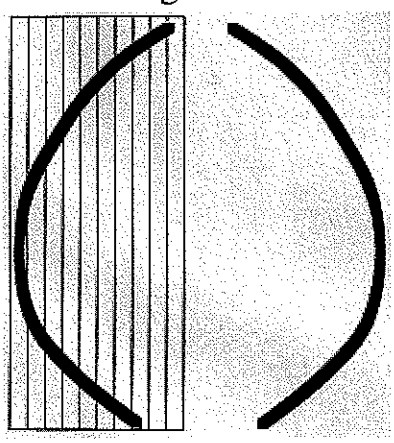
Segmented turning has held my interest for many years because it seems to have an unlimited number of possibilities to explore. One of those areas is what I call lamination trickery. Turning laminated layers on the lathe can produce dramatic effects without the painstaking effort required for ring-stacked construction or the difficulties of intricate joinery in other styles. In other words, it provides maximum effect with minimum effort. The goal of this project is to demonstrate how curved designs emerge by cutting at an angle through straight parallel layers on the lathe. Most segmented turning is at least 80% cutting, sanding, and gluing, and it usually requires a plan. The plan starts between your ears; first, you have to visualize a shape. Attractive wood and/or intricate surface designs will not overcome the negatives of a non-pleasing shape. Some doodling on paper (see **Diagram A**) helped me decide upon a shape. I selected this shape (the center vessel in the main photo below) for two reasons: I thought it was pleasing to the eye and that the profile would effectively display the many layers of my lamination.

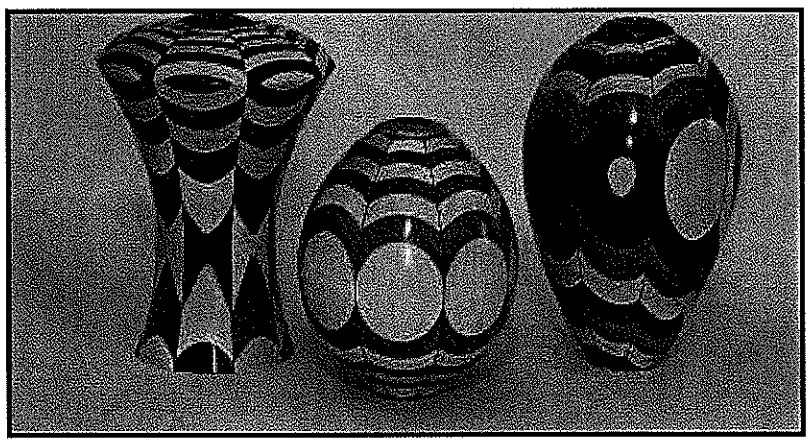
CONSTRUCTING..THE..LAMINATIONS

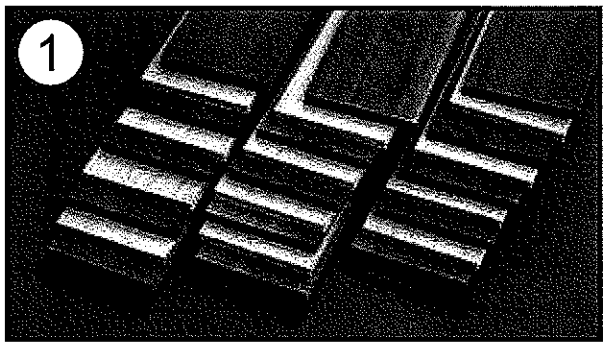
The main order of business is to construct a cylinder made from laminated staves. Using compound-mitered staves will save on wood, but in this case, the laminated layers need to be at an angle to the vessel wall, not parallel to the profile. Before constructing the cylinder, you must decide on the number of staves and number of layers in each stave. I knew from experience that more dramatic curves would emerge if the staves were wide, so I opted for only eight staves. By overlaying narrow vertical rectangles onto your desired profile (see **Diagram A**), you should be able to visualize the amount of layer exposure. I chose to laminate ten 1/4"-thick layers (see **Fig. 1**). As with most segmented turning, accurate milling of the raw material is extremely important. The exact thickness is not nearly as important as having it be consistent. The moisture content of the wood is also important. For the sake of stability, try to use only wood that measures less than 10%. Definitely avoid using two different species that are dramatically different in moisture content and, if possible, choose woods with similar densities. I chose hard maple and eucalyptus. To create the layers, use a table saw (or bandsaw) to re-saw 2-3/8" wide strips from 3/4"-thick boards and then thickness-sand them on a drum sander to 120 grit. The exact length is not critical, but enough length will be needed to crosscut eight pieces about 7" long from the laminations. In the absence of a drum sander, good quality surfaces from a planer will work as long as the strips are free of planer marks or snipe

Figure A

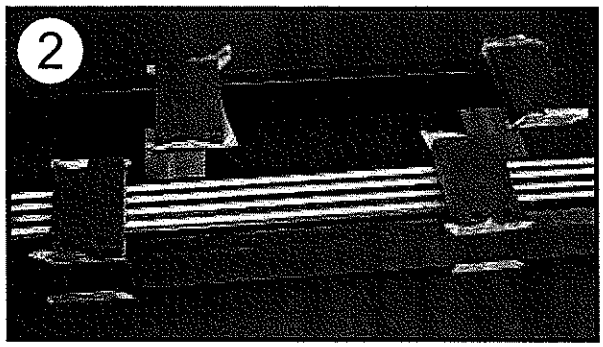


The dark line represents the vessel profile while the vertical rectangles represent the laminated layers.

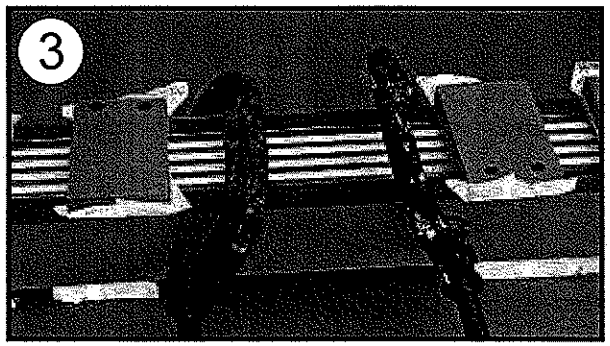




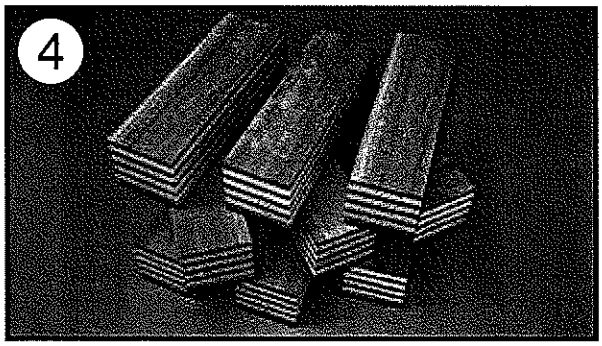
Consistent thickness and smooth surfaces are very important. A tiny error in the lamination can result in an irreparable defect later in the project.



Take the time to make a gluing jig. Without the use of the jig restraints, it is very difficult to keep the layers in their proper place.



Before applying glue, adjust all your clamps in order to reduce clamping time during the actual gluing. Use lots of clamps and lots of pressure; all the excess glue must be forced from the joints. During this actual gluing, I used at least 12 of this style C-clamp.



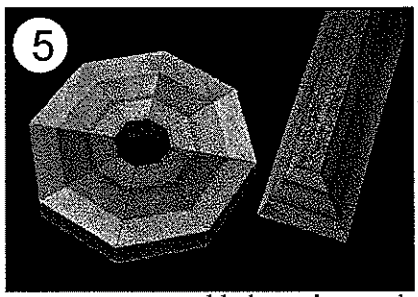
After gluing, the laminations must be "cleaned up." The surfaces have to be free of glue squeeze-out and the edges should be square. Accurate bevel cuts will be difficult to achieve otherwise.

GLUING THE STAVES

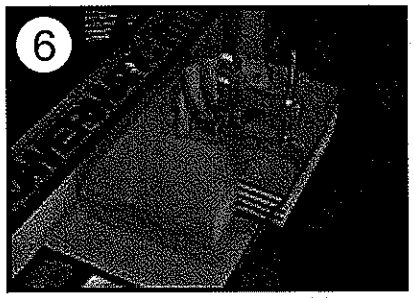
Gluing ten layers at one time can be a challenge. It requires that you spread the glue quickly and deal with the problem of clamp pressure trying to force the layers to slide apart. A simple gluing jig solves the "sliding" problem (see **Fig. 2**). Construct the jig from 3/4" medium density fiberboard (MDF) or plywood, and cover the exposed surfaces with duct tape or masking tape to permit easy removal after the glue has cured. The tabs confine the layers and prevent them from splaying sideways during the clamping (a little sliding lengthwise is not a problem). **Fig. 3** shows how the two parts of the jig come together to "trap" the lamination components. The choice of glue is important; adequate "working time" is needed. Possible glue choices include polyurethane (such as Gorilla Glue), plastic resin, or Titebond Extend. By scheduling the gluing job early in the morning when the temperature was still cool, I was able to use Titebond Extend. If the number of layers had been greater or if the temperature had been warmer, I probably would have opted for plastic resin. Use lots of heavy-duty, firmly tightened clamps. It does not hurt to tighten them a little more with a small "cheater" bar either. With this many layers, it is also a good idea to check on the clamp tightness after a few minutes. Once excess glue has been expelled from the joints, some of the clamps may not be as tight as you thought. The clamps should remain in place for a minimum of four hours but overnight is better.

CUTTING THE STAVE BEVELS

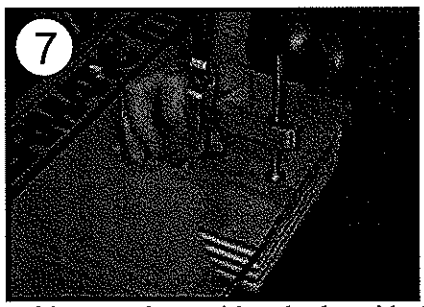
Clean up the laminations using a combination of glue scraper, jointer, and table saw. Then crosscut them about 7" long (see **Fig. 4**). Use your table saw with its blade set at 22.5 degrees to make the bevel cuts. These cuts **MUST BE** "dead on" accurate, so use scrap wood to make a series of test cuts, adjusting the blade angle until eight pieces form a ring with no visible gaps. I used a three-layer lamination of MDF (see **Fig. 5**) to make my test cuts because inaccuracies are much easier to detect if a thick test board is used. There is no need to cut eight staves in order to perform a test fit. Cut one test stave and then crosscut it into eight pieces. Be sure to "rip" both sides of the test stave each time you adjust the blade angle. The use of a sled to cut the staves will improve the quality of the cuts and eliminate the need to put your hands in harm's way. **Figs. 6** and **7** show my method of making this type of cut. The exact sled dimensions are not important; the photos should provide you with the concept. Attach the top angled piece of the sled with screws so that you can reverse it and remove it to modify its angle. Once your blade angle has been "dialed in," cut one side of each stave with them clamped against the square side of the sled fence. Then reverse the fence and clamp the staves against the angled fence surface for the second series of cuts.



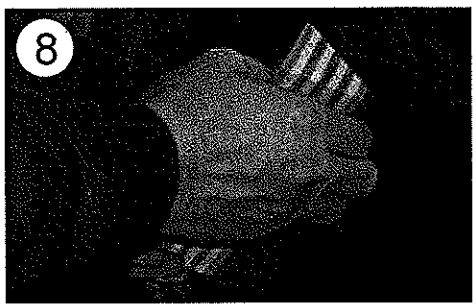
To ensure an accurate saw blade setting, make a series of test cuts on scrap wood first. There is no room for compromise; the angles must be perfect.



Take the time to build a simple sliding sled.



Making this second cut with only the aid of your saw's rip fence would be dangerous and would probably result in a poor surface. The sliding sled makes the job safer, easier, and more accurate.



Use a disc sander or stationary sanding block to improve the gluing surface

PREPARING TO GLUE

A light sanding to remove any imperfections from the joint surfaces is usually prudent. You can sand the stave sides several different ways, but gently holding them against a large disc sander is quick and easy (see **Fig. 8**). Another method is to attach a piece of 80-grit abrasive paper to a smooth piece of MDF (or plywood) with a little spray adhesive, and then carefully stroke the surfaces on the sandpaper. Be extra cautious to avoid "rounding" the ends of the staves. You should only use this method to remove minor surface imperfections, not to significantly alter the bevel angles.

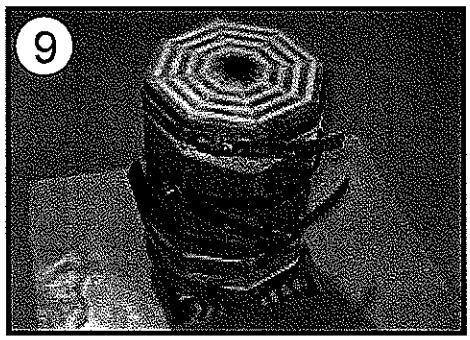
To check for any errors, secure all of the staves with rubber bands, then hold the assembly up to a bright light and examine each seam. There should not be any visible light coming through any of the joints. This is not a time to compromise; the fit has to be perfect (at least to the naked eye). Disassemble, lightly sand accordingly, and perform another test fit as necessary. My design calls for a piece of black veneer between each pair of staves. The consistent thickness of the veneer will not influence the accuracy of the bevels. Just for practice, however, make one more "dry-fit" of the assembly after cutting the veneer pieces.

GLUING THE STAVES TOGETHER

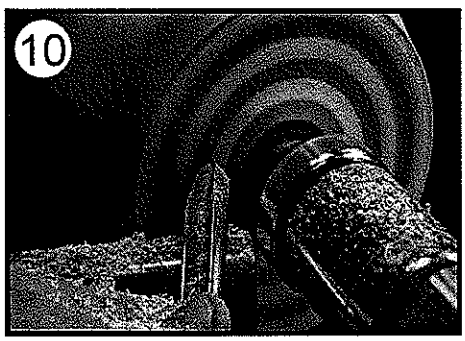
This project demands that the finished cylinder be perfectly round. To help ensure this, I opted to glue the cylinder all at one time as opposed to using a multi-step approach in which pairs are glued together. With a multi-step approach, there is a chance that the lamination seams will "miss" each other during the final glue step. Just like a surgeon, lay out all of your tools, Rrubber bands, hose clamps, glue-spreading device, screwdriver, etc. Careful planning will help ensure success. Here again I used Titebond Extend, but I still had to work quickly. The previously mentioned glue choices will also work. After coating all surfaces with glue, assemble the pieces and lightly secure them with several rubber bands. Be aware that the veneer pieces will immediately start to "curl" if glue is applied to only one side. Coating both sides simultaneously will reduce this "curl" The rubber bands and hose clamps shown in **Fig. 9** should automatically align the outside edges of the staves, but they will not align the veneer edges with the outside of the seams. You must check these and adjust their positions as necessary. With only light rubber band pressure, you should be able to adjust the components as necessary before applying the hose clamps. Allow the glue to cure overnight.

MOUNTING THE CYLINDER

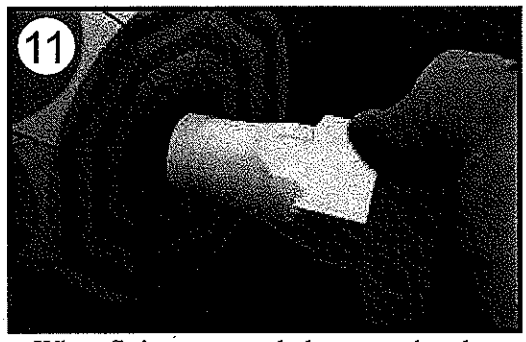
Use a disc sander or a drill with power-sander pad to "clean-up" the cylinder. Select one end for the top of the turning and sand as necessary to make sure that the surface is square to the sides. **It is very important that the end is square**; otherwise, the cylinder will not be parallel with the lathe spindle when mounted. Turn a waste block to the same diameter as the cylinder and, being very careful to center it, attach it with beads of hot melt glue applied to the top of the cylinder. This is only a temporary connection that will allow you to flatten the bottom of the cylinder (see **Fig. 10**) and permit you to turn a hole in the bottom of the cylinder so a base plug can be inserted (see **Fig. 11**). Position the tailstock Òlive centerÓ into the cylinder opening for added support. This will help ensure the centering of the cylinder and provide support during the initial outside turning. Just after you begin the turning of the outside of the cylinder, stop the lathe and examine the surface. If the cylinder is not centered, then remove it from the waste block and adjust as necessary. **It must be centered.**



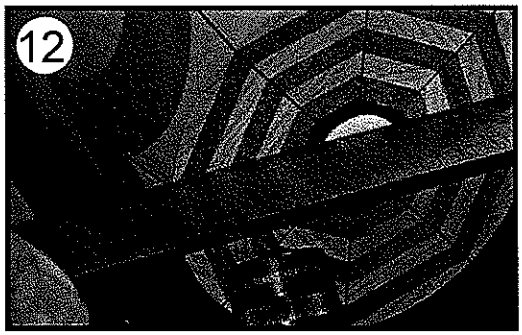
Because of the number of seams and the limited glue "working time", speed is important. While at the same time, precise alignment of all the components is critical.



Use a tailstock support whenever possible. Here the bottom is being prepared for the attachment of a waste block.



When fitting a tapered plug, turn the plug first and then enlarge the opening to fit.



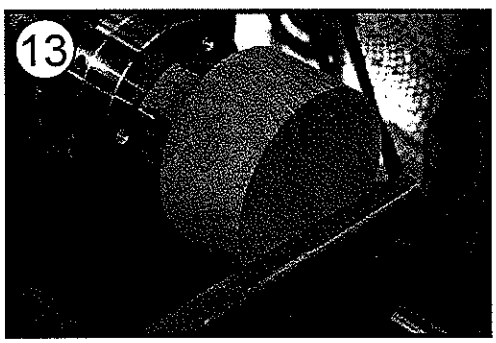
Check the bottom for flatness before attaching the centered waste block. A strong joint is important, especially during the "hollowing" portion of the lathe turning

INSTALLING A BASE PLUG

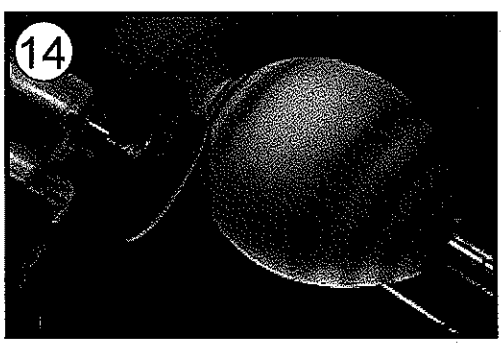
Mount and turn a slightly tapered plug. Its diameter should be just a little larger than the cylinder opening, and its grain direction should be the same as the staves. As you enlarge the cylinder opening, the inside bottom of the plug should "bottom out" first. Then carefully enlarge the inner portion of the opening until the outer visible gap disappears. If you do not bottom out the inside first, you have no way of knowing that the inside portion is snug. Apply glue (Titebond Original) and lightly tap the plug into place. Let the glue cure for at least 15 minutes and then "true-up" the bottom of the cylinder. Use a straight edge and flashlight to check the flatness of the bottom surface (see **Fig. 12**). Next, mount and turn a thick hardwood waste block to the same diameter as the cylinder. This waste block (see **Fig. 13**) should be thick enough (about 2") to permit access to the vessel base later in the project. Glue the waste block onto the cylinder bottom. This connection must be strong as the hollowing of the vessel will put considerable stress on this joint. Allow the glue to cure thoroughly.

TURNING THE VESSEL

Now it is simply a matter of turning the outside, hollowing out the inside, sanding, and applying finish. Start to turn the outside shape. Keep in mind, however, that you must maintain as much connection to the waste block as possible until you have finished the majority of the inside hollowing. This can be done by alternating back and forth between the hollowing and the outside shaping of the base portion. I recommend getting the wall thickness down to at least 1/4" or less. Normally, I do the majority of my turning with a 1/2" Glaser V-15 bowl gouge. The abundance of glue joints in segmented turning is abusive to cutting edges, and I find that the Glaser gouges withstand the abuse much better than most. The main tools I used for the inside hollowing were a Termite ring tool and a Stewart hooker tool.



Turn a thick waste block to the same diameter as the cylinder. Also, make sure that the mating surface is smooth and flat.



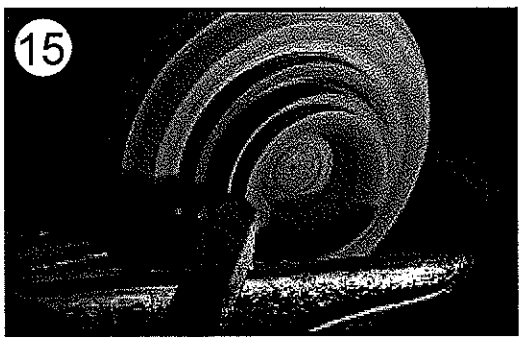
Here you can see the importance of a thick waste block. The mounting screws in a thinner block would have prevented this type of access.

SANDING AND FINISHING

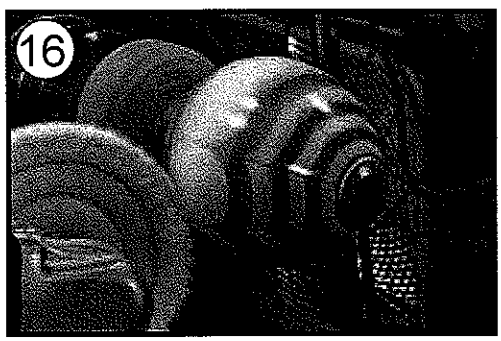
The small opening makes sanding the inside difficult; however, if the opening is small enough, sanding is not usually necessary. The outside should be sanded in incremental steps to 400 grit. Notice in **Fig. 14** the waste block has been cut away in order to provide access to the base area of the vessel. My preferred method of finishing is to apply a coat of universal sanding sealer such as Bulls Eye Seal Coat. After it has dried completely, I sand the vessel again, using 220-, 320-, and finally 400-grit abrasive paper. Then I apply another coat of sanding sealer; my goal is to fill the open pores of the wood. Usually two coats of sealer will accomplish this, but sometimes additional coats are necessary. No matter how many coats I apply, I still sand off the majority of the sanding sealer before proceeding to the finish coats. Then I apply three to four coats of General Finishes Arm-R-Seal (satin) and rub the surface with 0000 steel wool between coats. The Arm-R-Seal oil seems to protect without creating a heavy buildup, and the wood stays looking like wood instead of like plastic. With all this sanding, oiling, and buffing, you can see the advantage of maintaining a secure connection to the waste block until the very end. Even though the inside will not be very visible, it still needs to be sealed. Sealing all the surfaces equally will create a barrier against moisture. Humidity changes will still affect the wood, but a good finish will slow the process down and reduce short-term effects.

INSTALLING A COLLAR

A small collar inserted into the top opening adds a nice touch. An appropriate piece of wood should be selected for the collar. Its color should complement the vessel, and the grain direction of the collar should match the grain direction in the vessel-vertical. After you have completed the oiling of the vessel, enlarge the opening just a smidgen in order to create a fresh, un-oiled surface. This will provide a more dependable glue surface. Using a little cyanoacrylate glue (CA or superglue), mount the end grain of the wood selected onto a waste block and shape the underside of the collar to fit the vessel opening (see **Fig. 15**). Part it off and then cut a mortise (jam fit) into the waste block, which securely holds the collar with its top side exposed. Shape the top of the collar; a small, subtle shape that blends with the vessel profile usually works best. With a properly-sized, jam-chuck type of fit, you should be able to remove the collar and do a test fit on the vessel. Check the overall profile with the collar in place; continue the process until you are satisfied with the appearance. Pre-finish the collar, but avoid contaminating the gluing surfaces when applying the oil. With a good fit, final installation of the collar should only require a few drops of glue (CA or epoxy). Before removing the vessel from the waste block, a final buffing will add luster to the surface (see **Fig. 16**).



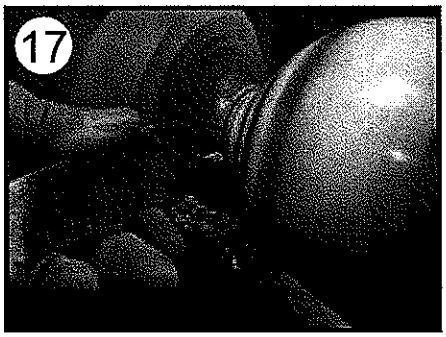
Creating a good collar fit requires patience and numerous test fits



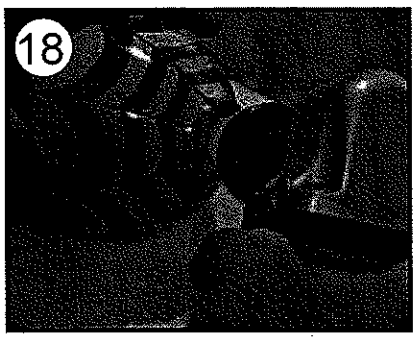
This is just one method of buffing. Handholding the piece against a buffing wheel is another method.

FINISHING THE VESSEL BASE

To finish the bottom, partially "part-off" the vessel (see **Fig.17**), and then finish the cut with a fine-toothed handsaw. Angle the parting cut slightly towards the vessel center; this will help create a concave base. Reverse mounting a turning with this shape and small diameter base is possible, but it is probably not worth the trouble. A little power sanding with a 2" disc will create an acceptable surface (see **Fig. 18**). Last, but hardly least, be sure to sign your work; people will appreciate your signature.



This is no time for carelessness. After executing a partial cut, complete the separation with a fine-toothed handsaw.



Use caution to create a slightly concave bottom that does not "rock." Be sure to sign your work before applying finish.

OTHER POSSIBILITIES

While creating this vessel, I also constructed the other two turnings (see main photo on page 20) from the same type of simple-mitered, laminated staves. The pattern on the left vessel is a result of alternating the arrangement of layers. I cut all the staves from the same laminations, but I cut four with a dark layer positioned to the outside while the other laminations had a light layer to the outside. This alternating arrangement of colors, along with a different vessel profile, produced a completely different look. For the vessel on the right, I cut all the staves with identical arrangements of layers, but when I mounted the cylinder onto its waste block for turning, I deliberately positioned it about 1/4" *off-center*. This produced different designs on the various sides of the vessel. This article has only scratched the surface of "lamination trickery," but I hope it has captured your imagination and inspired you to experiment with the technique. Have fun!

ABOUT THE AUTHOR

Malcolm Tibbetts lives in South Lake Tahoe, California with his schoolteacher wife, Tere. After a long career in the ski industry and after raising two children, he now works as a full-time wood artist. For many years, Malcolm was an amateur woodworker, then he became "hooked" on the lathe around 1993. His turnings have won many awards, and he has pieces in many prestigious collections around the world. Malcolm is the author of *The Art of Segmented Woodturning*, which was released by Linden Publishing in January 2005. You can view more of Malcolm's work on his website at www.tahoeturner.com . He welcomes questions and comments via e-mail at malcolm@tahoeturner.com. We thank him for his permission to reproduce this article.