Box-Joint Sled

by Alan Turner

A rock-solid jig delivers precise results.

WHEN I WAS A KID, my mother had a small, wooden recipe box that was made with box joints. I remember marveling at how exquisite those joints were, and so easy to understand, too—there's nothing hidden or mysterious about them. They're a perfect example of form following function.

As a woodworker, however, I've learned that there *is* a magic to box joints, and that's achieving the precision necessary to fit them together. Of course, it's really just sound engineering that does the trick, but when you first assemble a project with lots of box joints, like the tool chest at right, I'm sure you'll be amazed that a shop-made box-joint jig can work so well. It's a very simple device.

I use this jig quite often when I teach classes at the Philadelphia Furniture Workshop. It's safe, reliable and durable. The cuts are always square, tearout is minimal, and the jig can easily be adjusted to make box joints of any width and depth.

Let me first show you how the jig works. Then I'll show you how to build it and how to adjust it. For more details about how to lay out, cut and glue box joints, see "A Craftsman's Tool Chest," page 46.

Box joints are ideal for joining thin boards at right angles, such as the 1/2" thick sides of this case.

EDITOR: TOM CASPAR | PHOTOGRAPHY: MARIO RODRIGUEZ | ILLUSTRATION: FRANK ROHRBACH

How the sled works

WHAT DOES a box-joint jig do? Basically, it makes notches of any width, using a dado set in your tablesaw.

The jig automatically spaces the notches the same distance apart. After cutting the first notch, you lift up the workpiece, shift it to the right and lower the notch down onto an **indexing pin**. Then you cut another notch, and another, making a series of notches separated by **fingers**.

The precise width of each finger is critical. Ideally, *each finger should be the same width as each notch*—within a thousandth of an inch or so.

What determines the width of a finger? It's the distance between the blade and the indexing pin. On this jig, that distance is easy to tweak. On the drawing below, you'll see that the **indexing pin (H)** fits into a **sliding fence (F)**. The sliding fence rides on a **fixed fence (D)** that's fastened to the jig's base. Once the indexing pin and sliding fence are positioned to make a finger of the correct width, a pair of robust **handles (J)** locks the sliding fence in position.

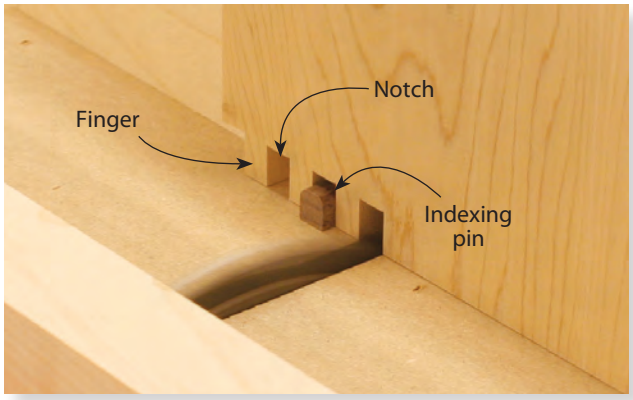


Fig. A
Exploded View

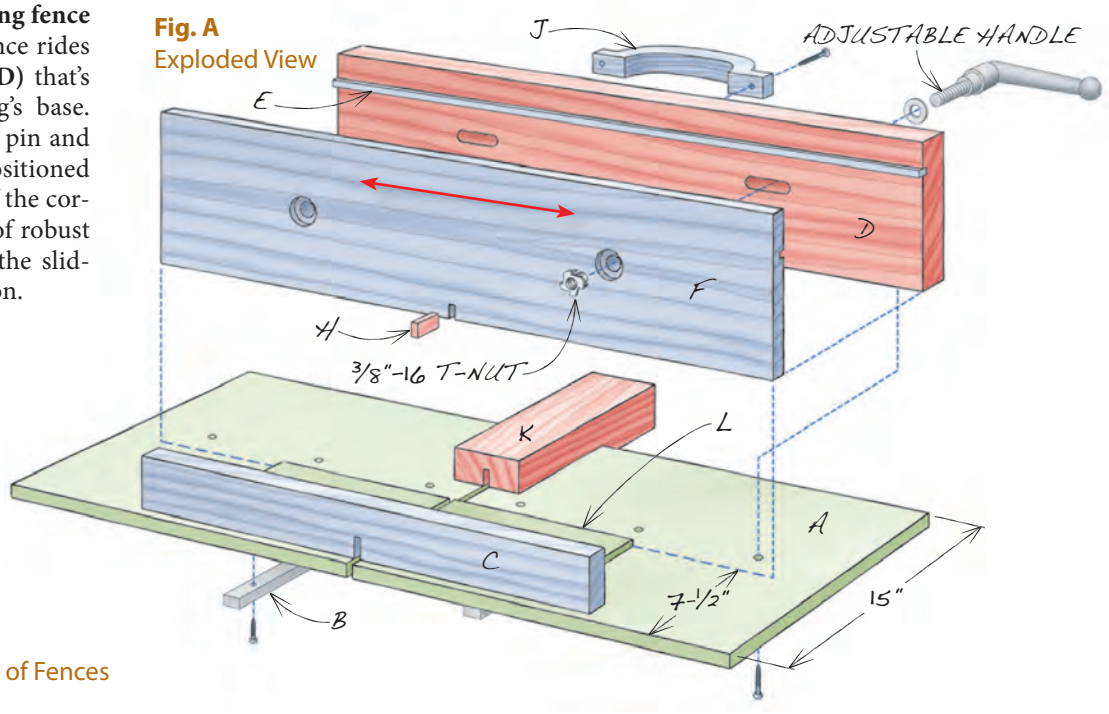
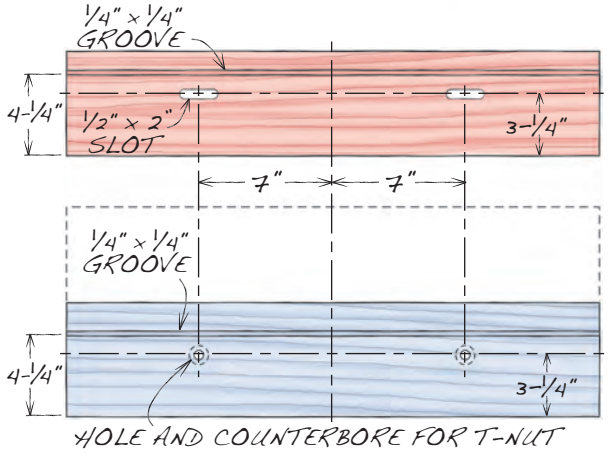


Fig. B Plan View of Fences



SOURCES

- McMaster-Carr, mcmaster.com, 330-342-6100, Adjustable Handle with Threaded Stud, #6271K35, $10.72 ea.
- Kreg, kregtool.com, 800-447-8638, Jig and Fixture Bar, 30" L, #KMS7303, $23.99.

Cutting List

Overall Dimensions: 11-1/2" H x 31-1/2" W x 15" L

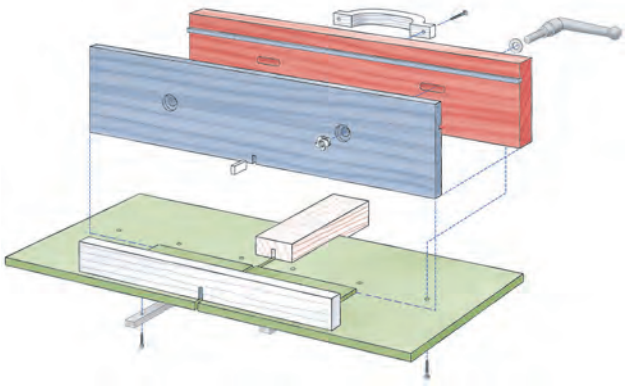
Part	Name	Qty.	Material	Th x W x L
A	Base	2	MDF	1/2" x 16" x 15"
B	Bar	2	see note	3/8" x 3/4" x 15" (a)
C	Bridge	1	Hard maple	1" x 2-1/2" x 20"
D	Fixed fence	1	Hard maple	1-5/8" x 5-1/2" x 28"
E	Fence spline	1	Baltic birch	1/4" x 1/2" x 28"
F	Short sliding fence	1	Baltic birch	3/4" x 6" x 28"
G	Tall sliding fence	1	Baltic birch	3/4" x 11" x 28"
H	Indexing pin	1	Hardwood	1-1/2" long (b)
J	Handle	1	Hardwood	1-1/4" x 2-3/4" x 8"
K	Blade guard	1	Hardwood	1-3/4" x 3" x 10"
L	Throat plate		MDF	1/4" x 6" x 16"

Notes:
a) May be made from wood, but an aluminum bar with setscrew adjustments for a tight fit is better. See Sources.
b) Make indexing pins as needed for each fence.

Build the base and fences

BOX JOINTS must be cut with the utmost precision, so you don't want your jig to wiggle. A sled using a single runner may have some play, but a sled that uses two runners, like this one, will track much better.

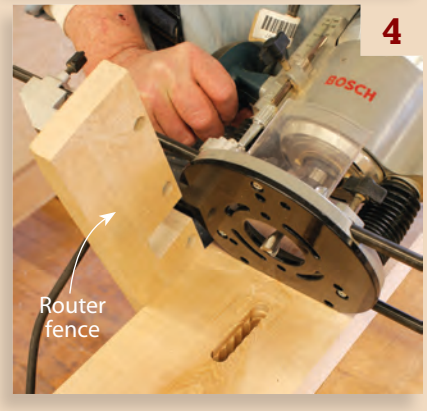
The challenge is to make runners that fit nice and tight in your saw's miter slots. While you can make your own runners from solid wood, plywood or hardboard, I prefer to use commercial miter bars that are adjustable in width. The miter bars shown here have small setscrews in their sides; adjusting the screws allows you to fine-tune each miter bar's width until it fits just right.



Build the sled's base from two pieces of 1/2" MDF. Attach a shop-made or commercial miter bar to each piece.

Place each piece in the saw's miter slot and cut off what will be its inside edge. Next, using the saw's fence, rip the outside edge parallel to the inside edge.

Make the sled's fences. Cut mating grooves in them to receive a spline. The spline will keep the fences aligned with each other.



Rout two large slots in the fixed fence. Remove most of the waste on a drill press first, to make routing easier.

Begin by cutting the two base pieces (A) to final size. Cut the miter bar stock (B), which comes 30" long, into two pieces. Measure the distance from the blade of your saw to each miter slot, then attach the miter bars to each base piece so that the base pieces will extend beyond the blade by about 1/4". I use CA glue to lock the bars in place first, then run in some screws (**Photo 1**).

When the miter bars are secure, adjust their fit in the saw's miter slots. Cut off the inside edge of each base piece (**Photo 2**). Then flip over both pieces and cut off about 1/8" from their outside edges. Both sides of the base pieces are now parallel and square to the blade.

Mill the wood for the sled's fixed fence (D). In addition, make two sliding fences (F and G). They're identical, except that one is short and one is tall. Use the tall fence for cutting box joints into boards that are more than 24" or so long.

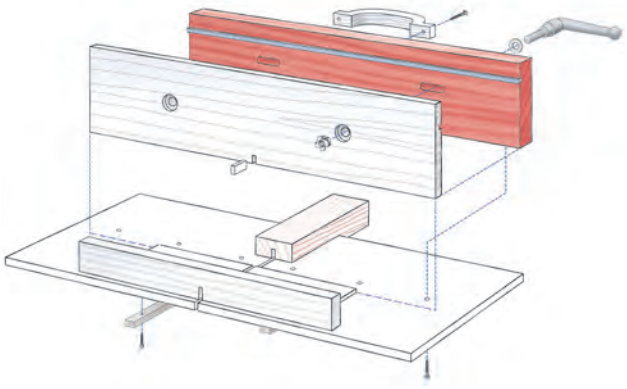
Cut mating grooves in the fixed and sliding fences (**Photo 3** and Fig. B, page 55). Cut slots in the fixed fence for the adjustable handles (J). Rout from both sides to get all the way through this thick piece (**Photo 4**). Make a piece of spline (E) to fit the grooves in the fences, then place the spline in the fixed fence. (I don't glue the spline, so the sliding fences are easier to remove.)

Drill holes for the T-nuts that go in the sliding fences. Drill the large diameter, shallow holes first. Install the T-nuts.

Square the fixed fence

THE FIXED FENCE is permanently fastened to the jig's base. The fence must be absolutely square to the saw's blade, so the box joints come out square, too.

To square the fence, I work very fast using a method that requires an 18 ga. brad nailer. If you don't have a nailer, or if you prefer to work more slowly, you can proceed in a different way. I'll explain below.



Connect the two halves of the base by gluing on a bridging piece. Then position the fixed fence square to the base.

Clamp and glue the fence to the base. While the glue is wet, run a single screw into the left hand end of the fence. Shoot one short brad into the right end of the fence.

Quickly make a test cut on a scrap piece. Check it for square.

If the piece isn't quite square, act fast before the glue grabs. Adjust the fence's position by tapping its right end. Make another test cut. If it's OK, clamp the fence to the base.

Make the bridge (C). Place both base pieces on the saw, spread glue on the bridge and place it in position—close is good enough. Rub the bridge back and forth until the glue squeezes out, then let the glue dry. Flip the assembly over and reinforce this glue joint with screws.

Place the fixed fence in position on the base using a framing square (**Photo 5**). Remove the square and trace around the fence. Remove the fence and drill one hole for a screw to fasten the fence to the base (Fig. A).

Put the fence back on the base, slide the base partly off the saw and clamp the fence in position (**Photo 6**). Drill a pilot hole into the fence. Unclamp and remove the fence.

Here's where you must move fast—you only have about three minutes. Spread glue on the fence and clamp it in position. Run in the screw and shoot one short brad into the fence's opposite end. Remove the clamp and make a test cut (**Photo 7**). If the cut is square, shoot in some more nails, clamp and let the glue dry. Add screws later.

If the cut isn't square, tap the fence's right end to nudge it into the correct position (**Photo 8**). Make another test cut, and so on.

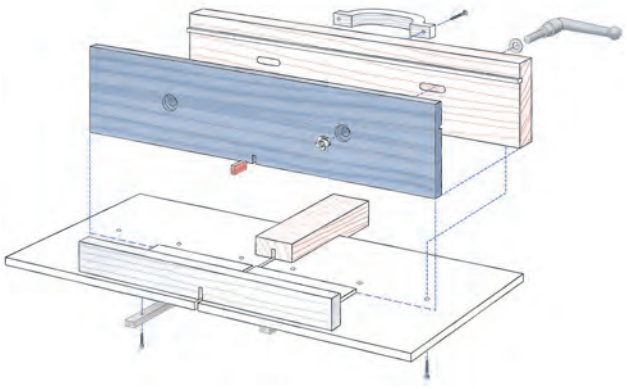
For a slower process, don't glue the fence while you're squaring it. Instead, screw an additional block to the top of the base about 1/8" behind the fence. Place a number of thin shims between the block and the fence, then clamp the fence to the block. Use a single screw, as above, to fasten the fence to the base. Make the same test cuts, and add or subtract shims to readjust the fence's position as needed. Once the fence is square, run in additional screws to permanently lock the fence in position.

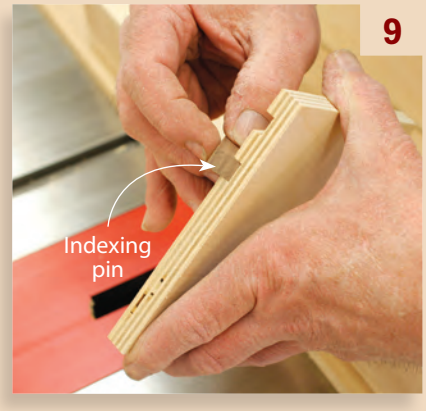
After the fence is installed, add a handle (J) and the blade guard (K).

Install the indexing pin

THE SLIDING FENCE carries the all-important indexing pin. Of course, the size of this pin will vary for each size box joint. I make a new indexing pin each time I make a new set of box joints (it only takes a few minutes).

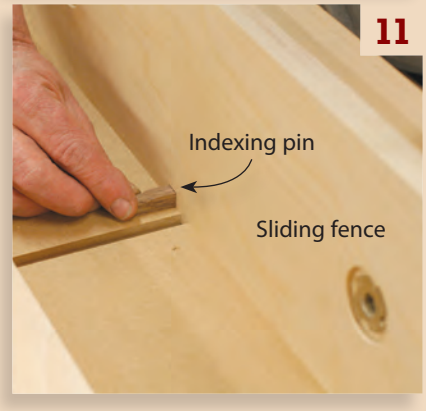
Doesn't a new pin require a new sliding fence, too? No, I just re-use the old one. I knock the old indexing pin out of its slot, glue in a patch piece and make a fresh slot for the indexing pin in a new location.





Cut a groove in a piece of scrap wood. Make the groove the same width as the box joints you'll cut. Make an indexing pin that fits tight in the groove.

Nail a sacrificial board to the base of the sled. When you cut through it, this piece becomes a zero-clearance throat plate.



Cut a slot through the throat plate and a notch in the sliding fence. Slide the fence to the right and glue the indexing pin into the notch.

Slide the fence and pin into the correct position, using a spacer that's the same width as the indexing pin. Tighten the handles on the sliding fence.

Making an indexing pin is fussy work, but it pays off. The width of the pin must exactly match the width of a notch made by your dado set, so the process starts by installing the dado set. Take a scrap piece of plywood, about 12" square, and use the dado set to cut two 1/4" deep grooves in it.

You can make the indexing pin from any scrap of hardwood. For safe cutting, the scrap should be at least 12" long. Remove the dado set from the saw and install a standard blade. In these photos, I'm making a 3/8" indexing pin, so I raise the blade about 1/2" high and set the fence 3/8" from the blade, plus another 1/64". I rip the piece of wood once, using a push stick, then flip the piece around and rip it a second time, producing a piece that's a fat 3/8" x 3/8" x 12".

Test the fit of this piece into both of the grooves in the plywood (**Photo 9**). If it's too tight, plane or sand the piece until it slides into the groove, or reset the fence and cut another piece. Cut a section from the piece that's about 1-1/2" long—this will be the indexing pin. Cut a second piece about 4" long—you'll use this as a spacer for adjusting the sliding fence later on.

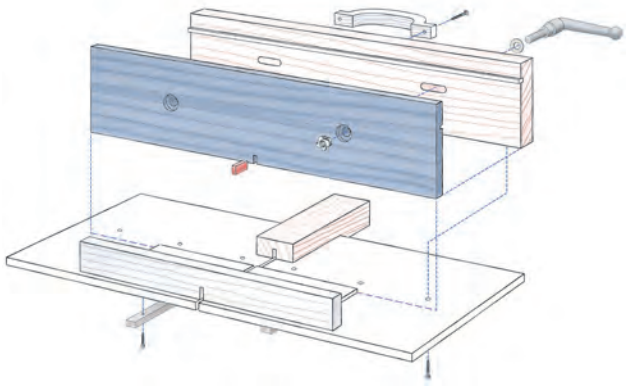
Put the dado set back on the saw. To minimize any chance of tearout when cutting box joints, nail a sacrificial throat plate (L) to the jig (**Photo 10**). Raise the blade to the correct height for your joints, then tighten the sliding fence to the fixed fence. Saw through the throat plate and the sliding fence.

Loosen the sliding fence and shift it to the right. Glue the indexing pin into the notch (**Photo 11**). Place the spacer between the blade and the indexing pin (**Photo 12**). Adjust the sliding fence until the spacer fits tight, then tighten the fence.

Test the width of the fingers

EACH TIME you make a set of box joints, you must readjust the position of the sliding fence to fine-tune the width of the joint's fingers.

This width must be very precise. If the fingers are too wide, the pieces won't go together. If the fingers are too narrow, there will be gaps between the notches and fingers. A few thousandths of an inch one way or another makes a big difference. You're aiming for a finger that's .001" or .002" narrower than a notch.



Start making test cuts. For the first cut, butt the stock right up to the pin.

13

Continue making cuts, moving the test board over one notch each time.

14

Cut the same notches in a second test piece. This time, the first notch starts at the edge of the board.

15

Continue making notches across the board. When you're done, fit the two test pieces together. If the fingers aren't exaclty the right width, which is typical, slightly loosen the handles of the adjustable fence.

16

Tap the adjustable fence closer to the blade if the joints are too tight. (This decreases the distance between the pin and blade, which reduces the width of the fingers.) Tap the opposite way if the joints are too loose.

17

Adjusting the width of the fingers requires trial and error cuts in scrap pieces. Use pieces wide enough to make at least 6 notches. Start by butting up the first piece to the indexing pin (**Photo 13**). Cut one notch. Retract the jig, lift up the piece and shift it to the right, then slide the notch down onto the indexing pin. Cut another notch (**Photo 14**). Repeat the process until you've cut notches all the way across the board. To make this easier, round over the top of the indexing pin with a file or sandpaper.

You could cut the mating board in the exact same way, starting with the piece butted up against the indexing pin, but here I'd like to show you how you would do it on the actual project (**Photos 15 and 16**). Chances are that your two test pieces won't fit perfectly. To adjust the width of the fingers, loosen the sliding fence and lightly tap it one way or another (**Photo 17**). Gripping the two fences with your fingers will allow you to tell when it has moved as little as .001"—the precision necessary for tight joints.