Benchmark

Bring your shop to the next level with a professional-grade workbench that you can build yourself. Complete with a wide end vise, bench dogs and a versatile patternmaker's vise on the side, this bench sets the standard for everything you'll make with it.

Most of us don't think of a workbench as a tool. After all, it doesn't have a motor, you don't plug it in and it never gets dull. But the fact is, it's probably the most important piece of equipment in your shop. It's where you hold, measure, mark, shape and assemble the pieces that make up most of what you create. And like any tool, a good bench makes it easier to do good work.

Our ideal bench starts with an ample, flat work surface. A flat top is important because everything you build will be gauged against it and guided by it. In addition, the bench must be solid and stable enough to withstand sawing and pounding without racking or sliding across the floor. To achieve these ends, we built our bench out of 8/4 (2-in.) hard maple for stability, strength and weight, and included a massive trestle stand that's assembled with heavy-duty threaded bench fasteners.

Without the ability to hold stock while it's worked, though, even the best bench is nothing but a heavy table. To keep things in place we've incorporated a full-width end vise, complete with bench dogs for gripping long panels. And in place of the standard woodworker's vise, we've chosen a cast-iron patternmaker's vise that adjusts to almost any angle for maximum versatility. The twin-screw end-vise hardware (No. 05G12.22, about $165) is available from Lee Valley, 800-871-8158; www.leevalley.com. The patternmaker's vise (No. 10G05.05, about $227) comes from Garrett Wade, 800-221-2942; www.garrettwade.com.

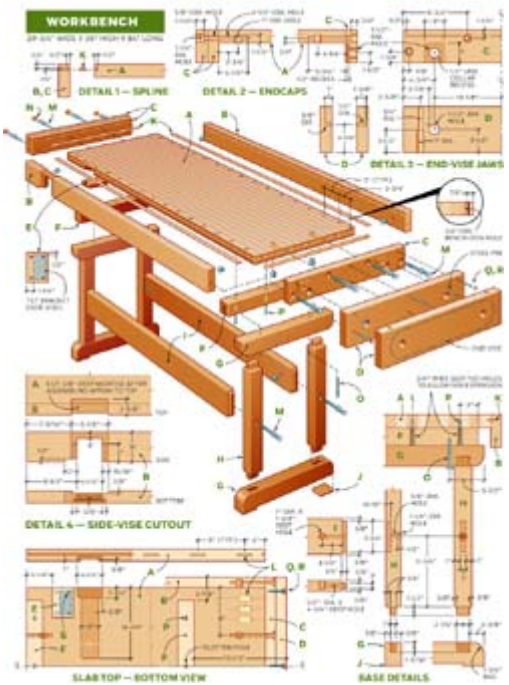

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ILLUSTRATION BY EUGENE THOMPSON

Materials List

Key	Qty.	Size	Description
A*	1	2 x 26-1/4 x 77"	maple (top)
B	2	1-3/4 x 5 x 77"	maple (apron)
C	3	1-3/4 x 5 x 29-3/4"	maple (endcap)
D	2	1-3/4 x 7 x 29-3/4"	maple (vise jaw)
E	1	1 x 3-3/8 x 5"	maple (block)
F	2	2-3/4 x 3 x 22"	maple (spacer)
G	4	2-3/4 x 3-1/2 x 24"	maple (rail)
H	4	2-1/2 x 3 x 26-1/2"	maple (leg)
I	2	1-3/4 x 6 x 61-1/4"	maple (stretcher)
J	4	1/2 x 2-3/4 x 3-1/2"	maple (foot)
K**	4	1/4 x 15/16"	maple (spline)
L	as reqd.	No. 20 plate	
M***	12		bench bolts
N	4	1-1/4" dia.	maple (plug)
O	4	3/8" dia. x 4-1/2"	lagscrew/washer
P	6	4" No. 10	fh screw
Q	6	2-1/2" No. 10	fh screw
R	6	1/2" dia.	maple (plug)
S	4	1-1/2" No. 8	fh screw

Misc.: Sandpaper; glue; Watco Danish Oil Finish, color: Natural.
* Assemble from 15 1-3/4-in.-wide strips.
** Cut lengths as required.
Side vise (patternmaker's vise, No. 10G05.05) available from Garrett Wade, 800-221-2942; www.garrettwade.com.
End vise (twin-screw vise, No. 05G12.22) and bench

bolts*** (No. 05G07.01) available from Lee Valley Tools, 800-871-8158; www.leevalley.com.

BUILDING THE TOP

Our plan calls for a 2-in.-thick top made up of 15 1-3/4 x 2-in.-wide maple strips, but we assembled it in three narrower sections. Working in stages makes it easier to true the surfaces, and the narrow blanks can be handled by a 12-in. thickness planer.

With the maple stock for the top milled to 1-3/4 in. thick, joint one edge of each piece so it's square to the faces. Then, rip 15 pieces to 2-1/8 in. wide and crosscut them slightly longer than needed.

Although it's not necessary to provide a mechanical joint between the top strips, we used joining plates to ensure accurate alignment during assembly.

Clamp together a group of slats and lay out the positions of the plate slots **(1)**. It's good practice to check each strip and arrange the pieces so the grain all runs in the same direction. This will make planing the top a much simpler task. Check the grain direction by making a small test cut with a plane and mark the grain direction of each piece with an arrow.

Cut centered slots at the plate locations **(2)**. Use a roller to spread glue on the mating surfaces of five strips and place joining plates in the slots. Since the plates are just for alignment, it isn't necessary to spread glue in the slots. Clamp the slats to pull the joints tight **(3)** and wait about 20 minutes before scraping off any excess glue. Repeat the process for the remaining two sections of the top.

Next, check each top section to see if it's flat. Place a straight stick, called a winding stick, at each end of a slab, and sight down the workpiece and across the two sticks. If they're not parallel, use a hand plane to true the surface. With one face of each slab flat, plane the opposite surface parallel with a 12-in. planer **(4)**. Bring the slabs to the finished thickness of 2 in. If you don't have a planer, take the slabs to a millwork shop for surfacing, or plane them by hand.

Crosscut each top section to finished length and then mark the locations of bench-dog holes along the outer edges of two sections. Use a 3/4-in. Forstner or multispur bit in your drill press to bore

1 Clamp a group of benchtop strips together and lay out the locations for the joining-plate slots. Arrange the strips so that the grain runs in the same direction to facilitate planing the top after the pieces have been glued together.

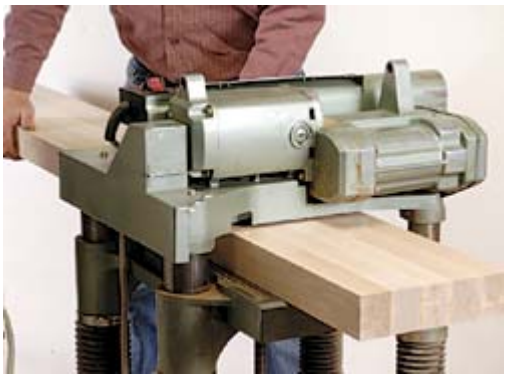
2 Use a plate joiner to cut slots at plate locations. Plates ensure good alignment between strips.

3 Glue up three sections of five strips. Then, check to see if the sections are flat and straight.

the holes **(5)**.

Cut joining-plate slots in the mating edges of the slab sections. Apply glue, install the joining plates and clamp the slabs together. Take extra care to ensure that the ends and top surfaces are perfectly aligned. After about 20 minutes, scrape off any excess glue, but leave the assembly in the clamps for at least 2 hours.

Check the top for flatness. If the joints are not perfectly aligned, use a cabinet scraper or sharp plane to trim them flush.



4 After truing one face of each piece with a hand plane, use a thickness planer to mill the opposite sides.

5 Lay out the bench-dog hole locations, and use a drill press and Forstner bit to bore the holes.

6 Use a slot cutter in your router to shape a spline groove around all edges of the benchtop slab.

7 Bore holes in the ends of the top and

APRONS AND ENDCAPS

Cut stock for the side aprons and endcaps. Glue together two pieces of 1-3/4-in.-thick stock for the doubled cap opposite the end vise. Use a slot cutter to rout a spline groove around the edges of the top slab **(6)** and on the inside edges of the aprons. Rip and crosscut splines from maple stock and set them aside.

Mark the positions of the 1/2-in.-dia. holes in the top and apron ends for joining the endcaps, and use a doweling jig to guide the drill **(7)**. Then, bore 1-in.-dia. stopped holes perpendicular to the 1/2-in. holes to house the cylindrical bench-bolt nuts **(8)**. Follow by boring and counterboring the bolt holes in the endcaps. Note that the endcap holes are 5/8 in. in diameter to allow for some movement with seasonal changes in humidity.

Lay out the cuts required for the side vise on one of the aprons. Use a sabre saw to cut the 3-in.-wide notch that provides clearance for the vise beam **(9)**. Then, transfer the position of the notch to the bottom of the benchtop, and use a router with a straight bit to cut a channel in the slab for beam clearance.

aprons for securing the caps. Use a doweling jig to guide the bit.

8 After routing a spline groove in each apron, bore stopped holes for the cylindrical bench-bolt nuts.

9 Lay out the cuts and mortises necessary for mounting the side vise. Use a sabre saw to cut the stock.

10 Before mounting the end-vise cap on the benchtop, install the threaded end-vise collars.

Next, cut the 4-1/4-in.-wide notch in the apron, transfer that notch location to the slab, and rout the required recess for the vise body. Rout a 3/8-in.- deep mortise on the face of the apron for the vise mounting plate, cut the notches on the inside of the apron to provide clearance for the vise mounting bolts, and add a small notch to provide clearance for the tilt bracket bar.

Apply glue and join the aprons to the top with the maple splines. Take care to ensure that the ends are perfectly flush, and clamp the assembly until the glue sets. Use the router and a sharp chisel to cut the mortise in the benchtop--this mortise will house the side vise. Check the fit of the vise in the mortise. The surface of the mounting plate should sit about 1/32 to 1/16 in. below the top. Adjust the depth of the mortise, if necessary, then set the vise aside.

To prepare the single endcap for the end vise, use a drill press to bore the 1-1/2-in.-dia. vise-screw clearance holes. Place the screw collars into the holes from the back side and trace around the collars **(10)**. Then, cut the collar mortises with a router and chisel, and secure the collars.

Reinstall the slot cutter in your router and cut the spline grooves in the endcaps. Note that the grooves stop short of the cap ends so that the splines are hidden.

Join the endcaps to the slab/apron assembly with splines and bench bolts **(11)**. Do not use any glue on these joints, as the parts need to be able to move in response to changes in humidity. Use a plug cutter in the drill press to make 1-1/4-in.-dia. maple plugs, and glue these into the doubled-cap

bolt counterbores to hide the bolt heads. Allow the plugs to protrude slightly until the glue sets, and then use a sharp chisel to pare them flush.

Cut stock to size for the two end-vise jaws. Clamp the jaws together to bore clearance holes for the vise screws, and be sure to maintain the same orientation of the jaws when installing them on the bench. Separate the jaws, then bore the 3/8-in.-dia. holes in the inner jaw for steel dowel pins and matching 1/2-in.-dia. holes in the outer jaw. Bore 3/4-in.-dia. holes in the top edge of the outer jaw for bench dogs, and 1-in.-dia. clearance holes from the bottom edge so that you can access the bench dogs if they are pushed in flush to the jaw surface. Bore screw pilot holes in the inner vise jaw for screwing it to the endcap and counterbore the holes for adding plugs over the screwheads.

Install the steel dowel pins in the inner vise jaw. If the pins are loose, use a dab of epoxy in each hole to lock them in place. Clamp the inner jaw to the endcap and fasten it with 2-1/2-in. No. 10 flathead screws. Glue plugs over the screwheads and trim them flush. Temporarily clamp the outer vise jaw to the inner jaw/endcap, keeping the ends and top surfaces aligned.

Follow the manufacturer's instructions for shortening the end-vise chain to suit the 20-1/4-in. screw centers that we used. Then, place the chain over the sprockets, insert the screws through the outer vise jaw and thread them into the screw brackets. Bore pilot holes and fasten the outer collars to the jaw with lagscrews **(12)**, and install the chain cover.

Install the side vise, turn the benchtop upside down and add the mounting block as shown in the drawing. Then, fasten the vise tilt bracket assembly to the block **(13)**.

11 Join the end-vise cap to the top with bench bolts. Don't use glue. The top must be free to move.

12 After adjusting the chain length, thread end-vise screws in place and attach outer vise collars.

13 Secure a mounting block under the benchtop to support the tilt bracket for the side vise.

MAKING THE STAND

Glue up thinner maple stock for the heavy stand components. Cut the two spacers to size and bore pilot holes for mounting them to the benchtop. Note that the pilot holes need to be elongated to allow for wood movement. Screw the blocks to the top.

Cut rail, leg and stretcher stock to size, and lay

14 Finish the mortises for the stand with a sharp chisel after boring out most of the waste.

15 Use a dado blade in your table saw to cut the tenons on the leg and stretcher ends.

16 Join the bench legs to the top and bottom rails, and clamp the parts to pull the joints tight. Compare opposite diagonal measurements to ensure that the assembly is square.

out the mortises on the rails and legs. Bore overlapping holes to remove waste from each mortise and finish with a chisel **(14)**.

Use a doweling jig to bore bench-bolt holes in the ends of the stretchers and then bore holes for the nuts in the sides of the stretchers. Bore and counterbore the bolt holes in the legs. Use a dado blade to cut the tenons on the legs **(15)**. Glue 1/2-in.-thick maple feet to the bottom rails, cut the curved profiles on all the rail ends, and bore pilot holes in the top rails for fastening the stand to the spacers.

Apply glue to the mortise-and-tenon joints for one set of leg/rail joints and assemble the parts. Clamp the joints and measure opposite diagonals to check that the assembly is square **(16)**. Repeat for the second base assembly. After the glue has cured, join the stretchers to the leg assemblies with bench bolts. Place the benchtop on the stand, bore pilot holes and secure the top with lagscrews.

FINISHING

Sand all surfaces to 120 grit, taking care to ease all sharp edges. Then remove the sanding dust. We finished our bench with three coats of Watco Danish Oil Finish (color: Natural). Use a brush or rag to liberally soak all surfaces of the bench, and allow the finish to soak in for about 30 minutes. Wipe off all excess oil and then let the finish dry overnight before repeating the process. If it ever becomes necessary to refinish the bench, lightly sand the surface and apply more oil.