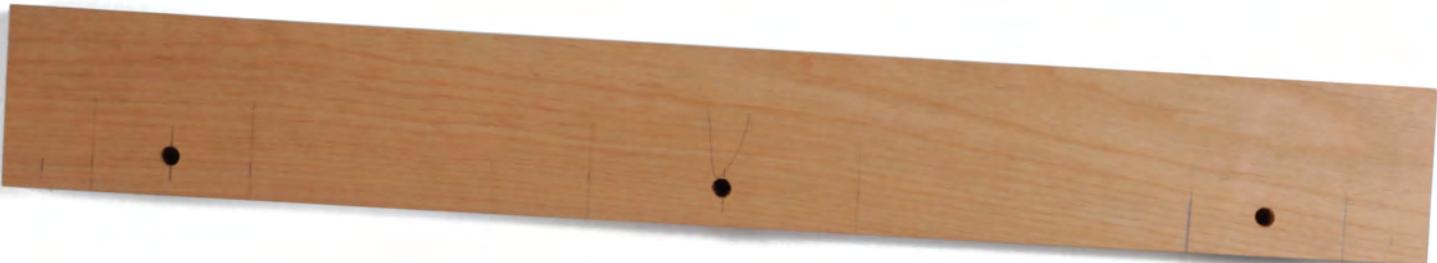


Breadboard Ends

Four methods for keeping panels flat

BY GARY ROGOWSKI



It was more than a few years back that I made a sewing table for my sweetie and, wanting to test my fledgling woodworking skills, decided to use breadboard ends across the tabletop. While they turned out fine, I nearly pulled out my hair doing them. In the time since, I've refined my processes, using breadboards on numerous projects both for their structural benefits and design opportunities.

Breadboard ends are narrow boards attached to a solid panel across the grain to help hold it flat. In this article, I go into four ways to attach them. They're all effective. But it's important to pick the right option for the scale of your project, so I outline when to use which and why. The different options involve different machine and hand-tool strategies. Regardless of the type, though, I always refine the joint by hand for a tight fit that will stay closed for years to come.

As for decorative elements, like contrasting woods and shapely plugs, I leave that up to you. For a little inspiration, though, I recommend looking at this article's Online Extra. It's a feature on a Greene and Greene side table I made, and its breadboard ends pull out all the stops.

Gary Rogowski hosts the podcast Splinters at northwestwoodworking.com.

Online Extra

To see how to build a Greene-and-Greene side table with striking breadboard ends, go to FineWoodworking.com/281.

1. Tongue-and-groove

LIGHT-DUTY JOINT FOR SMALLER PROJECTS

This option is great for small projects like lids for boxes, but its small tongue won't work well for bigger, thicker panels without reinforcement.

Cut the groove first. Set the tablesaw fence so the blade is just about centered in the workpiece. After taking the first pass, flip the board face for face for the second, centering the groove. Move the fence slightly farther from the blade and make pairs of passes until the groove is the desired width. The tongue is also centered, so when cutting it, flip the panel face for face between passes as you dial in the thickness. I aim for it to end up a little fat off the saw, letting me clean up the tongue with a shoulder plane for a great fit. Just don't make it too tight because with stock this thin, you can crack the face of the groove.

After the tongue fits, plane a spring joint. With a plane set for a very light cut, take two light swipes across the middle of the end's inside edge. This forms a slight concavity—about $\frac{1}{32}$ in., enough to barely see—that will close under clamping pressure. Glue the center 2 in. or 3 in. of the tongue and clamp it in the middle. The spring joint will hold the breadboard ends closed along the rest of the joint.



For a small panel on $\frac{1}{2}$ -in. stock, use a $\frac{3}{16}$ -in.-long by $\frac{3}{16}$ -in.-thick tongue.



Groove the breadboard end. Flip the workpiece face for face between passes, centering the groove. Use a rip blade for flat-bottom cuts.



Set the blade height for the tongue. Raise the blade to just shy of the bottom of the groove. This leaves the tongue thick, letting you sneak up on the fit by hand later.



Cut the tongue. With the blade partly buried in a sacrificial fence, make cuts on both faces. Then move the fence over to complete the tongue.



Spring time. Take two light passes along the middle of the breadboard end's inside edge. This forms a spring joint, a slight concavity that will keep the joint tight. Add glue to only the middle of the tongue to allow for seasonal movement of the panel.



2. Tongue-and-groove for bigger panels

REINFORCE THE JOINT BY ADDING SCREWS

#8 x 3-in.-long trim-head screws



Tables with breadboard ends need more strength because people will inevitably lift a table by the ends. I often use screws in these cases. They sit in elongated holes and are hidden with plugs.

I still use a centered tongue and groove, except this time, after cutting the groove at the tablesaw, I cut the tongue with a plunge router and straight bit. With large

panels, I find this method safer than using the tablesaw.

I cut the tongues about a third as thick as the panel, but typically not under $\frac{1}{4}$ in. or over $\frac{1}{2}$ in. Clamp the panel to the bench and put an extralong fence on your router to make locating the cut easier. When necessary, such as when making a smooth entry cut, hold the

router with one hand and use your other hand to guide the fence along the panel's end. After the first cut, flip the panel and cut from the other face. I get the tongue close with the router. Final fitting comes with a few passes of my shoulder plane.

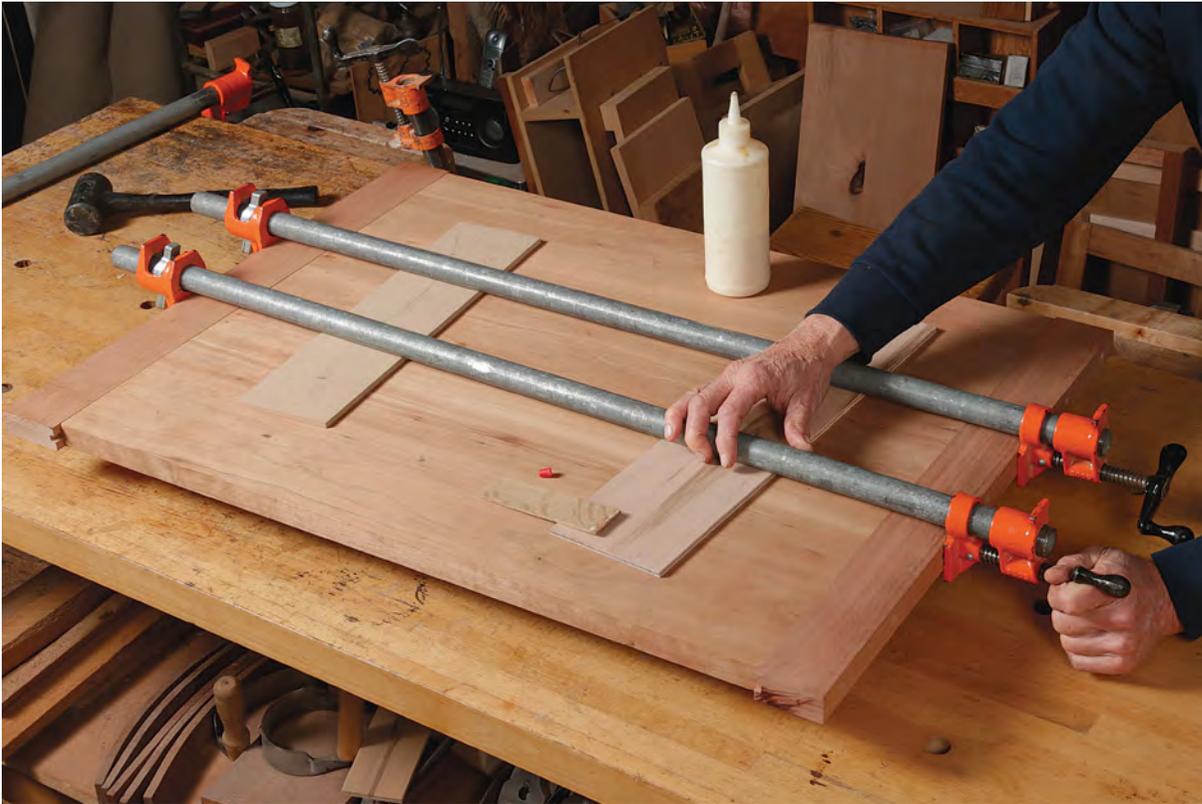
Once the breadboard end fits, I spring the joint (opposite page) before drilling for screws that run through the breadboard

Use a plunge router for the tongue. On long panels, Rogowski cuts the tongue with a plunge router equipped with an extralong fence. After getting the fit close with the router, he refines it with a shoulder plane. To counter any cup in the panel, clamp it between a pair of jointed battens (far right).



Drill holes for screws in the breadboard end. After planing the spring joint, drill the holes and counterbores. Then ream out all but the center hole to allow for wood movement. This lets the panel move seasonally within the breadboard ends. To ream the holes, Rogowski chucks a chainsaw file (handle end out) into a drill, pivoting it back and forth in the holes on the grooved edge (far right).





Glue and clamp the middle of the joint. The spring joint will help extend the pressure outward, keeping the joint tight end to end. Rogowski elevates the clamps with thin plywood spacers, letting him center the clamping force in the thickness of the breadboard end. They also prevent the pipe clamps from marring the workpiece.



Drill and drive screws into the panel. You'll likely need an extralong drill bit for this. Rogowski uses tape as a depth marker when drilling into the panel (far left) before driving the screws.

end and into the tongue. The screws sit in slotted clearance holes in the breadboard ends, and plugs cover them up. I have a simple method for elongating my screw holes. I drill a clearance hole first and then chuck a 1/4-in. chainsaw file backward in my cordless drill. Then I use the file's hardened handle to ream the hole by angling the drill back and forth.

Apply glue to the breadboard ends only in the middle 3 in. Clamp the ends in place and let the glue dry before adding the screws and plugs.



Cover with plugs. You can either make these a decorative element with contrasting wood or use the same species to make them more inconspicuous.

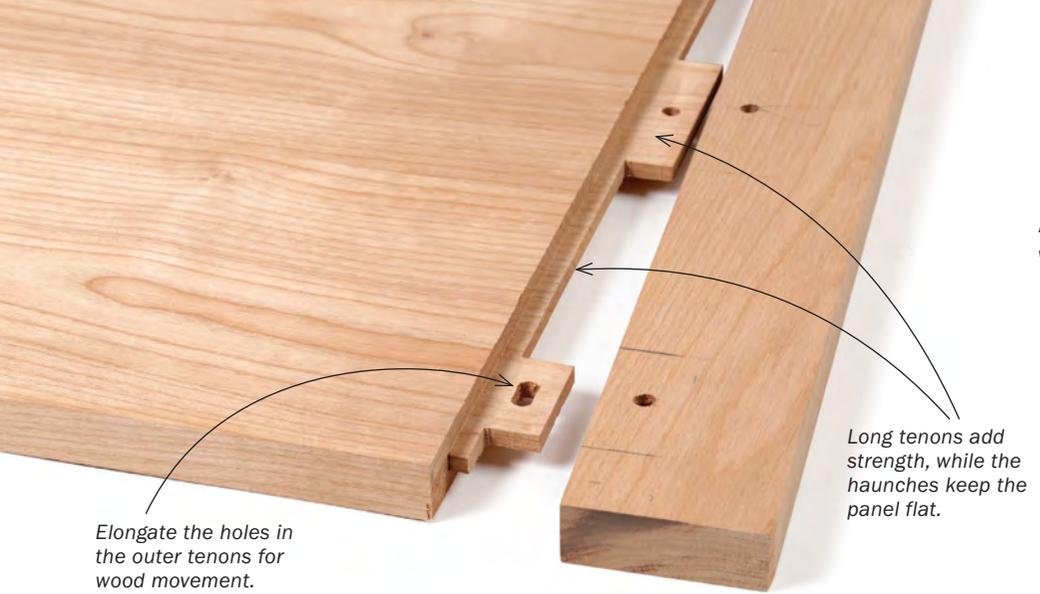
3. Tenons

A TRADITIONAL OPTION WITH PLENTY OF STRENGTH

When I want an option that's nearly bombproof, I use a series of pinned mortise-and-tenon joints connected by haunches between the tenons. It takes more time, but these ends are on to last.

The tenons, spaced across the width of the panel, provide great strength and allow you to pin the joint. The stub tenon fits in a groove, maintaining the integrity of the breadboard end by reducing how much material is removed. Here the groove is blind to conceal the joint and simplify fitting, but these types of breadboard ends work just as well with a through-groove.

The outer tenons should be narrower than their mortises so there's room for the panel's expansion. For a tabletop 24 in. wide or more, I cut mortises 2½ in. wide and tenons 2 in. wide. That gives plenty of space. To cut the groove and mortises, I use my router table with a



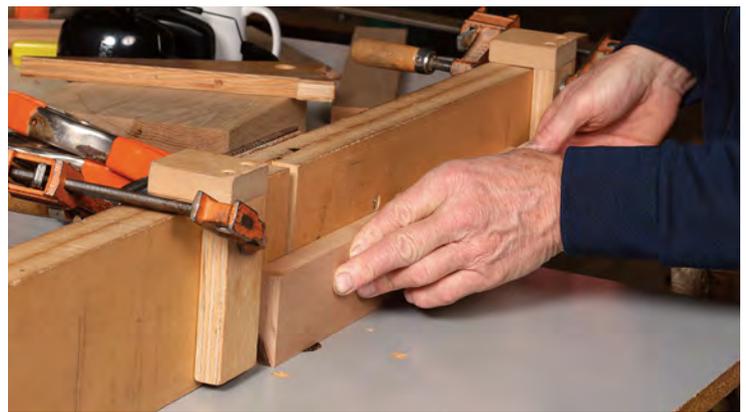
Elongate the holes in the outer tenons for wood movement.

Long tenons add strength, while the haunches keep the panel flat.

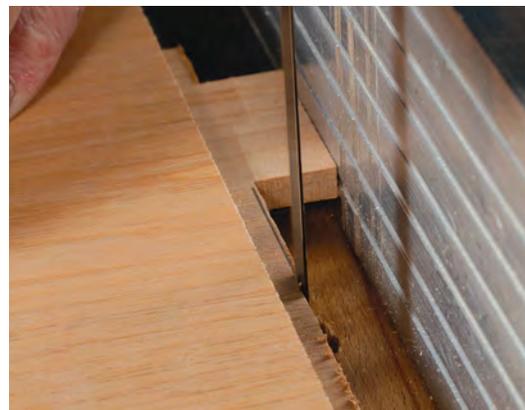
Groove between stops. With stops secured to the fence to control the groove length, Rogowski pivots into and out of the cut. Plywood shims clamped to the table let him take a light pass to cut the groove while keeping the bit at final height for the mortises.



Reset the stops. To rout the mortises, leave the fence setting but remove the table shims and reset the stops. To set the stops, use the mortise layout lines, lining up the ends of each mortise with the sides of the bit.



Drill for the pins in the breadboard ends. Keep these centered in the mortises. The holes can be either through or stopped.



Turn one tenon into several. Rogowski begins by plunge-routing one long tenon that runs the width of the panel. He then bandsaws it into individual tenons, trimming them slightly narrow to leave space for wood movement.



Dry-fit and transfer the hole locations to the panel. With the assembly clamped together, use the same bit you drilled the holes with to transfer those locations to the tenons.

fence and stops. The fence stays at the same setting, but the stops move for each cut. The mortises should be symmetrical along the length of the breadboard end, but don't flip the breadboard end face for face. If you're not mortising dead on in the middle of the thickness of the workpiece, you'll end up having to tweak the joint, and that's more trouble than the time saved flipping the piece. I mortise $\frac{3}{4}$ in. to 1 in. deep depending on whether the piece might get lifted at the breadboard ends. Deeper mortises make stronger joints.

To create the full and stub tenons, I start by routing one continuous long tenon across the panel's ends with a plunge router. I rout it slightly over thickness and then refine it with a shoulder plane. Then at the bandsaw, I cut the full tenons to width and crosscut between them to create the stub tenon. Once the mortises are cut and tenons fitted, I add the spring joint.

A great benefit of this method is that you can pin the joints for extra strength. After drilling through the mortises, dry-fit the panel and both ends, transfer the hole locations, and drill through the tenons. Elongate all but the middle hole into a slot so the pin doesn't prevent the tenon from moving in the mortise as the seasons change.

Glue the middle of the joint, clamp it tight, and add the pins.



Outside holes need elongating. After drilling the holes in the tenons, widen the holes in all but the middle tenon to allow for wood movement.



Pin the joints. While the glue on the breadboard ends cures and the assembly's still clamped up, add glue to the pins and drive them into place.

4. Loose spline

SIMPLER METHOD WITH DECORATIVE POSSIBILITIES

An easier and potentially more decorative alternative to the tongue and groove is two grooves with a spline between them. The spline can be made of a contrasting wood, but its grain has to run in the same direction as the panel's for strength and so the two will expand and contract together. This method is good for littler projects and small tabletops. To make life simple, mill the panel and ends to the same thickness. Make the spline out of a board wider than your panel, or use multiple pieces. If your panel is pretty wide, say over 12 in. or so, then using two or even three splines is a much easier way of working because the splines, all short grain, will be less likely to break. No one will know there's more than one spline in there.

Glue the splines into the panel. Trim them to length. Like before, use a spring joint on the breadboard ends and glue only the middle 2 in. or 3 in. of the joint.



Orient the grain of the spline parallel to that of the panel for greater strength.

Both parts are grooved for the spline.

Two grooves.
The panel and breadboard both get grooved. Set the bit to final depth, and temporarily clamp a piece of masonite to the tabletop for the first pass to avoid taking too deep a cut.



Cut the spline.
To make the spline stock, first crosscut a piece a bit over length. Next, cut it to thickness at the tablesaw (far right).

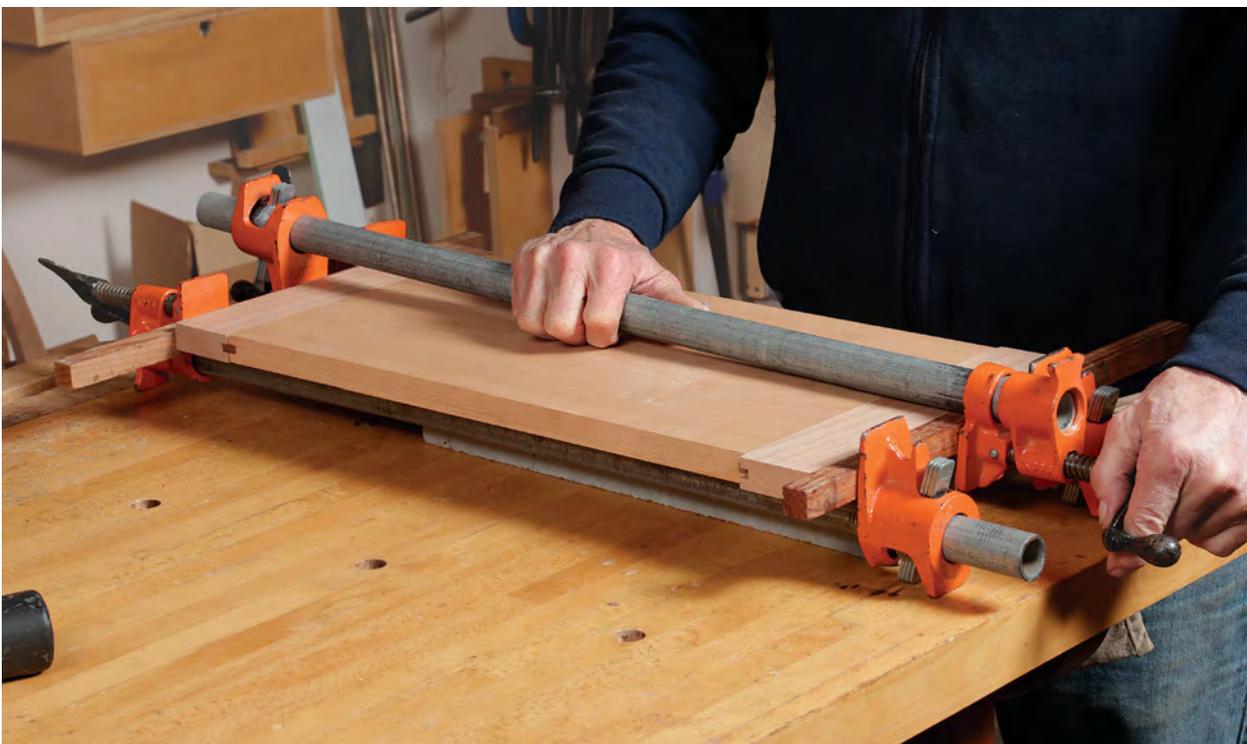




Cut the spline to length. Dry-fit the assembly so you can measure the gap between the panel and the breadboard end (far left). Trim this much from the spline stock.



Glue splines to the panel. Because the splines' grain runs in the same direction as the panel's, you can glue it in the whole length of the groove. For wider panels, use multiple shorter splines, which are less likely to break as you handle them. Lightly chamfer the corners afterward.



Glue up. As usual, Rogowski adds a spring joint to the breadboard end, glues the middle of the workpiece, and makes sure clamping pressure is straight across the joint.