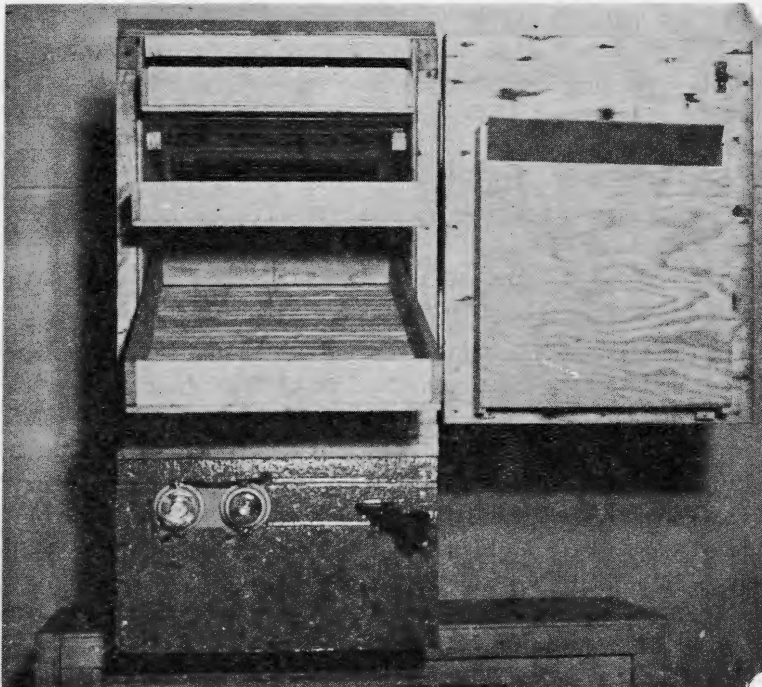




Extension Bulletin No. 311

June, 1944

# Building A Home Fruit and Vegetable Drier



Agricultural Extension Service  
The State College of Washington  
PULLMAN, WASHINGTON



# Building A Home Fruit And Vegetable Drier

By

John Dobie\* and R. N. Miller\*\*

## THE W.S.C. HOME DEHYDRATER

The iron wire dehydrater makes use of the radiant heat principle in insuring an even distribution of heat without a fan.

Each tray of produce is subjected to heat both from underneath and above. The air movement is controlled by adjustable slides in the top and bottom. The length of the wire is such that the heat is so low that it will not injure the supporting wooden strips.

The amount of wire at each position is as follows: (a) 35 feet; (b) 30 feet; (c) 30 feet; (d) 25 feet; (e) 20 feet; (f) 15 feet; (g) 15 feet; and (h) 10 feet. This makes a total of 185 feet of wire in the main heating element giving approximately 950 watts at 115 volts. The wire used is ordinary No. 19 black stove pipe wire, W and M gauge. Nichrome wire of suitable length to operate at black heat is preferable if available.

If a thermostat is not installed, an additional heating element is placed in the space "B" in the bottom of the cabinet, and is used to reduce the amount of heat in the dehydrater when the drying process is partially completed. The additional wire should be 185 feet long and is fastened on a framework as shown in Figure 3. Switch No. 1 controls high heat and Switch No. 2 controls low heat. The two sides are assembled first, complete with the one by four inch legs. Notch the wiring strips and screw them to the sides of the cabinet, spacing as shown in Figure 1. Then the back and the bottom are fitted and nailed in position. The sides are blocked and secured in the proper place, spaced according to the drawings, so that during the installation of the wire element the sides will not be pulled inwards out of position.

Each tray wiring strip is cut and notched for a certain position in the cabinet. The groove is made along an upper corner, and then it is notched across the top edge by dragging a hand saw across the strip. (Fig. 2). The notch needs to be just deep enough that the

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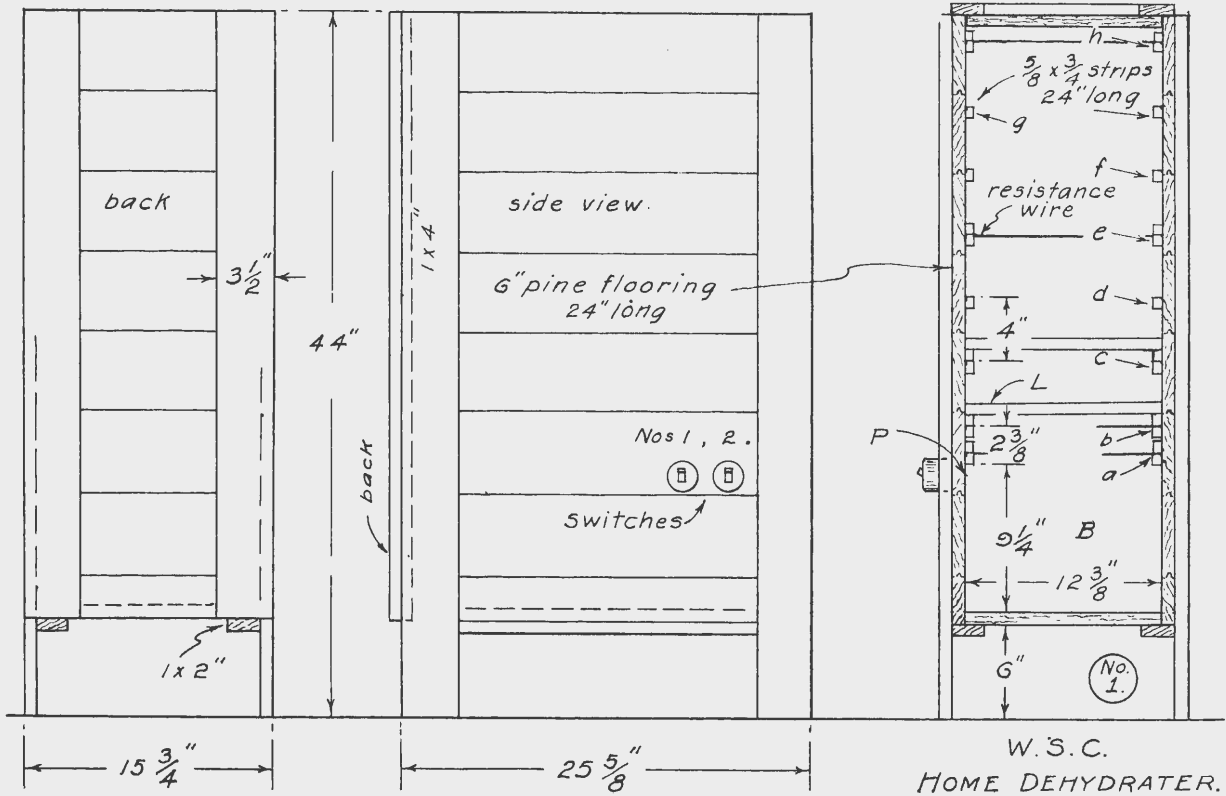


Fig. 1

W.S.C.  
HOME DEHYDRATER.

wire will fit flush with the top edge. The spacings of the notches are given for each level, and are the same on both sides at the same level. Strip (a) has 35 notches,  $\frac{5}{8}$  inch apart. At (b and c) 30 notches space  $\frac{3}{4}$  inch; (d) 25 notches,  $\frac{15}{16}$  inch apart; (e) 20 notches,  $1\frac{1}{8}$  inch spacing; (f and g), 15 notches,  $1\frac{1}{2}$  inches apart; and (h) 10 notches with  $2\frac{1}{3}$  inch spacing. The groove "G" is turned to the inside top.

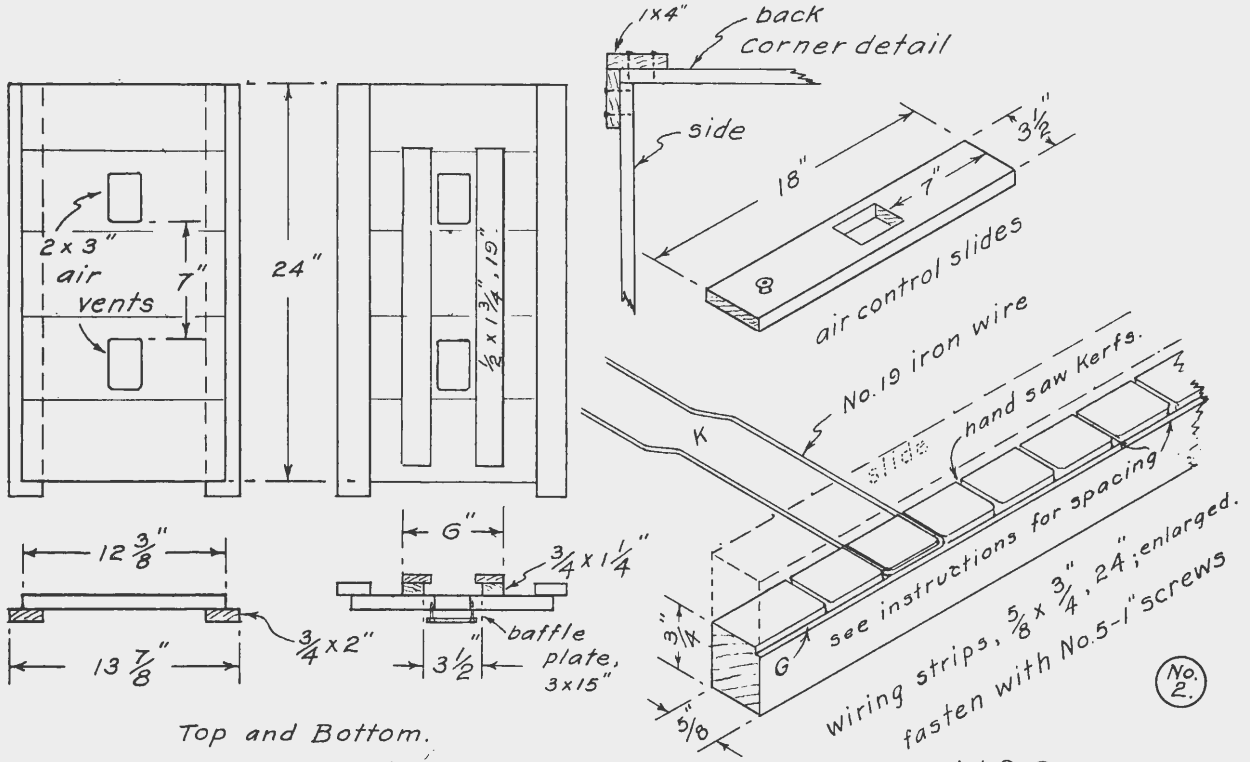
Starting at point "P" in Figure 1, and leaving wire for connections, the wire should be fastened to the left side and then laid in the front notch in strip (a). It is then stretched, by hand, across to the front notch in (a) on the opposite side, then laid in the groove against the side and brought back out the next kerf as shown in Figure 2. The process is then repeated, stretching the wire back to the first side and laying it in the second notch, around in the groove "G" and out the third notch. This process is continued until all the notches are filled in layer (a). Then the wire is carried to the next higher wiring strip by laying it along the back of the drier against the wall, out of the way of the tray. At this point in the procedure, the tray slide strips are tacked on top of the wiring strip as shown in Figures 1 and 2. If any slack is present in the wire, each wire should be kinked once as shown at "K" in Figure 2. Mount the wire on a reel so that it will unwind as needed without tangling.

A similar procedure should be used on (b) except that this time, the wire starts at the back of the drier and works toward the front. When going from one level to the next at the front, the wire must be out of the way of the trays. This procedure is continued until the entire dehydrater is wired. The end of the wire is then carried along the side and back of the drier, back to the switch, and fastened securely so that it will not come in contact with any of the other wire. Care must be taken not to injure the wire in such way as to decrease its cross section.

In making the additional resistance wire unit for the bottom, the framework for each level of this element is made first without the spacer blocks or legs. The wire is then fastened at one corner and wound around the frame, laying the wire in the kerfs to keep them in place. The wire is wound to the other end of the frame and is fastened at the diagonally opposite corner from where it was started. The second frame is wired in exactly the same manner. The wire is kinked, as before, to take up any slack.

The two frames are then laid together so that the wire ends on each frame are on the same corners. The spacer blocks and legs

5

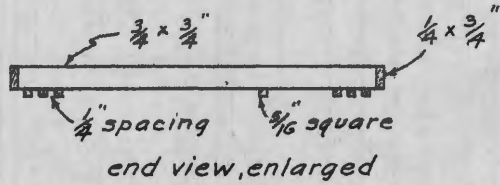
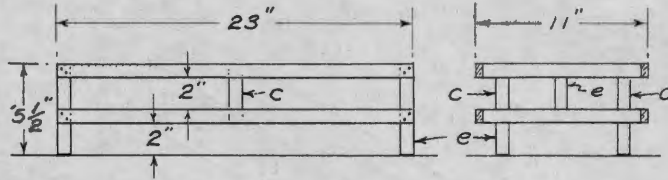
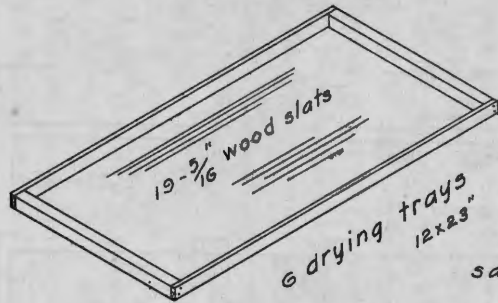


Top and Bottom.  
use 5d box, and screw in position

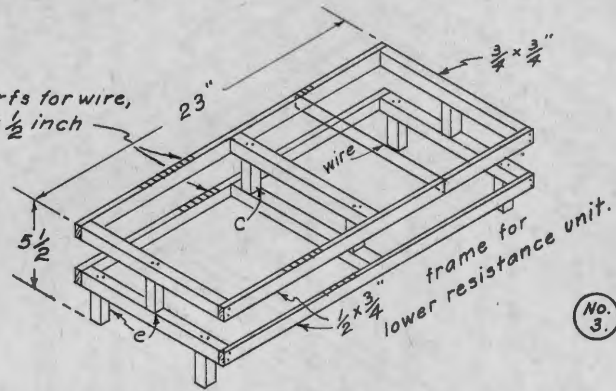
Fig. 2

W.S.C.  
HOME DEHYDRATER.

(No. 2.)



saw kerfs for wire,  
every  $\frac{1}{2}$  inch



No. 3.

W.S.C.  
HOME DEHYDRATER.

Fig. 3.

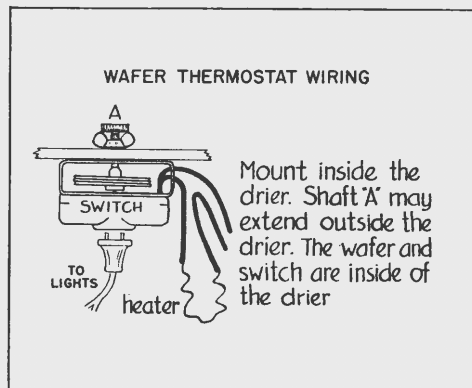
are nailed in place. The wire ends should be at the left front and right rear corners as one faces the front of the drier (Fig. 3). Splice the wires at the back and solder the connection. The unit is set in the bottom compartment and connected as shown in the wiring diagram.

Recently small, inexpensive thermostats suitable for use in home dehydrators have been placed on the market. An alternate, and in most cases preferable, plan is to install one of these thermostats on a bracket between banks (d) and (e) of the main element. This should be connected in series with the main element but should be shielded from it, since radiant heat affects it directly, giving poor heat regulation. If a thermostat is used, the extra bank of resistance wire on the framework in the bottom of the drier is eliminated, as is the need for the No. 2 switch. Temperature regulation will be much better and will be automatically controlled.

When all the wiring is completed, the top and door of the dehydrator are fastened in place. The slides for the top and bottom are made of 1 by 4 boards, as shown in Fig. 2. The opening is 2 by 3 inches.

All working parts should be sandpapered and shellacked. The baffle, as shown in Figure 2, should be fastened with screws, and should be blocked so as to give  $\frac{1}{2}$  inch clearance on all sides.

The trays may be made of box material or any thin lumber that is available. The slats that make up the bottom should be  $\frac{1}{4}$  to  $\frac{5}{8}$  inch wide, depending on the material available, and should be nailed with light finishing nails. Distance between the slats should not exceed  $\frac{1}{4}$  inch.



*main heating element. lower element.*

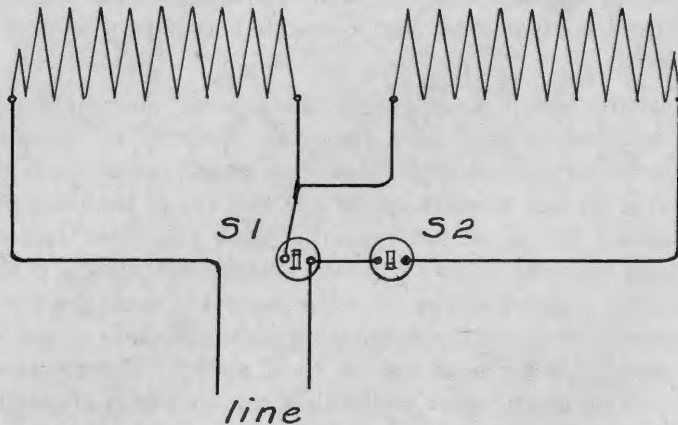


Fig. 4. Wiring Diagram for W.S.C. Dehydrator Without Thermostat.

### Operation of Dehydrator

Tray loading is one of the most important factors in the operation of any dehydrator, and even more so with this drier. Trays should be loaded evenly over their entirety, leaving no definite open spaces or large chunks of material to be dried. If insufficient produce has been prepared, spread out thinner but keep the loading uniform on the tray. If one tray is lighter than the rest, it should be placed in the top of the drier. **Warning. Do not overload.** Overloading slows down the drying process and gives a less desirable product. The trays should be staggered so that alternate trays are to the back of the drier and the others to the front, giving better air circulation.

The time of drying varies from six to eight hours for finer material such as corn and spinach, to 12 to 16 hours or even longer for larger fruits. The beginner, however, is inclined to over-dry. The drier should be preheated with the vents closed prior to putting in the produce to be dried. One or two thermometers with a temperature range up to 200° F. are very helpful in learning to operate the drier successfully.

**Warning.** The switch should always be turned off before opening the door of the drier, to eliminate as much as possible, any chance of accidental contact with a live wire. The heating element is of such design that it operates at a black heat, low enough in temperature that it will not burn the skin during contact of 4 or



5 seconds duration. It is, however, possible to get an electrical shock if anyone touching the wire is in contact with a good electrical ground. The drier should only be operated on a dry wooden floor or wooden rack, large enough that the operator must be standing on it at all times when operating the dehydrater. This equipment should never be used where the operator is in contact with the ground or standing on a moist surface. An arrangement may be used whereby the circuit is broken at both ends when the door is opened, thus eliminating this hazard automatically.

The temperature within the dehydrater is controlled mainly by the opening in the top, if no thermostat is used. After loading the drier, allow the temperature to rise to about 140° F. for vegetables and 120° F. for fruits before opening the vents. Then open the top vent about  $\frac{1}{2}$  inch and the bottom at least half way. The bottom vent should always be open at least as wide as the top. After two to three hours, the top should be opened at least half way. Thereafter the bottom slide should be opened wide, and the top opening varied to hold the temperature as desired.

When the temperature rises too high with the top wide open, the additional resistance wire should be switched on. Both the air inlet and outlet should now be left wide open, and the operation continued until the produce is dry. This switching time will vary from 4 hours to 8 or 9 hours after starting time, depending on the type of product being dried. If a thermostat is installed, the air temperature will be controlled according to its setting and the inlet and outlet will be used to control air movement only.

### Bill of Materials

- 11—1" x 6" x 6' tongue and groove flooring
- 2—1" x 4" x 16' clear pine
- 1—1" x 2" x 10' clear pine
- 2—1" x 2" x 8' clear pine
- \*2— $\frac{1}{4}$ " x  $\frac{3}{4}$ " x 12' clear pine
- \*1—1" x 4" x 8' clear pine

\*The last two items are for material to be cut up for trays and resistance wire frame and may be substituted with any material available.

#### Hardware—

- 2 tumbler switches
- 3 3-inch strap hinges
- 2 knobs for slides
- 1 screw eye and hook for door latch
- 2 lbs. No. 19 iron stove pipe wire—Washburn & Moen Gauge
- 1 extension cord—No. 12 wire

- 2 lbs. 5d nails
  - ½ lb. ¾-inch finishing nails
  - 1 thermostat—optional (if used, eliminate one switch and 1 lb. iron wire)
- Approximate total cost, \$5.00 without Thermostat—Thermostat \$2.75.

## Cut Lengths for Assembly

### Sides—

- 16 pieces 1 x 6 tongue and groove flooring—24 in. long
- 4 pieces 1 x 4 clear pine—44 in. long.
- 16 pieces ¾ x ¾ clear pine—24 in. long

### Back and Door—

- 4 pieces 1 x 4 clear pine—38 in. long
- 16 pieces 1 x 6 tongue and groove flooring—14 in. long

### Top and Bottom—

- 4 pieces 1 x 2 clear pine—24¾ in. long
- 10 pieces 1 x 6 tongue and groove flooring—12¾ in. long
- 4 pieces ¾ x 1¼ clear pine—19 in. long
- 4 pieces ½ x 1¾ clear pine—19 in. long
- 2 pieces 1 x 4 clear pine (for slides)—18 in. long

### Trays—

- 12 pieces ¾ x ¾ clear pine—11½ in. long
- 12 pieces ¼ x ¾ clear pine—23 in. long
- Material for tray slats—23 in. long  
(depends on size used and material available)

### Resistance Wire Frame—

- 6 pieces ¾ x ¾ clear pine—10 in. long
- 4 pieces ½ x ¾ clear pine—23 in. long
- 8 pieces ¾ x ¾ clear pine— 2 in. long

## THE ELECTRIC FOOD DRYER

Food products may be dried in any weather when artificial heat is supplied. Electric power, at rates in most parts of Washington, is economical, practical, and a satisfactory source of heat. With electric power, the temperature, moisture content and circulation of air can be controlled, resulting in high class products. A family size controlled heat drier with about 20 sq. ft. of drying surface will require about the following materials:

- 2 pcs. 32" x 38" ¼" plywood or ½" material, old boxes, etc.—(Sides)
- 2 pcs. 38" x 20" ¼" plywood or ½" material, old boxes, etc.—(Doors and end)
- 2 pcs. 32" x 20" ¼" plywood or ½" material, old boxes, etc.—(Top and Bottom)
- 1 pc. 18" x 18" ¼" plywood or material, old boxes, etc.—(Baffle)
- 1 pc. 12" x 18" ¼" plywood or ½" material, old boxes, etc.—(Fan opening)

- 2 pcs. 27" x 37"  $\frac{5}{8}$ " Insulation or cardboard from old boxes—(For sides)
  - 2 pcs. 18" x 37"  $\frac{5}{8}$ " Insulation or cardboard from old boxes—(For door and end)
  - 2 pcs. 20" x 32"  $\frac{5}{8}$ " Insulation or cardboard from old boxes—(For top and bottom)
  - 2 pcs. 16" x 18" —(Deflector and chimney)
  - 10 pcs.  $\frac{3}{4}$ " x  $\frac{3}{4}$ " x 30"—(Cleat for trays)
  - 13 sq. ft. baffles, chimney, etc.
  - 40 ft.  $\frac{3}{4}$ " x  $\frac{3}{4}$ "—(Tray frames)
  - 4 pcs. 2" x 2" x 68"—(legs)
  - 4 10 amp. fuses
  - 1 6-10" fan
  - 20 ft. No. 14 electric wire
  - 1 friction door catch
  - 76 ft. 1" x 2"—(Framing)
  - 180 ft.  $\frac{1}{8}$ " x  $\frac{7}{16}$ " x  $17\frac{1}{2}$ "—(Tray Slats)
  - 9 light sockets
  - 1 plug
  - 2 pr.  $1\frac{1}{2}$ " hinges (1 pr. on fan door)
  - 1 knob for door
- Nails, brads, linseed oil; thermostat optional.

Four 200-watt and two 300-watt light globes will be found practical as heating elements. Heat requirements vary with the kind of product to be dried, the amount placed in the drier, and lower temperature as drying progresses. The better the insulation used on the drier, the less electric current required. Slats used in tray bottoms should be placed  $\frac{1}{8}$ " to  $\frac{3}{16}$ " apart.

A double wafer or bimetallic thermostat built to operate to 175°, placed in the fan box, and wired to control the heating elements on one side of the drier may be used to control temperatures. With such a device the thermostat automatically maintains the desired temperature. Some heat is always needed, so the thermostat is connected to control one-half the lights or heating elements. A drawing shows the wiring detail.

The 6-inch or larger fan, circulates the air over the product, allowing a maximum amount of moisture absorption before exhausting through an opening in the top. A 2" x 12" opening in the top fitted with an adjustable cover regulates the amount of air admitted.

## Oil Heat

No fan is required in oil heated driers. Heat chimneys are built on the back wall and on the door. These prevent overheating the first two trays and conducts heat directly to the top trays. A

14" x 16" galvanized iron baffle or deflector is placed above the oil stove and under the two wood baffles to conduct the heat into the heat chimneys. Adjust the baffles to secure the best circulation of air in the drier.

### **Using The Driers**

Care should be taken to regulate the exposure of the sun drier so materials will dry but will not scorch or caramelize. For good drying adjust to full or partial sunlight.

The object of the recirculating fan in the electric drier is to circulate the air over the materials to be dried until maximum absorption is accomplished. This requires the movement of the warmed air over the product two or more times, before exhausting through the exhaust vent.

When using the controlled heat drier, both the top and the bottom vent are closed until the heat in the drier reaches a temperature of 150° to 160° F., then the damper over the lower hole is opened and the damper in the top opened a quarter to one-half inch. The temperature between the two lower and the top trays should vary a few degrees only. If the variation is more than 10° adjust the baffles to conduct heat to the colder part.

A six-inch or larger fan may be used to circulate the air. Fruit dries best in a rather humid atmosphere, so until the fruit is nearly dry the top vent is never entirely open. As the product dries the amount of heat necessary for drying may be greatly reduced and when the drying is about half done, half of the light globes are turned off. Experience will soon teach the amount of heat to use. The greatest amount of heat is necessary immediately after the product has been put into the drier.

When using oil, as a source of heat, the trays are staggered and a much larger vent is made in the top so the moist air can escape easily and circulation is sufficient to carry the heat quickly from the lower trays and prevent carmelizing. Changing of trays from top to bottom will be necessary to insure a uniform product when using oil, wood or coal.

### **Building The Drier**

There are many kinds of successful driers. Some are heated with electricity, others with kerosene, oil, wood, coal and some the heat from the sun. Driers should be simple in design, and a wide choice of materials for building is possible. Thin sides from clean boxes or other surplus material may be used. Lath tray bottoms,

corrugated paper from boxes with enough layers so insulation is  $\frac{1}{2}$  inch or more thick, and other inexpensive materials common around the home may be utilized.

The drier should be tight, and baffles, heat chimneys, etc., placed for proper air circulation. Use galvanized nails, and rust resisting hinges and screws. Linseed oil may be used on the inside and paint on the outside. Driers are more economically operated when free from drafts.

Conveniently sized trays, often 3' x 4' are made of 1" x 3" pine with bottoms of plywood  $\frac{1}{2}$ " boards, hardware cloth, or wood lath. Cheese cloth may be used as protection from insects.

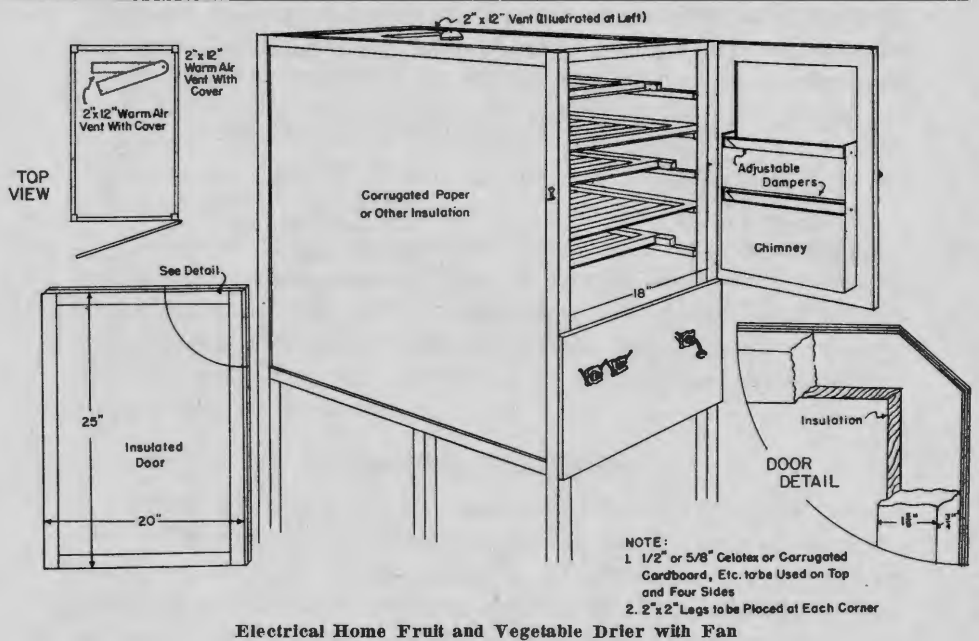
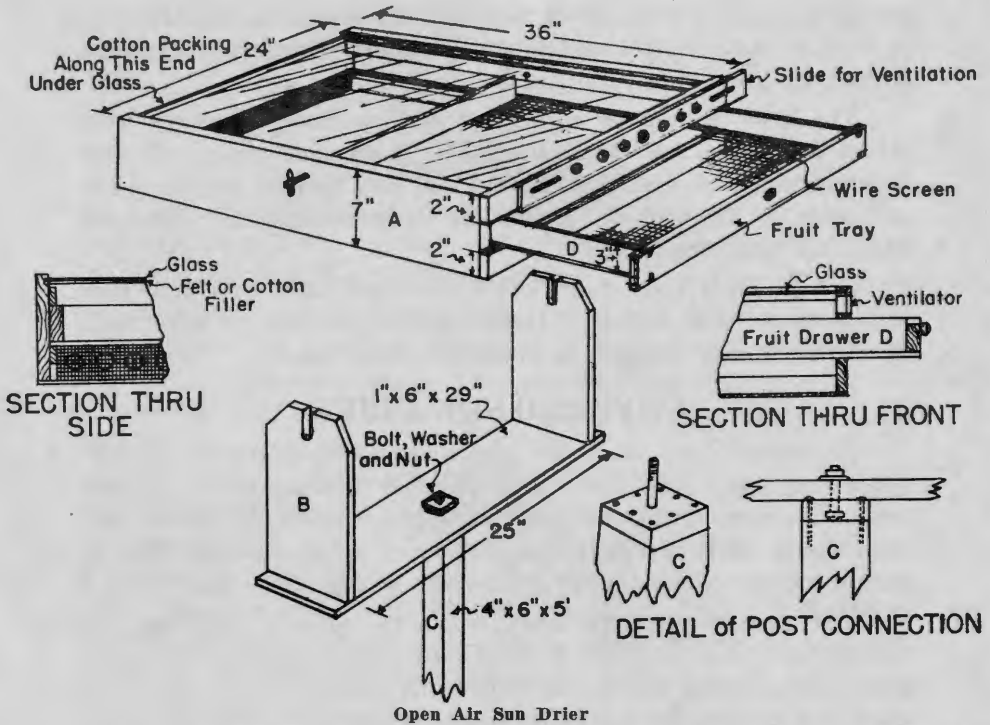
### COVERED SUN DRIER

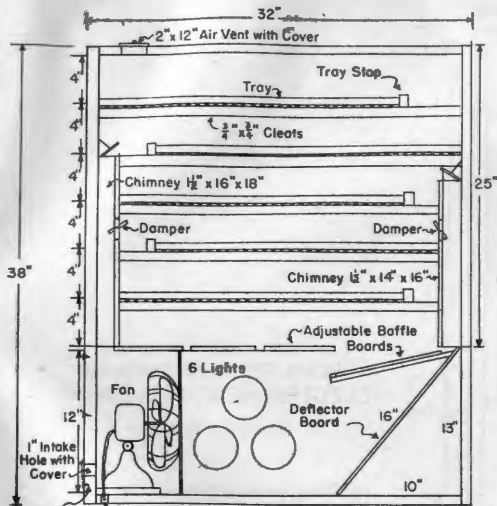
A covered 2' x 3' sun dryer (see illustration) will hold 12 to 14 pounds of fruit. Galvanized or copper fly screen placed over the ventilating holes makes the box nearly insect proof. A slide covers the holes to make the tray moisture proof when desired. Tilt, at different times of the day, to get the full benefit of the sun.

The glass top may be fitted into a  $\frac{1}{4}$ " groove and should be extended  $\frac{1}{2}$ " over end "B" to shed rain. A  $\frac{1}{4}$ " opening under the glass on the end of the box is filled with cotton. Ventilating holes allow dry air to enter and moist air to escape. Air is warmed under the glass after entering the drier and increases its moisture carrying capacity. Drying time depends upon the dryness of the air and temperature.

The list of material for the sun drier illustrated is:

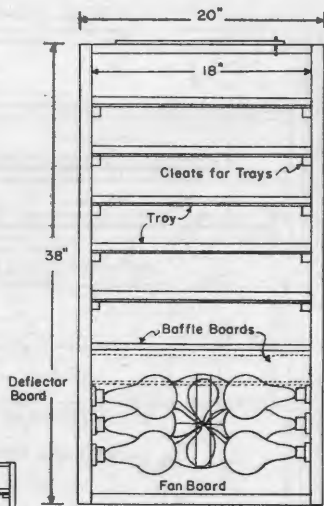
1 pc. 1" x 7" x 12'	1 $\frac{5}{8}$ " x 5" bolt
1 pc. 1" x 6" x 5'	1 4" x 6" x 2" block
1 pc. 4" x 6" x 5'	Mosquito netting
1 glass 25" x 36"	Cotton nails
1 pc. $\frac{1}{4}$ " plywood 26" x 38"	Drawer pulls
1 pc. 1" x 3" x 12'	



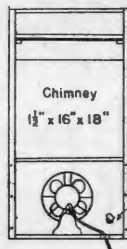


SIDE VIEW SECTION THRU MIDDLE

End Fastened with Screws to be Easily Taken Out for Placing Fan



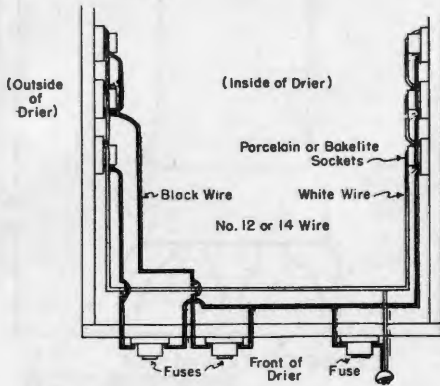
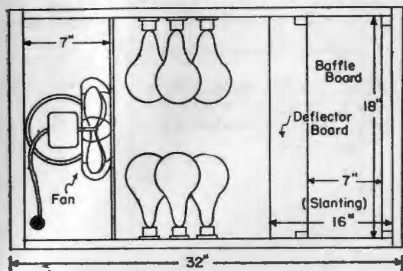
FRONT VIEW



BACK VIEW

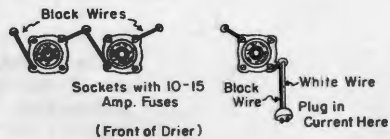
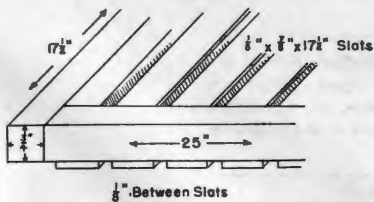
Screws  
1" x 1" Cold Air Intake With Movable Cover

TOP VIEW of HEATING UNIT

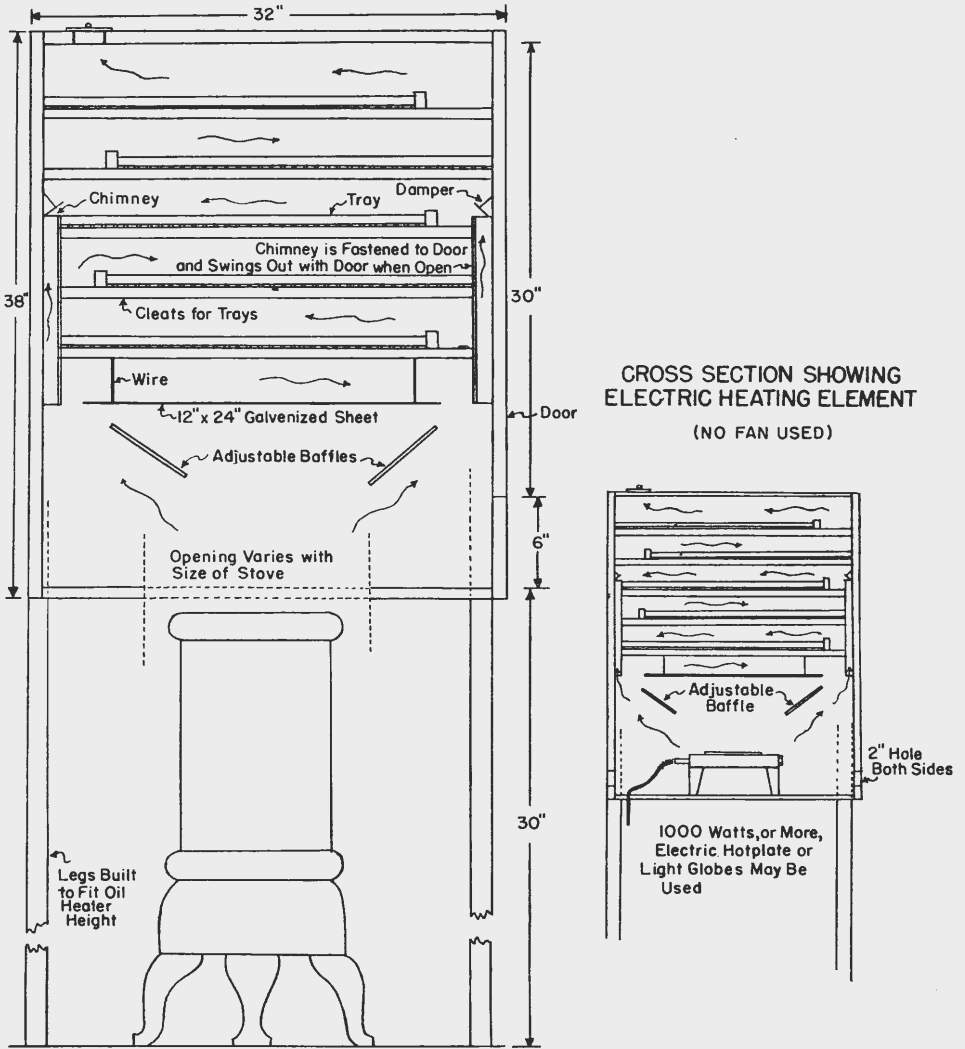


WIRING DETAIL

TRAY DETAIL



Building Plans for Electrical Drier with Fan



Drier Adjustable to Different Heating Units, Without Fan

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