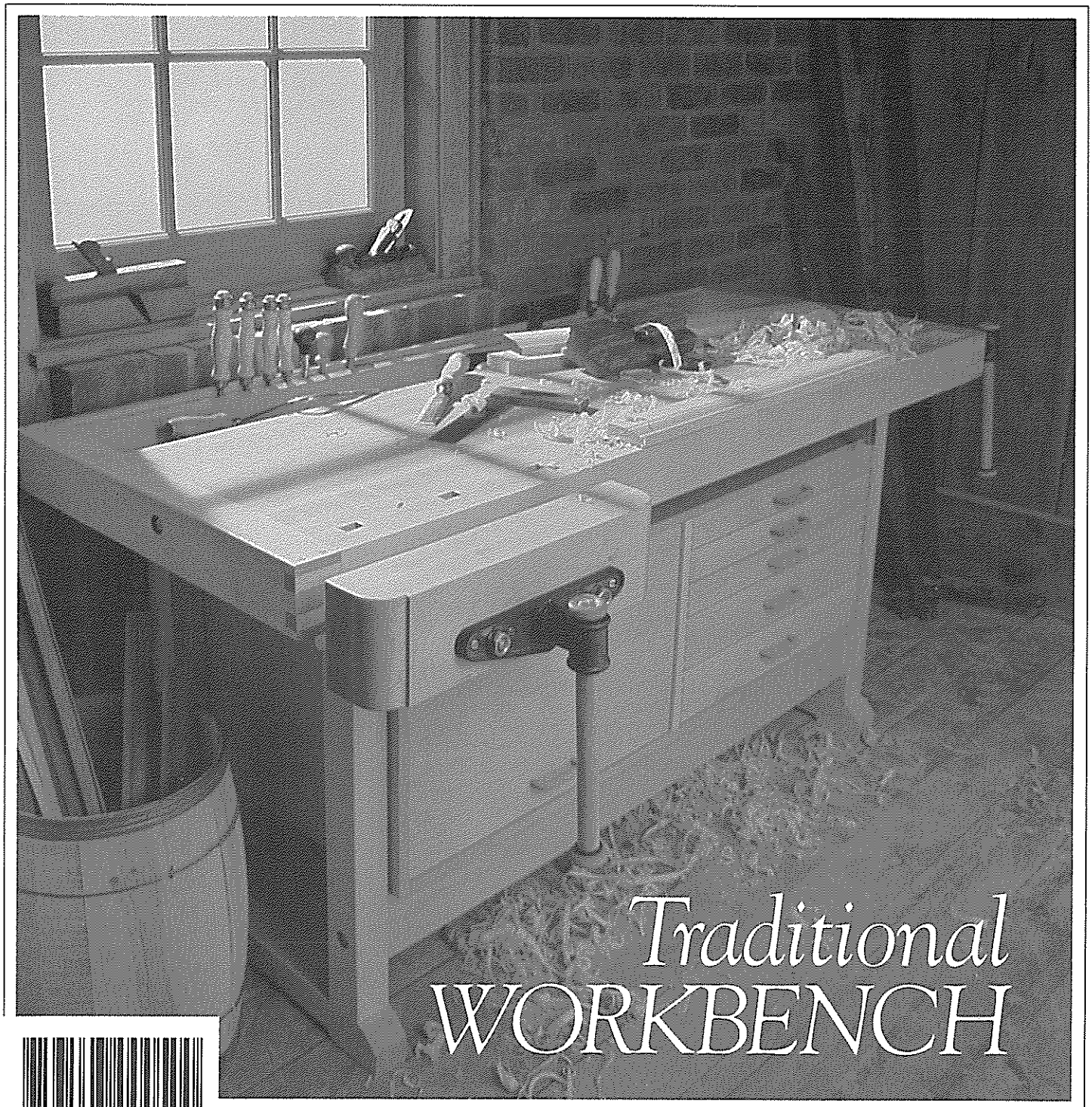
NO. 50 NOTES FROM THE SHOP

Woodsmith®



Traditional WORKBENCH

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Woodsmith

Number 50 April, 1987

WOODSMITH® (ISSN 0164-4114) is published bimonthly (February, April, June, August, October, December) by Woodsmith Publishing Co., 2200 Grand Ave., Des Moines, Iowa 50312. **WOODSMITH®** is a registered trademark of the Woodsmith Publishing Co.

Sawdust

ABOUT THIS ISSUE. Of all the hand tools in the shop, which is most important? My favorite tool is the hand plane . . . but the most important is my bench. A good bench is probably the single most important tool in the shop — especially if you want to increase you're level of craftsmanship.

That's a pretty strong statement, Don. Aren't you pushing things a little by saying that a bench is so important that it determines the level of craftsmanship?

Well, in a way I really think that's true. What a bench does (especially a European-style bench) is it allows you to work comfortably with hand tools. In effect, a bench is the primary tool that supports your work and holds it steady so you can work on it with the entire range of hand tools.

But what does that mean in terms of craftsmanship? Just because you work with hand tools doesn't make you a better craftsman.

That's true. But hand tools are essentially refinement tools. That is, the initial work on most projects starts with power tools. But as the project continues, hand tools are used to refine the work. Joints are refined with chisels and planes. The final surfaces are produced with planes, scrapers, even files and rasps.

The more you find yourself working with hand tools, the more you're refining your work. However, what all these hand tools need is a good bench to hold the work.

A GOOD BENCH. The next question is, what makes a good bench? Which leads to a dozen more questions. What kind of vises should it have? Should there be a tool tray? What kind of wood is best to use? How about a cabinet underneath it?

We tried to answer all these questions with the bench shown in this issue. It has all the features we wanted in a bench — particularly the vises.

Over the years, we've accumulated several benches for the shop. Each one has a slightly different approach to the vises. The one we like best is a big L-shaped "shoulder" vise that sits on the end of the bench and uses dogs to hold a workpiece down on the bench top.

There are two problems with it. It's very difficult to make, and it tends to get out of adjustment with changes in the seasons (humidity) and with use. The solution was easy. Put Ted to work to come up with a new version that solved both problems.

Undaunted, Ted came up with the vise shown on this bench. It's easy to make, works like a charm, and doesn't cost much.

THE WHOLE ISSUE. If there's a problem with this bench, it's that it requires the whole issue to describe how to build it. That's okay. It's an important project and we didn't want to short change it.

It would have been easy to say, "mount the front vise." Instead, we used two pages to describe this whole process — one that we found to be a real chore. It would have also been easy to say, "smooth the top." But we devoted three pages to this topic that's probably the biggest stumbling block in the whole project.

In all, we're happy to present the bench we've been wanting to build for years.

NEW FACES. We're also happy to have with us a new member of the staff. Ken Munkel joined us as a designer/craftsman/artist. A long title that he well deserves.

We first meet Ken about a year ago. At the time, we were in the process of remodeling the old carriage house that sits behind our office building.

Our building is in a part of Des Moines that was developed in the mid-1800's. Big mansions on large lots with nice views over the city. Although the original mansion is gone, the carriage house still remains.

Over the years, it had fallen on poor times. When we bought the property, it was used only for storage of things that didn't mind an occasional watering whenever it rained.

We decided to renovate it. We wanted to use the main area (where the carriages were stored) as a photo studio. And the back stable area was converted to an old-fashioned shop — a working shop, but also a museum of old tools. (The cover photo for this issue was taken in this shop area.)

In the process of finding local craftsmen to work on this rather large project, we ran into Ken. He was a furniture designer and cabinetmaker. And he also built custom doors and windows the old-fashioned way. Just what we wanted. So he built seven solid oak doors, eleven multi-pane windows, and two huge (ten-foot span) arched-top carriage doors with raised panels. These doors are the focal point of the project.

In addition to putting the final touches on the carriage house, Ken has been at work designing projects for future issues of *Woodsmith*. We have a "bank" of projects already designed and built.

I don't want to dwell on it, but we are beginning to make real progress at catching up on the schedule we're supposed to be on. The delays in mailing issues should gradually improve — to the great relief of all of us.

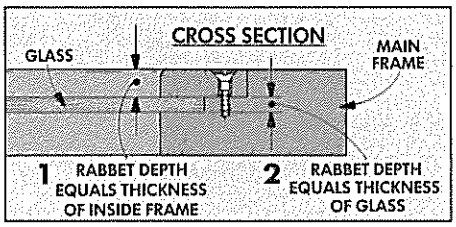
NEXT MAILING. Although we're making good progress, the next issue of *Woodsmith* (No. 51) will still be delayed somewhat. It will be mailed in the first part of August. Thanks for your patience.

Tips & Techniques

A DIFFERENT GLASS STOP

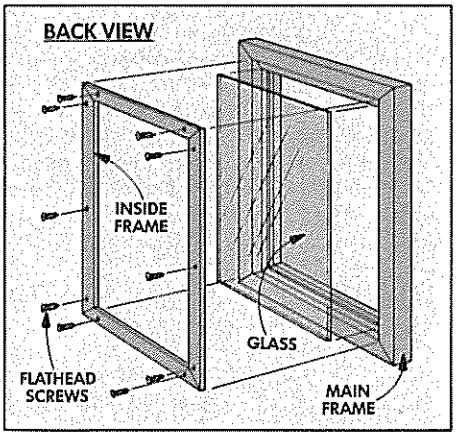
On projects that require a glass frame, I use a different system than the typical quarter-round glass stops. This alternative approach is to build a frame within a frame — the inside frame is actually a stop that holds the glass in place.

To make a frame with this system, start by cutting a double rabbet in the stock for the main frame. Cut the first rabbet wide enough and deep enough to accept the inside frame, see Step 1 in the Cross Section Drawing below.



Next, cut a second rabbet inside the first. The depth of this rabbet (from the bottom of the first rabbet) must equal the exact thickness of the piece of glass, see Step 2.

Now miter the main frame pieces to length. Then cut the thin inside frame pieces (stops) to fit in the rabbet.



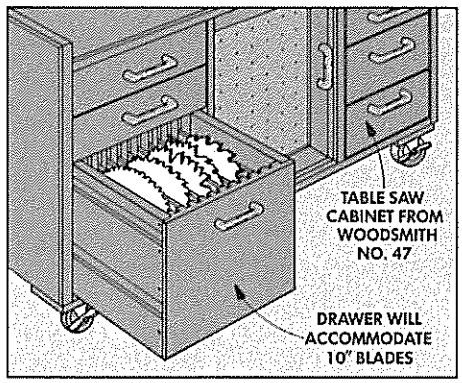
To assemble the frame, first construct the main frame. Then insert the glass and screw the inside frame in place with small flathead woodscrews.

Clarence Goff
Oregon City, Oregon

SAW BLADE FILE DRAWER

I built the table saw cabinet that was shown in *Woodsmith* No. 47 but made a slight change in the plans to include a large "file drawer" for my saw blades.

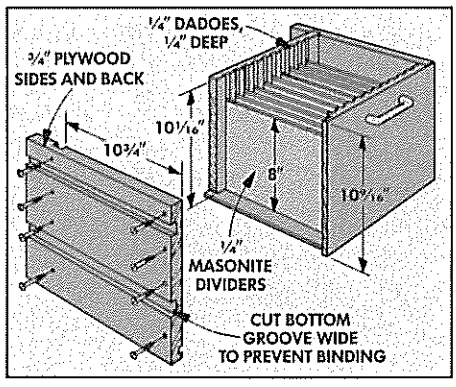
In studying the original plans, I discovered that the drawers were made large enough to hold 10" saw blades laid down flat. But that's not the best way to store blades since the teeth from one blade might chip the teeth of another.



By making one large drawer to replace the two bottom drawers, I can store the blades vertically like letters in a file cabinet. The new drawer is just deep enough for 10"-diameter blades.

Since a drawer full of blades is heavy, I used ¾" plywood for the drawer sides and back. If you have already built the cabinet following the original plans with four drawer runners on each side, you can put two runner grooves in each of the new larger drawer sides. (Note: Cut the bottom runner groove a little wide so the weight of the saw blades will be carried by the upper guides.)

To keep the blades from rolling toward the back when the drawer is pulled out, I moved the drawer's back in a little. That is, I cut the dado for the drawer's back 10¾" from the front edge, see drawing below. The drawer side should remain the full length to support the drawer when it's fully opened.



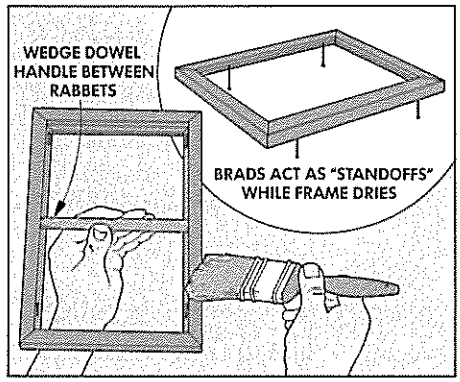
The ten dividers between the blades are made from ¼" Masonite. To hold the Masonite, cut ¼"-deep dadoes in the front and back at ¾" intervals. Then cut 8"-high dividers to fit between the dadoes and slide them down into place.

Ivan James
Houston, Texas

FINISHING PICTURE FRAMES

One problem I've always had with finishing a small project is how to hold the workpiece while brushing or wiping on the finish. At some point I usually have to hold a section that has wet finish on it and end up with fingerprints in the finish.

Recently while finishing some picture frames I came upon a better way to hold the frames. I cut a dowel to length about 1/16" longer than the inside width of the frame (from rabbet to rabbet). Then I wedged the dowel between the rabbets and used it as a handle while I brushed on the finish.



Another tip is to drive four small brads into the rabbets or back of the frame. When the frame is set down to dry, the brads act as "standoffs."

Ralph Mullally
La Crescent, Minnesota

FEELER GAUGE IN THE SHOP

I always keep a spark plug feeler gauge in my shop. I picked one up at an auto supply store — it looks a little like a pocket knife with various thicknesses of metal strips that fan out.

I use the metal strips to push glue into tight spots and under lifted veneers. The different gauge strips can also be used to check and set machine set-ups.

Dennis Ballard
Harrodsburg, Kentucky

SEND IN YOUR IDEAS

If you'd like to share a woodworking tip with other readers of *Woodsmith*, send your idea to: *Woodsmith*, Tips & Techniques, 2200 Grand Ave., Des Moines, Iowa 50312.

We pay a minimum of $10 for tips, and $15 or more for special techniques (that are accepted for publication). Please give a complete explanation of your idea. If a sketch is needed, send it along; we'll draw a new one.

A Classic Bench

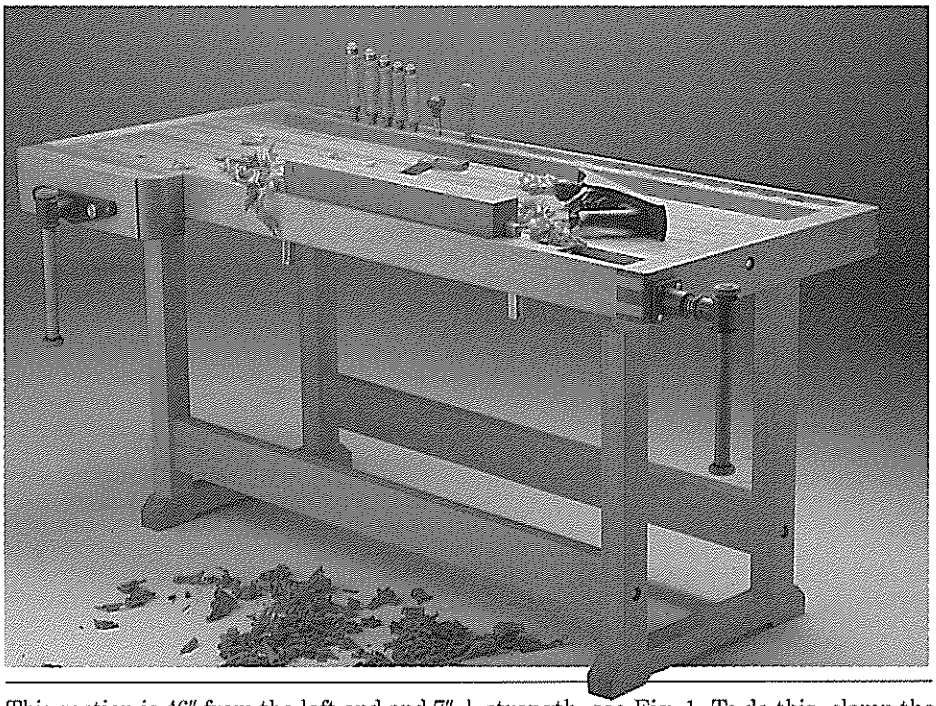
A WOODWORKER'S BASIC TOOL

Shortly after the very first issue of *Woodsmith* was sent out we received our first request for a workbench plan. And the requests have poured in ever since.

The workbench plan shown here has been on the drawing board for years. The problem in getting it off the board and into the shop has been that everyone here at *Woodsmith* has a different idea about what he wants in a workbench: Should it have a solid or plywood top? Should there be a tool tray? What kinds of vises? How many dog holes? Should there be any storage under the bench? The questions went on and on.

Finally, after considerable discussion, we decided to go ahead and build the bench. This plan has most of the items we agreed should be on a good, sturdy bench — and still keep the price and size within reason.

We all agreed that the most important feature of any bench is a stable, strong, flat surface. So that's where I started.



THE TOP SLAB

Begin building the top slab (A) by cutting seven boards of 8/4 stock (1¾" actual thickness) to a width of 1⅝" and a rough length of 72". (Note: The materials list for the workbench is on page 14.) Then glue the pieces together to form a 12¼"-wide slab.

To flatten the slab, I used a belt sander. (For a complete explanation on building and flattening the slab, see the article beginning on page 20.) After the slab is flat, cut it to a finished length of 60", see Fig. 1 (also see Talking Shop, page 23).

DOG BLOCK ASSEMBLY

Once the slab was cut, I built a dog block assembly that's part of the vise assembly along the front of the bench. Begin work by cutting three pieces (B) of 4/4 stock (13/16" actual thickness) to rough dimensions of 3⅝" wide by 60" long, see Fig. 1. (Note: Later, these pieces will form a long fixed dog block and a short sliding dog block, refer to Fig. 7.)

DOG HOLES. Before gluing the three pieces together into a block, I laid out and cut angled dadoes across the middle board to form square dog holes. The body of the dogs I used is ¾" thick by ¾" wide, so I cut the dadoes 1/16" deeper and wider to allow some clearance, see Detail in Fig. 3.

Note: It's best to buy or make the dogs first, and then cut a sample dado in scrap to check for fit. For more on dogs and why the holes are angled, see page 15.

Before laying out the 4° angled dadoes on the workpiece, you have to determine the location of the waste section between the long fixed block and the short sliding block. This section is 46" from the left end and 7" from the right, see Fig. 2. (Note: The length of the sliding block may vary depending on the type of vise screw used, see Sources, page 24.)

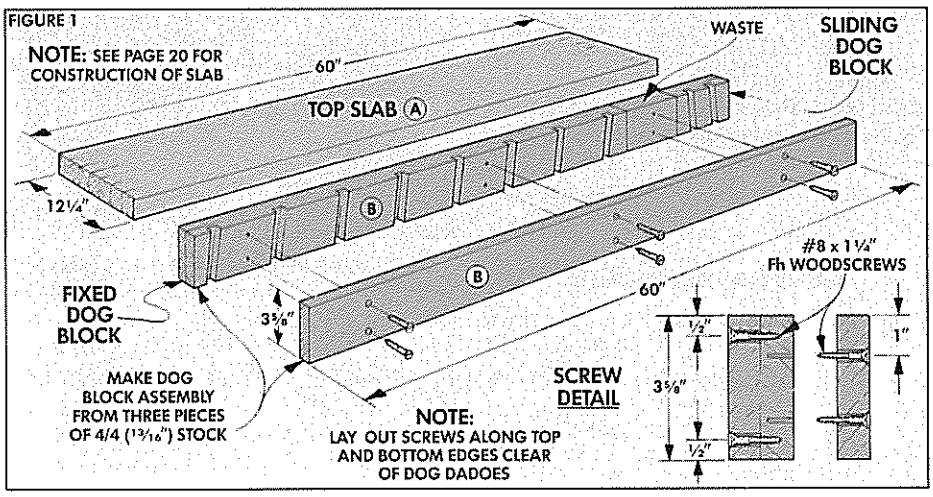
Then to mark the location of the first dadoes of each block, measure 1¾" from the waste toward the ends. Continue laying out the rest of the dadoes as shown in Figure 2. (Note: The dadoes on the fixed block angle to the right and the ones on the sliding block angle left, see Fig. 2.)

LAMINATE PIECES TOGETHER. Before cutting the 1/16"-deep dadoes, I laminated one of the dog block pieces (B) to the back of the piece to be dadoed to give it more strength, see Fig. 1. To do this, clamp the pieces together so the edges and ends are flush and drill holes for alignment screws. These screws keep the pieces from sliding when the glue is applied. (Note the location of the screw holes in the Detail in Fig. 1.) Then glue and screw the pieces together.

CUT THE DADOES. Next, add a long auxiliary fence to the table saw miter gauge and angle the gauge 4° clockwise. (This is a reading of 86° on some gauges.) Then cut the eight dadoes on the fixed end of the block, see Step 1 in Fig. 3.

Now angle the miter gauge 4° counterclockwise and cut the two dadoes for the sliding end, see Step 2.

FIGURE 1



DOG HEAD HOLE

There's one more step before gluing the third piece onto the face of the block to complete the assembly. The angled dadoes will accept the body of the dogs, but the top of each hole has to be enlarged to accept the dog's head, see Fig. 4.

ROUTER GUIDE. To make this cut, I built a special guide for the base of my router. The guide has a runner block that slides into the angled dadoes and a stop pin that determines the length of the hole.

To make the guide, replace the original router base with one made from ¼" Masonite, see Fig. 5. Then cut a runner block just wide enough to slide into the angled dadoes. Before attaching the runner to the base, drill two ¼"-dia. stop pin holes in the edge of the runner. Locate the holes 1⅛" from the centerline of the runner block.

Next, mount a ¼" straight bit in the router and raise it so the height of the bit from the Masonite base is equal to the depth of the dadoes in the workpiece (1⁵⁄₁₆"). Now screw the runner to the Masonite so it just touches the bit and the bit is centered between the two stop holes.

MAKING THE CUT. To enlarge the openings for the dog heads, set the router on the workpiece with the runner in the first dado in the long fixed dog block end and so the bit is *between* the dado and the "waste" section, see Step 1 in Fig. 6.

Now insert a stop pin (¼" dowel) into runner hole "A" and rout until the pin hits the edge of the workpiece. This should open up a 1⅛"-long slot for the dog head. Continue routing the seven other slots.

To enlarge the slots in the short sliding end, turn the router completely around (so the bit is between the runner and the "waste" section), switch the stop pin to the other hole ("B") in the runner, and rout using the same procedure, see Step 2 in Fig. 6.

CLEAN UP. Since the router bit is round, it leaves a dished-out area at the end of the cut, see Fig. 4. To prevent sawdust from building up in this area, I angled the shoulder toward the bottom using a paring cut with a chisel.

COMPLETING THE DOG BLOCKS

After the dog hole shoulders are cleaned up, screw and glue the third dog piece (B) to the front of the block, see Fig. 1.

CUT TO SIZE. Next, skim cut just enough off the top edge of the assembled block to clean up any chip-out left by routing and make the three pieces flush. Then rip off the bottom edge so the block is 3½" wide, see Fig. 7.

Finally, cut out the waste section from the assembled block so the fixed block is 46" long and the sliding block is 7" long, see Fig. 7. (Note: The length of the sliding block may vary depending on the vise screw used, see Sources, page 24.)

FIGURE 2

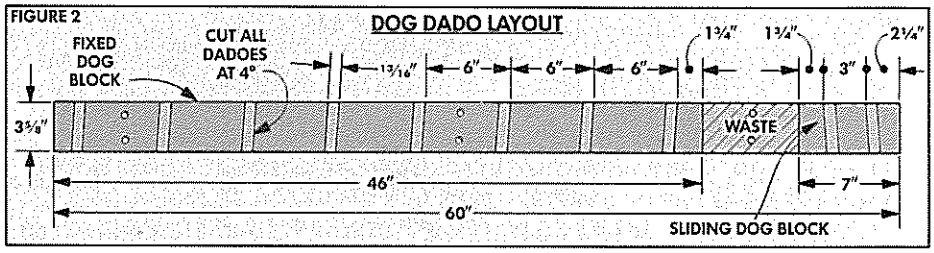
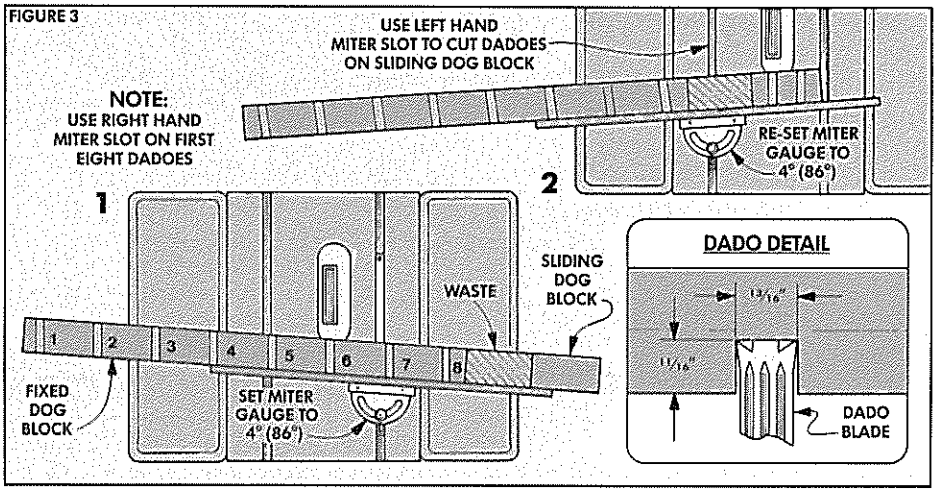


FIGURE 3



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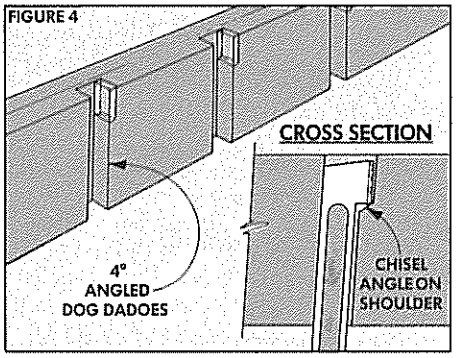

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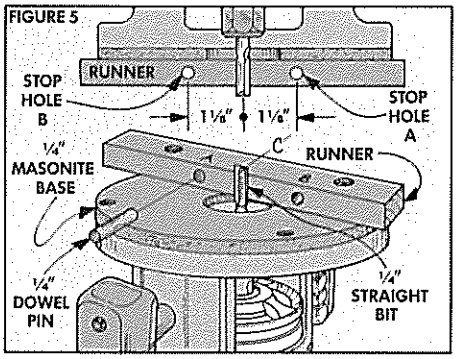
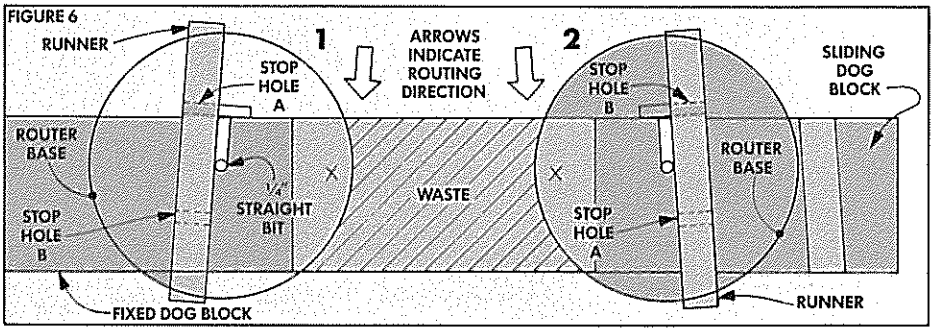


FIGURE 6



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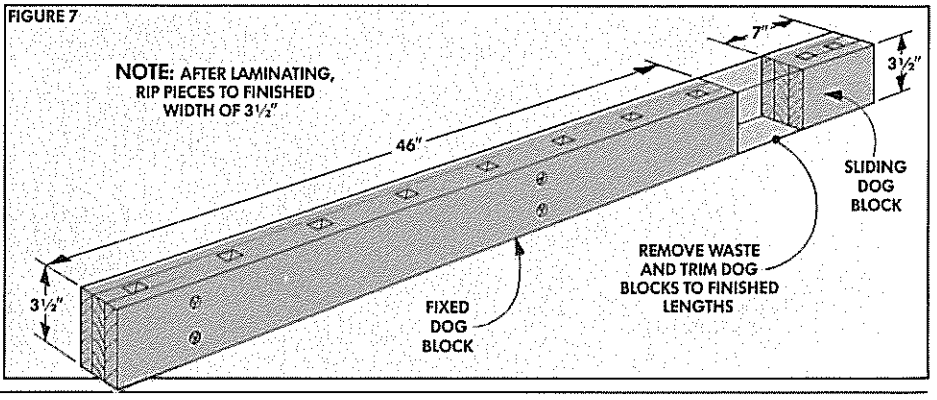
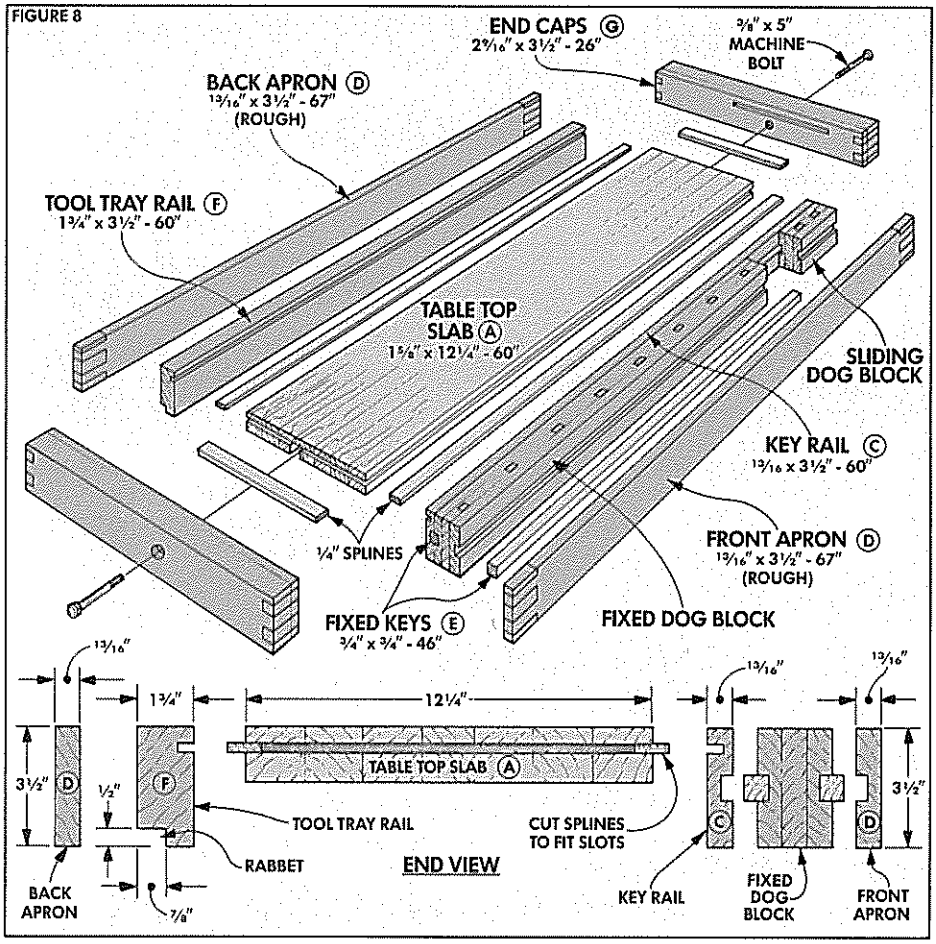
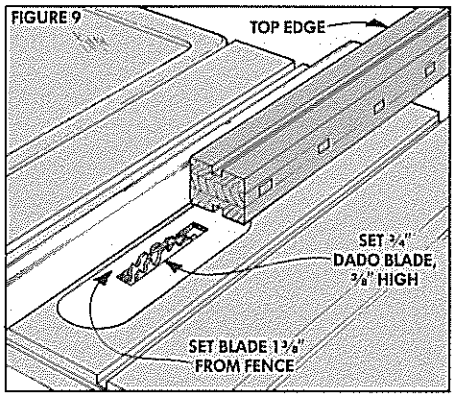
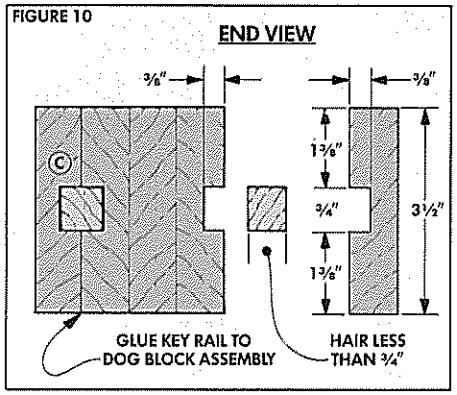
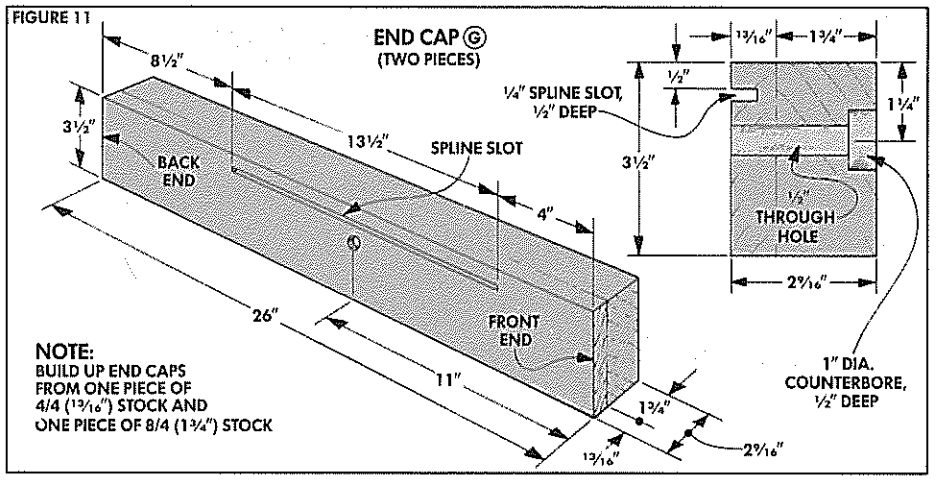










APRONS AND RAILS

After the dog block is cut apart, rails and aprons are added to the front and back edges of the top.

CUT TO SIZE. Starting on the pieces for the back of the bench top, cut an apron (D), from 4/4 stock and a tool tray rail (F) from 8/4 stock, see Cross Section in Fig. 8. Then cut a key rail (C) and another apron (D) for the front edge. All these pieces are 3½" wide.

The two rails (C and F) are cut to length to match the length of the slab (60"), and the front/back aprons (D) are cut to a *rough* length of 67", see Fig. 8.

TOOL TRAY RAIL. After the pieces are cut to length, cut a ½"-deep rabbet on the tool tray rail (F) to accept the ½"-thick tool tray bottom, see End View in Fig. 8.

KEY GROOVES. The key rail (C) and apron (D) for the front of the bench are mounted to the fixed dog block with the aid of two keys. I cut ¾"- wide grooves in these pieces and inserted alignment keys (E) in the grooves, see Fig. 10. (These same grooves also act as guides for the keys that hold in the sliding dog block.)

Note: To keep all the pieces flush across the top when they're assembled, cut the grooves on each piece (the key rail, the fixed and sliding dogs, and the front apron) with a *common top edge* against the fence, see Fig. 9.

KEYS. After the grooves are cut, cut two fixed keys (E) to fit the grooves and to length to match the length of the fixed dog block (46" long).

Now glue the key rail (C) to the back of the fixed dog block with one of the keys between the pieces, see Fig. 10. (The other key and front apron are added later.)

END CAPS

Before the rails and aprons were attached to the slab, I made end caps (G) for each end of the bench top. Begin work on the end caps by cutting two pieces of 8/4 stock and two pieces of 4/4 stock to a rough width of 3¾" and rough length of 27". Once the pieces are cut, laminate together one piece of 8/4 stock and one piece of 4/4 stock to make two blanks for the end caps.

When the blanks are dry, cut them to width to match the aprons and rails (3½") and to a finished length of 26", see Fig. 11.

COUNTERBORED BOLT HOLE. The end caps are *not* glued to the end of the slab. They're held to the slab with a bolt and nut block system, refer to Detail in Fig. 15. This system is made later, but now is a good time to drill a ½" counterbored hole in each end cap, see Detail in Fig. 11.

SPLINES

All the pieces that are joined to the four edges of the slab are held flush with ¼" splines, see Fig. 8. To cut slots for the splines

in all these pieces, I used a ¼" slot cutter on the router, see Fig. 12.

Since it's a deep cut in hard maple, rout the slot in two passes. For the first pass, don't push the cutter all the way into the ball bearing pilot, just hold it back and let the cutter break the surface. On the final pass, push the cutter in until the ball bearing pilot touches the wood, see Detail in Fig. 12.

SLOT THE SLAB. Begin by routing all the way around the slab working in a counterclockwise direction, see Fig. 12.

SLOT END CAPS. Next, rout stopped slots on the inside of the end caps, see Fig. 11. To keep the slots from showing in the tool tray, stop the slots 8½" from the back end and 4" from the front end.

SLOT THE RAILS. Next, rout a slot on the tool tray rail (F). Be sure it's on the side opposite the rabbet, see Detail in Fig. 13.

Finally, rout a slot on the fixed dog block assembly. To support the router over the end section of the key rail (that's only 13/16" wide), I temporarily clamped the sliding dog block to the key rail, see Fig. 13.

SPLINES. After all the parts are slotted, cut splines to match the slots, refer to Fig. 8. (I used ¼" Masonite for the splines.) To allow some glue space, cut the splines to width ⅛" less than the combined depth of the two slots.

BOLT/NUT BLOCK

When fastening the end caps to the slab, they need to be pulled up tight, but the slab still has to be able to expand and contract with changes in humidity. To allow this movement, I didn't glue the end caps on. Rather, I put together a bolt and nut block system that ties the end caps to the slab, see Fig. 15.

ROUT THE MORTISE. Start by laying out a "T-shaped" mortise at each end on the bottom of the slab, see Fig. 14. Then use a router and straight bit to freehand rout out the 13/16"-deep mortise and square up the corners with a chisel.

THE BLOCK. Next cut a small block to fit loosely in the mortise. (Note: Cut the block *shorter* than the length of the mortise. Remember, the slab may shrink in width.) Then drill a ½" hole through the center of the block to accept a ⅜" machine bolt, see Block Detail in Fig. 14. Finally, cut a notch in the back edge of the block that's exactly the same width as a ⅜" nut.

ASSEMBLY

After the blocks are made and the nuts are in place, insert a spline between the slab and end cap and temporarily bolt each end cap on with a ⅜" x 5" machine bolt.

Now the tool tray rail and fixed dog assembly can be glued and clamped to the front and back edges of the slab, see Fig. 15. (Note: Once the clamps are tight, remove the end caps so any glue squeeze-out won't glue them to the ends of the slab.)

FIGURE 12

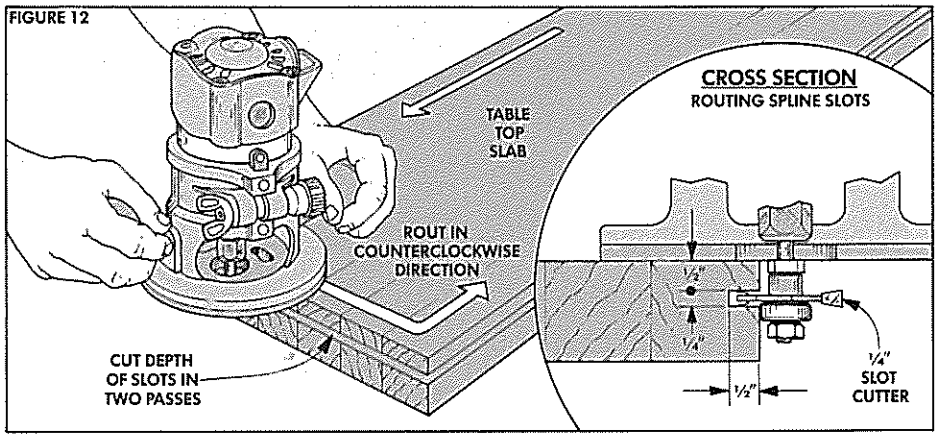


FIGURE 13

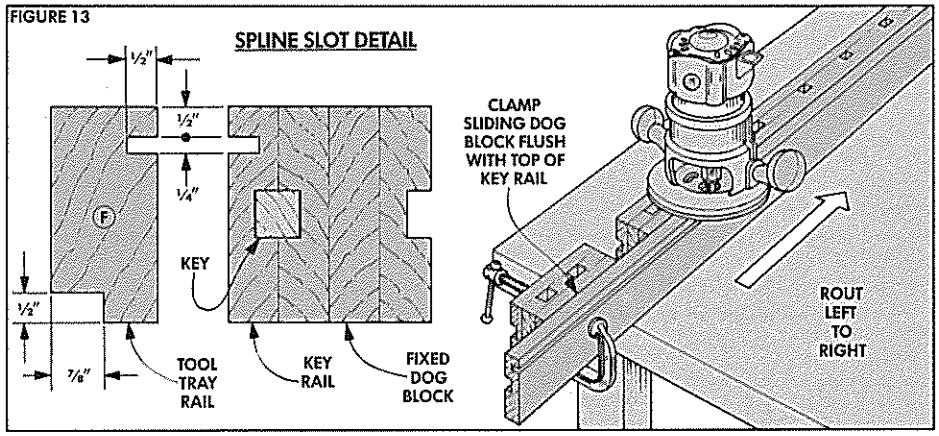


FIGURE 14

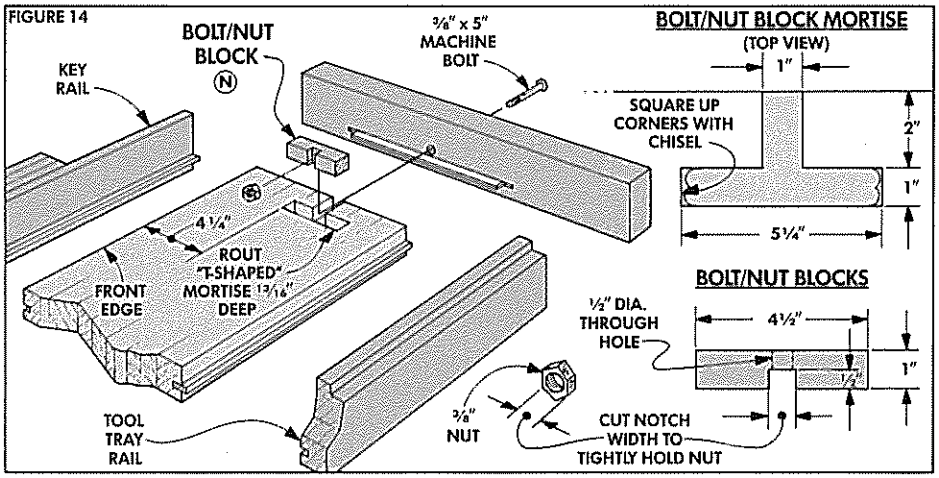
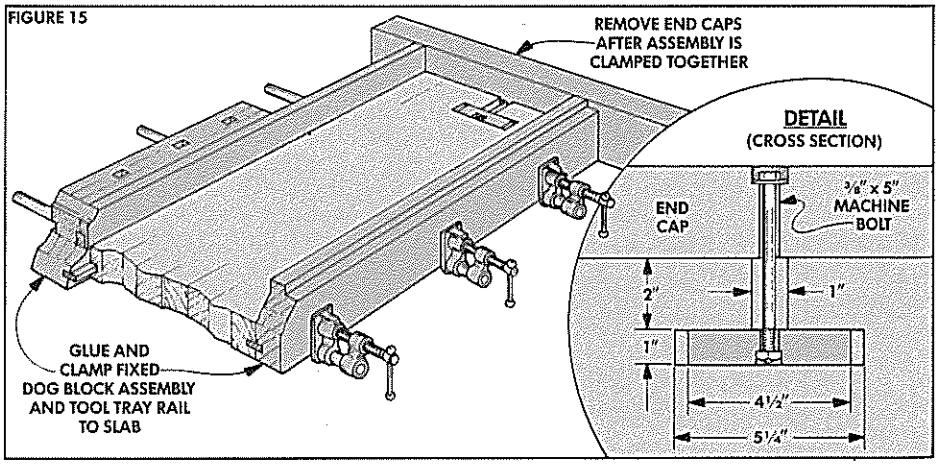
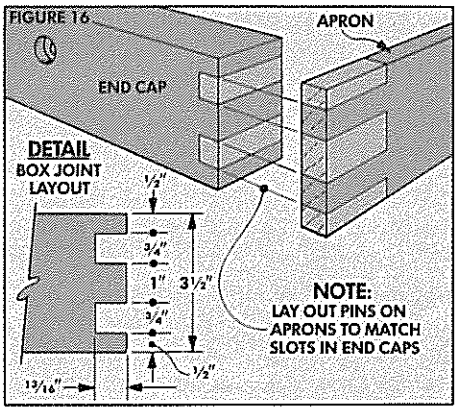
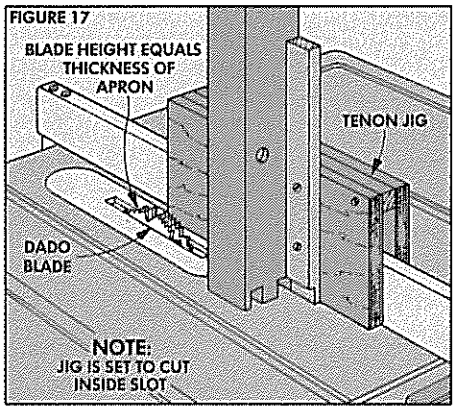
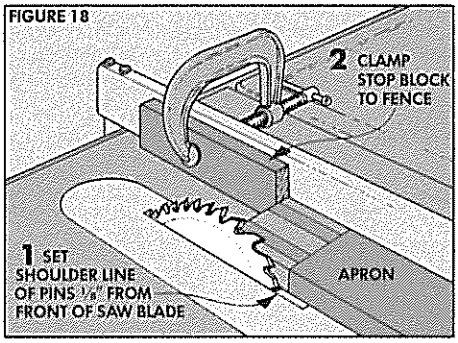


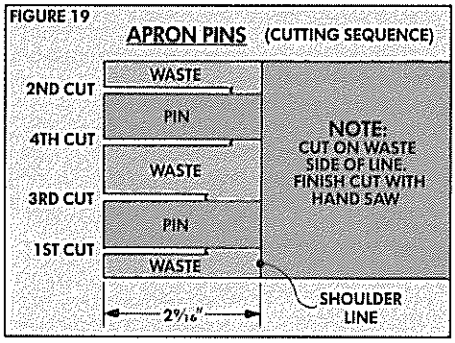
FIGURE 15

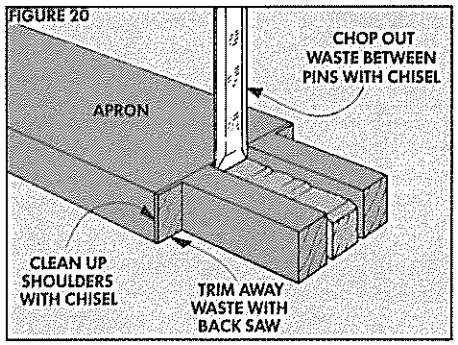


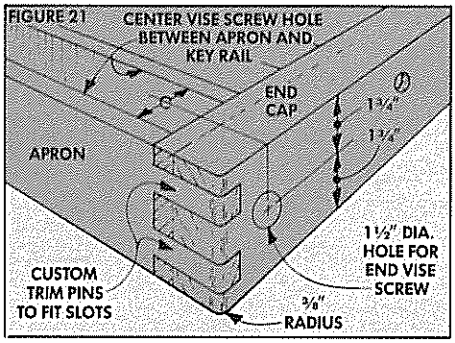


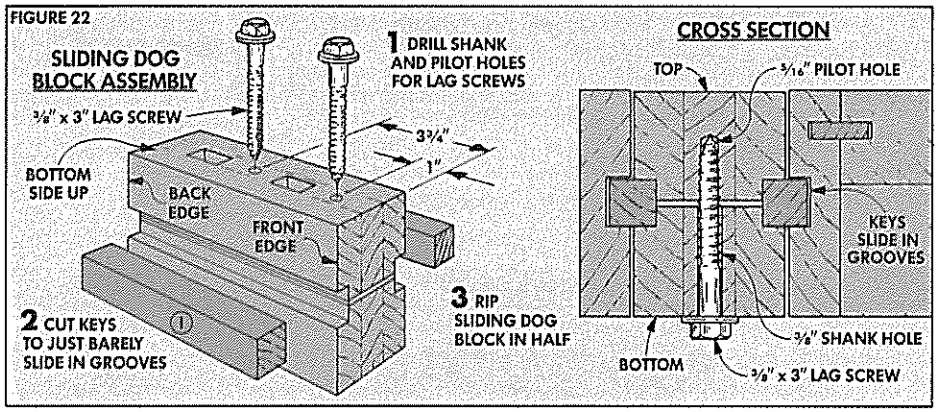


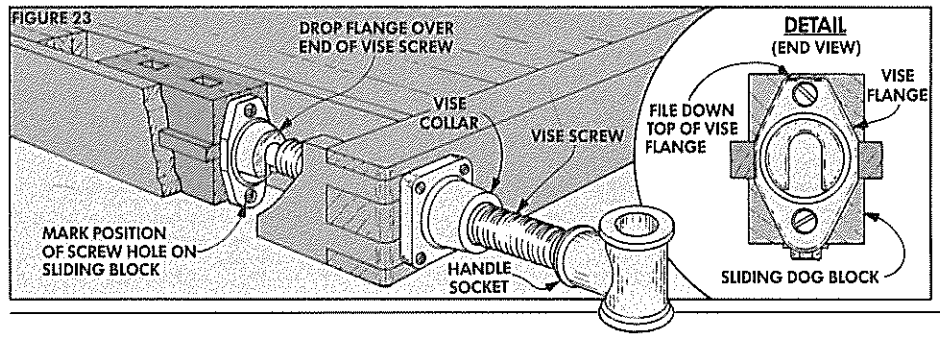












BOX JOINTS

After the dog assembly was glued to the slab, I added the aprons. Start by cutting the front and back aprons (D) to final length — the same length as the bench top with the end caps bolted in place, refer to Fig. 8.

After the aprons are cut, they can be joined to the end caps with box joints — but these pieces are so long the joints can't be cut the normal way with a box joint jig.

CUT SLOTS IN END CAPS. To make the box joints, start by laying out and cutting the slots on the end caps, see Detail in Fig. 16. To cut the slots, I used a dado blade and a tenon jig, see Fig. 17. Set the blade to the thickness of the apron (D) and set the rip fence so the jig is ½" from the blade.

Now stand the end cap on end against the vertical support of the tenon jig and make one pass. Then turn the workpiece around and cut the other slot.

CUTTING THE APRON PINS. After the slots were cut in both ends of the end caps, I laid out corresponding pins on the aprons. To cut the pins straight, start by mounting a combination blade on the table saw. Next, clamp a stop block to the rip fence to limit the length of cut, see Fig. 18.

To locate the stop block, lay the apron down alongside the saw blade. Then adjust the stop block so the shoulder line is ⅛" from the front of the saw blade, and clamp the block in place, see Fig. 18.

Now pull the workpiece back and move the rip fence toward the blade so the cut will be made in the *waste* area, see 1st Cut in Fig. 19. (Note: Cut just *outside* the pencil line, then clean up to the line later.)

After the first cut, flip the piece over and make a second cut without moving the fence. Then move the fence and make the third and fourth cuts, see Fig. 19.

TRIM TO THE SHOULDER. Finish the cuts down to the shoulder with a hand saw. Then cut away the two outside waste pieces with a hand saw and clean up with a chisel. Next, chisel out the waste between the pins (see Fig. 20) and custom-fit the pins to the slots, see Fig. 21.

VISE SCREW HOLE. Before gluing the pieces together, drill a hole for the vise screw in the right end cap, see Fig. 21.

ASSEMBLY. Now bolt the end caps to the slab and glue the aprons in place. After the glue dried, I rounded all the corners (see Fig. 21) except the front left vise corner.

SLIDING DOG BLOCK

After the corners are rounded, work can continue on the sliding dog block. Start by trimming a whisker off the thickness of the block so it slides in the bench opening.

The block is held in the opening with two sliding keys (I). To make the block removable (if it ever needs replacing or trimming), I cut the block in half and then screwed it back together to "sandwich" in the keys, see

Fig. 22. But before cutting it in half, drill holes for the lag screws, see Step 1 in Fig. 22.

Next, cut the keys (I) to fit in the grooves on the apron and key rail, see Step 2. Then cut the block in half (Step 3), mount it in the opening, and screw it back together.

END VISE

Once the sliding dog block is in place, mount the vise collar so it's centered on the hole in the end cap, see Fig. 23. Now slide the flange onto the end of the vise screw and mark the position of the screw holes on the end of the dog block, see Detail in Fig. 23. Then remove the sliding block from the bench, drill the holes, and replace the block.

Note: The top of the flange sticks above the top of the block, so I had to file down the flange, see Detail in Fig. 23.

TOOL TRAY

After the end vise was installed, I began work on the tool tray. To make the tool tray bottom (J), start by edge-gluing ½" stock to a rough width of 9" and length of 62".

CUT TO WIDTH. To determine the final width, turn the bench over and measure the distance from the inside of the back apron (D) to the inside of the rabbet on the tool tray rail (F), see Fig. 27. Then subtract ⅛" to allow the bench top to expand.

CUT INTO PIECES. After the bottom is cut to width, cut it into three pieces to make a sawdust cleanout door, see Fig. 24.

Since I wanted to add a tool holder strip to the tool tray, I had to cut two long notches on the back edge of the tray bottom, see Fig. 24.

TOOL HOLDER. Now cut the tool holder (K) from 4/4 stock to a width of 2½" and to length to fit inside the tray (60"), see Fig. 25. Then cut slots to hold different tools.

After the slots are cut, chamfer the top edge (see Detail in Fig. 26) and then glue the tool holder to the inside of the back apron so it's ½" from the bottom edge.

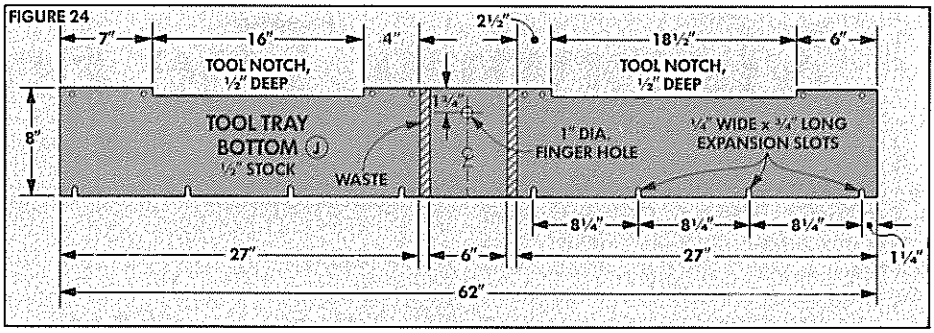
SCREW ON BOTTOM. Now screw the tray bottom onto the bottom of the tool holder and into the rabbet in the rail, see Fig. 27. (Note: Slot the front screw holes in the tray bottom to allow for expansion.)

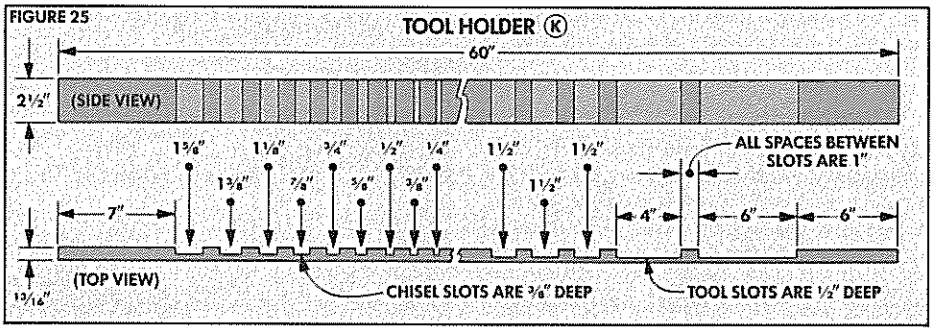
SAWDUST DOOR. Once the two bottom pieces are on, add two ½"-thick cleats (T) to hold in the sawdust door, see Fig. 28.

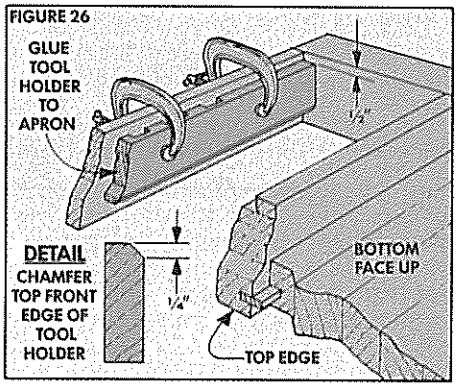
Then cut a notch on the bottom of the tool tray rail so the door can slide into position, see Fig. 29. Finally, drill a 1"-dia. finger hole in the door, see Fig. 24.

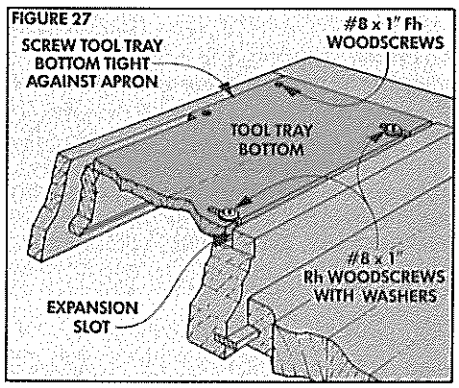
END BLOCKS. Next, screw beveled end blocks (L) to the ends of the tool tray to keep sawdust from building up in the corners, see Fig. 30.

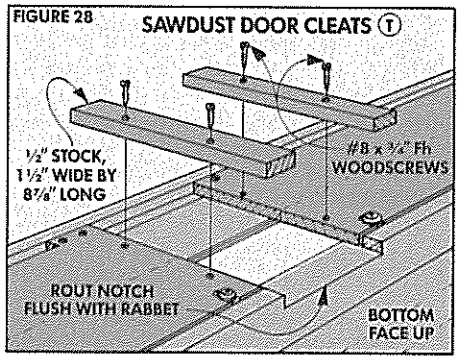
That pretty much completes the bench's top. The next steps are to mount the front vise (pages 10-11), build a base (pages 12-14) and build an under-bench cabinet (pages 16-19).

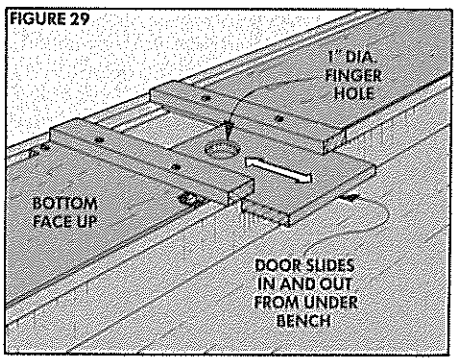


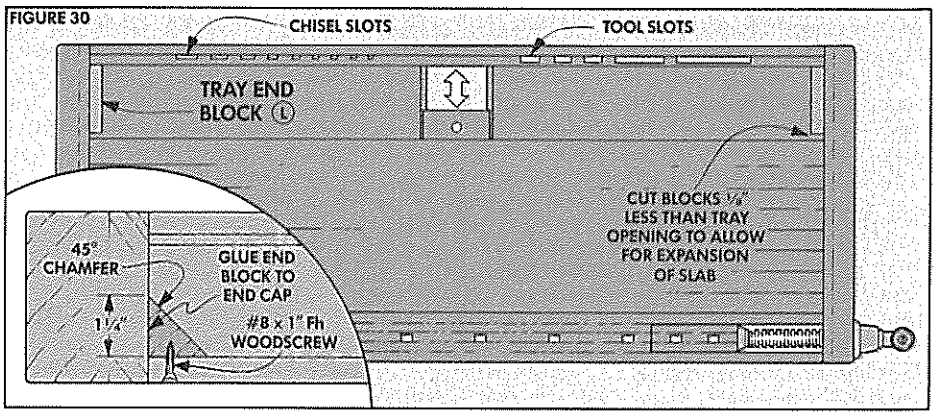












Mounting The Front Vise

THE VIRTUES OF A VISE

A woodworking vise is so basic that I often forget to mention it when talking about fundamental shop tools. But, a good vise is one of the most essential tools in the shop. So, when we decided to build a workbench for this issue, we gave the woodworking vise hardware currently on the market a close look.

TRUE TO TRADITION

Although there's a wide variety of vises available, they basically fall into two categories. One type has cast iron faces (usually called a woodworking vise). The other is really just the metal parts of the vise to which you mount wooden faces. (I call this a wooden vise, even though most of it is metal.)

After a lot of discussion, we decided to equip the *Woodsmith* bench with this second, more traditional type for two reasons. First, there's no metal near the work level to mar the workpiece, knock the edge off a sharp tool, or rap knuckles.

The second reason is part of the aesthetics associated with a wooden bench. A vise should be part of the bench, not something that's attached to it. So, the wooden-faced vise seemed natural.

VISE PARTS

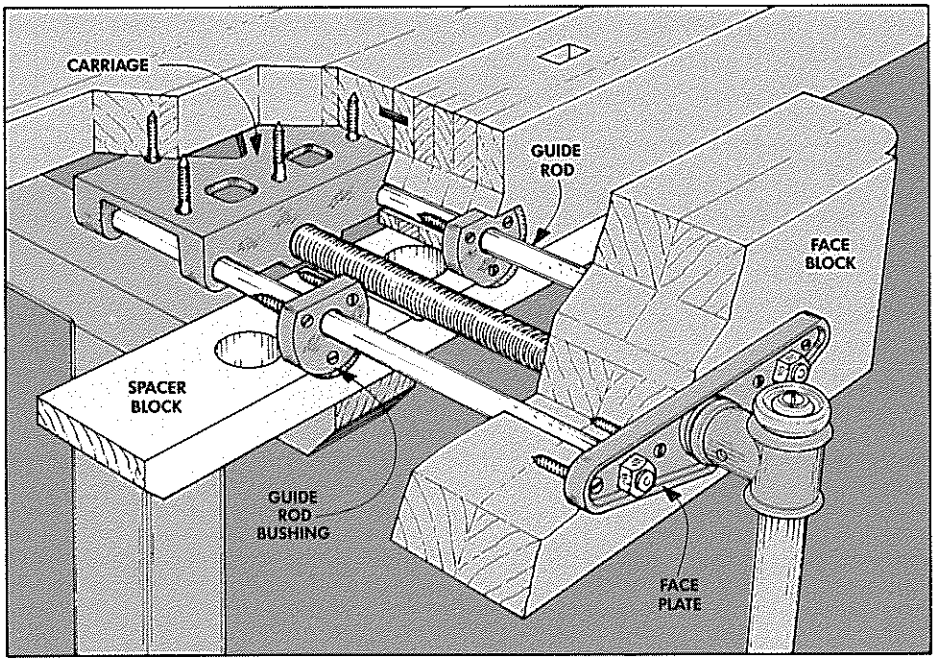
The basic function of a wooden-faced vise is no different from any other vise. It holds an object so you can work on it with two hands. But, since the object it holds is wood, it has to grip tightly without marring. To do this, it has some parts that are unique to woodworking vises and aren't on other types of vises.

FACE BLOCK. A wooden vise doesn't have jaws. Instead it has a large, movable face block that clamps the workpiece directly against the front of the bench. (When the workpiece is pressed against the front of the bench, it's less likely to slip than it would be when squeezed between the narrower faces of a cast iron woodworking vise.)

The face block on most wooden front vises is pretty massive (ours is 3½" thick). The thickness isn't for strength; it's to provide support for the guide rods.

CARRIAGE. The metal part of the vise — the carriage — performs three essential functions at once. The most obvious is holding the entire vise assembly to the bench. The second function is providing a threaded section for the vise screw.

The third function of the carriage is keeping the wooden face block parallel to the front of the bench. It does this with two guide rods that pass through double holes machined in each side of the carriage.



There is one problem with the carriage mounting system, though. The guide rods are unsupported where they pass through the bench's front apron. To overcome this problem, the better vise assemblies have guide rod bushings, see Fig. 8.

QUICK RELEASE. One part of the carriage is an option: quality vise assemblies offer a quick release. These mechanisms allow the face block to slide open and closed by giving the handle a partial turn to release the screw. Then you can push or pull the face block to where you want it.

Most vise assemblies are available with and without this mechanism, but I think the extra $10 to $20 it costs is worth it.

ASSEMBLY PROCEDURE

Once we decided on the vise (see Sources, page 24), we had the chore of mounting it to the bench. This turned out to be more of a challenge than we anticipated.

To attach the vise hardware onto the bench, two wooden parts are needed: a spacer block and a face block.

SPACER BLOCK. The arm on the vise-end of the base is notched to provide clearance for the vise assembly. To provide support for the front of the bench top, a spacer block (M) is needed. I made this block from a piece of 1"-thick maple 18" long and 3½" wide, see Fig. 2.

After cutting the block to size, mark and drill 1½" holes. (Since this block is mounted right over the row of dog holes, the 1½" holes provide clearance for the dogs.) Then screw the block in place.

FACE BLOCK. To make the face block (N) for the movable part of the vise, laminate two pieces of 8/4 hardwood together, see Fig. 3. When the glue dries, cut the block to 5" wide and 18" long.

FACE BLOCK HOLES. After cutting the face block to size, holes are bored through it for the vise screw and guide rods.

To locate the holes for the guide rods, first measure the thickness of the bench top and scribe a line this distance down from the top of the face block, see Fig. 3. Now, place the cast iron carriage centered on the block with its upper surface aligned with this line.

To locate the exact centers of the guide rod holes, slip a ¾" brad point bit through the carriage holes to mark the boring locations on the face of the block.

Next, the location for the vise screw hole is marked. To do this, trace the outline of the center hole of the carriage.

BORE HOLES. Now the holes can be bored on the drill press, see Fig. 4. Since the holes for the guide rods have to be precise, I used a ¾" brad point bit. The hole for the vise screw is oversized for clearance, so a 1¼" spade bit is adequate.

Shop Note: To prevent chipout, stop when the point comes through and finish boring from the other side.

LOCATE BENCH HOLES. After the holes are bored in the face block, matching holes

are bored in the bench. To do this, clamp the face block to the bench with its top and end flush with the top and end of the bench, see Fig. 5.

With the block clamped in position, use a ¾" brad point bit to mark the location of the two outside holes for the guide rods and trace the outline of the middle hole for the vise screw. Then, using a Portalign, bore 1" holes for the guide rods and a 1¼" hole for the vise screw. (Note: The guide rod holes are oversized to 1" dia. in the bench, but *not* in the face block.)

Shop Note: At this point the outside edges and outside ends of the block (except the edge that's even with the top of the bench) can be chamfered. I also bandsawed a profile on both ends, refer to Figs. 7 and 8.

ASSEMBLY. After the block is profiled, assembly can begin. First, the wooden face block is mounted to the metal face plate on the vise. To do this, fasten the guide rods to the metal plate with nuts. Then slide the face block onto the guide rods. Now drill pilot holes for screws, and screw the face block to the metal plate, see Fig. 7.

MOUNT CARRIAGE. There's a trick to mounting the carriage to the bottom of the bench. Begin by turning the bench top upside down. Then, push the guide rods and screw through the holes in the bench and slide the carriage loosely onto the guide rods. Now clamp the wooden face block tight against the apron, see Fig. 7.

With the wooden face block clamped in position, slide the carriage forward until the front of the carriage just touches the dog block assembly, see Fig. 7.

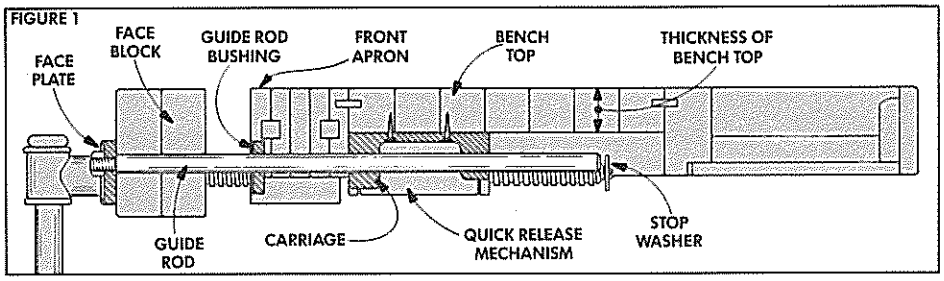
Note: If just one end of the carriage contacts the apron, don't try to force the other end flush. The whole idea is that even if the carriage itself is out of square, the holes for the guide rods are aligned with the front of the bench.

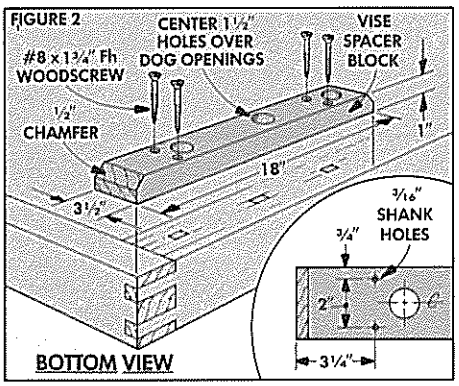
Then drill pilot holes and screw the carriage to the bottom of the bench.

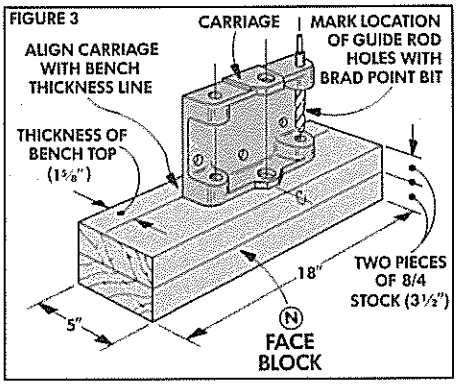
GUIDE ROD BUSHINGS. After the carriage is screwed in place, the guide rod bushings are mortised into the front of the bench. Begin by slipping the bushings onto the guide rods. Then insert the guide rods through the holes in the front of the bench, and trace the outline of the bushings on the apron, see Fig. 8.

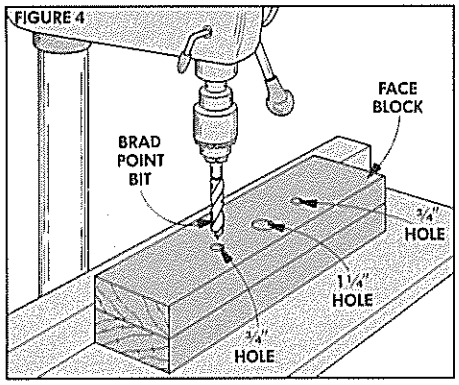
To mortise the recess for the bushing I used a router with a ¼" straight bit, see Fig. 9. Rout the recess by working out from the center hole to the line. Rout progressively deeper until the recess is ⅛" deeper than the thickness of the bushing. When the bushings fit the holes, drill pilot holes and screw the bushings in place.

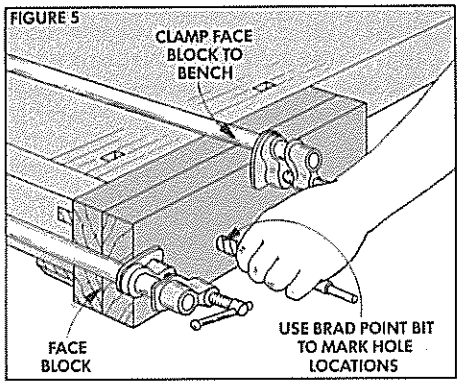
ASSEMBLE VISE. The last step is putting the vise back together. Just slide the guide rods and vise screw through the carriage. Then attach the washer on the end of the vise screw that keeps the assembly from pulling all the way out, refer to Fig. 1.

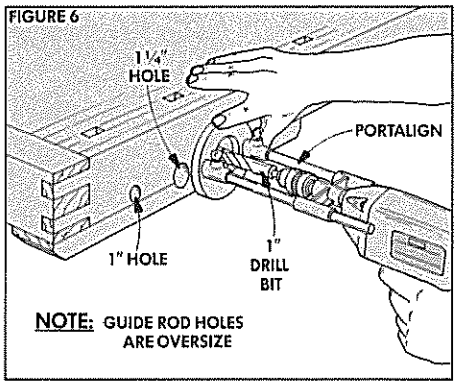


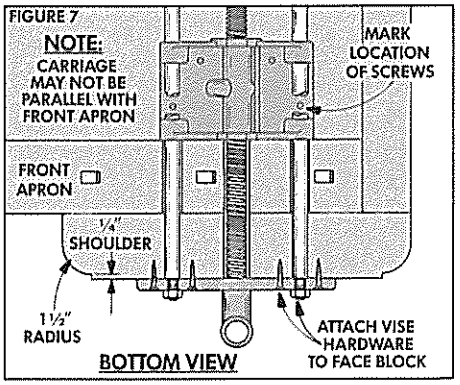


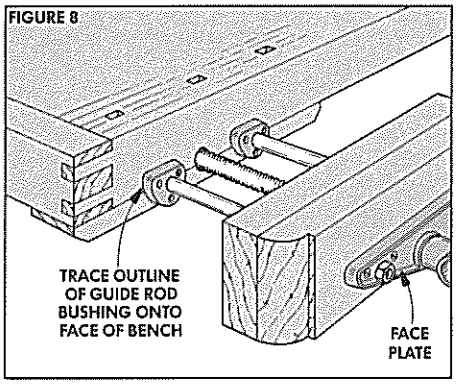


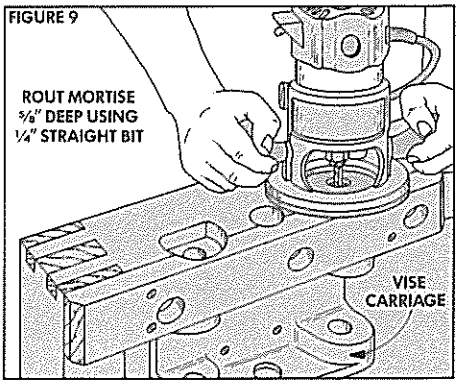








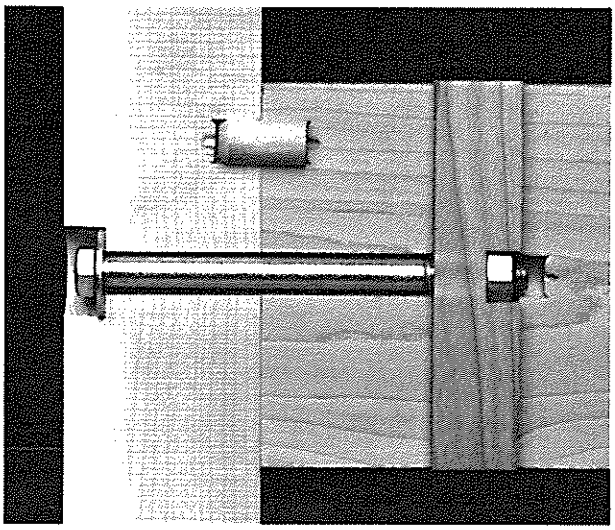




Bench Base

The base for the workbench gave me another opportunity to use the same bolt and block system (see photo at right) that I used to attach the end caps to the top slab of the bench.

The base consists of two end frames connected by two stretchers, refer to Fig. 10. The two end frames are almost identical, except the arm at the top of the left end is notched and 3" longer to help support the vise, see Fig. 1.



ARMS AND FEET

Each arm and foot is made from three pieces of 4/4 stock laminated together, see Fig. 2. I began work on the arms and feet by cutting twelve pieces of stock to a rough width of 2⅝" wide. Then cut nine of the pieces to a rough length of 23" and the other three pieces (for the long vise arm) to a rough length of 26".

CUT NOTCHES. After cutting the stock to rough size, lay out notches on the *center* board for each arm and foot. (When the three pieces are laminated together, the notches in the center board form mortises for the leg tenons.)

Start by laying out a 2"-wide notch 2" from the *back* end of each center piece, see Fig. 2. Then lay out a second 2"-wide notch 15" from the first.

LAMINATE AND CUT. After the 1½"-deep notches are cut, glue up the four blanks in sets of three with a notched board in the middle, see Fig. 2.

Once the blanks are dry, they can be cut to length. To determine the end points for cutting, measure out 1¾" from the notches on the right arm and two feet, see Fig. 3. Since the vise arm is longer, the front end is 4¾" from the notch, see Fig. 3. This makes the feet and right arm (O) 22½" long and the vise arm (P) 25½" long.

VISE NOTCH. There are a couple more steps before the arms and feet are complete. First, cut a long notch on the top of the vise arm to make enough room for the vise hardware, see Fig. 3.

MOUNTING HOLES. Next, drill counterbored holes on each arm to mount the top to the base, see Fig. 3. On the vise arm, center the hole 2½" from the front end. On the right arm, center the hole on the length.

CHAMFERS. Now cut 1" chamfers off the bottom ends of both arms and the top ends of both feet, see Figs. 3 and 4.

FOOT CUTOUT. The last step is to cut out an area on the bottom of each foot, see Fig. 4. To make this cutout, I temporarily clamped the two feet together and drilled a 1"-dia. hole so there would be a ½" arc in each leg, see Fig. 5. Then unclamp the pieces and cut a straight line between the arcs.

LEGS

After the arms and feet were complete, I began work on the four legs (Q). The length of the legs determines the overall height of the workbench. (See Talking Shop, page 23, for an explanation on how to determine the best bench height.)

FIGURE 1

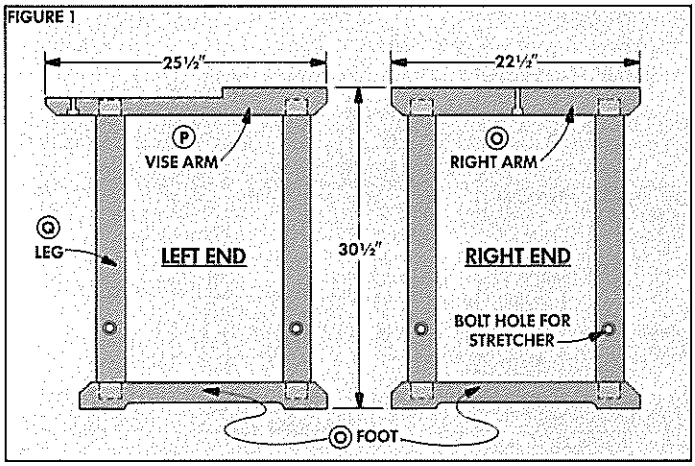


FIGURE 2

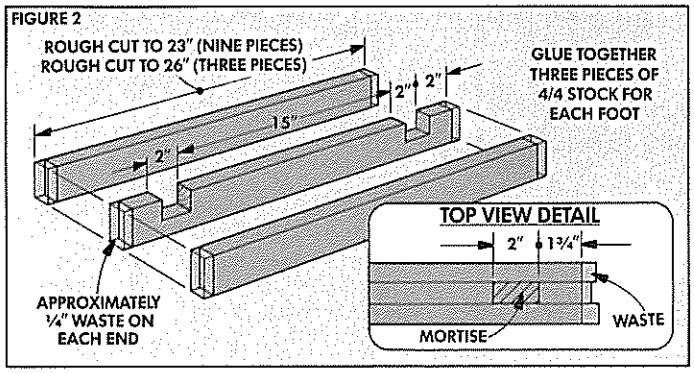
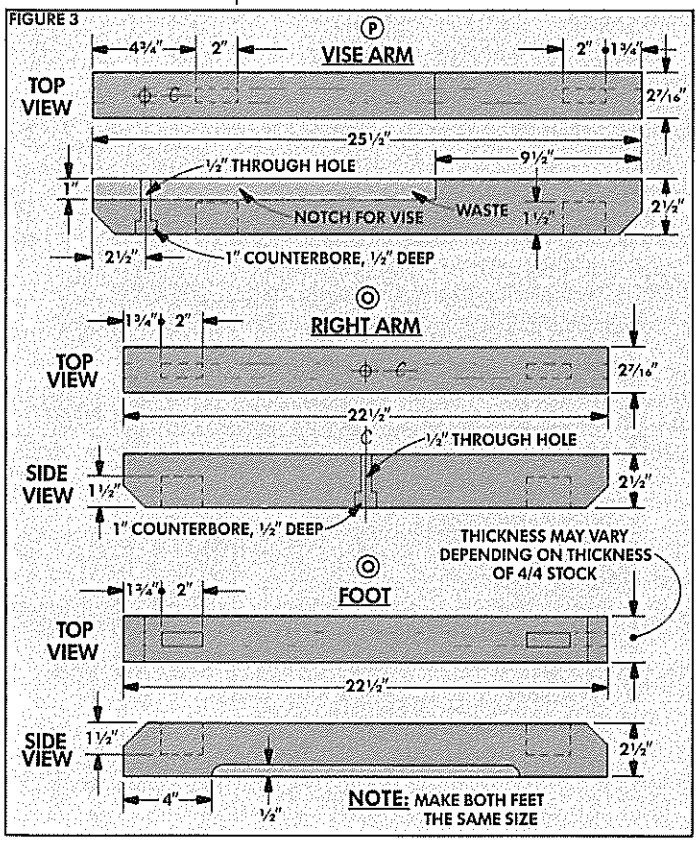


FIGURE 3



CUTTING THE PIECES. To build the legs, first cut twelve pieces of 4/4 stock to a rough width of 2⅝" and rough length of 30". Then laminate the pieces together in sets of three to make four leg blanks.

After the glue dries, trim the leg blanks to a finished width of 2½" and length of 28½", see Fig. 6. (This measurement can be increased or decreased for a higher or lower bench.)

TENONS. Next cut 1½"-long tenons on the ends of each leg to fit into the mortises in the arms and feet, see Fig. 6.

DRILL HOLES. To attach the stretchers to the legs, you need to drill two holes in the legs. First, drill a ½"-dia. counterbored through bolt hole 19¼" down from the tenon shoulder, see Fig. 6. Then drill a ½"-deep hole for a dowel pin on the *inside* of the leg 1½" above the bolt hole.

ASSEMBLY. Finally glue the legs to the arms and feet, checking for square.

STRETCHERS

To make the two stretchers (R), cut four pieces of 4/4 stock to a rough width of 4⅝" and finished length of 48⅛".

DADOES. Before laminating the pieces into pairs to make the stretchers, I cut 1"-wide dadoes on the inside face of each piece, see Fig. 7. When the pieces are laminated, these matching dadoes form mortises that accept the bolt/nut blocks (H), see Fig. 8.

BOLT/NUT BLOCKS. After the dadoes are cut, cut two 9"-long bolt/nut blocks to fit in the mortises. Then glue the pairs together to form the stretchers. (The blocks act as temporary alignment keys and should be removed before the glue sets.)

Once the glue dries, trim both the top and bottom of the stretcher flush until it's 4½" wide. Then put the bolt/nut block back into place and drill a ½"-dia. bolt hole in from the end of the stretcher through the block, see Fig. 9.

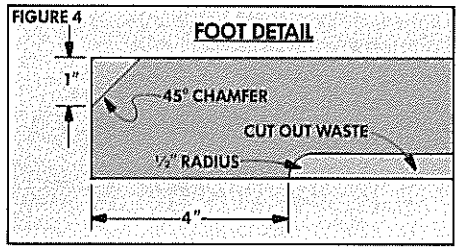
Next, insert a ⅜" bolt into the hole, mark the block with a pencil, and cut it off flush with the top and bottom of the stretcher. Then, cut a notch in the back to tightly hold a ⅜" nut.

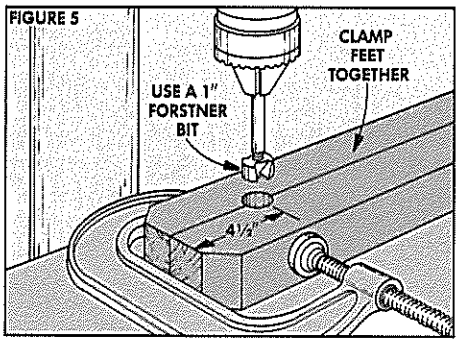
DOWEL PIN. To prevent the stretchers from twisting as the bolts are tightened, I added a ½" dowel pin to the ends of the stretcher. Drill a hole 1½" above the bolt hole and glue in a 1"-long dowel, see Fig. 9.

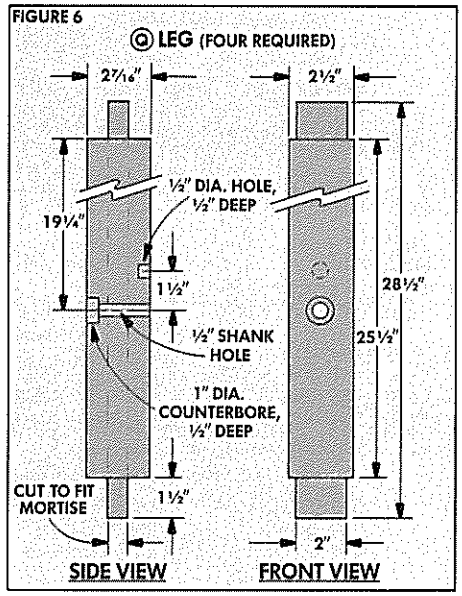
ROUND OVER EDGES. Before assembling the base, I rounded over all the edges on the stretchers and end frames with a ⅛" round-over bit.

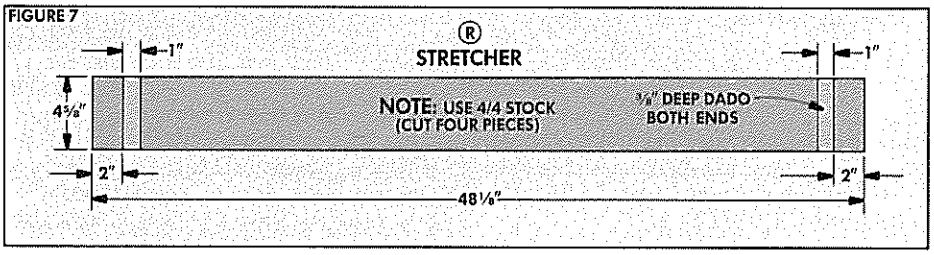
ASSEMBLY. Next, fit a nut into the notch in each bolt/nut block and insert the blocks into the mortises, see Fig. 10.

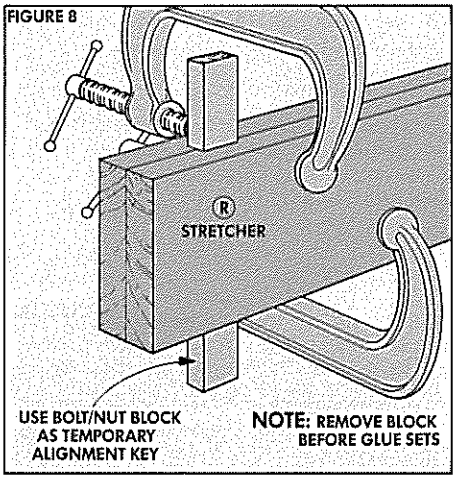
Then, push a ⅜" x 5" bolt through the leg and into the end of the stretcher. The dowel pin in the end of the stretcher should match the hole on the inside of the leg. Finally, tighten up the bolt.

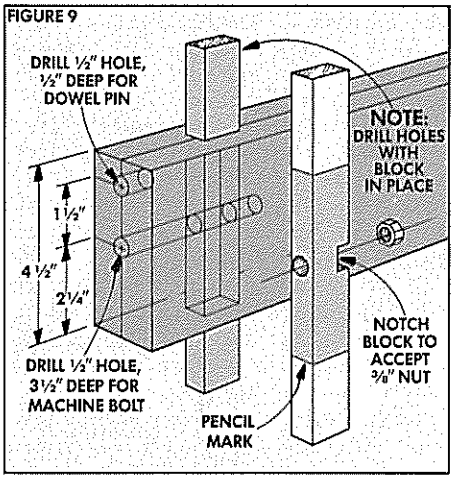












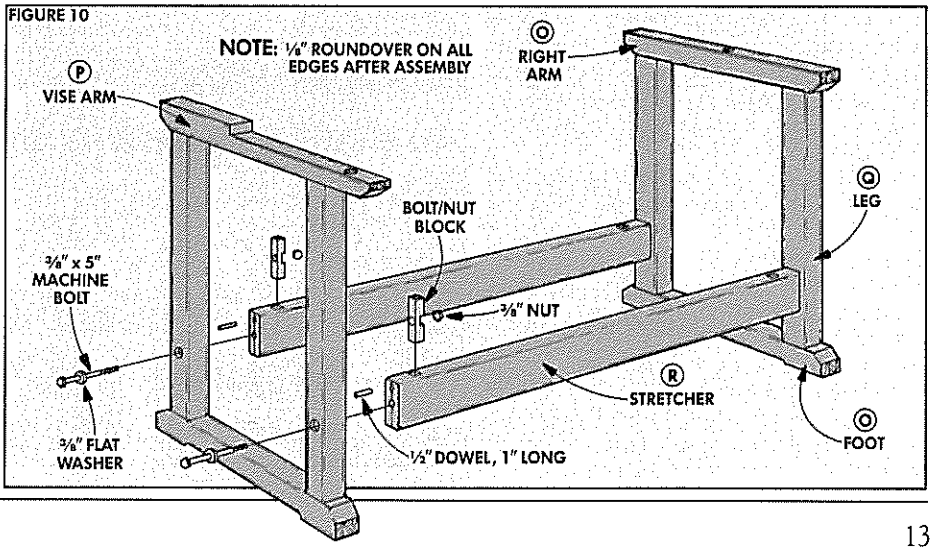


FIGURE 11

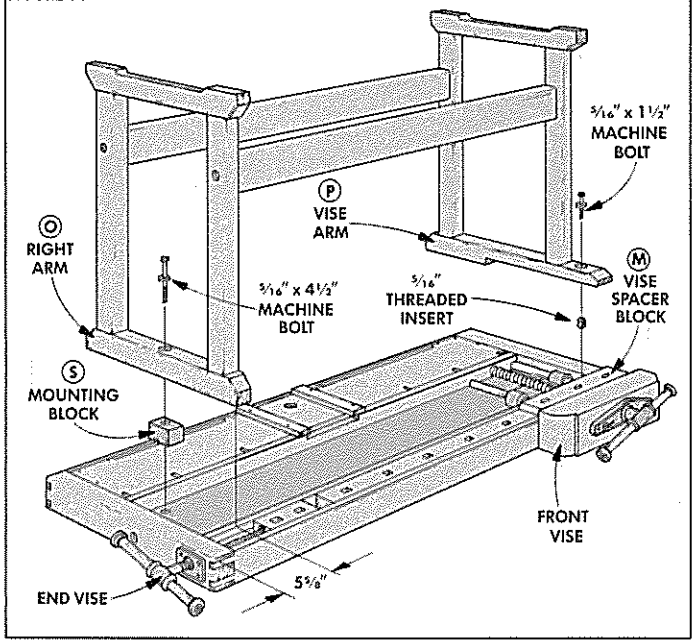
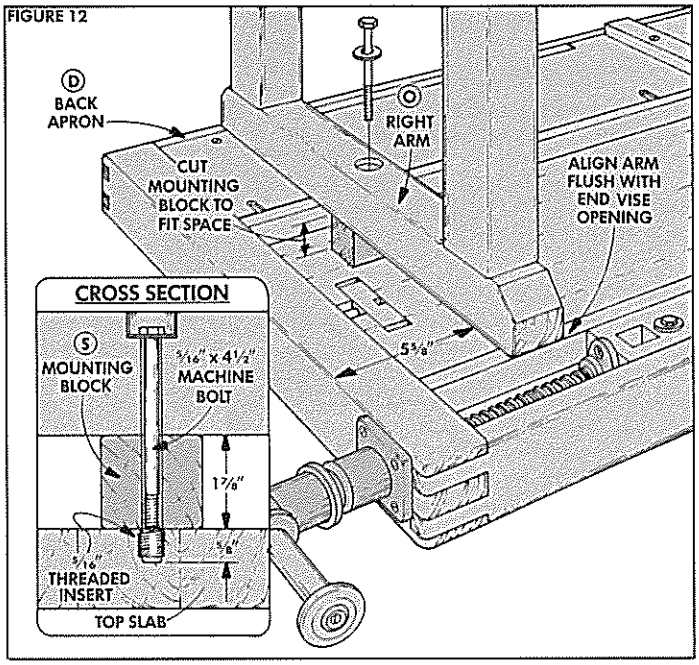


FIGURE 12



MOUNTING THE TOP

Once the base is assembled, the top can be added. To do this, I found it easiest to turn the top upside down and then position the base on top of it, see Fig. 11.

LOCATE THE BASE. Position the base so the vise arm (the longer arm) is over the front vise. Then go to the other end and position the front end of the right arm (the shorter arm) so it's flush with the back of the opening for the end vise, see Fig. 12.

Now measure the distance from the back end of the right arm to the back edge of the back apron (D). (It should be about ¼"). Then make sure the vise arm is the same distance from the back edge.

To position the base on the length of the table, line up the right arm 5⅝" from the end with the end vise, see Fig. 12. This should position the vise arm (at the other end) between the dog holes.

MARK THE POSITION. Now use a ½" brad point bit to mark through the hole in each arm into the bottom of the bench top.

MOUNTING BLOCK. Also, while the base is in position, I measured the distance from the bottom of the top slab to the top of the right arm, see Fig. 12. (My measurement was 1⅞".) Then I cut a mounting block (S) to fill this space.

Now drill a ½" hole through the center of the mounting block. (Note: To allow for expansion, I drilled ½" holes through the mounting block and the arms, but used 5/16" bolts to hold the top down to the base.)

THREADED INSERTS. Next, remove the base from the top and drill ⅝"-deep holes for threaded inserts, see Detail in Fig. 12.

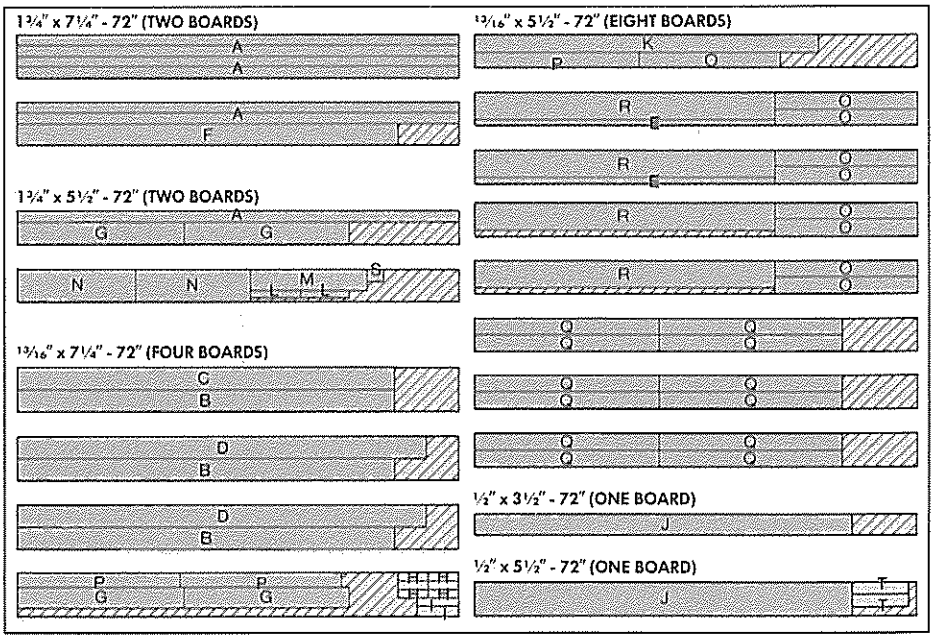
FINISH AND ASSEMBLY. After the inserts were in place, I finished the bench and base with two coats of tung oil. Then mount the top to the base with machine bolts.

MATERIALS LIST

Overall Dimensions: 29½" d x 65⅛" l x 34" h Working Surface: 18" d x 65⅛" l

A	Table Top Slab (1) (Build up from seven boards of 8/4 stock.)	1⅝ x 12¼ - 60
B	Dog Block Pieces (3)	13/16 x 3⅜ - 60 rough
C	Key Rail (1)	13/16 x 3½ - 60
D	Front/Back Aprons (2)	13/16 x 3½ - 65⅛
E	Fixed Keys (2)	¾ x ¾ - 46
F	Tool Tray Rail (1)	1¾ x 3½ - 60
G	End Caps (2) (Build up from 8/4 and 4/4 stock.)	2 7/16 x 3½ - 26
H	Bolt/Nut Blocks (6)	13/16 x 1 - 4½
I	Sliding Keys (2)	¾ x ¾ - 7
J	Tool Tray Bottom (1)	½ x 8 - 62 rough
K	Tool Holder (1)	13/16 x 2½ - 60
L	Tray End Blocks (2)	1¼ x 1¼ - 7 rough
M	Vise Spacer Block (1) (Resawn to 1" thick from 8/4 stock.)	1 x 3½ - 18
N	Front Vise Face Block (1) (Build up from two pieces of 8/4 stock.)	3½ x 5 - 18
O	Feet/Rt. Arm (3) (Build up from three pieces of 4/4 stock.)	2 7/16 x 2½ - 22½
P	Vise Arm (1) (Build up from three pieces of 4/4 stock.)	2 7/16 x 2½ - 25½
Q	Legs (4) (Build up from three pieces of 4/4 stock.)	2 7/16 x 2½ - 28½
R	Stretchers (2) (Build up from two pieces of 4/4 stock.)	1⅝ x 4½ - 48⅛
S	Mounting Block (1)	1¾ x 1⅞ - 2 7/16
T	Sawdust Door Cleats (2)	½ x 1½ - 8⅞

CUTTING DIAGRAM



Bench Dogs

CHOOSING THE RIGHT BREED

Although a bench dog looks like a simple square peg, it has a complex job. In addition to holding the workpiece down on the bench, it should hold its position (height) while you're getting the workpiece in place (when there's no pressure on the dog at all).

Also, when the dog isn't being used, it should drop just below the surface of the bench to be out of the way.

PEG PROBLEMS. But why go to all the trouble to make the angled square holes in the bench for square dogs? Why not just bore round holes and use dowels for dogs?

Dowels aren't suitable for several reasons. One of the problems is the holes. If the holes aren't bored all the way through the bench top, they fill with sawdust.

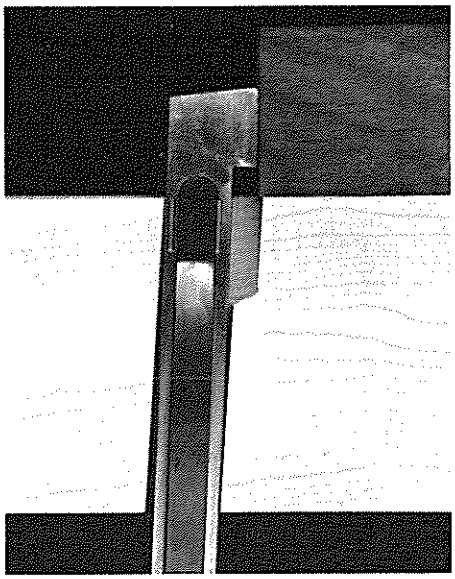
If they're bored all the way through, the pegs fall through. Putting a head on the peg stops it from dropping. But, this means having to find a place to put the peg when it's not being used because it can't be pushed below the surface of the bench.

NO BITE. But the biggest problem with dowel pegs is they can't get a good bite on the workpiece. This is because peg holes are usually bored perpendicular to the bench surface and a little oversized so the dowels won't bind. When pressure is applied, the dowels tip backward. So, instead of gripping the workpiece, they actually spit it up and out, see Fig. 1.

ANGLE HOLE. Angling the hole for the dowel would seem to help. Then when pressure is applied, the dowel would straighten up. But the round dowel doesn't provide much gripping surface and tends to spin, see Detail, Fig. 1.

SQUARE DOGS

Using square dogs solves the problems. They grip tightly, stay put, and slide down out of the way when not needed.



SMART ANGLE. The secret to getting a dog to grip is making sure the dog's head is angled at about 2° to 4° to the surface of the bench, see photo. This way, the dog actually forces the workpiece down onto the bench surface as pressure is applied.

To hold the dogs at this angle, I cut the dog holes in the bench at 4° — so they're angled toward the end vise of the bench. Then I angled the dog holes in the sliding block in the opposite direction.

TENSION SPRINGS. Another problem is getting the dog to stand up in the hole while you're getting the workpiece in position and tightening the vise. A tension spring solves this problem by pressing against the inside wall of the hole to hold the dog at whatever height is set.

Tension springs range from flat springs to bullet catches. To me the most sensible is a flat spring on the front of the dog.

WOODEN DOGS

Although the dog holes in the *Woodsmith* bench are designed for a set of steel dogs (see Sources, page 24), there are times when the steel makes me nervous about nicking a plane blade. So, I decided to make a pair of wooden dogs.

I especially like wooden dogs when working on thin stock. Then, if a plane blade or edge of a chisel runs into one, the dog won't take a bite out of the edge.

DOG BODY. To make the dogs, begin by ripping blanks from hardwood. (I used maple, as on the bench.) The thickness of the blanks should be about 1/16" less than the width of the hole (5/8" thick for our bench). The width of the blank is 1" — about 1/8" less than the length of the hole. These blanks are cut to 6" long, see Fig. 2.

DOG HEAD. The next step is forming the head on one end of the dog. To do this, begin by cutting a 3/8"-deep kerf across the front, 7/8" down from the top. Then use a bandsaw or handsaw to rip the waste piece from the front, see Step 1.

SPRING. To make the wooden spring, rip a strip 1/8" thick by 5/8" wide.

This strip is mounted to a chamfer that's planed on the dog's body, see Step 2. To make this angled surface, clamp the dog in a vise and rest a hand plane on it so its sole contacts the dog's head and end of the body, see Detail, Fig. 2. Then plane the end until the surface is about 2" long.

ATTACH SPRING. The last step is to attach the spring to the body. Apply glue and use No. 4 brass screws. If you want to be fancy, don't countersink the screws. Instead, let them stick out a little and file the screw heads flush until the screw slots disappear. (This makes them look like brass rivets instead of screws.)

FIGURE 1

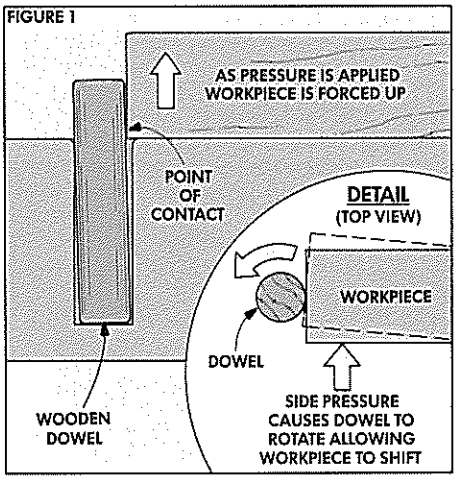
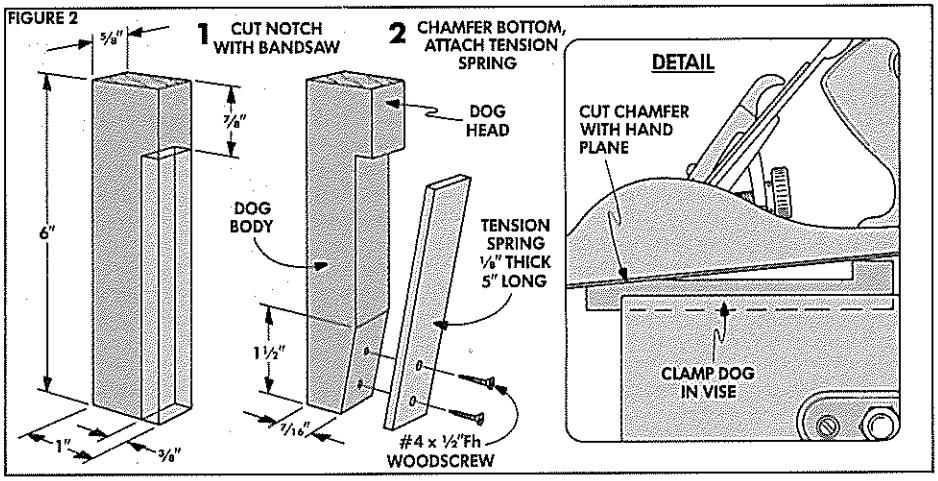


FIGURE 2



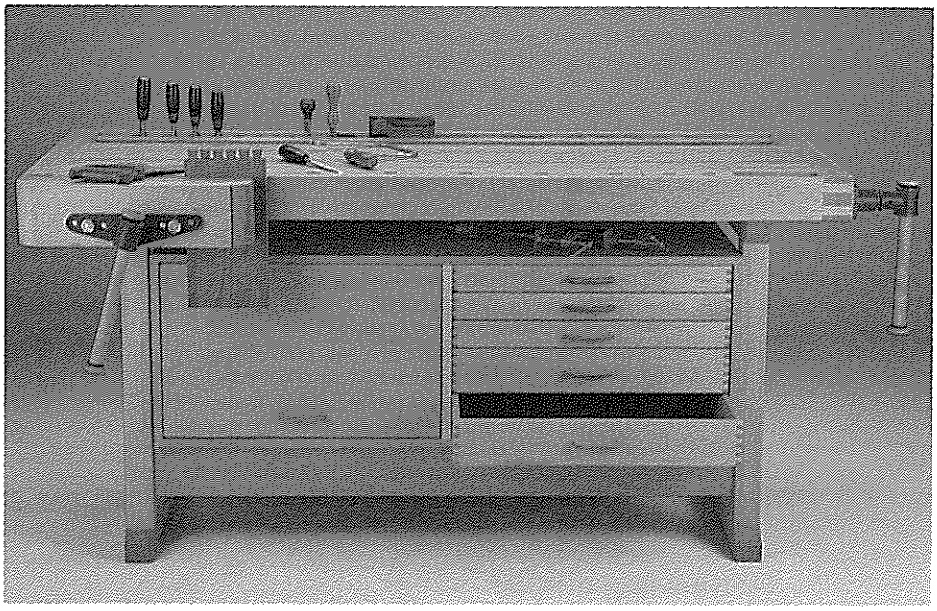
Workbench Cabinet

STORAGE PLUS STABILITY

While the last coat of tung oil was still drying on my new bench, I started building my first project on it: a tool storage cabinet to mount beneath the bench.

The under-bench cabinet actually serves two purposes. Of course, it keeps tools within reach and easy to put away. The other benefit is sort of a windfall. When the cabinet is stocked with tools, it adds weight and stability to the bench.

The cabinet is an open-front plywood box that's divided into two compartments. The left compartment is for storing bulky items like portable power tools. These are concealed behind a flipper door. The right compartment has five drawers for a large assortment of hand tools.



CUT STOCK TO SIZE

To build the cabinet, start by cutting all the plywood pieces to size, see Fig. 1. The top/bottom (A) and back (B) are cut to 46½"-long. (When edging strips are added later, the length of the cabinet will be ⅛" less than the distance between the legs of the bench.)

Note: The divider (D) is cut to the same size as the cabinet sides (C) to begin with to make it easier to match the spacing of the dadoes for the drawer guides. Then later, special "keys" are added to the edges of the divider to make up for the difference in dimensions, see Fig. 1.

EDGING STRIPS. Next, edging strips (F,G,H) are ripped from 4/4 stock. These strips conceal the edges of the plywood and are also part of the method of joining the corners of the cabinet, refer to Fig. 5.

To begin, cut these strips about 1/16" wider than the thickness of the plywood. (The strips are planed flush *after* they're joined to the plywood.) Then cut the strips to rough length — about 1" longer than the length of the plywood edge they'll be joined to later.

GROOVES IN PLYWOOD. After the strips are cut to size, grooves are routed in all four edges of all the plywood pieces (except the divider) for ⅛" Masonite splines. (The splines align the edging strips with the plywood.) To cut these grooves, I used a ⅛" slot cutter on the router table, see Fig. 3.

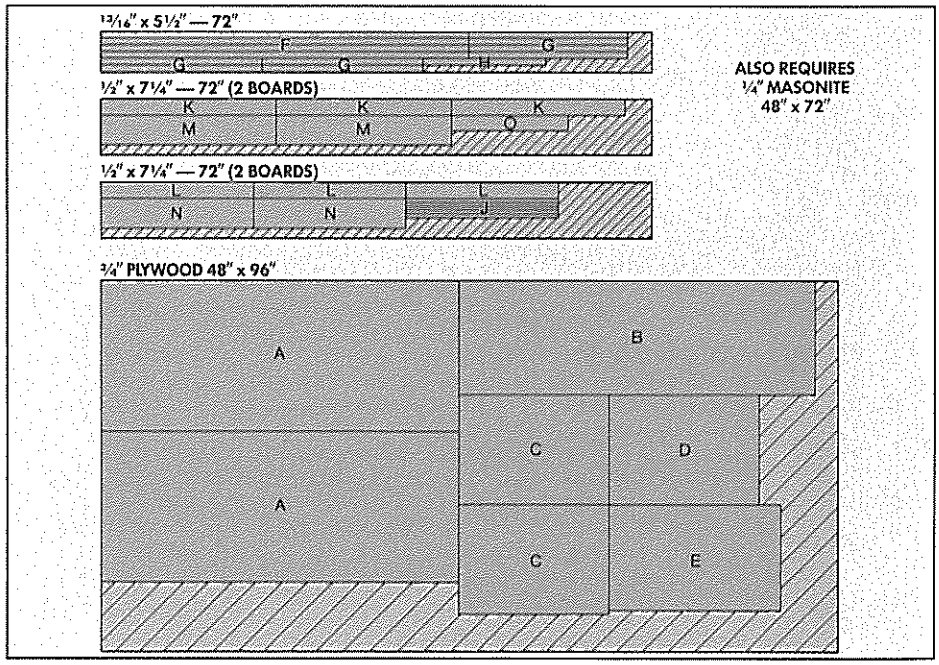
GROOVES FOR EDGING. The next step is making matching grooves in the edging strips, see Fig. 2. (All edging strips, except those on the front of the cabinet, are grooved on two sides.)

MATERIALS LIST

Overall Dimensions: 16⅛" h x 48" w x 21" d

	¾ Plywood	
A	Top/Bottom (2)	19½ x 46½
B	Back (1)	14⅝ x 46½
C	Sides (2)	14⅝ x 19½
D	Divider (1)	14⅝ x 19½
E	Door (1)	13 15/16 x 22⅜
	4/4 Hardwood	
F	Top/Bottom Edging (4)	13/16 x 13/16 - 48⅛
G	Side Edging (8)	13/16 x 13/16 - 21⅛
H	Divider Edging Strip (1)	13/16 x 13/16 - 16
I	Divider Keys (3)	¼ x ¾ - 21
	½" Hardwood	
J	Drawer Runners (10)	⅜ x ½ - 19½
K	Sm Drw Front/Back (6)	½ x 2¼ - 22¾
L	Sm Drw Sides (6)	½ x 2¼ - 19¾
M	Lrg Drw Front/Back (4)	½ x 3¾ - 22¾
N	Lrg Drw Sides (4)	½ x 3¾ - 19¾
O	Cleats (2)	½ x 2 - 15¼
	¼" Masonite	
P	Drawer Bottoms (5)	Cut To Fit

CUTTING DIAGRAM



DADOES

Before the cabinet can be joined together, three different widths of dadoes are cut in the plywood pieces.

Shop Note: It's important to cut the dadoes in the plywood *after* cutting the spline grooves. If the dadoes are cut first, the plywood will begin to warp and make it impossible to keep the spline grooves parallel to the plywood edge.

DIVIDER DADO. The first dadoes to make are used to join the center divider to the top and bottom, see Fig. 1. These are ¾" wide by ¼" deep, centered on the top, back, and bottom panels.

GLIDE PIN DADO. The next dadoes are channels for the ¼" dowels (glide pins) that are part of the flipper door assembly. These dadoes are ¼" wide and positioned ⅜" down from the top inside edges of the divider and left side panel, see Fig. 4.

DRAWER DADOES. And finally, cut five pairs of dadoes ⅜"-wide by ¼"- deep for the drawer runners on the right side panel and divider, see Fig 4.

DRAWER GUIDES. When the dadoes are finished, rip ten drawer guides to ⅜" x ½" to fit in the dadoes and glue them in place before the plywood panel begins to warp, see Cross Section in Fig. 5.

APPLY EDGING STRIPS

Now the edging strips can be applied to the edges of the plywood panels.

CUT SPLINES. Begin by ripping ⅛" Masonite splines 7/16" wide. (This is 1/16" less than the combined depth of the grooves to provide glue relief.)

Then cut all the splines to length so they're ½" *less* than the length of the plywood edge they'll be joined to. (This is to allow ¼" at each end so the splines won't interfere with one another at the corners during gluing.)

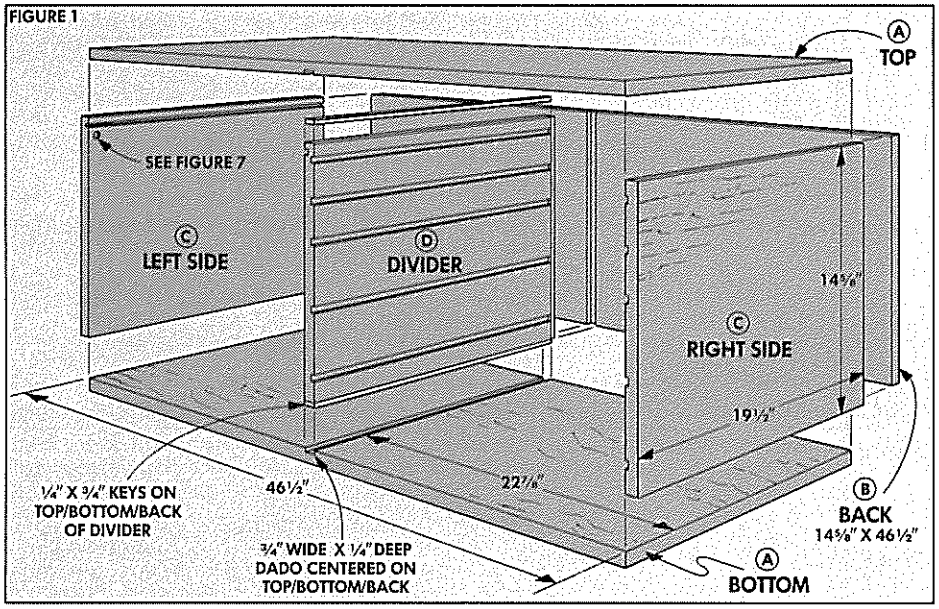
SIDE PANEL STRIPS. After cutting all the splines, I mounted the edging strips to the side panels first, see Fig. 5. Miter all the edging strips to length to fit around the plywood. Next dry-fit the strips to check the accuracy of the corners. Then apply glue and clamp the edging strips on.

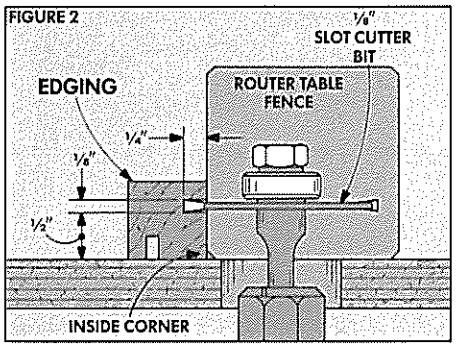
TOP AND BOTTOM. The front and back edges of the top and bottom panels are next. Glue the edging strips to the plywood (with the splines in place). Then saw the ends flush with the ends of the plywood.

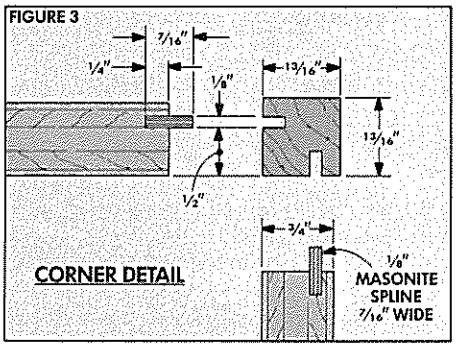
DIVIDER KEYS. There's one more step before the cabinet can be assembled. Keys are needed to fasten the divider into the top, bottom, and back panels.

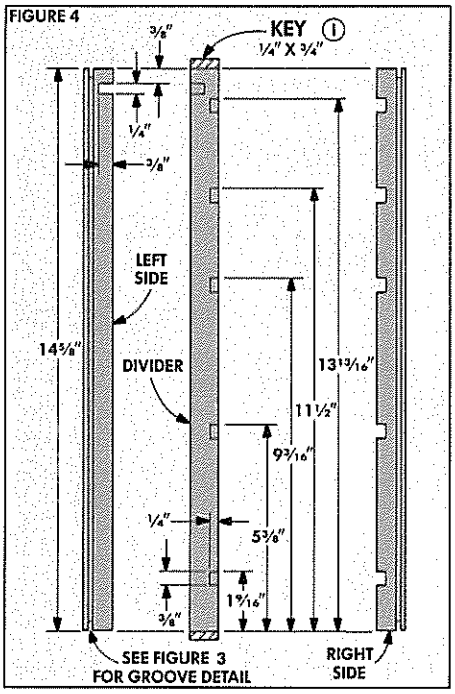
To make these keys, rip strips to the exact width and depth of the dadoes for the divider, see Fig. 1. Then, glue them to the top, bottom, and back edges of the divider.

With all the edging strips in place the cabinet is ready to dry-assemble to fit the compartment door.









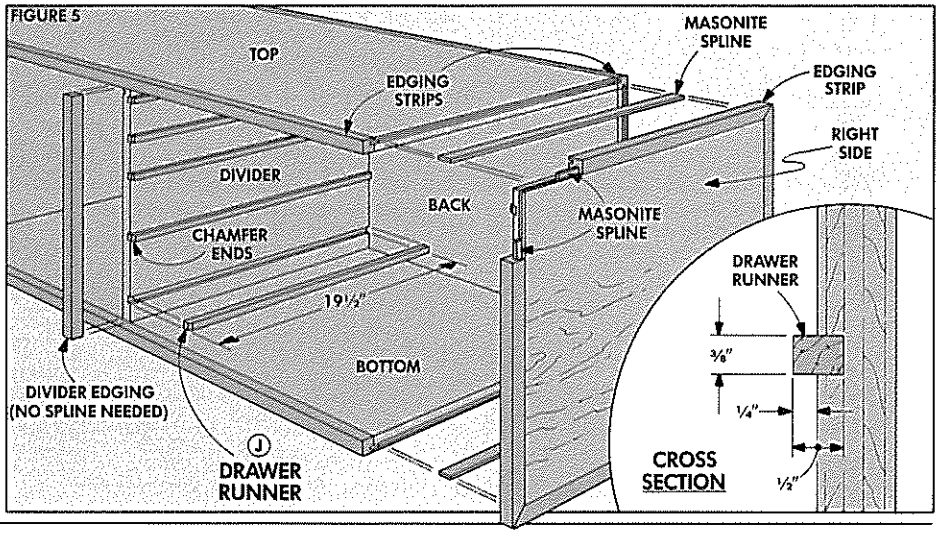


FIGURE 6

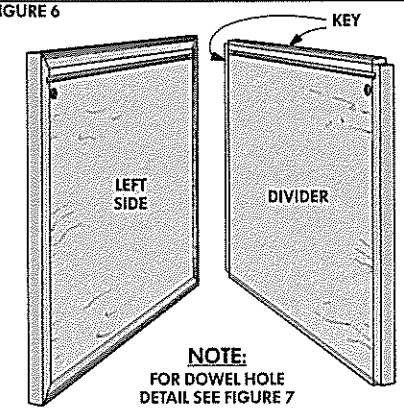


FIGURE 7

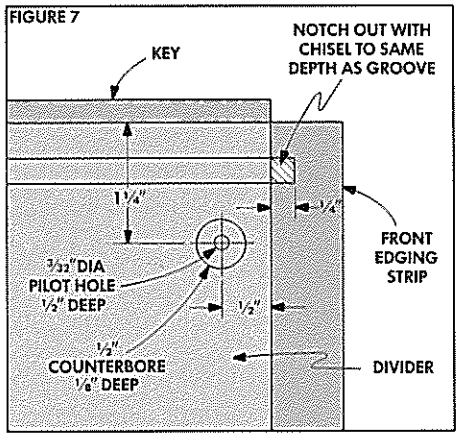


FIGURE 8

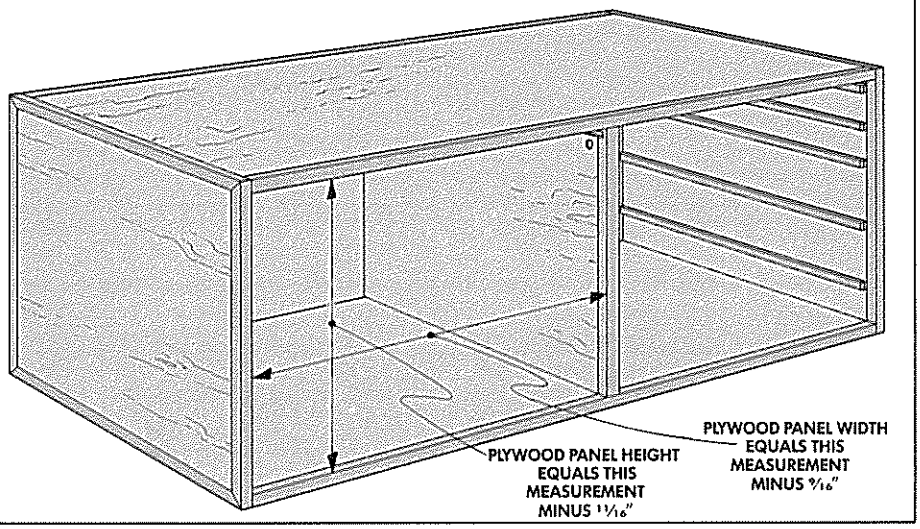


FIGURE 9

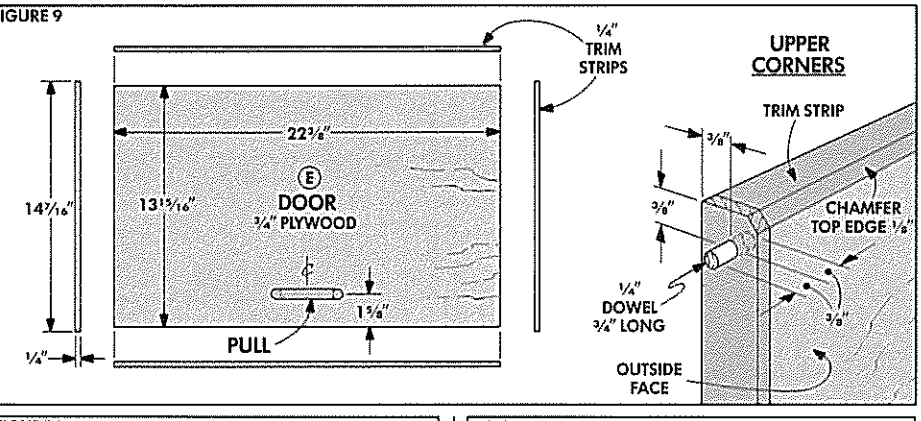


FIGURE 10

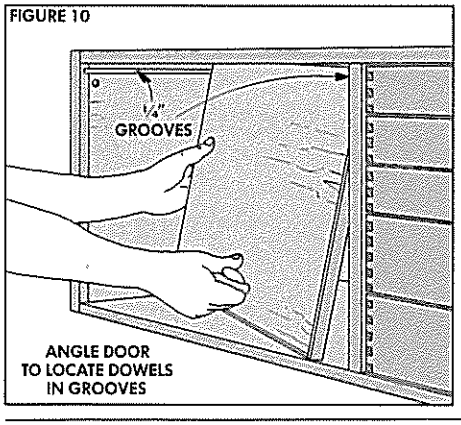
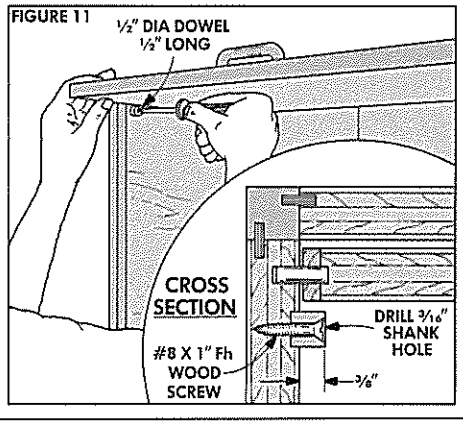


FIGURE 11



SUPPORT DOWELS

Before the cabinet can be glued together, the left side and the divider have to be prepared for installing the door.

SUPPORT DOWEL HOLES. The first step is to locate holes for the ½" dowels that hold the door up when it's open. Measure 1¼" down and ½" in from the edges of the plywood (not the edging strips), see Fig. 7.

Then bore a ½" hole ⅛" deep for the end of the support dowel. Also, drill a 5/32" pilot hole (in the bottom of the ½" hole) for the screw that will hold the dowel in place, refer to Fig. 11.

EXTEND GROOVES. The door actually hangs on two glide pins (¼" dowels) that slide in the grooves that were already routed on the inside top edges of the panels. These grooves have to be extended into the front edging strip by notching out a small section with a chisel, see Fig. 7.

ASSEMBLE CASE. Now the cabinet can be assembled by joining the corners with the edging strips and splines. (A detail of this corner is shown in Fig. 3.)

DOOR

After the cabinet is assembled, measure the opening to get the dimensions needed to make the door, see Fig. 8. For the door to swing freely, allow for a ⅛" gap at the top, a 1/16" gap at the bottom, and a 1/32" gap on both sides. Then, subtract an additional ½" from the width and height for the ¼"-thick trim strips that will be on the edges of the door.

TRIM STRIPS. After cutting the plywood door to size, rip ¼"-thick trim strips and glue them onto the edges, see Fig. 9.

GLIDE PINS. The door rides on glide pins that slide in the routed grooves. These pins are ¼" dowels mounted in the side edges of the door near the top, see Fig. 9. The holes for these pins are positioned to allow ⅛" clearance at the top of the door. To do this, measure ⅜" down from the top and ⅜" in from the back. Then bore holes ⅜" deep and insert ¾"-long dowels. (Don't glue the dowels — they might have to be removed if the door needs trimming.)

INSTALL DOOR. To hang the door, begin by chamfering off the front upper corner, see Fig. 9. Then install the door pull.

While holding the door in the compartment at an angle (see Fig. 10), align the glide pins with the grooves and twist the door parallel with the front of the cabinet.

SUPPORT DOWELS. The last step in installing the door is putting in the dowels that hold it horizontal when it's open, see Fig. 11. Begin by cutting two ½" dowels ½" long. Next drill a shank hole through the center. Then swing the door up and screw the dowels in place.

Note: Don't glue the support dowels in the holes. The idea is to make them removable so the door can be taken out if the glide pins need replacement.

DRAWERS

After the door is installed, the five drawers can be made. I decided to use box joints to assemble the drawers and started by cutting the pieces to size from ½" stock.

Note: The box joints have ⅜"-wide fingers and slots. The drawer dimensions are multiples of ⅜" so there's a full finger and slot at the top and bottom of each drawer.

RIP TO WIDTH. Before cutting the stock to final width, make practice cuts on oversized pieces. The idea is to get tight-fitting joints, spaced so the small drawers have three full fingers and slots, and the large drawers have five. (For procedures on making box joints, see *Woodsmith* issues No. 35 and No. 42.)

CUT TO LENGTH. After the joints are laid out, rip the pieces (K,L,M,N) to width. Then cut them to length so the front/back pieces are ⅛" (1/16" on each side) less than the width of the opening, see Fig. 12.

GROOVES. Next, two sets of grooves are needed. The most critical part of positioning these grooves is making sure they remain invisible from the front when the box joints are assembled.

RUNNER GROOVES. Start by cutting ⅜"-wide grooves on the outside of the drawer's side pieces to fit over the drawer runners. To position these grooves, align the drawer side with the dado blade so the blade exactly lines up with the second slot from the bottom, see Fig. 13.

Then slide the fence against the drawer side and cut the dado. When the drawer is assembled, the box joint finger on the drawer front will conceal the groove.

BOTTOM GROOVE. The second set of grooves are ¼"-wide grooves on the inside of all pieces for the ¼" Masonite drawer bottom. To make sure these grooves are not visible from the front, align the dado blade with the bottom edge of the bottom slot, see Fig. 13. This way the groove in the front pieces will be through a finger that's only visible from the side, see Fig. 14.

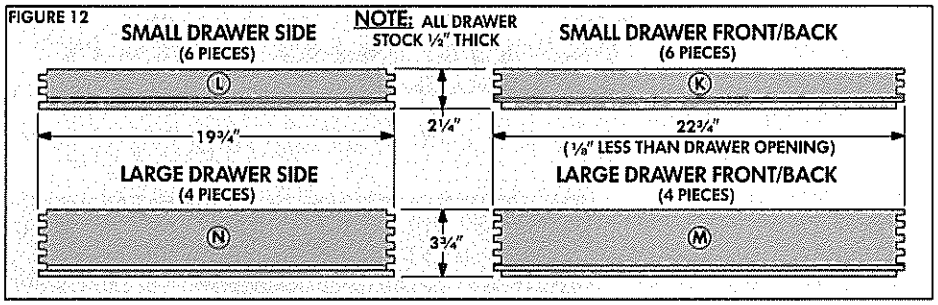
ASSEMBLY. After cutting the grooves, the drawers can be assembled. To make sure the box joints were clamped tightly, I used finger blocks, see Detail in Fig. 15.

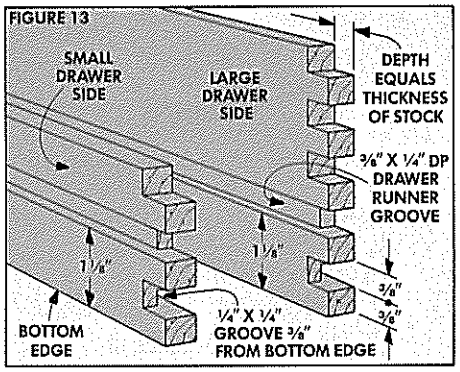
GROOVE CLEANUP. Before the drawers can be mounted to the cabinet, there are two groove cleanup operations. First, chisel out the finger that blocks the rear of the runner groove, see Fig. 14.

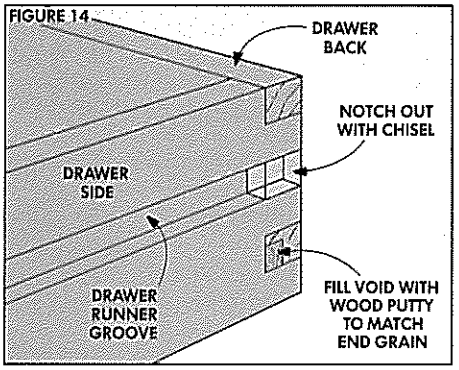
Next, fill the void in the sides (created by the bottom groove) with wood putty that matches the end grain color. Then mount the drawers in the cabinet.

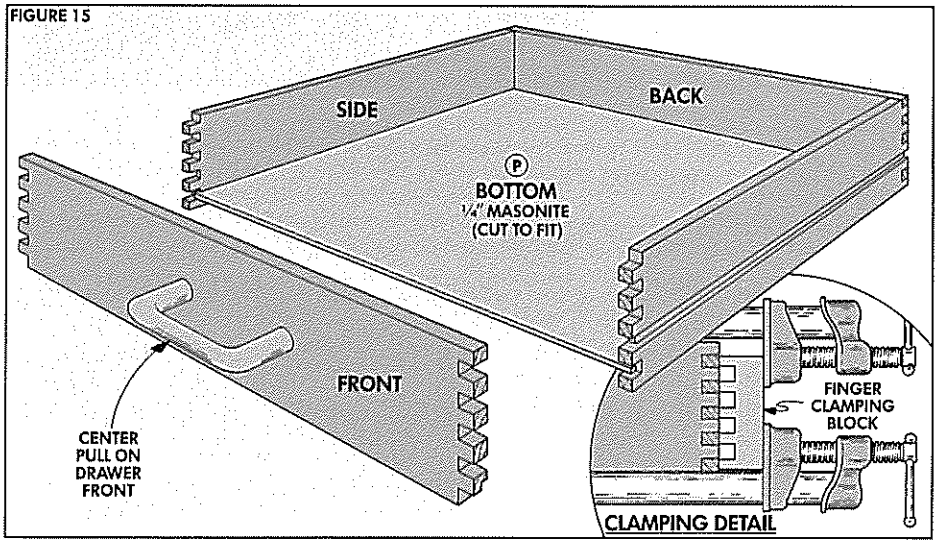
CLEATS. The last step before mounting the cabinet on the bench is mounting two cleats to the bottom of the cabinet to prevent it from sliding off the stretchers, see Fig. 17.

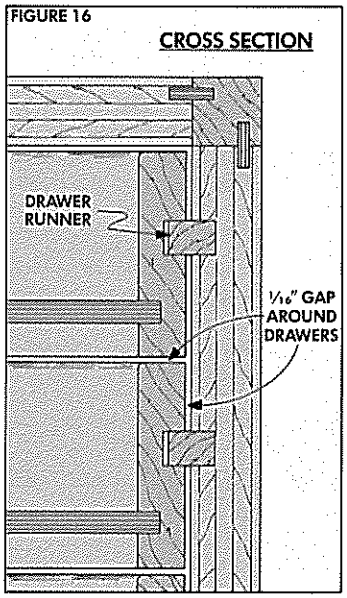
FINISH. As on the bench, I finished the cabinet with two coats of tung oil.

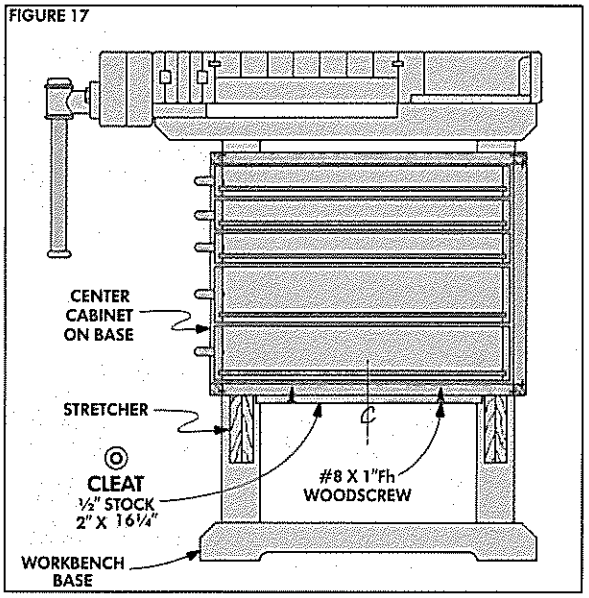






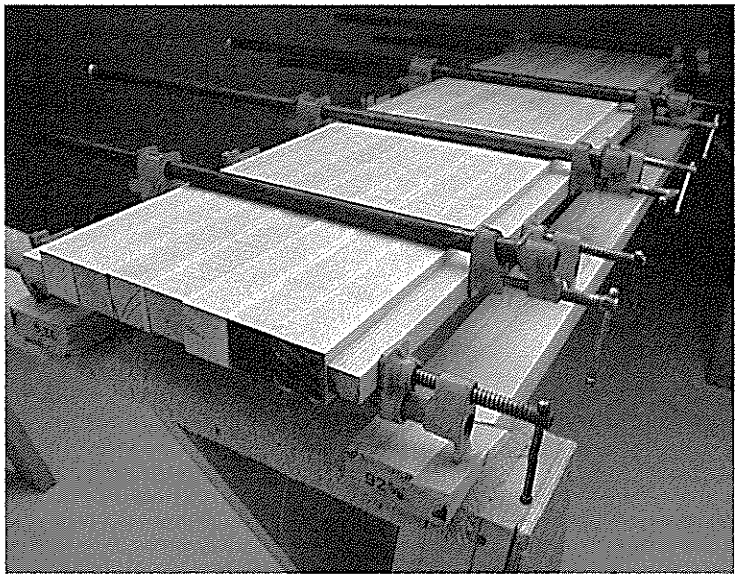






Building the Slab

STEP-BY-STEP TO A FLAT WORK SURFACE



For the past twenty years "butcher block" has been one of the most popular furniture styles available. The problem in building butcher block furniture (or the butcher-block slab top for the workbench in this issue) is getting the slab perfectly flat across its width and down its length. In a factory this is easy — it's glued up in a gluing jig and then sanded flat on a wide-belt production surface sander.

In a home shop it's another story, but it can be done. You need a little patience, a number of clamps, and a hand-held belt sander. (I didn't use a hand plane to flatten the slab — more on this later.) By taking your time, the bench top can be made as flat and smooth as though it came from a factory in the Black Forest.

RIPPING THE STRIPS

To build the workbench top, I started by ripping 1⅝"-wide strips from 8/4 stock (1¾" actual thickness) to a length that was about a foot longer (6 feet) than what was needed. (Note: Cut the pieces long to allow for any end checks, imperfections, or planer snipes in the stock.) Since the main part of the workbench is 12¼" wide, I ripped seven boards, see Fig. 1.

POSITIONING THE BOARDS

Before gluing up the boards to form a solid butcher block slab, there's a number of things to consider — especially when positioning the individual boards.

MATCHING PLANED SURFACES. After ripping, two surfaces of each board remain planed smooth and two will have sawblade marks. To create the best joint for gluing, flip the boards so the planed surfaces are against each other, see Fig. 1.

There's another reason for flipping the boards. Generally, butcher block slabs have the edge grain facing up. If the edge grain faces up, there's less shrinkage and movement across the width of the slab with changes in humidity.

WHICH SIDE UP? Now, take a close look at each board and decide which of the sawn surfaces should face *up*. For the best appearance, choose the surface to face up that has the straightest grain, the least chipout (created on the bottom edge when sawing), and fewest imperfections.

CHECK FOR BOW. After ripping, the pieces will usually have a slight bow over their length. Sight down the length of each board and pick out the two straightest boards. Set these two aside for the outside edges of the benchtop.

Next, line up the remaining pieces so the bow in one board opposes the bow in another when viewed from the *top*, see Fig. 2. Once they're glued up, the forces will neutralize one another and help keep the entire top straight.

Now, look at each piece from the *end* for any warp up and down — called crown or crook. Once again, place the pieces so the crown on one faces up and the one next to it crowns (sags) down.

Note: If the boards have a severe crown, you may want to consider using splines to keep the boards aligned, see the Box on the next page.

A PROBLEM. Okay, I know, there's a problem. You can't get every piece where it's supposed to be. When you put all the opposing bows together, the crowns won't oppose each other. Or there's some chipout or a knot right in the middle of the top.

It turns into a puzzle, usually without a perfect solution. You have to find a solution that has the *most* desirable features. Once you find the solution that seems the best, mark the top with a carpenter's triangle so the whole assembly can be put back into order later.

CLAMPING

Once the position of all the pieces in the slab is determined, the clamps can be laid out. (Note: Now is the time to go out and beg, borrow, or rent enough clamps to do the job. I used nine pipe clamps to glue up the slab for the workbench.)

SIGHTING. To produce a flat slab, the most important step is "sighting" the clamps. Start by finding the flatest surface available to clamp on. This might be a large table, a flat section of floor in the shop, or a couple sawhorses, see Fig. 3. Now lay down two *flat* 8'-long 2x4's side by side about a foot apart. (I call these base boards.) Then lay down two pipe (or bar) clamps across the base boards to accept the ends of the workpieces.

FIGURE 1

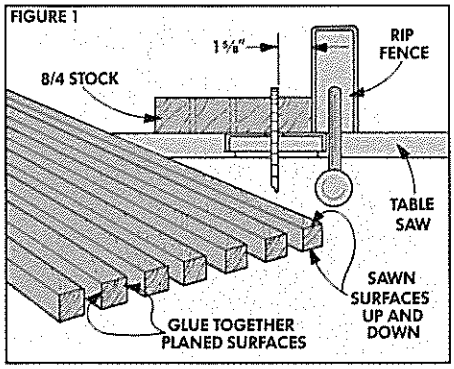


FIGURE 2

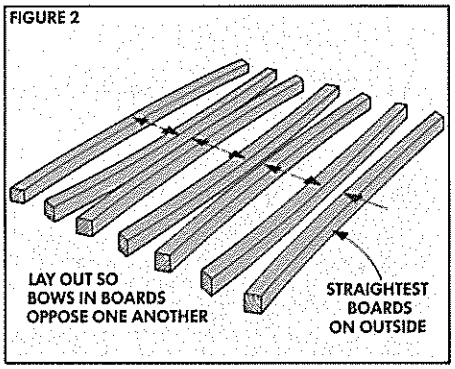
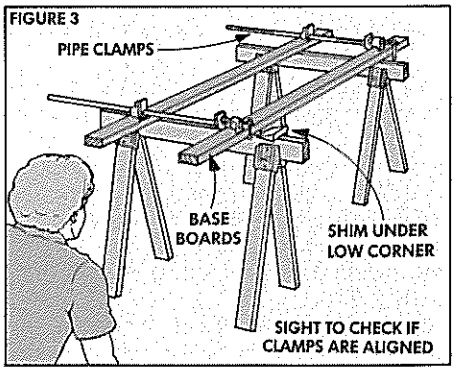


FIGURE 3



Before placing the pieces to be glued onto the clamps, stand back about five feet, get down until your eyes are even with the top of the clamps, and look for any twist from one clamp to the other, see Fig. 3. (This is "sighting" the clamps.) Both clamps should be aligned with each other. If they're not, shim under the base board at the low corner until the clamps are aligned.

POSITIONING THE CLAMPS. After the two end clamps are aligned, place more pipe clamps across the base boards about every 16". Then set the workpieces into position on top of the clamps. Now place more pipe clamps on *top* of the workpieces, so they're in-between the ones on the bottom. (This puts pressure about every 8".)

Shop Note: Putting wax paper between the wood and the pipes (or bars) helps prevent black marks from appearing when the metal in the clamps reacts with the acid in the wood and the water in the glue.

CLAMPING BLOCK. To keep even pressure on the assembly and to protect the outside edges from being dented, I placed ¾"-wide, 6'-long clamping blocks centered on the outside edges of the assembly, see photo. The clamping blocks keep the pressure centered on the thickness of the slab.

Shop Note: Keeping a clamping block centered on each edge is just one more thing to worry about when clamping up. (You have your hands full as it is.) To keep the blocks in position, I stick them to the edge boards with double-sided carpet tape.

GLUING

It's a good idea to go through all this clamping procedure in a dry test assembly before actually applying the glue. It helps you see where problems might arise and make sure all the opposing warped boards can be pulled together tight. But it doesn't help tell how much the pieces will "slide" once the slippery glue is applied. You can only do that by gluing it up.

REMOVE THE CLAMPS. After test clamping, remove all the clamps except the pipe clamps on the bottom. Keep the rest within an arm's reach and tightened down close to their final position.

GLUE ROLLER. To glue up the workbench slab, I used yellow woodworker's glue (Titebond) in a glue roller bottle, see Sources, page 24. You could also use a small paint roller. Either lets you get a quick, uniform film of glue.

TAKE A MINUTE. Once everything is ready to glue up, sit back, take a deep breath, and spend a couple minutes to double check everything. Are the clamps close at hand? Do I have a mallet or hammer for "adjustments?" Is there enough glue in the bottle? And most important of all, who is going to answer the phone for the next half hour?

SPREADING THE GLUE. Once all these questions are answered to my satisfaction, I tip up all the pieces on their sides so the gluing surfaces are exposed. Because of the time involved in spreading the glue and clamping up the assembly, it's easy to get a dry joint. For that reason, be generous with the glue and don't worry so much about squeeze out. I usually apply a thick uniform coat to one side only. It should be thick enough so the wood isn't visible.

As long as the wood is open, the glue won't dry very fast. But once you tip the pieces into position and pull them together, drying begins. (It's always a good idea to have a friend around at this stage to help prevent panic.)

TIGHTENING THE CLAMPS. After the pieces are in position, start tightening the clamps. Don't overtighten. The clamps should be tight enough so there's a uniform "squeeze-out" along the joints, but you should be able to loosen the clamp with one hand. If you can't, you're tightening too much which can "starve" the joint or crush the wood cells to the point where they won't swell back out.

There's one last step. Check to be sure that all the pieces are seated down against the bottom row of clamps. If they're not down flat, all the original "sighting" was wasted. To get all the pieces down flat, place a wood block on top of any high points and pound them down with a hammer.

REMOVING EXCESS GLUE

Once the slab dries overnight, remove all the clamps. I usually scrape off the beads of dried glue with a paint scraper. But on the workbench slab I changed my procedure.

Since the workbench slab was made of hard maple, and maple tends to chip, I was afraid that if I hooked the scraper on a bead of glue it might pull out a small fiber or chip with it. Instead, I started by paring off any large beads with a sharp chisel. Then I attacked the rest with a belt sander.

I keep old 80 grit belts around just for this purpose. (The glue gums up a belt.) To remove the glue, sand *across* the grain, working just down to the wood on the joints. (Don't sand to the edges of the slab.)

SPLINES ...*when and how?*

Should you use splines when building up a slab? Sometimes I do, but not for strength. (If the boards are joined and glued properly, splines won't add any strength.) I include them when the pieces are so badly crowned (up and down) that splines force the pieces into alignment when they're clamped.

THE SLOTS. To add splines, start by routing slots in all the matching surfaces with a ¼" slot cutter. (Be careful not to slot the two outside faces.)

Shop Note: Don't cut the slots with a table saw or on a router table. A hand held router will follow any of the contours of the boards and keep the slot a *uniform* distance from the top edge, see drawing below.

THE SPLINES. For splines I use ⅛" Masonite or rip hardwood strips ¼" thick. They should fit tightly in the slots, but not so tight that you can't easily slide them in and out. (It's best to cut them to fit, and then if they're too tight, sand or plane off any thick spots.)

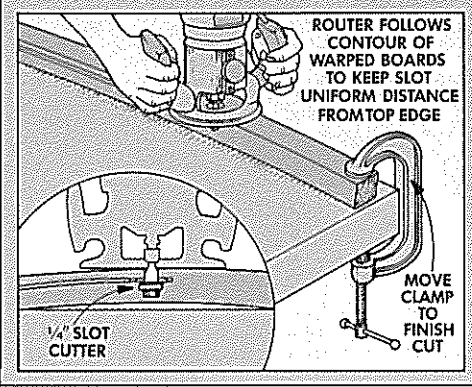
As for width, cut the splines about ⅛" less than the combined depth of the slots.

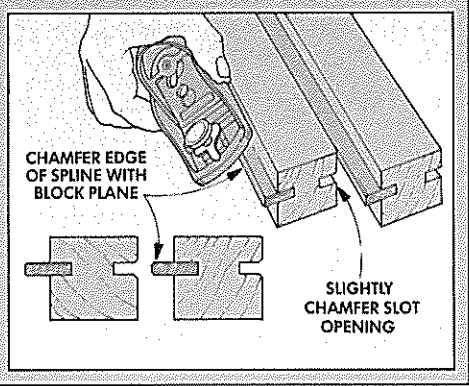
ASSEMBLY. To assemble the slab with splines, I start by tack gluing (apply spots of glue) in the slots on *one* side of each piece. Then slide a spline into each piece. After all the boards have a spline in one side, dry-clamp the boards to find out how they all fit together.

If the splines are cut for a tight fit, the spline in the first board might not fit easily into the slot in the second board. To help guide the spline into place, I slightly chamfer the edge of the spline with a block plane, see drawing below. I also slightly chamfer the opening of the slots.

When it checks out, glue up the boards. It's only necessary to add a uniform layer of glue to the edge of the pieces with the slots. Don't try to get glue down in all the slots or cover all the splines. Once the glue is uniformly spread on all of the pieces, clamp them together.

Although the splines won't keep the top and bottom *perfectly* flat (there's still some sanding required), they will keep the edges of warped boards closer in line.





SANDING THE SURFACE FLAT

Now the real work begins — making the surface flat and true. Traditionally, this would be a job for a plane. And if the slab were made of oak, I'd consider it. But not hard maple. The grain switches directions a couple times over the length of each board, and somewhere along the way, the plane is likely to start lifting chips.

BELT SANDER. Instead, I reach for my belt sander. Something should be said here about belt sanders. I don't think there's a tool in the shop that can destroy a project quicker. Out of control, a belt sander can bite, grab, and gouge wood like a shark in a feeding frenzy. The trick is keeping it under control.

Most of the time when I work with a belt sander I'm consciously thinking about holding it back as it's cutting. It's like a router without a base — it just keeps digging in if it's not held back. Most belt sanders are heavy; they don't need any more downward pressure than the weight of the sander itself. Use your hands and arms only to hold it back and guide it — not to press down. The feeling is to *pull back* on the sander, not push down.

There's one other thing I've noticed about belt sanders. Whenever I use one it wants to dig in on the left side. I think that's because I'm right handed. My right hand naturally wants to twist to the left. At the same time my left hand rests on the front knob with the weight of my left arm on the left side of the sander. All of this makes the sander dig in on the left. So I consciously put subtle pressure on the right hand side of the front knob.

SAND ACROSS THE GRAIN. Most books warn to *never* sand across the grain. But that's exactly what I do when I start leveling off a slab like the bench top. There's a number of reasons to start by sanding across the grain.

First, a belt sander will generally cut faster across the grain than with the grain. Since the slab requires a great deal of sanding to get it flat, sanding in both directions (first across, then with the grain) lessens the chance of deep gouges that come from sanding in one direction.

Also, since the sanding pad is only three or four inches wide, it will only ride on one or two of the boards when sanding with the grain. The sander tends to ride on the top of the high boards and then fall off and gouge the low ones. By first sanding across the grain, and then finishing with the grain, you end up with a flatter surface.

To start sanding, load a fresh 80 grit belt on the sander. Then sand perpendicular (90°) to the glue lines (across the grain). When rough sanding, work in an elliptical pattern and never make a total sideways movement, see Fig. 4. Always move the sander forward (or backward) *and* slightly sideways at the same time.

I start at the extreme right hand end of the slab and work to the left so I can see what I've just completed. Concentrate on an area of about one square foot and try to remove all the ridges in that area. Don't oversand. As soon as the ridges are gone, move on to the next area to the left.

STAY AWAY FROM EDGES. The biggest problem is sanding the outside edges. If they're not kept sharp and straight, the slab won't appear to have a uniform thickness. And if you allow the pad of the belt sander to work all the way out to the edges, the edges are likely to taper off or even round over.

I try to stop my sanding strokes about ½" from each edge unless it's necessary to remove a ridge. The problem is determining where the pad of the sander stops, see Fig. 5. That comes with practice, or by using reference points on the sander.

On my Sears belt sander, for example, I've determined that if I sand forward until the back of the front knob is directly over the far edge of the workpiece, the front of the sanding pad will be about ½" from the edge. On the back stroke, the center (axle) of the back wheel should be directly over the back edge if I want to stop sanding ½" from the edge.

SANDING WITH THE GRAIN. Once all the sharp ridges are removed by sanding across the grain, switch and sand with the grain using the 80 grit belt. When sanding with the grain, work slightly larger areas, but only as far as your arms will move. Never try to walk alongside the workpiece and sand.

The basic movement of the sander with the grain is a little different than the elliptical pattern followed when sanding across the grain. It's more of an up and back movement. Keep the sander parallel to the glue lines (and the edges of the slab) but move the sander up and back at a slight angle — like making a long, tall "W" shape, see Fig. 6. (Note: Still keep ½" away from the edges.)

Continue sanding with the 80 grit sanding belt, but the goal now is to eliminate all of the cross grain scratches. Watch carefully what you've just completed and once all the cross grain scratches are gone, stop sanding. That area of the table is flat. If there's a slight low spot in the middle where the cross grain scratches are still visible, continue to work the area around the scratches and stop as soon as the scratches disappear.

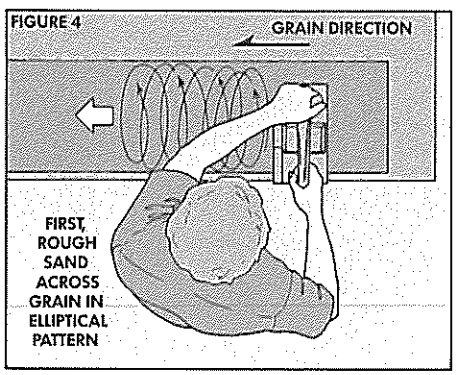
FINAL SMOOTHING. Once the top is flat, switch to a 120 grit sanding belt and continue working with the grain. (Don't go back across the grain again.) Follow the same basic tall "W" pattern as before. The goal now is to remove all of the scratches left by the 80 grit belt and leave fine scratches that can be removed with a pad sander (with 150 grit paper) or hand sanding with a block.

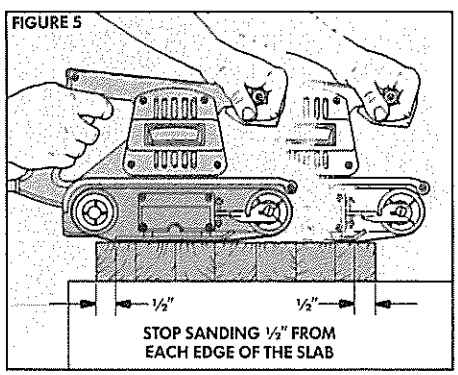
SANDING THE BOTTOM FACE. How about sanding the bottom face of the slab? Unless it's exposed, it's probably not worth it. I usually just remove the glue and then sand across the grain until it's fairly flat. (Note: It's a good idea, though, to apply finish to the bottom face to slow down any moisture imbalances in the slab caused by changes in relative humidity.)

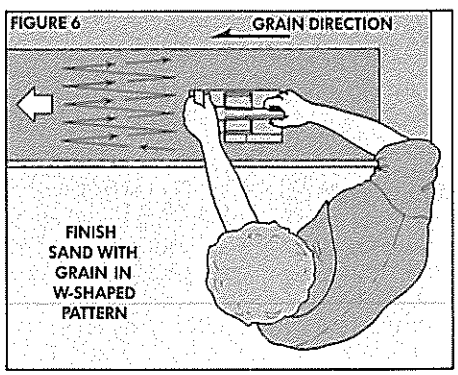
CONCLUSION

In thinking back about this whole procedure, I've come to the conclusion that the most important step is probably the first — start with a good flat surface.

It's critical that the clamps are down on a flat surface and all the pieces are seated down flat on the clamps when gluing. Once the slab is dry and the clamps are removed, there shouldn't be more than 1/16" offset between pieces that needs to be sanded down. If the offset is any more than that, by the time it's sanded down the slab won't be flat. And who wants a workbench that looks like a rolling farm field?







Talking Shop

AN OPEN FORUM FOR COMMENTS AND QUESTIONS

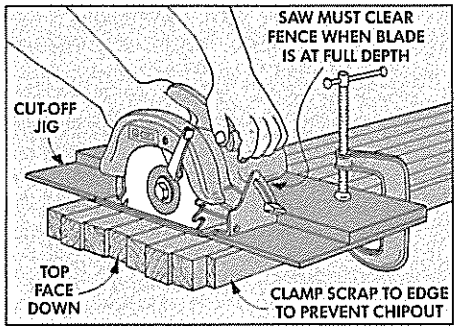
CUTTING THE SLAB TO LENGTH

After the slab for the workbench was glued up and flat (see article on the previous page), the next step was to cut it to length. At this point, it was so long and heavy that it was awkward to work with.

There was no way I would ever be able to cut it on the table saw, even with a panel cutting jig. And my radial arm saw's cross-cutting capacity was just a little shy of cutting all the way across without cutting from both directions.

PORTABLE CIRCULAR SAW. That left the portable circular saw. To be honest, my circular saw and I have never gotten along very well when working on finish work. The saw does a good job when rough cutting plywood and chopping off 2x4's. But any time I try to make a straight cut in something like thick, hard maple, there are problems.

Even with a carbide-tipped sawblade, the cut makes rough, heavy saw marks and burns. And the exposed shoulder isn't a nice clean, straight line.



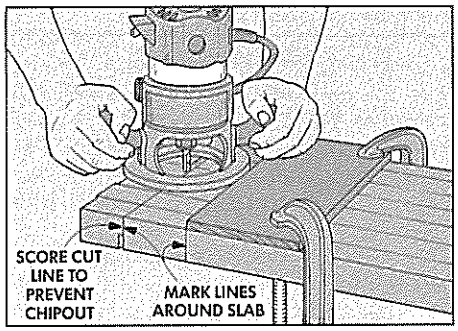
If you glued up the slab a foot longer than necessary, you will have some extra material to *try* a portable circular saw to see if you can get a straight, smooth cut. To do this, first turn the slab so the good surface (the top) faces *down*. This minimizes chipout on the face side since a circular saw cuts up from the bottom.

Now clamp a fence (or circular saw cut-off jig as shown in the drawing above) to the workpiece (90° to the edges) for the shoe of the saw to run along. Set up the cut so the heaviest (motor) part of the saw is on the workpiece instead of on the waste. (Note: This is the left side on most saws, the right side on a few others.)

Shop Note: To prevent chipout at the end of the cut, clamp an additional piece of scrap to the far edge of the slab.

When making the cut, think about pushing the saw all the way through. Don't slow down or the cut will burn and create heavy swirl sawmarks. Keep feeding the saw as fast as it will cut without bogging down.

ROUTER. Another way to cut the slab to length is with a router and a straight bit. It's a little more time consuming, but will give a smooth end with a clean shoulder.



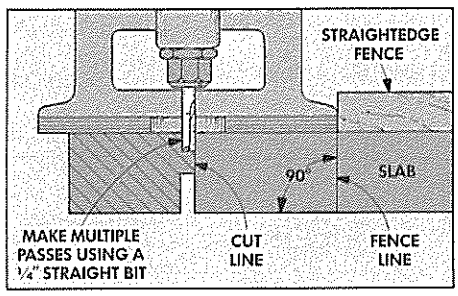
Note: You can cut the slab slightly (⅛") oversize first with a circular saw, and then come back and trim it with a router, but I didn't find that necessary.

To make the cut with a router, start by laying out a cut line and a fence line, see drawing. (The distance between the cut line and the fence line is equal to the distance from the outside of the bit to the outside of the router base plate.)

After marking the cut line, lay out the fence line parallel to it. Then use a square to scribe the fence line around the slab — so it's on both the top and bottom surfaces. Next, to prevent chipout at the end of the cut, score the cut line on the edges of the slab or clamp pieces of scrap to the edges.

To cut off the end with a router, I mounted a ¼" straight bit with a 1" flute (cutting) length into the router and clamped a straightedge to the fence line. Since the slab was 1¾" thick, I made a series of four passes (each about ¼" deeper than the preceding) all the way across one side until there was a 1"-deep groove.

Then flip the slab over, carefully clamp the straightedge right to the line on the other side, and start routing, see drawing below. After about three passes, the straight router bit cuts through and the scrap falls away.



BENCH HEIGHT

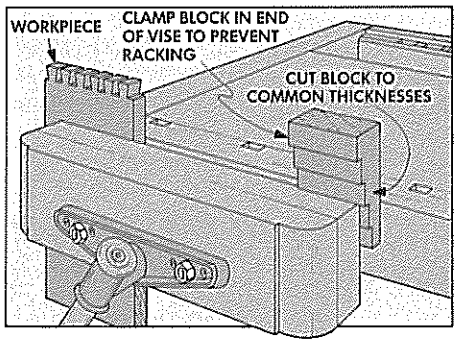
If you're going to take the time to build your own workbench, it might as well be a custom fit. That is, the height of the bench ought to fit you and the way you work. On most benches the working surface is somewhere between 33" and 36" high. If you're average height (somewhere between 5'9" and 6'0"), that's usually a comfortable height. But even a change of 1" up or down can make a big difference in how easy it is to work at the bench.

We've used a lot of methods to determine the best height for a bench. But one simple method seems to give the best results. Just measure the distance from the floor to the crease on the inside of your wrist. When I did this, the measurement was 34". So that's the height used on my bench. (If your "wrist crease" measurement is shorter or taller, increase or decrease the length of the legs as explained on pages 12-13.)

If you're 5'10" or taller, you may find that this wrist crease measurement is 35" to 37". This may seem too high for a bench — especially considering old standards. But those standards were valid when the population in general was much smaller.

PREVENTING VISE RACK

One of the problems with woodworking vises is that they rack. If you tighten down a piece of wood in one end of the vise, the other end of the vise toes in.



This racking means pressure will be applied only to one edge of the workpiece causing the workpiece to pivot or spin as you work on it. That defeats the whole purpose of a vise. (It's also creating a strain that's likely to enlarge the guide rod holes in the face block.)

To prevent racking, I cut a stepped block that offers a variety of possible thicknesses. Then I choose the thickness closest to my workpiece and slip it into the other end of the vise. Once it's tightened down, the vise faces are parallel and the workpiece is held tight.

Sources

WORKBENCH

When we designed the workbench, we looked at a wide variety of vises. Vises have more features than you might expect. And since vises are heavy, prices and shipping costs vary from one source to another.

We wound up using the heavy-duty front and end vises shown on page 4. We chose the front vise in part because it has standard (not metric) guide rods. It's important the holes drilled through the face block be an exact fit around the guide rods (see article on page 10-11). With most European vises you'll have to use a metric drill bit to drill the guide rod holes. So, we chose a vise that had standard guide rods.

FRONT VISE

The front vise features a quick-release mechanism (refer to page 10). A half turn of the handle to the left lets the vise slide in and out for quick adjustments. The vise attaches to the bench by drilling two standard (not metric) holes. Includes mounting screws, parts for the handle, and threaded inserts to attach the base to the bench top.

Front Vise

W50-785-110 Front Vise $119.95

END VISE

Woodsmith Project Supplies is also supplying the end vise. This piece of hardware is sometimes called a "vise screw" because the heart of the end vise is an 11" screw. The screw adjusts the position of a sliding block that holds one bench dog. (The other dog is placed in one of the holes in the bench top so large workpieces can be held between them.) Includes all the mounting screws and the parts for the wooden handle.

End Vise

W50-785-120 End Vise $44.95

DRAWER PULLS

Woodsmith Project Supplies is offering the oak pulls for the drawers and the door on the under-bench cabinet.

Drawer Pulls

W50-750-150 Drawer Pulls.....$12.95

- (6) Solid Oak Pulls
- (12) Machine Screws

BENCH DOGS

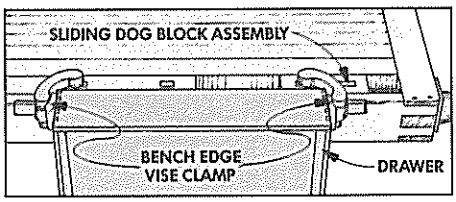
You can order steel or wooden bench dogs to fit the workbench from the Mail Order Sources listed below. **Woodsmith Project Supplies** is also offering the wooden bench dogs. The dogs are made of hard maple and come pre-assembled.

Wooden Bench Dogs

W50-750-130 Bench Dogs .....$12.95 a pair

BENCH EDGE VISE CLAMPS

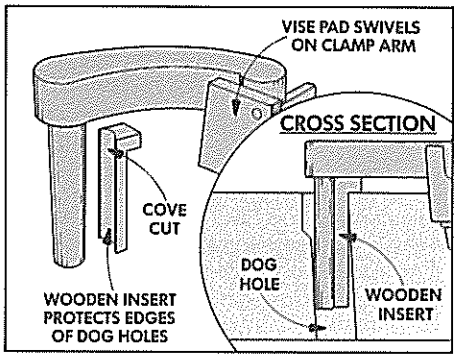
Bench dogs are great for holding a workpiece tightly *on* the benchtop. But there are also times when the workpiece has to be held *off* the edge of the bench to get the job done. This is convenient for tasks like trimming the box joints on the drawers for the under-bench cabinet.



To hold the drawer, I use a special set of dogs called "bench edge vise clamps." These clamps slip into the dog holes and have arms that swing out beyond the edge of the bench. (These clamps can be ordered from the sources listed below.)

On the other end of the arm there's a swiveling vise pad with two faces at 90° to each other. When pressure is applied on the gripping face of the pad, the other face is pressed tightly against the side of the bench. This keeps each face parallel for a firm grip on the workpiece.

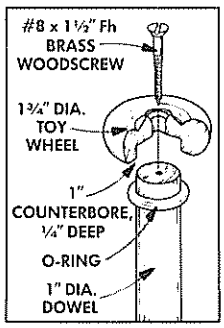
Note: These clamps have a round shaft that tends to deform the square dog holes. I made inserts that slip between the dog body and the wall of the hole, see drawing.



HANDLES

The vises listed below don't come with handles. We made handles from 12"-long pieces of 1"-diameter dowel. On the ends we added a knob and a rubber 1"-inner diameter O-ring to soften the blow on the knob when dropping the handle. O-rings can be found at most hardware stores.

The knobs on the ends of the handles can be turned on a lathe or a drill press. But we found that toy wheels worked just as well. To attach a wheel to the end of the dowel, counterbore the back face of the wheel and screw down through the front with a No. 8 x 1½" Fh woodscrew.



ORDER INFORMATION

BY MAIL

To order by mail, use the form enclosed with a current issue. The order form includes information on handling and shipping charges and sales tax. Send your mail order to:

Woodsmith Project Supplies
P.O. Box 10350
Des Moines, IA 50306

BY PHONE

For faster service use our Toll Free order line. Phone orders can be placed Monday thru Friday, 7:00 AM to 7:00 PM Central Standard Time.

Before calling, have your VISA, MasterCard, or Discover card ready.

1-800-444-7002

Note: Prices subject to change. Call for current prices.

MAIL ORDER SOURCES

Similar hardware and supplies may be found in the following catalogs. Please call each company for a catalog or information.

Woodcraft
800-225-1153
Front and End Vises, Bench Edge Vise Clamps, Bench Dogs, Toy Wheels

Garrett Wade
800-221-2942
Front and End Vises, BenchDogs

Meisel Hardware Specialties
800-441-9870
Threaded Inserts, Wheels

Trendlines
800-767-9999
Threaded Inserts