Woodsmith

CUSTOM WOODWORKING

Fine Hand Tools

TIME LIFE BOOKS

WOODSMITH CUSTOM WOODWORKING

Fine Hand Tools

SHOP SAFETY IS YOUR RESPONSIBILITY
Using hand or power tools improperly can result in serious injury or death. Do not operate any tool until you read the manual and understand how to operate the tool safely. Always use all appropriate safety equipment as well as the guards that come with your tools and equipment and read the manuals that accompany them. In some of the illustrations in this book, the guards and safety equipment have been removed only to provide a better view of the operation. Do not attempt any procedure without using all appropriate safety equipment or without ensuring that all guards are in place. Neither August Home Publishing Company nor Time-Life Books assume any responsibility for any injury, damage or loss suffered as a result of your use of the material, plans or illustrations contained in this book.

WOODSMITH CUSTOM WOODWORKING

Fine Hand Tools

By the editors of *Woodsmith* magazine

Time-Life Books

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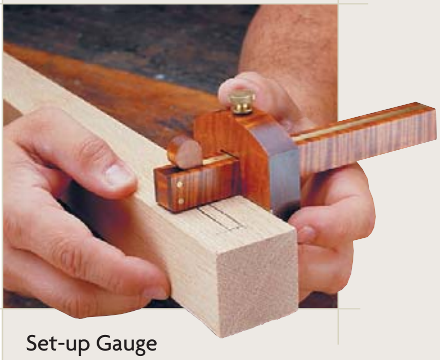
Set-up Gauge

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Hand Plane Jointer

Cabinetmaker's Tool Chest

Shop-Made Tools

Fine hand tools you make yourself not only perform a specific task — they also display your craftsmanship. These tools use hardwoods and brass so they will last, serving you and future generations with precision and style.

Set-up Gauge

In just a weekend you can build this beautiful tool that will give you a lifetime of accurate service. It can be built with wood from the scrap bin. And working with brass is easier than you think.

Setting a saw blade or router bit to an exact height (or depth) can be a challenge. The curved profiles on many router bits make it almost impossible to get a precise measurement using a tape measure or rule. And likewise, the curve of a saw blade (and the set of the teeth) makes it difficult to find the highest tooth for taking a measurement.

The problem is getting the rule or tape measure to sit flat on the table or base *and* be perfectly perpendicular to it. Otherwise, the measurement may be off.

This adjustable Set-up Gauge solves both problems. No matter what you're measuring, it's precise and easy to read.

TWO PARTS. There are two basic parts to the gauge: a body, and a sliding arm.

A groove in the body accepts a tongue that's cut in the arm. This allows the arm to slide up and down the body without twisting. Then, with a twist of a knurled knob, the arm can be locked in place to take accurate readings.

PRECISION. What makes this gauge precise is an accurate metal rule. (For sources, see page 126.) And what makes the gauge even more versatile is that the rule is held in place with a small magnet.

This means you can "pop" the rule off easily and use it separately. It also allows you to slide the rule past the base of the gauge to use it as a depth gauge (see photos on opposite page).

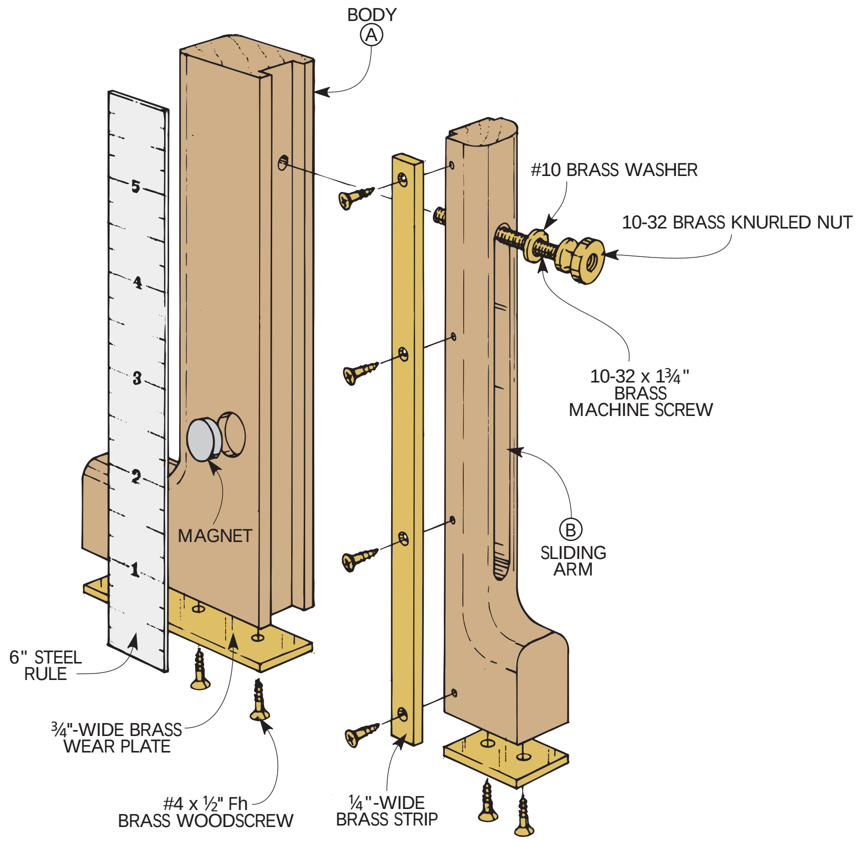
EASY TO READ. The key to making the Set-up Gauge easy to read is the sliding arm. It's supported by the body and extends out over the bit or blade.

In use, the arm is adjusted so the brass strip on the arm indicates on the rule the exact height of the bit or blade. Then the bit or blade can be adjusted to just touch the bottom of the sliding arm.

MATERIALS. You don't need much wood for this project. In fact, you can probably find what you need in the scrap bin. And the brass pieces can be found at most hobby shops.

EXPLODED VIEW

OVERALL DIMENSIONS:
4⁷⁄₈W x ³⁄₄D x 6H



MATERIALS LIST

WOOD

A	Body (1)	¾ x 3 - 5¹⁵⁄₁₆
B	Sliding Arm (1)	¾ x 2 - 10 rough

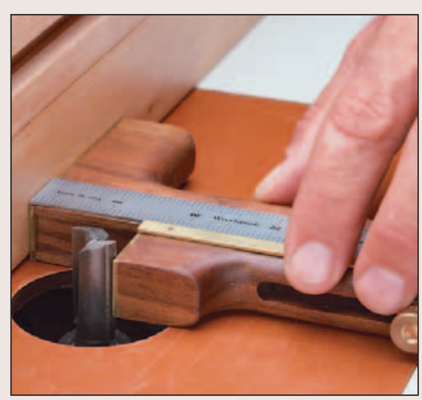
HARDWARE SUPPLIES

(9) No. 4 x ½" Fh brass woodscrews
(1) .064 x ¼" - 6" brass strip
(1) .064 x ¾" - 5" brass strip
(1) ½"-dia. rare-earth magnet
(1) 6" steel rule
(1) 10-32 x 1¾" brass machine screw
(1) 10-32 brass knurled nut
(1) No. 10 brass washer

USING THE SET-UP GAUGE

Height. *Accurate height readings are easy with this gauge. That's because the body rests flat on the work surface and the arm extends over the blade.*

Depth. *The rule of the gauge is held in place with a magnet. So it stays attached to the gauge, yet you can slide it to check the depth of a mortise.*



Distance. *A knurled nut locks the sliding arm in place so you can use the gauge to set a fence a precise distance away from a router bit or saw blade.*

BODY

Finding stock for this project wasn't too difficult. I had some walnut cut-offs I'd been saving for just the right project, and this was it. The contrast between the dark wood and the brass pieces gives the gauge a distinctive look.

The gauge consists of two main wood parts: an L-shaped body that holds a 6"-long ruler, and a locking sliding arm (refer to the Exploded View on page 9).

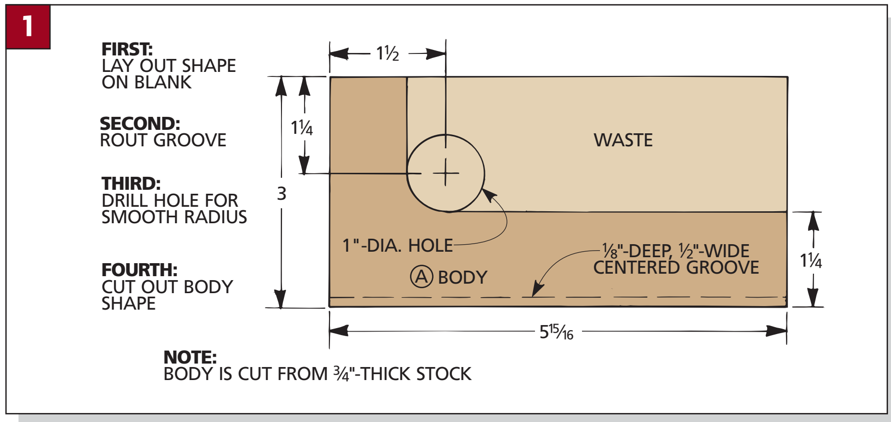
I started work on the L-shaped body (A). The first thing to do is to cut a $\frac{3}{4}$"-thick blank to finished size *(Fig. 1)*.

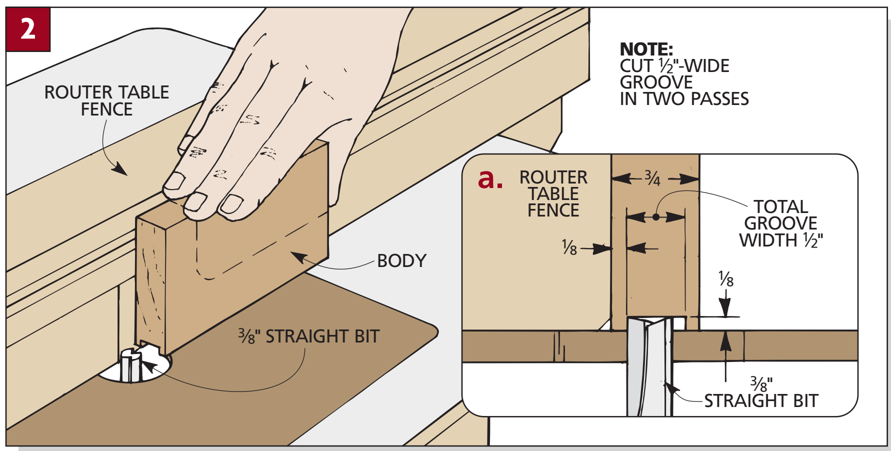
GROOVE. Next, a shallow ($\frac{1}{8}$" deep) groove is routed in one edge of the body. This groove is one half of a tongue and groove joint that allows the arm to slide up and down the body without twisting. The other half of the joint (the tongue) is cut on the sliding arm later.

The easiest way to rout the groove in the blank is to do it before the body is cut to shape. I did this using a straight bit on the router table *(Fig. 2)*.

To make sure the $\frac{1}{2}$"-wide groove is centered on the stock, I like to use a $\frac{3}{8}$" straight bit. Then I make two passes over the bit, flipping the workpiece end for end between passes *(Fig. 2a)*.

BODY SHAPE. After the groove is cut, you can lay out the shape of the body on the blank *(Fig. 1)*. (Be sure to take note of the location of the groove when laying out the shape. You don't want to cut off the groove you just routed.) Then drill a 1"-dia. hole and cut out the body with a jig saw or band saw. I made the cut just shy of the line and then came back with a sanding block to clean up the edges.



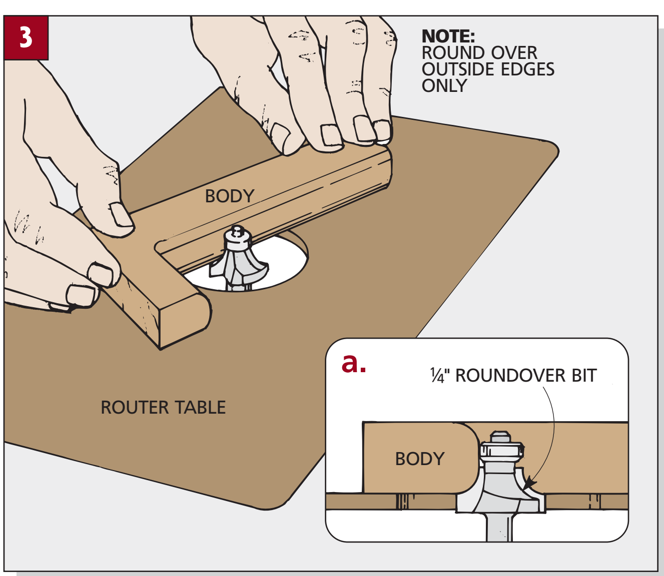


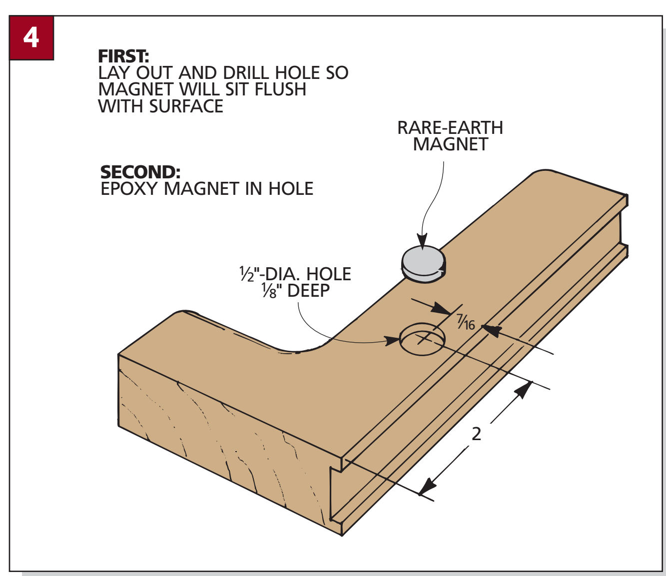
ROUND OVER EDGES. With the body cut out and sanded, the next step is to soften the outside edges so the gauge is comfortable to hold. With a $\frac{1}{4}$" roundover bit in the router table, this takes just a few seconds *(Fig. 3)*.

MAGNET. After the edges are rounded, go ahead and lay out and drill a $\frac{1}{2}$"-dia. stopped hole for the magnet that holds the rule in place *(Fig. 4)*. The hole should be just deep enough that the magnet sits flush with the surface of the body.

Note: To make sure the rule doesn't slip, I used a high-strength rare-earth magnet. (*Woodsmith Project Supplies* offers this magnet. See page 126 for ordering information and other sources.)

Finally, to complete the body, mix up a bit of epoxy and use it to secure the magnet in the hole.





SLIDING ARM

After completing the body of the Set-up Gauge, I started work on the sliding arm (B). Here again, I started with an oversized blank for this piece *(Fig. 5)*.

CUT THE TONGUE. The first step is to cut a tongue (the other half of the tongue and groove joint) to fit the groove in the body. The important thing here is to get a tight fit with the tongue, but one that still allows the arm to slide up and down in the groove smoothly without binding.

Just like the groove, I cut the tongue with a straight bit on the router table. But this time I moved the fence over the bit leaving 1/8" exposed *(Fig. 5a)*.

Before making any cuts on the actual workpiece, start with a test piece the same thickness as the sliding arm. Then take a light pass on each edge and test the fit of the tongue in the groove. If the tongue is too snug, just nudge the fence slightly and take another pass on each face. Once the tongue just fits in the groove, you're ready to cut the tongue on the sliding arm blank.

THE SHAPE. After the tongue is cut, the next step is to lay out the shape of the sliding arm on the blank *(Fig. 5)*.

Note: Just as you did when laying out the body, make sure to lay out the shaped portion opposite the tongue.

To make it safe to rout the sliding arm later, I left a short "handle" on each end *(Figs. 6 and 7)*. To make the handles, drill a 1"-dia. hole at one end and cut the blank to rough shape *(Fig. 5)*. Then sand the edges smooth.

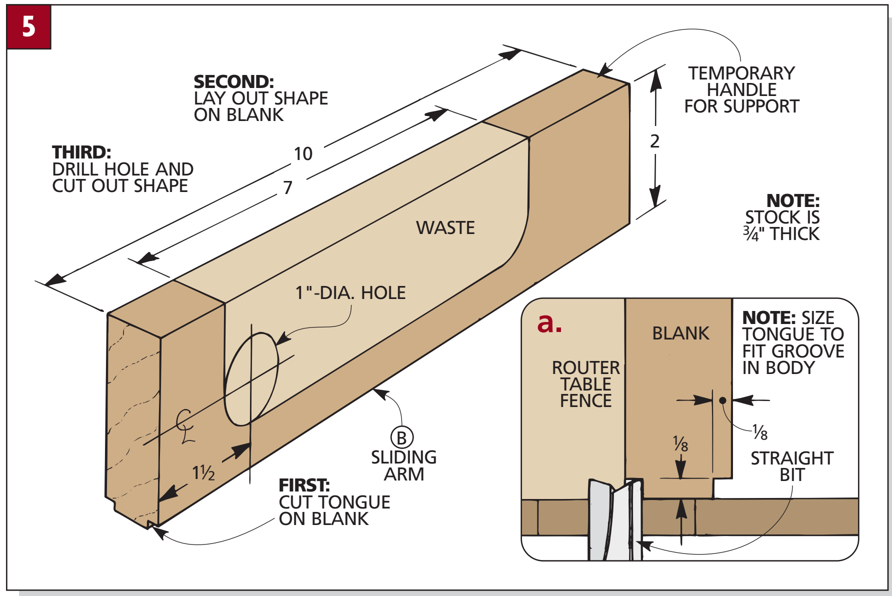
ROUND OVER EDGES. Now you can round over the outside edges of the sliding arm to match the body.

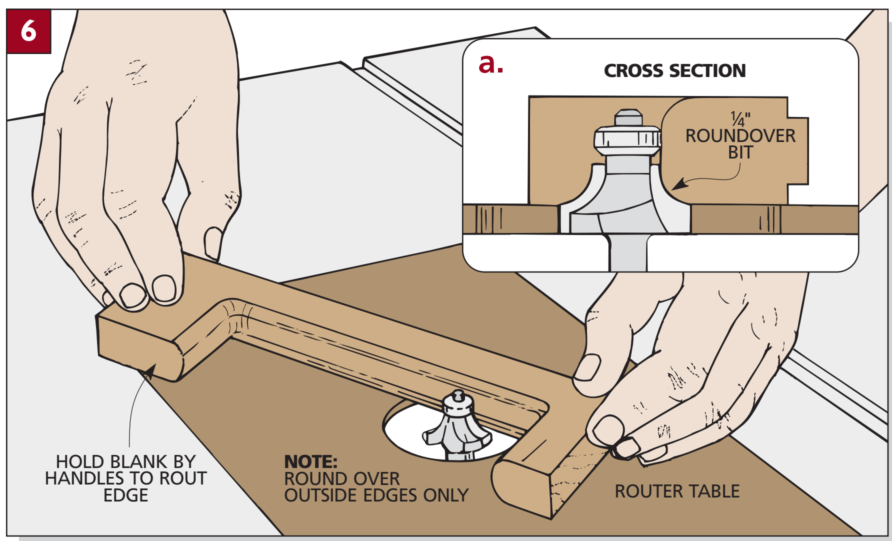
To do this safely, hold the sliding arm blank by the "handles" and rout a 1/4" roundover on each edge *(Fig. 6)*.

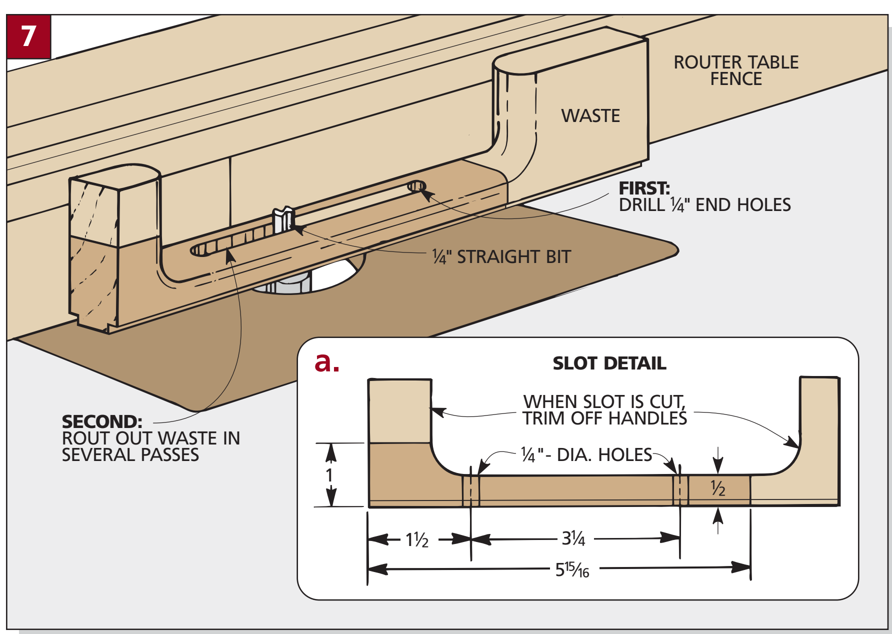
ROUT THE SLOT. To lock the Set-up Gauge in position after you've taken a reading, a knurled nut is tightened on a screw to press the sliding arm against the body. A slot in the sliding arm accepts the screw and allows the arm to move up and down *(Fig. 7)*. Routing the slot is a two-step process.

First, drill a pair of 1/4"-dia. holes to define the ends of the slot *(Fig. 7a)*. Then rout out the waste. This can be done in a couple of passes with a 1/4" straight bit on the router table *(Fig. 7)*. (Here again, use the handles for safety.)

Finally, trim the sliding arm to its finished width and length *(Fig. 7a)*.







ASSEMBLY

The sliding arm is attached to the body with a brass machine screw, washer, and knurled nut *(Fig. 8)*. Brass plates are added to the bottom of the body and arm, and a brass strip is attached to the arm.

BRASS SCREW. To locate a perfectly centered hole for the screw, I use a $\frac{1}{4}$" brad point drill bit.

All you need to do is hold the arm and body together with the ends flush. Then insert the bit in the end of the slot and mark the center *(Fig. 8a)*.

Now drill a hole slightly less than the diameter of your screw.

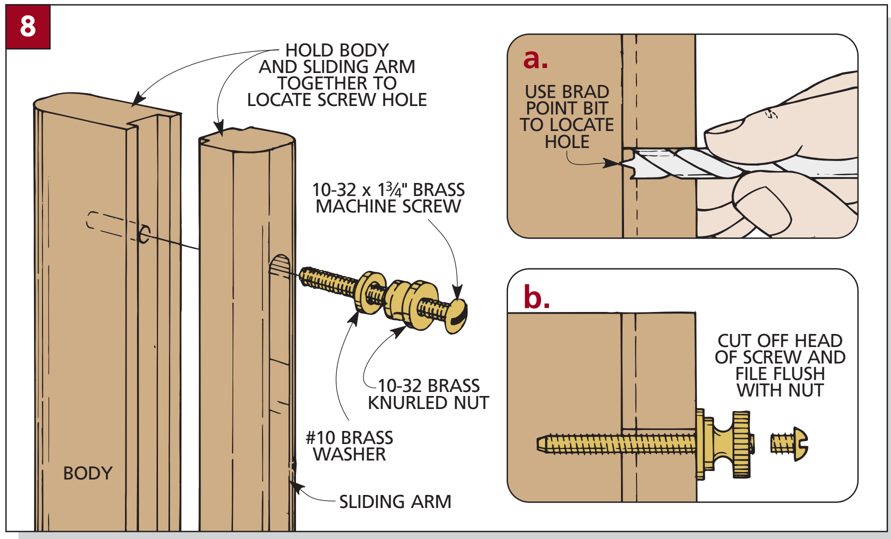
ASSEMBLY. Assembly of the gauge is simple. First, thread the brass machine screw into the body. Then the head of the screw is cut off.

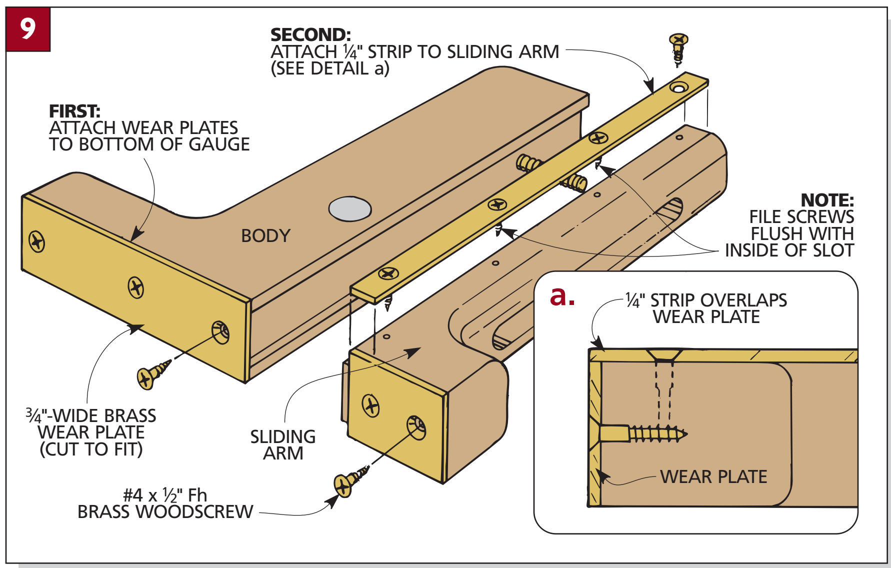
Next, slip the sliding arm over the screw and add the washer. Now just thread on the knurled nut and file the screw flush *(Fig. 8b)*.

BRASS STRIPS. There are three brass strips on the gauge: two $\frac{3}{4}$"-wide strips act as wear plates on the bottom, and a $\frac{1}{4}$"-wide strip on the sliding arm to keep the rule aligned *(Fig. 9)*. (For sources of brass, see page 126.)

Since the $\frac{1}{4}$"-wide strip is filed flush with the wear plate on the bottom, it acts as a pointer for the rule *(Fig. 9a)*. (For more on attaching brass, see box below.)

FINISH. After the brass is screwed in place, wipe on a couple coats of tung oil. Finally, attach the steel rule to the Set-up Gauge and it's ready to use. ■



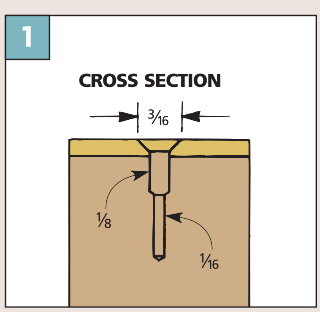


TECHNIQUE .... *Attaching Brass to Wood*

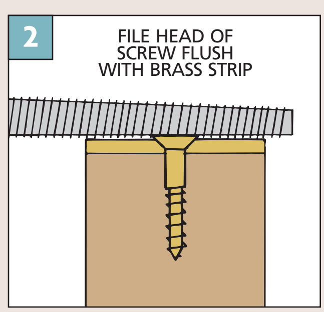
When I need to attach brass to wood, I like to use cyanoacrylate glue and brass screws. The "instant" glue holds the brass in place temporarily while I drill pilot and shank holes and the countersink *(Fig. 1)*.

PILOT HOLE. For the No. 4 screws on the Set-up Gauge, start by drilling a $\frac{1}{16}$"-dia. pilot hole, $\frac{1}{2}$" deep, through the brass and into the workpiece.

SHANK HOLE. Next, switch to a $\frac{1}{8}$"-dia. bit and drill a $\frac{3}{16}$"-deep shank hole centered over the pilot hole.



COUNTERSINK. Finally, add a shallow countersink to the brass plate. You'll want this countersink a little shallow so the screw head stands just proud of the brass strip.



The screws keep the brass strips attached over time. After the screws are in place, the heads are filed off flush and sanded smooth (refer to *Fig. 2* and the photo at right).

Perfect Fit. *A simple method for countersinking and filing a brass screw results in an almost invisible fit between the screw and brass strip.*

Tool Handles

Turning without a lathe? It's not only possible, but the results may surprise you. A shop-made jig and turning tools make it easy to create these beautiful and comfortable handles on your drill press.

Almost everyone has at least one chisel or file lying around that needs a new handle. Maybe the original handle broke after one too many hits with a mallet. Or the tool may not have come with a handle at all.

The good news is that you can easily put those tools back into service with a custom-turned handle. And one of the best reasons to turn your own handles is that you can customize the size and shape to fit in your hand comfortably.

JIG. There's nothing tricky about turning a tool handle. In fact, you don't even need a lathe or turning tools to make the handles shown above. They were all turned on a jig that uses your drill press as a "vertical lathe." And for turning tools, a couple of minutes at my grinder converted two old screwdrivers into scrapers. (See the Shop Jig article on page 18.)

WOOD. One of the first things to consider for a handle is the material. A chisel handle that's going to be hit with a mallet requires a tough, springy wood like oak. While a handle for a file or a paring chisel is a good place to try out different kinds of hardwood, or even an exotic wood.

FITTING. No matter what wood you use, the important thing is the fit of the handle on the tool. For tools with a tang (files and most chisels), you have to drill a hole in the end of the handle for the tang. Then the handle is driven down over the tang until it wedges tight. (This technique is covered on page 15.)

HOOPS AND FERRULES. But does driving in the tang risk splitting your newly-turned handle? It could. But to prevent that, a ferrule (metal collar) is mounted over the end of the handle.

The ferrules shown on the handles here are made from brass hex nuts. (See page 16 for more on this.)

And for chisels that get pounded on the top, a hoop made from a piece of brass pipe keeps the handle from splitting at the other end.

FILE HANDLE

One of the ironies with top-quality files and rasps is that they don't come with a handle. If you want to be comfortable while you use the tool, you're expected to make your own handle.

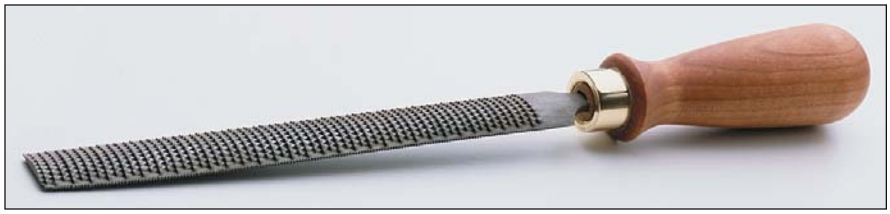
That's actually a blessing in disguise. I've found that the handles that come on most cheaper files are usually too small for comfort and control.

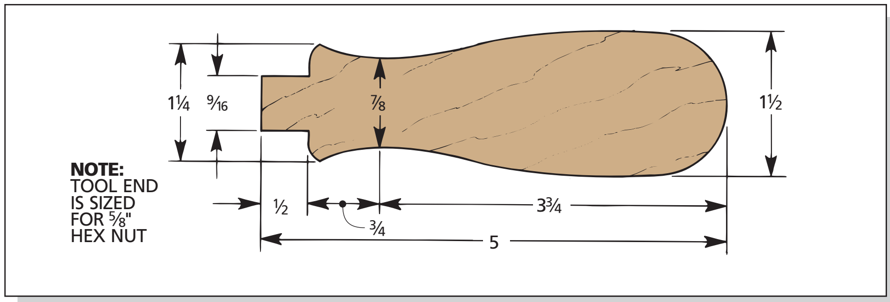
A good handle on a file can make a big difference in the fatigue you'll feel in your hand — especially on a project that requires a lot of shaping.

For large files and particularly wood rasps, I prefer a large handle (like the one shown in the photo above right).

MATERIALS. Making a file handle like this offers a good opportunity to experiment with different kinds of wood. I used cherry because it's tight-grained, it turns well, and the color contrasts nicely with the brass fitting.

HANDLE SHAPE. The handle is shaped with a large rounded end (see drawing). Then it tapers to a neck, and increases again to create a stop for your thumb.





The length and thickness of the handle is a matter of individual preference. To fit my hand comfortably, I turned the handle 5" long, with a 1½" diameter at its thickest point, and a gently rounded end.

This is slightly larger in diameter than most manufactured handles because I have a tendency to squeeze small handles with a "white knuckle" grip.

FERRULE. To prevent the end of the handle from splitting, I turned it to accept a 5⁄8" brass hex nut as a shop-made ferrule. (For more on ferrules, see the Technique article on page 16.)

PALM HANDLE

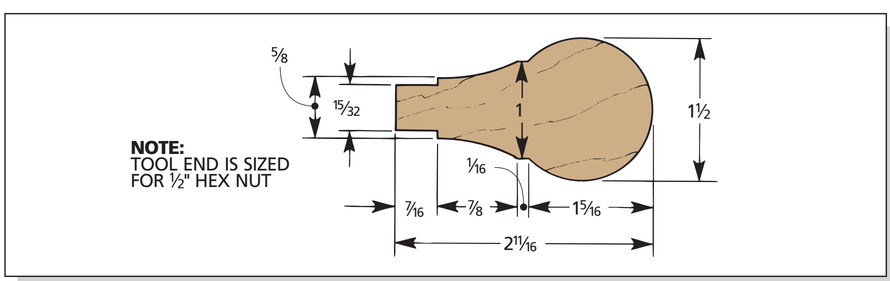
Smaller files are used for shaping and smoothing smaller areas. So they require a lighter touch — and a different handle. A rounded palm handle (like the one shown at right) makes filing a lot easier and provides protection so the end of the file doesn't poke into your hand.

ROUND KNOB. The idea of the palm file handle is simple. A round knob about the size of a golf ball provides a comfortable grip and a cushion for the palm of your hand (see drawing at right).

When I'm doing delicate work with a file like this, it's important that I be able to tell how the tool is cutting. And I get that feedback by placing my fingers on the blade of the tool. So this type of handle is designed to work with your fingers extending onto the tool itself. The round end really just serves as a "stop" against the palm of your hand.

I turned the knob to a diameter of 1½". But since everyone's hands are different, you may want to try this size on a piece of scrap first. Then modify the size depending on how it feels in your hand.

TAPER. The neck of the handle is turned to a short taper — just long enough to rest your knuckle and extend your index finger past the taper to guide the file. (The tapered neck on this handle is only 7⁄8" long.)



TOOL END. As with the large file handle shown above, a hole is drilled in the end of the handle to accept the tang.

The tool end of the handle is turned to a diameter to accept a brass nut that serves as a ferrule (refer to page 16). Because of the smaller tangs on these files, I used a ½" brass hex nut. (For more on fitting the tang in the handle, see the article on the opposite page.)

MATERIALS. As for the material for this handle, I used a piece of spalted maple to create a highly-figured design.

TECHNIQUE . . . . Fitting a Tang

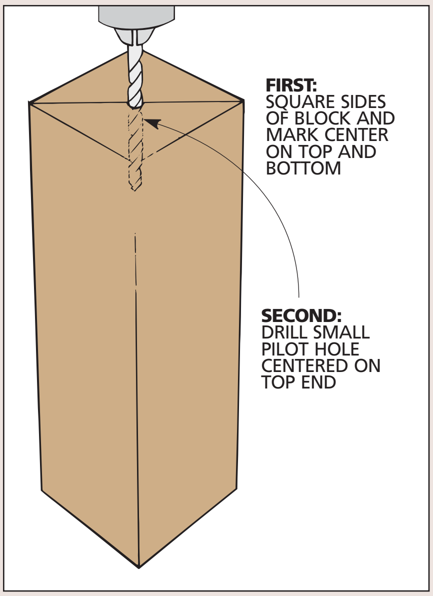
Before turning a handle to shape, you'll need to do some prep work so you can drill the hole for the tang of the tool later. First, while the blank is still square, drill a hole centered on one end *(Step 1)*. This hole will help guide a larger drill bit later after the handle has been turned to shape.

Then there's another important step to keep in mind. You need to leave a "base" in the waste at the bottom of the blank *(Step 2)*. This way the handle will stand on the drill press table when you drill the hole for the tang *(Step 3)*.

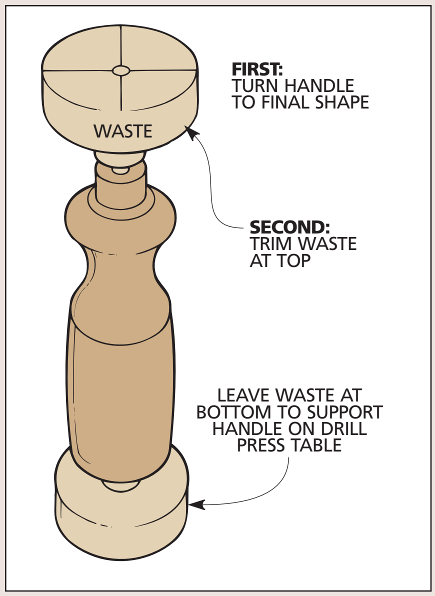
Once you've drilled the hole for the tang, the base can be cut off and the end can be sanded smooth *(Step 4)*.

HOLE SIZE. The size and depth of the hole for the tang depends on the tool the handle will be used on. Files have tapered tangs, while the tangs of chisels are usually straight. Refer to the section below on "Sizing The Hole" for more details.

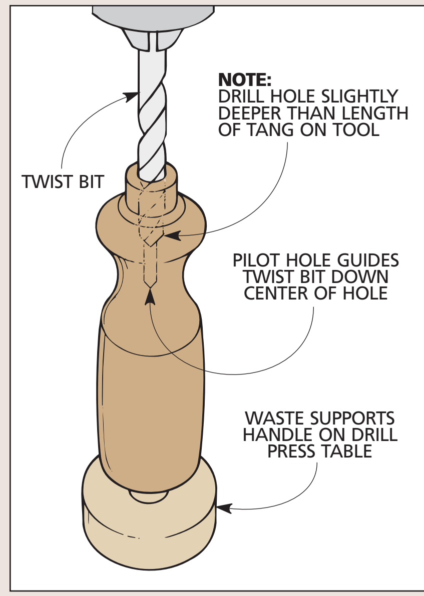
And finally, before you install the tool, you may want to add a ferrule or a hoop to extend the life of the handle. See the Technique article on the next page for more details about this.



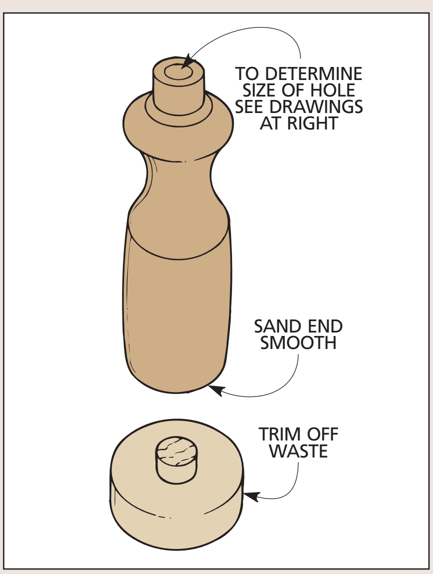
1 *First, square up the block and mark the centers on the ends. Then drill a pilot hole in the top. This helps guide the bit when drilling the hole for the tang later.*



2 *Turn the handle to shape and trim the waste off the top. The waste on the bottom is left on to provide a "base" to set on the drill press when drilling the hole.*



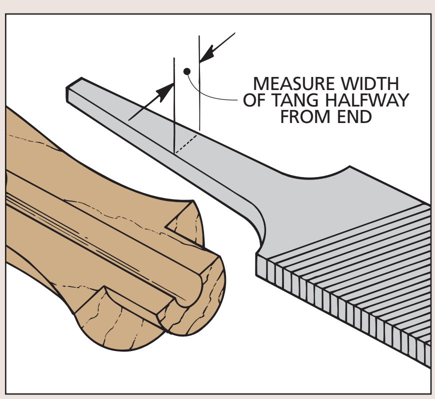
3 *Using a twist bit to "follow" the pilot hole, drill a hole that's slightly deeper than the length of the tang on the tool. (Also refer to "Sizing The Hole" below.)*



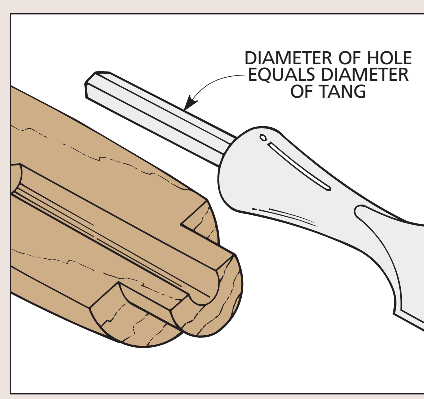
4 *To complete the tool handle, use a back saw to trim off the waste on the bottom end of the handle. Then sand the end smooth and apply a finish.*

SIZING THE HOLE

Chisels and files have differently-shaped tangs. So each requires a different method of measuring to determine the diameter and depth of the hole for the tang. Just follow the steps below to get the properly-sized hole for the tool.



File. *The hole for a file is sized to fit the width of the tang as measured halfway from the end of the tool, and is slightly deeper than the length of the tang.*



Chisel. *To fit a chisel in the handle, the hole is sized to match the diameter of the tang and drilled slightly deeper than the length of the tang.*

TECHNIQUE .... Ferrules & Hoops

Turning the handle to shape is just the first step. You also need to consider the everyday use the tool will get and how to make the handle last. For example, the tang of a tool can act as a wedge and split the handle easily. To prevent this, a ferrule is mounted to surround and reinforce the hole for the tang. And at the other end, you may want to add a hoop to reinforce the handle.

BRASS. I used brass for the ferrules and hoops for a couple of reasons. First, brass is soft, making it easy to work and shape. And second, after you polish the brass, it dresses up the tool.

FERRULES

I made a ferrule by grinding the "corners" off a brass hex nut. (You should be able to find these at most hardware stores or home centers.)

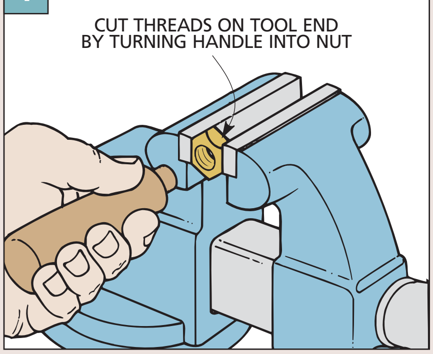
Installing the ferrule is simple. Just grip the nut in a vise and screw the handle into the nut like a wooden bolt *(Fig. 1)*.

FINISH. When the nut "bottoms out" on the handle, back it off a few turns. Then take the assembly to the grinder and smooth the corners *(Fig. 2)*. To polish the ferrule, sand it with progressively finer grits of silicon carbide sandpaper. (See the bottom of page 41 for more details about polishing and sealing brass.)

LEATHER WASHER. If the chisel will be struck with a mallet, you may want to add a leather washer between the blade and the ferrule *(Fig. 3)*. This acts as a "shock absorber" to further reduce the chances of splitting the handle.

SEAT HANDLE. After retightening the ferrule, the last step is to seat the chisel blade in the handle. To do this, place the cutting end of the blade against a wood block and use a mallet to drive the handle onto the tang *(Fig. 3)*.

1



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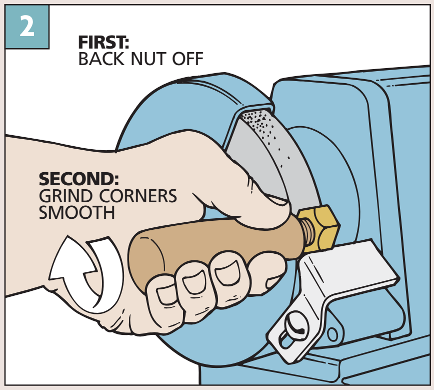

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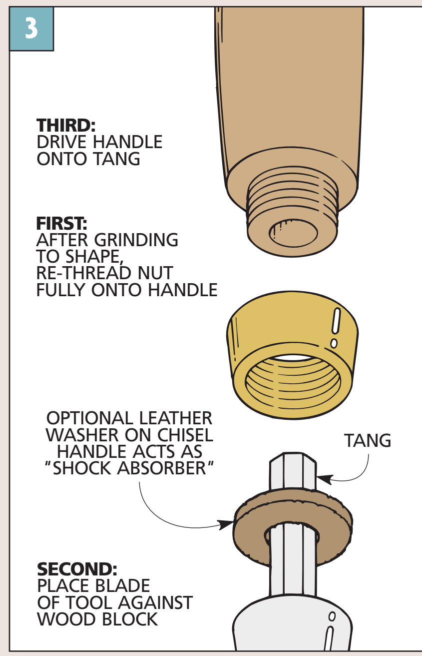


HOOPS

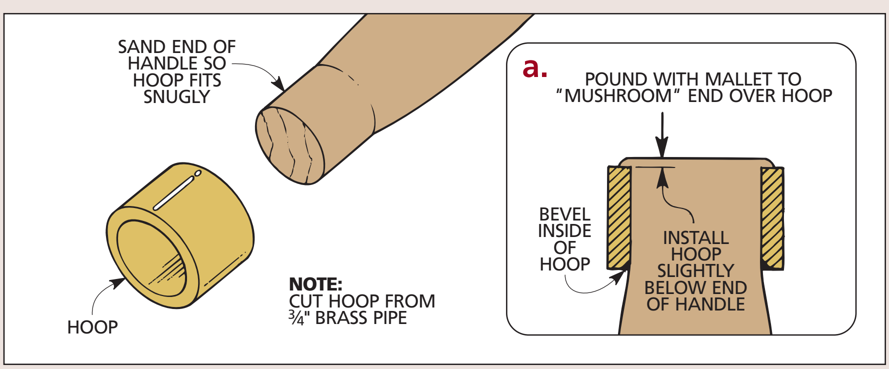
Adding a ferrule to a tool handle (as shown above) is a simple step that extends the life of the handle. But what about the other end of a handle? On a chisel that gets struck by a mallet, it doesn't take much pounding before the end starts to split and deform. To prevent this, I install a metal hoop on the end of a handle that's slated to see the business end of a mallet (see drawing).

BRASS PIPE. The hoop is cut from a short length of ¾" brass pipe. (I picked up the pipe in the plumbing department at the hardware store.)

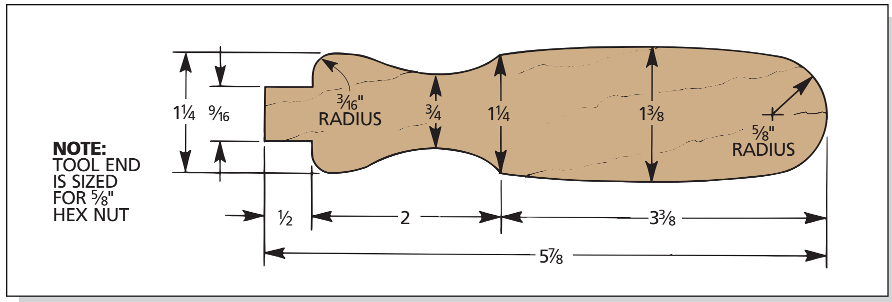
To prevent gouging the wood when fitting the hoop over the end, file a slight bevel on the hoop's inside edge (see detail 'a' in drawing at left). Then, sand the end of the handle until the hoop fits snugly.

There's one more thing to consider. Unlike the ferrules, there are no threads on the hoop to hold it in place. So how do you keep the hoop from slipping off as the handle shrinks with changes in humidity?

The trick is to cut the hoop to length so it sits slightly below the end of the handle (see detail 'a' in drawing). Then, after striking the handle a few times with a mallet, the exposed end grain bends over the hoop. This creates a "mushroom" that locks the hoop in place.



TRADITIONAL HANDLE



The form of a chisel handle is determined by its function. For a paring chisel (that is meant to be pushed rather than struck), I chose a rather traditional handle.

This style is especially suited for handwork because the barrel of the handle tapers to a small neck, which then flares to a thumb stop (see drawing at right). (Compare this serpentine shape to the straighter lines of the barrel handle shown below which is designed to be struck with a mallet.)

The barrel should be sized to fit your hand comfortably. And the neck should be sized and shaped to fit your thumb so you feel comfortable pushing the blade into the wood without fear of slipping. (You may want to turn a test handle first to find out what feels best in your hand.)

DOMED END. Another feature of this handle is the rounded or "domed" end. When using two hands to push the chisel through a workpiece, the dome helps cushion the heel of your hand.

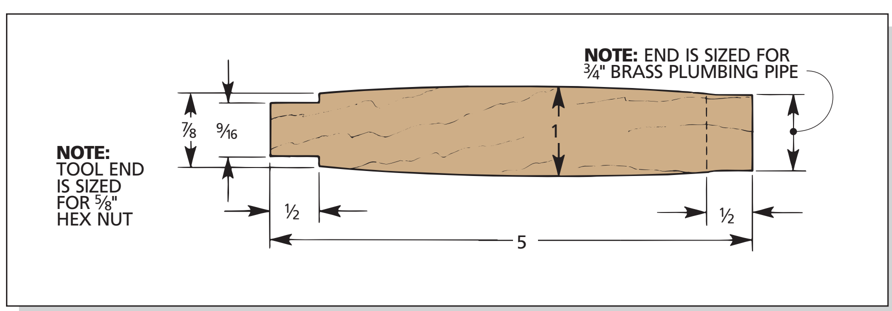
Although it's not intended to be hit with a mallet, the domed end can withstand light pounding without splitting. (If you need to strike the handle, it's best to use a wood mallet with a leather face.)

FERRULE. The tool end of the handle is sized for a 5/8" brass hex nut that serves as a ferrule (see drawing and photo). (For more on this, refer to page 16.)

As with the file handles on page 14, a hole is drilled in the tool end to accept the tang on a chisel. (See the Technique article on page 15.)

MATERIALS. Since this handle is not intended to be struck with a mallet you can use just about any kind of wood. I turned a piece of maple which created the unique swirling pattern on the handle shown above.

BARREL HANDLE



If you're going to use a chisel primarily for chopping, the handle should be designed to withstand repeated blows. This means you'll need to consider the type of wood you use and the shape of the handle.

WOOD. To take the shock from a mallet, the wood for the handle needs to be tough and springy. (I chose oak for the handle shown at right.) Also, the wood should be straight-grained and free of knots to reduce the chance of breakage.

HANDLE SHAPE. Since the shape of the handle is not as critical as that of a paring chisel, I chose a simple barrel shape that's easy to grip with my hand (see drawing). The smooth lines of this handle make it the easiest of the four to turn.

However, there are two more features added to this handle to help it withstand the shock from a mallet.

HOOP. First, I added a hoop on the end of the handle. This protects the handle from splitting or deforming as you strike it with a mallet.

The hoop is made from a section of brass pipe. Since it doesn't screw on (like the brass nut I used for the ferrule), it's fitted to the end of the handle and sized so the wood mushrooms over the hoop to hold it in place. At the other end of the hoop, the increasing diameter of the handle keeps it from sliding down. (For more details about making a hoop, refer to the opposite page.)

LEATHER WASHER. At the other end of the handle, I used a 5/8" brass hex nut for a ferrule, as on the handle above.

But before attaching the handle, I added a leather washer to fit between the tool and the ferrule. The washer acts as a "shock absorber" to help cushion the blows of a mallet. (I made this washer from an old belt.)

FINISHING THE BRASS. With just a little polishing, you can make the brass details shine. Refer to page 41 for details. ■

SHOP JIG . . . . Drill Press Turning Jig

When I first showed this turning jig to some friends, they were a bit skeptical. After all, using a drill press as a vertical lathe *is* a bit unorthodox (see photo). Not to mention the fact that I used a couple of ordinary flat-bladed screwdrivers as turning tools.

After turning a few tool handles, everyone was amazed at how much this jig functioned like a standard lathe. That's because it has the same basic components as a lathe: a drive center, a tailstock, and a tool rest *(Fig. 1)*.

DRIVE CENTER. To turn a block of wood, you have to prepare one end of the block by cutting a diagonal kerf, and drilling a hole for the drive center. (Refer to *Step 2* on the next page.)

The drive center transfers the rotation of the drill press chuck to the blank. It's made from a bolt with the head and threads cut off, and has a 6d nail mounted at one end of the bolt *(Fig. 2)*.

The trickiest part of making the drive center is keeping the drill bit on track as you drill the hole for the nail. A block of wood with a square end makes the job easy *(Fig. 3)*. The idea is to drill two holes in the block that are 90° to each other.

To do this, position the end of the block against a fence clamped to the drill press table. The first hole is drilled with a bit the same diameter as the bolt. Then rotate the block so it rests on its adjacent side, and insert the bolt *(Fig. 3)*.

Now you can drill a hole in the bolt the same size as the nail. The bit won't wander off the bolt.

To complete the drive center, just cut the head off a 6d nail, and secure the nail in the bolt with a dab of epoxy.

TAILSTOCK. The other end of the workpiece spins on a tailstock. This is just another piece of a bolt that fits in a block of 3/4"-thick hardwood.

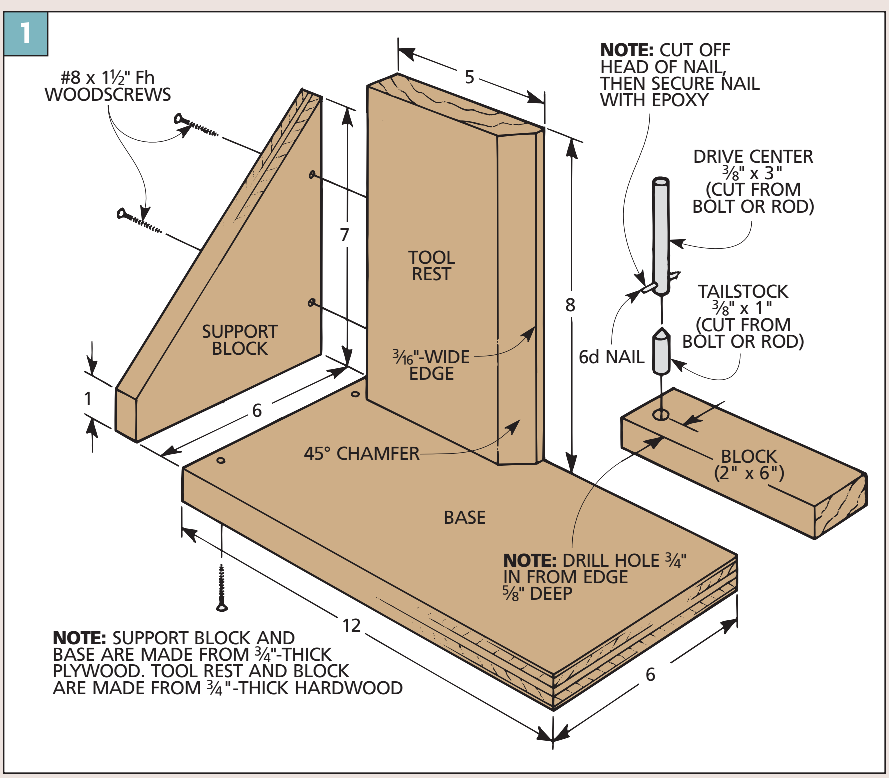
Here again, the head and threads are cut off. To fit the center of the workpiece, one end of the bolt is ground to a point.

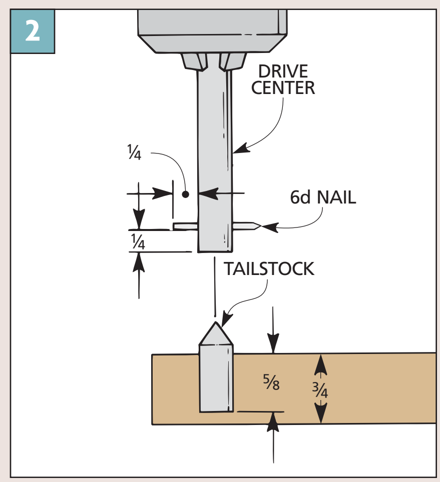
To do this, notch a block to fit around the bolt and clamp the block to the tool rest of your grinder *(Fig. 4)*. Then grind the point as you rotate the bolt by hand.

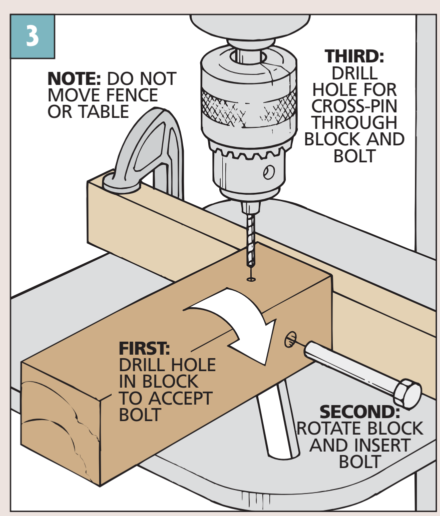
Finally, drill a hole in the tailstock block to support and position the bolt on the drill press table.

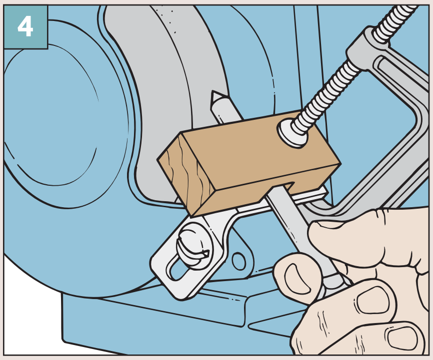
TOOL REST ASSEMBLY. The last part of the turning jig is a tool rest assembly. The purpose of this assembly is to support and guide the scraper. It consists of three parts: a tool rest, a support block, and a base *(Fig. 1)*.

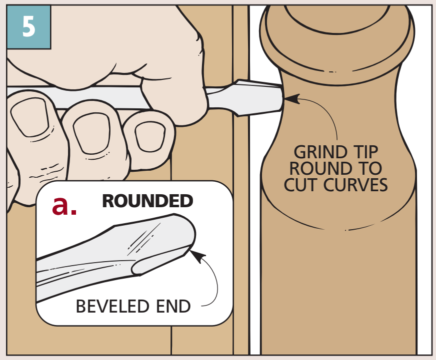
Note: The tool rest is made from hardwood, while the support block and base are made from plywood.

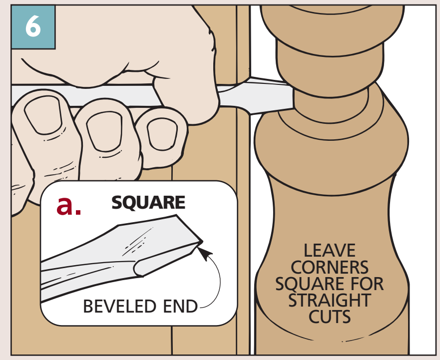












So that you can hold the scraper at an angle to the workpiece, cut a 45° chamfer on one edge of the tool rest, leaving a $^3/_{16}$"-wide edge *(Fig. 1)*.

And finally, screw the tool rest and support block to one corner of the base. Countersink the screws so the jig will sit flat on the drill press table.

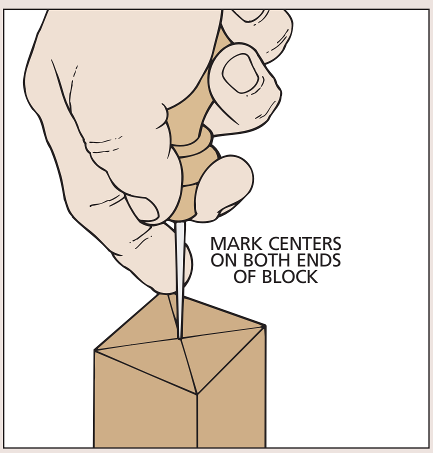
MAKING THE SCRAPERS

All that's required to make the scrapers used to turn the Tool Handles is a couple of flat-blade screwdrivers. You just need to spend a few minutes at the grinder with each tool to create a slight bevel on the end of each blade.

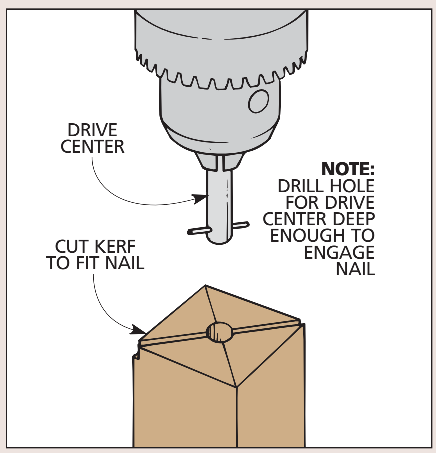
ROUNDED AND SQUARE. I made two different scrapers. On one, the corners are rounded slightly *(Fig. 5)*. This prevents the blade from "catching" the workpiece as you swing the handle up and down to scrape a curve.

The other has the original square corners for straight-shouldered cuts *(Fig. 6)*.

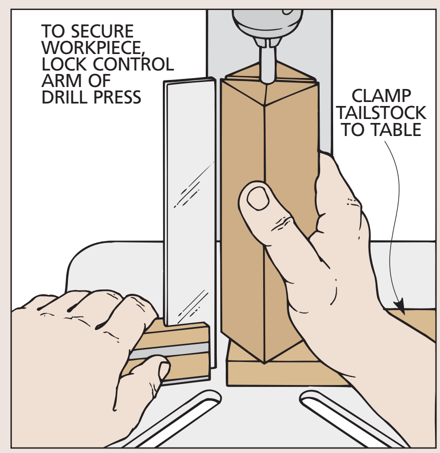
USING THE TURNING JIG



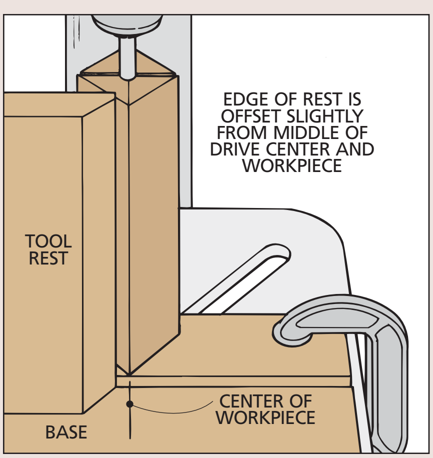
1 *To locate the top and bottom centers of the block, draw diagonals across the corners, and mark the centers with an awl.*



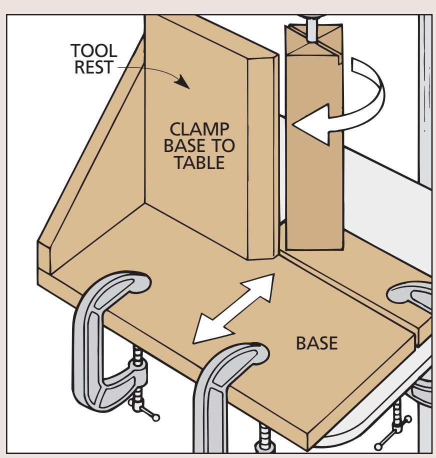
2 *Next, drill a hole to accept the end of the drive center. Then cut a kerf across one of the diagonal lines to engage the nail.*



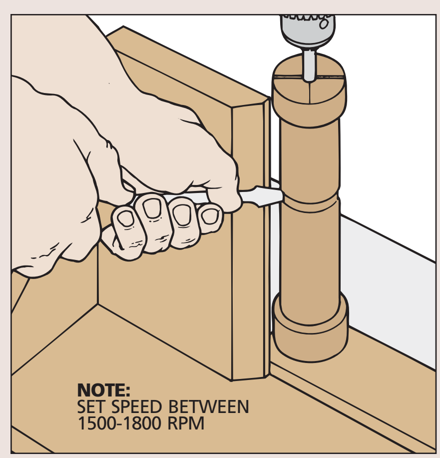
3 *After mounting the block between the drive center and the tailstock, square up the block and clamp tailstock to the table.*



4 *Next, position the base on the drill press table so the edge of the tool rest is slightly left of the middle of the workpiece.*



5 *Clamp the base so the edge of the rest is $^1/_8$" from the corners of the block. To check for clearance, rotate block by hand.*



6 *Holding the flat part of the blade against the edge of the tool rest, gently push the cutting tip into the spinning workpiece.*

Torpedo Level

Building a level may seem easy enough. But making it true might seem impossible. There are two simple techniques that ensure your level will be dead-on accurate on horizontal and vertical surfaces.

Recently, a friend dropped by to show me an old level he had picked up at a tool auction. The body of the level was dented and had more than its share of scratches. And one of the vials was broken.

But in spite of its rough condition, I still admired the workmanship that had gone into the level. Brass plates fit flawlessly into the wood body. And the ends tapered smoothly like a torpedo, probably to make it easy to slip into the pocket of a carpenter's apron.

After seeing that old level, I got to thinking about building a "torpedo" level of my own. Like the original, this level has a tapered wood body with brass accent strips. And two vials make it handy for leveling vertical or horizontal surfaces.

ADJUSTMENT SYSTEM. But the thing that's unique about this level is a built-in adjustment system. The vial that's used to level a horizontal surface is cradled in an adjustable holder (see the Exploded View on the opposite page). This allows you to calibrate the level without a lot of fiddling around. And if it ever gets knocked out of adjustment, you can "fine tune" the vial in a matter of minutes. (If you're wondering how to "level a level," that's covered on page 25.)

LEVEL AND PLUMB. The level has two vials. The one along the long upper edge is for checking level on horizontal surfaces. The other vial is positioned at 90° to the first and is used for checking plumb on vertical surfaces. A circular window allows you to see the plumb vial clearly.

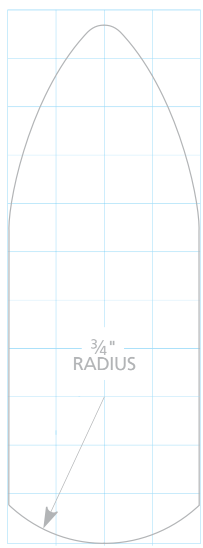
VIALS. It may take some searching to find the vials for the level. I found mine at a local hardware store. If you have trouble tracking them down locally, a mail order source is listed on page 126.

Depending on where you find yours, the vials may vary slightly in length and diameter from what I used. So it's a good idea to have them in hand before you start building your level.

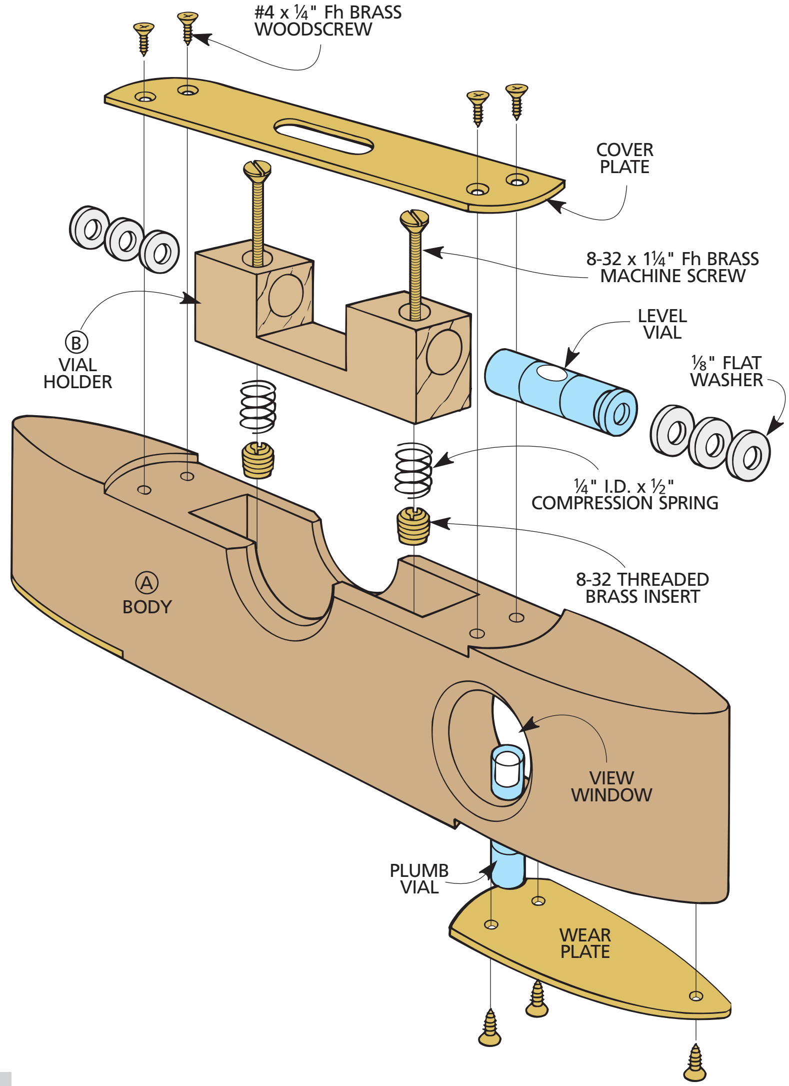
LONGER VERSION. The Torpedo Level is just the right size to use on smaller projects or where space is limited. But there are times when you need a longer span to get a more accurate reading (like when hanging a long shelf). It's easy to adapt this plan to make a 24"-long level. See the Designer's Notebook on page 28 for details about this.

EXPLODED VIEW

OVERALL DIMENSIONS:
9W x 1¾D x 1H



PATTERN (FULL-SIZE)



MATERIALS LIST

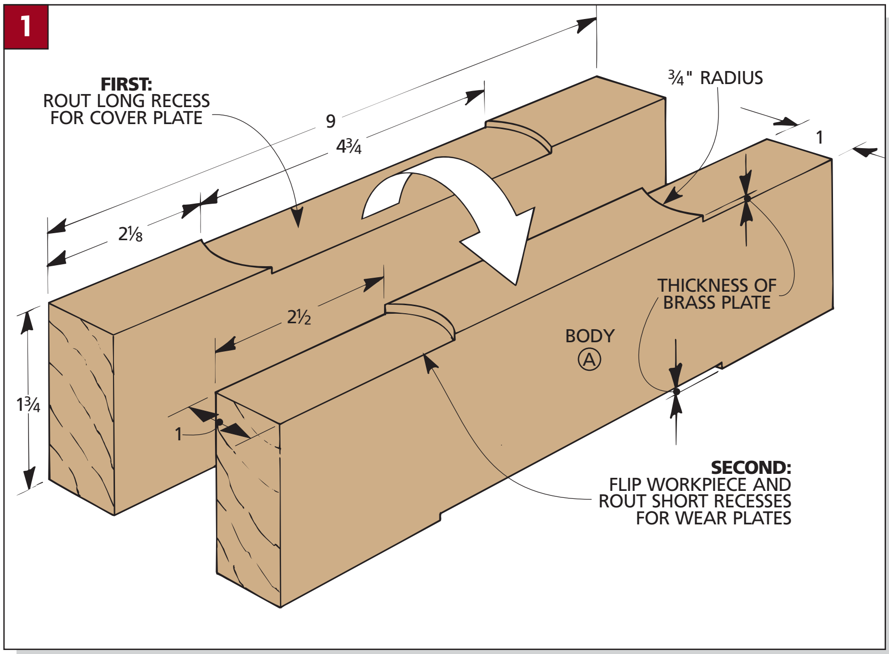
WOOD

A	Body (1)	1 x 1¾ - 9
B	Vial Holder (1)	⅝ x ⅞ - 2¾

HARDWARE SUPPLIES

(2) 8-32 x 1¼" Fh brass machine screws
(10) No. 4 x ¼" Fh brass screws
(6) ⅛" flat washers
(2) 8-32 threaded brass inserts
(2) ¼" I.D. x ½" compression springs
(2) ⅜" x 1¼" bubble vials
(1) 1/16" x 1" - 10" brass strip

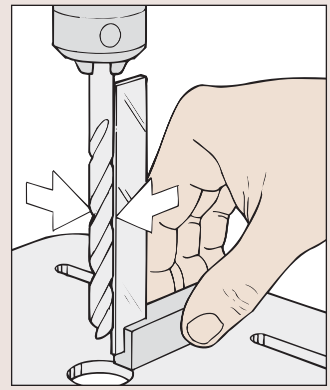
1



SHOP TIP

Squaring a Drill Press

To ensure that the drill press table is square to the bit, hold a square against the bit to check it in both directions.



BODY

To provide a stable base for the level, the body (A) starts out as a 1"-thick hardwood blank *(Fig. 1)*. (I used a nice piece of figured walnut I'd been saving for a special project.) After the body is cut to size, some shallow recesses and a few holes need to be cut in it.

RECESSES. The top and bottom of the body have brass plates inset to serve as wear plates and to protect the horizontal vial. To accept the brass plates, three shallow recesses are cut in the blank. A long recess in the top accepts a cover plate, and there are two short recesses in the bottom for a pair of wear plates.

While the lengths of these recesses vary, they all have one thing in common. The ends are shaped in a gentle curve where the wood body meets the brass plates. To ensure that this shape is consistent from one recess to the next, I used a hand-held router and a simple jig to make them. (See the Shop Jig article on the next page for more details.)

PLUMB VIAL. After routing each recess, you're ready to add the vial near the end of the level that's used to check whether a vertical surface is plumb. (For sources of vials and other hardware needed to build this level, see page 126.)

The plumb vial fits in a stopped hole that's drilled in the bottom edge of the level *(Fig. 2)*. (And don't worry about the hole showing. It's covered later when the brass plates are added.)

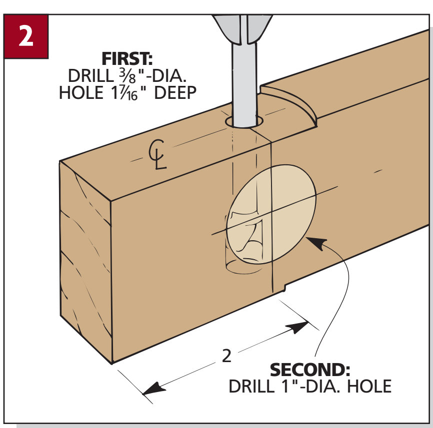
To produce an accurate reading, it's important that this hole is perpendicular to the bottom edge of the level. So start by checking that the table on your drill press is square to the bit. (See the Shop Tip above.) Then drill the hole using slow, steady pressure.

WINDOW. In addition to the stopped hole, a larger hole drilled through the sides of the level creates a "window" that lets you see the plumb vial *(Fig. 2)*. To drill this hole, I used a Forstner bit and a backing board to make a clean cut.

LEVEL VIAL. That takes care of the holes for the plumb vial, so you can turn your attention to the top vial that's used to level a horizontal surface (the level vial).

To provide a clear view of the level vial, there's a semi-circular opening in the top edge of the level. Here again, a Forstner bit and backing board produce a clean cut. Even though the Forstner bit is designed to drill a hole on the edge of a workpiece, I still wanted to provide extra support to keep the bit from wandering. So I clamped a short piece of scrap across the recess cut earlier for the cover plate *(Fig. 3)*.

2



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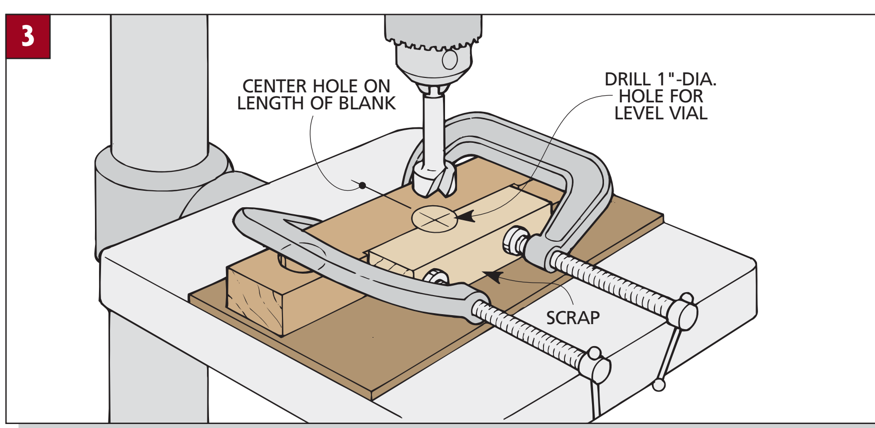
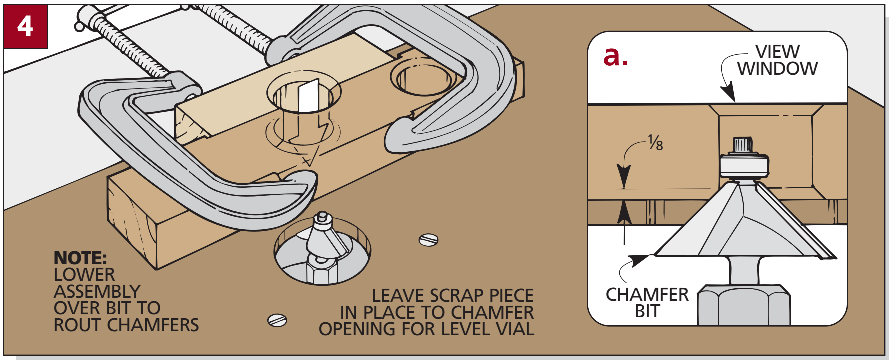
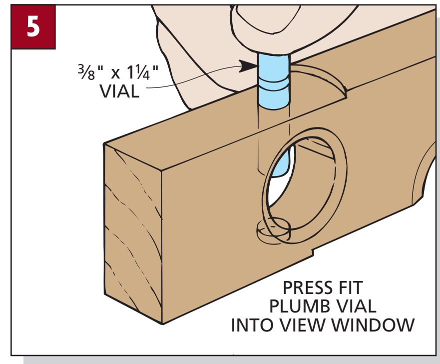






CHAMFERS. Once the hole is drilled, leave the pieces clamped together. The scrap comes in handy for the next step as well — routing an 1/8" chamfer around the rim of the hole on both sides *(Figs. 4 and 4a)*. While you're at it, chamfer both sides of the view window for the plumb vial near the end of the level too.

INSTALL PLUMB VIAL. Now all that's left is to install the plumb vial. To do this, simply press the vial into the hole until it bottoms out *(Fig. 5)*.

SHOP JIG . . . . *Recess Routing Jig*

Cutting the recesses for the brass plates on the Torpedo Level is easy. I used this simple jig to guide my router with a guide bushing and a straight bit.

JIG. The jig consists of a hardboard template with a curved notch, and two sides that hold the template.

When determining the size of the curved notch, remember that the guide bushing (not the bit) will ride against the template. So the notch needs to be slightly *larger* than the radius of the recess. (The pattern on page 21 shows the size of the completed recess).

To find out how much larger, measure the distance from the closest cutting edge of the bit to the *outer* part of the bushing. Then add that amount to the desired radius of the recess.

RABBETS. After cutting the curved notch, the template is glued into rabbets cut in the sides of the jig. The rabbets are sized so the sides of the jig fit snug against the level. This way, the workpiece will be pinched between the sides when you tighten the jig in a vise.

REFERENCE SHOULDER. Before routing the recesses, the next step is to establish reference shoulders that will help you position the workpiece in the jig.

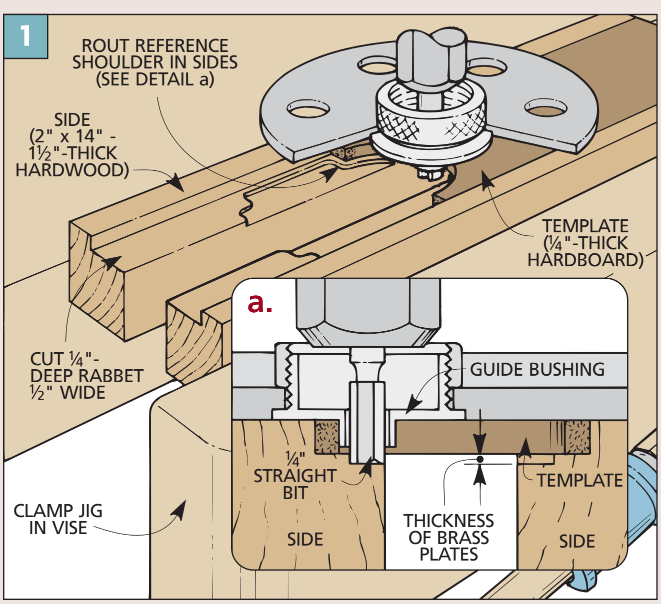
To create the shoulders, clamp the jig in a vise *(Fig. 1)*. Then plunge the router into the opening and rout along the template and sides of the jig *(Fig. 1)*.

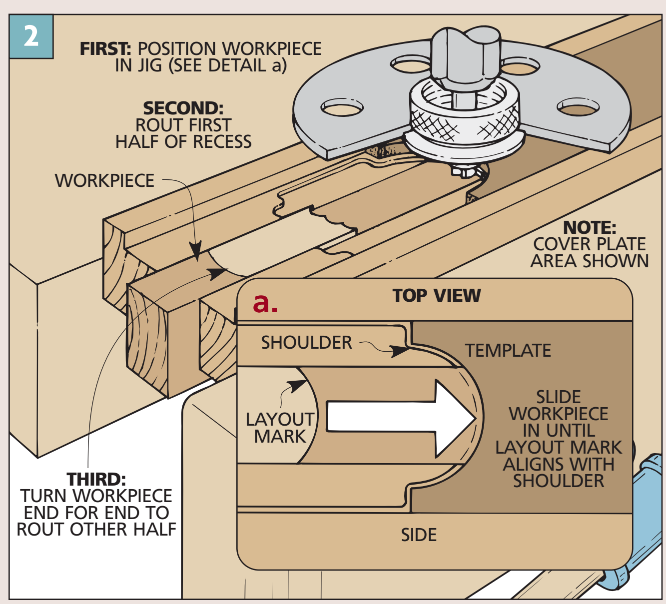
Note: Set the depth of cut to equal the thickness of the brass plate *(Fig. 1a)*.

ROUT RECESSES. Now you can use the pattern on page 21 to lay out the recesses. Note that the arcs for the wear plates curve toward the middle of the blank. The arcs on the cover plate curve toward the ends (refer to *Fig. 1* on page 22).

Then position the blank in the jig so a mark aligns with the reference shoulder *(Fig. 2a)*. After tightening the jig (and workpiece) in a vise, rout a recess.

For each wear plate, just rout to the end of the blank. For the cover plate, you'll need to rout only half the recess *(Fig. 2)*. Then, turn the workpiece end for end and rout the other half.





HORIZONTAL VIAL

The vial that's used to check a horizontal surface for level is housed in a small U-shaped holder. This holder fits inside a deep mortise in the body of the level.

ADJUSTABLE. The unique thing about this holder is that it's adjustable. This simplifies the initial calibration. (Refer to the Technique article on page 27.) And it allows you to "tune up" the level easily in case it gets knocked out of adjustment.

CUT MORTISE. Before making the vial holder, the first step is to cut the mortise for the holder *(Fig. 6)*. Besides being fairly deep ($1\frac{1}{8}$"), this mortise is also wide ($\frac{5}{8}$"). This means that the sides of the level near the opening for the vial will only be $\frac{3}{16}$" thick. As a result, any variation in thickness will be quite noticeable.

Fortunately, cutting the mortise so each side is identical in thickness isn't that difficult. What I found worked well was to drill a series of holes with a Forstner bit. Just be sure that the level is secured firmly in place when drilling each one. (I clamped the body to a piece of scrap that was squared up and attached to the table on the drill press.)

After removing most of the waste, it's just a matter of using a chisel to clean up the ridges on the sides of the mortise and to square up the ends *(Fig. 6b)*.

VIAL HOLDER

Once the mortise is completed, you can concentrate on the vial holder. In addition to securing the vial, the holder has a built-in adjustment system that makes it easy to calibrate the level.

ADJUSTMENT SYSTEM. The key to this system is a pair of compression springs (like you'd find in a ball point pen, but shorter) *(Fig. 7)*. Each spring fits over the end of a machine screw that passes through the vial holder and into a threaded insert in the level.

As you tighten the machine screw, the spring compresses and exerts pressure on the bottom of the holder. By turning the screw, you can vary the amount of pressure. This moves the end of the holder up or down which adjusts the position of the vial.

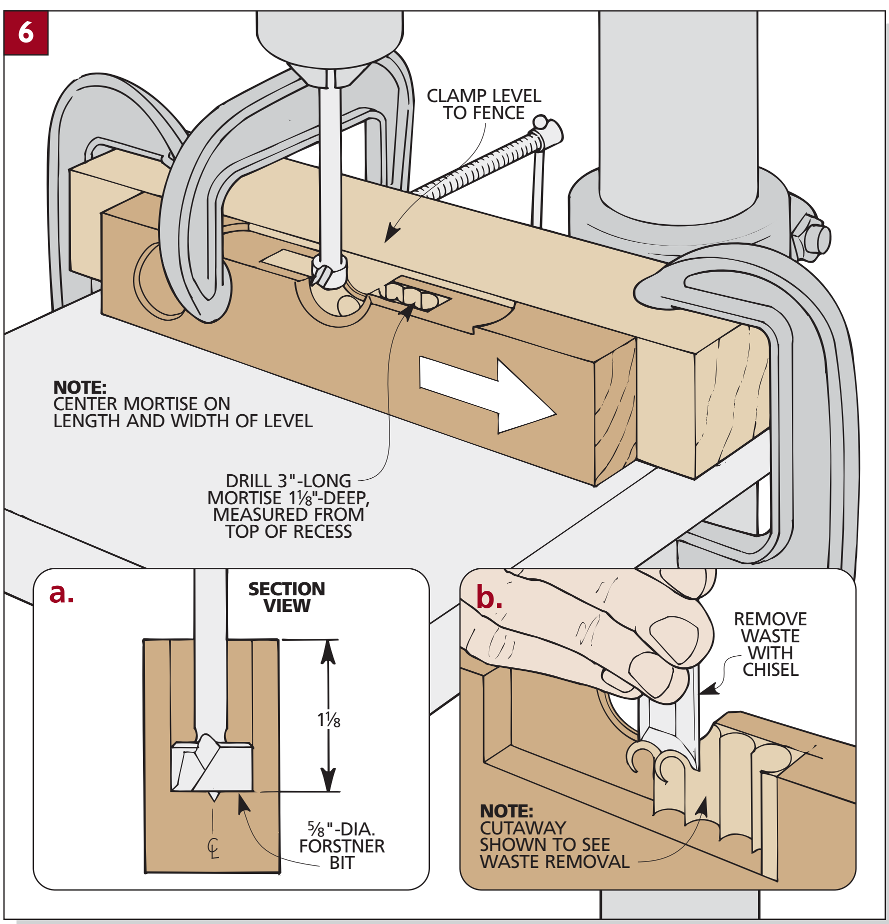
BLANK. Since the vial holder (B) is quite small, it's safer and easier to start by planing an oversize blank to thickness to match the width of the mortise. Then, after ripping it to final width ($\frac{7}{8}$"), you can cut the blank to length ($2\frac{3}{4}$") *(Fig. 8)*.

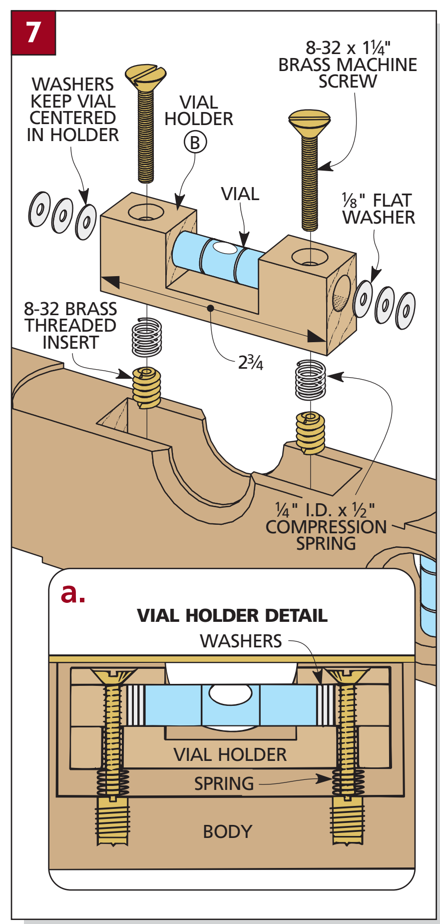
Once the blank is cut to size, the next step is to drill a hole through the ends to accept the level vial. Because you need to stand the blank on end, it's a bit tricky holding it by hand. But tightening the workpiece in a handscrew will hold it firmly in place *(Fig. 8)*.

NOTCH. Next, to create an opening in the holder that lets you see the vial, you'll need to cut a wide notch in the top edge *(Fig. 9)*. Again, since the piece is small, I used a handscrew to hold it in place while I cut the notch with a coping saw. As before, a chisel makes quick work of cleaning up the corners.

At this point, you're just about ready to install the holder. But first, you'll need to drill two countersunk shank holes for the machine screws that hold it in place in the body *(Fig. 9a)*.

These holes provide a handy way to establish the location of the threaded inserts in the body of the level. All you need to do this is to center the holder in the mortise and use a brad point bit to mark the location of each insert *(Fig. 10)*.



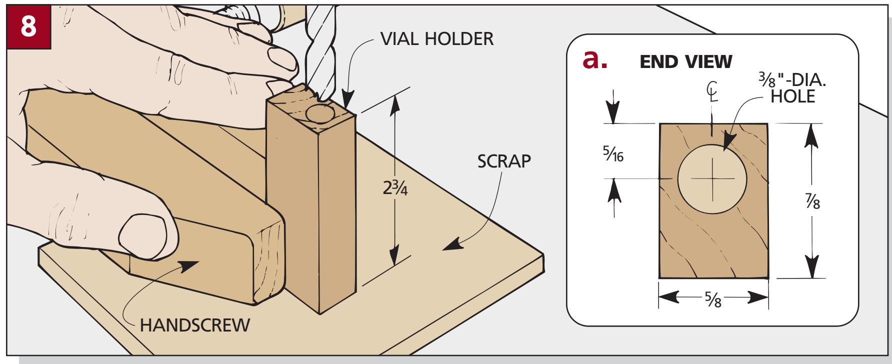


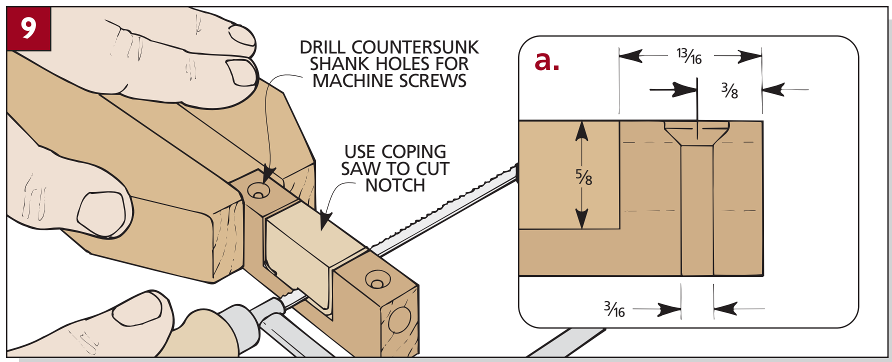
INSERTS. There's not much to drilling the holes that accept the threaded inserts *(Fig. 10a)*. The trick is installing the inserts so they go in nice and straight.

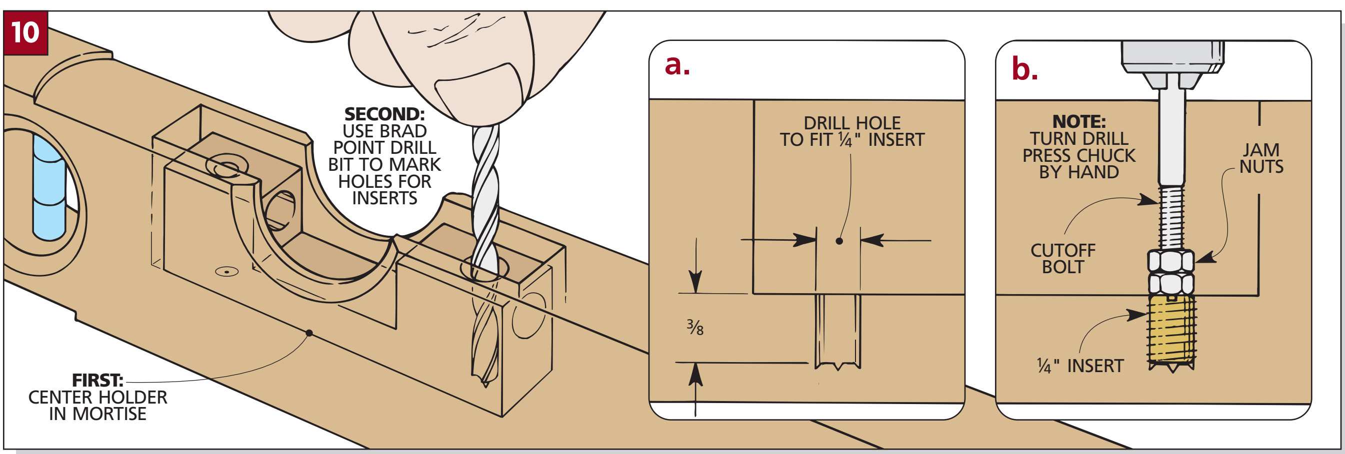
What worked well here is to start by chucking a cutoff bolt in the drill press and tightening two "jam" nuts on the end *(Fig. 10b)*. Then, with the end of the bolt threaded into the insert, rotate the chuck by hand to install the insert.

ASSEMBLY. With the inserts in place, you're ready to assemble the vial holder. The first step is to press the vial into the holder. To ensure that the indicator lines on the vial remains centered, I used small washers as shims. These washers fit between the ends of the vial and the machine screws *(Fig. 7)*.

Now all that's left is to install the vial holder. Although it may seem unusual, the best way to do this is to hold the level and vial holder upside down. This way, the compression springs won't fall off the machine screws as you tighten them into the threaded inserts.







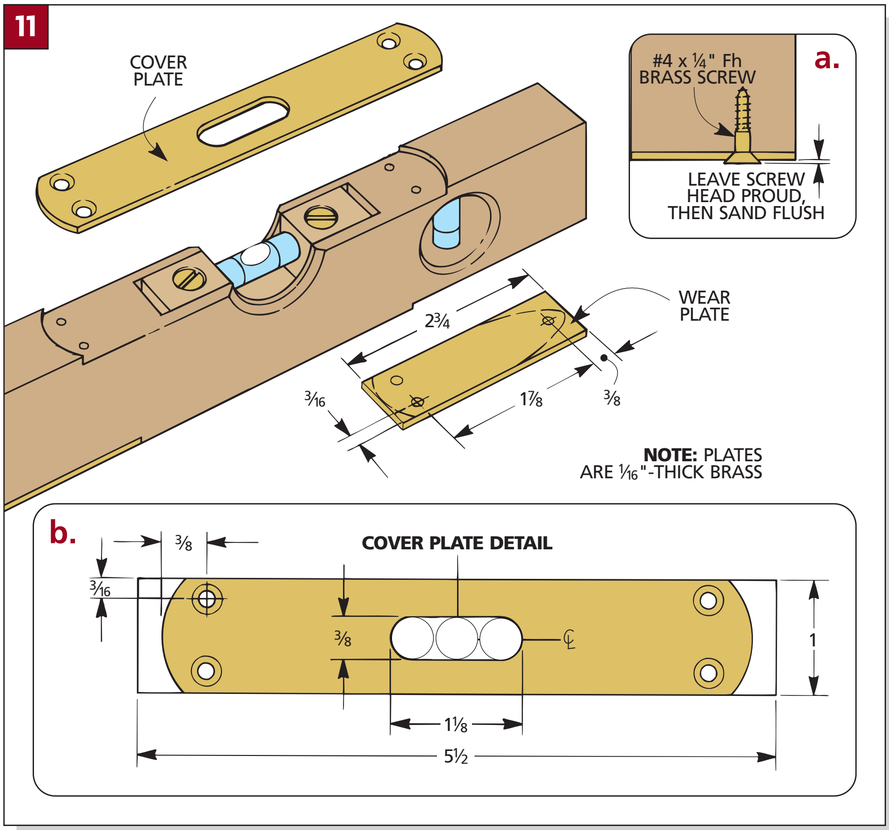
SHOP TIP . . . . Tube Level

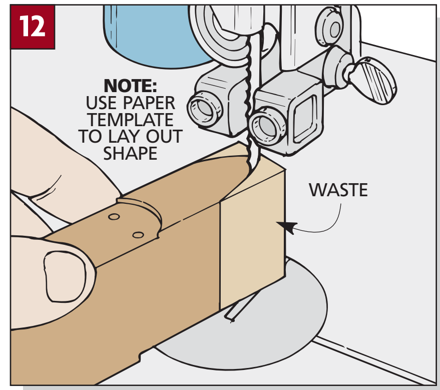
Before you can get an accurate reading on the Torpedo Level, you'll need to check it on a known level surface and adjust it if necessary.

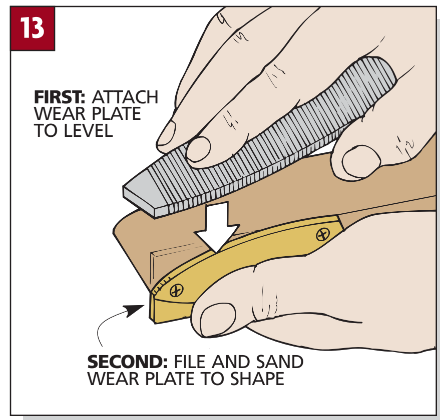
But how can you check that a surface is level if you don't have a level? One way is to use a clear plastic tube filled with water (see photo at right). The basic principle here is simple — water finds its own level.

To take advantage of this, fit the ends of the tube into notches in a flat piece of plywood and add water (a drop or two of food coloring makes it easy to read the level).

Then slide one end of the tube up or down until the water column is flush with the surface of the plywood. This will move the water column at the opposite end either higher or lower. Then simply shim under the side of the level where the water is highest until the water columns are equal. (I used playing cards for shims.)







BRASS PLATES

The brass plates on this level do more than provide a nice contrast with the walnut body. A cover plate on top protects the level vial. And a plate on each end of the bottom reduces wear.

Note: I used 1"-wide strips of brass. These are available at most hobby shops.

To fit the recesses cut earlier in the level, there's a gentle curve on the end of each plate. The trick is getting a perfect fit where the curved end meets the shoulder of the recess.

TEMPLATE. To do this, I made a template out of posterboard (see pattern on page 21). Then I used it to lay out the curved ends on the brass.

FILE. Now just file the ends to fit. What works well here is to set the file in a kerf in a scrap block (see *photo A* below). Then pivot the brass back and forth, checking the fit frequently.

COUNTERSINKS. The next step is to drill countersinks for the screws that will be used to attach the plates *(Fig.11)*.

After laying out the location of these holes, make a punch mark to keep the bit from wandering *(photo B)*. Then drill each countersink so the screw heads will be just a bit proud *(photo C)*. (They'll be sanded flush later.)

VIEW SLOT. In addition to the countersinks, there's also a "view slot" in the cover plate so you can see the bubble in the vial. Drilling non-overlapping holes and filing the edges smooth makes quick work of cutting this slot *(Fig. 11b)*.

TAPER ENDS. Before attaching the wear plates, you'll want to taper the ends of the level. You can use the same template as before to lay out the basic shape. Then cut the ends to shape *(Fig. 12)*.

ATTACH WEAR PLATES. The wear plates also have to be shaped to match the ends of the level. But it's easiest to do this after you attach them to the level.

The plates are held in place with brass screws *(Fig. 11a)*. The heads of these screws are then filed and sanded flush.

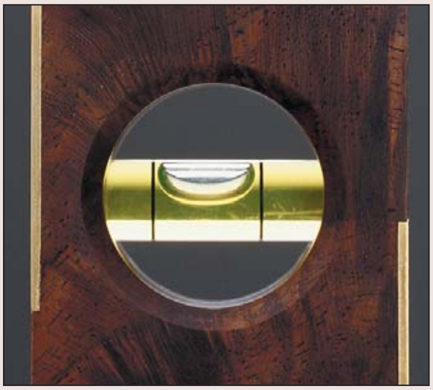
FILE AND SAND PLATES. All that's left is to file the edges of the wear plates to shape *(Fig. 13)*. Then sand them flush with the level. ■

A kerf in a piece of scrap holds the file so you can use both hands to control the plate as you fine tune the fit.

To keep the drill bit from "skating" across the plate, use a punch to make small dimples where the screw holes will be.

A regular countersink bit can be used to drill the countersinks in the brass plates. (Also refer to the Shop Tip on page 37.)

TECHNIQUE . . . . . Adjusting the Level



ADJUSTING PLUMB

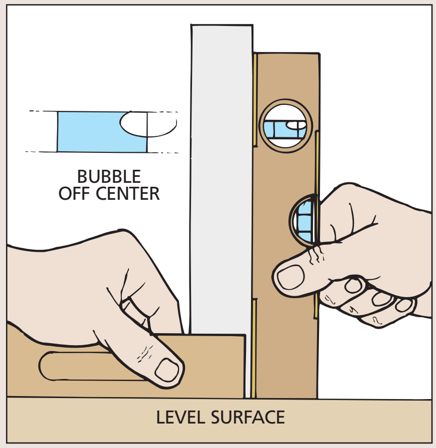
To get accurate results, the plumb vial needs to be perpendicular to the bottom edge of the level (see photo above).

Since the hole for the vial was drilled at 90° to this edge, it should be pretty close. But you may need to "true up" the bottom just a bit.

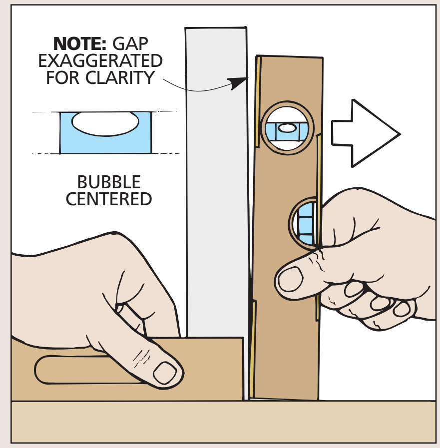
To find out, start with a known level surface. (Refer to the Shop Tip on page 25.) Then check the plumb vial *(Step 1)*.

If it's not accurate, reposition the level until the air bubble is dead on *(Step 2)*. This will create a slight gap between the try square and one end of the level.

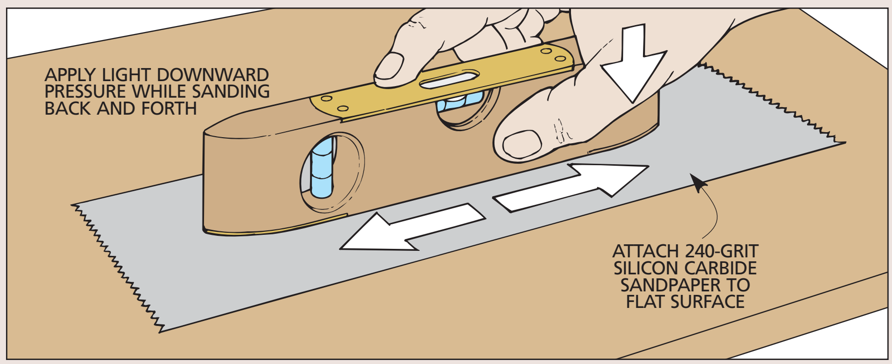
To true up the level, simply sand the opposite end *(Step 3)*, checking the vial again every two or three strokes.



1 *To check the plumb vial, place the level against the blade of a try square that's on a known level surface.*



2 *Now move one end of the level away from the square until the air bubble is dead on. Note which end will need sanding.*



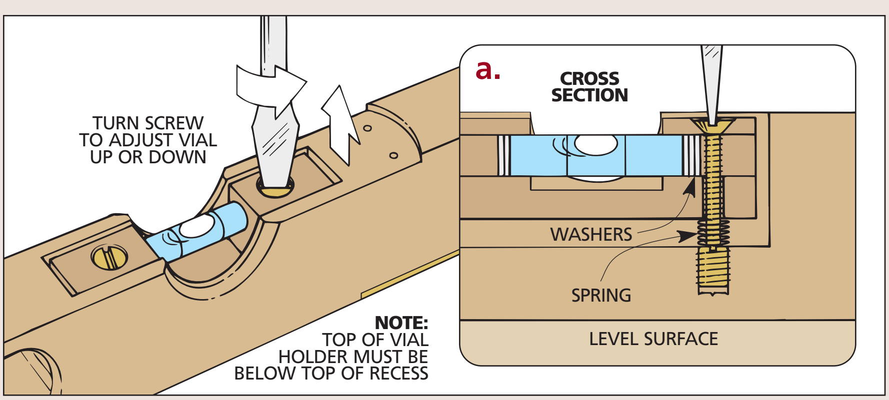
3 *To true up the bottom of the level, attach a piece of sandpaper to a flat surface. Then with pressure on the end that needs to be shaved down, take two or three light strokes.*

ADJUSTING LEVEL

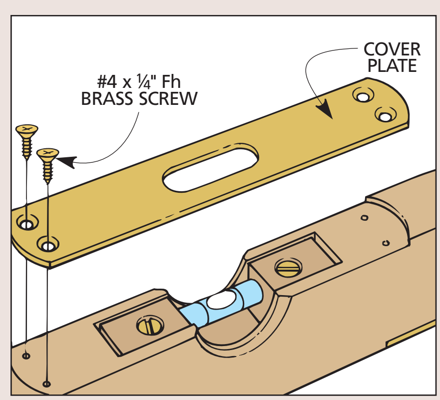
The second part of the adjustment process is to calibrate the level vial (see photo at left).

Here again, you'll need to use a known level surface to make a precise adjustment *(Step 4)*. After centering the air bubble in the vial, it's a good idea to double check the adjustment. To do this, turn the level end for end — the reading should be the same.

Once you're satisfied with the adjustment, attach the coverplate *(Step 5)*.



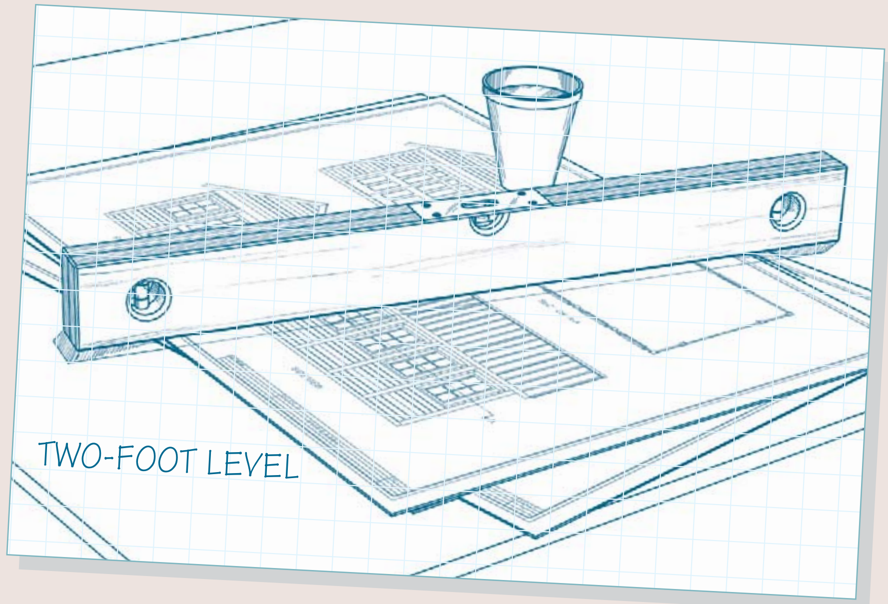
4 *With the level resting on a known level surface, adjust one end of the vial holder up or down until the air bubble is centered on the indicator lines of the vial.*



5 *Double check the adjustment of the vial, then screw the cover plate in place.*

DESIGNER'S NOTEBOOK

When checking a surface for level, a longer level will provide a more accurate reading. This version of the Torpedo Level uses Baltic birch plywood to make a stable body that won't warp or twist.



CONSTRUCTION NOTES:

■ This level is built from two layers of 3/4"-thick Baltic birch plywood. I used Baltic birch because it has more plies than regular plywood, is very stable, and is free of voids. So the body of the level won't change with changes in humidity.

■ Start by cutting the two body halves (A) to size (see drawing below).

■ Glue the two halves together to form the body of the level. In addition to clamping along the faces, tighten clamps across the edges and ends of the blank to keep the edges flush all around.

■ After the glue dries, joint the body if necessary to true up the edges. For the level to be accurate, it's important that the long edges are parallel to each other.

■ On this level, the recesses for the brass plates are easier to cut since they are all identical and have square ends (see drawing). I routed the recesses with a straight bit in the router table. It's a good idea to use a backer board behind the workpiece to prevent chipout.

■ Now you can bore the holes that hold the two plumb vials (see drawing).

■ After that, drill the 1"-dia. viewing holes for the plumb vials (detail 'b') and for the horizontal vial (refer to *Fig. 3* on page 22).

■ Now rout a 1/8" chamfer around each face of each viewing hole (detail 'b').

■ At this point, you can press a vial into each of the vertical vial holes.

■ Once these holes are complete you can bore the mortise for the horizontal vial.

■ The horizontal vial holder is identical to that of the Torpedo Level.

■ After the horizontal vial holder has been installed, you can cut the brass plates to size and mount them in the recesses. Then file and sand them flush with the edges of the level (detail 'a').

■ The next step is to true up the level as described on page 27.

■ And finally, to make the level more comfortable to handle, rout a 1/16" chamfer around each face (detail 'b').

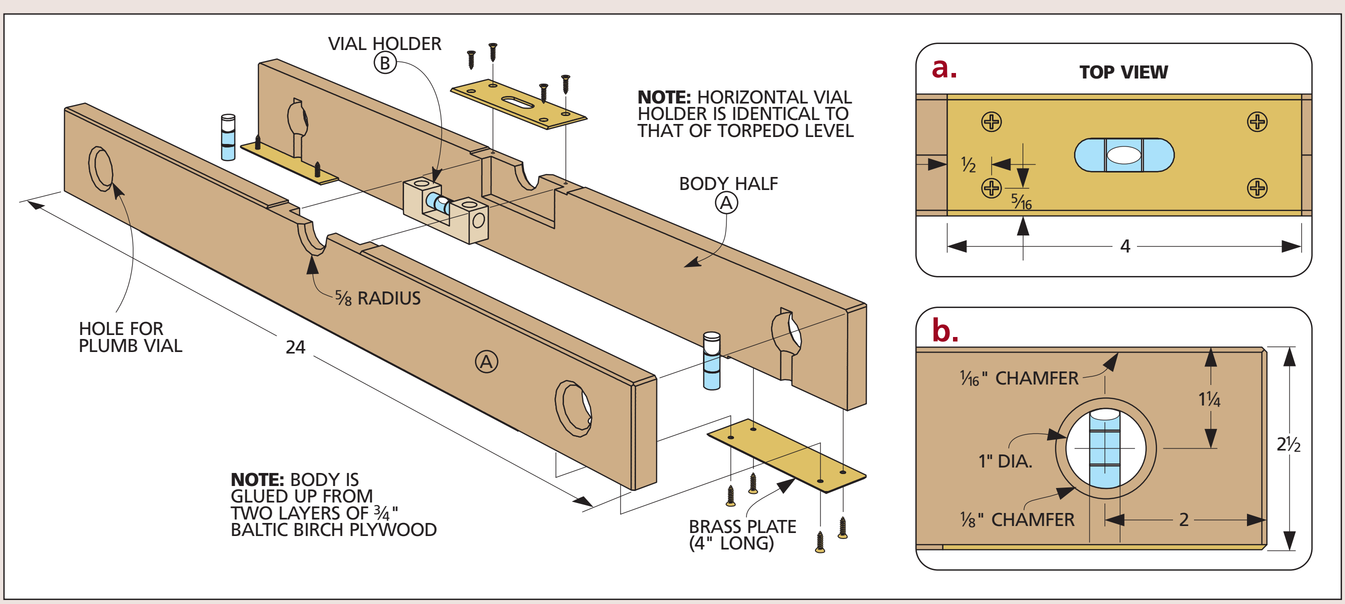
MATERIALS LIST

CHANGED PARTS

A Body Halves (2) 3/4 ply - 2 1/2 x 24

HARDWARE SUPPLIES

(12) No. 4 x 1/4" Fh brass screws
(3) 3/8" x 1 1/4" bubble vials
(1) 1/16" x 1 1/2" - 14" brass strip



Shop Mallets

Eye-catching and functional, these mallets are just what's needed to give something a good "whack" or to offer an assembly some gentle persuasion. And it takes almost no time to turn them on the lathe.

Compared to the table saw or router, the lathe is a quiet power tool. That's one of the reasons I like working on it. Another reason is that every time I turn a project, I'm amazed at how quickly it takes shape. And these mallets are no exception.

With just two basic tools (a spindle gouge and a parting tool), you can spend a quiet morning making shavings and end up with a mallet you'll use for years.

TWO MALLETS. Depending on the type of woodworking you do, you may want to turn one (or both) of these mallets. The heft of the carver's mallet (on the right in the photo) allows you to strike a chisel with a firm, solid blow. The round head lets you swing from any angle without changing your grip. By comparison, the carpenter's mallet (left) is best suited for tapping a chisel or to coax together a reluctant assembly.

WOOD. When choosing wood for a mallet, you have to consider the use it will get. The carver's mallet is subject to constant pounding — some gentle, some more forceful. A tight-grained hardwood (like maple) is needed to take the abuse.

The carpenter's mallet is meant for lighter, more occasional work. Maple was still used for the "business end" of the mallet. But I added some visual interest by making the handle from cherry.

BLANKS. The carver's mallet is turned from one blank. But instead of a single, solid piece of wood, I glued up a blank from three pieces of stock. That way, I could select clear, straight-grained pieces. This also reduces the chances of the mallet checking and splitting.

The carpenter's mallet is turned from two separate pieces. To join the pieces, a round tenon on the handle fits into a mortise in the head. Then a wedge is driven into the tenon to lock it into the mortise.

FINISH. I applied a couple of coats of an oil varnish to both mallets.

SELECTING TOOLS. If you're new to woodworking, being able to make a tool (like those in this book) not only saves you money, but gives you a tool you'll be proud to use. Still, you won't be able to make every tool you need. For some advice on selecting the rest, see page 32.

CARVER'S MALLET

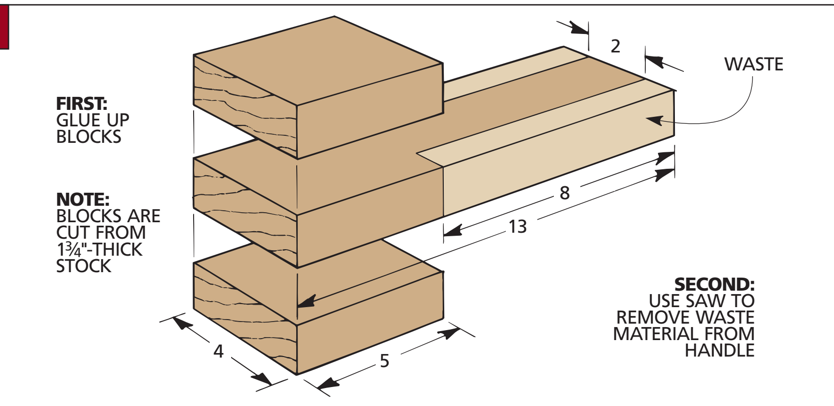
The outline of the carver's mallet looks sort of like an old schoolbell. The reason for this round shape is simple. It lets you strike a carving tool from any angle without changing your grip on the mallet.

Like a traditional carver's tool, both the head and handle of this mallet are turned from a single block of wood (see photo below). I made the block by gluing up three pieces of $1^3/_4$"-thick hardwood *(Fig. 1)*. (I used maple. Beech, hickory, or ash would also be good choices.)

HEAD. After mounting the block and roughing out the cylinder, you can start on the head of the mallet. To make it easy to strike a chisel squarely on the handle, there's a gradual taper cut on the head. (For a step-by-step procedure, see *Fig. 2* and the box below.)

HANDLE. The handle of the mallet is designed to be held right below the head — like "choking up" on a baseball bat. The large cove at the base of the head provides a comfortable grip. And a gentle curve that swells toward the cove and button at the end of the handle keeps your hand from slipping.

1



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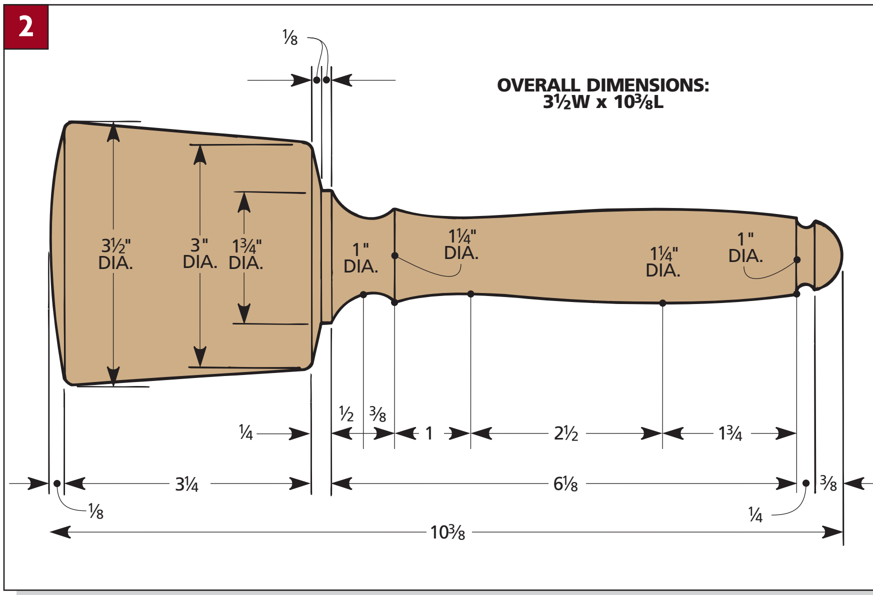


CARVER'S MALLET

1 First, rough out the block with a spindle gouge. Then use a parting tool to define the shape of the head and the end of the handle.

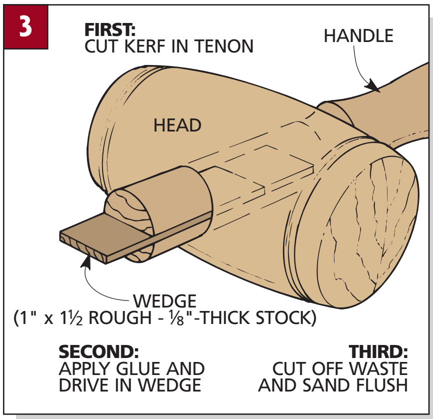
2 After using a spindle gouge to cut a gradual taper on the head, switch to a parting tool to cut the $1/_8$"-wide step at the top of the handle.

3 Next, use the spindle gouge again to scoop out the wide cove at the base of the head and shape the curves on the handle.

4 The narrow cove and the "button" at the end of the handle can also be turned using a small spindle gouge.

5 Use a parting tool to cut a slight dome at the large end of the mallet. Then sand the mallet before removing it from the lathe. Finally, saw off the waste from each end.

Two turning tools and a few minutes at the lathe are all it takes to turn the mallets on these two pages. A spindle gouge is used to shape most of the curved portions and a parting tool is needed to define the straight edges.



CARPENTER'S MALLET

The carpenter's mallet is turned from two blanks — maple for the head, and a cherry turning square for the handle (see *Fig. 4* and the box above right).

HEAD. The head curves gently from the center to a small bead near each end.

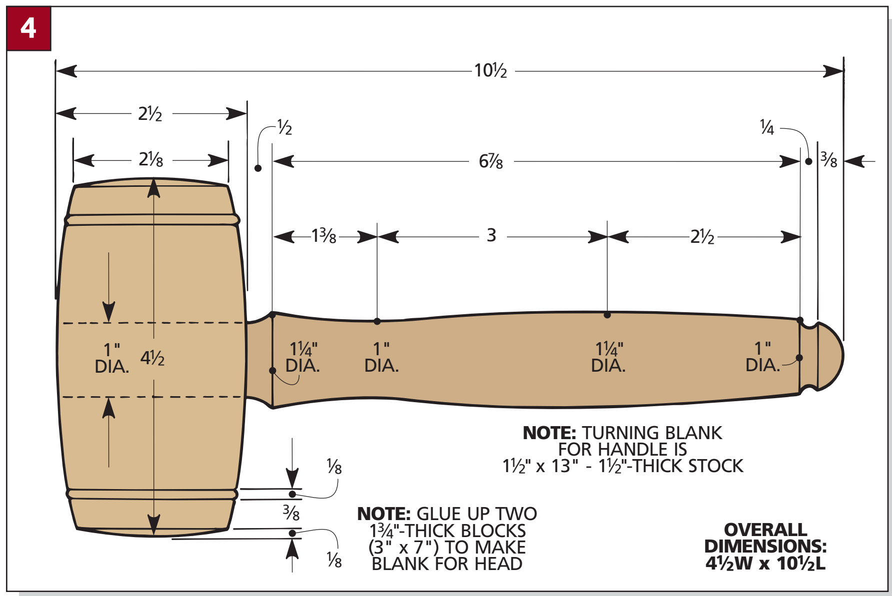
The striking surface (the ends) taper slightly. After removing the head from the lathe, I drilled a hole (mortise) for the handle using the jig shown below.

HANDLE. Except for a tenon on one end that fits in the head, the handle is identical to the carver's mallet. To sneak up on a perfect fit of the tenon into the mortise, remove small amounts of material and check the fit frequently.

WEDGE. The handle is locked in place with a cherry wedge. This is just a matter of cutting a kerf in the tenon, applying glue, and driving in the wedge *(Fig. 3)*.

CARPENTER'S MALLET

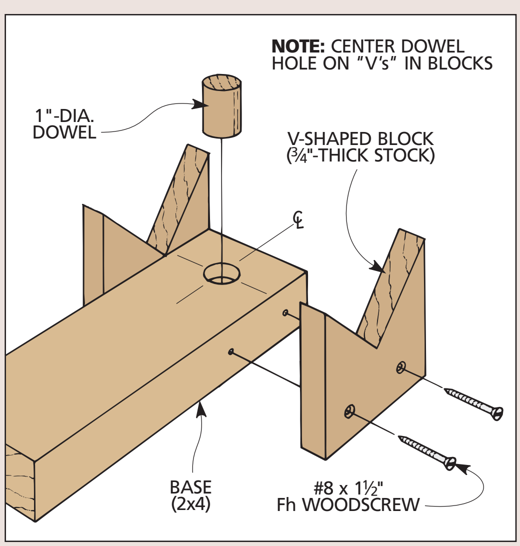
HEAD	HANDLE
1 *Rough out a cylinder with a spindle gouge, and use a parting tool to define the ends of the head.*	**1** *With the cylinder roughed out, mark the end of the handle and the flare at the base of the tenon.*
2 *Now use a spindle gouge to shape the curves that run from the center of the head to each end.*	**2** *Shape the handle between these marks with a spindle gouge. Then turn the cove and button at the end.*
3 *Complete the head using a parting tool to form two small beads and to cut the curves on the ends.*	**3** *Using a spindle gouge, turn the tenon on the end of the handle to fit the mortise in the mallet head.*

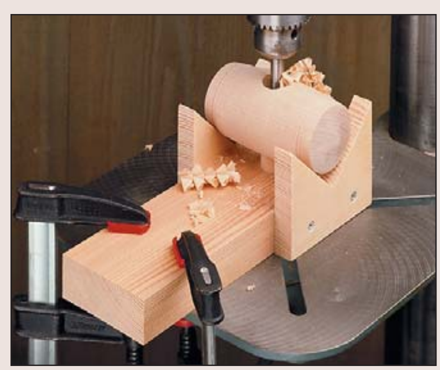


SHOP JIG . . . . *Drilling Jig*

Drilling a hole through a round workpiece presents a couple of problems. First, it rolls around. And second, you need to drill through from both sides to prevent chipout, yet still manage to have both holes end up perfectly aligned.

This simple jig solves both problems. To hold the head steady, two V-shaped blocks are screwed to a scrap 2x4 (see drawing). Then clamp the jig to the drill press and drill a hole in the 2x4 for a dowel. Glue a short piece of dowel into the hole. It will automatically align the holes in the mallet (see photo).





Using the Jig. *The secret to this jig is to clamp it in place so the bit aligns with the hole in the 2x4 that holds the dowel. Drill a hole in one side of the head, then fit it over the dowel. This way the hole drilled from the opposite side lines up.*

SHOP INFO . . . . Selecting Tools

Like many woodworking shops, my shop started out as a collection of hand tools used mainly for home improvements. When a bedroom door no longer closed, I bought a plane to make it fit again. To build a fence, I bought a circular saw and built a pair of sawhorses to help get the job done.

After a while, I had acquired enough tools to tackle my first woodworking project. In hindsight, I wish I had given some more thought to the tools I had purchased — a little more planning could have saved some money in the long run.

The following hand tools are those I'd recommend to anyone getting into woodworking. To keep costs down, plan ahead and don't wait until you need a tool to buy it. Watch for sales at hardware stores and home improvement centers.

You might also consider purchasing from mail-order catalogs or online vendors. (Some of these companies are listed in Sources on page 126.) These tools may cost less than those at a retail outlet. And some catalogs don't charge for shipping.

One other thing. I recommend buying the best tools you can afford — better tools last longer. And they'll out-perform their less expensive competitors.

POWER TOOLS

Most woodworkers begin their collection with power tools. And the most practical one to start with is the circular saw (upper center of photo at right).

CIRCULAR SAW. Even though a circular saw is used mainly for construction work, it's also great for cutting up sheet goods, like plywood and MDF. And with the help of a straightedge, it can be used to rip or crosscut lumber accurately.

Like most tools, circular saws fall in a wide price range — with the better saws being in the middle to upper price range. So it's a good idea to compare them closely and base your decision on how it will be used, and how much you'll use it.

Once you've made your pick, check to see what type of blade it comes with. If it isn't carbide tipped, invest in a quality combination tooth blade. You may pay twice as much for a carbide blade as for a steel blade, but what you'll get is a blade that cuts smoother with less chipout. This means the motor won't work as hard and will run cooler — which should make the saw last longer.

ELECTRIC DRILL. My next tool of choice is an electric hand drill with a $^3/_8$" chuck. It's a real time-saver when drilling pilot holes for screws and other fasteners. It's also great for assembly work or things like dowel joinery.

When looking for a hand drill, there are two roads to follow. You can buy a corded drill (fairly inexpensive). Or a cordless, rechargeable drill (right side of photo above) The cordless drill is more expensive due to the cost of the batteries that come with it. The biggest advantage of a corded drill (besides the lower cost) is that you'll have more torque (power) without having to worry about the charge left in the battery.

The advantage of a cordless drill is its portability. No more hassle with tangled extension cords. And you won't have to drag a cord through the house every time you want to hang a shelf.

RANDOM-ORBIT SANDER. Since most projects need some sanding, I'd buy a random-orbit sander (at left in photo). They're hard to beat for removing planer marks, chipout, and scratches. It won't eliminate hand sanding tight spots like inside corners, but you can save a lot of effort with a power sander.

ROUTER. I use a router in just about every project I build — whether it's routing a groove, a dado, or just a decorative profile. This versatile tool can even be mounted upside down in a shop-made or commercially-made table for use as a small shaping tool.

My first router had a $^3/_4$ hp motor with a $^1/_4$" collet. But now I use a $1^1/_2$ hp router with interchangeable $^1/_4$" and $^1/_2$" collets (upper right in photo). The two different collets allow me to use my old $^1/_4$" bits, but any new bit I buy has a $^1/_2$" shank. The larger shank allows the collet to get a firmer grip, so they tend to run more smoothly.

JIG SAW. When you need to cut a curve or a circle, you can use a coping saw. But a jig saw is quicker. And it can cut through thick stock much easier. (It's in the center foreground of the photo.)

If you're only going to use a jig saw every now and then, you can stay toward the lower end of the price range. But if you think it's a tool you'll use a lot, it's wise to spend more for a higher-quality tool that also offers more features.

THE ESSENTIALS

POWER TOOLS
- Circular saw (with carbide blade)
- Electric drill ($^3/_8$" chuck)
- Random-orbit sander
- Router (with carbide bits)
- Jig saw

HAND TOOLS
- Chisel set
- Mallet
- Block plane
- Jack plane
- Cabinet scraper
- Japanese pull saw
- Combination or try square

HAND TOOLS

In addition to the basic hand tools (like hammers, pliers, and screwdrivers), you'll need a few others for woodworking.

CHISELS AND MALLET. My favorite hand tools are chisels (shown in the lower center of the photo at right). I use them all the time to cut joinery (like dovetails and mortises) or to fine-tune the fit of parts.

Chisels are usually sold in sets that include several widths. A quality set of chisels isn't cheap. But as you may often hear when the topic is tools, spending more usually means you'll get more. Better quality chisels will sharpen more easily and hold an edge longer.

While you're at it, pick up a wood mallet or make one yourself (see pages 29-31). (A wood mallet is easier on the handles of your chisels.)

PLANES. You'll also need a couple of good planes. A jack plane (on the right in the photo) is good for edge jointing, smoothing, and flattening boards.

The plane I reach for most often is my low-angle block plane (shown in the box in the photo). It's useful for trimming and fitting parts. A low-angle block plane is the perfect tool for trimming end grain.

Note: If you'd like to build your own plane, see pages 70-79.

CABINET SCRAPER. A cabinet scraper is an excellent way to obtain glass-smooth wood. Unlike the large, thick curls a hand plane produces, a cabinet scraper produces micro-thin shavings. (It's in the middle of the photo, above the chisels.)

In fact, some woodworkers don't even use sandpaper. They'll scrape an entire project smooth, then apply the finish. A cabinet scraper can last a lifetime, and best of all, they cost very little. (Plans for a "holder" to make using a scraper even easier can be found on page 64.)

JAPANESE SAW. To cut wood by hand, I prefer a Japanese pull saw (shown next to the jack plane). This saw is designed to cut wood quickly, cleanly, and accurately. It has razor-sharp teeth and cuts on the pull stroke for better control. (This is especially useful when cutting dovetails and tenons.)

SQUARES. Finally, no shop is complete without an accurate square for checking corners. For most projects, a small try square with a 5" blade is all you'll need (in the box next to the block plane).

A combination square (upper center of the photo) is also nice to have. The ruler on the blade makes it useful for checking the depth of a mortise or the height of a bit or blade. The angled portion of the head is great for checking mitered corners or for drawing 45° layout lines.

STORAGE. Once you start acquiring tools, you'll need a place to store them. Some projects for this begin on page 80.

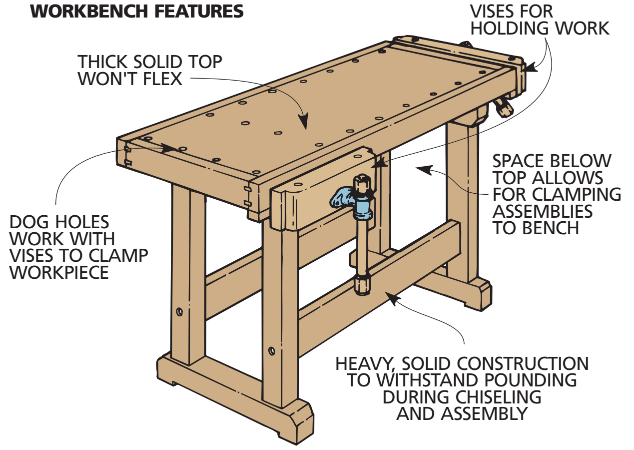
A PLACE TO WORK

Even though they can't be considered hand tools, a solid workbench and a pair of sturdy sawhorses are essential tools to have in the shop.

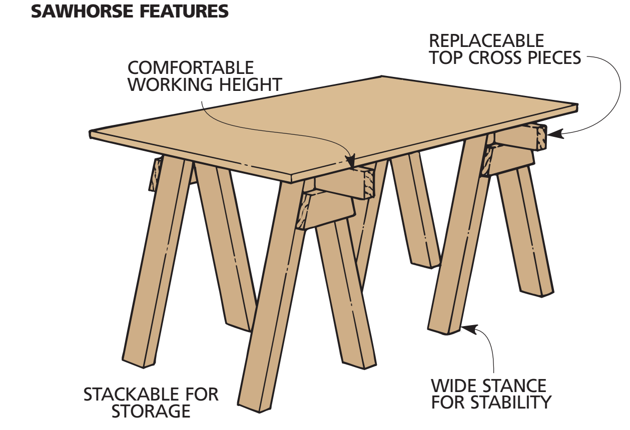
Quite often they're one of the first things you'll build for your shop: the workbench for general woodworking, and the sawhorses to support and work on oversized projects. (And by just dropping a sheet of plywood on them, sawhorses can even be used to create a quick, temporary work surface.)

As when selecting hand tools, you need to consider what type of work you plan to do in your shop and how you work. The drawings below show some features to consider whether you plan to buy these items or build your own.

WORKBENCH FEATURES



SAWHORSE FEATURES



Sliding Bevel Gauge

Think of it as a try square for duplicating angles. Use it to transfer an angle between workpieces, or to set a miter gauge or saw blade to match a bevel. And it takes almost no time at all to build.

Not every corner and angle in woodworking is a perfect 90°. Sometimes this is intentional; sometimes it's not.

Whatever the reason, if you need to cut a workpiece or set up a tool to match an odd angle, you can't use a square for the layout. That's where this Sliding Bevel Gauge really shines.

Like a try square, the blade of this gauge is positioned between two pieces of wood that form the handle. So you can hook the handle on the edge of a board with the blade extending over the workpiece. Or you can stand the gauge on edge, balanced on the handle.

The big difference between the Sliding Bevel Gauge and a try square is the pivoting blade. It can be set to match any angle. Then you can transfer the angle to another workpiece or use the gauge to help with a tool setup. (See the Technique box on page 39 for more details.)

CONSTRUCTION. You can probably build this gauge in a day. All you need are two small pieces of wood and a 1"-wide brass strip. (Brass is available at hobby stores or see page 126 for other sources.)

The brass does more than just dress up the gauge. It also prevents damage to the handle and provides a consistent, true surface for the tool to rest on.

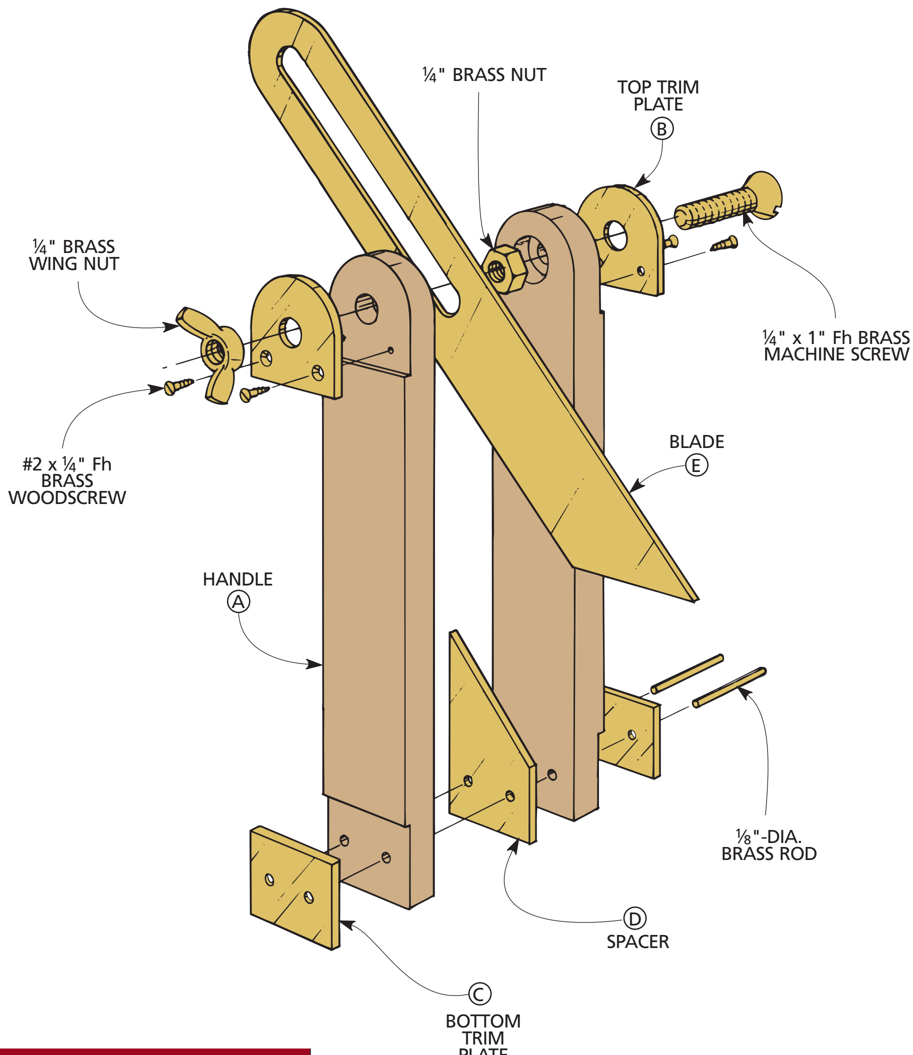
FASTENERS. I used a couple of methods to fasten the brass plates to the handle. At the top, two small brass screws are used on each face. The screw heads are left proud and filed flush with the plates. This makes the screws practically disappear.

The bottom plates are secured by a couple of brass rods that pass through the handle. The ends of the rods are then "peened" over to lock them in place. (There's more about this on page 40.)

The challenging part is getting an almost flawless fit between the brass and wood. Some simple techniques for doing this are outlined in the Technique article on pages 40 and 41.

EXPLODED VIEW

OVERALL DIMENSIONS:
1W x 1¼D x 7¹¹⁄₁₆H (FOLDED)



MATERIALS LIST

WOOD

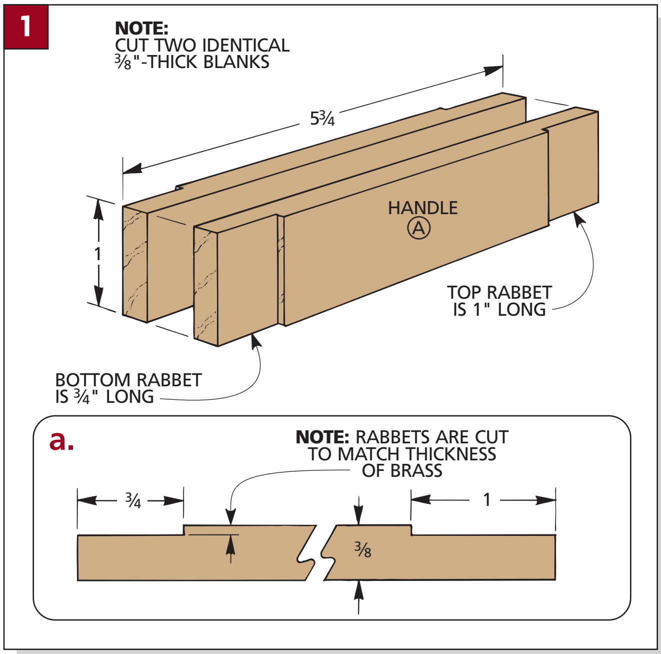
A	Handles (2)	⅜ x 1 - 5¾

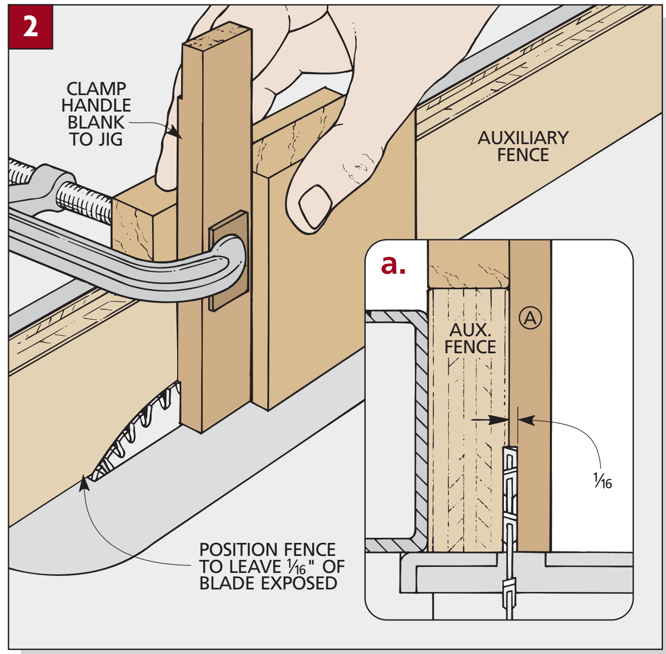
BRASS

B	Top Trim Plates (2)	¹⁄₁₆ x 1 - 1 rough
C	Btm. Trim Plates (2)	¹⁄₁₆ x ¾ - ¾ rough
D	Spacer (1)	¹⁄₁₆ x 1 - 1½ rough
E	Blade (1)	¹⁄₁₆ x 1 - 8 rough

HARDWARE SUPPLIES

- (4) No. 2 x ¼" Fh brass woodscrews
- (1) ¼" brass wing nut
- (1) ¼" x 1" Fh brass machine screw
- (1) ¼" brass nut
- (1) ⅛"-dia. x 12" brass rod





HANDLE

I started on the gauge by making the handle. The handle is two identical pieces with a rabbet in each end to accept the brass plates *(Fig. 1)*. Since brass can stain light colored woods when it's filed or sanded, I used walnut. The dark wood also contrasts nicely with the brass.

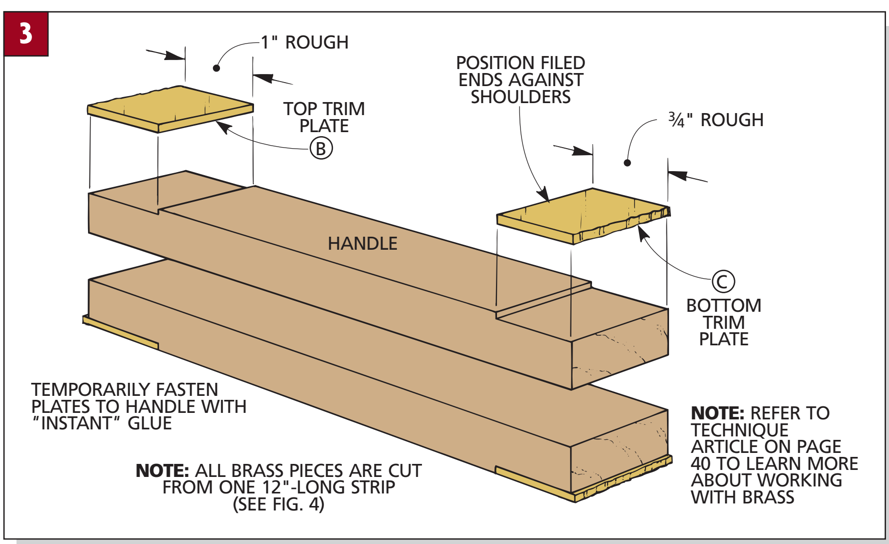
To make the handle (A), the first step is to cut two 3/8"-thick blanks to match the width of your brass strips (1" in my case) and 5 3/4" in length *(Fig. 1)*.

RABBETS. After these blanks are cut to size, a shallow rabbet is cut on each end to accept brass trim plates *(Fig. 1a)*.

The depth of the rabbets is the same thickness as the brass strip (1/16"). The only difference is their length (height). The rabbets on the bottom end of each blank are 3/4" long. But the rabbets on the top end are 1" long.

Since the rabbets are so wide, I cut them on the table saw with the piece standing on end. This is made easier with the help of a simple jig. First, I attached an auxiliary fence to the table saw rip fence, leaving 1/16" of the blade exposed *(Fig. 2)*. Then, to support the workpiece, I clamped it to an L-shaped jig that slides on top of and against the fence.

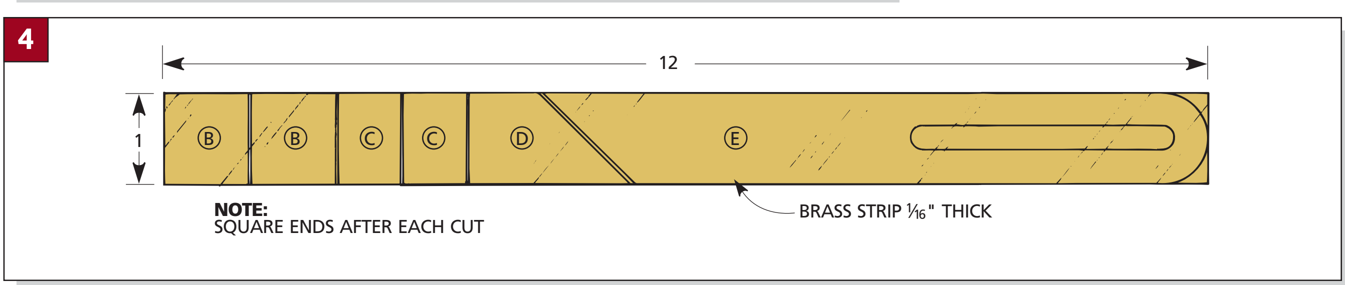
To make the cuts, I fed the workpiece through the blade slowly to prevent "swirl" marks. This produces a smooth face on the rabbet so the brass plate will fit tightly later.



TRIM PLATES

Once the rabbets are cut, the next step is to fit the top (B) and bottom trim plates (C) in the rabbets *(Fig. 3)*. All the brass parts (including the trim plates) are cut from a single 12"-long brass strip *(Fig. 4)*.

The unusual thing is that they're not all cut at once. Instead, the brass strip is



first squared at one end. (See the "Fitting Brass" section in the Technique article on page 40.) Then a trim plate is marked out and cut to rough length. The rough-sawn edge of the strip is squared up again, and the next plate is cut.

Cutting the pieces individually like this ensures that each trim plate will fit tight against the shoulder of the rabbet.

FITTING THE PLATE. But before you can cut the plates to length, the brass strip needs to be flattened. (Again, this is covered in the "Fitting Brass" section on page 40.) Then one end of the strip is squared and a trim plate is cut to rough length *(Fig. 3)*. Don't worry about the rough edge sticking past the end of the handle. It will be filed flush later.

GLUE TRIM PLATE. After each plate is cut to rough length, I use "instant" glue to temporarily hold it in the rabbet. Instant glue isn't strong enough to hold the brass strips in place permanently. Later, the strips will be attached for good with screws or rivets.

SHOP TIP . . . Brass Countersinks

Brass is a soft metal that works easily with regular woodworking tools. So drilling a countersink in brass is easy. I just use my regular countersink bit.

With the bevel gauge, it's important to keep a close eye on the depth of the countersink. Bore too deep and the slot in the screw head will still show after the head is filed down. Too shallow and there will be no head left on the screw to hold the brass plate in place.

One way to help control the cut is to mount the bit in the drill press and rotate the chuck by hand (see photo). This also keeps the bit perpendicular to the workpiece so the hole doesn't end up lopsided.

Note: The bit shown above is a Weldon countersink bit. It makes a smooth cut in metal and wood. See page 126 for sources.

ASSEMBLY

With all the trim plates glued in place, the next step is to attach the two 1"-long top plates permanently to the handle blanks.

TOP PLATES. Each top trim plate (B) is screwed to a handle blank with two No. $2 \times 1/4$" solid brass screws *(Fig. 5a)*.

Since I didn't want the slots of the screw heads to show, I countersunk the holes slightly so the slots were just above the brass strip (*Fig. 5a* and Shop Tip above). Then, after the screws are installed, the heads are filed flush with the top plate. As a result, the slot disappears.

A couple of tips here. First, it's easy to strip the slots in the head of a soft brass screw or even shear the screw off. So drive a *steel* screw of the same size into the hole first. This pre-threads the hole, making it easier to drive the brass screw. And second, poke the screw threads into wax to lubricate them so it takes less effort to drive them.

BRASS SCREW. The next step is to drill a hole through the top trim plates and handle blanks *(Fig. 5)*. This hole is for a brass machine screw (added later) that will help hold the blade in place. It also serves as the pivot for the blade.

To make sure the holes in both handle blanks align, fasten them together with carpet tape and then drill a $1/4$"-dia. hole through the assembly *(Fig. 5)*.

Note: Once the hole is drilled, separate the blanks and remove the tape.

To lock the machine screw in place, it's threaded through a brass nut *(Fig. 6)*. The nut is trapped in a "pocket" between the two handle pieces. I used a Forstner bit to drill a counterbored hole in the inside face of one of the blanks to create the pocket *(Fig. 6a)*.

Then I mixed up some quick-set epoxy to hold the nut in place. Just be careful not to get any epoxy inside the nut or else the machine screw won't thread through it.

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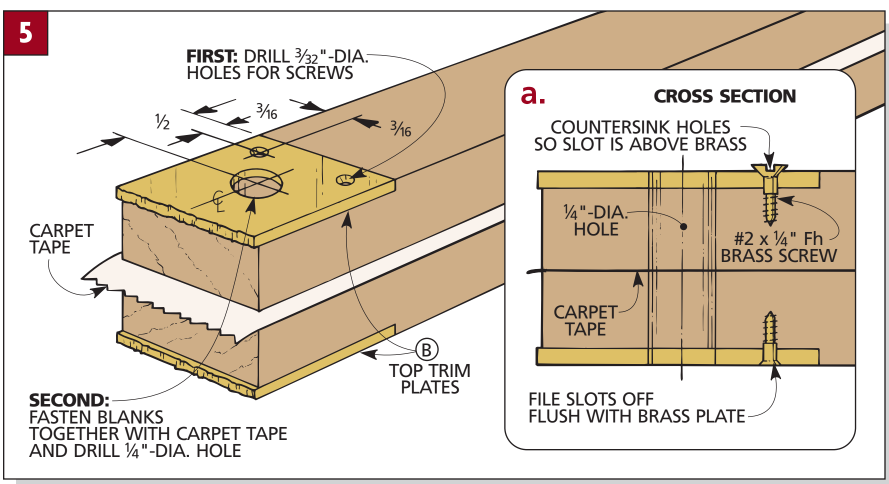

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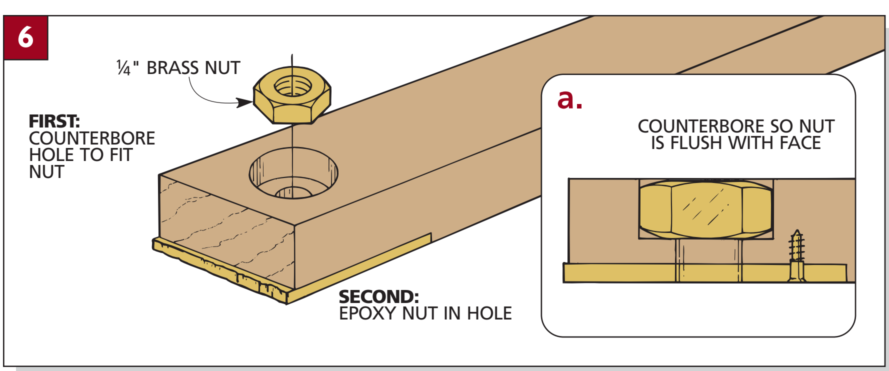


SPACER. Now you can begin work on the other end of the handle. The handle blanks are separated at the bottom by a brass spacer *(Fig. 7)*. The spacer provides clearance for the blade that's added later. And the mitered end acts as a stop for the mitered end of the blade when the tool is folded up.

To make the spacer (D), start by squaring up the end of the remaining length of brass strip. Then measure over 3/4" and cut a 45° miter *(Fig. 7)*. After the spacer is cut to size, file and sand the mitered edge smooth.

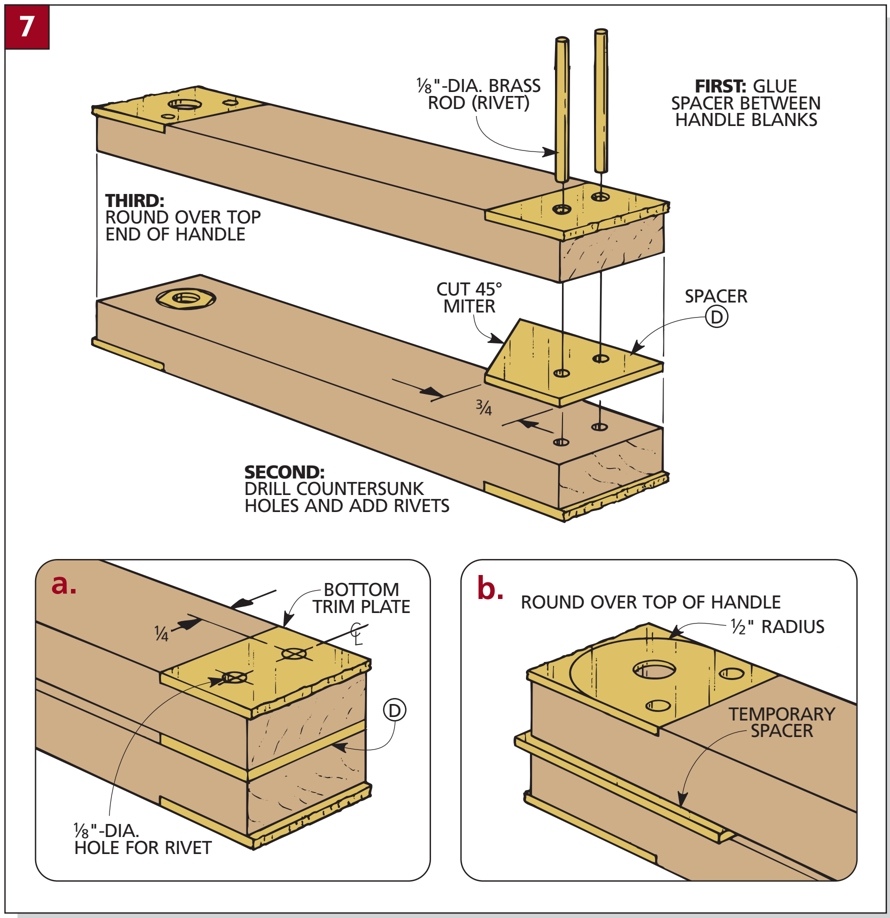
GLUE UP HANDLE. To ensure the spacer will glue up tight between the handle blanks, both faces of the brass strip need to be sanded flat. But you're halfway there since you've already flattened one side.

Once both faces of the spacer are flat, it can be glued between the blanks. A simple trick keeps all three pieces aligned (see the Shop Tip below).

RIVET HANDLE. Now the bottom of the handle can be joined together permanently. What you have here is a "club sandwich" of brass and wood. But regular screws can't reach through all five layers to "draw" the pieces together. So you'll need a different technique.

The solution is simple. I rivet the pieces together (*Fig. 7a* and the "Riveting Brass" section on page 40).

The rivets are just short pieces of 1/8"-dia. brass rod (available at most hobby stores). The ends of the rivets are peened over to lock the pieces tightly together.



SHAPE HANDLE. Now both ends of the handle can be shaped.

The first thing is to sand a roundover on the top end of the handle (*Fig. 7b* and the "Shaping Brass" section on page 41).

Note: To prevent the "open" end of the handle from flexing, insert a thin spacer between the handle blanks.

Once the top end is sanded to shape, the bottom trim plates can be filed flush with the bottom of the handle.

BLADE

After shaping and filing the handle, the next step is to make the blade (E) from the remaining brass strip *(Fig. 8)*.

Since the end of this strip is already mitered (from cutting the spacer earlier), all you have to do is file the miter smooth and round over the other end *(Fig. 8)*.

FIT BLADE. For the blade to fit in the slot of the handle, you'll need to flatten both faces (just like you did for the spacer).

SLOT. After fitting the blade, a slot is cut in one end *(Fig. 8)*. The slot allows the blade to slide and pivot to any angle. A brass machine screw will pass through this slot and lock the blade in place.

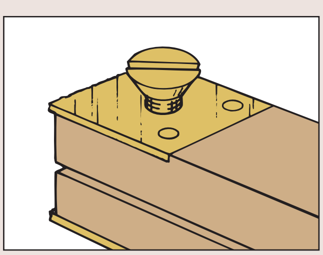
The technique I used to do this is shown in the "Slotting Brass" section of the Technique article on page 41.

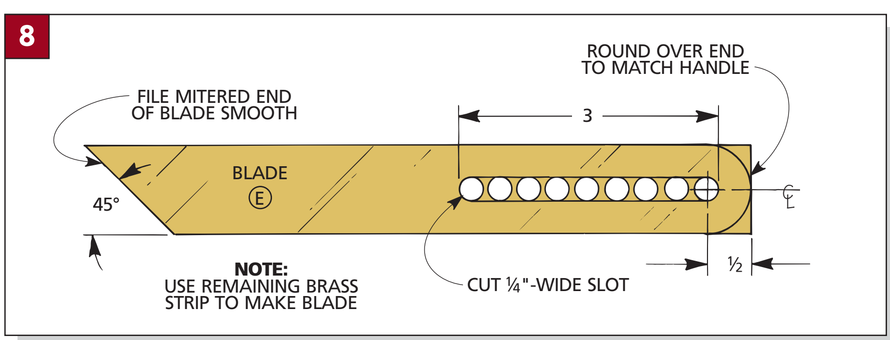
COUNTERSINK. With the blade complete, the last step is to countersink the

SHOP TIP

Alignment Screw

To keep the handle halves aligned during glue-up, insert the brass machine screw through the holes as a simple indexing pin.

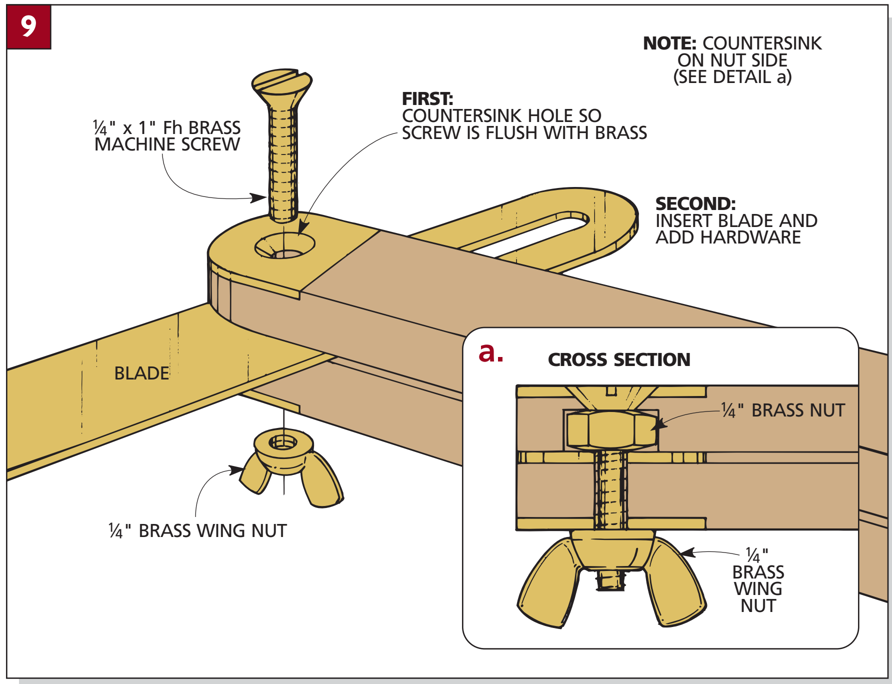




hole in the handle to accept the brass machine screw *(Fig. 9)*.

FINISH. Finally, to get a satin finish on the brass and wood, I use a simple buffing process (see "Finishing Brass" on page 41). When the gauge is smooth, add the blade, screw, and wing nut. ■

To lock the blade in position, tighten the wing nut to pinch the blade between the handles. The brass plates provide a bearing surface for the wing nut.



TECHNIQUE . . . . *Using the Bevel Gauge*

Using the Sliding Bevel Gauge couldn't be much easier. There are two main uses for the gauge — laying out an angle and duplicating an angle.

LAYING OUT AN ANGLE

A Sliding Bevel Gauge is frequently used to lay out an angle directly on a workpiece (such as a bevel or taper).

PROTRACTOR. A quick and easy way to set the bevel gauge is to use a protractor *(Fig. 1)*. Just loosen the wing nut, set the blade to the desired angle on the protractor, and lock the blade in place.

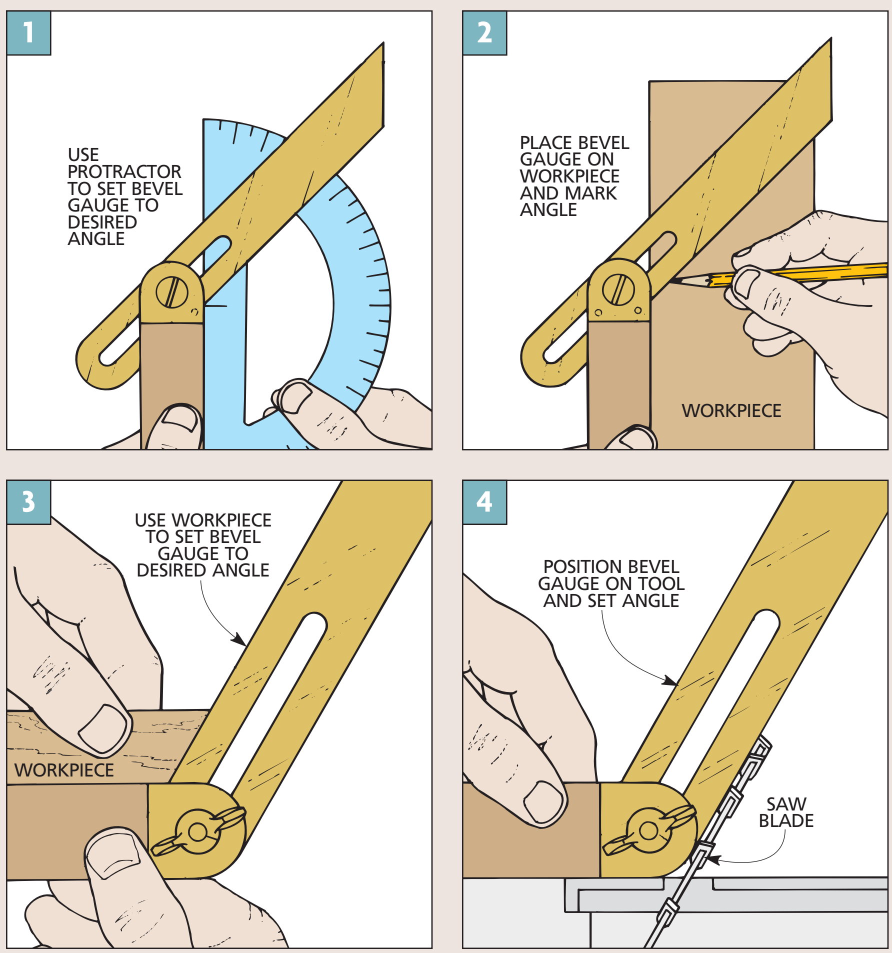
Once the gauge is set, place it on your workpiece and lay out the angle *(Fig. 2)*.

DUPLICATING AN ANGLE

A bevel gauge is also handy when you need to cut a workpiece to match another.

SET ANGLE. To set the gauge, hold the bevel gauge in one hand and the workpiece in the other. Then adjust the blade to match the workpiece *(Fig. 3)*.

TRANSFER ANGLE. After the gauge is set, you can transfer the angle. Simply position the gauge and set the saw blade to the same angle *(Fig. 4)*. The same procedure can be used to set an angle on the miter gauge or other tools.



TECHNIQUE . . . . . *Working with Brass*

Brass has long been used as a decorative trim and a reinforcement on fine hand tools. Drop the edge of a square with a wood handle on your bench and you could ruin the true edge with a dent. A strip of brass on the square will protect the edge. And as an added benefit, it adds a very nice look to the tool.

But you're a woodworker — what do you know about working with metal? Luckily, you don't have to know anything special. Or buy specialized tools.

CUTTING AND SHAPING. Brass is an alloy of copper and zinc. That means it's soft enough to be cut with carbide-tipped blades and bits. You can shape it further with silicon carbide sandpaper or a file.

FASTENING. And when it comes to fastening brass to wood, there are some simple methods (like screws and brass rivets) that will give you a secure joint and professional-looking results. (See the Technique on page 12 for more on using screws to fasten brass to wood.)

PROTECTING. Brass won't rust since it doesn't contain iron. But it will tarnish. Fortunately, you can prevent tarnish from forming with a little care. An occasional application of wax to the tool will keep the brass shiny and any moving parts moving smoothly. (It also adds a nice luster to the wood.) And if tarnish does begin to form, a brass polish with a soft cloth will usually remove it. If the tarnish is stubborn, try applying the polish with a 0000 steel wool before applying a coat of wax.

FITTING BRASS

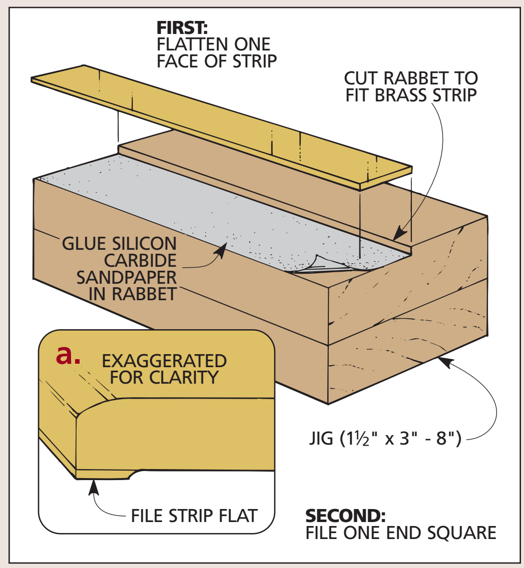
Flat and Square. *Fitting brass to wood is easy with this simple jig. First, the brass strip is flattened using a piece of sandpaper. Then, one end is squared with a smooth mill file, using the jig as a guide.*

For a brass strip to fit tight in a rabbet, it has to be flat and square. The problem is that they aren't made this way (see detail in drawing at right).

To solve this, I use a simple jig (see drawing). It's just a block of wood with a shallow rabbet cut in it for the brass strip.

FLATTEN FACE. To flatten the brass, glue a piece of 120-grit silicon carbide sandpaper in the rabbet. Then slide the entire strip back and forth until it's flat.

SQUARE EDGE. Next, to square an end, extend the strip past the end of the jig and clamp it. Then, using the end of the jig as a guide, file the end square (see photo).



RIVETING BRASS

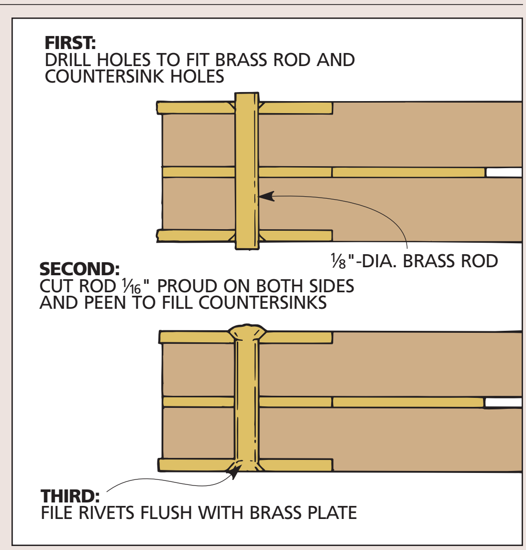
Solid Connection. *Rivets made from a brass rod "draw" the handle pieces tightly together when the ends are peened over like a mushroom.*

Riveting brass is a simple three-step process. All it takes is a brass rod and a little patience.

DRILL HOLES. The first step is to drill countersunk holes the same diameter as your brass rod (see top drawing at right).

CUT RIVETS. Then cut two pieces of brass rod to length so they extend about $^1/_{16}$" "proud" on both sides.

PEEN RIVETS. Now, to lock the plates in place, peen the rivets. The idea is to "mushroom" the ends so they completely fill the countersinks (see photo at left). When you're done, file the heads flush with the brass plates.



SHAPING BRASS

File and Sand. *Shaping the ends of the bevel gauge handle is easy. You can use a smooth mill file (see photo), or a drum sander in a drill press.*

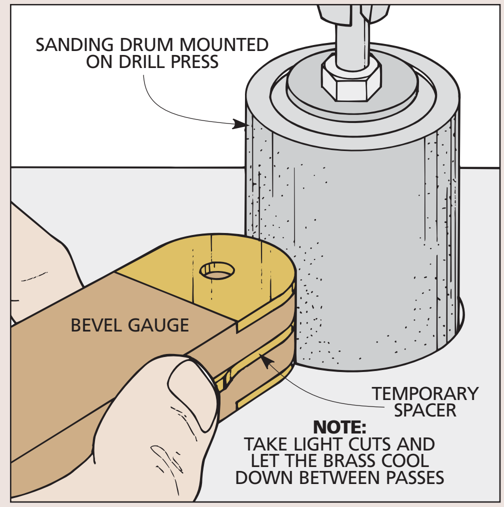
There are two basic ways to shape brass: filing and sanding.

FILING. You can use a mill file to shape brass (see photo). This works well, but takes time.

SANDING. Another option is to sand. A belt/disc sander works great. But work carefully, since it can remove stock quickly.

DRUM SANDER. I prefer to use a drum sander in a drill press (see drawing). It takes the material off slower, but that's okay. This way I can sneak up on the shape.

Note: When you are done sanding, switch to a file to smooth the radius at the top of the handle.



SLOTTING BRASS

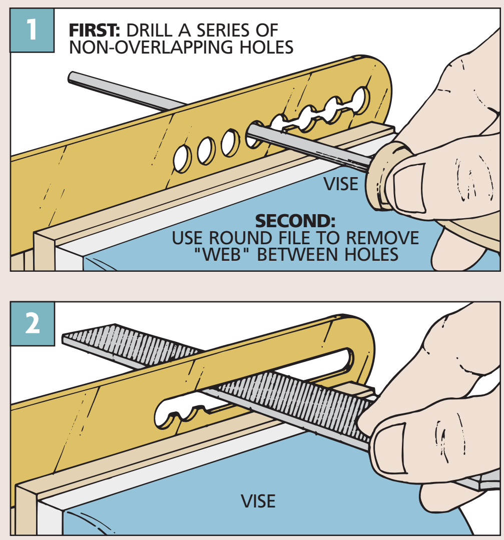
Drill Out Waste. *To cut a slot in brass, just drill a series of non-overlapping holes, then file the slot smooth. Use a metal punch to make a dimple at each hole location so the bit starts "true."*

It takes just two simple steps to cut a slot in a piece of brass — drilling holes and filing away the waste.

DRILLING. To drill holes in brass, you'll need a secure way to hold the brass strip. One way to do this is to use the same jig you used for filing the brass (see photo).

But the most important thing is that you drill non-overlapping holes. If you try to overlap them, the bit can catch and ruin the brass.

FILING. After the holes are drilled, I use two files to clean out the slot. A round file to remove the "web" between the holes *(Fig. 1)*. And a flat mill file to file the slot straight *(Fig. 2)*.



FINISHING BRASS

Polish and Shine. *To get a satin smooth finish on both brass and wood, I sand with progressively finer grits of sandpaper, then buff with steel wool.*

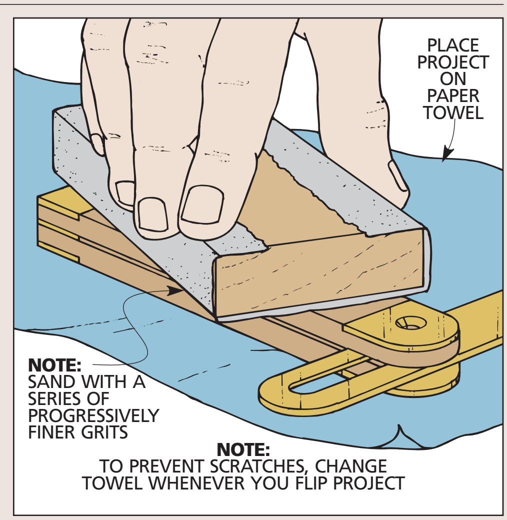
Finishing brass to a soft luster is easy. It's just a matter of sanding with silicon carbide sandpaper (see photo). I start with 120 grit, and go to 240, 400, and 600. Then buff with 0000 steel wool.

METAL FILINGS. There is one problem with sanding brass — it creates tiny metal filings that can scratch the project (see drawing).

PAPER TOWELS. A solution is to set the project on a paper towel.

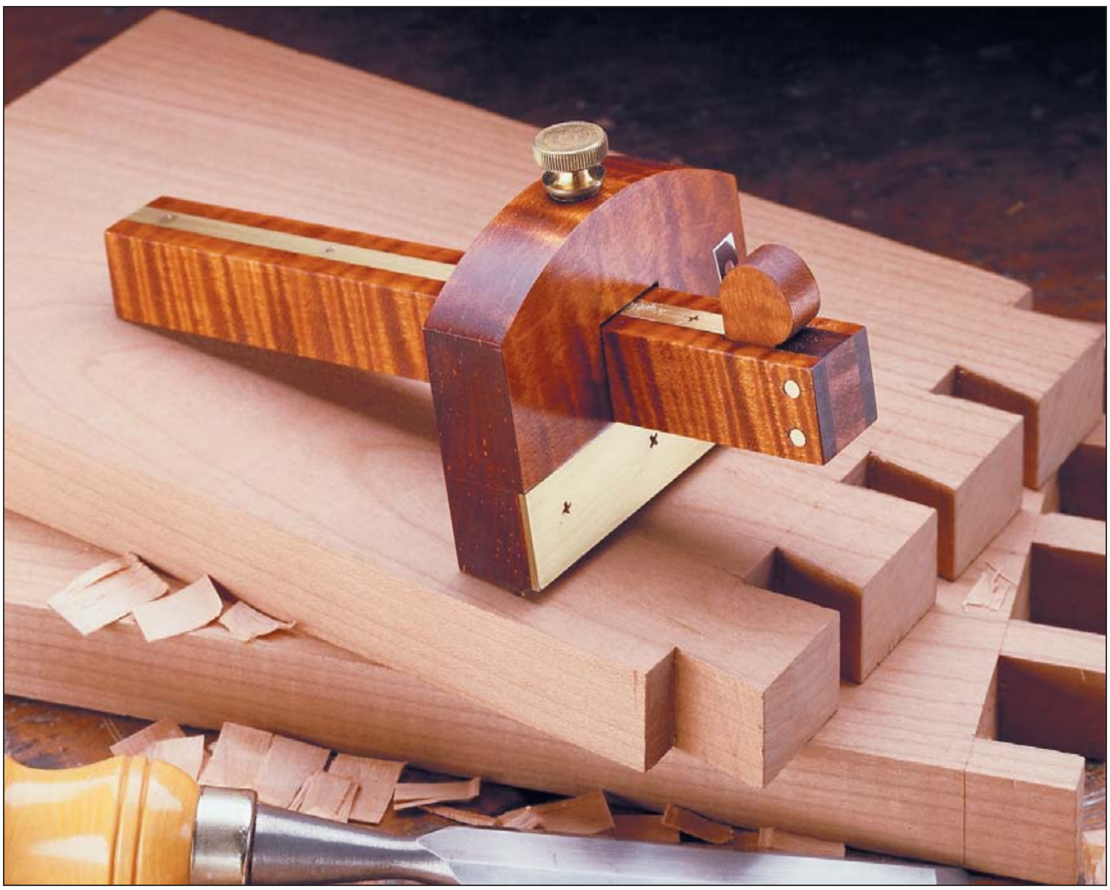
Note: Use a fresh piece when you turn the project over.

FINISH. Finally, to seal both the wood and brass, I wipe on a couple of coats of tung oil.



Marking Gauge

For accurate layouts, most marking gauges just don't "cut" it. This maple and brass hand tool does. Its razor-sharp knife scores wood to give a precise line. Or you can use a drafting lead for a dark line.



Call me old-fashioned, but I've always enjoyed the look and feel of a traditional, wood-bodied hand tool. Especially one that's dressed up with brass fittings.

In fact, that's one reason I decided to make this Marking Gauge. With a small chunk of highly-figured maple that I'd "squirreled" away and a few pieces of brass hardware, I had all the makings for a great-looking hand tool.

WORKING WITH BRASS. But isn't it difficult to fit the brass pieces to the wood? Actually, it's much easier than it looks. Some tips that will help produce a flawless fit are in the Technique article on page 40.

ACCURATE LAYOUTS. Of course, there's more to this hand tool than good looks. Like a traditional marking gauge, it provides a quick, accurate way to draw a line or lay out the joinery for a project.

But instead of using a sharp metal pin, this gauge can mark lines two ways.

DRAFTING LEAD. When working *with* the grain, a short drafting lead is wedged into the beam of the gauge (see the left photo on the facing page). The nice thing about the lead is it doesn't veer off and "follow" the grain like a metal pin can.

RAZOR KNIFE BLADE. To score a line *across* the grain, replace the lead with a razor knife blade (right photo on facing page). Unlike the ragged line and torn fibers that can be left by a pin, this blade severs the wood for a crisp, clean cut.

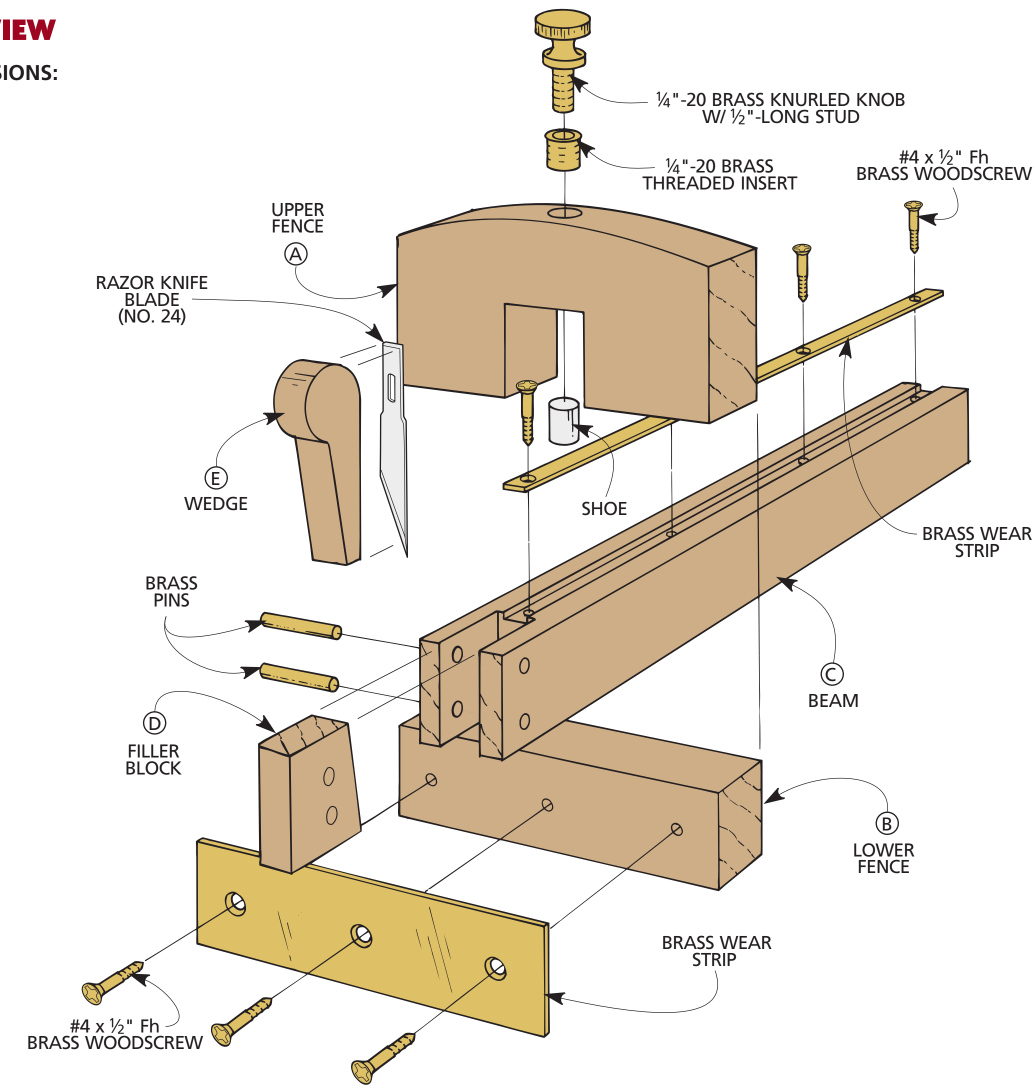
(I picked up the drafting lead and knife blades from an art supply store.)

CURVED SURFACES. I've also included a couple of simple modifications that make the gauge useful for marking curves. One allows you to mark a line parallel to an arc (see page 47). The other turns the gauge into a trammel for drawing arcs and circles (see page 49).

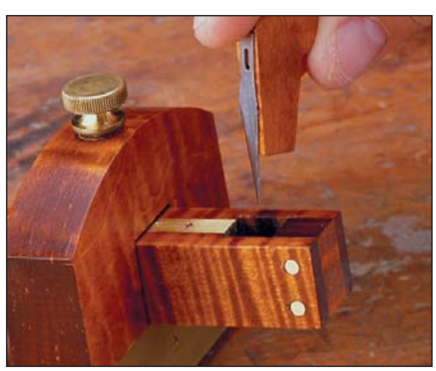
KIT. A complete ready-to-assemble kit for this project can be ordered from *Woodsmith Project Supplies*. See page 126 for ordering information.

EXPLODED VIEW

OVERALL DIMENSIONS:
3W x $6\frac{7}{8}$D x $2\frac{3}{4}$H



When marking layout lines in the same direction as the grain, I use a piece of drafting lead. It won't be drawn off course like a metal pin might. A groove in the wedge allows the lead to fit into the tool tightly without being crushed.



For lines marked across the grain, use a razor knife blade. Use steady pressure on the gauge and the blade will cut the wood fibers, leaving a very precise line. Since the blade scores the wood, this also helps prevent chipout along the cut line.

MATERIALS LIST

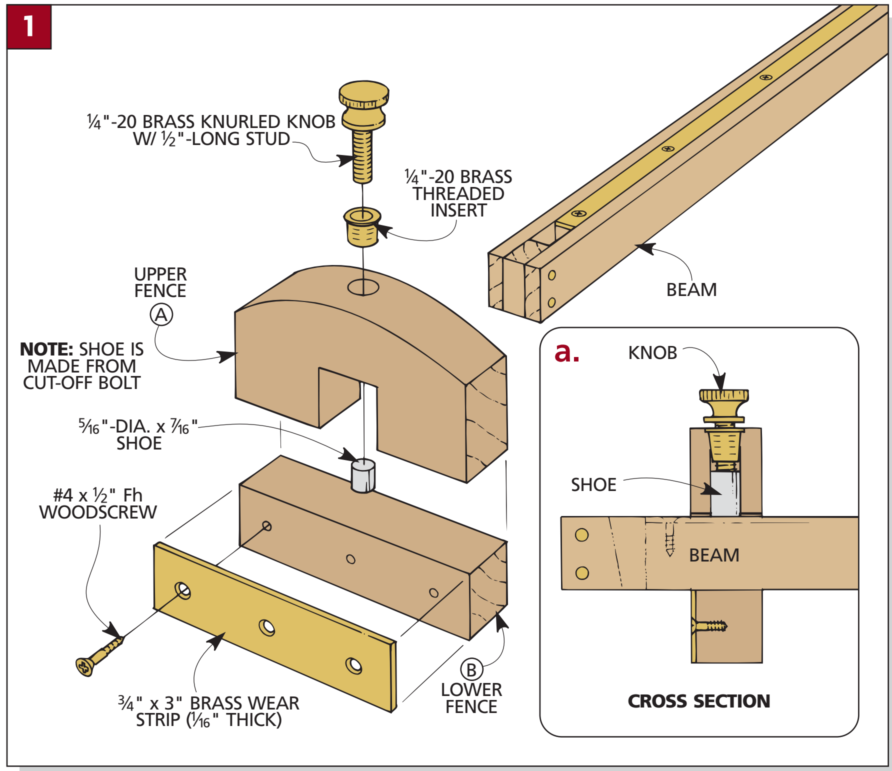
WOOD

A	Upper Fence (1)	$\frac{3}{4}$ x $1\frac{5}{8}$ - 3
B	Lower Fence (1)	$\frac{3}{4}$ x $\frac{3}{4}$ - 3
C	Beam (1)	$\frac{3}{4}$ x $\frac{3}{4}$ - $6\frac{7}{8}$
D	Filler Block (1)	$\frac{3}{8}$ x $\frac{5}{8}$ rgh. - $\frac{7}{8}$ rgh.
E	Wedge (1)	$\frac{3}{8}$ x $\frac{5}{8}$ - $1\frac{9}{16}$

HARDWARE SUPPLIES

(7) No. 4 x $\frac{1}{2}$" Fh brass woodscrews
(1) $\frac{1}{4}$"-20 knurled knob w/ $\frac{1}{2}$"-long stud
(1) $\frac{1}{4}$"-20 brass threaded insert
(1) $\frac{5}{16}$"-dia. bolt (for shoe)
(1) $\frac{1}{16}$" x $\frac{3}{4}$" - 3" brass strip
(1) $\frac{1}{16}$" x $\frac{1}{4}$" - 6" brass strip
(2) $\frac{1}{8}$"-dia. x $\frac{13}{16}$" (rough) brass rods
(1) No. 24 razor knife blade
(1) Drafting lead

With a short piece of drafting lead wedged in the opening of the marking gauge, it's easy to draw an accurate layout line that won't "follow" the grain.



FENCE

The Marking Gauge consists primarily of two assemblies — a beam and a fence that slides along the beam *(Fig. 1)*. The beam holds a drafting lead or knife blade for marking. The fence can be locked in place along the beam. It then serves as a guide that rides against the workpiece. This ensures that the line that's marked ends up a uniform distance in from the edge (or end) of the board.

TWO-PART FENCE. I began by making the fence. The fence is made up of two parts: an upper fence piece (A) and lower fence piece (B) *(Fig. 1)*. To create an opening that fits over the beam, the upper piece is notched. Then later, the two pieces are glued together to form the opening in the fence.

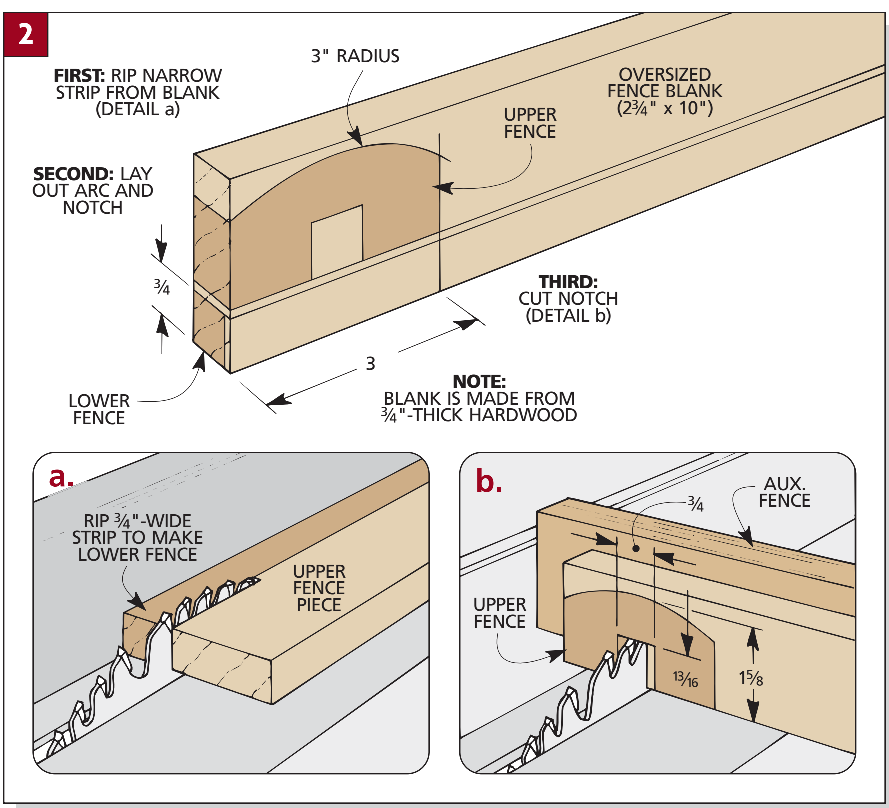
One thing to be aware of is that these fence pieces are quite small. (Even when the fence is glued up, it's only about the size of a credit card.) That's too small to work with safely on a table saw.

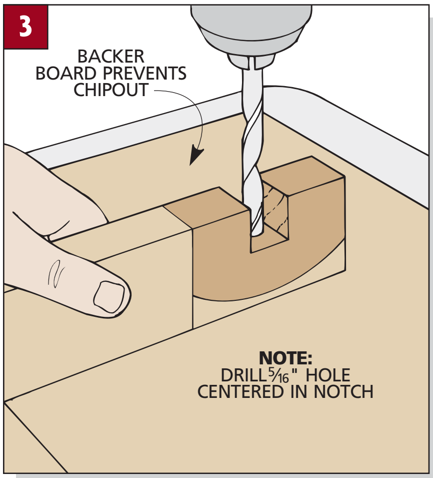
So I started with an oversized blank of ¾"-thick hardwood *(Fig. 2)*. It's a good idea to use a blank that's wide enough for both fence pieces. That way, when they're glued together later, you'll be able to match the grain to create a joint line that's nearly invisible.

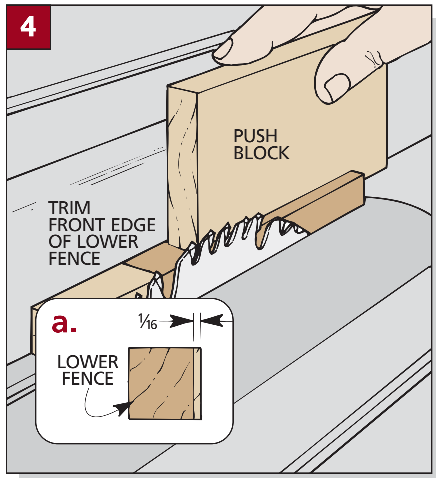
RIP A STRIP. With blank in hand, the first step is to rip a narrow strip that will be used to make the lower fence (B) *(Figs. 2 and 2a)*. You can set this strip aside for now. The remaining part is used to make the upper fence (A).

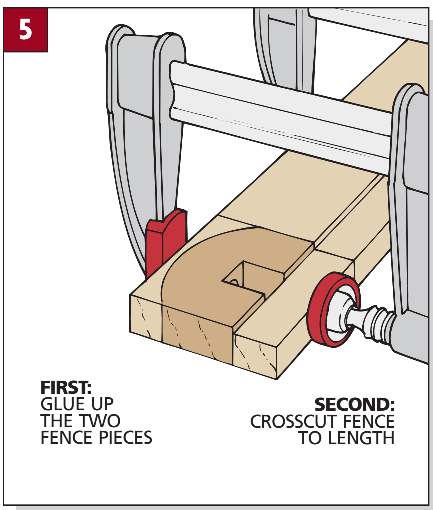
LAYOUT. Start by laying out the length of the upper fence as well as the notch that will form the opening *(Figs. 2 and 2b)*. You'll also need to draw a large arc near the top of the piece (refer to the Shop Tip on the opposite page).

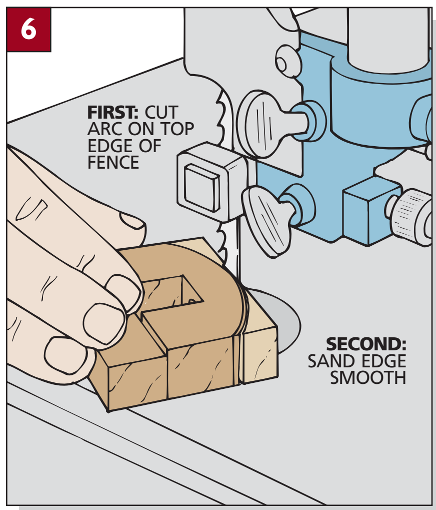
CUT NOTCH. Once the layout is done, you're ready to start shaping the upper fence. The first step is to cut the notch. The table saw and a standard combination blade will make quick work of this. To prevent chipout on the back of the piece, it's best to attach an auxiliary fence to the miter gauge *(Fig. 2b)*. Then after raising





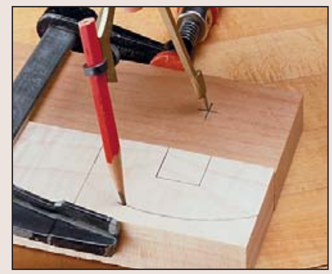






SHOP TIP
Compass Pivot

The radius for the arc at the top of the Marking Gauge is longer than the workpiece is wide. So where do you put the point of the compass when you want to draw the layout line? Just clamp a scrap block to the upper fence piece and mark the pivot point there (see photo).



the blade for a full-depth pass ($^{13}/_{16}$"), make a series of cuts, nibbling away the waste to form the notch.

Once the notch is cut, some light filing may be in order to smooth out the small ridges and valleys left by the saw blade.

DRILL INSERT HOLE. The next step is to drill a hole in the upper fence piece. This hole is sized to accept a threaded insert *(Fig. 1a)*. (The insert is installed later in the top of the fence.)

The purpose of the threaded insert is simple. When you tighten a knurled knob into the insert, it pushes a short metal "shoe" against the beam of the Marking Gauge *(Fig. 1a)*. The downward pressure applied by the shoe holds the fence at the desired setting.

The hole for the insert (and shoe) is centered on the notch. To locate it accurately, you'll want to drill the hole from the notched side, not the top *(Fig. 3)*. Even though you'll be trimming the top edge to shape later, it's still a good idea to use a backer board to prevent chipout when the bit breaks through.

LOWER FENCE. Before installing the threaded insert, turn your attention to the lower fence. Notice that there's a brass strip attached to the face of this piece *(Fig. 1)*. When the gauge is used, the fence is pressed firmly against a workpiece. The brass creates a durable surface that resists wear. (Brass strips can be found at most hobby stores. Other sources are listed on page 126.)

This wear strip fits in a shallow recess in the face of the fence. The goal is to end up with a recess that's just deep enough so the wear strip fits flush with the upper fence. This way, the full face of the fence will sit flat against a workpiece.

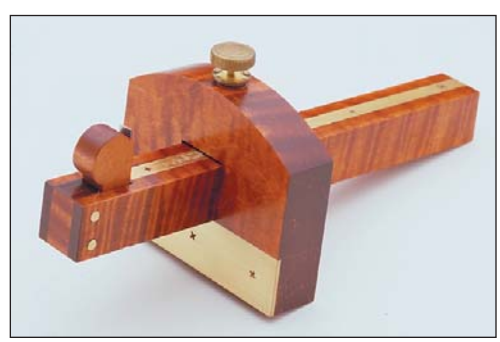
An easy way to do that is to trim off the front edge of the lower fence *(Fig. 4)*. Just be sure that the amount of material removed equals the thickness of the brass strip (about $^{1}/_{16}$") *(Fig. 4a)*.

GLUE UP FENCE. At this point, you're ready to edge-glue the two fence pieces together *(Fig. 5)*. Remember, to create a joint line that virtually disappears, orient the pieces exactly like they were before the lower strip was ripped from the blank.

Once the glue dries, there are just a few things left to complete the fence. But first, you'll need to crosscut it to final length *(Fig. 2)*. (I cut my fence 3" long.)

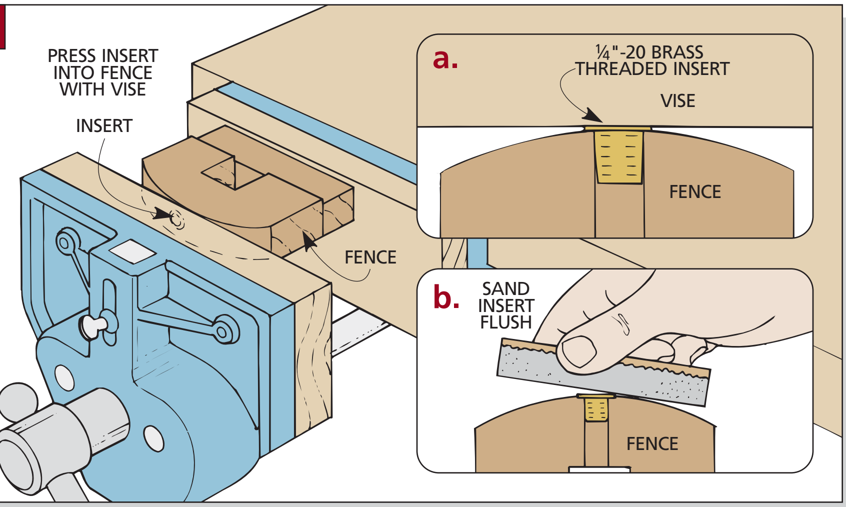
CUT TO SHAPE. Next, to prevent the sharp corners of the fence from digging into my hand, I cut a gentle arc on the top edge *(Fig. 6)*. A band saw (or coping saw) is all that's needed here. Either way, you'll want to stay about $^{1}/_{16}$" to the waste side of the line. Then you can use a sanding block or belt sander to bring the top of the fence to a smooth arc.

Note: Don't sand the sides or bottom until the brass wear strip is attached.



When the gauge is complete, the fence slides along the beam and is locked in place by a knurled knob on top. Brass strips prevent wear.

7



INSTALL INSERT. After sanding the edge smooth, it's time to install the threaded insert in the top of the fence. It fits down into the hole that was drilled earlier. The important thing is to get it in straight. What I found works well is to tap it lightly with a hammer just to get it started. Then use a vise to slowly press the insert in the rest of the way *(Fig. 7)*.

Notice that the insert has a thin lip around the top that won't fit into the hole *(Fig. 7a)*. It's not a big deal, but for appearances, I wanted the insert flush with the top of the fence. Since the brass is quite soft, a sanding block and some silicon carbide sandpaper make short work of that *(Fig. 7b)*.

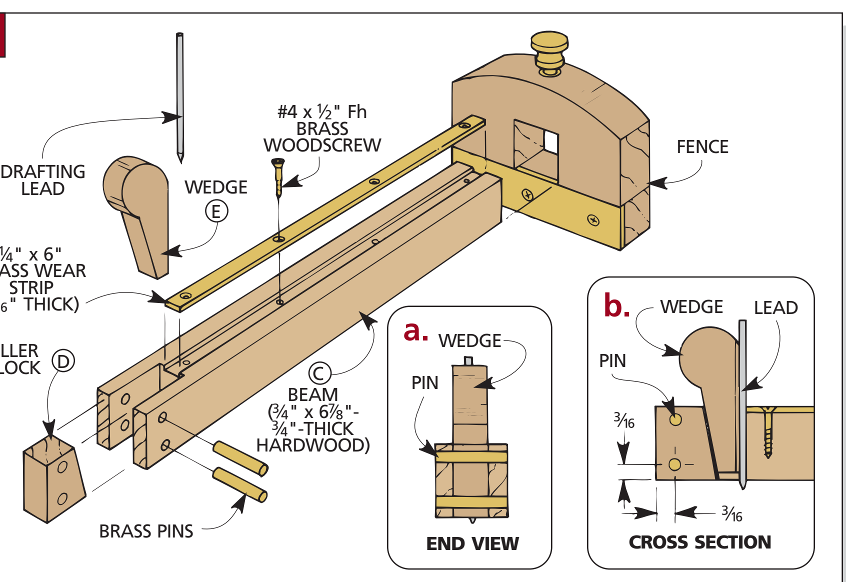
ATTACH WEAR STRIP. Attaching the brass wear strip along the bottom of the fence takes a bit longer, but it's a fairly straightforward process. (The information in the Technique article on pages 40 and 41 should help you get a good fit between the wear strip and the fence.)

Start by cutting the wear strip to the same length as the fence. After sanding the strip flat and filing off any burrs, the next step is to drill countersunk shank holes for the mounting screws.

The thing to watch here is the depth of the countersinks. To create a nearly seamless fit, you want the screw heads to sit slightly "proud" of the strip. (Refer to the Shop Tip on page 37.) Then just file and sand them flush with the strip.

INSTALL KNOB AND SHOE. All that's left to complete the fence is to add the knurled knob and shoe that are used to lock the fence in position. The knob threads into the insert in top of the fence (refer to *Fig. 1* on page 44). As for the shoe, I cut a short ($^7/_{16}$") section from the smooth shank of a $^5/_{16}$"-dia. bolt and stuck it in the hole.

8



BEAM

With the fence complete, the next thing to do is to make the beam. This is a cigar-length, square block of wood that guides the fence as you slide it back and forth *(Fig. 8)*. A brass wear strip on top protects the surface of the beam when you tighten the fence. And an opening in the end houses a wood wedge that holds the lead (or blade) tightly in place.

BEAM. As I mentioned, the beam (C) is a squared-up stick of wood. (I used maple.) To produce accurate results, it's important to get the beam to fit just right into the opening in the fence. If it's too tight, the fence is hard to slide. Too loose, and the beam wobbles from side to side.

PREPARE BLANK. The key to ending up with a perfect fit is to start by carefully preparing the wood blank used for the beam. Start by planing a board $^3/_4$" thick. (This allows enough room for the beam to slide under the shoe.) Then rip the blank to width by taking light passes, sneaking up on the width, until it fits the opening in the fence. Finally, crosscut the beam to finished length *(Fig. 8)*.

WEDGE OPENING. After squaring up the blank, the next step is to create an angled opening in the end of the beam that holds the wedge.

This is a simple two-step process. First, a short notch is cut in the end of the beam *(Fig. 8)*. Second, a wedge-shaped block is added to "fill" the end of the notch.

CUT THE NOTCH. A quick way to cut the notch is to use the table saw. This requires standing the beam on end to make a pass across the saw blade. So how do you keep it from tipping when making the cut?

The trick is to clamp the beam to a T-shaped support *(Fig. 9)*. With one piece of the support riding on the rip fence and the other backing up the workpiece, it's easy to hold the beam steady while making the cuts.

To cut the notch, start by raising the saw blade to a height of $^7/_8$" *(Fig. 9a)*. Then set the rip fence so the blade is roughly centered on the beam. Now make two passes, flipping the workpiece around for the second pass *(Fig. 9b)*.

This will produce a centered notch, but it needs to be a bit wider. So just nudge the fence away from the blade and make two more passes to end up with a $^3/_8$"-wide notch.

WEAR STRIP. The next step is to add the brass wear strip that the shoe bears on.

This wear strips fits in a shallow groove in the top of the beam *(Fig. 8)*.

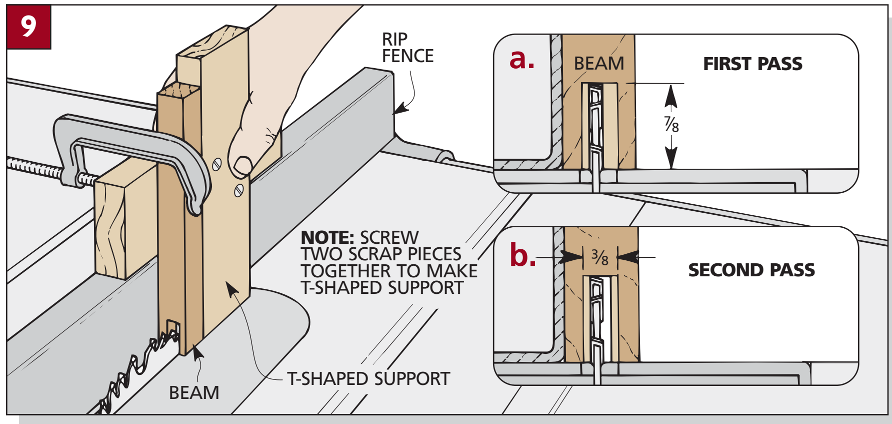
Here again, the idea is to make the strip fit flush with the beam. As before, I used a $\frac{1}{16}$"-thick strip. Only this time, it's $\frac{1}{4}$" wide. So I adjusted the blade on the table saw to make a $\frac{1}{16}$"-deep cut. Then I used the same two-pass method as before to center the groove *(Fig. 10)*.

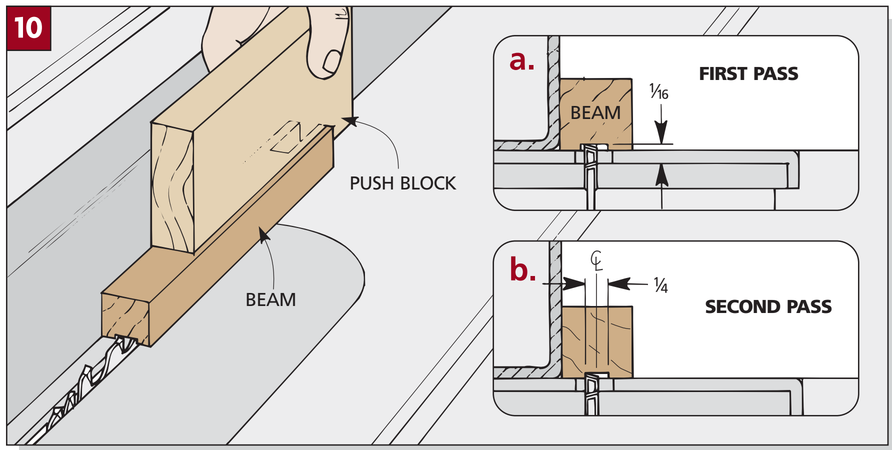
Start by setting the fence so the blade is roughly centered on the beam. Then make two passes, turning the workpiece end for end between each one. If necessary, repeat the process until the strip fits *(Fig. 10b)*. Then just screw the strip in place as before.

FILLER BLOCK & WEDGE

All that's left is to add two small pieces: a filler block that's fixed in the end of the beam and a removable wedge that fits in a pocket created by the block *(Fig. 8)*.

Notice that the inside of the filler block (D) is cut at an angle. This creates an angled opening in the beam. By pushing the wedge (which has a matching angle) down into the opening, it pinches the lead (or blade) against the beam and holds it in place.



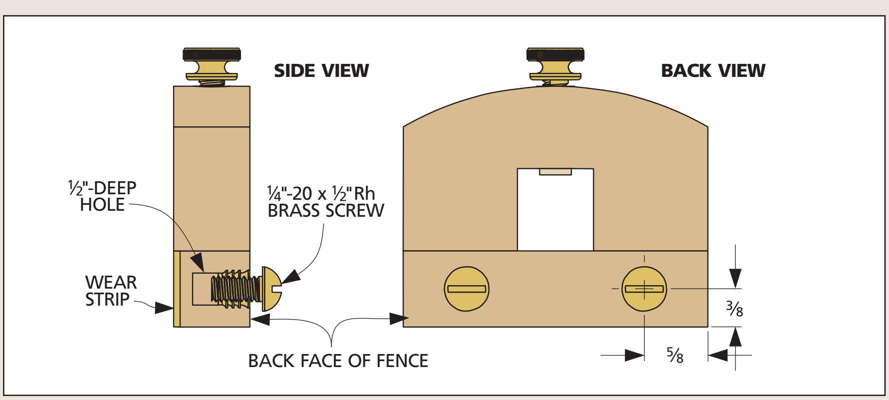


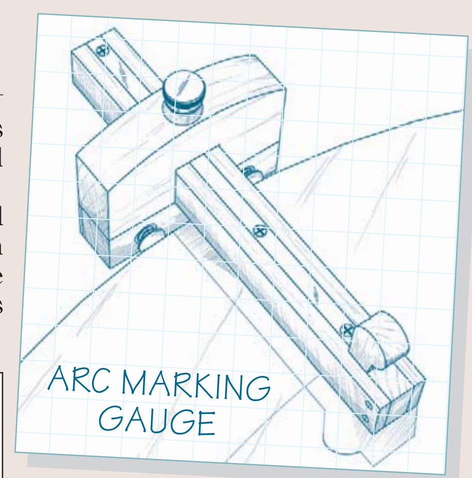
DESIGNER'S NOTEBOOK

This simple modification allows the gauge to follow a curved edge.

CONSTRUCTION NOTES:

- I came up with this modification for the Marking Gauge when I needed to lay out the location of an inlay on a round table top. It allows the gauge to follow the edge of a circle or arc without rocking.
- All you need to do is install two threaded inserts on the *back* face of the lower fence (see drawing below).
- Once the inserts are in place, all that's left is to thread a $\frac{1}{2}$"-long roundhead brass machine screw into each one.
- To use the gauge to mark a line parallel to a curved surface, adjust the screws in or out so the screw heads ride against the workpiece and the lower fence just clears the edge (see drawing at right).

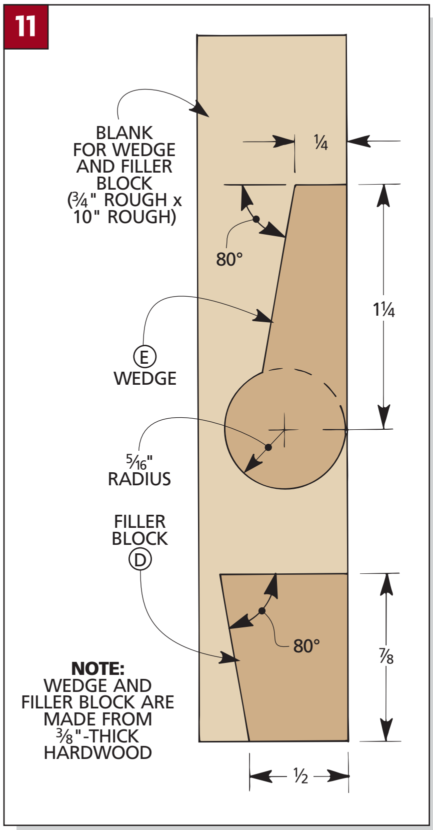


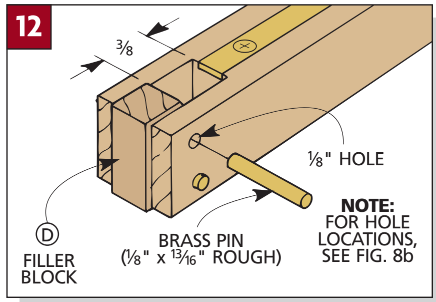


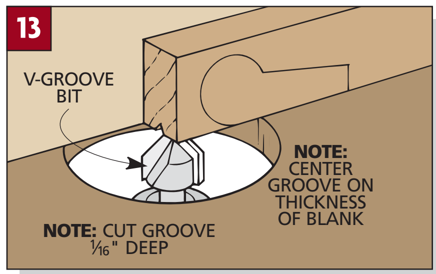
MATERIALS LIST

HARDWARE SUPPLIES

(2) $\frac{1}{4}$"-20 brass inserts
(2) $\frac{1}{4}$"-20 x $\frac{1}{2}$" Rh brass machine screws



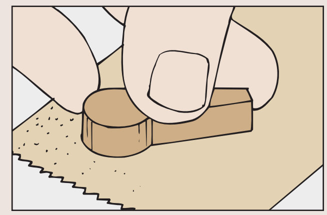




SHOP TIP

Sand to Fit

A snug fit between the wedge and the notch is important to the accuracy of the Marking Gauge. Sand the sides of the wedge until it fits the notch perfectly.



OVERSIZE BLANK. The filler block and the wedge are quite small. So it's best to make them from an oversize blank. After thicknessing this blank to match the width of the notch in the beam (3/8"), lay out the filler block and wedge *(Fig. 11)*.

Note: The dimensions for the filler block are rough measurements.

FILLER BLOCK. Once the filler block (D) is cut to rough size, you're ready to glue it in place. The important thing here is the size of the opening formed by the block. To make sure the wedge fits tightly, glue in the filler block to create a 3/8"-long opening at the top *(Fig. 12)*.

BRASS PINS. After trimming the block flush, I added two brass pins to help strengthen the joint. (They also add a decorative touch.) The pins are short pieces cut from a brass rod. It's best to make them slightly longer than the width of the beam. Then, after tapping the pins into holes drilled in the beam, file (or sand) them flush.

WEDGE. Now you can turn your attention to the wedge (E). It's just a block of wood with a rounded knob on top to make it easier to grip . A V-shaped groove in the straight side holds the drafting lead.

For safety, it's best to rout the 1/16"-deep groove before cutting the wedge from the blank *(Fig. 13)*. Then cut the wedge to rough shape on the band saw. Some sanding will bring it to final size (see the Shop Tip above).

FINISHING TOUCHES. To add some finishing touches to this special hand tool, I stained it with an aniline dye. (See the Finishing Tip below.) Then I wiped on three coats of an oil finish. ■

FINISHING TIP . . . . Using Aniline Dye

Since I chose a piece of highly-figured wood for the gauge, I wanted that figure to "pop out." The solution was to use an aniline dye. It produces a deep, rich color that doesn't obscure the grain.

The type of dye I use is a powder that dissolves in hot water. Because it's a water-based dye, it tends to raise the grain of the the wood a bit after it's applied. But there's a simple trick to keep this "fuzz" to a minimum.

Just dampen the wood slightly before applying the dye. Then lightly sand off the "whiskers" that rise. (I use sandpaper that's one grit finer than that used on the project.)

A rag or brush is all that's needed to apply the dye. To avoid lap marks, keep the workpiece surface wet and wipe off the excess before it dries.

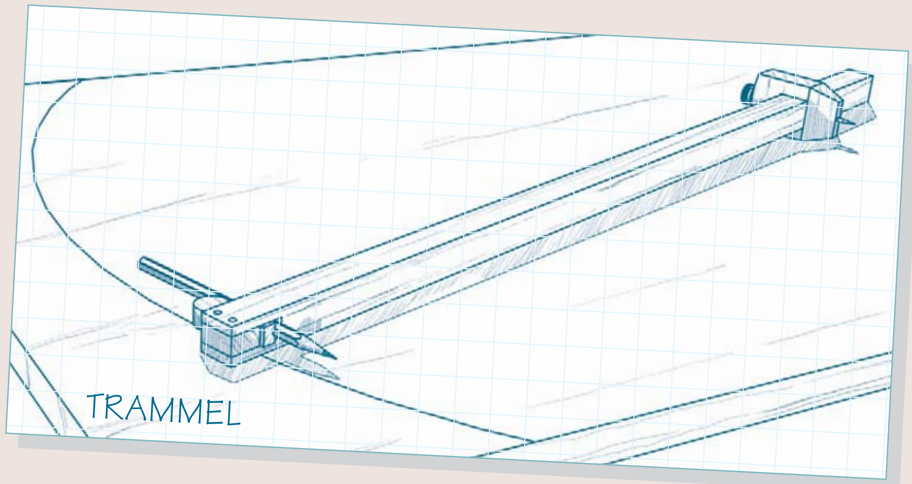
Be aware the dye will appear chalky or dull when it dries. Applying a top-coat will restore the vivid color. Just be sure it's oil-based — water will redissolve the dye.

Note: For sources of aniline dye and other finishes, see page 126.

DESIGNER'S NOTEBOOK

You'll appreciate having this Trammel in your tool collection every time you need to lay out a circle or draw an arc. A cut-off finish nail in the fence provides the pivot point and a pencil lays out your line.

CONSTRUCTION NOTES:



■ Construction of the Trammel fence is similar to that of the Marking Gauge. However, the upper fence (A) and lower fence (B) are shorter and the lower fence has a bevel on each face *(Fig. 1)*.

■ To cut the bevels safely, start with an oversized blank *(Fig. 2)*. Then tilt the table saw blade to 18° and set the rip fence ½" from the blade.

■ Now just make two passes over the blade to bevel each face *(Figs. 2 and 2a)*.

■ Once the bevels are complete, the lower fence is ripped from the blank.

■ Next, cut the notch in the upper fence.

■ Now you can drill a 5/16"-dia. hole to accept the threaded insert and shoe.

■ Once the hole is drilled, the fence pieces can be glued back together.

■ When the glue has dried, cut the blank to length (1½") so the notch is centered on the length of the fence *(Fig. 1)*.

■ The remaining bevels on the lower fence are cut with a band saw *(Fig. 3)*.

■ Now drill a hole in the lower fence and use epoxy to glue in a cut-off finish nail that will serve as the pivot point *(Fig. 1)*.

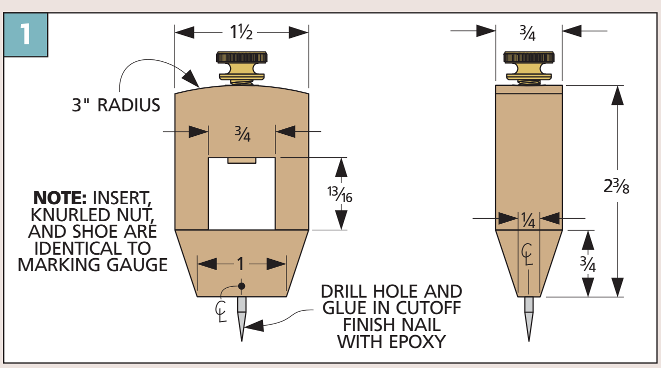
■ The beam (C) is built the same as for the Marking Gauge, except that it's longer. (Mine was 24".)

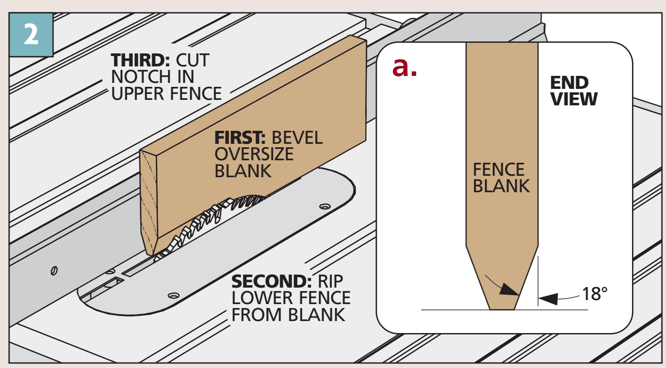
■ Also, the notch in the end is deeper *(Fig. 4)*. The notch is cut to a depth of 1⅛" so that a pencil will fit into it *(Fig. 4)*.

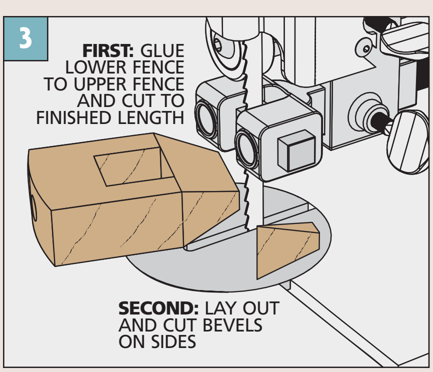
MATERIALS LIST

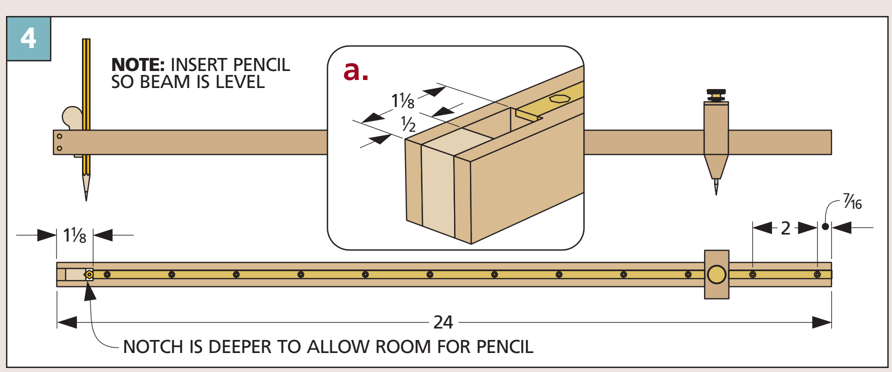
CHANGED PARTS			HARDWARE SUPPLIES
A	Upper Fence (1)	¾ x 1⅝ - 1½	(12) No. 4 x ½" brass woodscrews
B	Lower Fence (1)	¾ x ¾ - 1½	(1) 1/16" x ¼" - 24" brass strip
C	Beam (1)	¾ x ¾ - 24	(1) 4d finish nail
			(1) Drafting pencil

Note: Do not need ¾" x 3" brass plate, knife blade, or drafting lead.









Stock Preparation

Preparing stock properly and accurately is vital to the successful completion of any project. For some jobs though, using power tools just isn't practical.

For example, small trim or inlay can be damaged by using a power miter saw for crosscuts. The small piece miter box enables you to achieve the accuracy you need.

Or how do you true up pieces that are too small for a hand plane or power jointer? The hand plane jointer in this section is just the answer.

And no power tool can match the delicate, wispy shavings and smooth-as-glass surface created by a hand plane and a cabinet scraper. Imagine the satisfaction you'll get watching those shavings curl from a scraper plane or wooden plane you've built yourself.

Small Piece Miter Box

This unique miter box has a guide system to keep the saw cutting straight. Plus, you can adjust the base to the right or left. A "stop" lets you fine-tune the arm position for cutting perfect miters every time.

Cutting accurate miters on small pieces of trim can be a challenge. A table saw has a tendency to chip out small pieces. Another option is to use a hand miter box. But sometimes they're too large to be effective with small pieces.

So I decided to build my own scaled-down version of a professional miter box. It has all the features of a full-size miter box, including an adjustable miter arm and a guide system.

THREE PARTS. This Small Piece Miter Box has three main parts: a base assembly, a fence, and a pivot arm that's adjustable up to 45° in each direction. (I used 3/4"-thick maple for all wood parts.)

FEATURES. The miter box has a unique guide system that keeps the saw cutting straight no matter where it's set. This guide system is made up of several nylon spacers and compression springs slipped over bolts mounted to the pivot arm. The "back" of the saw rides on top of the spacers while they keep the saw blade "tracking" in a straight line, taking out any play when cutting. And the compression springs lift the back saw out of the workpiece after you make the cut.

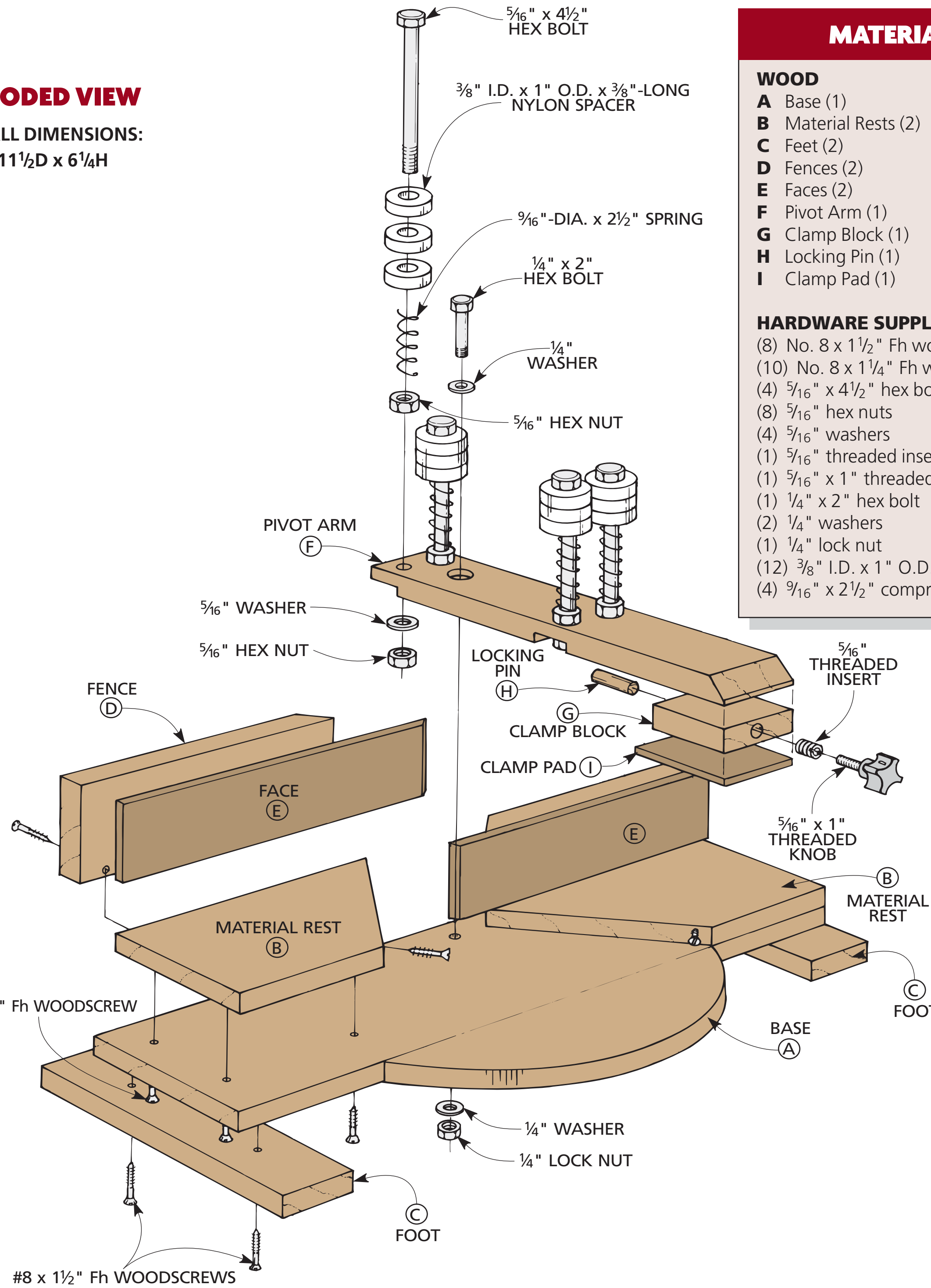
Finally, the base and the fence provide a flat, stable surface for straight and precise cuts, while the pivot arm makes it as versatile as a full-size miter box.

BACK SAW. I sized this miter box to be used with a 10"-long back saw that's great for cutting small workpieces. It has a thin, tempered blade with a rigid steel back to keep the blade straight while cutting (see Sources on page 126).

FIXED MITER BOX. Not everyone needs a small miter box that's adjustable. So if you only need a miter box to cut small pieces at 45° or 90°, take a look at the Woodworker's Notebook on page 55. This basic Fixed Miter Box is a lot easier to build, but every bit as accurate, thanks to its two-piece construction that lets you adjust the kerf and take out the "play" around the saw blade.

EXPLODED VIEW

OVERALL DIMENSIONS:
18W x 11 1/2D x 6 1/4H



MATERIALS LIST

WOOD

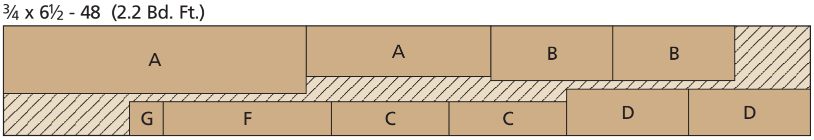
A	Base (1)	3/4 x 6 3/4 - 18
B	Material Rests (2)	3/4 x 3 1/4 - 7 1/4
C	Feet (2)	3/4 x 2 - 7
D	Fences (2)	3/4 x 2 3/4 - 7 1/4
E	Faces (2)	1/4 hdbd. - 1 7/8 x 8 3/4
F	Pivot Arm (1)	3/4 x 2 - 10
G	Clamp Block (1)	3/4 x 2 - 2
H	Locking Pin (1)	1/2 dowel x 1 3/4
I	Clamp Pad (1)	1/4 hdbd. - 2 x 2 1/2

HARDWARE SUPPLIES

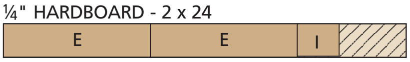
- (8) No. 8 x 1 1/2" Fh woodscrews
- (10) No. 8 x 1 1/4" Fh woodscrews
- (4) 5/16" x 4 1/2" hex bolts
- (8) 5/16" hex nuts
- (4) 5/16" washers
- (1) 5/16" threaded insert
- (1) 5/16" x 1" threaded knob
- (1) 1/4" x 2" hex bolt
- (2) 1/4" washers
- (1) 1/4" lock nut
- (12) 3/8" I.D. x 1" O.D. - 3/8" nylon spacers
- (4) 9/16" x 2 1/2" compression springs

CUTTING DIAGRAM

3/4 x 6 1/2 - 48 (2.2 Bd. Ft.)



1/4" HARDBOARD - 2 x 24



BASE ASSEMBLY

To get started on the Small Piece Miter Box, the first step is to build the base assembly. It consists of a base, a pair of material rests, and a pair of feet.

BASE. The base (A) is made up of two pieces *(Fig. 1)*. To allow clearance for the pivot arm to swing, the front edge is curved. An easy way to make this curve is to dry-clamp the pieces and then draw a 6" radius *(Fig. 1)*.

Then simply remove the clamp, cut the curve on the front piece, and glue the base together.

PIVOT HOLE. To complete the base, drill a 1/4"-dia. hole at the pivot point of the radius. This is used later to attach the pivot arm to the base.

MATERIAL RESTS. The next step is to make the material rests (B). The purpose of the rest is to raise the workpiece off the base. This creates a space that allows the pivot arm to swing back and forth.

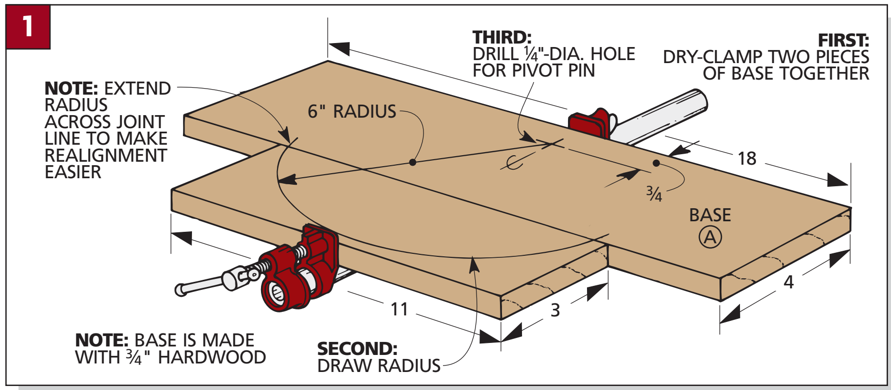
Each material rest has a 45° miter on one end *(Fig. 2)*. Holes are drilled in the mitered ends for adjustment screws. These screws act as "stops" for the pivot arm and are used to fine-tune the 45° angles of the saw.

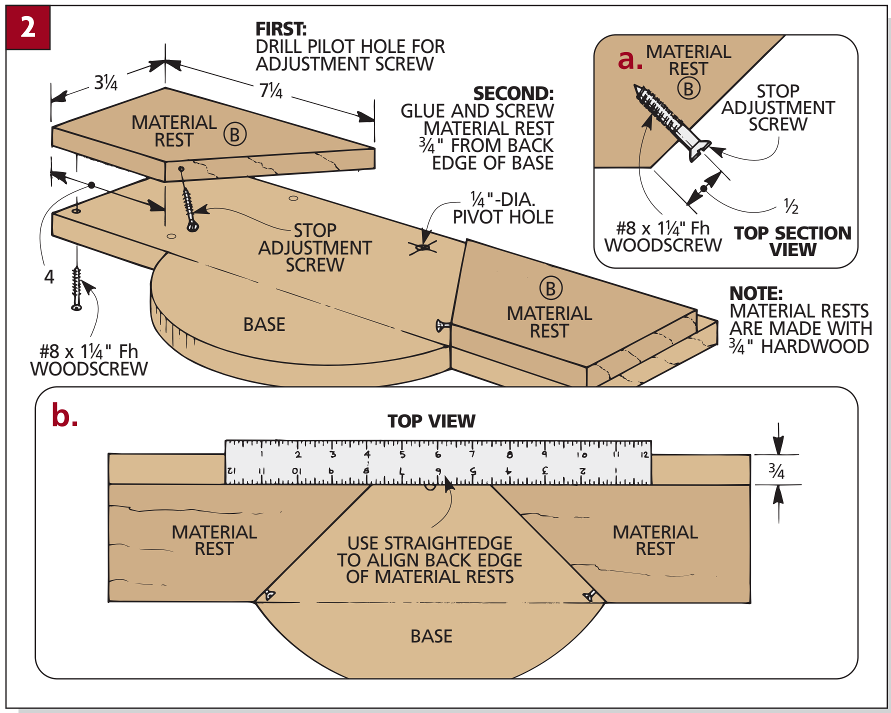
ATTACH REST. After the material rests are cut, the next step is to attach them to the miter box base.

Note: The back edge of each rest is located 3/4" in from the back of the base, to create a lip for the fence to rest on.

The trick is to position the two pieces so the back edges are in line with each other *(Fig. 2b)*. This ensures that the fence (which is screwed to the material rests later) will also be straight. I checked the alignment with a straightedge, and then glued and screwed the rests to the base.

FEET. To complete construction of the base assembly, screw a foot (C) to each end of the base *(Fig. 3)*.



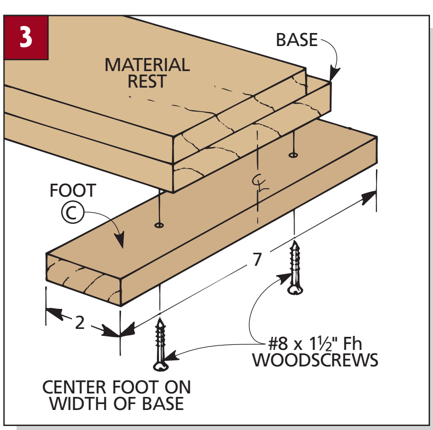


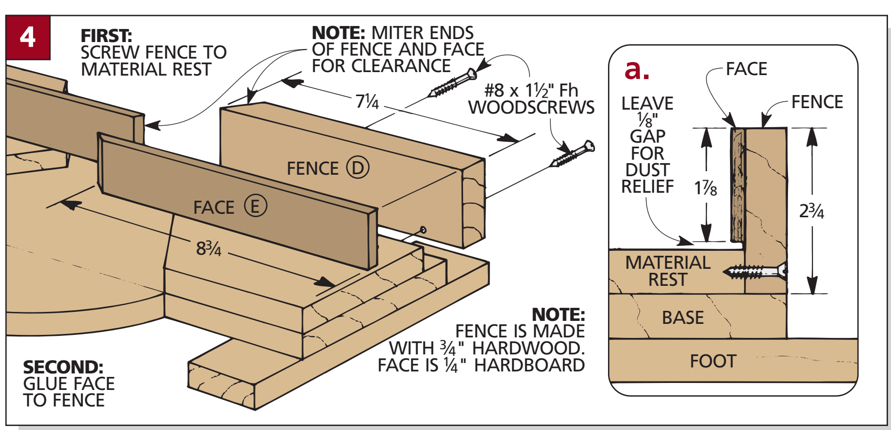
FENCE

The fence (D) provides a straight, even surface to hold a workpiece against. Like the material rests, it's made of two pieces.

Each piece is mitered on one end to provide clearance for the pivot arm. Then the fence is screwed to the back edge of the material rests *(Figs. 4 and 4a)*.

FACE. Next, add a hardboard face (E) to each fence. The ends are mitered (for clearance), then glued to the fence. To provide dust relief, I left a 1/8" gap between each material rest and face *(Fig. 4a)*.





WOODWORKER'S NOTEBOOK

The two-piece Fixed Miter Box lets you adjust the kerf to fit your hand saw and take out the "play" caused by everyday use. This adjustment feature helps you make accurate cuts at 90° and 45° every time.

FIXED MITER BOX

■ This fixed miter box makes it easy to make accurate cuts on small pieces, with "fixed" kerfs at the two angles used most often (90° and 45°). It's a "two-piece" miter box with an *adjustable* H-shaped base that gets attached to a *fixed* base *(Fig. 1)*. This makes it easy to adjust the kerfs to match your saw blade *and* close them up when they get wider with use.

■ The adjustable base is just three pieces of 3/4"-thick plywood glued together. A 1/4"-deep dado is cut through two side pieces (A) to keep the center piece (B) aligned *(Fig. 1b)*.

■ Now drill countersunk holes in the center piece for the screws. When gluing the base together, cut two extra pieces to support the assembly and make sure the side pieces end up square *(Figs. 1a and 1b)*.

■ Then to support this assembly, I added a fixed base (C). Transfer the position of the pilot holes to this piece and cut the slots *(Fig. 1)*.

■ To secure the two bases, add four wood "washers" to the bottom of the fixed base. The washers (D) hold a T-nut that matches the threads on the machine screw *(Fig. 1)*. (To keep the T-nuts from splitting the wood, mount them into an extra long blank, then cut them to length.)

■ At this point, you're ready to cut the adjustable base apart — with two 45° cuts and one 90° cut *(Fig. 2)*.

■ Next the Fixed Miter Box can be assembled *(Fig. 3)*. Because of the wood washers, this step is almost a one-handed operation. Just set the saw blade between two pieces and tighten them down. As the gap widens with use, you can close up the kerfs by loosening the screws and repositioning the adjustable base.

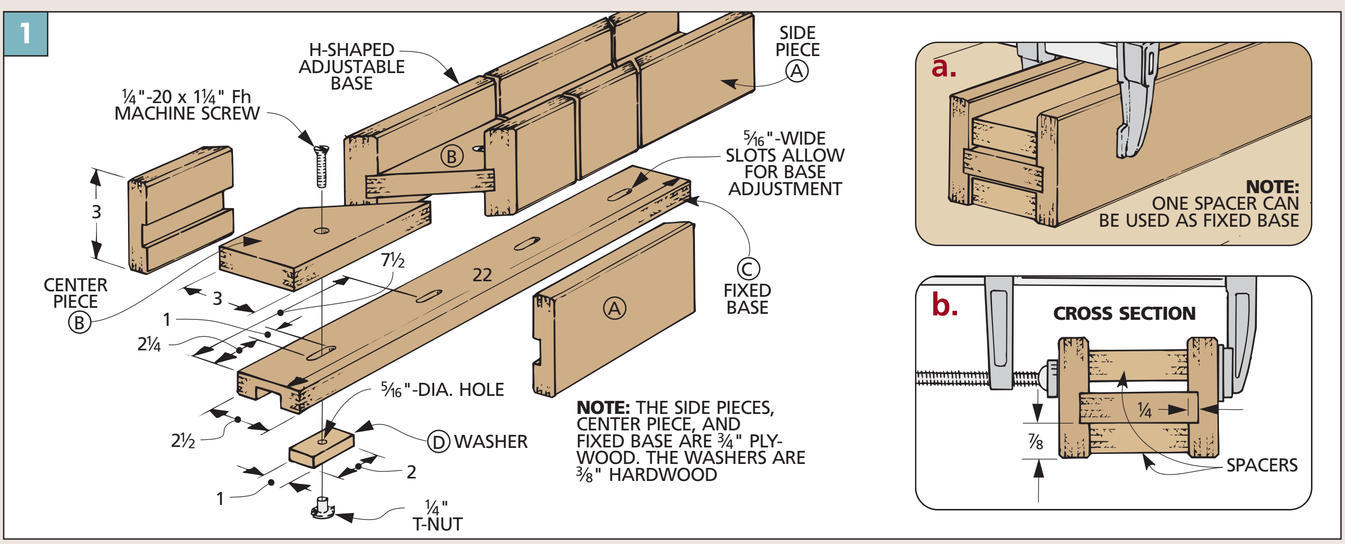
MATERIALS LIST

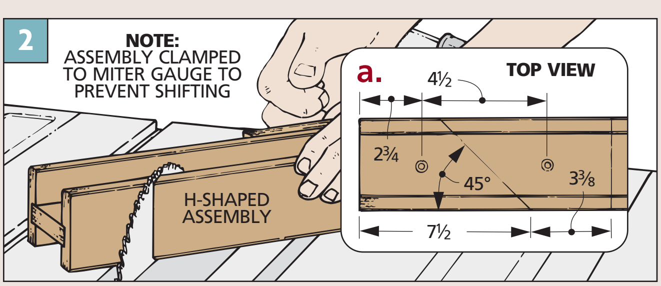
WOOD

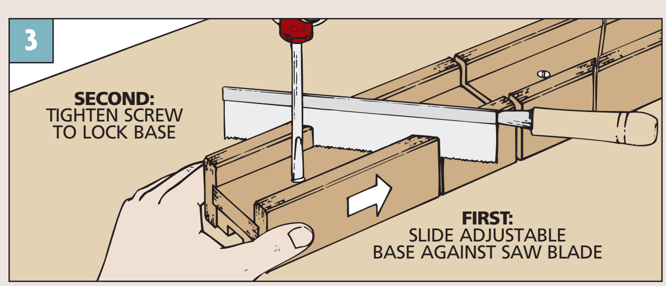
A	Side Pieces (2)	3/4 ply - 3 x 22
B	Center Piece (1)	3/4 ply - 3 x 22
C	Fixed Base (1)	3/4 ply - 2½ x 22
D	Washers (4)	3/8 x 1 - 2

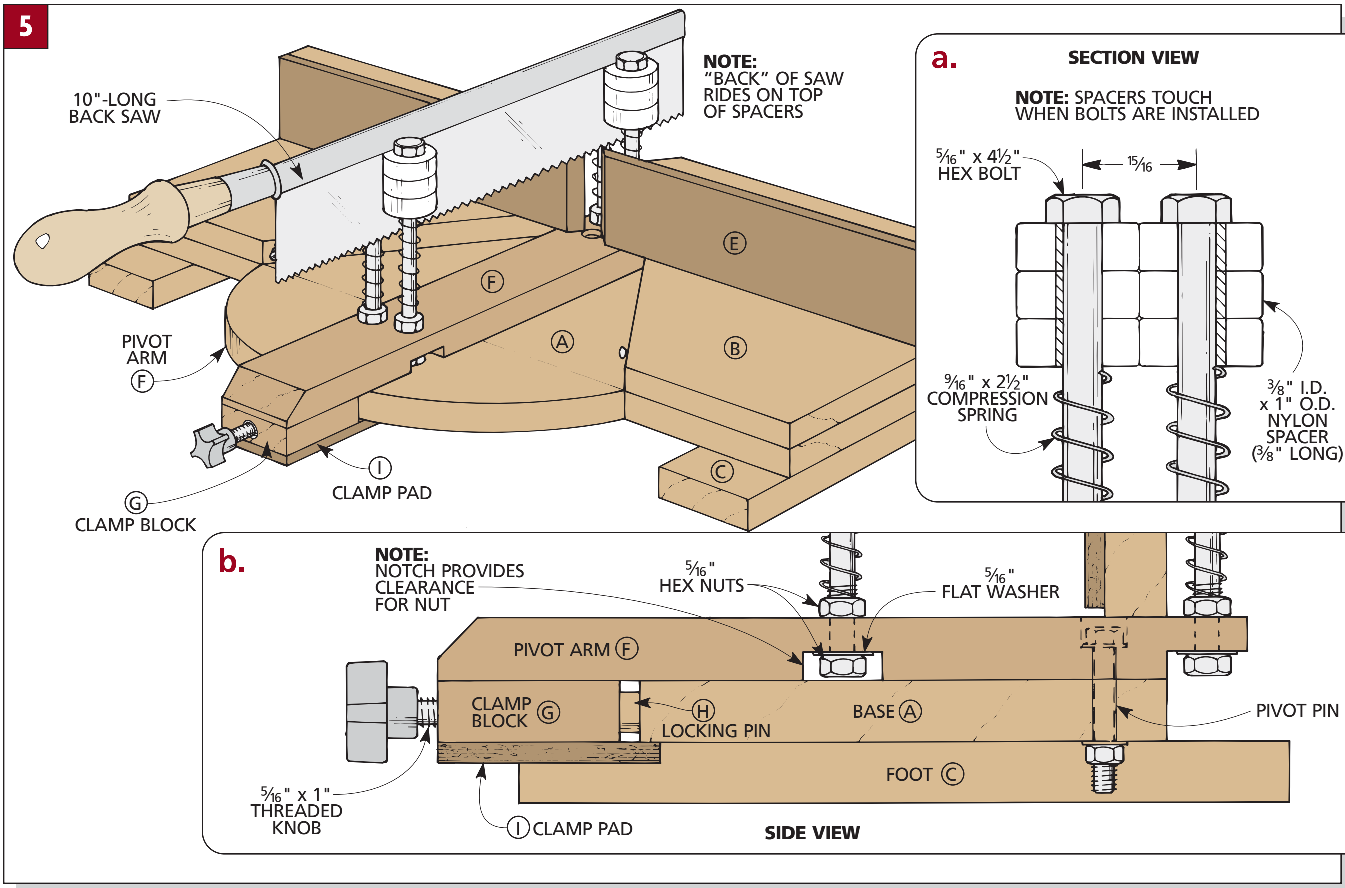
HARDWARE SUPPLIES

(4) 1/4"-20 x 1¼" Fh machine screws
(4) 1/4" T-nuts









PIVOT ARM

The heart of the miter box is the pivot arm. This arm does a couple of things. First of all, it serves as a platform for the system that guides the saw *(Fig. 5)*. And it pivots right and left to position the saw at the desired angle.

The pivot arm (F) starts out as a simple 2" x 10" blank *(Fig. 6)*. Then notches are cut on the bottom of the blank to provide clearance for the nuts that secure the guide system to the arm *(Figs. 5b and 6)*.

To attach the arm to the base, counterbore a pivot hole near the notched end. The other end of the arm is chamfered to relieve the sharp corner.

GUIDE SYSTEM

After cutting the arm to shape, the next step is to install the guide system. This system supports the saw and "tracks" the blade in a straight line.

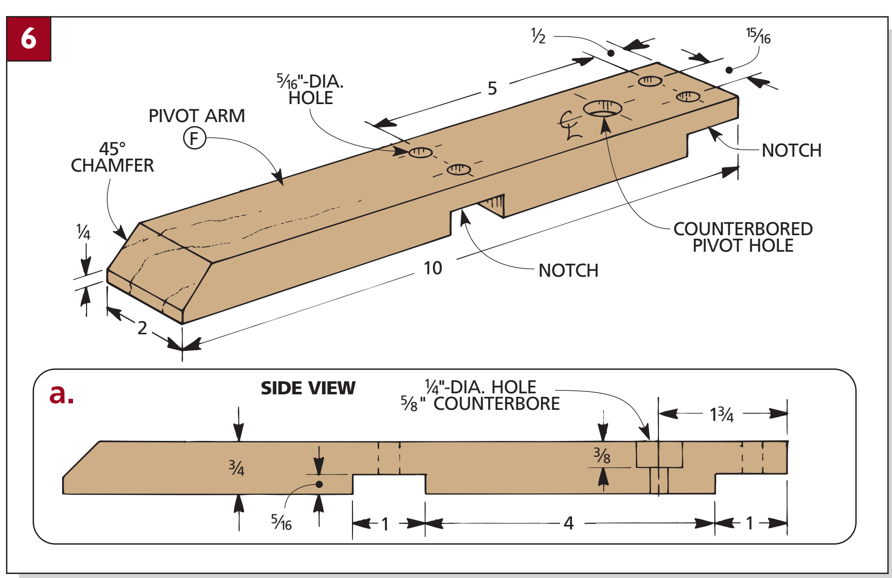
NYLON SPACERS. The key to the guide system is a dozen nylon spacers that I picked up at the hardware store *(Fig. 5)*. (There's also a source of hardware for the Small Piece Miter Box on page 126.) Three of these spacers and a spring slip loosely over each of four hex bolts. Then these "guide bolts" are mounted in pairs on the pivot arm.

When you slide the saw between the hex bolts, the spacers will press against the sides of the blade and eliminate any "play." This ensures a clean cut.

DRILL HOLES. To make this all work, it's important to locate the holes for each pair of hex bolts so the nylon spacers touch *(Fig. 5a)*. I drilled the holes so the centerpoints are 15/16" apart *(Fig. 6)*.

Why doesn't this side pressure cause the blade to bind? Because of the holes in the spacers. They're larger than the diameter of the bolts. So with each stroke of the saw, the spacers spin easily.

In addition to guiding the saw blade, the spacers support the metal "back" of the saw *(Fig. 5)*. When you make a cut,



the spacers travel down the bolts with the blade. When the cut is finished, the springs return the spacers (and saw) to the starting position.

CLAMP

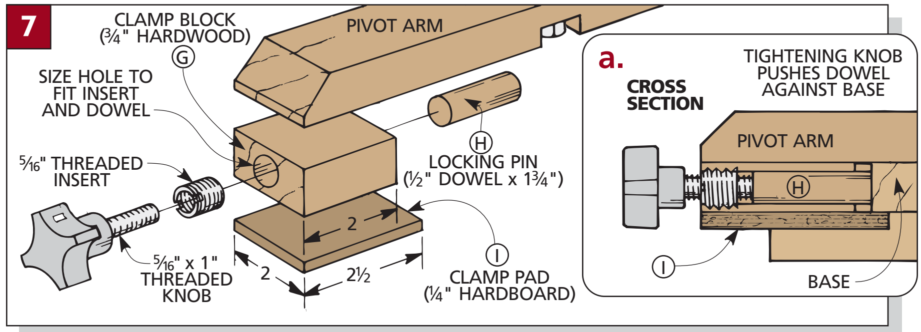
After installing the hardware for the guide system, I made a small clamp block (G) to lock the arm in place *(Fig. 7)*. The clamp is just a wood block with a hole drilled through it to house a threaded insert and locking pin (H) *(Fig. 7a)*.

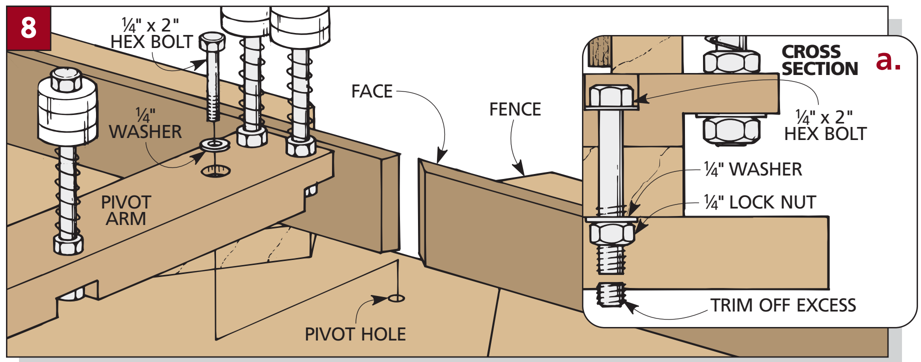
Tightening a knob (or thumbscrew) in the insert pushes the end of the locking pin against the curved edge of the base. This locks the arm in place.

Note: You'll need to sand the pin so it slides easily in the hole.

Next, to prevent the arm from lifting when the knob is tightened down, I glued a clamp pad (I) made from a piece of hardboard to the bottom of the clamp block.

ATTACH ARM. All that's left to complete the Small Piece Miter Box is to attach the arm to the base *(Fig. 8)*. To do this, I used a 2" hex bolt as a pivot pin. (This is longer than I needed, but the smooth shaft prevents the threads of the longer hex bolt from "chewing up" the pivot hole in the base.)





Finally, after tightening a lock nut snug on the end of the bolt, the excess threads can be cut off *(Fig. 8a)*. ■

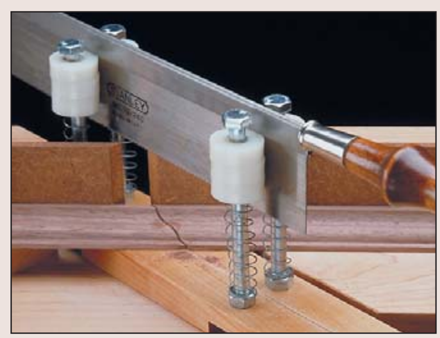
SHOP INFO . . . . *Setting Up the Miter Box*

Even though most of the cuts made on this miter box will be at either 90° or 45°, I made it fully adjustable for miters anywhere between 45° to the left or right. I also added a pair of woodscrews set in the angled edge of the material rests. These screws can be screwed in or out making it possible to "fine-tune" the miter saw for perfect 45° cuts.

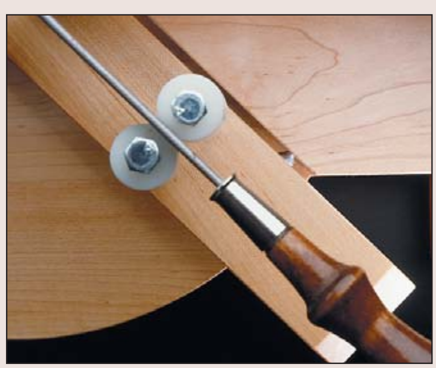
COMBINATION SQUARE. I've found that the best way to align the saw's pivot arm in rough position for a 45° cut is to use a combination square (*Step 1* below). Place the 45° face against the fence and lock the pivot arm in place.

TEST CUTS. Now make a test cut to check the accuracy *(Step 2)*. Move the screw in or out to fine-tune the angle.

SCRIBE A LINE. Finally, position the arm to make a 90° cut and repeat the test cuts until it's aligned. Then scribe a line on the base to mark the position *(Step 3)*.



1 *Place the 45° face of a combination square against the fence. Then pivot the arm so the guide bolts touch the edge of the blade and lock the arm in place.*

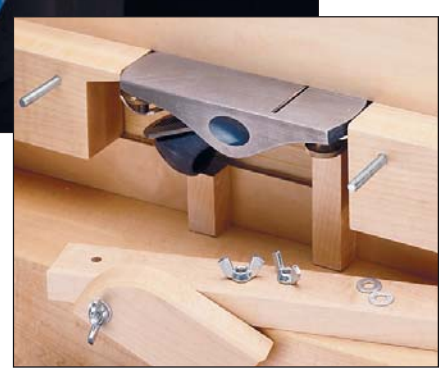


2 *Next, cut a test piece to check the accuracy. To fine-tune the 45° angle, move the adjustment screw in or out until the angle is perfect.*

3 *To position the pivot arm for 90° cuts, repeat the process of rough positioning the arm and making trial cuts. Then scribe a line on the base.*

Hand Plane Jointer

Not everyone needs — or wants — to stock their shop with every full-size power tool. So it's good to know that all it takes to get a perfectly square edge is a small hand plane and this shop-built jointer.



The idea for this jointer came about recently when I was looking for a way to get a straight, square edge on some pieces that were too small to plane by hand — or pass safely across the power jointer. My solution was to build a "holder" for my block plane that works just like a full-size jointer (see photo).

The jointer mounts in my bench vise and all it takes to build it are a few pieces of scrap and some hardware that can easily be found at your local hardware store or home center. Now when I have a few small workpieces that need to be squared up, all I have to do is mount the jointer in my bench vise and start planing.

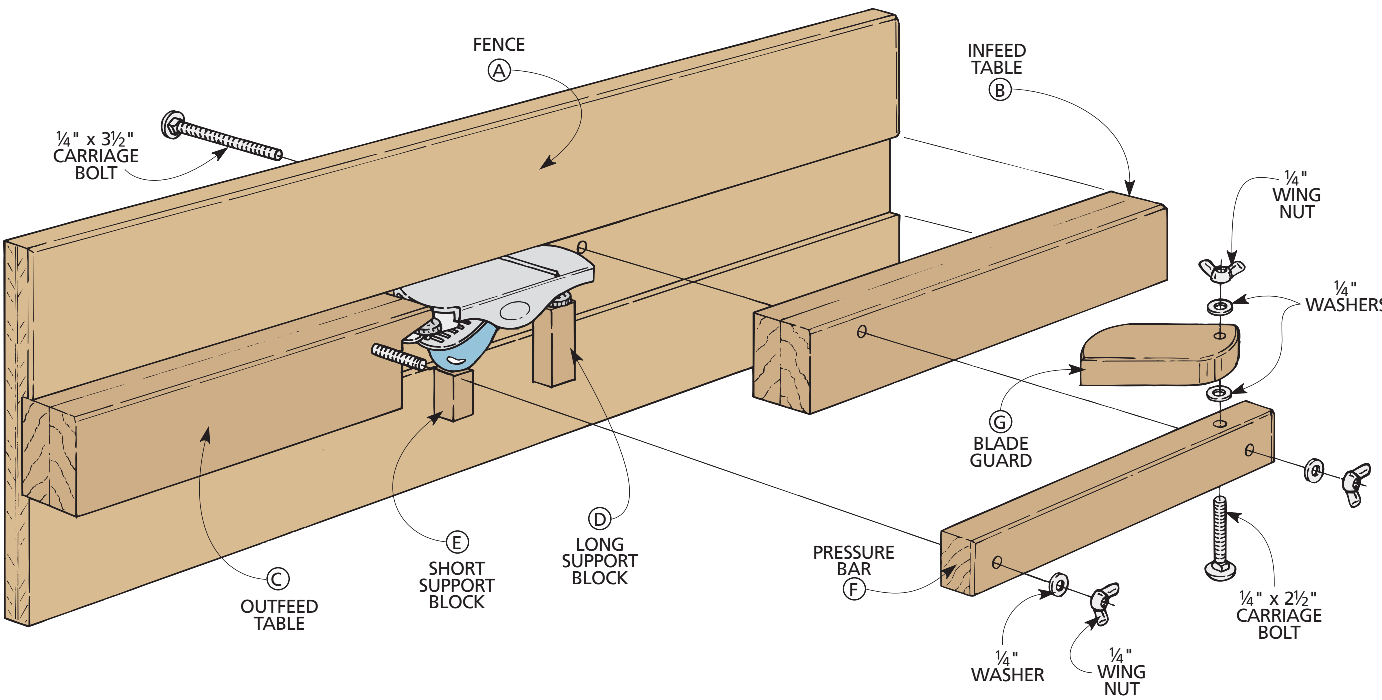
UPSIDE-DOWN. The secret to the Hand Plane Jointer is to hold the plane upside-down, so you can run a board across the stationary plane blade. I used two wood support blocks to hold the plane (inset photo). Infeed and outfeed tables made from solid wood and a tall fence made of plywood allow me to run the workpiece over the plane. A pressure bar holds the plane in place and keeps it from rocking (or even falling out), while a blade guard covers the exposed part of the blade.

SETUP. You'll find six easy setup steps in the Technique article on page 63. In it, you'll learn how to adjust the jointer to get a smooth cut and a square edge.

SMALL-PIECE JOINTER. The Hand Plane Jointer works great for most small workpieces. But occasionally I had a workpiece that was just too thin or narrow to comfortably push along the tall fence. So I designed a version that features a removable fence to make this job a lot easier. See the Designer's Notebook on page 61 to learn how I built it.

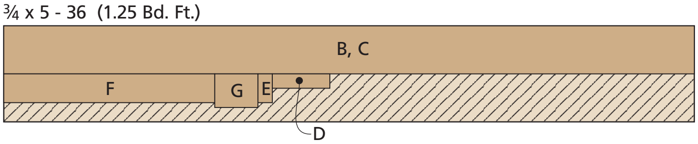
EXPLODED VIEW

OVERALL DIMENSIONS:
36W x 3¼D x 10H

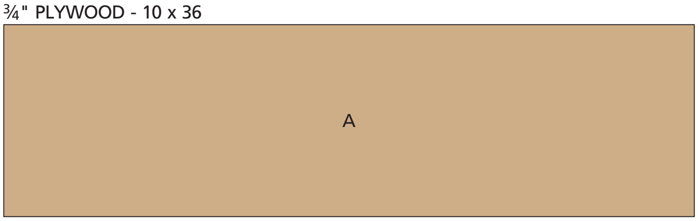


CUTTING DIAGRAM

¾ x 5 - 36 (1.25 Bd. Ft.)



¾" PLYWOOD - 10 x 36



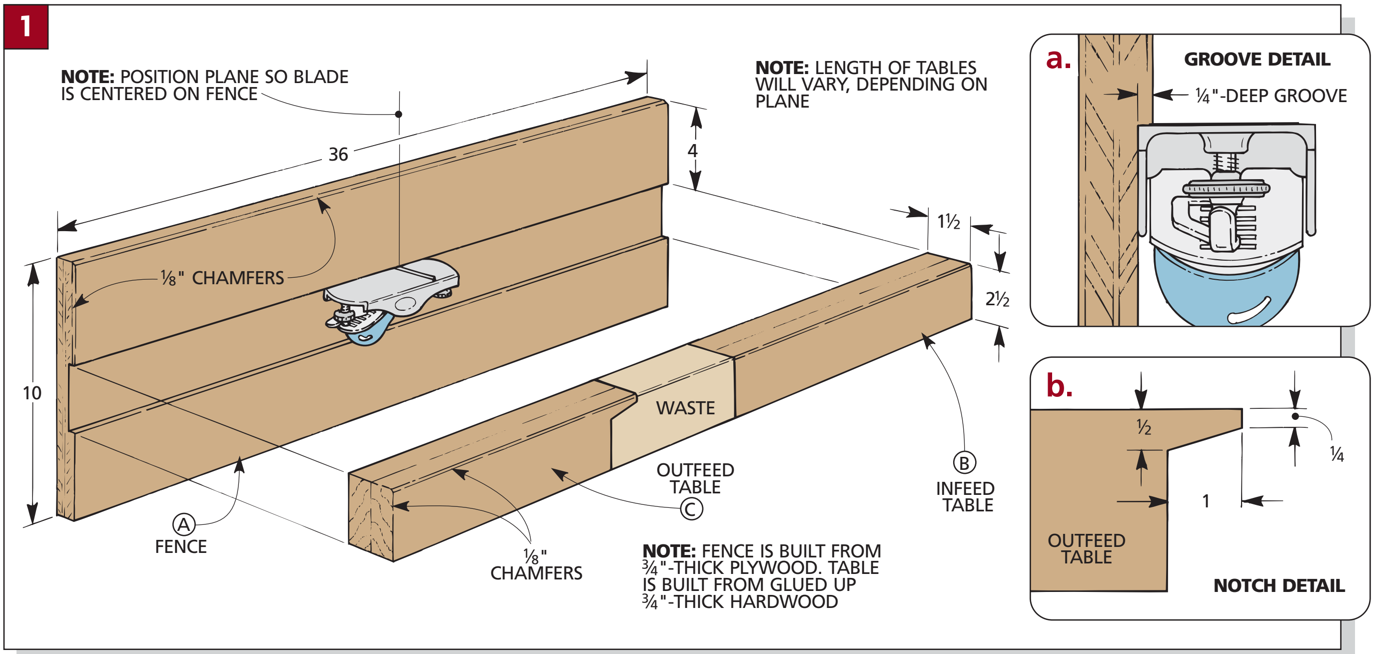
MATERIALS LIST

WOOD

A	Fence (1)	¾ ply - 10 x 36
B	Infeed Table (1)	1½ x 2½ - 18 rgh.
C	Outfeed Table (1)	1½ x 2½ - 12 rgh.
D	Lg. Support Blk. (1)	¾ x ¾ - 3 rough
E	Shrt. Support Blk. (1)	¾ x ¾ - 1½ rough
F	Pressure Bar (1)	¾ x 1½ - 11
G	Blade Guard (1)	¾ x 1¾ - 4¼

HARDWARE SUPPLIES

(1) No. 4 x ⅜" Fh woodscrew
(2) ¼" x 3½" carriage bolts
(1) ¼" x 2½" carriage bolt
(4) ¼" flat washers
(3) ¼" wing nuts



FENCE

The fence on the Hand Plane Jointer serves two purposes. First, the base (or bottom) portion will be clamped in a bench vise to provide a solid foundation during the jointing operation. The top portion is the actual fence that the workpiece rides along at 90° to the table.

Note: To make sure the jointer isn't going to move around while using it, it's best to clamp it into a heavy-duty vise mounted to the front of your workbench.

A long, wide groove that's cut in the fence helps to keep the tables (added later) flat and straight.

BUILD THE FENCE. Start off by cutting the fence (A) to size from a piece of ¾"-thick plywood *(Fig. 1)*.

GROOVE. After cutting the fence to size, the next step is to cut a wide groove along its length. In addition to accepting the two wood tables, the groove provides a recess for the plane. The thing to keep in mind here is the depth of the groove.

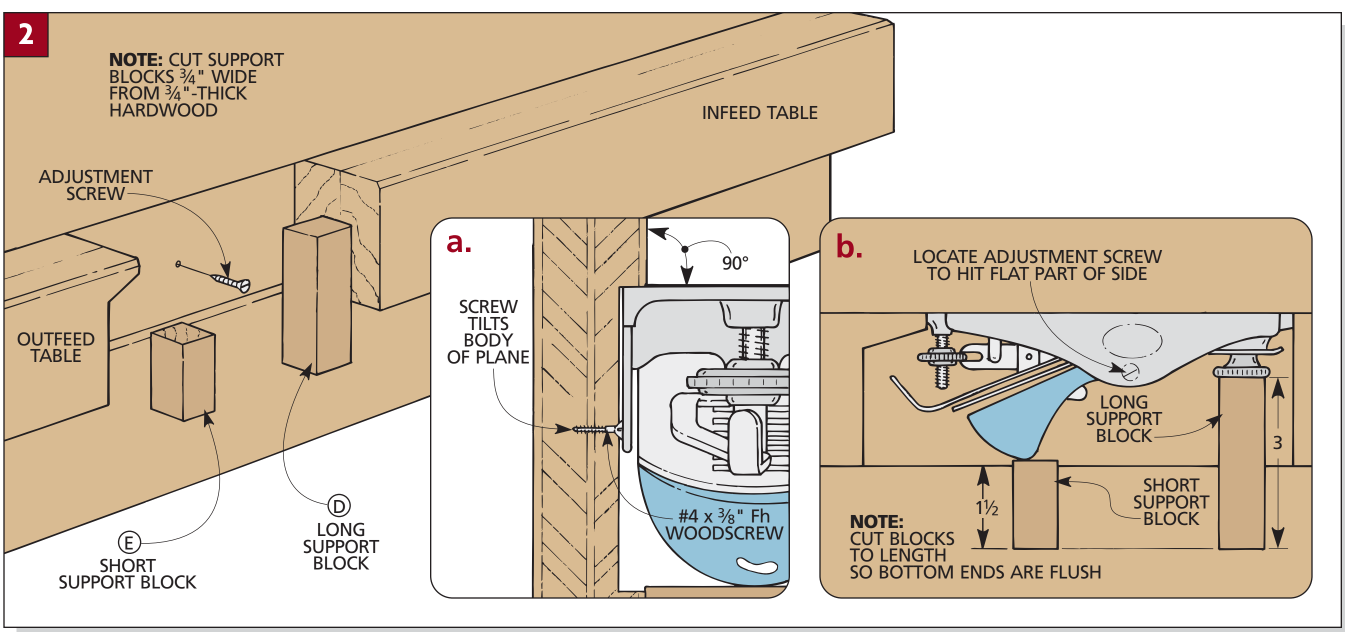
Since the blade on a plane doesn't extend clear to its side, the groove in the fence lets you "bury" the blade below the surface of the fence face *(Fig. 1a)*. This way, when the workpiece is held tight against the fence, the blade removes a shaving across the entire edge.

TABLES

Once the groove is cut in the fence, you can add the tables. Just like on a power jointer, there's an infeed and an outfeed table to support the workpiece. Each one is cut to size from two long pieces of hardwood glued up into one thick piece.

BLANK. The tables are made by gluing up two pieces of ¾"-thick hardwood. (I used hard maple.) It's easiest to start with one long blank that's ripped to width to fit the groove *(Fig. 1)*. Then the two tables can be cut to length.

TABLE LENGTH. But before you can determine the length of these tables,



you'll need to position the plane so the blade is centered on the length of the fence *(Fig. 1)*. Then the outfeed and infeed tables are built to fit around the base of the hand plane.

And to provide continuous support for the workpiece, the tables need to butt up against the ends of the hand plane. So with the plane in position in the groove in the fence, lay out and cut the infeed table (B) and outfeed table (C) to match the distance from the end of the jointer fence to the sole of the plane.

NOTCH. But depending on the hand plane, the adjusting mechanism will often stick out past the end of the sole. So once the outfeed table is cut to length, you may need to add a notch to get it to fit around the end of the plane *(Fig. 1b)*.

To do this, lay the plane against the end of the outfeed table and lay out a tapered notch to fit around your plane. Then cut it out with a band saw.

Note: The 1"-wide notch in my outfeed table provides plenty of clearance for a standard size block plane.

CHAMFERS. To keep my hand from hitting a sharp corner if it should slip off the workpiece during the jointing operation, I chamfered the exposed edges on the tables and fence *(Fig. 1)*.

ATTACH TABLES. Now it's simply a matter of gluing the infeed table flush at one end of the fence. Then I used the plane as a spacer and glued on the outfeed table at the opposite end of the fence.

ADJUSTMENT SCREW. To ensure that you end up with a square edge on the workpiece, you'll need to install an adjustment screw in the fence groove *(Figs. 2 and 2b)*. That's because the sides of a plane aren't necessarily 90° to the sole, so you'll need some way to adjust it. The screw allows you to compensate for this by tilting the body of the plane so the sole is 90° to the fence *(Fig. 2a)*.

Note: Be sure to position the adjustment screw to hit a flat part of the side.

SUPPORT BLOCKS. Next, I added two support blocks to keep the plane from falling out of the jointer. There's nothing complicated about the blocks. First, a long support block (D) is positioned under the front knob of the plane. And a short support block (E) is cut to fit under the cap *(Figs. 2 and 2b)*.

To provide a sturdy and stable work surface, the bottom ends of the support blocks should rest on top of your workbench vise when you tighten down the fence. So I cut the blocks to length and glued them in place so the bottom ends were flush *(Fig. 2b)*.

DESIGNER'S NOTEBOOK

The tall auxiliary fence adds versatility to the jointer, making it easier to use with extra-small pieces.

CONSTRUCTION NOTES:

- Start by building the fence (A). The only change here is that the fence is shorter than before (7½"), which makes it more comfortable when jointing small pieces. There's more room for your hand as you push the stock along the fence.
- Next, add the infeed and outfeed tables, support blocks, pressure bar, and blade guard as before.
- Now you can start working on the removable fence. The tall auxiliary fence (H) can be added when jointing large workpieces. It's held in place by four fence brackets (I) made from ¾"-thick hardwood. Cut the pieces to length and rip them to width (see drawing).
- Now lay out and drill a ¼"-dia. through-hole in each of the brackets and the base fence assembly. The holes are for a carriage bolt, wing nut, and washer that are used to secure the auxiliary fence to the base assembly. Complete the brackets by chamfering the sharp corners.
- Finally, attach the brackets to the back of the auxiliary fence and glue a face (J) made from ⅛" hardboard to the front.

MATERIALS LIST

CHANGED PART

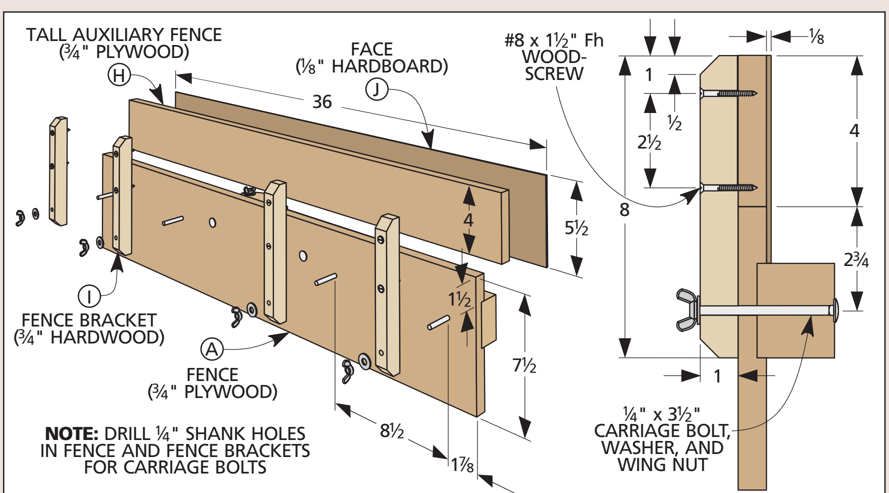
A	Fence (1)	¾ ply - 7½ x 36

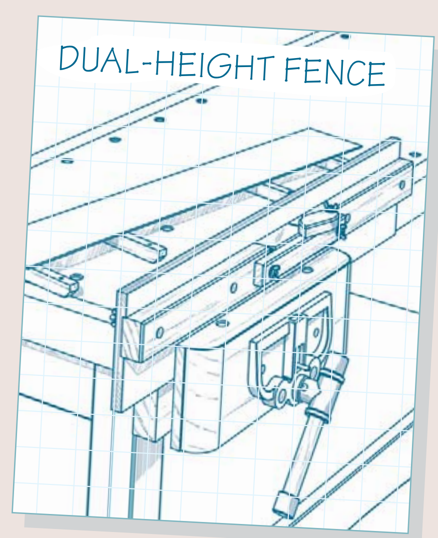
NEW PARTS

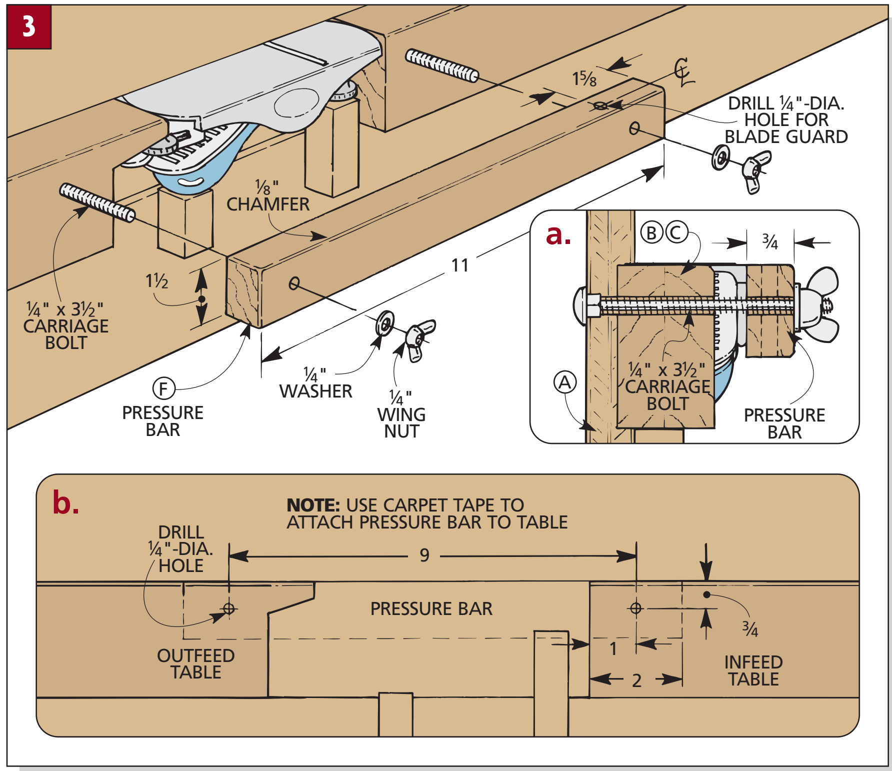
H	Tall Aux. Fence (1)	¾ ply - 4 x 36
I	Fence Brackets (4)	¾ x 1 - 8
J	Face (1)	⅛ hdbd. - 5½ x 36

HARDWARE SUPPLIES

(8) No. 8 x 1½" Fh woodscrews
(4) ¼" x 1½" carriage bolts
(4) ¼" wing nuts w/ washers







PRESSURE BAR

At this point, you've completed the fence and the tables, so now the jointer has a "pocket" for the hand plane to rest in. But there's nothing to prevent the plane from rocking to the side or even falling out during the cutting operation. This is where the pressure bar comes in.

PRESSURE BAR. As its name implies, the pressure bar (F) is a strip of $\frac{3}{4}$"-thick hardwood that presses against the side of the plane, holding it securely in place *(Fig. 3)*. Then pressure is applied to the bar by tightening down a couple of wing nuts on a pair of carriage bolts.

The carriage bolts pass through a pair of holes drilled through the pressure bar, the two tables, and fence *(Figs. 3 and 3a)*. An easy way to ensure these holes align is to attach the pressure bar with double-sided carpet-tape so it's flush with the top of each table *(Fig. 3b)*. Then lay out and drill the holes.

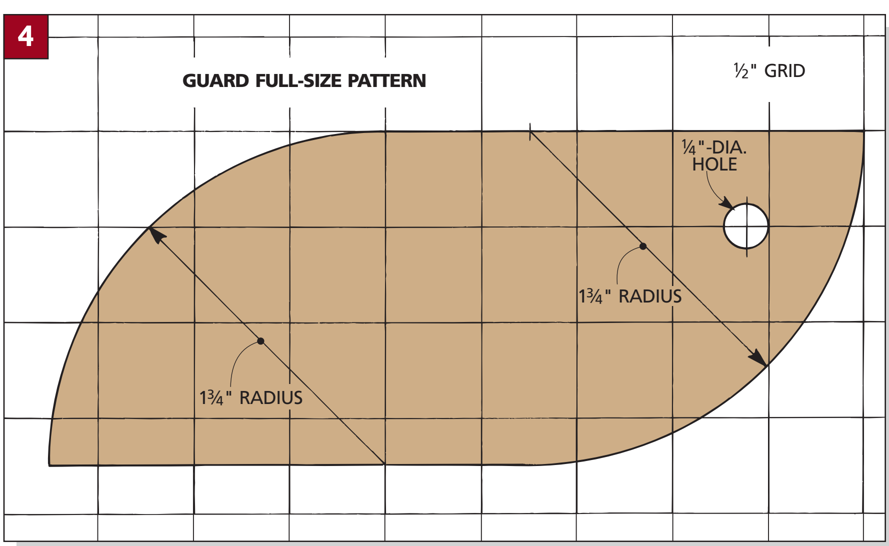
Before installing the pressure bar, there are two things left to do. First, to accept a carriage bolt to hold the guard in place, you'll need to drill a single hole through the width of the pressure bar *(Fig. 3)*. And, as before, add a $\frac{1}{8}$" chamfer to the top and ends of the outside edges of the pressure bar.

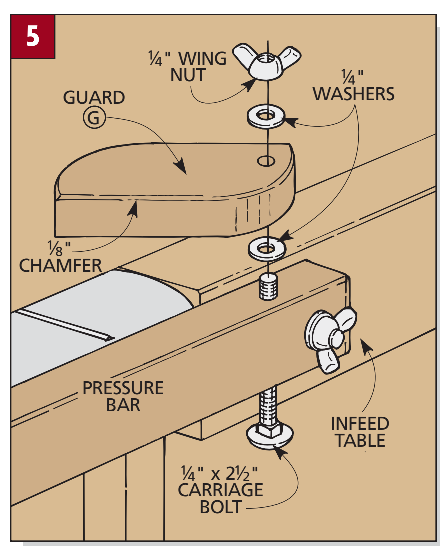
BLADE GUARD

Now that you've completed the pressure bar, you're ready to add the blade guard. It covers the exposed part of the blade so you don't cut your hand if it accidentally slips off the workpiece (see photo above).

The blade guard (G) is a piece of $\frac{3}{4}$"-thick stock with a gentle curve at each end *(Figs. 4 and 5)*. One curve keeps the workpiece from catching as you feed it across the plane. And the other removes the sharp corner. Here again, there's a $\frac{1}{8}$" chamfer around the top edge.

ATTACH BLADE GUARD. The guard is held in place with a carriage bolt that passes through the hole you drilled earlier in the pressure bar and a $\frac{1}{4}$"-dia. hole drilled in the guard *(Fig. 4)*. To keep the guard from rubbing against the plane blade, a washer is used to raise it above the pressure bar. Finally, thread on a second washer and a wing nut to tighten the blade guard in place. ■





TECHNIQUE . . . . Jointer Setup

The few minutes it takes to set up and properly adjust your hand plane, as well as the jointer itself, can make a big difference in the quality of cut you get.

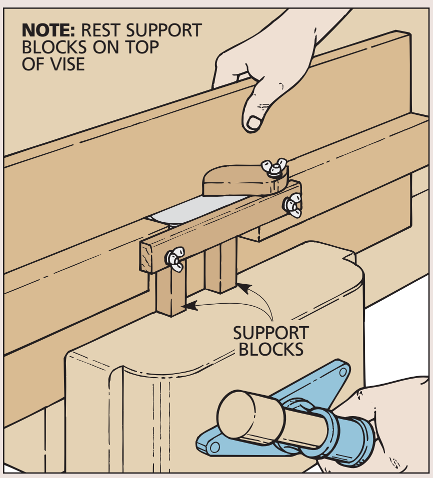
SMOOTH CUT. To produce a smooth cut, the jointer needs to be secured tightly in a bench vise (*Step 1* below).

Also, to keep the blade from digging into the workpiece, be sure to adjust the depth of cut on the hand plane to remove just a thin shaving *(Step 2)*.

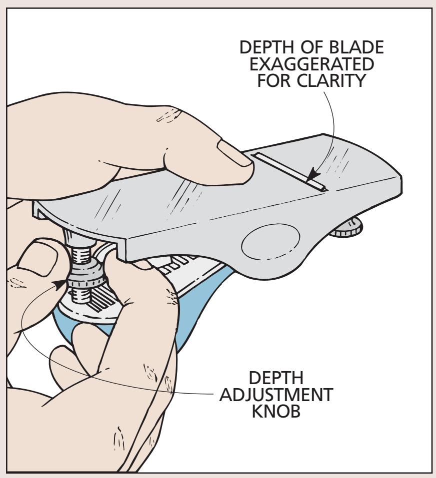
SQUARE EDGE. In addition to a smooth cut, one of the main reasons for using a jointer is to get a square edge on your workpiece. To do this, you may need to tighten (or loosen) the adjusting screw (on the jointer fence) until the sole of the hand plane is square (90°) to the fence *(Steps 3 and 4)*.

LIGHT PASSES. Finally, after tightening down the pressure bar and guard *(Step 5)*, simply make as many light passes as necessary to get a straight, square edge *(Step 6)*.

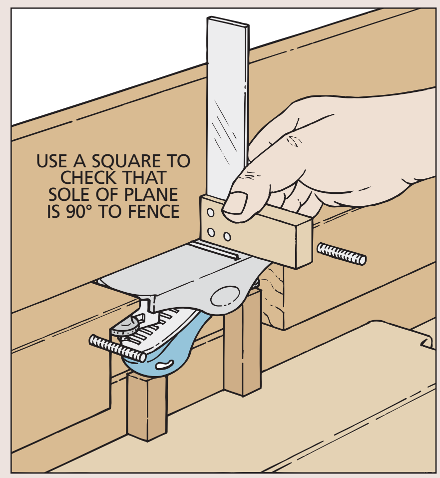
Adjust the Jointer. *Whether you're working with a wide board (see photo) or a small workpiece (see photo on page 58), the key to getting a smooth, square edge is adjusting the jointer correctly and then making a series of light passes.*



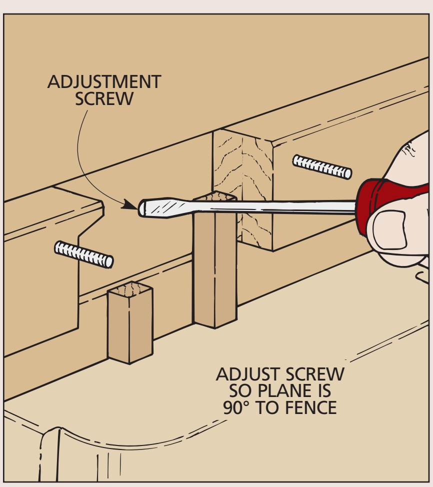
1 *To provide as much support as possible when making a cut, tighten the jointer in a vise. For added stability, the support blocks rest on top of the vise.*



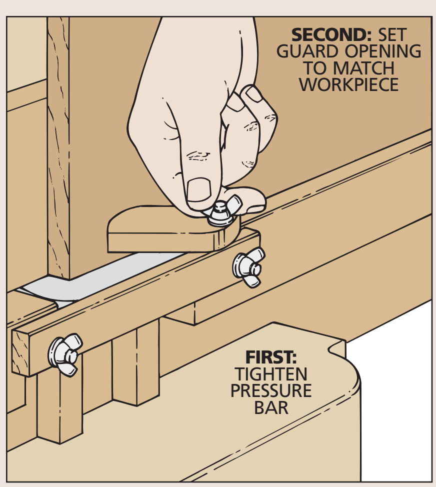
2 *Now adjust the blade so it extends just a hair beyond the sole of the plane. To check the setting, a test cut should remove thin, wispy shavings.*



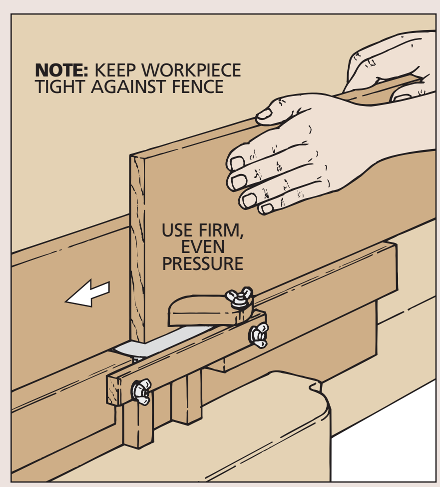
3 *After removing the pressure bar and guard, set the plane in its "pocket" and use a try square to check that the sole is exactly 90° to the fence.*



4 *If you need to square up the plane, tighten (or loosen) the adjusting screw. Now check the plane again and readjust the screw if necessary.*



5 *With the pressure bar tightened down against the plane, use the workpiece to set the opening for the guard. Then lock the guard in place.*



6 *Finally, keeping the face of the workpiece tight against the fence, apply firm, even pressure as you push it across the hand plane and jointer.*

Scraper Plane

This shop-built plane solves two of the biggest problems of using a hand-held scraper. It saves your thumbs from wear and tear. Plus, the handles keep your hands away from the heat caused by scraping.

Take a look around almost any woodworking shop and you're likely to see all manner of power tools that are designed to make smoothing and planing rough-cut hardwood fast and easy. But there's one tool you may not notice. It's a scraper. And it's one of my favorites when I feel like working with my hands instead of a power tool. It's just a thin piece of steel. Yet it's an ideal tool for leveling ridges left behind by a planer, removing burn marks, or smoothing highly figured pieces of wood.

WEAR AND TEAR. But as much as I like using a scraper to clean up a board, it doesn't take long before my thumbs start to wear out from the constant pressure required to keep the blade flexed. And the heat caused by the friction from scraping makes the blade uncomfortable to hold.

PLANE. The Scraper Plane changes all that. It's made up of a base with a built-in bridge to hold the scraper at a consistent angle. A tapered wedge locks the blade against the bridge and a simple finger screw adjusts the amount of flex in the scraper.With a pair of handles providing a firm, comfortable grip, you can make thin, wispy shavings all morning long *without* tiring.

SCRAPER. Before getting started on the plane, it's best to have the scraper in hand. I used a 3"-wide scraper (6" long). Then, to create a low overall profile, I cut it to a length of 4" (see photos on page 69).

HARDWARE. All you need to build the plane is a little hardwood (I used maple), a short piece of steel rod, plus a T-nut and finger screw. The handles can be turned, or cut from the ends of a towel holder. Turn to Sources on page 126 to locate the hardware supplies needed to build the plane.

FIGURED WALNUT. This may be a good project to use up some of that highly figured wood laying around your shop. The Designer's Notebook on page 69 shows what I did with some walnut I had.

MATERIALS LIST

WOOD

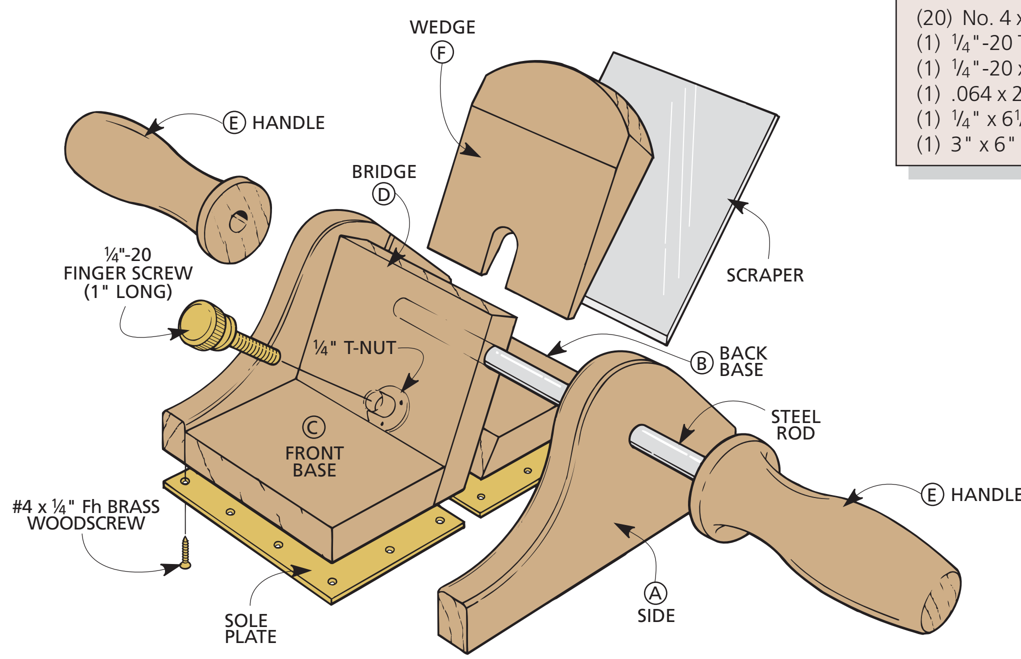
A	Sides (1)	½ x 2¼ - 4½
B	Back Base (1)	1½ x 2½ - 2 rough
C	Front Base (1)	1½ x 2½ - 1 11/16 rough
D	Bridge (1)	¾ x ¾ - 2½ rough
E	Handles (2)	1⅛ x 1⅛ - 3
F	Wedge (1)	½ x 2½ - 3

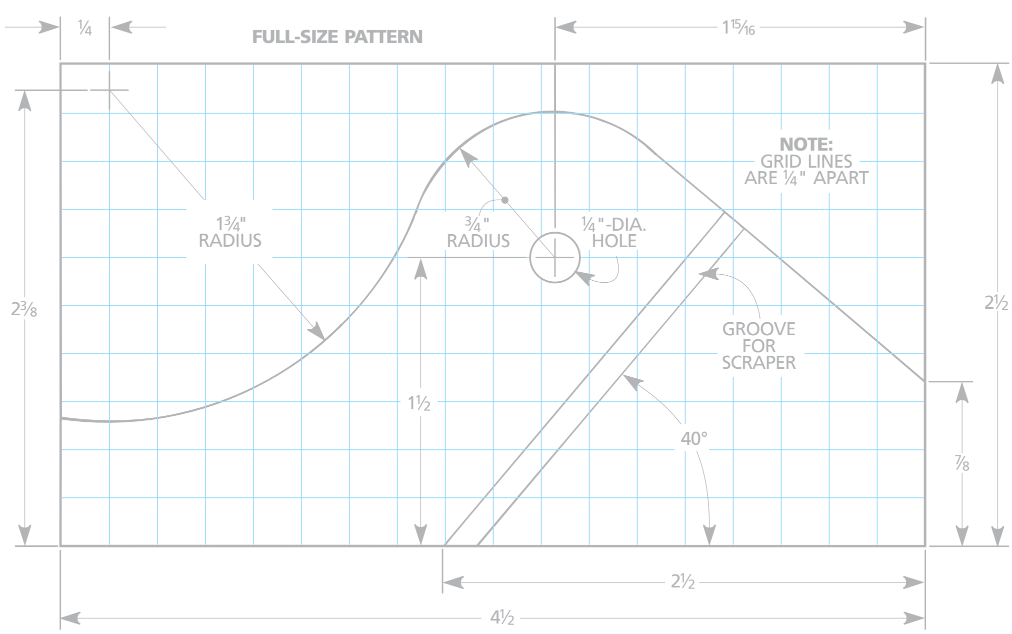
HARDWARE SUPPLIES

(20) No. 4 x ¼" Fh brass woodscrews
(1) ¼"-20 T-nut
(1) ¼"-20 x 1" knurled brass finger screw
(1) .064 x 2" - 12" brass plate
(1) ¼" x 6½" steel rod
(1) 3" x 6" scraper

EXPLODED VIEW

OVERALL DIMENSIONS:
9½W x 4½D x 2¼H





SIDES

I began by making the curved sides of the plane from two blanks (see *Fig. 1* and the pattern on page 65). (I used maple, but it's also a good chance to experiment with a piece of highly figured wood. Refer to the Designer's Notebook on page 69.)

GROOVES. To hold the scraper in the plane, an angled groove (kerf) is cut on the inside face of each blank *(Fig. 1a)*.

Note: You'll need to move the miter gauge to the opposite slot on the table saw and rotate the head to the opposite angle to cut the groove in the second blank.

To ensure the grooves align when the plane is assembled, I used double-sided carpet tape to fasten the blanks together so the kerfs matched up. And I used spray adhesive to attach the paper pattern to the outside face of one of the blanks. Then, after cutting and sanding the sides (A) to shape, drill a hole for a steel rod that's added later *(Fig. 1b)*.

All that's left is to take the sides apart and rout a slight (1⁄8") roundover on the top edges only *(Fig. 4)*.

CORE

With the sides complete, you can start on the core of the plane. It's made up of two base pieces that form the bottom of the plane, and a bridge that supports the handles and holds the sides together *(Fig. 4)*.

BLANK. Since these pieces are fairly small, it's safest to cut them from one long blank *(Fig. 2)*.

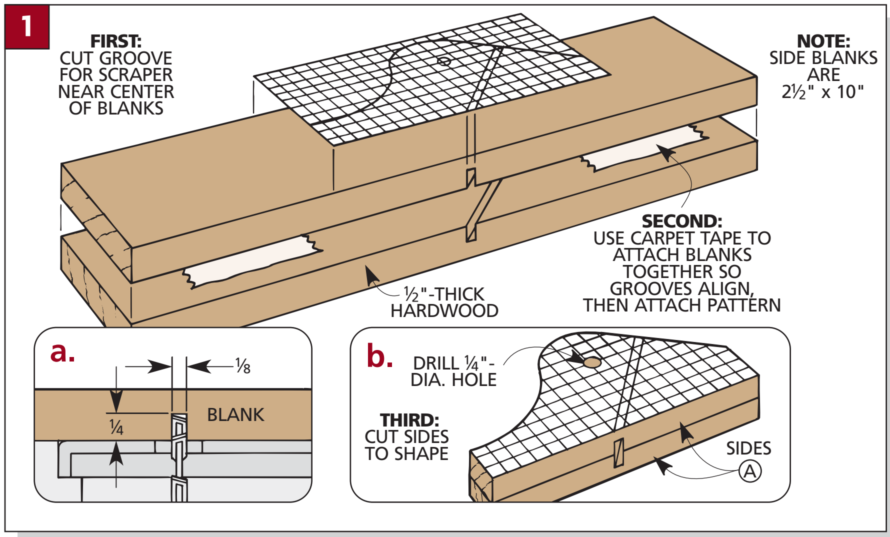
The beveled end on the back base (B) will keep shavings from clogging the plane. And cutting a single bevel to separate the front base (C) from the bridge (D) ensures a tight joint when these pieces are glued up.

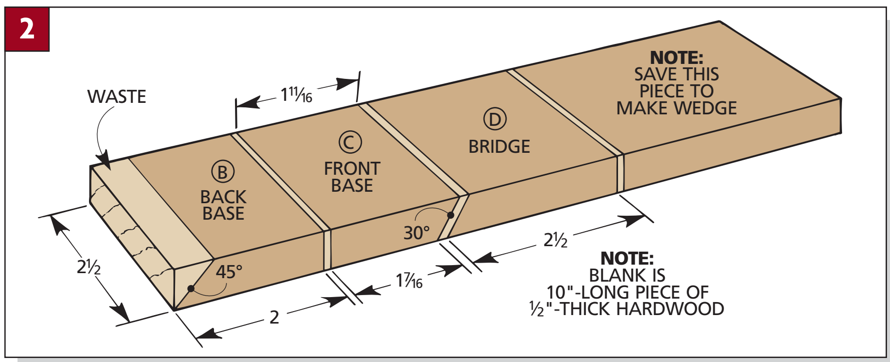
Note: Save the remaining part of the blank to use for the wedge later.

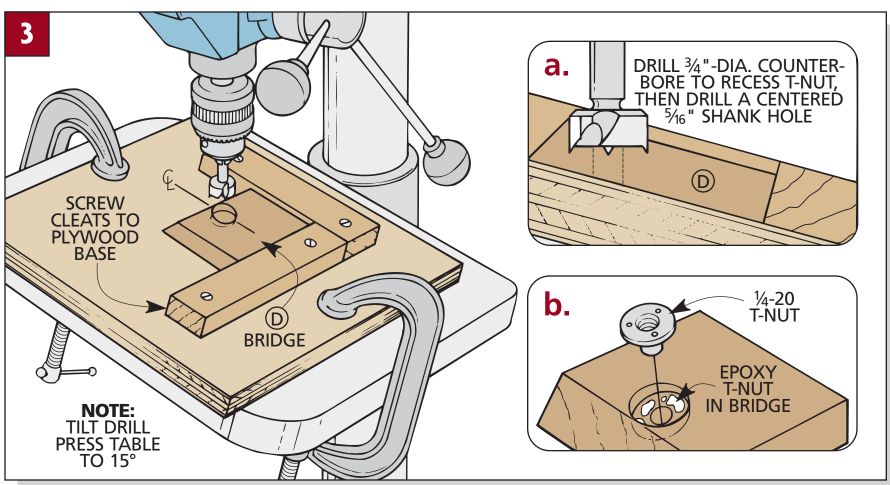
T-NUT. There's one last thing to do before assembling the core. To accept a T-nut and finger screw that work together to flex the scraper, I drilled a counterbored shank hole at an angle through the bridge *(Figs. 3 and 3a)*.

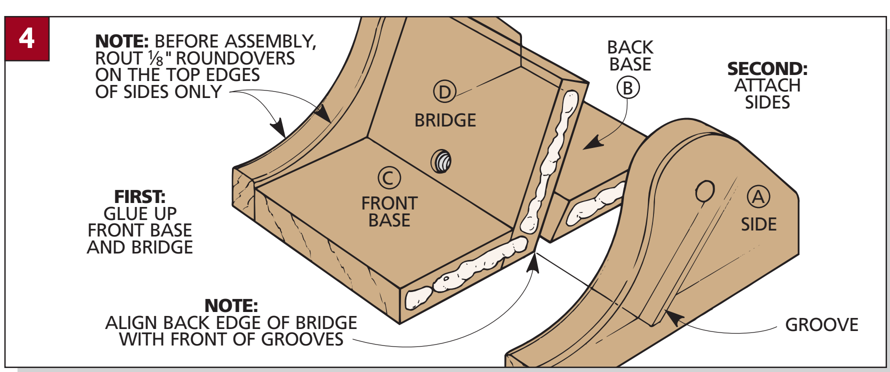
Note: A pair of cleats keeps the bridge from sliding as you drill the hole.

ASSEMBLY. After epoxying the T-nut in place *(Fig. 3b)*, assembling the plane body is just a matter of gluing up the sides and core pieces. The front base and bridge are glued together first *(Fig. 4)*. Then this assembly and the back base are sandwiched between the sides.









If you don't happen to own a lathe, towel holders (with ends already turned to shape) are a good source of handles. (See Sources on page 126.)

HANDLES

All that's left to complete the body of the plane is to add a pair of handles (E). There are a couple of ways to go about this. You can turn the handles to shape on a lathe (refer to *Fig. 8*). This is what I ended up doing for the walnut plane shown in the Designer's Notebook on page 69.

Or there's one other ready-made solution that works well for this plane — use the handles from a wood towel holder (see photo above and Sources on page 126). Just cut a handle from each end of the holder and use the drill press to drill a ¼"-dia. hole in the flat end.

STEEL ROD. Either way, the handles are held in place with an ordinary steel rod that I picked up at the local hardware store. To strengthen the handles, the rod passes through both sides and the bridge of the plane *(Fig. 7)*.

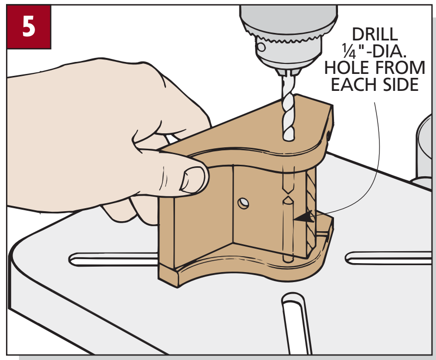
This requires drilling holes for the rod in the ends of each handle and through the bridge of the plane *(Figs. 5 and 6)*. To do this, drill halfway through from both sides using the holes drilled earlier in the sides as guides.

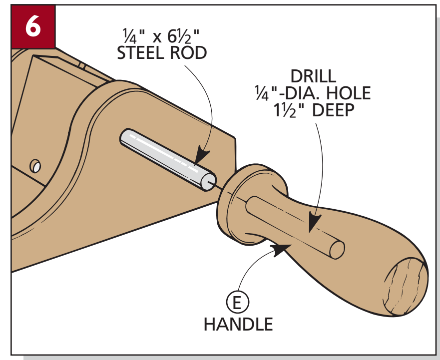
EPOXY. After drilling the holes, simply attach the handles to the rod and the sides of the plane with epoxy.

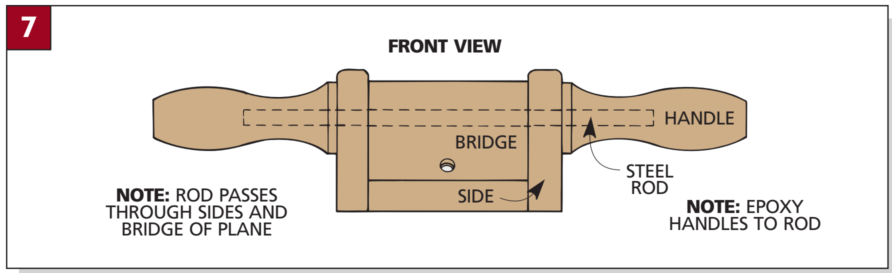
WEDGE

The scraper is held tightly in place by a wedge that slips down into the opening between the bridge and the scraper.

The wedge (F) is made from the remaining part of the blank used to cut the core pieces *(Fig. 9)*. A curved notch in the bottom allows the wedge to slide over the finger screw. (I drilled a hole and removed the waste with a hand saw.)



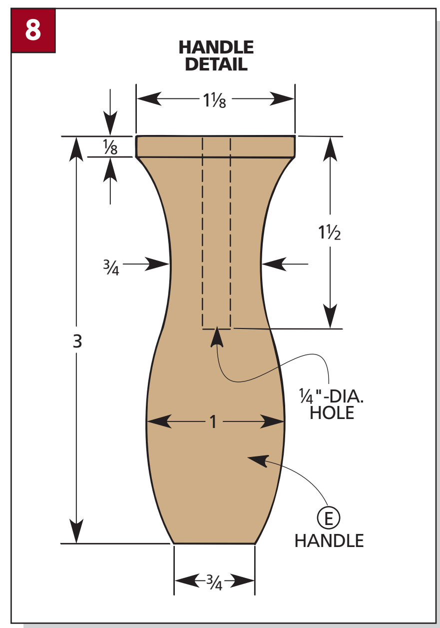


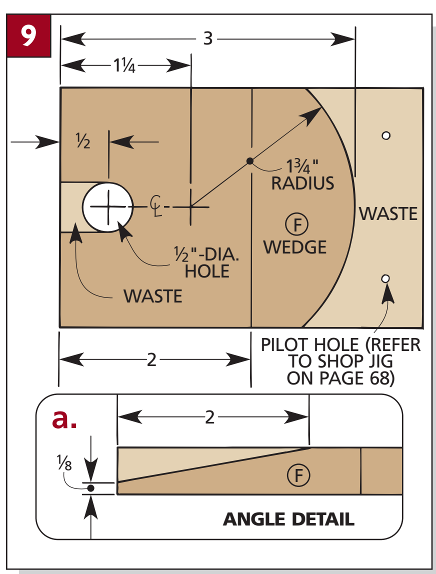


ANGLE-CUTTING JIG. After you've finished adding the notch for the finger screw, you still have to cut the angled face on the workpiece to complete the wood wedge *(Fig. 9a)*.

But this is a small workpiece, so to hold the wedge safely when cutting the angle on the face, I used a simple angle-cutting jig I made from a few pieces of scrap. You can learn more about how this is done in the Shop Jig box on page 68.

CURVED TOP. To complete the wedge, you need to round off one end. I did this by simply cutting a curve at the end opposite the notch with a band saw (or jig saw) and sanding it smooth (see photo below). Now all that's left is to add the brass sole plates and set up the scraper.





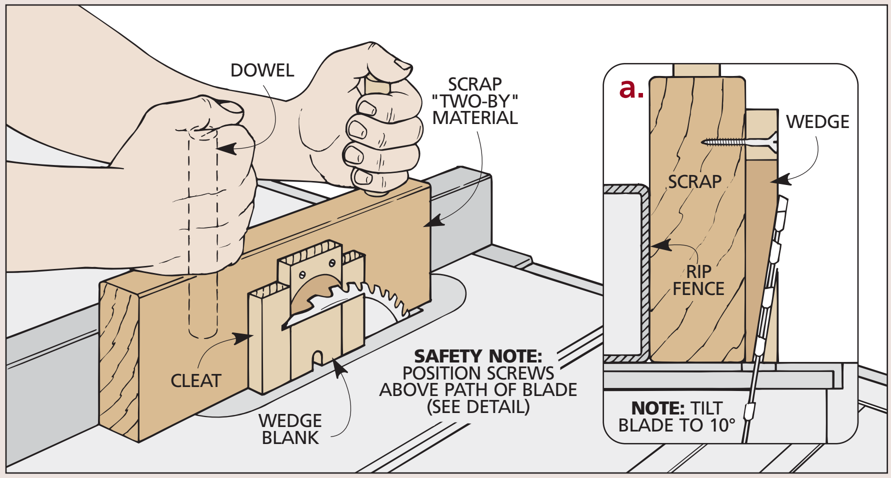
The wedge holds the scraper in place. It slides down into the opening between the bridge and scraper, and the notch straddles the finger screw.

SHOP JIG . . . . Wedge-Cutting Jig

The wedge is made from the waste piece left over from the core blank. Since it's so small, I used a jig to cut the angle on its face (see drawing). The jig is made from a piece of scrap "two-by" material with a couple of dowels for handles.

CLEATS. Fitting the blank between two small cleats makes it easy to cut the wedge. The cleats are glued in place after screwing the wedge blank to the jig.

Note: I didn't want to split this small piece, so I drilled two small pilot holes at the top of the piece (making sure to position them above the path of the blade). Then I screwed it to the jig (see detail 'a' in drawing at right).



SOLE PLATES

At this point, all the wood parts of the Scraper Plane are complete. But, to ensure a flat surface and protect the bottom of the plane from wear, I added two brass sole plates *(Fig. 10)*.

These are 2"-wide strips that are attached to the front and back base pieces. (I bought a .064"-thick brass strip at my local hobby shop.)

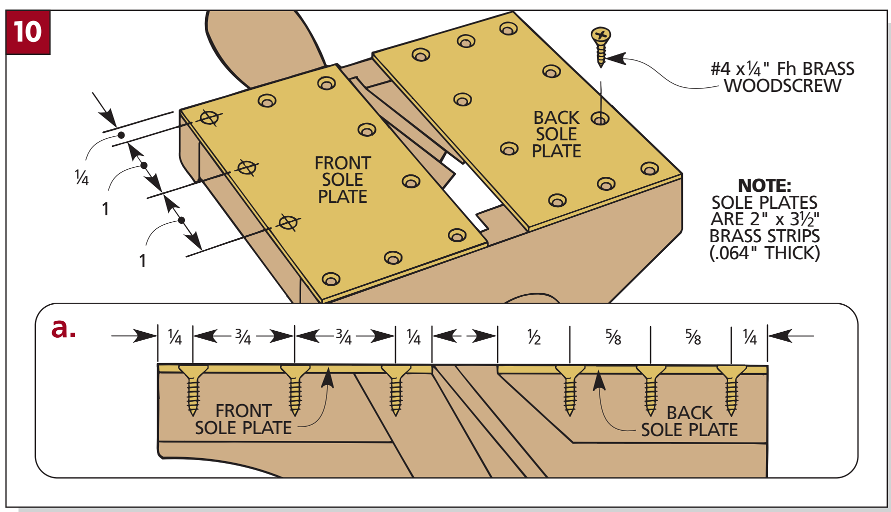
The strips are held in place with several small brass screws.

Note: To avoid splitting the wood, the holes for the screws in the beveled edge of the back plate are located farther from the inside edge *(Fig. 10a)*.

COUNTERSINKS. And to keep from gouging a workpiece while you're using the plane, the brass screws are countersunk in the sole plates. What I like to do here is to tighten a countersink bit in the drill press and turn the chuck by hand (refer to the Shop Tip on page 37).

FITTING. After screwing the sole plates in place, it's just a matter of filing and sanding the edges flush (*Step 1* below).

Next, I sanded the sole flat using silicon carbide sandpaper (up to 600 grit) *(Step 2)*. A piece of glass ensures a flat surface during this step.



1 *After you've screwed the sole plates in place, you'll want to file and sand the edges of the plate flush.*

2 *Sand the sole flat with silicon carbide sandpaper (up to 600 grit). A piece of glass ensures a flat surface to work on.*

3 *Most scrapers are sized to fit the hand, so mine needed to be shortened to fit. First, file a deep groove across the blade.*

4 *Then I tightened the scraper blade in a machinist's vise and bent it until the blade snapped in two.*

DESIGNER'S NOTEBOOK

Use some figured pieces of scrap to build this version.

FIGURED-WALNUT PLANE

■ The highly figured grain on this walnut Scraper Plane creates a fine tool that's as pleasing to look at as it is to use.

Built just like the maple Scraper Plane, a wood wedge and brass finger screw hold the scraper at just the right angle to produce thin, wispy shavings. And brass sole plates on the bottom resist wear.

■ If you haven't worked with figured wood before, there's one thing you need to be aware of — it tends to chip out along the grain if you use a portable planer to thickness it. So to solve this problem, I like to use a band saw to cut a thicker piece down to size, then I finish up by smoothing out the rough saw marks with a scraper.

■ Finally, use a lathe to turn your handles to size (see *Fig. 8* on page 67), then epoxy them to the rod as before.

SIZE THE SCRAPER

Most scrapers are sized to fit the hand. (I purchased a scraper that was 3" wide and 6" long.) But, to fit the plane body and to create a lower overall profile, I cut the scraper down to a length of only 4". To do this, I used a file to form a groove. (A handsaw file works well for this.) Then by clamping the scraper into a machinist's vise with the groove aligned with the top of the jaws, I was able to bend the scraper until it snapped in two (refer to *Steps 3 and 4* on the previous page).

SCRAPER SETUP

Now all that's left to complete the Scraper Plane is to set it up so that it can finally be used. But before you can set up your scraper and start using it, you'll first need to sharpen the scraper blade. What you want is to create a "hook" or burr that scrapes the wood fibers (see the detail in *Step 1* of the Technique box below).

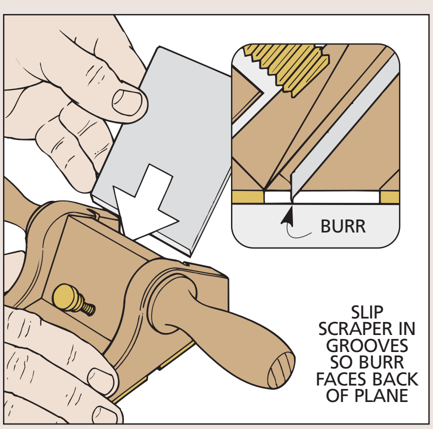
Once the blade is sharpened, you'll need to set up the plane (refer to the Technique box below). Finally, you can check the Scraper Plane by making several trial cuts. Pushing (or pulling) the plane across a board at an angle should produce thin shavings (see the photo at the top of this page). ■

TECHNIQUE . . . . Scraper Plane Setup

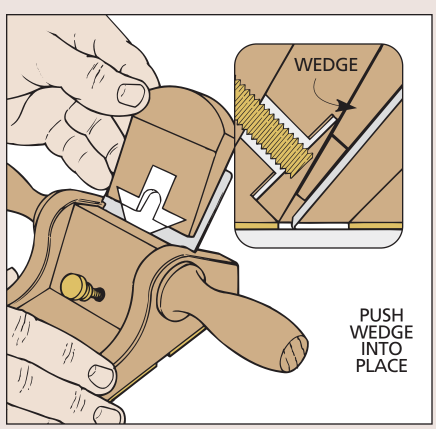
Once you've cut the steel blade to size, the Scraper Plane is easy to set up. To get started, you first need to sharpen the blade. To do this, start by filing the end of the scraper with a smooth mill file to about a 45° angle. (The exact angle isn't critical.) Then roll the edge against a burnisher or hardened piece of steel (like a drill bit) to form the burr.

SET UP AND USE. Once the scraper is sized and sharpened, you can set up the plane. The quickest way I found to do this is to place the plane on a flat surface. Then slip the scraper into the plane so the burr faces toward the back (detail in *Step 2*). And when the scraper "bottoms out," slide the wedge into place *(Step 2)*.

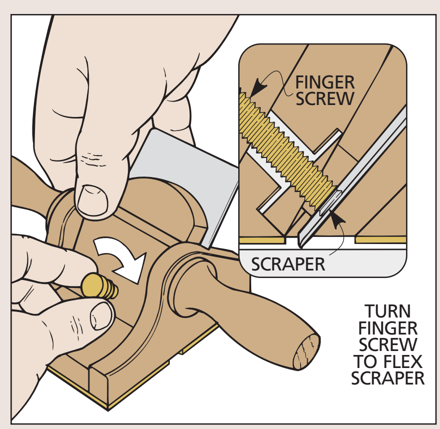
All that's left now is to flex the scraper in a slight bow by adjusting the finger screw *(Step 3)*. A half turn or so after it contacts the scraper is just about right.



1 File and burnish the end of the scraper to creat a burr. Rest the plane on a flat surface, loosen the finger screw and slip the scraper in until it bottoms out.



2 Now slide the wedge down (with the burr facing the back of the plane), until it's firmly seated between the bridge and the scraper blade.



3 Finally, turn the finger screw clockwise about a half turn. This will flex the scraper enough for the slight bow needed to produce fine, wispy shavings.

Wooden Plane

Designed to fit your hands comfortably, this plane has one feature that sets it apart from most wooden planes — an adjustable throat plate. The front knob loosens so the throat can slide to compensate for wear.

I'll admit to having a special fondness for wooden planes. Sure, iron planes are easier to adjust, and they hold up a lot longer, plus they don't need any special attention. But wooden planes are just a lot nicer to work with. They feel better in my hand and give a nice warm feeling that iron planes just don't have.

My personal fondness for wooden planes hasn't left me blind, though. The old wooden planes weren't perfect. So when I designed this smooth plane, I took a hard look at the shortcomings of the older models and incorporated a few features I feel have been missing on those wooden hand planes.

ADJUSTABLE THROAT PLATE. I've borrowed the sliding throat plate idea from block planes. By loosening the front knob, I can slide the lower part of the front block to compensate for wear, *and* have the versatility of an adjustable throat. This way, depending on whether you're making thick or thin shavings, adjusting the size of the opening is a snap.

ALL-AROUND USE. I've also decided to lower the blade mounting angle to 40°. I feel this angle is better for all-around use. And this lower angle positions the top of the $3^1/_2$"-long blade even with the top of the plane, so it doesn't dig into my hand. (See page 126 for sources of blades.)

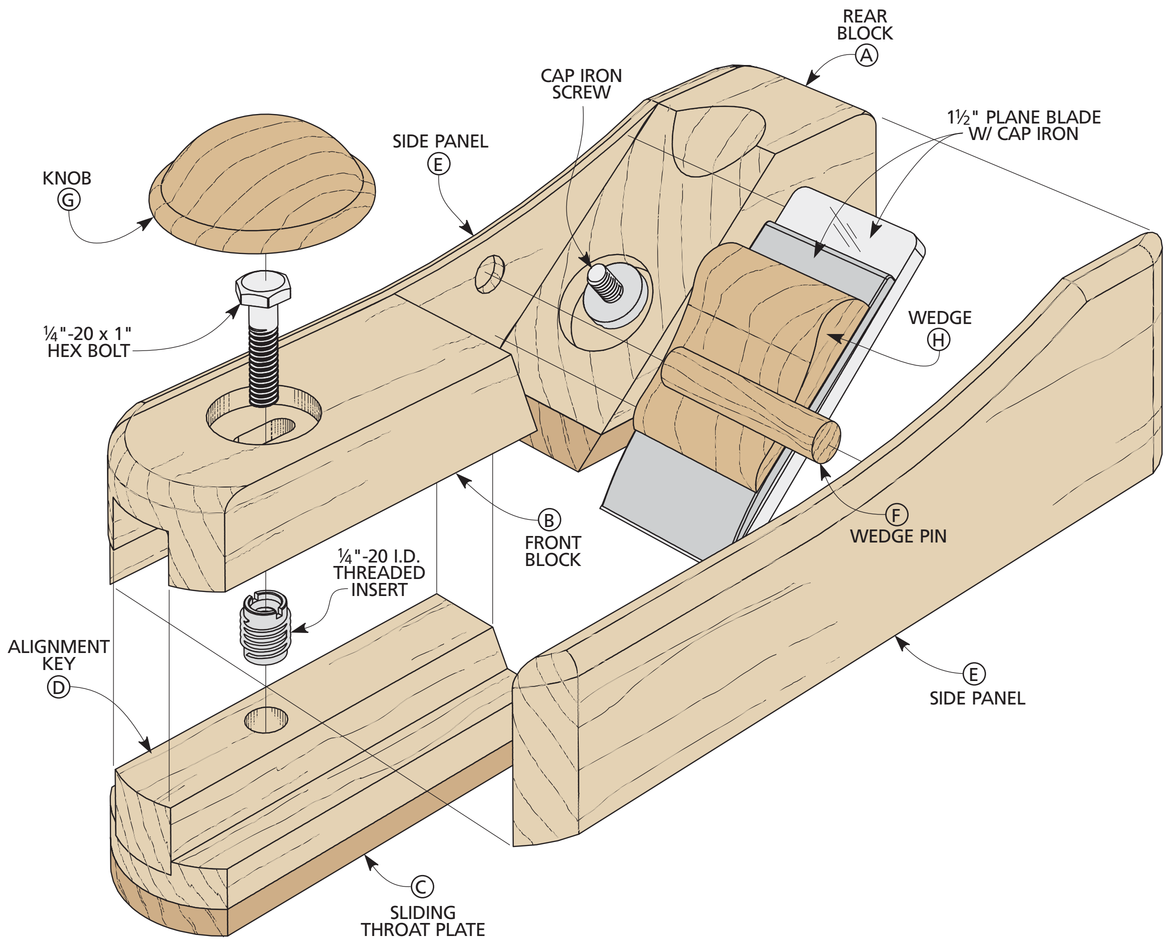
CENTERED THROAT. Finally, I've never understood why the throat should be closer to one end of the plane than the other. So I positioned the blade so it projects from the center of the sole where it gets maximum support at both the beginning and the end of a pass.

TUNE UP. My plane has a simple wedge and pin that hold the blade in place. You'll find everything you need on how to tune it in the Setup box on page 78.

CAPSCREW. Still, there are alternatives, to setting the blade with a wedge and pin. I've described how to use a capscrew to hold the blade and cap iron in place in the Designer's Notebook on page 79.

EXPLODED VIEW

OVERALL DIMENSIONS:
9W x 1 9/16D x 2 1/4H



MATERIALS LIST

WOOD

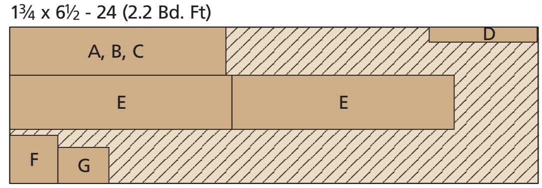
A	Rear Block (1)	1 9/16 x 2 - 4 1/2 rough
B	Front Block (1)	1 9/16 x 1 3/8 - 4 1/2 rgh.
C	Sldg. Thrt. Plate (1)	5/8 x 1 9/16 - 4 1/2 rgh.
D	Alignment Key (1)	5/8 x 3/4 - 4 1/2 rough
E	Side Panels (2)	1/4 x 2 1/4 - 9 1/4
F	Wedge Pin (1)	3/8 dowel x 2 13/16 rgh.
G	Knob (1)	3/4 x 2 rgh. - 2 rgh.
H	Wedge (1)	3/4 x 1 1/2 - 2 1/8

HARDWARE SUPPLIES

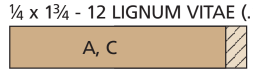
- (1) 1/4"-20 I.D. threaded insert
- (1) 1/4"-20 x 1" hex bolt
- (1) 1 1/2" plane blade w/ cap iron and screw

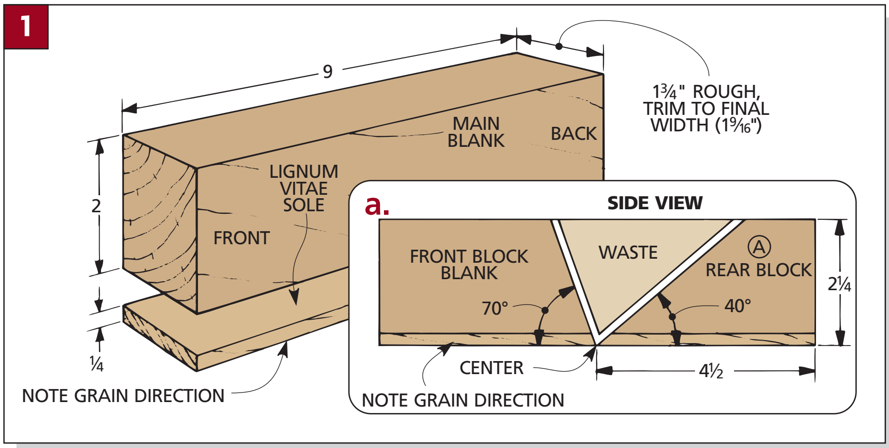
CUTTING DIAGRAM

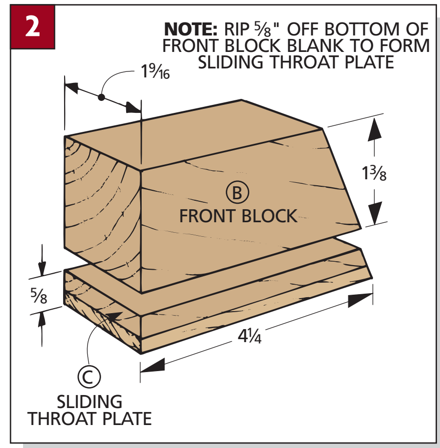
1¾ x 6½ - 24 (2.2 Bd. Ft)



¼ x 1¾ - 12 LIGNUM VITAE (.1 Sq. Ft.)







MAKE THE BODY

Like most wooden planes, this one looks like the center has been mortised out for the blade and wedge assembly. Actually, it's a sandwich with two thin side panels on the outside, that surround two angled blocks on the inside.

To make the plane, I began by cutting the main body blank to size from 8/4 ($1\frac{3}{4}$"-thick) stock. I started with a piece of hardwood about 9" long and 2" high before adding a sole *(Fig. 1)*.

Note: I used white oak for this plane. I've also built planes from walnut, maple, and a variety of exotic woods.

Next, I glued a thin slab of lignum vitae wood to the bottom to act as the sole. Lignum vitae makes an ideal sole because it's extremely dense and wear-resistant (see Sources, page 126).

When the glue dries, rip this block to final width. This measurement should be $\frac{1}{16}$" wider than the blade to allow for skew adjustments. Since I used a $1\frac{1}{2}$"-wide blade, I ripped the stock to $1\frac{9}{16}$".

Note: When gluing the sole in place, be sure that the grain of both the blank and the sole run in the same direction — toward the back of the plane. This makes the plane slide more smoothly.

CUT OUT BODY BLOCKS. After the main body blank is ripped to width, the front and rear blocks are cut to size. Since the blade will project from the center of the sole, mark this point as a reference for making the first cut *(Fig. 1a)*.

BLADE ANGLE. After marking the centerpoint, cut the rear block (A) at a 40° angle (which establishes the blade angle).

FRONT BLOCK. Then reset the miter gauge to a 70° angle and cut off the waste from the main blank to make the front block (B). (The 70° angle provides clearance for shavings.)

SLIDING THROAT PLATE

After the front and rear blocks are cut to size, the sliding throat plate (C) is ripped from the front block blank.

CUT THROAT PLATE. To make the throat plate first, set the table saw fence $\frac{5}{8}$" from the blade and saw off the bottom to form a laminated plate *(Fig. 2)*.

CUT ALIGNMENT KEY GROOVE. Then rout the $\frac{3}{4}$"-wide groove for the alignment key in the bottom of the front block (B) *(Fig. 3)*. To do this, I adjusted the router table fence to make a $\frac{1}{2}$"-deep groove, routing it in two passes with a $\frac{1}{2}$" straight bit *(Steps 1 and 2 in Fig. 5)*.

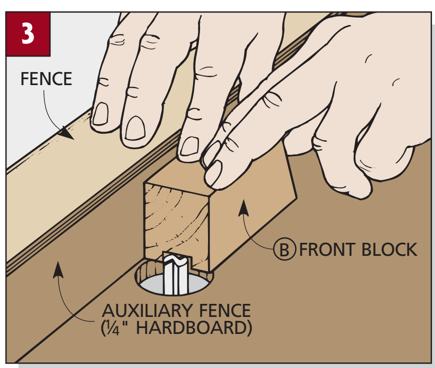
Note: To keep the small pieces from catching on the bit opening in the fence, I made an auxiliary router fence from a piece of $\frac{1}{4}$" hardboard.

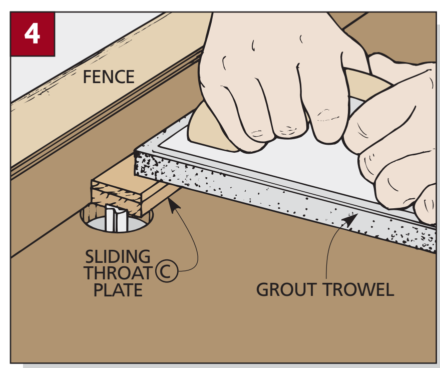
The same groove is routed in the top of the sliding throat plate (C), but it's only $\frac{1}{8}$" deep — just enough to hold the key in position while the glue dries *(Fig. 5)*.

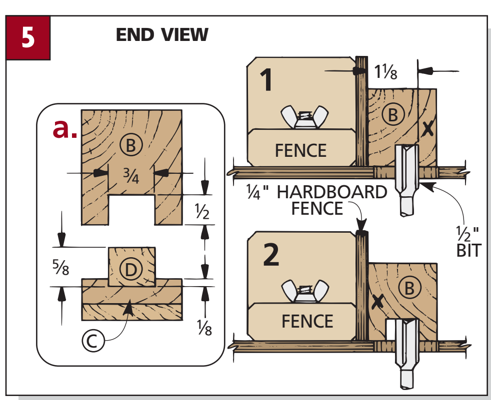
Note: The sliding throat plate is too small to pass over the router bit by hand. So I used a grout trowel as a holddown *(Fig. 4)* (see the Shop Tip on the bottom of the next page).

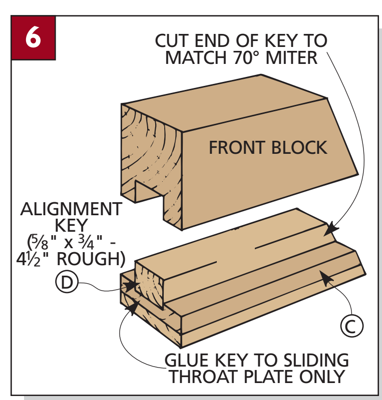
INSTALL ALIGNMENT KEY. After the grooves are routed, cut the alignment key (D) to fit. This key is glued into the throat plate only. The upper part slides in the groove in the front block *(Fig. 6)*.

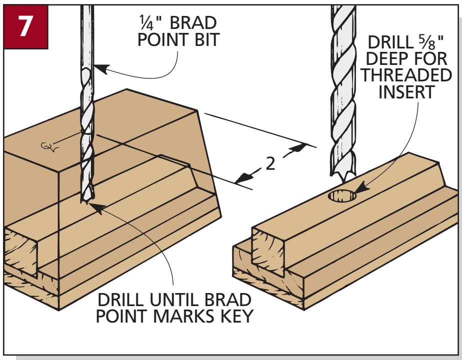
LOCATE INSERT. The sliding throat plate is secured to the front block with a bolt

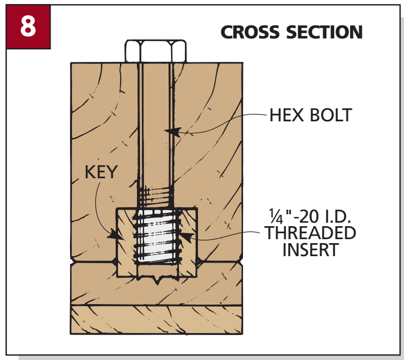


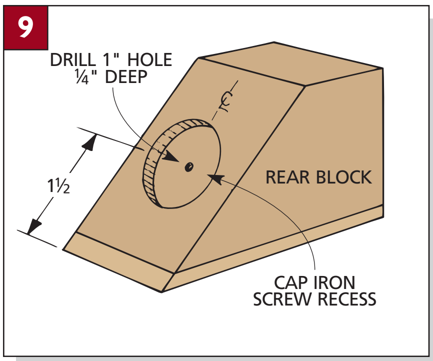


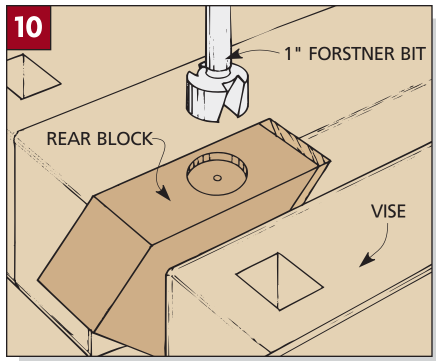












that extends through the block and into a threaded insert mounted in the alignment key *(Fig. 8)*.

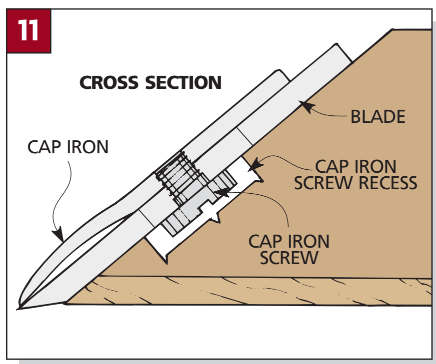
To mark the location for the threaded insert, use a ¼" brad-point bit to bore through the center of the front block. Set the depth stop so the point of the bit just breaks through the bottom of the block and marks the surface of the key *(Fig. 7)*. Then bore a hole at the mark on the key for the threaded insert.

THREADED INSERT. To install the threaded insert as straight as possible, I used a drill press (see the Shop Tip box above right). A drill press does a good job of aligning the insert so it's perpendicular to the top of the front block.

REAR BLOCK. That completes the front block. Next, I worked on the rear block. The angled face of this block supports the plane blade. But to allow space for the head of the screw (that holds the blade and cap iron together) I drilled a ¼"-deep recess in the angled face *(Fig. 9)*.

Note: The 1"-dia. Forstner bit I used to drill the recess leaves plenty of room to adjust the blade *(Fig. 11)*.

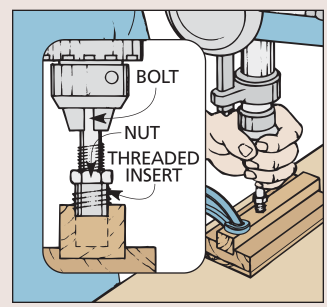
To locate this hole, measure the distance from the end of the cap iron to the threaded hole in the cap iron (1½" on the blade used for this plane). Next, make a mark this same distance up from the bottom edge of the block centered on the face. Then secure the block in a vise and bore the hole *(Fig. 10)*.



SHOP TIP
Installing a Threaded Insert

Whenever possible, I like to use my drill press to install threaded inserts to make sure they are straight and square in the workpiece.

To do this, start by cutting the head off a bolt that fits the insert. Next, thread a nut part way up and screw the insert onto the bolt so it "jams" against the nut (see detail). Then with the bolt gripped by the drill press chuck, you can hand twist the insert straight down into the key while exerting downward pressure on the quill (see drawing).

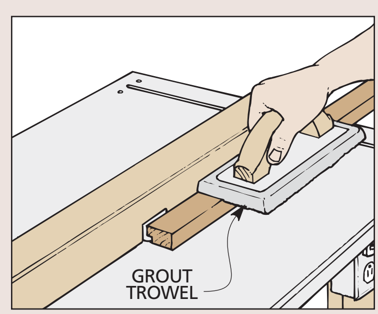


SHOP TIP . . . . Grout Trowel

Sometimes I get a little nervous when I'm working with very small workpieces (like the sliding throat plate for the Wooden Plane) on the table saw or router table (refer to *Fig. 4* on facing page).

So to solve this problem, I started using a grout trowel as a holddown (or push stick) during these situations (see drawing).

They're designed for putting the grout between ceramic tiles and are readily available at home centers and hardware stores. A nice big wooden handle provides a comfortable grip. But, best of all, it has a soft, sponge rubber bottom that grabs the workpiece and holds it securely as it's pushed over the cutter. Another thing I like about this tool — the long, flat surface of the grout trowel puts uniform pressure down on the workpiece without increasing the pressure on my nerves.



TECHNIQUE . . . . Sharpening

One thing I've learned over the years is there's more than one way to get a job done right. Take sharpening a plane iron for example. Lately, I've been using a "low cost" technique that doesn't even require a sharpening stone. Yet it produces a sharp edge in a matter of minutes.

SANDPAPER. The key to this system is an inexpensive (yet effective) abrasive that's available at most hardware and auto parts stores — silicon carbide sandpaper. What makes it such a good choice for sharpening is the particles of silicon carbide that are bonded to the paper. They're extremely hard and sharp, so they cut quickly.

Another advantage to silicon carbide paper is it can be used either *wet* or *dry*.

I prefer to use it "wet" by misting water on the sandpaper. This floats the filings away and keeps the paper from clogging up. And since it has a waterproof backing, the paper won't fall apart on you.

THE EDGE. Whether you use the paper wet or dry, there are two things to keep in mind as you're sharpening. First is squaring the edge so that the iron is 90° to the side of the plane. The second is the geometry of the cutting edge. It's formed by the intersection of two surfaces — the back and the bevel. To create a sharp edge, the secret is to make both of these surfaces as smooth and flat as possible.

GLASS. The only way to ensure a perfectly flat back (or bevel) is to work off a surface that you know is flat. I use a piece of 1/4"-thick glass. But the bed of a table saw would also work.

Note: If you're using the paper "wet" on a table saw, be sure to use an oil or silicon lubricant to prevent rust.

SQUARING THE EDGE

Before you start to smooth and flatten the back or sharpen the bevel on a plane iron or chisel, you should make it a habit to first check that the cutting edge is square to the sides of the blade.

This is especially important when sharpening the iron for your Wooden Plane. That's because the Wooden Plane is designed to hold a blade with an edge that's 90° to the sides.

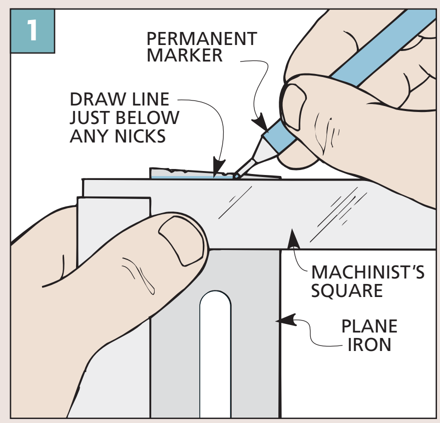
Fortunately, there's nothing complicated about squaring the edge. You'll want to start by squaring a line across the back of the blade *(Fig. 1)*.

Note: To keep the line from rubbing off, I use a fine tip *permanent* marker.

If a lot of material needs to be removed to square up the edge, I make a few *light* passes across the high corner with a mill file (or on a grinder). But if the edge is reasonably close to being square, I'll use a slightly different approach.

You want to square up the edge of the blade *and* flatten the bevel at the same time. Doing this is just a matter of applying more pressure to the high corner as you're sharpening. (See *Step 2* on the next page.)

1



SHARPENING THE BLADE

Now that the edge of the plane blade is square, it's time to concentrate on the one thing that will ensure a quality cut when using your plane — a sharp blade.

ELBOW GREASE. The first step is to flatten the back of the blade. Although this is not a difficult job, it does require a little elbow grease. The nice thing is that you only need to do it *one* time. Once it's flat, you just need to concentrate on the bevel the next time you sharpen the blade.

So why bother with the back at all? Because even with a brand new blade, it may not be perfectly flat. If the back has a slight hollow, you end up with a "dished" cutting edge *(Fig. 2)*. A crown on the back results in a curved edge.

To eliminate these problems, I start with a piece of 240-grit sandpaper.

Note: Spraying some water (or an oil or silicon lubricant) on the glass before positioning the paper creates a surface tension that helps keep the paper from sliding back and forth.

When flattening the back, the idea is to apply pressure over the beveled end of the blade and make firm, even strokes across the sandpaper *(Step 1)*. As the sanding progresses, you'll begin to see a shiny surface develop on the back of the blade. When it extends clear across the blade, the back is flat.

POLISH BACK. Even when the back is flat, it still needs some work. That's because the coarse grit paper leaves large scratches behind. Each of these scratches forms a tiny nick where it meets the cutting edge of the blade.

RANGE OF GRITS. To remove these scratches, I polish the back with a progression of finer grits. I move on to 400 grit next, and then follow it up with 800 and 1000-grit sandpaper.

While this produces a serviceable edge, I like to continue polishing with 1500 and 2000-grit paper to get a mirror-smooth finish. (I found these extra-fine grits of sandpaper at an auto parts store.)

FLATTEN BEVEL. Once the back is flat, you're almost there. Now all that's left is to make the bevel just as flat and smooth.

1 *Using a lubricant (either water or oil), sand the back of the blade back and forth across a piece of silicon carbide paper.*

2 *By holding the blade at a consistent angle, a honing guide ensures that the bevel remains flat as you're sharpening.*

3 *To remove the burr, alternately sand the bevel and the back with the final grit of sandpaper used to flatten the back.*

CONSISTENT ANGLE. The secret to getting a smooth, flat bevel is to hold the blade at a consistent angle. To do this, I use a honing guide. It's just a rolling clamp that holds the blade at the desired angle (*Step 2* and "Honing Guides" below).

When securing the blade in the honing guide, try to match the existing angle of the bevel. To do this, position the blade in the guide so the entire surface of the bevel lies flat on the glass.

Now it's just a matter of sanding the bevel. Once again, the idea is to proceed from a coarse to a fine grit. The trick is knowing where to start.

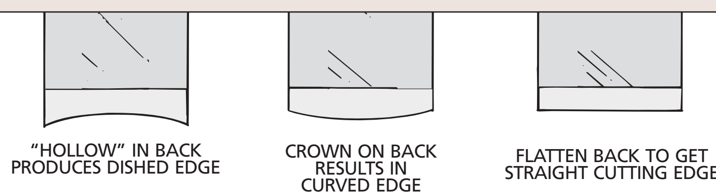
GRITS. This requires matching the grit to the condition of the bevel. If there's a nick in the edge, I'll start with 180-grit sandpaper. But for most work, this is too coarse. For example, a piece of 240-grit paper is fine for a new blade. But if you're just touching up an edge, you may want to start with 800 grit.

EVEN PRESSURE. The key when sanding is to apply pressure *evenly* across the blade. The only exception is if the blade is out of square. In that case, you'll want to apply a little extra pressure on the high corner to square the blade as you sharpen.

BURR. As you work, a burr will form on the back of the blade. Although you can't see it, you can feel the burr by running your finger up the back of the blade.

When you get a nice, even burr across the entire width of the blade, remove it by sanding the back and the bevel *(Step 3)*.

2



SHOP TIP

Knock Off Corners

To avoid gouging a workpiece while I'm planing, I like to knock off the corners of my plane iron.

This isn't hard to do, but I have found that it works best if you use a sharpening stone, instead of sandpaper. To do this, just drag each corner across the stone.

HONING GUIDES

When honing a plane iron (or a chisel), you could freehand the bevel across the sandpaper. But it wouldn't be long before the angle of the bevel was altered. And this would make it much more difficult to get a sharp edge.

HONING GUIDE. To maintain the same angle throughout the life of a blade and get it as sharp as possible, I like to use a honing guide (see the photo at right).

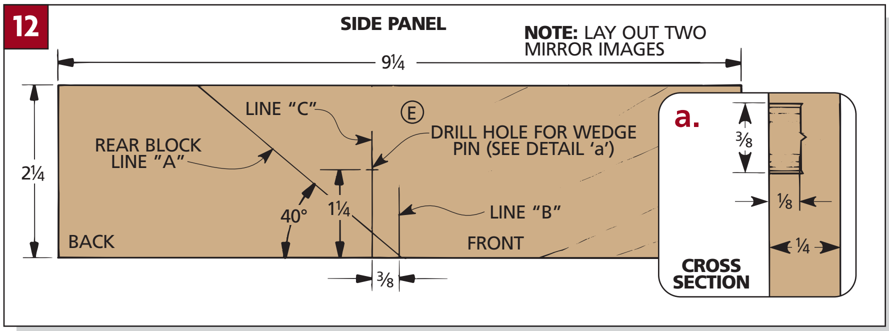
Honing guides are designed to hold the blade firmly and securely in place at the angle the bevel was originally ground at the factory. Most honing guides also have some type of roller system that makes it easy to slide the blade back and forth across the sanding surface during sharpening (refer to *Step 2* above).

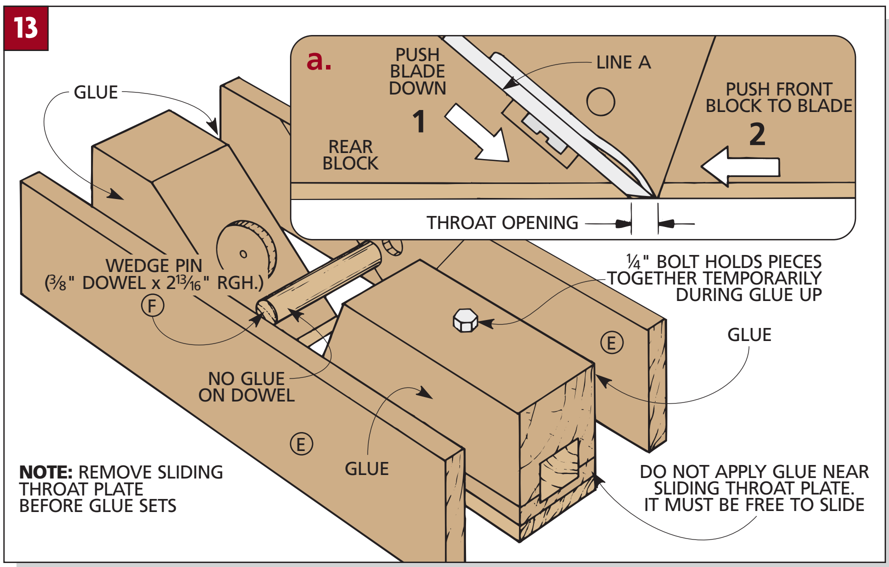
TWO TYPES OF GUIDES. There are two basic types of honing guides. The one I prefer is small and compact and rides directly on top of the sandpaper or sharpening stone (see guide at left in photo).

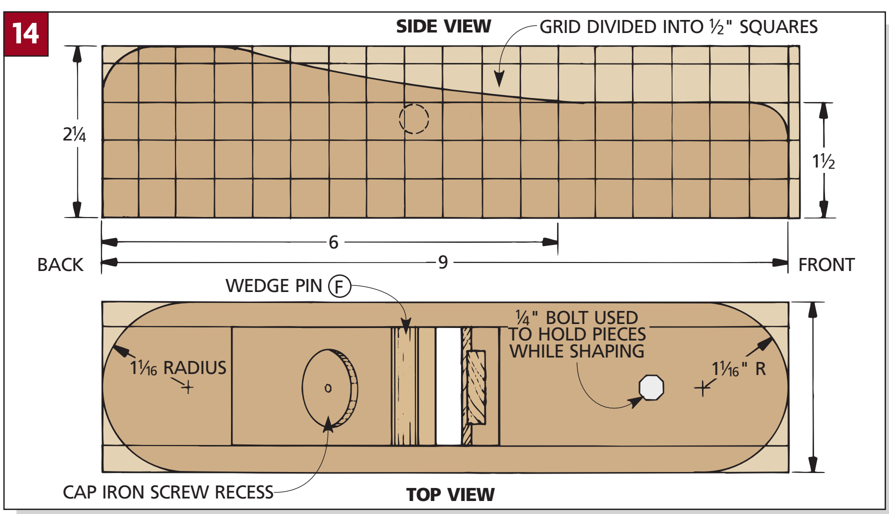
The other larger guide (at right in photo) is a bit more complicated to set up, and requires more room to roll since it rides farther behind the blade.

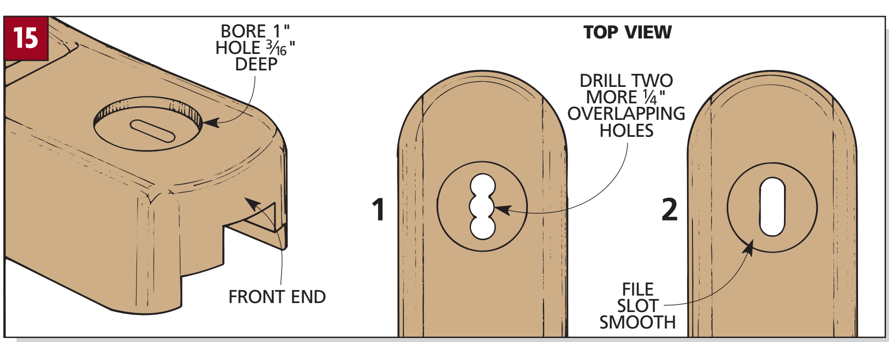
Note: Honing guides are adjustable for blades (or chisels) of various widths. Also, the instructions provided will indicate where to position the blade on the guide to sharpen the correct bevel.

Two Types. *The smaller, more compact honing guide (left) rides directly on the sandpaper (or stone). The guide on the right rides behind it.*









SIDE PANELS

After finishing the body blocks I made the side panels (E) that hold them together to form the plane. Start by resawing some ¾"-thick stock to size *(Figs. 12 and 12a)*.

MARK REAR BLOCK POSITION. After the sides are cut to size, mark the position of the rear block on the inside surfaces. Start by making sure the grain slopes downward from the front of the plane *(Fig. 12)*. (This makes it easier to plane the bottom edges flush with the sole later.)

Now, place the rear block against the inside face of the side panels with the bottom and back edges flush. Then trace the angle (40°) of the blade support face (line "A" in *Fig. 12*).

LOCATE WEDGE PIN HOLE. After line "A" is drawn on the side, it's used to locate a pin that will hold the wedge in place. To do this, begin by drawing a vertical line "B" that starts where the angled line meets the bottom of the side *(Fig. 12)*. Next, draw line "C" parallel to this line ⅜" toward the rear of the side panel. Then, mark a point on line "C" and mark a point for the wedge pin *(Fig. 12)*.

BORE HOLE. After the location of the wedge pin is marked, a stopped hole is bored in each panel to hold the pin. I used a Forstner bit to bore this hole halfway through the panel *(Fig. 12a)*.

ASSEMBLE PLANE BODY

Before final assembly of the plane, the wedge pin is cut to length.

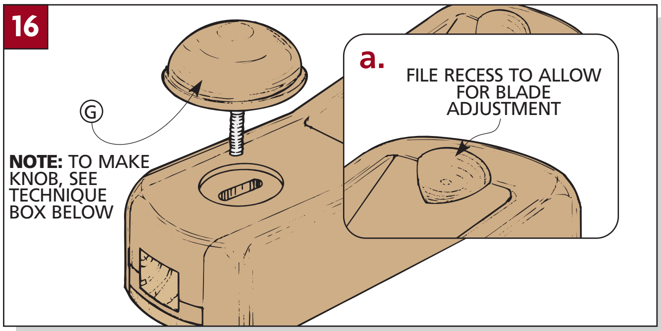
WEDGE PIN. The wedge pin (F) is a ⅜" dowel approximately 2$^{13}/_{16}$" long. The exact length should allow just a little space in the hole bottoms when the panels are pressed against the blocks.

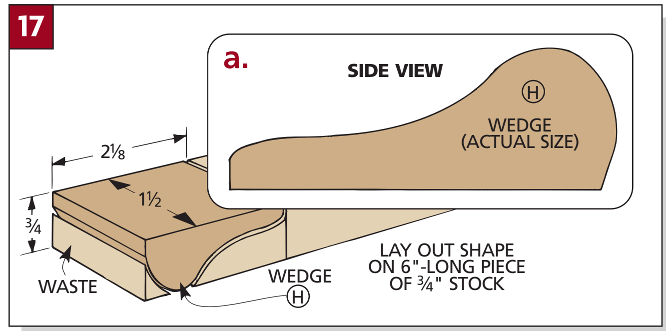
Note: The wedge pin is not glued in place. It spins in the holes when the wedge is tightened.

POSITION FRONT BLOCK. Next, the position of the front block has to be marked. To do this, dry-assemble the plane with the front face of the rear block aligned with line "A" on the panel.

Now, set the blade in place against the rear block *(Step 1 in Fig. 13a)*. Then, slide the front block back until the front edge of the throat opening touches the blade edge *(Step 2)*. Now trace the angle of the front block on the inside faces of the side panels to align this block later.

GLUING. After the front block outline is drawn, the sides and blocks are glued together to form the plane. Before I





started, I used a bolt to temporarily fasten the adjustable plate to the front block *(Fig. 13)*. Also, press the wedge pin into one of the holes in the sides.

Now apply glue to the sides of the blocks only. Be careful not to get glue on the side of the adjustment plate or close to the edges of the angled faces where it could squeeze into the "mortise."

Next, press the side panels together, making sure the wedge pin seats securely. Then align the blocks with the lines traced on the insides of the panels and clamp tightly.

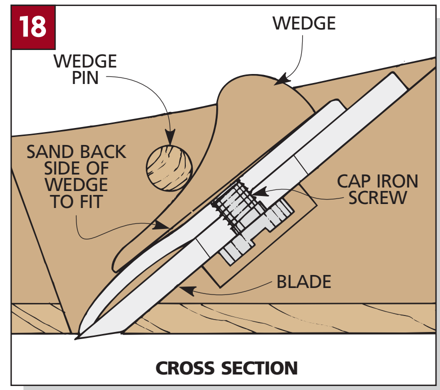
After the glue has dried for a few minutes, loosen the bolt and remove the throat adjustment plate so it doesn't get glued in place accidentally.

SHAPING. After the glue dries, the plane can be brought to its finished shape. Begin by pressing the sliding plate back in place. Then trace the shape you want (this can be any shape that fits your hands), and use a band saw to cut away the waste *(Fig. 14)*.

After it's cut to rough shape, plane the bottom edges of the side panels flush with the sole. Next, use a file to shape a recess to allow for blade adjustment *(Fig. 16a)*. Then smooth all the contours with a rasp or file and sand the shape smooth.

KNOB RECESS. After shaping the plane, I made the dome-shaped knob. You want the knob to bear only on its perimeter when tightened, so start by boring a 1"-dia. hole over the bolt hole on top of the front block *(Fig. 15)*. Then drill a series of overlapping holes to elongate the bolt hole, and file them smooth to form a slot for adjustment *(Steps 1 and 2 in Fig. 15)*. Then, I used my drill press to turn the knob from a block of wood (see the Technique box below to learn more about how I did this).

MAKE THE WEDGE. Now the plane is finished except for the wedge that holds



the blade in place. I cut the wedge (H) with a band saw from a piece of ¾"-thick stock *(Fig. 17)*. Then to get a perfect fit after it's cut to rough shape, sand the entire back face of the wedge. Stop planing when the wedge can be pushed under the pin to about one-third the way up from the end *(Fig. 18)*. ■

TECHNIQUE . . . . *Making a Knob*

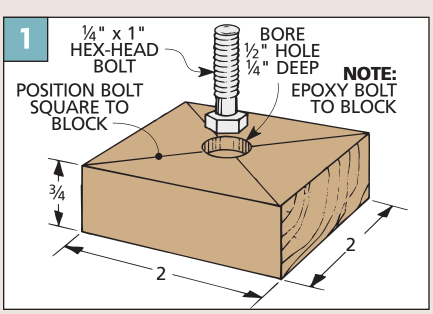
The round shape of the knob makes it a great handle at the front of the plane. It also provides you with a way to lock the throat adjustment plate in place. I suppose you could find a ready-made knob and drill the knob recess to fit, but by shaping my own, I could make a knob that matched the plane perfectly.

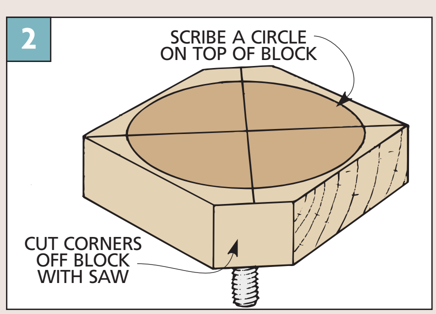
TURN THE KNOB. The dome-shaped knob is turned from a 2"-square block. Although this seems like a good job for a lathe, I found it can easily be turned to shape on a drill press.

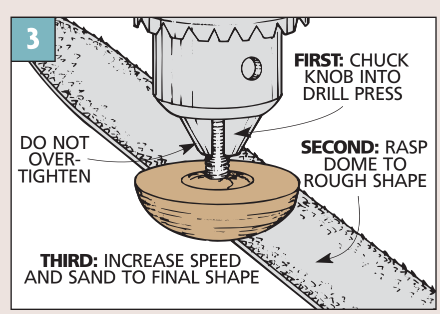
PREPARE BLOCK. To prepare the block, first I drilled a ½"-dia. hole, ¼" deep, in one side of the block. Then, I glued a ¼" x 1" hex head bolt into the center with epoxy *(Fig. 1)*. After the epoxy hardens, scribe a circle on the block and cut away the corners with a hand saw *(Fig. 2)*.

RASP TO SHAPE. After the corners are cut off the block, it can be brought to rough shape on a drill press with a file or a rasp. To do this, secure the bolt in the drill press chuck. Then, at low speed, bring the block to a dome shape.

When the knob was roughly shaped, I increased the drill press speed to about 1300 RPM and used several grits of sandpaper for final shaping.







SETUP . . . . Tuning a Wooden Plane

Adjusting and fine-tuning the blade setting in the Wooden Plane can be a bit tricky. That's because a wooden plane has only a simple wedge to hold the blade in place. And the method of tapping the blade into position correctly looks like something only a master craftsman can do accurately.

Well, just like a lot of things, it's easier than it looks — once the trick is learned.

SECURE THE BLADE. The first step in setting up a wooden plane is to secure the blade in the plane with the wedge.

Begin by placing the plane on a piece of soft wood *(Step 1)*. (This protects the blade edge and keeps your workbench from getting gouged.) Slide the blade in and press the wedge in place.

TIGHTEN WEDGE. With the wedge in place, drive it in tightly with a mallet — giving it a few good taps *(Step 2)*.

SET THE BLADE. At this point the wedge will probably have pushed the blade so it projects too far out the bottom. To reset the blade, you need to give the rear of the plane a sharp rap *(Step 3)*.

You're not adjusting the plane blade, you're adjusting the plane body. To move the blade up, you actually move the plane body down by tapping on the back end.

When you tap the body of the plane, it quickly shifts position while inertia keeps the blade in the same position. The effect is repositioning the blade.

To sight this, hold the plane upside down and sight from the front end of the plane toward the cutting edge. Tap until you see only a slight glimmer of the cutting edge above the surface of the sole.

SQUARE THE BLADE. At this point, the blade may be skewed. To square it, tap the side of the plane. Still holding the plane upside down and sighting over the sole, tap the "low side," where the cutting edge has dropped down into the throat until it's parallel with the sole *(Step 4)*.

FINE ADJUSTMENTS

Sighting along the sole gets the blade roughly adjusted for depth, but fine-tuning it takes some trial and error.

There are two techniques to fine-tune the depth of cut. On some planes I make adjustments by tapping the front and back end of the plane body alternately to set the cutting depth.

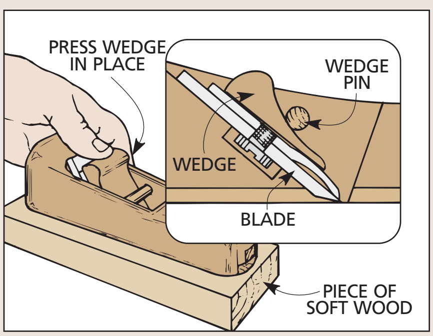
On the Wooden Plane I give the back end of the plane one good smack so the cutting edge shifts all the way up into the plane body. Then I tap down on the top of the blade itself *(Step 5)*.

Note: I use a dead-blow mallet when tapping on the wooden body. But I switch to a tack hammer (or a small ball peen hammer) to tap on the blade.

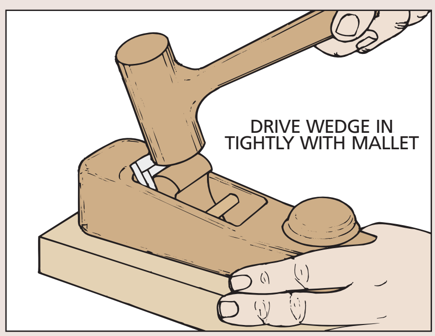
FINAL DEPTH. The true test of the cutting depth is to make a trial cut and make adjustments until the blade is set to cut to the depth you want.

FINAL SQUARENESS. When making these fine adjustments, if the blade needs a slight lateral adjustment (to take an even cut from side to side), just tap the top corners of the blade.

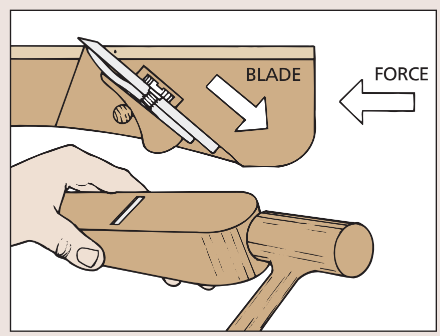
This may sound tedious, but it takes only a few seconds to master the tricks to tune a wooden plane for perfect shavings.



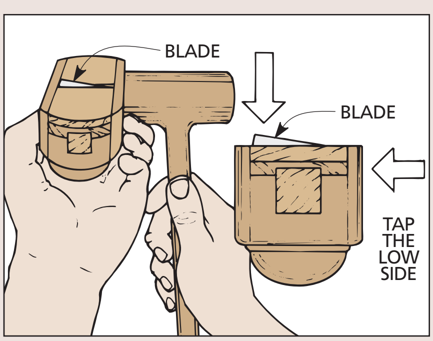
1 *Position the blade by centering it in the throat with the edge resting on a block of soft wood. Then, hold the blade in place and press the wedge in tightly.*



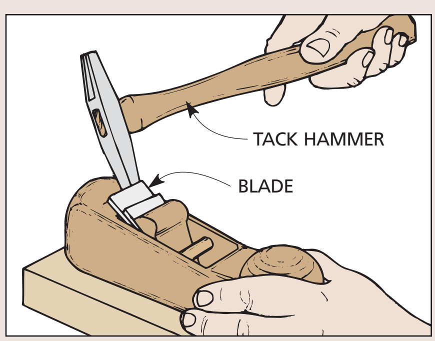
2 *Secure the blade by driving the wedge in tightly. A dead-blow mallet will force the wedge between the blade and the pin without deforming the top of the wedge.*



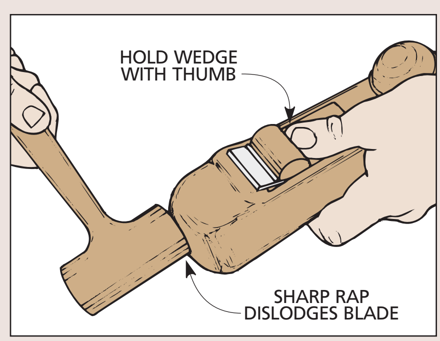
3 *Reset the blade for final adjustment by tapping the rear of the plane body. The plane moves in relation to the blade, so the edge will be drawn back into the throat.*



4 *Square the blade by tapping on the side of the body. Directing the blow to the side where the corner of the blade is low will lower the high side.*



5 *Fine-tune the blade for depth of cut by tapping the top of the blade with a small steel hammer. For skew adjustments, tap the top corners of the blade.*



6 *To disassemble the plane for sharpening, grip the body with thumb pressure back against the top of the wedge. Then tap the rear of the body.*

DESIGNER'S NOTEBOOK

There is a way to avoid the setup process on the Wooden Plane altogether. All it takes is to use a steel rod and a brass capscrew and washer to hold the plane blade and cap iron in place.

CONSTRUCTION NOTES:

■ The blade and cap iron are held in place with a capscrew that extends through the block and into a threaded cross pin mounted in the rear block.

■ Start by cutting the rear block (A) as before (refer to *Fig. 1* on page 72).

■ Then drill a hole in the angled face of the rear block for the machine screw (capscrew) *(Fig. 1)*. To do this, I used the bevel on the cutoff blank to hold the rear block at an angle while I drilled the hole on the drill press *(Fig. 2)*.

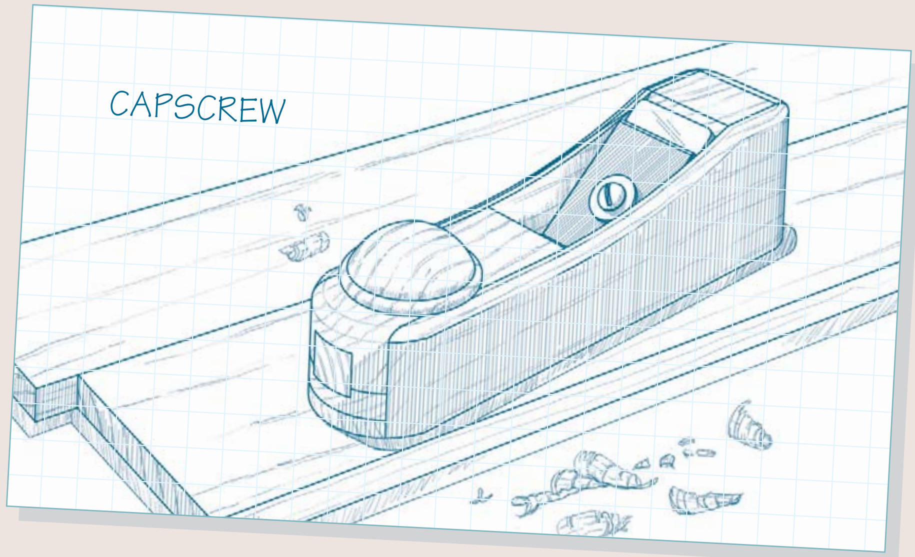
■ To hold the cross pin in place, you'll need to drill a hole in the side of the rear block, perpendicular to the hole for the machine screw *(Figs. 1 and 1a)*.

■ After these holes are drilled, use the drill press again to bore and tap a hole in a length of steel rod to make the cross pin.

To accurately bore the starter hole for the tap in the steel rod, I use a piece of scrap as a guide block *(Fig. 3)*.

■ To make the block, first rip a piece of scrap hardwood to width (1½"). Then drill a centered hole in the top of the block and another hole through the side for the cross pin *(Fig. 3)*. Slip the rod in place, making sure that it's flush with the end.

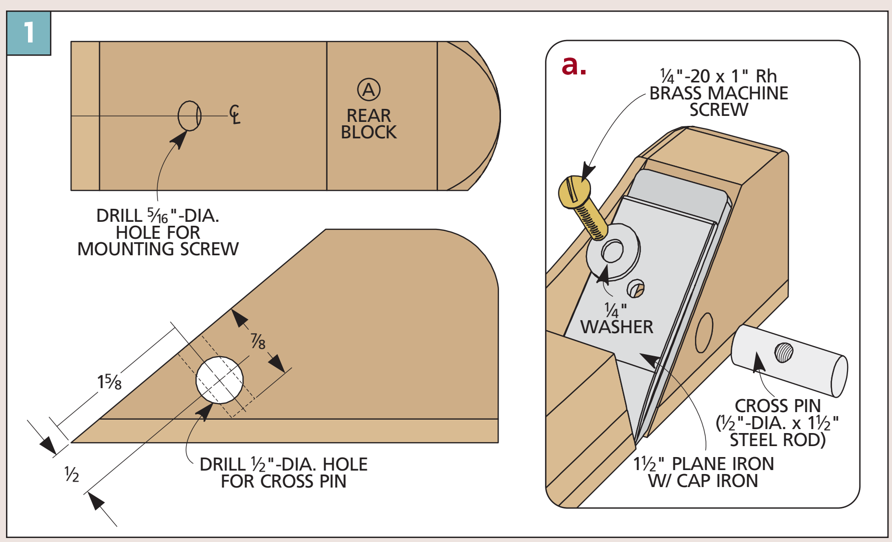
MATERIALS LIST	
CHANGED PART	
A Rear Block (1)	1⁹⁄₁₆ x 2 - 4½ rough
Note: Do not need parts F and H.	
HARDWARE SUPPLIES	
(1) 1½" plane blade w/ cap iron	
(1) ½"-dia. x 1½" steel rod	
(1) ¼"-20 x 1" Rh brass machine screw	
(1) ¼" washer	

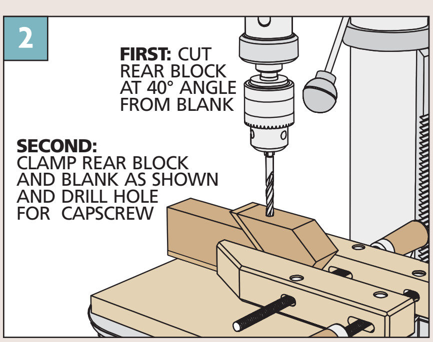


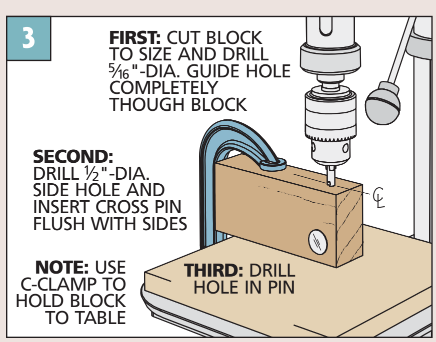
■ Now use the top hole as a guide and drill a starter hole in the rod *(Fig. 3)*.

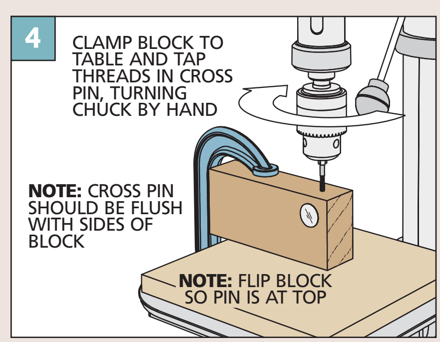
■ Then, flip the block over and use a ¼"-20 tap to thread the rod, pulling down on the arm of the drill press (power off) and turning the chuck by hand *(Fig. 4)*.

■ Finally, add the remaining parts and hardware to complete the plane.










DUTCH MASTERS
SPECIAL
DUTCH MASTERS

HAND TOOL STORAGE

Every woodworker knows that it doesn't take long to accumulate a large collection of tools. While that collection needs to be kept safe and secure, it also has to be easily accessible while you work. And since every woodworker's tool collection is unique, each of our tool storage projects can be adapted to fit your needs.

The chisel case serves as both a storage and display box or can be modified to hang on a wall.

The rolling tool cabinet and matching tool chest provide ample storage you can roll right to where you need it.

If you want to lock up your tools for safekeeping, then you'll like the cabinetmaker's tool chest with its intriguing system that locks both the drawers and lid.

Chisel Case

This case protects your favorite chisels and doubles as a working chisel stand. Instead of complicated joinery, the Chisel Case relies on a precise fit and on understanding the natural movement of wood.

There's a place in every shop for unique containers. This case not only holds and protects your best chisels, it's also a working display box.

END GRAIN. There are several things that make this case unique. First, the tolerances on the case are tight, so it's built so the grain runs in the same direction, almost as if the case was hollowed out of a single piece of wood. By doing this, any movement in the case will not open any of the joints or cause cracks to develop.

JOINERY. And while the joinery in this project is not complicated, precise fits are very important. So some pieces need to be cut oversize and trimmed to fit.

An interesting lid (that doubles as the sides of the case) pivots on special hinges I made using brass screws.

WOOD. When choosing wood for the Chisel Case, try to use hardwood workpieces that have been kiln dried. This helps minimize any problems you may have with checking or splitting, due to high moisture content.

I built mine out of walnut. The dark wood makes the light-colored chisel handles stand out. Plus, walnut is stable and relatively easy to work with.

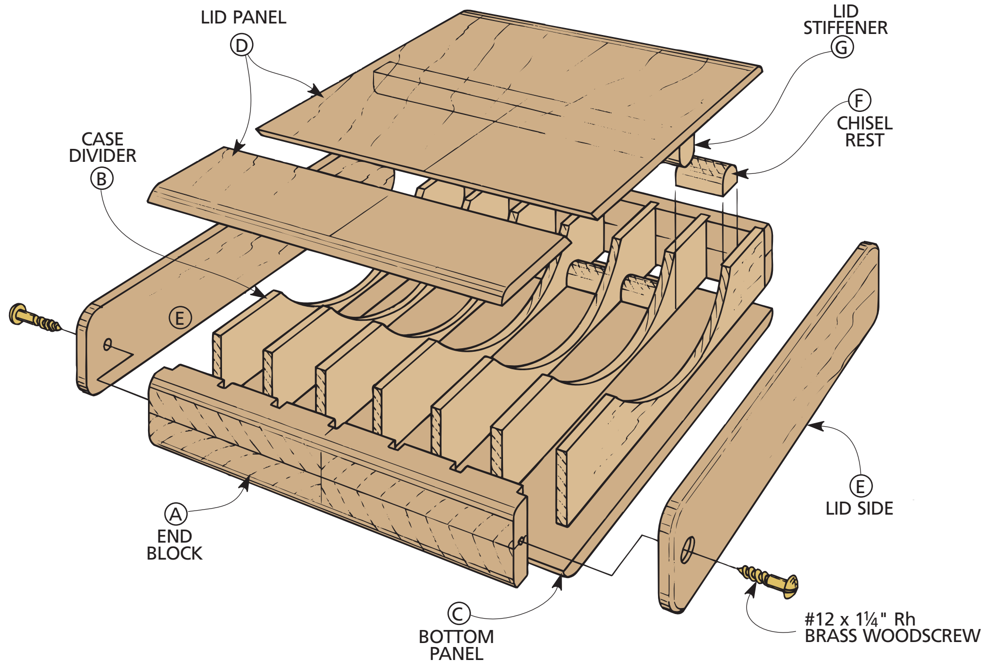
And finally, I used a technique called bookmatching to create the mirror image grain pattern on the lid (inset photo). This process can create some very interesting patterns, especially with woods that have a burl or swirling grain. (See pages 84 and 85 for some tips and techniques on bookmatching and edge gluing.)

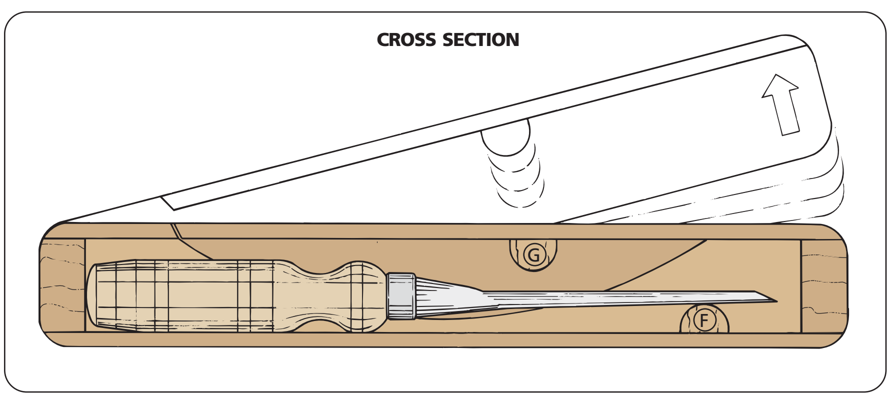
FINISH. I finished the case with three coats of hand-rubbed tung oil. But if you want to obtain a more durable finish, polyurethane will offer more protection.

WALL-MOUNTED CHISEL RACK. If you prefer to build a chisel rack that's a little more practical, see the Designer's Notebook on page 87. I removed the lid to make it easier to build. And a pair of wall brackets allow you to hang the rack on a wall near your work station.

EXPLODED VIEW

OVERALL DIMENSIONS:
9¾W x 12½D x 2H





MATERIALS LIST

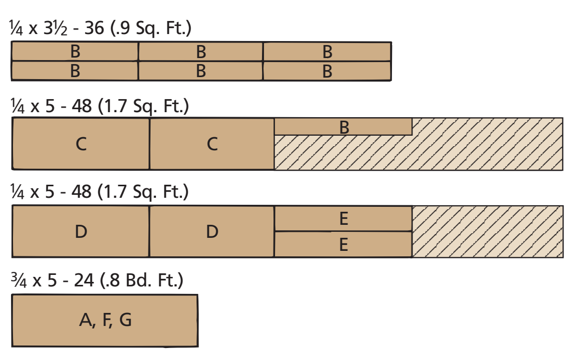
WOOD

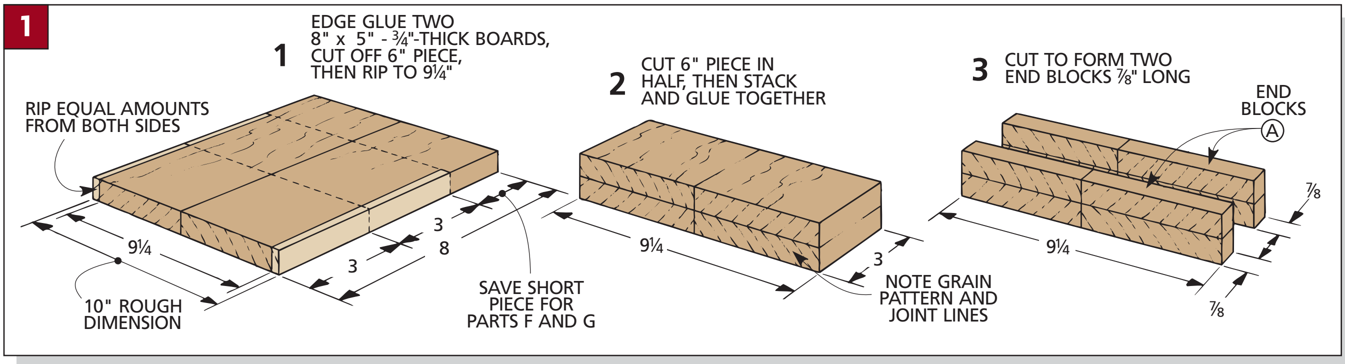
A	End Blocks (2)	1½ x 9¼ - ⅞
B	Case Dividers (7)	¼ x 1½ - 11¼
C	Bottom Panel (1)	¼ x 9¼ - 12½
D	Lid Panel (1)	¼ x 9¼ - 12½
E	Lid Sides (2)	¼ x 2 - 12½
F	Chisel Rests (6)	¾ x 1¼ - ½
G	Lid Stiffener (1)	¾ x 9¼ - ½

HARDWARE SUPPLIES

(2) No. 12 x 1¼" Rh brass woodscrews

CUTTING DIAGRAM





LAY OUT END BLOCKS

To lessen the chances of splitting with changes in humidity, the end blocks are formed from glued-up stock. This way, the grain of all the pieces (including the top and bottom panels added later) will run in the same direction, ensuring they expand and contract at the same rate during changes in humidity.

TRAY WIDTH. Start by determining the width of the end blocks. To do this, measure the widest part of your largest chisel, and add $1/8$" for clearance. This will be the width of each tray section. (My largest chisel is $1\,1/8$" wide, so each section is $1\,1/4$" wide.)

Once you know the size of each section, multiply that figure by the number of chisels. Now add to that number the total thickness of all seven case dividers to get the total width of the case tray and the end blocks. (My pieces ended up being $9\,1/4$" wide.)

END BLOCKS. To make the end blocks (A), edge glue enough stock to form a 10"-wide by 8"-long blank *(Fig. 1)*. When the glue is dry, trim both ends and then cut off a 6"-long piece *(Step 1 in Fig. 1)*. (Save the short piece for later.) Now, rip the 6"-long piece to the finished width for your end blocks ($9\,1/4$").

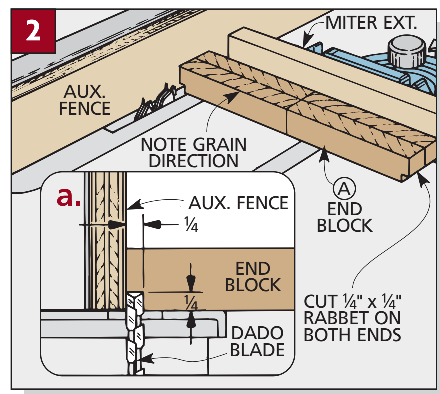
To get the thickness needed for the end blocks, I cut the long piece in half and then glued the two pieces together face-to-face to form a block *(Step 2)*. After the glue has completely set up, cut it to get two end blocks (A) *(Step 3)*.

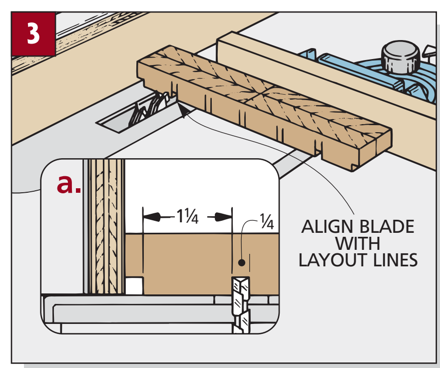
CUTTING THE GROOVES

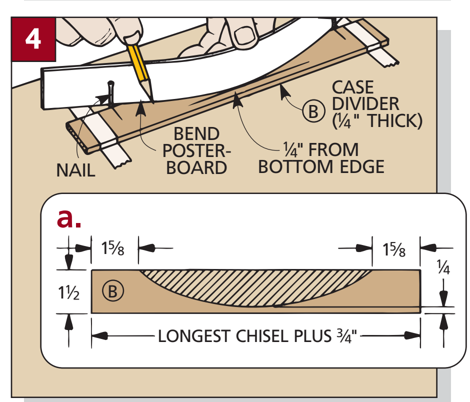
Now $1/4$" rabbets and grooves are cut in the end blocks to hold the case divider. (The dividers will be cut to fit the rabbets and grooves later.)

SET THE DADO BLADE. Begin by cutting the rabbets. To do this, attach an auxiliary fence to your rip fence and a wood extension on the miter gauge to support the piece and prevent chipout *(Fig. 2)*. Set the rip fence to act as a stop and cut a rabbet on each end of the end blocks *(Fig. 2)*.

Note: These rabbets (and the grooves) must be cut into end grain on the end blocks *(Fig. 2)*.

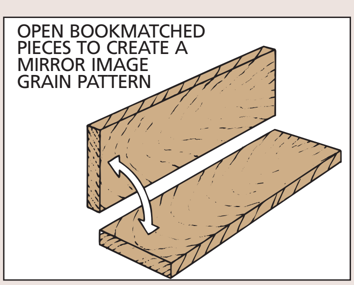






SHOP TIP . . . . Bookmatching

To create a bookmatched panel, select a piece of wood that has some interesting figure to it. Then resaw the piece into two parts of equal thickness. Open the "book" and edge glue the pieces back together side by side (see drawing).



Bookmatched. *By resawing lumber, and then edge-joining the pieces back together in a book match, you get a pleasing pattern with a mirror image.*

CUT GROOVES. After the rabbets are cut, divide the space between them into six equal spaces (or the number of chisels you own) with a $\frac{1}{4}$" groove between them *(Fig. 3)*. Now move the fence so that it acts as a stop for your next cut. After cutting the first groove, turn the piece end for end and cut another groove before moving the fence. Repeat this procedure until all of the grooves are cut.

DIVIDERS & BOTTOM PANEL

With the end blocks complete, begin work on the case dividers (B). First, rip the dividers to width to match the thickness (width) of the end blocks ($1\frac{1}{2}$").

DETERMINE THE LENGTH. Once the dividers are ripped to width, cut them to the correct length for your chisels.

To find this length, measure your longest chisel and add $\frac{3}{4}$". (This allows for the $\frac{1}{4}$" grooves in the end blocks and $\frac{1}{4}$" of clearance within the case.)

LAY OUT ARC. After the dividers have been cut to length, lay out a shallow arc to allow clearance to pick up the chisel.

An easy way to do this is to mark points $1\frac{5}{8}$" in from each end of one divider along the top edge *(Fig. 4)*.

To draw the arc, tape the divider to a scrap piece of plywood and drive a couple of nails alongside the two marks on the divider *(Fig. 4)*. Then bend a piece of posterboard inside the nails and adjust the arc so it's $\frac{1}{4}$" from the opposite edge of the divider. Then draw the arc.

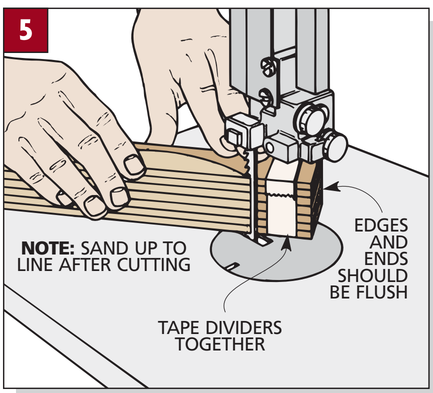
CUT THE ARC. Next, stack all of the dividers with the arcs on top and wrap the stack with masking tape, making sure that the edges and ends are flush *(Fig. 5)*. Now cut close to the layout line with a band saw, and then sand up to the line using a drum sander or a sanding block.

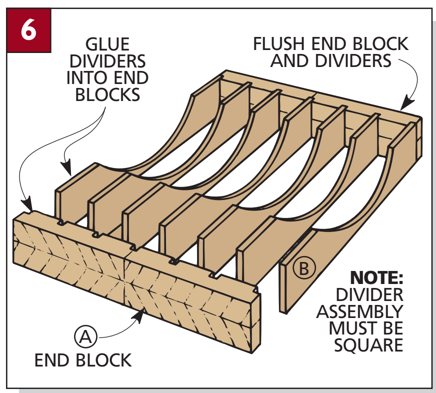
ASSEMBLY. With the dividers sanded, fit and glue them into the grooves in the end blocks *(Fig. 6)*. (Make sure that this assembly is square and that it sits flat.)

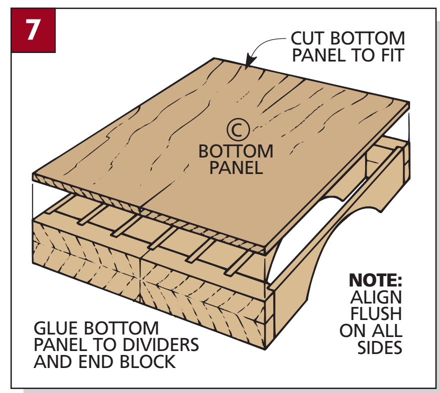
BOTTOM PANEL. Now you can make the bottom panel (C). For the best appearance, I used bookmatched panels (see the Shop Tip on the previous page).

Start by edge gluing enough stock to make the bottom panel (see Technique below). Then cut it to size to fit the tray that you just glued up *(Fig. 7)*.

Now lightly glue the bookmatched bottom panel to the divider tray. Keep the edges of the panel flush with the sides of the tray dividers and the end blocks.







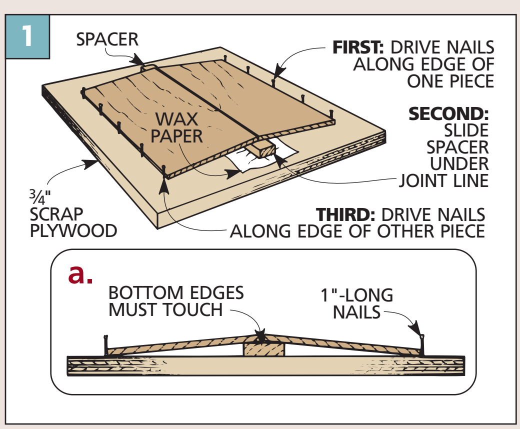
TECHNIQUE . . . . Edge Gluing Thin Stock

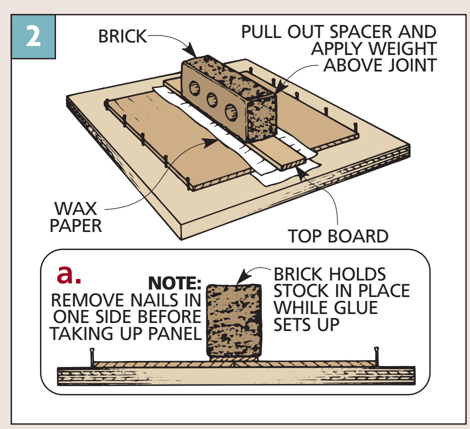
When edge gluing thin pieces like the bottom panels for the Chisel Case, I like to use a special technique.

PREPARE STOCK. First, I joint the two edges so they fit together without gaps.

WORK ON PLYWOOD. Now, place the two pieces edge to edge on a piece of plywood. Place a piece of waxed paper under the joint line to prevent them from sticking. Then, drive several nails into the plywood, along the edge of *one* of the pieces.

SPACER. Next, slide a spacer under the joint line. Center it on the joint line and make sure the bottom edges of the two pieces are *touching (Fig. 1)*.



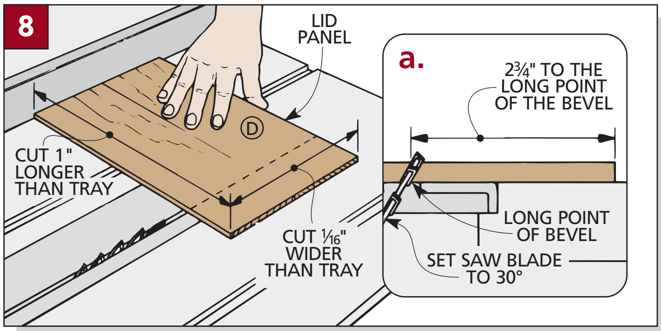


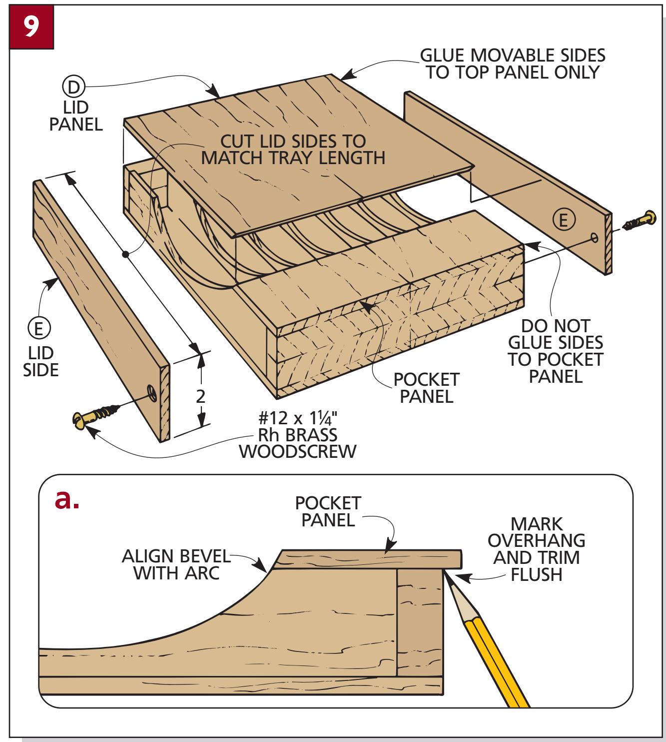
With both pieces in place, drive several nails into the plywood along the edge of the other piece *(Fig. 1)*.

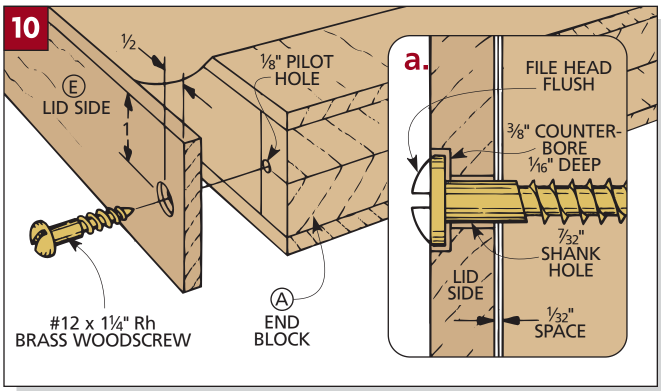
GLUE THE JOINT. Now, tilt one panel up and spread glue along the edge. Then gently set the piece back in place.

WEIGH DOWN TOP. Next, slide the spacer out and lay another strip of wax paper on top of the joint line. Now lay a board on top of the wax paper and stack a brick on the board.

Make sure the two pieces are flat, and let the glue dry. Finally, remove the nails before taking the panel up.







LID ASSEMBLY

After the tray is complete you can begin on the lid panel (D). Start by gluing up enough stock to make a panel that's $^1/_4$" wider and 1" longer than the tray. Then, rip the panel $^1/_{16}$" wider than the tray.

ASSEMBLE THE POCKET. Next, the lid panel is cut into two pieces. One piece is for the lid. The other forms a pocket at the bottom of the case for the chisel handles. To find the length of the pocket, measure from the end of the tray, to where the arc begins on the divider. Then add $^1/_2$".

Now set your saw blade at 30° and cut a piece off the panel that's the length you just determined *(Fig. 8a)*.

Next, set the short piece on the case so the beveled point touches the arc. Now mark and trim the end flush *(Fig. 9a)*.

LID SIDES. To make the lid sides (E), start by measuring the thickness (height) of the case. Then rip two pieces of stock to that measurement (2") and cut them to the same length as the case *(Fig. 9)*.

After the lid sides are cut, fasten them to the tray with double-sided tape.

HINGE SCREWS. With the sides in place temporarily, drill the counterbored holes for the hinge screws *(Fig. 10)*. Then remove the carpet tape and enlarge the shank hole in the lid sides *(Fig. 10a)*.

Before screwing the lid sides to the case tray, place a $^1/_{32}$" shim behind each lid side. Now tighten down a roundhead screw until the bottom of the screw slot is flush with the lid sides *(Fig. 10a)*. (Later, the screwhead will be filed down.)

ASSEMBLE THE LID. Next, fit the remaining part of the lid between the lid sides, and trim the end flush with the top of the case *(Fig. 9)*. Then glue the panel to the lid sides only. When the glue is dry, file the screw heads flush *(Fig. 10a)*.

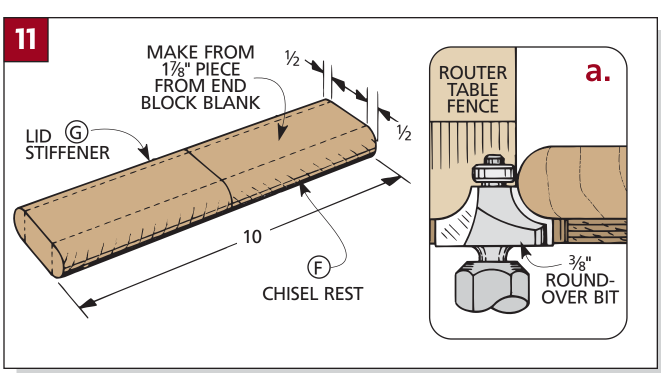
TOOL RESTS & LID STIFFENER

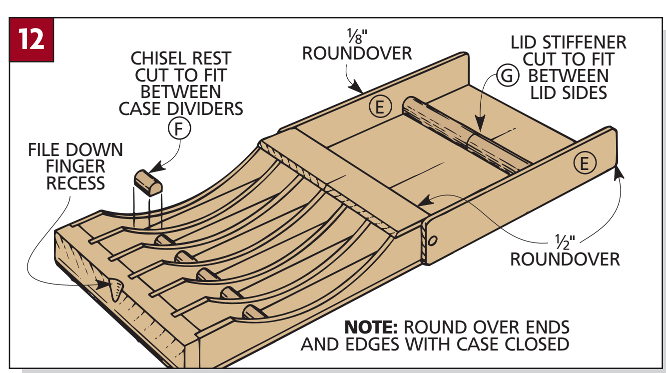
Once the lid assembly is completed, round over the sides ($^1/_8$") and ends ($^1/_2$") *(Fig. 12)*. Then you can begin working on the chisel rests (F) and lid stiffener (G).

ROUTING THE EDGE. Using the cutoff left over from making the end blocks (refer to *Fig. 1*), use a roundover bit and rout a bullnose on both ends *(Fig. 11a)*.

CUT TO FIT. After the bullnoses are complete, cut off two $^1/_2$"-long pieces *(Fig. 11)*. Now, cut the chisel rests to fit between the case dividers, and cut the lid stiffener (G) to fit between the lid sides *(Fig. 12)*. Finally, glue the pieces in as shown in the Exploded View cross section on page 83.

FINGER RECESS. The last step to complete the case is to file a $^3/_4$"-wide finger recess in the bottom end to make a lip for opening the lid *(Fig. 12)*. ■





DESIGNER'S NOTEBOOK

Simpler materials and a simpler design mean this open-faced case is less expensive and easier to build. Mount it on the wall by your bench to keep your chisels right at your fingertips as you work.

CONSTRUCTION NOTES:

■ With the changes made to this chisel rack it now can be hung on a wall. Tapered brackets hold the case and tilt the bottom away from the wall so the chisels won't fall out. And instead of figured stock, I'm using scrap for the end blocks and hardboard for the panels.

■ Since there's no longer a hardwood panel attached to the end blocks, you won't have problems with expansion and contraction. Start by ripping the end blocks (A) to width from 7/8"-thick pieces of scrap and then cut them to length.

■ Now the 1/4" rabbets and the dadoes can be cut in the end blocks to hold the case dividers (*Figs. 2 and 3* on page 84).

■ With the end blocks complete, you can begin working on the case dividers (B). First, rip the dividers to width to match the width of the end blocks. (Since this is a utility case, you can make the dividers from 1/4"-thick hardboard.)

■ Next, lay out and cut an arc in each divider (*Fig. 4* on page 84). An easy way to do this is to gang them together and wrap them with masking tape, then cut all of them at once on a band saw. You can use a drum sander or sanding block to clean up the saw marks.

■ Now make the bottom (C) and pocket (H) panels (see drawing). The pocket panel is ripped to rough width and cut to length (9 1/4"). One edge is beveled to match the arc in the dividers (see Side View in the drawing). Then set the beveled edge so it just touches the arc, mark the panel, and cut it to width.

■ The next step is to glue the panels to the case. Once the glue has set up, rout 1/4" roundovers on the top edges of the end block and pocket panel (see Side View in the drawing below).

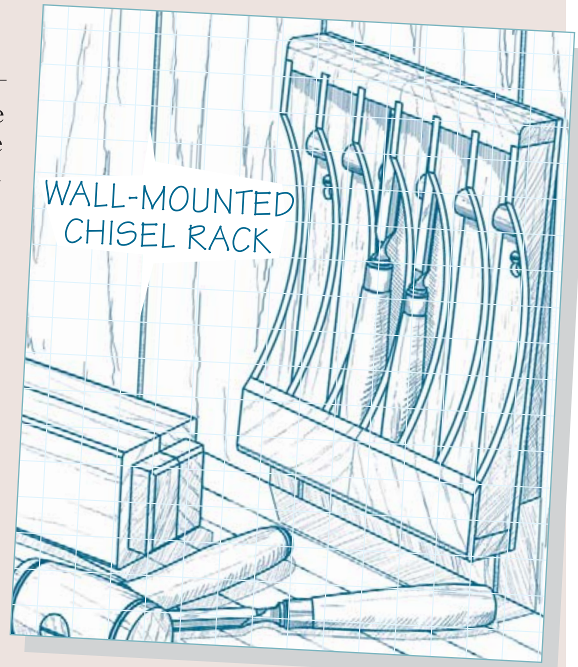
■ To complete the case, cut the chisel rests (G) to fit between the case dividers and glue them in place.

■ All that's left to do now is make the tapered wall brackets (I). To do this, start by cutting a couple of pieces of 3/4"-thick scrap to length and ripping them to rough width (see drawing).

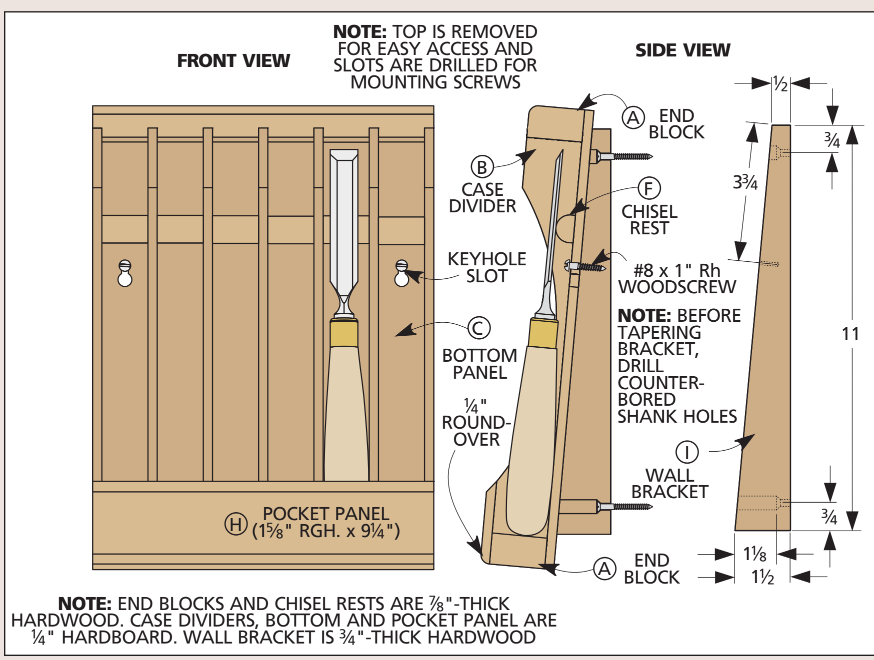
■ Before cutting the tapers on one edge of each bracket, you'll first need to drill a pair of counterbored shank holes in each bracket. These holes are for the screws used to attach the brackets to the wall.

■ Now lay out and cut the tapers.

■ Finally, add the keyhole slot in the back panel of the case. To make the slot, drill a pair of holes and remove the waste in between with a chisel. The top one is a 3/8"-dia. hole and the bottom hole is 1/4" diameter. They're spaced about 1/8" apart.



■ Once the slots have been completed, screw the brackets to the wall (spacing them to match the holes in the case). Then, position the case on the brackets and drill a pilot hole through each keyhole slot and into each bracket. These pilot holes are for the roundhead screws used to hang the case in place (see drawing).



MATERIALS LIST

CHANGED PARTS
A End Blocks (2) 7/8 x 1 1/2 - 9 1/4
B Case Dividers (7) 1/4 hdbd. - 1 1/2 x 11 1/4
C Bottom Panel (1) 1/4 hdbd. - 9 1/4 x 12 1/2
F Chisel Rests (6) 7/8 x 1/2 - 1 1/4
NEW PARTS
H Pocket Panel (1) 1/4 hdbd. - 1 5/8 rgh. x 9 1/4
I Wall Cleats (2) 3/4 x 1 1/2 - 11
Note: Do not need parts D, E, and G.

HARDWARE SUPPLIES
(4) No. 8 x 1 1/2" Fh woodscrews
(2) No. 8 x 1" Rh woodscrews

Rolling Tool Cabinet

You can roll this traditional-looking tool cabinet up close to your workbench. Three roomy drawers and a storage area below provide plenty of room for all your large hand tools and portable power tools.

There are plenty of nice tool cabinets that you can buy. But they're made from metal which just doesn't seem right for storing woodworking tools. What I wanted was a tool cabinet with a traditional appearance that's made from wood — one that I can roll right up to the bench so my tools are always handy. So I decided to build a Rolling Tool Cabinet of my own.

DRAWERS AND DOORS. The tool cabinet has a set of three progressively deeper drawers. And don't worry about struggling to remove tools from these deep drawers. I used full-extension drawer slides, so reaching all the way to the back of the drawers is easy.

Open the doors and you'll find storage for portable power tools as well. Inside this storage area is a sliding tray for the tools you use most often. The tray rests on an adjustable cleat that can be moved up or down to make more room for larger tools stored on the bottom shelf.

JOINERY. Finally, stub and tenon joinery makes assembling the cabinet quick and easy. This simple and strong joint can be cut on a table saw.

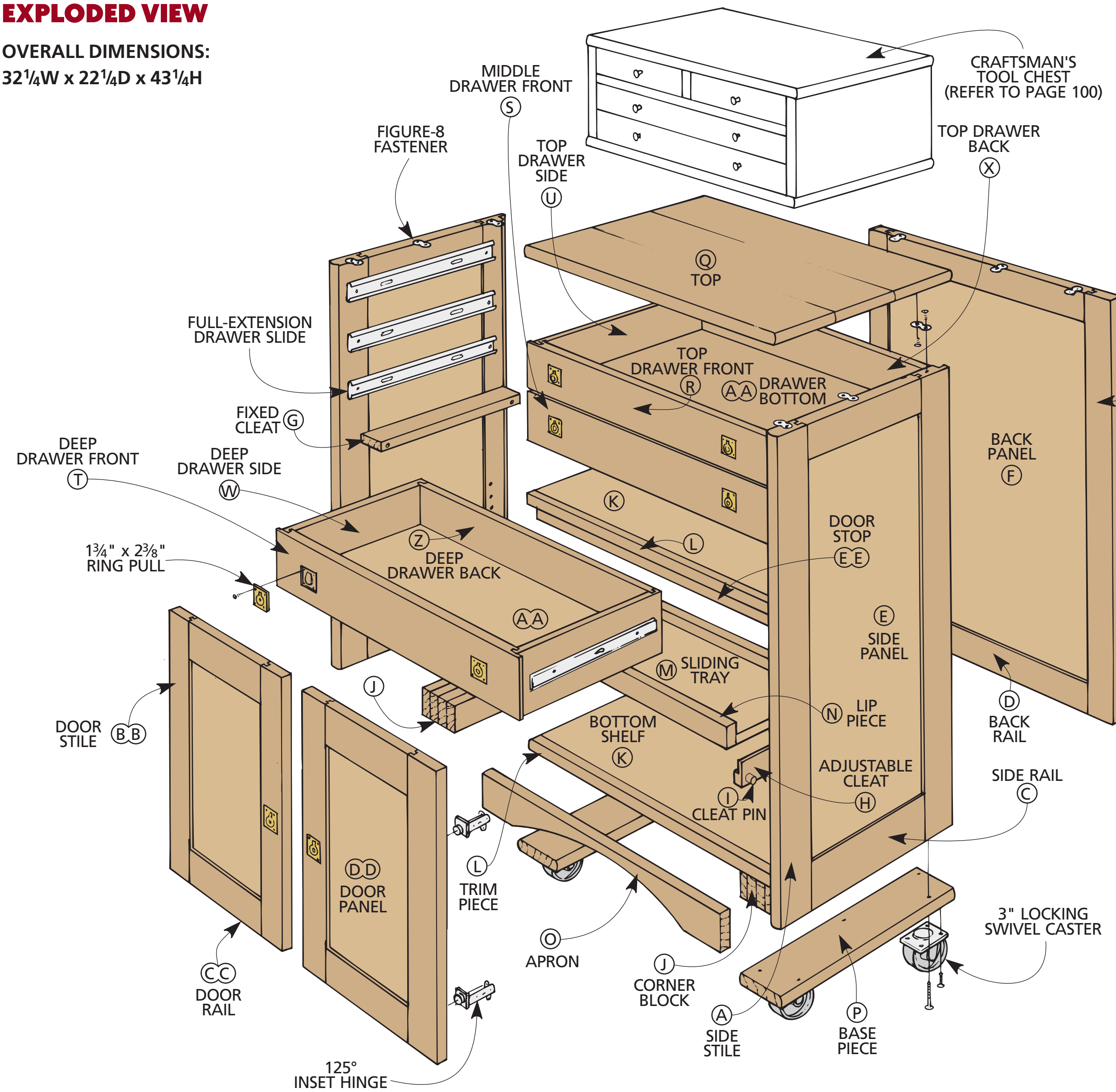
CRAFTSMAN'S TOOL CHEST. My cabinet is designed to stand alone, with plenty of space for most of my large hand tools. But small hand tools can get knocked around or "lost" in these big storage areas. So to make this project even more useful, consider building the matching small tool chest (on the bench in the photo above). See the Craftsman's Tool Chest article starting on page 100.

WOOD. The Rolling Tool Cabinet has the classic look of a mission-style piece of furniture. I used quartersawn red oak and riftsawn (straight-grained) oak plywood for the large panels to keep wood movement to a minimum.

TOOL CABINET STAND. After completing the cabinet, I found it can be difficult to reach the lowest areas. So I've designed a sturdy stand to boost the cabinet to a more comfortable working height. Find out how I built the stand in the Designer's Notebook on page 98.

EXPLODED VIEW

OVERALL DIMENSIONS:
32¼W x 22¼D x 43¼H

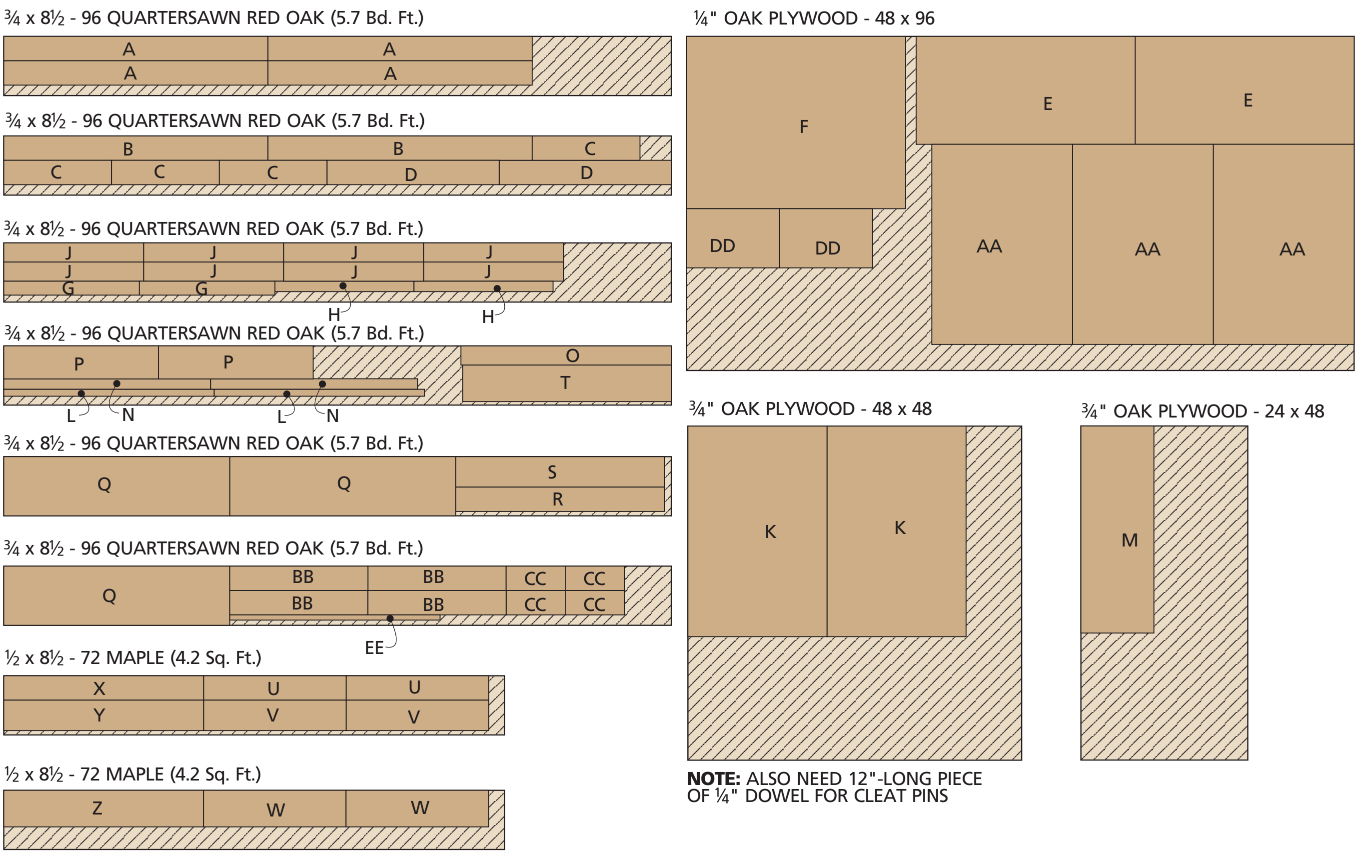


MATERIALS LIST

CASE	
A Side Stiles (4)	¾ x 3½ - 38
B Back Stiles (2)	¾ x 3½ - 38
C Side Rails (4)	¾ x 3½ - 15½
D Back Rails (2)	¾ x 3½ - 24¾
E Side Panels (2)	¼ ply - 15½ x 31½
F Back Panel (1)	¼ ply - 24¾ x 31½
G Fixed Cleats (2)	¾ x 2 - 19½
H Adjustable Cleats (2)	¾ x 1½ - 20
I Cleat Pins (4)	¼ dowel x 1¼
J Corner Blocks (8)	¾ x 2¾ - 20⅛
K Dvdr./Btm. Shelf (2)	¾ ply - 20¼ x 30¼
L Trim Pieces (2)	¾ x ¾ - 30¼
M Sliding Tray (1)	¾ ply - 10½ x 29¾
N Lip Pieces (2)	¾ x 1½ - 29¾
O Apron (1)	¾ x 2¾ - 30¼
P Base Pieces (2)	¾ x 4¾ - 22¼
Q Top (1)	¾ x 22¼ - 32¼
DRAWERS	
R Top Dwr. Front (1)	¾ x 3½ - 30
S Middle Dwr. Fr. (1)	¾ x 4⅜ - 30
T Deep Dwr. Fr. (1)	¾ x 5¼ - 30
U Top Dwr. Sides (2)	½ x 3½ - 20½
V Mdl. Dwr. Sides (2)	½ x 4⅜ - 20½
W Deep Dwr. Sides (2)	½ x 5¼ - 20½
X Top Dwr. Back (1)	½ x 3½ - 28¾
Y Mdl. Dwr. Back (1)	½ x 4⅜ - 28¾
Z Deep Dwr. Back (1)	½ x 5¼ - 28¾
AA Drawer Bottoms (3)	¼ ply - 28¾ x 20
DOORS	
BB Door Stiles (4)	¾ x 3½ - 19⅞
CC Door Rails (4)	¾ x 3½ - 8½
DD Door Panels (2)	¼ ply - 8½ x 13⅜
EE Door Stop (1)	¾ x ¾ - 30¼

HARDWARE SUPPLIES
- (4) No. 8 x 2½" Fh woodscrews
- (22) No. 8 x 1¼" Fh woodscrews
- (18) No. 8 x ⅝" Fh woodscrews
- (9) Figure-8 fasteners
- (3 prs.) 20" full-extension drawer slides
- (2 prs.) 125° inset hinges
- (8) 1¾" x 2⅜" ring pulls
- (4) 3" locking swivel casters
- (16) ¼" x 1" lag screws
- (16) ¼" flat washers

CUTTING DIAGRAM



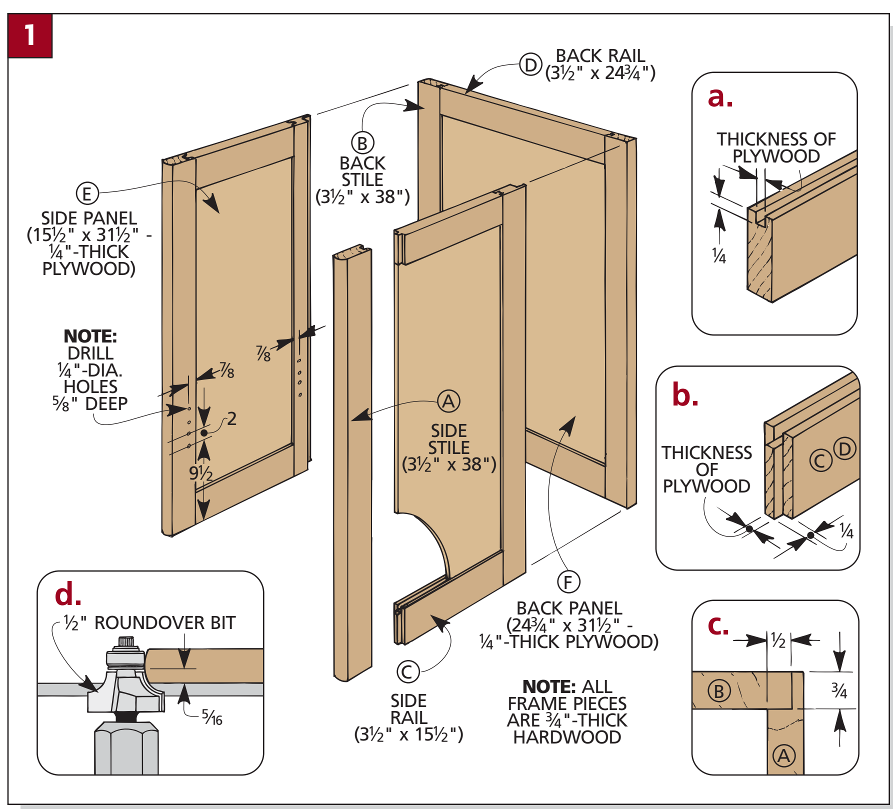
CASE

Start construction of the cabinet by making the case. It's just a large open box that's divided into two storage compartments: with three drawers at the top and a lower compartment for two shelves.

SIDES AND BACK. To add rigidity to this large case, the sides and back are made of solid wood frames and plywood panels. Each frame and panel is held together with simple (yet strong) stub tenon and groove joinery *(Fig. 1)*.

All of the pieces of these frames are made from $3/4$"-thick hardwood stock and all are identical in width ($3 1/2$"). And the length of the side stiles (A) and back stiles (B) are also identical *(Fig. 1)*. But since the sides are narrower than the back, the side rails (C) are shorter than the back rails (D).

STUB TENONS AND GROOVES. To accept the plywood panels and rails, a groove is cut in the inside edge of each frame piece *(Fig. 1a)*. And stub tenons are cut on the ends of each rail. Size these tenons to fit the grooves *(Fig. 1b)*.



PANELS. With the frame joinery complete, you can add the side (E) and back panels (F). These are just 1/4"-thick pieces of plywood sized to fit into the frames and glued in place.

At this point, there's still some work left to do on the sides. To make the sliding tray (added later) adjustable, I drilled a series of holes in the side stiles *(Fig. 1)*. And there's a rabbet that's routed in the back edge of each side to accept the case back *(Fig. 1c)*.

BULLNOSE. To soften the front edges of the side assemblies, I routed a bullnose *(Fig. 1d)*. But rather than buy a special bit to do this, I used a 1/2" roundover bit instead. The idea here is to make a pass on each side to rout the bullnose.

Note: This leaves a slight "flat" spot on the front of the side, but all it takes is a little sanding to smooth it out.

SUPPORTS

As I mentioned before, the case is divided into separate storage areas. The lower area has a small sliding tray and a large fixed shelf. It's easiest to add supports for the divider, sliding tray, and shelf before assembling the case.

FIXED CLEATS. The divider is supported by a pair of fixed cleats (G) made from hardwood *(Fig. 2)*. Be sure to drill countersunk shank holes for the screws first. Then after positioning the cleats flush with the inside edge of the rabbet, they're simply screwed to the side stiles.

ADJUSTABLE CLEATS. The sliding tray is also supported by two cleats. But to move the tray up or down, these adjustable cleats (H) have cleat pins (I) (made from dowels) that fit into the holes drilled earlier in the sides *(Fig. 2b)*.

To hold the cleats tight against the sides of the case, the tray sits in a rabbet that I cut in the top edge of the cleats *(Fig. 2b)*. This way, the edge of the adjustable tray presses against the cleats and holds them in place.

CORNER BLOCKS. There's one last set of supports to add to the inside of the case — a pair of corner blocks. Besides supporting the bottom shelf, these corner blocks direct the weight of the tool cabinet onto the casters (see the photo at the bottom of page 92).

To help carry this weight, the corner blocks (J) are made by gluing up four pieces of stock *(Fig. 2)*. Then these blocks are simply glued flush with the bottom of each side.

DIVIDER, TRAY, & SHELF

Now that all the supports are installed in the case, you can turn your attention to building the divider shelf, bottom shelf, and the sliding tray.

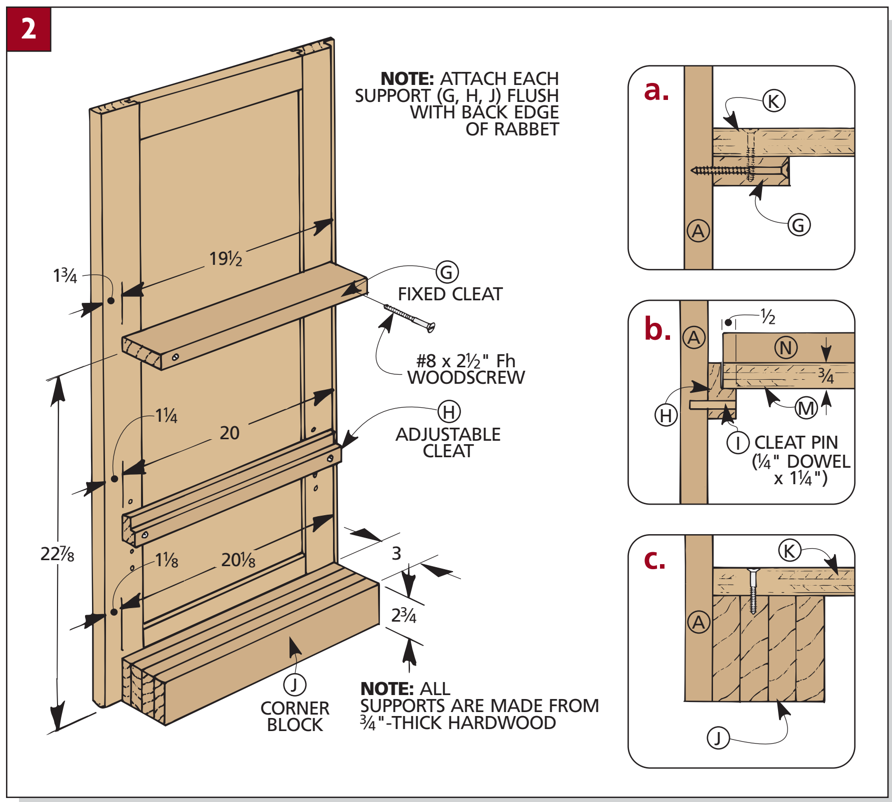
DIVIDER. The divider shelf separates the cabinet into an upper and a lower compartment. The top compartment houses three drawers for smaller hand tools. And the lower compartment provides a place to store small power tools and supplies underneath.

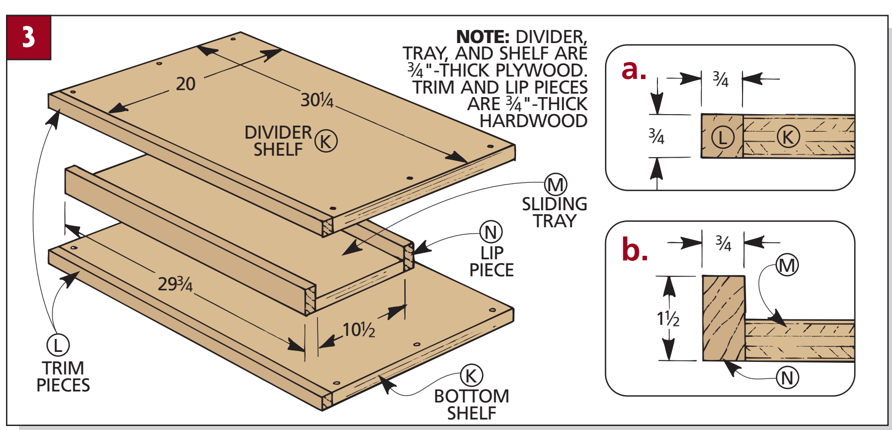
The divider shelf (K) is just a piece of plywood with holes drilled in it to attach it to the fixed cleats *(Fig. 3)*. I glued on a hardwood trim piece (L) to cover the plywood edge of the divider shelf *(Fig. 3a)*.

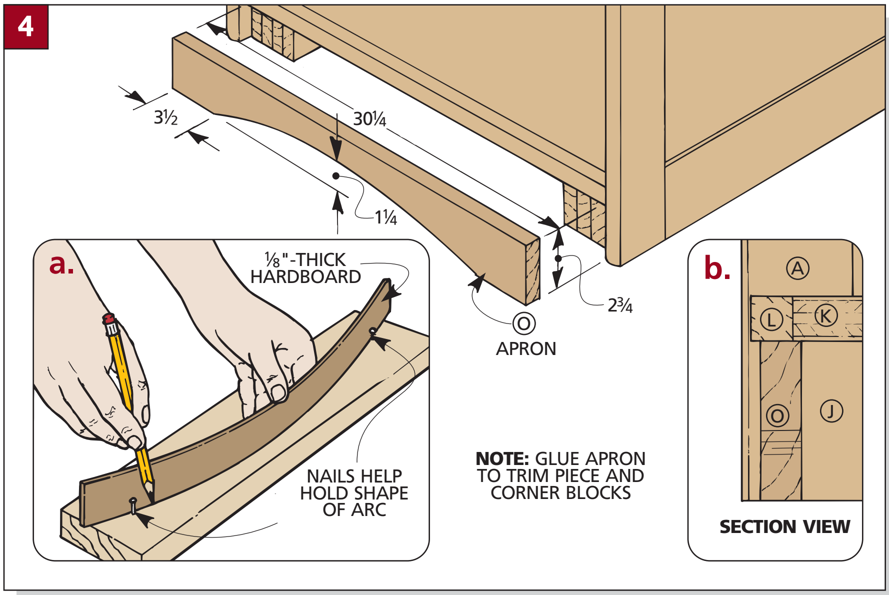
SLIDING TRAY. To provide easy access to tools, the sliding tray (M) is a narrow piece of plywood that pulls to the front of the cabinet. A couple of 1 1/2"-wide hardwood lips (N) glued to the front and back edges keeps tools from falling off *(Figs. 3 and 3b)*.

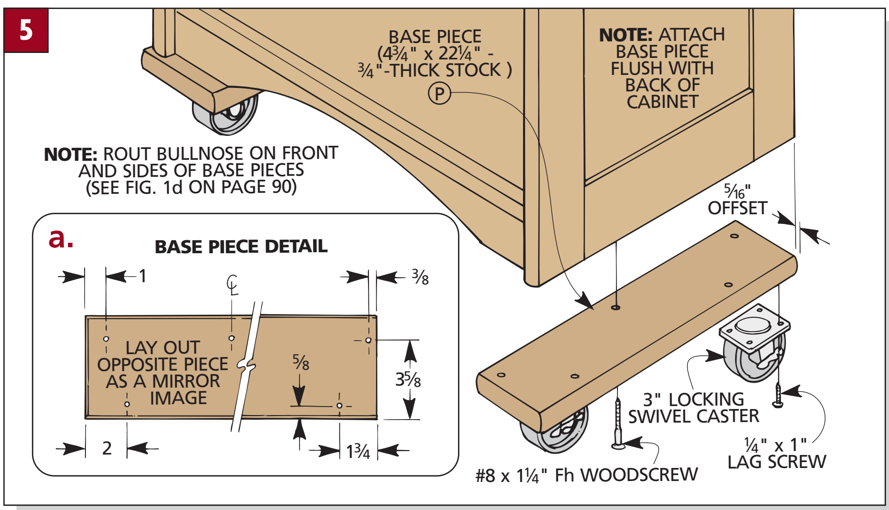
BOTTOM SHELF. Finally, for storage area at the bottom of the case, there's a bottom shelf (K) that's identical in size to the divider shelf. Again, a hardwood trim piece (L) creates a finished-looking edge.

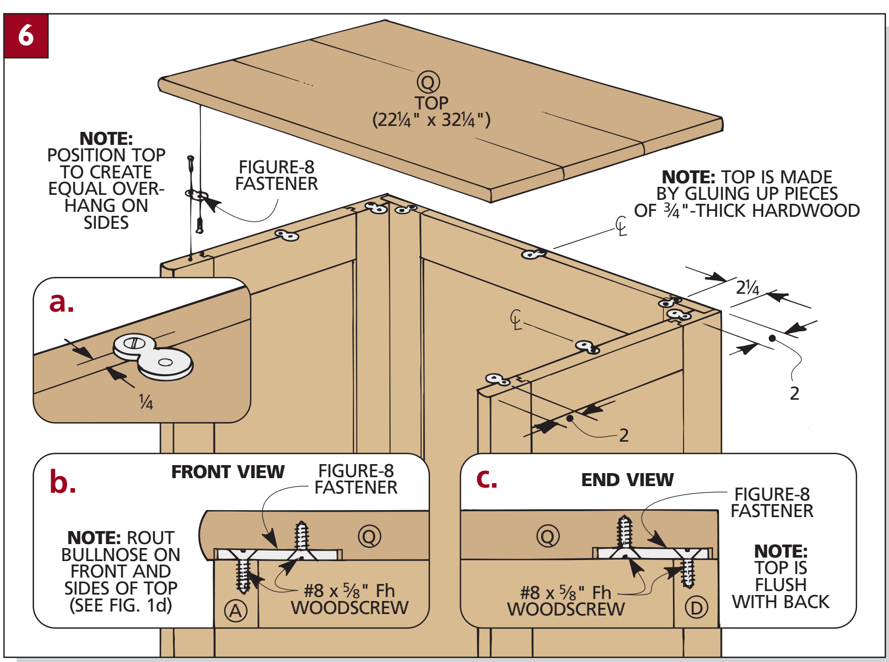
ASSEMBLY. At this point, you can glue up the case. To keep things square, I slipped the divider and bottom shelves into the case. When the glue dries, just screw them in place and install the adjustable cleats and the sliding tray.











APRON. The apron (O) is made out of a piece of hardwood with a gentle curve shape cut on the bottom edge *(Fig. 4)*. Cutting the curve is easy. First, I used a piece of scrap hardboard to lay it out *(Fig. 4a)*. Then, after cutting the curve with a band saw, I used a drum sander to clean up the bottom edge. Finally, the apron can be glued to the bottom shelf trim piece and corner blocks *(Fig. 4b)*.

CASTERS. All that's left is to add four locking swivel casters. To provide a sturdy mounting platform for the casters, two hardwood base pieces (P) are attached to the bottom of the corner blocks and the case *(Fig. 5)*. After routing a bullnose on the sides and front of the base pieces, they're screwed to the corner blocks and sides. Then just attach the casters with lag screws.

TOP

With the case complete, I started working on the top of the cabinet.

To provide a sturdy platform for the tool chest, the top (Q) is a solid wood panel that's made by gluing up pieces of ¾"-thick hardwood (oak) *(Fig. 6)*.

WOOD MOVEMENT. But a solid wood top creates an interesting problem when attaching it to the case. If you decide to add the tool chest later, it has to be held tightly in place. But to keep the top from splitting, it also needs to expand and contract with seasonal changes in humidity.

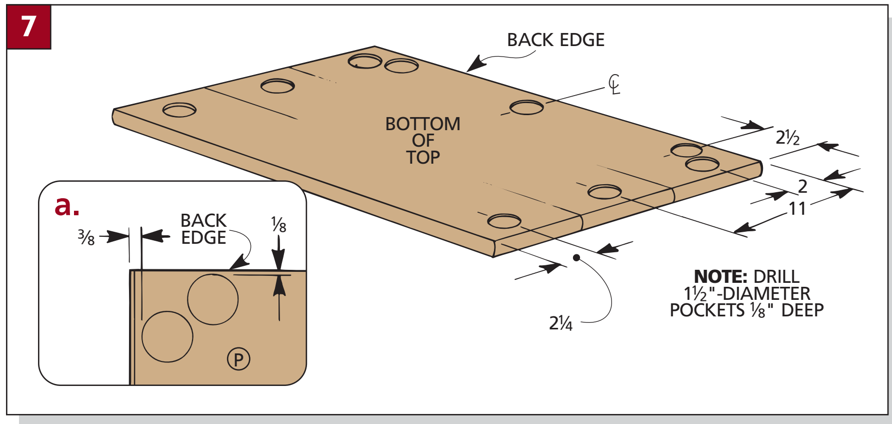
FIGURE-8 FASTENERS. To secure the top *and* allow for wood movement, I used

A thick corner block made from laminated hardwood and attached to the bottom of the case directs the weight of the cabinets and tools onto the casters.

several metal figure-8 fasteners. The small end of these fasteners attaches to the sides (or back) of the case *(Figs. 6a and 6b)*. The large end fastens to the top. This way, when the wood expands or contracts, the fastener pivots and keeps the top from splitting.

POCKETS. The figure-8 fasteners are recessed into shallow "pockets" that I drilled into the bottom face of the top. After laying out their location, I drilled the pockets with a $1\frac{1}{2}$"-dia. Forstner bit *(Figs. 7 and 7a)*. But if you don't own a Forstner bit that size, you could also drill small, overlapping holes with a 1"-dia. Forstner bit (see photos below).

Before attaching the top, there's one more thing to do. That's to rout a bullnose on the front and sides only. (The back edge is left square.)



INSTALL FASTENERS. At this point, you're ready to install the figure-8 fasteners (see the Hardware box below).

I used No. 8 x $\frac{5}{8}$" Fh woodscrews and screwed them to the case only *(Fig. 6)*.

Note: To provide easy access to the case when working on the drawers for the Rolling Tool Cabinet, it's best to wait until the drawer slides have been installed before attaching the top.

HARDWARE . . . . *Figure-8 Fasteners*

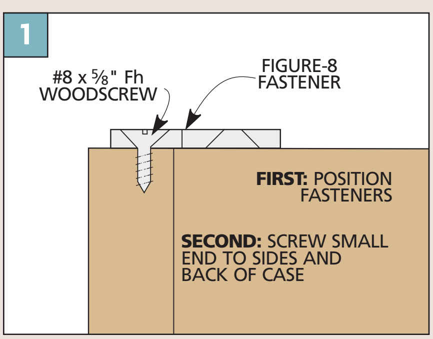
Installing figure-8 fasteners isn't that difficult. But there are a few things to think about. Since they help protect against splitting during expansion and contraction with changes in humidity, I added three fasteners on each side of the case. But then, to ensure the top is securely attached to the case, I added three more fasteners to the back edge. This allows the top to expand towards the front if needed.

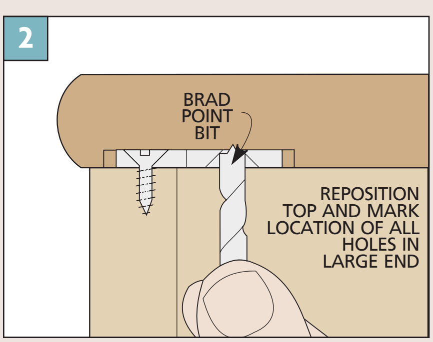
I started by positioning the fasteners on the top edges of the case sides and back (refer to *Fig. 6* on opposite page). Once you're satisfied the fasteners line up with the "pockets" you drilled earlier in the cabinet top (photos at right), drill pilot holes and screw the small end of the fastener to the top of the case *(Fig. 1)*.

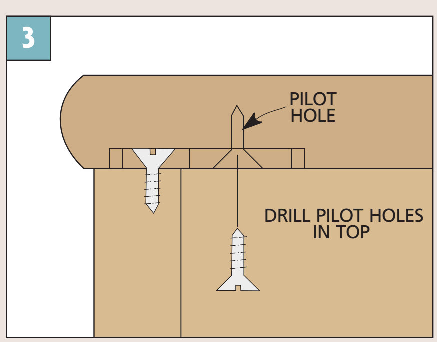
Note: These small screw heads twist off easily, so drill a pilot hole first.

Then reposition the top on the case and mark the location of all the holes in the big end of the fastener. I used a brad point drill bit to do this *(Fig. 2)*.

Drill pilot holes in the top, but wait until you've finished the drawers to fasten it in place *(Fig. 3)*. (For figure-8 fastener sources, see page 126.)

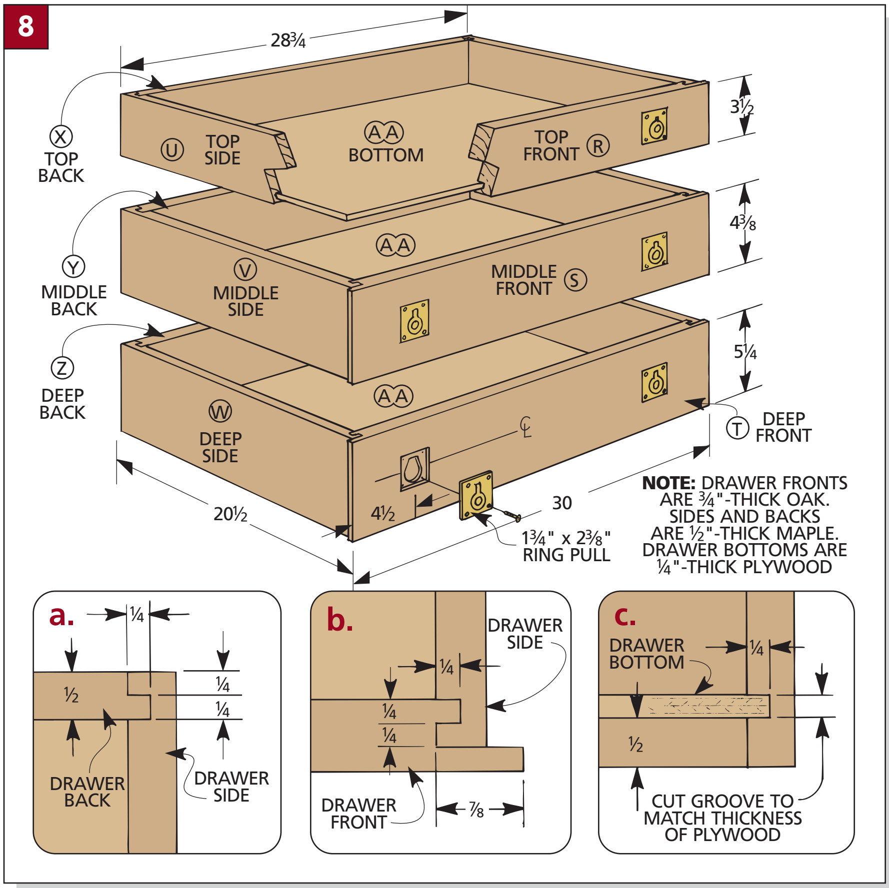


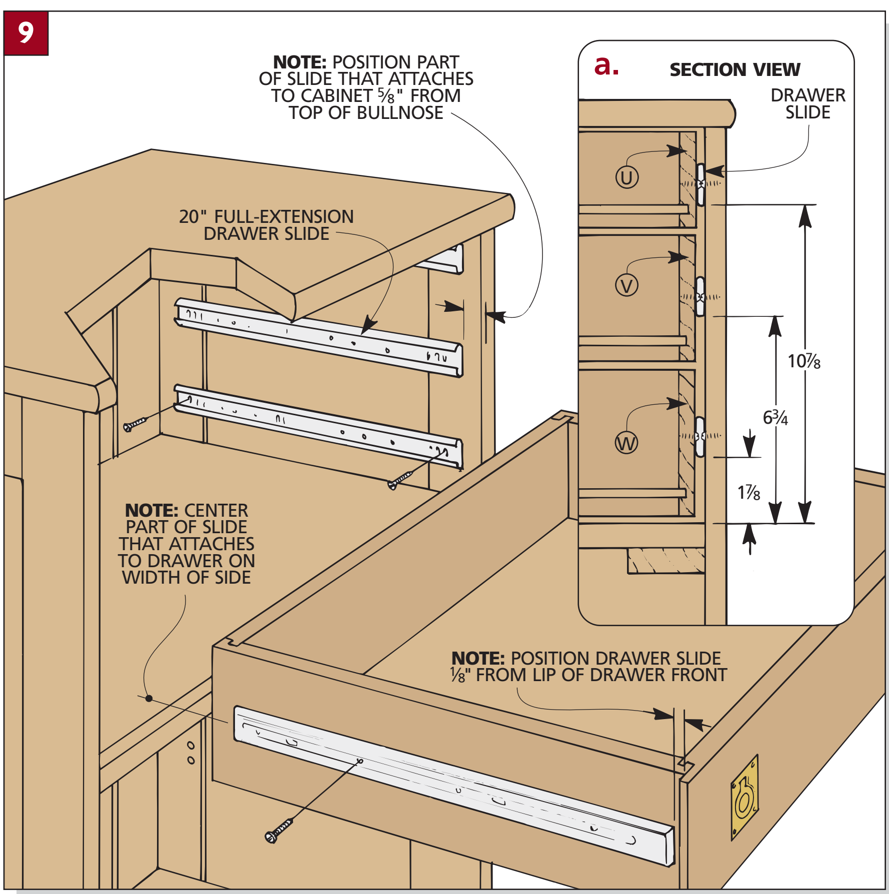




Single Hole. *To create crisp, clean pockets for the figure-8 fasteners, it's best to use a Forstner bit and the drill press. The pocket can be a large single hole, like the one drilled with the $1\frac{1}{2}$"-dia. bit shown above.*

Two Holes. *The pocket can also be drilled using a two-step process. Here I used a smaller 1"-dia. Forstner bit and drilled a pair of overlapping holes. Either way, be sure to drill them deep enough to hold the figure-8 fasteners ($\frac{1}{8}$").*





DRAWERS

To provide storage for different sizes of tools and materials, I built three progressively deeper drawers for the upper part of the tool cabinet *(Fig. 8)*.

Strong locking rabbet joints hold the drawers together. And full-extension drawer slides are used to provide easy access to what's inside.

There's nothing complicated about building the drawers. The top (R), middle (S), and deep (T) drawer fronts are made from ¾"-thick hardwood stock (oak) *(Fig. 8)*. And I used ½"-thick stock (maple) for the drawer sides (U, V, W) and backs (X, Y, Z).

Note: All of the drawer pieces are sized to allow ½" clearance for the drawer slides and a ⅛" gap all the way around each drawer front.

LOCKING RABBETS. With the pieces cut to size, you can concentrate on the locking rabbet joints *(Figs. 8a and 8b)*. (Refer to the Joinery article starting on page 96 for more on how to make locking rabbet joints.) Then just cut grooves for the plywood bottoms (AA) *(Fig. 8c)*.

DRAWER PULLS. Before gluing up the drawers, it's easiest to install the ring pulls on the drawer fronts. (For a step-by-step procedure on how I did this, refer to the Technique box on the next page.)

DRAWER SLIDES. Now it's just a matter of adding the drawer slides. These slides have two basic parts.

The first part of the slide is centered on the width of the drawer sides and positioned about ⅛" from the lip of the drawer front *(Fig. 9)*. This part of the drawer slide lets you adjust the drawer up and down, so you'll be able to "fine-tune" the drawers for a consistent ⅛" gap all the way around the opening.

The other part gets attached to the side of the cabinet *(Figs. 9 and 9a)*. By adjusting this part of the drawer slide, you can position the drawer fronts farther in or out of the cabinet.

Note: Since I wanted to recess the drawer fronts about ⅛" back, I located the slide ⅝" in from the top of the bullnose.

ATTACH TOP. Now all that's left is to attach the top and slide in the drawers.

DOORS

To keep dust and chips out of the lower part of the tool cabinet, I added two doors. Like the sides and back, the doors are simple wood frames and plywood panels that are once again held together with stub tenons and grooves.

APPEARANCE. In addition to the joinery, I also wanted to maintain a consistent appearance between the different parts of the cabinet.

So the door stiles (BB) and door rails (CC) are the same width (3½") as the stiles and rails on the sides and back *(Fig. 10)*. And to match the spacing of the drawers, these frame pieces are cut to length to allow an ⅛" gap all the way around *(Figs. 10a and 10b)*.

Once the pieces are ripped to width and cut to length, you're ready to cut the stub tenon and groove joinery on each end (refer to *Figs. 1a and 1b* on page 90). Then cut the door panels (DD) size and glue up the doors.

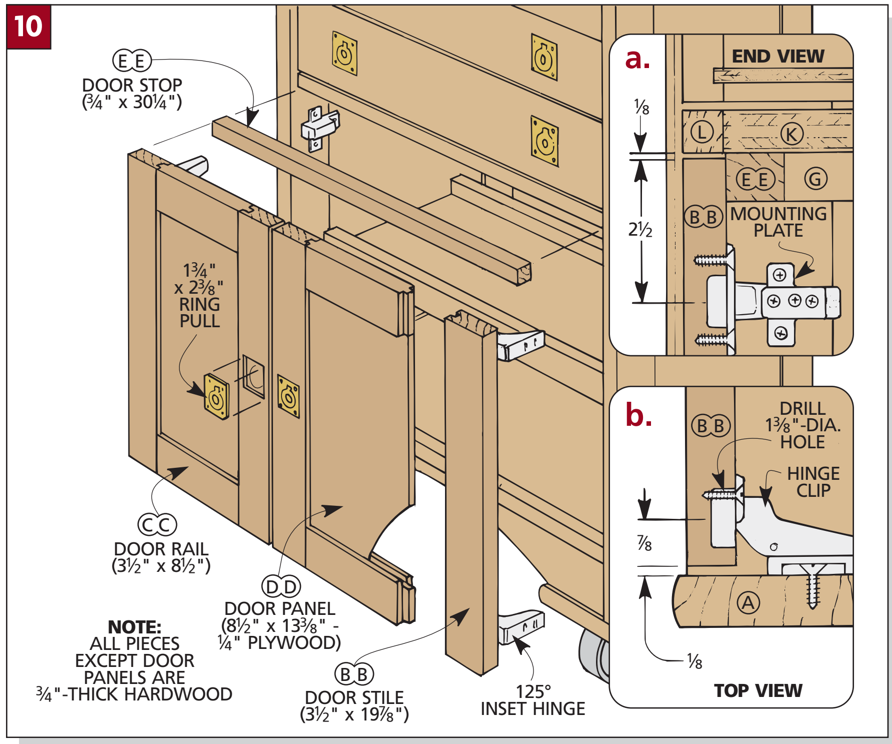
Before installing the doors, I added a door stop (EE) that's sized to keep them flush with the front edge of the divider when they're closed.

This is a strip of ¾"-square hardwood that's set back for the width of the doors and then simply glued in place under the divider *(Figs. 10 and 10a)*.

INSTALL DOORS. After adding a ring pull to each door (see the Technique box below), you can install the doors. They're held in place with 125° European-style inset hinges *(Figs. 10a and 10b)*.

This requires drilling a 1⅜"-dia. hole in the door stile to accept the hinge clip *(Fig. 10b)*. Then attach the mounting plate to the side *(Fig. 10a)*.

Note: Use the template provided with the hinges to locate the hinge parts. ■



TECHNIQUE . . . . Installing Ring Pulls

Installing a ring pull (like the ones I used on the Rolling Tool Cabinet) flush with the surface of a door (or drawer) is really pretty easy. All it takes is to cut a two-tiered mortise — a deep, oblong-shaped pocket for the part that sticks out in the back, and a shallow, rectangular recess for the mounting plate.

TEMPLATE. To lay out the deep pocket, I use a hardboard template with a horseshoe-shaped opening that matches the portion that sticks out in the back *(Fig. 1)*. Also, to allow for some adjustment when positioning the mounting plate on the cabinet, I made the opening ¹⁄₁₆" larger than the back of the pull.

Note: Draw a pair of centerlines on the template and the workpiece to make it easy to align them.

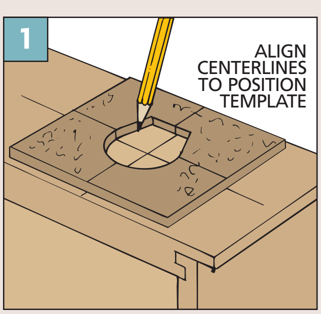
DEEP POCKET. To form the deep pocket, it's easiest to use a straight bit in a hand-held router and freehand the ⅜"-deep pocket up to the line *(Fig. 2)*.

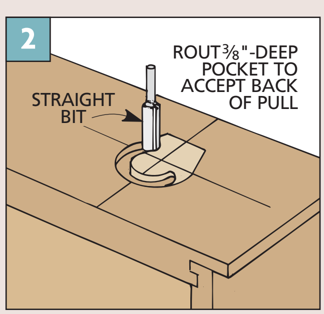
Note: It isn't necessary to clean up the edges of the deep pocket, since it will be hidden once the pull is installed.

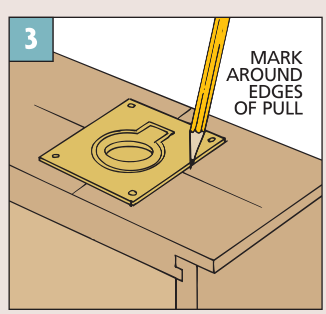
SHALLOW RECESS. Next, set the pull into the opening (making sure the edges

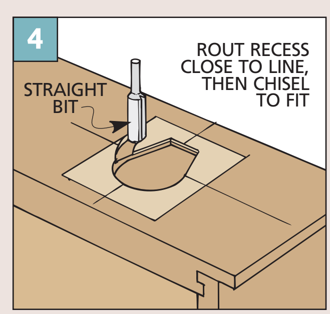
of the plate are square with the edge of the drawer or door face), and mark around the mounting plate *(Fig. 3)*. Then rout the shallow recess close to (but not touching) the line *(Fig. 4)*.

Now use a sharp chisel to clean up the edges, carefully checking the fit of the pull as you work to prevent gaps.





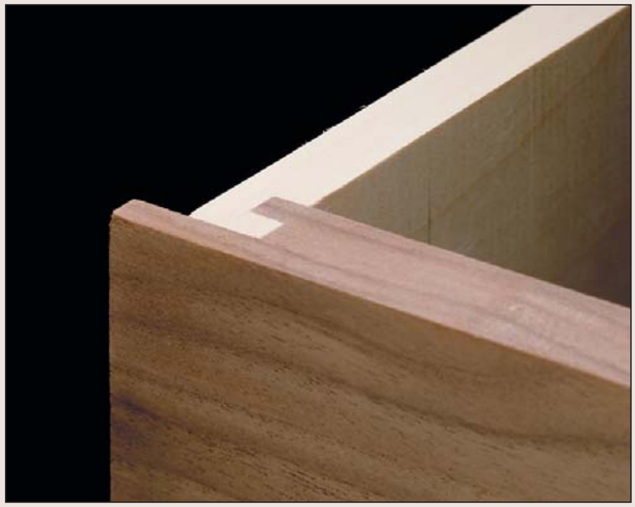


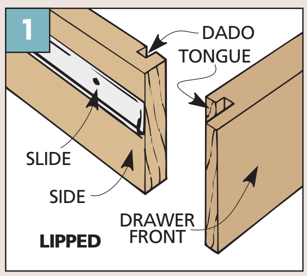


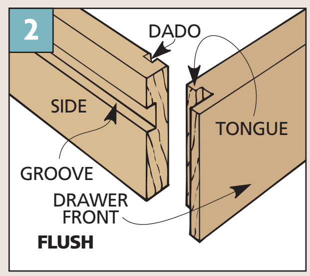
JOINERY . . . . Locking Rabbet Joint

Because they'll get a lot of use in my workshop, I knew I needed a strong joint when building the drawers for the Rolling Tool Cabinet and the Craftsman's Tool Chest. (Go to page 100 for more on how to build the tool chest.)

I guess I could have used dovetail joinery for my drawers, but that would have taken more time and a lot of setup, and I was looking for something a little simpler to build. So I decided to use locking rabbet joints for each.







TWO VERSIONS. Depending on the type of guide system that supports the drawers, I had to use one of two different types of locking rabbet joints: lipped and flush.

LIPPED FRONTS. The large drawers on the Rolling Tool Cabinet use a lipped locking rabbet joint (*Fig. 1* and the left photo on the opposite page). That's because the drawers ride on full-extension drawer slides that mount on the *surface* of the sides and cabinet. To cover the slides, there's a short lip on the ends of the drawer fronts that sticks out past the side.

FLUSH FRONTS. With the small drawers used in the Craftsman's Tool Chest, you don't have to worry about hiding any drawer slides. That's because the hardwood guides that support the drawers are recesssed into a groove in the sides of the cabinet and the drawers. This means the drawer front can be left flush with the sides (*Fig. 2* and the right photo on the opposite page).

TONGUE AND DADO. Regardless of the type of locking rabbet you use, the construction is very similar. There's a tongue on the drawer front that fits in a dado in the side *(Fig. 5)*.

Note: Both the tongue and the dado are cut with a $\frac{1}{4}$"-wide dado blade.

SETUP & SAFETY

To form the tongue, the first step is to cut a groove in the end of the drawer front. This requires standing the workpiece on end (refer to *Fig. 5*). But, standing a workpiece on end to make a cut on the table saw can be a challenge. Plus, it's not exactly the safest procedure. But there are ways to make this job not only a lot easier, but a lot safer as well.

TALL AUXILIARY FENCE. First, to provide extra support for long workpieces like the drawer fronts, one of the most important things you can do is attach a tall plywood auxiliary fence to your table saw's rip fence *(Fig. 3)*.

ZERO-CLEARANCE BASE. Also, a zero-clearance base (made from $\frac{1}{4}$"-thick hardboard) keeps the workpiece from dropping into the opening between the blade and the insert.

The base doesn't have to be anything fancy. To make it, I use double-sided carpet tape to attach the hardboard to the saw table and raise the blade.

Note: To support the base, leave the existing metal insert in place over the blade.

SUPPORT BLOCK. Finally, to hold the workpiece tight against the fence (and avoid tipping it forward), I clamp it to a support block *(Figs. 4 and 5)*.

The support block is just a scrap with a piece of hardboard that extends out in front so you can apply pressure to the side of the workpiece. Cutting a notch in the block creates a clamping surface. And sticking on a strip of adhesive-backed sandpaper keeps the workpiece from slipping around while cutting.

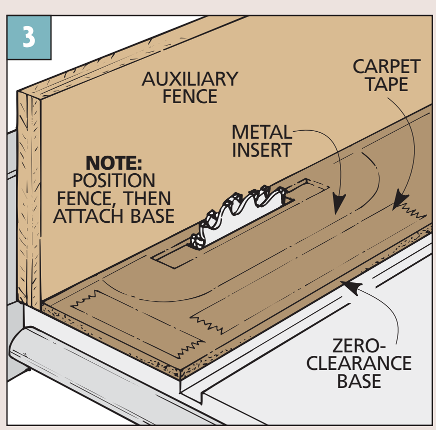
CUTTING THE JOINT

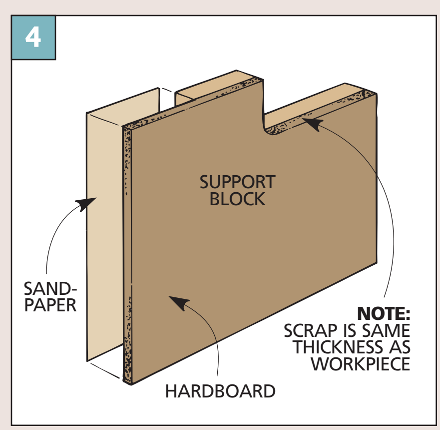
When cutting the groove in the end of the drawer front, the goal is to end up with a $\frac{1}{4}$"-thick tongue. This way, you won't have to adjust the width of the blade when you cut the dado later. So start by positioning the rip fence $\frac{1}{4}$" from the inside of the blade.

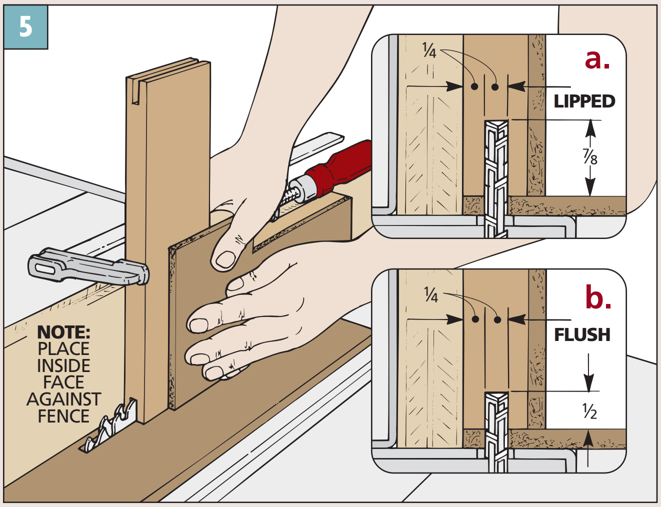
Then raise the table saw blade to the correct height (for either a lipped or flush locking rabbet joint) and cut the groove *(Figs. 5a and 5b)*.

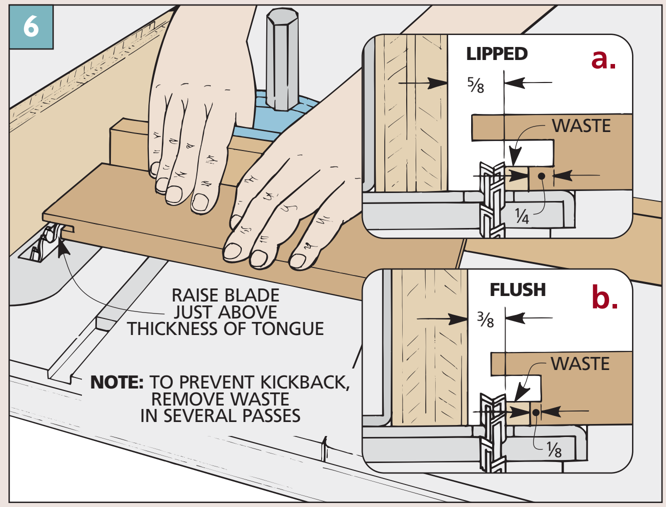
Note: Place the inside of the drawer front against the fence.

The second part to making the tongue is to cut it to length *(Fig. 6)*. Doing this is just a matter of using the rip fence as a stop to establish the final length of the









tongue for either a lipped or flush drawer front *(Figs. 6a and 6b)*.

When cutting the tongue, there's one more thing to be aware of. If you remove the waste in a single pass, the cutoff can get pinched between the blade and the fence and come flying back. To prevent this from happening, I make several passes until the workpiece "bottoms out" against the fence.

DADO. When you're done with the tongue, the next step is to cut the dado in the side of the drawer *(Fig. 7)*.

You're after two things here. The tongue on the drawer front needs to fit the dado in the side. And the narrow stub (the part that's left on the end after you cut the dado) has to slip into the groove in the drawer front.

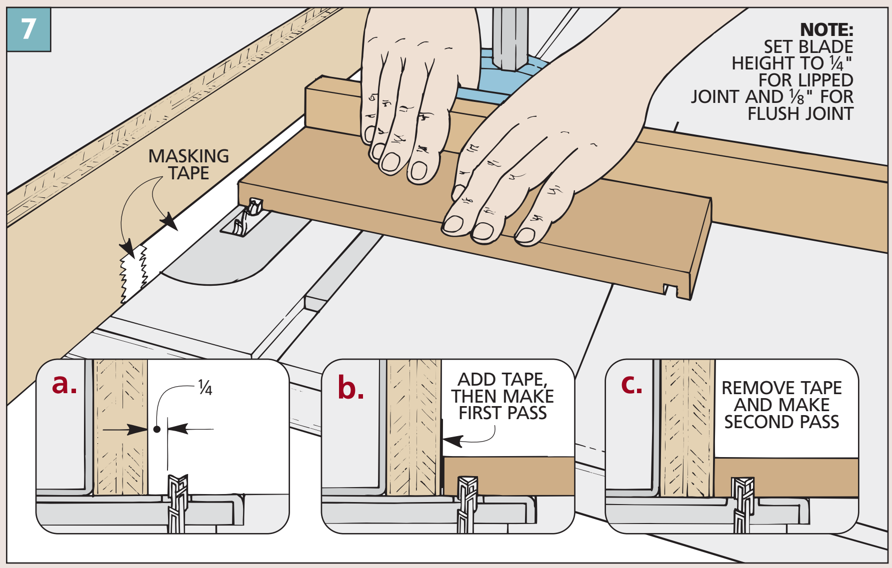
In theory, this should be easy. Just adjust the blade height and set the rip fence. But in practice, I've found this can produce such a tight fit that the stub can break off easily.

TWO-PASS METHOD. To prevent this from happening, I use a simple two-pass method on the table saw. The goal is to make the dado just a hair *wider* and the stub a bit *narrower*.

Start by setting the fence and blade height "exactly by the numbers" *(Figs. 7 and 7a)*. This means, I set the blade height to $1/4$" for a lipped joint and $1/8$" for a flush rabbet joint.

But don't cut the dado just yet. Instead, add a couple of strips of masking tape to the auxiliary rip fence *(Fig. 7)*. (You may need to experiment, to come up with the right number of layers.)

This nudges the workpiece slightly away from the fence when you make the first pass *(Fig. 7b)*. Then, removing the tape and making a second pass produces a perfect fit *(Fig. 7c)*.



Lipped Joint. *To hide the metal slide portion of the drawer slide, this locking rabbet has a lip on the drawer front that extends past the side.*

Flush Joint. *Grooves cut in the sides of the drawer recess the guides that the drawer runs on, so that this drawer front is flush with the side.*

DESIGNER'S NOTEBOOK

The Tool Cabinet Stand lifts the cabinet off the floor to a more manageable height. Switching the drawers to the bottom gives you better access to the storage compartment above.

CONSTRUCTION NOTES:

■ I've taken the casters off the Rolling Tool Cabinet so I could better utilize the cabinet space. By lifting the cabinet and placing it on a stand, I've made this a permanent storage area.

Having the cabinet on wheels positioned the drawers at the right height (I like to be able to easily look down into the drawer space). But it can be a hassle having to always lean over to peer into the storage area below. So to solve this problem, I also redesigned the cabinet.

Now the drawers are placed below the open storage area. This way you're still able to look down into the drawers, but now the storage area is more accessible and it's a lot easier to reach into.

■ Start by building the case sides and back exactly as described before. The corner blocks, the fixed cleat, and the adjustable cleat remain the same as well. But now the fixed cleat is re-positioned so it's lower in the case and the holes for the adjustable cleat are drilled nearer the top of the side stile *(Fig. 1)*.

■ Complete the divider, sliding tray, and bottom shelf as described and add the apron to cover the exposed end portion of the corner blocks.

■ Next, rip the base pieces (P) to width and cut them to length *(Fig. 2)*.

■ Then go ahead and lay out and drill the countersunk shank holes for the mounting screws (*Fig. 5a* on page 92).

■ Now lay out and cut each of the through mortises in the base pieces. These mortises are sized to accept the tenons on the tops of the stand legs *(Figs. 2 and 5)*. It's important to remember that these pieces are mirror images to each other.

I used a drill press and jig saw to cut the mortises *(Figs. 3 and 4)*. Start by drilling a ½"-dia. starter hole in each corner of the mortise and use the jig saw to remove the waste. Then square up the corners with a sharp chisel.

Note: The swivel casters, lag screws, and washers are no longer needed with this version of the tool cabinet.

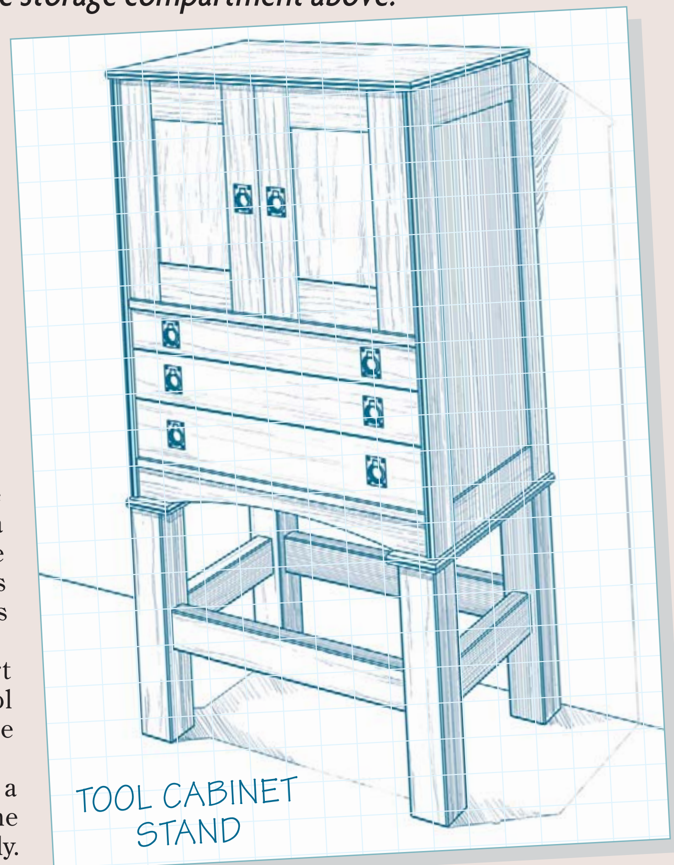
■ Finally, to complete the cabinet, I added a bullnose detail to the front and both sides of the base pieces *(Fig. 2)*.

■ Now you can start working on the tool cabinet stand (see drawing at right).

To support such a heavy cabinet, the stand has to be sturdy. So all four legs (FF) are made with two pieces of 1¾"-thick hardwood stock, glued up to form the 3½" square legs *(Fig. 5)*.

■ Once the glue has dried, you can start work on the mortises. These mortises are for a pair of stretchers and rails that hold the stand together. You'll need to make two mirrored sets of legs with mortises on opposing sides.

Note: Since you'll be cutting a tenon at the top of the legs to connect with the base pieces on the cabinet, lay out the

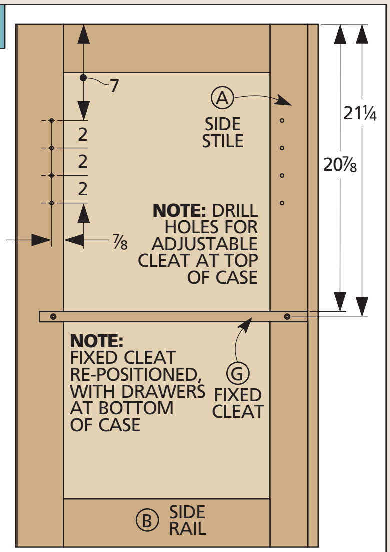


MATERIALS LIST

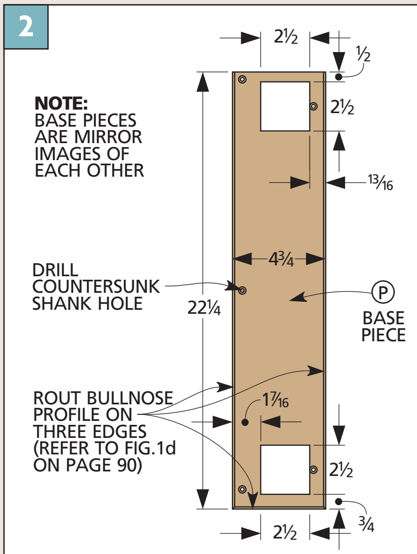
NEW PARTS		
FF	Legs (4)	3½ x 3½ - 21¼
GG	Stand Stretchers (2)	1¾ x 3½ - 26¾
HH	Stand Rails (2)	1¾ x 3½ - 17

Note: Don't need casters, lag screws, or washers.

1



2



mortises on all of the legs from the bottom edge. I marked this edge with an "x" to keep them straight.

■ To cut the mortises, I like to use a 1"-dia. Forstner bit, first drilling a series of holes to rough them out *(Fig. 6)*. Then I go back and use a sharp chisel to clean up the sides and square the ends.

■ Now that the mortises have been cut in the legs for the rails and stretchers, the next step is to cut a tenon on the top of each leg *(Fig. 5)*. These tenons fit into the mortises cut into the base pieces (P) earlier. This connects the cabinet to the stand, making it possible to remove the cabinet if necessary *(Fig. 8)*.

■ The easiest way to cut these tenons is on the table saw. To do this, first install a $^3/_4$" dado set. Then attach an auxiliary fence to your table saw's rip fence and position the fence to cut the rabbets using a single pass *(Fig. 7)*.

Note: The auxiliary rip fence protects your table saw fence from being nicked by the dado set as you make the cut.

I also attached an auxiliary fence to my miter gauge to back up the workpiece. This helps prevent chipout. Now cut the tenon, rotating the workpiece after each pass to cut the $^3/_4$"-wide rabbet on all four sides of the leg *(Fig. 7)*.

■ Finally, complete the legs by chamfering the sharp corners. I routed a $^1/_8$" chamfer along all the edges, including the top of the tenon and the bottom edges of the legs. The only area I didn't chamfer was the shoulder near the top of the leg and the sides of the tenon itself *(Fig. 5)*.

Note: The chamfers on the end of the leg tenons make it easier to align the cabinet onto the stand.

■ Once the legs are complete, you can start working on the stretchers and rails. These are heavy-duty workpieces and they're also made from 8/4 ($1^3/_4$") stock.

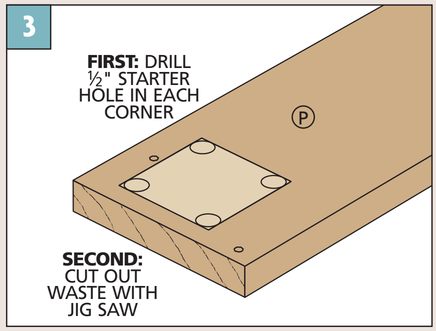
■ Start by ripping the stand stretchers (GG) and the stand rails (HH) to the same width ($3^1/_2$"). Then cut each of them to final length *(Fig. 9)*.

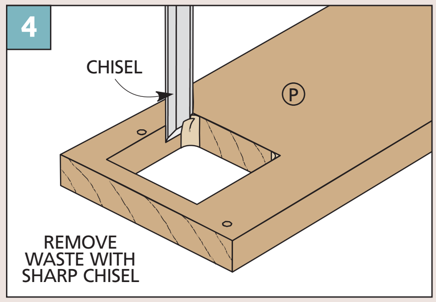
■ The tenons on the ends of the stand stretchers and stand rails are sized to fit the mortises cut in the legs earlier.

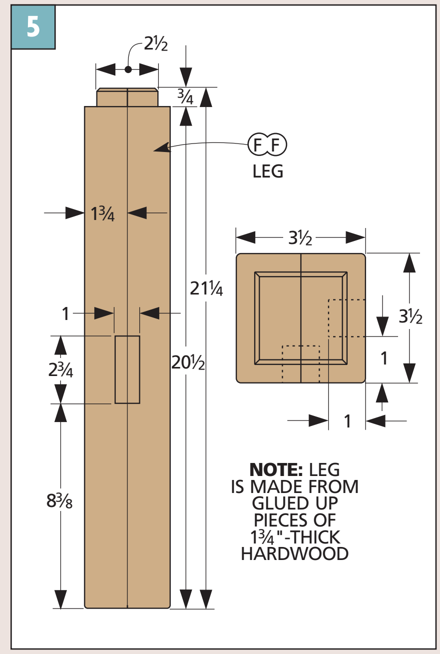
And once again, these tenons are easy to cut on a table saw using a dado set. But this time, set the blade height to $^3/_8$" and position the rip fence to act as a stop. The tenons are 1" long *(Fig. 9)*.

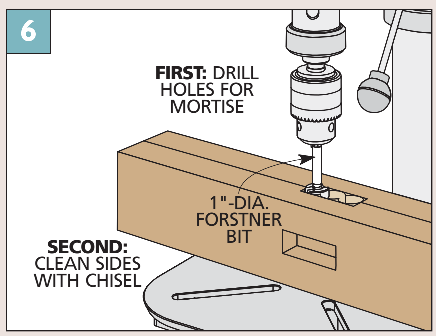
Note: Leave the auxiliary fence on your miter gauge to back up the workpiece and prevent tearout.

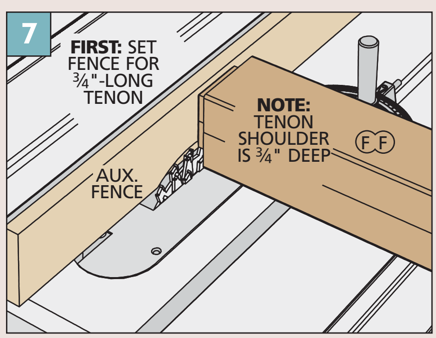
■ Finally, rout a $^1/_8$" roundover on the exposed edges of the rails and stretchers.

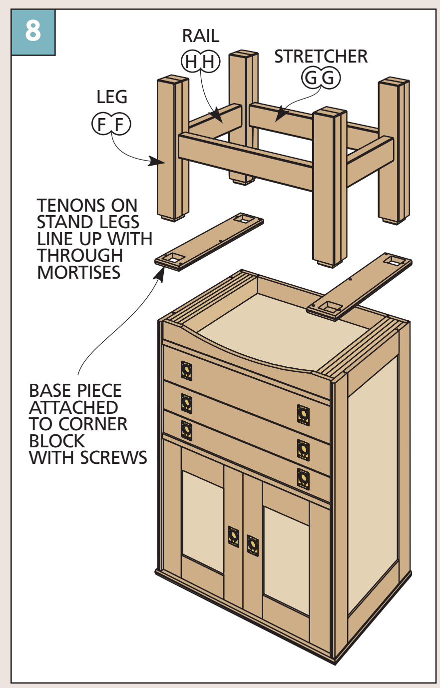


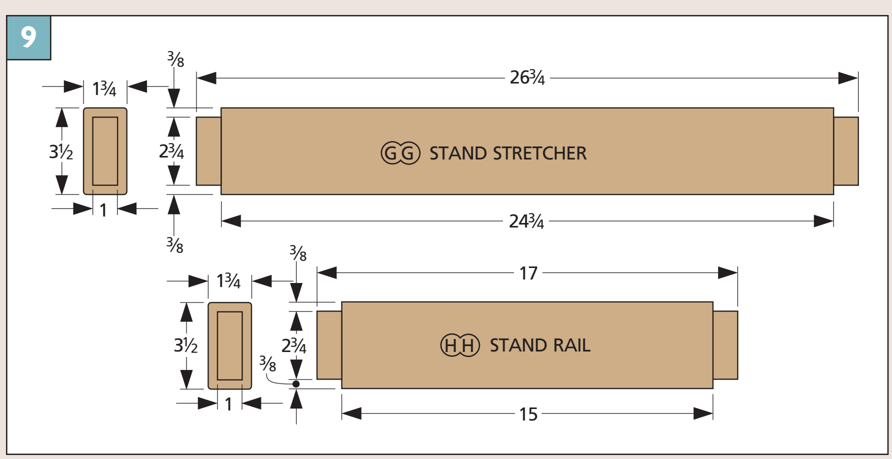












Craftsman's Tool Chest

By itself or sitting on top of the Rolling Tool Cabinet, this handsome tool chest protects and organizes your precision hand tools. Felt lining and brass knobs draw attention to attractive and sturdy drawers.

Special tools deserve a special place. At least, that's how I feel about my hand tools. Whether it's the bevel gauge that belonged to my grandfather, a brand new precision square, or my best set of chisels, it's reassuring to know they won't get knocked around or damaged; and that they're within easy reach when I need to use them.

TOOL CHEST. That's why I built this Craftsman's Tool Chest. It protects and organizes my best hand tools. But what I like just as much about the tool chest is its traditional appearance — as comfortable as the look and feel of a tool that's polished with use.

SOLID WOOD. One thing that adds to this look is its solid wood panels made from quartersawn oak. Along with soft bullnosed edges, this makes the tool chest a perfect companion piece to place on top of the Rolling Tool Cabinet (see page 88). But you could build the chest to stand by itself. It looks just as nice sitting on top of a workbench.

DRAWERS. Either way, a bank of four shallow drawers provides plenty of storage and easy access to your tools.

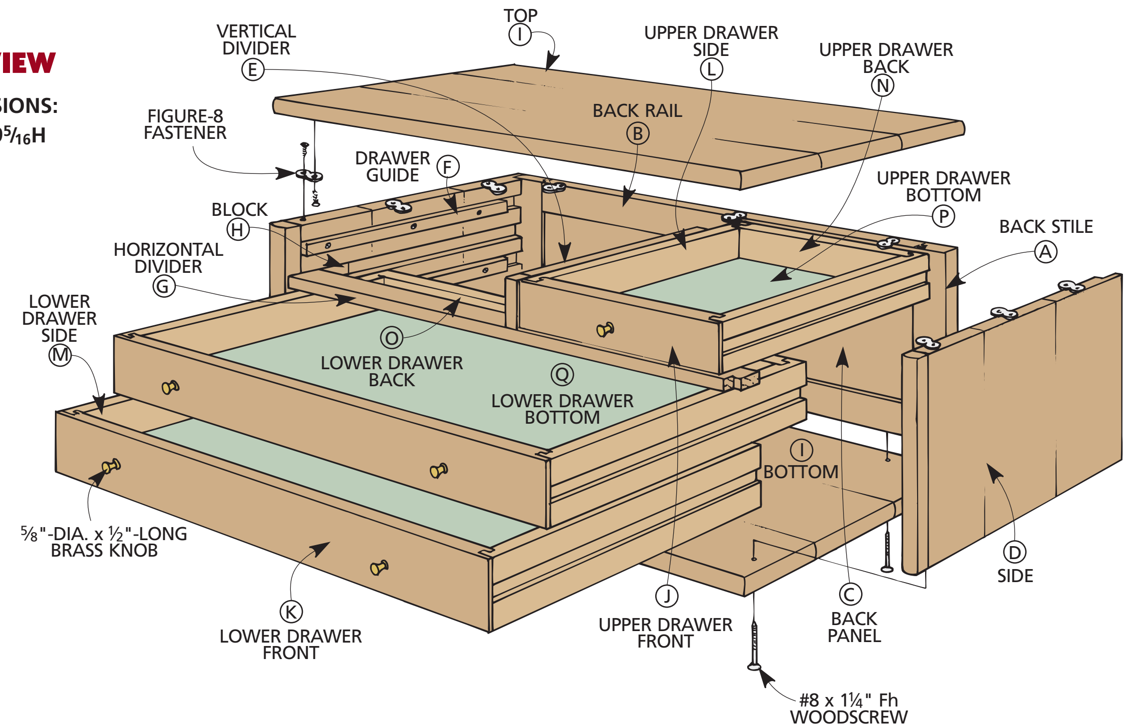
The drawers are made with locking rabbet joinery for extra strength. But instead of using full-extension drawer slides like those on the tool cabinet, the drawers for the chest run as smooth as glass on solid wood guides. To make sure they stay solid, I placed the guides in stopped dadoes cut in the sides of the case. And, since it's important that these dadoes align, I also came up with a slightly different way to cut them that's easy and accurate.

FELT LINING. Lining these drawers with felt adds that final touch of craftsmanship. See the Designer's Notebook on page 105 to learn how I did this.

BENCHTOP CHEST. With the expanding collection of brass pulls, knobs, and hinges that I use in my projects, I've always wished for a case to hold it all. So to store this specialty hardware, I designed the Benchtop Chest. You can find out how to build it in the Designer's Notebook starting on page 106. Its space-saving design fits on a bench top in even the most crowded workshop.

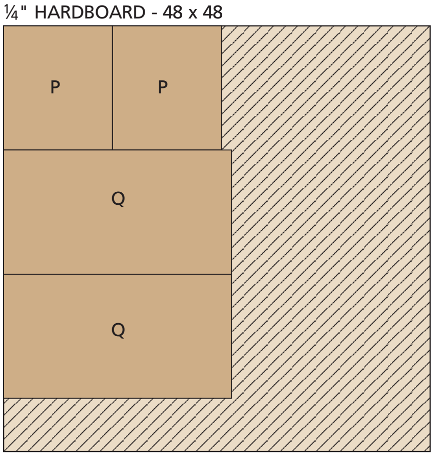
EXPLODED VIEW

OVERALL DIMENSIONS:
28 1/4W x 16 1/4D x 9 5/16H



CUTTING DIAGRAM

1/4" HARDBOARD - 48 x 48



MATERIALS LIST

CASE

- **A** Back Stiles (2) — 3/4 x 1 1/2 - 7 13/16
- **B** Back Rails (2) — 3/4 x 1 1/2 - 24 3/4
- **C** Back Panel (1) — 1/4 ply - 5 5/16 x 24 3/4
- **D** Sides (2) — 3/4 x 16 - 7 13/16
- **E** Vertical Divider (1) — 1/2 x 14 - 1 7/8
- **F** Drawer Guides (8) — 7/16 x 1/2 - 13 3/4
- **G** Horiz. Divider (1) — 1/2 x 1 - 26 1/2
- **H** Blocks (2) — 1/8 x 1/2 - 1 1/2
- **I** Top/Bottom (2) — 3/4 x 16 1/4 - 28 1/4

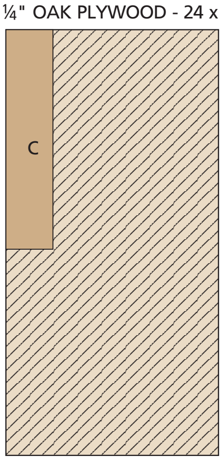
DRAWERS

- **J** Upr. Drwr. Fronts (2) — 3/4 x 1 3/4 - 12 3/4
- **K** Lwr. Drwr. Fronts (2) — 3/4 x 2 5/8 - 26 1/8
- **L** Upr. Drwr. Sides (4) — 1/2 x 1 3/4 - 14 1/2
- **M** Lwr. Drwr. Sides (4) — 1/2 x 2 5/8 - 14 1/2
- **N** Upr. Drwr. Backs (2) — 1/2 x 1 3/4 - 12
- **O** Lwr. Drwr. Backs (2) — 1/2 x 2 5/8 - 25 3/8
- **P** Upr. Drwr. Btm. (2) — 1/4 hdbd. - 14 x 12 1/4
- **Q** Lwr. Drwr. Btm. (2) — 1/4 hdbd. - 14 x 25 5/8

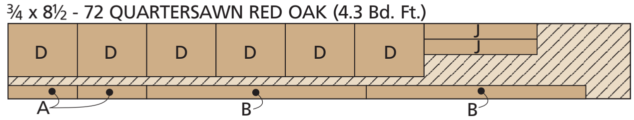
HARDWARE SUPPLIES

- (24) No. 6 x 3/4" Fh woodscrews
- (1) No. 8 x 3" Fh woodscrew
- (2) No. 8 x 2 1/2" Rh woodscrews
- (9) No. 8 x 1 1/4" Fh woodscrews
- (18) No. 8 x 5/8" Fh woodscrews
- (6) 5/8" x 1/2" brass knobs
- (9) Figure-8 fasteners

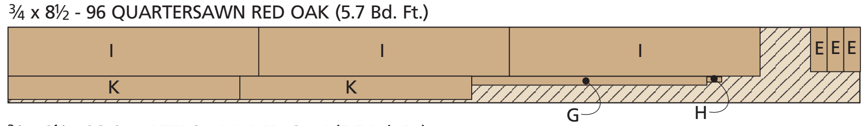
1/4" OAK PLYWOOD - 24 x 48



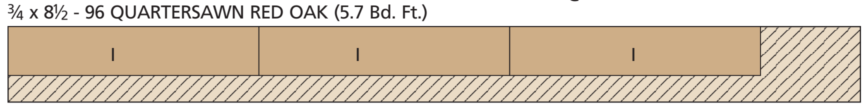
3/4 x 8 1/2 - 72 QUARTERSAWN RED OAK (4.3 Bd. Ft.)



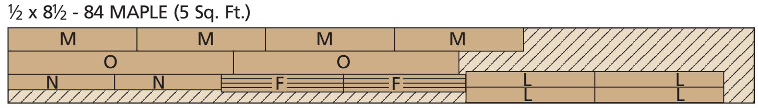
3/4 x 8 1/2 - 96 QUARTERSAWN RED OAK (5.7 Bd. Ft.)



3/4 x 8 1/2 - 96 QUARTERSAWN RED OAK (5.7 Bd. Ft.)



1/2 x 8 1/2 - 84 MAPLE (5 Sq. Ft.)



CASE

The case for the Craftsman's Tool Chest is simple enough. It has just two sides made from ¾"-thick hardwood, and a frame and panel back that form an open, U-shaped frame *(Fig. 1)*.

Note: I used quartersawn red oak and riftsawn (straight-grained) oak plywood for the tool chest.

BACK. Like the sides and back of the Rolling Tool Cabinet, the back of the tool chest is just a wood frame that surrounds a plywood panel. The frame pieces are made from hardwood stock and consist of two stiles (A) and two rails (B) that are identical in width *(Fig. 1)*. Once the rails and stiles have been ripped to width they can be cut to length.

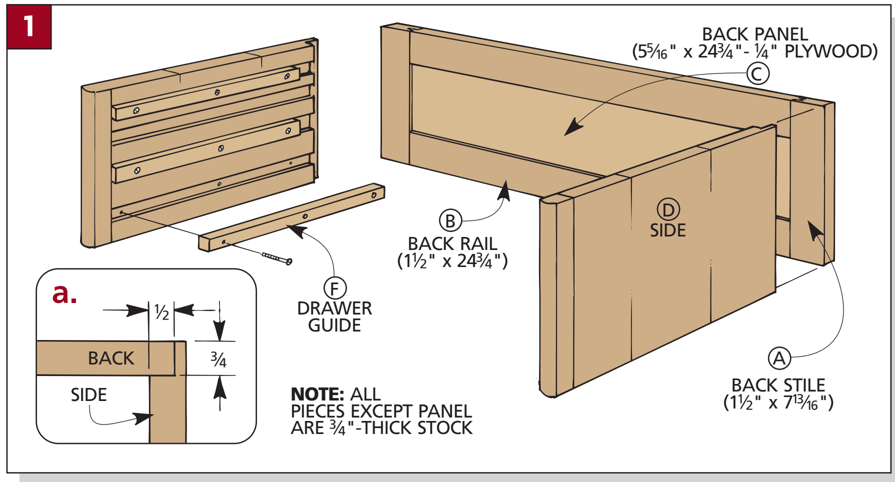
STUB TENONS AND GROOVES. Now, to accept the plywood panel, a groove is cut in the inside edge of each stile and rail *(Fig. 2a)*. And then to connect the frame pieces, stub tenons are cut on the ends of each rail. These tenons should be sized to fit the grooves *(Fig. 2b)*.

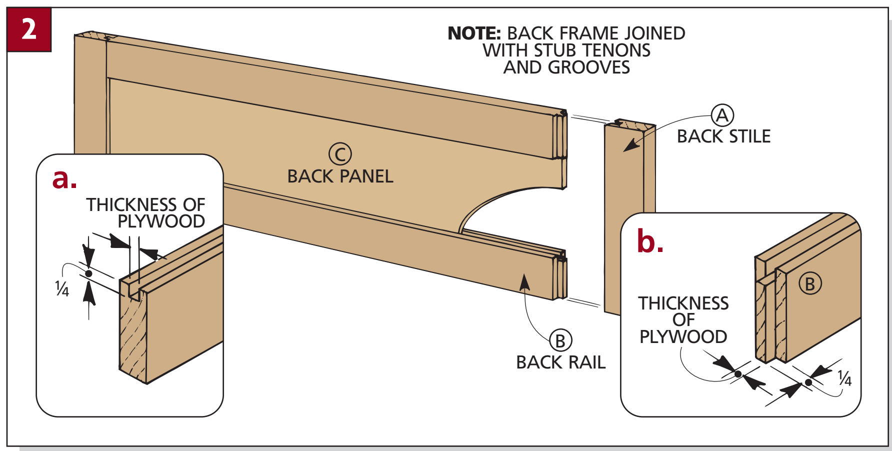
PANELS. With the frame joinery complete, you can add the plywood back panel (C). The panel is simply cut to size and glued in the frame.

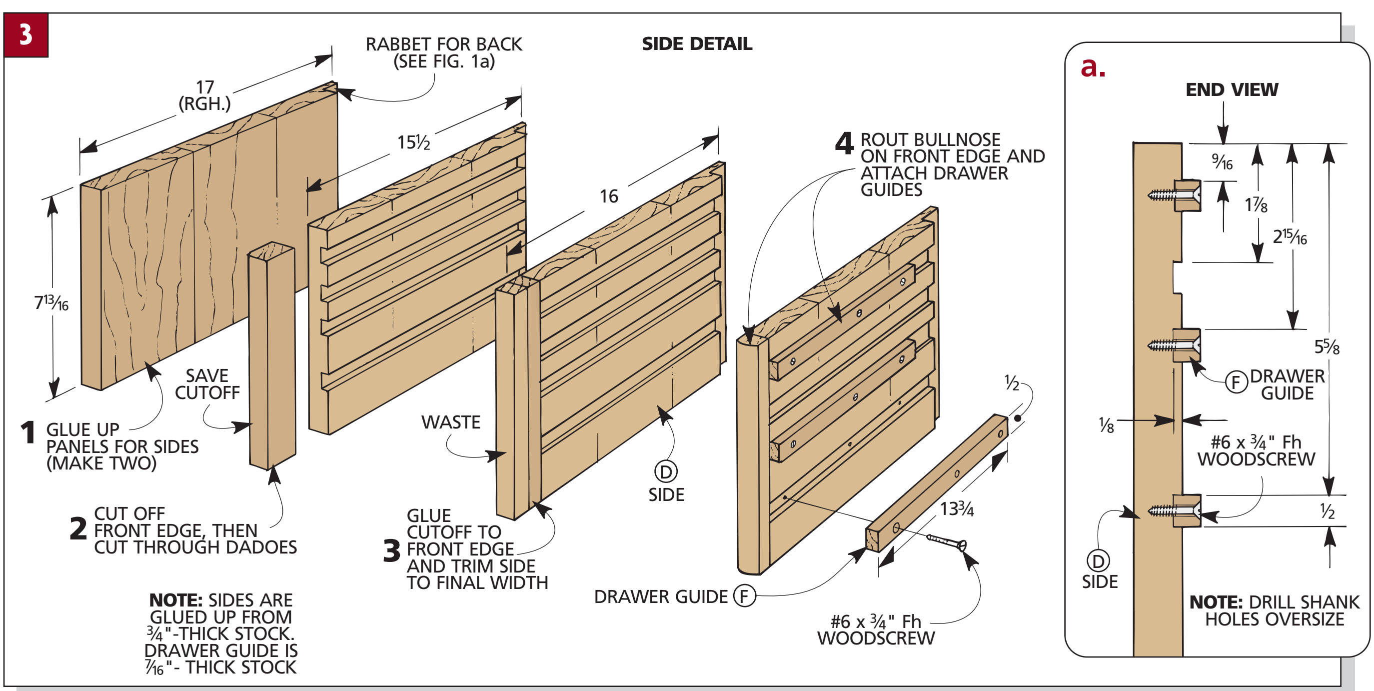
SIDES. Now that the back has been built, the next step is to add the two hardwood case sides *(Fig. 3)*. Besides enclosing the case, the sides support the wood guides for the drawers.

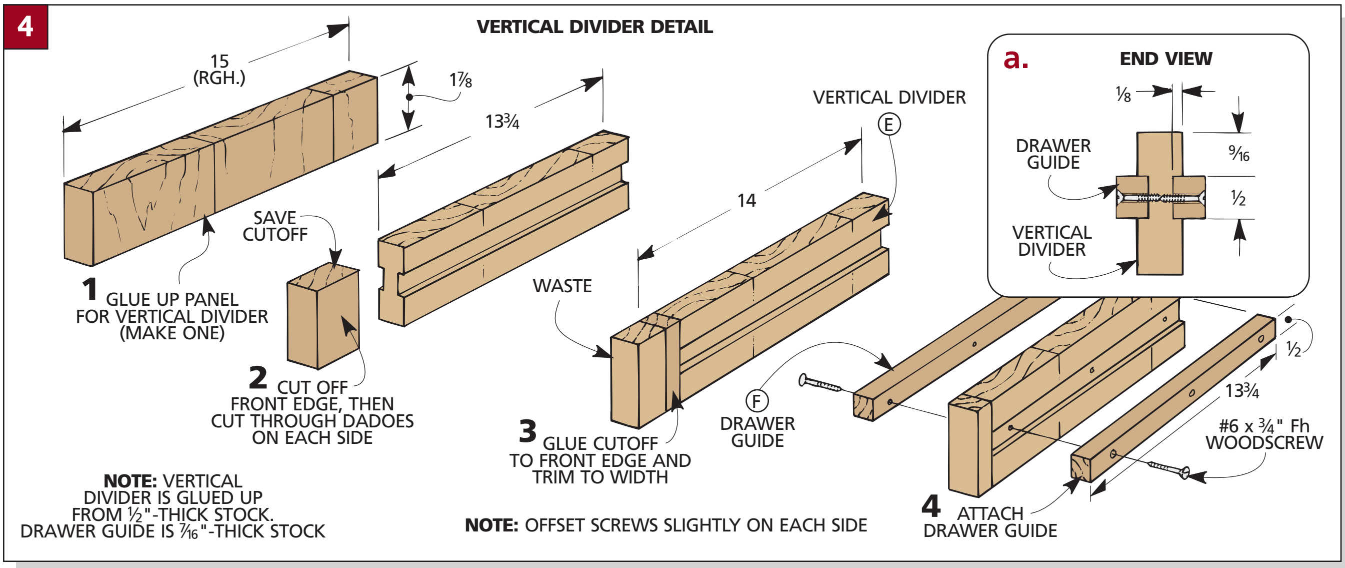
VERTICAL DIVIDER. In addition to the drawer guides on the sides, the vertical divider that separates the top two drawers also supports a pair of drawer guides *(Fig. 4)*. So it's easiest to work on it at the same time as you make the sides.

SOLID WOOD PANELS. To provide additional strength, both the sides (D) and the vertical divider (E) are made by gluing up solid wood panels *(Figs. 3 and 4)*.









I made the sides from $^3/_4$"-thick hardwood, and the vertical divider is made from $^1/_2$"-thick hardwood. But the thing to be aware of here is that the grain direction of these panels runs vertically. This way, as the wood expands and contracts with changes in humidity, the side panels will move with the top and bottom of the case — instead of against them.

When the glue dries, the panels can be cut to final length (height). But to make it easier later when cutting stopped dadoes for the drawer guides, they're oversized in width.

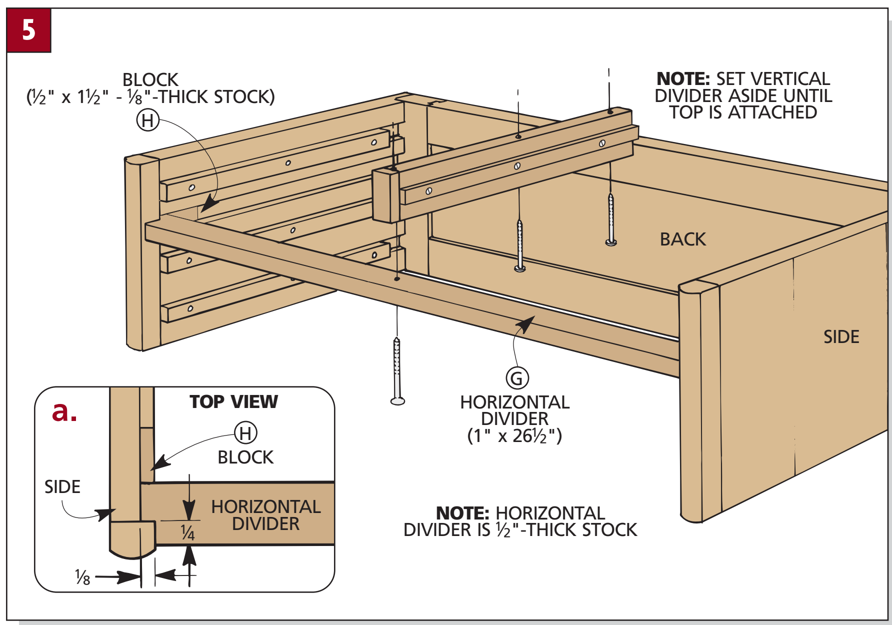
RABBET. Before cutting the dadoes, there's one more thing you need to do. That's to rabbet the back edge of each side (not the vertical divider) to accept the back of the chest *(Fig. 1a)*.

STOPPED DADOES. Now you can turn your attention to the stopped dadoes. One dado (the second one from the top on each side) accepts a horizontal divider that's added later. The others hold the drawer guides in place *(Fig. 3a)*.

To keep the drawers from binding, it's important for these dadoes to align. At first, this sounds simple — just cut the dadoes in pairs using the same fence setting (and the same reference edge) on the table saw. But there's a problem.

After cutting one dado, the only way to cut the matching dado is to flip the side (or the vertical divider) end for end. This means you'd be cutting *through* the front edge of the panel. To get around this, I used a slightly unorthodox technique.

The idea is simple. To start, cut the front edge off each panel (save the cutoff) *(Step 2 in Figs. 3 and 4)*. This way, after cutting *through* dadoes, you can glue the cutoff back in place to form the *stopped* dadoes *(Step 3 in Figs. 3 and 4)*.



You'd think this technique would create an obvious glue line. But because the grain of the panels is oriented up and down, you're gluing two pieces together with matching face grain, creating a glue joint that's nearly invisible.

CUT TO WIDTH. After the glue dries, cut the sides (D) and vertical divider (E) to final width *(Step 3 in Figs. 3 and 4)*. To match the profile on the edges of the Rolling Tool Cabinet, you should rout a bullnose on the front edges of each side (refer to *Fig. 1d* on page 90).

DRAWER GUIDES. Now it's just a matter of cutting the drawer guides (F) to fit the dadoes. These are strips of hardwood that are screwed (not glued) in place.

Note: I drilled the shank holes in the guides slightly oversize. This will allow the case to expand and contract with changes in humidity.

HORIZONTAL DIVIDER. With the guides in place, I added a horizontal divider (G) to separate the top and bottom drawers *(Fig. 5)*. It's made from a $^1/_2$"-thick piece of hardwood cut to length to fit between the dadoes in the sides. Then it's notched at each end so it fits around the front edge of each side *(Fig. 5a)*.

ASSEMBLY. All that's left is to assemble the case. Doing this is just a matter of slipping in the horizontal divider, then gluing and clamping the sides and back together. Finally, to hold the horizontal divider in place, I glued short blocks (H) into the dadoes behind it *(Fig. 5)*.

TOP & BOTTOM

The case of the tool chest is sandwiched between two solid wood panels — one for the top and the other for the bottom.

Both the top and bottom (I) are made by gluing up pieces of ¾"-thick stock *(Fig. 6)*. The idea here is to orient the pieces so there's edge grain in front and back of the panels. This way, the top and bottom will move together with the sides (across their width) as they expand and contract with changes in humidity.

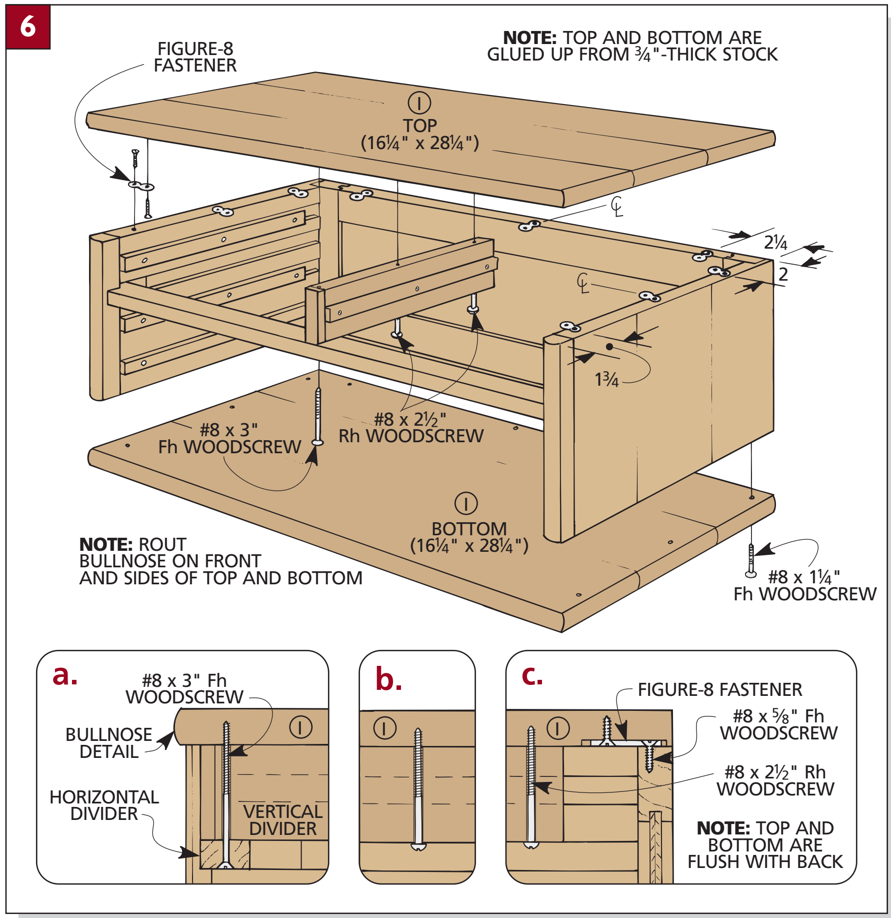
BULLNOSE. After gluing up the panels, there's one more thing to do. That is to soften the edges by routing a bullnose profile on the front and sides of each panel. I used a ½" roundover bit to do this, making a pass on each side *(Fig. 6a)*.

ATTACH TOP. Now you're ready to attach the top. I decided to use figure-8 fasteners to hold it in place, but not because of wood movement. (Remember, the panels will all move together.) Instead, the fasteners are just an easy way to attach the top without any hardware showing on the surface.

The figure-8 fasteners are recessed by drilling a series of pockets in the top *(Fig. 7)*. Then the fasteners are screwed to the sides and back of the case *(Fig. 6)*. (See the Hardware box on page 93.)

To attach the top, it's easiest to lay it upside down on a work surface *(Fig. 8)*. Then, after positioning the case so the top extends an equal amount on each side (and it's flush at the back), simply screw the top in place.

VERTICAL DIVIDER. At this point, you can attach the vertical divider to the top. It's held in place with three screws. A long flathead woodscrew passes through holes drilled through each divider and into the top *(Figs. 6a and 8)*. And shorter roundhead woodscrews are installed in the center and back *(Figs. 6b and 6c)*.



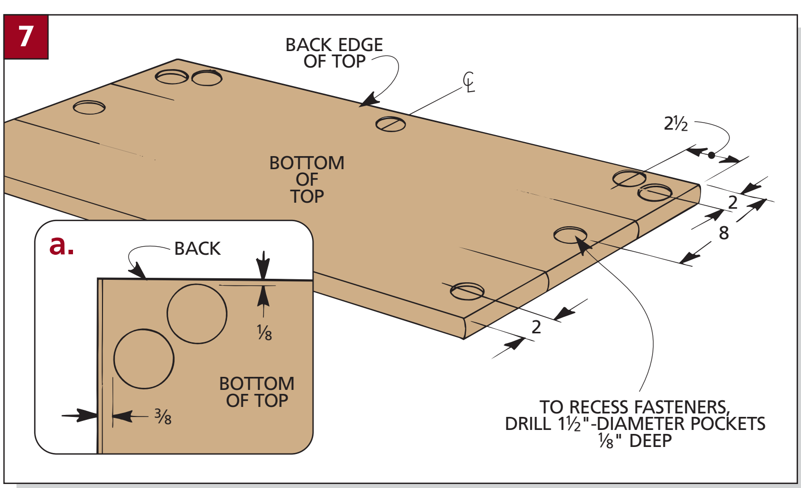
ATTACH BOTTOM. All that's left to complete the assembly is to screw the bottom to the sides and back of the case *(Fig. 6)*.

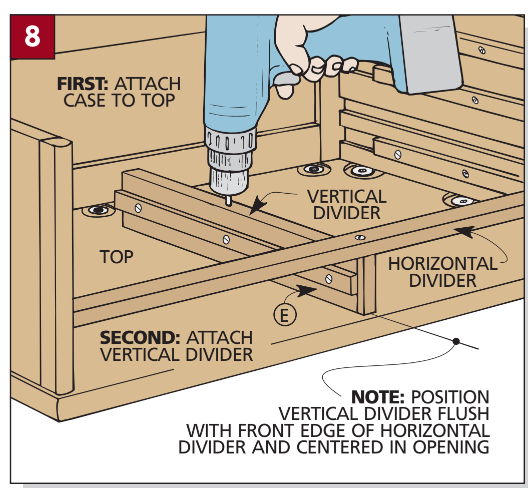
DRAWERS

I wanted my tool chest to hold different size hand tools, so I built it with two narrow drawers on top and two wide drawers at the bottom. They slide in and out of the tool chest on the wood drawer guides installed earlier.

LOCKING RABBET. The drawers are held together with locking rabbet joints. But before cutting the joints, there are a couple of things worth mentioning.

First, the drawer fronts, backs, and sides are all sized to create a $^1/_{16}$" gap all the way around. And second, there's no need for a lip on the front of the drawer. Instead, the front is flush with the sides of the drawer *(Fig. 9c)*.



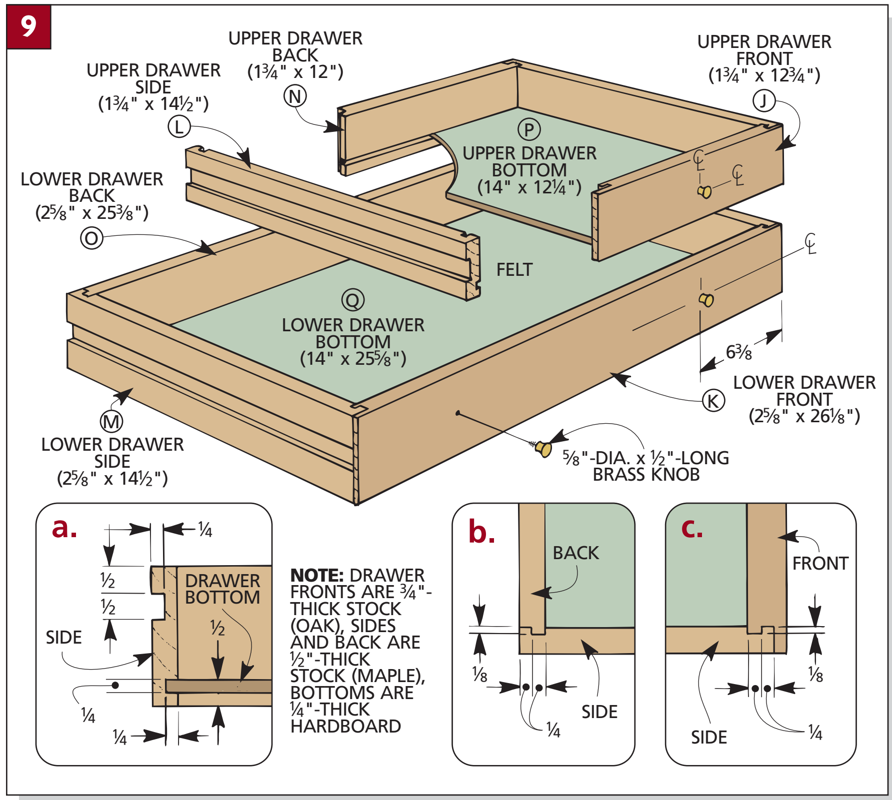


RECESSED GUIDES. The reason for this is simple. When the drawers are installed, the wood guides are recessed into grooves in the sides of the drawers. So they're hidden by the drawer front. As a result, you don't need a lip to cover them like you do with the metal slides on the Rolling Tool Cabinet.

Other than that, building the drawers is fairly straightforward. After cutting the drawer fronts (J, K), sides (L, M), and backs (N, O) to size, it's just a matter of cutting the locking rabbet joints on the ends of each piece *(Figs. 9b and 9c)*. (To learn more about how to make locking rabbet drawer joints, see the Joinery article on page 96.)

GROOVES. Before assembling the drawers, you'll need to cut the grooves in the side pieces for the drawer guides. To create a consistent 1/16" gap, the grooves are located 1/2" down from the top of each drawer side *(Fig. 9a)*.

In addition to the grooves for the drawer guides, you'll also need to cut grooves for the 1/4"-thick hardboard drawer bottoms (P, Q) *(Figs. 9 and 9a)*. Then just glue up the drawers.



FINAL DETAILS. To complete the chest, I added a set of brass knobs. These just screw into the drawer fronts. A single knob is centered on each of the upper drawer fronts, but there are two knobs on the lower drawer fronts *(Fig. 9)*.

FELT LINING. As a final touch, you could line the drawer bottoms with felt (see the Designer's Notebook below). The felt lining not only helps show off your hand tools, it also does a good job of protecting them from nicks and scratches.

DESIGNER'S NOTEBOOK

After taking the time to build this beautiful chest, it just makes sense to line the drawers with felt.

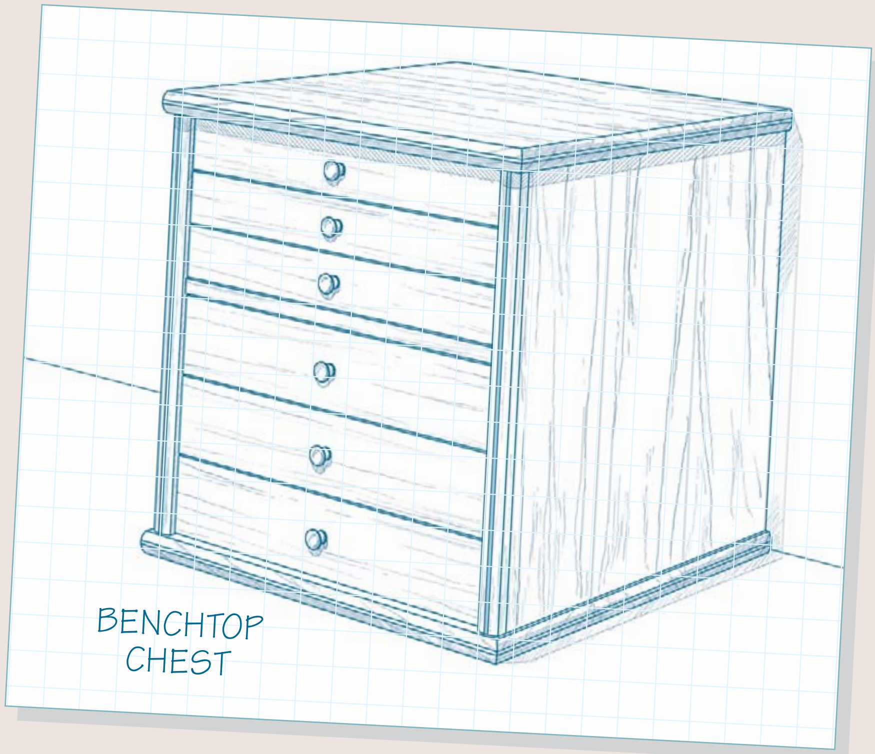
FELT LINING

- A surefire method to make the drawers on your tool chest stand out is to use contrasting woods. That's why I made the drawer fronts from oak and the sides (and back) from maple.

  But for the drawer bottoms I wanted to save some money, so I used hardboard. The problem is, hardboard just doesn't look that good. So I decided to "line" them. And nothing shows off a set of tools better than a drawer lined with felt (see photo). Plus it's easy to install.
- Start by using some spray adhesive to attach an oversized piece of felt to a piece of posterboard that's cut to fit the drawer bottom. Then simply wrap the felt around the posterboard. Trim it so it will lie flat and press it into the drawer bottom.
- If you choose to build the Rolling Tool Cabinet (page 88), those drawers would look great if they're lined with felt as well.

DESIGNER'S NOTEBOOK

You'll get almost the same amount of storage (and the same good looks) in a smaller footprint with this space-saving Benchtop Chest. It features six drawers arranged vertically inside the case.



CONSTRUCTION NOTES:

■ This chest is a perfect complement to the Rolling Tool Cabinet (page 88) and the Craftsman's Tool Chest.

Most of the workpieces have changed size. Plus, a change in the orientation of the drawers means you'll no longer need the vertical divider.

■ As before, start by building the case. The back is a simple wood frame with 1½"-wide stiles and rails surrounding a plywood panel. After ripping the back stiles (A) and the back rails (B) to width, go ahead and cut them to length.

■ Now cut the stub tenon and groove joints on these pieces *(Figs. 1 and 1a)*. Then cut the back panel (C) to size and glue it into the frame.

■ Once the back is complete, begin work on the sides (D). Each is made from three hardwood pieces, glued up to make a pair of wide panels *(Fig. 2)*. These panels have dadoes cut in them for the solid wood guides that support the drawers.

■ When the glue has set up, the sides can be cut to length (height), but leave them oversized in width. Then you can cut off the front edge as before, making it easy to cut the through dadoes. Before cutting the dadoes though, you need to rabbet the back edge on each side piece to accept the back frame *(Fig. 2)*.

■ Now lay out and cut the dadoes for the hardwood drawer guides and the horizontal divider added later.

■ With the dadoes cut, glue the cutoff back onto the front edge of the side panel, and cut the sides to final width. Then rout the bullnose profile on the front edges of each side *(Fig. 2)*.

■ Next, cut the drawer guides (F) to fit and screw them in place (no glue) in the dadoes you cut in the sides *(Fig. 2)*.

■ Now you can glue up the ¾"-thick stock for the top and bottom (I).

MATERIALS LIST

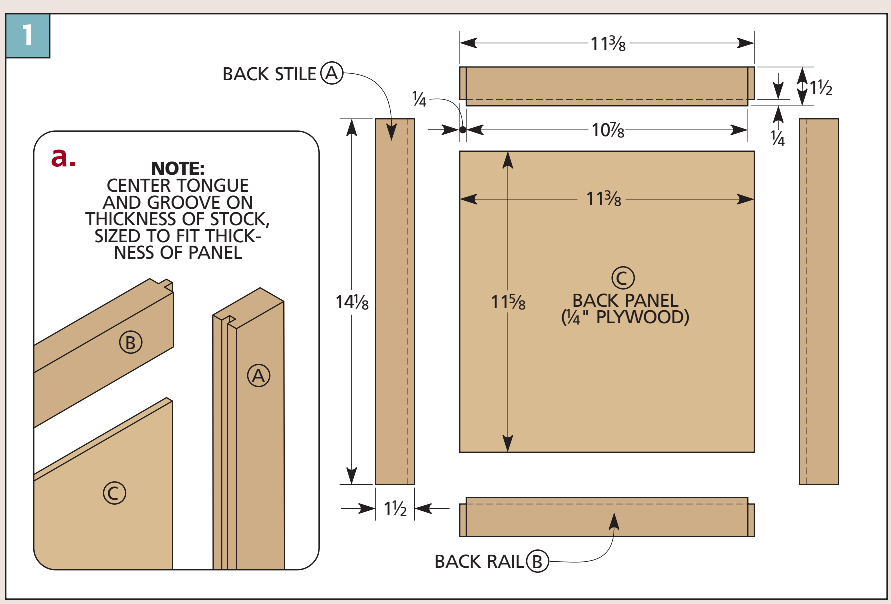
CHANGED PARTS

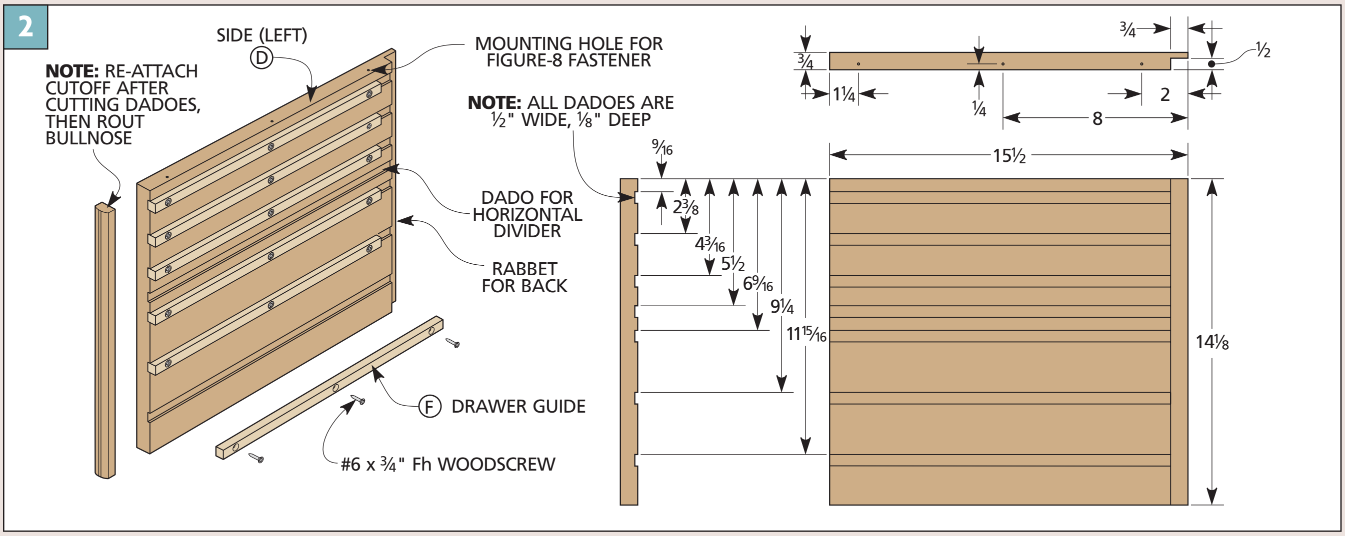
A	Back Stiles (2)	¾ x 1½ - 14⅛
B	Back Rails (2)	¾ x 1½ - 11⅜
C	Back Panel (1)	¼ ply - 11⅝ x 11⅜
D	Sides (2)	¾ x 15½ - 14⅛
F	Drawer Guides (12)	7/16 x ½ - 13¾
G	Horiz. Divider (1)	½ x 1 - 13⅛
I	Top/Bottom (2)	¾ x 16¼ - 14⅞
J	Upr. Drwr. Fronts (3)	¾ x 1¾ - 12¾
K	Lwr. Drwr. Fronts (3)	¾ x 2⅝ - 12¾
L	Upr. Drwr. Sides (6)	½ x 1¾ - 14½
M	Lwr. Drwr. Sides (6)	½ x 2⅝ - 14½
N	Upr. Drwr. Backs (3)	½ x 1¾ - 12
O	Lwr. Drwr. Backs (3)	½ x 2⅝ - 12
P	Upr. Drwr. Btms.(3)	¼ hdbd. - 14 x 12¼
Q	Drawer Bottoms (3)	¼ hdbd. - 14 x 12¼

Note: Do not need part E.

HARDWARE SUPPLIES

(36) No. 6 x ⅝" Fh woodscrews
(14) No. 8 x ⅝" Fh woodscrews
(7) No. 8 x 1¼" Fh woodscrews
(7) Figure-8 fasteners





Note: When gluing up the boards for these pieces, be sure to orient them so the edge grain faces the front and back of the case. That way, the sides, top, and bottom will all expand and contract in the same direction.

After the glue dries, rout the bullnose on the front and sides of both the top and bottom to match the sides pieces *(Fig. 3)*.

■ Next, cut the horizontal divider (G) to length and notch it to fit in the shallow dadoes in the sides *(Fig. 3)*.

■ I assembled the case by slipping the horizontal divider in the dadoes first. Then I glued and clamped the side and back. And once again, I glued short blocks (H) in the dadoes behind the divider. This helps hold the horizontal divider in place.

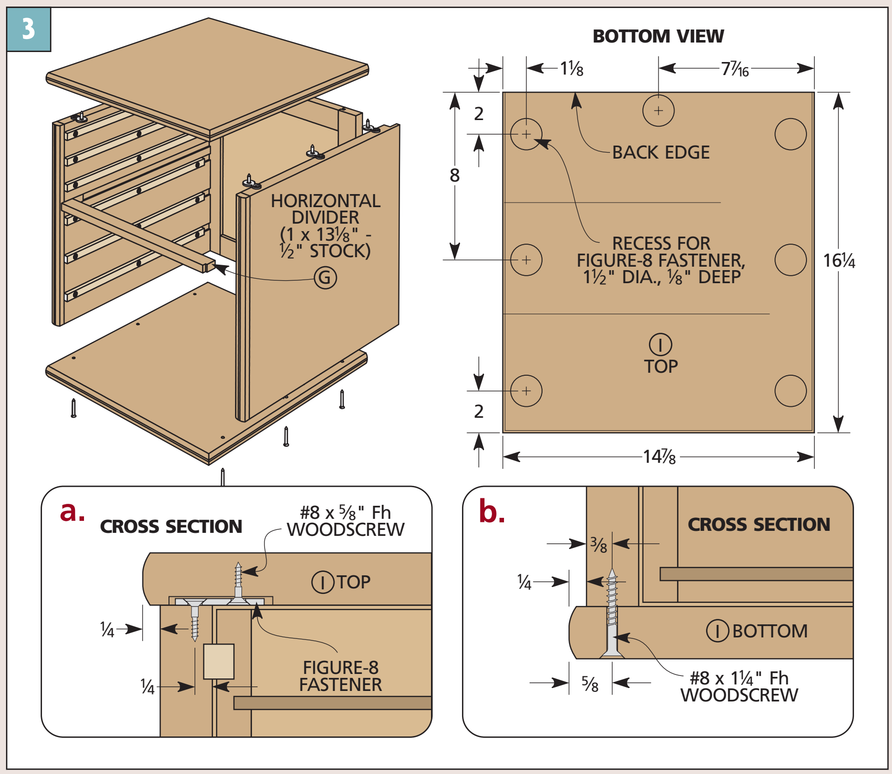
■ Now you can attach the top to the sides and back with figure-8 fasteners, drilling pockets in the bottom side as before *(Figs. 3 and 3a)*. After that, screw the bottom to the back and sides to complete the assembly *(Figs. 3 and 3b)*.

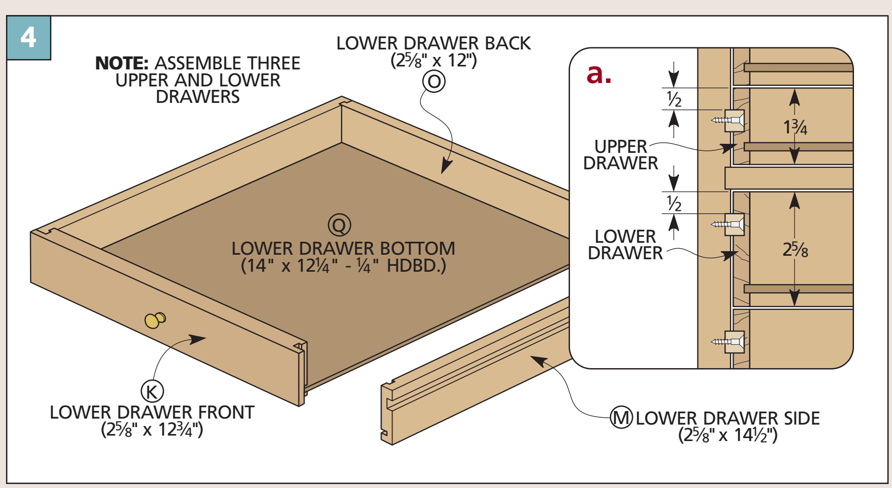
■ The Benchtop Chest has three shallow drawers on top and three deeper drawers at the bottom. The drawers are held together with locking rabbet joints and the fronts should be flush with the sides of the drawers *(Fig. 4)*.

■ The upper drawers are the same size as previously, but the lower drawers are now narrower, so go ahead and cut new fronts (K), sides (M), and backs (O) to size. Then cut the locking rabbet joints on the ends of each piece *(Fig. 4)*.

■ Cut the grooves in the sides for the drawer guides. And cut a groove for the drawer bottoms (Q) *(Fig. 4a)*.

■ Finally, glue up the drawers and add the brass knobs (centered on the drawer fronts). I also lined the drawers with felt.





Cabinetmaker's Tool Chest

Designed to protect your best tools for generations to come, this chest's many features — including veneered panels and a two-part locking system — make it a challenging, yet gratifying project to build.

There's been quite a bit of envy among recent visitors to my shop. One look at this Cabinetmaker's Tool Chest makes it easy to see why.

With its figured wood and solid brass hardware, the chest provides safekeeping for my fine hand tools.

But the real treasure isn't the chest, or even the tools inside. It's all the interesting woodworking challenges that building a chest like this presents.

FRAME AND PANEL. The main case is made up of several frame and panel assemblies. The frames are solid wood. But the panels only appear to be. They're actually pieces of hardboard covered with bird's-eye maple veneer on both sides.

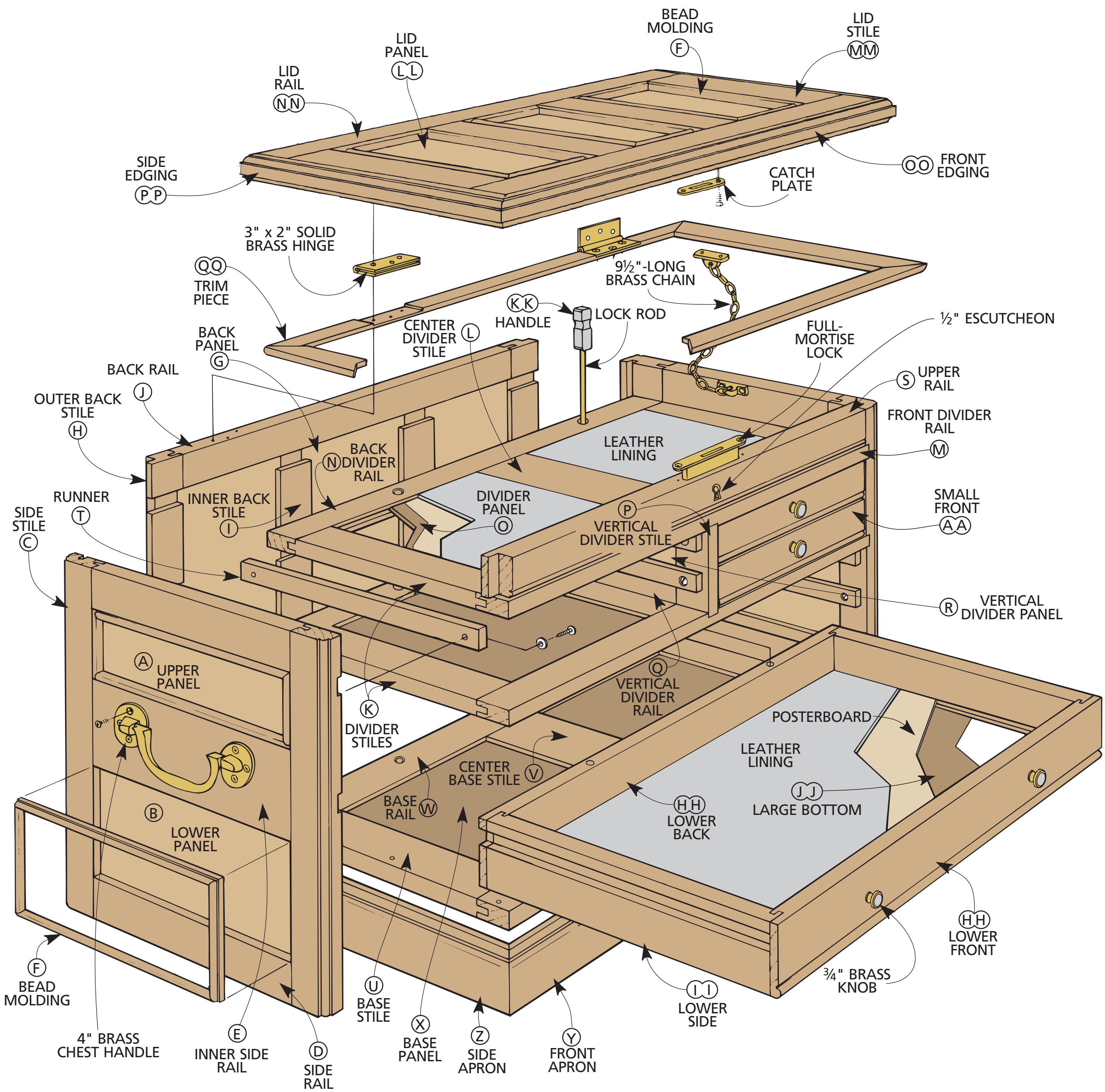
BEADS. Another interesting part of building this chest is making two types of decorative beads. One is routed on the drawer fronts, the other is molding applied to the panels.

HARDWARE. A beautiful tool chest deserves some special hardware. The solid brass drawer knobs have a "turned" wood plug. A pair of heavy-duty handles on the sides allow you to get a good grip for carrying your tools.

LOCK SYSTEM. Also featured is a unique two-part system that locks the drawers and lid. It keeps your tools secure and keeps the drawers closed when you need to move the chest.

EXPLODED VIEW

OVERALL DIMENSIONS:
25W x 13D x 15$^{7}/_{16}$H



MATERIALS LIST

SIDES
- **A** Upper Panels (2) 1/8 hdbd. - 3 3/16 x 9 3/4
- **B** Lower Panels (2) 1/8 hdbd. - 4 3/4 x 9 3/4
- **C** Side Stiles (4) 3/4 x 1 1/2 - 12 7/16
- **D** Side Rails (4) 3/4 x 1 1/2 - 9 3/4
- **E** Inner Side Rails (2) 3/4 x 3 - 9 3/4
- **F** Bead Molding 3/8 x 5/16 - 360 rough

BACK
- **G** Back Panels (3) 1/8 hdbd. - 6 3/4 x 10 3/16
- **H** Outer Bk. Stiles (2) 3/4 x 1 - 12 7/16
- **I** Inner Bk. Stiles (2) 3/4 x 1 1/2 - 10 3/16
- **J** Back Rails (2) 3/4 x 1 1/2 - 21 3/4

DIVIDERS
- **K** Divider Stiles (4) 1/2 x 1 1/2 - 9 3/4
- **L** Ctr. Dvdr. Stiles (2) 1/2 x 3 - 9 3/4
- **M** Fr. Divider Rails (2) 1/2 x 1 1/2 - 22 3/4
- **N** Bk. Divider Rails (2) 1/2 x 7/8 - 22 3/4
- **O** Divider Panels (4) 1/4 hdbd. - 9 1/8 x 9 3/4
- **P** Vert. Dvd. Stiles (2) 3/4 x 1 1/2 - 3 7/16
- **Q** Vert. Dvd. Rails (2) 1/2 x 1 1/2 - 9 1/8
- **R** Vert. Dvd. Panel (1) 1/4 hdbd. - 1 3/16 x 9 1/8
- **S** Upper Rail (1) 3/4 x 1 1/2 - 23
- **T** Runners (14) 1/4 x 5/8 - 11

BASE
- **U** Base Stiles (2) 1/2 x 1 1/2 - 9 5/8
- **V** Ctr. Base Stile (1) 1/2 x 3 - 9 5/8
- **W** Base Rails (2) 1/2 x 1 1/2 - 23 7/8
- **X** Base Panels (2) 1/4 hdbd. - 9 11/16 x 9 5/8
- **Y** Fr./Bk. Aprons (2) 1/2 x 1 3/4 - 24 7/8
- **Z** Side Aprons (2) 1/2 x 1 3/4 - 12 7/8

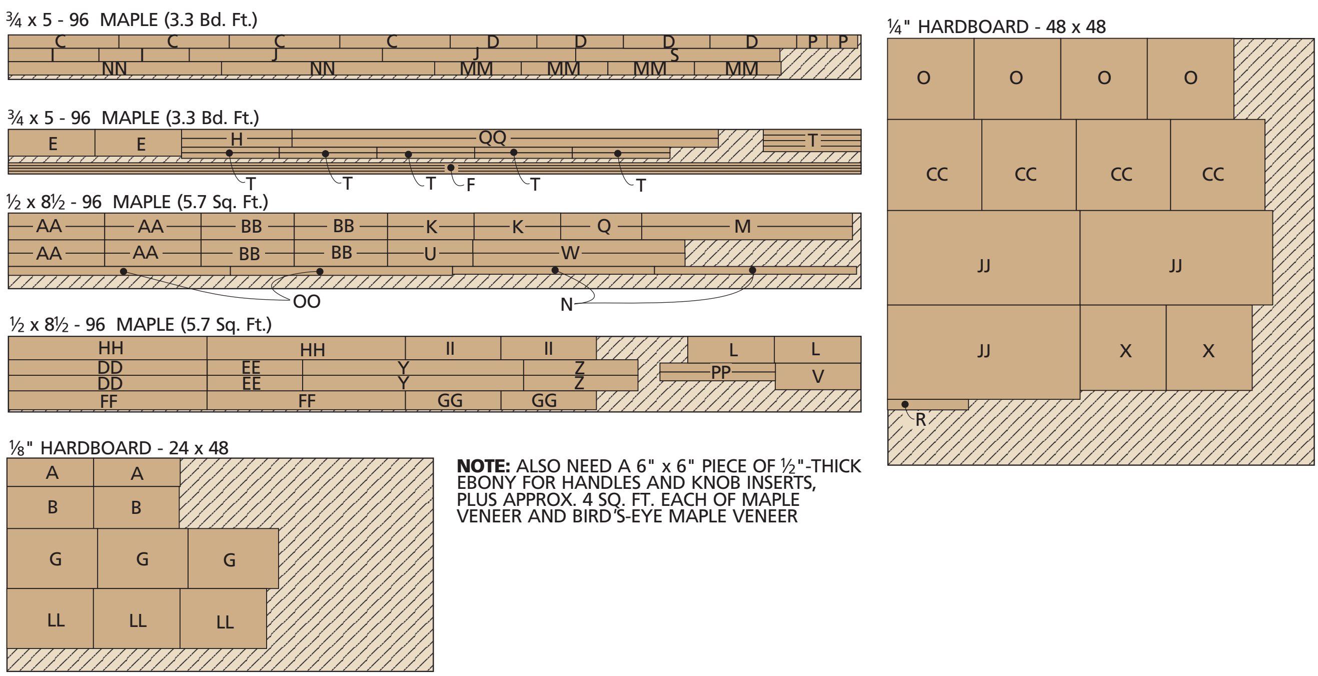
SMALL DRAWERS
- **AA** Small Fr./Bks. (8) 1/2 x 1 1/2 - 10 27/32
- **BB** Small Sides (8) 1/2 x 1 1/2 - 10 3/4
- **CC** Small Bottoms (4) 1/4 hdbd. - 10 1/4 x 10 5/8

LARGE DRAWERS
- **DD** Upper Fr./Bks. (2) 1/2 x 1 3/4 - 22 11/32
- **EE** Upper Sides (2) 1/2 x 1 3/4 - 10 3/4
- **FF** Mdl. Fr./Backs (2) 1/2 x 2 1/8 - 22 11/32
- **GG** Middle Sides (2) 1/2 x 2 1/8 - 10 3/4
- **HH** Lwr. Fr./Backs (2) 1/2 x 2 5/8 - 22 11/32
- **II** Lwr. Sides (2) 1/2 x 2 5/8 - 10 3/4
- **JJ** Large Btms. (3) 1/4 hdbd. - 21 11/16 x 10 5/8
- **KK** Handles (2) 1/2 x 1/2 - 1 1/2

LID
- **LL** Lid Panels (3) 1/8 hdbd. - 6 3/4 x 9 3/4
- **MM** Lid Stiles (4) 3/4 x 1 1/2 - 9 3/4
- **NN** Lid Rails (2) 3/4 x 1 1/2 - 24
- **OO** Fr./Bk. Edg. (2) 1/2 x 1 - 25
- **PP** Side Edging (2) 1/2 x 1 - 13
- **QQ** Trim Pieces 1/4 x 15/16 - 155 rough

HARDWARE SUPPLIES
- (12) No. 6 x 1/2" Fh brass woodscrews
- (12) No. 6 x 5/8" Fh brass woodscrews
- (9) No. 6 x 1 1/2" Fh woodscrews
- (28) No. 4 x 1/2" Ph sheet-metal screws
- (28) 5/32"I.D. x 3/8"O.D. flat washers
- (1) Brass lock w/ 1/2" escutcheon
- (1 pr.) 4" brass chest handles
- (1 pr.) 3" x 2" solid brass hinges
- (10) 3/4" brass insert knobs w/ screws
- (2) 9 1/2"-long brass chest chains
- (2) 3/16"-dia. x 12" brass rods
- (1 pc.) 48" x 48" posterboard
- (1 pc.) 48" x 48" deerskin

CUTTING DIAGRAM



NOTE: ALSO NEED A 6" x 6" PIECE OF 1/2"-THICK EBONY FOR HANDLES AND KNOB INSERTS, PLUS APPROX. 4 SQ. FT. EACH OF MAPLE VENEER AND BIRD'S-EYE MAPLE VENEER

CASE

I began work on the Cabinetmaker's Tool Chest by building a U-shaped case. It consists of two sides and a back that are made up of small, veneered panels surrounded by solid wood frames.

PANELS. Start by cutting the upper (A), lower (B), and back (G) panels to size from hardboard *(Fig. 1)*. Then to create the appearance of solid wood, they're covered with maple veneer.

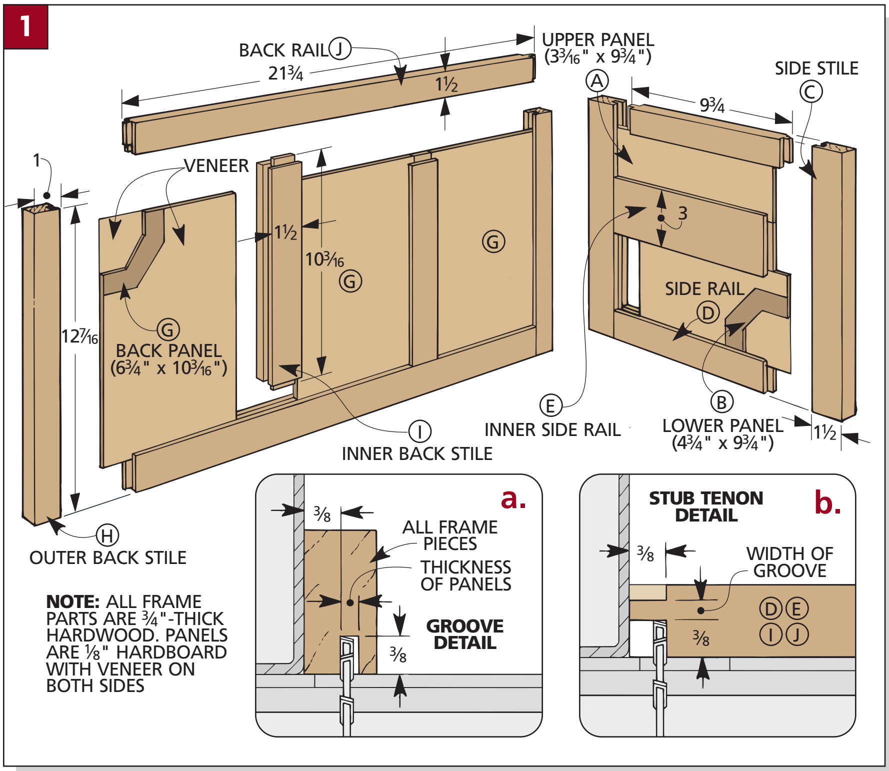
Note: To keep the panels from warping, it's important to apply veneer to *both* sides of each panel.

First, I glued bird's-eye maple veneer to one side. It creates a dramatic look on the "show" side. But the other side will be hidden, so I used plain maple veneer. (To learn more on veneering panels, see the Technique article on page 112.)

FRAMES. The next step is to "wrap" the panels with hardwood frames. The side frames are made up of two side stiles (C), two side rails (D), and an inner rail (E). The back frame has two outer (H) and inner (I) stiles each and a pair of back rails (J) *(Fig. 1)*.

STUB TENON AND GROOVE. These frame pieces are assembled with stub tenon and groove joints. This means that instead of a mortise, there's a groove in the frame piece that houses a short (stub) tenon. This groove also holds the panel.

Note: There's a groove in *each* edge of the *inner* rail and stiles (E, I).



OFFSET GROOVES. One thing to be aware of is that the grooves are offset toward the *inside* face of each frame piece. The reason is simple. The offset grooves recess the panels far enough into the frame so that when the bead molding is added later, the molding will sit flush with the face of the frame.

GROOVE WIDTH. Another thing to consider is the *width* of the grooves. This is determined by the thickness of the panels.

You want the panel to fit the groove with a "friction fit." To accomplish this, use a combination saw blade and cut each groove by making two passes.

Start by locking the rip fence on the table saw so it's 3/8" away from the inside of the saw blade *(Fig. 1a)*. Then, after making one pass on each frame piece, nudge the fence away from the blade and make a second pass. Test the fit of a veneered panel in the groove, and nudge the fence again to sneak up on the final width of the groove.

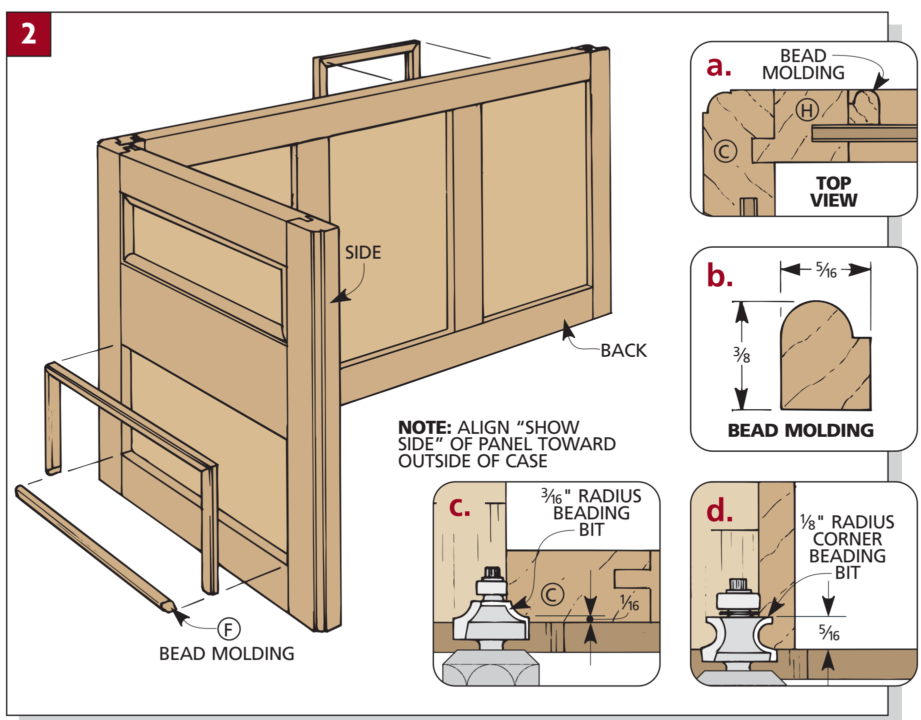
CUT TENONS. Now you're ready to cut the stub tenons. The tenons need to be offset by the same amount as the grooves. Otherwise, the frame pieces won't fit flush with each other.

So start by setting the height of the saw blade to match the offset and cut the first cheek *(Fig. 1b)*. Now lower the blade and flip the workpiece over to cut the second cheek. Continue raising the blade in small increments and making additional passes until you sneak up on the final thickness of the tenon.

GLUE-UP. After cutting all the stub tenons, you can glue up the frames for the sides and back. Just remember to orient the "show side" of the panels so they face the *outside* of the frame *(Fig. 2)*.

TONGUE & GROOVE

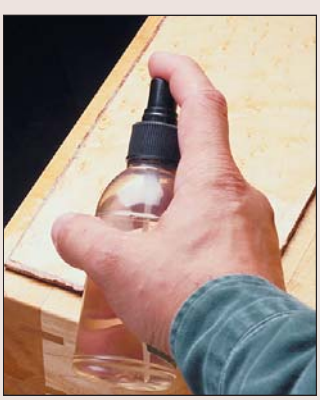
Once the glue dries on all the frames, the next step is to cut the joinery that's used to assemble the sides and back frames to each other. I used a simple tongue and groove joint *(Fig. 2a)*. Cutting this joint is a two-step process.



SHOP TIP

Veneer Decurler

If the veneer curls up when you place it on the core piece, mist it lightly with water to make it lie flat.



TECHNIQUE . . . Veneering Small Panels

Typically, veneer comes in random length pieces. So you often have to edge-glue pieces together to cover a large surface.

But applying veneer to small panels like those on the tool chest is considerably easier. They can usually be covered without having to match sheets of veneer together.

Another advantage of working with small pieces of veneer is it doesn't require special clamps. Just a few bar clamps provide all the pressure needed (see photo at right).

CUTTING VENEER

You won't need any special tools to cut the veneer either. A utility knife and straightedge work just fine.

GRAIN PATTERN. But before making a single cut, pay attention to the grain pattern and color of the veneer. Sometimes the grain is so "wild," it's difficult to visualize how the veneer will look once it's applied to the panel.

PICTURE FRAME. One way to simplify things is to make a "picture frame" out of posterboard. Cut a frame with an opening to match the size of your panel. Then by sliding the frame across the sheet of veneer, you can see exactly how the panel will look once it's covered with veneer.

Occasionally you'll "zero in" on an area only to find a split or crack in the veneer. Fortunately, these splits or cracks are easy to fix with a little veneer tape and some glue (see photo below).

MAKING CLEAN CUTS. After marking the desired section, you're ready to cut the veneer from the sheet. Be aware that veneer splits easily. And even with a sharp blade, it's possible to tear the wood fibers.

Repairing Veneer. *If a piece of veneer is split, fixing it is simple using veneer tape and glue to create a "seamless" joint.*

So to prevent tearout when cutting across the grain, I lightly score the wood fibers first. Then just snap the veneer along the score line. When cutting with the grain, the blade may *follow* the grain line. So hold the knife firmly against the straightedge to prevent it from wandering.

OVERSIZE PIECES. No matter how careful you are when cutting veneer, there's still likely to be some chipout. So to end up with a crisp, clean edge, it's best to start with an oversize piece of veneer (about 1/2" longer and wider than the desired size of the panel). Then glue it onto a core piece that's about 1/8" larger than the veneer. This way, when the panel is trimmed to size, any small splits near the edge are removed.

GLUING & CLAMPING

Once the veneer is cut to rough size, the next step is to glue it onto the core piece. I use a simple "press" to glue the veneer down flat (see photos above and at right).

Note: To ensure the panel stays flat, I added veneer to both sides of the hardboard core piece ('A' in photo).

GLUE. Another thing to consider is the type of glue you use. Yellow woodworker's glue works fine with tight-grained woods. But for open-grained woods like oak or mahogany (or highly-figured wood), I use a gap-filling glue that doesn't absorb into the wood fibers.

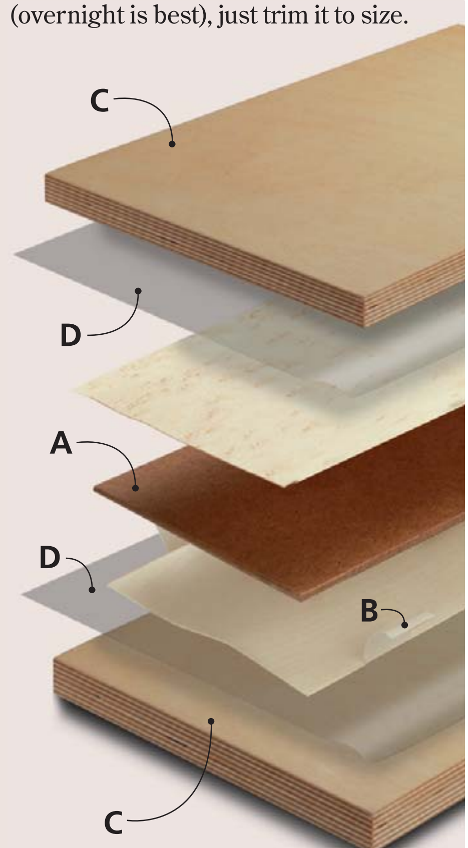
TAPE. After covering both sides of the core piece, it's a good idea to tape the veneer in place ('B' in photo). The tape prevents the veneer from slipping around the core piece once pressure is applied.

Note: I use drafting tape because it's easy to remove.

CLAMPING BLOCKS. When you clamp the veneer to the core piece, the goal is to distribute the pressure evenly across the entire surface. An easy way to do this is to slip the panel between two plywood blocks ('C' in photo) and clamp the "layer cake" together.

Note: Slipping in a couple of pieces of waxed paper ('D' in photo) will prevent the panel from sticking to the clamping blocks.

DRY TIME. Once the glue sets up (in about an hour), you can remove the panel from the clamping blocks. It will still feel damp to the touch. So stand the panel on edge to allow air to circulate around it. When the panel is completely dry (overnight is best), just trim it to size.



Veneer Press. *The core piece (A) and veneer (B) are sandwiched between two pieces of plywood (C). Waxed paper (D) separates the plywood from the veneer.*

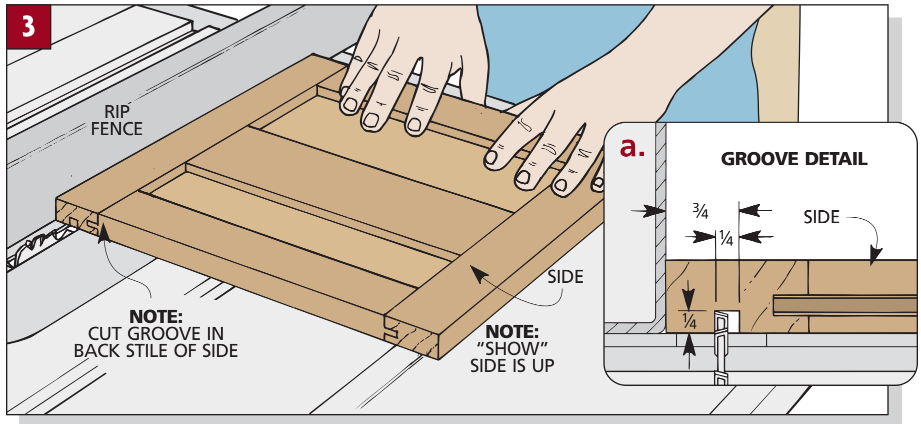
CUT THE GROOVE. The first step in cutting the joinery is to cut a groove in the back stile of each side *(Figs. 3 and 3a)*. Once again, I made two passes over a combination blade, repositioning the rip fence between passes.

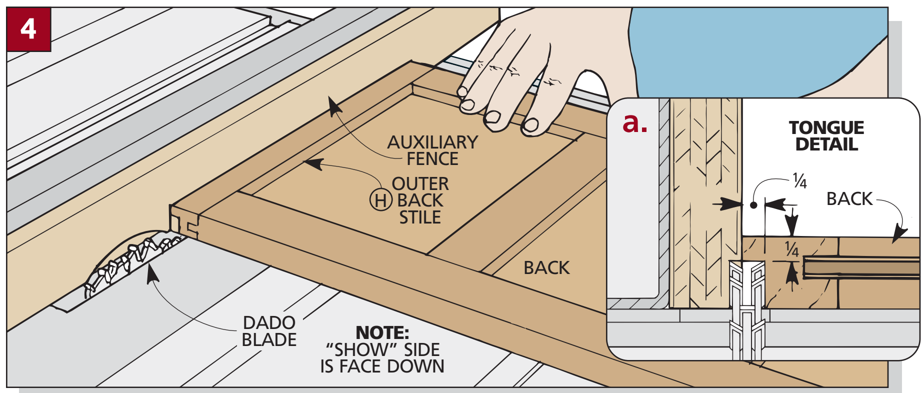
ADD RABBET. The second step is to rabbet each end of the back to form a tongue that fits the groove. To do this, I "buried" a dado blade in an auxiliary fence leaving 1/4" exposed *(Fig. 4a)*. Then I made a pass to cut the rabbet *(Fig. 4)*. It's a good idea to start with the blade slightly low. Then you can raise it gradually to sneak up on the final fit of the tongue in the groove.

CORNER PROFILE. Once the joinery was complete, I routed a decorative profile on each outside corner of the sides (refer to *Figs. 2a and 2c* on page 111).

BEAD MOLDING. In addition to the routed profile, I applied strips of bead molding (F) around the panels. These are narrow strips of hardwood (curly maple) with a decorative bead that's routed with a beading bit (refer to *Fig. 2b and 2d* on page 111).

Note: Because the bead molding pieces are so small, it's best to make the molding by routing both edges first on an extra-wide workpiece. Then use a simple jig to rip the strips of molding to a consistent width on the table saw. (To learn more about ripping thin strips safely and accurately, see the Shop Tip box below.)

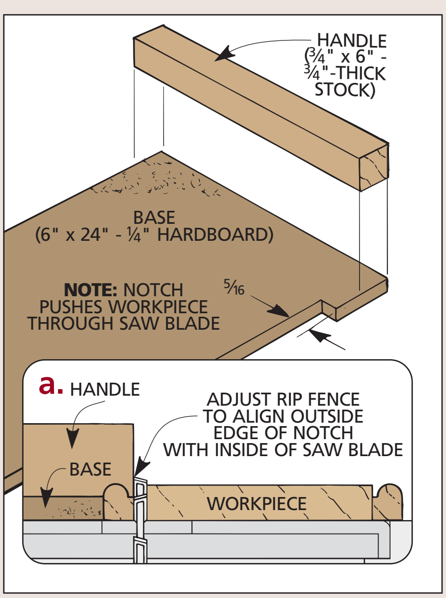




Then after ripping both edges from the wide workpiece, just rout another set of beads and repeat the process until you have enough molding for the case sides.

While you're at it, it's a good idea to make extra molding to use on the lid of the tool chest. (I made thirty linear feet for this chest to allow for waste and the occasional piece that gets cut incorrectly.) After mitering the strips of bead molding to length, they're simply glued in place (refer to *Fig. 2* on page 111).

SHOP TIP . . . . Ripping Narrow Strips



Whenever I need to rip narrow strips of material (like the bead molding on the tool chest), I use a simple jig that rides against the rip fence on the table saw (see photo). It ensures that each ripped strip is identical in width.

The jig consists of two parts. The first part is a hardboard base that has a notch sized to match the width of the strip (see drawing). And a wood handle is glued to the base.

To set up the jig, start by positioning the rip fence so the outside edge of the notch aligns with the inside of the saw blade (see detail 'a' at left). After fitting the work-

piece in the notch, push the jig past the saw blade to rip the first strip of molding from the blank.

To rip the molding from the opposite edge, don't reposition the rip fence. Just rotate the workpiece and repeat the process.

Note: It's best to use a workpiece that's at least 3" wide so your hands stay well away from the blade.

ROUT GROOVES & DADOES

The inside of the case is divided to form an upper storage compartment and the openings for three sets of drawers. To do this, I added an upper rail, a pair of large horizontal dividers, and a small vertical divider *(Fig. 5)*.

The upper rail and the two horizontal dividers fit into a series of grooves and dadoes that are cut in the sides and back of the case *(Fig. 6)*.

STOPPED GROOVES. But before you get started, there's one thing to be aware of. To accept the upper rail, you'll need to cut a short, *stopped* groove in the front stile of each side *(Fig. 6)*. I used a table-mounted router and a $\frac{1}{4}$" straight bit to do this. But there's only one problem — since the sides are mirror images, it requires two different setups.

Start by positioning the fence and clamping a stop block to it *(Fig. 7)*. Then with the side riding against the fence, slide it forward until it hits the stop block.

Note: Wait for the bit to stop spinning before lifting the side.

To cut the groove in the second side assembly, you'll need to reposition the stop block *(Fig. 8)*. Then lower the side onto the spinning bit and slide it forward until the bit cuts through the top edge of the side assembly.

DADOES. The next step is to cut the dadoes that hold the horizontal dividers. I used a table-mounted router here as well. But this time, I installed a $\frac{1}{2}$" straight bit and adjusted it for a shallow ($\frac{1}{8}$") cut *(Fig. 6a)*.

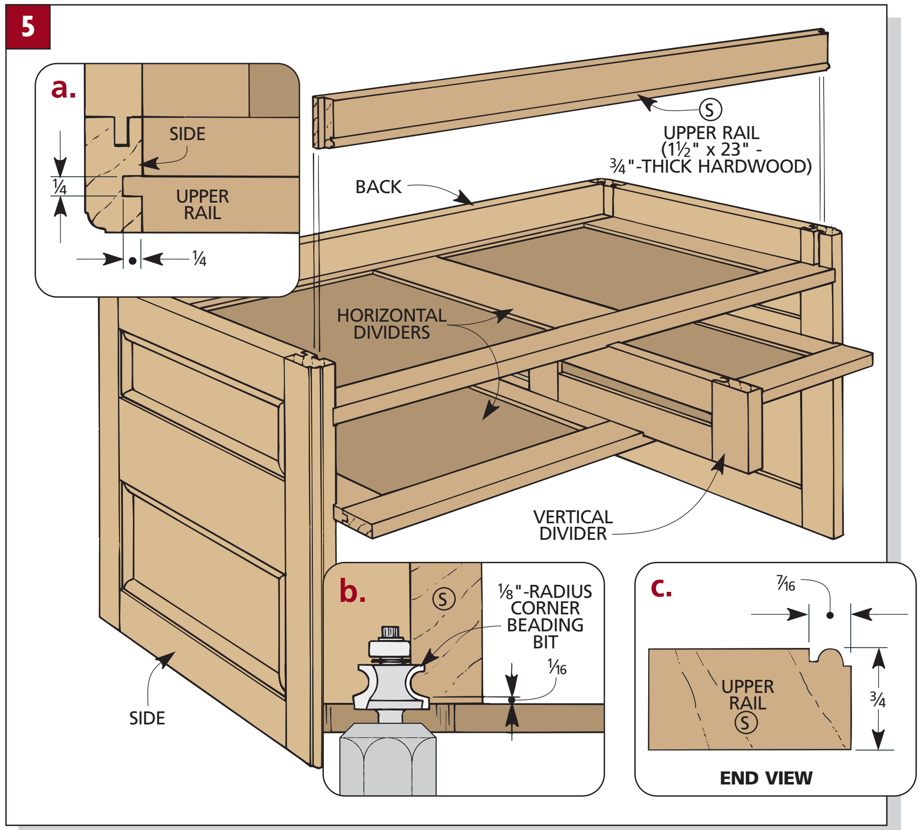
Once again, the dadoes in the *sides* are stopped short of the back edge. This way, the ends of the dadoes won't be visible when the case is assembled.

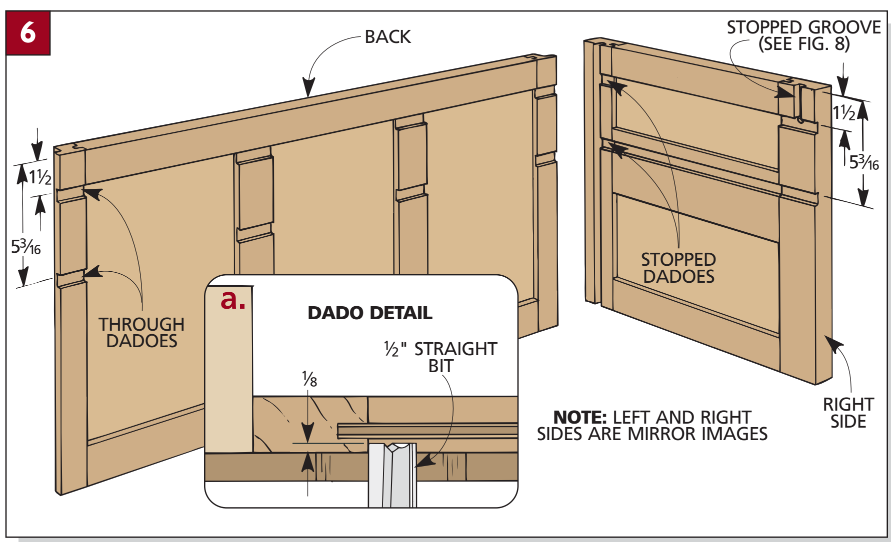
To rout these stopped dadoes, I used the same basic method. The only difference here is the stop blocks are clamped farther from the bit.

But when it comes to routing the dadoes in the *back* of the case, there's no need to use stop blocks. That's because the dadoes go all the way through.

DIVIDERS

Now you can turn your attention to the two horizontal dividers and the vertical divider. Like the sides and back of the case, each divider is a simple frame and panel assembly that's held together with stub tenon and groove joints. But there are a few differences worth noting.





FRAMES. First of all, the divider stiles (K), center stiles (L), vertical stiles (P), front rails (M), back rails (N), and vertical rails (Q) are $\frac{1}{2}$"-thick hardwood instead of the $\frac{3}{4}$"-thick stock I used for the side and back assemblies *(Fig. 9)*.

Most of these divider frame pieces will be hidden inside the case. But the *front* edge of each frame will be exposed once the tool chest case is assembled. So when making the rails (or stiles) that are visible in front, it's worth taking a little extra time to select the wood that best complements the grain pattern in the rest of the chest.

PANELS. Another difference in the dividers is that the divider panels (O) and vertical divider panel (R) are made of $\frac{1}{4}$" hardboard instead of $\frac{1}{8}$" material. And since the panels will be covered up, there's no point in applying veneer.

GROOVES. The divider panels fit into grooves that are *centered* on the thickness of the frame pieces.

Cutting a centered groove is easy. Just set the rip fence so the blade is *roughly* centered on the workpiece *(Fig. 9a)*. Then make two passes, flipping the piece end for end between each pass. If you need to widen the groove, simply nudge the rip fence away from the blade and repeat the process.

STUB TENONS. Of course, the stub tenons will have to be centered on the thickness of the rails as well. Once again, it's best to make two passes, one on each side *(Fig. 9b)*. If necessary, raise the blade a bit and repeat the process until the tenon fits in the groove.

DADOES. After gluing up all three dividers, the next step is to cut a dado in each horizontal divider. These dadoes are centered on the length of the horizontal dividers *(Fig. 9)*. And they're sized to accept the vertical divider *(Fig. 9d)*.

DRILL HOLES. Then, to complete the dividers, two countersunk shank holes are drilled in the back rail of each horizontal divider *(Figs. 9 and 9c)*. Later these holes accept a brass rod that slips through the back of each drawer, locking them in place.

UPPER RAIL

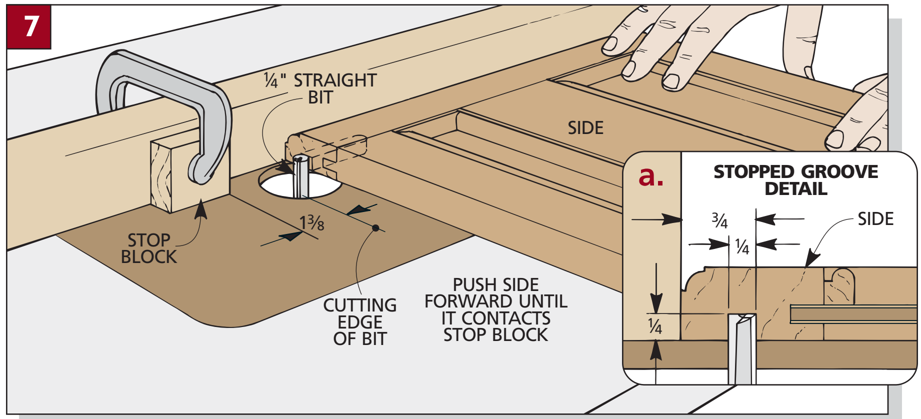
There is just one piece left to make before the case can be assembled. The upper rail spans the opening in front of the case and encloses the storage compartment.

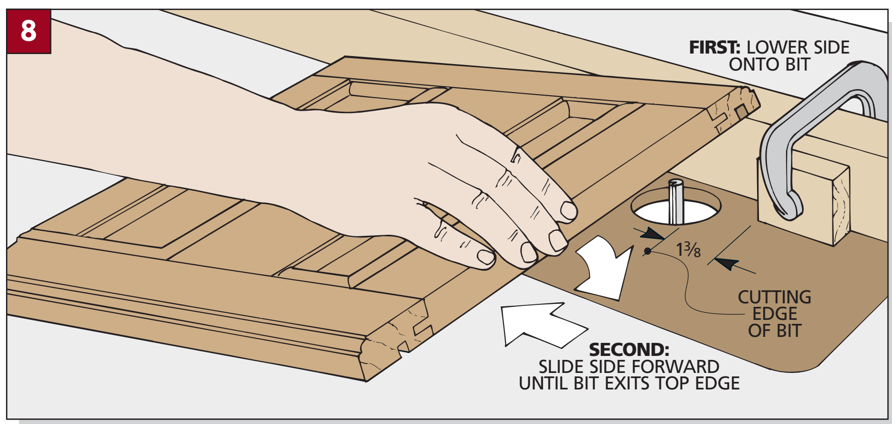
The upper rail (S) is a narrow strip of ¾"-thick hardwood that's cut to the same length as the back of the case *(Fig. 5)*. It's also joined to the sides the same way as the back — with a tongue at each end that fits into the grooves you've already cut in the side assemblies *(Fig. 5a)*.

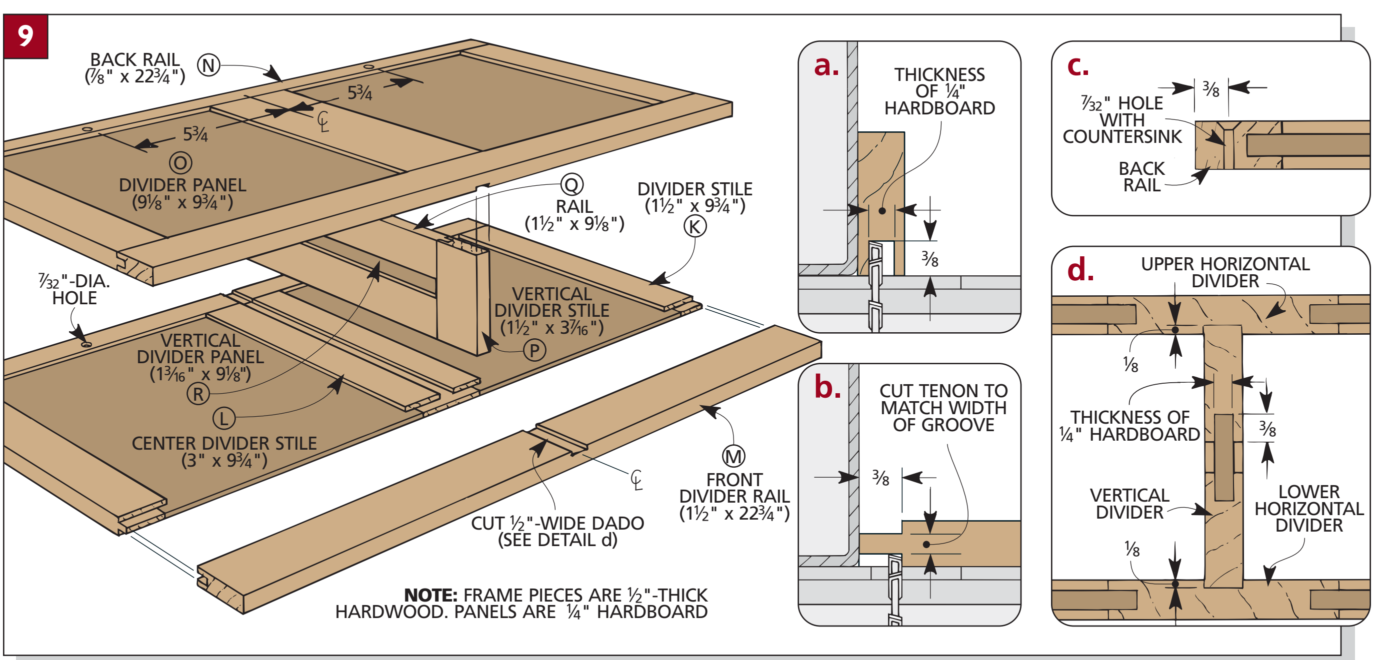
BEAD. Before gluing the rail in place, there's one more thing to do. That's to rout a bead along the bottom edge of the upper rail *(Fig. 5b)*. I used the same router bit here as when making the bead molding. But there's a slight twist.

To create a "shadow line" between the rail and the divider, adjust the height of the bit to form a shoulder along the bottom of the bead. This shadow line imitates the gap between the drawers which will be added later *(Figs. 5b and 5c)*.

Finally, you can glue up the panels, dividers, and upper rail *(Fig. 5)*.







RUNNERS

The drawers in this tool chest slide on a series of hardwood runners that are screwed to the case sides and the vertical divider *(Fig. 10)*. So mount these runners *before* assembling the case — while there's room to work.

The runners (T) are thin, narrow strips of hardwood *(Fig. 11)*. (I made fourteen runners, two for each of the seven drawers.) I started by ripping enough stock for all the runners to their final width (5/8"). Then I ripped a total of fourteen 1/4"-thick strips.

MOUNTING HOLES. After cutting the runners to size, the next step is to drill a hole near each end of each runner for a mounting screw *(Fig. 11)*. One thing to note is that the holes are a different distance from each end of the runner. This way, when it's time to mount the runners to the vertical divider, you can flip two of the runners end for end to prevent the screws from hitting *(Figs. 10c and 10d)*.

Aside from their location, the holes are identical (*Fig. 11a*). A counterbore creates a "pocket" for a washer and the head of a screw. And oversized shank holes make the runner adjustable.

INSTALL RUNNERS. Now you're ready to install the runners. Even though the mounting holes provide some adjustment, it's still important to pay attention to the alignment of the runners.

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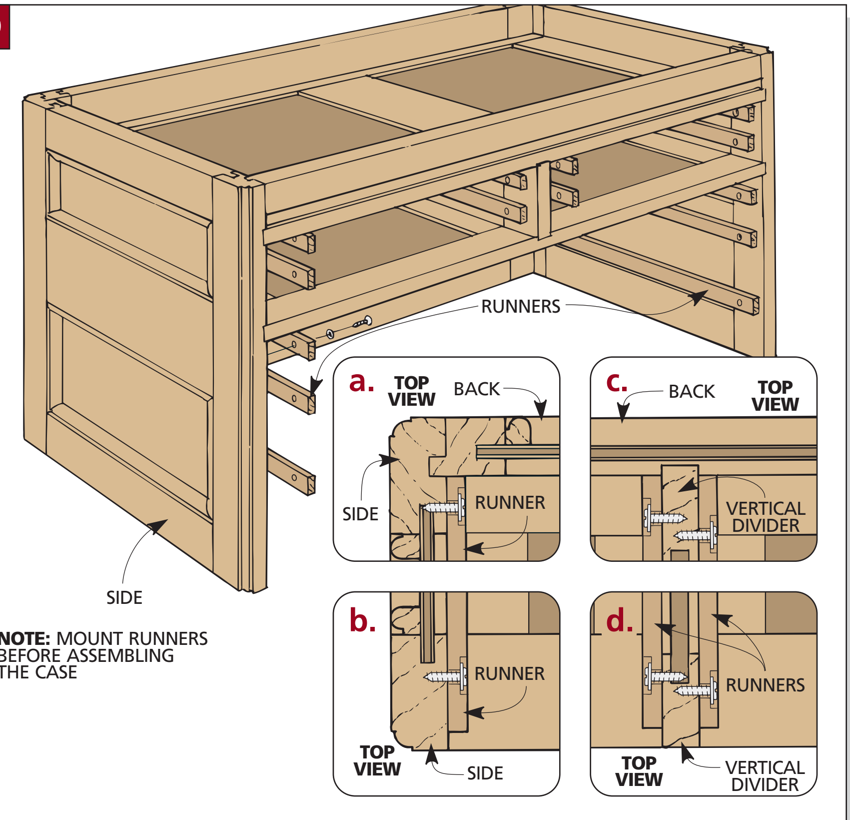
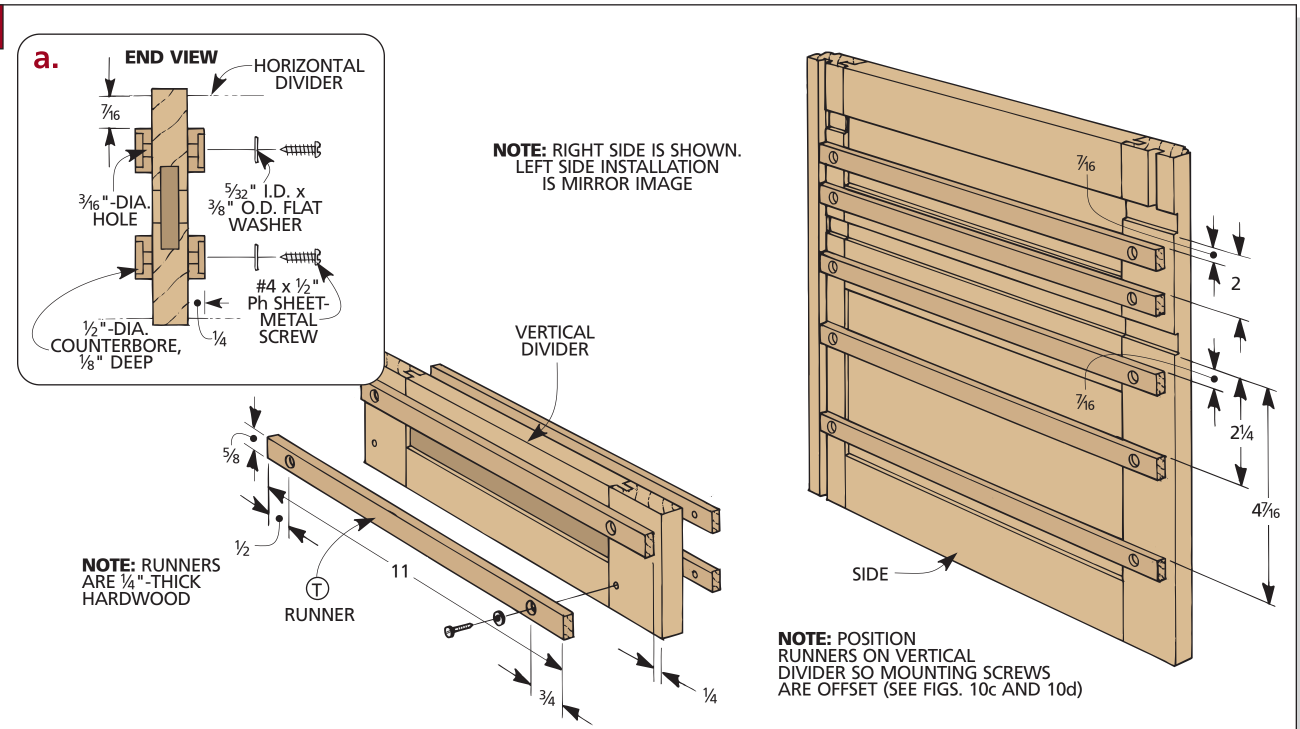


The goal is to locate each pair of runners so the *top* edges are level. (That's because the drawers will rest on the *top* edge of the runners.) This will ensure you end up with an even gap above and below each drawer.

ALIGNMENT BLOCKS. To accomplish that, I dry-assembled the case and used two scrap blocks to align the runners in their correct positions inside the case *(Fig. 12)*. These are just pieces of MDF with grooves that hold the runners.

11



The idea here is to locate the grooves the same distance from the *top* of the blocks as the distance of the runners *below* the dividers. This will ensure that they're positioned accurately in the case.

To make this work, you'll need to cut each block to fit snug in either the large or small drawer opening. Also, the depth of the grooves is slightly *less* than the thickness of the runners, which means the runners will sit just a bit "proud."

The reason for this is simple. After "loading" the runners in the grooves (flush with the back edge of the blocks), a short strip of carpet tape is applied to each end of each runner *(Fig. 12a)*. This way, when you press the blocks against the sides (or vertical divider), the tape sticks each runner in its correct position.

Note: The blocks should be aligned flush with the front of the case.

To install the remaining runners, use the same alignment blocks. But you'll need to flip them end for end to locate the runners in the opposite side (or on the other side of the small drawer opening).

DISASSEMBLE CASE. Now you can disassemble the case so you can mark the locations of all the pilot holes for the mounting screws. One tip though: before removing the runners to drill the holes (and take off the tape), score a line that shows their location *(Fig. 12b)*. This line comes in handy when repositioning the runners to screw them in place.

Note: Don't forget to position the runners on the vertical divider so the mounting screws are offset.

GLUE UP CASE. Once the runners are installed, you can glue up the case. It's a good idea to practice this a few times by *dry-assembling* the case first. Then you can use a slow-setting glue to provide plenty of working time.

BASE

Once the case is glued up, you can turn your attention to the base that it sits on. The base is a frame and two-panel assembly similar to the horizontal dividers. It's then wrapped with a decorative hardwood apron *(Fig. 13)*.

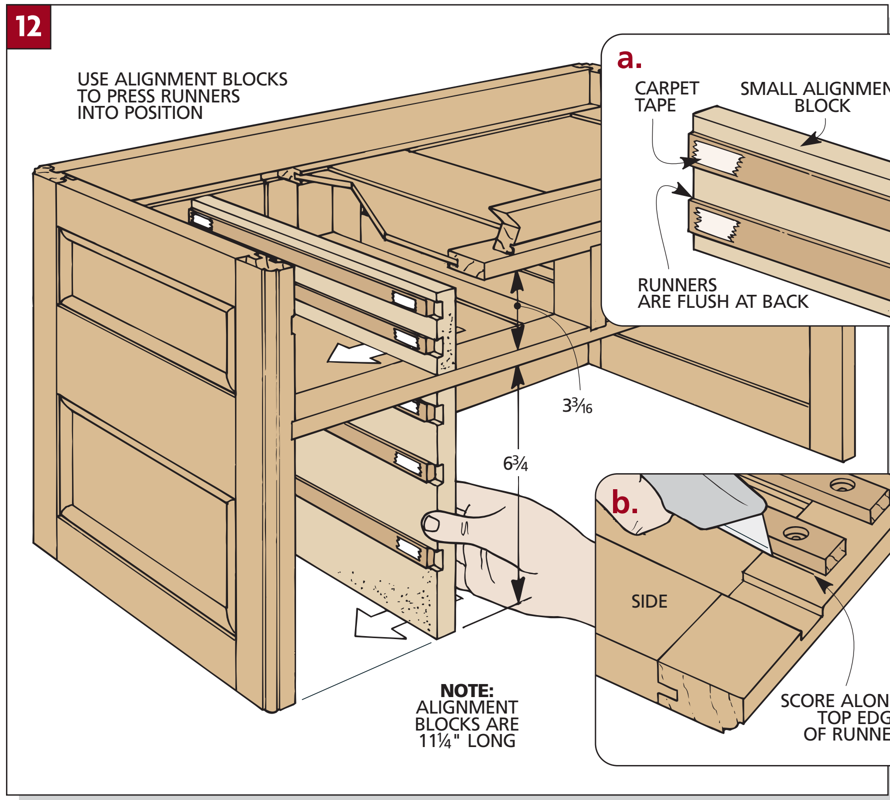
FRAME AND PANEL. The base assembly is identical to the horizontal dividers except for two things — it's slightly longer and wider. This way, the apron will extend beyond the case all the way around.

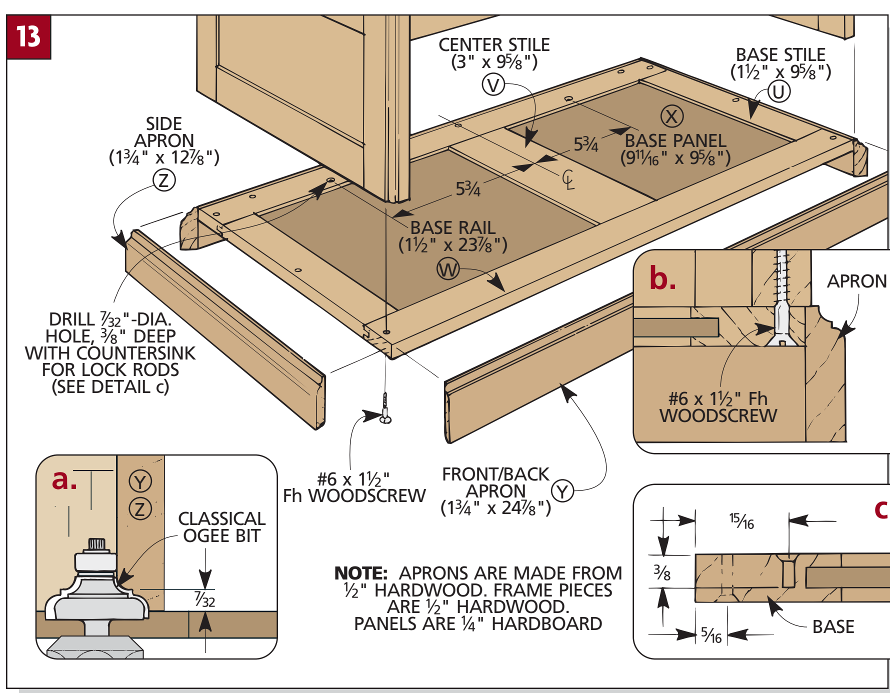
As before, the base stiles (U), center stiles (V), and base rails (W) are assembled with stub tenon and groove joints *(Fig. 13)*. And the grooves are sized to accept 1/4" hardboard base panels (X).

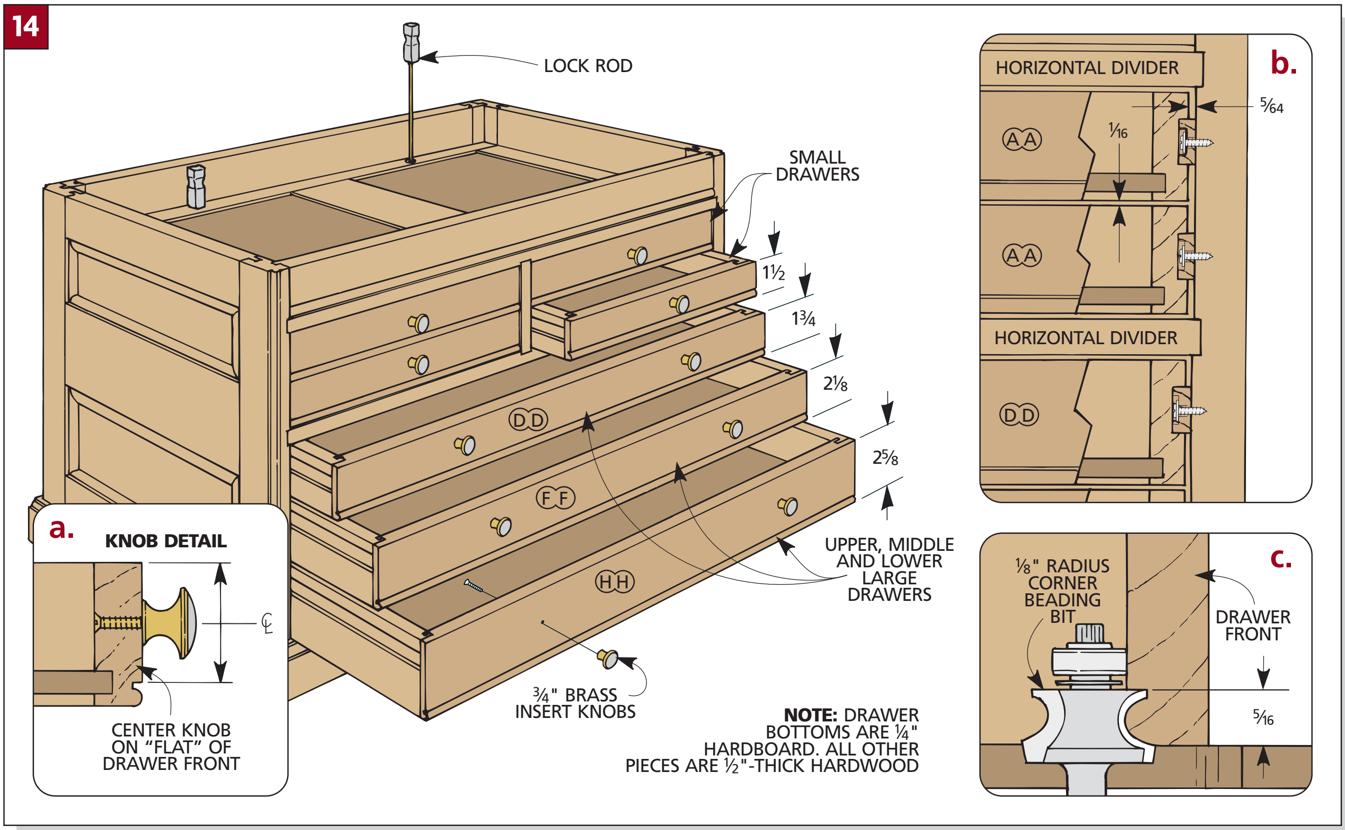
After gluing up the frame and panels, the next step is to drill shallow (stopped) holes to accept the lock rods that are added later *(Figs. 13 and 13c)*. While you're at it, it's a good time to also drill the mounting holes for screws added in the bottom of the base.

APRON. Now it's just a matter of adding the apron. The first step is to rout an ogee profile on extra-long strips of hardwood *(Fig. 13a)*. Then miter the front and back (Y) and side (Z) apron pieces to length and glue them around the frame.

ATTACH BASE. At this point, all that's left is to center the base on the case and screw it to the sides and back *(Fig. 13b)*.







DRAWERS

Since hand tools come in all different sizes and shapes, I designed this chest with different size drawers.

The upper part of the case holds four half-width drawers that are all the same height *(Fig. 14)*. And there are three full-width drawers in the lower part of the case. These drawers get progressively taller from top to bottom.

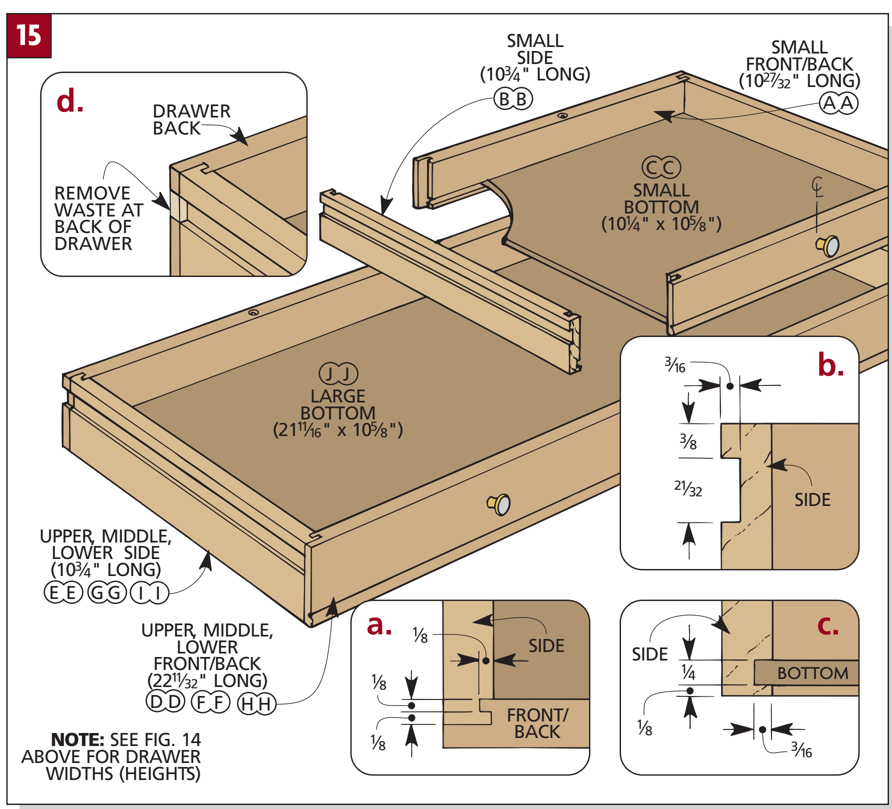
To strengthen the drawers, they're assembled with simple locking rabbet joints. With this type of joint, a tongue on the drawer front (and back) fits into a kerf in the side piece *(Fig. 15a)*. The tongue forms a strong, interlocking connection that won't pull apart.

THICKNESS STOCK. To ensure accurate results when cutting the joinery, I started by planing all the wood for the drawers to thickness (1/2"). Before cutting any of these pieces, though, you'll need to determine the size of the drawers.

SIZE. The height of each drawer creates a 1/16" gap above and below the drawer *(Fig. 14b)*. But I allowed a little "extra" on the sides to allow the drawers to slide smoothly. As for length (depth), each drawer is sized to sit flush with the front of the case when it's slid all the way in against the back.

With that in mind, start by ripping the large and small drawer fronts and backs (AA, DD, FF, HH) and the large and small drawer sides (BB, EE, GG, II) to finished width *(Figs. 14 and 15)*. Then cross cut each piece to final length.

LOCKING RABBETS. Now cut the locking rabbet joints. This requires standing the



front and back pieces on end to cut a kerf. (I use a support block to hold the workpiece steady. Refer to the Joinery article on page 96.) Then just trim the tongue to length *(Fig. 15a)*. To complete the locking rabbet joint, all that's left is to cut a kerf in the drawer sides to accept the tongue.

CUT GROOVES. Each of the drawer pieces also needs a groove near the bottom inside edge to accept the 1/4" hardboard that will be used for the drawer bottoms (CC, JJ) *(Figs. 15 and 15c)*.

To fit the drawer over the runners, you'll also need to cut a wide groove in the outside face of each side piece. I cut these grooves 1/32" wider than the runners to create a smooth, sliding fit *(Fig. 15b)*.

ROUT BEADS. There's one more thing to do before assembling the drawers. That's to rout a bead along the bottom edge of each drawer front *(Fig. 14c)*. It matches the profile of the bead molding on the sides and back of the case.

NOTCHES. After gluing up the drawers, the back piece will cover the end of the groove that fits on the runners. So you won't be able to install the drawer until you notch the back *(Fig. 15d)*. A hand saw and chisel make quick work of this.

KNOBS. Finally, I added some brass knobs. They have a shallow recess in the center that lets you insert a wood plug to complement the chest (see Sources on page 126). The plugs are held in place with epoxy and can be "turned" to shape (see the Shop Tip box below).

The mounting holes for the knobs are centered on the "flat" between the top of the drawer front and the bead *(Fig. 14a)*. I centered a single knob on the width of each of the small drawers. But I used a pair of knobs in each of the three larger drawers below.

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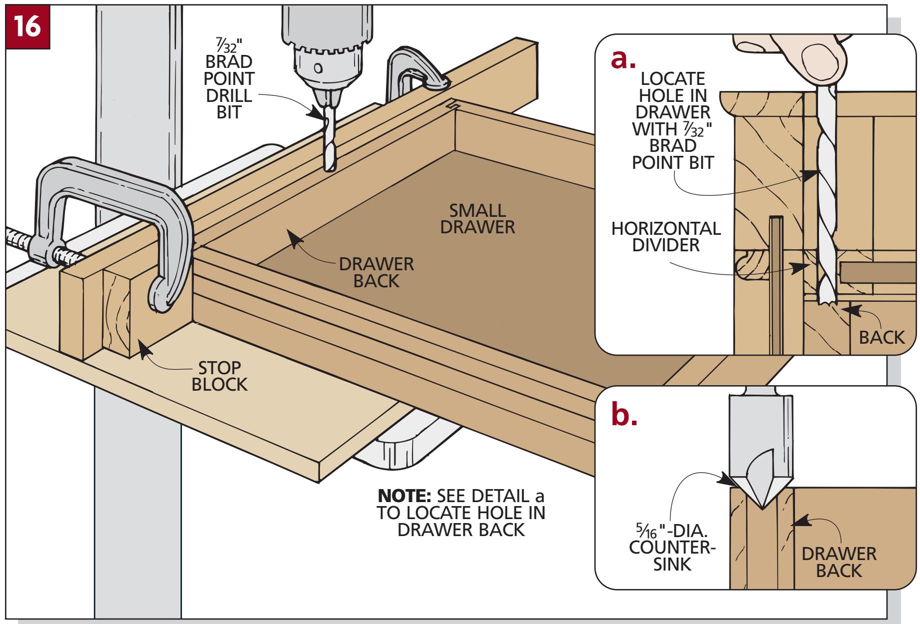

LOCK ROD

The tool chest has a pair of brass rods that "lock" the drawers. To do this, the rods slide down through holes in the dividers and the drawers, locking them together.

DRILL HOLES. This means drilling a hole in the back of each small drawer and two holes in the large drawers. To locate these holes, start by installing the upper two drawers. Then insert a brad point bit in each hole in the divider and make a dimple in each drawer *(Fig. 16a)*.

To drill the holes, clamp a fence to the drill press table and use a stop block to position the drawers *(Fig. 16)*.

I used this setup to drill a hole in each of the two small drawers on the left side of the case. Then the same setup can be used to drill the hole on the left side of each large drawer.

For the drawers on the right side of the case (and the second hole in the large drawers), clamp the stop block to the opposite end of the fence, repeat the process, and then countersink each hole *(Fig. 16b)*. This makes it easy to "find" the hole as you slip the lock rod in place.

LOCK RODS. Now add the two lock rods. Each rod has two parts: the brass rod and a wood (ebony) handle *(Fig. 17)*. (See page 126 for sources.)

HANDLE. First, cut the rods to length. Then add the handle (KK) *(Fig. 17a)*.

To make the handle, start with an extra-long piece of ebony and sand it to shape *(Fig. 17a)*. Then cut the handle to length, drill a hole in the end *(Fig. 17b)*, and use epoxy to hold the rod in place.

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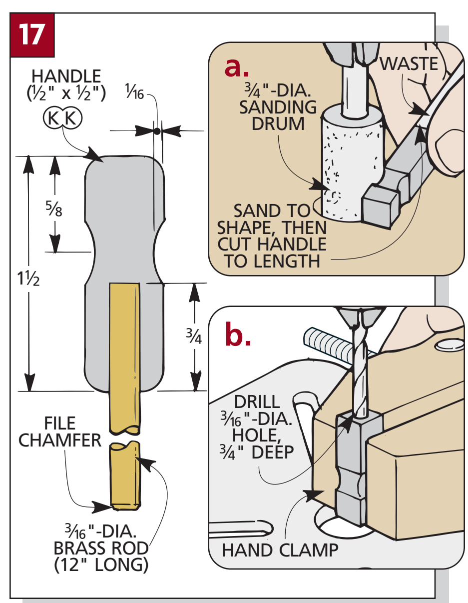
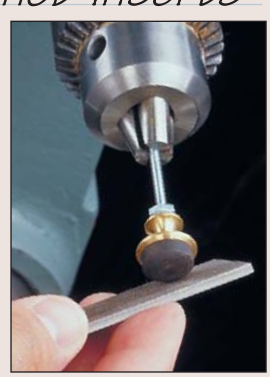


SHOP TIP . . . . Knob Inserts

I wanted my knobs to be as distinctive as the chest itself. So I added special knobs with ebony inserts to all the drawer fronts (see photo). The brass knob has a shallow recess in the front that lets you insert a wood plug that's "turned" to shape.

But you don't need a lathe to do this. All that's needed is a drill press and file. First thread the knob onto a rod chucked in the drill press. Then use two "jam" nuts to hold the knob in place and simply file and sand the ebony plug to shape.



LID

All that's left to complete the tool chest is to add a hinged lid that encloses the storage compartment *(Fig. 18)*.

PANELS. Like the sides and back of the case, the lid consists of $1/8$" hardboard lid panels (LL) surrounded by a wood frame *(Fig. 19)*. Here again, both sides of the panels are covered with veneer. Only this time, I glued bird's-eye maple veneer to each side so the panels look good on both the inside *and* the outside.

As before, the lid stiles (MM) and lid rails (NN) are assembled with stub tenon and groove joints *(Figs. 19a and 19b)*. And once again, the grooves that hold the panels are offset toward the inside of the frame to create a recess for strips of bead molding *(Figs. 19a and 20)*. (This is the extra bead molding made earlier.)

EDGING. After gluing on the bead molding (F), the next step is to "wrap" the outside of the lid with the front, back, and side edging (OO, PP). Besides creating a decorative profile, the edging makes the lid appear thicker than it is.

To make the edging, I started by planing a piece of hardwood to a thickness of $1/2$". Then, after ripping 1"-wide strips, I routed a *different* decorative profile on each edge.

The profile routed on the top edge matches the corners on the sides of the case *(Fig. 20a)*. So I routed this edge with a beading bit in a table-mounted router *(Fig. 20b)*. Then, to create a smooth transition between the lid and the case, rout a cove in the bottom edge *(Fig. 20c)*. After mitering the edging to fit around the lid, it's glued in place.

TRIM PIECES. In addition to the edging, I also added trim pieces (QQ) to the bottom of the lid and top of the case *(Figs. 21 and 21a)*. These are thin, hardwood strips with a roundover routed on one edge *(Fig. 21b)*.

The trim pieces on the lid create a flat mounting surface for the hinges. They're just mitered to length to fit inside the lip created by the edging and glued in place. After mitering the strips for the case, they're glued flush with the inside edge.

INSTALL HARDWARE

I spent quite a bit of time looking at hardware for the chest. Some of it was purely functional, which didn't seem right for such a nice chest. What I wanted was hardware that was functional *and* beautiful.

Fortunately, I found just what I was looking for while paging through a specialty woodworking catalog — solid brass hardware that's made with old-fashioned, quality craftsmanship. (See page 126 for sources of this hardware.)

HINGES. The hinges have a nice, reassuring heft. And the leaves of the hinges are thick slabs of polished brass.

The hinges fit into mortises cut in the case and lid *(Fig. 22)*. After laying out the location of the mortises on the case, a hand-held router and $1/2$" straight bit make quick work of removing most of the waste. After routing up close to the layout line, use a chisel to carefully pare away the remaining waste.

Once the hinges fit in the case you can lay out the mortises in the lid. To do this, set the lid on the case so it's centered in both directions and mark the ends of each mortise (see the Shop Tip box on the next page). Then remove the lid and lay out the long edge of the mortise.

Note: This edge is set in from the rounded edge of the trim strip.

Now you're ready to rout the mortise. Here again, you'll want to chisel away the remaining waste until the hinge fits the mortise like a hand in a glove.

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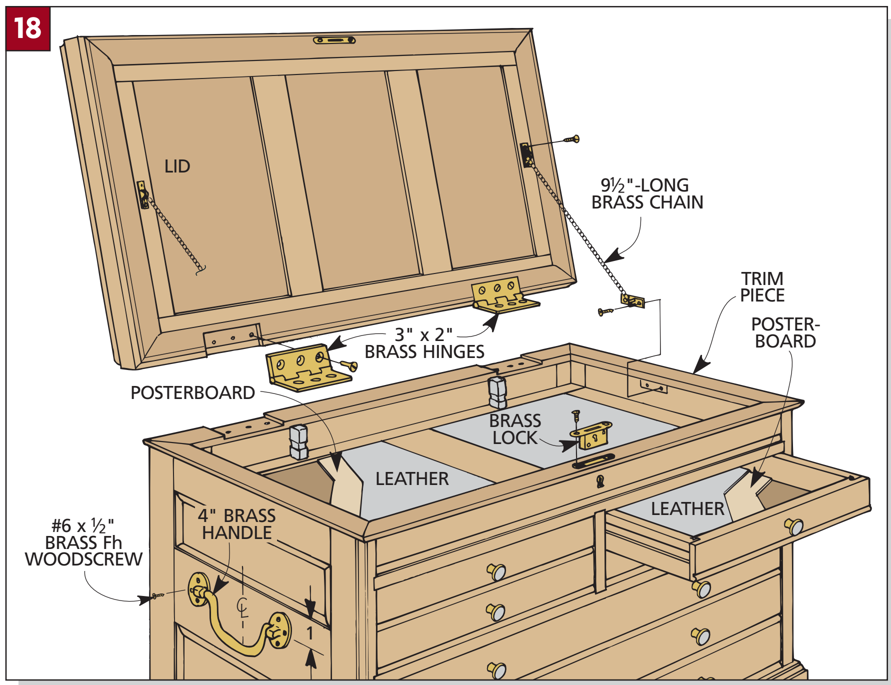

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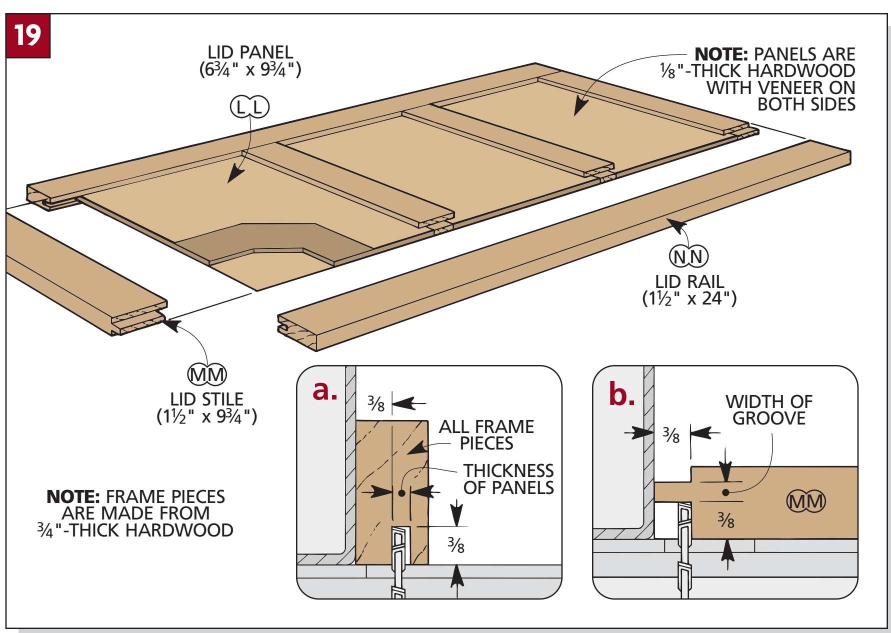


SHOP TIP

Hinge Location

To lay out the location of the hinge on the lid, simply score a line with a sharp utility knife. I used the mortise already added to the chest as a guide for the knife blade.

CHAINS. To keep the lid from falling back when it's open, I added a pair of brass chains *(Figs. 18 and 22)*. The idea is to provide easy access to the tools in the storage compartment without having to constantly open and close the lid. You want to locate the chains so the lid tilts back at a slight angle. So measure your project before cutting the chain to length. (My chains were $9^1/_2$" long.)

ADD LOCK. After installing the chains, I added a lock to secure the lid. The lock I chose has three parts that are mortised into the case. (For step-by-step instructions on installing this lock, see the Technique article starting on page 122.)

HANDLES. When this chest is loaded with tools, it's quite heavy. So in order to get a good grip when carrying it around, I mounted a pair of heavy-duty brass handles to the wide rails on the sides *(Fig. 18)*.

Each handle is centered on the length of the rail. But it's offset slightly toward the top. This way, the handle won't hang down below the rail.

FINISH. At this point, I removed all the hardware and applied a finish. Three coats of a wipe-on oil finish emphasized the dramatic swirl marks in the bird's-eye maple and made the "ribbons" in the curly maple shimmer. And a coat of paste wax gave the chest a smooth, silky appearance. (Once again, to find sources for these finishes, see page 126.)

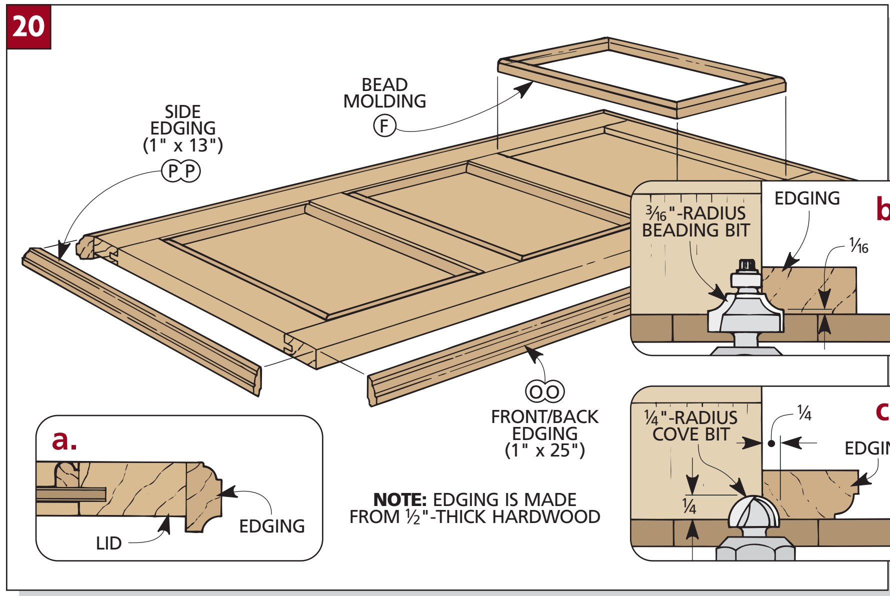
LEATHER. Finally, to protect my favorite hand tools there was one last thing I'd been wanting to try. That was to add a leather lining to each of the drawer bottoms and the two recesses in the upper storage compartment.

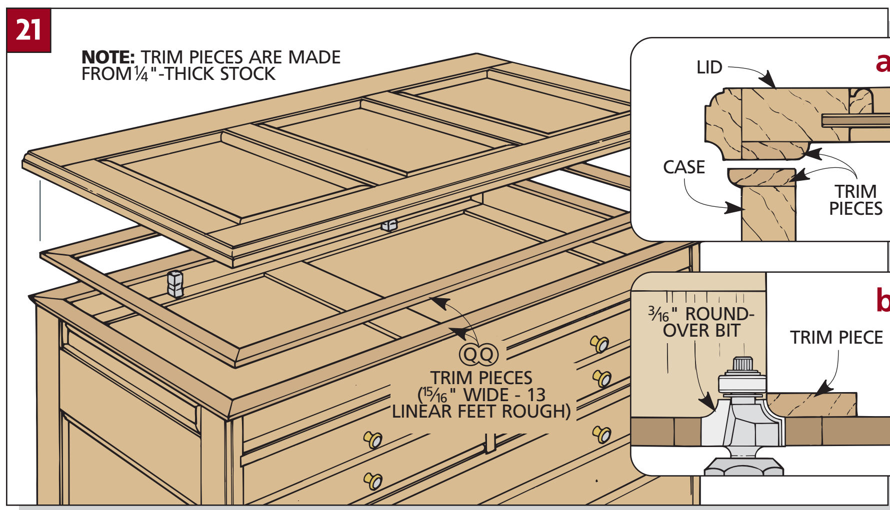
At first I thought that finding the leather might be a problem. But after checking around at a local leather store, I found two deerskins that worked just fine for this Cabinetmaker's Tool Chest.

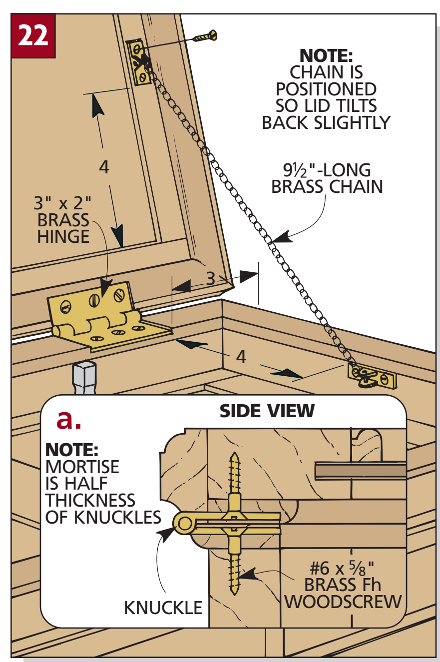
The leather is first mounted to a piece of posterboard that's cut to fit inside the drawers and the recesses inside the storage compartment.

Note: I used two pieces of posterboard for each recess to make the leather flush with the frame.

Now it's just a matter of cutting oversize pieces of leather and using a spray-mount adhesive to attach them to the posterboard. After trimming the edges of the leather flush with the posterboard, simply press it in place. ■







TECHNIQUE . . . . Full-Mortise Lock

One of the challenges in building the tool chest is installing the lock. To latch the lid securely, each part of the lock must be accurately aligned. Plus, it requires cutting mortises in the chest *after* it's nearly completed.

Now, I'll admit installing the lock can be a bit nerve-racking. But a careful layout and a simple wood block make it a fairly straightforward task.

The lock I used has three main parts: the lock body, a brass escutcheon, and a catch plate (see drawing below).

LOCK BODY. The body of the lock is housed in two mortises cut in the top edge of the case. A long, shallow mortise accepts the mounting flange on the lock body. And a short, deep mortise holds the lock mechanism.

Start by laying out the mortise for the mounting flange (*Step 1* above right). To cut this mortise, I used a handheld drill and a brad point bit with a stop collar. The only problem with this method is trying to hold the drill bit perpendicular to the top of the case.

The solution is a thick, hardwood guide block with a groove that fits over the edge of the case *(Step 2)*. A hole in the block guides the drill bit. The idea is to locate this hole so the mortise is centered on the thickness of the *upper rail*, not the trim piece on the top of the case *(detail 'a' in Step 2)*. After aligning the guide block, it's just a matter of drilling a series of overlapping holes.

Note: Shine a flashlight into the hole so you can see the layout lines as you align the guide block.

Once the flange fits the mortise, you can lay out the deep mortise for the lock mechanism *(Step 3)*. To cut this mortise, I drilled a smaller hole in the guide block (to match the thickness of the mechanism) and used the same process as before to remove the waste *(Step 4)*.

ESCUTCHEON. After squaring up the mortise, it's time to add the escutcheon. It's just a brass piece that prevents the key from wearing against the hole in the case.

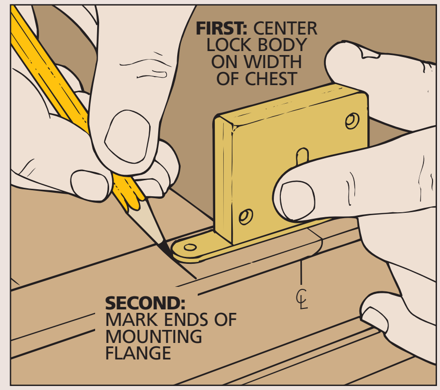
The escutcheon fits in a keyhole-shaped opening in the upper rail. To ensure a good fit, I started by creating an opening that's just large enough to accept the key *(detail 'a' in Step 5)*. This requires drilling a hole in the upper rail and then filing a short slot *(detail 'b' in Step 5)*.

Note: Insert a piece of scrap in the mortise to prevent chipout as you drill.

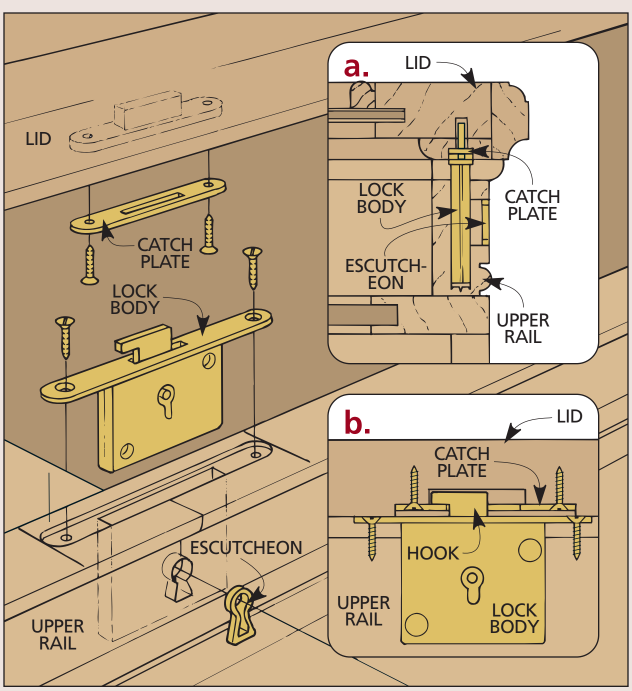
Once the key fits in the opening, lay out the shape of the keyhole *(detail 'c' in Step 5)*. Then file up to the line, checking the fit frequently *(detail 'd' in Step 5)*. When you're happy with the fit, press the escutcheon in place *(detail 'e' in Step 5)*.

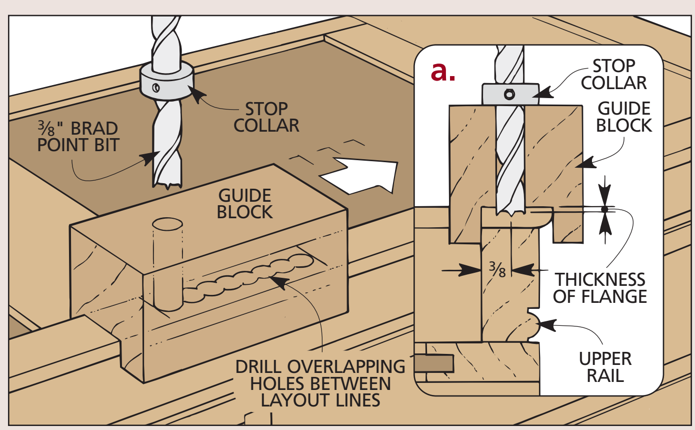
Note: To make it easy to install the escutcheon, I used an ordinary C-clamp. To do this, leave in the scrap piece inserted earlier into the lock mortise and tighten the C-clamp over the escutcheon. This way, you'll apply even pressure to the escutcheon while it's being installed, without leaving marks in the case.

CATCH PLATE. All that's left is to mortise the catch plate into the lid. Here

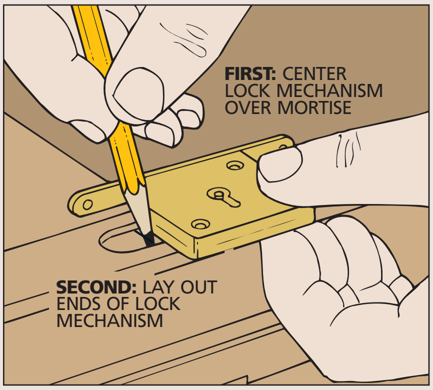


1 *Start by centering the lock body on the width of the case. Then mark the ends of the mounting flange to locate the mortise for the flange.*

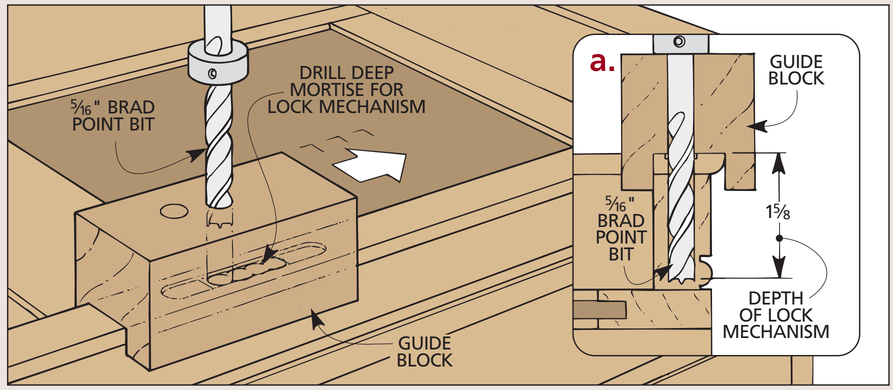




2 *After aligning the hole in the guide block with the layout line, cut the mortise by drilling a series of overlapping holes with a handheld drill and brad point bit. Then clean up the ridges with a chisel.*



3 *Now you can lay out the location of the deep mortise that will hold the base portion of the lock mechanism.*



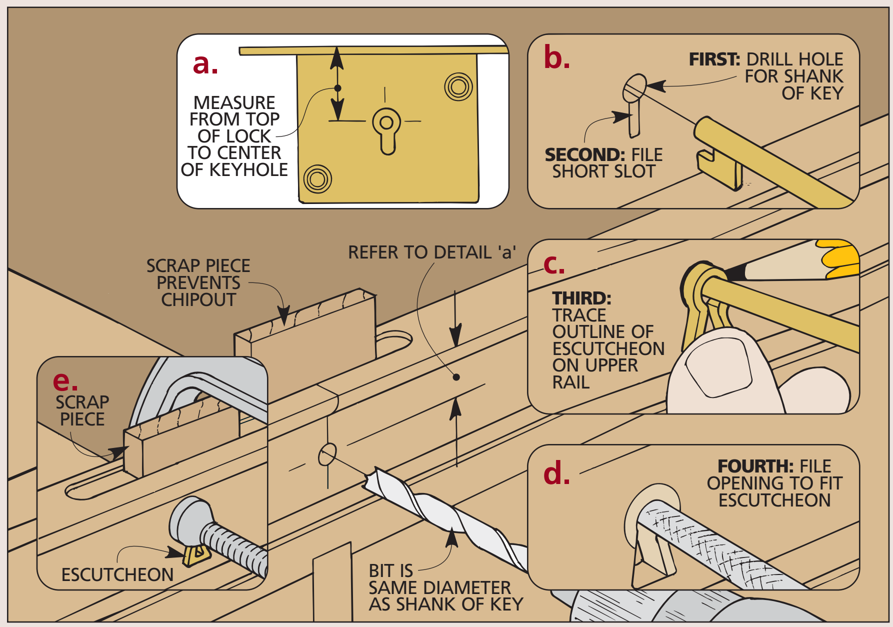
4 *After drilling a smaller ($\frac{5}{16}$") hole in the guide block, drill a series of 1$\frac{5}{8}$"-deep holes to form the mortise for the lock mechanism (see detail 'a'). Then pare off the remaining waste with a chisel (see the photo on the facing page).*

again, a shallow mortise accepts the plate, and a deep mortise provides clearance for a hook in the lock.

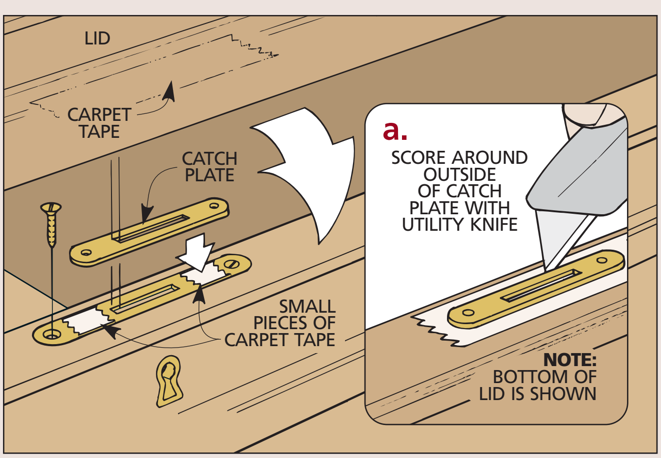
To determine the location of the catch plate, start by attaching it to the lock with two small pieces of double-sided carpet tape *(Step 6)*. You'll also want to attach a large piece of carpet tape to the lid at this time. Then close the lid and press down firmly. When you open the lid, the catch plate should be in its proper location — stuck to the large piece of tape.

After removing the lid and carefully scoring around the catch plate *(detail 'a' in Step 6)*, it's just a matter of cutting the two mortises *(Step 7)*. Here again, I used two different-sized bits to drill the mortises in the lid. The first holes are drilled just deep enough to hold the catch plate *(detail 'a' in Step 7)* ($\frac{5}{16}$"-dia.). And the second mortise should be deep enough to provide space for the locking hook *(detail 'b' in Step 7)* ($\frac{3}{16}$"-dia.).

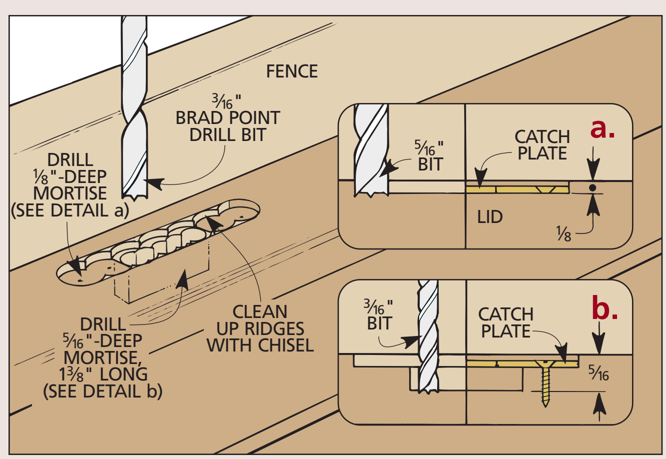
Note: To ensure the hook draws the lid down tight, it's best to recess the catch plate about $\frac{1}{16}$".



5 *To create the opening for the escutcheon, start by drilling a small hole in the upper rail to accept the shank of the key (details 'a' and 'b'). Then file a slot that's just large enough so you can slip the key in the opening (detail 'b'). Next, slip the escutcheon onto the key. Then insert the key and trace around the escutcheon (detail 'c'). Finally, file the opening so the escutcheon fits snug and press it in place (details 'd' and 'e').*



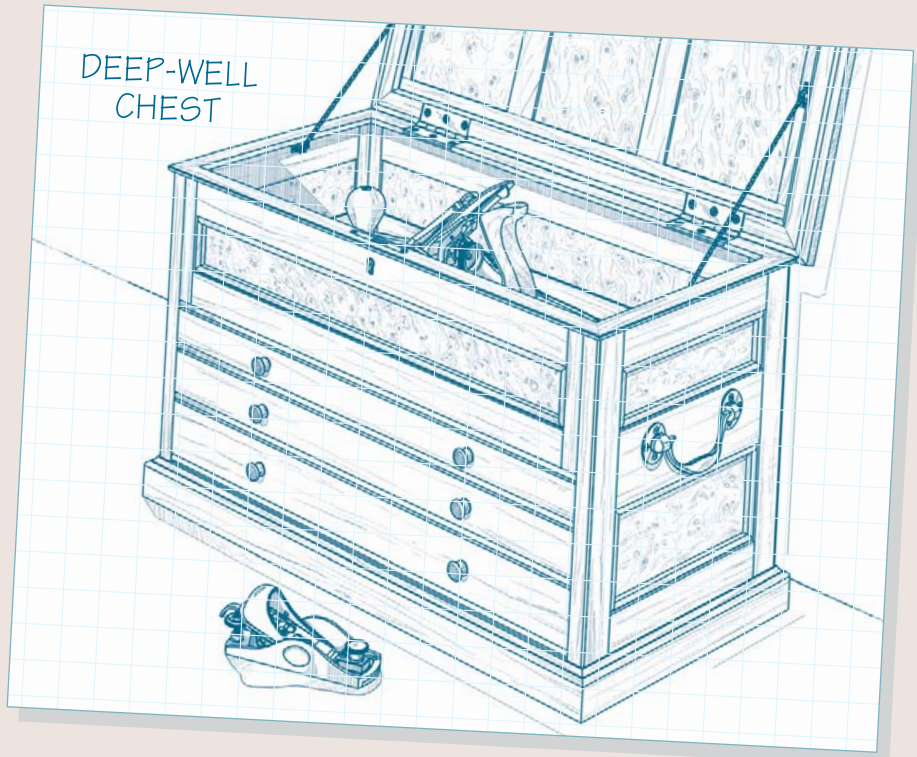
6 *Small pieces of carpet tape hold the catch plate in place. A large piece "pulls" it to the lid. After removing the lid of the tool chest, use a utility knife to mark the location (see detail 'a').*



7 *Finally, drill the two mortises in the lid. The first is sized to hold the catch plate (detail 'a') and the second mortise provides clearance for the hook (detail 'b').*

DESIGNER'S NOTEBOOK

To provide a deeper compartment to store larger hand tools, such as planes, this design eliminates the top drawers and combines that space with the storage compartment at the top of the chest.



CONSTRUCTION NOTES:

■ The construction of the side assemblies is the same as before, although the positions of two of the grooves have changed (more about that later).

■ There are some changes in the back panel. If the back were built the same as the Cabinetmaker's Tool Chest, you'd see gaps between each back panel and the horizontal divider when the lid is open. For that reason, the back panel assembly has an inner back rail (RR) *(Fig. 1)*. A groove in this rail supports the entire back edge of the horizontal divider.

■ This inner rail means the chest has two horizontal panels (SS, TT) instead of three vertical panels. Start work on the back by veneering these panels and cutting them to size.

■ Next cut the frame pieces for the back to size. An offset groove is cut in each edge of the inner back rail (RR) to accept the back panels *(Fig. 1a)*. Also, a stub tenon is cut on each end of each rail to fit the grooves in the stiles. (Don't cut the groove for the horizontal panel yet.)

■ Once all the joinery is cut, the frame can be glued up around the panels.

■ The next step is to build an upper panel that forms the front of the storage compartment. This assembly also uses frame and panel construction around a veneered panel *(Fig. 2)*.

■ The front rails are the same length (21 3/4") but are different widths. The wide front rail (UU) is 1 1/2" wide. The narrow front rail (VV) is only 1 7/16" wide *(Fig. 2)*. This allows for 1/16" clearance between the top panel assembly and the top drawer when the case is assembled.

■ The front rails and front stiles (WW) have the same stub tenon and groove joinery that was used in the side and back assemblies *(Figs. 2 and 2a)*.

MATERIALS LIST

CHANGED PARTS

F	Bead Molding	3/8 x 5/16 - 460 rgh.
K	Divider Stiles (2)	1/2 x 1 1/2 - 8 1/2
L	Ctr. Dvdr. Stile (1)	1/2 x 3 - 8 1/2
M	Fr. Divider Rail (1)	1/2 x 1 1/2 - 22 3/4
N	Bk. Divider Rail (1)	1/2 x 1 1/2 - 22 3/4
O	Divider Panels (2)	1/4 hdbd. - 9 1/8 x 8 1/2
T	Runners (6)	1/4 x 5/8 - 11

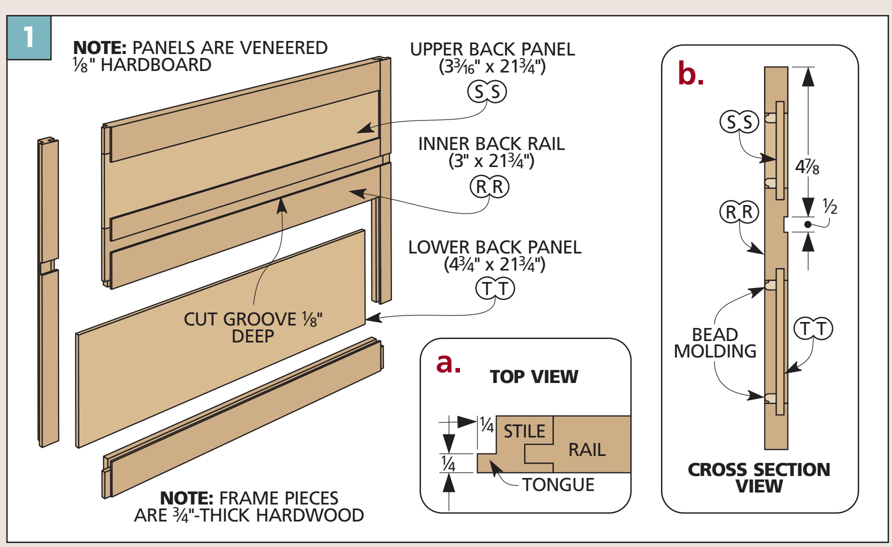
NEW PARTS

RR	Inner Back Rail (1)	3/4 x 3 - 21 3/4
SS	Upr. Back Panel (1)	1/8 hdbd. - 3 3/16 x 21 3/4
TT	Lwr. Back Panel (1)	1/8 hdbd. - 4 3/4 x 21 3/4
UU	Wide Front Rail (1)	3/4 x 1 1/2 - 21 3/4
VV	Nrw. Front Rail (1)	3/4 x 1 7/16 - 21 3/4
WW	Front Stiles (2)	3/4 x 1 - 5 3/8
XX	Front Panel (1)	1/8 hdbd. - 3 3/16 x 21 3/4

Note: Do not need parts G, I, P, Q, R, S, AA, BB, CC.

HARDWARE SUPPLIES

(6) 3/4" brass knobs w/ wood inserts
(12) No. 4 x 1/2" Ph sheet-metal screws
(12) 5/32" I.D. x 3/8" O.D. flat washers
(2) 3/16"-dia. x 8" brass rods



■ When the frame pieces have been cut to size and the stub tenons and grooves are completed, the frame and panel can be glued together.

■ Now cut a rabbet on the front of each stile to leave a 1/4"-thick tongue. These will fit in grooves in the side stiles later.

■ After each of the four assemblies has been glued up, you can miter bead molding (F) to fit on the panels around the inside of each frame *(Fig. 5)*.

■ At this point, you can set up to rout the grooves for the divider in the back and sides *(Figs. 1 and 4)*.

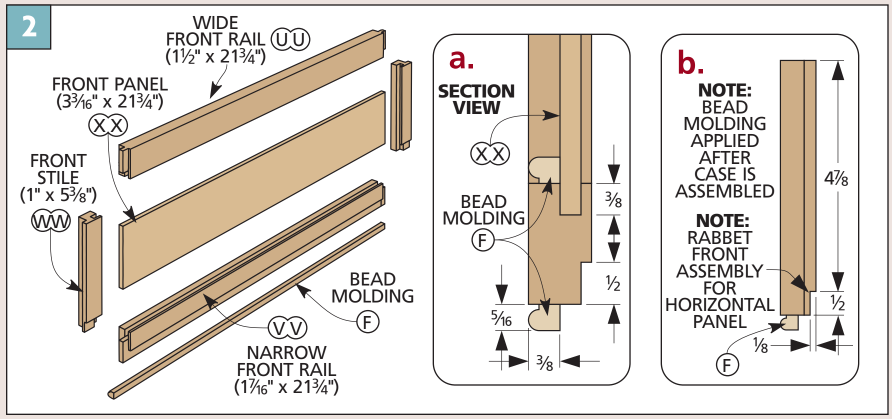
Note: Since the upper compartment and the area for the small drawers have been combined, there is only one horizontal divider in this chest.

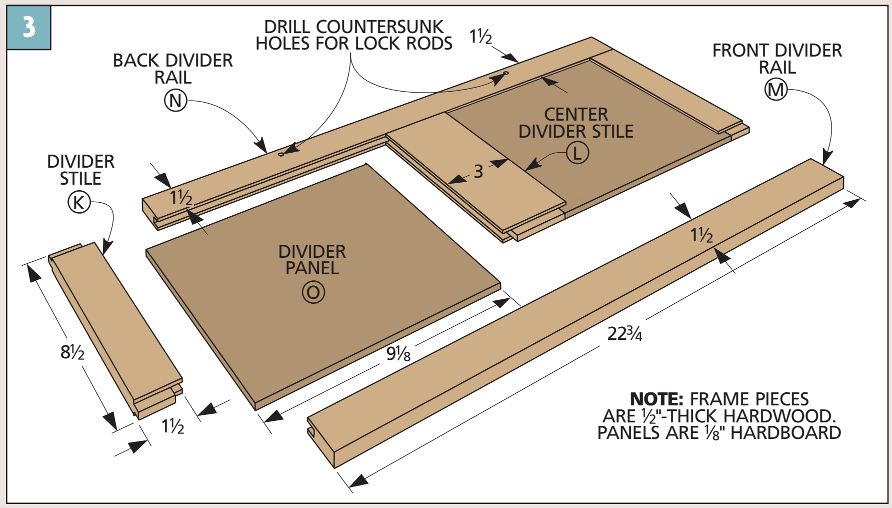
On this version of the chest, the grooves are 4 7/8" from the top edge of each assembly *(Figs. 1 and 4)*. There is also a rabbet along the bottom edge of the front assembly that aligns with the grooves in the sides and back *(Fig. 2b)*. To cut this rabbet, I reset the router table fence next to the bit. This way, the workpiece isn't fed between the bit and the fence. That would cause the bit to "grab" the workpiece and pull it.

■ The next step is to rout the grooves in the side stiles to accept the tongues on the front and back assemblies. Note that the groove at the front of each side stops at the groove for the divider *(Fig. 4)*.

■ Now you can start construction of the horizontal divider *(Fig. 3)*. The divider stiles (K, L) for this assembly are shorter (8 1/2") because the divider will sit behind the front panel assembly instead of extending to the front edge of the chest.

■ Since the horizontal divider is shorter (shallower), the divider panels (O) will also be shorter *(Fig. 3)*.





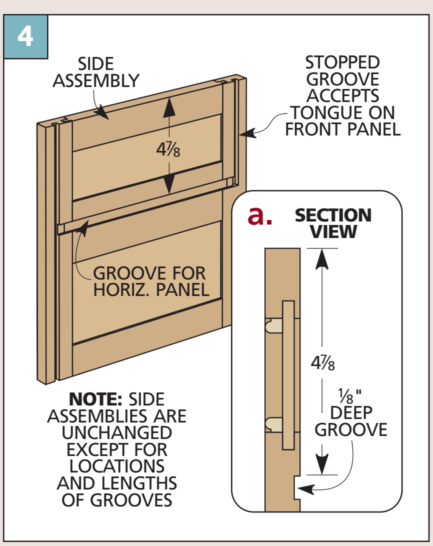
■ After the divider is glued up, you can drill the holes for the locking rods and countersink the tops of the holes *(Fig. 3)*.

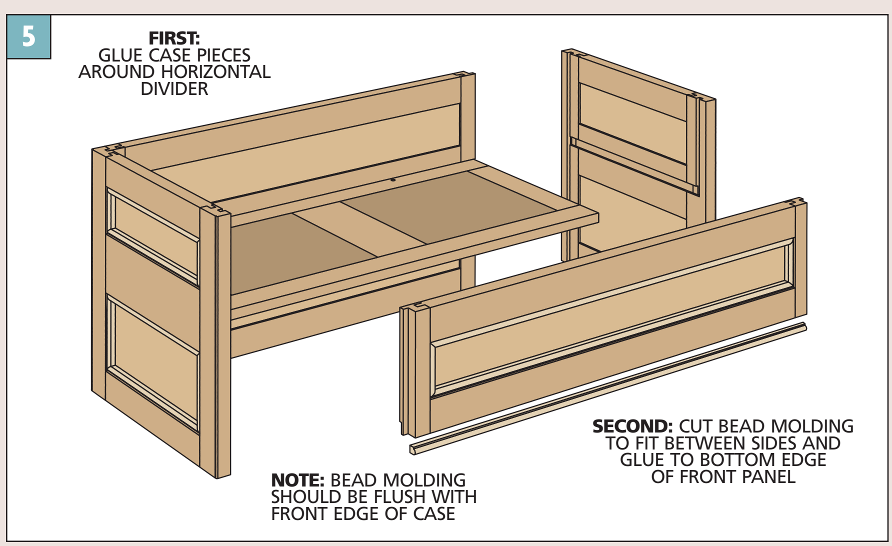
Note: You won't need to cut a groove for the vertical divider.

■ Once the horizontal divider is complete, you can glue up all five assemblies to form the case *(Fig. 5)*.

■ After the case is glued up, a piece of bead molding (F) is cut to fit between the sides and is glued to the bottom of the front panel *(Fig. 2b)*. The front edge of the bead molding should be flush with the front edge of the case.

■ The remainder of construction of the chest is the same as before, except you'll need only six runners (T), you won't need to build the small drawers, and the brass lock rods will be shorter than those on the Cabinetmaker's Tool Chest.





SOURCES

One of the first things we take into consideration when designing projects at *Woodsmith* is whether hardware is affordable and easy to find.

You'll be able to find most of the hardware and supplies for the projects in this book at your local hardware store or home center. Sometimes, though, you may have to order hardware through the mail. If that's the case, we've tried to find reputable sources with toll-free phone numbers and web sites (see the Mail Order Sources box at right).

In addition, *Woodsmith Project Supplies* offers hardware for a couple of the projects in this book (see below).

WOODSMITH PROJECT SUPPLIES

At the time this book was printed, the following project supplies were available from *Woodsmith Project Supplies*. For current prices and availability, call toll free:

1-800-444-7527

Set-up Gauge
(pages 8-12)

Rare-earth magnet .....No. 1001250

Marking Gauge

(pages 42-49)

This is a ready-to-assemble kit (see photo below). The wood pieces are pre-cut. All you need to do is assemble the pieces and apply a finish. ....No. 7512550

KEY: TL14

MAIL ORDER SOURCES

Some of the most important "tools" you can have in your shop are your mail order catalogs. The ones listed below are filled with special hardware, tools, finishes, lumber, and supplies that can't be found at many local hardware stores or home centers. You should be able to find many of the supplies for the projects in this book in one or more of these catalogs. Many even offer online ordering.

Note: The information below was current when this book was printed. Time-Life Books and August Home Publishing do not guarantee these products will be available nor endorse any specific mail order company, catalog, or product.

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