Keeping Tabletops Flat

Three ways to keep a top from cupping while letting it move with the seasons

BY CHRISTIAN BECKSVOORT

A ny well-made solid-wood table has a dead-flat top when new. And you expect that top to stay flat for years to come. But unless the maker follows some basic rules, the top is likely to warp down the road, courtesy of the humidity in the air. That said, if you understand how to assemble, finish, and restrain these wide panels, they will be flat when the next millennium arrives.

Understanding tabletop warp

Moisture entering the cell walls of wood causes the cells to expand, while moisture leaving the cells makes the walls contract. Warp results when different areas of the wood expand and contract at different rates. One common form of warp, called cup, occurs when one side of a board expands and contracts at a different rate from the other. All else being equal, cup tends to become more pronounced as boards get wider.

Quartersawn vs. flatsawn—When viewed from the end of a board, the growth rings can tell you a lot about whether the board is likely to cup. If the rings meet the face at between 45° and 90°, the wood is considered quartersawn. The rings on flatsawn wood meet the face at less than 45°.

Quartersawn wood moves only about half as much as flatsawn and is much less likely to cup. So quartersawn wood often is a good choice for tabletops that cannot accept a mechanical support to help keep them flat.

When edge-gluing several flatsawn boards to create a tabletop, some
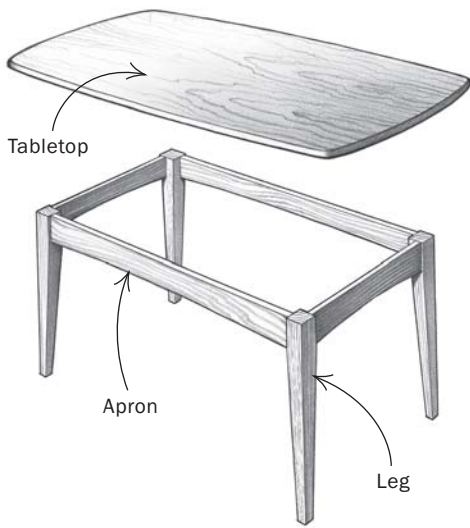
1. Take advantage of aprons


Tabletop

Apron

Leg

Aprons provide a built-in means to keep a tabletop flat. When secured to the flat, straight aprons, the tabletop stays flat and straight, too. On wide tabletops (generally 24 in. and wider for oak or hard maple, 30 in. and wider for cherry), Becksvoort uses wood buttons that slip into grooves cut into the inside face of the aprons. On narrower tabletops, he simplifies the process by screwing through pocket holes in the aprons.

TWO OPTIONS FOR ATTACHING THE TABLETOP

SHOPMADE BUTTONS

Buttons fit into grooves in the apron and are screwed to the tabletop.

Tabletop

Button

Space allows top to expand.
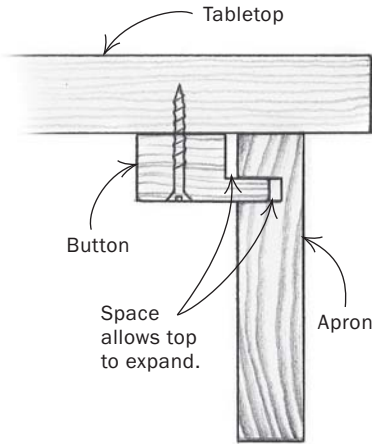
Apron

Make the buttons. After rabbeting the end of a board to create a lip, Becksvoort uses a tablesaw and a miter gauge to crosscut the stock into individual buttons.

Add the buttons. The lip of each button slips into a groove in the apron. It takes just a single screw to secure the button to the underside of the top.

POCKET HOLES

Angled holes are drilled into the aprons before assembly. The oversize shank holes allow for seasonal movement.

Tabletop

Oversize shank hole
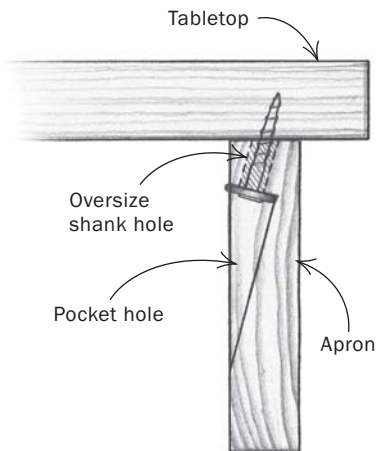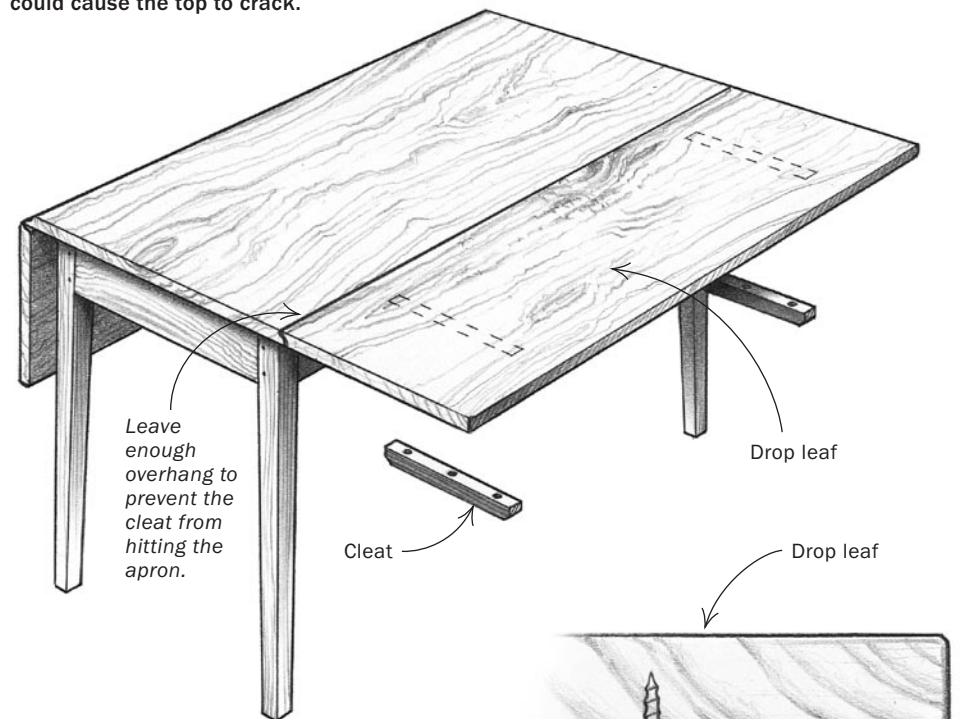
Pocket hole

Apron

Jig simplifies pocket-hole drilling. A shop-made drill-press jig holds the apron at a suitable angle for drilling the pocket holes with a Forstner bit (above). A screw driven through an oversize shank hole in the pocket joins the top to the apron (right) while allowing the top to expand and contract.

2. Screw cleats to the bottom

A straight cleat, screwed to the underside of a drop-leaf table, an extension table, or a pedestal table, is a simple and effective way to keep a top flat. Don't use glue here, however, or the top won't be free to expand and contract with changes in humidity, and that could cause the top to crack.
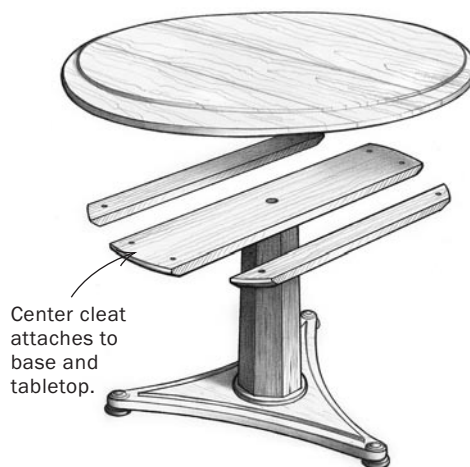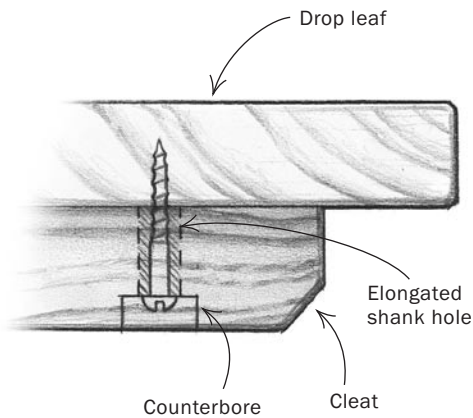
Leave enough overhang to prevent the cleat from hitting the apron.

Cleat

Drop leaf

Elongate the end holes. *A typical cleat has three holes, with the two nearest the ends elongated to allow the top to expand. The author uses a round rasp for the job.*

DROP LEAVES
Cup generally doesn't become a problem until a drop leaf is wider than 12 in. or so. With a wider leaf, two or three cleats screwed to the underside should keep the leaf flat.

Drop leaf

Elongated shank hole

Counterbore

Cleat

Leaf

Cleat mimics apron.
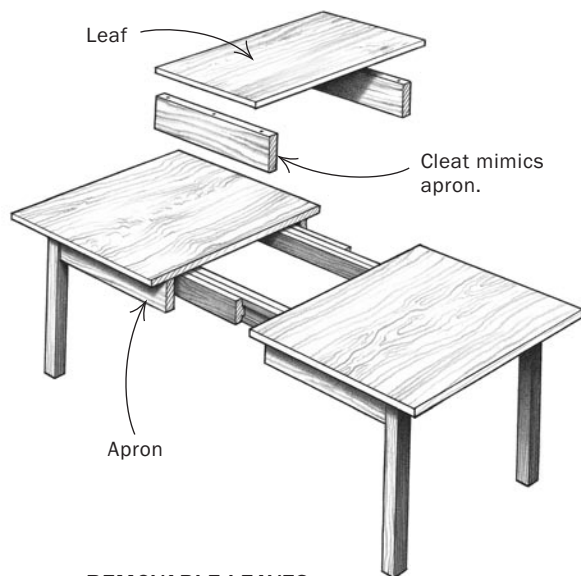
Apron

REMOVABLE LEAVES
An extension-table leaf might cup without some sort of support. A cleat mimicking the apron provides a perfect solution.

Center cleat attaches to base and tabletop.

PEDESTAL TABLES
The wide, mostly unsupported top of a pedestal table is a prime candidate for cup. In addition to the center cleat, a couple of outside cleats provide extra support.

woodworkers prefer to alternate the growth rings (concave toward the top, then concave toward the bottom, and so on), while others prefer to run them in the same direction. But after 40 years of gluing up hundreds of tabletops and thousands of panels, I find that grain orientation really makes little difference. My priority is to position sapwood and blemishes on the underside of the table, which usually means that the growth rings are concave toward the top.

Wood species can make a difference—Some wood species tend to cup less than others. If you aren't tied to a specific type of wood, consider one of these cup-resistant species: Ash, cherry, yellow birch, black walnut, and white pine are good choices.

An even finish can help—For a finish to reduce cup effectively, all of the surfaces of a tabletop (top, bottom, and all four edges) must be finished equally. If not, one surface will gain or lose moisture faster than the other, and that's a formula for cup. The ends require particular attention. They absorb and expel moisture faster than face grain, and should be sealed with a few extra coats.

Furthermore, tables should always be finished with the top removed. When a table is finished after assembly, it ends up

Photos: Michael Pekovich; drawings: Michael Gellatly

Mark the hole locations. *Position the cleat on the underside of the top and mark the center of the middle hole. Make a series of points with a scratch awl to mark the elongated holes.*

Outline the elongated holes and locate the position of the outside screws. *With the points made by the scratch awl as a guide, use a pencil to scribe the elongated shape. If you anticipate the top is likely to expand, locate the pilot hole near the inside end of the elongated hole. If the top is expected to shrink, put the pilot hole near the outside end.*

with unfinished areas under places like cleats, stretchers, aprons, and bases.

Mechanical support ensures flatness

Ultimately, no finish will exclude moisture completely. Many furniture pieces need mechanical support to keep their tops from cupping.

Take advantage of aprons—Most table designs incorporate four aprons that support the legs and provide a means to attach the tabletop to the base parts. But aprons can do more. They are perfect for serving double duty as cleats to hold a tabletop flat, given enough attachment points.

Tabletops can be secured to aprons in several ways. For a wide top, I use wood buttons, as they allow for a lot of expansion and contraction. On a narrow table, I mount the top through pocket holes in the aprons, a faster and simpler method. Although it allows only limited wood movement, this method is more than enough for most narrow tables.
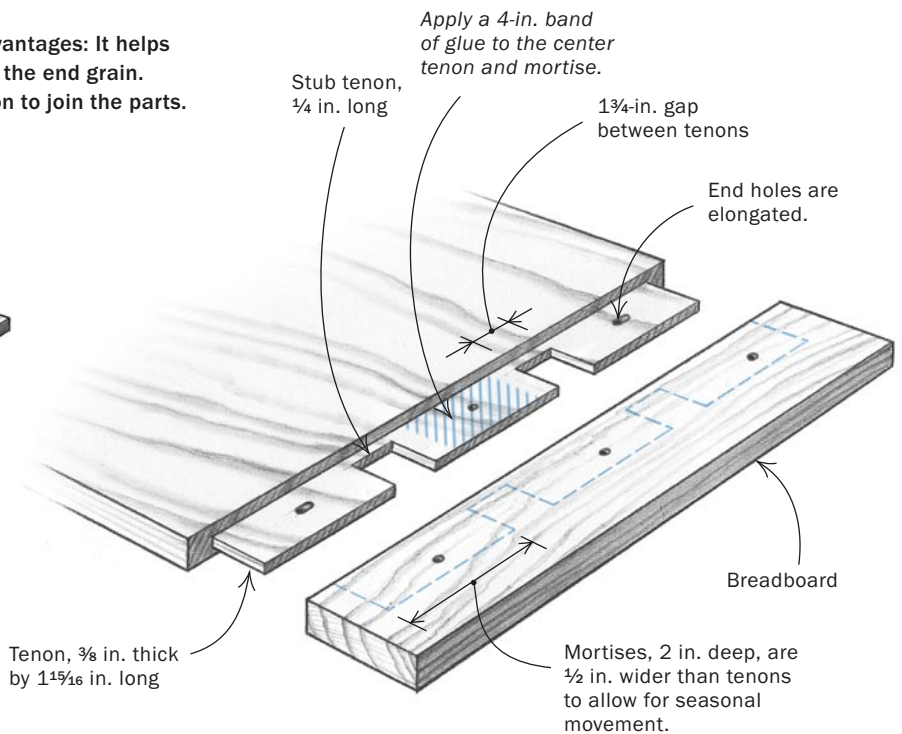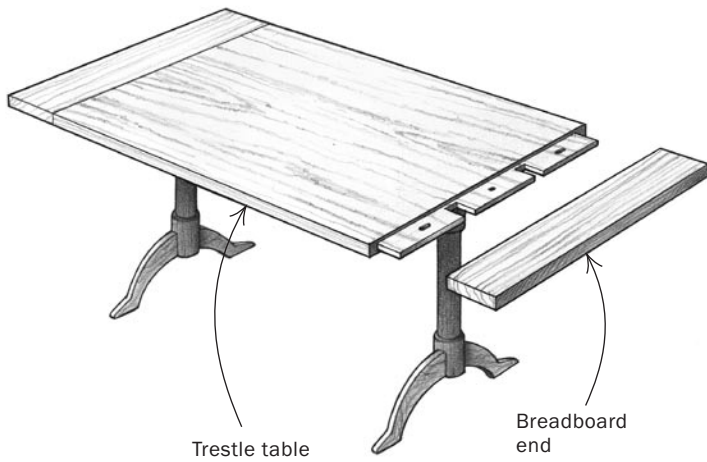
Cleats work effectively—A cleat is simply a flat, straight piece of relatively narrow wood that is attached, typically with screws, to the underside of an otherwise unsupported tabletop. It is found most often on drop leaves, extension-table leaves, and pedestal tables. To prevent the tabletop from cupping, attach the cleat at

Drive the screws. *After drilling pilot holes, drive the screws through the cleat until it's snug against the underside of the top. Don't use glue.*

3. Add breadboards to the ends

Mounting a cleat to the ends of a tabletop has a couple of advantages: It helps keep the top flat while allowing the top to move, and it covers the end grain. Becksvoort uses an elongated version of the mortise-and-tenon to join the parts.

Stub tenon, ¼ in. long

Apply a 4-in. band of glue to the center tenon and mortise.

1¾-in. gap between tenons

End holes are elongated.

Trestle table

Breadboard end

Tenon, ⅜ in. thick by 1¹⁵⁄₁₆ in. long

Mortises, 2 in. deep, are ½ in. wider than tenons to allow for seasonal movement.

Breadboard

Cut the tenons. *Use a router with a straight bit guided by a straightedge to cut the shoulders and cheeks (top). Cut the notches between each tenon using a dovetail saw (bottom) parallel to the grain followed by a coping saw across the grain.*

Assemble the breadboard ends. Check the tenon fit in the breadboard mortise, and trim the tenons as needed. When the fit is right, use pipe clamps to snug the breadboard ends to the tenon shoulders, then drill holes all the way through for the pins.

a right angle to the grain. Don't use glue; the top has to be free to expand and contract. Generally, a screw at the midpoint of the cleat anchors the parts at the center. Screws on either side of the anchoring screw go into slotted holes in the cleat.

Drop-leaf tables may or may not require cleats, depending on the size of the leaf. For relatively narrow leaves, say, 12 in. or less, I tend to avoid cleats when working with stable woods such as cherry or pine. On wider leaves, or when using less well-behaved woods such as oak or hard maple, a few cross-grain cleats on the underside are in order. They must be relatively small so that they won't bump into the apron when in the down position or interfere with any slide or spinner supports.

Extension-table leaves, when used on a leg-and-apron table, can be kept flat by continuing the aprons below the leaf. Again, use an anchoring screw at the center and slotted holes on either side. Also, make the extension apron a bit shorter than the leaf. That way, when the leaf shrinks in the dry winter season, it won't become narrower than the length of the aprons and create a gap between the leaf and the tabletop halves.

A cleat also can be a welcome addition to a pedestal table. Make the cleat as long as possible, but not so long that it can be seen easily. Again, use an anchoring screw at the midpoint with slotted holes on either side of the anchor.

Breadboard ends are another good option—Because of their large overhangs on either end, trestle tables traditionally have breadboard ends to keep the tops flat. Essentially, a breadboard end is a cleat attached to the end of a tabletop with a mortise-and-tenon joint. Each end of the tabletop is tenoned, while a mortise is cut into the breadboard ends.

For overhangs of 14 in. or less, I tend to avoid breadboard ends because the cross brace at the top of the leg is close enough to keep the table flat. But they are a good option for overhangs of 18 in. or more.

The downside to a breadboard end is that its ends are flush with the table edges for about half the year. The rest of the time, either the top is a bit wider than the breadboard, or the breadboard is a bit wider than the top.   □

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Elongate the holes. *With the breadboard ends removed, use a marking gauge to scribe a pair of lines tangent to the end holes. A round file or rasp is ideal for elongating the end holes, but stay just inside the lines.*

Drive the pins. *Reassemble the breadboard ends after adding glue to the center tenon and mortise. Then add a thin coat of glue to each pin and drive them home. Trim the ends flush with the table.*