NESTED BIG BOWLS ON A SMALL LATHE

by David Lutrick

Introduction

(The text below is from a paper in 2008. I now have a new, larger lathe and no longer have to use this method for coring big bowls. I do use these techniques for balancing blanks and reducing their weight. DJL Feb. 2020)

My vintage Delta "Homecraft" lathe has a limit slightly less than 12 inch diameter over the bed. In order to turn larger bowls and platters, I have modified the lathe stand to allow out-board turning of bowls and vessels up to 22 inches in diameter. This lathe has a fixed headstock with an outboard, left-hand threaded spindle. In this article, I will describe the modifications and the evolution of techniques that allow these larger bowls and platters to be safely turned on a lathe typical of what many turners use. With these techniques and a "McNaughton" set of coring tools, I can now make as many as three bowl blanks exceeding the 12 inch over-bed capacity from a single raw blank. The center portion of the raw blank yields another three blanks under 12 inches.

In addition to the desire to turn some big pieces of wood, to utilize these techniques a turner needs a lathe that can mount blanks outboard, a bandsaw, a coring system that can be used off the lathe bed, a large outboard faceplate, and mounting screws.

Lathe and Stand Modifications

My first modification of the lathe stand for turning large outboard blanks was to bolt 4x4 inch wooden extension pieces to the front and back. These extension pieces are approximately three feet long and extend outboard past the headstock by 18 inches. A cross member that slides between the extension pieces is bolted into a slot cut through the extension pieces. The purpose of these extensions and cross member is to provide support for the tool rest while outboard turning. The extensions effectively limit the maximum diameter when outboard turning to 22 inches. The width of the lathe stand platform is 13 inches. A wider platform will increase the maximum turning diameter. The 22 inch limit not proven to be much of a limitation, as other considerations, such as the weight of a blank of that diameter, have tended to control the size of a project I will attempt. The size and quality of your band saw also plays a part in what size project will be possible.

The next modification to the lathe stand was to bolt a one-half inch thick steel plate between the lathe stand platform and the lathe's cast iron bed. The plate supports and adds rigidity for the coring tool support. The tool rest banjo clamp mechanism engages the edge of the plate. In use, the banjo is placed upon the top of the plate with the tool support at the proper distance from the centerline. An extension shaft added to the bottom of the tool support shaft is necessary to compensate for the height difference between the top of the plate and the lathe ways. The shaft extension brings the tool support to the correct cutting height. The four-inch long extension is a one-inch diameter shaft with a treaded rod screwed in the end. The tool support shaft was drilled and tapped for the threaded rod. A large parallel jaw wood clamp helps to secure the tool rest banjo with the tool support to the plate. See Figure 1. Note that not all coring systems can be used off the lathe bed as described here.

Vibration Control

As anyone who has turned a large, out-of-balance turning blank on a medium sized lathe quickly discovers, teeth-rattling vibrations will occur. I combat the vibrations in a number of ways. The lathe has a belt drive with a jack shaft and pulley diameters that achieve rotation speeds as low as 250 rpm. Several bags of gravel on a lower shelf of the lathe stand help dampen vibrations. The most important technique I have learned to apply to avoid excessive vibration is to trim the blank to as symmetrical a shape as is possible before starting the lathe.

Making Symmetrical Blanks

Any time spent making symmetrical blanks pays off, once the raw blank is mounted on the lathe and turning commences. Out-of-balance blanks can vibrate enough to loosen mounting screws, compounding the vibrations, and creating a possible safety hazard should the screws come completely out of the wood.

To begin, I chain saw raw logs into pieces light enough manage by hand. These pieces are typically about 24 inches on a side, and from six to ten inches thick. The band saw cutting depth limits the thickness. The pith side of the chain-sawn blank is trimmed as flat as possible. The objective is to get a flat surface suitable for mounting a faceplate after the edges of the blank are trimmed to a symmetrical shape. With wet wood, such a chain-sawn blank will weigh about 60 to100 pounds. Additional trimming on the band saw is necessary. If the blank contains a portion of the natural edge of the log or is otherwise irregular, simply cutting a circular disk with the band saw will not necessarily produce a blank that is balanced enough to be usable. It is necessary to trim the blank so that it resembles the geometric shape known a “frustum of a cone.” That is a shape with the pointy end of a cone trimmed off in a plane parallel to the plane of the cone’s base

These same procedures can be used to shape a cylindrical disc blank, should the turner want to reduce the weight of the blank or the amount of rough turning necessary.

Band saw tables tilt so that a thick blank cannot be cut into the desired shape on the inside of the blade – as the blank will hit the band saw frame. If you try to trim the blank on a tilted table outside of the blade, you may have to have a second flat face. Even with a second flat face, portions of an irregularly shaped rough blank may not be supported well enough to allow a safe cut to be made. Managing 60 pounds on a tilted table is not a simple task!

Pivot Jig

I use a hinged pivot jig to work around these problems. The jig is used on the outside of the band saw blade with the table horizontal. The saw frame cannot interfere. The largest face of the raw blank is face down on the jig, providing stability, and the heavy blank is much more manageable.

The pivot jig is made of two pieces of plywood joined along one edge with hinges. The top piece has a slot down the center, with a wider rabbet along the slot. A small metal plate fits in the rabbet. The plate is drilled and tapped for a 3/8 inch bolt. The bolt extends through the slot and the plate and projects above the top plywood piece, becoming a pivot around which the wood blank rotates during the trimming process. The slot allows the pivot bolt to be loosened and moved from the edge of the jig, changing the finished diameter of the blank. A strip of wood glued to the bottom pivot board, extending beyond the hinges, shields the hinges from the band saw blade. Clamp a separate guide board to the band saw table to guide the jig through the trimming process. Slot the guide board for the blade so that the edge of that board is parallel to the blade and about ¼ inch past the outside of the blade. See Figure 2.

Trimming the Blank

After using a large compass to determine the maximum diameter possible on the flat face of the chain saw blank, one should consider the grain pattern and growth rings. You may decide to give up some potential diameter in favor of a more attractive, but smaller, final product by repositioning the center. Figure 3 shows a typical blank from the chain saw. The big-leaf maple blank was from a log that had been down for several years. The blank weighed 58 pounds and was about 22 inches on a side. After trimming the excess wood off one edge and cutting the four corners off, the blank weighed 48 pounds, see Figure 4.

The next step is to cut the blank at a cone angle to remove as much “excess” wood as possible. “Excess” wood is that beyond the natural curve of the blank at any distance from the rotational center point when the blank is mounted on the lathe. Drill a hole for the pivot bolt at the chosen center point of the blank, but not too deep, as the pivot hole depth may determine the depth of the smallest bowl that can be cut from the blank. Place the chain-sawn blank hole over the pivot bolt. The pivot jig is tilted upward and held in place with a wedge of wood. The weight of the blank will usually hold the wedge in place throughout the trimming process. If there is a natural curve left on the blank, the best angle to set the jig can be “eye-balled” to just take the minimum “excess” off that natural curve. Once the angle is set, the blank should be rotated completely to confirm that no corners hit the band saw table, the guide board or the clamps. If there is interference, the blank needs to be removed from the pivot jig and retrimmed or the tilt angle reduced.

The jig with the blank is moved into the band saw blade along the guide board clamped to the table. A straight cut is made and the blank then is rotated on the pivot. Additional cuts on the band saw using the pivot jig will now cut off “corners” that would have to be removed, in any case, to achieve a circular shape on the lathe. On the lathe, some of these "corners" could end up being several inches thick, requiring what can be a bone jarring effort to true up the blank. The blank is rotated completely around the pivot. The rotation can be repeated, removing ever-smaller corners until a near-circular "frustum" is achieved. Figure 5 shows the result. The trimmed blank, now ready for mounting on the lathe, weighs only 32 pounds, a 45% reduction from the untrimmed weight. This weight was much more easily managed and when rotated on the lathe, produced only slight vibration.

Mounting the Blank

The blank was mounted on a six-inch steel faceplate with screws. The faceplate has double threads, allowing it to be used both inboard and outboard, which is convenient later in the process. I have found that for sound wood, if the blank surface is flat where the faceplate is placed, from four to eight screws will be sufficient. Some effort to produce a flatter surface with a hand plane or joiner may be well worth it, rather than having to take a heavy blank off the lathe to re-screw it because of an uneven surface. The screws should be as close as possible to the center. As with the center pivot hole, the depth of the screw holes may determine the size of the smallest bowl obtainable from the blank.

Some turners caution that standard dry wall screws are too thin and brittle for this application. The heads WILL twist off if screwed to the face place too tightly. I use the screws sold for cement board installation. Those screws are considerably more robust than standard dry wall screws, and drive as easily. Sheet metal screws are an even-more robust alternate, but in dense wood, may require a pilot hole.

The band saw trimming process reduces the amount of wood that must be removed on the lathe. In the case of the 32 pound example blank, the maximum depth of the lathe cut needed to remove the remaining "corners" was about one half inch. After truing up the blank on the lathe and turning the bottom flat, the blank, now truly a "frustum of a cone," weighed 28 pounds. The rotational speed of the lathe could be increased without vibration. Some large blanks will still be unbalanced at this stage, as the distribution of mass around the rotational axis may be asymmetrical because of differences in wood density or moisture content. Slow rotational speeds must be used in those cases to achieve tolerable vibration.

Turning the Blank Base

The final outside shape of the outer-most bowl should be turned next. Depending on the accuracy with which the bowl blank can be remounted to turn the inside, the "final" outside surfacing may need to be repeated later to achieve uniform wall thickness.

At this point in the process one must plan ahead. Since several of the nested bowls may still be larger than the diameter that can be mounted inboard using a chuck, the method used to mount those large blanks outboard on a faceplate has to be determined. These large bowl blanks have to be remounted carefully, as small variations at the bottom diameter against the faceplate are translated into large variations at bowl rim dimensions that approach two feet. The simplest solution may be to accept some waste off the bottom and screw the bowl blank directly to a metal faceplate. However, parting off a large bowl so mounted in order to eliminate screw holes will be a challenge and some bowl depth will be sacrificed.

Figure 6 shows an alternate solution. This blank is marked for multiple separate "feet" or "legs." Note the irregular surface feature. It dictates the position of two of the "feet." In the space between these feet, screws for mounting a faceplate mounting can be placed. When the wood between the feet is removed later, the screw holes will be removed along with the irregular surface feature. Three or four separate feet could be used. Depending on the diameter of the bottom, and what size steel faceplates are available, the bowl blank would be screwed to the faceplate. It is handy to leave a center cone in the bottom, to aid in centering the blank on the faceplate. Use one-inch thick plywood as a secondary faceplate if the steel faceplate is not large enough for the chosen bottom diameter.

If the outermost bowl is to have a flat base or a continuous circular "foot" without screw holes, a sacrificial wooden faceplate can be used, glued to the bowl blank. Cut a recess into the sacrificial wood disk just fitting over the bowl blank bottom foot or base. If this method is used, pay particular attention to achieving a very flat bottom of the foot ridge or base. Use a sanding board to do this. It is a ¾ inch thick plywood piece sized to fit just inside a 60-grit, 6 x 48 inch sanding belt. Hold the sanding board against the bowl bottom while rotating the blank on the lathe. Sand enough off the base to eliminate any irregularity, assuring good glue adhesion. The sacrificial faceplate will be parted-off at the glue line.

Multiple Bowl Blanks

Once the bottom of the outer-most bowl blank is finished to accommodate the chosen method of remounting, that bowl blank is cut off the raw blank with the coring tool. One should be prepared to spend a considerable amount of time with large bowls on a medium sized lathe, as it will not be unusual to stall the piece frequently if the cutting rate is too fast. The big leaf maple in my example was relatively dry, but still had enough moisture to show in the end grain. The outermost bowl blank took over an hour to remove. Greener wood will cut much faster, but chip removal may be slower than with dry wood. Expect to cut through the bottom of a few blanks when using one of the coring tools, until you learn the "right" combinations of diameter, depth and tool orientation for each cutting tool size.

After experiencing the agony of cutting through the bottom of another large blank, I added a laser pointer to my coring tool. The frame to hold the laser pointer was made from salvaged aluminum channel, bolted to the coring tool blade and handle. See Figure 7. I mount the pointer to the tool once the cut is about 2/3 finished. Then the cut can be adjusted, as needed, to achieve the desired (greater than zero !!!) base thickness for the blank.

For the example shown, six bowl blanks were obtained. See Figure 8. The wall thickness was based on my past experience that big leaf maple distorts only a slight amount upon drying, allowing relatively thin walls. (Madrone requires thicker green blank walls.) The combined weight of the six unfinished blanks was 16 pounds, which meant one half the wood that was mounted on the lathe ended up on the floor. Outer rim diameters were 4.5, 7, 9.5, 12, 15 and 19 inches. These rough bowl blanks were each be remounted when dry to finish the inside surface and touch up the outside surface. The rough wall thickness also determines the limits of the possible final bowl profiles.

As each bowl blank is cut off, the remounting decision for the next inter-most blank must be made. The coring tool blades have a fixed shape so that the resulting bowl blanks will have similar profiles. Unless the turner has allowed for it by cutting an extra-thick wall, options such as separate "feet" or "legs" will be harder to design into the finished bowl than was the case for the outer-most blank. As the blanks get smaller, simpler remounting techniques will suffice, as the mass and relative dimensions render small remounting "errors" less critical to one's ability to achieve an acceptable rough bowl blank.

Moving Inboard for Smaller Blanks

Once the diameter of the raw blank is less than my 11.5 inch over-bed limit, I move inboard. This is when the double threads in the faceplate pay off. For my example, after the 19, 15 and 12 inch blanks were removed, the remaining core, still screwed to the faceplate, was mounted inboard and a spigot was cut. Then the faceplate was removed, the blank reversed, and the spigot gripped in a self-centering chuck. Then a recess was cut around the original pivot hole. This recess, which is finally removed from the interior of the smallest blank, is used to hold the core while cutting a new spigot in each successive blank. The spigot is turned on the bottom of each bowl blank before it is cut off the core. I always use the tail stock with a live center in the pivot hole while cutting the bowl blanks inboard. The added stability from the tailstock comes at a cost of occasional interference between the tail stock handwheel and the handle of the cutting tool. I overcome the interference by raising the handle as much as necessary to clear the tailstock, even though that may not give the optimum cutting edge-to-wood angle during a portion of the coring. The screw holes from mounting the faceplate and the center pivot hole have to be removed from the center of the final small bowl blank in the core.

Finishing the Bowls

The inside surface of larger remounted bowls is finished using a tool rest anchored to the lathe stand extension pieces. See Figure 9. For some bowls, the tool rest banjo can be used as with the coring tool set-up by adding a four-inch extension shaft to the regular lathe tool rest support shaft. I also have a floor mounted tool rest consisting of two lengths of steel pipe with a base. The outer 1¼ inch pipe is hammered into a salvaged 12 inch steel tire rim that serves as the floor stand base. The inter 1 inch pipe is just the right ID to accept the tool rest one inch post. Bolts lock the pipes and tool rest at the correct turning height. I use parallel jaw wood clamps to hold the floor tool rest stand to the extension pieces for added rigidity.

Figure 10 shows the set of finished bowls from the example blank. The smallest blank was not finished.

Summary

The techniques described allow a turner with limited lathe capacity to create larger sets of nested bowls by turning a portion of the set outboard on the lathe. A pivot jig is used to safely trim large, raw blanks to a manageable weight and symmetrical shape, avoiding most vibration problems.

More photos of the process of making these large nested bowls can be seen at my website: www.davidlutrick.com

Figure 1 Coring tool mounted outboard

Figure 3 Chain-sawn blank

Figure 5 Blank trimmed on pivot jig

Figure 2 Pivot jig on bandsaw

Figure 4 Corners trimmed from blank

Figure 6 Position future feet on piece

Figure 7 Laser pointer on coring tool

Figure 9 Remounted large bowl to
finish interior surface

Figure 8 Roughed out bowls from blank

Figure 10 Finished Bowls