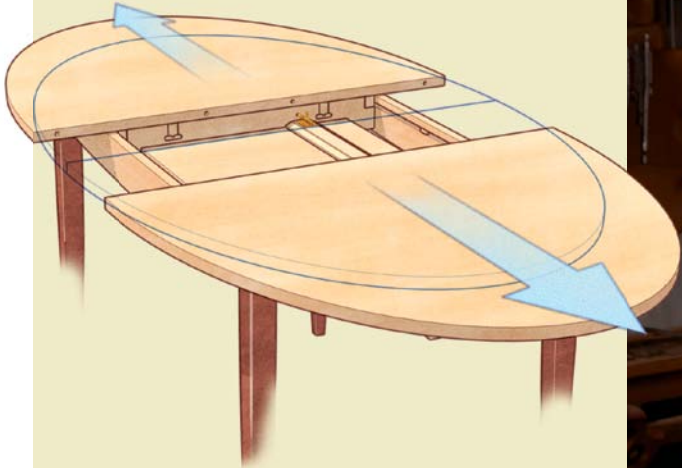


Finest Way

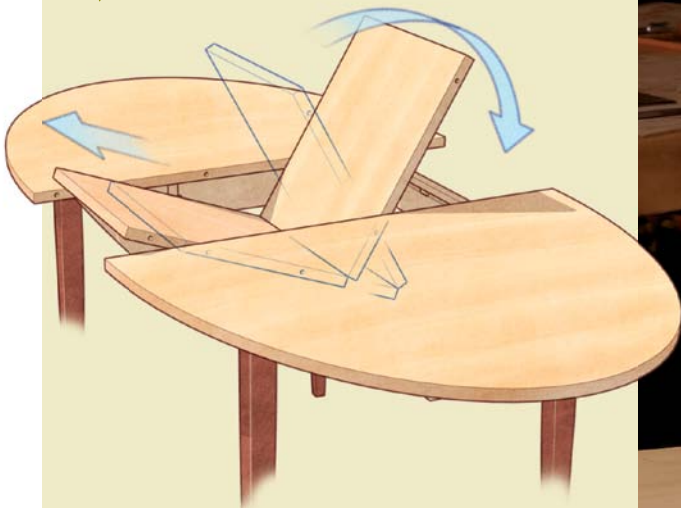
BUTTERFLY LEAF RISES AND SPREADS ITS WINGS

The secret to this expanding table is a hinged leaf that swings on pivot pins. It stays hidden under the table when not in use, but quickly spreads open when you need extra space.

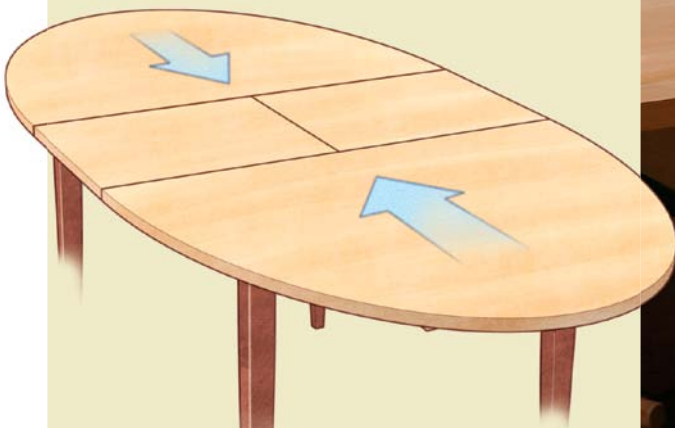
1 OPEN THE TOP



2 PULL LEAF UP FROM BELOW



3 CLOSE TOP FOR EXPANDED TABLE



to Expand a Table

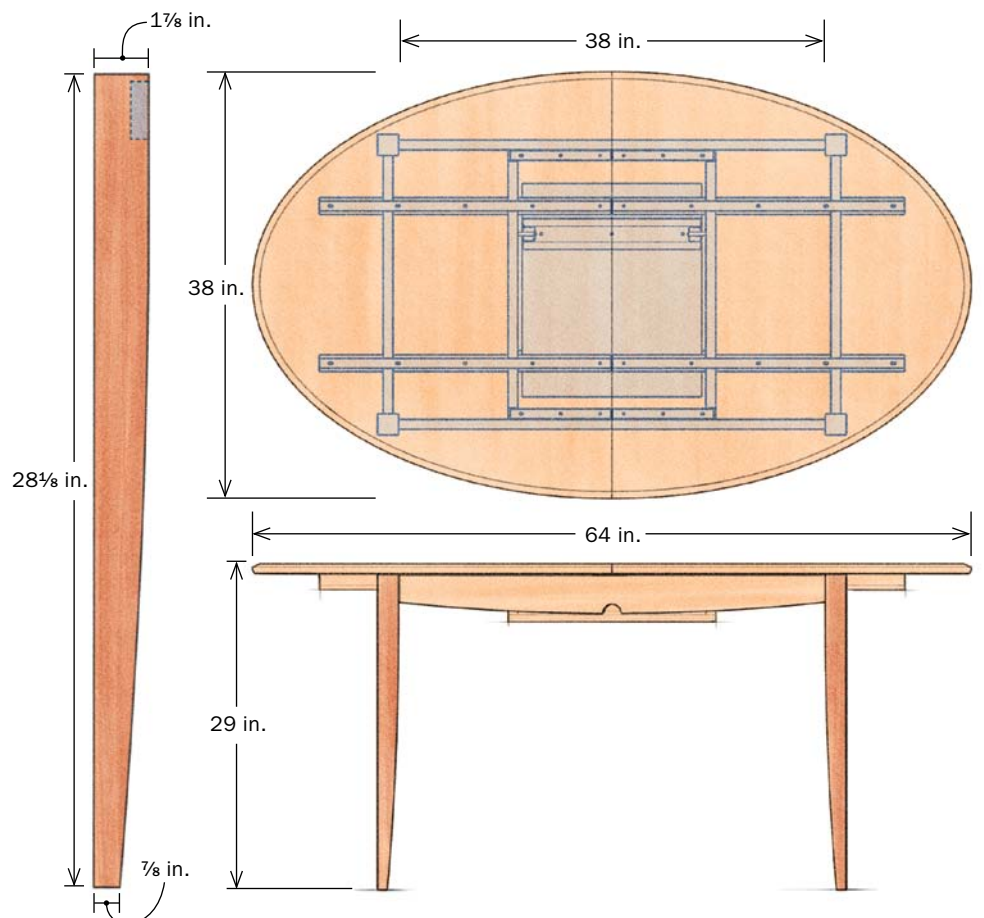
Pivoting leaf is ready when guests arrive

BY MICHAEL C. FORTUNE

When it comes to expanding tables, nothing beats a butterfly table for grace, beauty, and just overall coolness. Its leaf lies under the tabletop and then, like a mechanical wonder, swings up and open, coming to rest fully expanded on the aprons. As the name suggests, it's like a butterfly emerging from its cocoon—sure to draw a gasp of admiration from your dinner guests and fellow woodworkers, too.

The mechanism is both simple and ingenious. The leaf is two pieces joined by barrel hinges. It is connected to the table by a pair of pivot pins, and stores neatly under the tabletop. Then, as your guests arrive, you slide the top apart, take hold of the top half of the leaf, and pull up. As you do, it rotates on the pins and opens, rising up from beneath the top and unfolding until it rests on the aprons. At that point, you simply push the sides of the top against it and, voila, you have a bigger table. To stow the leaf, you just reverse the process. No struggle, and no loose leaves to store in a closet.

The genius of the mechanism, paired with your craftsmanship, is the perfect way to show how far you've come as a furniture maker. It's not as hard as you might

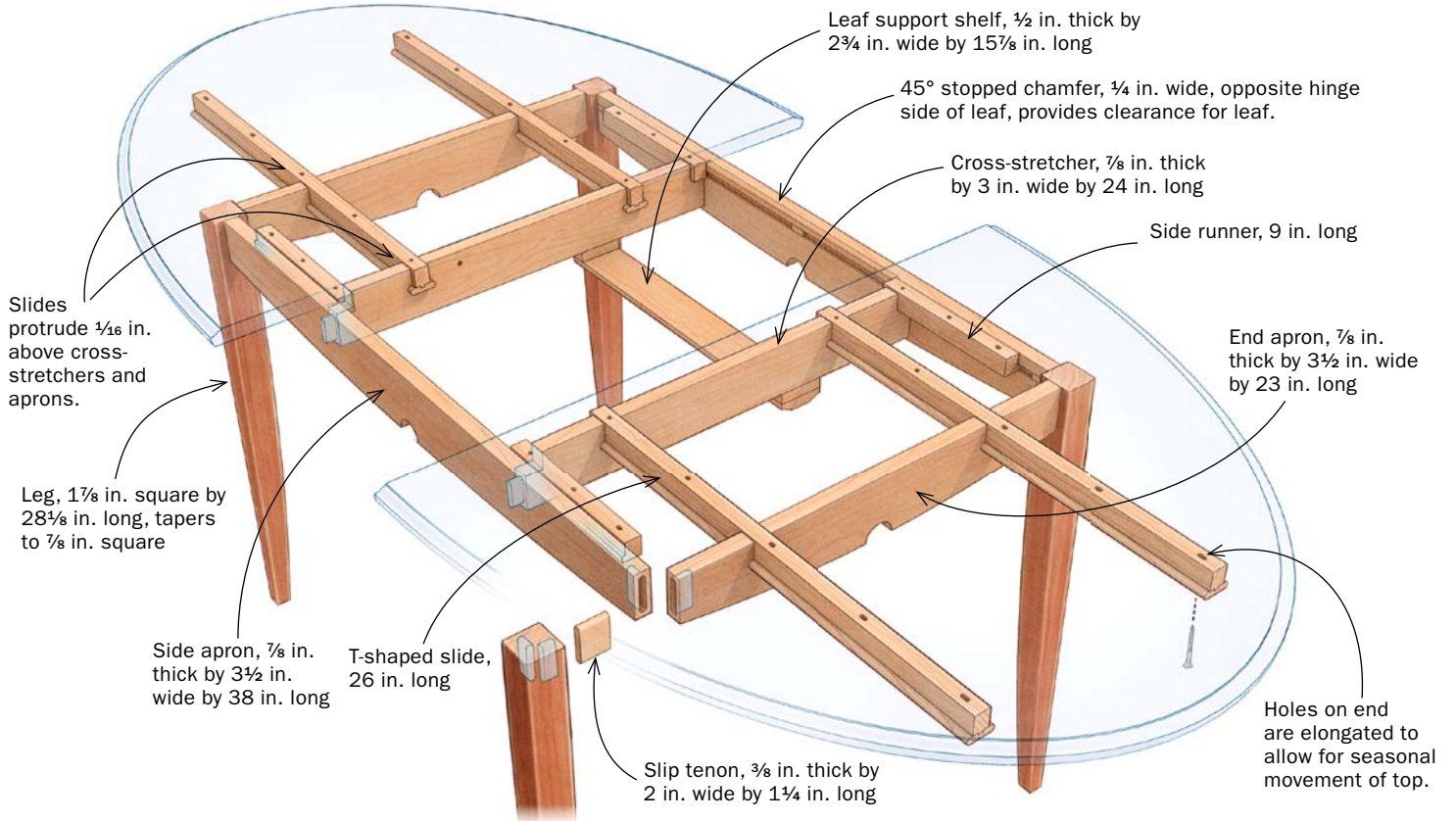


Online Extra

To see three more butterfly tables by Michael Fortune, go to FineWoodworking.com/extras.

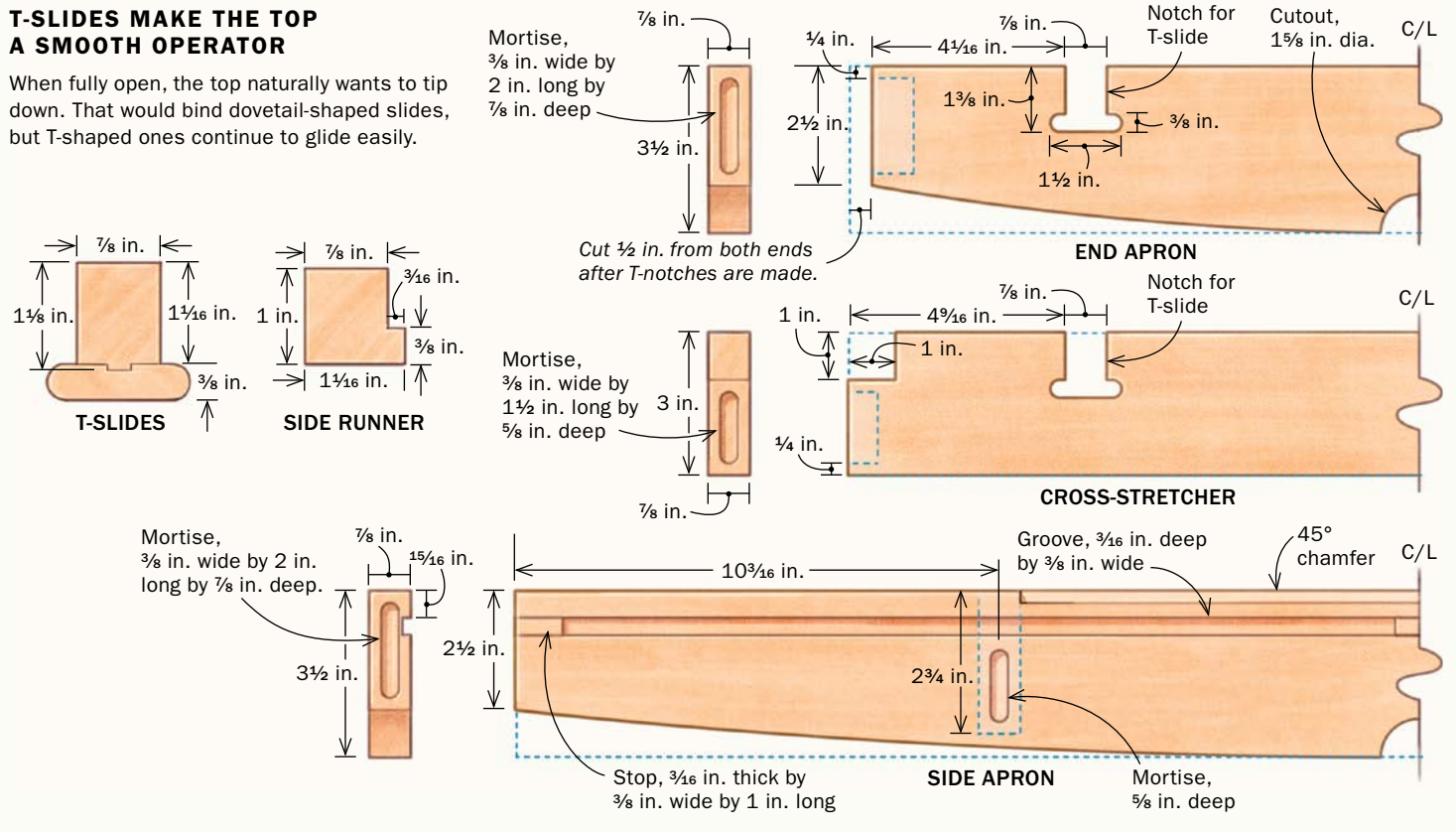
MAKE THE NOTCHES AND SLIDES FIRST

For the slides to work without binding, they must be parallel to one another, and that means the notches in the two aprons and two cross-stretchers must be located precisely. To make that easier, start with all four parts the same length and cut the aprons to final length after the notches are done.



T-SLIDES MAKE THE TOP A SMOOTH OPERATOR

When fully open, the top naturally wants to tip down. That would bind dovetail-shaped slides, but T-shaped ones continue to glide easily.





CUT THE NOTCHES

Tablesaw, then router. A pair of stops on a sled's fence controls the width of the notch. Cut the sides and then nibble away the waste in between. Flip the part end for end to cut the second notch (above). Repeat for the other six notches. Fortune uses a $\frac{3}{8}$ -in.-dia. spiral upcut bit to make the horizontal part of the notch (right), taking several light passes. Use a pair of edge guides for a straight cut and a pair of stops to control the length.



MAKE THE T-SLIDES

Two-part T-slide. First cut a groove down the center of the horizontal part. Fortune uses a dado set for that. Then round its edges to match the notch (above). Rout a tongue on the upright to fit the groove. Two passes along a straight bit (right) is all it takes.



think. Locating the pivot pins properly is the trick, but I'll show you a trouble-free way to do it. And the mechanism is simple enough to work with just about any type of table. The one I've made for this article is fairly conventional—four legs joined to aprons—but you can make one with a pedestal or trestle base. The top can be rectangular, round, oval, or just about any shape. I even have made tops with a serpentine leaf. It works on big tables, too, as long as you beef up the slides (ball-bearing slides are best for big tables) and use more hinges on the leaf.

Straight-grained slides won't bind

The basic structure of this table is simple. I joined the legs and aprons with slip tenons. The aprons are curved and the legs tapered, but I keep them square until after I've made the butterfly mechanism and routed the mortises. However, the butterfly mechanism does need some explanation. The two halves of the top are attached to slides that ride in notches cut into both the end aprons and a pair of cross-stretchers that run between the side aprons. The slides and notches are T-shaped and work much better than dovetail-shaped slides, which tend to bind when the top is extended.

Make the notches and then fit the slides to them. Cut the vertical part of the notch at the tablesaw, using a standard blade and crosscut sled. After the vertical part is cut, rout the horizontal part of the notch. I use a handheld router and a spiral upcut bit. A pair of edge guides ensures a straight slot and a pair of stops controls the length. After the notches are done, cut the end aprons to length, cutting both ends of the apron to locate the notches properly.

Now make the matching slides. They are assembled from two pieces of hardwood, which should be straight-grained because it is less likely to warp, twist, cup, and bind in the notches. Rip the pieces to width and then cut them to length. Use a dado set to cut a shallow groove down the middle of the piece that becomes the horizontal part of the slide. A tongue routed in the vertical part of the slide registers in that groove during glue-up. Then round over all four edges so that the slide moves smoothly through the notch. Glue the two pieces together to make the T-shaped slide.

The slide mechanism also has a pair of L-shaped runners attached to both sides of the top. They ride in grooves cut in the side aprons. Stops glued into the grooves limit the in-and-out travel of the top. Cut the grooves (I use a dado set at the tablesaw), then make the runners. They're just a length of hardwood with a rabbet that I cut at the tablesaw with a standard blade—one pass for each wall of the rabbet.

For the top to close completely after the runners are installed, the cross-stretchers need to be notched to allow the runners to pass through. To make the notch,



JIGS ALIGN TOP AND LEAF PERFECTLY

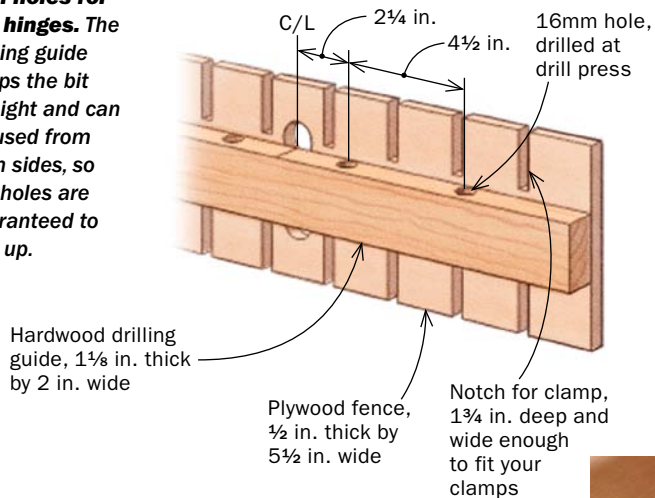
The location of the hinges and alignment pins is critical, ensuring that the halves of the top and the leaf are perfectly level when the table is expanded, but simple drilling guides lock in their location.

BARREL HINGES CONNECT THE LEAF

The round hinges are installed in holes drilled in the adjoining edges of the leaf parts.



Drill holes for the hinges. The drilling guide keeps the bit straight and can be used from both sides, so the holes are guaranteed to line up.



Install the hinges. Pound the hinges into one leaf with a mallet. If the fit is too tight, sand the barrels lightly with P320-grit paper. Add the second leaf, tapping back and forth across the end. The clamp keeps one side on while you tap the other.

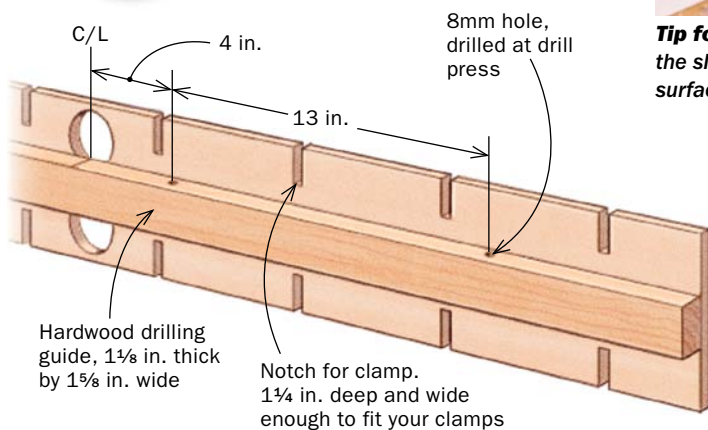
first stand the cross-stretchers on edge and guide them past the tablesaw blade with a crosscut sled. Then make a ripcut at the bandsaw to free the waste. I notch the runners in the same way.

Finally, make the stops, but don't install them until after the base is assembled and the runners have been attached to the top.

Now, before moving on to the top and leaf, assemble the base. Rout mortises in the aprons, cross-stretchers, and legs. Make slip tenons to fit. I start with a long board, round the edges, and then crosscut tenons from it. Gluing the base together is difficult if you do it all at once, so I don't. Instead, I glue up one pair of legs and an end apron, then the second pair to their apron. The side aprons and cross-stretchers are then glued together as a unit. To help keep it square, I cut a piece of particleboard to fit in the space between the cross-stretchers, assemble the side aprons and cross-stretchers around it, and then put on clamps. I leave it there while the glue dries. After the glue has dried on all three components, I glue them together to form the base.

PINS ALIGN THE TOP AND LEAF

A similar drilling guide is used to drill the holes for the alignment pins and sleeves.



Tip for the sleeves. To sink the sleeve without marring the surface, put in a pin and tap it.

To make the leaf, glue up an oversize panel and, after the glue has dried, rip it to width. Leave it long for now; it will be cut to length after a dry-assembly of the top and leaf, so you can mark it directly from the two halves of the top.

How to hinge the leaf

To make the leaf, glue up an oversize panel and, after the glue has dried, rip it to width. Leave it long for now; it will be cut to length after a dry-assembly of the top and leaf, so you can mark it directly from the two halves of the top.

ATTACH THE TOP TO ITS SLIDES

The top doesn't attach to the base with buttons or screws as on a conventional table that doesn't expand. Instead, it's attached to T-shaped slides that allow the two halves to move freely in and out, and prevent the open halves from tipping.



Install the slides. Center the halves of the top first, and leave a bit of space between the ends of the slides.

After ripping the leaf, cut it in half and install the hinges. The perfect hinge for this application is a concealed barrel hinge. On a top like this, which is $\frac{7}{8}$ in. thick, a 16mm hinge is the right size (leevalley.com; No. 00H36.16). The two hinges on the outside are 2 in. from the edge. Space the rest equally between them.

To drill the holes for the hinges, I make a jig at the drill press. One half of the leaf is drilled from first side of the jig and the other half from the opposite side. This ensures that the holes in both halves are mirrors of one another and align perfectly. After the holes are drilled, install the hinges.

Pins align tabletop sections

Now it's time to install alignment pins in the leaf and tabletop halves. To do that, I use a jig similar to the one I used for the hinges. The holes in the two halves of the top must mirror one another, and the holes in both sides of the leaf must mirror those in the top that they align with.

There are two parts to the alignment pins (leevalley.com; part No. 00S10.06): the pin and sleeve. One half of the top gets only pins, and the other half gets only sleeves. After you've installed them, put them in the leaf, too. Now close the top (without the leaf) and shape it. I used a router and full-size pattern, taking several passes to rout through the full thickness. Put the leaf in place, mark both ends from the top, and cut it to final length.

Install the pivot pins last

Now that the base is glued together and the top and leaf are made, install the pivot pins. The pins for this table are nothing fancy. I use window bolts bought at a local hardware store. I like them because you can slide the bolt in and out of the pivot hole, which makes it easy to test-fit the leaf, take it out for finishing (and any time you need to move the table), and then put it back in.

The pins are attached to a batten screwed to the underside of the leaf. The batten serves two purposes. First, it lowers the pivot point



Put the stops in next. A bit of glue is strong enough to hold them in place. There are three stops per groove: one in the center and one at each end.



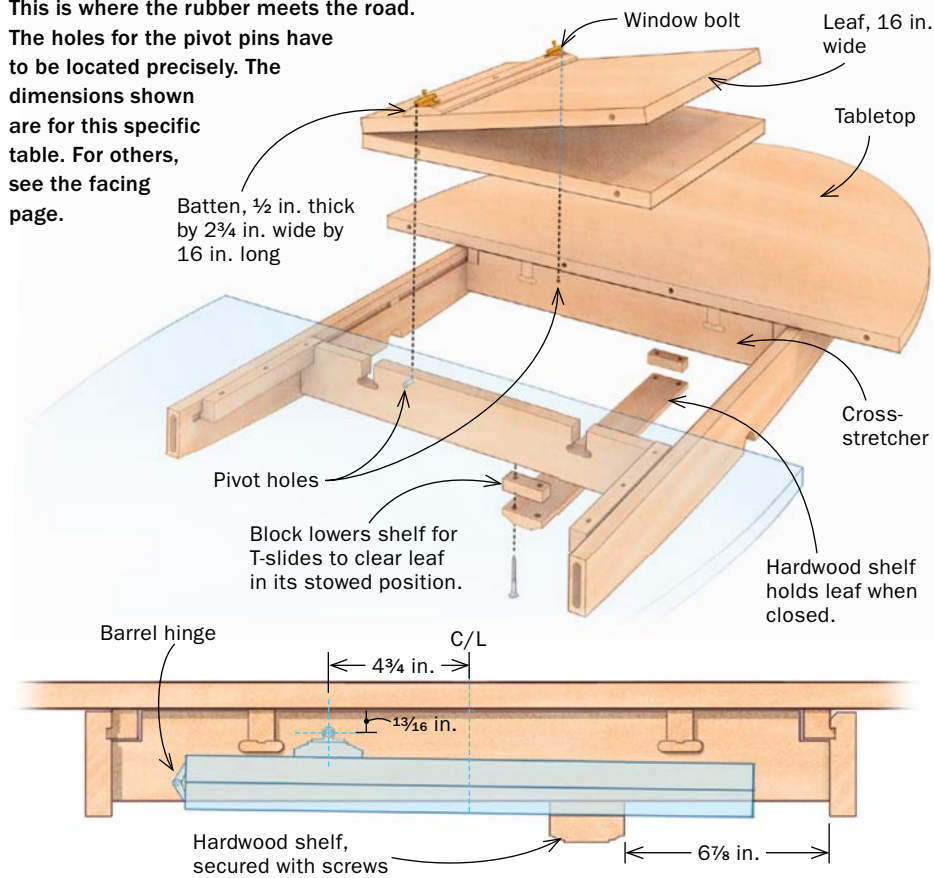
Add the side runners last. Fortune drills a clearance hole in the runner, transfers its location to the top with a punch, and then drills a pilot hole in the top.



Small shelf supports the folded leaf. Turn the table over and open the top so that you can clamp the shelf in place. Add blocks as shown on p. 66 to lower the shelf. Drill clearance and pilot holes and screw the shelf in place.

INSTALL THE LEAF

This is where the rubber meets the road. The holes for the pivot pins have to be located precisely. The dimensions shown are for this specific table. For others, see the facing page.



Drill the pivot hole. Use a drilling guide that references off the side apron. That keeps the two holes aligned and the leaf swinging freely.



Attach the pivot pins. Fortune uses a window bolt because they make it easy to take the leaf in and out for fitting, finishing, and moving the table.

far enough down the cross-stretchers to allow the leaf to clear the underside of the slides when it is stored in the table. Second, it helps to keep the leaf flat. Because it is screwed across the width of the leaf, use elongated screw holes in the batten to accommodate the seasonal movement of the leaf.

With the pins installed, drill the pivot holes in the cross-stretchers. I use a drilling guide made at the drill press to ensure the hole is straight and square to the face of the cross-stretcher. It is long enough to register against the side apron, ensuring that both holes are the same distance from the apron. If the holes aren't aligned properly, the leaf sits askew under the table and won't open properly.

Now install the leaf. Make sure that it opens and closes without problem. (If you've drilled the holes in the wrong place, plug and re-drill them.) Close the leaf and screw a narrow hardwood shelf to the underside of the cross-stretchers. When closed, the leaf rests on it, taking the weight off of the pivot pins and holes. Remove the leaf. Place the top upside down on the bench and then put the base on the top. Put the slides in their notches and then screw them to the top. Now glue the stops into the grooves in the side aprons, and screw the runners to the top. □

Contributing editor Michael C. Fortune is a furniture designer and maker who lives near Warsaw, Ont., Canada.

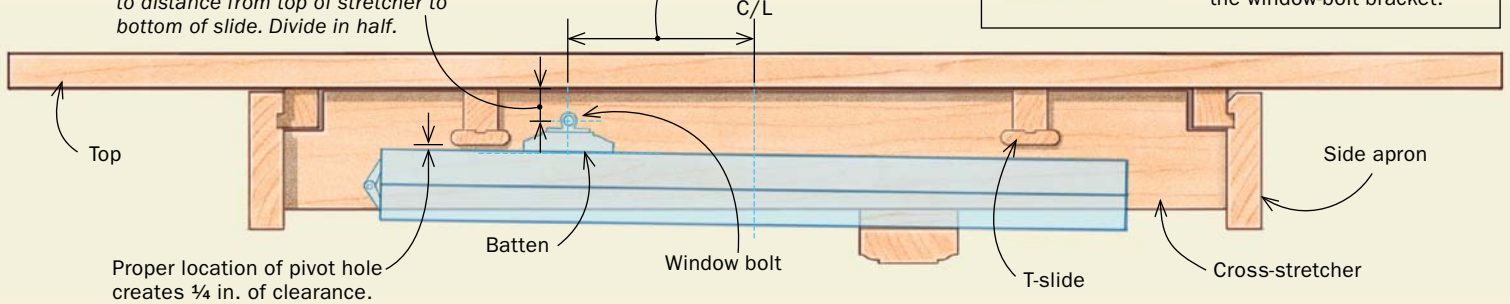
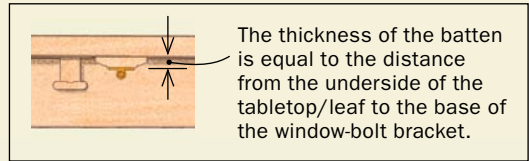


Put the leaf in place. Fold the leaf and let one end rest on the shelf while you lock the bolts into their holes.

Different table dimensions? Here's how to locate the pivot

To calculate this dimension, add $\frac{1}{4}$ in. to distance from top of stretcher to bottom of slide. Divide in half.

Horizontal pin location is $\frac{1}{8}$ of leaf's total length from center line



Measure from the table base's centerline one-eighth of the leaf's final length. Draw a vertical line down the cross-stretcher there. Next, add $\frac{1}{4}$ in. to the distance from the top of the cross-stretcher to the bottom of the T-slide and divide in two. Use the result to find the center point of the pivot hole on the vertical line.

In theory, that should be perfect, but I found out on my first butterfly table that there is more to it than theory. The leaf must be able to clear the slides and the apron. So, I now use a narrow mock-up of the leaf to test the pivot hole location. It is 2 in. wide and as long as the leaf, cut in half and hinged with tape. Add a spacer as thick as the batten and screw on a window-bolt bracket that has had its bolt removed. Use a drill bit or transfer punch the same diameter as the bolt in its place.

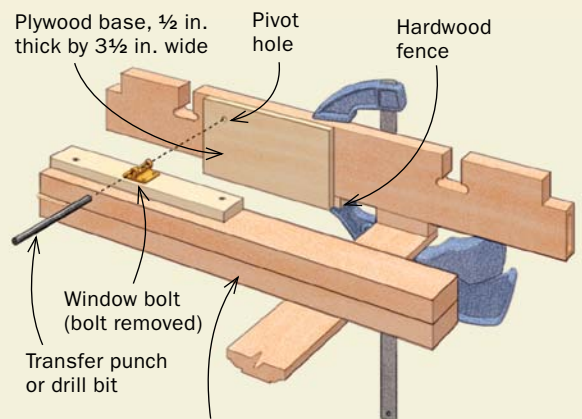
I then drill a hole in a piece of plywood and attach a fence to it. Clamp it in place so that its hole lines up with the location you marked on the cross-stretcher. Put the narrow leaf in place and insert the drill bit. Swing the leaf open and closed. If it swings without hitting the T-slide and side apron, use that location for the hole. But before you drill, locate the support shelf so that as you open the leaf, it rides on the support and just clears the side apron. That's best done by trial and error. I clamp the support to the cross-stretchers about 1 in. from the side apron and test the leaf's swing. If it hits the apron on its way up, move the support closer to the table's centerline and try again. Repeat this process until the leaf opens with no problems. Then screw it in place and drill the pivot holes.



Put a temporary leaf in place. Fortune clamps a piece of plywood with a pivot hole to the cross-stretcher. He then puts a transfer punch (or drill bit) in place of the window bolt.

VERIFY YOUR MATH WITH TWO JIGS

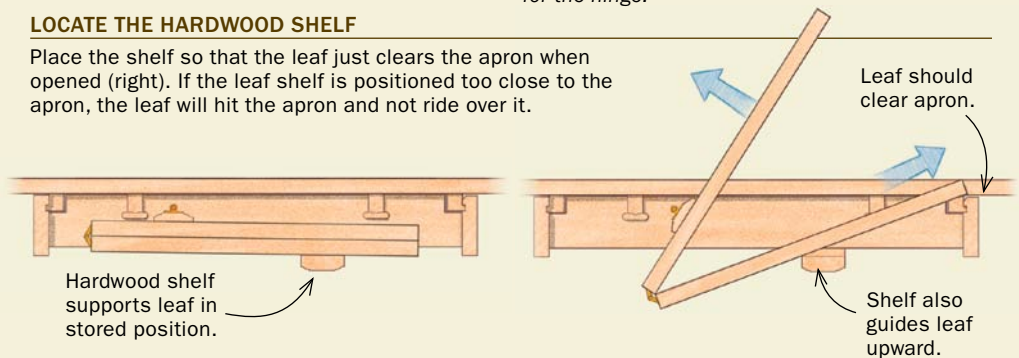
One jig lets you place the pivot hole where you think it belongs. And a simple leaf mockup lets you dial in the location of the window bolt.



Narrow leaf mockup, 2 in. wide and same thickness and length as full-size leaf. Use tape for the hinge.

LOCATE THE HARDWOOD SHELF

Place the shelf so that the leaf just clears the apron when opened (right). If the leaf shelf is positioned too close to the apron, the leaf will hit the apron and not ride over it.



Swing it open to check for problems. The side on the bottom is the one to watch. As it rides up the leaf support, it should just slide over the apron's chamfered edge.