

Twisted Boxes on a Shopmade Jig

David Springett

Boxes with six twisted sides can be made entirely on the lathe, using a shopmade jig to hold and reposition the workpiece.



At first glance, these twisted boxes appear to be impossible to turn on the lathe, but hold one horizontally and look along one of the six twisted sides. You will see that the cove has a clear and almost straight pathway. Boxes like these can be fully turned using a shopmade jig and a basic $\frac{3}{8}$ " (9mm) spindle gouge.

The sequence is to first prepare the box blank by turning a cylinder with a tenon on each end (*Photo 1*), then part the blank to turn the join and inside cavity of the box. The jig now holds the prepared blank on the lathe crosswise, off-center, and at a 45-degree angle—exactly how it needs to be for excavating one twisted cove. Rotating the blank in the jig repositions it for turning the next cove. Finally, with all six covens cut, sanded, and polished, the tenons can be cut off and the

box top and base mounted on jam chucks for shaping and finishing.

The jig indexes by way of a pin in a series of holes. This simple method can be applied to make similar jigs, allowing any number of faces to be presented and cut. The jig as shown cuts a twist that rises from left to right, but the opposite twist can be turned simply by reversing the position of the index blocks. It's also possible to twist-turn two blanks at one time, with the second blank replacing the offside block that spaces and balances the jig. I would really like to see how inventive other woodturners can be in using this twist-turning idea.

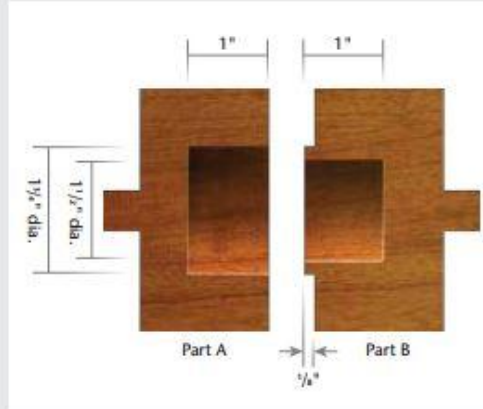
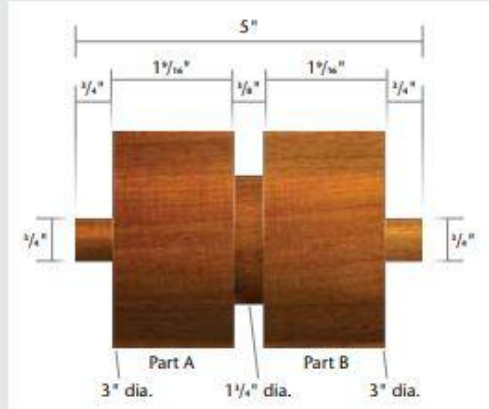
Turn the box blank

Choose a stable, clean-cutting hardwood for the box blank—I'm using

padouk in the photos—and turn it to the dimensions shown in the drawing (*Figure 1*). Mark a pencil line along its length to help realign the grain. Carefully part through the middle section alongside Part A, leaving the majority of the $1\frac{3}{4}$ " (44mm-) diameter portion attached to Part B, which will become the bottom of the box. Use the $\frac{3}{4}$ " tenon to mount the box bottom (Part B) in a chuck so you can turn the shoulder, removing as little wood as possible. Then hollow the inside about 1" deep (*Photo 2*). Set Part B aside.

Chuck the box top (Part A) to turn the face flat and true, again removing as little wood as possible. Then turn a 1" hollow to match the step on Part B and fit the two parts together (*Photo 3*). ▶

Box dimensions



Figures 1, 2. Turn the box blank between centers to 3" diameter, with an accurate 3/4" tenon on each end. Part the block to turn the interior and make the step that joins the two parts.

Turn the box blank



1 Mount and turn the box blank with a tenon on each end, then part it at the waist.



2 Use the tenon to chuck the box bottom (Part B) and turn the step, the square shoulder, and the inside hollow.



3 Chuck the top of the box (Part A) to turn the matching flat face and hollow, then fit the two parts together.

Materials and tools

Wood

- Box blank: Good, close-grained hardwood 5" (13cm) long by 3 1/4" (8cm) square
- Jig body: Two softwood disks, 8" (20cm) in diameter by 3/4" (19mm) thick
- Offside block: Softwood, 8" long by 4 1/2" (11cm) by 4 3/4" (12cm), can be laminated
- Index block: Clear hardwood block cut accurately to 3 3/8" (8cm) long by 3" (7.6cm) square, with a short length of 1/4" (6mm) dowel for the index pin

Tools & Supplies

- Hot-melt glue gun
- Scissors
- 1/4" bradpoint drill bit
- No. 8 wood screws
- 3/4" saw-tooth drill bit
- 1" (25mm) and 1 1/2" (38mm) long
- Calipers
- Index card
- Pencil compass
- Wood glue
- Craft knife

Index pin



4 To locate the indexing pin, fit the card template over the tenon on Part A and mark one of its six points into the wood beneath.



5 Bore the marked hole for the bullet-shaped indexing pin using a 1/4" bradpoint drill bit.

Index pin

The boxes shown have six facets, indexed with the help of a ring-shaped card template marked with an accurate ring of equally spaced hole centers (see *Photo 4, template in use*). To make the template, use the pencil compass to draw three concentric circles onto an

index card. The circles should have the following diameters: 3", 1½", and ¾". While the compass is still set for the middle circle, step it around that circle to locate six equally spaced points. Press the compass point through each of the six hole locations, cut around the outer circle, and use the craft knife

to cut the inner ¾" circle, completing the template.

Part A carries the indexing pin. To locate its hole, slip the index template over the tenon and choose any one of the six points. Mark the wood beneath by pressing the compass point, or an awl, through the card (*Photo 4*).

At the drill press, use a ¼" brad-point bit to bore ¼" deep at the marked point (*Photo 5*). Into that hole fit a ¼" dowel with about ¼" exposed. Make the exposed section bullet-shaped and about ⅞" (5mm) in diameter.

Index blocks

To position and hold the workpiece on the jig, the tenons on the box parts fit holes bored in two triangular index blocks. One of the index blocks has a ring of six equally spaced holes to accept the index pin in part A. Make the two index blocks from a single piece of wood that is an

Drill index block



6 Bore a centered ¼" hole completely through the index block.



7 Use the index template to mark locations and bore a ring of six ¼" holes around the centered ¼" hole.

Mark & cut index block

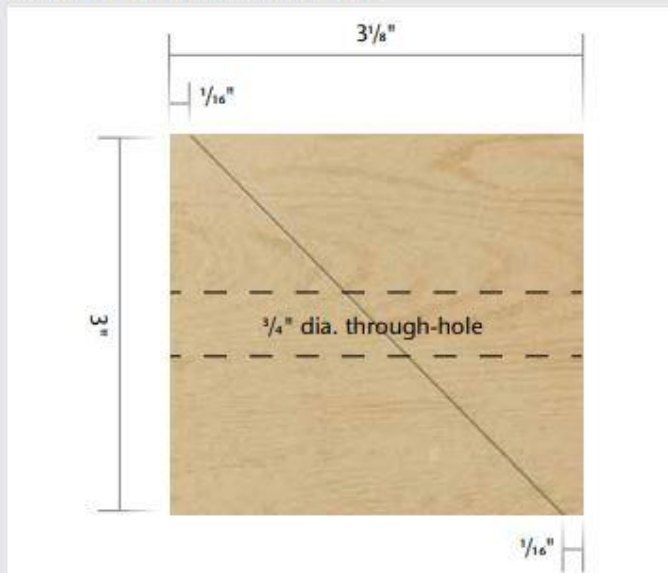
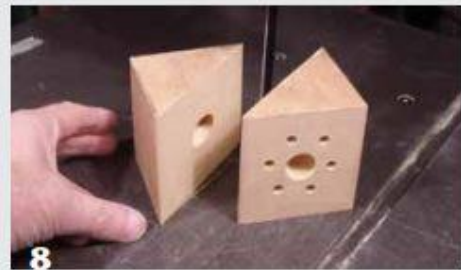


Figure 3. Measure and mark an accurate cut line.



8 Saw the index block into two parts.



9 Verify that Part A, with its index pin, fits in each of the block's six positions.

accurate $3\frac{1}{4}$ " long by 3" square, with end faces 90 degrees to the sides. Mark pencil diagonals on one end face, and at that center point bore a $\frac{3}{4}$ " hole completely through the block (*Photo 6*).

Place the index card template on the end face of the block, aligning the hole in the card precisely on the bored hole. Carefully push the awl through each of the six marked holes, making clear indents. Bore $\frac{1}{4}$ " holes to a depth of $\frac{3}{8}$ " at each point. These index holes must be accurately marked and drilled (*Photo 7*).

Lay the block on its side with the drilled hole running horizontally and mark the 45-degree line shown in *Figure 3*. Bandsaw along the marked line, then verify that Part A fits in each position (*Photos 8, 9*).

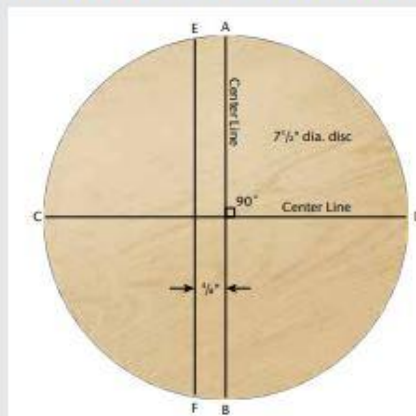
Jig body

The two 8"-diameter softwood disks sandwich the index blocks and box blank on the lathe. To make the disks match, fix one disk centrally on a faceplate, then use a live center in the tailstock to press the second disk against the first and screw them together. Turn the two disks down to $7\frac{1}{2}$ " (19cm) diameter. Mark a datum across the edges to help with relocation, and remove the top disk (*Photo 10*).

As shown in *Figure 4*, mark a center point on the disk held on the faceplate and draw the diameter AB. Mark a second diameter CD at 90 degrees to AB. Mark a third line EF that is $\frac{5}{8}$ " (16mm) away from and parallel to AB.

The offside block spaces the two disks apart, locates and anchors the index blocks, and balances the weight of the workpiece on the lathe. To make it, prepare a softwood block according to the dimensions in the *Materials and Tools* sidebar. As noted there, the offside block can be laminated.

Turn & mark outside disks



Turn the two softwood disks together so they match.

Figure 4. Remove the top disk and mark the faceplate disk according to these measurements.

Measure height

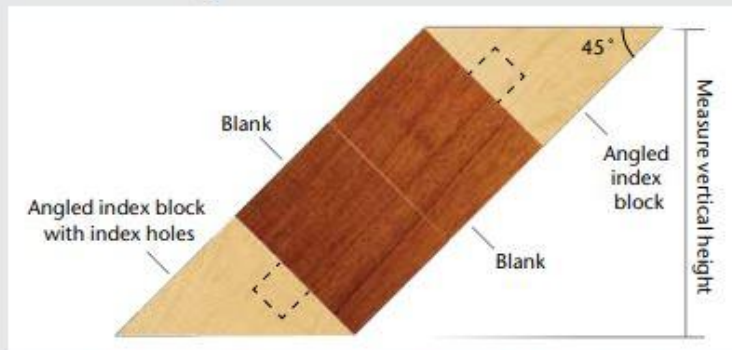


Figure 5. Sandwich the box blank between the two index blocks and measure the assemblage's height.

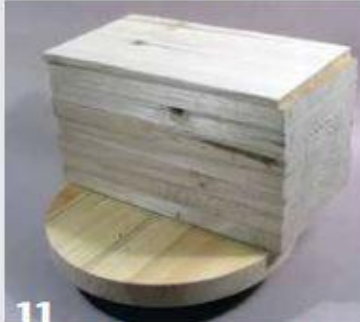
Fit the two-part workpiece between the two index blocks so you can measure its vertical height; it will be about $4\frac{1}{2}$ ", but use your own measurement. Accurately cut the offside block to the measured thickness from its $4\frac{3}{4}$ "-thick side (*Figure 5*).

Set the offside block onto the softwood faceplate, aligning its front edge precisely on line EF and covering line AB. The block has to be glued and screwed (from underneath) to the softwood faceplate. Then

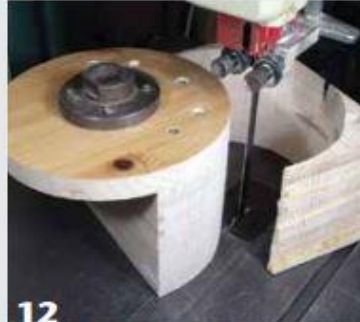
bandsaw the block to match the faceplate (*Photos 11, 12*).

Now fit the box blank between the index blocks and test it against the jig parts, confirming they are the same vertical height. Mount the assembly on the lathe, position the second softwood disk, and bring up the tailstock center to press and hold everything in position while you screw—do not glue—the second disk to the offside block. Use a try square to transfer the centerline CD from the softwood ▶

Assemble jig parts



11 After cutting the offside block according to the measurement found in Figure 5, screw the offside block to the disk. Locate its edge on line EF, covering line AB, and screw it in place from under the disk.



12 Use the softwood faceplate as a guide to bandsaw the offside block.



13 Confirm that the assembled box blank and index blocks are the same vertical height as the jig parts.



14 Use the tailstock to align and clamp the second disk, and screw it to the offside block. The jig body is now complete.

faceplate to the inside surface of the second disk (Photos 13, 14).

Fitting the index blocks

To yield a uniform twist, the front edges of the top and bottom index blocks must be set exactly the same distance from the centerline CD. If the top index block is $\frac{1}{8}$ " to the left of CD, then the lower index block must be $\frac{1}{8}$ " to the right of CD. They may both fall on the line (Photo 15).

The index blocks need to sit flat against the offside block and be screwed and glued in place. Position each index block exactly, tack it down with hot-melt glue, and screw it in place. Then bandsaw the index blocks so they follow the profile of the rest of the jig (Photos 16, 17).

Turning the twists

Finally the jig is ready to use, but first, the two halves of the box blank need to be temporarily joined. Hot-melt glue them together, aligning grain pattern or original pencil datum. Now you can fit the jig onto the lathe and mount the blank into the jig, making sure all the screws are tight and that the tailstock center is locked firmly in place.

The first time you use the jig, you'll also be cutting a cove in the index

Fitting the index blocks



15 Set the front edges of the index blocks on the centerline CD, or locate them exactly the same distance to either side of the line.



16 Use hot-melt glue to tack each index block in the exact position, and screw them to the disks.



17 Bandsaw the index blocks to the profile of the two disks.

blocks and offside block. This cove will guide all subsequent cuts, so it needs to be made to the correct width in the first place. But how wide is that? Because the index block has six positions, each cut should be one-sixth the circumference of the workpiece, which can be stepped off with the compass set to its radius, here $1\frac{1}{2}$ ". Because our workpiece is held at 45 degrees, we can draw a 45-degree line and measure $1\frac{1}{2}$ " along that line, mark vertically down from the start and finish points of that line, and measure the horizontal distance: $1\frac{1}{16}$ " (27mm), the true width of the cut. You could confirm this by geometric calculation: in a 45-degree triangle, the short sides are always .707 times the long side (Figure 6).

Next measure or confirm the distance between the two softwood disks holding the angled blank, $4\frac{1}{2}$ " in our setup. Halve this distance to locate the centerline, then to either side measure half of the true width of the cut, $\frac{7}{32}$ " (13.5mm). Mark these two positions on both the workpiece and the offside block (Photo 18).

Before switching the lathe on, rotate the jig by hand to make sure nothing catches. The lathe speed should be around 500 to 700 rpm. Using a regular $\frac{3}{8}$ " gouge, begin turning from

Determine cut width

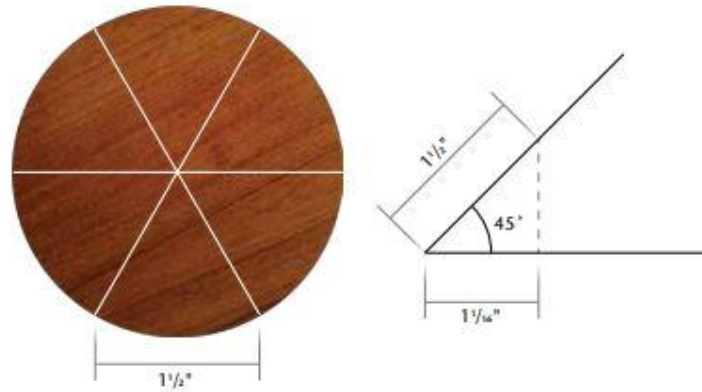


Figure 6. Set the compass to the radius of the workpiece and divide the blank into six equal segments, as shown at left. Since the blank is held at 45° in the jig, mark the segment width on a 45° line to find the true width of cut – in this case, $1\frac{1}{16}$ ".

the two marked positions toward the centerline. These first, intermittent cuts must be quite light but as the cove deepens you can take more confident cuts (Photo 19).

Switch the lathe off to check progress. At the start, the gouge will cut top left and bottom right. As the cut deepens you will see the full curved cut. Continue turning right up to the

true width of the cut as indicated by the two marked positions. Interestingly, the twisted face is produced as a series of scalloped cuts, not one sweeping cut. And the cut along the centerline is what completes the top and bottom edges of the twisted face (Photo 20).

When you are satisfied with the turned face, switch the lathe off, hand-sand, and apply finish. ▶

Turn a cove



18 Mark a centerline, then use the true width of cut to mark the edges of the first cove.



19 Turn the first cove to the marked edges. The cove will be cut into the jig along with the workpiece.



20 The deepest cut along the centerline completes the top and bottom edges of the twisted face. Sand the cove by hand before turning the next face, or cove.

Next, withdraw the tailstock, loosen the screws holding the top softwood disk, lift out the workpiece and move it round one position on the index, re-center the softwood disk using the tailstock center, screw it in place, and lock the tailstock firmly against the jig (*Photo 21*).

Cut the second face as before, but this time the profile that has been cut into the softwood block will act as a guide. When all six faces have been turned, sanded, and polished, the piece may be removed from the lathe (*Photo 22*).

Saw off the turned tenons from either end of the twisted box blank and remove the bullet dowel (index pin). To soften the hot-melt glue so that the halves may be separated, take the blank to the microwave and heat on full power for twenty seconds, but do not overheat.

Finish-turn the top and base

To turn the top of the box, mount it onto a jam chuck and retain it with hot-melt welds, and bring up the tailstock for initial support. I turned the padauk box in the photos to a gentle dome. Turn the box bottom the same way, fitting it onto a plug chuck and securing it with hot-melt glue (*Photos 23–25*).

Troubleshooting

A turned cove that is wide at one end and narrow at the other shows that the angled index blocks were not set equally away from the centerline CD. Three remedies: enjoy the form you have created, try to remove and realign the angled index blocks, or make a new jig.

If the cuts on various faces are uneven or unequal in size, this indicates that the top softwood disk may not have been replaced accurately each

time, or the index ring of holes was not bored with sufficient care.

Chipping out at the edges may be caused by dull tools or a poor choice of wood, while a chattering cut is most likely caused by a loose jig. The remedy is to make sure all screws are tight and add a tack of hot-melt glue on the blank to make sure it cannot move between the index blocks.

All illustrations by Robin Springett.

David Springett is a British woodturner known for his inventive creations. He is the author of Woodturning Wizardry, Woodturning Full Circle, Woodturning Magic, and, with Nick Agar, Woodturning Evolution.

You read the article— now see the video!

This article has an accompanying online video in which David Springett further explains and demonstrates the use of this shopmade jig. To view the video, visit tiny.cc/TwistedBox or scan the QR code with your mobile device.



Reposition & turn more covers



21 Undo the tailstock disk to rotate the blank one index position for the next coved face.



22 The profile just cut into the offside block now guides the second and subsequent cuts.

Finish-turn top & base



23 To finish the top to a nicely rounded dome, mount it on a tightly fitting plug chuck and anchor with hot-melt glue.



24



25 Use the same mounting process for the base of the box and turn a clean, slightly undercut foot.