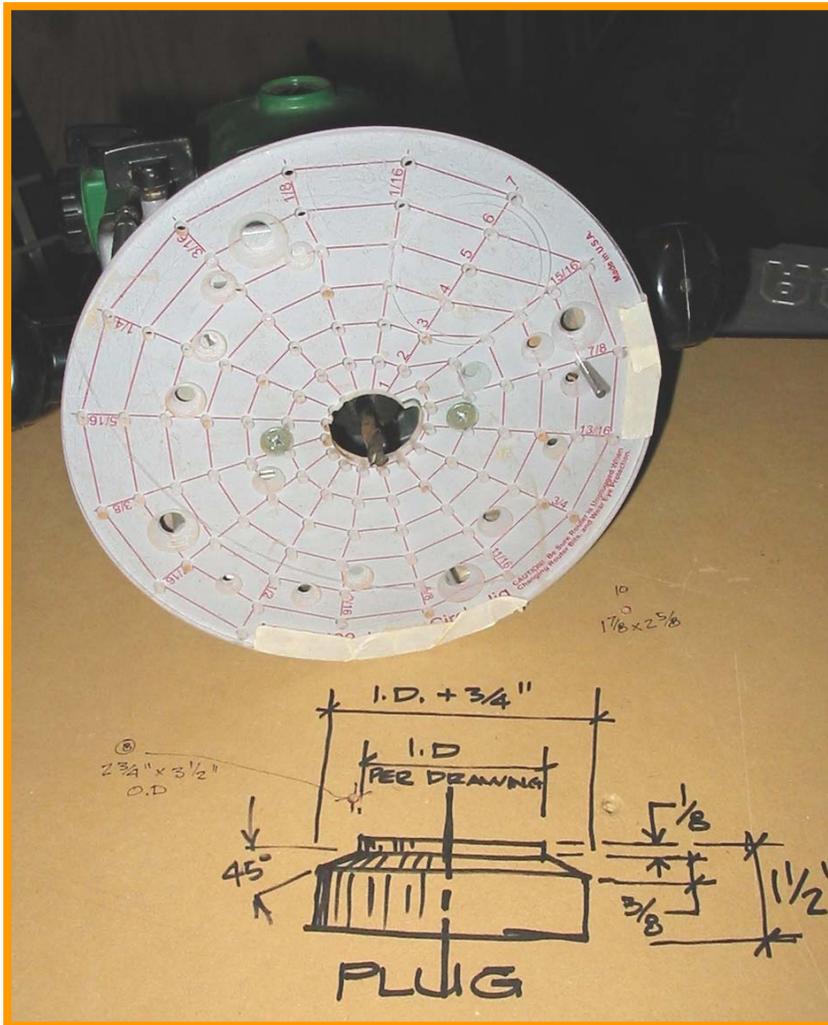


I spoke to Bob Barrows about using the 45 degree dies to press the rib hole flanges. He commented that as the flange angle increases it helps stiffen the rib and 45 degrees would be okay for the die. It does not have to be exact & with about a 10 degree spring back they probably are in the 35 degree range.

Using standard router bits allowed us to form accurate flange forming dies with a precision router circle cutting base. This eliminated a lathe and be dependent on their timelines. It may actually be quicker to cut the pieces with the router than with a lathe. At the end of the day I think all the tooling worked so well that could have only be done better with a CNC or a lot of machining time.

There is only one set up necessary for each cut and that set up can be used to machine all the plugs at one time by simply changing the router radius. This process goes fast.

Start with gluing two pieces of MDF together with a generous amount of good carpenters glue. Put some screws in & add some weight on top of the boards to make sure they are well bonded to one another. The boards need to be wide enough so that the router can swing in circles and stay flat on the board. The spacing of the plugs is arbitrary and they can be fairly close together.



A sketch of a typical male die plug drawn on the MDF. The drawing is always there for a reference while machining the plugs from the MDF.

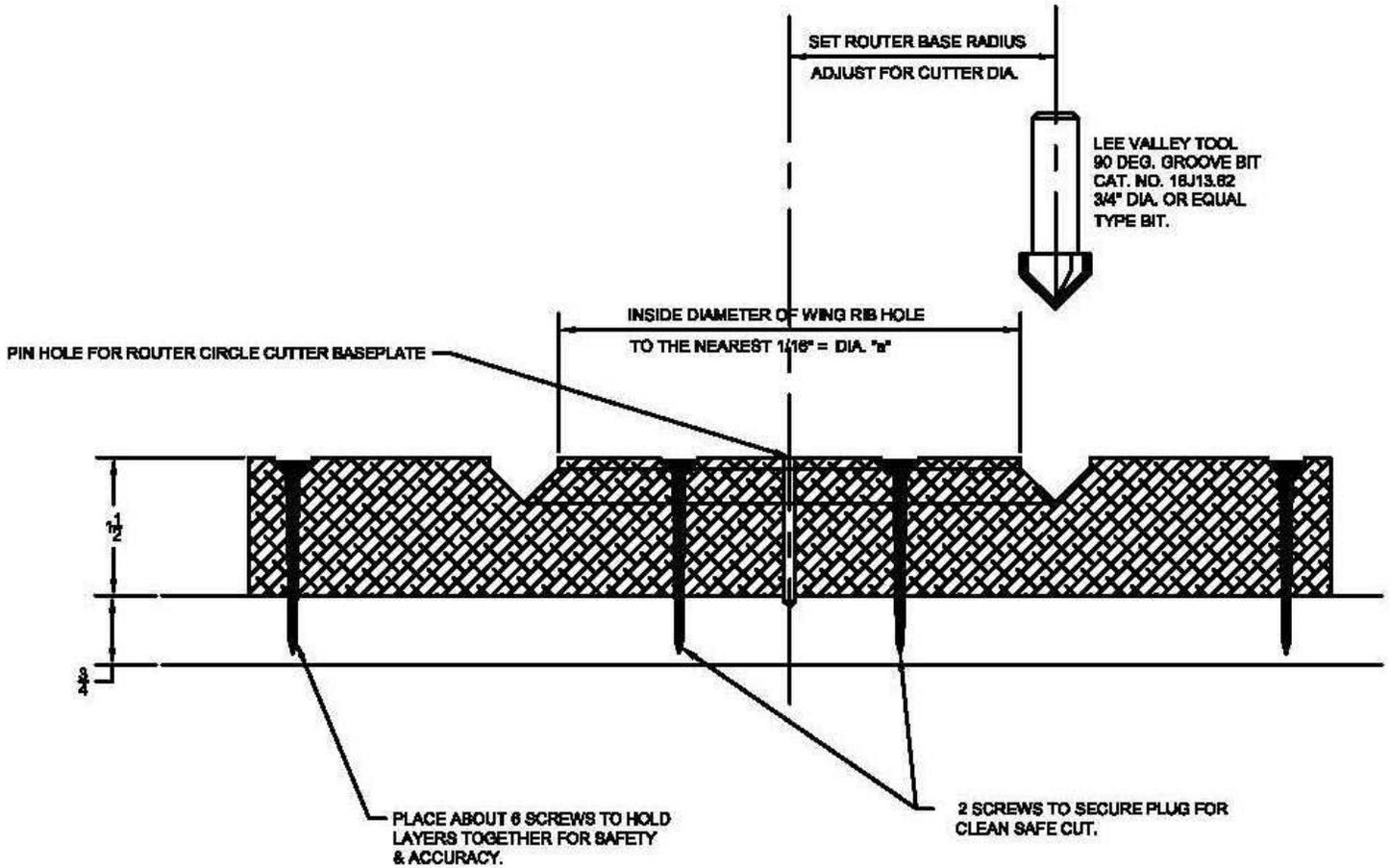
The raised face is  $\frac{1}{8}$ " and is used as for alignment to centre the plug in the aluminum cut out.

The router is shown with the precision circle cutting base system from Lee Valley tools P/N 46J91.03. The router is shown with a 45 degree bit for the 2nd router operation on each plug.

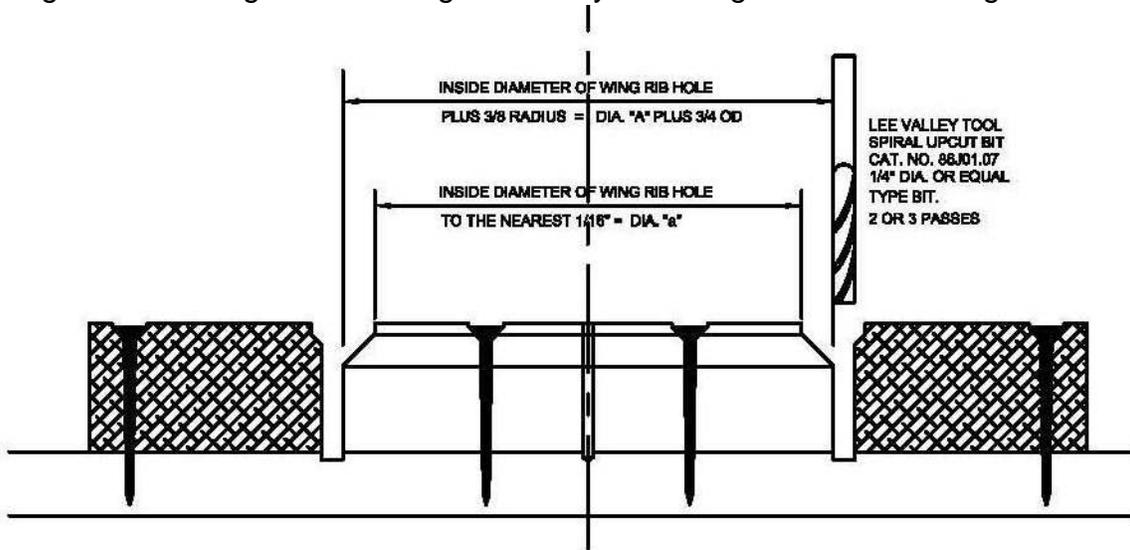
This photo show the base & my sketch of what the plug was to look like so that I could plan the cuts.

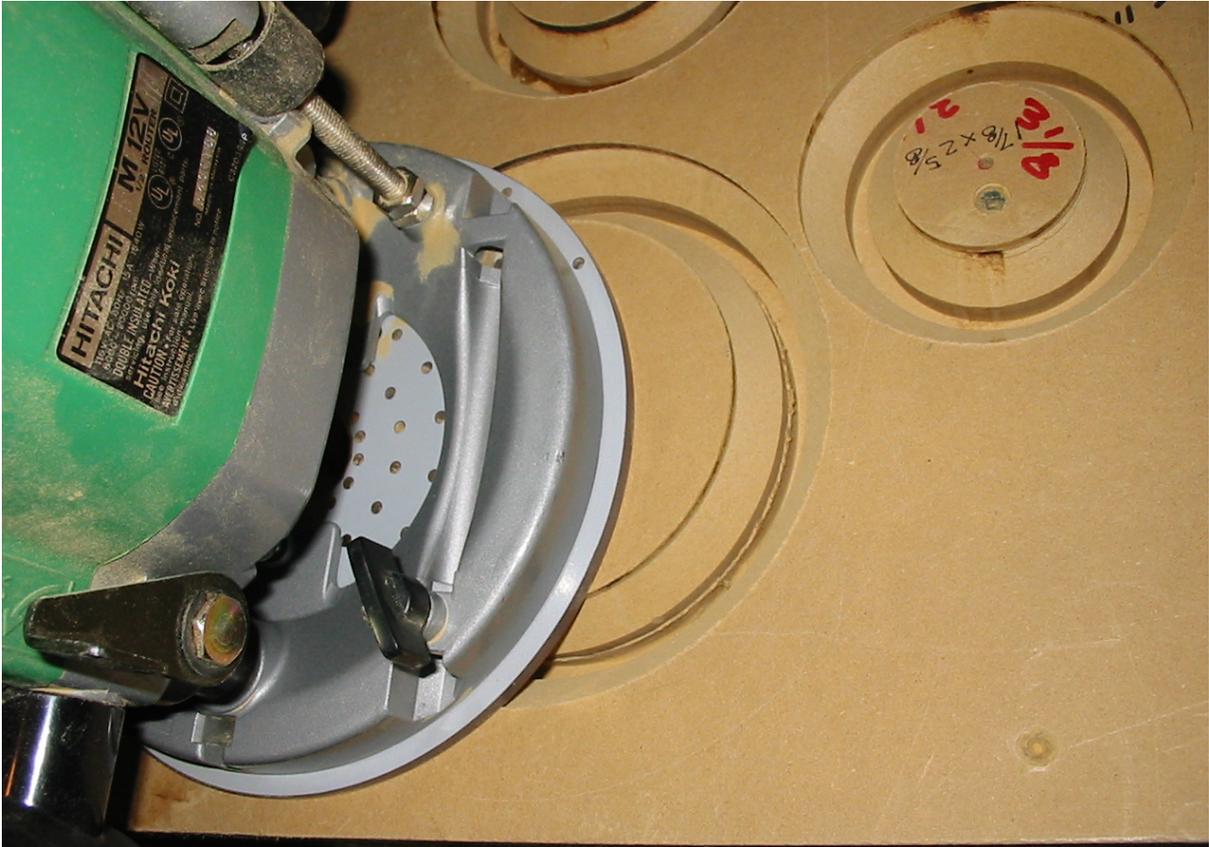
The male plug has a raised

On with project. The intended plugs & laminate are secured with countersunk screws so the first cut is the 45 degree V cut as shown below:



This cut creates the 1/8" hole index flat & the 3/8 x 45° shoulder to form the flange. The next steps are to cut it free. It is best to do this with at least 2 passes with a spiral up cut bit. The advantage of the up cut bit is that it constantly pulls out what it cuts and it provides more cutting edge than a straight bit. A straight bit really is not a good choice for a groove cutter.

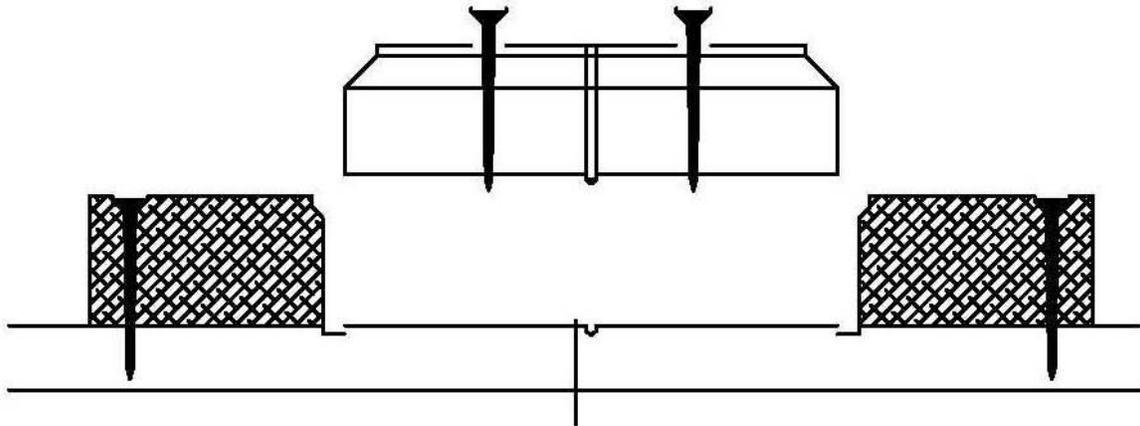




Optional 1st step is a straight plunge cut to give clearance to run the 45 degree. The 1.5 board & plugs to be cut are screwed to an MDF backer board to keep it steady when cutting parts free. The lesson learned was use 2 screws in the plugs rather than one as shown. Deep cuts are done in increments to reach final depth. All male plugs are cut at together with each router set up to save time as shown below

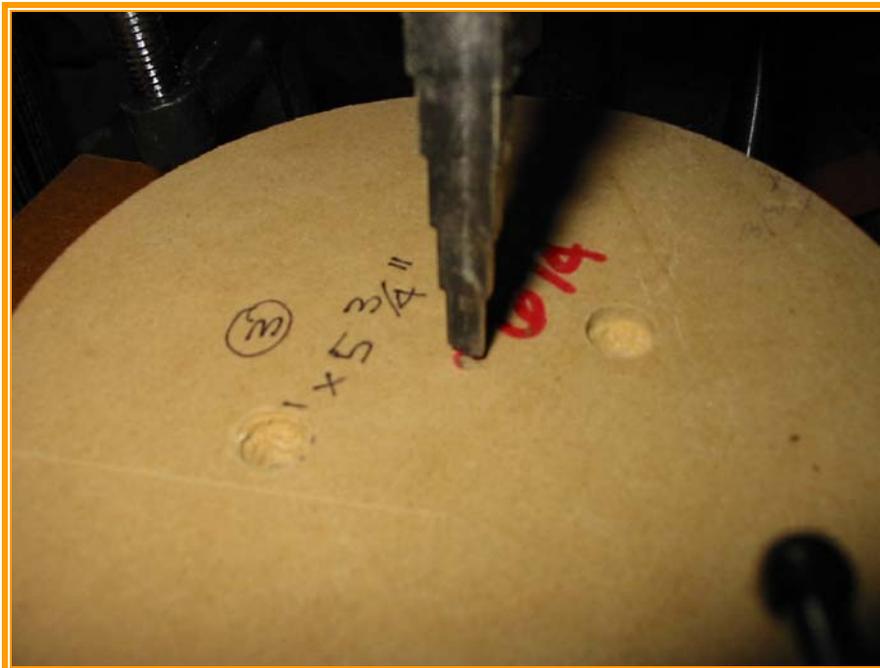


The last cut should be through the laminated piece into the backer board about a 1/32 to a 1/16 inch for the last cut. Do the final cut for all the plugs then remove the screws to free the plugs.



This should give you a nice set of plugs. Our cuts were tight so the 1/8" pin holes were drilled to so a piece of threaded rod could be installed. This allowed the plugs to be spun in the drill press with a bit of sandpaper to allow them to slide in the clamp plate. The ID's & OD's of parts were quite precise.

Using a step drill to enlarge router pin hole to accept 5/16" threaded rod to allow plug to be mounted in drill press for a quick sand. The plugs fit the plate holes too accurately and need to have some clearance added. Quick and simple to turn down plug with sandpaper in the drill press.



This is where the magic starts. Take the duplicate wing template or if you must your master. Fasten the clamp board to the template board with No.10 screws and with wing nuts. I used a router table but if you are not stack your boards accordingly. Make sure the heads of the screws are set in so that the piece will lay flat or the router will run over it without interference. Take a flush cut bit with a bearing and flush cut the clamp plate to template. Pull apart and cut adjacent to the spar line or rib end.

The following illustrations show how the parts stack up & where to mark the plugs. Second show the assembly with a rib ready to press..

