Micro-Adjustable Tenon Jig

Precise positioning permits you to rout a tenon in less than a minute

BY PATRICK WARNER

Most of the furniture making I do is experimental. Nothing in the design is standard. Consequently, when making tenons for joinery, I want a jig that will accommodate a wide range of sizes. Some adjustable woodworking jigs use the tap-and-clamp method. That works, but it's simply not very handy when you're making lots of different-sized tenons.

The jig I use to make tenons (see the photos at left and below) is nowhere near as sophisticated as some screw-driven woodworking machinery, but with a slight turn of the adjusting handle, I can dial in tenons to within 0.001 in. and cut 2-in.-long tenons in under a minute. The range of travel allows for shoulder widths up to ⅝ in. A straight bit in a router does the cutting. The jig works with either a template guide bushing or a bearing-guided pattern bit.

Although only one face is machined at a time, the work can be flipped, remounted and milled in fewer than 10 seconds. The jig shown here will only cut two-faced tenons or four-faced tenons on narrow stock (approximately less than 1½ in.). For four-faced tenons on wider boards, you can (1) expand the size of the travel mechanism and clamp base to accommodate all four cuts; (2) cut the two short tenon faces by hand; or (3) build another similar jig for wider stock so that it will handle the other two faces.

Cutting a stack of tenons in under three minutes. *Precise adjustments and fast-acting toggle clamps on this jig allow you to make uniform router-cut tenons in quantity.*

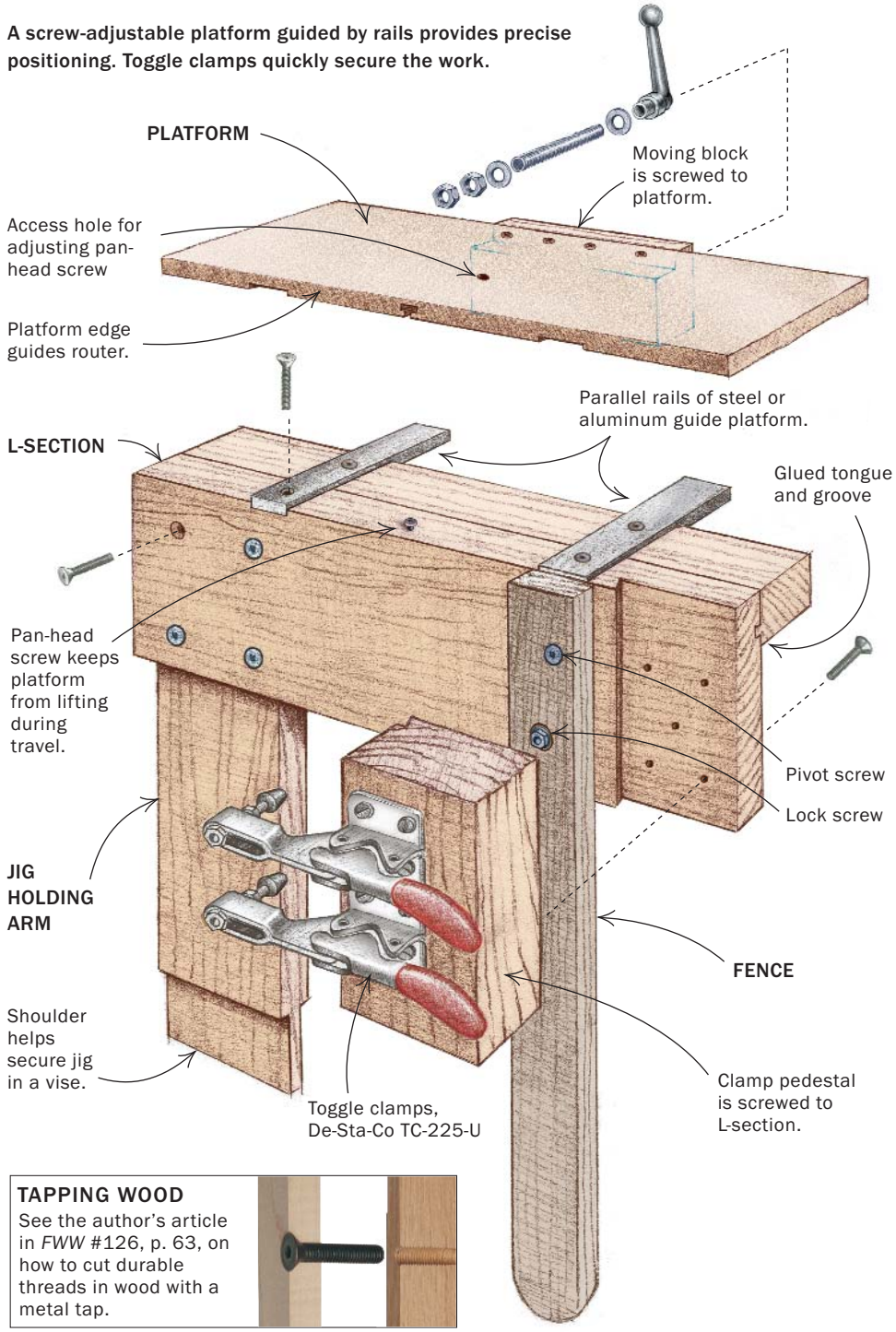
Making the jig

A simple L-section forms the backbone of this jig (see the drawings on the facing page). An adjustable platform above the work supports and guides the router, controlling the tenon size. This platform is positioned by a

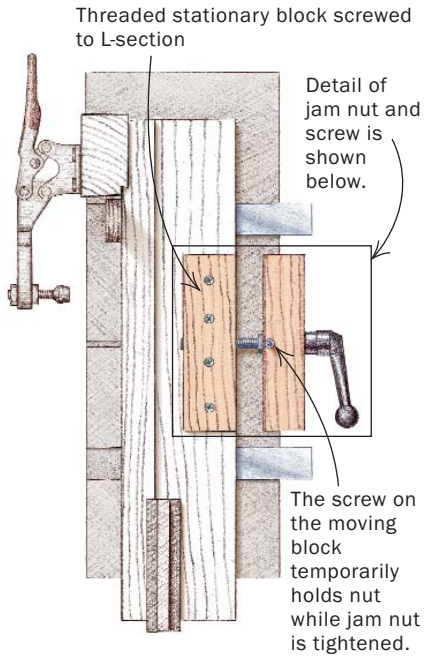
Photos: Dennis Preston

JIG ANATOMY

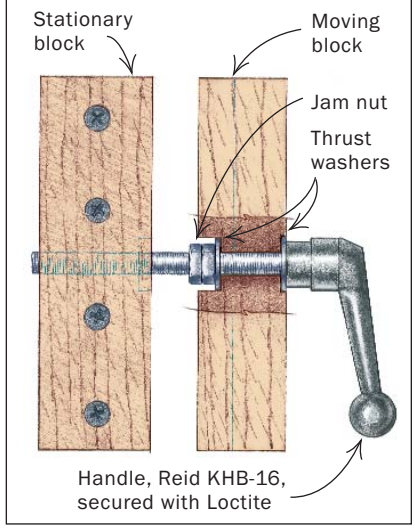
A screw-adjustable platform guided by rails provides precise positioning. Toggle clamps quickly secure the work.



BOTTOM VIEW OF JIG



DETAIL OF JAM NUT AND SCREW



TAPPING WOOD

See the author's article in *FWW* #126, p. 63, on how to cut durable threads in wood with a metal tap.

threaded rod (or lead screw) and held in alignment with metal guide rails. Toggle clamps secure the work in place, while a holding arm allows the jig to be secured in a vise or clamped to a bench. This jig will hold stock up to 8/4 thick and 10 in. wide and of any length.

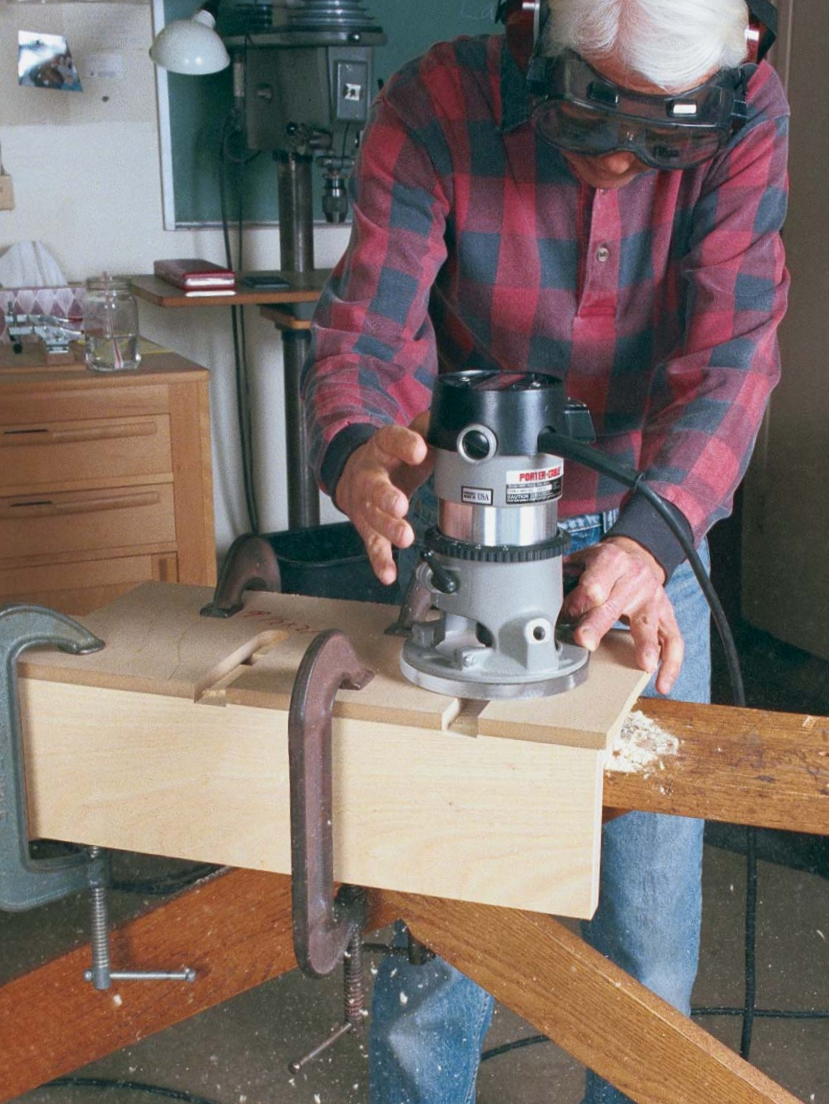
The jig is made mostly of wood, but for many parts I used metal joinery methods, which produce rugged, accurate jigs. Rabbets or grooves align parts, and machine screws hold them together. I cut threads directly into the mating wooden part using machinist's taps (see *FWW* #126, p. 63). You could also use wood screws, carriage bolts and threaded inserts for the assembly.

For strength, most of the wood used in this jig is red oak. The adjustable platform, however, is medium-density fiberboard (MDF) because I wanted a smooth, flat, stable material to guide the router.

L-section and guide rails—Begin by sizing the two pieces of stock that form the L-section. I joined these pieces with a shallow tongue and groove and glue. After the glue dries, router-cut all of the joinery and the guide-rail slots, and drill and countersink the holes for the machine screws.

I made the platform guide rails for this jig from ¼-in. by 1-in. steel flat bar. Aluminum flat bar would have worked just as well

Drawings: Melanie Powell



A template makes matched rail slots. *Align the front edge of the template with the L-section. Repeating this operation on the platform ensures that the rails stay in alignment and that the jig operates smoothly. The cuts are made with a top-bearing pattern bit.*

and been easier to cut and drill. The guide rails are let into and fastened to the L-section. The platform has mating slots to engage the rails. The four slots must be correctly spaced and parallel; otherwise, the platform will bind. I made a simple 10-in. by 17-in. rail template from ⅜-in.-thick MDF (see the photo at left) to cut the slots. Using a top-bearing pattern bit, I cut two 1-in.-wide slots about 1 in. longer than the platform width and perpendicular to the open end (the reference edge) and slightly deeper than ⅛ in.

Cut the flat bar to length and drill and countersink the mounting-screw holes. Position the rails on the L-section and mark the center points for the screws. Be sure to set the rails back from the face of the L-section by about 1/16 in. to prevent a collision with the router bit later when you trim the platform edge. Now, drill and tap these holes and mount the rails.

The platform—Once the rail slots have been milled, route a T-slot midway between the two rail slots. This T-slot engages a #10 pan-head sheet-metal screw in the L-section and keeps the platform from lifting during its travel. A hole through the platform allows convenient access to the pan-head screw for adjustment.

For the travel mechanism, I used a 5/16-in., 18-tpi (threads per inch) screw thread. One full revolution produces 1/18 in. (0.056 in.) of platform travel; a quarter turn, therefore, produces 0.014 in. of platform travel, and so on.

The key parts of the travel mechanism are a threaded stationary block attached to the L-section, a moving block fastened to the platform and a 5/16-in., 18-tpi threaded rod with a lever (see Sources of Supply on the facing page). The moving block is rabbeted along the edge to join the platform and is drilled for a 5/16-in. through-hole and counterbored on the inside face to house two nuts and a thrust washer. A thrust washer on the opposite side is recessed into a shallow counterbore. After screwing these two blocks in place, mark the pilot hole for the thread through the 5/16-in. hole in the moving block using a machinist's transfer punch. The transfer punch has the same nominal shank diameter as the drill. A small

Tapping holes. *Turn the drill-press spindle by hand. Once the tap engages the wood block, it self-feeds, cutting uniform threads.*

Square the fence to the platform. *Tighten the two fence-mounting screws to lock the position. A slightly oversized hole allows the fence to be positioned at exactly 90°.*

Edge trimming. *Trim the platform edge parallel to the L-section face. The metal rails are set back from the face to prevent damaging the router. A vacuum hose catches the MDF dust.*

point exactly in the center of the punch perfectly centers the two holes. Now remove the stationary block and cut threads using a drill press (unpowered) as a tapping fixture (see the bottom left photo on the facing page).

Two nuts tightened against each other hold the screw and the lever assembly in the moving block. The pan-head screw is tightened against the innermost nut to prevent it from turning while the jam nut is tightened. Once the nuts are tight, the pan-head screw is backed away, allowing the shaft to turn freely.

The fence, clamp pedestal and jig holding arm—Cut the stock for the fence. The fence pivots on a 5⁄16-in., 18-tpi flat-head machine screw. The lower screw has an elongated hole, which allows the fence to be positioned exactly 90° to the underside of the platform (see the middle photo on the facing page).

To mount the clamp pedestal, transfer the bolt-hole pattern from the L-section. Use the clamp base as a pattern to locate the pilot holes for the mounting screws. The jig holding arm is lap-bolted to the L-section. Transfer the mounting-screw location from the L-section. The shoulders on the end of the arm help keep it square in the vise and resist rotation during use.

Dialing in the perfect tenon. *If the test cut results in too big a tenon, adjust the jig and cut again. The author has made a number of jigs based on the same basic design; the screw clamps on the jig shown here will hold wider stock than the jig on p. 62. The top surface of the platform is a handy place for notes and reference lines for cutting multiples or to repeat a setup at a later time.*

SOURCES OF SUPPLY

TOGGLE CLAMPS AND HANDLE

Reid Tool Supply Co., 2265 Black Creek Rd., Muskegon, MI 49444; (800) 253-0421

Also available at local industrial supply houses and through other mail-order hardware suppliers.

THREAD-LOCKING ADHESIVE

Loctite is sold in most automotive-supply stores.

Truing up the platform edge—Remove the fence and clamp pedestal and secure the jig in a vise. Now, extend about 1⁄32 in. of platform past the face of the L-section. Using a router with a flush-trimming bit (bearing on the end of the bit), cut the platform edge parallel to the L-section face (see the right photo on the facing page). This matches the platform edge to the L-section face. Reassemble the jig, and you're ready to make tenons.

Making tenons with the jig

I prefer using a fixed-base router when I make tenons with this jig. A plunge router may be better for multiple-depth cuts, but it's difficult to plunge one safely along an edge because of the small footprint and high center of gravity.

Install the cutter and guide collar on your router, and set the depth of cut. Adjust the toggle clamps to the stock thickness. Very large work may require the addition of a C-clamp. Be sure to position the work against both the fence and the underside of the platform. Routing in this orientation, across the grain, quickly peels away material. Nevertheless, deep cuts should be done in multiple passes.

Position the platform at your best first guess and rout the first cheek of the tenon. I usually climb-cut (moving along the edge right to left) because there is so little resistance to the cut. When climb cutting, take light cuts to avoid a runaway router. Reposition the work and cut the opposite cheek without moving the platform. Test the tenon in its mortise. If it's too big, determine by how much and divide by two. Then move the platform back by that amount and repeat the cut (see the photo above). □

Patrick Warner lives in Escondido, Calif. He has written three books on routing and even has a web site on the subject. Visit the site at www.patwarner.com.