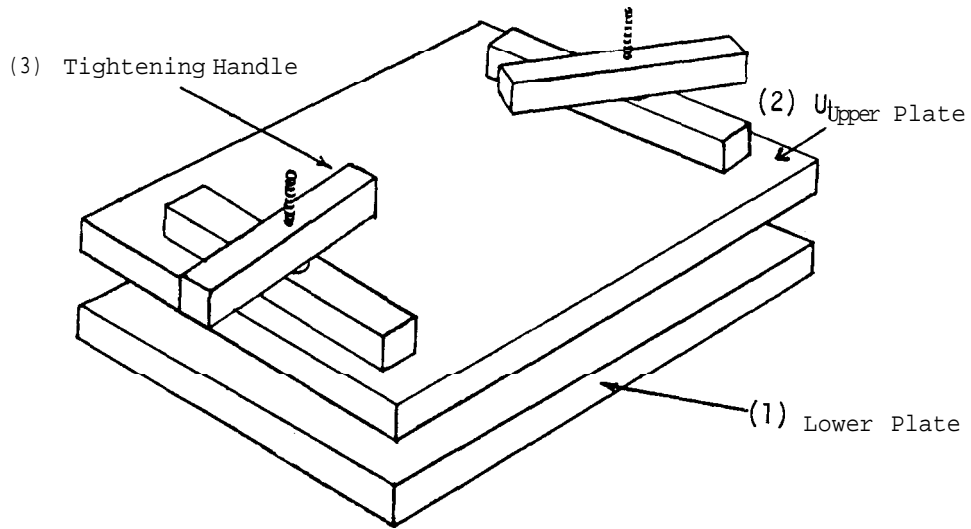
Section of Inner Tube

c. Notes

(i) Use the field plant press to hold plant materials until they can be returned to the laboratory. Place the plants between several layers of newspaper, and place the newspapers between the press plates. Wrap the rubber straps around the plates and newspapers to hold them securely until they are returned to the laboratory.

(ii) Lengths of rope or belt-like straps can be used to tighten the press rather than the rubber straps.

D2(2). Plant Press (Laboratory Type)

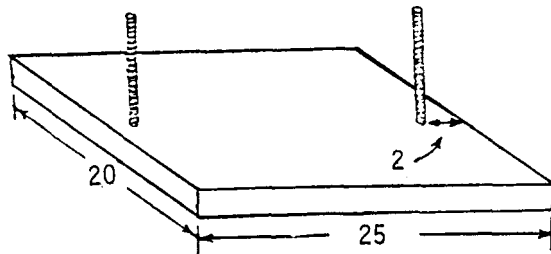


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Lower Plate	1	Plywood (A)	25 cm x 20 cm x 1.25 cm
	2	Bolts (B)	15 cm long, 0.7 cm diameter
(2) Upper Plate	1	Plywood (C)	25 cm x 20 cm x 1.25 cm
	2	Wood (D)	15 cm x 1.75 cm x 1.75 cm
(3) Tightening Handles	2	Nuts (E)	0.7 cm inside diameter
	2	Wood (F)	15 cm x 1.75 cm x 1.75 cm
	2	Washers (G)	1 cm inside diameter, 2 cm outside diameter

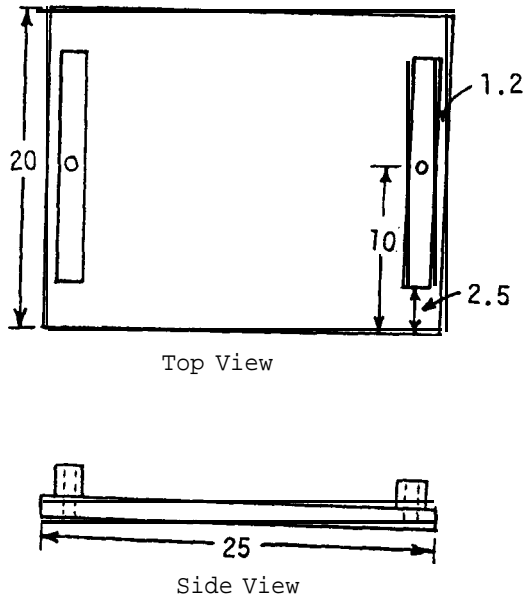
b. Construction

(1) Lower Plate



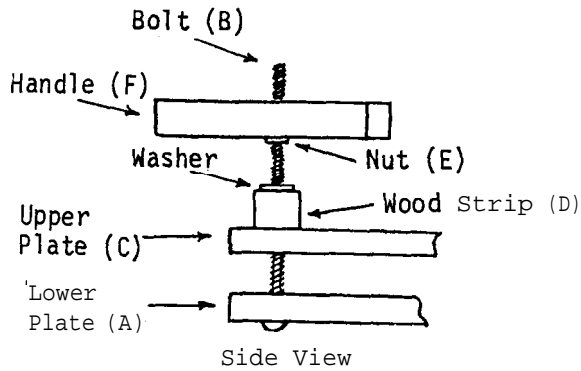
Drill a hole through each end of the plywood (A) (regular wood may be used as well) 2 cm from the end and centered. The holes should be 0.8 cm in diameter. Pass the bolts (B) through these holes as far as they will go.

(2) Upper Plate



Nail or glue the two wood strips (D) to the plywood (C) 1.2 cm from the ends and parallel to the edge. Drill a hole 0.8 cm in diameter through the wood strip and plywood at each end. Put the upper plate into position by running the two bolts (B) in the lower plate through the holes in it (the upper plate).

(3) Tightening Handles



Drill a hole 0.8 cm in diameter through the center of each strip of wood (F). Then, place a nut (E) directly over the hole in the wood and give it a sharp rap with a hammer. Remove the nut from the depression thus formed, put some epoxy resin cement in the depression and glue the nut in place in the depression. When the glue has hardened, place a washer (G) over each bolt, and screw on the tightening handles. The laboratory plant press is now ready for use.

c. Notes

(i) To use the laboratory plant press, place collected specimens between several layers of newspaper and tighten the two plates of the press together very tightly. Leave the plants in the press until they are thoroughly dried out.