



Online Extra

Hack explains every feature of his bench in a free video at FineWoodworking.com/extras.

A Workbench 30 Years in the Making

Hand-tool expert designs his second bench,
based on everything he's learned

BY GARRETT HACK

When I built my first bench well over 30 years ago, I had limited furniture-making experience, so I adapted the design from some benches I had used in various classes. That first bench has been a solid friend in the shop for many years. But as my experience level increased, I kept a mental list of improvements I'd make if I were to build a new one. I recently said as much in a lecture at Colonial Williamsburg, and *Fine Woodworking* decided to pay me to stop procrastinating.

Over the years, I've developed a love of hand tools. I use them in every aspect of furniture making, and details made with these elegant tools are a signature of my work. So my first priority was to make the new bench better suited to my hand-tool habits.

What makes a bench work

In building this bench, I wanted a tool that would withstand the daily stresses heaped upon it, and the materials and design reflect that approach. A bench can be fashioned with humble materials (any dense and stable hardwood will do) and basic joinery and work very well.

Base is rock-solid

To withstand the rigors of handplaning, the base is made from thick hardwood stock and held together with sturdy joinery.

Peg the short rails. The trestles are assembled with beefy mortise-and-tenons. The rails are reinforced with hardwood pegs.



Wedge the shoes. The mortise-and-tenons in the top and bottom of the trestles are wedged.

Add beef—The benchtop is big enough to clamp a large case piece in almost any arrangement, with room for many tools, and it's thick and sturdy. The base of the bench can hold a heavy load (the top weighs more than 200 lb.), but more importantly, it's rigid enough to withstand the racking forces created by handplaning.

At 35 in. tall, my bench will work for a wide range of tasks, from handwork to machine work to assembly jobs. But I'm over 6 ft. tall. You may have to experiment to find a comfortable height.

Lots of ways to hold work—Because I do a lot of handwork, I need surefire ways to hold workpieces. In my experience, the best tools for the job are a front vise and a tail vise, used in tandem with benchdogs and a holdfast. Finally, I added a sliding stop at the left end. It can be set high or low and is useful for planing panels, thin drawer bottoms, tabletops, or multiple parts.

Build the top on a pair of strong horses

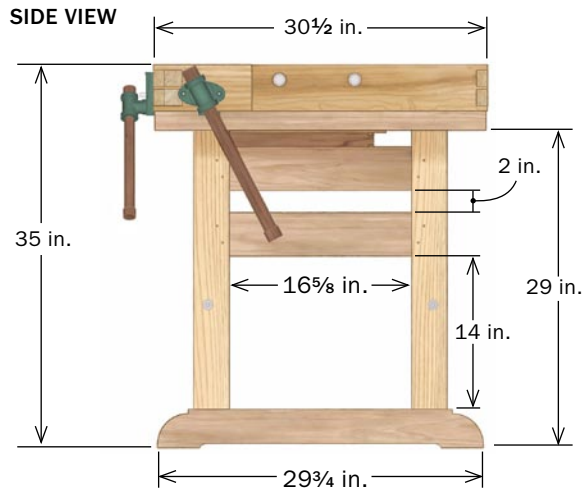
The top looks like a bunch of 12/4 planks glued together, but it's actually three layers of 1-in.-thick boards. This design is very stable so it will stay flat,



Big stretchers. Threaded rod gives a secure connection between the stretchers and trestles.

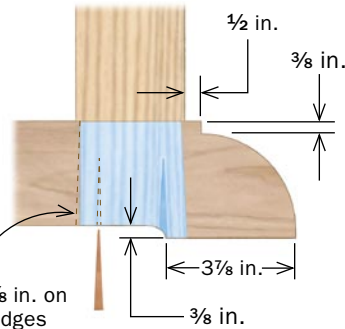
Anatomy of a great bench

To build this bench, you'll need lots of clamps and glue. The trickiest parts will be the top (p. 36), which is built up in layers to get the 3-in. thickness, and the tail-vise assembly (p. 38). On the other hand, the trestle base is assembled with straightforward mortise-and-tenon joinery.



Slide-up hardwood stop for handplaning, 2 1/2 in. wide by 21 5/8 in. long, tapers from 7/16 in. at top to 3/4 in. at bottom, so it tightens when raised.

SHOE DETAIL



Mortise flared 1/8 in. on each side for wedges

Screws, #10, 1 1/4 in. long

Groove for till bottom, 3/4 in. deep

Front vise

Breadboard end, 2 in. thick by 4 1/4 in. wide by 30 1/2 in. long

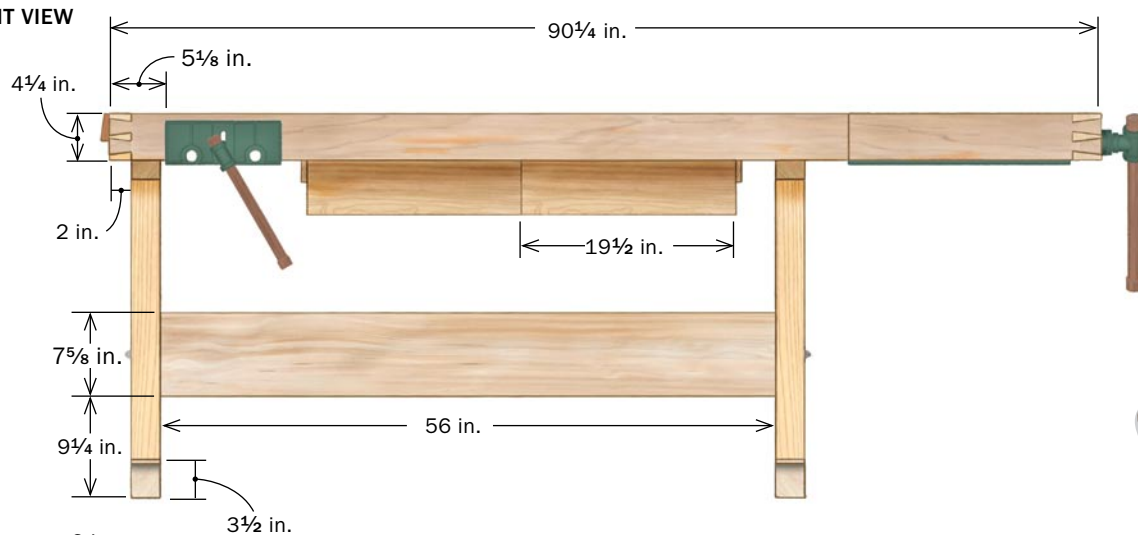
Benchdog apron, 2 5/8 in. thick

Trestle

Screws attach top.

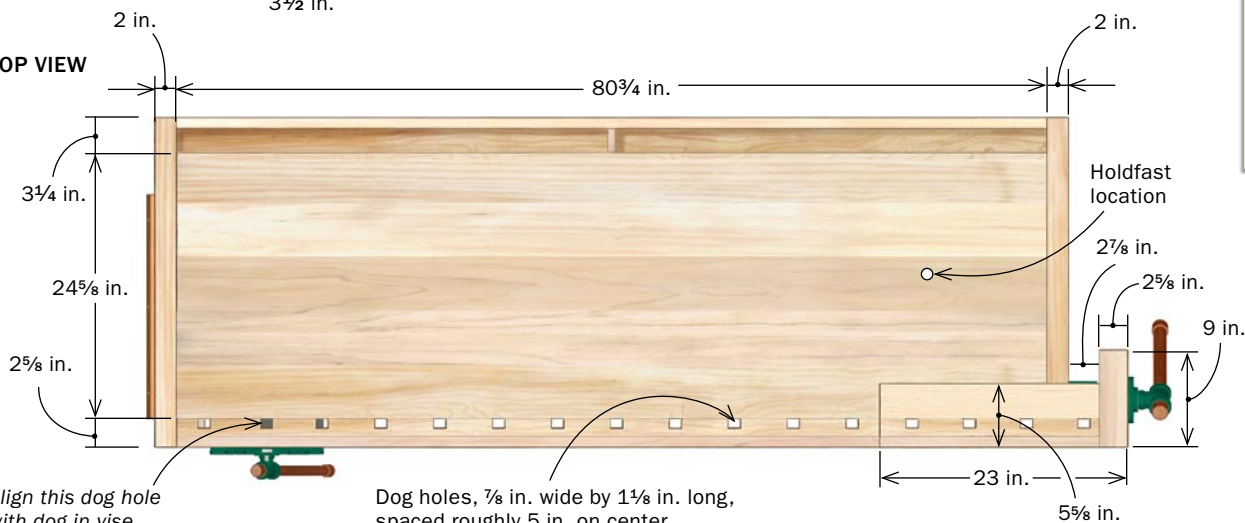
Stretchers, 1 in. thick by 7 5/8 in. wide by 59 in. long

FRONT VIEW



Drawers, 19 1/2 in. wide by 19 1/2 in. long, are set back 4 5/8 in. behind front of bench.

TOP VIEW



Align this dog hole with dog in vise.

Dog holes, 7/8 in. wide by 1 1/8 in. long, spaced roughly 5 in. on center

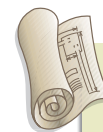
Holdfast location

2 7/8 in.

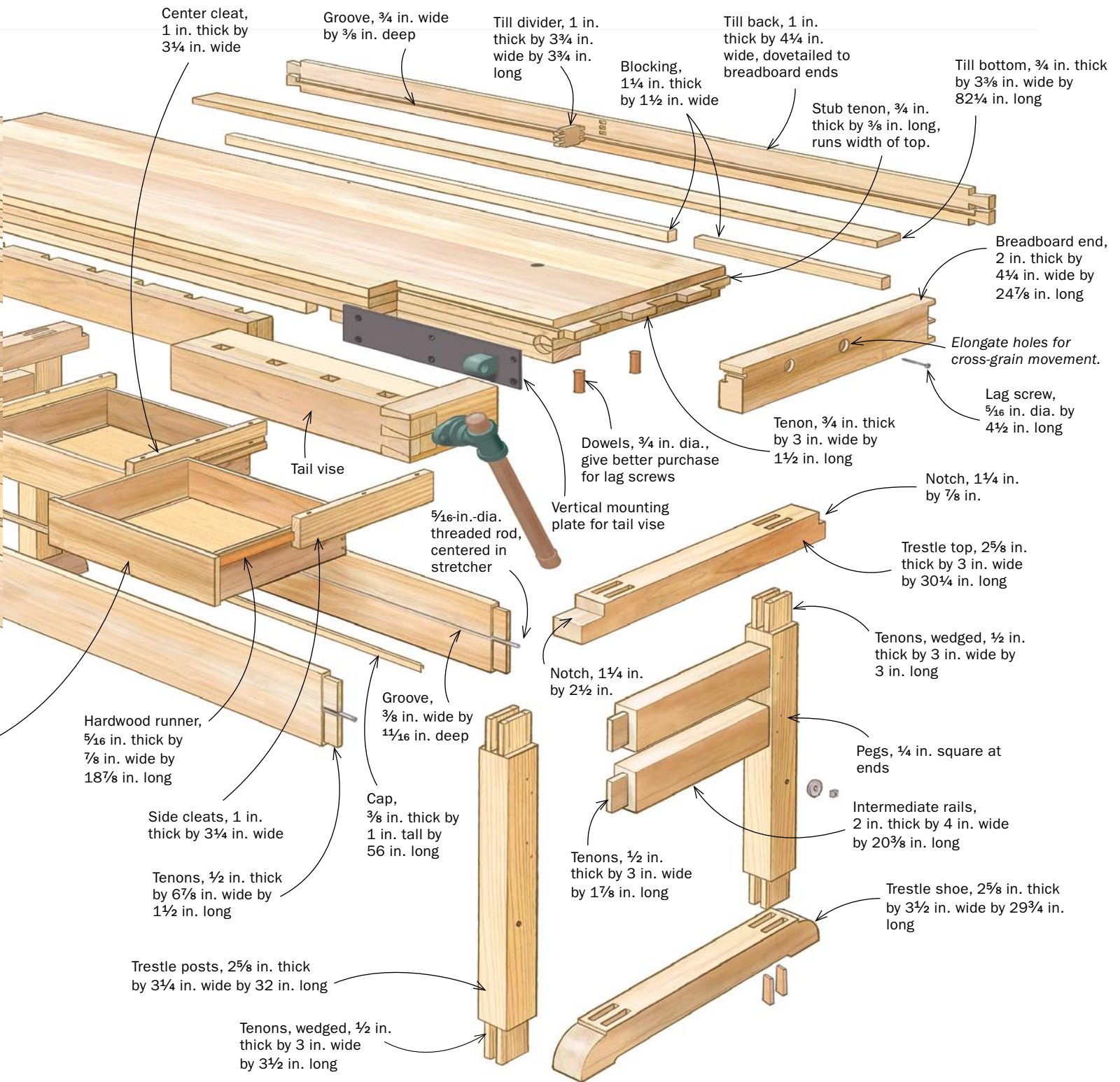
2 5/8 in.

9 in.

5 5/8 in.



To purchase full-size digital plans and a complete cutlist for this bench and other projects, go to FineWoodworking.com/PlanStore and click on "digital plans."



and it's an economical way to use materials. I used hard maple, yellow birch, and beech, dedicating the best of the maple to the top layer and the breadboard ends, and using narrower and somewhat lower-quality material for the middle and bottom layers.

Glue up the top one section at a time. To make the job less stressful, I recommend Unibond 800, a slow-setting urea-formaldehyde glue (www.vacupress.com) typically used in vacuum veneering. Once you have the top glued together, use a circular saw to trim the benchtop to length. Clean up the

edges with a scraper and a handplane, and flatten the top. When the top is flat, rout the rabbet for the till bottom on the back lower edge.

Make the benchdog apron—The benchdog apron is laminated from two pieces. After gluing the pieces together, lay out and cut the mortise for the front vise hardware in the apron; depending on the vise, you may need to cut a hollow under the top to accommodate the hardware. Once that's done, use a dado set to cut the dog holes. Attach the vise's rear jaw to the apron

Tackle top in sections

Assemble the benchtop in sections on a pair of sturdy sawhorses. Offset the pieces in each section to create a strong tongue-and-groove interlock and guarantee alignment.

TONGUE-AND-GROOVE TRICK

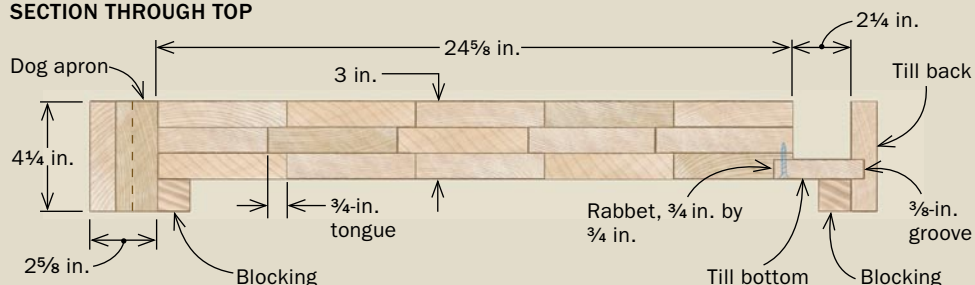


First section kicks it off. Glue the first three boards together, then let the assembly dry. Clean up squeeze-out so it won't interfere with the following section.



Three boards at a time. After the glue dries from each previous section, add the next three boards, applying glue to all mating surfaces. Clamp across the faces and edges. Repeat until the whole slab of the top is assembled. You'll need lots of clamps. Use cauls to keep the assembly flat.

SECTION THROUGH TOP



BREADBOARDS KEEP IT FLAT

How to handle big breadboards. After mortising the breadboard pieces, cut the tongue and tenons on the top. Use a router and fence to make the cheek cuts and a handsaw to remove the waste between the long tenons. Clean out the corners with chisels.



and then set the piece aside as you start working on the breadboard ends.

Breadboard ends are next—Cut the breadboard ends to width and thickness but leave them a bit long. Cut them to size after you lay out and cut the joinery to attach them to the benchtop. At the rear of each breadboard, rout the groove for the till bottom; it should align with the rabbet in the benchtop. Then drill holes for the lag screws that will help anchor the breadboards to the top. Finally, lay out and cut the dovetails.

Use a router and fence to cut the tenon cheeks on the ends of the top. Then lay out and cut the long tenons that will go deep into the breadboards. Clean up the inside corners with a chisel, and fine-tune the fit using handplanes.

Once the breadboards have been fitted, drill the pilot holes for the lag screws. To give the screws extra purchase (so they don't just go into weak end grain), I mortised hardwood dowels from under the benchtop, in line with the pilot holes.

Attach the breadboards, apron, and till—Start by gluing the apron to its breadboard end. Then apply glue to the apron and front edge of the benchtop. Screw on the breadboard end, and clamp the apron in place, working from the corner out. Don't worry about exactly where the apron ends; you'll be notching out that end of the benchtop for the tail vise. Finally, install the other breadboard end.





The apron frames the top

To allow for wood movement, the breadboard ends are tenoned to the top, with lag screws cinching the parts. Use slow-setting urea-formaldehyde glue everywhere else to buy time for fine-tuning.

Start at the front left corner. Connect the breadboard to the apron (left). Then apply glue to the breadboard tenons and to the interior face of the apron. Go lightly to avoid squeeze-out into the dog holes. Clamp the breadboard in place to help support the long dog apron (upper right), then drive in the lags. The right-hand corner of the top (reversed in lower-right photo) will be notched for the tail vise, so there's no need to make the dog apron the full length of the bench.



After the glue cures on the breadboard ends and the benchdog apron, install the till parts and 1x blocking underneath, which increases stiffness and gives better clamp purchase.

Assemble the base—Once the top has been glued together, build the trestles and make the stretchers of the base. Before gluing and wedging the top of the trestles, notch both ends to go around the benchdog apron in front and the till in back.

Add the tail vise

Building a smooth-working tail vise can take nearly as long as building the benchtop or base. The work is worthwhile because a tail vise is unmatched at holding work flat on the benchtop between dogs. Have the hardware in hand before you start and make a full-scale drawing of the whole assembly to make layout easier. Use a circular saw and hand tools to cut a notch in the benchtop for the vise, and tune the vertical surfaces square with the top. Rout the groove for the top plate (see top photo, p. 38) a bit oversize to provide a little clearance and leave room for adjustment, if needed. Now attach the vertical mounting plate to the bench (with only two screws so you can adjust it later if need be), aligned with the top-plate slot and perfectly parallel with the benchtop.

The core is key—The core of the vise accommodates the screw and nut, and is laminated from two pieces. Before gluing them together, hollow out the interior of one piece with a core-box bit

The till goes on last. Screw the till bottom into its rabbet under the top. Glue the divider in the till back, then glue the assembly to the breadboard ends and the top.



Tail vise is a worthwhile challenge

Hack begins by notching out the front right corner of the benchtop. The vise design uses readily available steel hardware for the mechanical parts (\$80; Woodcraft #144807), housed in a shopmade wooden sliding jaw.

CHECK THE ACTION OF THE HARDWARE

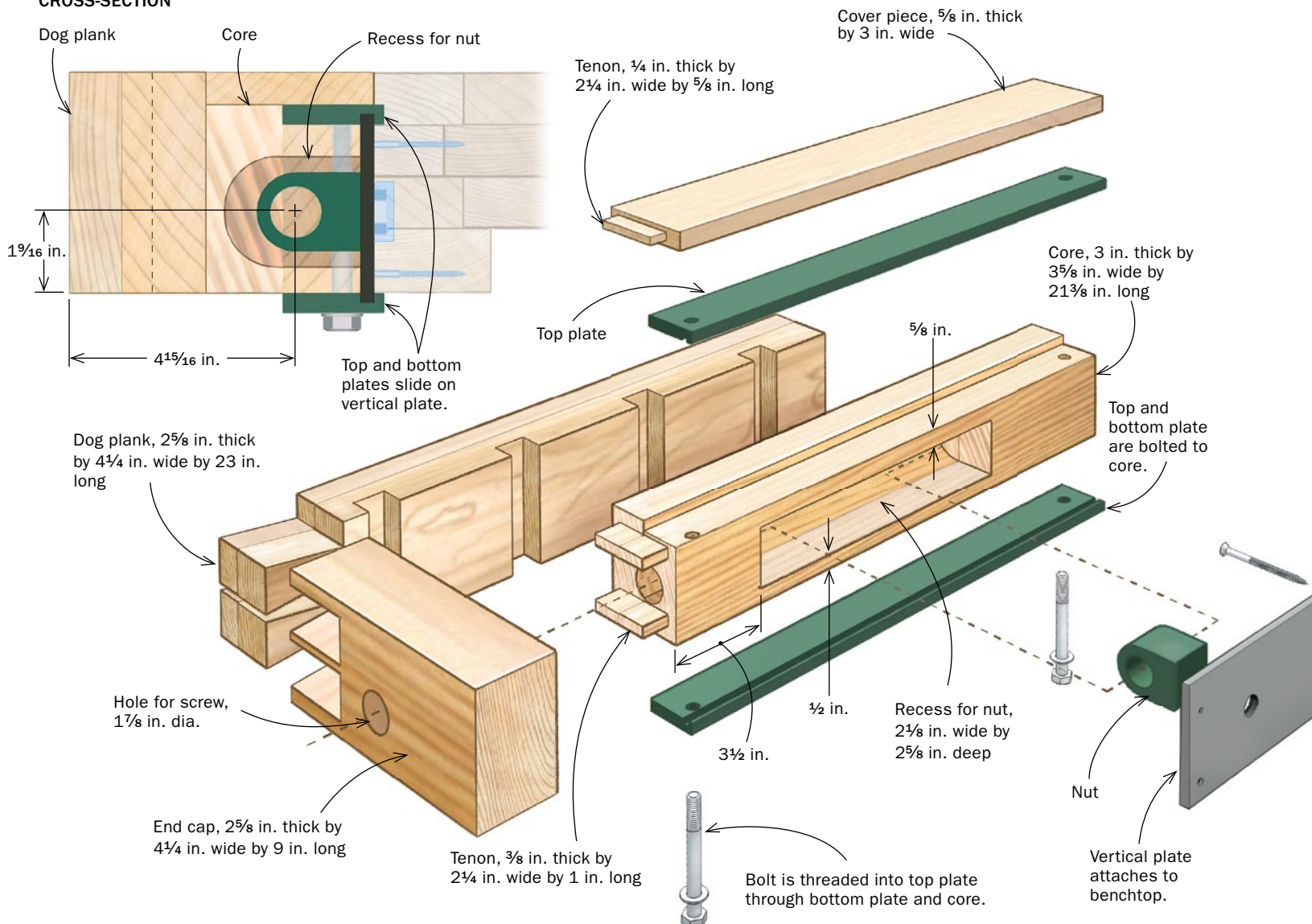
Make way for the top plate.

Use a three-wing slot cutter to rout a groove parallel to the benchtop to house the top plate. The vertical board tacked in the corner acts as a spacer to prevent the bit from cutting too far.



Attach the vertical plate. Clamp the bottom plate in place. Align the top of the vertical plate with the groove, drill pilot holes, and drive in the top screws. Now attach the top and bottom plates and try the sliding action.

CROSS-SECTION





ASSEMBLE THE WOOD PARTS



Glue up the parts. Dovetail the end cap to the dog plank first. Next, remove the top and bottom plates from the core and glue it to the end cap and to the dog plank. Try not to get a lot of squeeze-out inside the dog holes.

and router. The other piece has a rectangular section removed with a saw. Glue these two pieces together and let them dry.

Now make the dog-hole plank and dovetail it to the end cap. Cut two mortises in the end cap and mating tenons on the end of the core, for alignment and added strength. Also, cut the shallow mortise into the end cap and a tenon on the end of the top cover. Cut a shallow rabbet in the top edge for the top guide plate.

Attach the top and bottom guide plates to the core and slide it onto the plate on the bench. Test the action—there should be little wiggle when you lift the front edge, and the core should move parallel to the bench. If the guide plates grip the steel plate on the bench too tightly, the core movement will be stiff. Shim the bottom guide plate with a piece of veneer or a business card. If you have lots of wiggle, the plates need to be tighter together, so deepen the rabbet for the top guide into the core slightly and retest.

Add the dog plank and top—When the core moves smoothly, remove it from the bench. Now glue the dog-hole plank and end cap together and to the core. Mount the assembly to the bench-

top, adding the last screws to the mounting plate. Thread in the lead screw and fasten the flange to the end cap and test the vise action. Finally, install the top piece, which is tenoned into the end cap and glued to the top of the core.

Final details

Now finish the surface prep on the benchtop. Bring all surfaces flush and smooth using handplanes. I chamfered all edges with a block plane. Add the slide-up stop on the end of the bench, install the drawers, and make a couple of handles for your vises. Last, finish the top with two coats of boiled linseed oil. □

Longtime contributing editor Garret Hack loves his new bench.

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FINAL ASSEMBLY



Mount the wood jaw to the hardware. Be sure to clean up the wood parts to remove any glue squeeze-out that could interfere with the assembly (above). Thread the bolts through the core, and then screw each plate to the core. Glue the top cover to the core and to the end cap (below).

