



# Open the Door to Japanese Joinery

Cut a scarf joint to learn the basics

BY ANDREW HUNTER



**Lock with a wedge.** A tapered pin drives the two halves together, creating a rigid connection that can also be knocked apart later.

Traditional Japanese joinery, with its intricacy, precision, and strength, is awe-inspiring, and very enticing to any woodworker. But learning how to cut these joints can be a challenge regardless of your skill level. Layout doesn't rely on straight and square reference faces, and determining the order in which to cut things can be tricky.

The joint in this article, the kanawa tsugi, translated as a half-blind tenoned, dadoed, and rabbeted scarf joint, is an excellent place to start. Used in Japan for centuries to splice two members together end to end, it creates a single longer one capable of sustaining multidirectional forces.

Layout is the hardest and most important part of the joint. Instead of working off two straight and square reference faces adjacent to each other, everything works off a centerline. You'll also use an ingenious story stick that, with five layout lines and a precise width, contains the keys to the whole joint.

I prefer to cut this joint by hand, as I've found no advantage in using power tools. But don't feel limited to using Japanese tools, as I do. This scarf joint can just as well be made with Western tools and work-holding methods.

## Story stick tells the whole tale

Many of the dimensions in this joint are  $\frac{5}{8}$  in., especially around the T-notches, so my story stick is  $\frac{5}{8}$  in. wide and has a  $\frac{5}{8}$ -in. square in its middle. It also has marks showing the total length of



## AN EXCEPTIONAL PAIR

Like other scarf joints, the kanawa tsugi lets you join two pieces of wood end to end, with its T-shaped notches providing exceptional strength. In the article, I'll be cutting only one half of the kanawa, but to complete the joint, you'll have to cut both halves. The two are identical.

## LAYOUT BASED ON CENTERLINES AND A STORY STICK



**Draw the centerlines.** After laying out the centerlines on the ends, Hunter uses a straightedge to connect them along all four faces. This lets him deal with stock that may be warped or out of square.

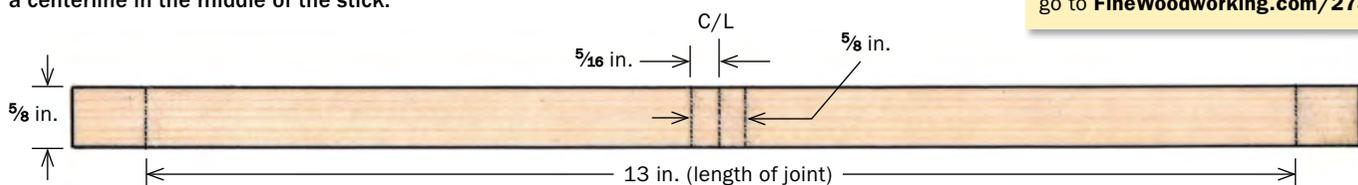
the joint, in this case 13 in., so make the story stick slightly longer than the joint. To make the joint shown here, I used stock that was  $3\frac{1}{2}$  in. square, but don't feel limited to this. The members can certainly go bigger—in traditional Japanese house construction, posts are often about 5 in. square—in which case  $\frac{5}{8}$  in. remains a viable standard. In fact, this dimension is the width of a Japanese framing square, which is used in Japan to lay out this joint. If you use smaller stock, though, I recommend reducing this dimension. At 3 in. square, drop to  $\frac{1}{2}$  in.; at 2 in. square, try  $\frac{1}{2}$  in. or  $\frac{3}{8}$  in.—whichever looks better to your eye. The size of the stock dictates the joint's length, too, which is generally three to four times the width of the workpiece.



**Draw layout marks on a story stick.** The story stick is overlong, letting you draw the length of the joint. The stick is  $\frac{5}{8}$  in. wide, and it has a centerline with marks  $\frac{5}{16}$  in. away on either side, giving you a  $\frac{5}{8}$ -in. square in the middle. Square these lines down the stick's edges.

## STORY STICK FOR SPEEDY LAYOUT

The stick is  $\frac{5}{8}$  in. wide, a dimension that appears a lot in the joint, especially around the T-notches. Making the stick this width expedites layout. To help even more, mark the overall length of the joint and draw a  $\frac{5}{8}$ -in. square and a centerline in the middle of the stick.

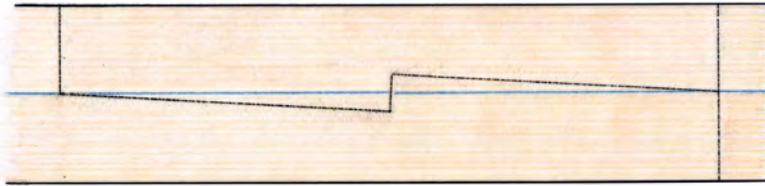


## Online Extra

For more on using centerlines, including how to lay them out on irregular stock, go to [FineWoodworking.com/278](http://FineWoodworking.com/278).

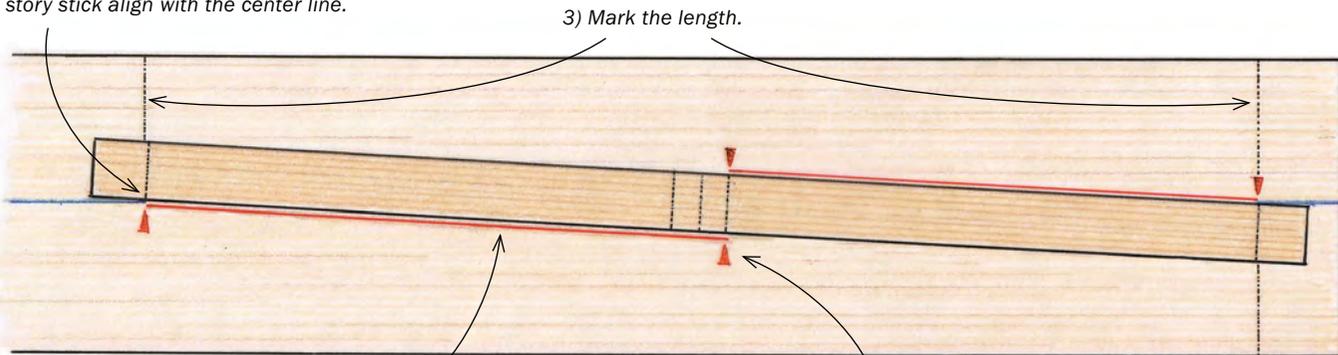
# Laying out the kanawa joint

## 1. BEGIN WITH THE SCARF



SIDE VIEW

1) Angle the story stick so that the end marks on opposite edges of the story stick align with the center line.



2) Trace the scarf faces.

3) Mark the length.

4) Mark the step.

**Step is square to the scarf.** Lay a flat square along the scarf face and use it to connect the two step marks. This is the only line that runs perpendicular to the scarf faces.



**Square the length marks around the workpiece.** Reference off the centerline now and for the rest of the layout.



**Angle the story stick across the centerline and transfer the layout marks.** Trace the two sloping scarf faces and transfer the length marks. Be sure to leave waste at the butt end of the joint. Do the layout on both sides of the workpiece.

## Centerlines guarantee mirror images

The simplest and most accurate way to lay out this joint, and many others like it, is using centerlines on each face—essentially X-Y axes. During layout, all measurements and angles originate from these centerlines, not the outside edges. It may be confusing at first, but it's ultimately quite liberating. It lets you seamlessly join any two pieces whether they're milled square and true, as they are here, or irregularly shaped from a log. (Another reason I prefer hand tools here: I'm not limited to flat and square reference surfaces.)

There are many ways to establish these centerline axes, which must be coplanar and square to each other. I start by leveling the workpiece before marking the center point on each end. Next I use a level to draw level and plumb lines intersecting these points. To double-check the layout, I use long winding sticks tacked to the lines. I finish by using a straightedge to connect these axes along the workpiece's faces.

## Lay out one side at a time

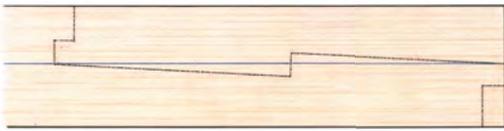
The two halves of the joint are nearly mirror images, so if you can lay out (and cut) one half, you can handle the other.

I recommend laying out one side entirely before the other. Begin by angling the story stick so its end marks

## 2. ADD THE NOTCHES



TOP VIEW



SIDE VIEW



BOTTOM VIEW

on two opposite edges touch the centerline. Hold the stick down tight and transfer the sloping scarf faces and the end points. The two scarf faces are parallel and  $\frac{5}{8}$  in. apart, so lay them out by tracing on either side of the stick. Take into account any flaws in the stock, placing them in the waste.

Without moving the stick, draw the two ticks for the step, which is one wall for the wedge that will lock the joint.

Now you can extend those marks. The step is square to the scarf faces, so register the square on one of the scarf lines when drawing the step line.

To draw the length of the joint, wrap the end marks around the stock. These lines need to be perpendicular to the centerline, so register a flat square off of the centerline when drawing the lines around the beam. If you don't have a flat square, a piece of MDF or plywood with a square corner will do the job.



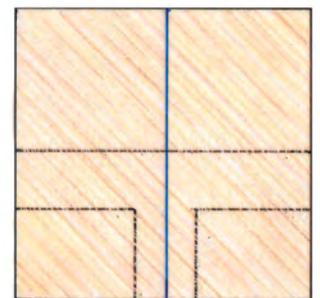
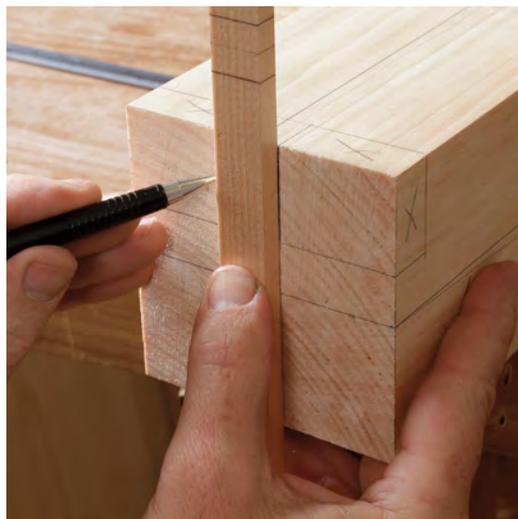
**Begin with the interior T-notch.** To establish the depth of the notch, use the full width of the stick. For the centered square, align the stick's centerline with the workpiece's and transfer the  $\frac{5}{16}$ -in. marks (top) before tracing the stick's width to connect them (left). You'll finish laying out this notch after making preliminary cuts.



**Work on the end T-notch.** Use the story stick the same way as for the interior notch, this time drawing the joint on the sides and bottom of the workpiece.



**Square up the end of the joint.** Saw carefully around the stock, staying as close to the layout lines as you feel comfortable. End grain is hard to clean up.

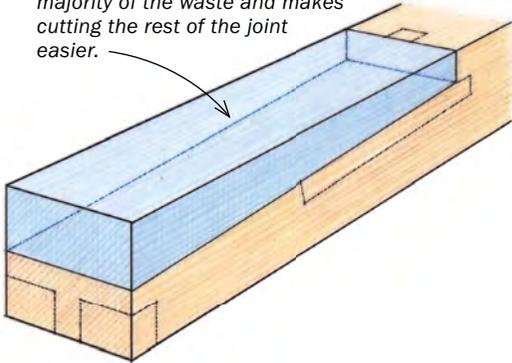


**Complete T-notch layout on the end of the workpiece.** With the workpiece cut to length, use the story stick to connect the lines for the end notch. Mark the waste as well.

# Make the scarf

## 1. SAW OUT THE BULK OF THE WASTE

A pair of sawcuts removes the majority of the waste and makes cutting the rest of the joint easier.



**Long angled rip is the first cut.** Saw as close to the scarf line as you feel comfortable. Since this is long grain and can easily be planed to the line afterward, Hunter plays it safe, staying about  $\frac{1}{16}$  in. away.



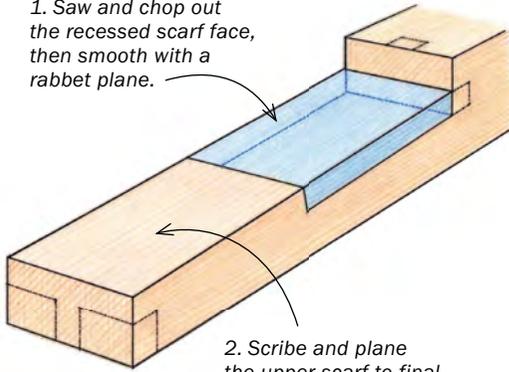
**Wedge keeps kerf from closing as you saw.** This is a long rip, and the farther you go, the more likely it is the kerf will pinch shut and bind your saw. A long, thin wedge prevents this from happening.



**Crosscut frees the waste.** Don't stop when you reach the angled rip, but saw down to the lower scarf face.

## 2. CLEAN UP THE FACES

1. Saw and chop out the recessed scarf face, then smooth with a rabbet plane.



2. Scribe and plane the upper scarf to final dimension.



**Crosscuts down to the lower scarf.** Since you'll remove the majority of the waste here with a chisel, start with a series of crosscuts to sever the fibers, stopping short of the layout line.



**Chisel out the bulk of the waste.** Start with heavy chops away from the line before switching to controlled paring cuts as you approach it. Work in from both sides to prevent blowout. Avoid undercutting this surface, as that will make future layout more difficult.



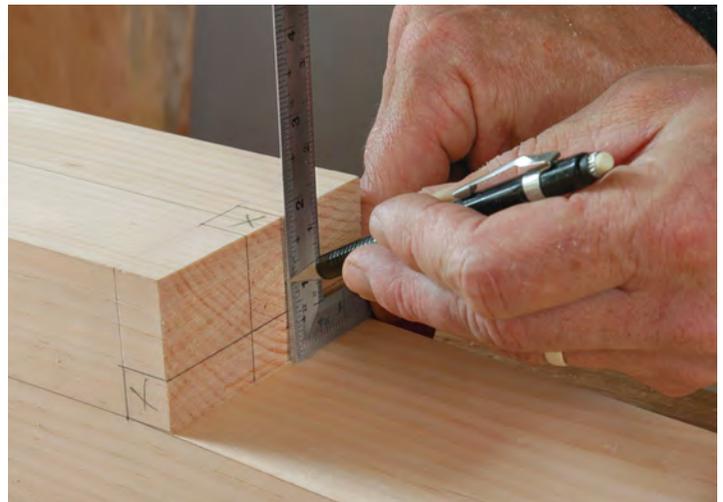
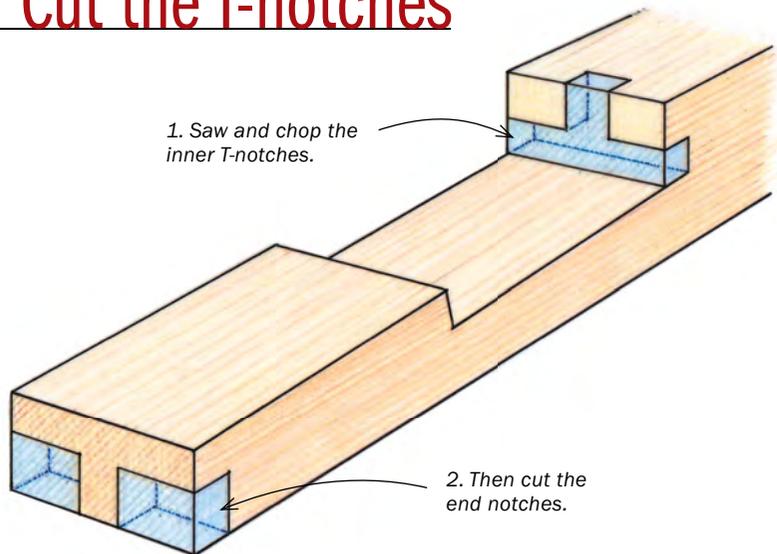
**Plane to the layout line.** Hunter uses a rabbet plane so he can plane right up to the joint's shoulders.



**Draw a layout line across the step before planing the upper scarf.** Use a straightedge to connect the upper scarf's side layout lines. This way, you have layout lines on all four sides of the upper scarf, letting you monitor your planing much more carefully.



# Cut the T-notches



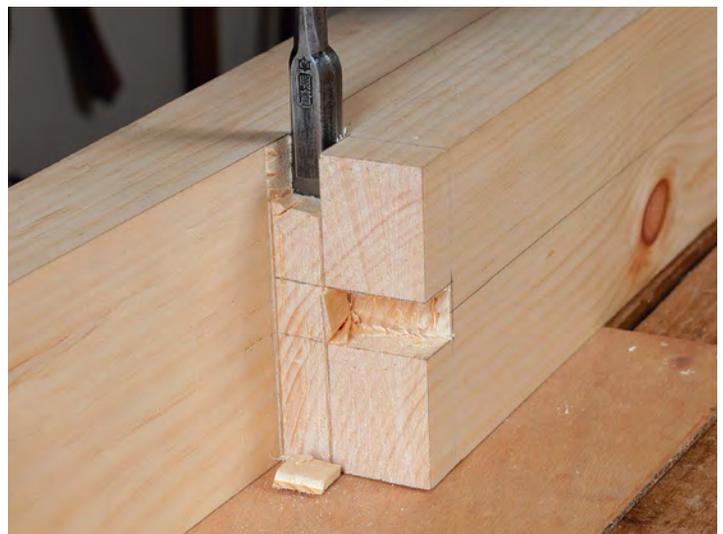
**Bring layout lines onto the end grain.** Use a flat square for this layout. If you undercut the lower scarf, place a straightedge across the joint so you can reliably register the square.



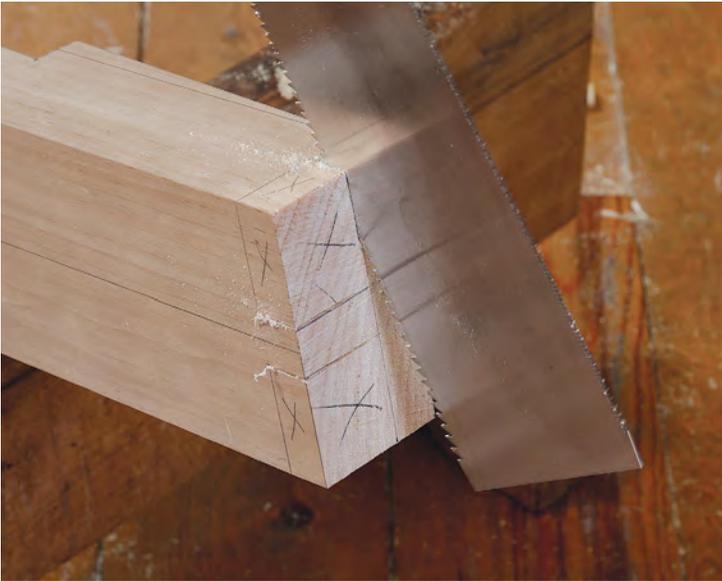
**Start with rips.** Saw the side walls of the vertical slot (above) and the upper wall of the horizontal slot (right).



**Use a shim for the lower wall of the horizontal slot.** The shim elevates the saw just above the layout lines, leaving a bit of waste to pare with a chisel.



**Chisel out the T-notch.** The slot is  $\frac{5}{8}$  in. wide, so use a  $\frac{5}{8}$ -in. chisel. To prevent blowout, work in toward the middle from all ends of the notch.



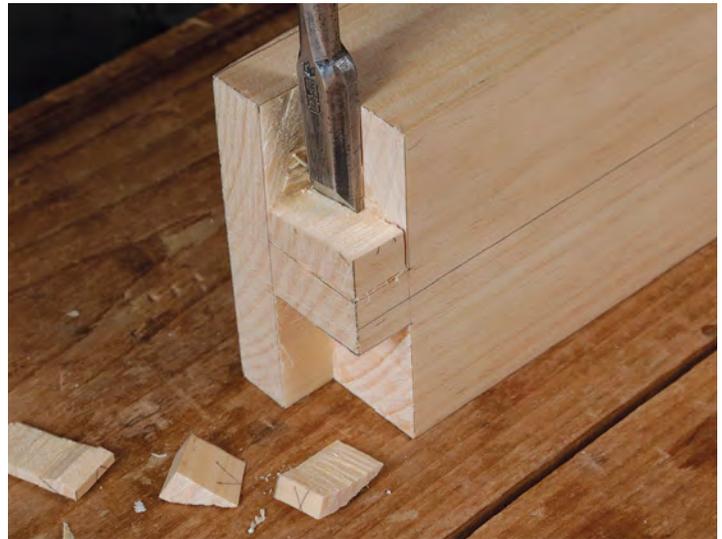
**Start sawing the end T-notch.** Cut the rips before the crosscuts. Hunter uses an offcut to support the workpiece.

With the length lines drawn, you can start laying out the T-notches. You'll continue laying these out as you make cuts, since right now there's waste in the way. Making preliminary marks now lets you connect the lines later.

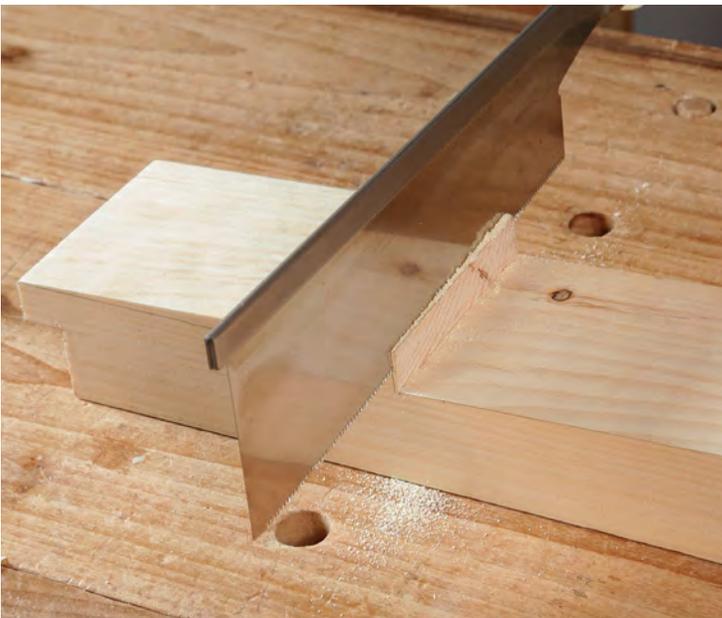
This preliminary layout for the notches is done almost entirely with the story stick. Depending on which section of the notches you're laying out, you'll use either the width of the story stick or, if it's the part of the notch centered on the workpiece, the  $\frac{5}{16}$ -in. marks in the middle of the story stick. For this, just align the stick's centerline with the centerline on the workpiece.

### Cutting the joint

I am careful to not go over my layout lines when sawing. Rips are easy to clean up, so I tend to give myself extra room there. Conversely, when making crosscuts, I try to saw to the line, since end grain is a lot harder to pare. Still, it's more important not to go over the line, so if you're less confident in your

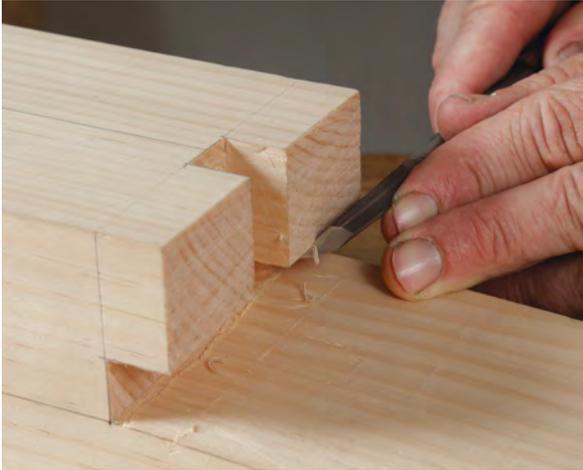


**Chisel to the line.** Start with rough chops to remove much of the waste before lightly paring to the line.



**Wedge needs a taper.** For the wedge to work, saw a  $\frac{1}{16}$ -in. taper on the step of one half of the joint (left). Then make a hardwood pin to fit (above). Make the pin overlong so you can trim it flush later.

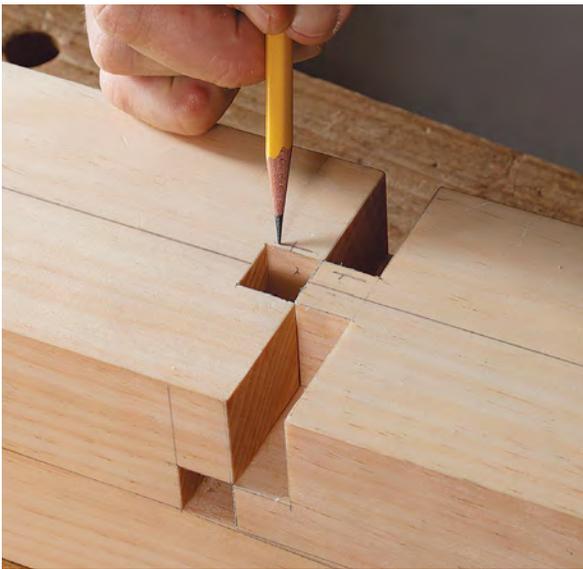
# Fine-tune the fit



**Chamfer unseen corners.** This lets the joint slide together more easily and prevents splitting.



**Give it a squeeze.** Place one half on top of the other and press the joint together with a few light hammer taps to test the fit.



**Mark the high spots.** Look for areas where the joint compresses too much, and check to see whether there's still waste beyond your line. After taking the joint apart, carefully pare back these areas.



**Don't hesitate to bang it apart.** While you are fitting the *kanawa tsugi*, it can be difficult to take apart. This joint has a lot of mating surfaces, and there can be a lot of compression. To separate the two parts without marring them, Hunter clamps a scrap to one half and hammers on it.

sawing, cut away from the line and carefully pare to it.

First cut the workpiece to length. With it trimmed to size, complete laying out the T-notch on the end. Next, make the long ripcut for the upper scarf, and free the waste piece with a crosscut.

To begin clearing out the lower scarf, make a series of crosscuts down to the sloped line. Then use a wide chisel to remove the bulk of the waste. As I get close to the line, I switch to a paring chisel, then finish with a rabbet plane.

While you can undercut the face of the lower scarf, I don't recommend it. The next step is to lay out the T-notch on the inside of the joint by transferring the initial layout marks down the end grain. To do this, I register a flat square on the lower scarf. If you undercut this face, you lose your reference surface. If you do undercut it, however, lay a thin straightedge across the face and

reference your square off that. Cutting out the notches is pretty straightforward: Saw out at much as you can and chisel to the lines. Having a  $\frac{5}{8}$ -in. chisel here—the same width as your story stick—expedites things.

The two halves of the joint are identical and made the same way, but you'll likely need to test the fit a few times to find and correct any high spots. Pay close attention to the T-notches, as high spots here can act as wedges and split the stock.

When both sides fit, taper one step to accept a hardwood wedge. This taper is  $\frac{1}{16}$  in. over the joint's width. Prepare the wedge blank oversize and plane it to fit. Drive the wedge home and trim it to length. Flush the two halves of the joint with a handplane. □

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