# Ornamental TURNING

## PATTERNS CUT THROUGH Thin Layers

Bill Ooms

My fascination with thin layers started when I was introduced to the work of the late Dale Chase. I am told he was somewhat secretive about the equipment and techniques he used to create ornamental boxes. As a result, I have taken some time to recreate the techniques (or create new techniques) to make thin layers that can be cut through with an ornamental lathe, and then extend those techniques into new work of my own.

In my previous article (vol 28, no 1), I introduced the use of a mini metal lathe for wood. I will build on that foundation to show how to make multiple thin layers on the outside of a box, and then cut through those layers with a rose engine ornamental lathe. I assume the reader has taken the time to understand the basic techniques of using a metal lathe for turning wood, as well as a basic understanding of the use of a rose engine. If you do not have a rose engine, you could cut through the thin layers using appropriate cutters on a rotary tool (such as a Foredom).

*Inspired by Dale Chase*, 2011, African blackwood, bloodwood, boxwood, 1.8" × 2.5" (46mm × 64mm)

### Mounting the work

The biggest challenge comes from transferring work between a regular lathe, a metal lathe, and an ornamental lathe. Regular chucks are not sufficiently accurate to transfer work among various machines—slight irregularities in the thickness or concentricity of the layers will be noticeable when the layers are cut through to create a pattern. Precision is the

1 Drill and tap a blank Morse taper arbor for a screw. Mount a scrap-wood block onto the arbor.

2 A MT2 to MT3 adapter sleeve can be used if necessary, but may require inserting a screw into the end of the arbor to permit removing the sleeve with a tapered knockout bar.

3 The inner core of pink ivory and the outer layer of Katalox are mounted on MT2 arbors to enable moving from one lath to another. Note the vent hole in the waste block on the lower piece.

goal in creating the layers and cutting the patterns.

The alignment error can be nearly eliminated by mounting work on a Morse taper arbor instead of using chucks. Morse tapers are more accurate and consistent among various machines. If your ornamental lathe does not have provision for a Morse taper, you may have to take your spindle to a reputable machine shop (or, if the lathe is new enough, contact the manufacturer). Otherwise, you will have to resort to a leveling chuck and align the work each time you move from one machine to another.

I use 2MT arbors (littlemachineshop.com #2394) and drill/tap a 1/4-20 hole in the end. Even though the ends of the arbors are supposed to be machinable, you may find you need a cobalt steel tap (mcmaster.com #2662A11). I attach scrap wood to the arbor with a recessed screw and square off the end on the metal lathe (*Photo 1*).

If your metal lathe uses a 3MT and your wood lathe uses 2MT (which is my situation), then use a 2MT-3MT adapter sleeve. Just be sure you have a way to remove the sleeve afterward—I had to put an extension screw in the end of my arbor so I could use a tapered bar to knock it out (*Photo 2*).

Whenever possible, use a drawbar to keep the arbor snug. If it is not possible to use a drawbar, lightly tap the arbor in place with a plastic or wood mallet. Keep the Morse tapers clean—it only takes a bit of sawdust to lose an accurate fit. I use a dowel with steel wool to clean the tapers in the spindles and blow out with an air hose. There are also Morse taper cleaning tools available commercially.

## Starting materials

Start by rough turning the inner and outer layer on your regular lathe. Any contrasting woods can be used, but for this project I've chosen a central core of pink ivory, 2.5" (64mm) long and 1.875" (48mm) diameter, with an outer layer of katalox (Mexican ebony), 2.5" (64mm) long and 2.125" (54mm) diameter. The central layer will be maple veneer. The base and lid of the box are katalox (each piece .625" [16mm] thick and 2.125" diameter).

The outer layer will need a vent hole to let air out when the inner core is inserted into it (this will become more apparent later). Drill the vent hole in the scrap block all the way through to the recess for the mounting screw. Once this is done, you can square off one end of the cylinders and glue to the blocks on the MT2 arbors (I use five-minute epoxy). Note the vent hole shown in *Photo 3*.

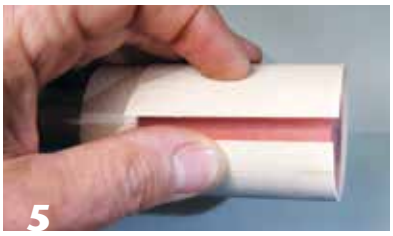
## Inner core and central layer

With the metal lathe, turn the pink ivory, along with the scrap block to a diameter of 1.740" (44mm) (*Photo 4*). Set the dial on your cross-slide to zero and *do not change or remount anything until after turning down the central layer.*

Now, cut a piece of maple veneer that is about 2.6" (66mm) in the direction of the grain, and about 6" (152mm) wide. Use veneer softener so the veneer is pliable (you can do this in advance so it will be ready when you need it). Try wrapping the veneer around the cylinder and mark where you will need to make a cut so the ends just meet. It is better to make several small cuts to approach the final dimension (*Photo 5*). A guillotine-style paper cutter works well on the softened veneer.

After the size is right, apply PVA glue to the outside of the cylinder. Apply enough glue to make a good joint, but not so much to cause a lot of squeeze-out. Wrap the veneer around ▶

Make multiple cuts to reduce the outer diameter of the core.



Use softened maple veneer for the middle layer. Trim the size to give an exact fit around the core cylinder.

Glue the veneer onto the core cylinder and wrap with rubber bands (long strips cut from an inner tube work well).

When dry, soak with CA, give it a shot of accelerator, then trim down leaving a very thin layer of the maple veneer.

Trim the excess off the end of the cylinder.

After drilling out the bulk of the outer wood, use a boring bar to match the dimension of the inner assembly. Note the small hole drilled through to allow air to escape when the pieces are assembled.

Only apply glue on the bottom inside of the outer wood, then assemble and clamp in the lathe until cured.

After parting off, turn the exterior leaving a very thin layer of the outer Katalox wood.

Trim the excess off the end of the assembly showing the thin layers around the inner core of pink ivory.

the cylinder letting it extend a bit over the end of the cylinder and wrap securely with rubber bands. I use a long strip cut from an old inner tube (*Photo 6*).

When dry, remove the rubber bands, soak the surface of the veneer with CA glue, and give it a shot of accelerator. Now we can turn the outside of the central layer. My veneer was 0.024" (.610mm) thick, so I am going to make the central layer 0.020" (.508mm) thick. Back off the cross-slide dial by 0.025" (.635mm) and make a cut to remove the excess glue (*Photo 7*), then make two shallow cuts until the outer diameter is 1.780" (45.2mm) (the original 1.740" (44.2mm) plus two times the 0.020" veneer). Finally, trim the end of the cylinder flat (*Photo 8*).

Alternate option: Rather than using veneer, you can put a layer of colored epoxy on the central core. I have used black TransTint dye to color five-minute epoxy and then turned it down to a thin layer, as thin as 0.006" (.152mm) to give a pleasing dark contrast between two lighter woods.

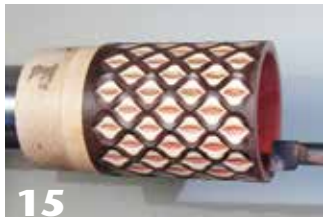
## Outer layer

Square off the end of the katalox and note the overall length (mine was 2.40" [61mm]). Drill out the bulk of the inside with Forstner bits to a depth less than the overall length—I drilled mine 2.25" (57mm) deep. I do this in two passes: first with a 1.25" (32mm) bit and then with a 1.625" (41mm) bit. I do this in my regular lathe with the belt set to lowest speed so I have good torque at low rpm (370 rpm). Drill out a .25" (6mm) hole through the bottom so it goes all the way through the katalox. There should now be a clear path for air to escape from the inside of the cylinder through the vent hole provided earlier. Check with a blast of compressed air to make sure you have achieved a clear escape vent. Note the final depth of the hole for later cut-off. Mine was 2.25".

Using a boring bar, enlarge the interior of the cylinder to 1.780" (45.2mm) (*Photo 9*). Approach the final dimension with small cuts. If you experience chatter, try a slower rpm. Chatter can also be dampened by carefully placing the tip of your finger on the shank of the boring bar. Bevel the edge slightly with abrasive, blow out any sawdust, and check the fit of the inner cylinder.

On the rose engine, start to cut the pattern so it barely goes through the outer layer and apply CA glue with a cotton swab.

Cut the pattern with multiple passes each going a bit deeper. Soak with CA glue after each pass.



Drill out the bulk of the inside of the box, then use a boring bar to cut to the final dimension.

Part off with the cut-off tool and catch the cylinder with your finger.

If necessary, make an additional pass with the boring bar taking off 0.001" (.025mm) and try again. In my case, I achieved a snug fit with an inner diameter of 1.784" (45mm). The goal is have as close a fit as possible, while still being able to insert the inner cylinder.

It is not possible to spread glue down the full length of the joint—the glue will bind up before fully inserting the two pieces. I sparingly apply five-minute epoxy on the bottom surface of the hole and up the side by only .125" (3mm). *Do not apply the glue to the cylinder.* Insert the inner cylinder while it is mounted in the tailstock to maintain straight alignment (*Photo 10*) and leave it clamped in the lathe until dry. The air escapes out of the vent hole.

When dry, apply CA glue around the joint to seep in. It will not flow all the way down the joint, but it will hold the edge secure during the next few steps. Mark the outside of the cylinder and cut it off to the left of the bottom of the hole—that is, cutting through the solid portion that remains of the katalox. The best option is to cut it by hand with the Morse taper arbor sticking out on the right side. It is *not* safe to part it off with a parting tool. Additionally, do not cut round stock on a bandsaw unless you have the proper equipment to hold cylinders and spheres securely.

Turn the outside diameter to 1.840" (46.7mm) (*Photo 11*), which will give an outer layer of 0.030" (.762mm) with the middle layer 0.020" (.508mm). Then cut off the end of the katalox to reveal all the layers (*Photo 12*). Apply some thin CA glue to seep into the joint and clean up the end again.

## Cut the outside pattern

Plan your outside pattern so it comfortably fits on the length of the cylinder. For this project, I am using a Lotus rosette with twelve repeats. It is similar to the rosette available from Jon Magill for the MDF Rose Engine. It is important that the rosette amplitude matches the cut depth. In addition, the cut depth should just go through the two outer layers to reveal the inner core. In my case, I am cutting a total depth of 0.065" (1.65mm), so I will have a rosette with a 0.065" (1.65mm) peak-to-valley amplitude. Some rose engines have the ability to adjust the amplitude. If yours does not have this capability, you will have to make or purchase a rosette of suitable amplitude.

*Do not cut the entire pattern to full depth at one time.* I first cut to a depth of 0.035" (.889mm) to barely go through the outer layer. I then apply CA glue with a cotton swab so that it soaks into the joint that was not glued thoroughly (*Photo 13*). Spray with accelerator to cure.

Cut further to a depth of 0.055" (1.40mm) to go through the middle layer, then apply more CA glue. Follow that with a cut to a depth of 0.060" (1.52mm), more CA, then 0.064" (1.63mm), more CA, then a final cut of 0.065" (1.65mm). Note that the final pass takes off only a thousandth of an inch—this leaves a clean-cut surface that the CA has soaked into between layers (*Photo 14*).

Normally, I do not do anything further to a surface after cutting with the ornamental lathe, however, there will be small areas of uncut surface that have a coating of CA glue. The glue must be removed. Sanding is a poor choice—it will round over the crisp edges of the pattern. So, I use a negative-rake scraper to carefully turn away the glue on the un-patterned portion of the surface. Use a freshly sharpened tool and be gentle.

## Hollow the body

I didn't hollow the body of the box until this point because I wanted a solid interior to make sure no distortion would occur. If you hollow out ▸

The base of the box has a tenon cut to match the inside of the cylinder and can be decorated with the rose engine.

On your regular lathe, turn a profile on the base and lid of the box while the lid is held in place securely with the tailstock.

Cut a recess in top of the lid, glue a disk of pink ivory, turn it to shape, and drill a shallow hole for the lid's center button.

Pattern the lid of the box being careful to align the pattern with the side of the box (note the blue tape).

the center earlier, you'll find some of the internal stress of the wood is relieved and the pattern will distort. When doing any thin-layered work, always keep as much wood as possible until the thin layers are cut.

Hollow the interior as before using a 1.25" (32mm) and 1.5" (38mm) Forstner bit to a depth that just goes past the end of our pattern (2.3" [54mm] in my case). Use a boring bar to enlarge the diameter to 1.550" (39.4mm), which gives a side thickness of 0.145" (36.8mm), and will allow adequate thickness for threads inside the box (*Photo 15*). This is a good time to sand the inside.

In this design, I decided to thread the inside of the box and put male threads on the lid. If your ornamental lathe does not have the ability to make threads, use a threading jig or you can hand chase the threads.

Finally, cut off the cylinder with the cut-off blade at the edge of the cut pattern (*Photo 16*). Catch the cut cylinder by placing your finger inside it.

*Lacy Box*, 2012, Katalox, maple, pink ivory, 2.9" × 2" (74mm × 51mm)

## Base of the box

Rough out the base on the regular lathe and put a recess on the bottom for an expansion chuck. Then on the metal lathe, clean up the end and cut a tenon 0.12" (3.0mm)wide to match the inside diameter of the cylinder. Sand the face and cut an appropriate pattern on the surface (*Photo 17*) and apply finish. I used a coat of Renaissance wax, and it is easy to buff it at this stage.

Glue the cylinder to the base being careful to align the inner pattern with the exterior pattern.

## Top of the box

Rough out the top on a regular lathe and turn a tenon for the male threads. Hollow out a recess inside the lid—I hollowed mine out about .25" (6mm) deep and 1.25" (32mm) diameter—and sand the inside. Cut the threads on the tenon so the fit is a bit loose. The lid and the inner core of the body are dissimilar woods, so extra space is prudent to allow for expansion/contraction. When you twist the lid onto the box, it will not feel loose because the threads will pull everything snug.

On your regular lathe, turn a shape on the edge of the base and the lid (*Photo 18*) and sand. Note the use of the tailstock for added safety.

Mount just the lid with the expansion chuck inside the recess you previously cut in the lid. Then cut a recess in the top of the lid for an insert—I made the recess 1.55" (39mm) diameter and 0.10" (2.5mm) deep. For an insert on the top of the lid, I used pink ivory, cut to fit the diameter of the recess. Glue in the insert and shape the top. Drill a .375" (9.5mm) hole in the top for the center button (*Photo 19*). *Do not drill all the way through.*

Plan the top pattern to complement the side pattern. I placed a small piece of blue masking tape on the side of the top so that I could align the top pattern with the side pattern (*Photo 20*).

I made the button from a .375"-diameter piece of African blackwood with a .25" (6mm) hole filled by a piece of boxwood. Glue in the button and turn the shape as desired. The final box is shown below.

A similar technique can be used to make thin layers in the inside of a cylindrical box and on the flat bottom of a box. The result resembles the work done by Dale Chase. The same techniques can be used to put multiple layers on the top surface of a box.

Creating thin layers on concave or convex surfaces requires more sophisticated techniques. After plain turning a curved surface, I digitize the curve and cut a matching piece with my computerized ornamental lathe. After gluing the matching pieces together, I can precisely cut off all but a thin layer of wood.

Cutting through thin layers can result in patterns similar to segmented work, but on a much smaller and more delicate scale. From a distance, the work might be mistaken for segmented work, but close examination will show the cut facets reflecting the light and giving the work a sense of depth. ■

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*Bill is a second-generation woodturner and learned basic woodworking from his father. As a young man, Bill's desire was to envision and create new things, which led to a career in engineering. In retirement, he has returned to his roots as a full-time woodworker. Recently, he has been working with rose engine and ornamental turning, which combine his woodturning skills with his math and engineering background. More of Bill's work can be seen at billooms.com and a profile of him appeared in* Woodturning *magazine, November 2012, no 246. Bill and his wife Pam have their home and studio in Arizona.*

# Ornamental TURNING

## GALLERY

*Neapolitan Box,* 2012, Katalox, maple, pink ivory, betel nut, 3.3" × 2.2" (84mm × 56mm)

*Shawl Vase,* 2012, Maple burl, black epoxy, bubinga, 4.5" × 2.7" (114mm × 69mm)

*Pierced Vase,* 2012, maple burl, black epoxy, maple, ebony 5" × 2.7" (127mm × 69mm)

*Purple Bowl,* 2012, Purpleheart, holly, 1" × 4.7" (25mm × 119mm)

*Inspired by Dale Chase,* 2012, African blackwood, 2.2" × 2.5" (56mm × 64mm)

*The Eighth Note,* 2012, African blackwood, holly, sterling silver, 6" × 6" (152mm)

AAW POP 2013 invitational exhibit "Harmony"

The head of the note is threaded and opens to reveal a triplet of small quarter notes made from sterling silver. The staff is made from wood and metal (painted black) on a base covered with printed parchment. The photo is a composite to show the note open.