DESIGNING SOLAR COOKERS,

A New Approach

July 26, 1992

Solar box cookers rely solely on sunlight to heat an oven-like box to cooking temperatures. Design is centered around getting the box hot enough.

Usually, the boxes are large enough to heat several pots of food at once, so they are convenient for serving several people. Their success is due to reducing lost heat from the large box by insulating it and glazing the open top with glass or plastic. Typically they measure about 24 inches wide by 30 inches long and 12 inches deep, more or less. A flat cover hinged at one end can be propped up to reflect more light into the box. Such a large volume is not easy to keep hot.

I suggest a different approach. Start with the food and heat it directly with the sunlight, so only the pot needs to be glazed and insulated. This approach centers the design around getting the food hot which is clearly a smaller problem than getting the big box hot.

Both approaches use the same four elements:

food container,
light reflector, (one flat, the other conical)
insulation,
glazing.

The crux of the new approach is the reflector used to concentrate the sun's energy on the food. Flat reflectors used with box cookers reflect extra light down into the box over a large area, but to heat food directly it is necessary to collect light and funnel it down into the opening in the top of the pot. Fortunately, there is a proven method to do this.

The March, 1991, issue of Scientific American carried an article by Dr. Roland Winston titled "Nonimaging Optics." Winston describes how to design and use solar concentrators that accept sunlight from a wide angle without the need to move them as the sun moves. A simple version of such a concentrator, which I call a sun funnel, is shown in the attached drawing. Held above a pot, it can funnel light down directly onto the food where it turns to heat. Incidentally, that's how an electric toaster works.

Sun funnels can be made many ways. Vacuum formed plastic panels can be covered with aluminum foil. Hand forming soft aluminum sheet into an inexpensive mold by pounding with sand bags doesn't take much skill, and blanks are easily cut to shape with tin snips. Or, gores can be stitched up out of the same reflective cloth used to make forest service fire shelters.

In primitive societies, sun funnels could be made of wattle and daub. Plastered and "papered" inside with aluminum foil, they may be the cheapest of all. The device lends itself to cheap manufacture without the need for expensive machinery.

Let's see what we get when we design the simplest possible cooker with this approach in mind, remembering the importance of using materials and methods obtainable by poor people who are most in need of solar cookers.

First, snuggle the pot in a bed of dry grass in a basket filled with grass up to the rim of the pot.

Next, cover the pot with a glass lid, or other glazing.

Finally, set a sun funnel on top of the pot, supported by the basket rim and the pot lid.

This direct heating approach needs to be tested. Making a solar cooker along these lines for test and evaluation would not be expensive and seems worth the effort.

Roland Saye 7/26/92
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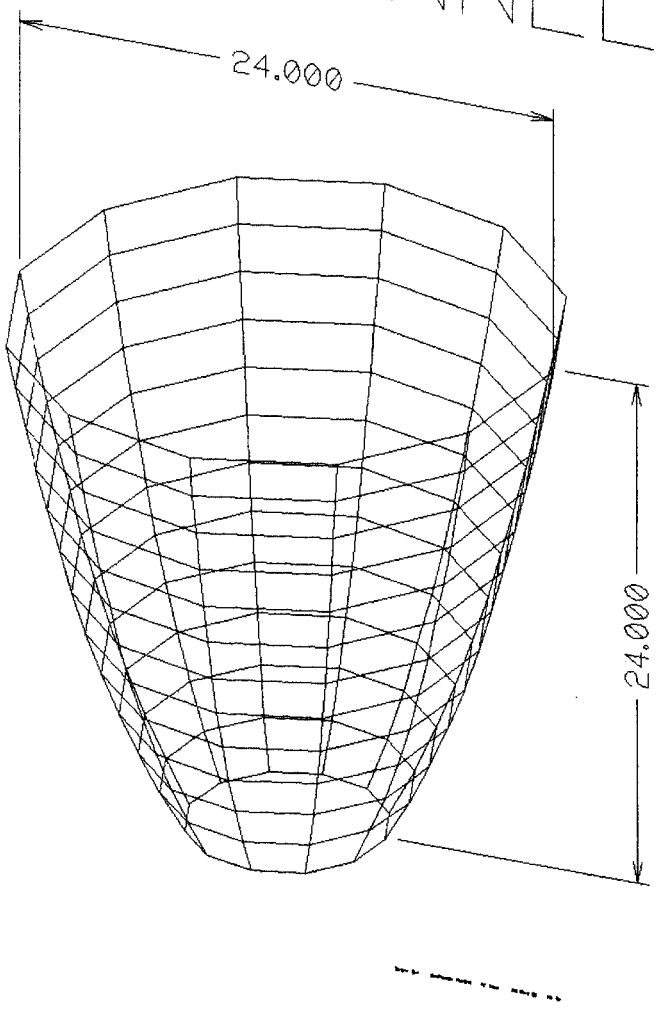
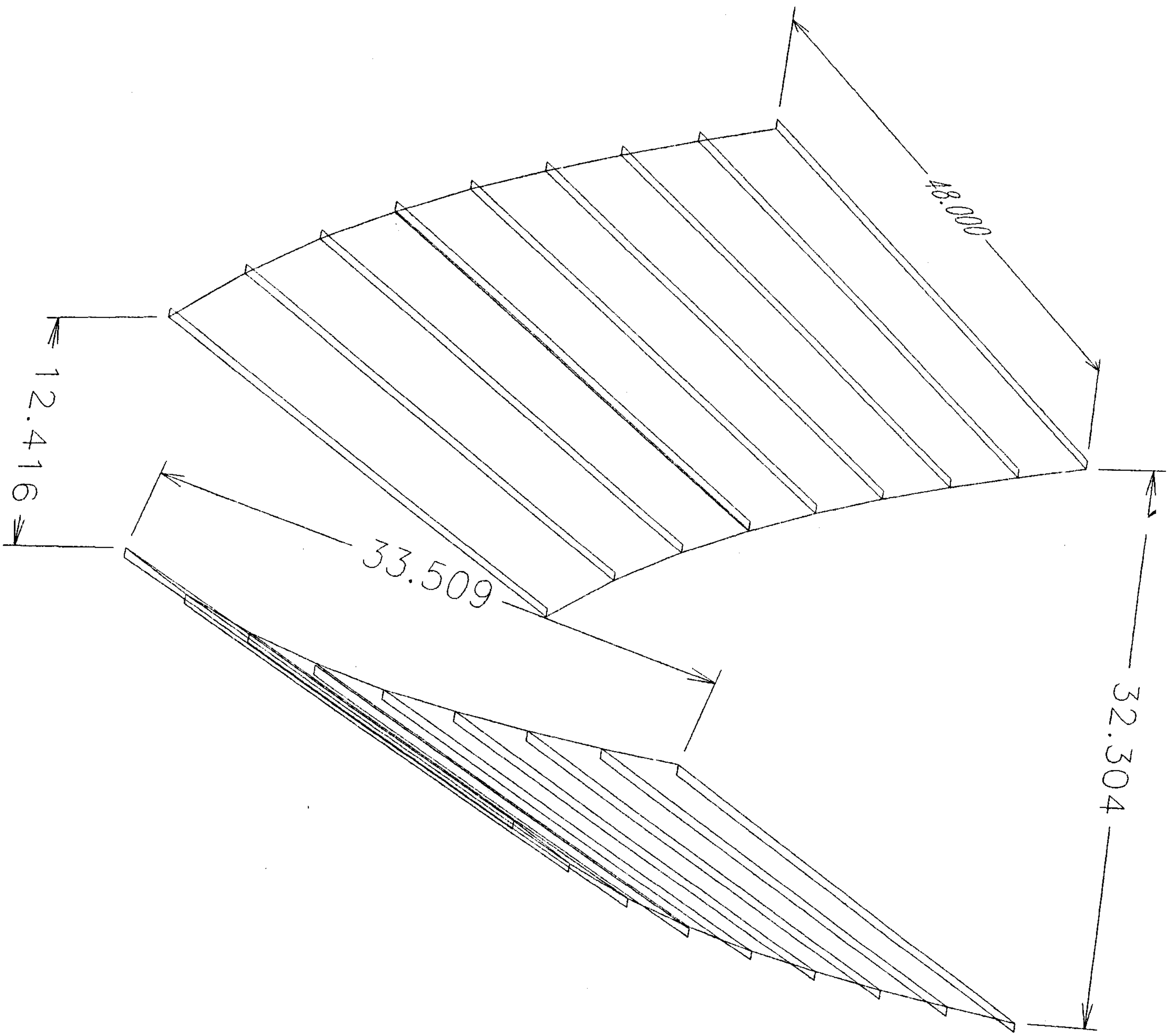
SUN FUNNEL

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