



# Easy Angled Tenons

Router jig simplifies complex chair joinery

BY JEFF MILLER



Chair joinery is a challenge. Many of the joints are angled, and all of them are subjected to powerful stresses when the chair is in use. To contend with these issues, I almost always choose the mortise-and-tenon joint. If the joints are angled, I prefer to cut straight mortises and then angle the tenons.

The tricky part is cutting the angled tenons. But the jig presented here, used with a plunge router fitted with a straight bit and guide bushing, greatly simplifies the task. With an upright that clamps in your vise, a platform that supports the router, and a template that guides the bushing, the jig enables you to cut the two main cheeks and shoulders of an angled tenon in a single, stable setup. Then, using the routed shoulders as a reference, you can finish the tenon with a bit of simple chisel

work. The jig works equally well for straight tenons.

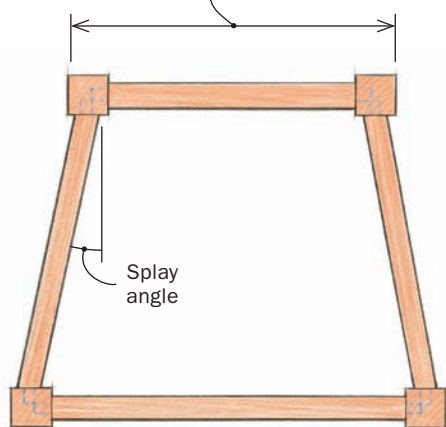
The template is removable, and you'll want to make separate templates for tenons of different thicknesses. The wedge that holds the workpiece at the correct angle is also removable, so you can use different wedges depending on the tenon angle you want.

## Take care with the template

The base of the jig is straightforward and quick to build, but slow down when you get to the template. I glue it up from three parts—two notched side pieces and a guide strip between them. The router's bushing will ride on both sides of the guide strip to produce the tenon, so the strip must be sized accurately. To determine its thickness, start with the thickness of the tenon you want and subtract the difference between the

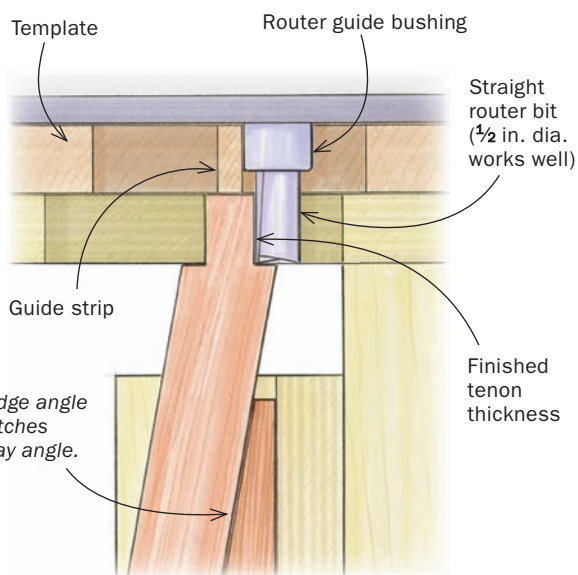
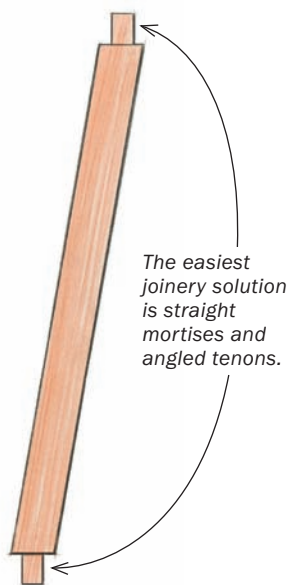
## HOW THE JIG WORKS

A typical chair narrows at the back, creating an angle at each side seat-rail joint.



CHAIR GEOMETRY

The easiest joinery solution is straight mortises and angled tenons.



WEDGE HANDLES THE ANGLED TENONS

# Simple router jig for tenons

Easy to make and simple to use, this router jig will crank out perfect-fitting tenons (angled or straight) with perfectly aligned shoulders.

## A STURDY SUPPORT

The top plate supports the router and orients the template (opposite page). If the top plate is aligned with the L-fence below, the tenons will be square and accurate.

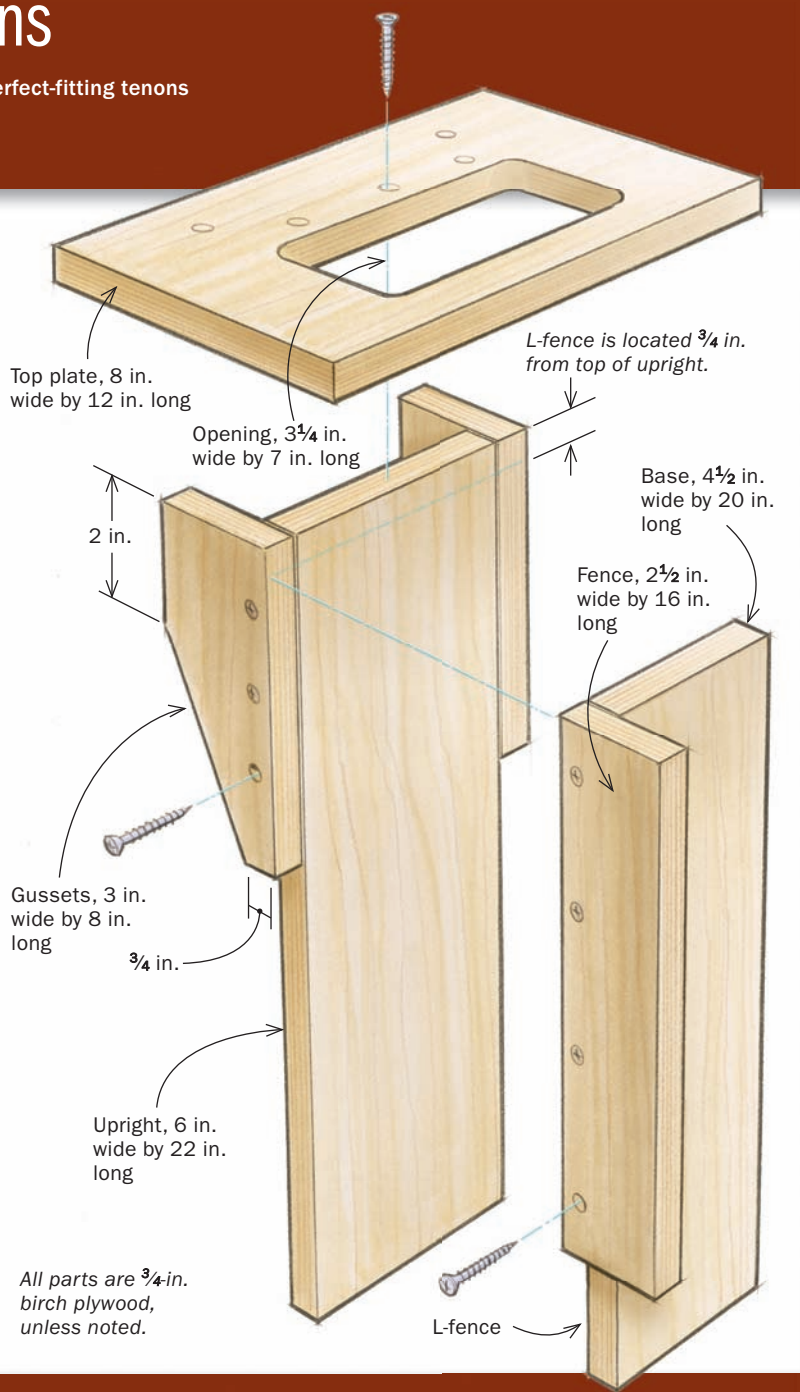
**Gussets go on flush.** If the gussets are square and you attach them flush to the upright, the top plate will go on square. Clamp the gussets as you screw them on.



**Square the top plate side to side.** Drive a single screw in the middle, square the edges of the top plate with the upright below, and then clamp and add the remaining screws.



**Now the L-fence.** Screw the L-fence together and then attach it to the upright, squaring it to the top plate before clamping and screwing it down. Be sure the L-fence sits well below the top for router-bit clearance.



guide bushing and router bit. For example, if you're using a  $\frac{5}{8}$ -in.-dia. bushing with a  $\frac{1}{2}$ -in.-dia. bit (a difference of  $\frac{1}{8}$  in.) and want a  $\frac{1}{2}$ -in.-thick tenon, make the guide strip  $\frac{3}{8}$  in. thick.

Start by notching the two side pieces, and then mill the strip. To dial in the thickness of the guide strip, dry-clamp the template and use it to cut a test tenon. If the tenon doesn't fit the mortise perfectly, either plane the strip a bit thinner or make a new, slightly thicker one. When the tenon fits the mortise perfectly, glue the

strip permanently into the template.

Once the template is glued up, add the rails, which register the template square to the workpiece. To attach the rails accurately, clamp an alignment board into the jig, sticking up past the top, and clamp the guide strip tight to the board. Then screw the rails to the template so they fit snugly against the top plate.

## Practice with a straight tenon

To get the hang of the jig I recommend cutting a straight tenon first. Lay out the

tenon in pencil, both cheeks and shoulders. Now clamp the workpiece in place, with the top end against the underside of the template. Adjust the template so the guide strip is centered on the layout lines, and then clamp it in place. Last, set the plunge depth on the router so the bottom of the bit lines up with the shoulder line.

Start the router in the raised position and then plunge to full depth without touching the workpiece. Make a light climb cut first, to avoid tearout at the shoulder, and then make conventional cuts to finish the job.



## ACCURATE TEMPLATE IS THE HEART OF THE JIG

Make a dedicated template for each tenon thickness you want.

Width of guide strip depends on thickness of tenon.

Template rails, hardwood, roughly  $\frac{3}{4}$  in. thick by 1 in. wide

Template notches,  $1\frac{3}{8}$  in. wide by 6 in. long

Template, solid hardwood,  $\frac{3}{4}$  in. thick by  $8\frac{3}{8}$  in. wide by  $14\frac{1}{2}$  in. long



**Dial in the strip.** To size the guide strip, take the difference in size between the bit and bushing, and subtract that from the desired tenon thickness. Plane the guide strip to that dimension or just a bit over.



**Give the template a dry run.** Clamp the template parts together dry, attach the template to the jig, insert a workpiece, and cut a tenon (1). Test the tenon in its mortise (2). If you are happy with the fit, glue the parts together and run the template through the planer to clean it up. To align the template and attach the rails, clamp a board into the jig and clamp the guide strip to it (3). Then clamp the rails snug to the top plate below, and screw them to the template.

I trim the tenon to width by hand, and it goes quickly. Using a chisel wider than the tenon is thick, I make a shallow chop at the shoulder line, using the pencil line and the existing shoulders to line up the chisel. Then I pare away a small chip (see p. 43). Now I can chop deeper at the shoulder and pare off a longer chip, repeating the process until the tenon is done.

### Angled tenon is just a wedge away

For angled tenons, I draw a full-size top view of the seat to determine the angle of





# Using the jig for angled tenons

Make a plan view of the seat to figure out the tenon angle, and then make a wedge at that angle, at least 12 in. long. The wedge works on both the tablesaw and the router jig.



**Ends first.** Use the wedge with a miter gauge on the tablesaw to cut off the ends of the workpiece at the correct angle.



**Lay out just one workpiece.** Lay out the cheeks and shoulders for one tenon with a sharp pencil. The other tenons need only rough marks to make sure you cut them in the right orientation.



**Add the wedge.** After cutting off a small piece for the back side of the jig, screw the long wedge to the L-fence.



**Load in the workpiece.** With the workpiece butted against the bottom of the template, clamp it in place. The tip cut from the wedge serves as a clamping block.



**Locate the template.** Slide it sideways until the guide strip is centered on the tenon layout below.

the tenons, and make a long wedge that will go into the router jig. Make the wedge about the same width as the workpiece, and at least 12 in. long. Cut off a short piece of the wedge to go on the back side of the jig to provide purchase for the clamp.

Before screwing the long wedge in place, use it at the tablesaw to help crosscut the ends of the side seat rails. Now screw the wedge securely to the router jig, clamp a side rail in place, and rout these angled tenons just as you did the straight ones.

## Compound angles are easy, too

For compound-angled tenons, add a second wedge, this one screwed to the jig's fence. Use both wedges together at the tablesaw to cut the end of the rail, then mount them on the jig to rout the tenons.

One last tip: For minor adjustments to the tenons, use tape to shim the jig. □

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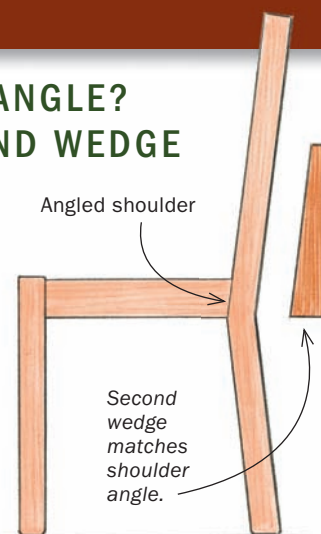


**Rout one side at a time.** Plunge the router fully, then start with a light climb cut to prevent tearout at the shoulder. Then make a series of light normal cuts until the guide bushing reaches the guide strip. Now do the same to form the other side of the tenon.

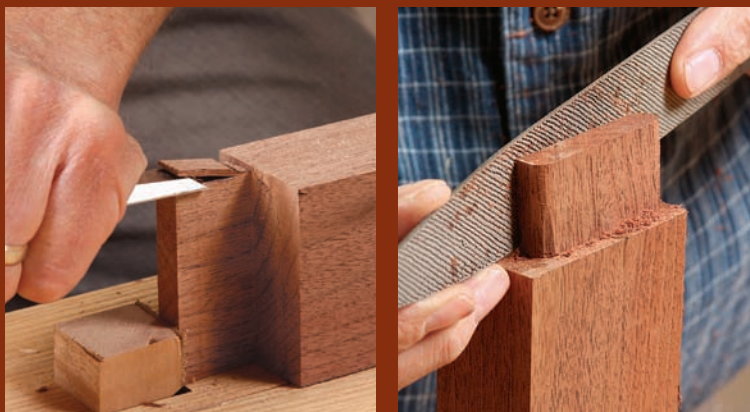


## COMPOUND ANGLE? ADD A SECOND WEDGE

On many chairs the seat slopes backward for comfort. On others the back legs are splayed. Do another full-size drawing to determine the angle between the rails and legs.



**Add the second wedge.** The second wedge is screwed to the side of the L-fence (left), and the two wedges work together to create the compound angle. Mark the parts carefully to be sure you position them correctly in the jig (below) and rout as usual.



**Cut the ends by hand.** Use a chisel that is wider than the tenon but narrower than the workpiece to trim the top and bottom of the tenon. Then use a file to round the tenon to match the routed mortises.

**Perfect fit on an angled tenon.** If the cheeks are a bit fat, trim them with a shoulder or rabbet plane. Then test-fit the tenon and watch the four shoulders close perfectly, with no gaps.

