Solar Oven Construction Manual

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General Comments on Constructing a Solar Oven:

- All dimensions listed in the plans are in inches: i.e. 6.5 = 6.5" = 6.5 inches (1" = 2.54 cm).

- The carpentry involved in constructing a solar oven is very simple and straightforward; plan ahead and work carefully and you will have an excellent oven.

- Good carpentry is a trade-off between the dimensions you calculate, the accuracy of your work, and reality of the wood. **Measure everything over and over again:** this will minimize your errors, and give you a recourse to fix problems that arise.

- The goal of the construction is to produce a well-insulated (i.e. well-sealed) box. To accomplish this you should:

  ⇒ check and re-check your measurements
  ⇒ test the fit of all pieces, then assemble them with glue and nails
  ⇒ minimize the number of nails used
  ⇒ use lots of glue to seal the oven
  ⇒ use lots of paint to seal the oven, particularly along the seams

- Common problems and recommendations include:

  - warped plywood ⇒ keep it dry, and place weights on it overnight

  - the materials available are different from those listed ⇒ there are no "secrets" to the oven, a well-insulated box of almost anything will work

  - irregular wood-cuts lead to gaps along the walls ⇒ match "good" sides of wood together, and be aware of what surfaces need to be flat, and which are unimportant

- Ovens can be built of any size.

- Experiment with both the construction and with solar cooking methods!

Acknowledgement

This solar oven construction manual would have been impossible without the assistance and input of dedicated solar oven carpenters and chefs in numerous communities in Kenya, and without the work of EarthCorps volunteers. In particular Francis Muthoka of Ambassadors Development Agency, Josephine Mwota, Christine Mwende, Daniel and Francisca Musyoka and Patrick Ngalla have all tirelessly worked to improve the design and to spread the solar oven technology throughout Kenya. We would like to give particular thanks to Professors Odhiambo, Munavu, Genga and Drs. Kola and Rabah for their support of the renewable energy project in East Africa, and to Professor Lankford of George Mason University. This research is supported by the Department of Physics at the University of Nairobi and the Kenya National Academy of Sciences, the African Academy of Sciences, the United Nations Cultural, Educational and Scientific Organization and Earthwatch and its Research Corps.

Tools and Materials Necessary to Construct a Solar Oven

Tools	Materials
Wood saw	48" x 96" (4' x 8') sheet of 1/4" thick plywood
Coping saw	~ 216" of 1" x 1" wooden rods
Metal Saw	~ 3 square yards of cardboard or hardboard
Regular and Star screwdrivers	1" nails (with heads, and some headless)
Hand drill	1/4" tacks
Drill bits	2 3" square hinges
Measuring stick/square	2 4" T-hinges
Hammer	1 liter of wood glue
Silicone gun	Half tube of high-temperature silicone sealant
Utility knife	Assorted wood screws (0.5" to 1.5" in length)
Wood file	21" x 24" (approx.) 16 - 24 gauge metal sheet
Pencil	1 wide roll of heavy aluminum foil
Paint brush	1/4 liter flat black paint
Measuring tape	1 liter of oil-based exterior paint
C-clamps (optional)	2 - 3 yards of twine, nylon string, or thin rope
	2 sheets sand paper (e.g. 80 grade)
	2 sheets of 4 mm thick clear glass:
	Lower sheet: 27" x 30"
	Upper sheet: 29" x 32"
	One sack of insulating material
	(wood shavings, rice husks, paper, etc.)

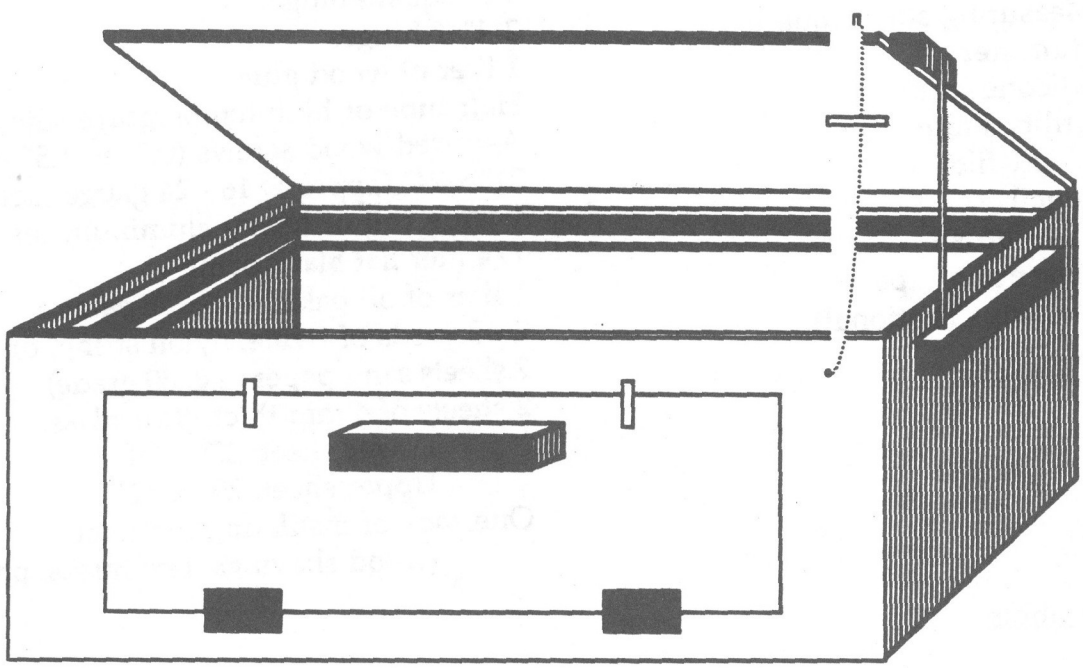
Symbols:

Approximately
Inches

The materials cost about Ksh 1,600, or US$ 32.

There are a wide variety of solar oven designs that all work very well. Further, each time we hold a solar oven workshop new modifications emerge. We ask that you please send us comments on this design, changes, and whole new designs that you have constructed.

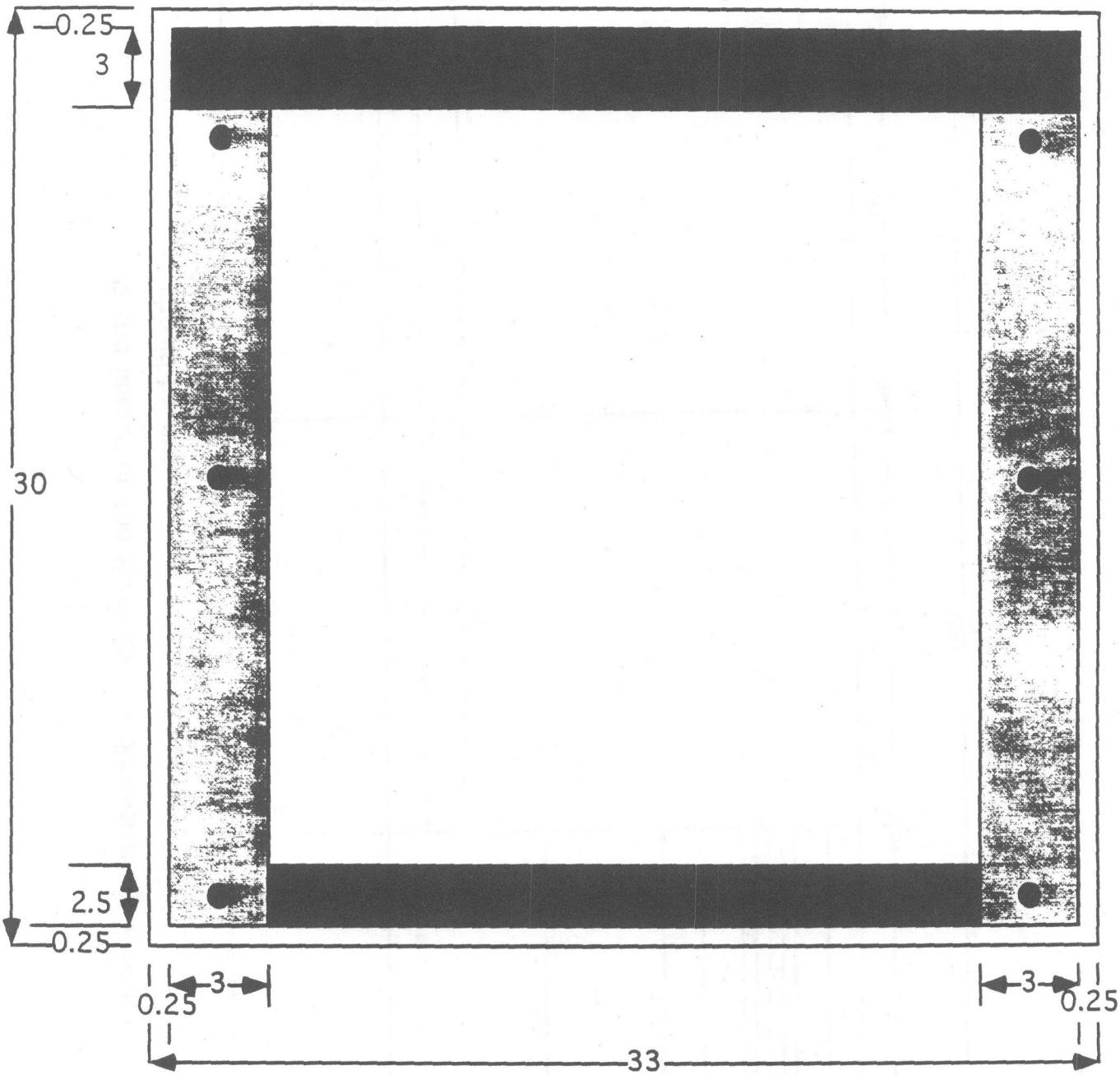
COMPLETED SOLAR OVEN



The solar oven is a well insulated wooden box with two panes of glass as a top. Inside the wooden box is an inner cardboard box. Insulation is placed between the set of wooden and cardboard wall. The cardboard walls are covered with aluminum foil, or can be painted black. Also show is a cover, connected by hinges to the box, with its inner surface covered with aluminum foil so it can also be used as an additional reflector.

Fig. 1

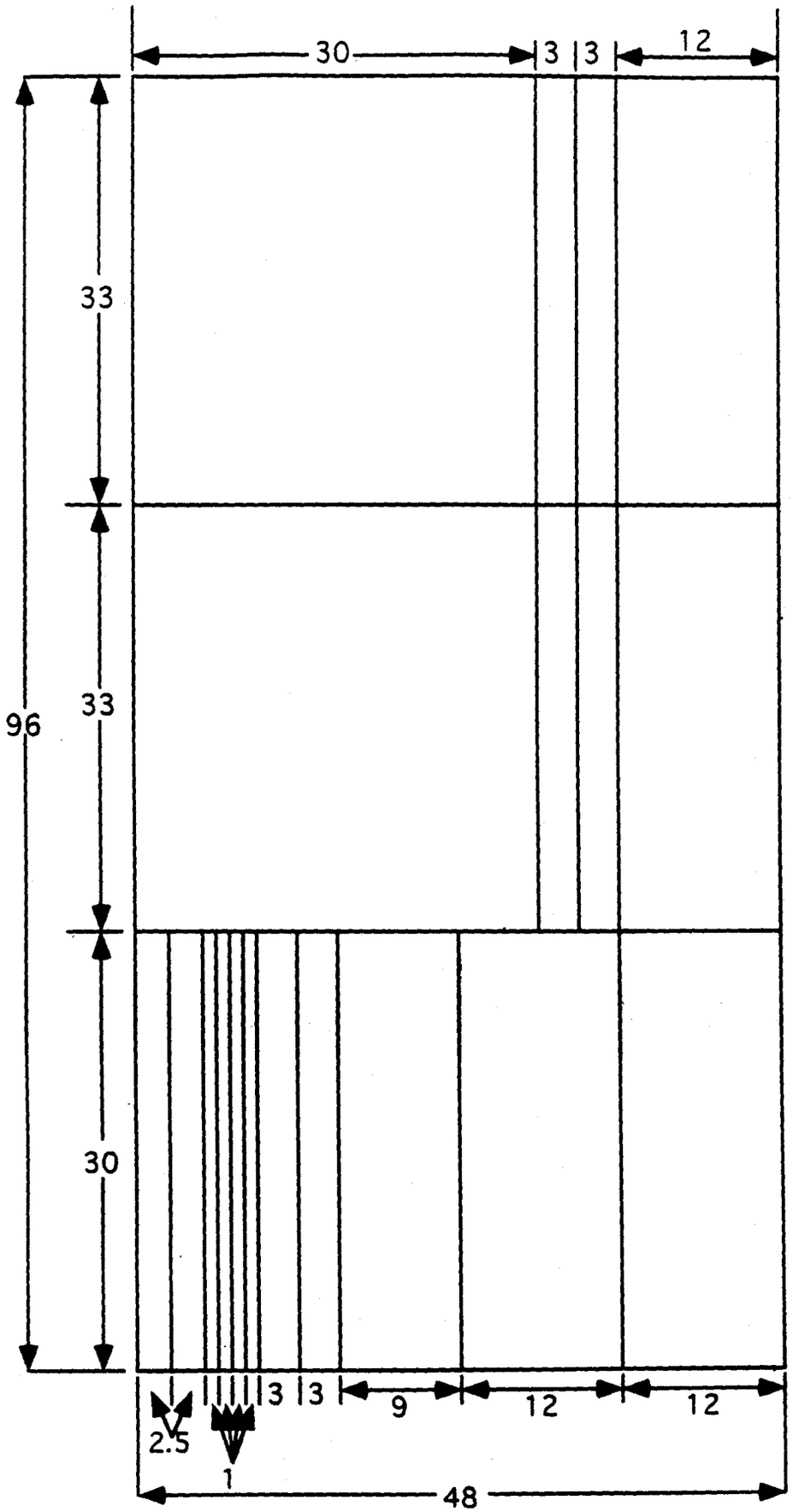
BOTTOM with GUIDES



The bottom of the oven is a large plywood sheet with thin strips of plywood nailed and glued to it. The thin sheets leave a quarter inch gap all around the edge: this serves as a guide for the oven walls.

Fig. 3

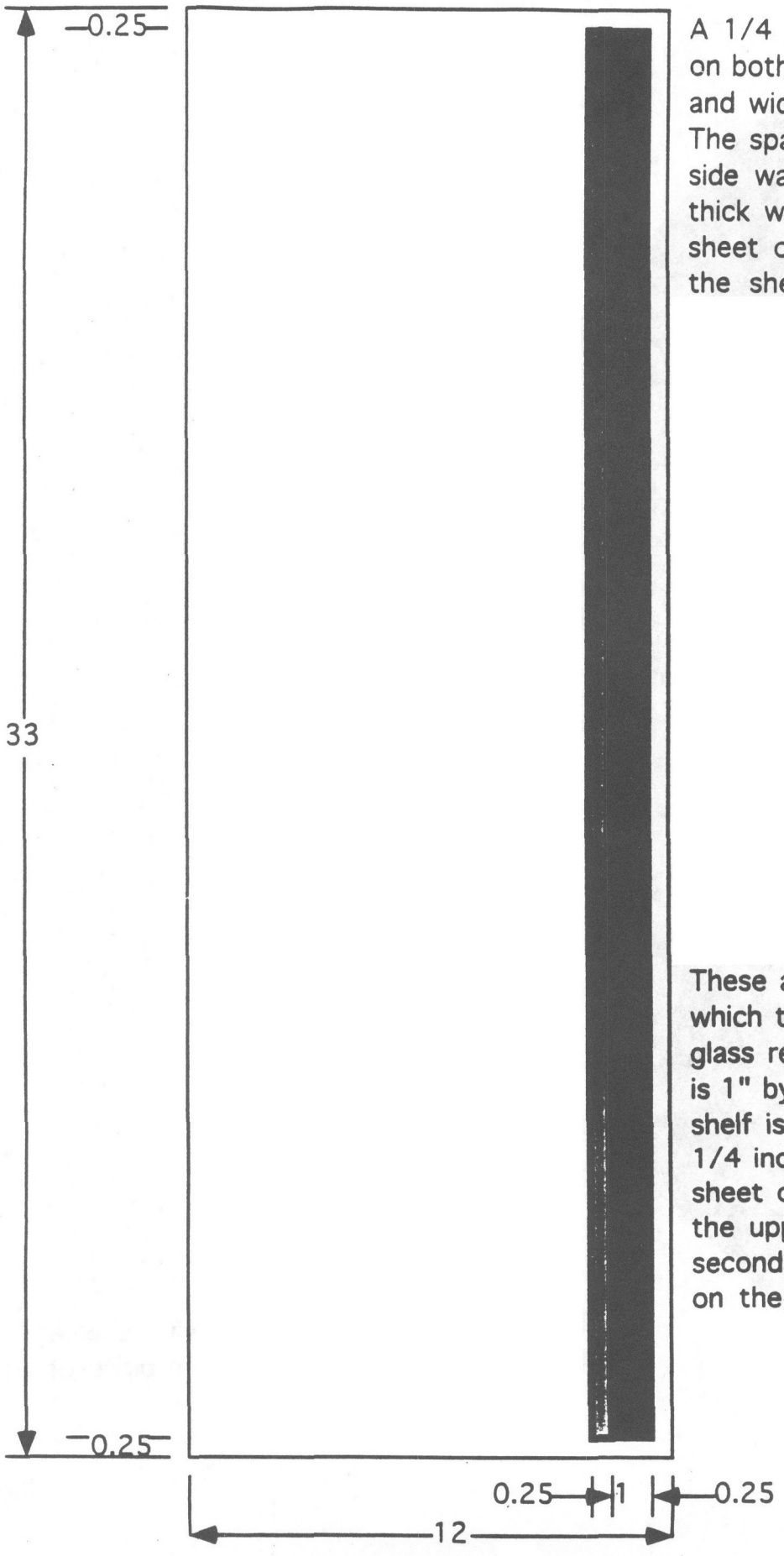
BLUE PRINT



This is the layout of the Plywood and dimensions of how it should be cut.

Fig. 2

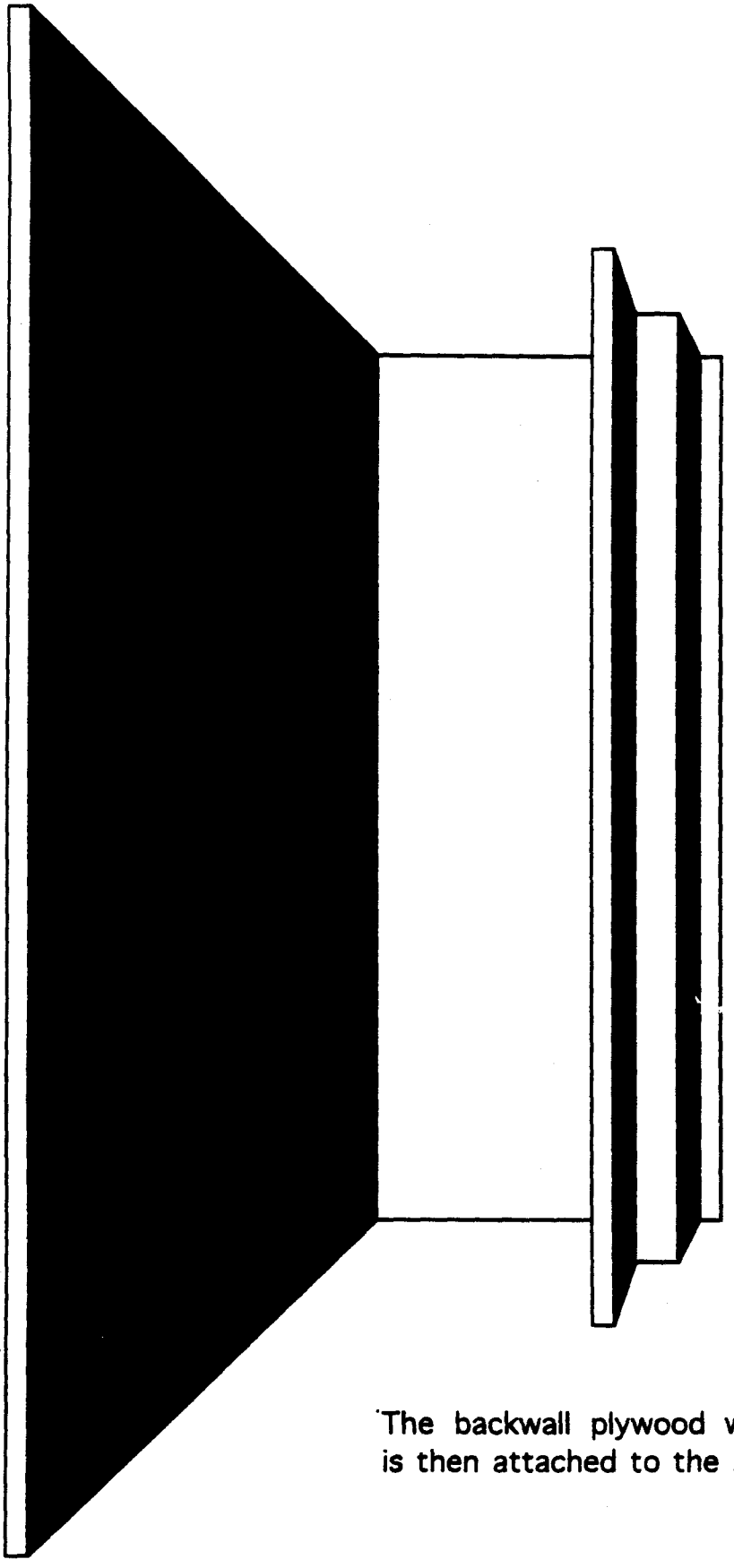
BACK WALL and SHELF



A 1/4 inch is left on both the length and width of the shelf. The space is where the side wall (also 1/4 inch thick will fit). A top sheet of glass fits over the shelf.

These are shelves upon which the two sheets of glass rest. The upper shelf is 1" by 1" and the lower shelf is 3 inches wide and 1/4 inch thick; the top sheet of glass rests on the upper shelf while the second sheet of glass rests on the lower shelf.

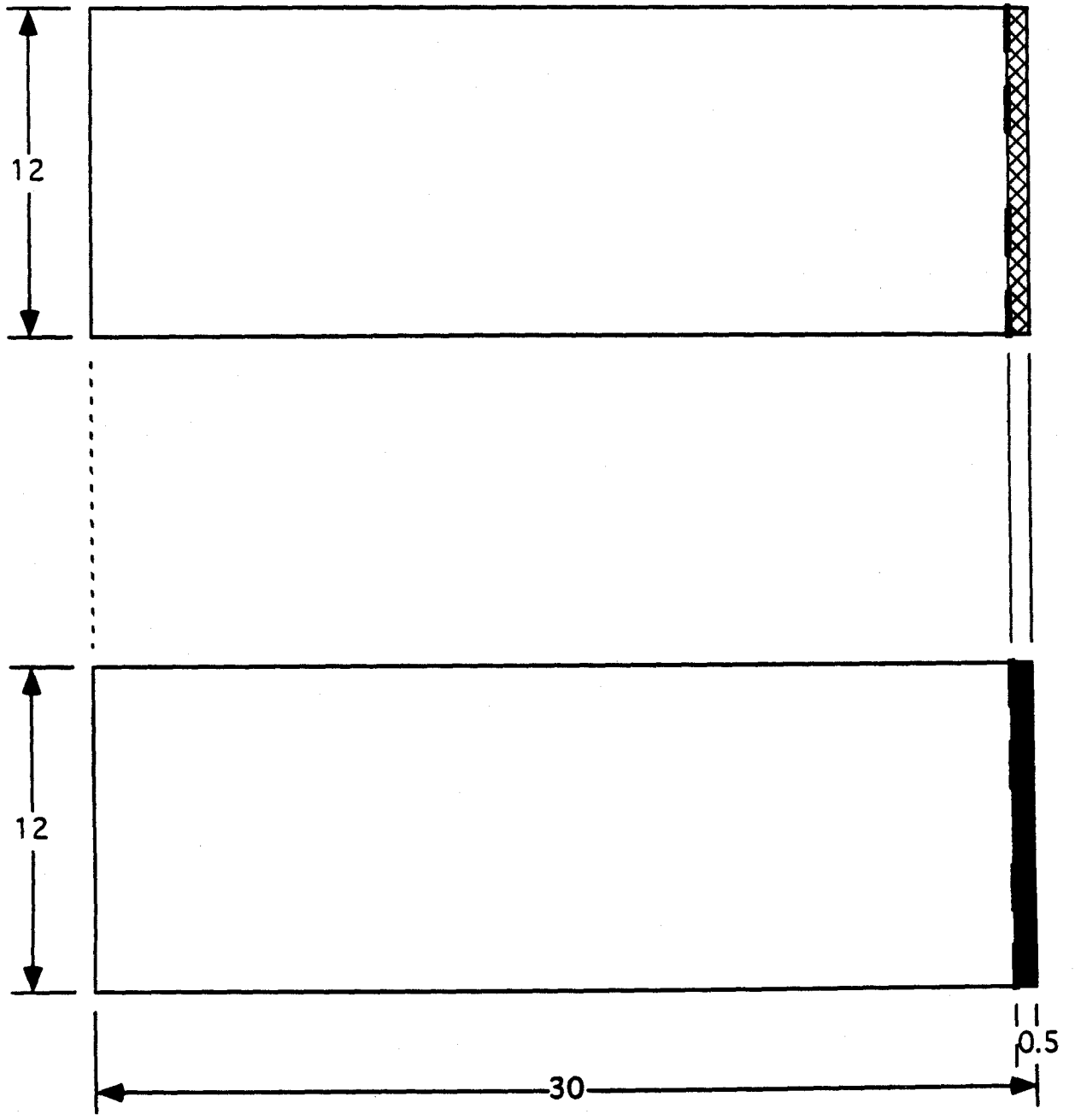
Fig. 4



The backwall plywood wall with shelves is then attached to the bottom piece of wood.

Fig. 5

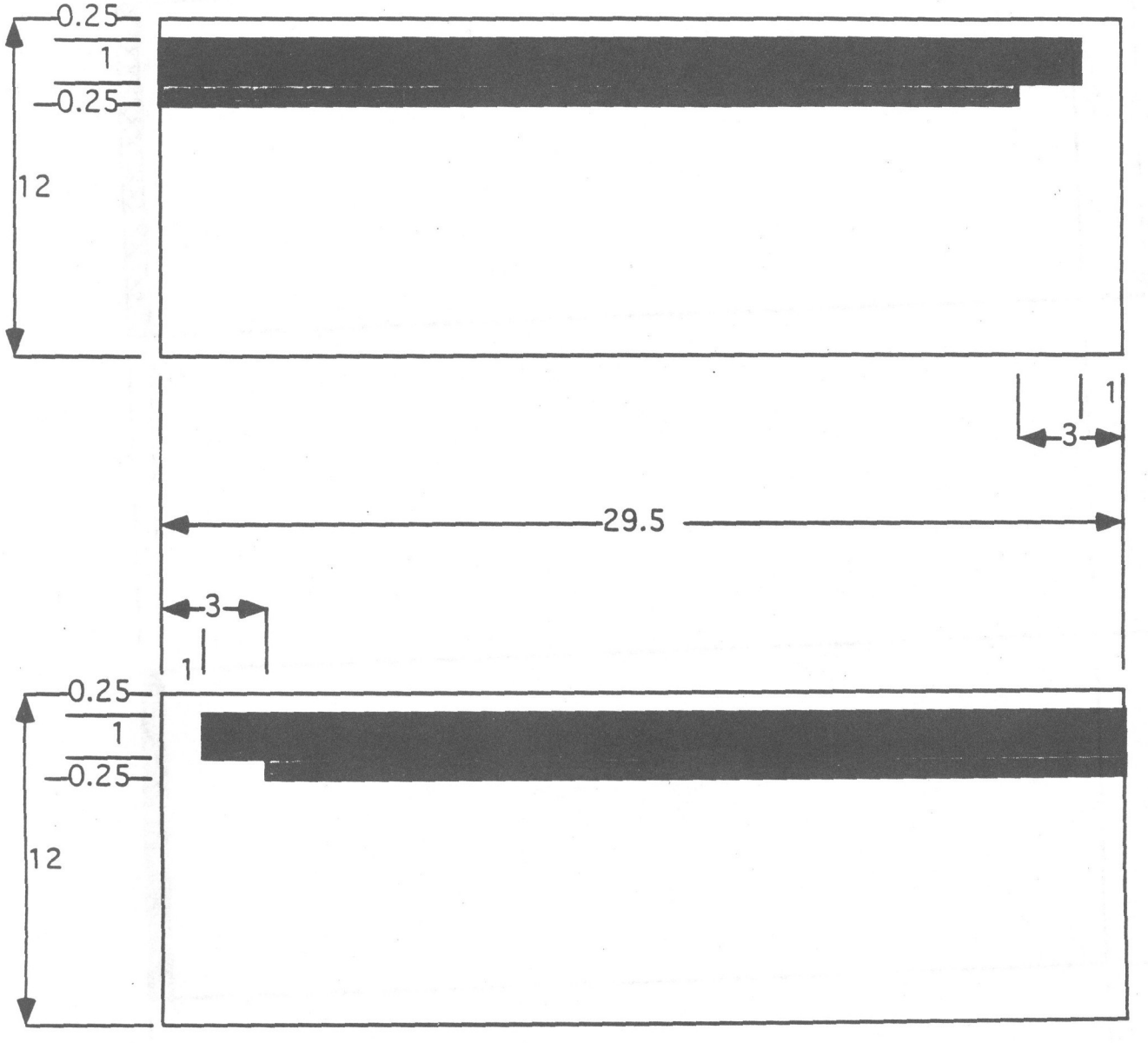
SIDES: CUT to FIT



A 1/4 inch is cut from each side of both plywood walls so that they fit between the back and front walls.

Fig. 6

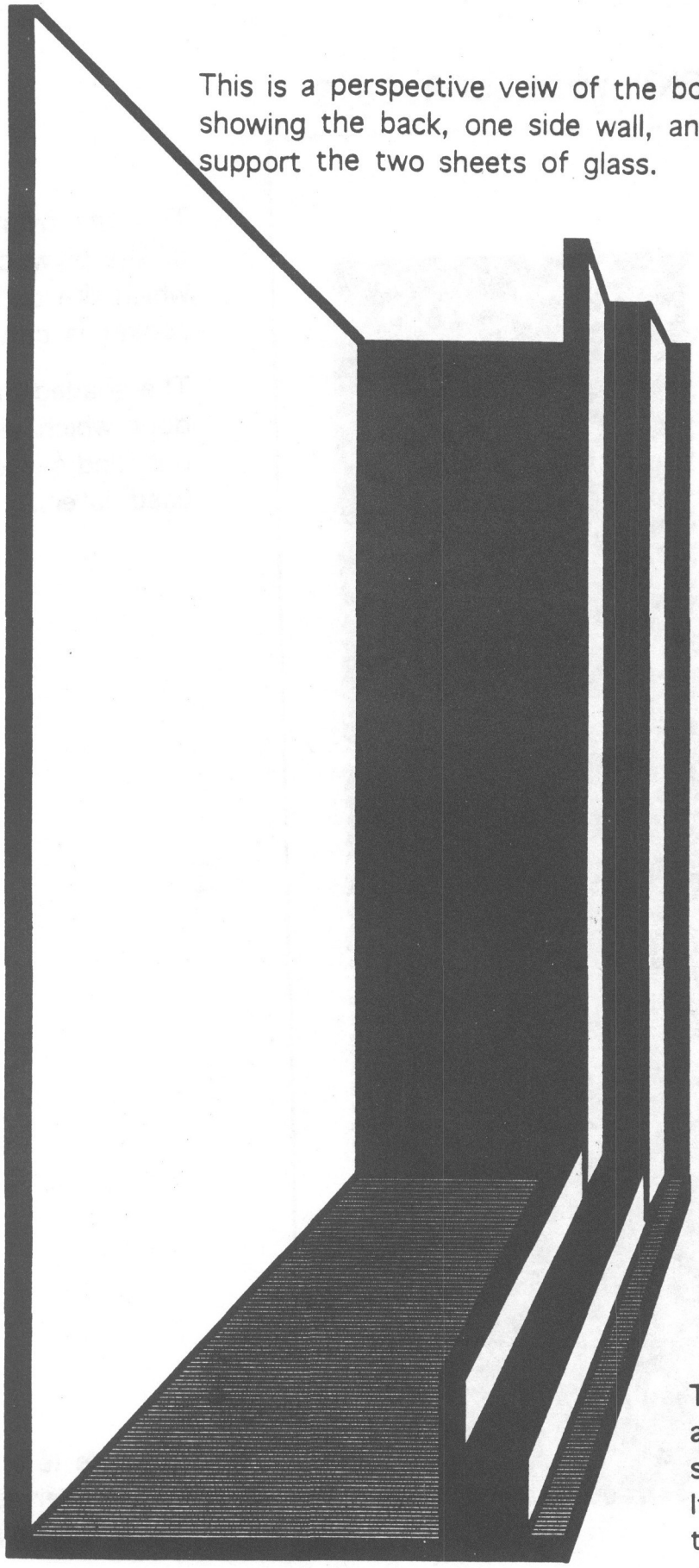
SIDES with SHELVES



The above two diagrams, exemplify how the sides wall appear once the two shelves are attached. The dark shaded is the upper shelf which is a 1" by 1" upon which the top sheet of glass rests, while the light shaded is 3 inches wide and 1/4 inch thick and form the lower shelf upon which the second sheet of glass lies.

Fig. 7

This is a perspective veiw of the bottom of the oven showing the back, one side wall, and the shelves that support the two sheets of glass.

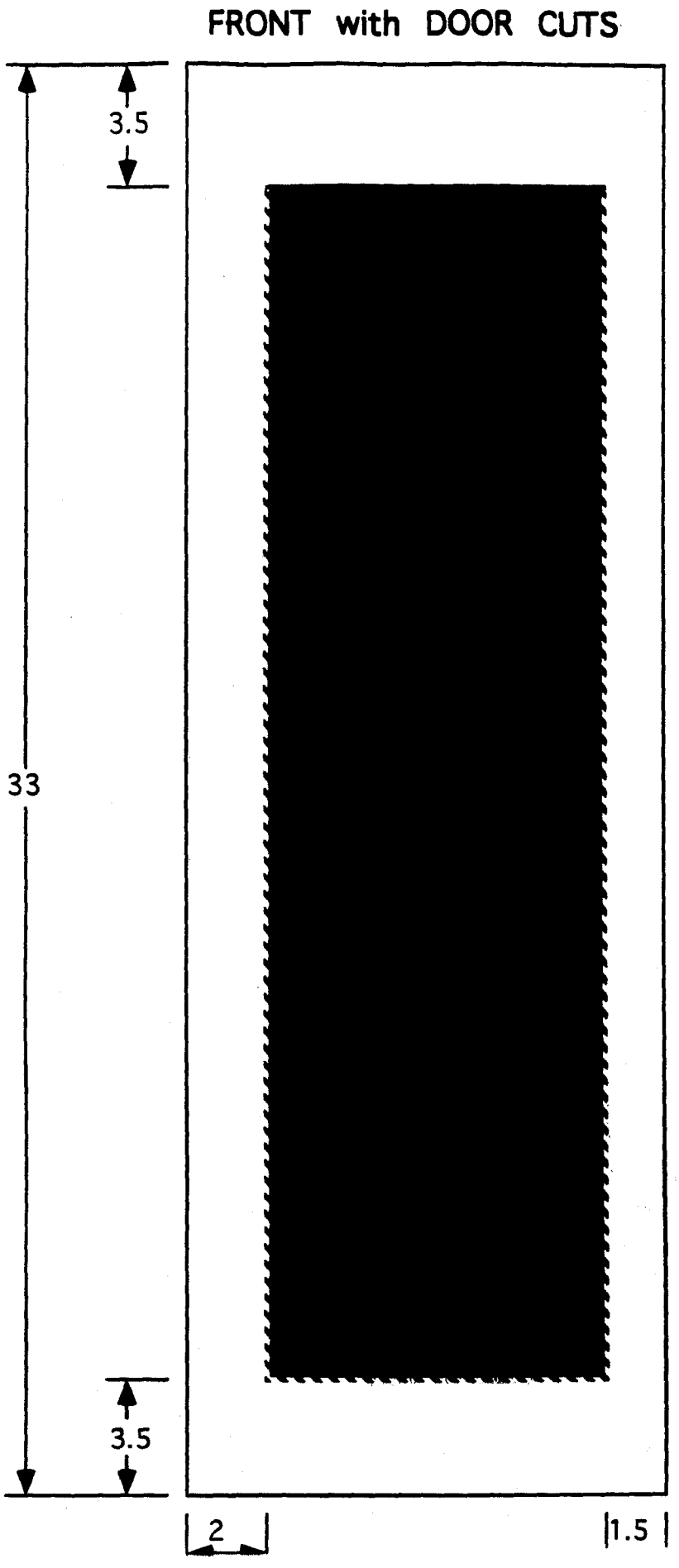


The backwall has two shelves fixed on it. The upper shelf is made from the 1" by 1" wood. It supports the top sheet of glass, and measures 29" by 32". The lower shelf is 3 inches wide and 1/4 inch thick; it forms the shelf for the small sheet of glass (27" by 30").

The shelves of the back and side walls fit tightly together -- forming a level surface for the glass.

This the side wall is attached to the 1/4 inch space on the bottom guide. It has two shelves fixed on the upper side.

Fig. 8



This the front part of the plywood from which the door of the cooker is cut.

The shaded part is the door which will be cut out (and saved to be used later).

1.5 inches are left above the door for shelves that will support the glass.

Fig. 9

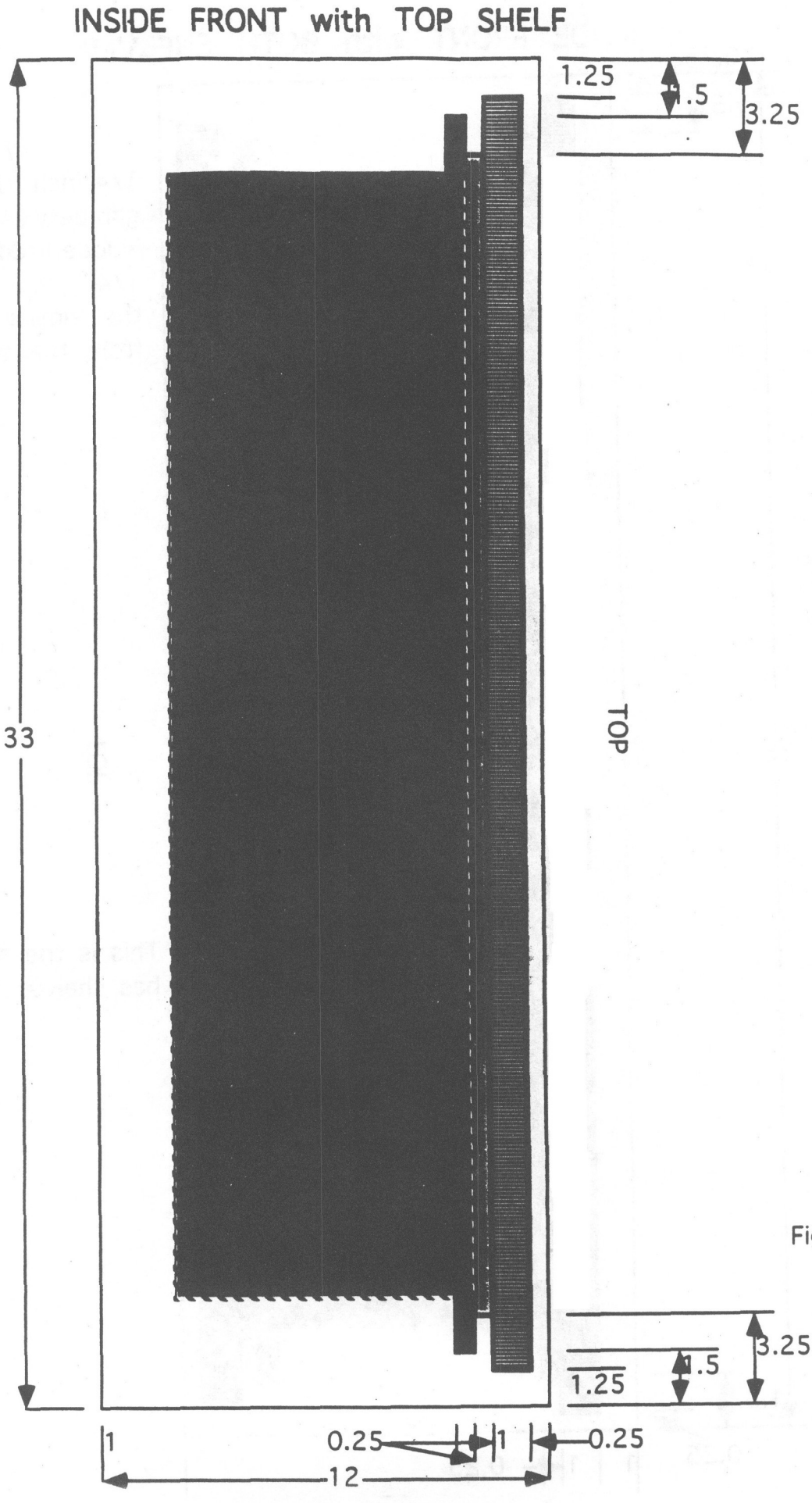
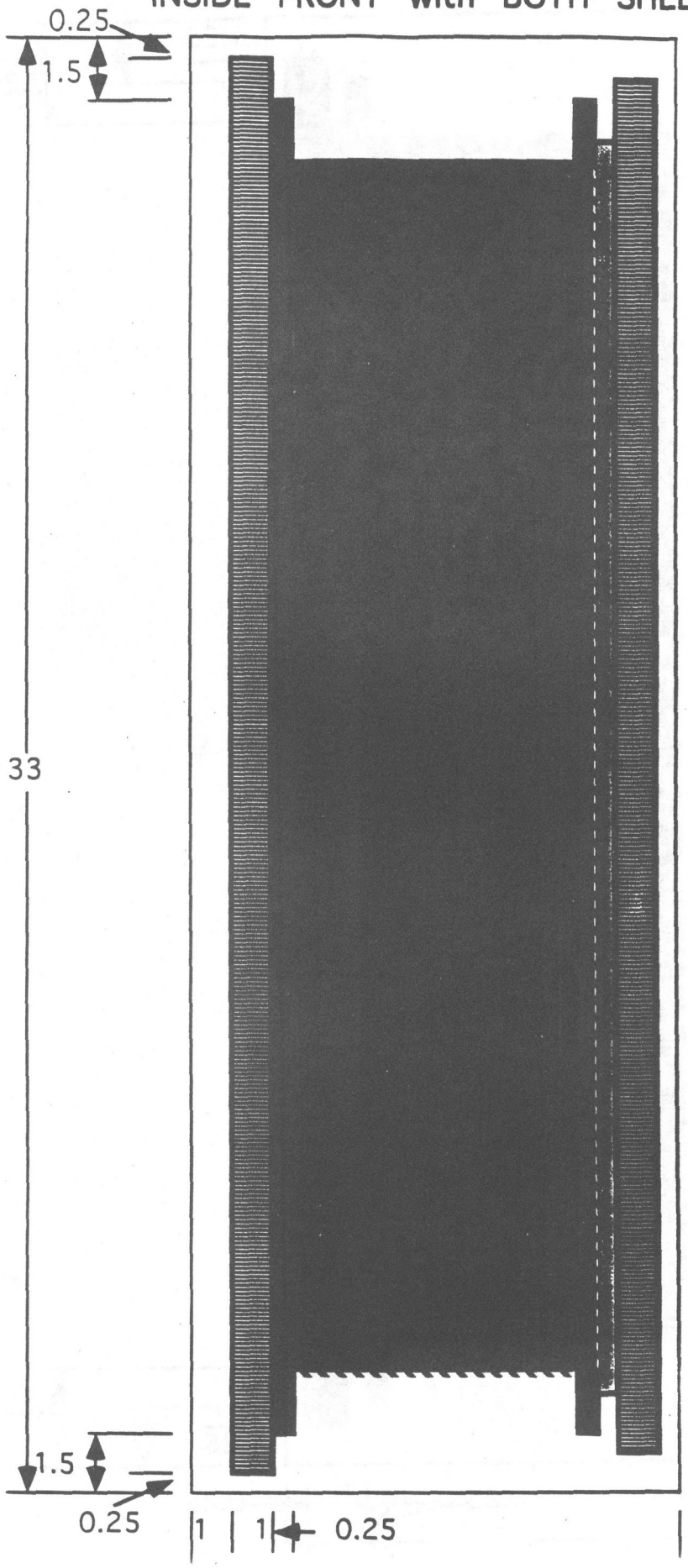

INSIDE FRONT with TOP SHELF
1.25
1.5
3.25
33
TOP
3.25
1.5
1.25
1
0.25
1
0.25
12

Fig. 10

INSIDE FRONT with BOTH SHELVES



1/4 inch 'U-shaped' end gap between 1" by 1" wooden rod and lower 1/4" piece will "hold" the similar shelf pieces from the side walls.

This is the front part which has shelves fixed on.

Fig. 11

PERSPECTIVE VIEW OF OVEN WITH ONE WALL AND
THE INSIDE OF THE FRONT DOOR COMPLETED

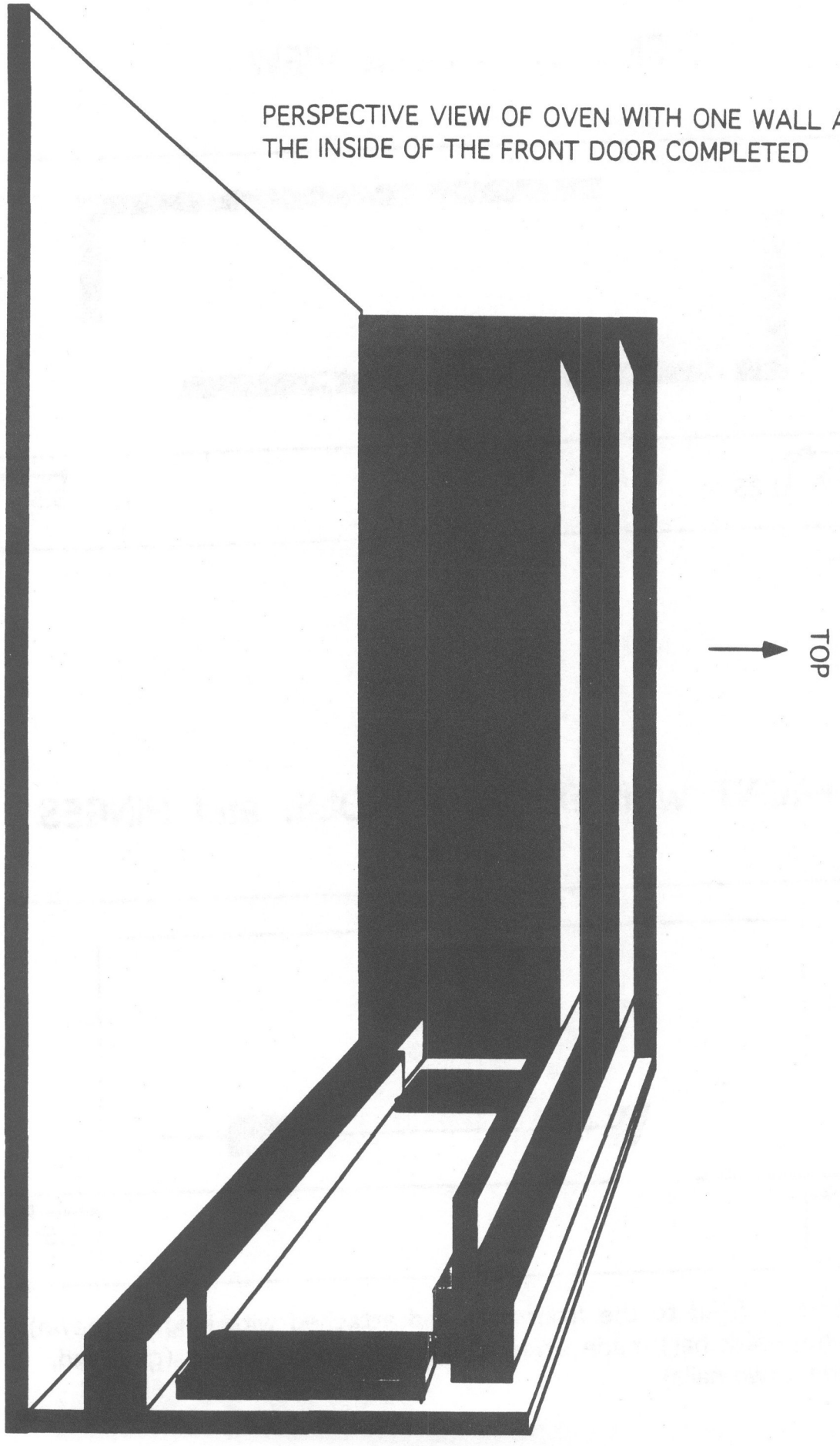
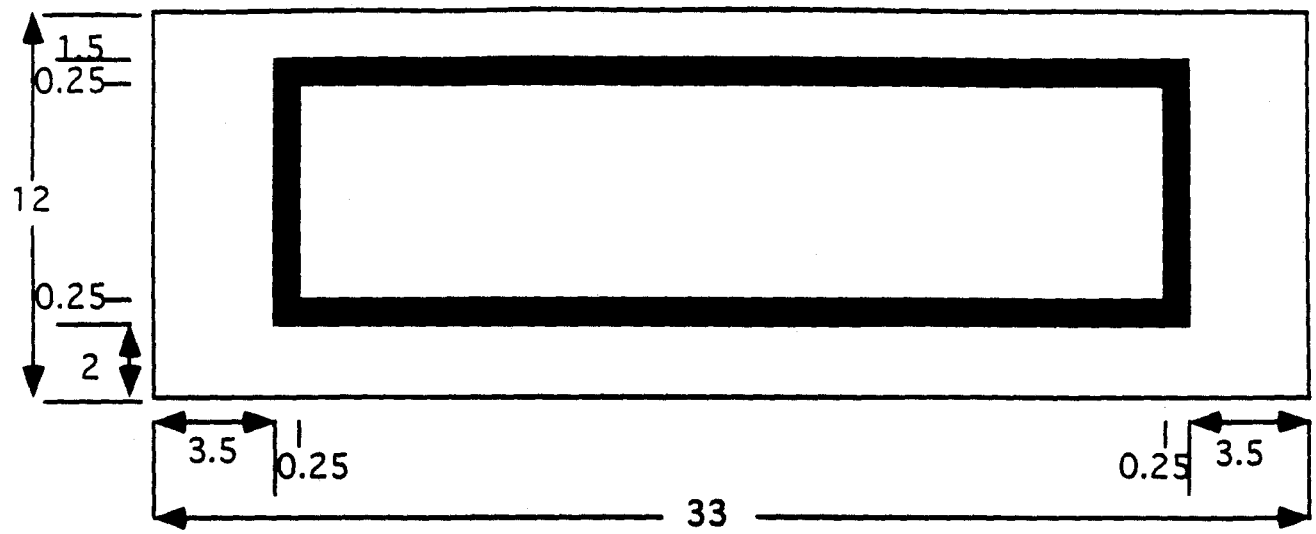
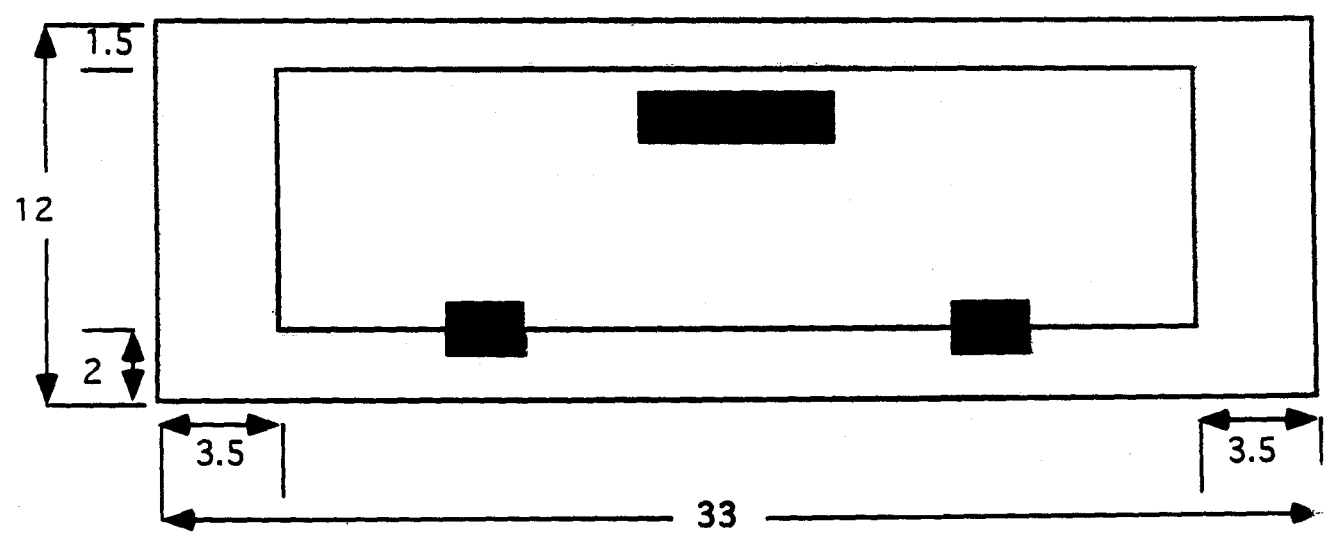


Fig. 12

FRONT: OUTER VIEW



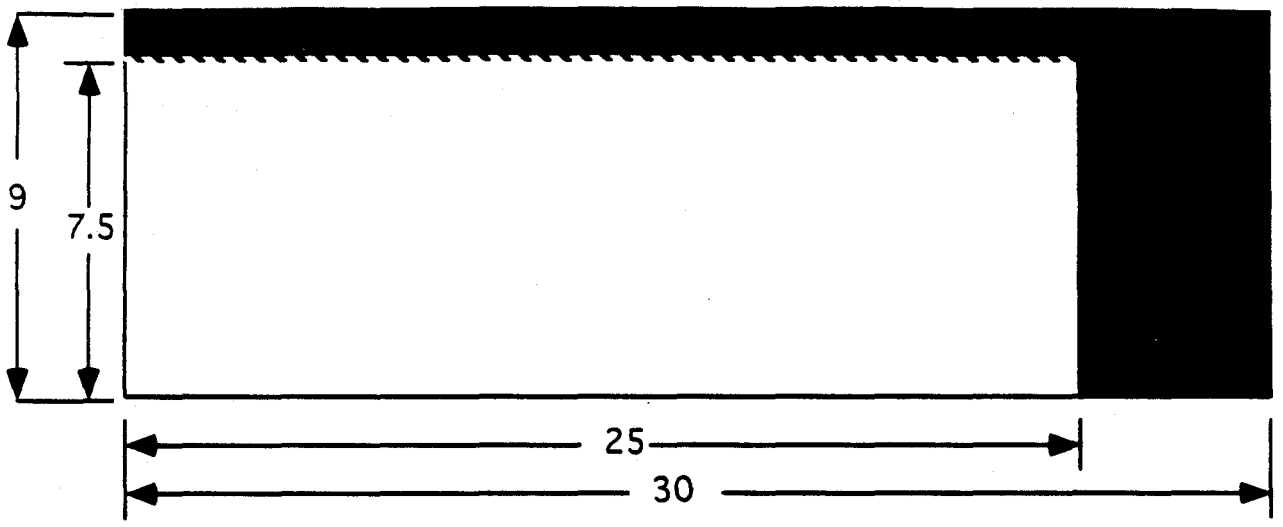
FRONT with DOOR, HANDLE, and HINGES



The door is fixed to the front part and attached with hinges (shown). A handle (dark bar) made of scrap wood is also attached (glue and, if needed, two nails).

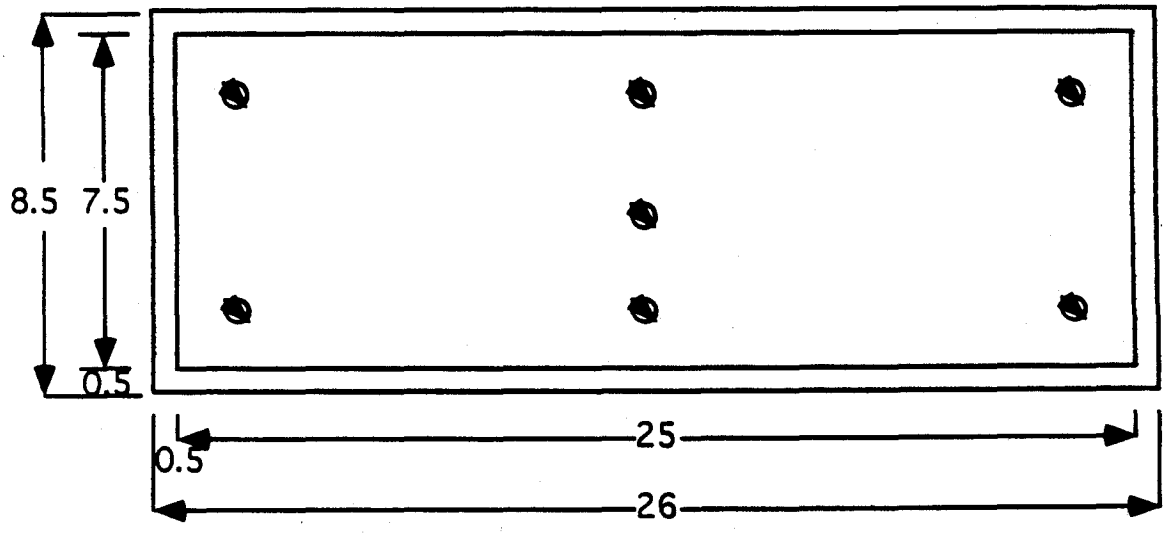
Fig. 13

INNER PANEL for DOOR: CUT to FIT



As shown above, a piece of the "scrap" wood cut from the front to make the door hole is used to add a second panel to the door. It is cut and then fixed on to the door to strengthen it.

DOOR with INNER PANEL

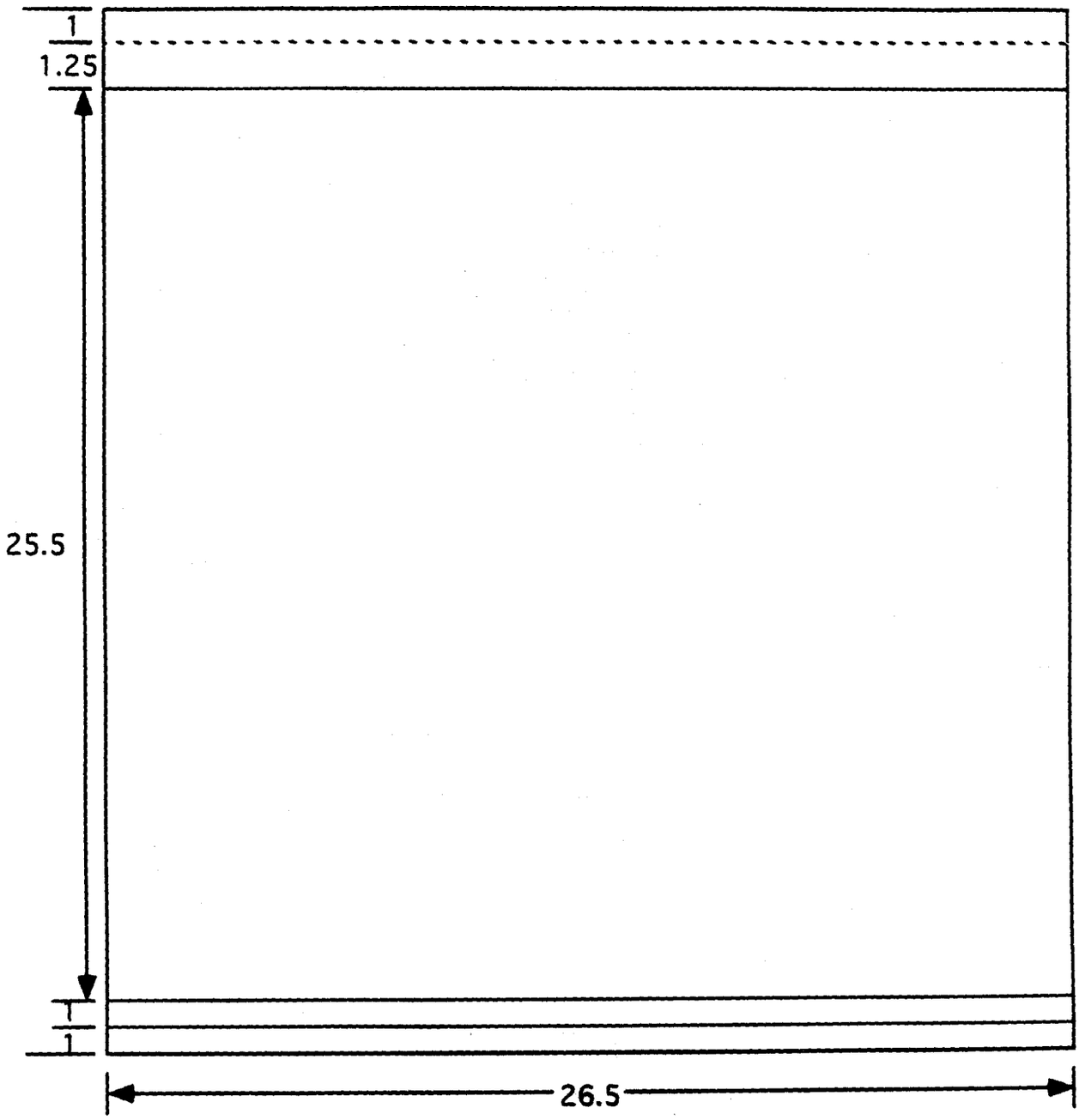


The panel is attached to the door and screws and glue.

Fig. 14

CARDBOARD BOTTOM

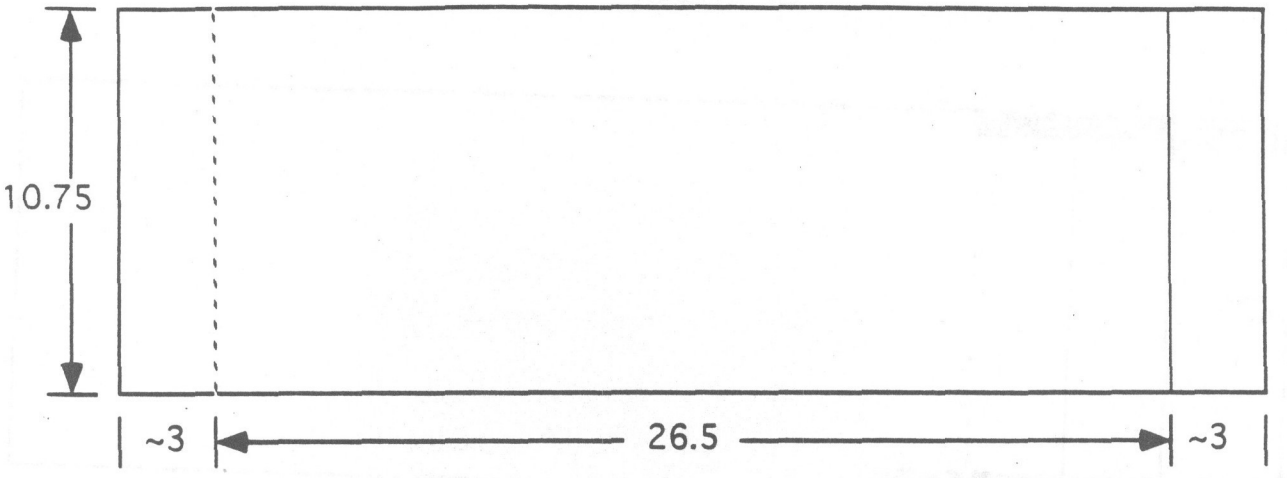
1 inch is folded and lies on the bottom. 1.25 is then folded vertically; These right angle folds make a lip to be attached to the oven floor.



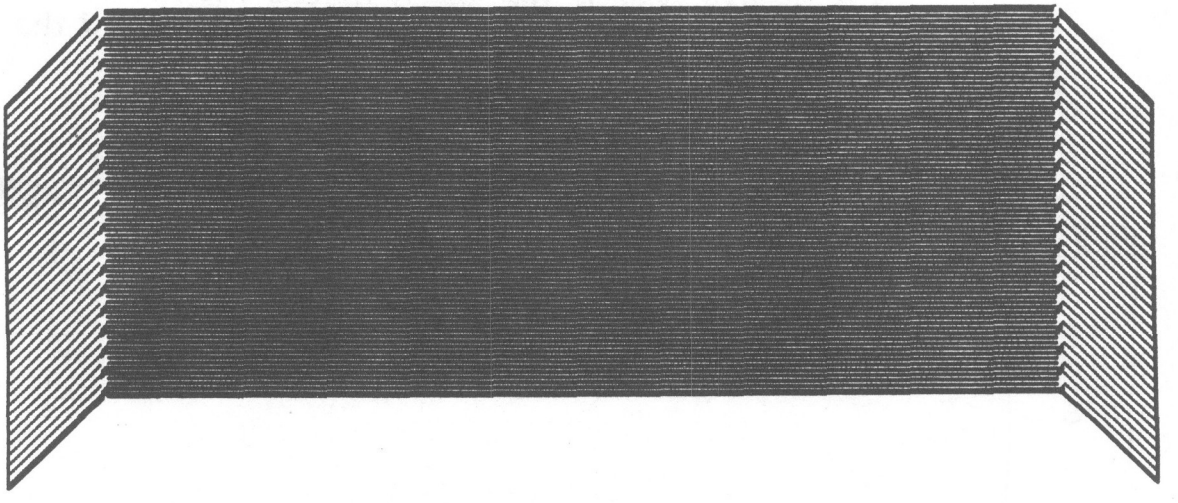
This is the bottom cardboard which forms the floor of the cooking area. 25.5 inch is the length of the inner box; 1 inch is folded downwards to cover the 1 inch piece that is placed on the bottom.
26.5 inches is the width of the inner box which is made of cardboard.

Fig.15

CARDBOARD BACK



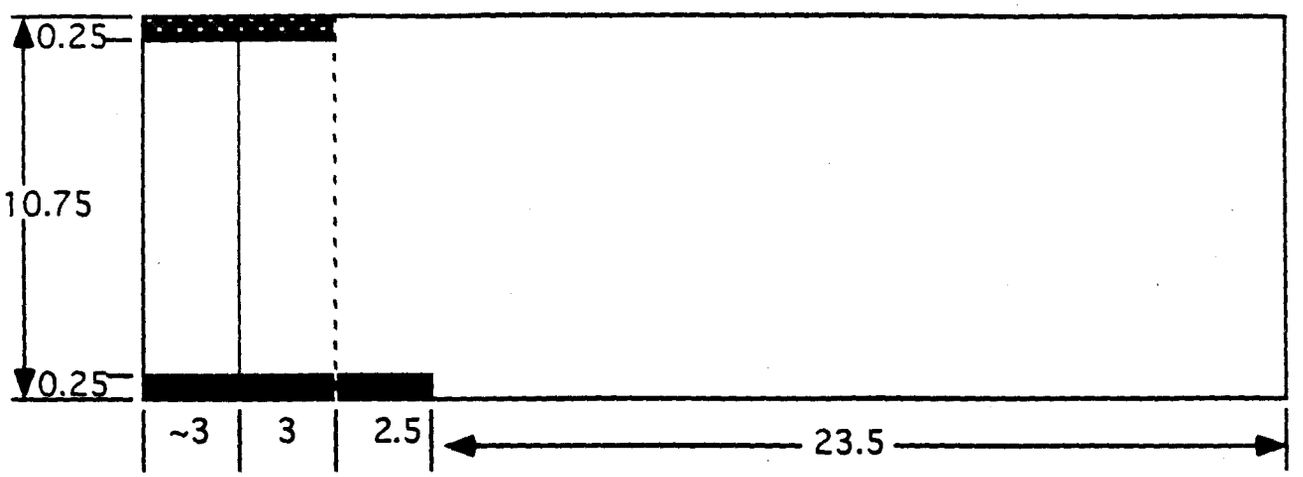
Cardboard forms the inner wall: the "cooking area."
The piece above,forms the back of the inner wall and fits in the inside of the bottom guides. ~3 extends along the sides of the inner wall, and holds the back inner wall firmly.



Once the cardboard is measured, it is folded as shown above and is fitted in the inside of the bottom guides.

Fig. 16

CARDBOARD SIDES



This is one of the side pieces of cardboard that forms the inner box of the oven. The side length of the oven is 23.5".
It is folded several times to "cap" the end, holding in the sawdust or other insulation. The dark strips are cut off to make room for the floor pieces and shelves (1/4" thick).
The 3" fold covers the space between the outer and inner box (this is the space that is filled with sawdust).
The next 3" fold bends backwards along the side of the oven wall.

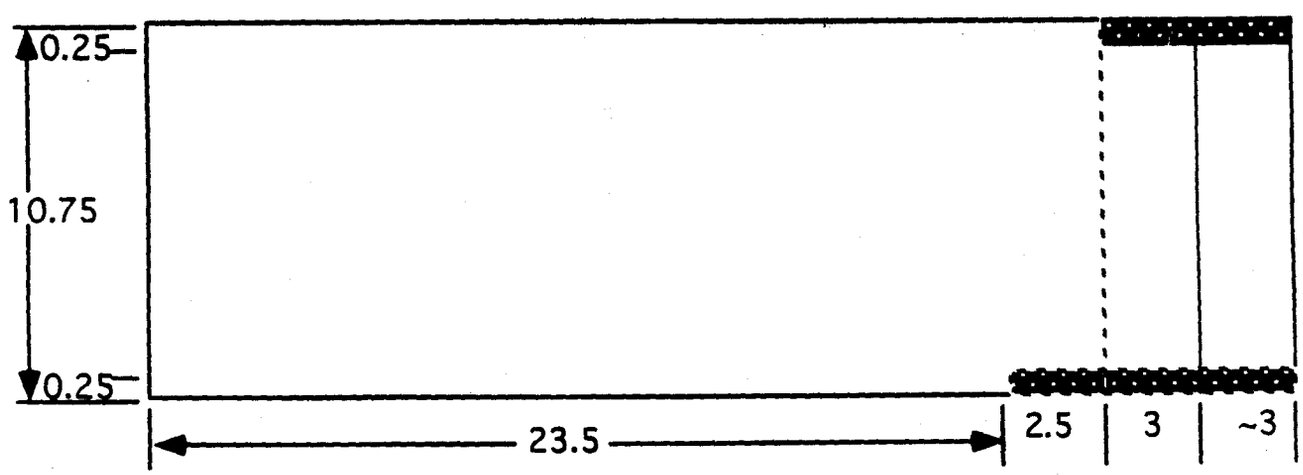
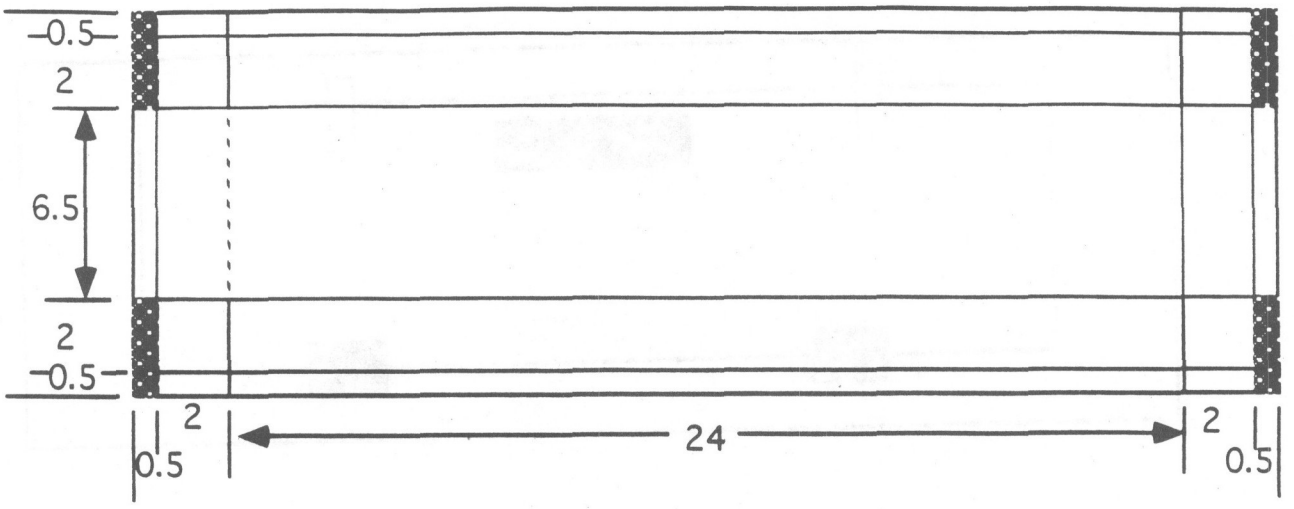


Fig. 17

CARDBOARD DOOR



The pattern is then covered with aluminum foil (outside only) and stuffed with sawdust (which itself can be held in a folded piece of aluminum foil). The folded patters is shown below:

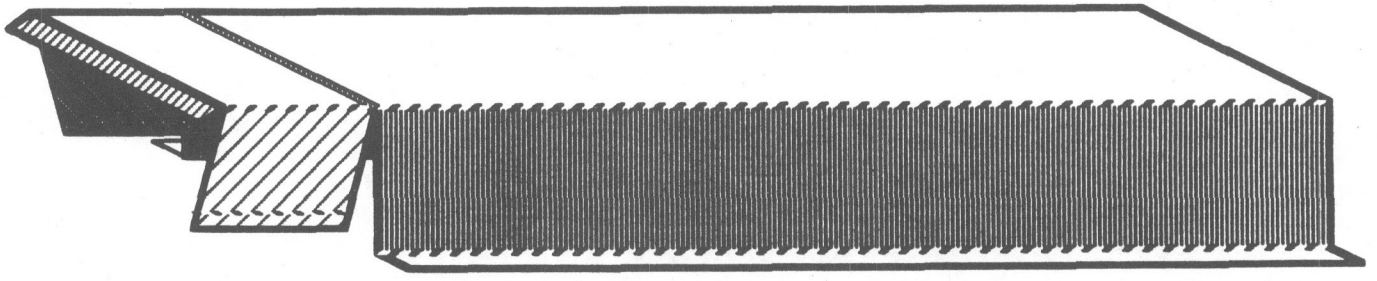
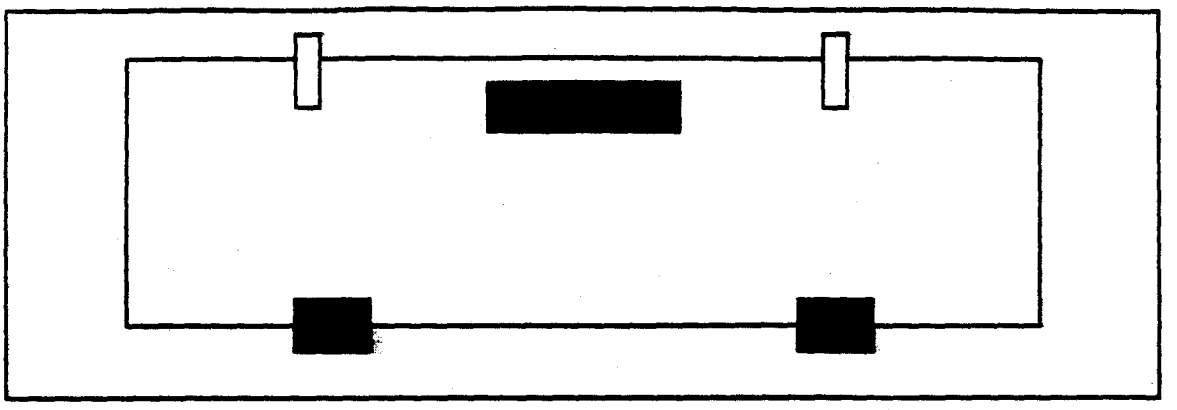


Fig. 18

FRONT with DOOR LATCHES



LID with HINGES

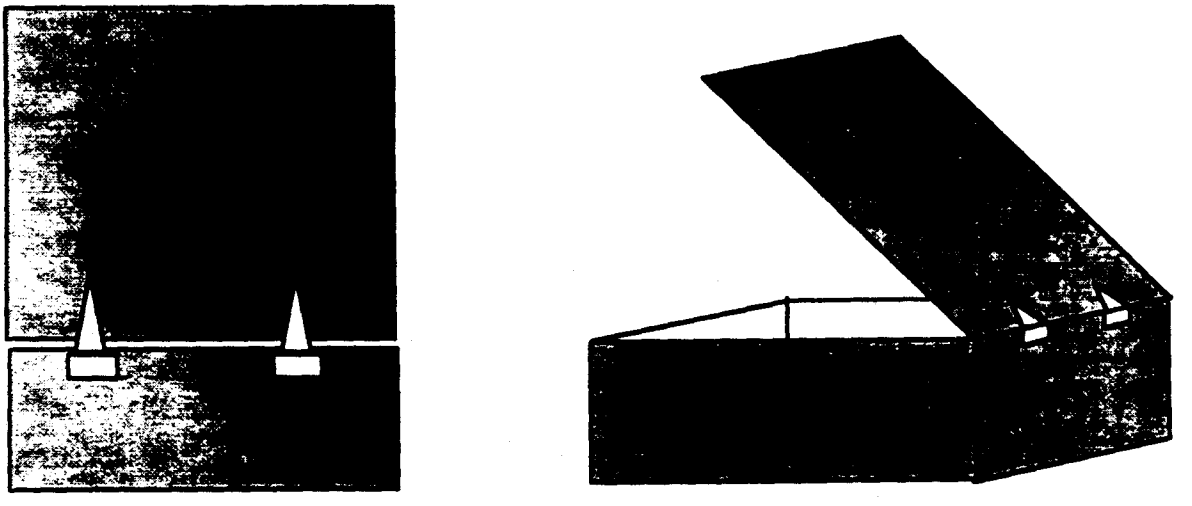
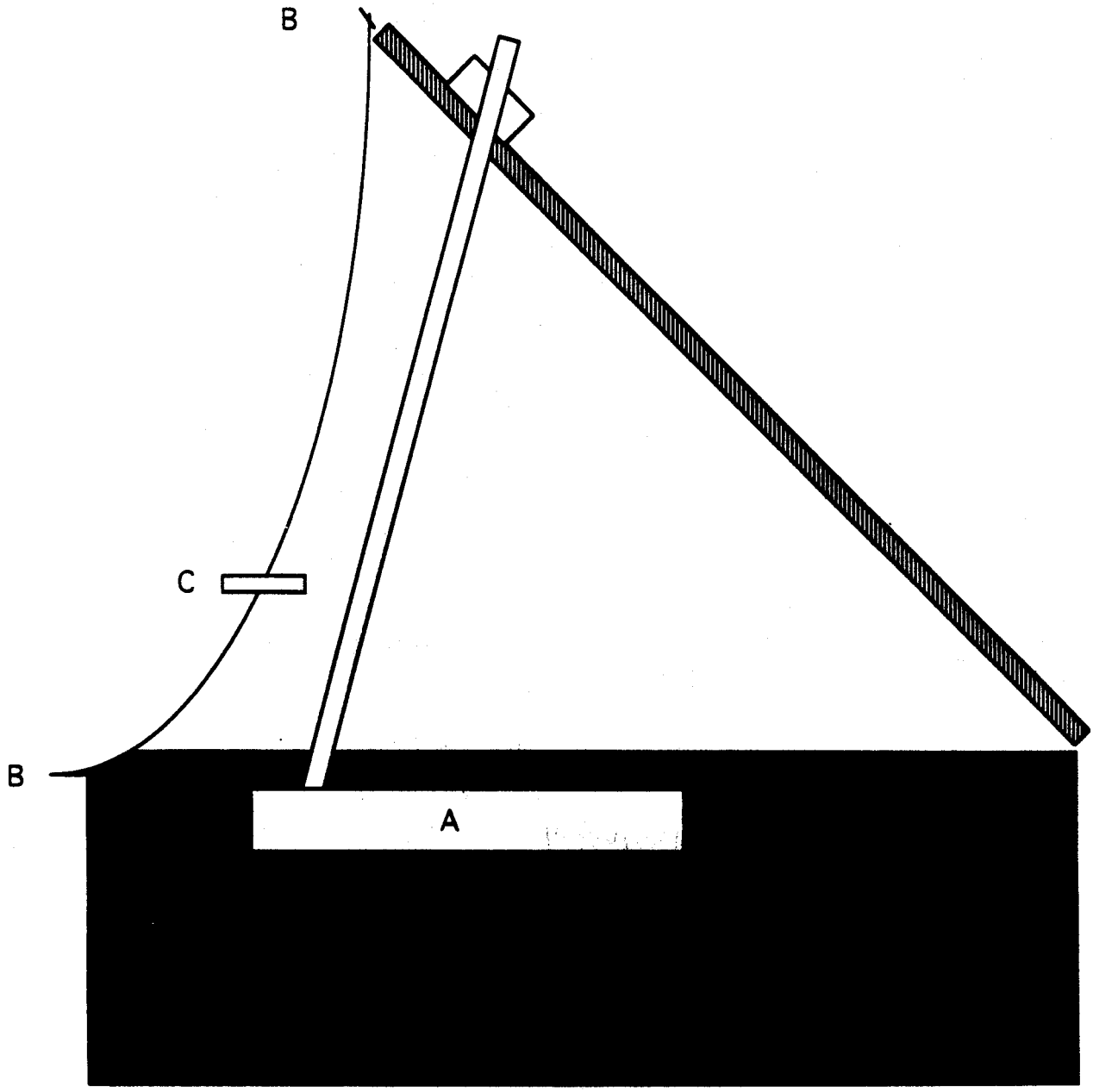
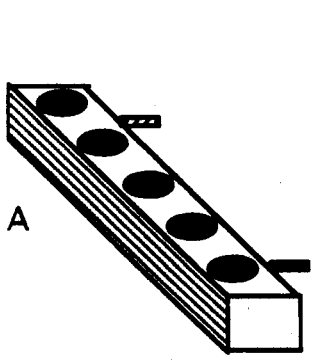
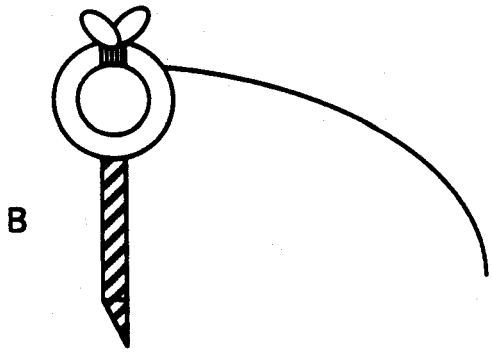


Fig. 19

LID PROP AND STRING







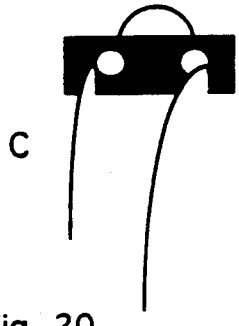


Fig. 20

COMPLETED SOLAR OVEN

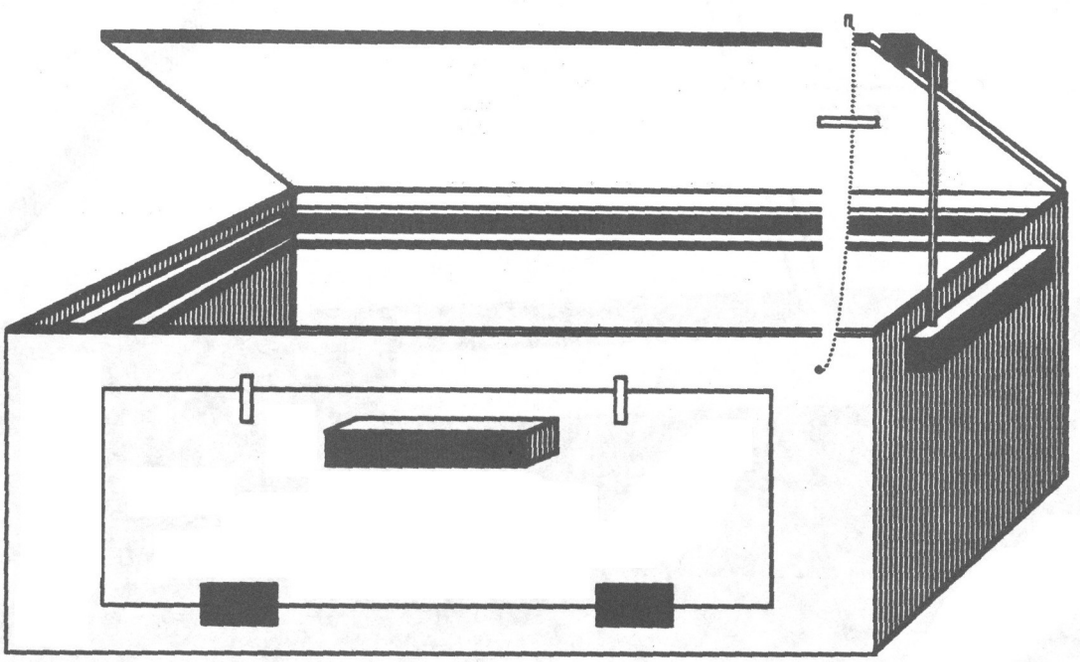


Fig. 21