

Which End is Up?

by Michael Stafford • process photos by Gail Stafford



When I first started turning boxes, I read all the books I could find on the subject. The various authors had a lot of conflicting opinions about proportions, particularly the proportions between the height of the lid and the height of the body section of the box. One author would say the ratio should be 30% lid/70% body, while another suggested that 40% lid/60% body was the ideal ratio. And most of them suggested that a 50%/50% ratio was a recipe for failure. They went on to say proportions were not the only factor that had to be considered, because the shape of the box also was a part of the equation. Use of the golden ratio was encouraged to help fashion the ideal proportions. All in all, there were no hard-and-fast rules that a beginning box maker could use.

Now that I've confused you with the rules, let's break

some of them and turn a box where the lid and the bottom are exactly the same height and mirror each other in form, yet the finished diameter to height ratio is almost exactly equal to the golden ratio (1.6 to 1). I gradually began turning boxes with coved sides to lighten their overall appearance and ended up with this design, where the diameter is much greater than the height, and the top and bottom are mirror images of each other in shape. Many other box makers turn similar boxes, so I cannot claim ownership to the design.

WOOD SELECTION

Choosing the right piece of wood for this design is critical. The finished box is less than 2" tall, and grain alignment at the join will be quite visible because the final shape offers

SUPPLIES

Wood: straight-grained wood – 3" square x 3-1/4" long; waste block

Tools: lathe with chuck, drive, and live centers; bandsaw; fingernail-ground spindle or detail gouges; spindle roughing gouge; 1/2" square scraper; parting tool and beading/parting tool; 3/16" diamond parting tool; skew chisel; No. 3 Hunter tool; V-shaped jig or cradle; center finder; calipers; depth gauge; diamond hone; power sanding materials (optional)

Assorted grits of abrasive paper

Paste wax for sanding (optional)

Finish of choice

Microcrystalline wax for topcoat

Ruler and pencil

Paper towels and solvent

Masking tape

Please refer to all manufacturers' labels for proper product usage.

no disguise. Therefore, select a piece of wood with very straight grain along its length to minimize the grain mismatch at the join. Also, the wood should have an interesting pattern on the end grain, because it will end up as the most prominent feature of the box. I chose a piece of straight-grained Brazilian tulipwood with a beautiful arching end-grain pattern (see **Fig. 1**). Care must be exercised when using some of the exotic timbers, since there are people who are allergic to the rosewood family, of which Brazilian tulipwood is a member.

LET'S GET STARTED

Start with a piece of wood about 3" square x 3-1/4" long; mark the centers on each end. I like to score the end where the drive center will be located by holding it in a V-shaped jig and cutting a diagonal from corner to corner with the bandsaw (see **Fig. 2**). Sometimes the point of the drive center can split dense exotic hardwoods, so I use a drive center with the point removed.



Fig. 1

Select a piece of straight-grained wood with interesting end grain.

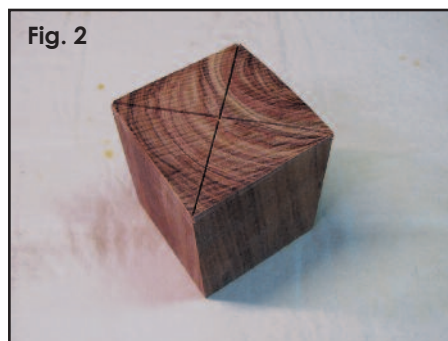


Fig. 2

Cut the diagonals with a bandsaw.

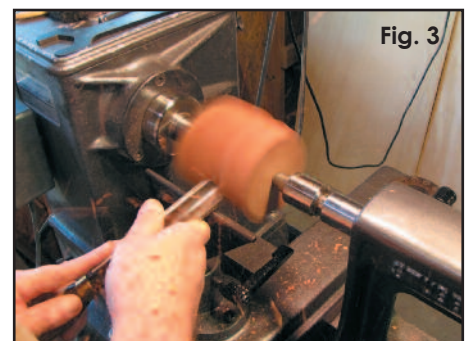


Fig. 3

Round up the blank with a spindle roughing gouge.

Mount the blank between centers and turn it round, using a spindle roughing gouge (see **Fig. 3**). Once the blank is round, turn a spigot on each end sized to fit your chuck. I use a Super Nova II chuck with 50mm jaws, so I sized the spigot accordingly with calipers and a 3/16" diamond parting tool to form a slight dovetail shape (see **Fig. 4**). My blank ended up being 3" long between the spigots.

PROPORTIONS FOR THE PARTING CUT

The completed lid and the body of the box will be the same size in both height and diameter. However, two things must be considered when deciding where to part the blank—the amount of overlap of the lid over the body flange and the waste lost due to the parting and cleanup cuts. For this style box, I try to have a 3/8" flange on the body of the box. What this means is that the lid will overlap the body by 3/8". If you allow another 1/4" for the parting and cleanup cuts, then the body section of the blank must be about 5/8" longer than the lid section. **Fig. 5** shows the layout for the parting cut 1-1/8" from the end that was chosen to be the top of the lid. The section for the body will be approximately 1-3/4" tall after the parting cut (see **Fig. 6**). I like to start the cut with a thin 1/16" parting tool and then finish cutting the blank in two with the bandsaw, using a V-shaped cradle to prevent the round blank from rolling into the blade.

Safety note: Do not try to cut a round blank in two on the bandsaw without a cradle. Failure to use a cradle can permit the blank to roll into the blade and break, or worse—pull a finger into the saw. Respect the bandsaw!

HOLLOW THE LID

Mount the lid section in the chuck, tighten it securely, and true the blank along its length, ending with a fingernail-ground spindle gouge (see **Fig. 7**). In order to preserve grain match when truing-up the end, do not remove more wood than absolutely necessary. When cleaning up the end grain, try to angle the cut toward the center, creating a slight concavity. A concave surface will make it easier for the lid and body to fit together seamlessly.

Once the lid blank is trued-up, measure 1" from the trued-up face and make a mark to establish the working height of the lid (see **Fig. 8**). Mark the blank around its circumference, and use a parting tool to remove some



Fig. 4

Size the spigot with a parting tool to match your chuck.



Fig. 5

Lay out the box to make the initial parting cut.

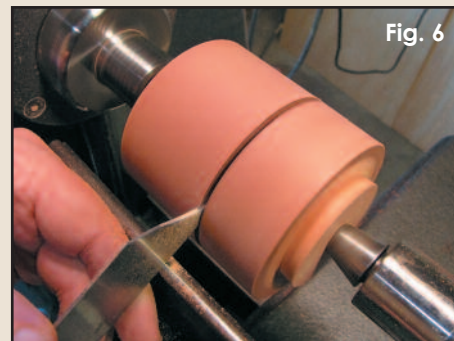


Fig. 6

Make the parting cut with a thin parting tool.



Fig. 7

True-up the end grain with a spindle gouge.



Fig. 8

Mark the working height of the lid.

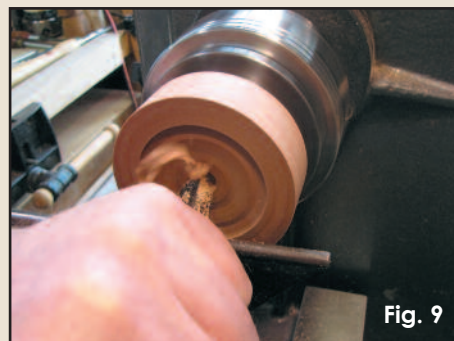


Fig. 9

Take light cuts to avoid tearout.

of the wood on the waste side of the pencil line to provide a visual reference of the lid height while hollowing. Set a depth gauge to measure about $5/8"$ to $11/16"$ for the depth to which the lid will be hollowed. I try to have a finished lid thickness of about $3/16"$ to $1/4"$.

Using a fingernail-ground spindle or detail gouge, hollow the interior of the lid with a sweeping cut from the center outward. I prefer to use a detail gouge because the extra steel thickness under the flute reduces vibration. Begin the cut with the flute of the gouge aimed at 12:00 (as on a clock face), cutting at center. Push the gouge straight into the wood and swing the handle slowly to the right. As the gouge sweeps out from the center, slowly rotate it counterclockwise so that the flute is aimed between 9:00 and 10:00 (see **Fig. 9**). Take light cuts with a sharp gouge to avoid tearout. Stop hollowing when the gouge is about $9/16"$ from the outside of the blank. The final wall thickness of the lid sides will be determined in the next step. Check the depth frequently (see **Fig. 10**). When within $1/8"$ of the final depth, I switch to a No. 3 *Hunter* tool for the smoothest possible cut surface on the end grain—smooth cuts on end grain greatly reduce sanding time!

CUTTING THE LID FLANGE—A VERY IMPORTANT STEP

Once the lid is hollowed and shaped to satisfaction, it is

time to form the flange where the lid will seat upon the body of the box. Use a freshly sharpened $1/2"$ square scraper for this task. Hone the top and the left side of the tool with a diamond hone to make sure that it cuts cleanly. You do not want to sand this surface once it is cut. With the tool's cutting edge slightly above center, align the square scraper visually with the ways of the lathe bed and push slowly and deliberately into the wood (see **Fig. 11**). The goal here is to push the scraper as straight as possible into the wood so that the sides of the lid flange will be parallel with each other. If the lid sides are not parallel, the lid will not stay on during jam chucking and it will never fit properly. So take your time to get this right.

Next, use internal calipers to check if the lid flange is parallel (see **Fig. 12**). Insert the calipers with the tips spread a little wider than necessary to find the maximum diameter on the inside of the lid, and gradually tighten the caliper nut until the tips just rub the sides of the flange on both sides. Slide the calipers in and out. If the sides are parallel, the tension on the tips should remain the same (that is, the tips should not spread out or close). If necessary, recut the flange to ensure that the sides are parallel. Once it is determined that the sides are parallel, do nothing more to the inside surface of the lid flange; keep the cut surface pristine. I like to leave a little step between the

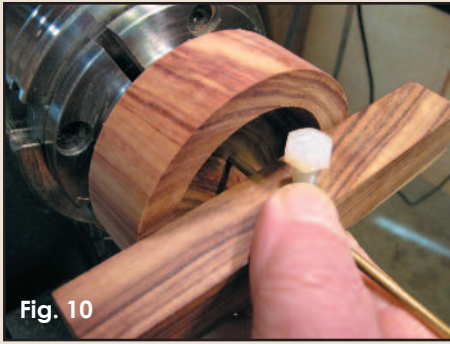


Fig. 10

I use a shop-built depth gauge to check the depth of the box.



Fig. 11

Line up the square scraper with the lathe bed to ensure that it is parallel.



Fig. 12

Use internal calipers to check the lid flange for parallelism.

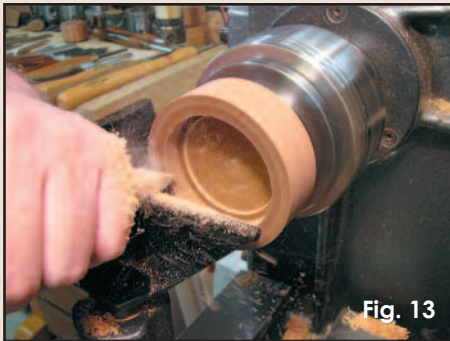


Fig. 13

Truing the lid flange with a sharp skew will produce a polished surface.



Fig. 14

A little wax on the sanding disk will reduce heat buildup.

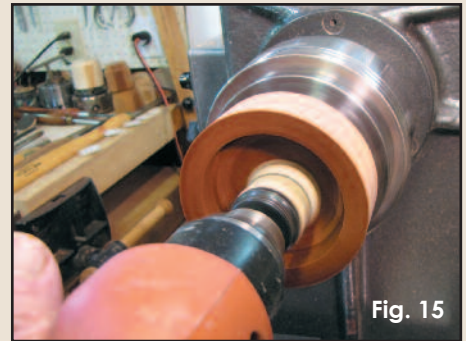


Fig. 15

I frequently power-sand my boxes.

inside surface of the lid and the flange so that I don't sand the flange while sanding the inside of the lid. Sanding this flange can cause it to end up out of round.

TRUE THE BOTTOM OF THE LID FLANGE

Sometimes when hollowing, stresses can be released in dense timbers, such as rosewoods, and can cause the lid to warp slightly. This is particularly true in highly figured woods. For this reason, it is good practice to true-up the bottom of the lid flange by gently scraping the surface with a sharp skew laid flat on its side on the tool rest, acting as a negative-rake scraper (see Fig. 13). If the skew is sharp, the scraped surface will have a polished appearance.

SAND AND FINISH THE INSIDE OF THE LID

Carefully sand the inside and the bottom edge of the flange of the lid. The wood must be sanded as smooth as possible. Slow down the lathe and use good-quality abrasive paper, sanding thoroughly with paper that is fine enough to remove all visible scratches. In dense exotics, such as this Brazilian tulipwood, it may be necessary to sand through 1200 grit or higher for the best possible finish. If there is tearout of the end grain, use grit that is coarse enough to remove it.

Attempting to remove tearout with fine abrasive paper can generate excessive heat on the end grain and cause heat checks in some hardwoods, particularly exotics. Sanding with paste wax as a lubricant can help reduce friction-generated heat. Just put a small dab of wax on the paper and sand normally (see Fig. 14). The wax also helps eliminate some of the airborne dust that can be irritating. Clean off the wax and sanding residue between grits with a paper towel dampened with solvent. And before applying a finish, clean the surface thoroughly to remove any waxy residues.

I frequently use a 1" disk holder and power-sand the interior of the boxes with a right-angle drill (see Fig. 15). Again, use slower lathe and drill speeds, and keep the disk moving across the surface of the wood. Use light pressure so that the abrasive does the work without generating heat. Be sure to clean out all sanding residue between grits.

I like to finish my boxes with several coats of Behlen Qualalacq lacquer, thinned 50%. Using small folded pieces of paper towel, wipe on an even coat and immediately wipe it dry using a clean piece of toweling. Between coats, rub out the finish with small pieces of cheesecloth and 4/0 steel wool. Once I am satisfied with the finish, I like to apply a light coat of microcrystalline wax using a

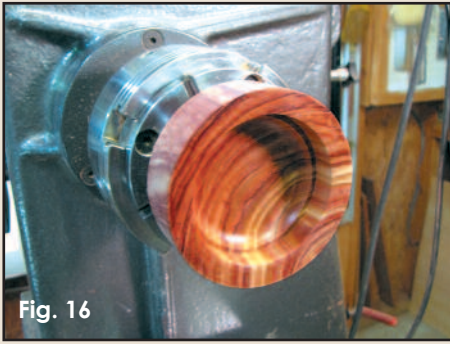


Fig. 16
The interior of the lid is sanded and polished.

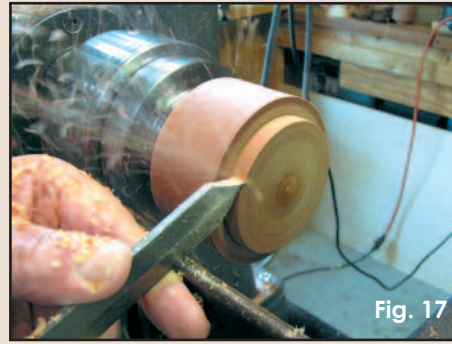


Fig. 17
Cut a tapered tenon on the body blank.

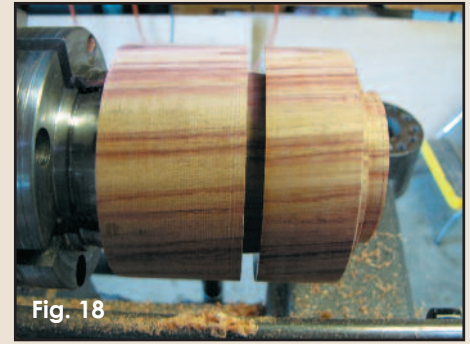


Fig. 18
The lid will sit on the tapered body tenon when cut properly.



Fig. 19
Measure and mark the body height on the blank.

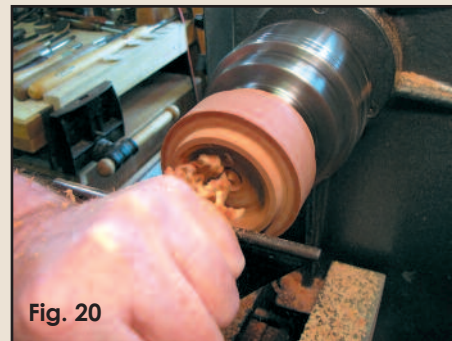


Fig. 20
Use the same technique explained previously to hollow the body.



Fig. 21
Carefully adjust the tenon for a jam fit.

white woven pad. Buff the wax with a soft cloth or felt (see Fig. 16).

TURN A TAPERED TENON FOR THE LID

Mount the body blank in the scroll chuck. True-up the length of the blank and the end, as was done with the lid section.

Use a parting tool or beading/parting tool to cut a tapered tenon on the body section (see Fig. 17). The tenon needs to be tapered so that the lid will just sit on the end of the taper, which will later be re-turned to form the body flange upon which the lid will fit (see Fig. 18). The point at which the lid sits on the tapered tenon is the precise diameter where the lid will fit on the box. While hollowing, it is easier to estimate the wall thickness of the box flange with the known flange diameter as a visual reference. It is far too easy to remove too much wood and have a thin, weak body flange. It is important not to fit the lid at this time, as hollowing could release wood tensions that sometimes result in the box becoming slightly oval and the lid no longer fitting.

MARK THE LENGTH OF THE EXTERIOR

After the length of the tenon has been established, it is time to measure and mark a reference for the overall

height of the body blank. The lid section was laid out to be 1" long; the body blank must be the same. Measure and mark a line 1" from the shoulder that was established while cutting the tenon (see Fig. 19). Remove some of the waste wood to the left of the measured line to provide a visual reference for the size of the body.

HOLLOW THE BODY OF THE BOX

Using the same technique as described for the lid, hollow the body, checking the depth frequently as the hollowing progresses (see Fig. 20). Be very careful not to make the body of the box deeper than the lid section; the depth of the body section should equal the depth of the lid section plus the height of the body flange, which is about 3/8". Therefore, the finished hollowing depth of the body should be between 1" and 1-1/8". It is also important not to thin the body flange too much while hollowing, as its final diameter/thickness has yet to be adjusted to accommodate the lid.

SAND THE INSIDE OF THE BOX

Sand the inside of the box once all the tool work is completed, using a combination of both hand- and power-sanding. It is important to finish the inside of the body to the same degree of fineness as the inside of the lid.

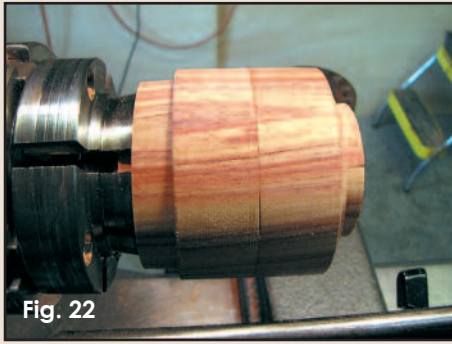


Fig. 22

Just remove dust until the lid fits properly.



Fig. 23

Measure 1/2" on either side of the joint to lay out the cove.

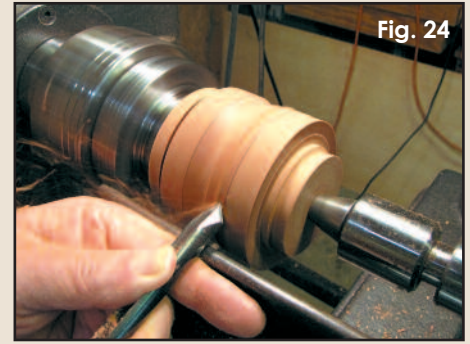


Fig. 24

Turn the cove with a sharp spindle gouge.

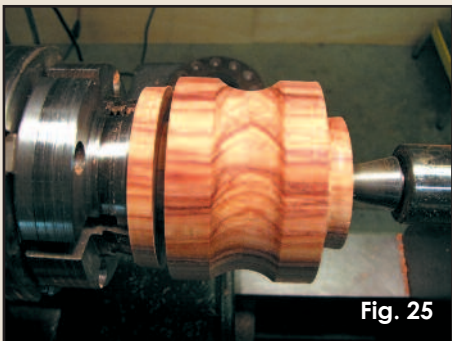


Fig. 25

Sand the cove before cutting the dome-shaped lid.

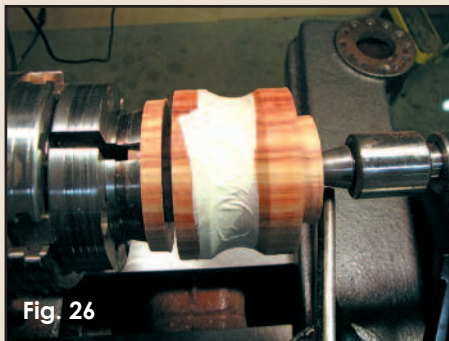


Fig. 26

Tape is such cheap insurance!



Fig. 27

Shape the majority of the lid before removing the tailstock.

JAM-FIT THE LID ON THE BOX

The goal here is to reduce the tapered tenon to the proper diameter for the lid to fit snugly (i.e. jam-fit) upon the box flange so that the two can be turned as a unit. With a parting tool or beading/parting tool, carefully reduce the taper on the box flange while frequently stopping the lathe and checking the fit of the lid (see **Fig. 21**). The lid should fit tightly—too tight for normal use, but tight enough so that the body of the box can hold the lid in place while shaping the top of the lid. Remember that there is a fine line between a tight jam-fit that securely holds the lid in place, enabling it to be turned, and splitting the lid; check the fit frequently and remove only dust to “sneak up” on the proper fit (see **Fig. 22**).

LAY OUT THE COVE

With the lid jammed on the body, true-up the exterior of the entire box. The goal here is to turn the entire assembly parallel with both ends and the middle exactly the same diameter.

With a ruler, measure 1/2" to each side of the join line to lay out the width of the cove (see **Fig. 23**). Normally, it might not be necessary to measure so accurately, but it is important to have the proportions between the lid and the bottom of the box match exactly and to ensure that the

cove is centered on the join between the lid and bottom.

CUT THE COVE

I like to bring up the tailstock for insurance whenever I can to prevent accidents (and the potential use of bad words!). With the tailstock guaranteeing the security of the jam-fit, cut the cove. Use a sharp spindle gouge and form a perfect cove between the layout lines centered on the join (see **Fig. 24**). The cove should be cut about 5/16" deep, which leaves approximately 3/16" thickness remaining in the lid flange. Once the cove is shaped to your satisfaction, it is time to sand it (see **Fig. 25**). I like to sand the cove before I cut the domed shape of the lid so that I can keep the tailstock in support as long as possible. Sometimes sanding the cove can generate enough heat expansion to allow the jam-fit to loosen and cause the lid to come off. The tailstock prevents this from happening.

FINISH SHAPING THE LID

Before I finish turning the lid exterior, I like to wrap some masking tape around the join in the cove (see **Fig. 26**). The lid will be held only by the jam-fit, and the cuts that are necessary to shape the lid sometimes have a tendency to pull the lid off the box. With the tailstock in support, begin

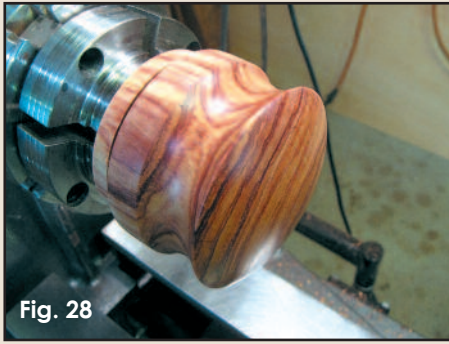


Fig. 28
The cove and the top of the lid have been sanded.

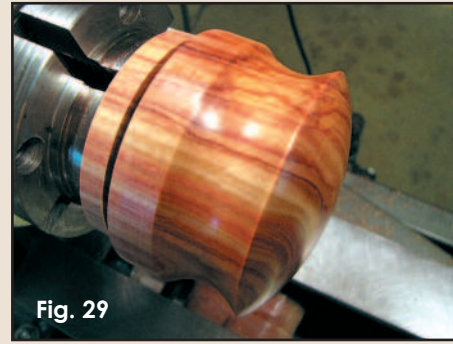


Fig. 29
Apply finish to the cove and lid.

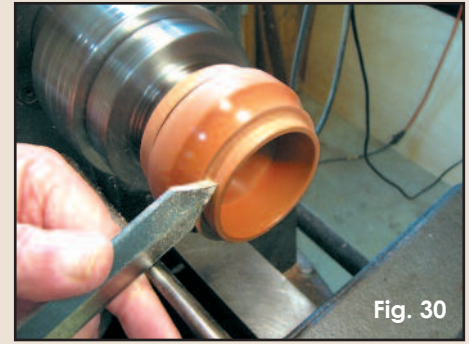


Fig. 30
Size the tenon to achieve a suction fit.

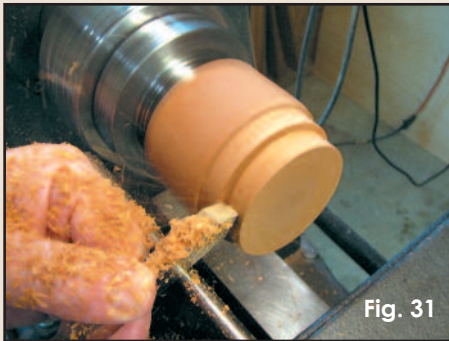


Fig. 31
Cut the stepped waste blank tenon carefully.

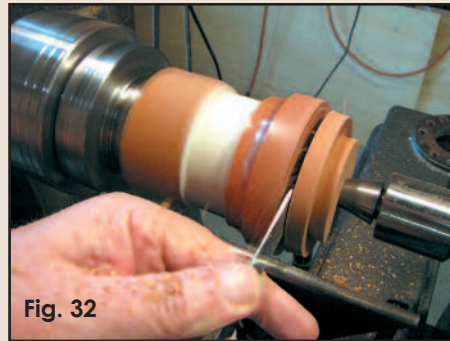


Fig. 32
Part off the waste.



Fig. 33
Shape the bottom so that the curve mirrors the top.

to form the lid shape, removing as much waste wood as possible. The domed shape of the lid should peak at the center and form a sharp edge at the cove. After the bulk of the waste wood is removed, it is safe to back off the tailstock and complete the shape (see **Fig. 27**).

SAND AND FINISH THE COVE AND THE LID

Sand and finish the cove and the lid with both hand- and power-sanding, using wax as a lubricant, if necessary. It is important to have a perfectly sanded finish where the grain is clearly visible for the viewer to enjoy. Be careful not to round over the intersection between the lid dome and the cove too much; it should be pleasant to grasp when removing the lid, but not severely rounded over (see **Fig. 28**).

Apply finish to the cove and top of the lid (see **Fig. 29**). Any poor sanding marks or torn grain will be immediately visible once the finish is applied, and they should be fixed before moving on to the next step where the fit of the lid is adjusted.

FINAL FITTING OF THE LID—ANOTHER IMPORTANT STEP

Now it is time to fit the lid. At this point, the lid fit is too tight to easily open and the flange on the box body must be reduced in diameter ever so slightly to yield a suction fit. Use a freshly sharpened parting tool to remove dust in tiny

increments until the lid slips on with a suction fit (see **Fig. 30**). When the fit is right, the user should be able to lift the box by the lid without the lid coming off, but he or she should be able to remove the lid without great difficulty. The difference between a quality "gallery" box and a "craft show" box is the fit of the lid; so take time to get it right.

REVERSE-TURNING THE BOTTOM OF THE BOX

The last turning step is to reverse-turn the bottom of the box, which should be turned to mirror the dome formed on the lid and finished to the same quality as the rest of the box. To do this, I like to jam-chuck the body onto a waste block, and prefer to use soft woods, such as basswood, poplar, or pine, for the jam chuck. Softer woods will compress slightly when jam-fitting and will hold the bottom more securely.

The process is exactly the same as jam-fitting the lid onto the body of the box. Turn a tenon on the waste block so that the box body will tightly fit without splitting. For this style of box, I turn a stepped tenon on the waste block where the second step matches the diameter of the flange on the body of the box (see **Fig. 31**). This step allows me to add some tape for insurance while shaping the bottom. Jam the box body onto the jam chuck, and with

the tailstock in support, part away the chuck spigot (see **Fig. 32**) and shape the bottom into a dome that matches the dome formed on the lid (see **Fig. 33**). I frequently hold up the lid and sight over it as a reference to see if the dome that I am forming on the bottom is shaped the same.

SAND AND FINISH THE BOTTOM

Sand and finish the bottom to the same level of perfection as the rest of the box. Don't rush this part of the process and leave a poorly sanded bottom for the prospective owner to find.

FINAL THOUGHTS

The finished diameter of this box is 3" and the height is 1-7/8", which is a near-perfect golden ratio. And the lid and body of the box are almost perfect mirror images of each other. Of course, those exact dimensions do not have to be duplicated to end up with a box with a pleasing appearance, but it is fun to make a box that breaks the rules, yet maintains the golden ratio.

This little box is a great project for using a small piece of very special or expensive wood. When completed, it is fun to place the box on a table and give it a nudge and watch it rock and spin. People love to pick up this box and caress it with their hands. And best of all, you can open it and store something precious inside, if you wish. It makes a lovely gift box for that "special ring."

Turning a properly fitting box is a test of one's skills. With a few specialized tools, a box can be turned on any lathe. So fire up your lathe and turn a box that violates the rules. Give it to a friend and let them figure out which end is up.

Mike Stafford

Mike Stafford, a.k.a. "Big Mike," is a lifelong woodworker who has built everything from toys to tackle boxes to furniture. He began woodturning in 2003 and is primarily self-taught, although he has studied with Don Russell, Jamie Donaldson, Ed Moore, and Frank Penta at the John C. Campbell Folk School.



Mike's specialty is turned boxes, and he strives to turn as many box forms with as many woods as possible. He has demonstrated for woodturning clubs around the country, and has taught woodturning at local woodworking stores and the American Sycamore Woodworking Retreat. He currently teaches a class on turning boxes at the Campbell Folk School. Mike's boxes are available through his website (www.turnedboxesbymike.com) and at selected galleries.

Mike is one of the moderators for the Wood Central online woodturning forum and is a frequent contributor to the Internet-based WoW forum. He welcomes your questions and comments, and can be reached by e-mail at mgstaff@suddenlink.com.