

Rock-Solid Workbench



Ready-made hardware simplifies end-vice construction

BY JON LEPPA

I knew that when I eventually got around to building my dream workbench, it would have to meet a few basic requirements. It would have to be sturdy enough to last a few lifetimes. It would have to have storage underneath. And it would have to have good front and end vises so that I wouldn't have to do a lot to get a workpiece held securely.

In 1998, I finally built my bench. And I'm pleased to say that after five years of heavy work, it has fulfilled my expectations, and then some. It's rock solid and has plenty of useful storage, thanks to 15 drawers and an area of open space between the base and the top.

Building such a large workbench can be an intimidating task, but it's actually basic woodworking. The only parts of the bench that call for anything other than straightforward biscuit and mortise-and-tenon joinery is the end vise. Whether you decide to build this bench using the foldout plans or add the end vise to a bench you already have, this article walks you through the process.

Vises, benchdogs and a board jack help anchor workpieces

The front and end vises, along with benchdogs and a board jack, offer plenty of clamping options.

In the front of the bench I had planned to use a typical cast-iron vise with wood jaws until I ran across an Internet ad for a used patternmaker's vise, and I couldn't resist the temptation to buy. The vise, built in the 1930s by the Emmert Manufacturing Co., allows me to clamp a workpiece in almost any position. Patternmakers favor this type of vise because it adjusts in several planes, making it possible to hold work of almost any shape. Like me, you'll occasionally see a used Emmert vise offered for sale on the Internet. Also, you can sometimes find them at vintage tool dealers or, more rarely, at flea markets. Expect to pay upwards of \$500 for one in good condition.

My vise is one of the larger ones Emmert produced. Modern reproductions of the vise are available in mostly smaller sizes, generally about 15 in. long. Some of these are fairly inexpensive, about \$300, and the quality is decent. Higher-quality ones can cost more than \$1,000.

A sliding board jack helps support long, wide stock, with the front end of the stock held in the Emmert vise. The board jack is adapted directly from one I found in *The Workbench Book* by Scott Landis (The Taunton Press, 1987), modified only slightly to fit my

Anatomy of a sturdy bench

The base of this bench, modeled after the one master woodworker Robert Whitley built for his bench, consists of five frame-and-panel assemblies—two end frames, a back frame and two horizontal frames—bolted together with carriage bolts. And while I wouldn't exactly call this a knockdown bench, it can be disassembled.

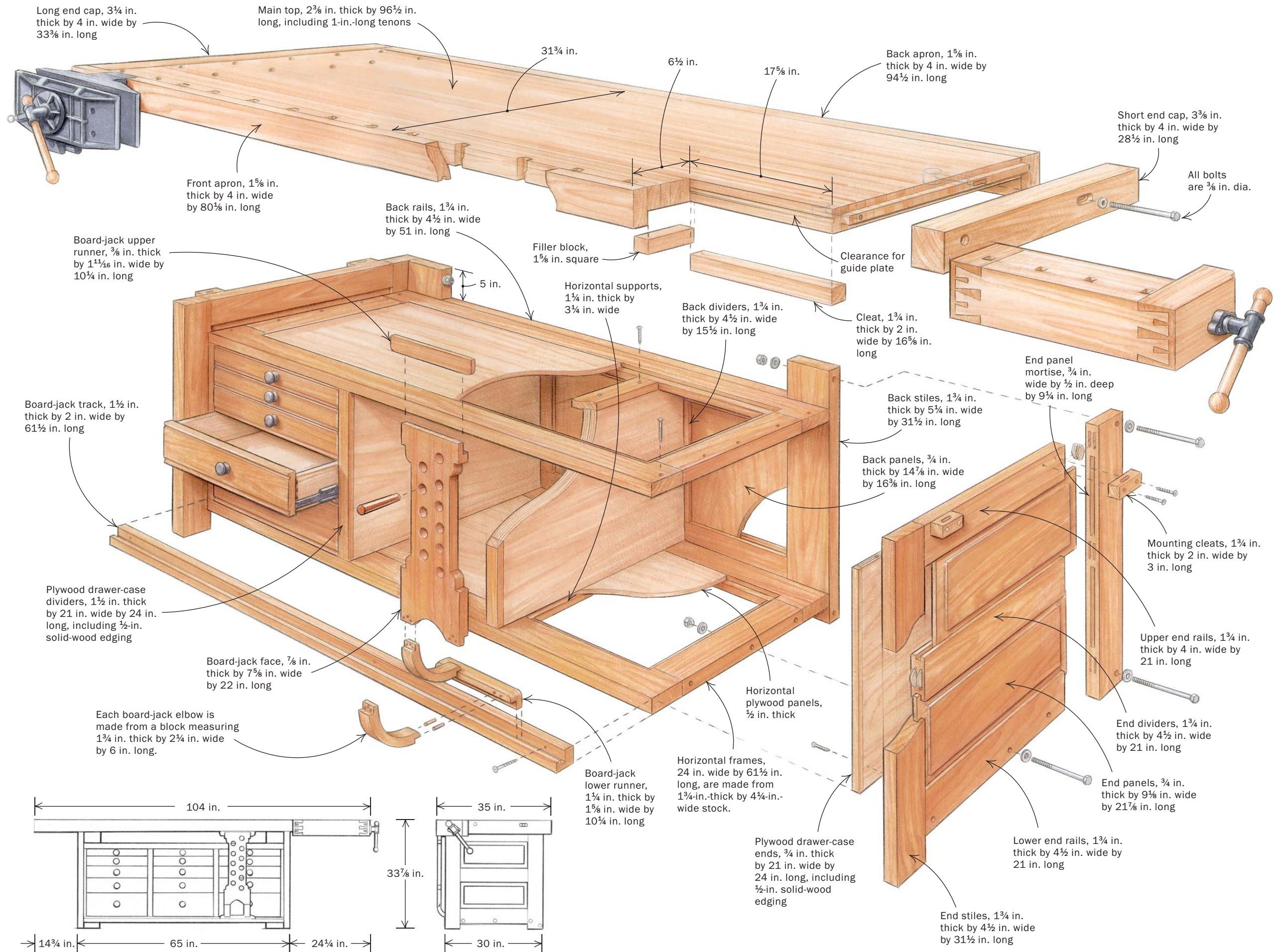
I joined the panel frames with a double row of #20 biscuits, mostly because of speed and convenience. The base carcass sees mostly compression loads on vertical grain members rather than racking forces, which would stress the biscuit joints. A purist would have used mortises and tenons here. But I've had no trouble using biscuits in this kind of application.

The top is made from hard-maple laminations face-glued together. Each end of the bench has a long tenon. Later, when a pair of caps is made, each tenon fits into a mortise in the corresponding cap pieces.

I used a circular saw to cut the tenons. With a straightedge clamped to the benchtop to guide the saw, I made several crosscut kerfs and chiseled away the waste.

Both the long and short end caps are mortised to accept the tenons on each end of the bench.

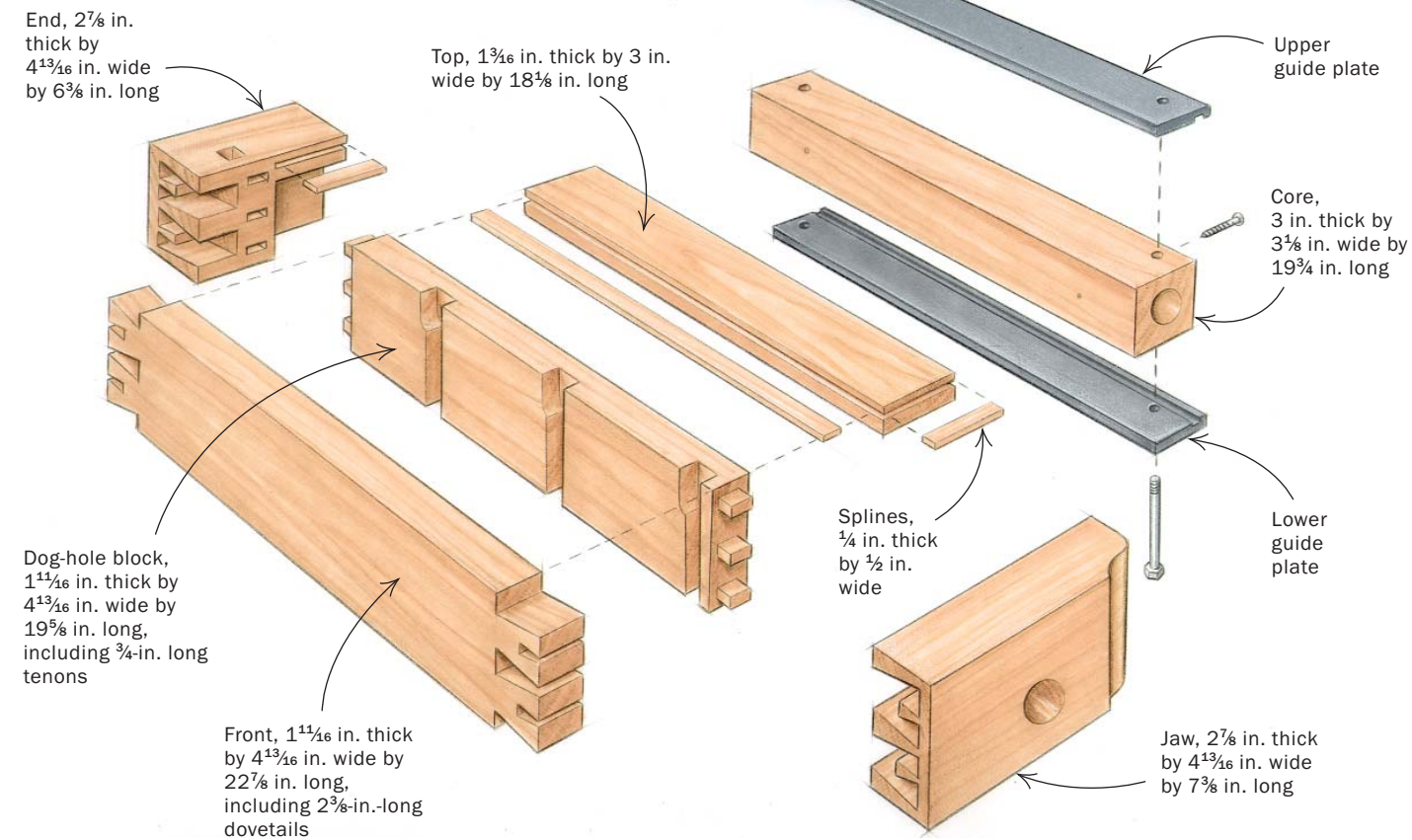
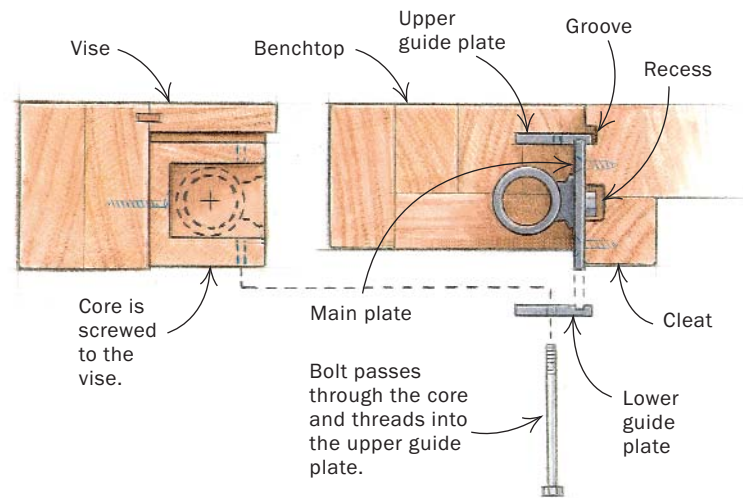
To allow the top to move, the end caps aren't glued in place. Instead, each one is held in place with a pair of bolts. One of the bolt holes on each end cap is slotted so that it can move with the top. Once I had the end caps mounted, I flattened the entire benchtop using handplanes and winding sticks. Mounting an Emmert vise is relatively simple, although they are often heavy (mine is about 85 lbs.). The vise itself mounts on a large hinge that's mortised into the top face of the benchtop and also the front face of the front apron. To allow clearance for the vise screw, a channel is cut into the underside of the apron and the benchtop.



END-VISE CONSTRUCTION



The main plate is mounted to the edge of the benchtop with wood screws and is the only vise part that doesn't move. All of the other wood and steel vise parts simply slide back and forth along the main plate.



bench. The bottom track screws to the bottom frame, capturing the board jack. An occasional application of paste wax to the tracks keeps the jack sliding smoothly.

End vise adds versatility

I originally considered a commercially made twin-screw end vise, but in the end the extra versatility that a traditional vise offers has made the effort worthwhile. Whether you build my bench from the ground up or not, adding an end vise to a work-

bench will make it much more user-friendly. Building the end vise is also the trickiest part of the process.

The end-vise hardware consists of four parts (the vise hardware is available from Woodcraft—800-225-1153): a main plate that includes a cylindrical nut; a long screw with a flanged bracket and handle collar; a top guide plate with a lengthwise groove and a pair of threaded bolt holes; and a bottom guide plate with a corresponding groove and a pair of countersunk through-holes. A pair of bolts is also included. By the way, it's important to have

DOVETAILING THE END CAPS AND FRONT OF THE VISE



Cut the dovetails. Use a fine-toothed backsaw to cut the sides of the dovetails.



Mark the pin locations on the outside and inside ends. With the end cap clamped in a vise, the front piece is used as a template to mark the pin locations.



Cut the pins. Use a Forstner bit to remove most of the waste material from the pin ends. A chisel takes care of any waste that remains.

the hardware on hand before making the vise. Some of the dimensions are taken directly off the steel parts.

The main plate is screwed to the edge of the benchtop. All of the other parts, effectively working as one component, simply slide along the main plate. One end of the long screw is attached to the outside end of the vise, while the other end is threaded into the nut on the main plate. As the screw is turned, it threads in or out of the fixed nut, and in the process the vise is carried along for the ride. The top and bottom guide plates connect the vise and the main plate while allowing the vise to slide. The secret here is the single lengthwise groove near one edge of each guide plate. The grooves in the guide plates simply slide over the main plate, held apart by the wooden core.

Core prevents a sloppy fit—The core maintains the correct distance between the top and bottom guide plates.

To make the core, start by measuring between the top and bottom guide plates while the two parts are assembled to the main

plate. Add $\frac{1}{4}$ in. or so for clearance, then rip the core to width. Now clamp the two guide plates to the core and try sliding the core along the main plate. If the fit is too loose, remove the plates, then run the core through a thickness planer, but make the cut an especially thin one. Repeat as needed. If the fit is too tight, add shim stock between the core and a guide plate.

Cut the core to length and drill a clearance hole for the vise screw in one end. Then hollow out the center of the core using a Forstner bit, and clean up what remains with a chisel. Now use the top guide plate to mark the locations of the mounting holes on each end of the vise. The end of the plate should be flush with the drilled end of the core. To provide a little clearance between the core and the main plate, the slot in the guide plate should extend past the edge of the core by no more than about $\frac{1}{2}$ in. Once marked, use a drill press to bore the holes.

Cut and assemble the end-vise parts—After cutting the front, end, top, jaw and dog-hole block to size, it's time to tackle the

A vise with good moves



The jaws on an Emmert patternmaker's vise adjust in three planes, a feature that can prove useful when clamping odd-shaped parts. The jaws rotate 360° (left), pivot 90° (center) and taper (right).



ASSEMBLING THE VISE

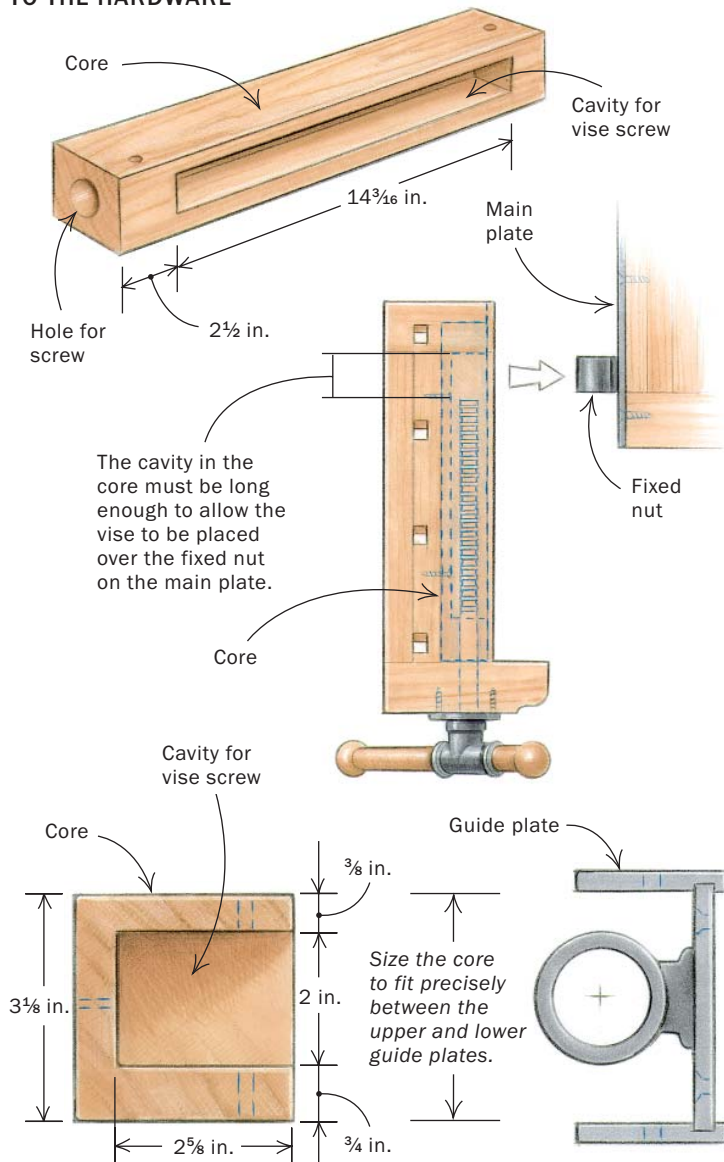


Begin gluing the vise parts. Glue the end, the jaw, the dog-hole block and the top. You'll need several clamps to squeeze the four parts together.



Add the front piece. Apply glue to the tails on the front piece and the pins on the end and jaw, then use a mallet to tap the front into place.

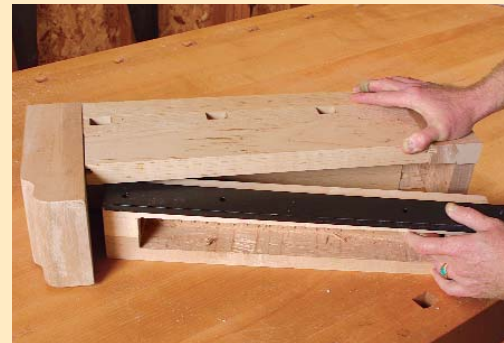
THE CORE CONNECTS THE VISE TO THE HARDWARE



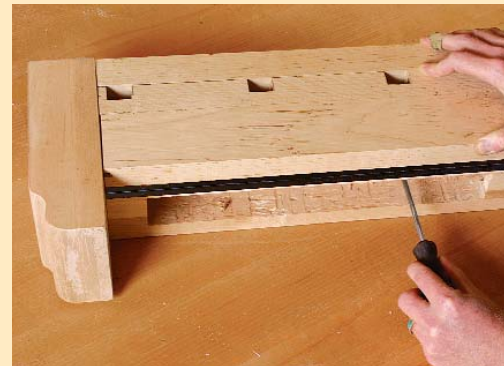
MAKING THE CORE



The core provides a means to secure the vise hardware. The core is made from a glued-up block of wood. After drilling out the cavity, use a chisel to clean up any waste that remains.



Mounting the core. With the upper guide plate temporarily placed on the core to serve as a spacer, slip the core and plate into the vise cavity (top). Then attach the core to the vise by driving four screws through the core and into the dog-hole block (bottom).



INSTALLING THE END VISE

Secure the main plate. Position the top edge of the plate slightly above the bottom edge of the groove in the top.



Slide the top plate onto the main plate. When properly located, the top guide plate should slide smoothly along the main plate without interference.



Mount the vise. With the cylindrical nut on the main plate roughly aligned with the open space at the back end of the core cavity, slip the vise onto the guide plate. Then thread the screw into the nut.

Bolt the guide plates. After slipping the lower guide plate onto the bottom edge of the main plate, add the two bolts that thread into tapped holes in the upper guide plate.



double dovetails that join the front to the end and the jaw. Double dovetails simply are small dovetails cut between larger ones (see the top photos on p. 54). They require a lot of chopping by hand, even after hogging out much of the waste with Forstner bits. Plus, it takes special care to avoid breaking the pins at the narrow end.

Mark the tails on each end of the front, then use a backsaw to remove a good part of the waste. Finish the work with a chisel. Now mark the pin profile. I clamped the jaw on end in the Emmert vise and used a chisel to mark most of the pin profile, reaching places my marking knife couldn't. Remove the pin waste using the drill press. You can do this with Forstner bits and then finish with a chisel. Repeat the steps to cut the pins on the end piece.

The dog-hole block has three tenons on each end that fit into mortises cut into the end and the jaw. Cut the dog holes first, then use a router to expand the top end slightly, creating a small step.

The top piece has a spline groove on three edges. Cut matching grooves in the end, the jaw and the dog-hole block.

After dry-fitting all of the parts to make sure everything goes together okay, glue and clamp the end, the jaw, the top and the dog-hole block. Then glue the front in place.

Mount the vise—The entire vise hangs on the main plate that mounts at the notch in the right end of the top. But, before the vise can be mounted, you need to cut a groove in the edge of the top to provide clearance for the upper guide plate. A router and an edge guide, with the router operated horizontally, can be used to create most of the groove. A chisel is used to extend the groove to the corner of the notch.

Before the main plate can be mounted, a shallow hole must be drilled in the edge of the benchtop to provide clearance for the bolt head on the back of the plate. Finally, glue the cleat in place.

The top edge of the main plate must be parallel to the benchtop, and the front edge of the plate must be flush with the front of the end cap. It also must be located a distance from the benchtop that's equal to the thickness of the top plus the thickness of the top guide plate, minus the depth of the groove in the guide plate.

Once everything is lined up, drive a couple of screws to secure the main plate in place. The remaining screws will be installed after the vise has been test-fitted. Next, add the core. Temporarily place the top guide plate on the core and slide the two parts into the vise. While squeezing the plate between the core and the underside of the top, drive four screws through the back of the core and into the dog-hole block. Once the core has been installed, remove the plate. Now drill a hole in the jaw and slip the screw through the hole and into the core. A pair of screws driven through the flange secure the screw to the vise.

Next, with the top guide plate resting on the main plate, slip the vise over the guide plate. Position the vise so that the cylindrical nut ends up in the opening between the end of the screw and the back of the core.

To complete the vise assembly, insert the two bolts supplied with the hardware through holes drilled earlier in the core. Snug up each bolt with a few turns of an adjustable wrench. The wood handles are made from maple dowels, with ends made from hardwood balls that are available from a number of woodworking mail-order outfits. □

Jon Leppo is an amateur woodworker in Denver.