Good breadboard ends allow seasonal wood movement while keeping a tabletop flat. *The battens on the top of the author's cherry dining-room table are mortised to receive four separate tenons at each end of the table. Rosewood pins add strength and visual interest.*

Breadboard Ends Hold Panels Flat

Four ways to make this fundamental joint

by Garrett Hack

Sooner or later every woodworker has to come to terms with breadboard ends. You can reject them as nonessential elements, or you can reject them just because they take time and effort to make and attach. But if you want an elegantly practical way to keep desktops, tabletops, chest lids and other panels flat, adding breadboard ends is the way to go.

But what are breadboard ends (sometimes, they are called just breadboards) anyway? Basically, a breadboard is just a narrow board (or batten) at the end of and running cross-grain to a panel, preventing the panel from cupping. To attach the breadboard to the panel, you need a joint that keeps the end snug to the end grain of the top. The joint must be strong enough not to break off (even if the panel is picked up by the breadboard end itself), yet it still must allow the top to expand and contract with seasonal changes in humidity.

Fortunately, there are a number of useful joints for attaching breadboard ends, ranging from crude but functional to fine and elegant, though more time-consuming, solutions. All share a tongue and groove or sliding dovetail, either of which will keep the batten and panel engaged over the whole length of the batten.

In deciding which technique to use for a particular application, I consider the end use of the item, the type(s) of wood in which

Photos: Vincent Laurence

I'm cutting the joint, the width of the panel being breadboarded, how wide the batten should be (both structurally and aesthetically) and how the breadboards relate to the overall design. For example, the breadboards for a cutting board don't need to be as fancy as those for a drop-front on a traditional desk. Similarly, the lid to a small writing box won't be subject to the rigors a dining-room table will be, so the simplest solution that's in keeping with the design of such a piece is probably best. Also, the wider the batten, the more stiffness it can impart, but the trade-off is that it's also more vulnerable to being broken off.

There's one final aesthetic consideration: Because the panel will be moving across its width with fluctuations in humidity, the outside edges of the table and the breadboard will rarely line up flush. Part of the year, the breadboard will project past the table edges slightly; at other times, the table edge will be proud. Some people find this objectionable and probably avoid breadboards because of it, but sitting at my favorite table, I often find my fingers seeking out this difference, as if to affirm the living nature of wood. I do take care, however, to keep the difference as consistent as possible from side to side, and I slightly ease any sharp edges at the batten ends.

Quick, simple breadboarding

For utilitarian purposes, and even for smaller items you want to make look nice, there are some quick and simple methods of attaching breadboard ends. These basic methods include splining batten and panel together; tongue and grooving the panel end and one edge of the batten; and dovetailing batten and end together (see figure 1 at right).

If I'm using well-seasoned, dry stock, I generally feel pretty comfortable gluing the center third of the batten to the top, as long as the panel is less than, say, 30 in. For splined or tongue-and-grooved breadboard ends, I like to use at least two screws on either side of the glued center, one of them a few inches from each edge and one more centered on each side between the outboard screws and the inner pair (see figure 1). The outer screws should have elongated holes to allow for at least ⅛ in. of movement. For the screws closer to the center, I usually just drill slightly oversized holes.

You could also simply nail the batten on. The lids of many old blanket chests feature this construction using cut nails, which hold well in end grain and are less prone to splitting the panel than contemporary wire nails. And cut nails just look nice on more utilitarian, traditional pieces. Cut nails are still available from Tremont Nail Co., which has been making cut nails since 1819 (P.O. Box 111, Wareham, Mass. 02571; 508-295-0038). You wouldn't use this technique for fine work, but it works well for tops that are less than 20 in. or so and for softer woods. It is perfectly satisfactory where function is the sole criterion.

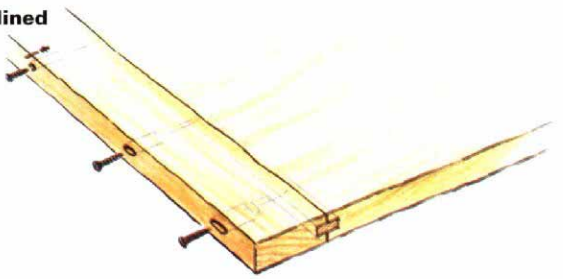
A sliding dovetail between batten and top is a good method for breadboarding smaller surfaces such as cutting boards and, if done well, can be strong and attractive. To work effectively, though, the joint must be tight over its whole length, and this is difficult to do over wide expanses. That's because wide panels tend to cup or warp, causing slight variations in thickness of the dovetail when you rout it, which causes the joint to be either sloppy or too tight in places.

Another drawback is the batten is potentially weakened by the dovetail: The dovetail flares in thickness, requiring that the walls of the batten around the dovetail slot be thinner than they would be for a tongue-and-grooved batten. This situation worsens with thinner stock. For these reasons, when using a sliding-dovetail batten, I keep the batten narrow, making it less liable to be broken off. I also drill and drive a wooden pin or two through the joint at the center of a dovetail batten to keep the movement even on both sides.

Fig. 1: Simple breadboarding techniques

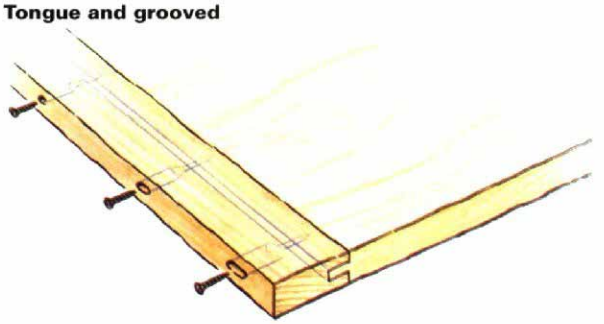
Grooves are cut with the grain in the batten to take advantage of the long-grained strength of the tongue or dovetail in the panel. Spline should have long grain running with the panel.

Splined



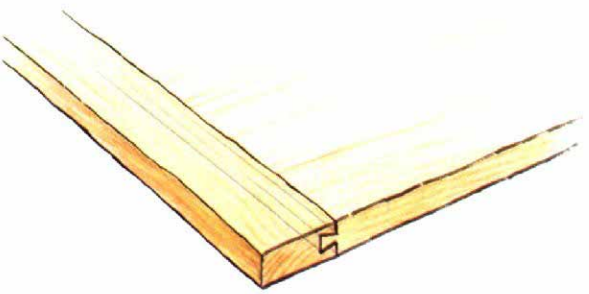
Grooving the panel and the batten and inserting a spline is the simplest way to breadboard an end. Elongated screw holes allow the panel to move.

Tongue and grooved



Grooving the batten and rabbeting the panel on both sides to create a tongue take a little more effort, but the joint is stronger and looks nicer.

Dovetailed



Dovetailing the panel and routing a dovetailed groove in the batten provide mechanical strength to the construction. This joint looks nicer still, but the process requires greater precision.

The best breadboard: separate tenons, stub tongue

The breadboarding technique I turn to most often is a series of mortise and tenons and a stub tongue and matching groove (see figure 2 on p. 80). It's not overly complicated, but it's certainly more time-consuming than the other methods that I have described. It more than makes up for that, though, with its strength, durability and clean appearance. Large separate tenons lend strength and rigidity to the batten ends, helping them withstand

Drawings: Dan Thornton

MORTISING AND GROOVING THE BATTEN ENDS

A horizontal slot mortiser does a quick, accurate job *of mortising the battens. A router and mortising jig or drill press used with a fence would give you similar results.*

Cutting a groove in a batten is best done on the tablesaw. *You can take multiple cuts with a standard blade, or you can shim a dado to get the proper-thicknessed groove.*

Squaring to the mortise layout lines takes just a couple of minutes *with a sharp chisel and a mallet.*

being leaned on, lifted (so that they're supporting the entire weight of the table) and all the rest that a kitchen or dining table must endure. The stub tongue keeps top and batten aligned. Pinned, slotted holes in the outer tenons let the panel move while keeping batten ends tight against the panel.

After gluing up the top slightly wide and a couple of inches long, I handplane top and bottom flat, paying particular attention to the two ends where the battens will be attached. Then I square up the top on my bandsaw and jointer, or when working a very large panel, I'll use a handsaw and plane. I mill the battens at the same time, a couple of inches longer than needed and about 1/16 in. thicker than the table. After the joint has been assembled, I'll plane the whole assembly flat. Other woodworkers may choose to sand the top flat instead.

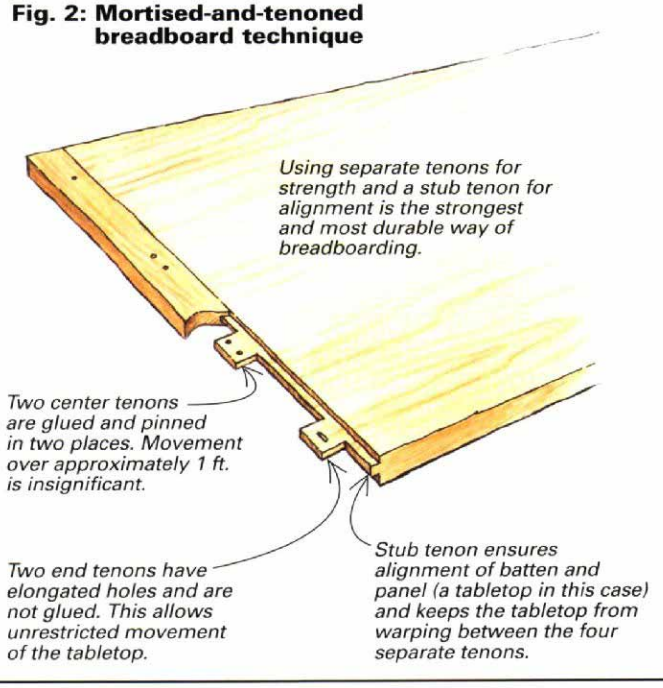
I mark out the tenons and the shoulder line for the batten on the top, using four tenons evenly spaced, with the outer two starting about 2 in. from the outer edge (2½-in.-wide tenons seem to work well). I make them as deep as possible to resist the bending stresses on the batten ends, usually stopping them just about ¼ in. from the outside edge of the battens. If the battens will be shaped later, though, I reduce the length of the tenons and the depth of the mortise, so I don't expose the tenons when shaping the batten.

I transfer the layout marks from table to batten, and I mark the tabletop's outer edges on the batten. In my experience, a cherry top of this size, made from straight-grained, not quartersawn, air-dried boards, will move seasonally about ¼ in. To compensate for this in the joinery, I mark out mortises about ⅛ in. wider than the outside tenons and about 1/16 in. wider than the pair of center tenons.

I always allow for both expansion and contraction, even if it's the end of the dry season and the wood is dry. At the opposite end of the moisture extreme, in more humid months, I'll allow for a bit of expansion, but mostly I plan for the inevitable shrinkage.

Mortising and grooving the batten ends—I cut the batten mortises on a horizontal slot mortiser, and then I square them to my layout lines with a paring chisel (see the top and bottom photos on this page). You could also do the mortises with a plunge

Fig. 2: Mortised-and-tenoned breadboard technique



router, on the drill press or even chop them entirely by hand.

Next I rip the groove that mates with the stub tongue on the tablesaw (see the center photo on the facing page). It's the same width as the mortises. There are times when, for aesthetic reasons, I prefer to have this tongue and groove blind at the outside edges of the table. In those instances, I stop the groove just short of each end by at least ¼ in. and mate it to a small haunch cut on the ends of the tongue.

Cutting the tenons and stub tongue—For the tenons, the first thing I do is rout the tenon and tongue areas down to thickness while leaving the stock between the tenons to support the base of the router (see the top photo). For the final router pass, I move the fence back ever so slightly to rout a crisp shoulder for the batten to snug up to. Then I do the same on the other side. I take care not to flip the board I'm using for a fence so that any slight deviation in the fence is *exactly* the same on both sides of the table. Also, it's critical to have both shoulders at exactly the same distance from the tenon ends. I ensure this by making a mark with my knife on either side of the table where the fence meets it and then squaring down from there to the underside of the table.

I square across the tenon stock from the layout lines on both the top and bottom of the table, and then I cut the cheeks with a backsaw and remove the waste with a coping saw (see the center photo). I find or plane a small block of scrap to the same thickness as the tongue height and scribe all along the tongue to give me a line to which I can pare and plane. Starting on the back, I use a large paring chisel and then a sharp rabbet plane to true up the tenon cheeks and tongue and just ease the arris (see the bottom photo). I fit the tenons and tongue in the top to the mortises, and I groove in the batten with careful passes with rabbet and block planes until the batten fits snugly over its whole length. A scrap with the batten groove ripped in it is useful to size the tenons and tongue. The extra inch or so of waste at either end of the batten is also helpful for tapping on to remove the batten as you're test-fitting.

Attaching the battens—The pair of center tenons will be glued and pegged into their mortises, but the only thing holding the batten to the table at the outside tenons are small pins, which I drawbore slightly and drive through elongated holes in the tenons to allow for wood movement. *Drawboring* simply means that I drill the hole in the tenon just a hair closer to the shoulder than the hole I drill in the batten. This causes the joint to "draw" up tightly when the pins are driven home.

I first drill all of the pin holes through the batten, separate from the table. I use a scrap the same thickness as the tenons inserted in each mortise to prevent tearout. I reassemble the joint, mark pin locations and remove the batten one last time. The holes in the outside tenons need to be slightly closer to the shoulder than the layout marks I transferred from the batten. They need to be elongated, so I use a scrap block of the appropriate thickness as a spacer to mark them. Then I drill all the pin holes and elongate the holes in the outer tenons with a small chisel or gouge.

Next I put a thin layer of glue on the inner tenons, clamp the whole assembly together and then drive the pins home. I like to use a hardwood, such as rose-wood, for the pins so that they can be kept small and still work well. After the glue has cured, I'll cut the extra stock off the ends of the battens, trim the pegs nearly flush with the batten and then finish-plane the whole tabletop flat and smooth. □

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CUTTING THE TENONS AND STUB TONGUE

Waste stock between tenons supports the router base. *A series of passes with the router takes tenons to thickness.*

Horizontal coping-saw cuts remove waste between tenons *after vertical backsaw cuts define tenon edges.*

Pare the tongue to the line. *Use a sharp chisel between the tenons to clean up where the waste was sawed away.*