

24" High Three Legged Stool

Introduction:

My large stools are designed in a similar fashion as my mini stools or 17" high stools. If you have time, do a quick read through of the Mini Stool handout as there may be some tips or tricks that I have not covered in this handout. The seat of the stool is the most visible part of the stool; therefore using a figured wood will enhance the overall appeal of the finished stool. I prefer to make the seats from figured maple and the legs from a contrasting wood. The seat is indented in the top, similar to the shape of a healthy red blood cell; this makes a more comfortable seat. The 24" stools and taller require cross bracing to prevent the legs from spreading out and breaking. I like to angle the back cross brace down to the foot brace. This is a design technique, which I first saw on David Scott's stools and have since adapted to my own stools. In general I turn my seats approximately 12" to 14.5" in diameter for 24" and higher stools and 10.75" to 12" diameter for 17" high stools. It all depends upon the availability of wood for the seats and the customer's preference. I also adjust the splay of the legs on the 27" stools to insure that they do not extend too far beyond the seat footprint, as this could create a tripping hazard. The straighter the grain is in the legs, the easier they are to turn and the stronger they will be. When working on the design for the legs, keep in mind that simple flowing lines are easier to turn and are visually less distracting from the overall look of the stool than a design loaded with beads and coves. Once you have sketched a design for the legs, it is a good idea to turn a sample leg out of scrap wood. Sometimes seeing a design in 3-D will inspire changes that will enhance the overall design of the finished piece. Now let's select the wood and turn a beautiful and comfortable heirloom stool.



Finished Stool Seat



Stool Seat with Legs and Leg Braces

Materials:

Figured wood seat (I prefer figured maple) 12" to 15"

Wood for legs & braces (contrasting color wood such as Walnut or Padauk) 2" x 2" x 25"

Wood for braces 2" x 2" x cut to fit (*legs must be in tension and compression, therefore the size of the braces are dictated by the height of the stool and the final splay of the legs and are cut to fit each individual stool*) approximately 13" long for back brace and 17" long for foot brace

Spacer disk for screw chuck (made from 1/4" thick Masonite approximately 4" to 6" in diameter)

Tools:

1 1/4" Spindle Roughing Gouge
5/8" Bowl Gouge with a side grind
5/8" Bowl Gouge with traditional grind
3/8" Spindle Gouge
1/4" Parting Tool
5/8" Spur drill bit
1" Spur Drive Drill bit
3/8" Screw Center
Strong Hold Chuck
7/8" Steb Center
1/2" Steb Center
Bearing Center with Cone Center



Photos of some of the tools that I use



The chuck, drill bits, Steb center, screw & bearing center



Adjustable drill press table for drilling holes in the seat

Turning the Stool:

Note: The steps for turning full size stools are the same as in turning the miniature stool with the exception of the added cross braces. The 17" and smaller stools do not need cross bracing. The 24" high and taller stools require cross bracing to prevent the legs from splaying out and breaking.

1. I always turn my seat first and drill the holes in it for the legs. I can then turn the tenons for each leg to fit in its matching leg hole to insure a good fit. Some drill presses and drill bits tend to wander and wallow out the hole thus requiring a slightly larger tenon.

2. Before I cut my seat blank from my chosen board I like to run what will be the back side or bottom of the seat through my planer to flatten the bottom and give it a nice finished surface. If it is too large for the planer I use a belt sander or a hand plane to flatten the surface of the bottom or back side. When turning the seat I try not to turn more than necessary on the back side of the seat. I turn just enough of the back side so that the curve on the outer edge of the seat blends in smoothly to the bottom of the seat.

3. Once the bottom is flattened I then cut the blank to size (for example a 12" x 12" square) and mark the center on the bottom or back side with a straight edge going from corner to corner.

4. Next using a large compass or a bar compass I draw out a circle.

5. With the aid of my drill press I drill a hole for the chucks screw about 1/2" deep. (use the proper size drill bit to fit your chucks screw) *I like to use the screw made by Oneway, so I use a 13/32 drill bit to drill a pilot hole for the Oneway screw.* I like to use a spacer (stabilizer) between the chuck and my blank so that I do not have to drill a deep hole and to provide more support for the blank to help minimize the vibration.

Note: For the spacer I use a piece of scrap 1/4" Masonite or 1/4" plywood disc with a 1/2" hole drilled in the middle which I sometimes put a slight chamfer on with a chamfer drill bit. The slight chamfer helps to prevent the bits of wood that sometimes twist out of the screw hole from pushing the blank off the disk and causing it to wobble.

6. Once mounted on the lathe, begin turning the top of the seat. Start by truing up the outside of the seat and roughing in the outside curve on the edge of the seat. Once that is roughed in I begin to dish out the seat in the shape of a red blood cell or life savor.

7. Next blend the outside edge curve to the seat curve creating an appealing shape.

8. Once I am happy with the feel and look of the seat I sand it. I start with 100 grit sand paper and sand all the way to 1500 grit wet dry paper and then buff it with a Grey Scotch Brite pad followed by the Gold Scotch Brite pad.

Note: I do not sand the back of the seat at this time because I still need to lay out and mark for the leg holes. I have also discovered that it is easier to use a belt sander and or hand held orbital sanders to sand the back after the leg holes have been drilled.

9. To mark the seat bottom for the leg holes I first determine how far from the edge of the seat that I want the legs to be placed. On my 24" and above stools I like the legs set in about 1 3/4" from the outside edge of the seat. I have made a gauge that has notches cut in it for the various set backs that I like to use on my stools.

Note: I use a button that is similar to the buttons that I glue into the hole to cover it, but instead of having a raised knob it is concave with a dimple in the center to aid in setting the compass point for marking the circle for the positioning of the leg holes.

10. Using my set back gauge I mark the spot for the first leg hole, which is 1 3/4" in from the outer edge of the stool seat. I usually place this first hole in the center of the face grain (end grain area of seat if viewed from the edge) of the seat on what I consider to be the back face of the seat.

11. Next set the compass to draw a circle from the center of the seat to this mark and around the seat. Using the radius of the circle just drawn, set the point of the compass in the mark for the first hole and draw an arc where it crosses the circumference of the circle and continue drawing arcs from arc to arc around the circumference of the circle (the result should be six arcs on the circle). Starting back at the first mark repeat marking arcs going in the opposite direction from the first set of marks the arcs should cross at exactly the same point but if they don't, not to worry, just split the difference between the marks. Next skipping every other cross mark from the first leg hole mark the spot for the other two legs. Using a scratch awl or some other pointed marking device make a dimple for the tip of the drill bit to bite into at each leg hole. There should be three evenly spaced marks for the leg holes.

12. Next use a straight edge to draw sight lines on the seat bottom connecting the center point of the leg hole to the center of the two arcs directly opposite the leg hole. (These lines are used as sight lines to help line up the drilling of the holes and to keep the same splay angle on the legs).

13. Next it is off to the drill press to drill the holes for the legs. The holes in the seat are 1" in diameter and 1" plus deep to accept the 1" tenon on the legs. The angle of the leg hole varies between 10 degrees and a hair shy of 15 degrees depending upon the height of the stool. For stools 24" and above I drill the mortise at 10 to 12 degrees, for stools 17" and smaller I drill the mortise at 15 degrees.



Photos of how I lay out and space the holes for the legs, using the radius of the circle to divide the circle with six arcs and then skipping every other arc mark them for drilling the leg holes

14. I set my homemade adjustable table top on the drill press so that I can drill the proper hole angle, in this case it is 11 or 12 Degrees. At this time I also use a scrap piece of 1/4" Masonite as a spacer to set the drill press stop so that I cannot drill through the top of my seat.

15. Once everything is set I drill the holes for the legs.

Note: I prefer not to have the tenons on my legs go through the seat as I think that they would visually break up the figure and detract from the clean look of the seat top. The strongest way to attach the legs to the seat is by using a tapered mortise and tenon through joint and have the legs wedged into the seat similar to the wedges used in axe handles. The mortise and tenon would have a 6 degree taper for the best results. For more on this method of tapered leg joints see Peter Galbert's article in the AAW Woodturning Journal Spring 2009 Vol. 24, No. 1 titled "Tapered Mortise and Tenon"

16. I then finish sanding the seat and finish the seat with one coat of Zinssers' Bulls Eye Shellac Sanding Sealer Finish, followed by several coats of lacquer, shellac or polyurethane.

17. Now it is time to turn the legs. I like to use a contrasting wood for the legs 2" x 2" x 25" for a 24" high stool.

18. Find the center of the leg blanks and mount them on the lathe between centers. Next use a story stick to mark the legs and then turn the legs. I generally turn all my legs and then sand them all as I fit the tenons to each individual leg hole and mark the legs to the corresponding mortise. I like to use a numbering system if turning multiple stools, for instance, leg A1 goes in hole A1, etc.

19. Before drilling the holes in the legs, I dry fit the legs into the seat.

20. With the legs in the seat, mark the angles for drilling the mortises in the legs and measure for the size of the cross braces.



Photos showing how I mark the angles for the cross braces

21. The size of the seat, the splay of the legs and the finished thickness of the legs will determine the length of the cross braces. The length of the braces will vary a bit from stool to stool so I do not cut them to length until after I dry fit the legs. Dry fit the legs in the seat and then push the legs apart firmly

to put them in tension and compression then measure the length of the stretchers remembering to add in the depth of the mortises which in this case is 5/8" plus 5/8" or 1 1/4". Now it is time to cut the stretchers to length.

22. I use a straight edge and some clamps to line up the holes and measure for the braces. At this time, I also mark the angle on the leg for drilling the mortise with a watercolor pencil. (I find that a white watercolor pencil shows up better on dark woods and is easily removed with a bit of moisture.)

23. The holes on the two front legs as measured down from the top of the tenon are roughly 16" to 17" down from the top of the tenon.

24. The location for the mortise in the back leg is approximately 12" to 12.5" down from the top of the tenon depending upon the design of the legs.

25. After marking the legs I drill a 5/8" diameter hole 5/8" plus deep in them to accept the 5/8" tenon on the braces. I like to use Oneway's "Drillwizard" that mounts in the banjo on the lathe and holds a hand drill for boring holes in objects mounted on the lathe. It is best when designing your legs to take the positioning of the leg braces into consideration and insure that the area for the mortise is thick enough, thus avoiding any problems with drilling the holes for the tenons.



*Tommy Boyd's jig for drilling mortises
on a tilting head drill press*

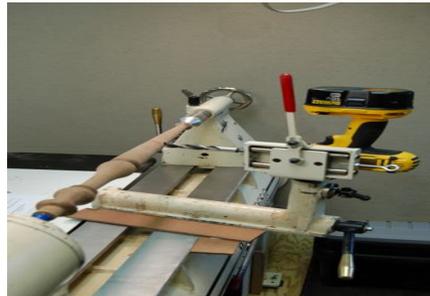


Side view of Tommy's jig

Note: I now use the Oneway "Drillwizard" assembly to mount a hand drill on my lathe to drill the angled holes in the legs, as it is much easier to hold the legs in place when drilling the holes.



The old jig in use on the drill press



*The Oneway "Drillwizard" in action
with leg hole angle jig for easy set up*

Note: In a Windsor Chair Class at the John C. Campbell Folk School in Brasstown, NC that I recently attended, I learned a simple method for drilling the holes in the legs for the stretchers. In that

class we used a 5/8" spade bit attached to a spade drill bit extender and lined it up level with the marks for the leg mortises and aimed it from one mark to the dimple where the hole will be drilled and drilled the mortise. This method takes two people as someone needs to hold the stool steady and help keep an eye on the angle of the extended drill bit as you are drilling. No need to measure angles or use elaborate techniques or jigs just aim and drill.



Drill with Drill bit & Extension



Using hand drill with spade bit to drill leg mortises

26. After cutting the braces to length, I turn them and test fit the tenons into the appropriate leg mortise.

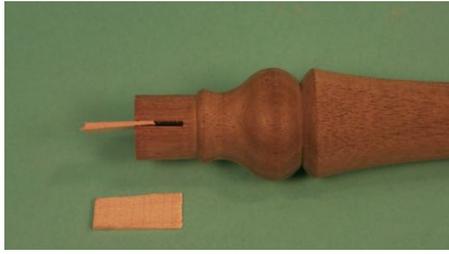
Note: When fitting the tenons they should not be too tight or too loose; a good fit is when the tenon slides into the mortise with just a little bit of force; if you have to work to get the tenons to go into the mortise they are too tight, if they slide in very easily and wobble around they are too loose and will need a wedge in the end of the tenon to spread it apart inside the mortise.

27. I am now ready to sand and apply finish to the legs and braces.

28. I use masking tape to cover up the tenons to prevent the finish from interfering with the glue bond.

29. If all the tenons fit snugly into the mortises, I then proceed to glue up the stool.

30. If some are loose, I take the offending tenon to the band saw and cut a groove to accept a wedge on the face grain side of the tenon to just shy of where the tenon meets the turning. When it is glued up the wedge and groove will not be seen. The wedge should be trimmed smaller than the width of the end grain portion of the tenon and shorter than the length of the tenon and thick enough to spread the tenon out in the hole to lock the leg in place.



Loose leg tenon with wedge for a tighter fitting joint

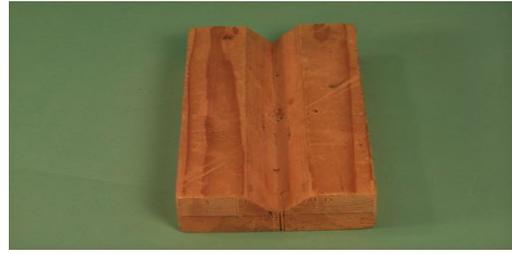


Photo of V Jig for cutting cylinders on the Band Saw & for cutting the slot in the leg for the wedge

31. I use either a rubber mallet or a wooden maul to drive the legs into the mortises. The legs must be driven in evenly, a little bit at a time so as not to wedge them in and not be able to get all legs to bottom out in the mortice.

32. Now turn a button with a 3/8" tenon to stick in the hole in the bottom of the seat to cover up the screw chuck hole.

33. Stand back and admire your finished stool. Give it a test run, well okay a test rest as you deserve to get off you feet for a break.



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