

# STRAIGHT 8 CONSTRUCTION

## Preparation

### Materials included in Straight 8 Cabinet and Plans Kit

16—treated 5" aluminum cone mid-woofers  
2—treated 1" titanium dome tweeters  
2—3.3  $\mu$ F polypropylene film capacitors  
2—0.68 mH foil inductors  
8—Big Stud binding posts  
120' 20.5 ga. long crystal "six nines" copper magnet wire  
30 square feet damping felt  
2 pints silicate loaded latex coating

### Materials to be supplied by the builder—

1-1/4 sheets 3/4" MDF sheets, 49" x 97"  
200 #6 x 1-1/4" particle board screws  
Box of #6 round head square drive screws for driver mounting  
Polyurethane wood glue  
Body putty and glazing putty (Bondo)  
120 grit sandpaper  
Paint to finish (see suggestions below)  
Spray Adhesive (3M 77 recommended)

### Tools required

Tapc measure and steel ruler  
Table saw capable of 11-1/2" rip cuts  
1-1/2 HP Drill press with adjustable circle cutter  
Router with 3/8" rabbet bit and 1/2" round over bit  
Drill with #6 countersinking bit and Phillips screwdriver bit  
Square head screwdriver  
Sander  
foam brush  
Utility knife  
Body filler spatula  
Soldering iron and solder

## Cutting the panels

You will need about 1-1/4 sheets of standard 3/4" MDF in 49" x 97" sheet size to build both speakers. Rip enough MDF width-wise to give ten 12" wide by 49" long panels. This can usually be done at the lumberyard where you purchase the MDF, which will make it easy to haul the panels back to your shop. Trim the widths of these panels down to the widths specified in the panel "blueprints". Remember, "Measure twice and cut once!" Note that the front, back and side panels are all 49" tall, and thus they will not need to be trimmed for length, except perhaps only slightly to even up lengths cut from two different sheets of MDF.

### Cut list

2—11-1/2" x 49" front baffle panels  
2—11-1/2" x 49" back panels  
4—10-1/2" x 49" side panels  
2—10-1/2" x 10" top panels  
2—10-1/2" x 10" bottom panels

The top and bottom panels are identical. All four can be cut from one 12" x 49" panel.

4—10-1/2" x 10" interior braces

All four can be cut from one 12" x 49" panel.

Refer to the cabinet assembly pictures for the relative location of the panels. The front and back panels are to be trimmed down to 11-1/2" wide, and the side panels are trimmed to 10-1/2" wide. The panels will simply butt together, with the side panels edges sitting 'inside' the front and back panels. The top and bottom will sit 'inside' the other panels, as will the internal braces. All of these horizontal panels are 10"W x 10-1/2"D. This will yield a finished cabinet 11-1/2"W x 12"D x 49" tall, with asymmetrically placed internal planar braces to reinforce the cabinet and break up cabinet resonance modes.

The back panel requires the cutting of two 3" diameter holes for the vent tubes and four 3/8" diameter holes for the woofer and tweeter binding posts. The 3" holes are best done with an adjustable circle cutter in a drill press. Be sure to test the diameter of the hole cut by the circle cutter on a piece of scrap before using it to cut the actual panels.

The internal braces require the cutting of a 6" diameter hole in the center, which are best done with the adjustable circle cutter as well.

The front baffles require the cutting of eight 4-3/8" holes and one 3-1/2" hole per panel. Lay out the hole centers very carefully to assure even 1/4" spacing between the drivers. Double check your measurements before cutting. Note that the linear array of driver holes is off center side-to-side to reduce diffraction losses, and that the left and right front baffles are mirror images of

each other.

Once the holes are cut in the front baffles the 3/8" rabbet may be cut around each hole with a router, so that the drivers will sit flush with the surface of the baffle. Note that the woofer rabbet is 1/8" deep, while the tweeter rabbet is only 1/16" deep. Make sure that you route the holes so that the resulting panel fronts are mirror images.

Finally, set a woofer into a woofer mounting hole and mark the four screw hole positions. Remove the woofer and drill the holes for #6 mounting screws. Repeat this process for all woofer holes, then do the same for the tweeter mounting holes, using a tweeter as the layout guide for the three holes. Be careful, the tweeter domes are easily punched in. Replacement domes are not available, only entire replacement tweeters. If this happens, remove the three tweeter flange mounting screws, remove the flange, carefully pull the magnet assembly apart from the dome assembly, and push the dome back out from behind, being careful not to remove the ferrofluid from the voice coil. Based on our rather extensive experience stupidly punching these domes in, there will be little to no loss in sound quality...

## Cabinet panel assembly



Use the illustrations on the cabinet assembly page to put the cabinets together. Two people working together can make assembly a much easier job.

For each step apply an unbroken bead of glue to one of the pair of edges to be joined. Set the panels to be fastened together in very careful alignment, and drill holes with the #6 countersinking bit every four to six inches along each joint. Drill the holes so that the screw heads will sit about 1/8" to 1/4" below the surface of the panel when tightened. Sink the #6 x 1-1/4" particle board screws into the pre-drilled holes, tightly, to clamp the joint together. Be sure the heads of the seated screws sit below the surface of the panel.

Make sure that all joints are air tight, filling any gaps with more glue. A tight cabinet will have superior bass response. Included in your kit are some materials for damping the interior of the cabinets. You may wish to apply these materials before attaching the front baffles to the cabinets.

## Application of Cabinet Damping



First apply the silicate loaded paint found in the cans. Pour a small puddle of paint onto an interior panel and spread it around fairly thickly on the internal surfaces of each cabinet, using a foam brush. It is not necessary to cover every square inch, and a 'lumpy' coat may actually work better than a smooth coat. The thick paint will require about 24 hours to dry.

When the paint has dried cut out pieces of the felt to fit for each flat area in the cabinet. The felt can be cut with an inexpensive utility knife and a steel ruler. Apply spray adhesive to the panel area and to the felt, and after a few seconds press the felt in place. On the back panel be sure to leave a couple inches diameter of the panel around the binding post mounting holes

clear of felt, and leave a small area clear on the bottom panel below the binding post holes for mounting the crossover components.

## Filling and sanding

If you have not yet attached the front baffle, attach it now.

Mix small batches of the body filler and use it to fill the countersunk screw holes. Mix small amounts, as the filler sets in about 2-3 minutes. When the filler has dried, maybe 10-15 minutes, sand the cabinets smooth with 120 grit sandpaper, leveling off all the filled holes. If any holes are sunken, fill them with glazing putty (also good for any seams which may be uneven) and lightly re-sand.

Using a 1/2" roundover bit, round all the 12 edges of each cabinet, being careful to round the eight corners evenly. Lightly sand the rounded edges.

## Finishing the cabinet

The finish we chose for the prototype is a variation of one that we have applied to various cabinets with great success. It is composed of a latex base coat, one of the various "faux granite" spray finishes commonly available in home improvement stores, and a final coat of acrylic sealer.

For our cabinets we chose a flat black latex base coat, which we applied with a smooth roller. Be sure to get the base coat into the rabbets for the drivers so that any gaps between driver and panel will not show. Let the base coat dry overnight.

The stone finish we applied was a metallic granite finish composed of gold and copper colored flecks over a dark bronze mist. We have also used a "black granite" type of finish with great success, and have even used a "sandstone" version of this stuff on bare MDF successfully, although it takes a lot of cans to coat adequately without first applying a base coat underneath.

Once the stone finish has dried overnight, apply a clear acrylic or polyurethane topcoat. Most of the stone finish paints have a finish specially formulated to work with them, but we have also used Varathane Professional with success.

This type of textured finish is very soft until it completely polymerizes. This can take a few days. A heat gun may help to speed up the initial curing time, but it will actually be several weeks before the finish achieves its ultimate hardness. Treat the cabinet accordingly, don't set heavy items on the finish, which will flatten the texture, and be careful not to scrape the edges when moving the cabinets and fitting the drivers.

## Wiring and installing the tweeter



Begin by inserting the vents into their holes on the back panel. Then insert the binding posts into their holes and tighten their nuts securely. The top set of posts will be assigned to the tweeter and the bottom set will be assigned to the woofers. Consult the wiring diagram for the wiring scheme and crossover component location.

The tweeter wiring is straightforward. Attach the 3.3 $\mu$ F capacitor to a nylon tie hold down with a nylon tie. Remove the adhesive backing from the hold down and stick this assembly to the cabinet near enough to the top right binding post to allow one lead of the 3.3  $\mu$ F capacitor to reach it. Solder one end of the 3.3  $\mu$ F capacitor to the top right binding post (as viewed from the outside). Now cut two pieces of the 20.5 ga. magnet wire 6" long. To strip the 20.5 ga. magnet wire, apply the tip of a hot soldering iron to each end to be tinned, holding it there as the varnish coating boils off. Apply solder to the bared end to tin it. Attach one of these wires to the free lead of the 3.3  $\mu$ F capacitor by cutting the lead short (about 3/4") and putting a small loop in the end of it to insert the wire through. Label the free end of this wire with a piece of tape marked "+". Attach the other wire to the top left terminal. Label the free end of this wire with a piece of tape marked "-".

Now pull the two wires through the tweeter mounting hole. Solder each wire to the corresponding terminal on the tweeter, being careful not to overheat the terminals. The "+" terminal on the tweeter is marked red. It is a good idea to mark the polarity of the terminals on the back of the magnet with a marking pen, as the red mark on the positive terminal is easily erased by soldering.

Set the tweeter in its mounting hole and secure it with three #6 screws. Square drive screws are a safe bet to avoid accidentally plunging a screwdriver through a dome or cone.

## Wiring and installing the woofers

The woofers are a bit more tricky to wire. The woofers have 8 ohms nominal impedance. Four woofers are wired in series to produce a 32 ohm impedance, and then the two sets of series wired drivers are wired in parallel at a terminal strip near the binding posts, to create a single ended tube amp friendly 16 ohm impedance.

Begin by mounting the inductor to two nylon tie hold downs with nylon ties. Stick this assembly close enough to the lower right hand binding post to allow soldering one end of the foil inductor to the lower right hand binding post. Now attach a terminal strip to the bottom panel of the cabinet with a screw. Mark the terminal at one end "+", mark the terminal at the other end "-". For each cabinet cut eight pieces of 20.5 ga wire about 6" long and tin the ends of each. Braid or twist four wires together, and solder all four wires at

one end to the free end of the inductor. Solder the other end of each wire to the "+" terminal of the terminal strip. Now twist or braid the other four wires together and solder one end to the lower left hand binding post. Solder the other end to the "-" terminal of the terminal strip.

Now for each cabinet cut wires to the following lengths:

Two pieces five feet long  
Four pieces four feet long  
Two pieces two feet long  
Twelve pieces one foot long

Tin each end and then twist two wires of each length into twisted pairs, to create heavier conductors for the bass signals. Then refer to the wiring diagram for an easy to understand picture of the following wiring scheme:

Attach one end of the five foot twisted wire to the "+" terminal of the terminal strip. Put the other end of the five foot twisted wire out the uppermost woofer mounting hole. Solder the end to the driver's "+" terminal. NOTE: the "+" and "-" markings are on the white fiber pads attached to the speaker terminals. Once again, marking the magnet to show terminal polarity may help you to locate the proper terminal. Solder a piece of one foot long twisted wire to the driver's "-" terminal. Mount the driver in the topmost woofer mounting hole with four #6 square drive screws.

Now fish the free end of the just attached one foot twisted wire out through the next lower woofer mounting hole. Solder this free end to the "+" terminal of another woofer. Then solder another one foot twisted wire to the "-" terminal of the driver, feed the wire thru that driver mounting hole, and mount the driver in the second woofer hole, as above.

Repeat for the third woofer.

Now fish the free end of the third one foot twisted wire out through the fourth woofer mounting hole. Solder this end to the "+" terminal of the fourth woofer. Now solder one of the four foot twisted wires to the "-" terminal of the driver and attach the other end to the terminal strip near the woofer "-" binding post.

Repeat this entire process for the fifth through eighth woofers, using a four foot twisted wire for the "+" terminal of the fifth driver to connect to the "+" terminal of the terminal strip near the binding post, and a two foot piece of twisted wire to connect the "-" terminal of the eighth driver to the "-" terminal of the terminal strip near the binding post.

## Hooking it all up

If you intend to run the Straight 8s with a single amp, you will need to jumper the "+" tweeter binding post to the "+" woofer binding post, and jumper the "-" tweeter binding post to the "-" woofer binding post. This is easily done externally with a couple of pieces of your favorite wire. Connect the amp to the woofer binding posts rather than the tweeter binding posts to ensure that the bass signal doesn't have to pass through the jumper.

If you wish to biamp using the internal first order passive crossover, omit the jumpers and connect the tweeter amplifier directly to the tweeter binding posts, and the woofer amplifier directly to the woofer binding posts. Use of Afterglows or Paraglows on the tweeters and B-Glows or Parabees on the woofers is a truly exceptional combination.

If you plan to biamp using an external active crossover you would naturally eliminate the capacitor from the tweeter wiring and the inductor from the woofer wiring and connect the "+" binding posts directly to the tweeter and woofers respectively.

In some systems in some rooms with the speakers running from a single amp one may find the tweeter a bit



bright. Substituting a good quality 5 ohm 10 watt wirewound resistor for the jumper between the tweeter and woofer binding posts will create a bit of lower treble attenuation of the tweeter without affecting its top end extension much. Be sure to connect the amp to the woofer binding posts or this won't work right. This is a sign of the speaker's ability to resolve the differing tonal character of various types of output tubes rather than an actual peak in the speaker's response, and thus the use of such attenuation will mostly be a matter of the listener's taste.

NOTE: when new, any speakers may be a bit disappointing. Drivers and wire need to break in before one can properly judge the speaker. Give them a few days of play and you will find greatly improved bass and a general smoothing of the sound.

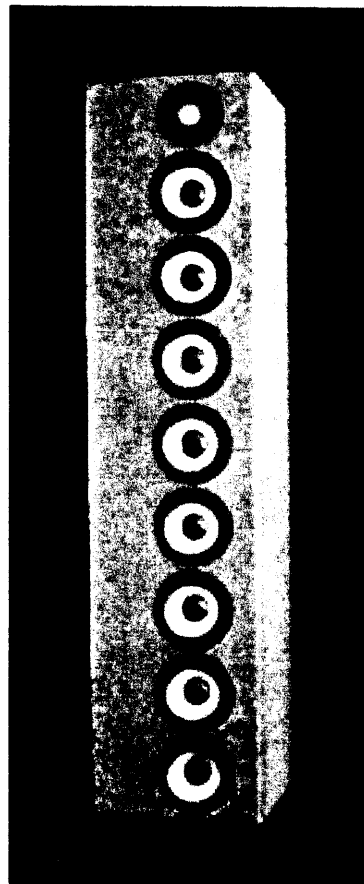
### Positioning

Our current impression is that the speaker will work well at any distance from about 8' on up. They seem to work best pointed directly at the listener. Drivers should be toward the inside edge of the front baffle. Distance between speakers seems to be predicated more on the shape of the listener's pinna than listening distance, and should be determined experimentally. We ended up using 6-1/2' between driver array centers in a lightly acoustically treated 13' x 13' room. Location some distance from the front and sidewalls is appropriate, more seems to be better within the limitations posed by the room dimensions and resonance modes. When we first listened to these speakers they were in a 30' long room that varied in width from 12' to 15'. Near field listening was not quite as pleasant to this listener's ears as listening from 10' or more, and imaging was a bit problematic, with the left speaker seeming to put out less than the right. When the speakers were brought up to a small but symmetrically shaped room, near field listening became very pleasant, and we realized that problems we were attributing to the speakers themselves were actually due to problems of asymmetry and poor room treatment in the room we had been using for the past 8 years!

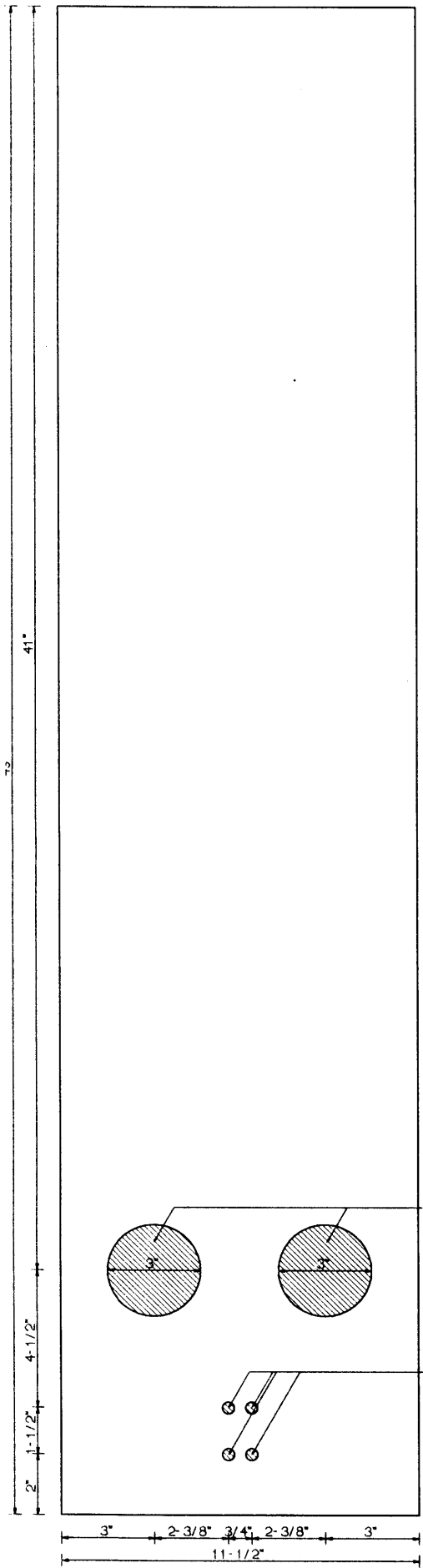
Once broken in the speaker will go low enough to excite errant room modes. This should be a consideration when locating the speakers, as their bass response is quite flat and should be preserved without false 'room boost'. The speakers should measure flat to about 54 Hz in open air, and in most rooms they measure flat to 40 Hz or so with the aid of floor coupling.

### Disclaimer

While Electronic Tonalities guarantees the quality of the drivers and other components supplied with the kit, we obviously have no control over materials used to construct and finish the cabinet, nor the skills (or lack thereof) of the builder. As such Electronic Tonalities will assume no liability related to injury incurred during construction and/or implementation of the speakers. While do-it-yourself speaker cabinets are a frequent audio hobbyist's construction project, one must always bear in mind that construction of such cabinets requires skills involving the use of potentially dangerous power tools, and that injured power tool operators are frequent hospital emergency room patients. If you feel incapable of assuming liability and/or responsibility for any damages incurred in the construction of the cabinets or the use of the speakers, we strongly suggest that you have the cabinets built for you, by a responsible entity. If you do assume the responsibility, never, ever forget that a table saw, drill or router can easily cripple the thoughtless operator with its cutting edge or with thrown materials! Use proper safety equipment- eye protection, hearing protection, and respirators - during the construction, and use hearing protectors when measuring the frequency response of the finished speaker. Do not defeat any safety interlocks or guards on the power tools. And don't work with power tools alone, make sure someone is nearby in case you need assistance.





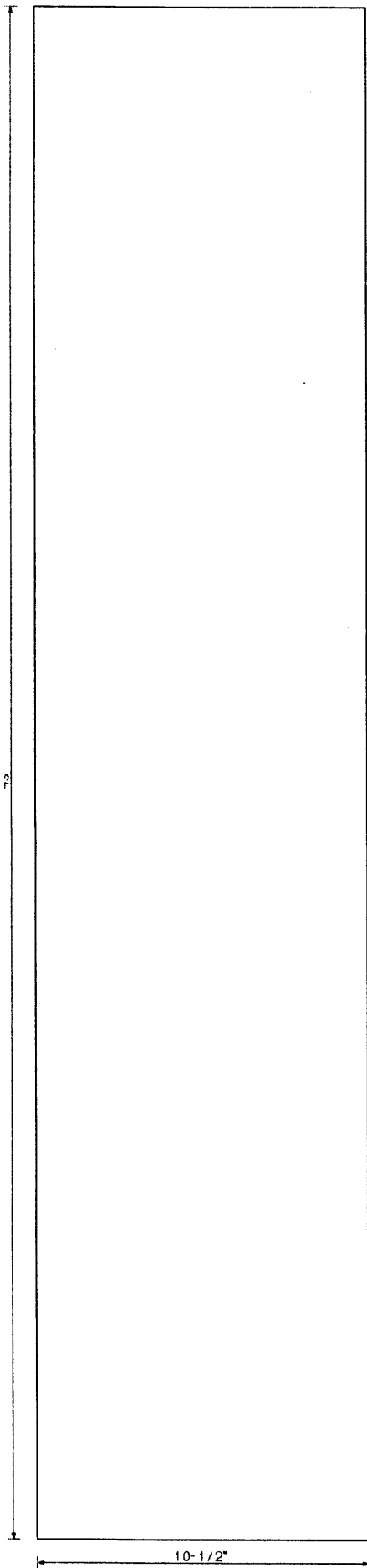


NOTES  
 CUT TWO PANELS  
 ALL PANELS 3/4" MDF  
 CUT PANEL TO WIDTH ON TABLE SAW  
 LAYOUT HOLE CENTERS  
 REMOVE SHADED AREAS  
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bottlehead.com  
 Straight-8  
 rear baffle

HOLES FOR PLASTIC VENT TUBES

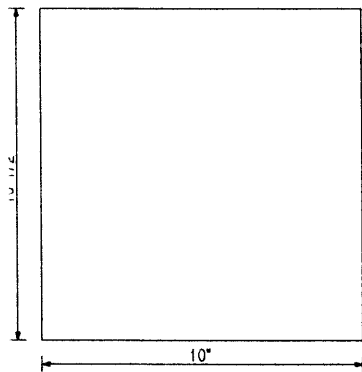
BINDING POST HOLES ALL 3/8" DIAMETER



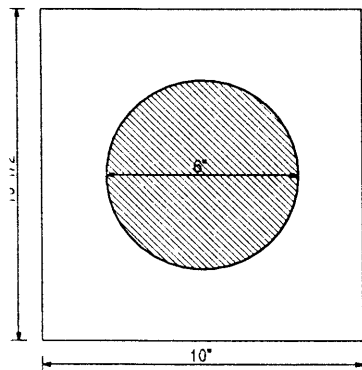
NOTES  
CUT FOUR PANELS  
ALL PANELS 3/4" MDF  
CUT PANEL TO WIDTH ON TABLE SAW

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**bottlehead.com**  
**Straight-8**  
**side panel**

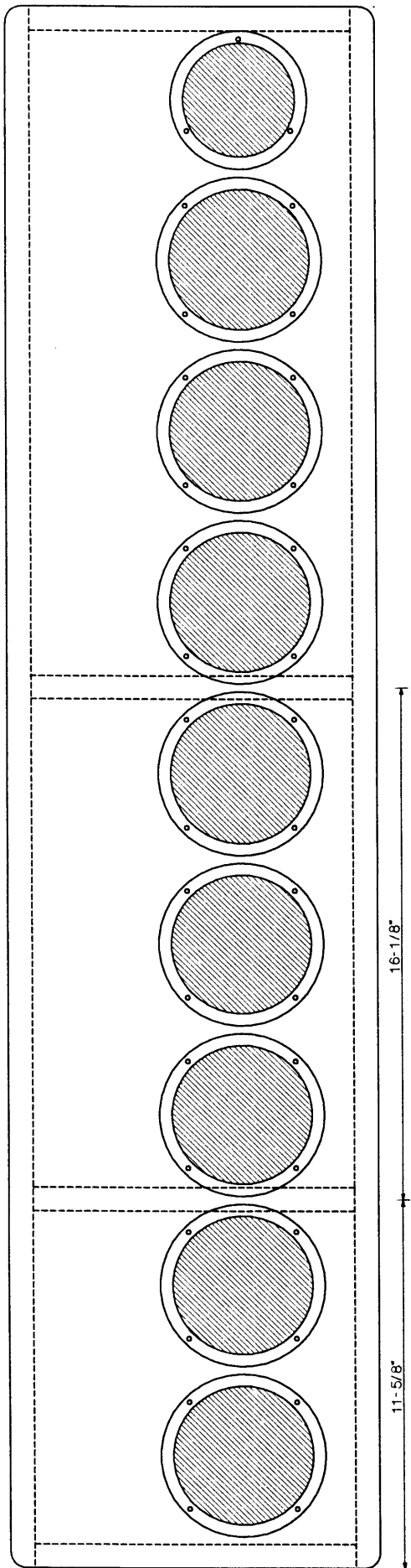


bottlehead.com  
 Straight-8  
 top and bottom panels  
 (make four)



bottlehead.com  
 Straight-8  
 internal planar braces  
 (make four)

NOTES  
 ALL PANELS 3/4" MDF  
 CUT PANEL TO WIDTH ON TABLE SAW  
 REMOVE SHADED AREA WITH ADJUSTABLE  
 CIRCLE CUTTER IN DRILL PRESS  
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Straight 8  
front elevation  
& internal brace placement  
left speaker

# STRAIGHT 8 CABINET ASSEMBLY



Step One: attach the back panel to one side panel, and attach the bottom, to form a square corner. Use #6 x 1-1/4" particle board screws countersunk 1/4", spaced every 4"-6", and polyurethane wood glue. You will need about 100 screws for both cabinets.



Step Two: install the lower and upper internal braces to line up between the second and third, and the fifth and sixth driver holes, counted up from the bottom. Use the front panel as an alignment guide. Install the top.



Step Three: install the remaining side. TIP: You may wish to paint the inside with the flexible silicate coating and install the felt damping pads at this point



Step Four: install the front panel, securing to the internal braces as well as the outer panels.

# Straight 8 internal wiring

