

\$175

For about the cost of a quality jigsaw you can build a bench that will retire from woodworking long after you do. And by the way, the price includes everything — wood, hardware and even the vise.

by Christopher Schwarz

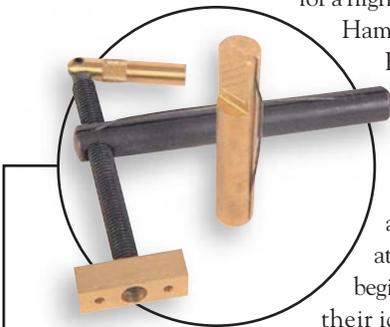
I've hauled my grandfather's workbench across snow-covered Appalachian mountains, down narrow stairwells and into a dirt-floored garage that should have been torn down during the Eisenhower administration. I've built a lot of good stuff on that bench, but now it's time to retire the old horse.

For starters, the bench is too low for the way I work. And the top is pockmarked with three different shapes and sizes of dog holes. And during the last few years I've become fed up with the tool tray. The only thing it seems designed to hold is enough sawdust for a family of gerbils. So I need a new bench, but there's no way I'm going to spend \$1,200 to \$1,400 for a high-quality bench from Hoffman & Hammer or Ulmia.

Enter Bob Key from Georgia. He and his son have been building benches using off-the-rack pine for a few years and have even built a website showing how quick and easy this is to do (visit them at www.mindspring.com/~bobkey/beginners.htm). I was impressed with their idea. So I spent a week reading every book on benches I could find. I pored over the woodworking catalogs. And after a lot of figuring I came up with a simple plan: Build a bench for

less than \$175.

Believe it or not, I came in 92 cents under budget and ended up with a bench that is tough, sturdy and darn versatile. I made a few compromises when choosing the hardware to keep the cost down, but I designed the bench so that it can later be upgraded with a nice tail vise. However, I made no com-



8	2 x 8 x 12' Southern yellow pine boards @ \$9.57 each	76.56
8	3/8" x 16 x 6" hex bolts @ 51 cents each	4.08
8	3/8" x 16 hex nuts @ 7 cents each	.56
16	5/16" washers @ 3 cents each	.48
1	Veritas Bench Dog (see Supplies for ordering information)	8.95
1	Veritas Wonder Dog (see Supplies for ordering information)	19.95
1	Veritas Front Vise (see Supplies for ordering information)	63.50

Total Cost \$174.08
plus tax and shipping.

workbench





When you glue up your top, you want to make sure all the boards line up. Lay down your glue and then clamp up one end with the boards perfectly flush. Then get a friend to clamp a handscrew on the seam and twist until the boards are flush. Continue clamping up towards your friend, having your friend adjust the handscrews as needed after each clamp is cinched down.

is useful for joinery and opening cans of peanut butter.

Preparing Your Lumber

Cut your lumber to length. You've probably noticed that your wood has rounded corners and the faces are probably less than glass-smooth. Your first task is to use your jointer and planer to remove those rounded edges and get all your lumber down to $1\frac{3}{8}$ " thick.

Once your lumber is thicknessed, start working on the top. If this is your first bench, you can make the top, then throw it up on sawhorses to build the base. The top is made from $1\frac{3}{8}$ " x $3\frac{3}{8}$ " x 70" boards turned on edge and glued face-to-face. It will take five of your 2 x 8s to make the top. Build the top in stages to make the task more manageable. Glue up a few boards, then run the assembly through the jointer and planer to get them flat. Make a few

more assemblies like this, then glue all the assemblies together into one big top.

When you finally glue up the whole top, you want to make sure you keep all the boards

in line. This will save you hours of flattening the top later with a hand plane. See the photo above for a life-saving tip when you get to this point. After the glue is dry, square the ends of your assembled top. If you don't have a huge sliding table on your table saw, try cutting the ends square using a circular saw (the top is so thick you'll have to make a cut from both sides). Or you can use a hand saw and a piece of scrap wood clamped across the end as a guide.

Build the Base

The base is constructed using mortise-and-tenon joinery. Essentially, the base has two

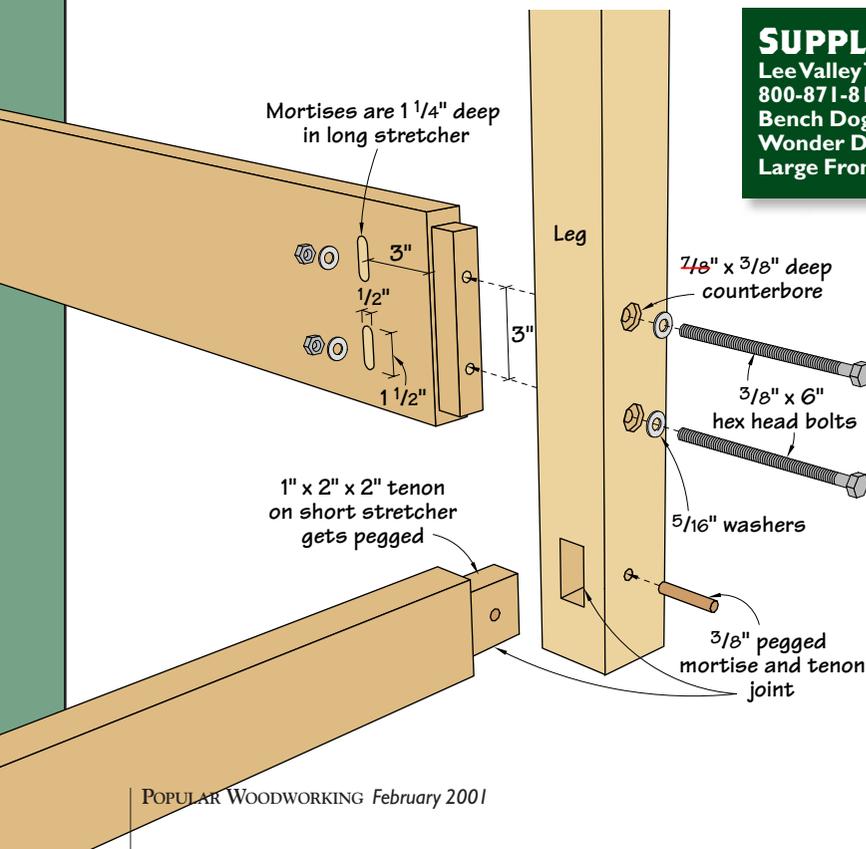
promises in the construction of the top or base. You can dance on this bench.

Let's Go Shopping

OK friends, it's time to make your shopping list. First a word about the wood. I priced my lumber from a local Lowe's. It was tagged as Southern yellow pine, appearance-grade. Unlike a lot of dimensional stock, this stuff is pretty dry and knot-free. Even so, take your time and pick through the store's pile of 12-foot-long 2 x 8s with care to get the best ones possible. You can hide a few tight knots in the

top, but with luck you won't have to.

Here's the story on the hardware. The bolts, nuts and washers are used to connect the front rails to the two ends of the bench. Using this hardware, we'll borrow a technique used by bed makers to build a joint that is stronger than any mortise and tenon. The Bench Dog and Wonder Dog will keep you from having to buy an expensive tail vise. Using these two simple pieces of hardware, you can clamp almost anything to your bench for planing, sanding and chopping. The traditional face vise goes on the front of your bench and



SUPPLIES

Lee Valley Tools
800-871-8158
Bench Dog #05G04.01, \$8.95
Wonder Dog #05G10.01, \$19.95
Large Front Vise #70G08.02, \$63.50

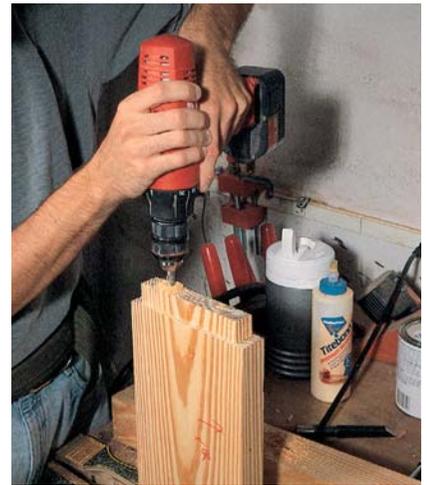
end assemblies that are joined by two rails. The end assemblies are built using big 1" - thick, 2"-long tenons. The front rails are attached to the ends using 1" x 1" mortise-and-tenon joints and the 6"-long bolts.

Begin working on the base by cutting all your pieces to size. The $2\frac{3}{4}$ "-square legs are made from two pieces of pine laminated together. Glue and clamp the legs and set them aside. Now turn your attention to cutting the tenons on the rails. It's a good idea to first make a "test" mortise in a piece of scrap so you can fit your tenons as they are made. I like to make my tenons on the table saw using a dado stack. Place your rails face down on your table saw and use a miter gauge to nibble away at the rails until the tenons are the right size. Because pine is soft, be sure to make the shoulders on the edges 1" wide on the upper side rails. This precaution will prevent your tenons from blowing out the top of your legs.

Now use your tenons to lay out the locations of your mortises. See the photo at right for how this works. Clamp a piece of scrap to your drill press to act as a fence and chain-drill the mortises in the legs. Make your mortises about $\frac{1}{16}$ " deeper than your tenons are



Drilling the $\frac{3}{8}$ " holes for the bolts is easier if you do it in this order. First drill the holes in the legs using your drill press. Now assemble the leg and front rail. Drill into the rail using the hole in the leg as a guide (left). Remove the leg from the rail and continue drilling the hole in the rail. The hole you drilled before will once more act as a guide. You still need to be careful and guide your drill straight and true (right).



long. This will give you a little space for any excess glue.

Once you've got your mortises drilled, use a mortise chisel to square the round corners. Make sure your tenons fit, then dry-fit your base. Label each joint so you can reassemble the bench later.

Bed Bolts

There's a bit of a trick to joining the front rails to the legs. Workbenches, you see, are subject to a lot of racking back and forth. A plain old mortise-and-tenon joint just won't hack it. So we bolt it. First study the diagram at left to see how these joints work. Now here's the best way to make them.

First chuck a 1" Forstner bit in your drill press to cut the countersink in the legs for the bolt head. Drill the countersinks, then chuck a $\frac{3}{8}$ "-brad-point bit in your drill press and drill in the center of the counterbore through the leg and into the mortise.

Now fit the front rails into the leg mortises. Chuck that $\frac{3}{8}$ " bit into your hand drill and drill as deeply as you can through the leg and into the rail. The hole in the leg will guide the bit as it cuts into the rail. Then remove the leg and drill the $\frac{3}{8}$ " hole even deeper. You probably will have to use an extra-long drill bit for this.

OK, here's the critical part. Now you need to cut two small mortises on each rail. These mortises will hold a nut and a washer and must intersect the $\frac{3}{8}$ " holes you just drilled. With the leg and rail assembled, carefully figure out where the mortises need to go. Drill the mortises in the rails as shown in the photo. Now test your assembly. Thread the joint with the bolt, two washers and a nut. Use a ratchet and wrench



After you cut your tenons, lay them directly on your work and use the edges like a ruler to mark where the mortise should start and end (top). Use a 1" Forstner bit in your drill press to cut overlapping holes to make your mortise (middle). Now square up the edges of the mortise using a mortise chisel and a small mallet (right).





The mortises in the front rails are also made on the drill press. Make them $1\frac{1}{4}$ " deep to make sure you can get a washer in there. If you can't, try clipping an edge off of the washer.

to pull everything tight. If your bench ever wobbles in your lifetime, it's probably going to be a simple matter of tightening these bolts to fix the problem. Remember to tell this to your children.

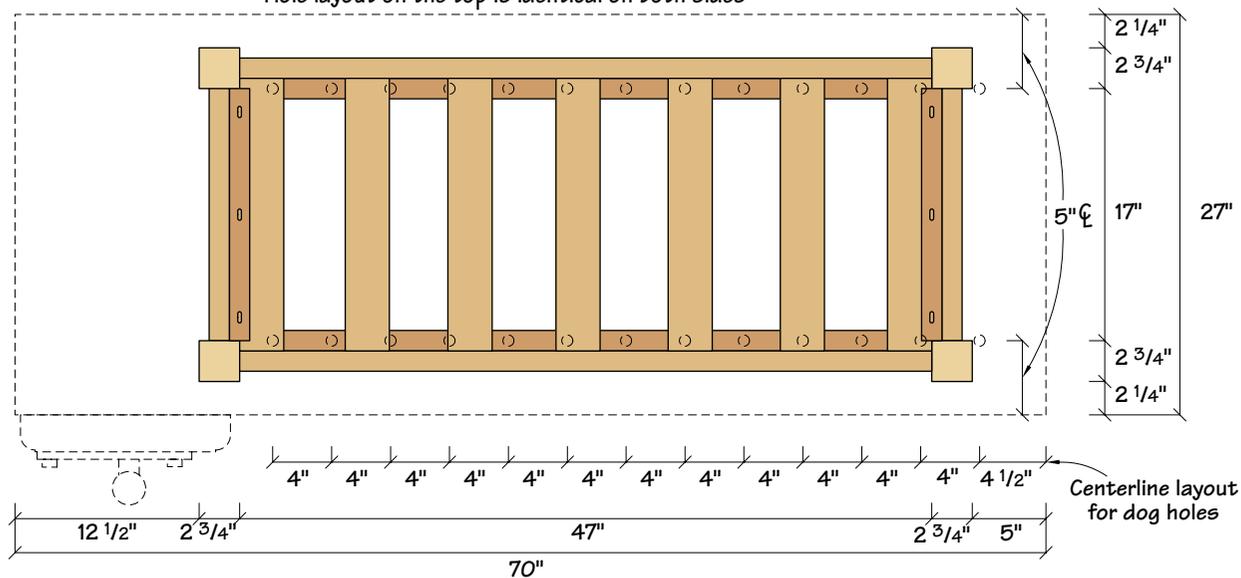
Base Assembly

This bench has a good-sized shelf between the front rails. Cut the ledgers and slats from your scrap. Also cut the two cleats

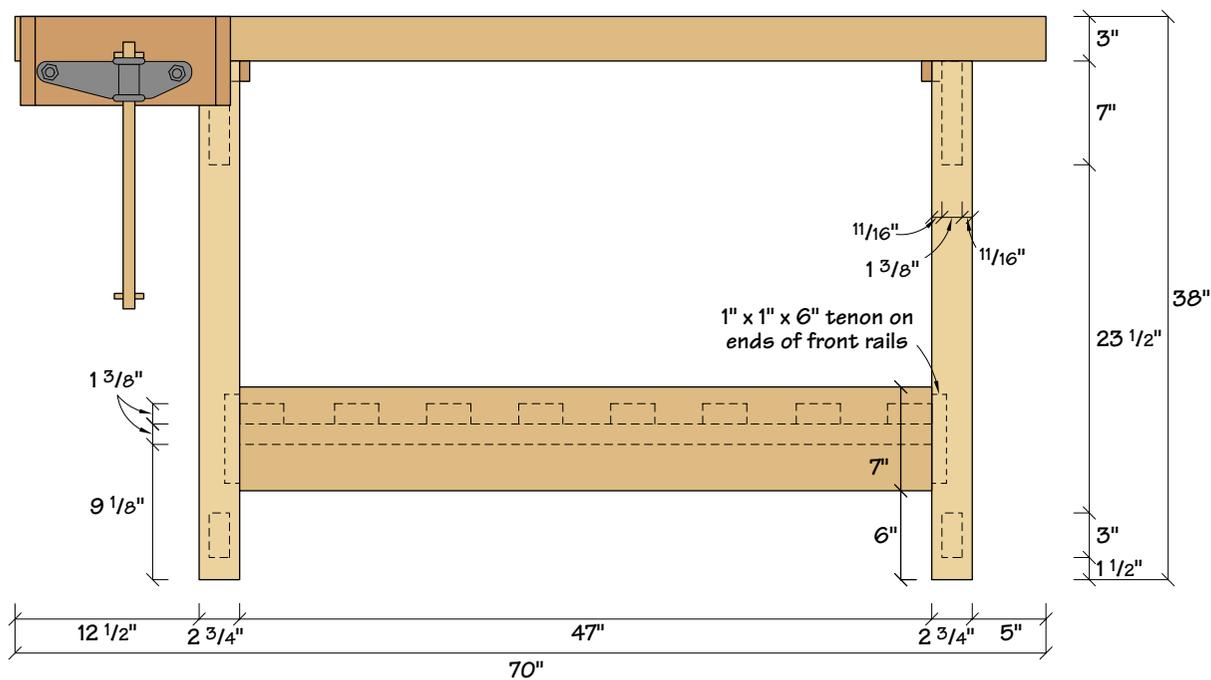
that attach the top to the base. Now sand everything before assembly — up to 150 grit should be fine.

Begin assembly by gluing up the two end assemblies. Put glue in the mortises and clamp up the ends until dry. Then, for extra strength, peg the tenons using $\frac{3}{8}$ "-thick dowel. I had some lying around. If you don't, buy the dowel at the hardware store and add \$1 to your bottom line.

Hole layout on the top is identical on both sides



Plan



Elevation

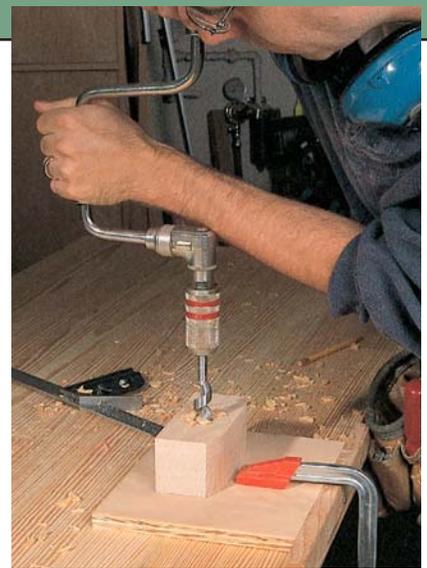
THE PLEASURE AND PAIN OF PINE

Southern yellow pine is cheap, but you probably know that it likes to twist, cup, wind and bow — everything but corkscrew. There's a way to prevent this, and it's a simple trick that will help reduce warping in all your projects.

First, after you cut your pieces to size, store them on edge with about an inch of space between them. One of the major reasons pine bows is that it's not completely dry (surprise). When you stack it flat, one side is exposed to the atmosphere and the other is not. As a result, one side dries faster than the other and the board bends. Leave a pine board alone for a night like this and the next morning you'll probably have a bowl.

Here's another tip. When you get set to assemble your top, do it all in one day. Surface all your boards and glue them up as fast as you can. If a pine board is in a lamination, it's much less likely to bow because it has other boards that may cancel out its tendency to warp.

Drilling your dog holes may seem like hard work using a brace and bit. It is. However, you get an amazing amount of torque this way — far more than you can get with a cordless drill. Sadly, I had cooked my corded drill, so this was my only option.



Screw the ledgers to the front rails. Make sure they don't cover the mortises for the bed bolts, or you are going to be in trouble. Now bolt the front rails to the two ends (no glue necessary). Rub a little Vaseline or grease on the threads first because after your bench is together you want to seal up those mortises with hot-melt glue. The Vaseline will ensure your bolts will turn for years to come.

Screw the cleats to the top of the upper side rails. Then drill oval-shaped holes in the cleats that will allow you to screw the top to the base. Now screw the seven slats to the ledgers.

Finishing the Top

Before you attach your top, it's best to drill your dog holes and attach the vise. Lay out the location of the two rows of dog holes using the diagram. I made a simple jig to guide a $\frac{3}{4}$ " auger bit in a brace and bit. The jig is shown in action in the photo above.

Now position your vise on the underside of the top and attach it with the bolts provided by the manufacturer. This Czech-made vise is of surprising quality, with a heavy-duty Acme-thread screw. The only downside to the vise is you are going to

have to make your own wooden face. I must confess I didn't have enough wood left over from my 2 x 8s to make the face. So I made it from a small piece of scrap from another project. You'll need to drill three holes in the wooden face so it fits over the bars, but this is pretty self-evident when you pull the vise out of the box. All the European benches I've seen have a bead cut on the edges. I'm not one to argue with tradition, so I used a beading bit in a router table to cut beads on mine, too.

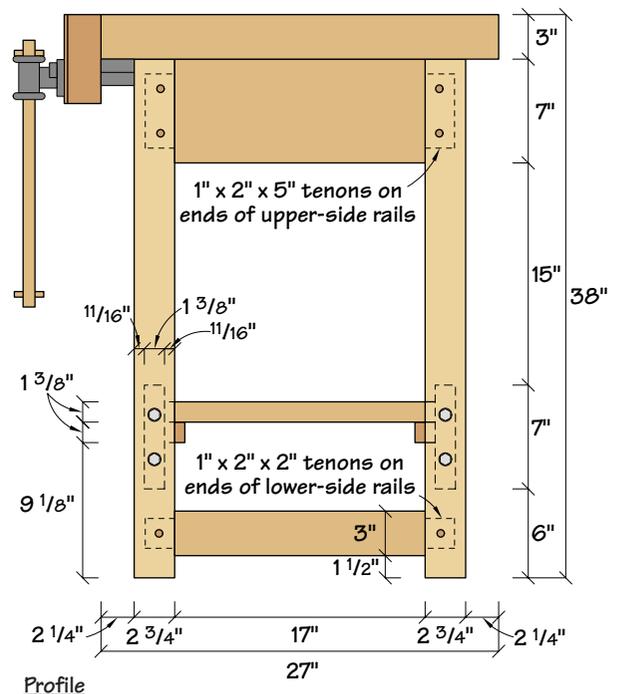
Make the vise's handle from a length of 1" -diameter oak dowel. My handle is 20" long, which is just the right length to miss whacking me in the head at every turn. I'm a tall guy, so you might want to make yours a bit shorter.

You are now almost done. It's necessary to flatten the top. Use "winding sticks" to determine if your top is flat.

Winding sticks are simply identical, straight lengths of hardwood. Put

one on one end of the top and the other on the far end. Now crouch down so your eye is even with the sticks. If your top is flat, the sticks will line up perfectly. If not, you'll quickly see where you need work. Use a jack plane to flatten the high spots. Then sand your top and rag on a couple coats of an oil/varnish blend on the base and top.

With the bench complete, I was pleased with the price and the time it took, which was about 30 hours. However, I'm now itching to build a cabinet beneath the bench and to add a leg jack for planing the edges of long boards. Maybe I'll get to that next issue, or maybe I'll let a future granddaughter take care of those details. **PW**



\$175 WORKBENCH

No.	Item	Dimensions T W L	Comments
1	Top	3" x 27" x 70"	
4	Legs	$2\frac{3}{4}$ " x $2\frac{3}{4}$ " x 35"	
2	Front rails	$1\frac{3}{8}$ " x 7" x 49"	1" TBE
2	Upper side rails	$1\frac{3}{8}$ " x 7" x 21"	2" TBE
2	Lower side rails	$1\frac{3}{8}$ " x 3" x 21"	2" TBE
2	Ledgers	$1\frac{3}{8}$ " x $1\frac{3}{8}$ " x 47"	
7	Slats	$1\frac{3}{8}$ " x 3" x $18\frac{1}{2}"$	
2	Cleats	$1\frac{3}{8}$ " x $1\frac{3}{8}$ " x 17"	

TBE= Tenon, both ends