

Bowl from a board – Revision II By: Edward G. Robinson all rights reserved.
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This is documentation of my jigs and methods for creating a bowl from a board (BFAB). I will place emphasis on creating a more rounded form rather than the traditional straight sided funnel like forms that are common when using this process. There are two elements that help achieve a more rounded form. The first is increasing the thickness of the blank especially on larger bowls. Three to five layers to attain the desired bowl height is optimal. I generally attempt to use four layers (rings including the base) to achieve my desired bowl height but five can also be managed as well. So when you have determined the bowl height divide it by 4 or 5 to determine the optimal finished blank thickness (add machining allowance). The second element is careful plotting of the ring cutting angles. Some diagrams below illustrate my approach to achieving optimal cutting angles.

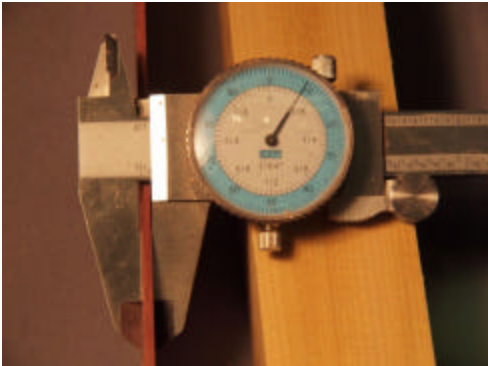
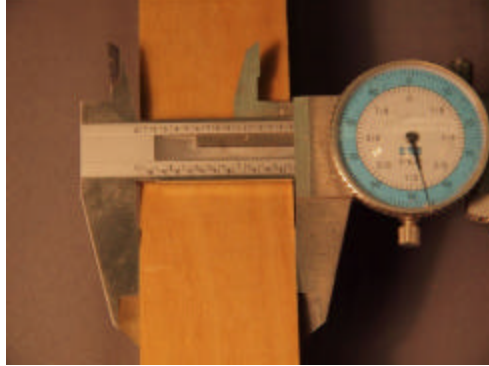
This documentation also illustrates how to construct a bowl blank to achieve a segmented bowl as illustrated in the first picture below. However the BFAB blank can be anything from a raw board to a complex glue up as illustrated below. No matter how the blank is prepared the bowl is cut, stacked and glued up in the same way. The configuration below was inspired by Michael Mode and a bowl you can see on his web site (www.michaelmode.com). His form is what I have attempted to change to a more traditional bowl shape. After several experiments it became clear I needed to develop new jigs and techniques in order to attain the accuracy required to get consistently good results.



This configuration requires a high degree of accuracy in assembling the blank, cutting the rings and assembling the ring stack. The registration of the lines between each layer must be dead on or the flaw will jump out at you and spoil the impact of the design. My two wedge variation illustrated below is an attempt to reduce the number of intersections that require this exact registration. This will become clear once you machine your first one and review the uninterrupted line registrations that remain. Layer orientation in this document refers to aligning the grain and/or overall pattern to its original configuration. Changing the orientation will always interrupt the grain pattern but is sometimes done on purpose. Registration refers to alignment of continuous lines in the pattern between each layer so that no misalignment occurs at the joints. It is possible to rotate the orientation 180 degrees and still maintain registration as Michael Mode has done with some of his bowls.

The following illustrates the construction of a 13 inch bowl similar to the first picture above. In this example I am using Yellowheart, Purpleheart, and Blood Wood wedges. What ever size you are attempting to make, try to use an odd number of rectangular pieces so that a thin separator does not end up in the center. Somehow it seems to look

better to me that way. The trick is to find the right combination of thin and thick pieces that add up to exactly the width of your bowl. This may take some trial and error if you are not great at fractional math. In this case you can see the separators are just under 1/8 inch wide and the width of each rectangle is just under 1/2 inch. The thickness of both is about 1 1/2 inches. You should make sure the combined total width is not greater than the length so a circle can be cut without losing any width. You can see my blank is 13 3/8 wide by 13 1/2 long. I glued and clamped the entire group in one clamping, then machined it flat (drum sander in my case) before proceeding to the second stage.





Now that the blank is glued together it is time to add the wedges to both ends and opposite sides of the blank (one at a time). The following illustrates the jig I use to set the correct angle while using the jointer to create the flat angled glue joint needed. The aluminum angle is mounted with slotted bolt holes to allow some adjustment. This along with fence adjustment should accomplish the correct finish angle. I prepare a wooden template for each bowl that is used to set the position of the fence and the aluminum angle. It takes several passes (keeping the end tightly against the fence) to get to the desired cut width but you end up with a flat and square taper. The contrasting wedge must also be flat and smooth so a good glue joint can be achieved. If you prepare a flat wedge blank and cut the angle on the band saw you can use the outside flat as the glue joint or joint the sawed side with a plane or jointer. Usually I can get both wedges out of one piece of material. Depending on your jointer you may have to remove the blade guard as I did, so be sure to use push blocks and proceed with care.





Any tear out on the trailing edge is cut off when roughing out the circle on the band saw. The wedge should be oversized and at least 1/8 thick at the thin edge. An edge too thin can wrinkle with the moisture in the glue and leave a ragged edge when resurfaced. Note the grain orientation of the wedge. It should be the same direction as the blank to avoid cross grain glue joints.



Tape the prepared wedge in position so that it won't creep while clamping. When putting wedges on opposite sides, you should taper one side of the blank and glue one wedge at a time. You must retain one surface undisturbed until you have resurfaced newly wedged the blank. After the first glue up has dried resurface before adding the second wedge. After the second wedge is done resurface that side, then draw a circle the size of the bowl and rough cut it out on the band saw. It is now ready to mount on the faceplate. It is very important to get the center of the circle exactly centered to the width of the blank. Center punch this spot for use while mounting the blank to the face plate.

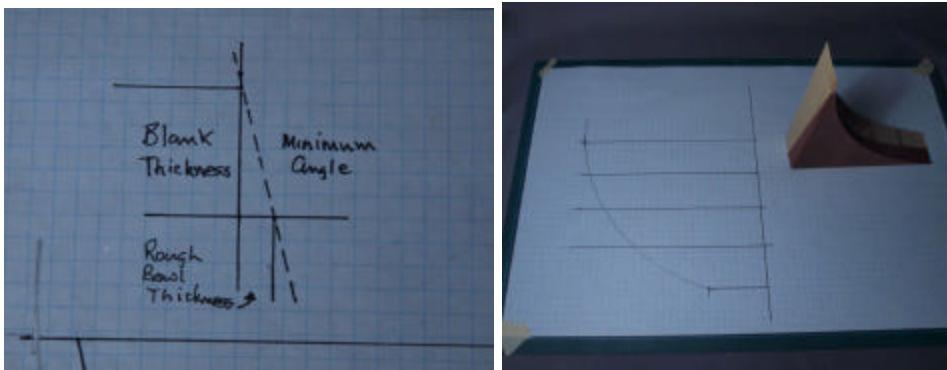


I use thick (gap filling) CA glue and quick set to mount the blank to a 3 inch face plate with a 3 1/2 inch hard maple mounting block. It can be easily removed after the bowl is complete using a chisel and hammer while still mounted on the spindle. The block has a 1/2 inch flat outer rim that accepts the CA glue. The inner section is recessed about 1/8 of an inch for clearance. Put a generous coat of glue on the face block outer rim, spray the quick set generously on the center 4 inches of the blank, and use the center mark and the tail stock with a live center to push the blank firmly against the face block and wait until set. This should result in a true running centered mount. Face off both sides if the blank is not running completely true and square off the outer rim.

You now have the finished blank dimensions needed for the next step.

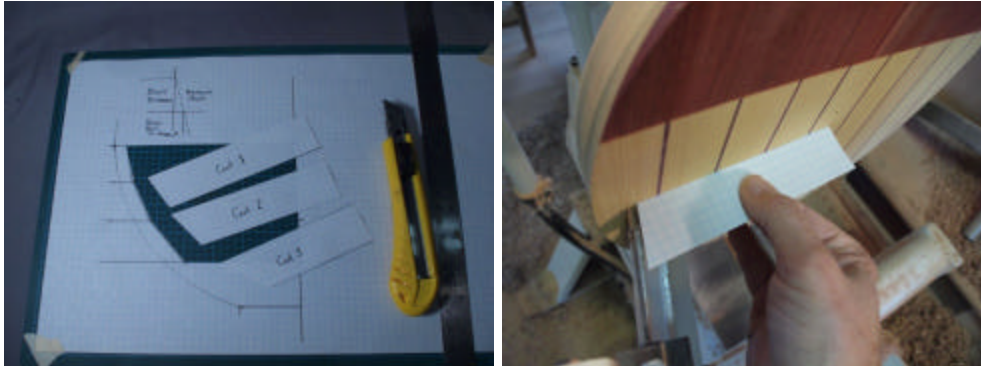


Now it is time to calculate the angles to cut the rings out of the final blank you have mounted. First using the finished dimensions of your blank and your rough bowl wall thickness (1/4 to 3/8 inch is typical) calculate the minimum cutting angle. The diagram below illustrates how to do this. The first ring (because it is the most vertical) is often the only angle that needs to use this minimum. The remainder of the cut angles are usually well beyond the minimum. Then lay out the bowl and layers reflecting your blank thickness and diameter as in the diagram below. Leave a flat spot that will be your bowl bottom and add the layers from there (4 in this example).



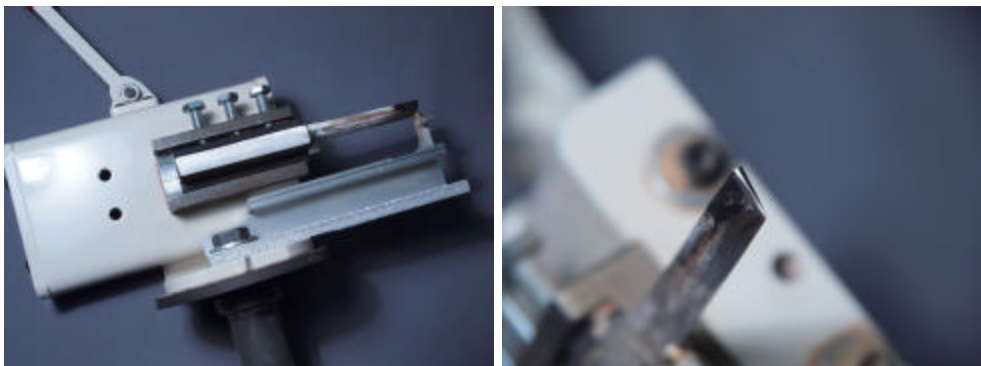
Next I draw lines using a 3/8 thick wooden rule to follow the curve as shown below. Use the points where the circle intersects each horizontal layer line as your guide. Of course the first angle must be no less than the minimum. I have not added any space for the kerf of the cutter. That is handled later. I then label and cut out the resulting templates to be

used as a guide for the ring cutter. The bottom section is never needed so 3 templates are all that are needed in this example.



My ring cutter is made by modifying the Oneway Drill Wizard to hold a 3/32 metal machine parting bit ground down as shown below (details on the last page). The tip support is an important enhancement that significantly stabilizes the bit throughout the cutting, but especially at the beginning. I made it out of a piece of aluminum extrusion I had in my junk pile. It is possible however a piece of hard wood could be used instead. A brass slotted screw using the slot, serves as the pivot point and guide. I had a machinist make the block (with the hex head bolts) that retains the bit and bit holder and replaced the Drill wizard's drill mount mechanism with this bit holder. See the link for a source and description of this unit. http://www.oneway.ca/workshop/drill_wizard.htm

A 3/32 machinists parting tool is ground for clearance and mounted on the Drill wizard using one of the parting tool holders shown. The second one requires the mounting bracket shown in the picture below (with hex head bolts) but is easy to mount.



It is also important to grind the bit so that it is shaped on the side to follow the curve of the smallest circle to be cut. Serious burning, vibration and bit breakage can occur if the bit is not properly ground on the side and the tip. See tool detail on last page.



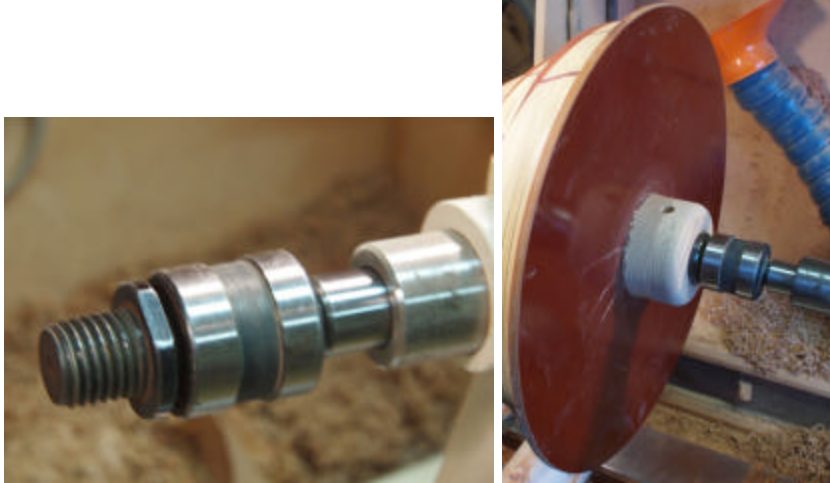
You can see the cutter in action and the final result is clean and burn free. The sound of the cut changes significantly as it nears breakthrough on the back side. This is your clue to slow down the rotation and prepare to shut off the machine as soon as the ring breaks free. Do not have any protrusions on the inside (spindle side) that can grab the ring and cause it to break or cause damage. Remove or cover any protrusions that may be a hazard. You will have to remove the blank from the spindle to get the ring off and you will need to sand any splinters off before glue up.

I measure the inside diameter of the bottom of each ring as I remove it and compass a circle of this diameter on to the remaining blank (using the center already there) before putting it back on the lathe (i.e. kerf compensation). This gives me a reference point to start cutting the next ring. I leave about 1/8 inch material inside this circle when determining the next starting point and adjust the angle for the next ring. I do this because the paper templates do not exactly represent the right distance from center unless you take time to compensate for the cutter kerf in your angle diagram (which I generally don't bother with).

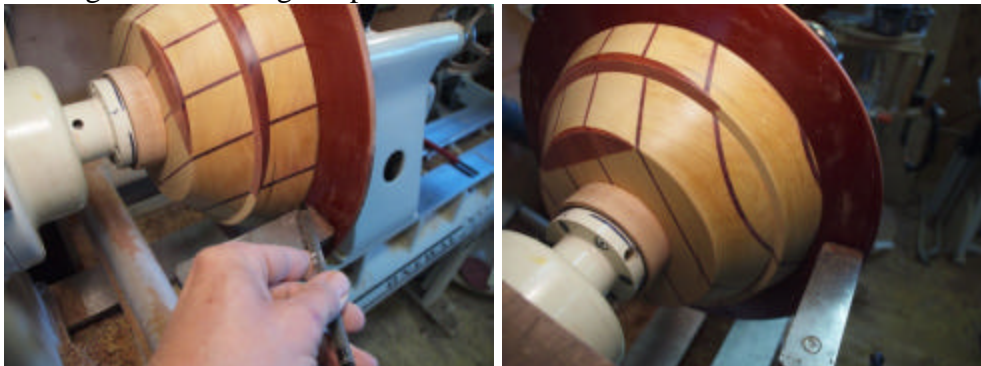
The drill wizard provides 2 1/4 inches of bit movement and has a long handle which makes it very easy to control the feed and withdrawal of the bit so it is easy to keep the chips from building up. The last cut is the deepest and at the greatest angle so it will be the biggest challenge to your tooling. Don't let the chips jam up the cutting path or you risk breaking the tool bit. As soon as the chips stop coming out it is time to withdraw the bit and start again. When all the rings are cut you are now ready to clean up the edges, stack and glue the rings. Now is the time to check to ensure the rings have not distorted due to wood stresses and flatten again if necessary. It is difficult to get good glue joints if a ring has distorted due to common wood stresses while cutting the rings.

To assemble the rings I use the tail stock and a disk press with a live center adaptor. This allows me to push the ring on to the bowl base, center it up, clamp and glue it exactly on center and in registration. My next generation will be 3/8 to 1/2 inch thick clear plastic

disk so I can see the inside as well. I discovered a ¼ inch thick clear plastic disk is not strong enough to give the required glue joint pressure for circles greater than 10 inches.



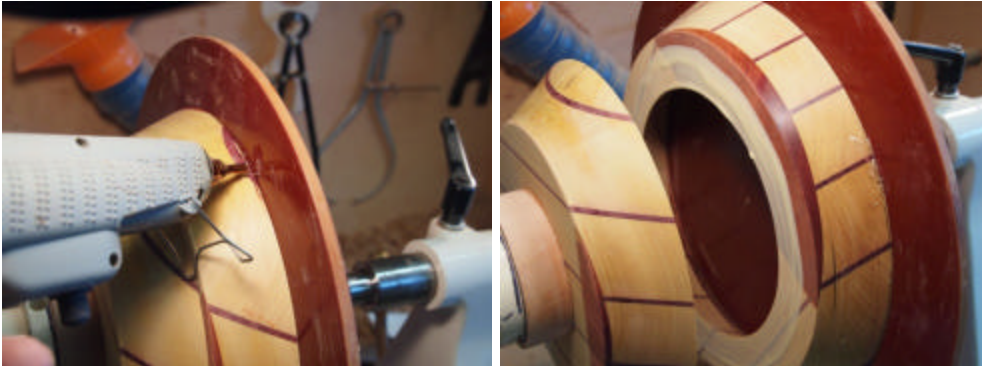
After putting the first ring in place, set the correct orientation, registration, and lightly tighten the hand wheel as you hand center it. Then run the lathe slowly as you use a pencil to mark the high spot. Stop the lathe and tap it down and redo the above centering until it is running true and aligned. Sometimes wood movement does not allow a perfect center but get it as close as possible. Good registration is only possible if each layer is running true to its original position.



When it is centered, orientated and in registration, hot glue the ring to the press plate and wait until set. Mark a registration pencil line across an intersection of the two pieces to be joined so you can get it back to exactly the alignment position you currently have. You can now slide the tail stock back and apply glue the adjoining surface as needed. After the glue is in place push the tail stock back to the original position, align the pencil lines and clamp it tight with the tail stock wheel. It should now be perfectly aligned again and give you good clean glue joints as well. Don't overdo it, the disk has a limited tolerance for pressure but can withstand enough pressure to ensure a good glue joint. When the wood glue is set cut the hot glue free and remove and clean up the clamping disk. You are now ready for the next ring.

Note: When doing this type of blank its structure makes the ring stacking orientation obvious. If you are doing a one piece blank however be sure to draw a reference line on

the front and back faces from the center to the one outside edge and use these lines to keep the grain orientation lined up to it's original state as you add each ring.

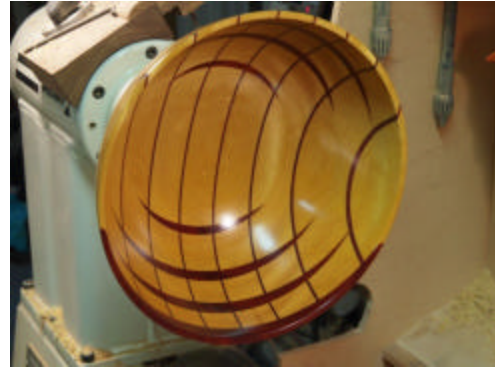
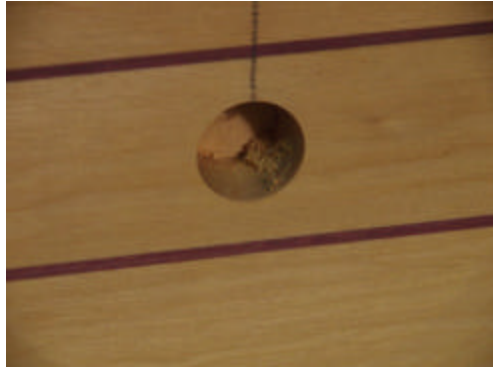


Do each layer the same way until done. Depending on the glue used allow each layer to dry about 1/2 hour and then all layers clamped over night before machining.



After all layers are dried you can now machine the outside to the desired shape. In order to illustrate how the rounded profile is possible, I cut out the outer circle from the ring angle graph and placed it on the bowl's outer profile. As you can see it is reasonably close to the circle I drew on the angle diagram. Cut the minimum amount of wood off the outside (just down to a clean glue joint) while attaining your profile, the desired wall thickness can be adjusted as you do the inside. If you want a rounded shape with no rim flair, be sure to allow a little extra rim thickness (about 5/8 inch) from the outer edge before cutting the first ring. If you want to flair out the rim then you do not need much more than 3/8 to 1/2 inch from the edge to start the first cut.

Now that the outside is roughed out you can start the inside machining. I start with drilling a hole as deep as I expect the bottom to be and then make sure I do not machine any deeper than the hole. It is easy to calculate the depth of the hole at this point so that the appropriate thickness is left for the bottom. This hole also helps as a reference when shaping the bottom to a nice transition to the sides.



The final results are shown below.

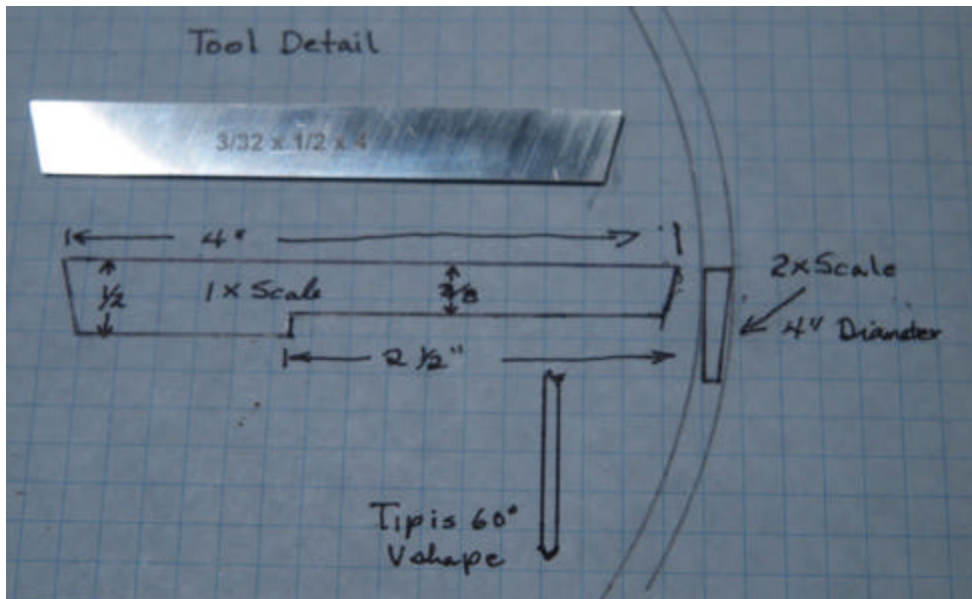




You might have noticed that I have kept the grain pattern as close as possible to the original by numbering the pieces as I cut them off the original board and assembling them back in the same order. This bowl was wider than the board so a few extra carefully selected pieces had to be added to the outside. The bottom of the bowl still retains the original grain pattern however.



Tool detail: The tool bit starts with a $\frac{3}{32}$ by $\frac{1}{2}$ by 4 inch metal parting tool. It is ground down to $\frac{3}{8}$ inch back from the tip to $2\frac{1}{2}$ inches in length. Note the profile shown in the 2 times scale circle diagram for clarity. It illustrates that the tool should be ground on the outside to a narrower bottom to provide clearance when cutting as small as a 4 inch diameter circle. It is also possible to tilt the tool slightly to assist in providing additional clearance. Also note that the tip is ground to a 60 degree V which seems to work best for starting a cut at an angle. Proceed with the cut very slowly until the bit has made a clean start (tip angle is no longer visible). The top should remain flat with no rake which helps reduce grabbing but still allows the chips to clear. This also allows for sharpening without loosing the proper profile (sharpen the end not the top). Cutting (height) on center seems to work best for me. Adjust the speed of the lathe rotation and feed to get the best chip clearance for each different wood species. I have cut many hard and soft woods with this tool without any problems. Be prepared to hold back on the tool feed handle should there be a tendency to grab. It takes very light feed pressure to get it to cut nicely and allow the chips to clear. Do not try to use this tool bit free hand. It needs good steady and accurate support as provided by the drill wizard.



I included my e-mail address not only for questions, but also so pictures of completed projects can be forwarded to me. I love to see the variations that often arise from the wonderful minds of others.

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