

LARGE FRESNEL LENS

The Fresnel Lens is a flat, thin piece of acetate butyrate in which a series of small concentric stepped zones are molded. They extend from the center to outer margins. Each groove is a minute refracting facet capable-of-bending light apart. Its transmittance (ability to pass light) is greatly increased over that of a conventional lens of the same focal length. These lines are only a few thousandths of an inch. Each concentric line acts as a part of a lens. Taken all together, they form the function of a true lens. This Fresnel Lens is an extremely powerful solar collector which can ignite flammable materials in seconds. It must be used with caution around sunlight.

WARNING - Be sure to read all safety instructions before using this product!!!

SPECIFICATIONS

Lens: 11" square and $\frac{1}{16}$ " thick; 50 lines per inch.

SUGGESTED EXPERIMENTS

Included in this information are two suggested applications for the fresnel lens Stock No. 30528-33: the solar furnace and a variation of the solar furnace, the camp cooker.

SAFETY INSTRUCTIONS

This product should not be used by children unless supervised at all times by a responsible adult.

This product can cause injury to the eye if used without proper protection. Any person within close proximity of the Fresnel lens during its use should wear protective eye wear to avoid such injuries.

This product can cause severe burns if the image produced by the Fresnel lens comes in contact with the skin. Any person within range of the focal length of the lens should be sure to avoid any contact with the image produced.

THE SOLAR FURNACE

The solar furnace is a practical instrument which is the result of the construction of a wooden frame for the 11" sq. Fresnel lens, Stock No. 30528-33. It allows you to use the lens as a kiln for art work, as a solar cooker for heating prepared foods, or other solar experiments.

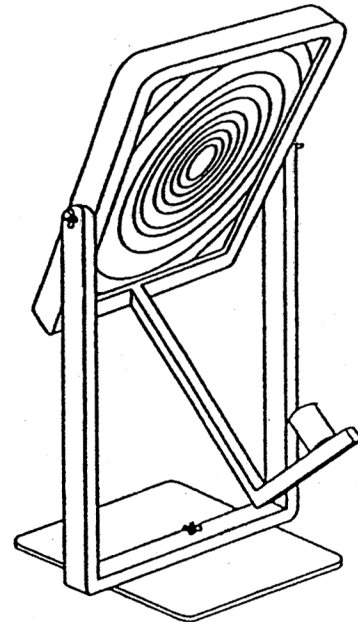
SPECIFICATIONS

L-shaped frame: 18" H x 15 $\frac{1}{2}$ " W
Fresnel lens frame: 13 $\frac{1}{2}$ " H x 13 $\frac{1}{2}$ " W

L-shaped bracket: Specific to focal length of Fresnel lens and height of crucible.

Fresnel lens: 11" sq. x $\frac{1}{16}$ " thick; 50 lines per inch.

FIGURE 1. Illustration of Solar Furnace.



ASSEMBLY

You can make a simple solar furnace with a single Fresnel lens mounted in a wooden frame as shown in Figure 1. All wood used in the construction of the frame should be from the same stock. (this does not apply to the plywood base.) You should acquire a sufficient amount of wood needed to complete construction of the frame before you begin.

1. BASE

The base consists of $\frac{1}{2}$ " thick plywood with rounded corners.

2. U-SHAPED FRAME

The U-shaped frame is made out of 1 x 1 $\frac{1}{2}$ " wood (these dimensions are not too critical). The frame stands 18" high and is 15 $\frac{1}{2}$ " wide. To secure this frame to the base, drill a hole in the bottom part of the U large enough to pass a $\frac{1}{4}$ " bolt and wing nut. This wing nut assembly will allow you to shift the furnace from left to right.

Design the U-shaped frame in such a way that the two arms are slotted at the top to accept $\frac{1}{4}$ " bolts and wing nuts which protrude out from the mid-point of the frame holding the Fresnel lens.

3. FRAME WHICH HOLDS THE FRESNEL LENS

The wood used to construct this frame should be from the same stock used for the U-shaped frame.

The outside dimensions of the frame measure $13 \frac{1}{2}$ " X $13 \frac{1}{2}$ " Cut a groove deep enough to accept approximately $\frac{1}{4}$ " of the Fresnel lens in the middle of each of the four pieces of wood which make up the frame Before inserting the Fresnel lens into the frame, drill two holes at the mid-point of two of the frame sections. Through each of these holes pass a $\frac{1}{4}$ " bolt. These bolts, tightened with wing nuts, form the axis upon which you can tilt the Fresnel lens up or down in order to be perpendicular to the sun.

The next step is to insert the lens into the frame grooves. Use glue or brads to secure the four pieces of the frame together.

NOTE—At this point, you are ready to give the furnace a try. Crumple up a sheet of newspaper and place it underneath the furnace. When you point the lens at the sun, the paper will burst into flames. **BE CAREFUL!** You are in effect concentrating a disk of sunshine 13 " in diameter into an area less than an inch in diameter.

4. L-SHAPED BRACKET

The mount of the L-shaped bracket that will hold the crucible is the last step in the construction of the solar furnace. This bracket is fastened in place with two round-head screws to the bottom of the frame holding the Fresnel lens. The length of the bracket is determined by the focal length of the Fresnel lens, with allowance for the height of the crucible. By considering the focal length of your Fresnel Lens along with the height of your particular crucible, you can determine the exact length of the L-shaped bracket needed for your furnace.

An alternative method of construction involves making the projecting arm out of aluminum. For, if the crucible is not in place when the furnace is exposed to the sun, the wood arm will burst into flames. The aluminum will not burn if accidentally left exposed to the sun's rays. However, it will give you a nasty burn if you touch the hot surface. You should treat the furnace with respect and be careful in order to avoid an accident.

5. CRUCIBLE

The crucible can be made out of ordinary firebrick or a good grade of ceramic tile. If you do not wish to make your own, you can buy a small crucible, such as the one shown in Figure 1, from a supply house specializing in products for college chemistry classes.

OPERATION

When you set up the furnace, make sure that the crucible is in place, otherwise you will char and burn the wooden bracket. This furnace will develop a temperature of $2,000^{\circ}\text{F}$, so be careful. Remember to read the safety instructions under **LARGE FRESNEL LENS**.

WARNING!!!—As you begin to use the solar furnace, be sure to exhibit great caution. Be careful never to get your hand near the bright spot produced by the lens and to avoid any contact with the hot surfaces of the furnace. Any such contact will result in **SEVERE BURNS**. If burns do occur, immediately seek medical attention. Also, **NEVER LOOK DIRECTLY INTO** the projected image of the sun.. wear dark glasses, if you must. This hot spot produced is as bright as the arc in a welder's torch, and welders always wear dark glasses!

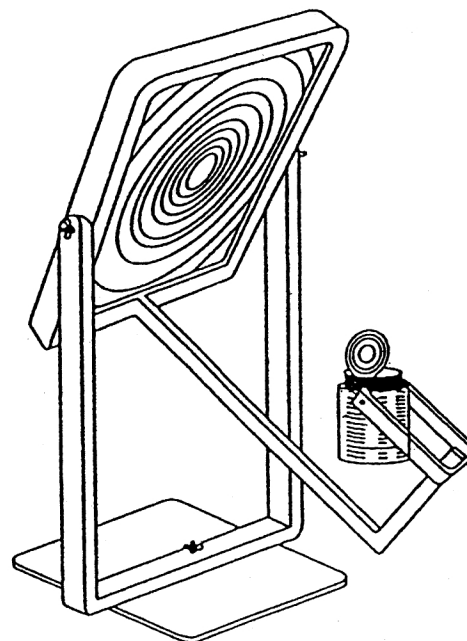
SUGGESTED EXPERIMENTS

The solar furnace can produce some unusual jewelry. At about $1,500^{\circ}\text{F}$, powdered enamel will fuse to metal, but since some enamel colors reflect and absorb heat more than others, some really exotic effects will be produced due to the differences in melting rates. This process can be observed through dark glasses.

THE CAMP COOKER

The camp cooker is really a variation of the solar furnace. The only differences existing in the length and shape of the projecting L-shaped bracket. This arrangement creates what is in effect a double boiler. It is ideally suited for heating soups, franks and beans, and other prepared canned foods.

FIGURE 2. Illustration of Camp Cooker.



ASSEMBLY

Construction of the camp cooker is identical to that of the solar furnace except for the projecting L-shaped bracket. This bracket is somewhat longer, measuring 15 " in length. Also, at its end it has a small U-shaped yoke designed to hold an ordinary can. The can is mounted with two round-head screws. The screws should be just tight enough to allow the can to move so that it is always vertical to the ground, regardless of the tilt of the Fresnel lens and assembly. The can used should be just large enough to hold the size can to be cooked. The can shown in Figure 2 is $3 \frac{1}{2}$ " in diameter, just wide enough to accept a slightly smaller can of soup.

For other assembly instructions refer to the **SOLAR FURNACE INSTRUCTIONS**. Remember to consider the alternative method of construction for the L-shaped bracket.

OPERATION

To use the camp cooker, fill the space between the two cans with water and paint a black spot on the outside of the larger can. The black paint serves to absorb the heat of the sun and as a result, produces the equivalent of a double boiler. Before you place the food to be heated in the camp cooker, you must open the top of the can. A two or three minute exposure to the sun will cause the water to boil, effectively warming up the contents of the inner can.