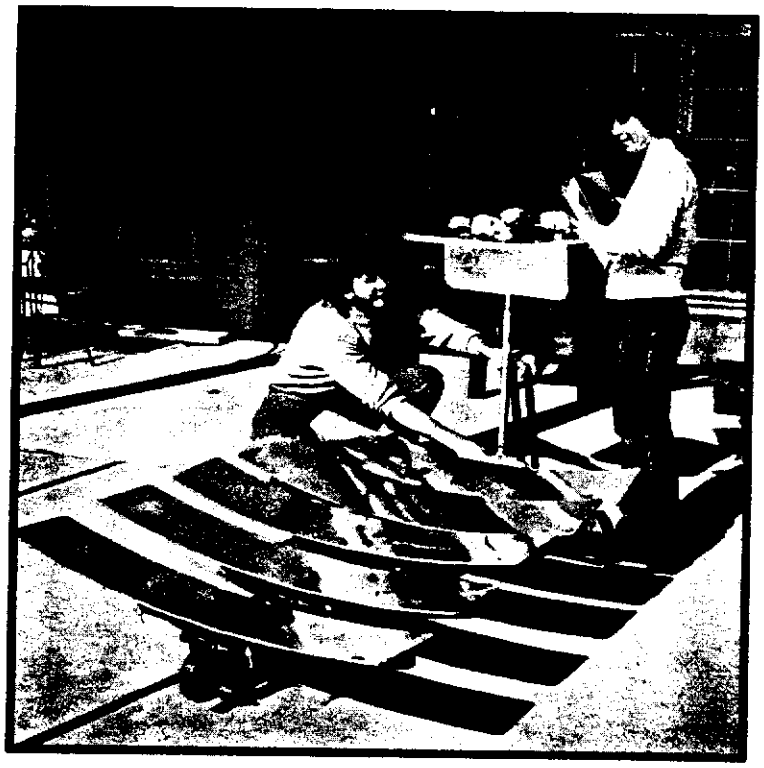
5 Solar Barbecue



This solar barbecue is somewhat of a breakthrough in using solar energy at home. It is easy to use, lots of fun, efficient, durable, and handsome. It can be the center of attraction in your outdoor living space. The barbecue is a unique, high-temperature cooker that can easily broil meat or bake potatoes in the same length of time as a conventional barbecue—but without the use of any energy except the sun.

Five reflectors focus the sun's rays onto a griddle. Each reflector is set at a slightly different angle and radius to concentrate the sunlight on the griddle properly. By concentrating all the energy that strikes the

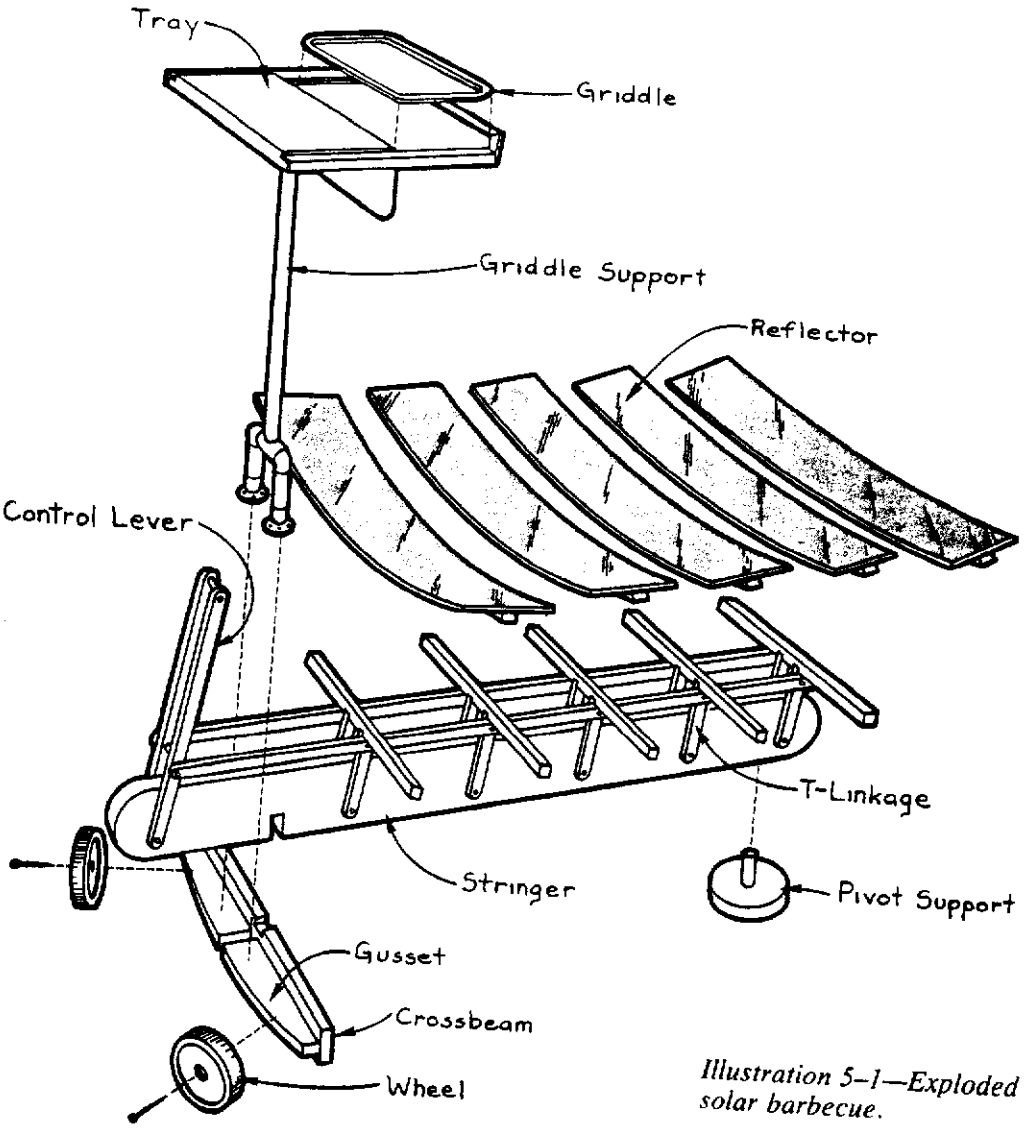


Illustration 5–1—Exploded view of the solar barbecue.

large reflector area onto the smaller griddle, high temperatures are reached. The barbecue is sized to handle a big steak or several pieces of chicken at one time. An added plus is that the grilling surface is at a convenient working height.

The solar barbecue is constructed of redwood, 1-inch pipe, and steel reflectors. It can easily be partially dismantled for winter storage.

CHART 5–1—
Materials

DESCRIPTION	SIZE	AMOUNT
Lumber		
Redwood	2 × 6 × 8′	4
Redwood	2 × 4 × 8′	1
Redwood	2 × 2 × 8′	1
Redwood	1 × 2 × 8′	4
A-C Exterior Plywood	¼″ × 4′ × 4′	1
Hardwood Dowel	⅞″ × 8″	1
Hardware		
Finishing Nails	8d	6
Aluminum Nails	1¼″	5
#14 Flathead Wood Screws	1¼″	12
#10 Flathead Wood Screws	3½″	4
#10 Flathead Wood Screws	1½″	1
#8 Aluminum Flathead Wood Screws	1½″	16
#8 Aluminum Flathead Wood Screws	1″	60
Lag Bolts with Nuts	½″ × 4″	2
Hex Head Bolts with Nuts	⅜″ × 4″	6
Hex Head Bolts with Nuts	¼″ × 5½″	6
¼–20 Toggle Bolts	3″	10
¼–20 Hex Nuts	···	30
Flat Washers	½″	4

CHART 5–1—*Continued*

DESCRIPTION	SIZE	AMOUNT
Hardware—*continued*		
Flat Washers	¼″	20
Fender Washers	⅜″	12
Fender Washers	¼″	12
Loose-Pin Hinges with Screws	1½″ × 2″	10
#8 Cup Hook	…	1
Screw Eyes	⅜″ × ¾″	10
Aluminum Angle	¾″ × ¾″ × ⅛″	58″
Aluminum Flashing	8″ × 22″	1
Miscellaneous		
Pipe Flanges	1″	3
Pipe Nipples	1″ × 5½″	2
Pipe Nipples	1″ × 2″	2
Pipe Elbows	1″	2
Pipe Tee	1″	1
Pipe	1″ × 30″	1
Wheels	7″	2
Waterproof Wood Glue	…	1 pt.
Trim Adhesive	…	1 can
Metal Primer	…	1 can
Aluminum Paint	…	1 can
Exterior Urethane	…	1 qt.
Lead Solder	…	trace
Flux	…	trace
Reflective Mylar	8″ × 20′	5
Cast-Iron Griddle	10″ × 17″	1

CHART 5–2—
Tools

- Hacksaw
- Circular Saw
- Backsaw
- Saber Saw with Rip Guide
- Drill and Bits
- Bar Clamps: 12-inch
- Utility Knife
- Wood Chisel
- Pipe Wrenches
- Protractor
- Trammel Points
- Grinding Wheel (optional)
- Propane Torch
- Angle Finder

At first the solar barbecue may appear complicated to build, but the construction methods are not difficult. Our directions are detailed for the novice builder. We include a complete list of materials, chart 5–1, and of the tools you will need, chart 5–2. An exploded view of the barbecue is shown in illustration 5–1.

The design that follows is for a wheeled version of the solar barbecue. The unit could be mounted permanently, and the modifications needed for a permanent mount are discussed at the end of this chapter.

Begin construction of the solar barbecue with the support stringer, shown in illustration 5–2. Cut the 2 × 6 stringer to a length of 74 inches. Measure 4 inches, 16 inches, 28 inches, 40 inches, 52 inches, and 70 inches from one end of the stringer. Drill ⅜-inch-diameter holes 1 inch from an edge, designated as the lower edge, at the six points. Five holes are for the reflector pivots and one, at the 70-inch mark, is for the control handle pivot. Draw a 2¾-inch-radius half-circle at each end of the stringer, and round off the ends with a saber saw.

The stringer is also notched to fit a 2 × 4 crossbeam, set on edge. Measure 15 inches and 16½ inches from the control handle end to mark the sides of the notch. Referring to illustration 5–2, measure 2½ inches from the lower edge for the depth of the notch. Cut the notch and clear away any excess wood with a wood chisel.

The solar barbecue is designed to pivot around a fixed point at the front of the stringer so that the reflectors can easily be turned to face the sun. The pivot pin is glued into a ⅞-inch-diameter hole drilled 2 inches deep into the bottom edge of the stringer. Drill the hole 11 inches

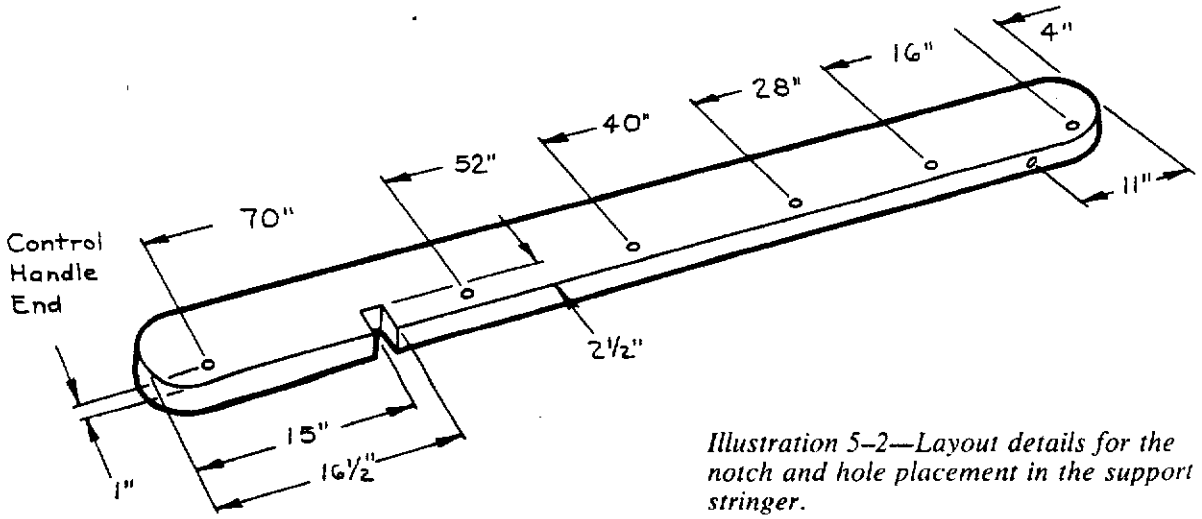


Illustration 5–2—Layout details for the notch and hole placement in the support stringer.

from the reflector end of the stringer. Cut a 3¼-inch-long piece of ⅞-inch-diameter hardwood dowel to make a pivot pin. Chamfer the bottom end of the pivot pin by rasping or sanding a 45-degree bevel around the edge. The chamfered end will rotate inside the pivot support. Glue the pivot pin into the hole in the stringer with waterproof glue.

Make a circular pivot support, shown in illustration 5–3, from scrap 2 × 6 redwood, to hold the pivot pin. Be sure to save three 8-foot 2 × 6s for the reflector bases and the gusset. Cut a 5½-inch-diameter circle, using the saber saw. Drill a 1-inch hole ¾ inch deep in the center to fit the pivot pin. Then drill a ⅛-inch-diameter pilot hole through the center of the larger hole for the fastening screw.

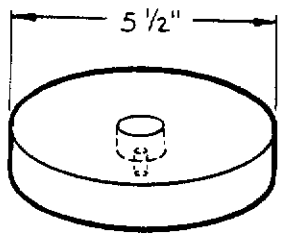


Illustration 5–3—Pivot support.

The crossbeam, illustration 5–4, supports the stringer and, with the gusset, provides a stable support for the wheels that allow the grill to be turned to face the sun. Cut the crossbeam from a 2 × 4, to a length of 31¼ inches. The crossbeam receives a notch 1 inch deep and 1½ inches wide, centered in the crossbeam. Cut this notch as you did the one in the stringer.

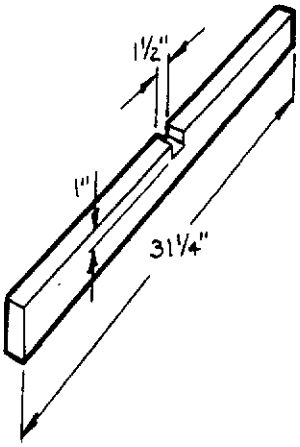


Illustration 5–4—Crossbeam layout.

The wheels of the barbecue are attached to two gussets, made from a single piece of 2 × 6. The gussets are curved to set the wheels at an angle so they easily move around the pivot point. The gusset shape is drawn onto a single board, then the board is cut to make two gussets, as shown in illustration 5–5. First, cut the 2 × 6 to 29¾ inches and clamp it to a flat surface where you have several feet of work space. At the midpoint, measure 4 inches across the width and make a mark. Draw a line on your work space perpendicular to the midpoint of the 2 × 6,

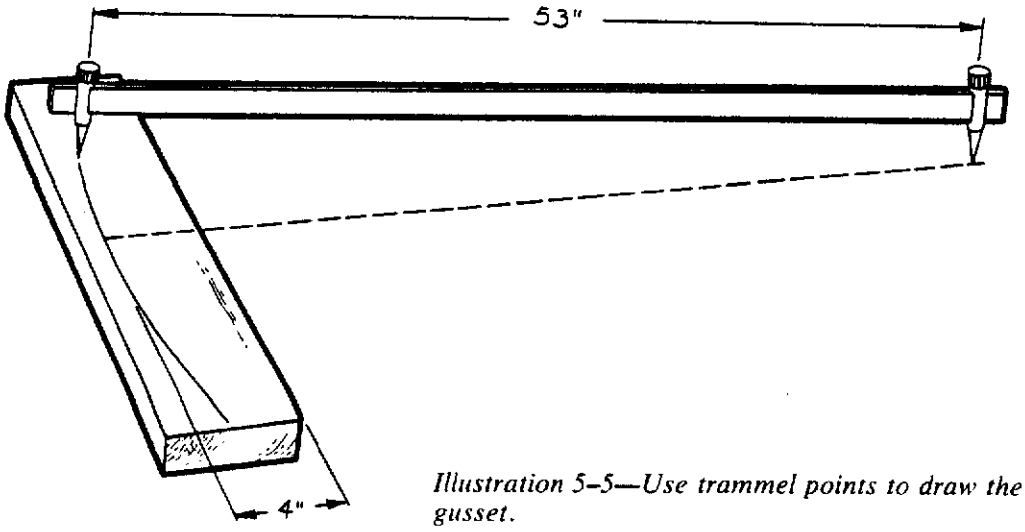


Illustration 5–5—Use trammel points to draw the radius on the gusset.

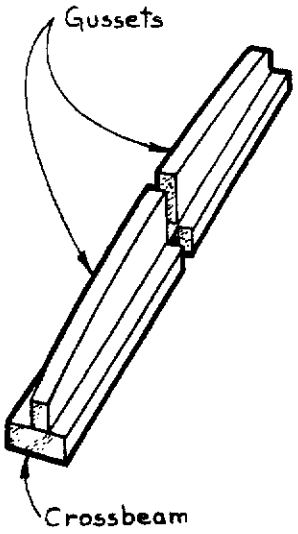


Illustration 5–6—Gussets and crossbeam.

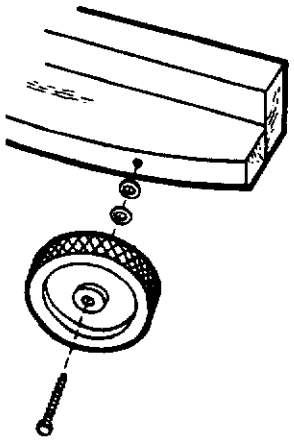


Illustration 5–7—Wheel assembly.

Photo 5–1—Draw the 53-inch gusset radius, using a shop-made compass pivoting from the floor.

extending 53 inches from the mark. Set trammel points, which are shown in photo 5–1, for a 53-inch radius. With one end on the perpendicular line and the other end on the 4-inch mark at the midpoint of the gusset board, draw a 53-inch radius lengthwise onto the gusset, as shown in illustration 5–5. Cut the curved edge first, then cut the board in half at the midline to make the two gussets.

Fasten the gusset pieces to the crossbeam with four 3½-inch #10 flathead wood screws and waterproof glue. Set the crossbeam on its face, and place the gussets on edge in the center of the crossbeam, ends flush. Be sure to leave a space to fit the stringer between the gusset halves, as shown in illustration 5–6. Glue the pieces, clamping them together, then drill ⅛-inch-diameter pilot holes and 3/16-inch-diameter shank holes 4 inches and 10 inches from the center of the crossbeam. Screw the crossbeam to the gussets.

When the glue has set, attach the crossbeam-and-gusset assembly to the stringer, using waterproof glue and 8d finishing nails. Then sand the assembled unit while the surfaces are still accessible.

Drill ⅜-inch-diameter pilot holes 3 inches from the ends of the gussets for fastening the two 7-inch-diameter wheels, as shown in illustration 5–7. The next step is to attach the wheels. For each wheel, use two ½-inch flat washers as wheel spacers between the wheel and gusset. Slip a ½ × 4-inch lag bolt through the wheel and two washers, then screw it into the gusset.

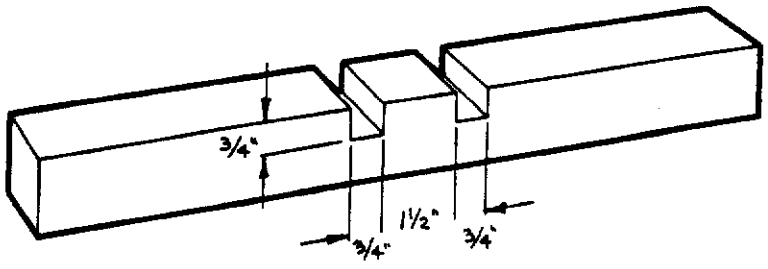


Illustration 5–8— T-linkage crosspiece.

The adjustment system for your solar barbecue is the T-linkage, which enables you to move all five reflectors with just one lever. In this way, maximum sunshine can be directed to the griddle at any season of the year or any time of the day. The T-linkage enables you to capture the sun as its angle of altitude changes due to seasonal variations, and the pivot point allows you to swing the entire unit to track the sun's path during the day!

The T-linkage is constructed from redwood. First cut five pieces of 2 × 2s, each 16 inches long, for the cross members. As shown in illustration 5–8, each crosspiece receives two dadoes. Each dado is ¾ inch wide and ¾ inch deep, and starts ¾ inch on either side of the centerline of the crosspiece. This positioning allows a 1½-inch space for the stringer. Mark the lines and cut the dadoes, then clean the cuts with a chisel.

Next, for the vertical pieces, cut ten pieces of redwood 1 × 2s, each 8 inches long. Measure ¾ inch from one end of each piece, and drill a ⅜-inch-diameter hole as the pivot. Mark a point 6¼ inches from the same end, and drill a ¼-inch-diameter hole for the control arm. Cut and shape a ¾-inch radius at the bottom of each vertical piece, as shown in illustration 5–9.

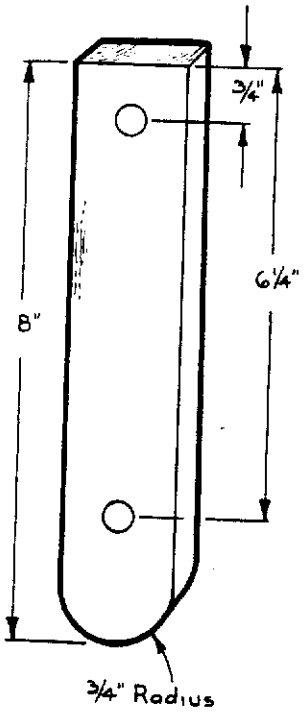


Illustration 5–9— T-linkage vertical piece.

Assemble the pieces of the linkage with waterproof glue and 1½-inch #8 aluminum flathead wood screws, as shown in illustration 5–10. Drill a 3/16-inch-diameter shank hole and a 1/16-inch-diameter pilot hole, and screw down through the crosspieces into the vertical pieces. Put two ¾-inch-long, ⅜-inch screw eyes into each crosspiece to serve as adjustment guides for the reflectors. Position the screw eyes 1 inch from each end and ½ inch above the lower edge of the crosspiece. Drill ¼-inch-diameter pilot holes, and insert the screw eyes. Tighten the screw eyes and position them so they are parallel to the long axis of the crosspiece. Sand the completed T assembly, and move on to the control linkage.

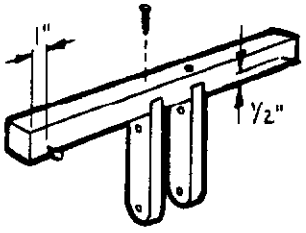


Illustration 5–10— T-linkage assembly.

The T-linkage is controlled through two arms extending the length of the barbecue. The arms are fastened to the Ts and to the control lever. Refer to the exploded illustration 5–1 to see the entire control assembly. First, cut two pieces of clear redwood 1 × 2s, each 68 inches

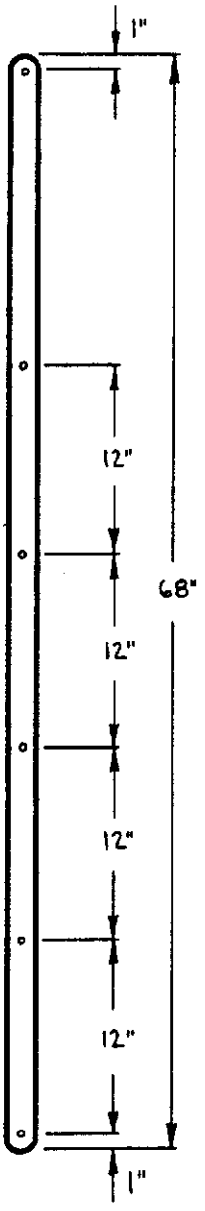


Illustration 5–11—Adjustment rod layout.

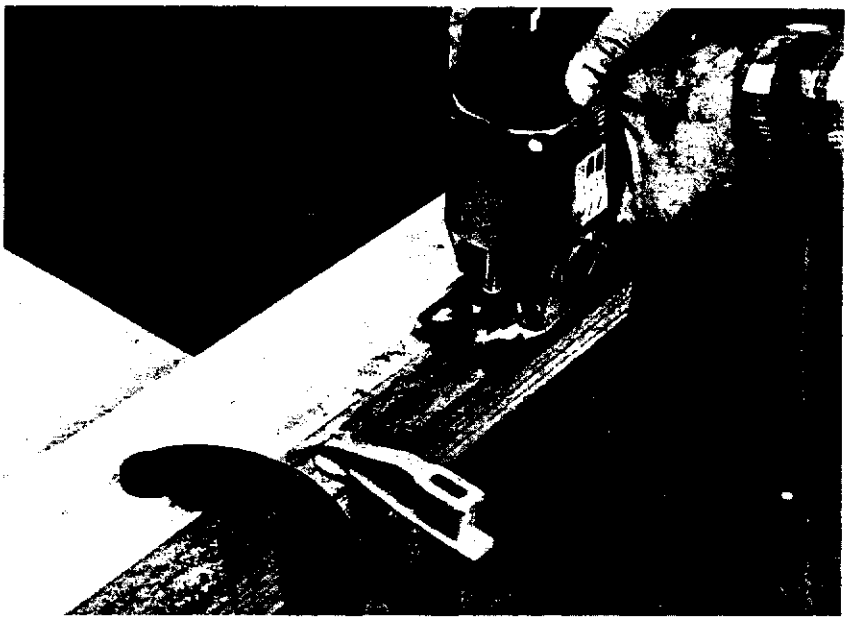


Photo 5–2—Rip 1-inch-wide T-linkage strips, using a saber saw and the guide arrangement shown here.

long. Rip each piece to 1 inch wide. If you have only hand-held power tools, use the method shown in photo 5–2.

Drill six ¼-inch-diameter holes, as shown in illustration 5–11, starting at a point 1 inch from an end, and repeating at 12-inch-on-center intervals from the first hole for four more holes. The last hole goes 1 inch from the other end. At each end of the arms, cut and shape a 1-inch-diameter radius.

The lever controls extend to a convenient height so that you can easily adjust the reflectors. Cut two pieces of redwood 1 × 2, each 24 inches long, for the levers. Round both ends of each piece by cutting a 1½-inch-diameter radius. Then, ⅜ inch from the end designated as the top, drill a ⅞-inch-diameter hole in each control lever to fit the dowel handle. The ⅜-inch-diameter pivot holes are ¾ inch from the bottom end of the control lever. The ¼-inch control arm holes are 6¼ inches from the bottom end.

Finally, for the handle, cut a ⅞-inch-diameter hardwood dowel 3¾ inches long. Glue the handle between the lever controls, keeping them parallel and spacing them so that they easily slip over the stringer. Sand the parts of the control system, rounding or "breaking" the edges.

The power of the solar barbecue lies in the reflectors. Each panel has been designed with a different curve to best concentrate the sun's

rays on the griddle. Since we have already calculated these arcs, all you need to do is use the figures we give here to lay out the reflector bases. Label each one, as it is important to assemble them in a particular order. Each reflector consists of a redwood base, plywood backing, and a laminated Mylar and aluminum reflective surface.

Illustration 5–12 shows the layout for the reflector bases. Cut five base pieces, each 48 inches long, from redwood 2 × 6s, and label the pieces *A–E*. On each piece, measure 24 inches to the center point, and square a line across. Measure ⅞ inch from the edge, and make a mark on the centerline. Use this point to strike off each radius. As you did for the gusset, clamp the base pieces to your table, and draw a line from the center point perpendicular to the base. Draw the radius lines with trammel points, giving each reflector base a dished shape, ⅞ inch wide at the narrow center point. The radii of the reflectors are as follows: reflector A, 64 inches; reflector B, 68 inches; reflector C, 79 inches; reflector D, 97 inches; and reflector E, 114 inches.

Lay out the bottom edges of the reflector pieces before cutting the arc radii. Mark 7 inches in from each end, then measure 1½ inches down from the point at which the arc crosses the end of the base. Draw a diagonal line from the 7-inch point to the end point, and cut along this line. Then cut along the curved radius lines of the upper edges.

Making the reflector backing is next. Cut five pieces, each 8 × 48 inches, from ¼-inch plywood. Round each corner by cutting a ½-inch

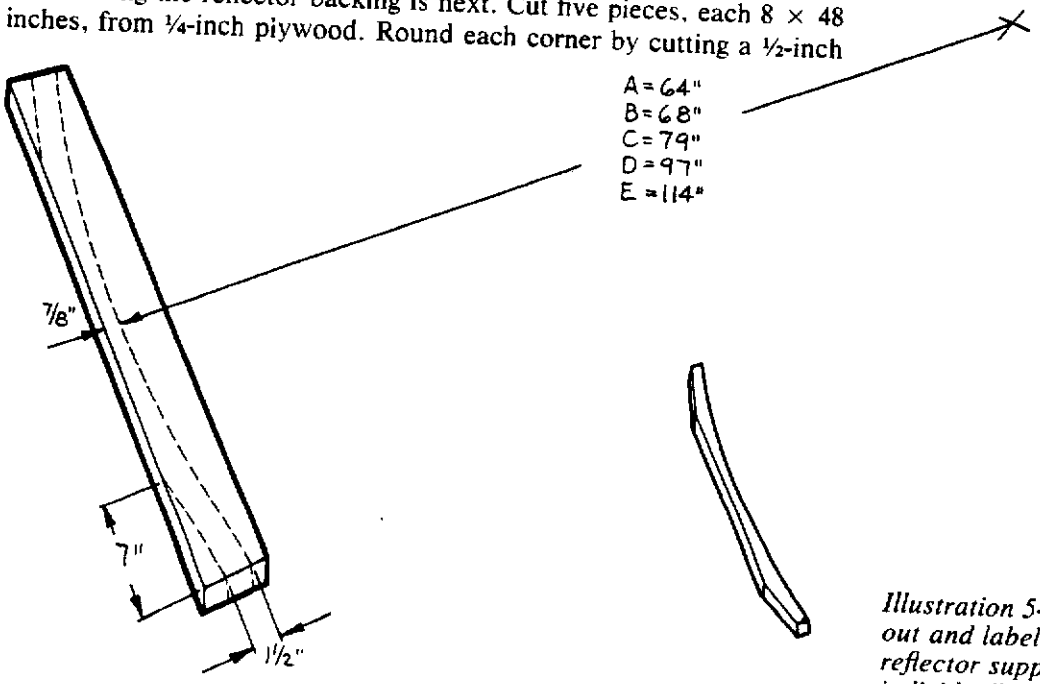


Illustration 5–12—Lay out and label each reflector support individually.

radius. Center the backing pieces on the bases, and fasten them with waterproof glue and 1-inch #8 aluminum flathead wood screws. Drill 1/16-inch-diameter pilot holes and 3/16-inch-diameter shank holes, and countersink the screws. Use ten screws in each reflector. Sand the completed reflector bases to remove any sharp edges.

At this stage, finish all the wood parts of the solar barbecue with three coats of exterior urethane, or the finish of your choice.

The next step in constructing the reflectors is to add a surface of reflective material. Use Mylar and aluminum flashing, as described below, or substitute heavy-duty aluminum foil for the Mylar. Aluminum foil will need to be replaced periodically. A very durable reflector material is polished stainless steel, although it is somewhat expensive initially, harder to work with, and not always available in some locales. The description that follows pertains only to the aluminum flashing and Mylar construction.

Cut five pieces of aluminum flashing material to 8 × 48 inches each. Fasten the flashing pieces to the plywood reflector backing pieces with automotive trim adhesive. Round the corners of the flashing to match the plywood backing pieces with a utility knife. The flashing reflects a good amount of light to the griddle, but this amount can be increased with the addition of reflective Mylar. Cut the Mylar pieces slightly oversize, apply them to the aluminum flashing with automotive trim adhesive, and trim them to size with a utility knife.

Now that you have built all the parts of the solar barbecue, you are ready to assemble them. Start the assembly by fastening each reflector

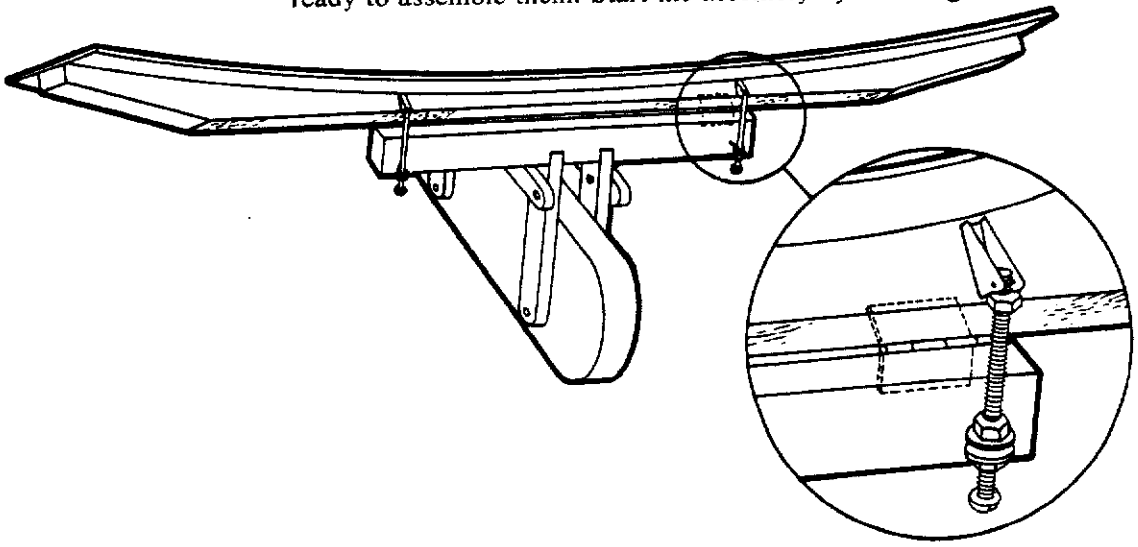


Illustration 5–13—Reflectors are adjusted with modified toggle bolts.

to the T-linkage with two loose-pin hinges. Using loose-pin hinges will allow you to remove the reflectors when you want to store the barbecue. Center the reflectors over the T-linkage. Place the hinges ½ inch in from each end of the horizontal member, and screw them to it and to the reflector base. Check illustration 5–13 to be sure you are mounting the hinges correctly.

Adjusting rods are necessary on each reflector to set the reflector to the correct angle. The rods are made from 3-inch-long ¼–20 toggle bolts, as shown in illustration 5–13. Remove one ear from each toggle bolt, and drill a 3/16-inch-diameter hole in the remaining ear. Trim the ear if necessary to fit the base. Using 1-inch #8 aluminum flathead wood screws, screw the toggle bolt ear to the reflector base directly above the adjustor screw eye on the T-linkage crosspiece, as shown in photo 5–3. Use three ¼–20 hex head nuts to secure the adjustor in position, one at the ear and two around the screw eye, as shown in illustration 5–13. Also use ¼-inch flat washers between the nuts and the screw eye. Repeat this procedure for each reflector, two adjustors for each one.

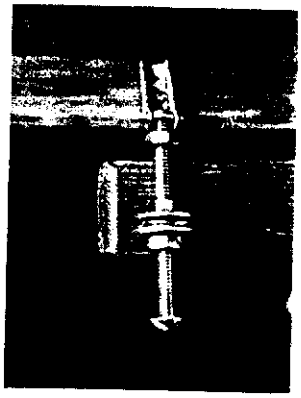


Photo 5–3—Modified toggle bolt.

Proceed to assemble the remaining parts of the barbecue and then make the final adjustments. *Note:* Each nut-and-bolt joint is a pivot, so do not overtighten them. Begin by fastening the control lever to the stringer with a 4-inch-long, ⅜-inch-diameter hex head bolt. Use two large washers and a hex nut with the bolt.

Next, attach the control arms to the control lever with a 5½-inch-long, ¼-inch-diameter hex head bolt. Use a hex nut to match and two ¼-inch fender washers at the head and nut. Finally, fasten the reflector units to the stringer and control arms. Be careful to keep the reflectors in order, with reflector A closest to the griddle and reflector E at the far end of the T-linkage. For the connection at the stringer, use 4-inch-long, ⅜-inch-diameter hex head bolts with two ¼-inch washers and a hex nut. *Note:* Mount reflector A, the reflector closest to the grill, with its adjustor rods on the grill side, opposite the other four reflectors, as shown in illustration 5–19, on page 77. At the control arm connection, use 5½-inch-long, ¼-inch-diameter hex head bolts with two ¼-inch fender washers and a hex nut.

The griddle, which is the cooking surface, is supported by a 1-inch galvanized pipe assembly. Following illustration 5–14, assemble the parts of the griddle support. Join the two 5½-inch nipples to the flanges and elbows. Use two pipe wrenches to tighten these joints, as shown in photo 5–4. Trim two of the flanges with a hacksaw to a width of 3¼ inches, as shown in illustration 5–15, so they will fit onto the gusset. The next four joints will need to be permanently fixed by soldering, brazing, or a mechanical connection. In preparation for soldering or brazing, clean the ends of the 2-inch nipples, the elbows, and the tee

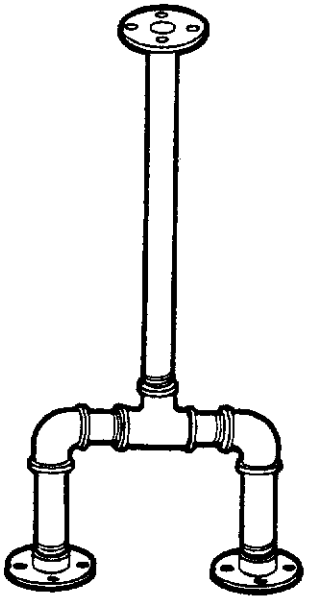


Illustration 5–14—Grill support.

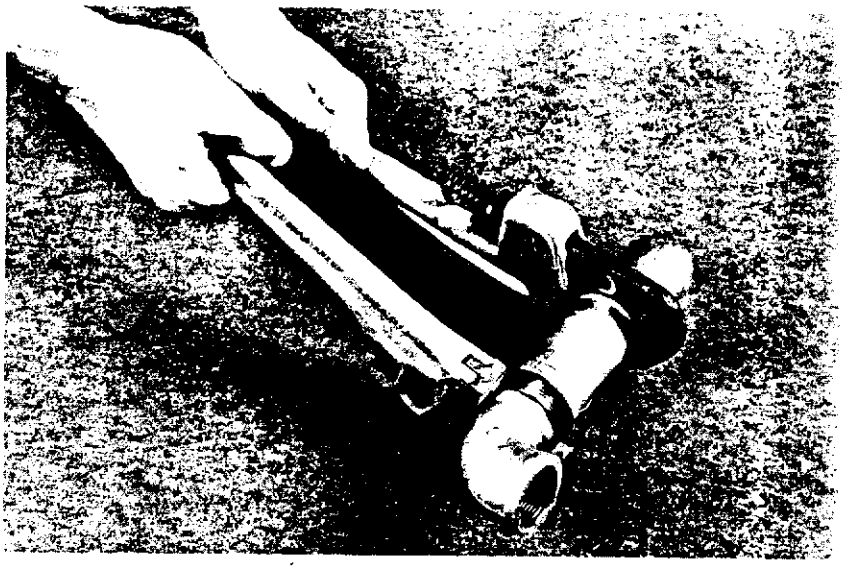


Photo 5–4—Use two pipe wrenches to tighten the fittings for the griddle support.

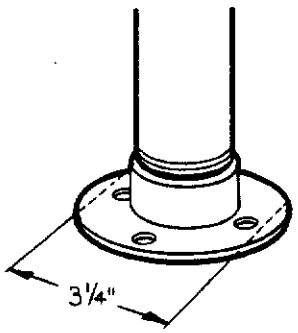


Illustration 5–15—Cutting details for the flange.

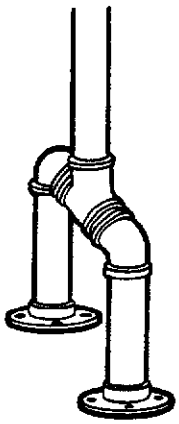


Illustration 5–16—Supports must be plumb.

with solvent to remove any grease. Cover the joint areas with flux or soldering paste. Tighten these pieces together and be sure the tee is in the correct vertical position in relation to the flanges, as shown in illustration 5–16. Using a propane torch (or Mapp gas in the case of brazing), flow lead solder into the four joints so that the tee cannot change position.

If you prefer, these four joints can be secured with ¼-inch rolled pins. Drill a ¼-inch hole through each joint to match the pin diameter, tap in the pin, and cut it flush with the pipe.

Finish the support assembly by adding a 30-inch section of pipe to the tee. Paint the griddle support, using a metal primer and finish coat of aluminum spray paint.

Fasten the griddle support to the gusset with 1¼-inch #14 flathead wood screws. First set the support in place to mark the holes. Drill ⅛-inch pilot holes in the gusset, then screw down the flanges.

At the top of the support we have designed a tray of redwood to help hold the griddle and to provide an additional work surface. Our dimensions are calculated to fit a 10 × 17-inch cast-iron griddle (including the handles, which rest on the aluminum frame). Adjust your dimensions for the tray and frame if your griddle is a different size. The tray is made of three pieces of redwood 2 × 4, cut to 18¾ inches long. Using waterproof glue, fasten the three pieces together on edge lengthwise, as shown in illustration 5–17. Hold the pieces with pipe clamps until the glue has set.

The ends of the tray are rabbeted to fit the aluminum angle that holds the grill. To mark the rabbet, draw a line $^{9}/_{16}$ inch from each end

of the tray. Mark ¾ inch deep at each end of both lines. With a backsaw or circular saw, cut just to the line, as shown in photo 5–5. Remove excess wood with a wood chisel, and sand the tray, rounding the top edges and the corners, then finish it with three coats of exterior urethane.

Fasten a pipe flange underneath the tray to fit the pipe support. The outer edge of the flange is ¼ inch from the forward edge of the tray and centered on the width.

The griddle is held by an aluminum angle frame, which is cut and shaped to fit. As illustration 5–18 shows, the aluminum is cut with a hacksaw through one side only so that the bends can be made. Cut a piece 58 inches long, and measure 18 inches, 21½ inches, 36½ inches, and 40 inches from one end of the aluminum. Cut a 45-degree angled V at these points. Bend the angle so that it will rest on the rabbets in the tray. Lay the shaped angle in place against the tray. Drill 3/16-inch-diameter countersunk holes in the aluminum and 1/16-inch-diameter pilot holes in the tray. Be sure the countersink is shallow so the screw can't slip through the aluminum. Fasten each side with three 1½-inch #8 aluminum flathead wood screws.

A tray shield serves to protect the tray and the person cooking if the reflectors are accidentally focused incorrectly. Cut the 8 × 18¾-inch shield from aluminum flashing. Fasten it to the front edge of the redwood tray between the griddle and the tray, using 1½-inch aluminum nails. Paint the flange as you did the support, then fasten the tray unit in place onto the support pipe.

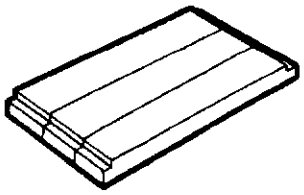
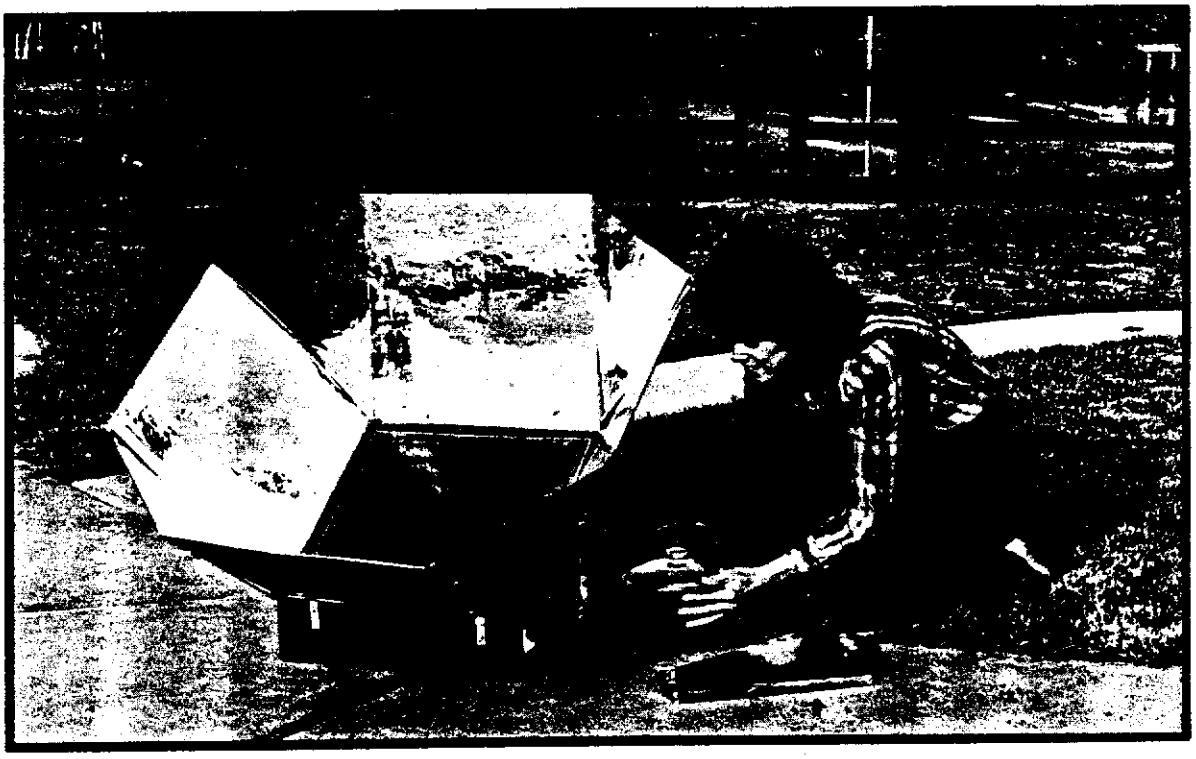


Illustration 5–17—Grill tray.

Photo 5–5—Cut the rabbets in the ends of the tray with a handsaw or a circular saw.

6 Solar Oven



It really works! Organic Gardening magazine tested many solar oven cookers and chose this design as the most effective. The temperatures normally achieved are higher than those in a slow cooker, yet the foods retain their natural juices and are very flavorful. Solar oven users are finding these cookers successful for nearly every food that is usually baked—from turkey to breads. The oven is sturdy, good-looking, and inexpensive.

The solar oven has large, flaplike reflectors made of thin plywood covered with either shiny Mylar or heavy-duty aluminum foil. The reflectors direct sunlight into the plywood oven section, which is insulated

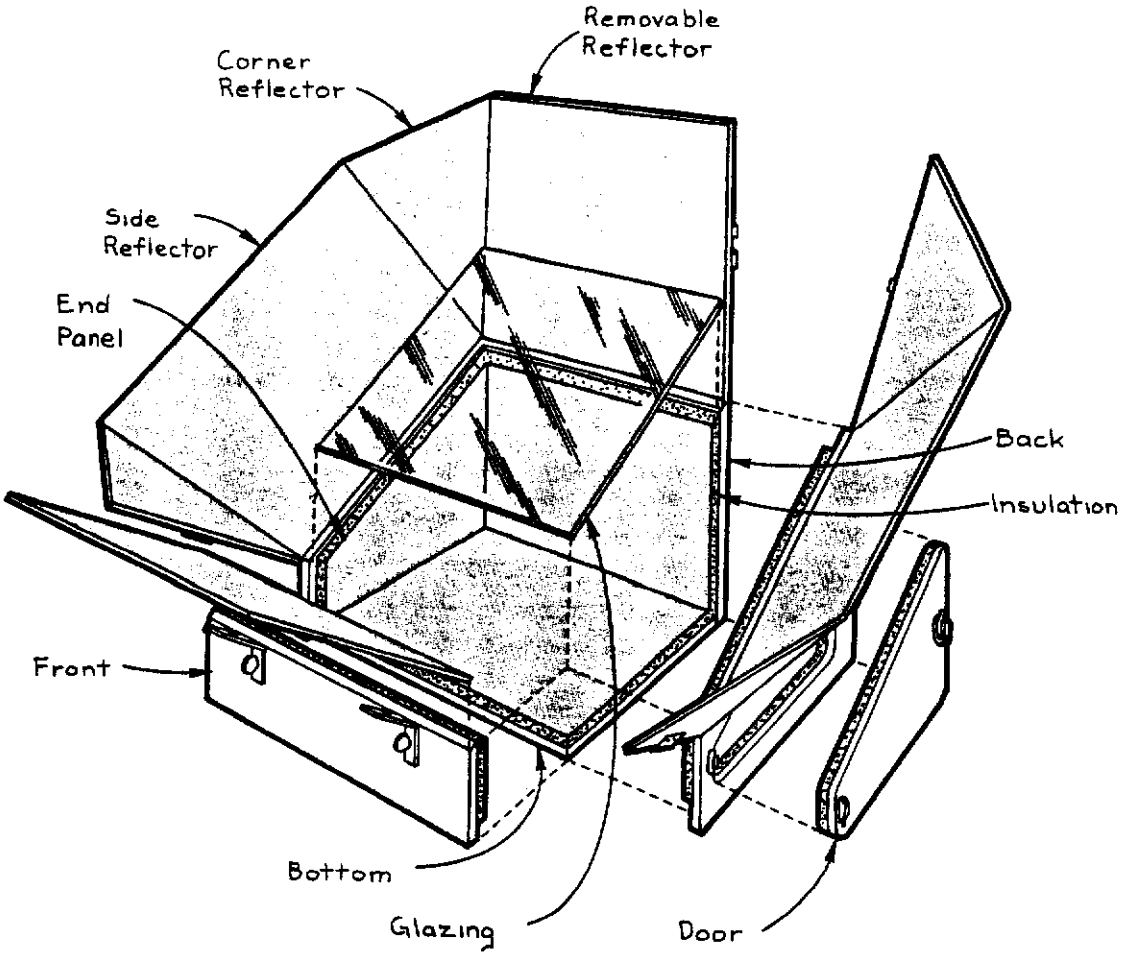


Illustration 6–1—Exploded view of the solar oven.

with ¾-inch foil-clad rigid foam insulation. The oven may be positioned for either low or high sun, so it will be useful in the winter as well as summer. The opening is covered with a layer of double-strength glass, and a removable door on one sidewall of the oven allows easy access. The reflectors may be folded in and two of them removed, so that the oven is easy to move and store. The exploded view, illustration 6–1, shows the principal parts of the oven. A materials list, chart 6–1, and a tools list, chart 6–2, follow.

CHART 6–1—
Materials

DESCRIPTION	SIZE	AMOUNT
Lumber		
A-C Exterior Plywood	½″ × 4′ × 4′	1
A-C Exterior Plywood	⅛″ × 4′ × 8′	1
Hardware		
Finishing Nails	4d	30
#4 Flathead Wood Screws	½″	8
#10 Tee Nuts	½″	4
#10 Tee Nuts	⅜″	4
#10 Thumbscrews	½″	4
#10 Thumbscrews	⅜″	4
Shutter Hinges	1½″ × 1½″	4
Butt Hinges	1½″ × 1½″	4
Sash Locks with Screws	···	2
Straight Braces	3″	2
120-Degree Braces	3″	2
Miscellaneous		
Foil-Clad Rigid Foam Insulation	¾″ × 2′ × 8′	1
Nontoxic Wood Glue	···	4 oz.
Epoxy	···	1 tube
Trim Adhesive	···	1 can
Primer	···	1 pt.
Exterior Enamel	···	1 pt.

CHART 6–1—*Continued*

DESCRIPTION	SIZE	AMOUNT
Miscellaneous—*continued*		
Nontoxic Flat Black Enamel	...	1 pt.
Double-Strength Glass	1/8" × 18" × 18"	1
Aluminized Mylar or Heavy-Duty Aluminum Foil	...	18 sq. ft.
Heat-Resistant Aluminum Tape	...	1 roll
Duct Tape	...	1 roll

CHART 6–2—
Tools

Saber Saw
Circular Saw
Drill and Bits
Utility Knife

Begin construction of your solar oven with the oven box itself. Working with ½-inch plywood, first cut out the bottom, 15⅞ × 18 inches. Next, lay out the back, 14⅛ × 18 inches. The top edge must be beveled to match the slope of the side, and it is best to make this angle cut first. Set your saw to cut a 30-degree angle. Working on the good side of the plywood, with the board clamped to your bench, cut the top edge on an angle, as shown in photo 6–1. Then, resetting the saw, check your original measurements and cut out the rest of the back.

Photo 6–1—Clamp the back piece firmly to a workbench, and cut the 30-degree angle with a circular saw.

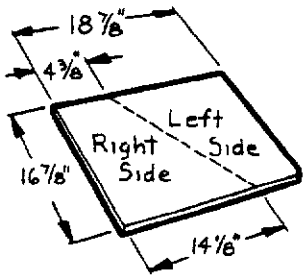


Illustration 6–2—Side layout.

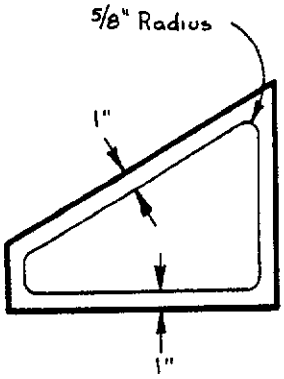


Illustration 6–3—Oven door layout.

In the same way, measure out the front, 4¾ × 18 inches. However, this time make the bevel cut along the top edge from the back of the plywood. Then check the measurements and cut out the three remaining edges of the oven front.

Cut one 16⅞ × 18⅞-inch piece of ½-inch plywood for the ends of the oven box. Illustration 6–2 shows the measurements to use when laying out the diagonal cut which separates the two end pieces. The angle from 14⅛ inches to 4⅜ inches will match the beveled front and back. *Note:* One end piece is a little higher than the other to accommodate the folding reflectors.

Use the shorter end piece, the right side, to make the oven door. Measure in 1 inch on all sides of the panel. Lay out a ⅝-inch radius at each corner, as shown in illustration 6–3. Start the cut by pressing the front edge of the saber saw base firmly against the wood. Tip the saw forward so that the blade does not touch the wood. Turn on the saw and gradually lower the blade into the plywood on the cut line. This is called plunge cutting. Photo 6–2 shows this useful technique. If you drill a hole to start the blade, you will have to cut a replacement door panel. Cut the door free from the panel.

Now you are ready to put the oven together. Assemble the oven box with wood glue and 4d finishing nails. First attach the front and back to the bottom, then add the ends, fastening them to the bottom and to the front and back.

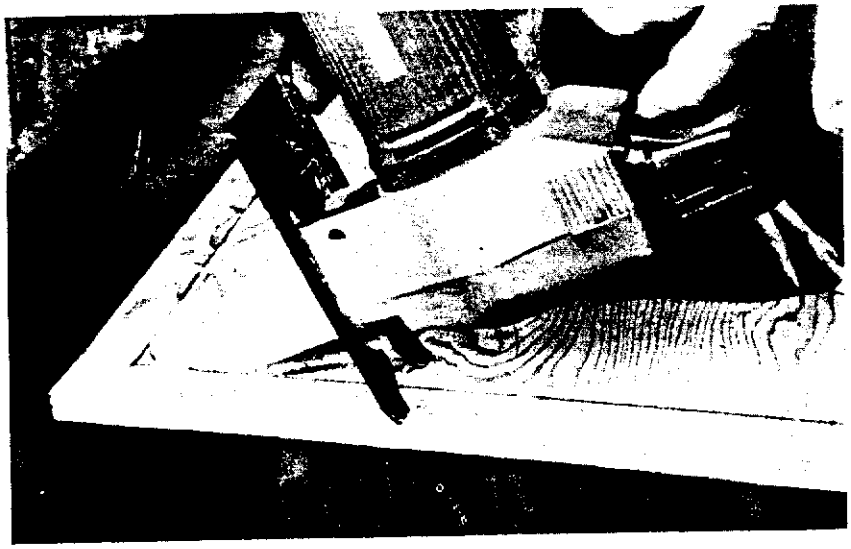


Photo 6–2—Plunge-cut the door panel by starting the saber saw on an angle. Lower the blade slowly and accurately into the cut line.

Two sash locks, the type used on windows, hold the door in place. Lay out the locks on the door and end panel, drill pilot holes, and screw them in place.

With the box constructed, but before you put in insulation, fasten two reflector braces on the back and two on the front, with the hardware shown in illustration 6–4. Use straight braces on the back and 120-degree braces on the front. If you are unable to buy 120-degree braces, clamp straight braces in a vise and hammer them to the necessary angle. Mark and drill 3/16-inch-diameter holes in the plywood and the braces to accept the ½-inch #10 tee nuts, one for each brace. Hammer the tee nuts into the front and the back from the inside of the oven. Brace the sides of the oven on your workbench to absorb the pounding.

Insulation maintains the oven's heat. Use foil-clad rigid foam insulation. Cut the insulation to fit ⅛ inch below the top edges to leave room for the glass top. Use a utility knife and a straightedge, as shown in photo 6–3, to cut the insulation.

Cut the bottom piece of insulation 15⅞ × 18 inches, and cover all

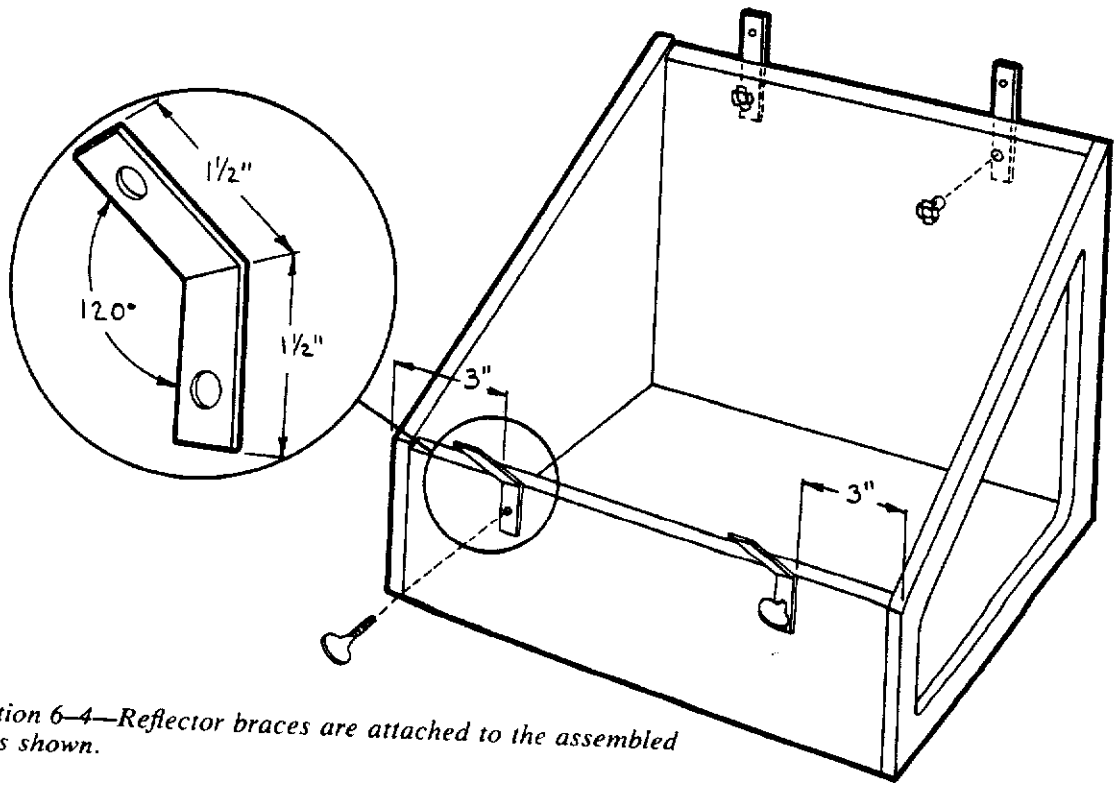


Illustration 6–4—Reflector braces are attached to the assembled oven, as shown.

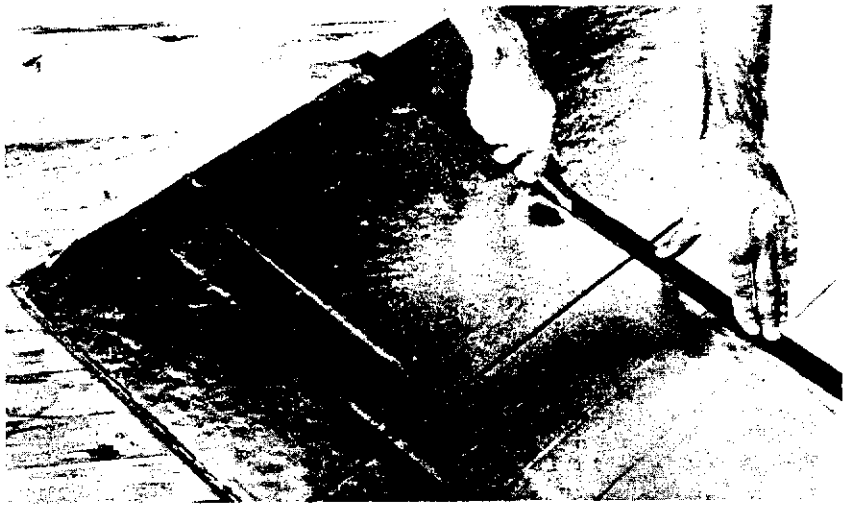


Photo 6–3—A straightedge and a utility knife will help you cut the insulation accurately.

the edges with heat-resistant aluminum tape. It is important to tape the edges so that the insulation will not deteriorate from exposure to light. Install the bottom insulation panel with nontoxic wood glue. Next, cut the back insulation to fit, approximately 12½ × 18 inches. Bevel the top edge of the panel to 60 degrees, cover all the edges with aluminum tape, and glue it in place.

Cut the front insulation panel to fit, about 3¾ × 18 inches. Bevel the top edge of the insulation to 60 degrees. Tape all the edges and install this front panel as you did the back.

Measure, cut, and tape insulation to fit the left side of the oven. Use wood glue to fasten it in place. Cut a second piece of insulation to fit the door side. Cut the door opening and install the pieces on the door and space around the door. Tape all edges of the pieces and then fasten them to the door end with wood glue. Be sure that the insulation is ⅛ inch below the edge of the oven all the way around so the glass will fit.

Paint the interior of the oven flat black so it collects the maximum heat available. We suggest that you use a flat black paint that is nontoxic. This paint is sold for use on barbecues and engines, and as solar collector paint.

Having finished the oven box assembly, you are ready to make the reflector panels from ⅛-inch plywood. Paneling is a good, inexpensive alternative. Illustration 6–5 shows the dimensions and pattern of the reflectors. First, cut the two side panels. The left-hand panel is 17¾ × 19⅜ inches and the right-hand panel is 17½ × 19⅜ inches. For

the corner sections, cut four triangles, each 12¾ × 17½ × 17½ inches. Cut the removable front and back panels, each 18 × 19 inches.

Set the removable front and back reflector panels in place on the braces, flush with the ends of the oven, and mark the hole placement of the braces on the panels. Drill two 3/16-inch-diameter holes, and insert two ⅜-inch #10 tee nuts in each removable panel.

Next, position two corner pieces on each side panel, as shown in illustration 6–6. With the two triangular pieces in place, apply aluminum tape the length of the joint on the outside of the panels to make a flexible union. Carefully open the panels and tape the inside of the joint. The triangular sections should be capable of being folded onto the side panels, which in turn can be folded onto the oven, for convenient storage.

Cover each of the two side reflectors and the front and back reflectors with reflective material. Cut aluminized Mylar or aluminum foil to fit each reflector area. Spray a panel with trim adhesive, and carefully smooth the reflective material from one side across the panel, as shown in photo 6–4. It is important to keep it as wrinkle-free as possible. Repeat this operation on all of the panels.

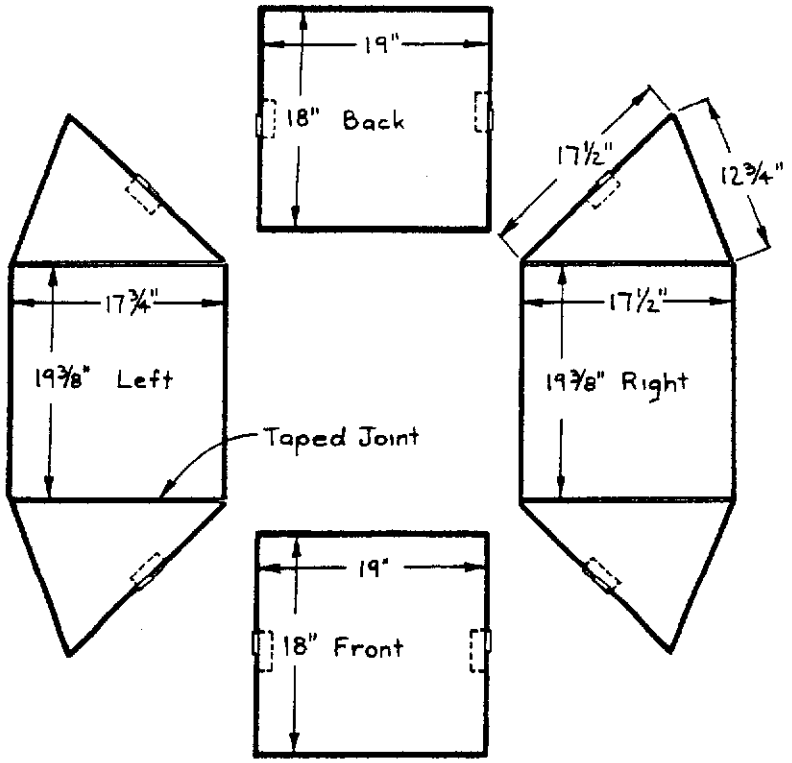


Illustration 6–5—Layout details and placement of the reflectors.

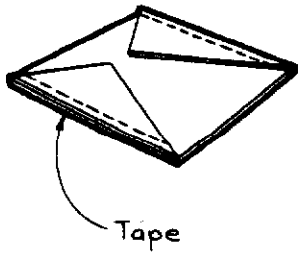


Illustration 6–6—Tape hinge.

Photo 6–4—Carefully smooth the reflective Mylar onto the plywood reflector backs, using trim adhesive.

Prime and paint the outside of the reflectors and the oven any color you choose.

Attach the reflectors to the oven by attaching two butt hinges at the lower edge of each reflector side panel, using epoxy. Then screw the hinges into the outer face of the oven end pieces using ½-inch #4 flathead wood screws.

Set the removable reflectors into the front and back braces. Fasten them in place with ⅜-inch #10 thumbscrews turned into the tee nuts.

The corner reflectors are joined to the removable panels with loose-joint shutter hinges, shown in illustration 6–7, which are easily disassembled. If shutter hinges are not available, butt hinges with a removable pin are satisfactory. Using epoxy, cement the male half of a shutter hinge about 4 inches below the top edge of each corner panel. Then, cement the corresponding female half with epoxy to the adjacent removable panel. This will allow the removable panels to be slipped in and out of place for assembly and easy storage.

Glazing is necessary to complete the oven enclosure. Cut or buy a ⅛ × 18 × 18-inch piece of double-strength glass. Use aluminum tape to cover the edges for safety. Lay the glass on the edges of the insulation to close off the top of the oven. Tape the glass in place with aluminum tape to seal the oven fully.

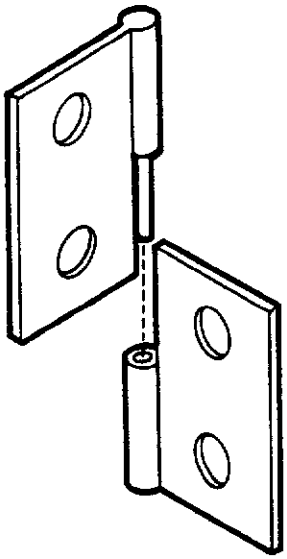


Illustration 6–7—Loose-joint hinge.

To use your oven, place a dark cookie tin on the bottom and rest a small cooking rack on it to allow air circulation around your pot. Use dark-colored cookware, such as cast iron or dark blue enamel. Be sure the pot has a tight-fitting lid. Light-colored cookware will reflect light and diminish the heat.

For maximum heat, orient the oven into the sun every 20 minutes or so. However, if you wish to leave it unattended, place the cooker in mid-position for the time it will be cooking. An oven thermometer will let you monitor cooking temperatures.

Don't underestimate the heat achieved by this small oven. Use potholders to handle the equipment, and expect the cooker to operate effectively. Illustration 6–8 shows the two positions of the oven. When the sun is high, set the oven in position A. When the sun is lower, flip the oven so that it is in position B to capture heat more effectively.

Before cooking with your oven for the first time, allow it to heat up for several days with the door open so the paint residue can burn off. To keep food warm in the oven after sundown, heat a clean, dark rock in the oven with your cookware, and cover the oven with a blanket when the sun is low.

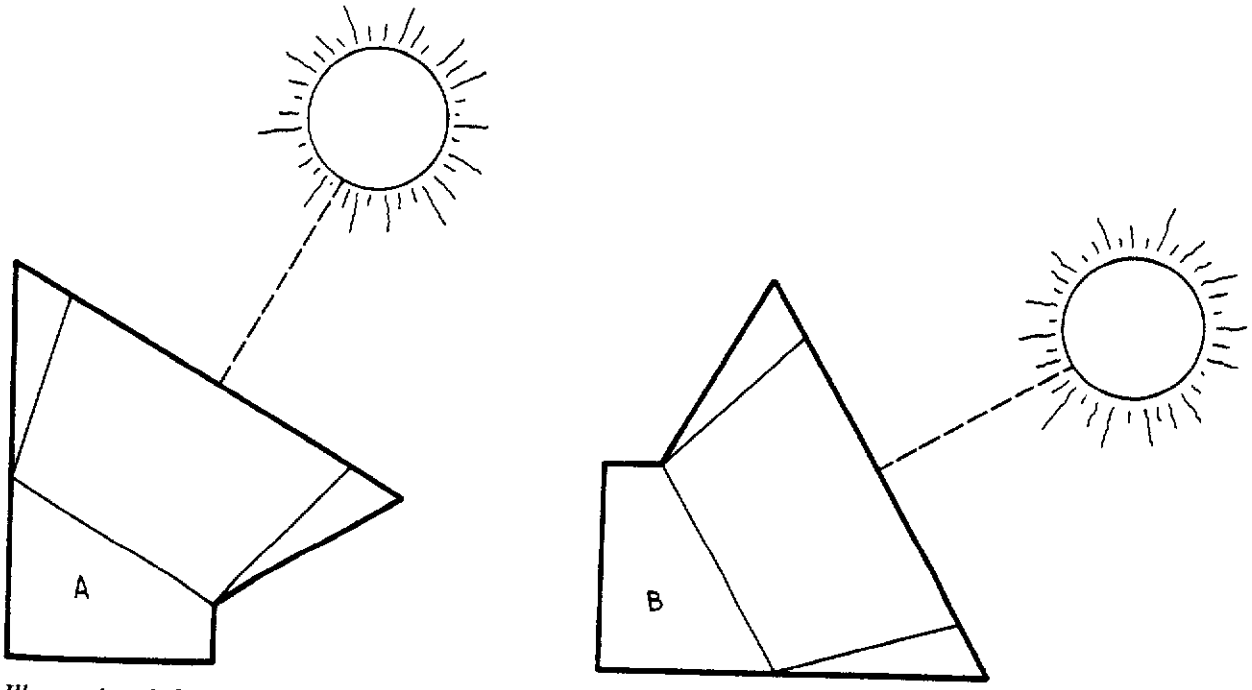


Illustration 6–8—The oven can be adjusted for summer (A) and spring/fall (B) use.

7 Stovepipe Food Dryer

Instead of turning on your oven or buying an electric dryer, thus adding to your utility bills, you can use this stovepipe dryer. The drying chamber is fashioned from 8-inch-diameter stovepipe. A curved reflective surface concentrates sunlight onto the drying chamber. More than a pound of food can be dried at a time on trays inside.

It is difficult to give exact times for solar drying, as conditions vary from one climate to another. Rodale researchers determined that here in Pennsylvania most solar food dryers require about two days of strong sun to dry fruits and vegetables, whereas in Colorado, one full day of bright sun and low humidity might actually toast your foods. A small

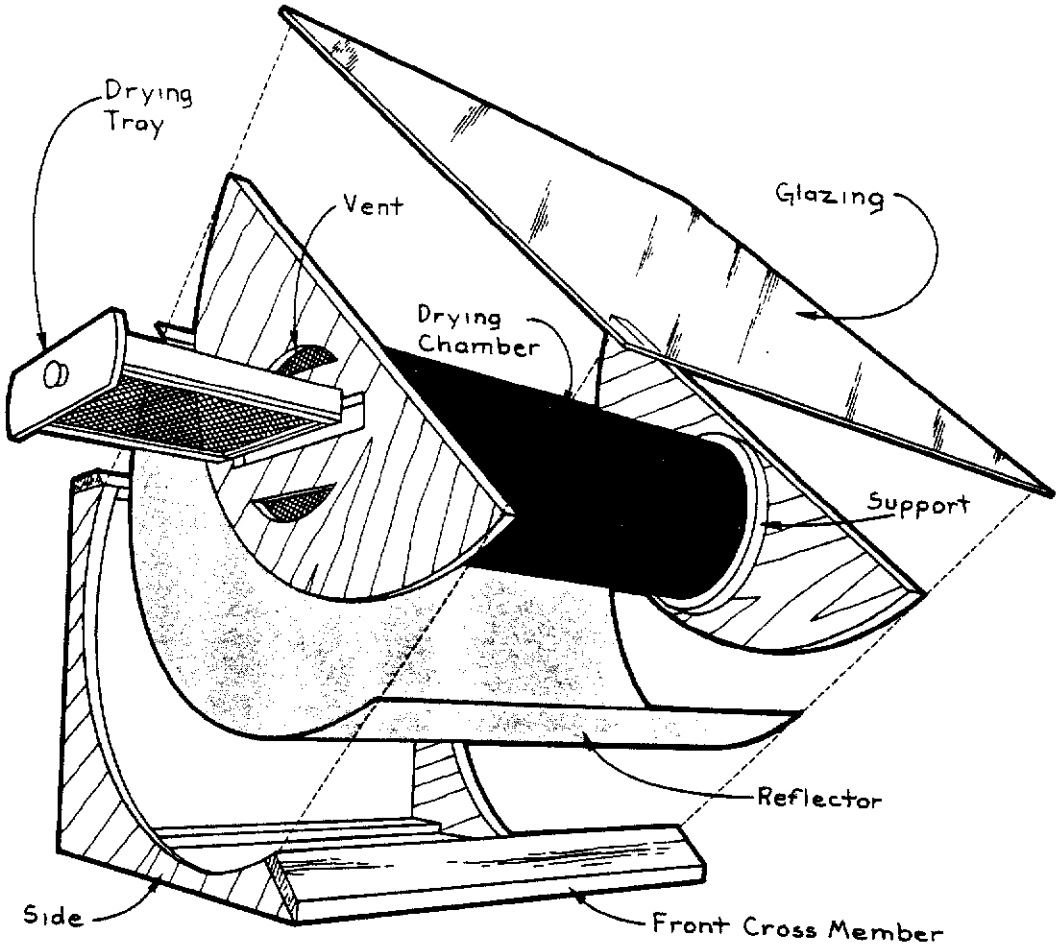


Illustration 7–1—Exploded view of the stovepipe food dryer.

oven thermometer will help to monitor the dryer and avoid excess heat. Usual air temperatures required for drying are 95°F to 130°F. *Note*: We do not recommend the use of a solar dryer to dry meat. Blanching is required as a pretreatment for drying most foods, as it is for freezing them. A more complete discussion of methods of drying foods may be found in Rodale's *Solar Food Dryer* Plans Book, *Stocking Up*, and other books.

An exploded view of the dryer is shown in illustration 7–1. The materials and tools you will need are detailed in the materials list, chart 7–1, and a tools list, chart 7–2, which follow.

CHART 7–1—
Materials

DESCRIPTION	SIZE	AMOUNT
Lumber		
#2 Pine	3/8" × 3/4" × 8'	1
#2 Pine Trellis Stock	1/8" × 1 1/4" × 8'	1
A-C Exterior Plywood	3/4" × 2' × 4'	1
A-C Exterior Plywood	3/8" × 6" × 8 1/2"	1
Hardware		
16-Gauge Brads	1 1/4"	16
16-Gauge Brads	5/8"	1 box
#8 Flathead Wood Screws	2"	4
#6 Brass Roundhead Wood Screws	3/4"	12
Cement-Coated Box Nails	4d	1 box
Aluminum Pop Rivets	1/8" × 1/8"	6
Staples	3/8"	...
Wooden Knobs	1" dia.	2
Aluminum Flashing	2' × 4'	1
Fiberglass Screen	1' × 2'	1
Miscellaneous		
Stovepipe	8" dia.	22"
Closed-Cell Foam Weather Stripping	1/8" × 1/2"	8'
Waterproof Wood Glue	...	4 oz.
Trim Adhesive	...	1 can
Primer	...	1 qt.

Begin construction with a 24 × 48-inch piece of ¾-inch exterior plywood. First, cut a 22 × 22-inch square for the sides of the dryer. As shown in illustration 7–2, draw diagonal lines from corner to corner. Using trammel points with the intersection point of the lines as the center point, draw a circle 20 inches in diameter. Cut along one diagonal line, to give you two triangular sidepieces, each with a half-circle marked on it. Do not cut out the marked half-circles at this time.

Mark the vent openings and tray opening on both sidepieces, using illustration 7–3 as a guide. Be sure to mark the pieces so you end up with a pair, with the good side of each piece facing out. First, designate one 22-inch edge as the bottom of the dryer. The other 22-inch side is the back edge, and the diagonal edge is the front.

Measure 7 7/16 inches from the 90-degree corner along the back edge and along the bottom edge, and square lines across from the back and bottom edges toward the front edge. Using the intersection of these lines as the center point, draw an 8-inch-diameter circle. Measure ¾ inch into the circle from both the top and bottom of the circle along the vertical line from the bottom. Square lines across the marks, perpendicular to the back edge, to mark the vent openings, as shown in photo 7–1. For the tray opening, measure ¾ inch both above and below the center point of the circle, and square lines across the circle.

Cut out the large half-circles from the sides, using a saber saw. Work carefully, and save the whole board, since both pieces of each half are needed. Clamp the plywood to your workbench, readjusting it as necessary for the saw cut. Mark the pieces so that you can later

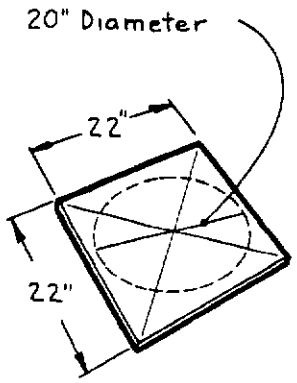


Illustration 7–2—Side layout.

CHART 7–1—*Continued*

DESCRIPTION	SIZE	AMOUNT
Miscellaneous—*continued*		
Exterior Enamel	...	1 qt.
White Exterior Enamel	...	1 qt.
Flat Black Absorber Paint	...	1 can
Wood Putty	...	4 oz.
Acrylic Sheet	1/8" × 23½" × 22"	1
Heavy-Duty Aluminum Foil	23½" × 32 7/16"	1

CHART 7–2—
Tools

- Saber Saw
- Circular Saw (optional)
- Drill and Bits
- Pop Rivet Tool
- Heavy-Duty Staple Gun
- Tin Shears
- Wood Chisel: ½-inch
- Trammel Points or Compass

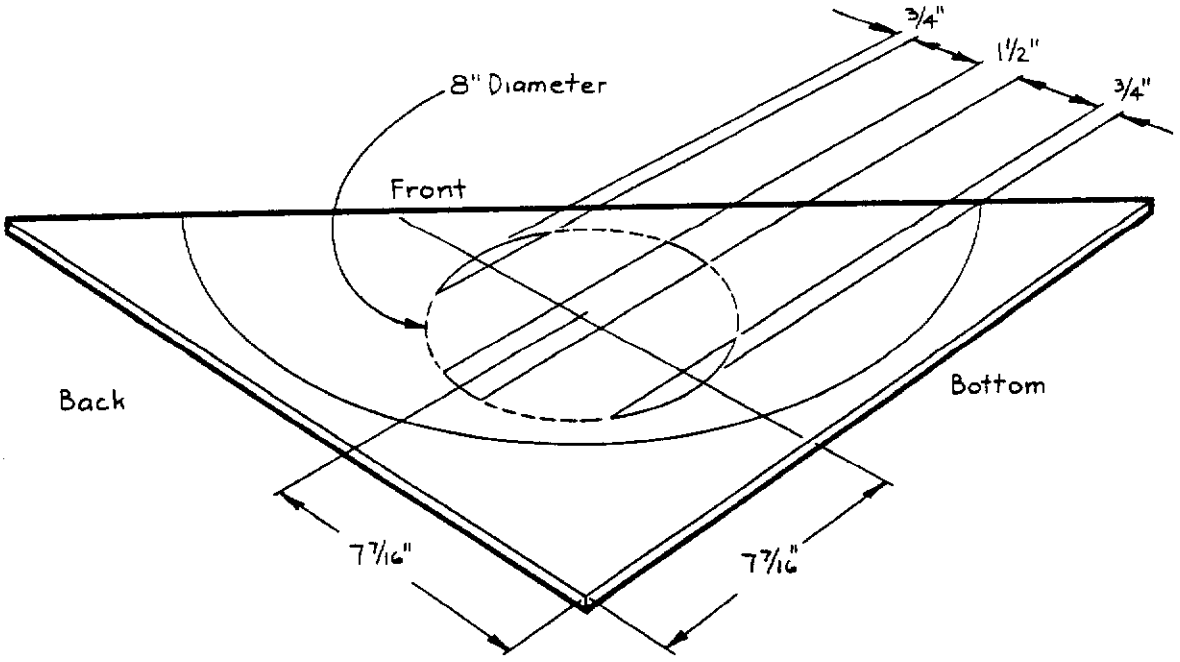


Illustration 7–3—Layout details for the vents, tray openings, and stovepipe placement on the sides.

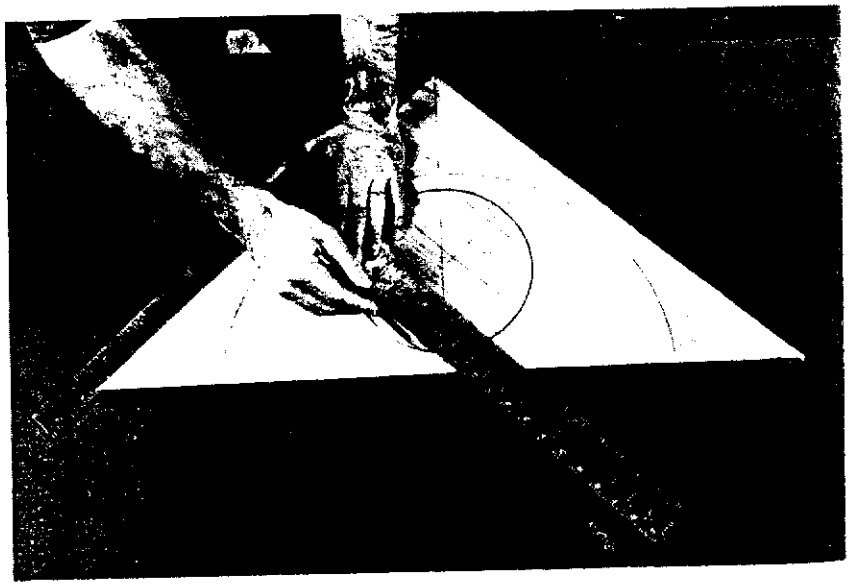


Photo 7–1—Mark the vent opening positions with a carpenter's square within the 8-inch circle.

reassemble them in their original position. Clamp one of the half-circles to your workbench before cutting the vent and tray openings. To start the saw cut, first drill a hole large enough to receive the saber saw blade in the area to be removed and near the line you will cut. Cut out the vent and tray openings on both sidepieces.

On the triangular sides, mark the cuts to fit the top and front cross members, as shown in illustration 7–4. First mark off a strip ¾ inch wide along the front corner, from the half-circle to the bottom edge. Next, measure 18 1/16 inches from the 90-degree corner toward the top corner, and square a line across to meet the end of your half-circle line. Cut off these two pieces on both sides.

Cut the top cross member, the back cross member, and the front cross member all from the same 23½ × 10½-inch section of ¾-inch plywood. Mark the plywood as shown in illustration 7–5. Cut the 45-degree angle for the top and front cross members at the same time. Set the saw to cut a 45-degree angle, and cut the top and back cross member angles. Reset the saw and cut the 2 × 22-inch strip for the back cross member.

Construct the dryer frame with waterproof wood glue and 4d cement-coated box nails. Fasten the back cross member flat between the sides at the lower back corner. Then nail and glue the top cross member to the sides, keeping the ends flush with the sides and the 45-degree angle in front. Fasten the front cross member across the sides at the lower front corners with the 45-degree angle at the bottom.

On the remaining ¾-inch plywood, lay out two circles, each 10 inches in diameter, to make the doughnut-shaped drying chamber supports. Inside each circle draw a second circle with a diameter of 8 inches. Drill entry holes near the circles and cut out the inside piece with the saber saw. Check the fit of the 8-inch stovepipe in the support rings. If the circles need to be trimmed, use a rasp or sandpaper.

Cut four 2 × 7-inch pieces of fiberglass screen, and staple these

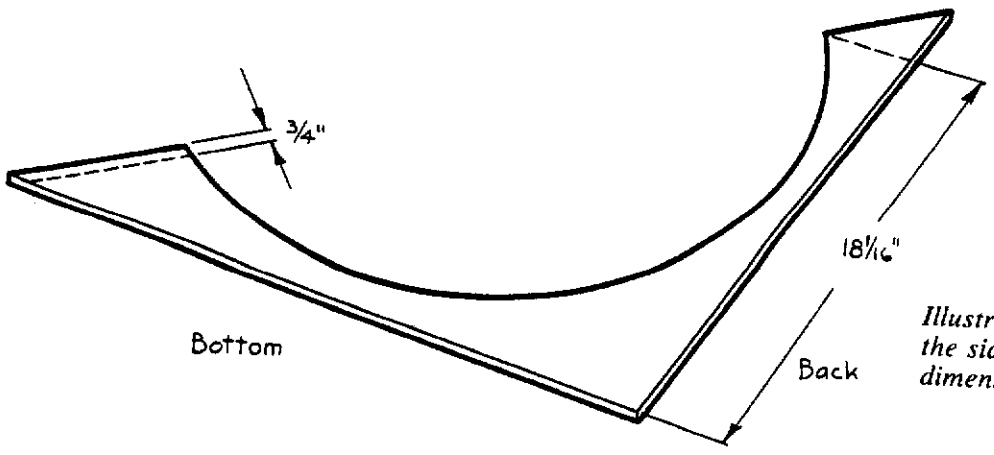


Illustration 7–4—Trim the sidepieces to the dimensions shown.

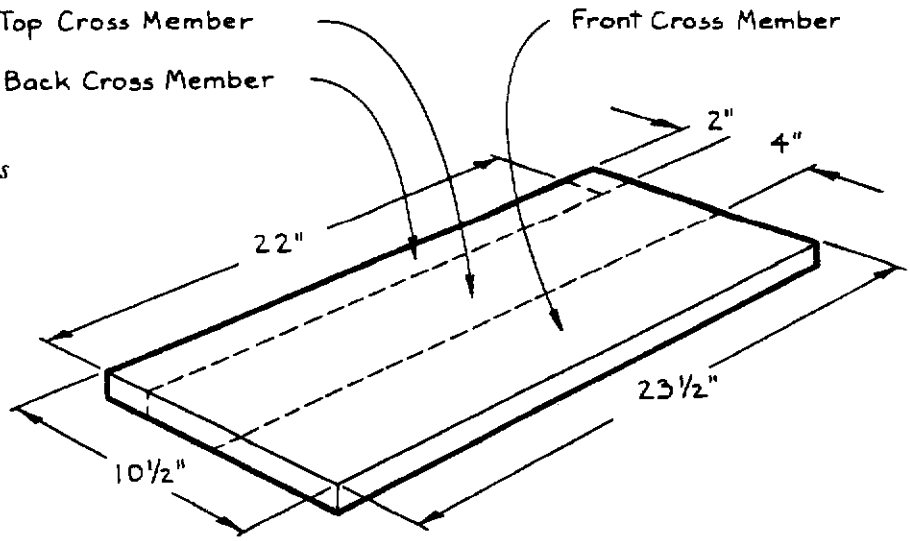


Illustration 7–5—Cross member cutting pattern. Note placement of the beveled edges.

across the inside of each vent opening. Fasten the support rings to the inside faces of the semicircles, over the screening, lining them up with the tray and vent openings. Use waterproof glue and 1¼-inch 16-gauge brads to hold the supports in place.

For the tray fronts, cut two 2½ × 8½-inch pieces of ⅜-inch plywood. Use wood putty to fill cracks in the plywood of the dryer frame, particularly the edges, and between framing pieces. Sand the frame and tray fronts. Use a primer and two coats of exterior enamel to cover the tray fronts, the half-circles, and the dryer frame. The interior of the half-circles should be white to reflect light onto the drying chamber. The outside of the semicircles, the frame, and the tray fronts may be painted the color of your choice.

Photo 7–2—Carefully cut the stovepipe to length with a tin shears. Be very careful of the sharp edges.

The drying chamber is made from a section of 8-inch-diameter stovepipe. The pipe can be unhooked along its seam and laid out flat, then later rehooked into a cylindrical shape. With a tin shears, cut the pipe to a length of 22 inches. Photo 7–2 shows the stovepipe opened up with the tin shears cutting along the side. In this way, the narrow cutoff strip curls up out of the way of the shears. Rehook the stovepipe seams after cutting the length.

Cut a 7 × 23-inch piece of aluminum flashing to form the intake baffle. Draw two lines diagonally from corner to corner to find the center point. As in illustration 7–6, mark out the 2 × 6-inch rectangular opening in the center of the baffle. Use the tin shears to cut out this space, after punching a starting hole with a screwdriver or drill.

Shape the corner notches in the intake baffle, ½ inch from each corner, referring again to illustration 7–6. Use the tin shears to snip out the notches. Draw a line on each side, ½ inch from the edge of the baffle. Lay the intake baffle on a block of wood, with the line at the

edge of the block. With a straightedge, bend the flange down (approximately 45 degrees) to conform to the inside diameter of the stovepipe (see photo 7–3). Measure ½ inch from the baffle ends, and use a straightedge again to bend the shorter flanges 90 degrees in the same direction.

A small piece of flashing, the cross baffle, is cut to match the curve of the stovepipe and to fit in the space below the intake baffle opening. When this baffle unit is installed in the drying chamber, the cool air drawn in through the lower vents is heated and forced up through the drying trays and out the upper vents, drying the food. Cut a 2 × 6-inch piece of flashing. Use the stovepipe as a pattern to mark the curve. Cut the baffle pattern, then bend a 90-degree angle at the top ½ inch. Hold the flange of the cross baffle with pliers across the center of the

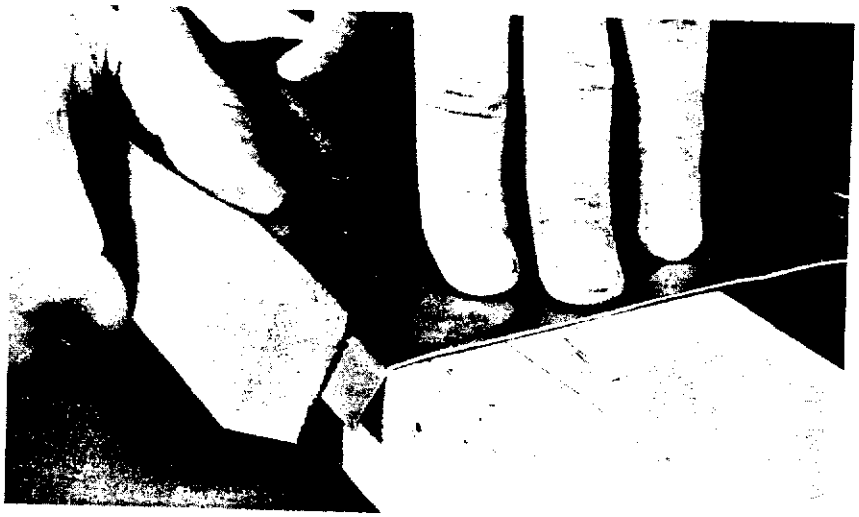


Photo 7–3—Bend the baffle by clamping the flashing material between two boards.

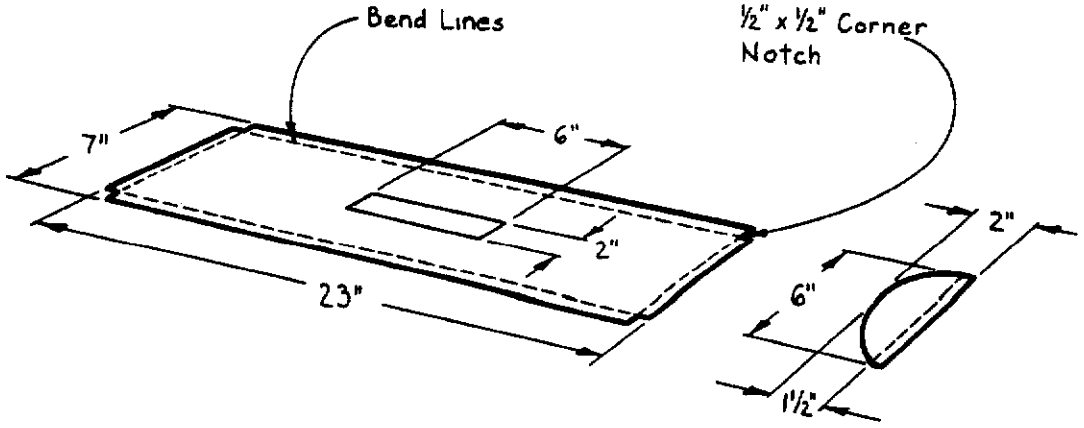


Illustration 7–6—Layout details for the aluminum flashing air baffles.

intake baffle opening. Drill two ⅛-inch holes through both pieces. Rivet the cross baffle to the intake baffle with ⅛ × ⅛-inch pop rivets.

Place the baffle inside the stovepipe, and, holding the two pieces firmly with pliers, drill ⅛-inch holes through the pipe and the flanges of the baffle. Rivet the baffle in place. An interior view of the drying chamber is shown in illustration 7–7. Paint the outside of the stovepipe with flat black absorber paint to make it a more efficient absorber of solar energy.

Cut a 23½ × 32⁷⁄₁₆-inch piece of aluminum flashing for the reflector. Bend one 23½-inch edge to make a 1-inch flange. Place the aluminum sheet into the semicircle of the sides with the flange at the top, as shown in illustration 7–8. The flange overlaps the top cross member. Nail the reflector to the plywood top, sides, and front with ⅝-inch 16-gauge brads.

Spray trim adhesive on the aluminum collector, and press aluminum foil into place, keeping it as smooth as possible to maximize reflection.

Assemble the drying chamber and the semicircular sides by slipping the stovepipe into the supports. The intake baffle must be parallel with the bottom of the dryer. Fasten the drying chamber unit into the triangular frame with four 2-inch #8 flathead wood screws, as shown in illustration 7–9. Drill ³⁄₁₆-inch holes in the frame and ⁷⁄₆₄-inch pilot holes in the semicircles. Place the screws 11 inches from the lower back corner of the frame, at the points where the frame is most narrow.

Cut the acrylic glazing to 23½ × 22 inches, and position the sheet over the front of the dryer to check the fit. File the edges of the sheet to remove any sharp edges or burrs. Tape the glazing onto the dryer temporarily so that the mounting holes can be drilled. Drill ⁷⁄₆₄-inch holes through the glazing and into the plywood edges. Space the holes evenly, with three in each side. Remove the tape and drill the holes in the glazing larger, to ³⁄₁₆ inch, to allow for expansion of the glazing material.

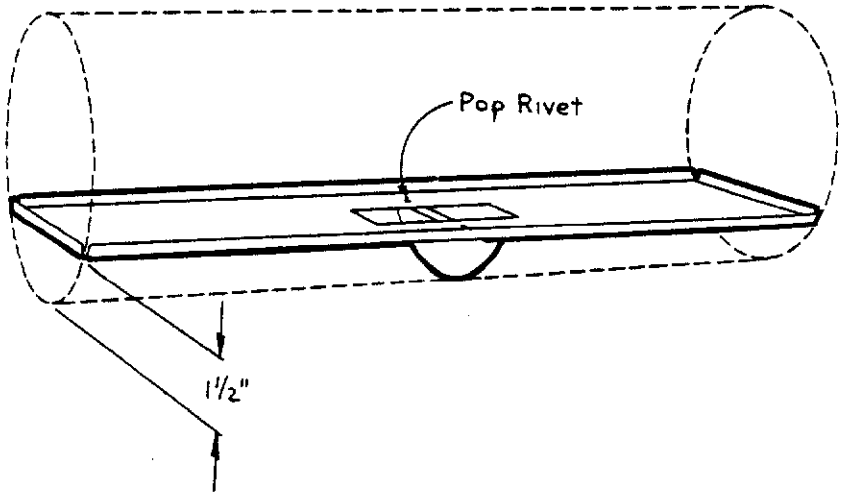


Illustration 7–7— Assembled baffle arrangement inside the stovepipe.

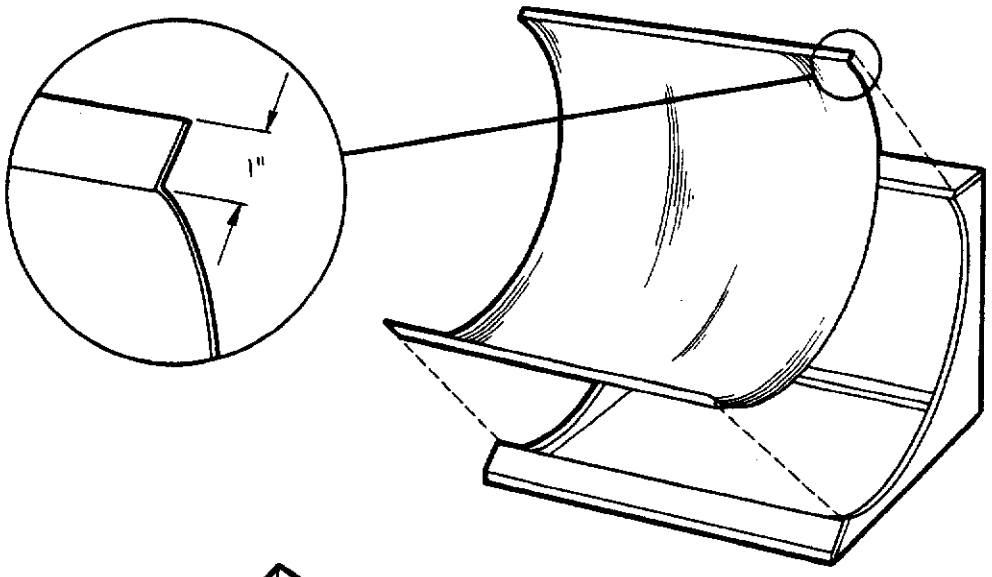


Illustration 7–8— Reflector attachment details; note placement of bend.

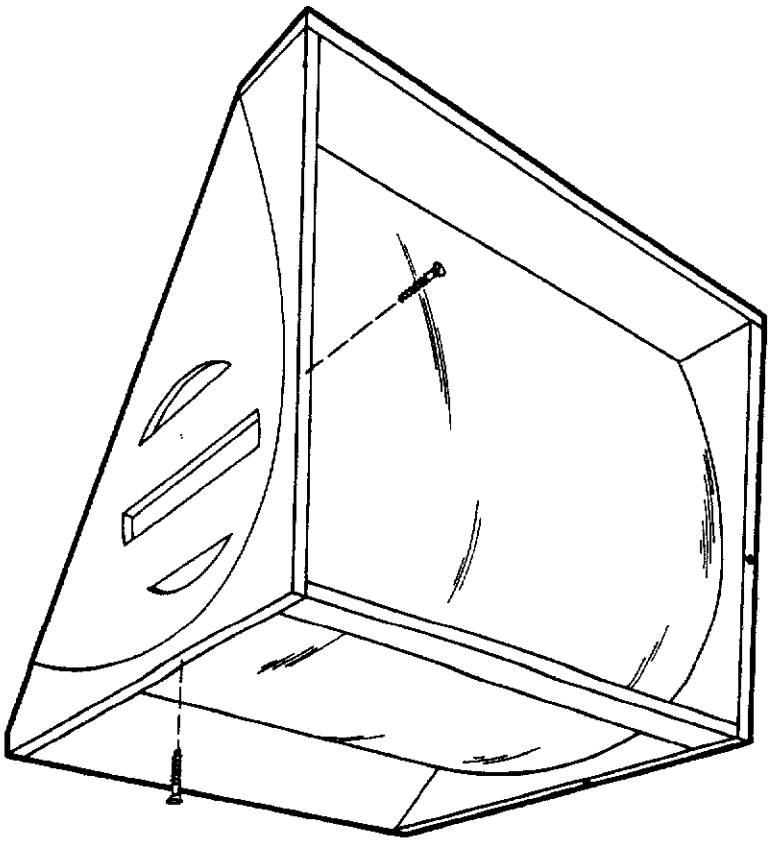


Illustration 7–9— Fasten the side sections together with screws placed as shown.

Apply weather stripping to the front edges of the dryer where the glazing will be mounted. Clean the glazing and set it on the weather strip. Realign the screw holes, then fasten the glazing to the front of the dryer with ¾-inch #6 brass roundhead wood screws. *Note:* Do not overtighten the screws, as this will crack the glazing.

Next, construct the sides and ends of the drying trays from ⅜ × ¾-inch pieces of pine. Cut four 11⅝-inch pieces and four 7⅜-inch pieces. Shape a rabbet on the end of the tray sides to make a stronger joint than butting the pieces together would make. To cut the rabbet, shown in illustration 7–10, set an end piece in position against the end of a sidepiece. Mark the width of the rabbet on the sidepiece. Mark 3/16 inch as the depth of your cut. Use a handsaw to cut just to the marked depth. With a ½-inch wood chisel, remove the excess material from the rabbet, as shown in photo 7–4. Repeat the rabbet on each end of the drying tray sides, a total of eight rabbets.

Screen molding holds the screen to the tray bottoms. Cut trellis stock to 7 feet long. Then rip the 7-foot piece to ⅜ inch wide. Use a rip guide on the saber saw, and clamp the trellis stock to your workbench. From this ripped piece cut four 11⅝-inch pieces and four 7-inch pieces. Cut two 7¾ × 11⅝-inch pieces of fiberglass screen for the bottoms of the trays.

Referring to illustration 7–10, assemble the trays by first fastening the tray fronts to two of the ends with waterproof glue and one ⅝-inch brad at each corner. Staple the screen to the bottoms of the trays, keeping the frames square. Tack the screen molding strips over the staples, using ⅝-inch brads. Fill and sand all the voids in the tray joints with wood putty. Fasten a 1-inch wooden knob in the side-to-side center of each tray front but keep it above the end piece.

Make tray guides from two 1 × 23½-inch pieces of aluminum flashing. Clamp a strip lengthwise between two straightedges with ½ inch

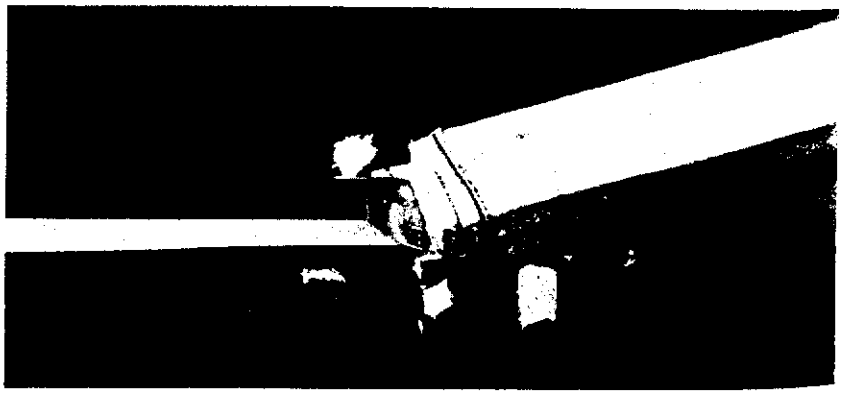


Photo 7–4—Clean the rabbet areas for the tray piece with a sharp wood chisel.

extending the length of the strip. Bend the aluminum into a right angle. Slide the tray guides into the dryer chamber, and fasten them to the sides at the edge of the tray opening with ⅝-inch nails. Nail through the end of the guide into the plywood of the openings in the dryer sides, as shown in illustration 7–11.

To use the food dryer, load the trays with thinly sliced fruits or vegetables. Leave space between the pieces so air can circulate. Set the oven in bright sun with the glazing facing the sun. You might need to reorient the dryer as the sun moves overhead. Enjoy those tasty pieces of dried food!

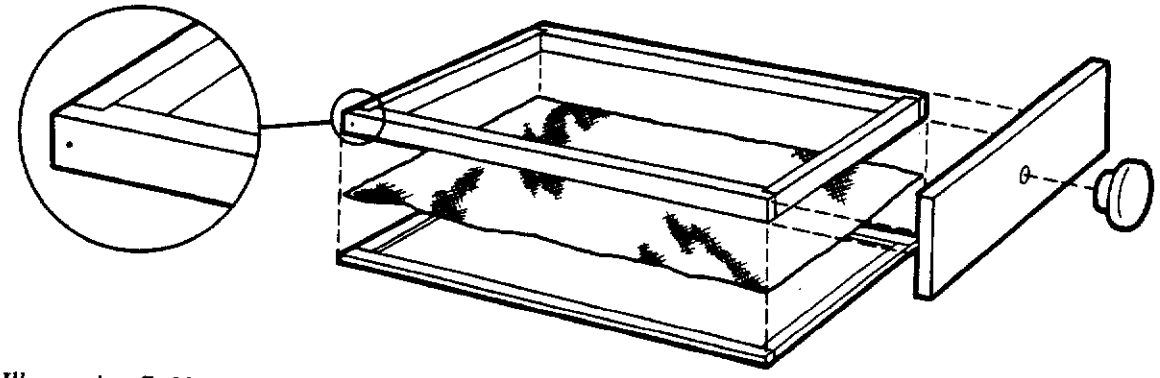


Illustration 7–10—Tray assembly details; note the rabbet detail at the corners.

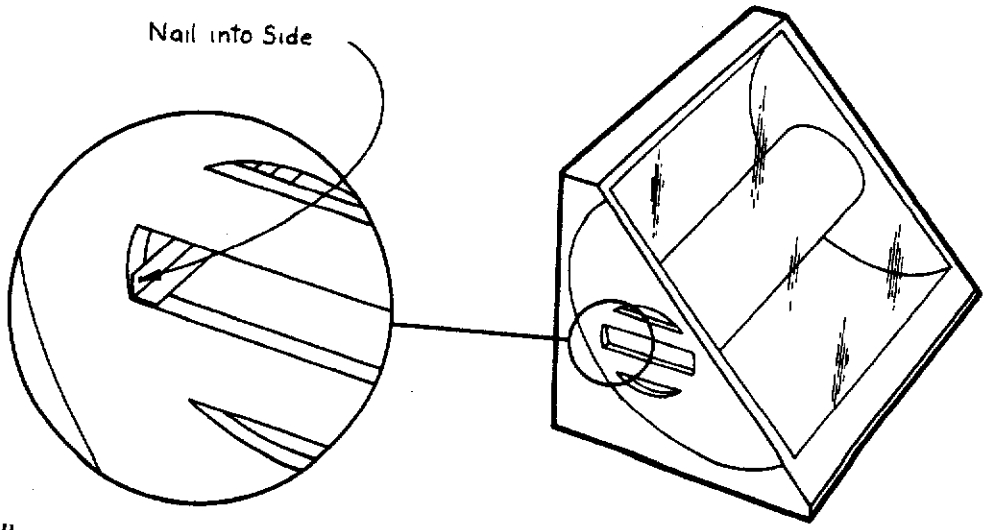


Illustration 7–11—The trays slide on small angles installed inside the side openings.