Notes on Wooden Mugs

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A wooden mug is a turned vessel, similar to other turned vessels like bowls. Turning bowls and making blanks are discussed in Chapters 42- 46 in *Notes and Reflections*. In my opinion, making staved mugs requires an intermediate to advanced skill level.

Usually, a mug has a handle, which makes it asymmetrical and adds the challenge of attaching it to the cylinder.

Construction alternatives for mugs are segments, staves, and hollowed out solid wood. A segmented cylinder may be the most attractive looking because the grain pattern can run around the mug. The possible disadvantage of flat segmented constructions, however, is that the end grain joints in a thin (e.g., ¼") wall may be weak.

A staved cylinder may be stronger. Tibbets uses staves, with laminated stock. Both flat segments and staves require a bottom to be fitted.

A mug made from a solid block has its own bottom, so glue failure and leakage are not problems. The interior can be bored out with a Forstner bit on the lathe, although this is tedious because of the friction between the large bit and the wall of the bored out cylinder.

Excellent instructions for staved and solid mugs come with the stainless steel inserts from Rockler. Also, Malcolm Tibbets has a typically complete and interesting article on the web.[a]

I would prefer to make mugs without an insert, but that raises the issue of waterproofing the inside. Max Clr Epoxy is advertised as "food safe," meaning that the ingredients are food safe when mixed according to directions. MaxClr does not appear to leave any residual odor after curing. I sealed my prototype with West System epoxy and it smelled faintly of hardener weeks later, but the smell disappeared after I sanded the inside.

If the smell had persisted I would have applied a coat of wipe on polyurethane (water based). An alternative approach to waterproofing the interior is to coat the inside of the mug with paraffin wax (canning wax).

A stainless steel insert, or even a heavy plastic cup, is an alternative to applied waterproofing. This approach is probably more acceptable if the mugs will be offered for sale. Also, with an insert, you can use PVA glue to assemble the mug and not worry about leaking, wood movement, etc.

You can make a mug of any size and proportion if it does not have to accept an insert. A pint is 28 cu in. A 3" ID by 6"H mug holds about 42 cu in. (1½ pts) Using an insert reduces design choices, however, because the turning must fit the insert.

A Staved Mug to Fit an Insert

Here are steps to summarize how I make staved wooden mugs that will accept a stainless steel insert (Rockler # 46371).

1. The mug should finish to about 2-15/16" *inside diameter*. Hollowing the cylinder is tedious and a bit difficult. (The heat created may soften the PVA glue joints so that the staves come apart or the bottom falls off.) It will require a wall width *at the lip* of 3/16" so

[a] www.tahoeturner.com/instructions/pdf/coffeemug.pdf

that's about 3⅛" OD finished at the lip of the cylinder. The mug will have to be fitted to the insert, however. The bottom of the profile does not have to fit into the insert, so it can be slightly wider if desired. The insert tapers to 2-3/16" OD at the bottom.

I feel that ¾" thick stock will allow enough room for shaping and fitting the mug to the insert. Half-inch stock is the bare minimum and makes a somewhat fragile mug. One-inch stock is too thick, so a laminated board should be made up from ¼"-⅜" layers.

Segments	12
Upper Outside Diameter	4-1/4"
Lower Outside Diameter	4-1/4"
Upper Inside Diameter	2-27/32"
Lower Inside Diameter	2-27/32"
Upper Wall Width	11/16"
Lower Wall Width	11/16"
Board Thickness	3/4"
Segment Edge Length	1-1/8"
Segment Length	7"

Table 1. Specifications for Mug With Liner, 3/4" Stock

Aim for an inside diameter of 2-⅞". Then about 1/32" can easily be removed from the top 2-2½" to fit the insert. With ¾" stock, an ID of about 2-⅞" corresponds to an OD of 4¼". With 12 segments, that will require a stave width of 1-⅛". (See Table 1.)[b]

2. Cut staves with a 15° angle and straight sides from a board measuring about 7" L by 15" W or equivalent narrower pieces. *Note that long grain is vertical in staves* . The board can be solid wood or a lamination (see below). You can use strips between staves to add character if desired, but the total width of each stave, including strips, should be as shown above (e.g., 1⅛") to get the necessary diameter.

I prefer to cut the short, narrow staves for mugs on a sliding compound miter saw, using a secondary table and hold-downs. (Figure 1) I set the angle with a shop-made template, just a plywood triangle.

3. Check the cut angles of the staves and glue them into half-cylinders. Correct the fit of the half-cylinders as necessary, and glue them together into a cylinder.

The staves for a mug blank can have parallel sides, so assembling and clamping is straightforward, very similar to the way the flat segmented rings are assembled. I use three adjustable screw-operated pipe clamps. (See Chapter 43 in *Notes & Reflections*).

4. Square and smooth the ends of the cylinder. A band saw is best, although you may need to smooth away the saw marks. Make sure that the resulting length of the cylinder is at least 6-1/8".

5. Mount the cylinder on the lathe at the end that will be the top. Use the step jaws on a scroll chuck inside the cylinder (leave at least one of the pipe clamps on to reinforce the cylinder)

6. Turn or bore a mortise inside the bottom of the cylinder. The mortise should be about 2 ⅞ - 3" in diameter and ¾" deep. The most accurate method is to bore it out with a 2 7/8" Forstner bit, or you could just smooth out the interior 12-sided surface into a circle. Leave at least one pipe clamp on at the end to hold the cylinder together.

7. To make the mug bottom, fix a square piece of stock of the desired size (e.g., 4½" square) to a waste block.

- If the waste block will be mounted in #3 jaws it should be 3-⅛ - 3-¼" in diameter. If it will be screwed to a

[b] The minimum OD with ¾" stock is 3¼, which requires a ⅞" stave width. This requires a lot of hollowing and leaves too little wall width for shaping.

faceplate it should be large enough for the faceplate and thick enough that the screws don't penetrate through its thickness.

- Find the center of the waste block and the stock piece. Drill a small hole (diameter of a stiff centering wire) through the centers.
- Draw a 4-½" or larger diameter circle on the stock piece, and saw the corners off.
- The quick way to mount the bottom on the waste block is to use cyanoacrylate glue. Put CA glue on the stock piece and accelerator on the waste block, line them up with the wire, and press them together until the glue sets. This mount sometimes fails while you are turning the blank, so consider using PVA glue and/or adding a #10 screw to the center of the mount (essentially a small screw chuck)

Let the cylinder cure overnight if you have not already done so.

8. Mount the waste block on a faceplate or in a scroll chuck. Turn a solid disk from the bottom stock with a diameter to fit snugly inside the mortise you made in step 6, e.g., 2 7/8". Drill a 7/16" diameter by 3/16" deep depression in the center. The idea is to have a tight seal of the round tenon in the mortise and the tenon shoulder against the bottom of the cylinder

9. Glue in the bottom of the cylinder and let it cure overnight. At this point you have a cylinder that is closed at one end, with a spigot on the bottom that is already on a faceplate or that you can mount in a scroll chuck.

10. Mount the cylinder on the lathe. Measure

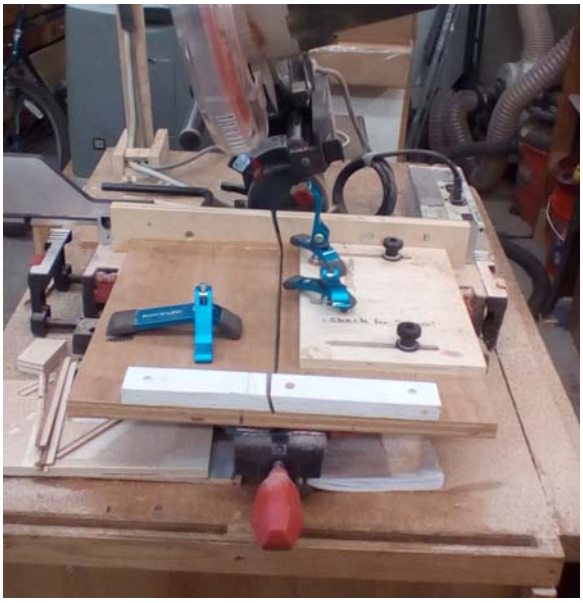

Figure 1. Setup for Cutting Staves on a SCMS

the depth inside the cylinder and trim it to about 5-⅝" (It can be deeper if desired.) Carefully bore out the inside of the cylinder from the top with a 2⅞" Forstner bit. (You may need to cut a groove for the Forstner bit with a parting tool to get it started because the cylinder has no center for the bit to bite into.)

You should need to bore only 3" or so from the top. Then carefully enlarge the ID of the cylinder with a scraper or chisel until the insert fits. The top 2-2½" of the cylinder should have a ID of 2-15/16". Note that the mug is meant to slide under the lip of the insert after you have turned the profile. Don't glue the insert yet

11. Remove the pipe clamps and turn the profile using a jam chuck and live center at the right end to support the cylinder. Turn the wall thickness at the top of the cylinder to fit under the lip of the insert (about 3/16" wall thickness at the rim of the mug). Keep in mind that you may want to fit a handle.

12. Part off the waste block and spigot from

the bottom of the mug. (Watch out for mounting screws!) Reverse the mount and smooth the bottom. Consider using a jam chuck at the left end and live center at the right to mount the cylinder by its top. If you mount it with a scroll chuck on the inside, replace at least one pipe clamp to support the wall of the cylinder.

13. Design and cut the handle. Long grain should run lengthwise along the handle.

14. There are three ways to attach the handle. (I prefer (a) and (b).

(a) Drill matching holes in the handle and the mug and attach the handle with dowels.

(b) Make a flat on the side of the mug to receive a squared off handle

(c) Shape the handle to fit the profile of the mug by sanding the handle joint on a cylinder of the correct diameter. It will fit best if you sand both ends of the handle at the same time (put sandpaper over the mug profile to sand the correct arc).

The dowel holes in the handle and the mug must be positioned very accurately and they must be parallel. I use a template (a thin piece of plywood with two holes drilled in it) to get matching holes. See Figure 2. (It might also be possible to drill holes in the ends of the handles and then use dowel centers to mark the position of the holes on the mug.)

Neither the mug nor the handle provide a good reference surface to ensure that the holes will be parallel. I use a drill press vise and a spirit level to make sure that the holes in the handle are perpendicular to the drill press table. Then I use a cradle to hold the mug in place for drilling. I can shim the cradle if necessary to make the holes in the

Figure 2. Mug, Handle, Cradle and Template

mug perpendicular to the drill press table.

15. If the ends of the handle fit well against the side of the mug, just glue the handle to the mug with PVA. If there are small gaps, use a wood putty made of PVA and sanding dust or epoxy cement to fill the gap.

16. Glue in the insert and finish the mug. Linseed oil followed by shellac and acrylic varnish is a good choice for the outside.

Laminated Staves

If the staves are made up from laminated boards, a wide variety of visually interesting effects can be achieved. (See the article by Tibbetts.)

One important tip from Tibbetts is to use a gluing fixture (Figure 3) so that the laminations line up well. As you apply glue and clamp the layers together, the laminations

may tend to slide around. When the uneven edges are trimmed, wood will be wasted. A gluing fixture may help to keep them lined up. It should be raised off the bench by enough to allow clamps to get under the fixture. Use waxed surfaces or waxed paper to keep the laminations from sticking to the fixture.

If the mug is to be an actual drinking mug (as contrasted to a vase), then it should be fairly light weight, with a maximum wall thickness of about ½". Three-quarter inch stock, as recommended above, suggests three ¼" layers or six ⅛" layers, or some combination of ¼" and ⅛" layers.

Efficiency in cutting is an additional consideration. Sometimes, you can get another stave from a stock board if you can flip it over, compared to the yield if every stave is cut from the same position. However, if the staves are to be uniform, they have to be symmetrical in cross-section. Therefore, they need to have an uneven number of layers, say, 3.

So, for example, consider making up laminations from 3 boards approximately ¼" thick. This implies staves 1⅛ " wide. With a ⅛" saw kerf, a 4" wide board would yield 3 staves. A board 28⅜" long will yield 4, 7" long staves. So the nominal board size for 12 staves is 4 x 28⅜.

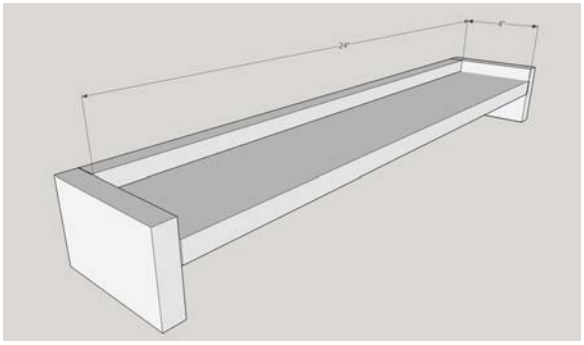

Figure 3. Lamination Gluing Fixture

Alternatively, if you don't want the boards to be symmetrical in cross-section, you can make two sets of matching blanks at one time.

References

Malcom Tibbetts. Java With Style *American Woodturner* Winter 2007

Instruction sheets for Rockler 46371 Stainless Steel Insert

Table 2 Segment Width for Various Stock Thickness

Stock Thickness	O.D.	Segment Width for ID~2 15/16"
½"	3 ¾"	1"
⅝"	4"	1 1/16"
¾"	4 ¼"	1 ⅛"
1"	4 ½	1 7/32