Ornamental Turning

A Cricket Cage

Bill Ooms

Ornamental turning equipment does not have to be expensive. By using simple indexing techniques, you can make a pierced box with a pierced lid. Nearly all lathes have some means of indexing.

Most of the earliest ornamental lathes (including those made by Holtzapffel) utilized indexing. The rose engine concept came much later in development. My interest in pierced boxes (or cricket cages) began when I saw the lattice boxes of English ornamental turner Paul Fletcher. My work has evolved from there, along with inspiration from Josh Salesin's pierced boxes.

A Foredom handpiece is mounted on the compound tool-rest of a mini metal lathe.

Equipment

Although most lathes come with the ability to index twenty-four positions on the spindle, it may be necessary to make or buy an additional indexing wheel. For example, Iron Fire Innovations LLC (ironfirellc.com, item #892255000719 or alisam.com) produces an indexing wheel that can be adapted to most lathes through its wide range of indices.

You will also need a high-speed rotating cutter. Options include tools made by Dremel, Foredom, Mastercarver, or even an air-driven turbine. High rpm is important for a clean cut. Tools with a flexible shaft will separate the motor vibration from the work, but for the purpose of this project, that is not a big concern. I modified a Foredom handpiece so that it is driven by an overhead belt system. I use a 1/16" (1.6 mm) end-mill bit with two flutes made from solid carbide. This size is durable and the two flutes help to make the initial plunge cut.

You will need to mount the cutter handpiece to something rigid that can be moved with some amount of control. I recommend using a metal lathe (such as the mini Grizzly G8688 in *Photo 1*) and mounting the cutter handpiece to the compound feed or mounting a compound slide table (normally used on a drill press) onto the bed of your metal lathe. A basic compound slide table can cost as little as $90 (Enco #201-2826). For a bit more money, something with less backlash would be good.Adapt the compound slide table to fit onto the bed of your lathe and then mount the cutter handpiece to it. Usually, this involves using a T-nut in the bed of the carriage so that the handpiece can be moved to different positions. I use a quick-release tool post, because I use a lot of other cutters for different kinds of work. Construction details for how I mounted my Foredom handpiece can be found on my website, billooms.com, under Resources.

A compound rest and carriage have calibrated dials: The dial can be zeroed, allowing the cutter to be advanced into the work a specific amount with one crank, moved laterally with the other crank, and then returned to the zero position after the slot has been cut. With the cutter firmly held on the table of the compound or on the compound feed of the metal lathe, there is no danger of it grabbing the wood and making unwanted cuts. Repeat cuts that are identical in length can be made with this kind of arrangement.

I mount the cutter behind the lathe, and I work from the back of the lathe when I do the piercing. This arrangement keeps the cutter from getting in the way for plain turning.

There are many other options for cutters and compounds; creativity is required to adapt your lathe to a compound and a cutter. The expense, however, is not prohibitive.

Plan the work

There are times when I simply play with a new concept. When it comes to making a final piece, however, I plan my work. This is especially true when dealing with tight tolerances and thin walls. The box is made up of three pieces, all made from a single block of wood *(Figure 1)*. If you use wood that has a pronounced grain pattern, advance planning is required so that the grain—and the pattern—can be aligned.

Choose the wood

Select wood that is about 2¼" × 2¼" × 4" (57 mm × 57 mm × 100 mm) and has a grain that runs lengthwise. Select a hard, dense wood with close grain and little figure. I used bubinga, but other suitable woods include African blackwood, cocobolo, kingwood, purpleheart, or bloodwood. Woods with open pores are not suitable for this project. Softer woods do not have the strength. Hard maple would be marginal in strength.

Rough turn the block between centers to a cylinder 2¼" (57 mm) in diameter. Turn a tenon on one end to mount into a chuck *(Photo 2)*.

Form the base

With the cylinder mounted in a chuck, true its end. This end will become the bottom of the base. Cut a recess in the base that is 0.1" (2.5 mm) deep and about 1¼" (32 mm) in diameter. This recess will be used to hold the piece in the chuck later when turning the shape of the base. Add decoration on the bottom of the base now, if desired.

Sand the bottom surfaces, and part off the base 0.3" (7.6 mm) high *(Photo 3)*. Set it aside.

Main body of the box

True the end of the cylinder again, and turn the cylinder to a diameter of 2" (51 mm) for a length of 2¼" (57 mm). This will be the main body of the box, which will be pierced. Sand the outside of the cylinder now.

To hollow the cylinder, use Forstner bits. Start with a 1¼" (32 mm) bit and drill to a depth of 2¼" (57 mm), then drill a second time to enlarge the hole with a 1⅞" (48 mm) Forstner bit *(Photo 4)*. A lot of torque and slow rpm are required for ▸

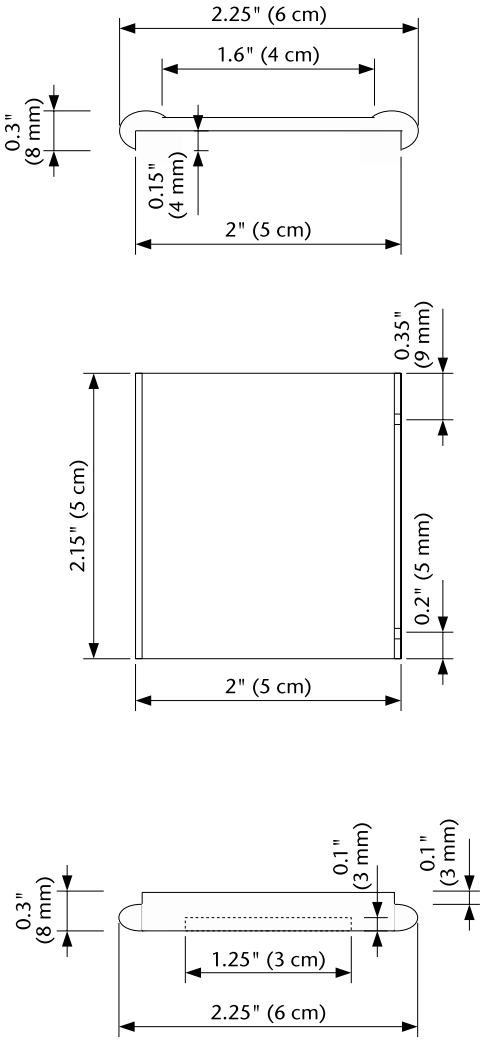

Figure 1. Overall plan and dimensions of the three sections that form the cricket cage.

2 Turn the block to 2.25" (57 mm) in diameter and turn a tenon on one end for mounting in a four-jaw chuck.

3 Clean up the cylinder's face and cut a recess 0.1" (2.5 mm) deep and 1.25" (32 mm) in diameter, part off the base, and set it aside.

4 Drill out the center with a 1⅞" (48 mm) Forstner bit.

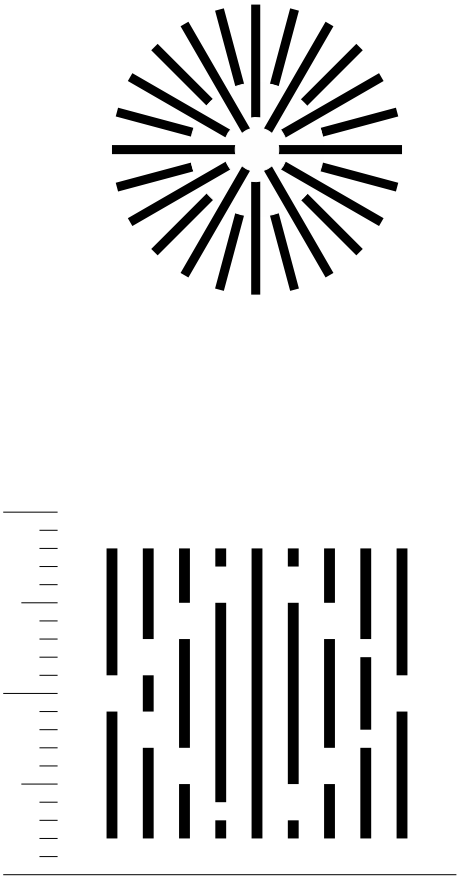

Figure 2. Side and top patterns. The side pattern is repeated six times. Each pierced column starts and stops on a multiple of 0.1" (2.5 mm).

this operation, so change the belts on your lathe to the lowest rpm to achieve the highest torque. The lathe speed should be no faster than 200 rpm. Make sure your drill chuck is secure in the tailstock so that it does not slip and that the drill bit is firmly fastened in the chuck.

My lathe's tailstock quill is 10 tpi, so if I make 22½ turns, starting from the end of the cylinder, I will have drilled to the desired depth. Use a steady feed—the shavings should come off like the thin shavings of chocolate. If the feed is too slow, too much heat will be generated. Be sure that the drill starts out straight, and avoid any wobble as the bit advances into the cylinder.

The center of the cylinder can be drilled out, leaving only 0.06" (1.5 mm) wall thickness. This works because the force is all on the solid section of the wood. Once the thin remaining portion is past the cutting edge of the Forstner bit, there is no stress on the walls. Gently sand the interior. With hardwoods, the shell is rigid because it is still firmly attached to the rest of the wood cylinder. At this point, the wall thickness is about 50 mils.

Pierce the pattern

There will be 48 columns of piercing around the perimeter of the box, which requires an index wheel that has 48 divisions. With a 2" (51 mm) outside diameter, that gives a circumference of approximately 6.28" (160 mm). With 48 pierced holes, each 1/16" (1.6 mm) wide, this leaves the material between the pierced columns about 0.068" (1.7 mm). The holes and the remaining wood are about equal.

I use the pattern shown in *Figure 2* and repeat it six times. The pattern starts with the center of the cutter 0.2" (5 mm) from the open end of the cylinder (which is the bottom of the box). The total pattern height is 1.6" (41 mm) and the gap in each column is 0.2" (5 mm) (center-to-center). All the cuts start and end on multiples of 0.1" (2.5 mm), which is convenient if you use a compound rest with dials that are 0.1" per turn (such as a Hardinge). Other compounds may have 0.04", 0.06", or 0.0625" per turn (or metric). Keep the numbers straight, or modify the pattern so that start and end points are even multiples of a turn.

I first make the cuts that are closest to the open end of the cylinder *(Photo 5)*. This will give the greatest support from the uncut portions of the cylinder. Then I make the cuts toward the middle portion, and finally do the cuts closest to the chuck. When making each cut, I advance the cutter in about 0.1" (2.5 mm) so that the end of the mill is all the way through the wood. Move the cutter the desired length and retract it, keeping the tip away from the surface. Next, rotate the spindle and change the index for the next cut. It may help to make a checklist with the index hole number marked on the list—it's easy to make a mistake counting. When finished, it should look something like *Photo 6*.

Pierce the cylinder using a 1/16" (1.6 mm) end mill and the cutter mounted on a compound or slide rest.

After piercing, clean-up work with fine sandpaper is necessary.

Clean-up work

Here's the bad news—all the fuzzes must be manually cleaned up. Time to listen to good music and employ extra lighting. I use 2X magnifiers for this operation. Start by scraping the edges

Turn a 0.1" (2.5 mm) tenon on the top of the base. This tenon will form a snug fit with the turned and pierced cylinder.

Add decoration to the inside surface of the base.

Glue the pierced cylinder to the base, and turn the edge of the base to form a pleasing curve.

of the cuts with a sharp knife (such as an Exacto blade) to remove big stringers. Then, fold a narrow strip of abrasive to utilize two sides of the strip, and sand into the interior of each slot. Slightly round over the cut edges. Abrasives in the range of 180 to 320 grit are optimum.

After cleaning up all the cut slots, it is time to gently part off the pierced cylinder. This is a delicate operation—you don't want to ruin the piece now! Sharpen a 1/16" (1.6 mm) parting tool. With a pencil, mark a line at a length of 2.15" (55 mm). The hollow portion of the cylinder is 2.25" (57 mm) deep, so you will be cutting through the thin wall of the cylinder. Run the lathe at a low speed (about 300-500 rpm works well). I hold the parting tool in my left hand, and with my right hand I insert my index finger into the cylinder to catch it when it comes off. Make your parting cut gentle and clean to end up with only a slight amount of wood remaining when the cylinder parts off. Clean up the nub with a sharp knife and sandpaper. Be gentle; the cylinder has no support and can easily be crushed.

Back to the base

Mount the base piece that was set aside earlier into the chuck with the jaws expanding into the recess on the bottom. Clean up the face and turn a tenon 0.1" (2.5 mm) deep and a little less than 2" (51 mm) diameter (to fit inside the pierced cylinder). As with any snug-fitting joint, remove only small amounts of material as you work toward the final dimension. A tight fit is not necessary because you want some room for glue in the joint. The cylinder should fit on the tenon easily without needing to press with force *(Photo 7)*.

Sand the top of the base. Add decorative elements at this point. I used a different cutter (with a 60° point) to make a simple indexed pattern *(Photo 8)*. You could also use a pointed chamfer mill with a 90° point to make a pattern.

This is a good time to put a coat of finish on the top surface of the base and the pierced cylinder. It is easier to apply finish before gluing the two pieces together. I like to use an oil finish, but any type of wipe-on finish is okay. Take the time to remove excess finish from the patterned areas to avoid weeping. I do not recommend spray-on finish; it is difficult to get a uniform layer on all the cut work—no sense in having faulty finish ruin the effect of the crisply cut pattern.

When the finish is dry, carefully sand the area to be glued (the outside of the tenon on the base and a narrow strip inside the bottom of the cylinder). I apply a light coat of wood glue (Titebond original) on the outside of the base tenon. This way, the squeeze-out goes toward the outside rather than the inside. ▸

The inside of the lid is recessed 0.15" (3.8 mm) at a diameter that will form a snug fit with the pierced cylinder.

Make a jam-fit chuck for the lid, then turn a recess 0.075" (1.9 mm) deep and to a diameter of 1.6" (41 mm).

When piercing the lid, go all the way through the top and into the jam chuck.

After all the cuts are made, clean up the rough edges with fine sandpaper.

Clean up any squeeze-out with a damp rag.

After the glue is dry, remount the base and carefully turn a bead around the perimeter. Although this could have been done earlier, I can now blend the formed bead into the cylinder's shape. I also added a small cove in the bottom *(Photo 9)*.

The top

There is enough of the original piece of wood left for the lid and a jam chuck to mount it. Clean up the face and make a recess that is 0.15" (3.8 mm) deep and about 2" (51 mm) in diameter. The actual diameter is determined by having a snug fit to the top of the pierced cylinder. Approach the final dimension with care. The goal is to have a snug fit without having to apply a lot of pressure to the delicate box. Sand the inside surface of the lid, then part it off at 0.3" (7.6 mm) *(Photo 10)*.

With the wood that remains in the chuck, make a jam-fit chuck for the lid. The goal is to have a sufficiently tight fit to hold the piece while turning, yet not so tight that the delicate lid breaks when removing it. I made the fit gently snug, then shimmed it with plastic food wrap, which is very thin, allowing for layers to be added to get just the right fit. When making the jam chuck, it is best to have the top surface of the jam chuck touch the inside surface of the lid. This will provide support when thinning the lid during the next step.

Turn the lid to a final thickness of 0.075" (1.9 mm) within the recessed area, 1.6" (41 mm) in diameter. This means removing 75 mils of material. Although there is support for the thin lid because the jam chuck contacts the inside of the lid, a gentle approach is necessary to avoid the lid flying off.

A small negative-rake angle scraper works well to get a smooth, flat cut on the top.

Finally, round off the corners of the lid and sand the top *(Photo 11)*.

Pierce the lid

Change the position of the cutter so that the drill is aligned along the axis of the lathe to make cuts perpendicular to the surface of the lid. The height of the cutter should be adjusted so that center of the cutter aligns with the center of the top. The pattern consists of 6 large cuts, 6 medium cuts, and 12 small cuts, as shown in *Figure 2*. There are 24 cuts, so use the same 48-hole index wheel. The large cuts start 0.12" (3 mm) from the center point and extend to the edge of the recessed area. The medium cuts start 0.24" (6 mm) from the center point, and the small cuts start 0.5" (12.7 mm) from the center point *(Photos 12, 13)*.

Gently pry the lid off the jam chuck (I use a knife edge to gently lift from each side). The lid is fragile. As with the pierced cylinder, there will be clean-up work.

Apply finish to all unfinished surfaces. Sign your name on the bottom (I use a vibrating engraver). Experiment with different patterns of your own design. You can use similar techniques for decorating bowls and goblets. Do not limit yourself to straight edges—with a bit of practice it's easy to make cuts that follow gently curved surfaces. ■

Bill Ooms is a second-generation woodturner who learned basic woodworking from his father. His first career was in engineering. He has now returned to his roots as a full-time woodworker, combining his technical background with rose engines and ornamental woodturning. Bill will demonstrate at the AAW symposium in Saint Paul this June. Visit Bill's website at billooms.com.

Gallery

Paul Fletcher, *Lattice Box,* 1990, Mopane, 3¾" × 2¾" (95 mm × 70 mm)

Josh Salesin, *Lattice Boxes,* 2008, Mopane, blackwood, and lignum vitae, all with European boxwood inserts, 2" × 2" (50 mm × 50 mm)

Jon Sauer, Untitled, 1991, African blackwood, Corian, 3½" × 1⅛" (90 mm × 30 mm)

Photo: Richard Sargent

Dewey Garrett, Untitled, 2010, African blackwood, 2⅓" × 1⅛" (60 mm × 30 mm)

Paul Fletcher, *Lattice Cage,* 1990, Ivory and African Blackwood, 4½" × 3" (115 mm × 75 mm)