

Build a Pizza Pan, Red Tube, Wobble-Disk Coffee Roaster
Larry Cotton



Have you ever craved a cup of coffee brewed from beans you roasted? In a roaster you built? That sports a wobbling disk, an 8-cup flour sifter, most of a 13" pizza pan and three red tubes? No?

Well, here's your chance to build one! Roasting times of 12-20 minutes are typical for 300+g (~11 oz) of green (raw) beans in ambient temps of 40+F and above, depending on your likes. Unlike most commercial roasters, you can roast back-to-back batches with no cooling pauses.

In the building process you'll sacrifice the flat part of the pizza pan*--well seasoned or brand new--to yield most of the roaster's metal parts.

Though it's nowhere near as sophisticated and feature-rich as commercial machines (think \$\$, technical savvy and space requirements), I guarantee it will yield many amazing cups of very fresh coffee.

Green beans are widely available online: check out Sweet Marias (diy coffee roasters' paradise) and other green bean sources.

This plan specifies the materials and tools needed to build the roaster. Depending on your workshop and materials on hand, costs should be around \$100-\$150.

Warnings: Both building and using this coffee roaster require tools, parts and procedures that can injure you if safety is ignored. A heat gun (normally used for stripping paint and such), and the sifter surrounding its nozzle, can reach 450+ deg. F. This roaster *must* be used outdoors or in a building or garage with an open door. Coffee beans can emit smoke near the end of a dark roast, and *will catch fire* if left unattended. And the hard-working wobble disk that stirs the beans *could injure you* if you touch it while roasting.

I highly recommend using the main parts as specified; they've been thoroughly tested in more than a few home-built roasters I've built over the years (see fig. 01.)



Fig. 01

The cheapest heat gun that Harbor Freight sells can heat the beans to about 450 deg. F. Its only switch controls two heat/fan settings and off. A small 12VDC motor turning the wobbling disk inside the sifter thoroughly agitates the beans--the key to excellent coffee bean development--while exposing every bean to the same amount of heat and time. This roaster does precisely that, so let's get started!

Here are the main parts:

Heat Gun: Warrior brand, 1500W, dual-temperature: Harbor Freight

Sifter: 8-cup capacity, crank-style, preferably with a flange on the bottom: Chef Giant, TigerChef, etc.: Amazon

Pizza pan: 13" dia. for making all* the aluminum parts, Metalcraft: Amazon

Wobble Disk Motor: Greartisan, 12VDC, 100RPM: Amazon

Coupling: 12mm Flange Coupling Connector: Amazon (fig. 12)

Speed control: Aledeco, 12VDC output, 2A minimum: Amazon

Adapter (transformer): 120VAC to 12VDC, 3A minimum: Amazon, Walmart, Target, etc.

Metal tubing: At least three feet, 7/8" OD thin-wall, for sifter supports: Lowes, Home Depot, etc.

1/2"-thick plywood for the base and motor support: Lowes, Home Depot, etc.

Wood dowel: 6" minimum, 1-1/4" dia. for a new sifter handle; Hobby Lobby, Lowes, etc.

Wood dowel: three 1/4" dia. x 1-1/2" pieces to locate the air-intake end of the heat gun (unauthorized hint: kids' Tinker Toys work)

Paint: fire-engine red (yes!) for tubes, black or grey for base and motor support

Wire: insulated, 24 ga. minimum, for wobble disk motor and speed control

Foam board 1/8"- or 1/4"-thick for the "feet": Hobby Lobby, etc.

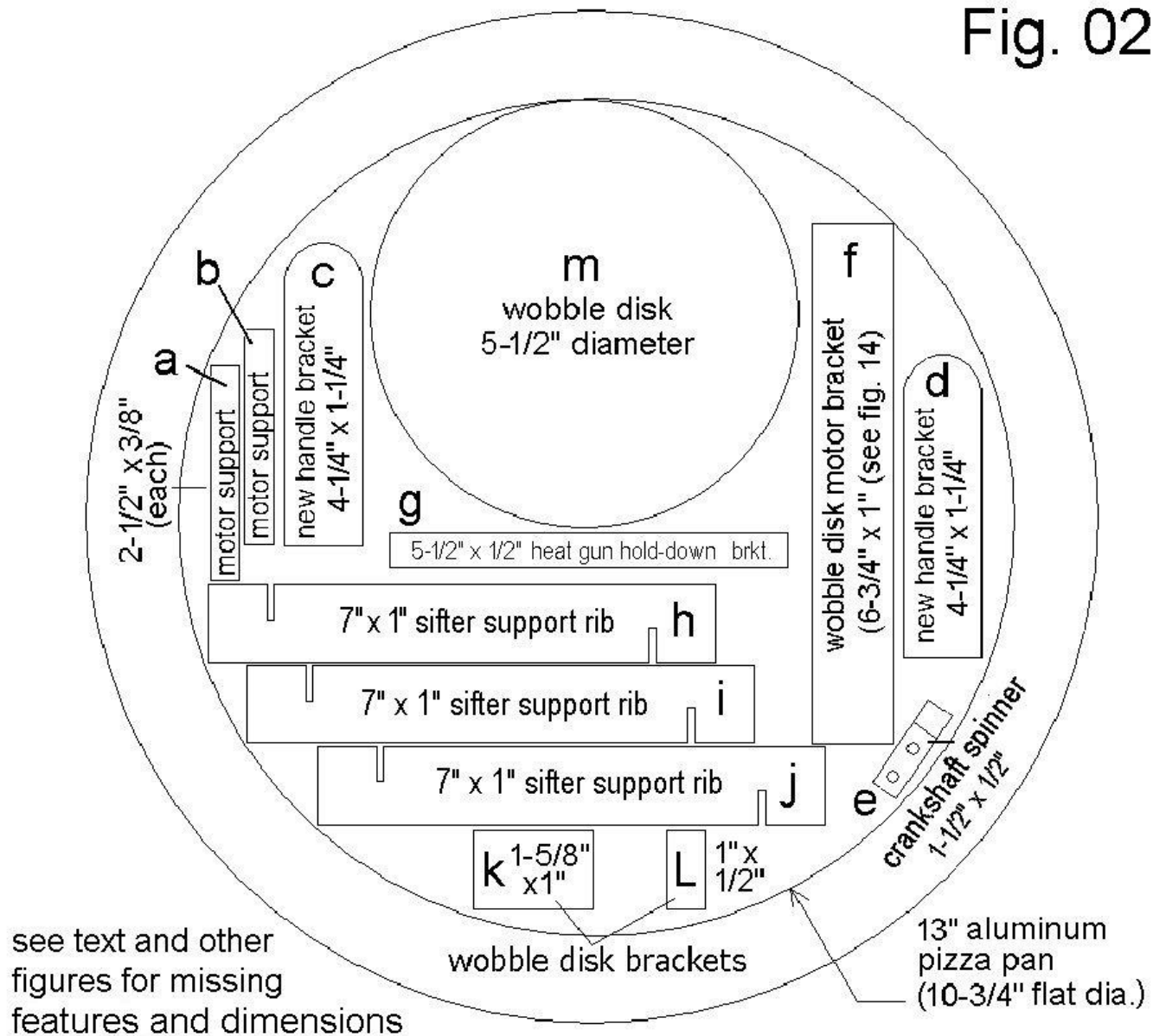
Various wood screws, sheet metal screws, machine screws and nuts

And don't forget your raw (green) coffee beans! (Read up and order a few pounds.)

Construction Details

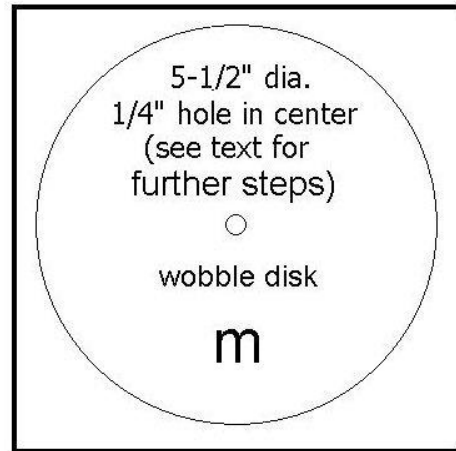
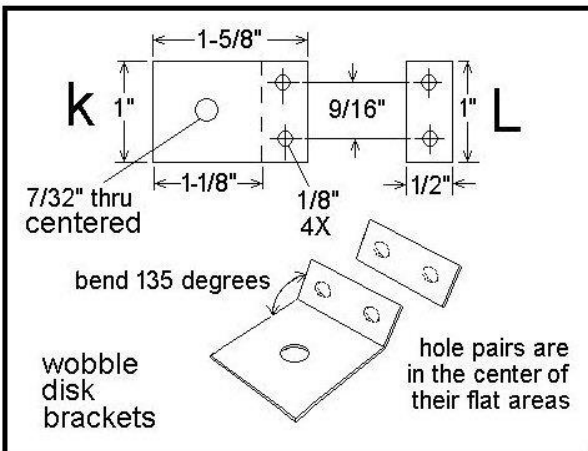
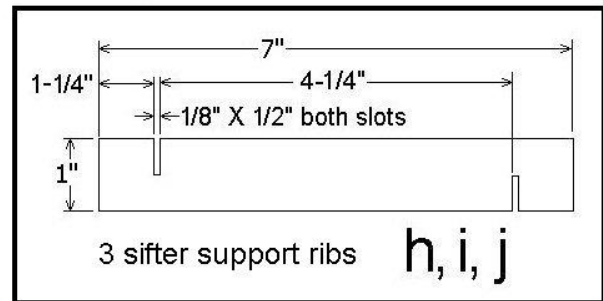
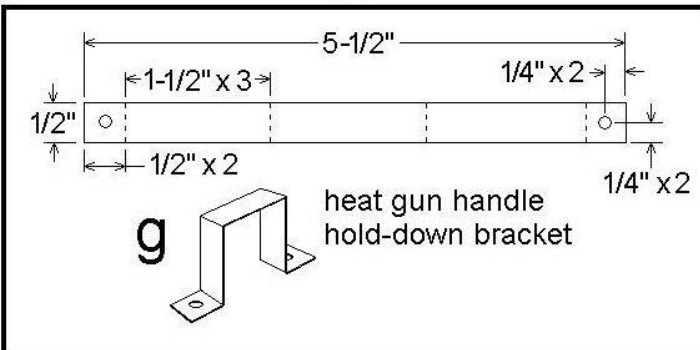
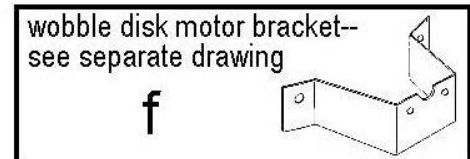
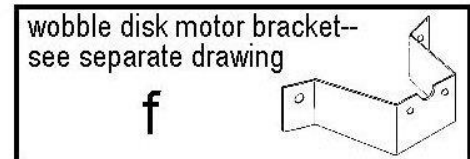
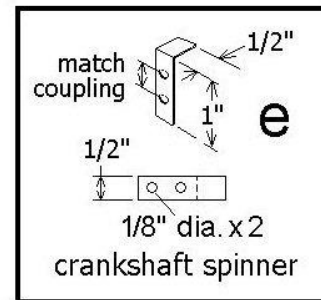
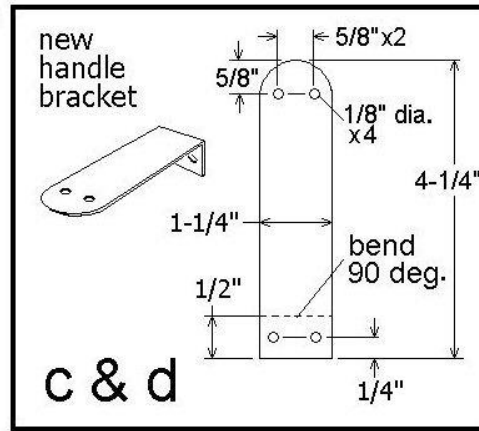
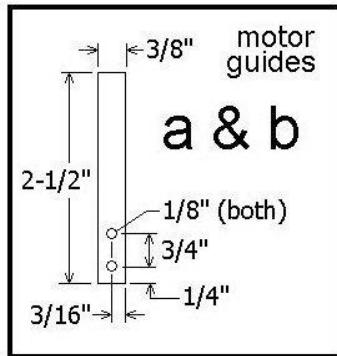
1. Figures 02 and 03 show the 13" pizza pan and all the aluminum parts (lettered 'a' though 'm') used in the roaster. They can be cut--barely--from the pan's flat area.* Copy the parts' outlines and their identifying letters onto your pan. You may want to use at least a few paper cut-outs to start.

Fig. 02



drawings are not to scale;
dimensions are accurate

**Fig.
03**



**aluminum
pizza pan
parts**

- Carefully cut the aluminum parts from the pizza pan with a bandsaw or metal-cutting shears. Don't worry about anything but their outside dimensions and letter identifications for now.
- Cut the roaster's base and the two wobble disk motor support pieces from 1/2" plywood. Round the base's corners and drill its holes. Sand and paint both parts grey or black. See figs. 04-06.
- Fasten the two motor support pieces together *but do not attach that assembly to the base yet--* its height depends on the exact location of the sifter's sieve, which varies slightly from sifter to sifter.

Fig. 04

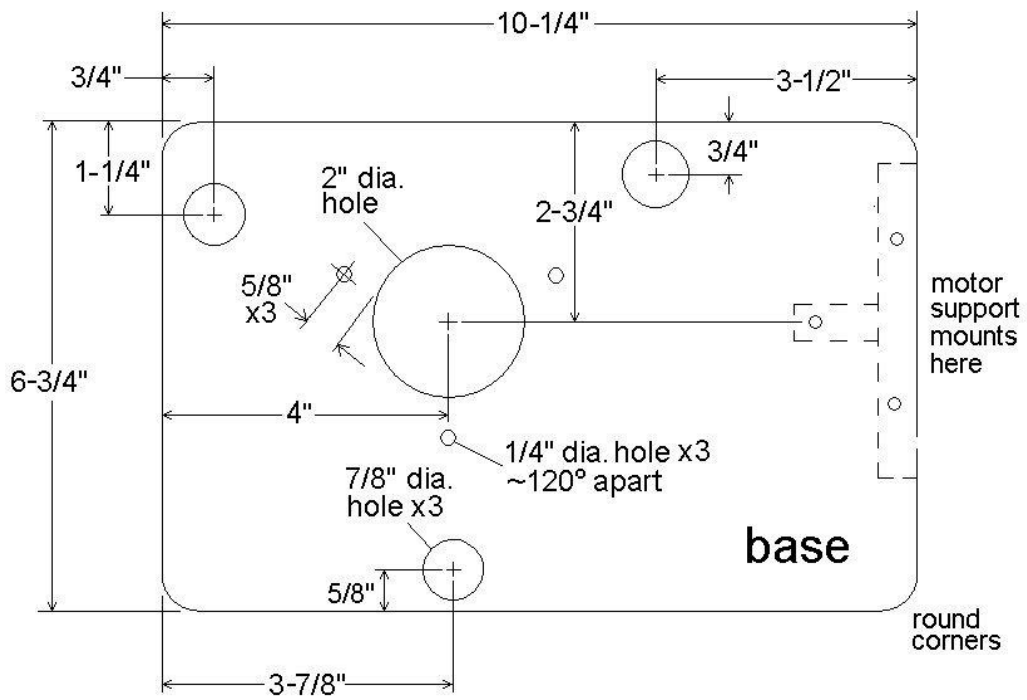
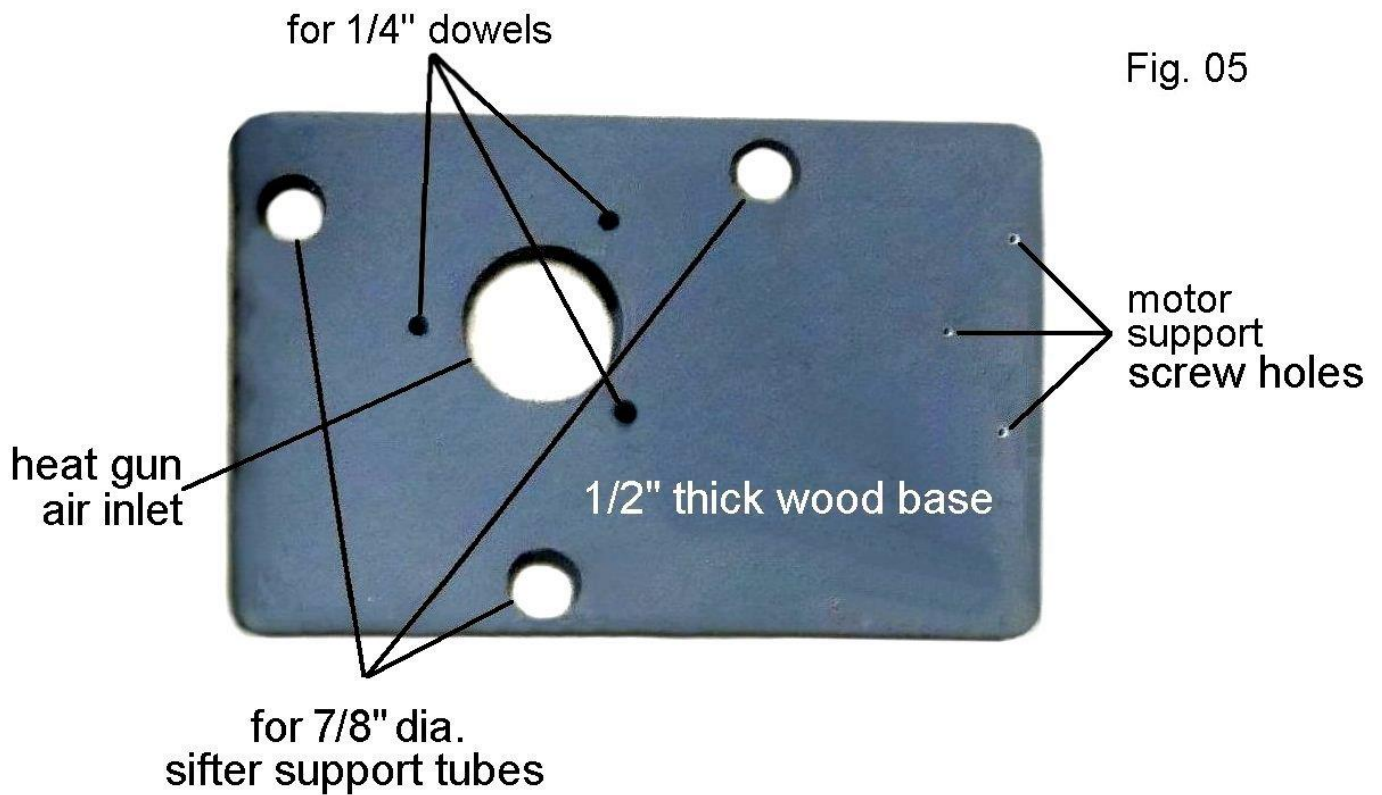
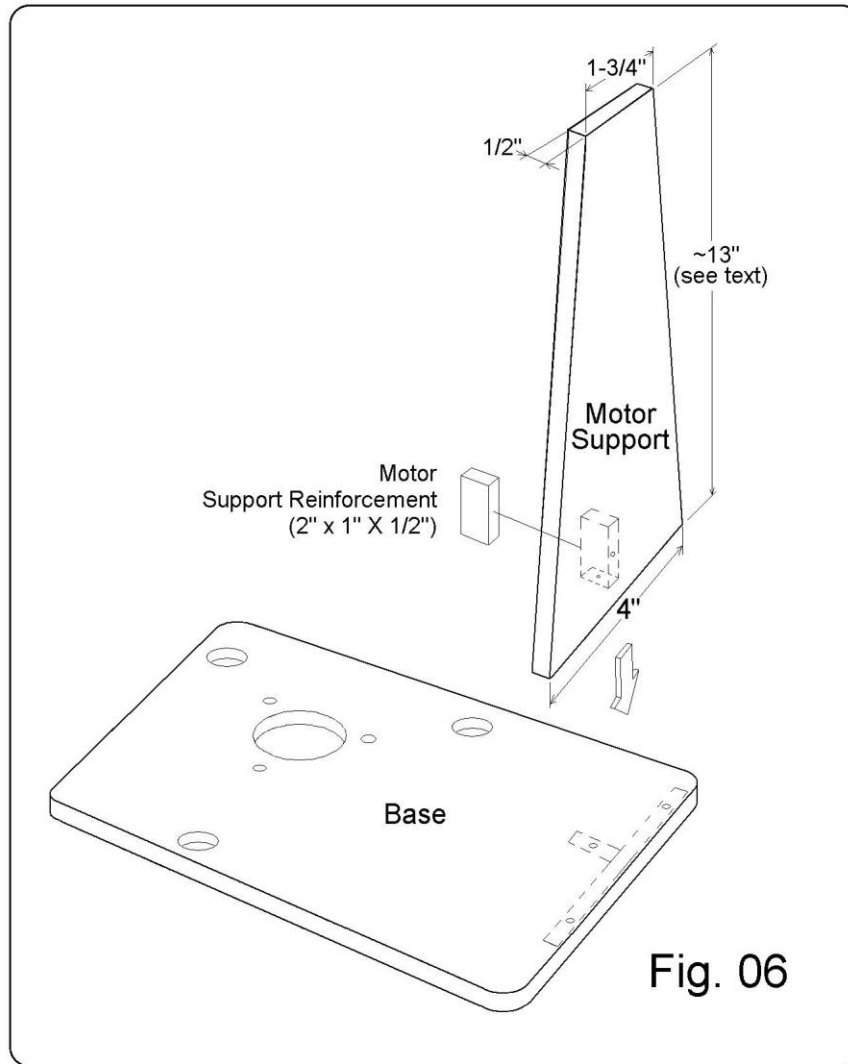
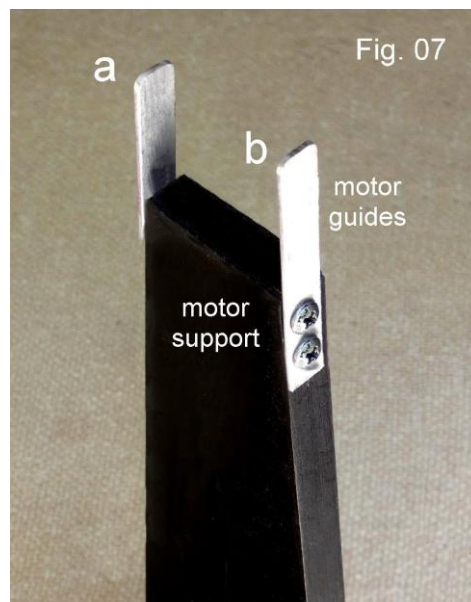


Fig. 05





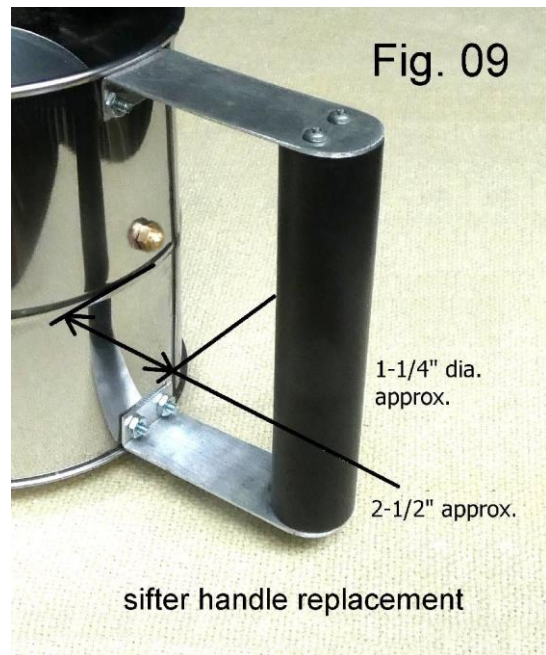
5. Find the two small aluminum motor guides 'a' and 'b' in figs. 02 and 03. Add four screw holes and fasten the guides to the top (small end) of the wooden motor support with two wood screws on each side.



New Sifter Handle

The sifter's factory handle gets much too hot to use, so replace it with a better one.

1. Clamp the sifter's handle in a vise and cut it in half with a hacksaw (fig. 08 below). Carefully pull the two spot-welded pieces off the sifter and recycle.



2. Make a new 6"-long sifter handle from 1-1/4" diameter wood dowel (Hobby Lobby or other) and two identical aluminum brackets--'c' and 'd' in figs. 02 and 03.

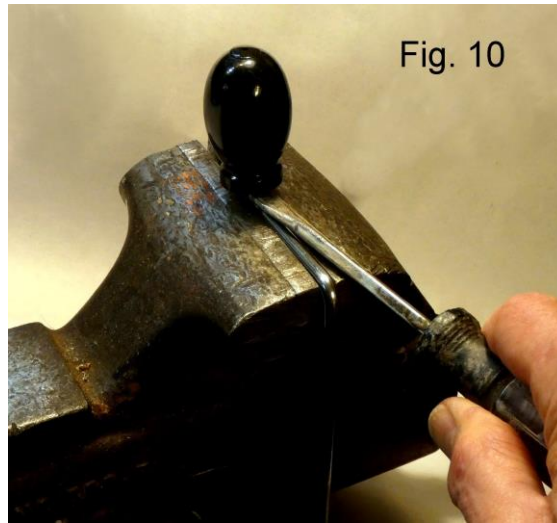
3. Drill 4 holes in each bracket, then bend each one to a 90-degree angle. Fasten the dowel between them using two wood screws at each end. Don't scrimp on the fasteners; *the dowel must not rotate!* Mount the handle to the sifter in line with the wobble disk shaft with 6-32 or 8-32 machine screws and nuts. Test the strength, rigidity and ergonomics of the handle; I think you'll like it. See fig. 09 above.

Attaching Wobble Disk Motor to Sifter

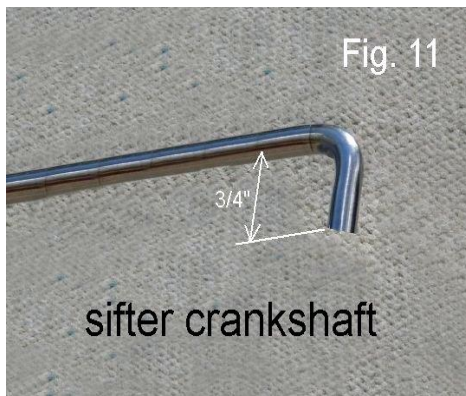
The next few steps are a bit tedious, but not difficult; take your time.

1. Remove--and keep--the 5/16" brass cap nut from the end of the sifter crankshaft. Hold the sifter's loops (or other stirring means) and turn the shaft counterclockwise if necessary to remove it. Recycle the loops.

2. Hold the shaft in a vise and pry its handle off with a screwdriver, fig. 10. Recycle the handle.

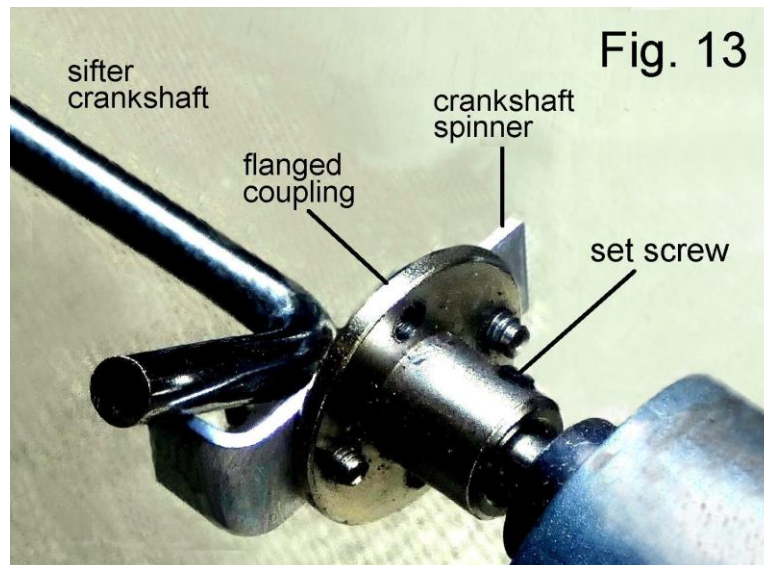


3. Carefully with a hacksaw, cut the shaft as shown in fig. 11 (left) below. The short section (about 3/4" or 19mm) will be driven by the wobble disk motor and its crankshaft spinner.



4. Temporarily reinstall the sifter's shaft and add its cap nut.

5. Add a flanged coupling (often sold as pairs as in fig. 12 above) to the end of the wobble disk motor shaft. Secure it with its included set screw(s). See fig. 13 below.



6. Make the crankshaft spinner ('e' in fig. 03) to match the coupling. Bend it into an L and attach it to the coupling with two short (usually 3mm) threaded machine screws. See fig. 13 above. Tighten the screws thoroughly.
7. Make the bracket that holds the wobble disk motor to the sifter as shown as 'f' in fig. 02, with details in fig. 14 below.

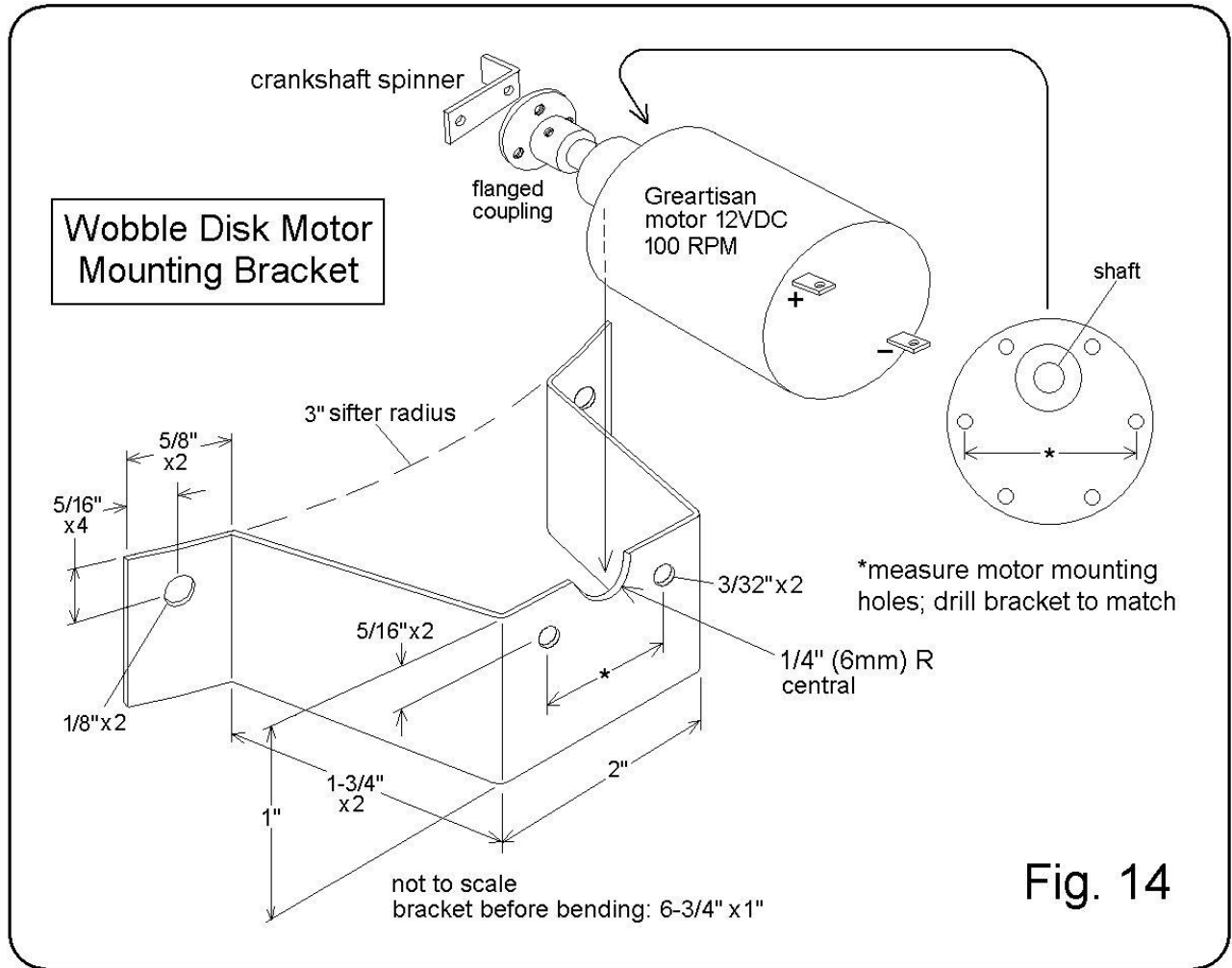


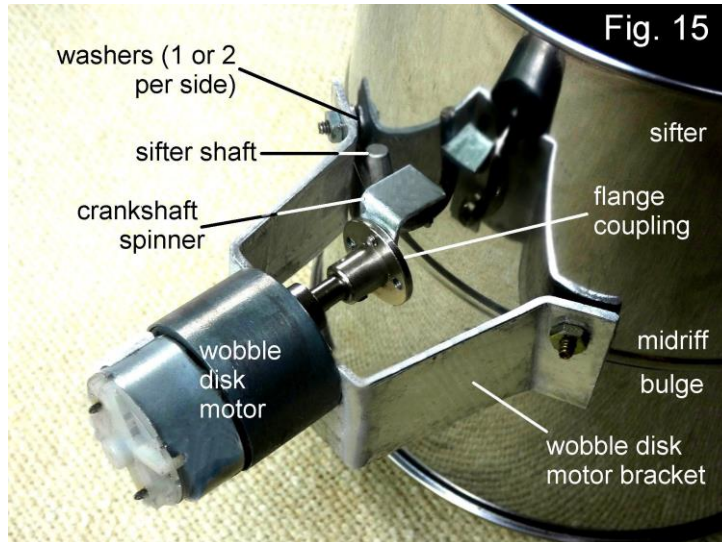
Fig. 14

8. Alignment of the sifter and motor shafts is critical: the motor's crankshaft spinner must freely turn the sifter's shaft with no binding or skipping. Drill as many screw holes in the bracket as possible while it's flat. Then bend it, keeping it reasonably symmetrical. If you have access to a bench vise, I recommend using it. Carefully measure the mounting hole spacing on the motor and transfer that dimension to the bracket. Mount the motor to the bracket with two machine screws. (Typical thread is 3mm, but your mileage may vary.)

9. Read this whole paragraph before you follow its instructions. Because sifters--and our own building skills--vary a bit, you must decide exactly where to mount the bracket to the sifter wall. The key is to *keep the motor's shaft and crankshaft in alignment*. Mark through the bracket's two mounting holes onto the sifter wall. The sifter's midriff-bulge may be in the way (see

below). All the holes can be drilled somewhat oversize to allow adjustment of the relationship of the shaft and its driver. Drill those holes (sifter bodies are tough, so use a new drill bit). Then *tightly attach* the assembly with two machine screws and nuts.

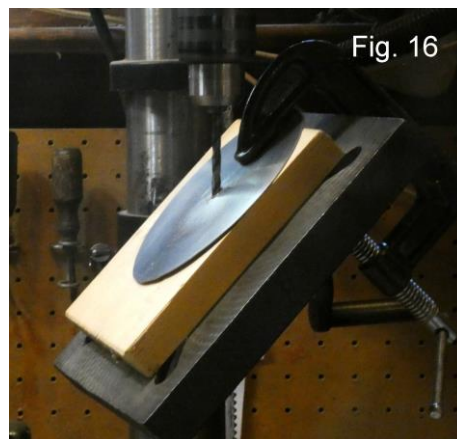
10. If necessary to compensate for the sifter's bulge, add one or two washers on each side to keep the motor perpendicular to the sifter body. See fig. 15 below.



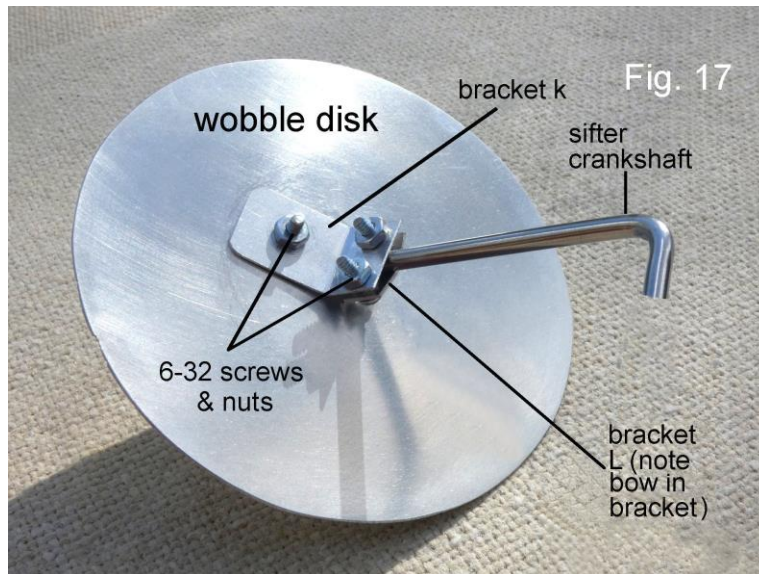
11. Test the assembly now. Plug in the adapter (transformer) and temporarily connect it to the wobble disk motor via the speed control. Notice input/output polarities marked on the speed control. Run the motor slowly at first. The sifter's crankshaft *must smoothly turn clockwise* (looking at it from the bracket) with no interference. Please don't take any shortcuts here!

Make the Wobble Disk

1. Refer to figs. 02 and 03 again. Cut the disk 'm' to 5-1/2" diameter, then smooth any rough edges or surfaces with a fine-toothed file and/or sandpaper. Drill a 1/4" hole in the center of the disk *at a 45-degree angle* using a drill press (fig. 16 below) if you have one. If not, clamp the disk vertically in a vise and drill a 1/4" hole in the center (hold the drill perpendicularly), then slowly tilt the drill to a 45-degree angle as the bit turns. The disk *must be at a 45-degree angle* to its shaft to properly agitate the beans.



2. See figs. 02, 03 and 17 (below) for the next few steps. Make two brackets 'k' and 'L' that hold the wobble disk to its shaft. Drill their holes so they line up with each other. Loosely assemble the wobble disk and its brackets with 6-32 machine screws and nuts, *keeping the nuts tool-accessible*. Push the shaft halfway into the sifter, then between the two bracket pieces, then through the wobble disk.



3. Tighten the two nuts with a hex nut driver, ensuring the disk and bracket fit snugly together, and mark the disk through the third hole in the larger bracket. Again disassemble and drill through that mark for the all-important attachment screw.

4. With the wobble disk bracket screws loose, push the sifter shaft halfway into the sifter, then through the brackets and the disk itself. After the end of the shaft passes through its hole on the other side of the sifter, replace and tighten the cap nut, then add a short 6-32 machine screw and nut to hold the bracket to the disk. Tighten that nut thoroughly.

5. Center the disk in the sifter and tighten its two bracket nuts. The smaller bracket needs to be fastened tightly enough to *bow about the shaft*. Once more: note in fig. 17 that the disk and shaft are at a 45-degree angle to each other. If any of those screws and nuts are not thoroughly tightened, the wobble disk could slip on its shaft (threaded or smooth) and ruin a roast!

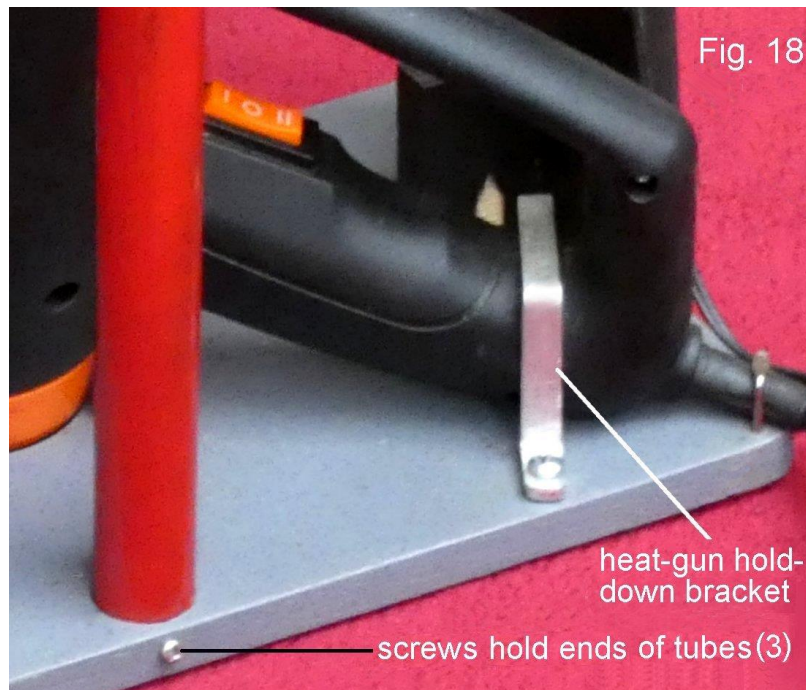
6. Spin the shaft by hand to ensure the disk doesn't touch the sifter sieve. Press gently on any spots of interference with the sieve. If they still touch, try relocating the disk slightly to ensure there's no drag.

7. Sifter sieves aren't in the exact same positions from sifter to sifter. If there's still disk/sifter-sieve interference, try trimming the disk locally and minimally. The disk doesn't need to be perfectly round, nor exactly in the middle of the shaft, but its rim needs to be smooth and no more than about 3mm (1/8") from the sieve, but *never touching it*. Any interference will

quickly wear a hole in the sieve and the beans will pour down into the heat gun's nozzle and catch fire. Keep that fire extinguisher handy!

Sifter Support Tubes and Heat Gun Handle Holder

1. Press the three 12" metal tubes into the base and fasten each with one sheet metal screw (see fig. 18 below) at the bottom through the outside edges of the base. The end of the tubes should be flush with the bottom of the base.
2. Find the aluminum heat gun handle hold-down bracket blank, drill its two screw holes and bend it. See 'g' in figs. 02 and 03.
3. Place the heat gun over its 2"-diameter air inlet hole in the base, among the three small dowels (Tinker Toys).
4. Hold the heat gun's handle in place with its bracket and two wood screws. If necessary, bend the middle section of the bracket to apply a bit of pressure to the handle (some resisting movement is OK). You may want to also add a cord clamp now, as well. See fig. 18.



The Most Important Steps in this Build

1. After much experimentation over the years with the same heat gun model and sifter capacity, a dimension between the tip of the heat gun nozzle and sifter's sieve has emerged. It consistently delivers an excellent, very even roast in about 12-20 minutes, depending somewhat on bean variety and ambient temps. That dimension is 1-1/4". So cut a small block of wood with 1-1/4" as one of its dimensions. Later you'll set it on the heat gun's nozzle end with its 1-1/4" dimension vertical. In fig. 19, the red area represents that distance between the heat gun nozzle and the lowest point on the sifter sieve.

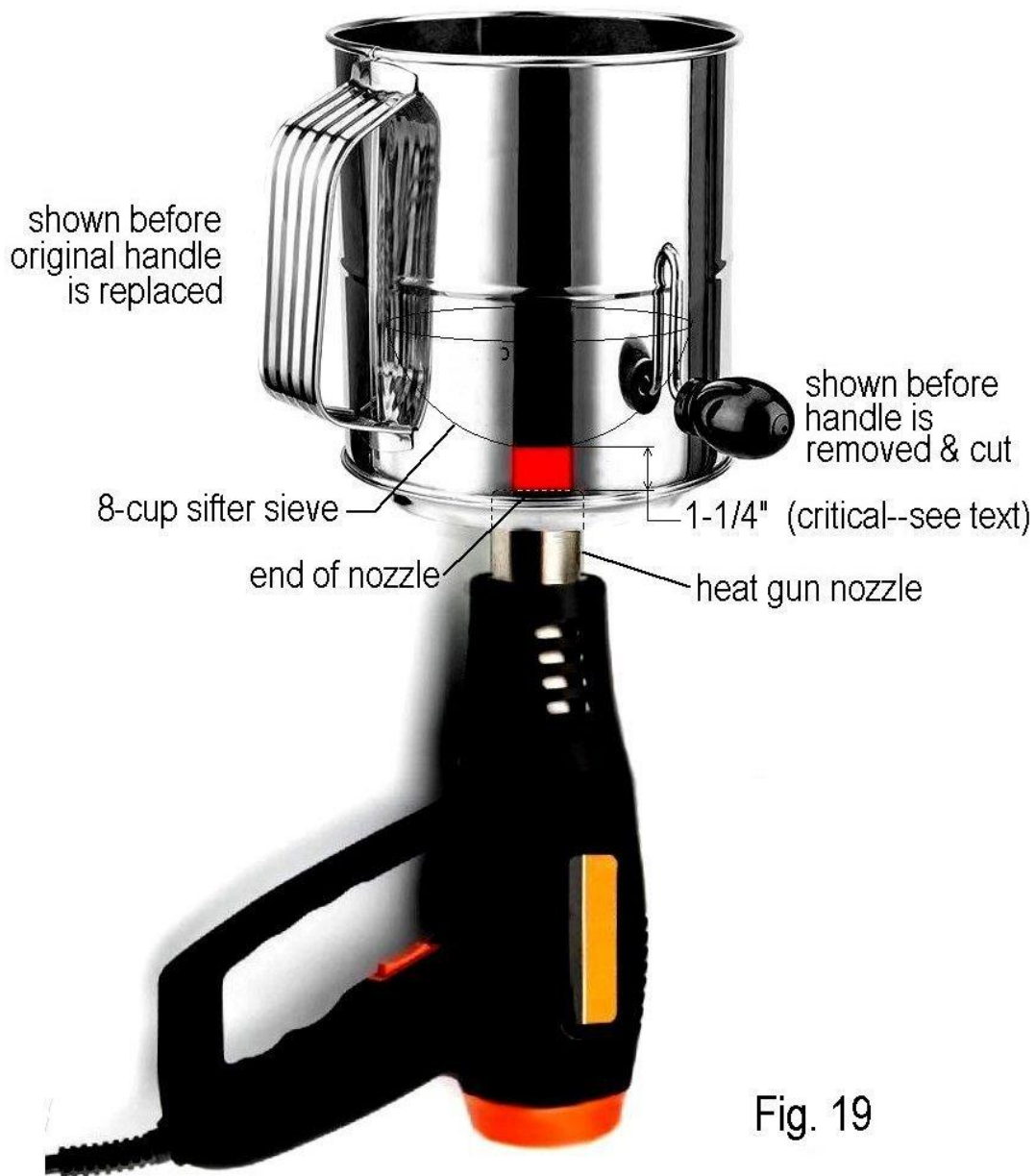
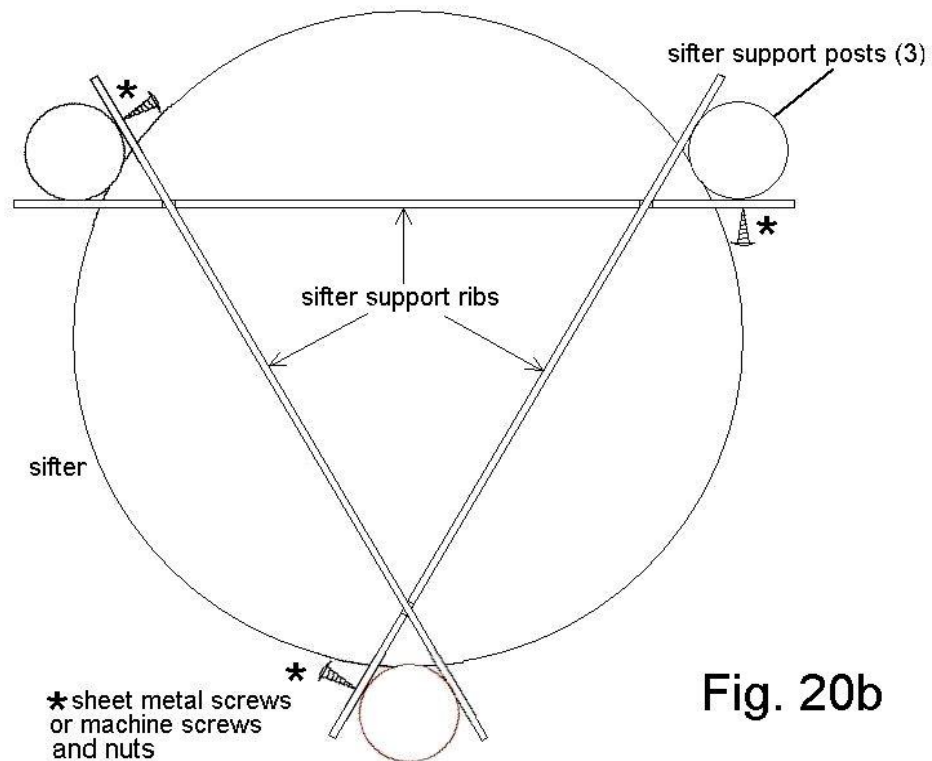
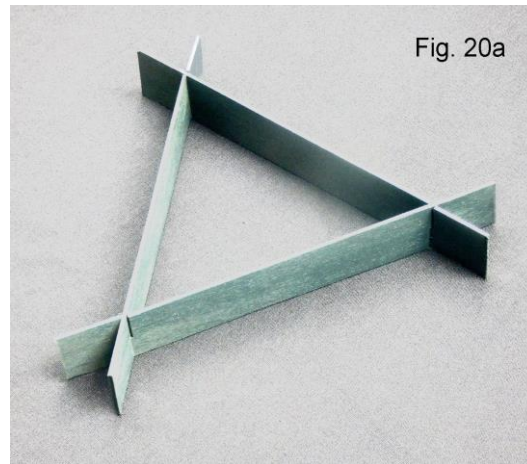


Fig. 19

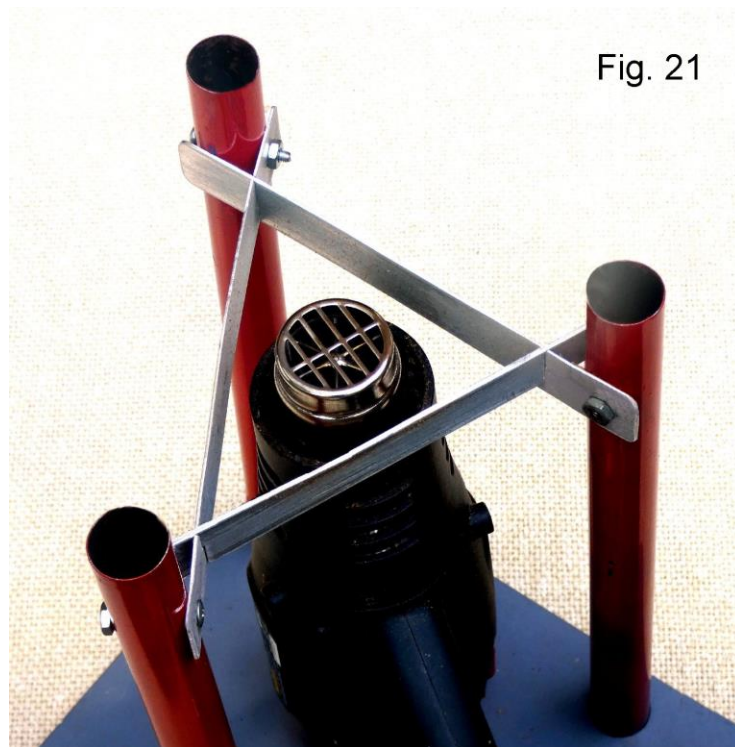
2. At this point, you may need to enlist some help; things can get a bit tricky.

3. Make 3 identical aluminum sifter-support ribs h, i and j in figs. 02 and 03. Assemble them into an extended triangle. If they won't stay frictionally assembled, temporarily tape them lightly together. They'll be the supports for the sifter. See figs. 20a and 20b below. Keep that triangle at the ready.

4. Once again, check the sifter sieve for dents or protrusions and carefully smooth them.



5. With the heat gun mounted to the base, place the wood block on its nozzle with the 1-1/4" dimension vertical.
6. Lower the triangle about an inch among the three tubes. It's ok if it's a little loose. Hold it in place for the next step.
7. Ask your assistant to lower the sifter--with wobble disk motor attached--until the sifter's bottom end just touches the triangle in three places.
8. Push both sifter and triangle very slowly and gently until the *sifter's sieve touches the top end of the wood block*.
9. Mark on the tubes where the screws will need to be to attach the triangle.
10. Gently remove the sifter but don't allow any movement of the triangle.
11. Attach the triangle to the tubes with sheet-metal screws or machine screws and nuts.
12. Remove any tape and the wood block. See fig. 21 below.



13. Once again, check that the wobble disk never touches the sieve. Check this with a few manual revolutions of the wobble disk.

Wobble Disk Motor Support

A very important piece--the wooden wobble disk motor support--has been patiently waiting for this paragraph; the roaster will not work without it. Refer to figures 04 - 07.

1. Set the sifter/wobble disk combo on all three parts of the triangle and close by, or even touching, all three red tubes. It should stay in place--barely balanced *and level*.
2. Carefully measure the distance from the top of the base to the lowest point of the wobble disk motor.
3. Cut the motor support *at its bottom* to the length you measured and mount it to the base with three 1-1/2" wood screws: 2 for the support itself and one screw for the motor support reinforcement block.
4. Ensure the wobble disk motor is level, fits easily between its two aluminum motor guides and rests on the top of the motor support.
5. Add four 1"-square pieces of the foam board (as "feet") to the bottom of the roaster's base. These help air to flow through the heat gun's air-inlet hole in the base.

Wiring

1. Mount the wobble disk's on/off/speed control near the top of the motor support, fig. 22 below.



2. Connect the output of the 120VAC-to-12VDC adapter to the input terminals of the speed control (they're marked). Wires can be hidden somewhat if attached to the inside wall of the motor support.
3. Add two short wires from the output of the speed control to a small female jack. I used a surplus RCA jack and telephone wire for this.
4. Use an approximate 2 ft., 2-wire (24 ga. min.) cable between the motor's terminals to a 2-terminal plug to match the jack. Just-roasted coffee beans can be dumped close by without disconnecting.
5. Turn on the speed control and slowly increase the wobble disk motor's speed. Ensure the wobble disk *turns clockwise* when viewed from the motor side of the sifter and *doesn't touch the sifter sieve*.

Instructions for Use

1. Place the roaster on a hard, sturdy, flat, level surface.
2. The speed of a roast is sensitive to input power. Plug in the heat gun and wobble disk motor adapter. You can use a 14-gauge (or larger) extension cord up to 15 ft. long; this gauge and length are the minimum to support the heat gun's current draw.
3. Pour about 300g (~11 oz.) of raw beans into the sifter. Don't start the heat gun yet.
4. Turn on the wobble disk motor and check for moderately fast (60-70 RPM), smooth and thorough bean agitation. You may try a faster wobble disk, but be aware that beans expand as they are heated and can escape.
5. Turn on the heat gun (switch in the handle) to setting II (high).
6. *Stay with the roaster for the entire roast.* The beans will expand and shed small, light pieces of chaff, which makes a mess but is totally benign. Near the end of darker roasts, the beans can emit some smoke caused by heating the oil seeping to the beans' surfaces. To me, that's a sign to quickly dump the beans.
7. There are many variables from bean species to ambient temperatures to the roaster itself. If a roast seems too fast, switch the heat gun to its lower temperature and fan speed. If anything seems to be going wrong, unplug the roaster immediately. Check out "Roasting Tips" below.
8. Beans will continue to roast after the heat gun and wobble disk are turned off. So grab your new wood handle, unplug the wobble disk motor if necessary, and *carefully* dump the 400+F degrees beans to cool. I cobbled up a wood-framed screen with a cheap Walmart desk fan

blowing up into the beans, figs. 23 and 24, but a cool baking sheet can also be a very good heat sink.



9. Unless you plan more roasting, unplug both power cords.

Roasting Tips

1. If roasts usually exceed 25-30 minutes, try getting closer to your 120VAC source and/or using a heavier-duty and/or shorter extension cord.
2. If a 300g (11 oz.) roast would be done to your liking in less than ten minutes, toggle the lower heat gun setting to slow the roast a bit. Recall that 12-20 minutes is a typical roasting time for 300g of beans in ambient temps of 40 to 90 degrees F.
3. Under windy and/or very cool conditions, consider setting the roaster down into an *open-top* corrugated box. This works well at the beach!
4. If your roasts consistently take over 30 minutes, consider reducing the gap between the heat gun and the sifter sieve. Remove the screws holding the bottoms of the support tubes, then cut no more than 1/4" off the tube bottom ends *and the wooden motor support* and reassemble.

Cautions, Warnings and Troubleshooting

1. Roast only coffee beans in the roaster.
2. Do not roast coffee indoors! Chaff is prolific and smoke can be dangerous.
3. Do not operate the roaster with a damaged power cord or plug, or operate it after the roaster malfunctions, or if the roaster has been damaged. Don't allow its cord to contact a hot surface.

4. Never immerse any part of the roaster in water or any other liquid. This includes the power cord(s) and plug(s).

Heat Gun Characteristics

1. Read and understand the heat gun manual.

2. The heat gun nozzle and sifter are too hot to touch during use.

3. The specified heat gun has two settings. Start the roast on II (higher heat and fan speed), and switch to setting I if the roast is proceeding too quickly. One sign of that is significant chaff within the first couple of roasting minutes; that's a bit too early. Try to make your roasts last about 12-20 minutes or so.

4. The Warrior heat gun literature says its switch and fan motor are *not spark-free* and can pose a serious ignition hazard. For these and other reasons, do not roast near flammable materials.

5. Never obstruct or cover the heat gun's air inlets or nozzle. If air flow is restricted, the heat gun will overheat, blow its fuse, and possibly catch fire.

A Few More Cautions

1. When roasting coffee, stay with the roaster from start (loading cool green beans) to finish (dumping 400 deg+F roasted beans).

2. Do not use the roaster near combustible or flammable materials/atmospheres.

3. Do not look straight down into the roaster while the roaster is on.

4. Never insert anything in the heat gun's nozzle.

5. Keep in mind the presence and direction of the heat, smoke and chaff produced.

6. Always switch the heat gun and wobble disk off before dumping roasted beans.

7. Let the roaster cool before storing it.

8. Keep young children away!

*All of the aluminum parts can be cut from the flat area of one 13" pizza pan, but there's very little "wiggle room" for a miss-cut piece. I recommend you order two.