
Power
Tools

Master the Miter




How to cut, trim, glue up and reinforce this multipurpose joint

BY GARY ROGOWSKI

The attraction of a miter joint is easy to see. It is an elegant and straightforward method for joining parts that meet at an angle without showing any end grain. Whether you are building the frame for a veneered panel (tabletops, case goods), applying wrap-around molding or constructing a simple picture frame, a miter joint will serve your needs. But as the saying goes, the devil is in the details. The very visibility of the miter joint means that errors in machining or assembly are hard to conceal. However, with a little patience and lots of practice cutting and assembling miters, you too can master the joint.

Generally used for right-angle corners between two boards of equal thickness and width, miters are made with matching cuts. These cuts are at 45° so no end grain shows. But the miter joint isn't reliable solely as a glue joint for most constructions. Where any real tenacity is required, strengthening with biscuits, splines or keys is always the prudent choice. In short, to get perfect miters requires perfectly mating joints, a slip-proof gluing system and at least one form of strengthening.

Cut miter joints with a chopsaw or tablesaw

No matter what type of saw you cut miters with, use a sharp, clean blade. Generally the more teeth to a blade, the smoother the cut, but no blade will cut well if it's dull or covered with pitch. Every cut is made in two directions: at 45° across the width of a board and at 90° across its face. For a miter to close up well, both angles need to be cut exactly. Make rough adjustments using a plastic 45° drafting triangle, then take several practice cuts, checking the results with a combination square.

A chopsaw works great at cutting miters. Just make sure the fence is flat and straight. If necessary, add an auxiliary fence and shim it to make it square to the table. Frame parts can lie flat on the chopsaw table. Angle the blade 45° to the fence to make the cuts. Clamp stops onto the auxiliary fence to index matching cuts.

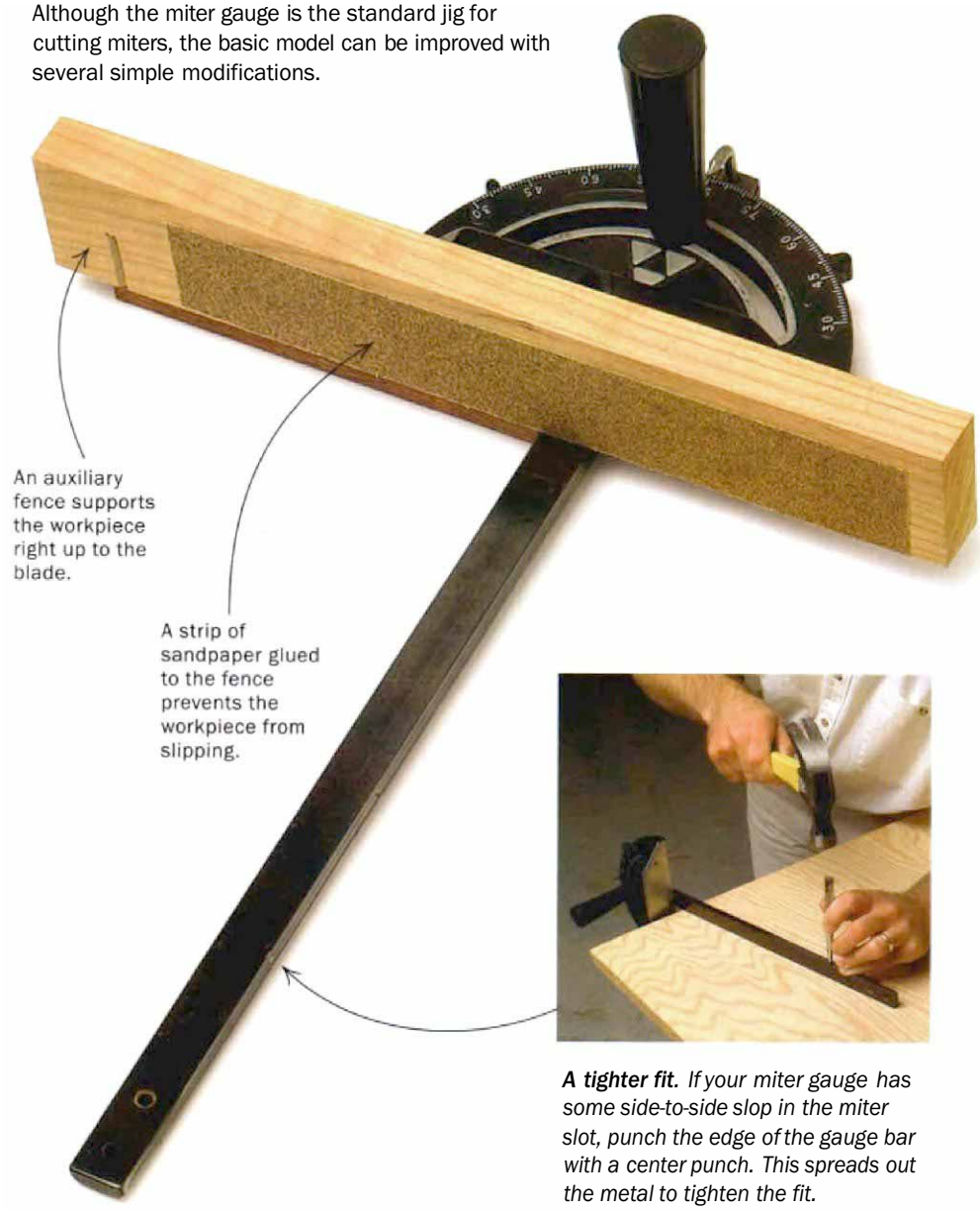
When cutting miters on a tablesaw, you'll get the best results using a jig that holds your work to move it past the blade.

The miter gauge is, of course, the stan-

Photos, except where noted: Mark Schofield

MITER-GAUGE TUNE-UP

Although the miter gauge is the standard jig for cutting miters, the basic model can be improved with several simple modifications.



A tighter fit. *If your miter gauge has some side-to-side slop in the miter slot, punch the edge of the gauge bar with a center punch. This spreads out the metal to tighten the fit.*

dard jig used for cutting miters. Be sure to check your settings for the angle of cut (see the photos below). Attach an auxiliary fence to the miter gauge to support the workpiece near the blade.

When cutting frame miters, angle the gauge down and away from the blade. This way, if the workpiece slips, it will slide away from the blade, not into it. A piece of sandpaper glued to the fence will help prevent slipping. Make certain that your gauge is cutting a true 45° angle, then cut one end of each matching part. Measure and mark off the required length and clamp a stop onto the auxiliary fence to index the cut so matching parts are the same length.

Picture-frame jig ensures accuracy

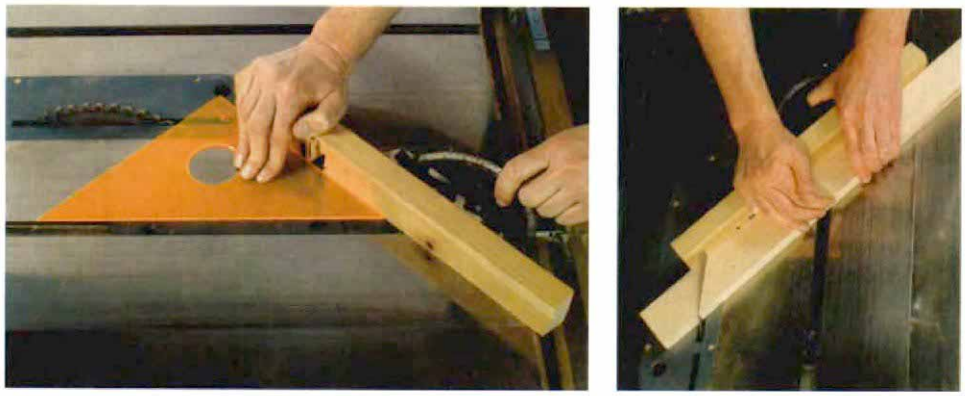
A picture-frame jig has four parts: a flat base, two runners, a fence and clamping blocks. The base can be made of any flat ½-in.-thick sheet stock. Make the runners, which attach to the bottom of the base, out of quartersawn hardwood, so seasonal movement won't affect their fit.

The fence of the jig is ¾-in.-thick plywood. Cut the corner of the fence at a right angle, then screw it to the base. It won't matter if it's mounted a little off a true 45° angle as long as you always cut one piece of the miter joint on the left side of the fence and the other on the right side. The cuts will always be complementary and mate perfectly. Put on the clamping blocks last. You can clamp a stop block to these blocks to make cuts of uniform length.

Fine-tune the fit before glue-up

After cutting the miters, do yourself a favor and take some time to prepare them for

MAKE A TEST CUT AND CHECK FOR SQUARE

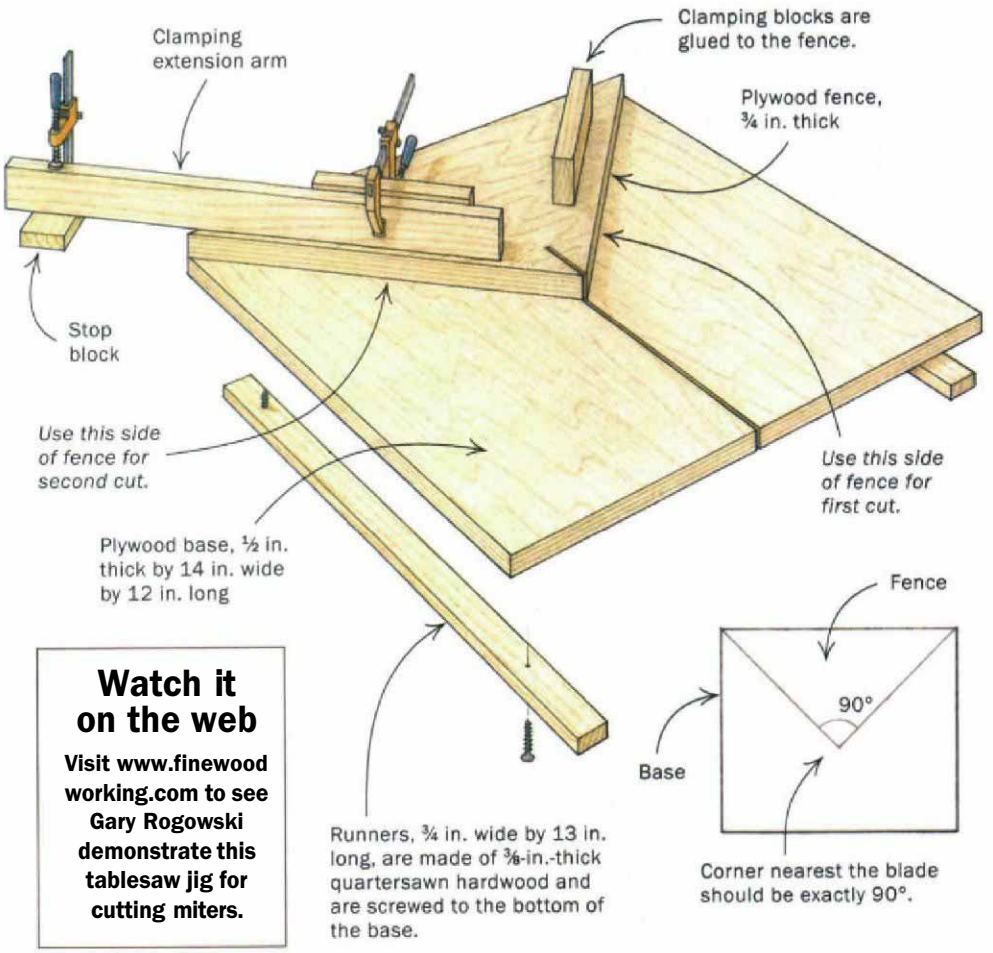


To set the miter gauge at exactly 45°, first align a drafting triangle against the miter slot in the tablesaw (left). Make a cut in a piece of scrapwood (middle). Flip over the cut-off piece and hold both pieces tightly against a square (right). Adjust the miter gauge until there is no gap, and you are set to cut perfect miters.

Photos, this page: Michael Pekovich

PICTURE-FRAME JIG

Cut adjoining parts on opposite sides of the jig to guarantee a 90° joint.



Watch it on the web

Visit www.finewoodworking.com to see Gary Rogowski demonstrate this tablesaw jig for cutting miters.

The first cut is made on the left-hand side of the jig. *If the work slips, it will do so away from the blade.*

Uniform length. *Mark the length on the workpiece and on the right-hand fence. Clamp a stop block against the mitered end.*

Make the second cut on the right-hand side of the jig. *With the stop block in place, you are assured of consistent cuts.*

gluing. First check your cuts to see how well your saw performed. There are several ways to remedy a cut that is less than smooth. Trim the miter with a low-angle block plane, tuned up with a freshly sharpened blade. Put the workpiece in a vise and take a few light passes off each mating face, but don't change the angle. Check your results with a combination square.

A disc sander outfitted with a miter-gauge jig can also be used to fine-tune miters. This jig rides in the slot in the sander table and has a plate on it cut at 90° but positioned 45° to the sanding disc. Work on both sides of this fence to ensure that mating pieces get complementary cuts, but always work on the left side of the moving disc. In this way your work will always get pushed down into the supporting table. Take only light passes, and try to move the work past the disc so you don't burn the wood or load up the disc in one spot. Before starting, double-check that the sander's table is exactly 90° to the disc.

A third method of trimming is to use a shooting board. A stop angled 45° on both sides is screwed to the base. When used with a square-sided plane, this jig will trim the miter at 45° across its width and at 90° to its face.

Even clamping pressure is critical

Wood is made up like a bundle of straws. Crosscut or miter the end of a board, and you expose the ends of those straws, which suck up glue and starve a joint, weakening it. The faces of a miter joint should be sized by precoating them with a light wash of glue to fill the pores. Scrape off any excess glue before it dries. Despite the normal warning not to apply glue to an already glued surface, in this case sizing will strengthen the glue joint.

Dry-fit and clamp everything before the final glue-up, and you'll thank yourself later for your calm demeanor and slow heart rate. Mind you, I am a yellow-glue devotee, so all of this advice comes from

Drawings, except where noted: Vince Babak

TRIMMING MITERS BY HAND AND MACHINE

A light plane. *A few passes with a well-tuned block plane clean up the surface and alter the angle, if necessary.*

Accurate shooting. *This shooting board, when used with a square-sided plane, trims the wood at 45° across its width and at 90° to its face.*

Sand to fit. *Another way to fine-tune a miterjoint is to use a jig that holds the workpiece at 45° to a sanding disc.*

using quick-setting glue, not some expansive, messy polymer.

Band clamps fit around a box or a picture frame to apply even pressure to the miter joints. Practice locating and tightening the band clamp in place right over the joint. Use several clamps for wider glue-ups, and stagger the clamp heads so they're not in each other's way.

You can put clamping corners over the joint to help spread the pressure. Some band clamps come with self-adjusting corners suitable for any angle; you can also buy aftermarket versions. Again, practice with these systems before gluing.

When gluing up miters with splines or keys that would interfere with a band clamp, I use shopmade clamping blocks clamped right onto the frame side. These blocks have a notch cut right into them where you can place another clamp to apply pressure directly across the joint. If your clamping blocks slip too much, glue a piece of sandpaper to them on the side that rests against the workpiece.

How to strengthen miters

Reinforce miter joints by using splines or biscuits, which are inserted before the joint is glued up, or keys, which are added after glue-up. Which method you use is determined by several factors, the most important being aesthetic considerations. Do you want to conceal the strengthening for a seamless look, as with a gilded picture frame, or do you prefer to emphasize it, as with face-frame keys? The second factor is the difficulty and length of time involved.

Splined miters in frames—Through spline cuts are made along the length of the miter. They're most easily made on the tablesaw. Use a spline-cutting jig to support the workpiece at a 45° angle to the blade. Make this jig out of a straight piece of ¾-in.-thick plywood and a support piece glued and screwed on at a 45° angle. Make certain that your fasteners are higher than the tablesaw blade at its highest setting.

With your frame piece in the jig, set the fence so that the sawkerf is centered in the thickness of the stock. If it's not, the faces of your frame members will not be flush. One way to prevent this is by having a miter jig with two fences on it for each side of the miter (see the photos and drawings on p. 48). The jig is rotated 90° to cut the spline in the adjoining workpiece.

GLUING AND CLAMPING MITERS

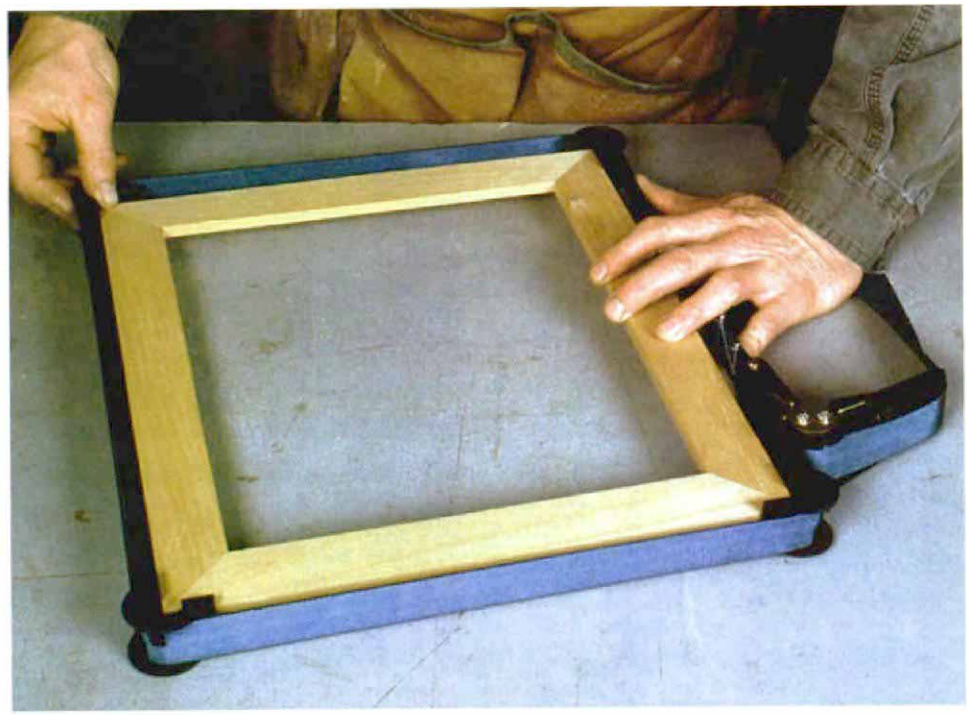
Sizing the joint. *The open grain on the face of a miter should be sealed with a thin layer of glue and allowed to nearly dry. The sealed end grain won't starve the joint when glue is applied to connect the miter.*

Set the blade height for a ¼-in.-to ⅜-in.-deep cut, but no deeper. Because the grain direction of a spline in a solid-wood frame has to run in the same direction as the frame members, too deep a spline cut makes for a wide and fragile spline. Hold or clamp the work firmly in the jig. Place your hands carefully out of harm's way and make a pass. Use a flat-grind blade to put a flat bottom on the cut.

Mill up the spline material out of a contrasting wood to set off the joint. Using a tenoning jig, hold the board vertically and run it past the blade to trim your spline to thickness. Then cut the spline to length. If your spline doesn't quite fit, use a block plane to trim it to thickness. Be careful not to snap the short grain of the spline as you plane. You're looking for a snug fit, not one that's overly tight.

Fit one side of the spline and check to see that it will let the joint close up nicely. Trim its end grain with a block plane, if needed. Size the end grain of the miter, then put glue in one of the spline cuts with a thin piece of wood. Set the spline in place all the way down to the bottom of the groove. Then put glue on the rest of the joint and clamp it up. If the fit is a bit loose, clamp across the face of the joint as well. You can also pin this spline in place with dowels for extra strength and an additional design detail.

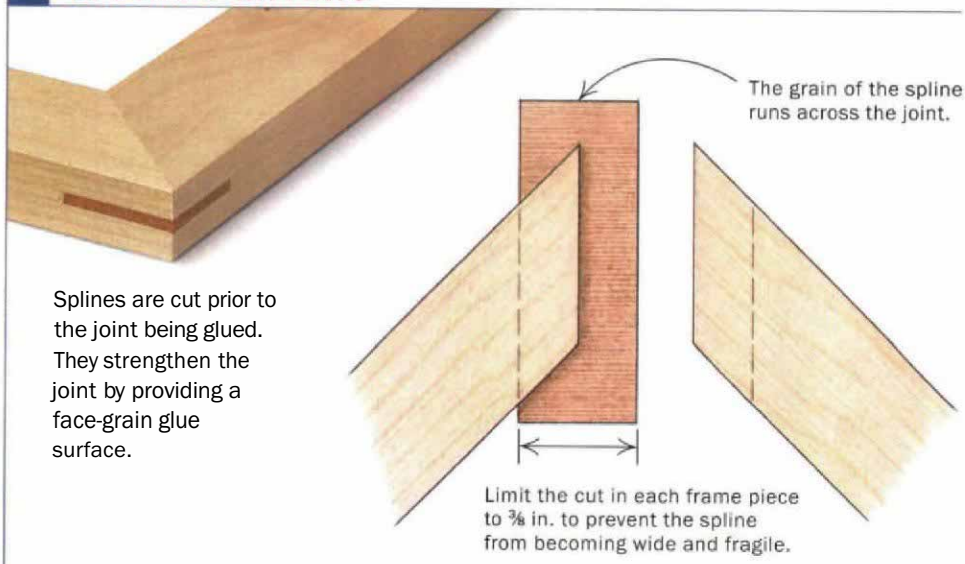
Biscuit splines—You can also strengthen a miter with a biscuit joint. Mark the frame



A better band clamp. *Plastic corner blocks added to a band clamp reduce the risk of crushing the corners of the workpiece.*

Bar-clamp techniques. *Shopmade clamping blocks distribute pressure across the joint and won't mar the workpiece.*

SPLINED MITERS



Splines are cut prior to the joint being glued. They strengthen the joint by providing a face-grain glue surface.

Cutting the spline. *Use a tenoning jig to trim the spline to thickness.*

No band clamps here. *Because the spline extends beyond the outside corner, it is necessary to use block clamps.*

members across their faces with a pencil at the center of the joint or closer toward the inside corner of the joint so that the cut won't show at the corners. Center the joiner in the thickness of the stock. Support or clamp the frame members securely, and hold the joiner tight to the miter as you cut.

Keys can reinforce miter joints

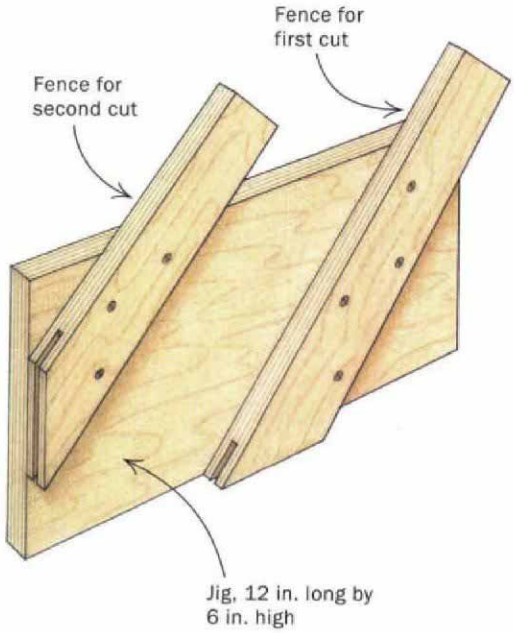
Mitered frames may also be reinforced after glue-up using exposed keys. These keys are inserted into mitered corners from the outside after cutting the appropriately sized slots. Slots may be cut on a tablesaw or on a router table.

Cutting straight keys on the tablesaw—A keyed miter jig works great for holding a glued-up frame in place while you pass it through the sawblade (see the photos and drawings on the facing page). Set the blade height for the full depth of cut, and use a fiat-grind blade if you have one. Cut each corner, holding the same face of the frame to the jig.

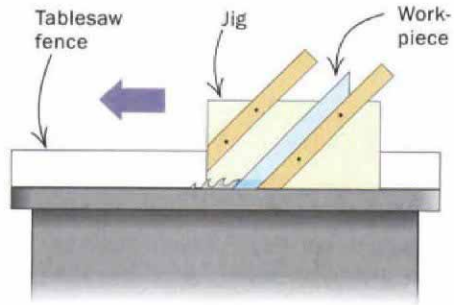
Mill up key stock wider than the depth of the key cut. Trim the stock to thickness on the tablesaw. You should use a thin

SPLINE-CUTTING JIG

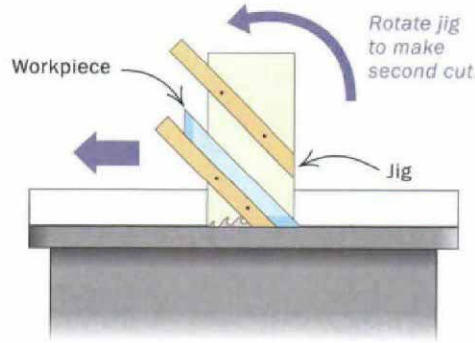
This jig has two 45° fences, which allow miters to be cut on both ends of the workpiece while keeping the same face registered against the jig. All parts are made of ¾-in.-thick-plywood.



Cut one end. *Hold the workpiece firmly in place and register the jig against the tablesaw fence.*

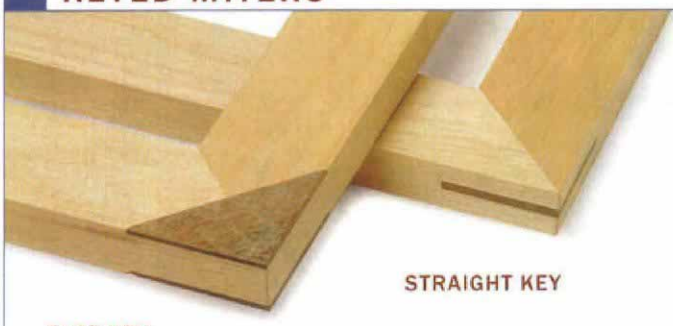


Then cut the opposite end. *Rotate the jig and register the workpiece against the other fence,*

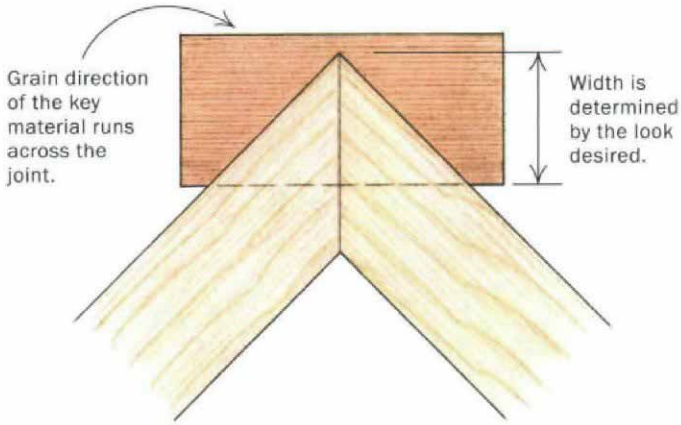


Drawings, this page (bottom right): Michael Pekovich

KEYED MITERS

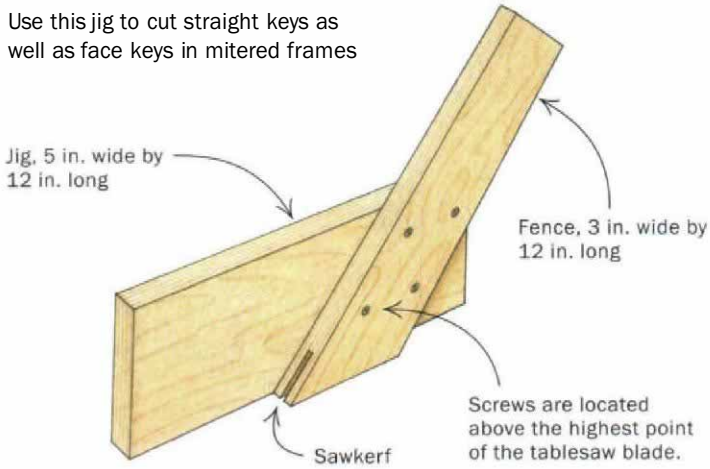


Keys are added after the joint has been glued. Both face keys and straight keys add to the glue area of the joint.



KEY-CUTTING JIG

Use this jig to cut straight keys as well as face keys in mitered frames



One jig cuts two keys. *Simply by adjusting the fence of the tablesaw, the key-cutting jig can cut either straight keys in the center of the frame (above), or face keys on the front of the frame (right).*

push stick to help you move the work safely past the blade. Use a handplane to trim the key exactly to thickness, then cut it longer than necessary.

Fit keys in their cuts so that they're snug and only require a light tap to position them. Make sure when gluing that they fit all the way down in the key cut at both its sides. Once the keys are dry, clean them up on the bandsaw. Sight along the edge of your frame as you make the cut so you don't cut into the piece. Then handplane away from the corner in each direction to trim the key flush. If you plane toward the corner, you will tear out the tip of the key.

Cutting face-keyed miters—Face-keyed miters for frames probably originated when someone made a straight key cut in the wrong spot. It was a pretty mistake. Make these cuts using the keyed miter jig on the tablesaw. Place the cut just on the outside edge of each corner on both faces of the frame. Make up key stock as before, but this time just make it conveniently thick. When gluing, make sure the keys fit down to the bottom of the cut on both sides of the joint. Put clamps across the keys to hold them in place. The final step is to plane the keys flush with the face of the frame, being careful of the contrasting grain directions. □

Gary Rogowski runs The Northwest Woodworking Studio in Portland, Ore., and is a contributing editor to Fine Woodworking.