The Amazing Elliptical Jig

This ingenious device takes you beyond the circle.

by Richard Tendick

MANY WOODWORKING TOOLS, like the saw, chisel and plane, go way back. We've no idea who invented or refined them. An elliptical jig is one of those anonymous acts of genius—how did somebody come up with such a neat idea? You spin an arm around a block of wood that has two grooves arranged in a cross. Instead of tracing a circle, the end of the arm outlines a perfect ellipse. Wow.

Mechanisms like this were used by woodworkers long ago to draw an ellipse with a pencil or stylus, which they would then cut out by hand. Substituting a router for the pencil makes the job go much faster!

I've designed a modern version of this jig to work with an ultra-smooth action—it doesn't hesitate or skip. Using a simple micro-adjust feature, it produces a perfectly smooth edge.

Watch the jig in action at AmericanWoodworker.com/WebExtras

This jig works on a simple principle: Two blocks (at points A and B) are screwed to a long arm. As you rotate the arm, the blocks slide back and forth in a cross pattern. To make ellipses of different sizes, you adjust the distance between the blocks.
The exact dimensions of the jig’s base (A) aren’t really all that important—what counts is sticking to this design. If you want to make an ellipse that’s smaller or larger than the range given in Fig. H, you’ll need to change the base’s size.

For the jig to work smoothly, the sliders (B) that run in the base’s grooves must fit just so—not too tight, but not too loose. The less friction, the better. While you could make the sliders from solid wood (maple would be best), I used UHMW plastic (see Source, page 59). This material is quite slippery and will never need lubricating.

Cut the base to final size. Be sure that it’s absolutely square. Next, set up a dado set to cut a groove to fit your slider material (Photo 1). Cut two of these grooves in the base (Photo 2; Fig. B.)

Next, make the sliders. Begin by cutting two rabbets on both ends of the piece of plastic (Photo 3; Fig. J). I used a rabbeting bit in a router table, but a dado set would work just as well.

Crosscut the plastic to free the sliders (Photo 4). Note that the length of this cut determines the slider’s height. The exact measurement will depend on the depth of the grooves you cut in the base. When you place each slider in a groove, the top of its upper shoulder should be about 1/64” lower than the surface of the base. This clearance is necessary for the slider to travel freely.

I clamped a stop block to my saw’s fence to set the length of the cut. The block is exactly 1” thick. Using the scale on the saw’s front rail, I positioned the fence at the slider’s precise height and added 1”.

If, on the first try, you make the slider too tall or too short, you won’t be able to salvage it. No problem. Just cut some new rabbets and try again. That’s why I used my router table, rather than a tablesaw, to cut the rabbets.

Drill holes in the middle of the sliders, then tap the holes to receive 8-32 screws (Photo 5). Place the sliders in the base. Four plates (C) prevent the sliders from lifting out of the grooves. Cut the plates to size and fasten them to the base (Photo 6). If you use ordinary plywood for the plates, which is slightly less than 1/4” thick, the top of the sliders will sit about 1/32” above the plates. That’s fine—this clear-

**PART 1 - Make the Jig**

**1** Set up a dado blade to cut a groove that precisely fits a piece of 3/4” thick UHMW plastic.

**2** Cut two grooves at right angles to each other on a square piece of plywood. This is the jig’s base.

**3** Rout rabbets on both sides of the plastic, forming a T-shape. Repeat this operation on the other end of the plastic.

**4** Cut off both ends of the plastic, creating two T-shaped “sliders.” Use a 1” thick stop block clamped to your fence to set up this cut.

**5** Tap holes in the sliders for fastening them to the jig’s arm.

**Tip** Using a router table to cut rabbets, dadoes and grooves can free up your tablesaw for other work. If there’s a chance you must remake a piece, leave the router table set up as long as you can.
Put the sliders in the base's grooves, then trap them with four square pieces of 1/4" plywood. Fasten these pieces to the base.

Cut off the corners of the jig.

Make the jig's arm. Drill holes spaced 1/2" apart down the length of the arm, then cut out the arm's shape.

Make two platforms for the arm. This one will be drilled to fit a router; the other one is for use with a pencil.

Plastic sliders give the jig an ultra-smooth action.

ance is exactly what you want. When you attach the jig's arm to the sliders, you don't want the arm to drag on the base. The arm should be slightly elevated above it.

To complete the base, cut off its corners (Photo 7). These cuts don't have to be dead straight—they just reduce the base's size for routing small ellipses.

The arm (D) can be as long or short as you wish. It's designed to place your router as close to the work surface as possible so you don't need an extra-long bit. You may have to modify the size of the arm's fork to fit your router.

The arm has a series of holes spaced 1/2" apart. They allow you to quickly set up the jig to make an ellipse of any size, in increments of 1".

Let me explain the spacing of the arm's holes. Ellipses are defined by two dimensions: a major diameter (the long way across) and a minor diameter (the short way across)—see Fig. H. Think of each hole in the arm as the center of a major or minor diameter; basically, it's the equivalent of a circle's radius. The actual diameter will be twice the distance that the hole is from the router bit, just like a circle's diameter is twice its radius. For example, the hole labeled 10" refers to a 10" diameter, but it is actually only 5" from the bit. If you need to make an ellipse with fractional dimensions, just drill some new holes alongside the existing holes.

Drill the ellipse-diameter holes and the holes for mounting the spacers (E) and platforms (F) using a drill press. Cut out the arm (Photo 8; Fig. C) and mark the holes. Make the spacers (Fig. F).

Next, make the platforms (Photo 9; Figs. D and E). One is for drawing the ellipse; the other is for routing it. The drawing platform has a small hole for a pencil point. When you mount this platform on the arm, its pencil hole should be exactly 4" from the hole marked 8" on the arm.

The routing platform has a large hole for the bit to pass through. Note that the center of this hole is not in the same location as the center of the pencil hole. You'll want the edge of the bit to cut right on the pencil line, so the precise location of the routing platform's hole will depend on the diameter of the bit you'll use. I use a 1/2" bit.

I've added an optional micro-adjust feature to the arm...
**Cutting List**

<table>
<thead>
<tr>
<th>Part</th>
<th>Name</th>
<th>Qty.</th>
<th>Material</th>
<th>Th x W x L</th>
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<tbody>
<tr>
<td>A</td>
<td>Base</td>
<td>1</td>
<td>Plywood</td>
<td>1/2&quot; x 14&quot; x 14&quot;</td>
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<tr>
<td>B</td>
<td>Slider</td>
<td>2</td>
<td>UHMW plastic</td>
<td>3/4&quot; x 35/64&quot; x 4&quot;</td>
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<tr>
<td>C</td>
<td>Plate</td>
<td>4</td>
<td>Plywood</td>
<td>1/4&quot; x 6-7/8&quot; x 6-7/8&quot;</td>
</tr>
<tr>
<td>D</td>
<td>Arm</td>
<td>1</td>
<td>Plywood</td>
<td>1/2&quot; x 9-1/2&quot; x 42&quot;</td>
</tr>
<tr>
<td>E</td>
<td>Spacer</td>
<td>2</td>
<td>Plywood</td>
<td>1/2&quot; x 1-1/2&quot; x 3-5/8&quot; (a)</td>
</tr>
<tr>
<td>F</td>
<td>Router platform</td>
<td>2</td>
<td>Plywood</td>
<td>1/4&quot; x 6&quot; x 9-1/2&quot; (b)</td>
</tr>
</tbody>
</table>

**Notes:**

- **a)** Thickness is approximate.
- **b)** Use one platform for drawing only, if desired. Adjust width of second platform to fit the base of your router.
that allows me to trim an ellipse 1/16” smaller all around on a final pass (see Photo 15). After making a series of stepped cuts to outline the ellipse, this final cut ensures that the edge of the ellipse will be perfectly smooth. Basically, the micro-adjust allows you to move the platform 1/16” closer to the center of the ellipse and lock it there with a pair of indexing pins (Fig. G). To do this, the holes in the arm that go under the wing nuts must be made oval, using a file.

Mount the routing platform on the arm before you drill the holes for the indexing pins. Note that there are two sets of these holes; they go on both sides of the platform. Neither the distance between the holes nor their location are important; it’s their 1/16” offset that counts. To drill the holes, loosen the wing nuts and pull the platform to its farthest position away from the center of the ellipse. Tighten the wing nuts, then drill a 1/8” hole through the arm and down into the spacer. Move the platform in 1/16”, then drill another set of holes; label these as the “Trim” position and you’re all set.

**SOURCE**
Woodcraft Supply, woodcraft.com, 800-225-1153,
UHMW Sheet, 3/4” x 4” x 48”, #124228, $40.

The elliptical jig’s base must be fastened to your workpiece, so it can’t move. Screwing it to the underside of the workpiece is the best solution (Photo 10).

Place the sliders in the position shown in Photo 10, then mount the drawing platform onto the arm. Attach the arm to each slider (Photos 11 and 12). Lining up the second hole with its slider can be a bit awkward; using an awl to align the holes before inserting the screw usually does the trick.

Draw the ellipse (Photo 13), then remove the arm from the base. Saw near the line to remove most of the waste. Place some non-slip blocks on your bench and put the workpiece on the blocks.

Remove the drawing platform and substitute the routing platform, with the router attached. Refasten the arm to the base and you’re ready to rout (Photo 14). Remember to go in a counterclockwise direction, as you would when routing the profile of any piece.

If making stepped cuts resulted in a slightly uneven edge, cut a new edge using the micro-adjust feature (Photo 15).