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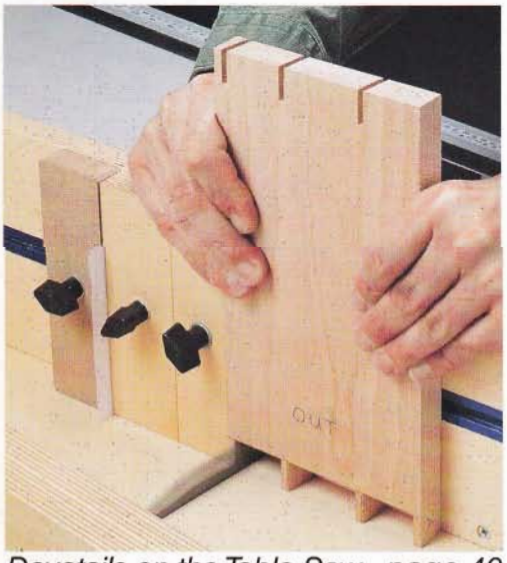
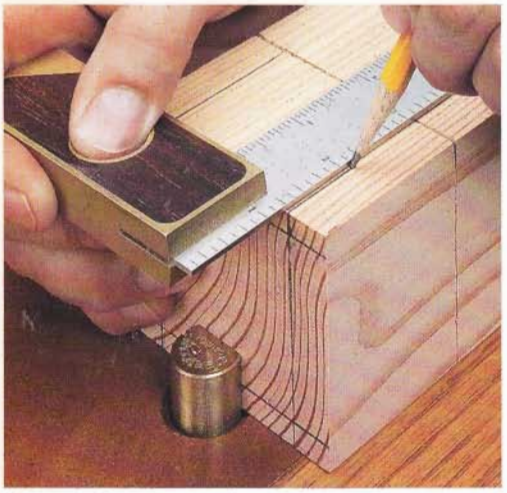
Bending Sheet Metal page 14



Dovetails on the Table Saw page 40

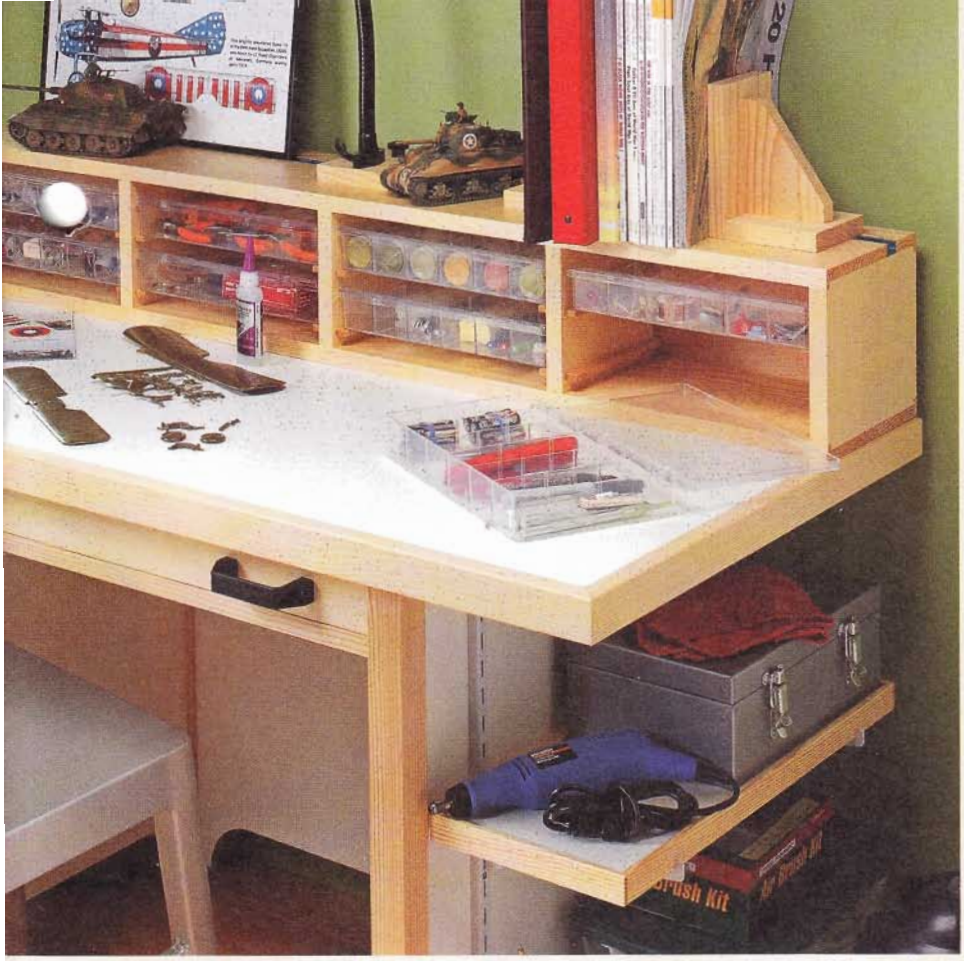


Hand-Cut Tenons page 32

Contents

Features

Departments



Hobby Bench page 24

Cutoffs

I think every article we publish is a winner. But in this issue, there's one that's my hands-down favorite. And it's the one on cutting through dovetails on the table saw. I expect it to generate a lot of interest and, honestly, maybe a question or two.

At first glance, cutting dovetails on a table saw doesn't make sense. But the fact is the table saw is a surprisingly quick, easy, and accurate way to create dovetails that look hand cut. Plus, you won't need to spend a lot of time practicing to get great results.

All it takes is a shop-built jig that you can knock together in an afternoon. After a couple test joints, you'll be ready to cut through dovetails for a wide range of projects, from boxes to blanket chests.

And be sure to check out *Shopnotes.com* for even more great information.

Terry

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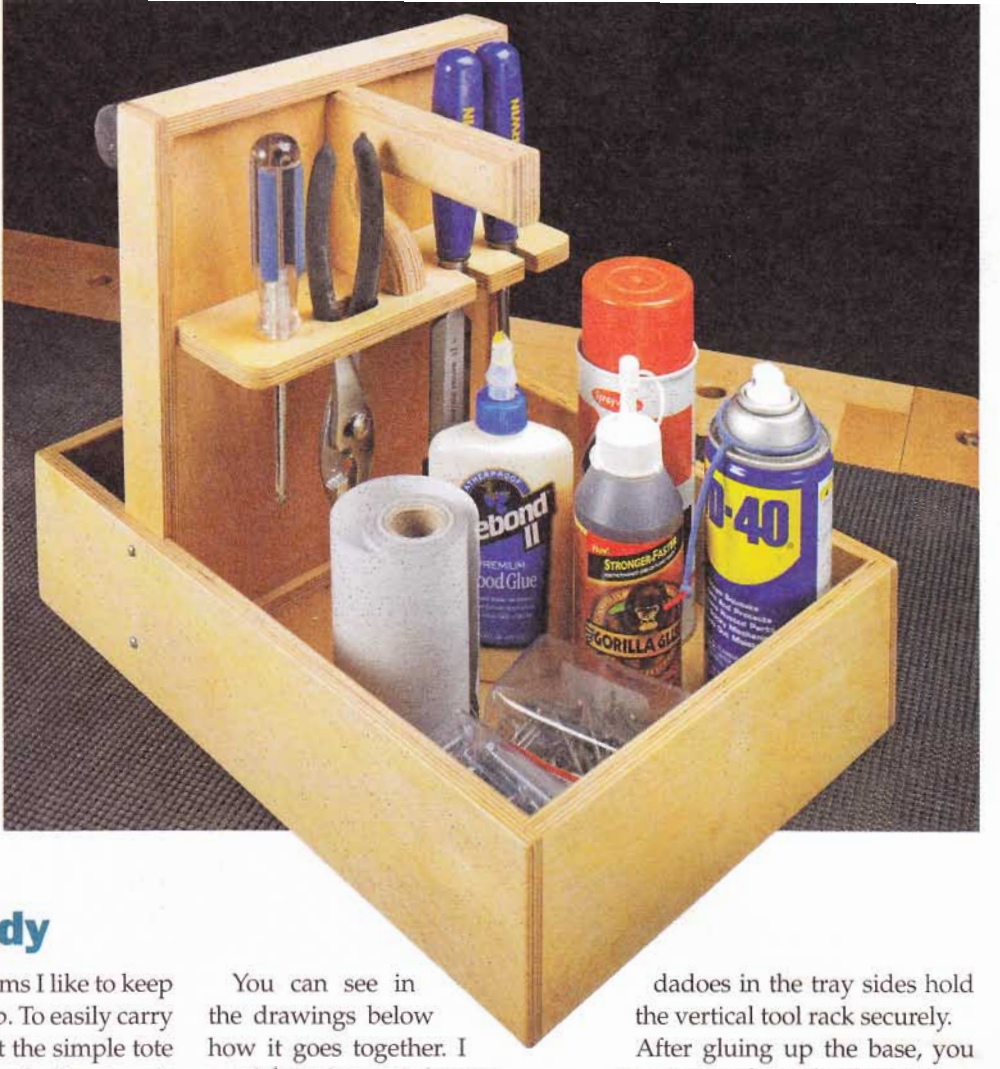
from our Readers

Tips for Your Shop

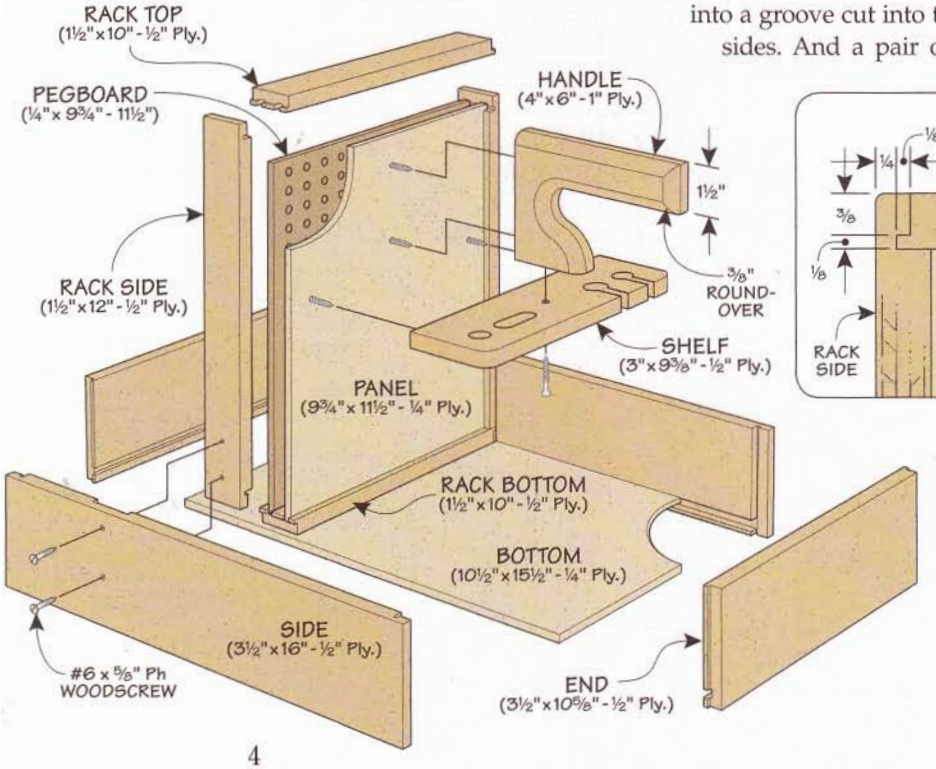


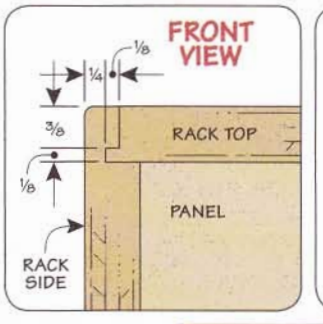
Tool Caddy

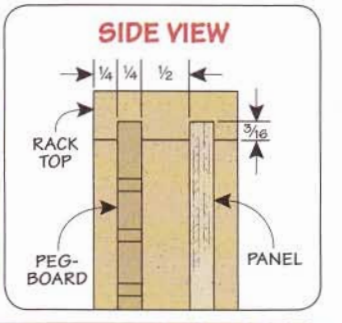
There are a few items I like to keep at hand in the shop. To easily carry them about, I built the simple tote you see above. The shallow tray is divided into two sections by a vertical rack. The rack has pegboard on one side and a shelf and handle on the other. This provides a lot of flexibility for storage.

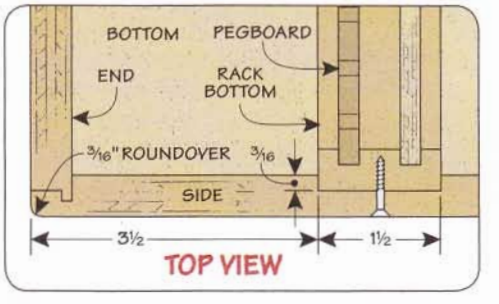
You can see in the drawings below how it goes together. I used ½" plywood for the majority of the construction. The base of the tote and rack frame are built with tongue and dado joints (Front View and Top View below). A hardboard bottom fits into a groove cut into the tray sides. And a pair of wide dadoes in the tray sides hold the vertical tool rack securely.

After gluing up the base, you can start on the rack. The frame of the rack has parallel grooves on the inside to accept pegboard and plywood panels. These spaced grooves create clearance for the pegboard hooks. But before assembling the rack, you'll need to make the handle and shelf.









The handle is glued up from two layers of ½" plywood and rounded over for a comfortable fit. For the shelf, it's simply cut to size. Then you can drill holes and cut slots to store your most-used hand tools.

Now you're ready to fasten the handle and shelf to the plywood panel. To make it easier to access the screws, you'll want to do this before you assemble the panels and the rack's frame.

After assembling the rack, slip it into the dadoes in the tray and screw it in place. Now just load the tote up with a few supplies and tools.

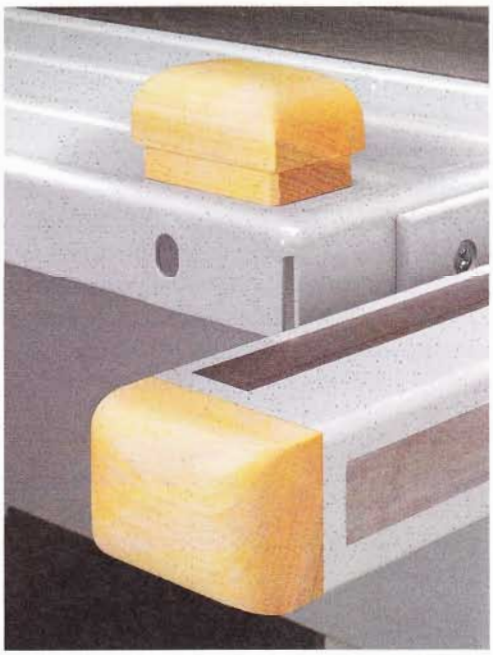
Mark Thiel
Coral Springs, Florida

Fence Rail Bumper

The rail for my table saw's rip fence is a hollow steel tube. It serves the purpose well but it causes me another problem. Walking around the shop, I've bumped into the rail and caused a scrape or two. The shop-made, hardwood "bumper" you see here solves the problem.

I sized the bumper for a flush fit with the outside of the rail. Shallow rabbets on all four sides allow for a tight friction fit inside the rail. Finally, the outside is shaped and the edges rounded over for a user-friendly fit and finish.

William Fulcher
Ottumwa, Iowa



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There, you'll be able to describe your tip in detail and upload photos or drawings. Or you can mail your tip to the editorial address shown in the right margin. We will pay up to $200 if we publish your tip. And if your tip is selected as the top tip, you'll also receive the *Bosch Impactor* shown on the right.

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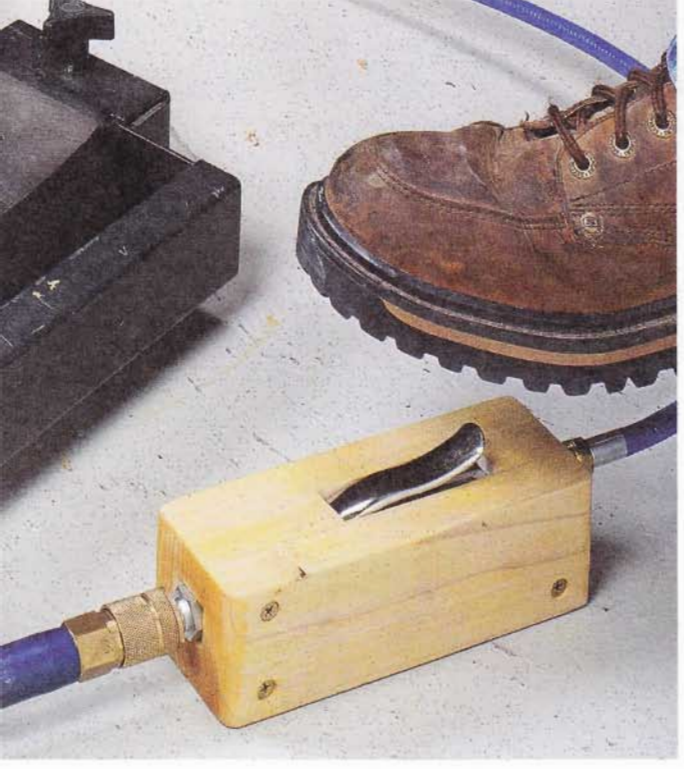
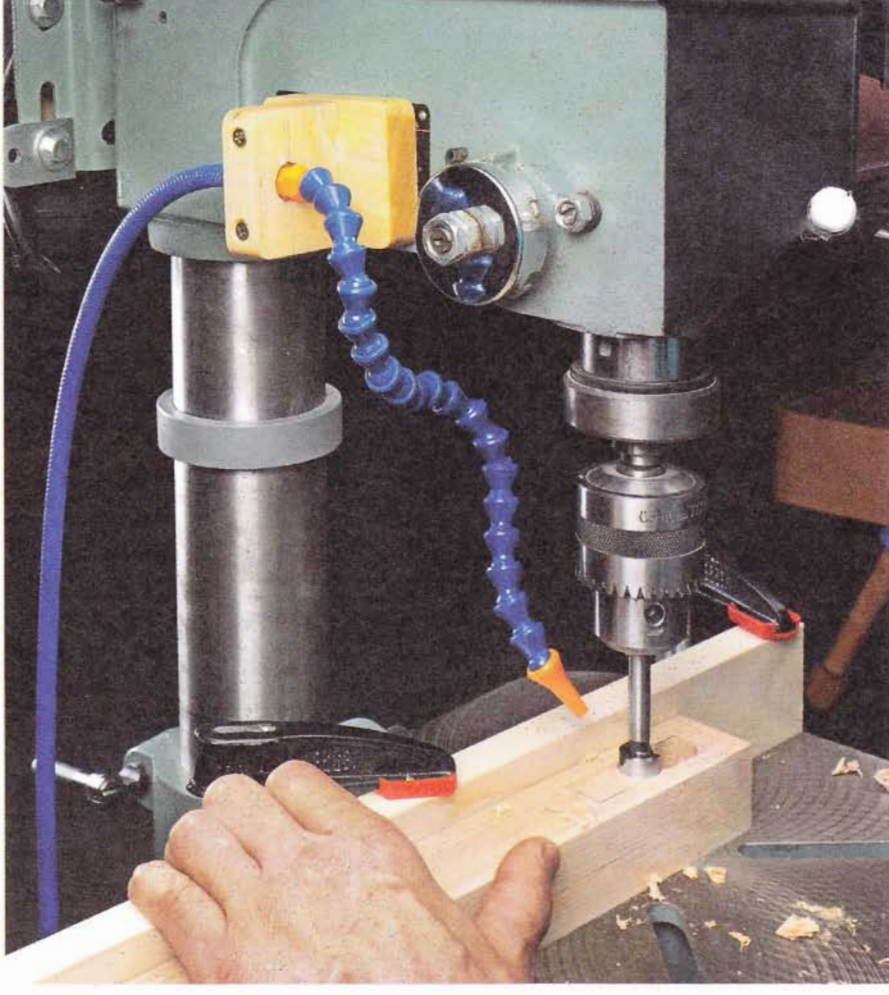




Foot-Controlled Air Nozzle

THE WINNER!

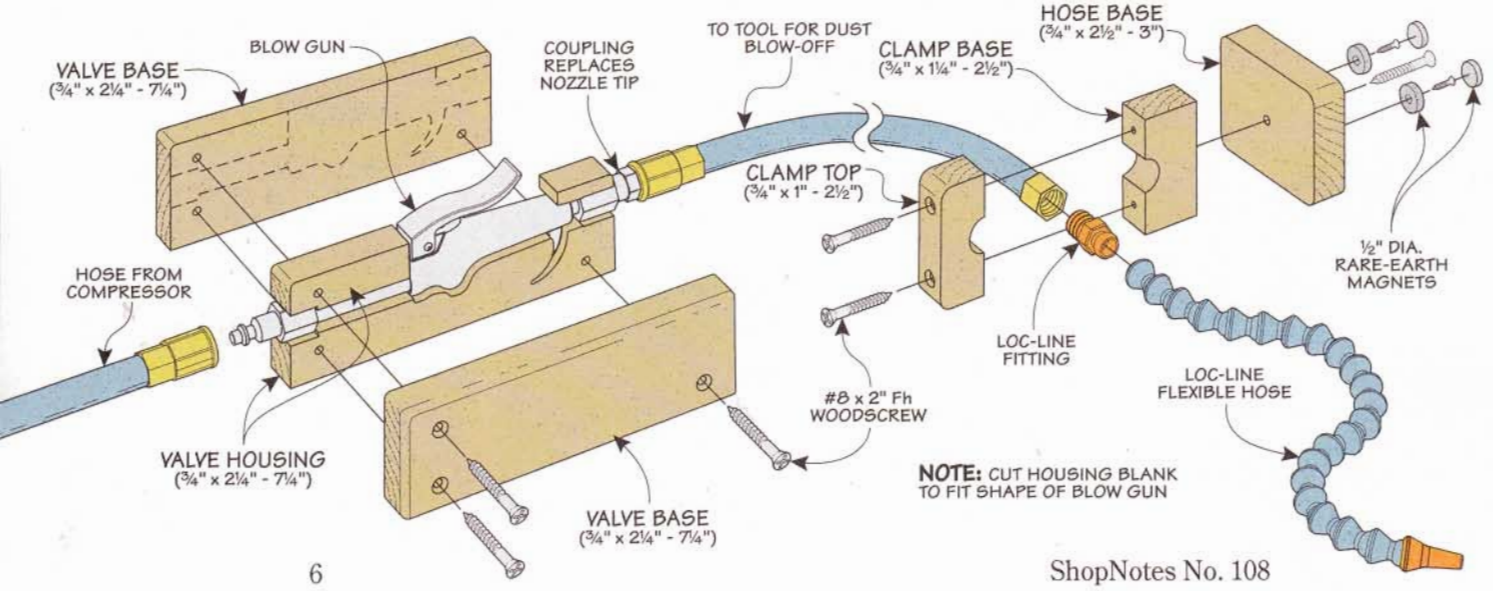
There are a few tools in the shop that generate chips and dust that make it difficult to see what you're doing. The biggest culprits are the drill press, band saw, and scroll saw. The portable, foot-powered air nozzle shown above is my solution to this problem.

The drawings below show you all the parts you'll need to put it together. The "business end" of the assembly is the air nozzle. I used a flexible *Loc-Line* hose from *Reid Supply* (Item No. LP-40413). It can be aimed where you need it and it holds that position. It connects to a fitting in a small hardwood base. The base has a pair of rare-earth magnets set into the bottom. This makes it easy to position and hold the nozzle on the tool.

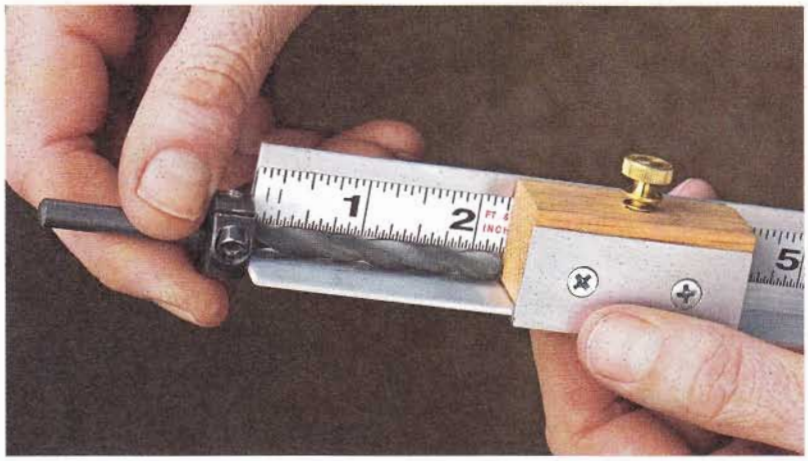
From the nozzle base, a small-diameter hose connects to the foot switch assembly. Here, a few fittings are trapped in a hardwood base. The "switch" is a blow gun with the handle positioned for easy access with the tip of your shoe. From the foot switch, you'll need a section of hose to connect to your air compressor.

There are a couple of benefits to this system. It's easy to set up on any tool in a matter of seconds. And a simple tap of the "switch" with my foot directs a puff of air to blow away debris as I'm working.

Robert Curtis
Big Lake, Minnesota



Shop-Made Set-Up Gauge

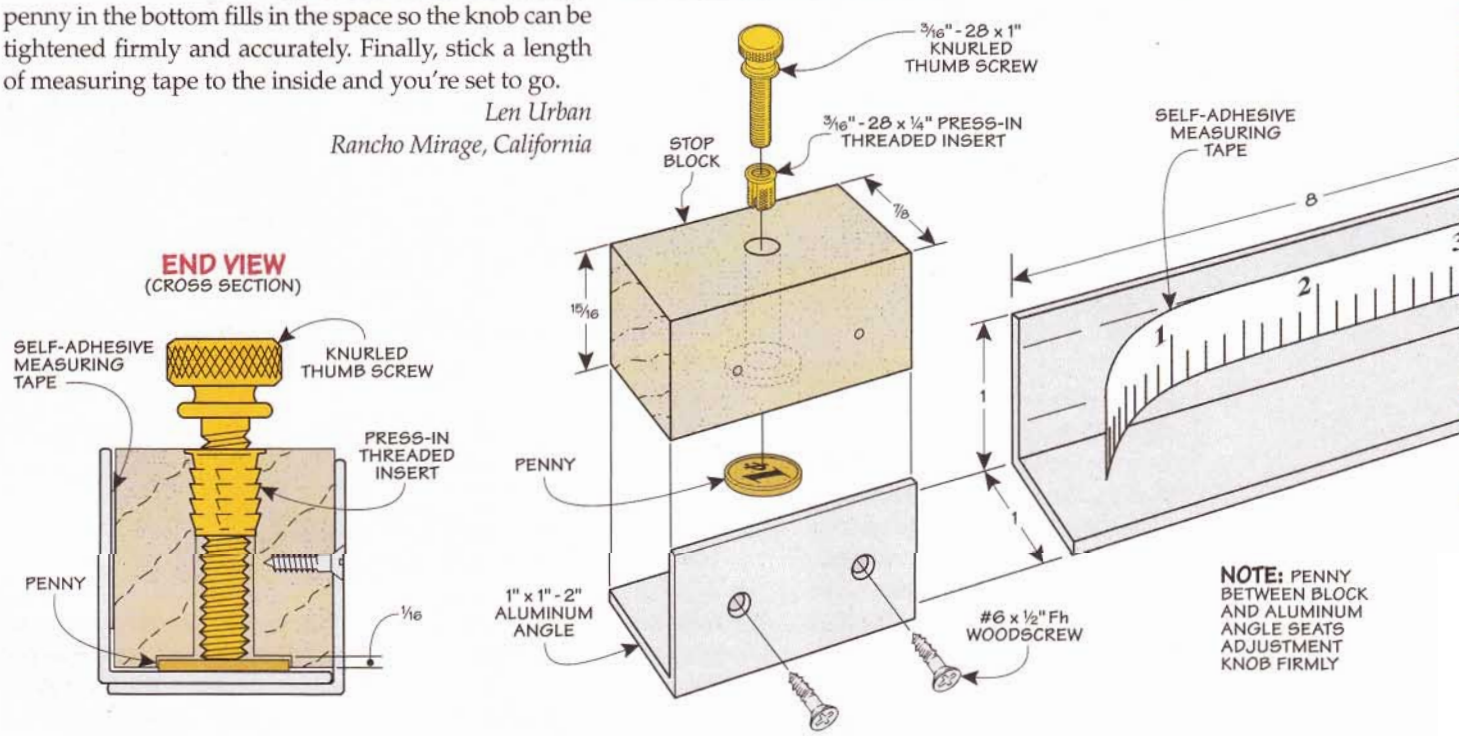


Locating the depth of drill bit collars, determining the length of dowels, or setting the cutting depth for tools accurately can be challenging. To make these tasks easier, I built the set-up gauge shown in the photo at right.

The gauge frame is simply made of a piece of 1" x 1" aluminum angle. To this I added a second piece of shorter aluminum angle with a wood stop block attached, like you see illustrated in the drawing below.

A threaded insert on the top of the wood block accepts a thumb screw that is used to set the tool. Adding a penny in the bottom fills in the space so the knob can be tightened firmly and accurately. Finally, stick a length of measuring tape to the inside and you're set to go.

Len Urban
Rancho Mirage, California



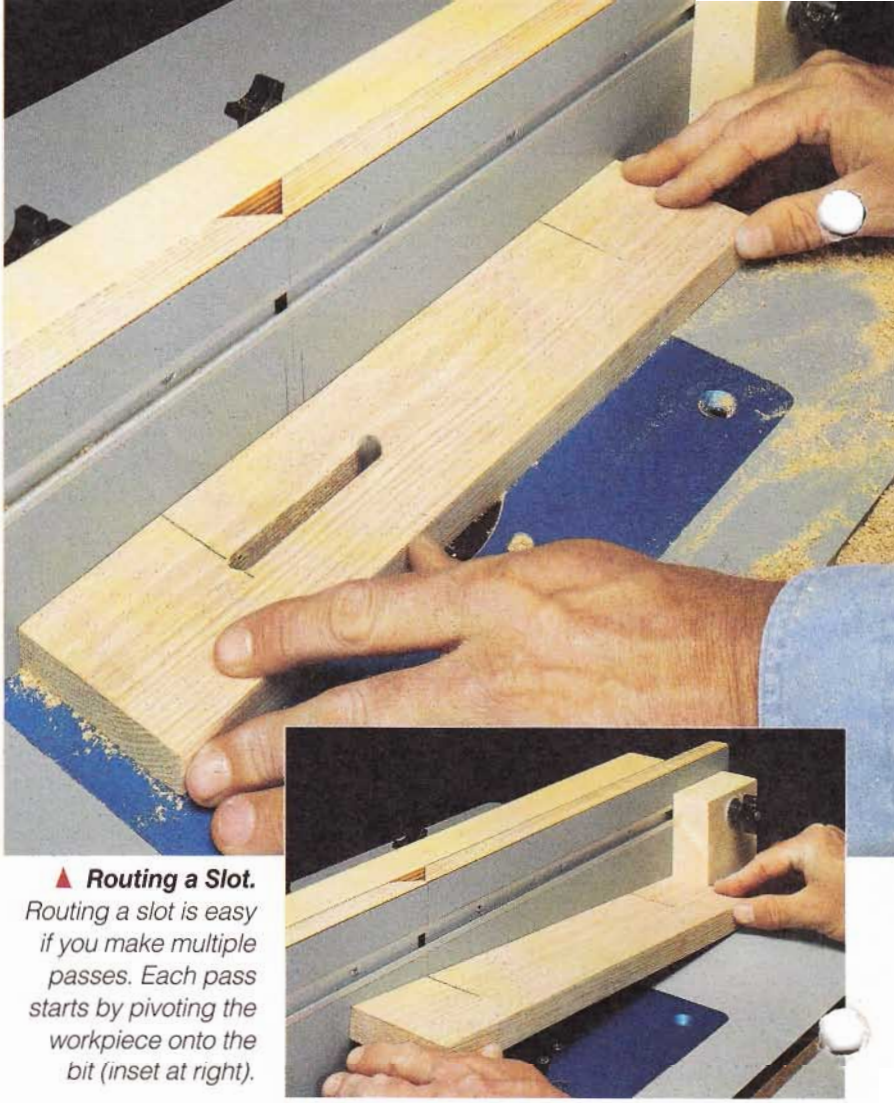
Quick Tips

▲ **Craig Highsmith**, of Annandale, New Jersey, discovered some brands of cat litter are made from silica gel crystals. Bundled in cheesecloth or nylon, the crystals absorb moisture in drawers to prevent rust.

▲ Buying epoxy in bulk and then storing and using it is easier if you use medication bottles, says **Charles Mak** of Calgary, Alberta. The containers keep the epoxy fresh and ready to use.

creating Accurate Slots

Follow this must-know router table technique for smooth, straight cuts.



▲ ***Routing a Slot.*** *Routing a slot is easy if you make multiple passes. Each pass starts by pivoting the workpiece onto the bit (inset at right).*

One way to make a jig or accessory adjustable is to use fasteners in slots. So over the years, I've made a lot of slots. The process I use to create perfect slots takes place at the router table with an ordinary straight bit and a quick-and-easy layout.

Start with a Layout. The first part of the process of routing an accurate slot is to do a little layout work. The workpiece has to be lowered over the bit to rout the slot, so you need a way to accurately line up the workpiece with the bit. This is done in two steps.

The first step is to lay out the location of the slot on the workpiece. The key is to mark the end points of the slot on the top face of the workpiece. Since these marks serve as a guide, they should be drawn along the edge of the workpiece that will ride against the fence (photo above and left photo below).

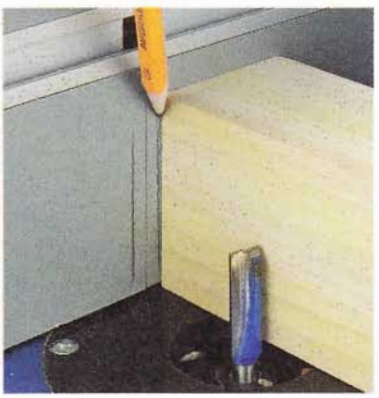
Smooth Fence Face. For the second step of the layout, you'll need to make some marks on the router table fence. The router fence shown here has adjustable faces that can be closed together. This provides a place to mark the bit location and it creates a continuous guide surface for the workpiece.

If your router table fence has a one-piece fence with a fixed bit opening, you can attach an auxiliary face to provide a surface for the layout marks.

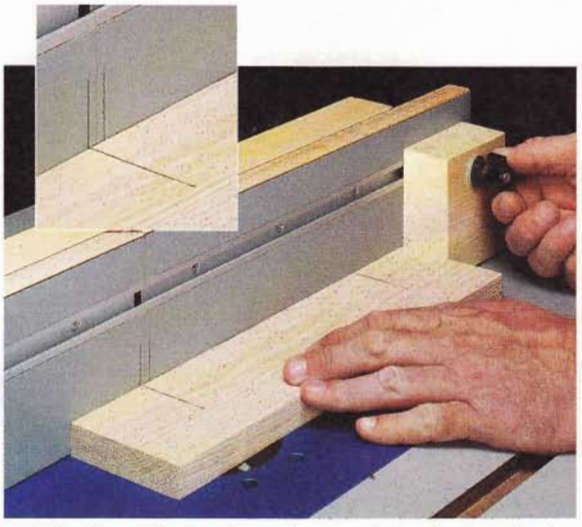
The idea here is to create alignment marks that define the front and back cutting edges of the bit. One mark indicates where to start the cut and the other where it ends.

After setting the fence to locate the slot, mark the leading and trailing edge of the bit. I like to use a thick block of wood for this. Rotate the bit so the cutting edge is parallel with the fence. Then bring the block up to the bit and against the fence and make a line (lower right photo). The alignment marks should extend up the fence a few

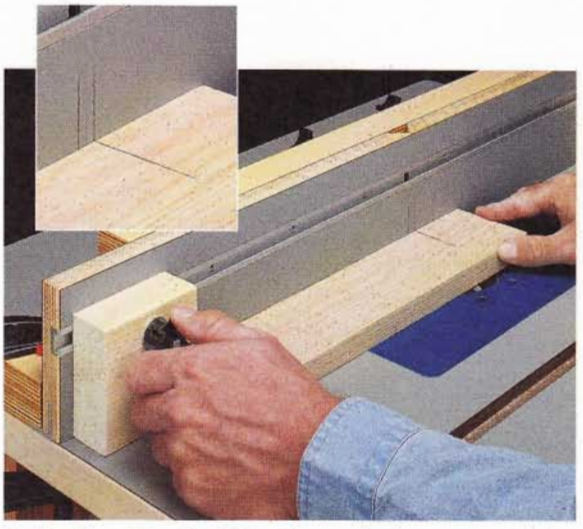
▲ ***Layout Lines.*** *Mark the starting and ending points of the slot on the edge of the workpiece that will ride against the router table fence.*



▲ ***Mark The Fence.*** *Use a block to mark the router table fence to show the position of the bit.*



▲ ***Starting Block.*** *Align the mark for the beginning of the slot with the left edge of the bit (inset). Then attach a stop block to the fence on the right end.*



▲ ***Ending Block.*** *Slide the workpiece over so the right-hand marks on the workpiece and fence are aligned (inset). Then, position the other stop block.*

inches so it will be visible as you lower the workpiece over the bit.

Stop Blocks. You have one more step to take before you're ready to begin routing. And that's to attach stop blocks to the fence. The stop blocks provide positive starting and stopping points for the slot.

To do this, lower the bit and align the "start" mark of the workpiece with the left bit mark on the fence (left photo above). Then clamp a stop block on the right side of the fence. The left stop block is positioned in a similar way, with the end mark on the workpiece aligned with the mark on the right side of the fence (upper right photo).

Start Routing. With the setup complete, you can rout the slots. Depending on the thickness of the workpiece, it may be too tough on the router and bit to rout a slot in a single pass. Instead, it's best to rout the slot in several, shallow cuts — no more than ¼" at a time.

Note: When I'm working with plywood, I make a very shallow first pass to score the face veneer and minimize any chipout.

To begin the cut, rest the workpiece against the right stop block and slowly lower the workpiece onto the spinning bit. As you do this, be sure to keep the workpiece held firmly against the fence. Once it's on the table, push the workpiece forward until it contacts the second stop block. At this point, you can turn off the router and lift the workpiece off the bit.

Completing the slot is just a matter of raising the bit slightly and repeating the process.

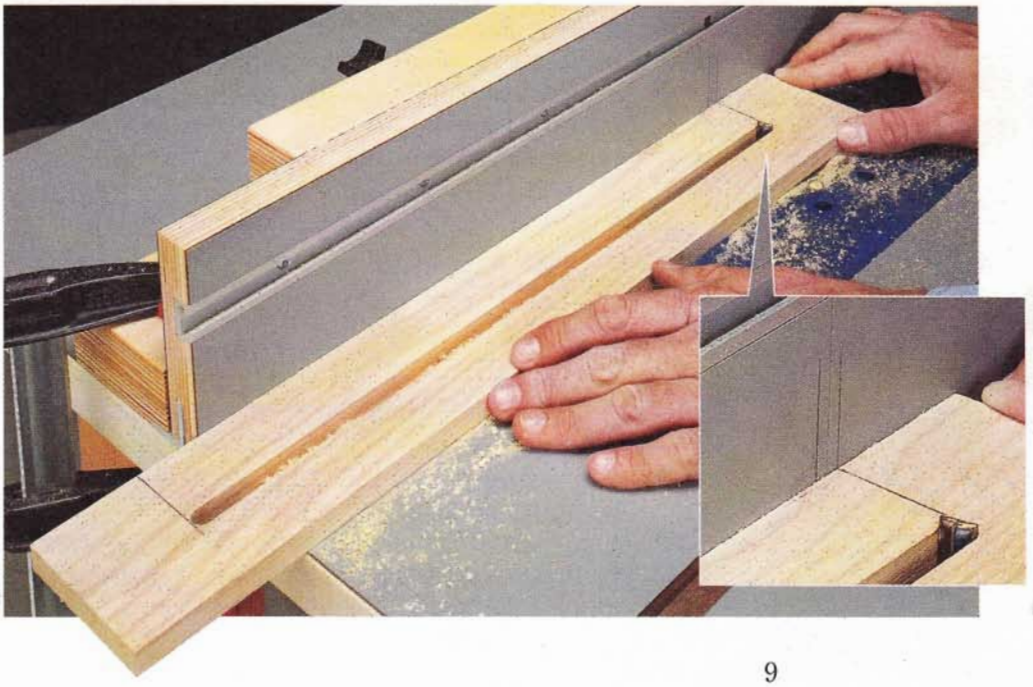
Pull Out the Stops. I mentioned earlier that I prefer to use stop blocks, if possible. But when a workpiece is long, you need to do things a little differently. That's because the fence isn't long enough to attach a pair of stop blocks.

Since there's no stop block, you'll need to use the edge of the router table as the pivot point. Line up the left fence mark with the starting line on the workpiece and lower the workpiece onto the bit. Once the workpiece is resting flat on the table, slide it along the fence until the end line and right bit line meet.

Since you don't have positive starting and stopping points, you may find that the beginning and ending of the slot are stepped or uneven. This results from slight variations in where the workpiece was lowered over the bit.

The solution is pretty simple. You can use a round file or even sandpaper wrapped around a dowel to clean up the ends. Finally, I like to soften the edges of the slot with some sandpaper to keep it from chipping out or splintering.

The result is a smooth, straight slot. All it takes is a bit of layout work and a simple process.



▼ ***Long Slots.*** *If you can't attach stop blocks, use the layout lines on the workpiece and fence to control the beginning and end of the slot.*

essentials of a sheet metal Tool Kit

You only need a few simple tools to easily cut and securely fasten sheet metal.

As a long-time woodworker, working with sheet metal can make me feel like I'm in foreign territory. But as I found out when making the storage box on page 17, all you need is a small set of inexpensive tools and a little practice.

BASIC SUPPLIES

To start with, there are a few accessories you're probably familiar with — and may even have on hand. The first thing on the list is a good pair of gloves. Sheet metal, with its sharp corners and razor-like edges, isn't very kind to hands. Wearing an inexpensive pair of leather utility gloves prevents cuts and scrapes.

Other Basics. There are a few other tools and accessories you'll need. When working with sheet metal, I like to use a fine-point, permanent marker for laying out cuts and bends.

Then when it comes time to attach hardware or fasten parts with rivets, you'll also need a center punch and a set of twist drill bits. Finally, it's a good idea to have a pair of ordinary pliers on hand. They're perfect for smoothing out bent edges and seams.

CUTTING TOOLS

The other tools you'll need for cutting sheet metal pieces to size and fastening them together are more specialized. For starters, you'll find a wide variety of cutting tools for sheet metal, ranging from basic tin snips to specialized "aviation" snips.

Simple Snips. If you could take a look inside Grandpa's workshop, you'd probably find a set of tin snips similar to the pair shown below. The simple design has proven effective for generations.

The long handles and hardened steel jaws easily cut through sheet metal like scissors on paper. Tin snips are most effective at long, straight cuts. But the key to a smooth cut is to keep the intersection of the jaws in contact with the workpiece as you open and close them.

Aviation Snips. While you can use tin snips for gentle curves, aviation snips are the way to go if your project call for tight curves. These special snips have short, slender jaws and are designed for specific cuts. For example, you can buy snips designed specifically for straight cuts or for cutting a small-radius curve to the left or to the right. For this reason, you may find it handy to have a set of all three snips for the most versatility.

▲ ***Tin Snips.*** *Simple tin snips excel at making smooth, straight cuts without a lot of effort (photo at left).*

Aviation snips have a couple of other handy features. For one, the jaws are designed to curl one side of the cut up and away. This provides clearance for your hand and tool. The other nice feature is the compound lever action that makes it easier to cut sheet metal. This way, you don't apply as much pressure to make a cut.

◄ ***Specialized.*** *The compound action of aviation-style snips multiplies your hand pressure and makes cutting sheet metal effortless.*

RIVET-SETTING TOOL

One of the easiest and fastest ways to assemble sheet metal projects is to use blind rivets. And for that you'll need a rivet-setting tool (main photo on the opposite page). It's sometimes called a "pop rivet" gun because of the noise it makes when the rivet is set.

Squeeze and Snap. The way this tool works is pretty simple. First, insert the long mandrel of the rivet into the tool. Then press the rivet into a through hole in the workpieces that need to be joined.

As you repeatedly and gently squeeze the handles, the tool grabs the mandrel and tries to pull the round head through the rivet. The head of the mandrel compresses and deforms the material on the back side of the rivet. At a predetermined pressure, the mandrel finally snaps off inside the rivet, making the familiar "pop" sound. The deformed rivet squeezes the sheet metal pieces against the head of the rivet to hold them securely. (For more about blind rivets, take a look at the box below.)

Working with sheet metal isn't complicated and opens up new options for shop projects and jigs. And all it takes are a few simple tools that won't break the bank.

choosing & using Blind Rivets

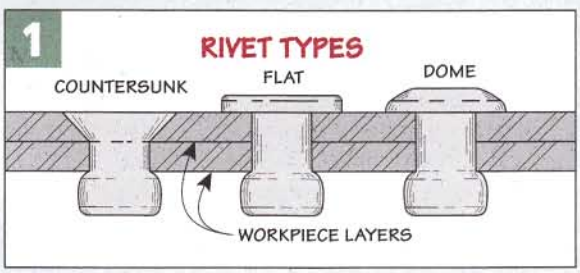
◄ ***Variety.*** *Blind rivets come in an assortment of colors, materials, and head styles.*

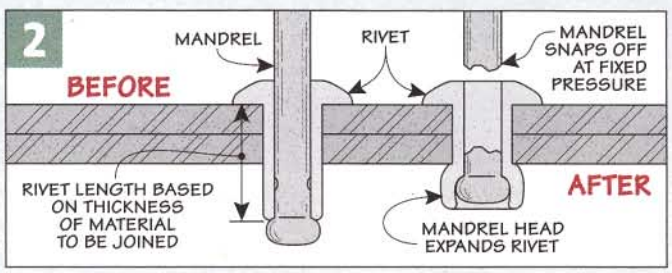
For all their simplicity, blind rivets do a remarkable job of fastening sheet metal. They're available in a variety of colors and materials like aluminum, copper, brass, mild steel, and stainless steel. You can find them in three head styles, as shown Figure 1.

The anatomy of a blind rivet is pretty basic (photo above and drawings below). The common component to all blind rivets is the mandrel. It's the nail-like piece that runs through the center of the rivet and is typically made of soft steel.

To select the right blind rivet, choose one that's compatible with the material you'll be fastening. You'll also need to know the total thickness of the materials (Figure 2). The package will tell you the thickness range appropriate for the rivets.

To install the rivet, first drill a through hole in all the parts that will be joined. The diameter of the hole should closely match the diameter of the rivet. Then use the rivet setting tool I talked about above to install the rivet, as shown in Figure 2.





perfect Mitered Edging

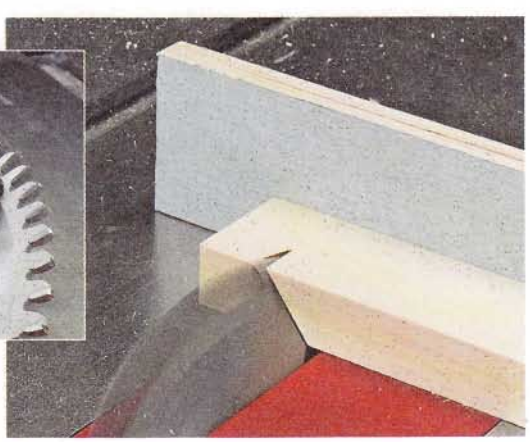
With the right setup and a few simple techniques, you can cut perfect, gap-free joints.

When I saw the hobby bench (page 24), one of the first things that got my attention was the perfectly mitered edging (inset photo above). Getting seamless miter joints can be a challenge so I asked Steve, our shop craftsman, how he did it. He uses a simple technique that guarantees great results.

Start Square. It goes without saying that you need to start with a straight and square panel. This makes the process of fitting the edging go a lot smoother. It also means making sure your table saw is set up for accurate 90° cuts. And an accurate setup carries over to cutting the mitered corners of the edging that wraps around the panel.

Table Saw Setup. While I sometimes angle the miter gauge to cut miters, Steve pointed out that he gets better results by tilting the blade, as in the photo at left. He uses a digital angle gauge to set the blade to 45°, leaving the miter gauge square to the blade (inset photo at far left). Using this method, the top of the saw table fully supports the workpiece. This helps keep it stable during the cut and minimizes any flexing.

▲ ***Accurate Setup.*** *A digital angle gauge helps guarantee an accurate miter.*

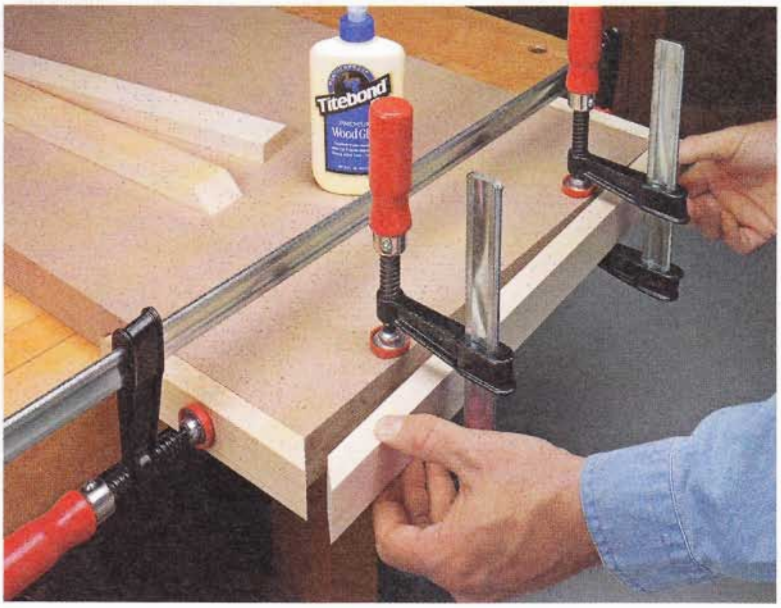


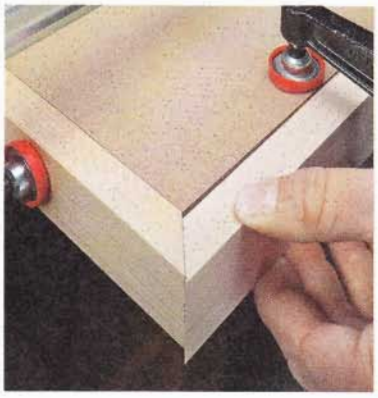
▲ ***Tilted Blade.*** *Using the table top to support the workpiece along its length yields an accurate cut and a tight-fitting joint.*

APPLYING THE EDGING

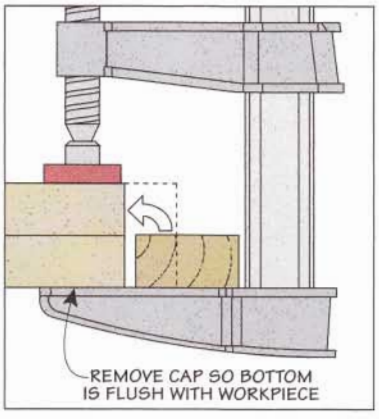
With the saw set up, you can start to work on the edging. Let me give you an overview of the process. Instead of starting on one side and working around the panel, the process starts with the ends (short sides) of the panel first. Once those pieces are positioned accurately, you fit the longer pieces between them. You'll see the benefits of this method on the step-by-step process that follows.

Reference Blocks. Before getting started, the first step is to miter a couple short pieces of edging to use as reference blocks. You'll use these blocks to help locate and fit the first piece of edging. The photo at the top of the opposite page shows you what I mean.





◄ ***Reference Blocks.*** *A mitered scrap piece clamped to each end will help you fit the first piece of edging.*



◄ ***Handy Helpers.*** *Use clamps to help hold the workpiece when applying glue.*

Cut to Fit. Start by temporarily clamping one of the reference blocks on the long edge of the panel at the corner. You can use the second reference block to position it precisely at the corner.

Now cut a miter on one end of the edging and fit it against the reference block. Then it's an easy task to mark the length of the edging along the opposite edge of the panel. This mark will be a guideline as you sneak up on the fit.

At this point you can clamp the second reference block to the opposite edge, as shown in the photo above. Now you're ready to do a little fine-tuning on the short end piece. Cut the edging a little long and check the fit.

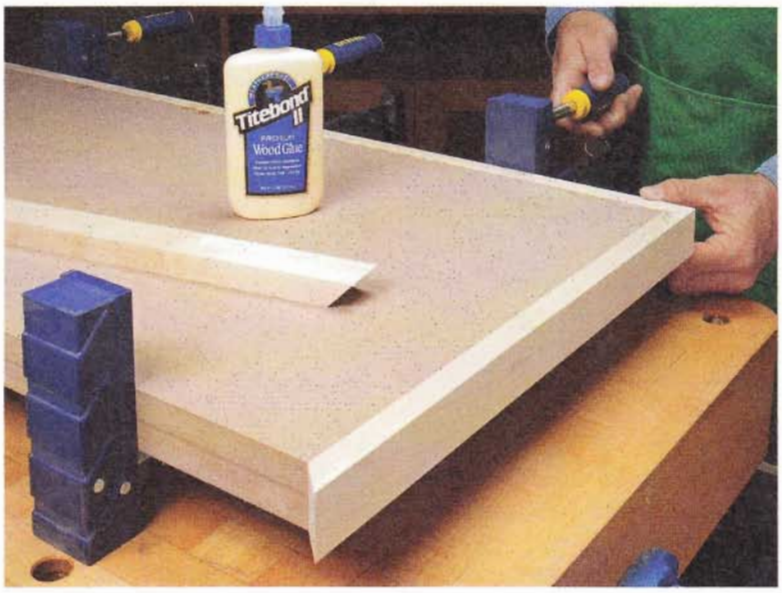
Keep checking the fit and shaving a little at a time until you get a perfect joint. You're aiming for a seamless miter and no gap all along the edge of the panel. I like to use a couple of bar clamps to lend a helping hand during this process (drawing at right).

Time For Clamps. Once you're happy with the fit, it's time to apply the glue and clamp the edging in place. Parallel-jaw clamps are ideal for this, as you can see in the main photo and photo at right.

But I find F-style bar clamps work as well. Just make sure to place a few both under and over the panel to keep the edging tight along the top and bottom edges of the panel for a gap-free joint line.

Glueup. It's during the glueup that the reference blocks provide one last benefit. They keep the edging from slipping side-to-side on the wet glue as you tighten the clamps down. And the shorter vertical clamps help provide a working platform for applying glue and rotating the piece into place, as you can see in the photos and drawing above. With one end complete, you can repeat the process at the opposite end of the panel.

Long Edges. After you've glued on the two short edges, they'll become your references for cutting and fitting the long pieces. Here again, concentrate on one piece at a time (photo below). These longer pieces have a tendency to bow and twist more than the shorter ones, so they require a little more time and test-fitting. But it pays off in a seamless fit, as the inset photo on the opposite page shows. The result of a little patience and taking one step at a time will speak for itself.



◄ ***Take It Slow.*** *After the short pieces are glued in place, turn your attention to the long edges.*

best-built jigs & fixtures

sheet metal Bending Brake

The possibilities for shop projects are endless with this simple jig for bending sheet metal.

Most of my time in the shop is spent on woodworking projects. But learning how to work with sheet metal has opened up a lot of potential for practical projects.

In the next few pages, I'll show you how to build and use a simple bending brake like you see above. It makes crisp, clean bends on sheet metal (up to 22 ga.) for great-looking results. It's made from a few pieces of hardwood to form the base and hinged handle.

The sheet metal is clamped under a piece of angle iron that creates the bending point, or mandrel. As you lift the handle, the metal is easily formed into a tight bend between a metal breaker bar and mandrel.

So, for minimal cost, you can build a tool you'll use over and over again. As a matter of fact, you can use the bending brake to build a handy supply box. You'll find the plans starting on page 17.

MAKING THE BRAKE

The mechanics of the metal brake are pretty simple. Figures 1 and 2 show you how a base frame with a hinged handle creates the bending jig. You can start with the base.

Simple Base. The base starts with a front apron and two end pieces assembled using simple butt joints to make a frame. A front rail sits on top of the frame and is where all the action takes place when bending sheet metal.

Hinges. There are a few things to do before you can attach the rail to the base frame. The first is to rout mortises for the hinges. Figure 2a shows how the mortise depth centers the hinge pin at the front edge of the rail. And for extra strength, I drilled and countersunk extra screw holes in the leaves.

Index Blocks. The next things to add are the index blocks that hold the bending mandrel in position on the front rail. Then you can fasten both the front and rear rails to the base frame.

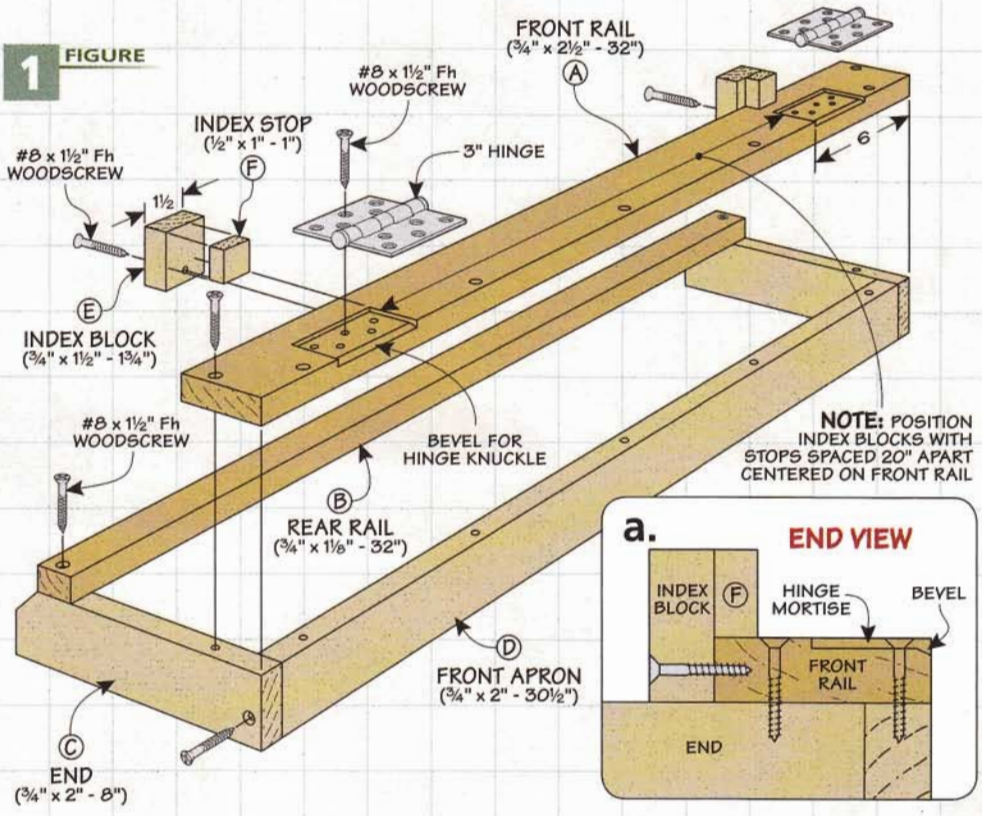
The Handle. The handle assembly is just another hardwood frame. The hinges are attached to the apron. And a pair of hinge blocks provides the extra material needed for the hinge screws.

You can see in Figure 2 that the handle assembly also includes a strip of metal to form a breaker bar. This mates up with the mandrel and does the hard work of forming the sheet metal. The key here is that the breaker bar should be flush with the top of the front rail on the base when the handle is attached to the base frame.

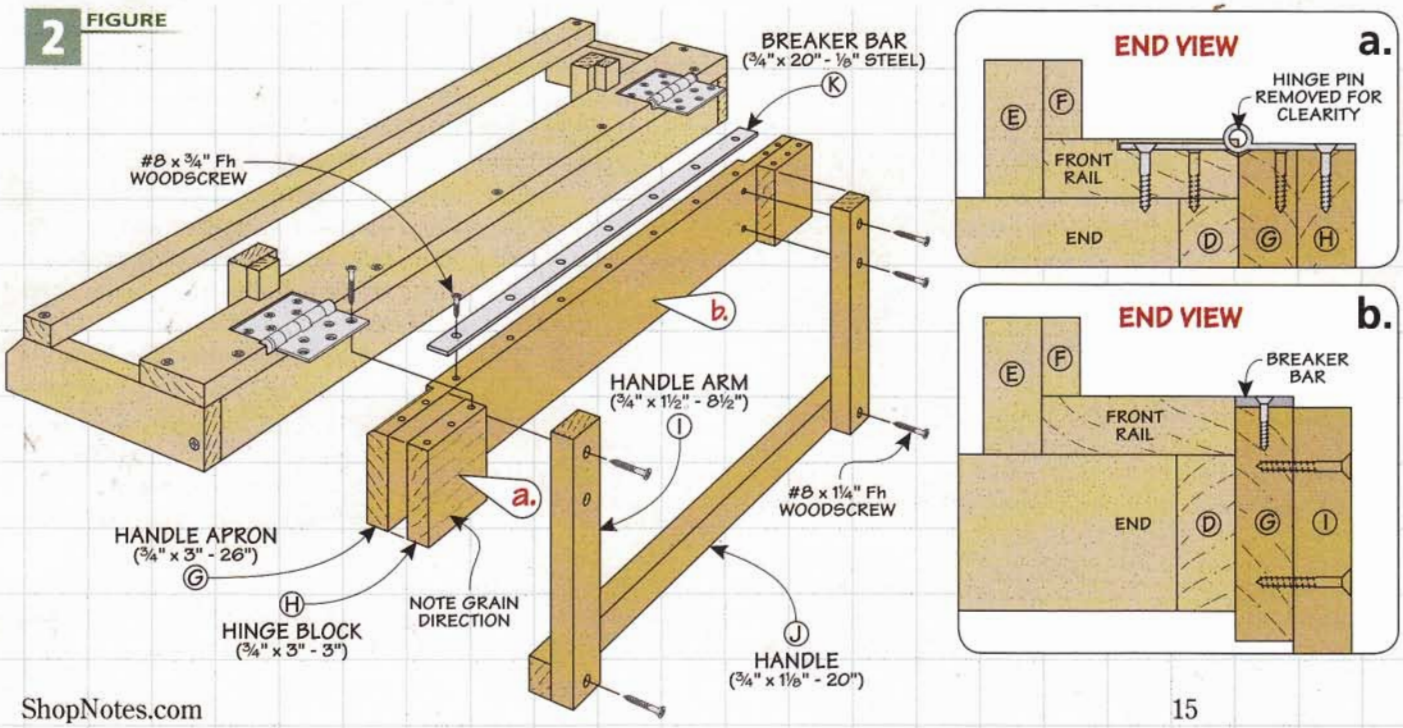
Attaching the Handle. When you fasten the handle to the hinges, you'll find a couple of clamps can lend a hand. Use the clamps to hold the handle assembly tight against the base as you fasten the hinges to the handle apron and hinge blocks. You can see what this looks like in Figures 2a and 2b.

You're on the home stretch to completing the brake. Go ahead and clamp the brake to your bench (main photo) then turn the page to make the bending mandrel.

1 FIGURE



2 FIGURE



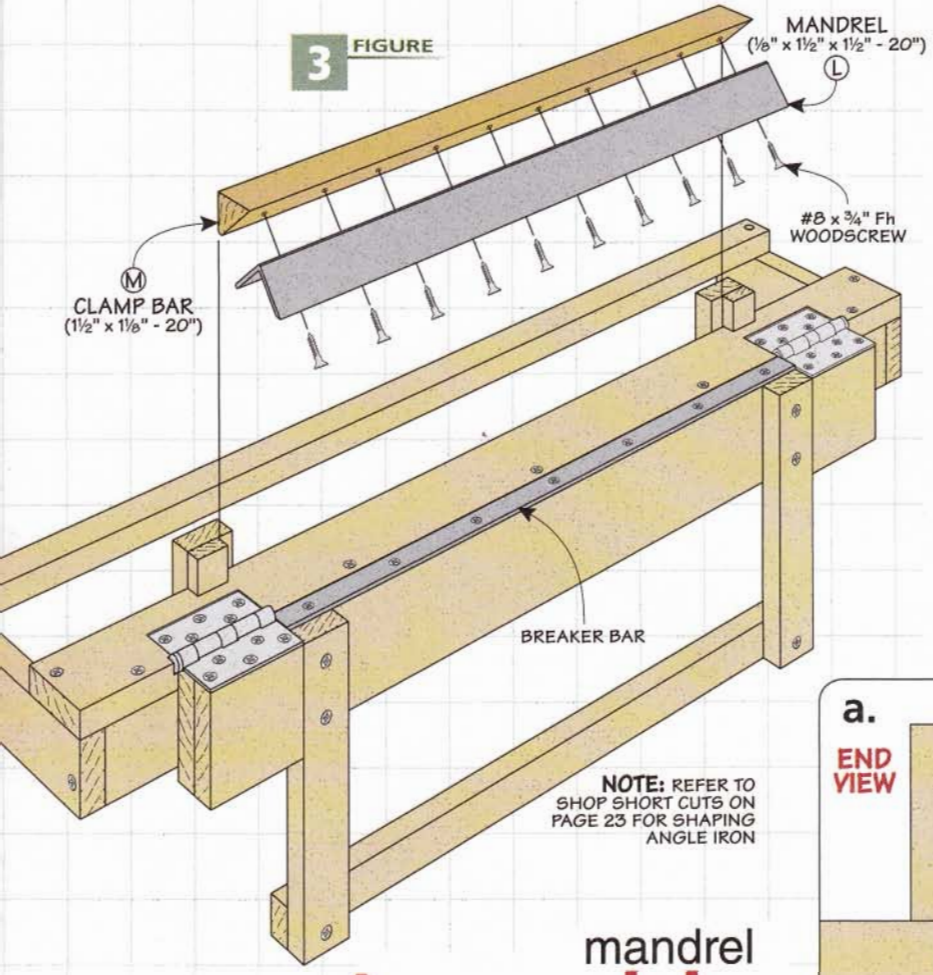
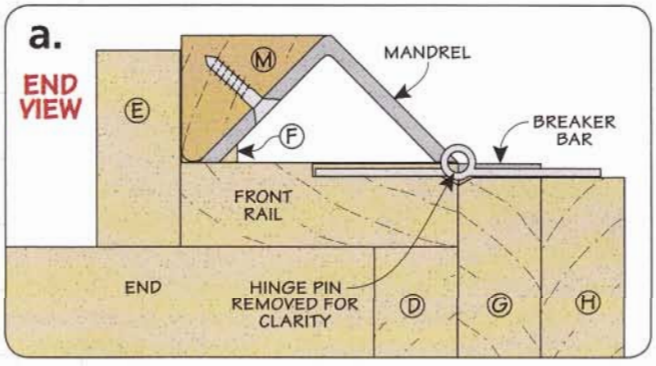


FIGURE 3

▲ ***Location.*** *Getting the brake to function properly means the mandrel, breaker bar, and hinges must be properly positioned.*



mandrel Assembly

The brake isn't complete without a bending mandrel. The mandrel and hinged breaker bar are the two main components that put all the pressure on the sheet metal when making a bend. Since this requires quite a bit of force, all of the components need to be able to stand up to the task.

Shaping the Mandrel. The mandrel is made from a length of steel angle for strength. Besides cutting it to length to fit between the index stops, there's one other thing you'll need to do. And that's to file off the rounded edges of each leg of the angle. This creates a sharp 45° edge that will yield crisp, clean corners. I won't kid you, the filing will take some elbow grease, but with the right setup, it doesn't take long. Turn to Shop Short Cuts on page 23 for some helpful tips.

Clamp Bar. To complete the mandrel assembly, drill the countersunk holes for attaching the clamp bar. The clamp bar is a piece of hardwood beveled to fit on the back side of the metal mandrel you completed earlier. Its purpose is to provide a flat bearing surface for the clamps you'll need to use when bending sheet metal. You'll learn more about that as you build the box in the following pages.

Final Assembly. With the holes drilled in the mandrel, head back to the table saw to cut the clamp bar, as shown in Figure 3a. To make beveling the edge a safer operation, I tilted the blade of the table saw and ripped the clamp bar from a wide blank. With that done, all you need to do is cut it to length and fasten it to the mandrel.

Final Test. After all this work, you're ready to put your new bending brake to the test. And there's no better way to do that than build the storage box starting on the next page.

Materials & Hardware

A	Front Rail (1)	¾ x 2½ - 32
B	Rear Rail (1)	¾ x 1⅛ - 32
C	Ends (2)	¾ x 2 - 8
D	Front Apron (1)	¾ x 2 - 30½
E	Index Blocks (2)	¾ x 1½ - 1¾
F	Index Stops (2)	½ x 1 - 1
G	Handle Apron (1)	¾ x 3 - 26
H	Hinge Blocks (2)	¾ x 3 - 3
I	Handle Arm (2)	¾ x 1½ - 8½
J	Handle (1)	¾ x 1⅛ - 20
K	Breaker Bar (1)	⅛ x ¾ - 20 Steel Bar
L	Mandrel (1)	⅛ x 1½ x 1½ - 20 Steel Angle
M	Clamp Bar (1)	1½ x 1⅛ - 20

- (2) 3" Hinges
- (6) #8 x 1¼" Fh Woodscrews
- (33) #8 x 1½" Fh Woodscrews
- (17) #8 x ¾" Fh Woodscrews

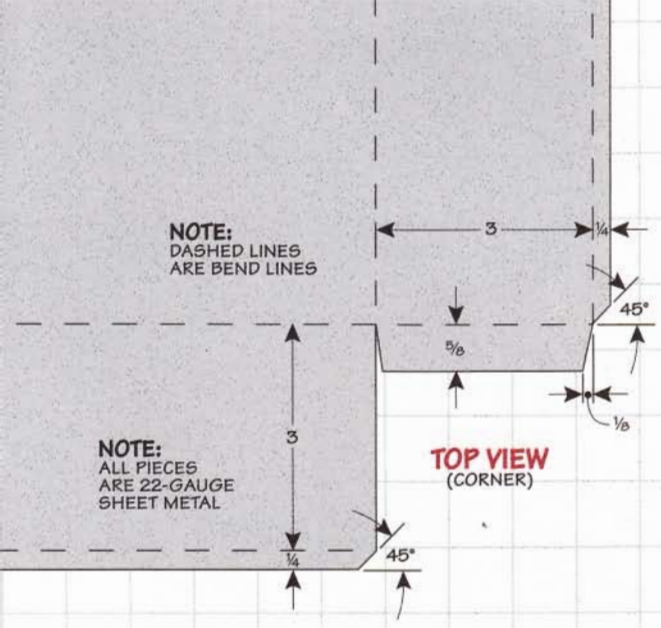
sheet metal Supply Box

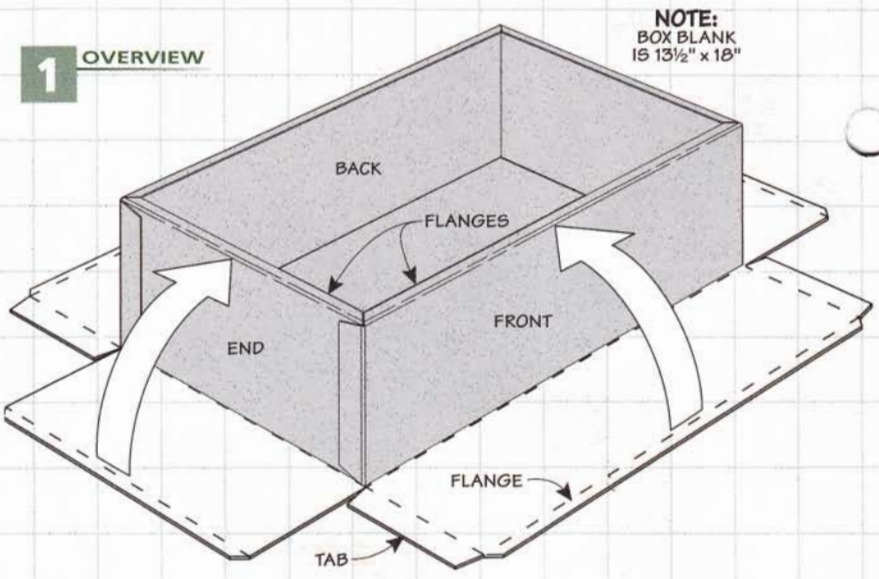
With a shop-made jig, you can easily make this handy storage box.

Working with sheet metal isn't difficult — if you have the right tools. All it takes to make the items shown here are some basic tools, a pair of tin snips, and the metal brake featured on page 14. You'll also need patterns for laying out the cuts and bends.

In the next few pages, I'll show you all of the easy-to-follow techniques you'll need to build the supply box. After that's completed, you can use those same techniques to build any of the storage items at right. You'll find all of the patterns for these projects on our web site at *ShopNotes.com*.

I think you'll discover that after fabricating these few simple projects, you'll be ready to design and build your own. And to me, that's half the fun of being in the shop — applying what I've learned to build something that's practical and long-lasting.





storage Box

There are a few key components to guarantee success when building any sheet metal project. They include an accurate layout, a sharp set of tin snips, and a metal brake, like the one on page 14.

Sheet Metal. But the first thing I want to talk about is sheet metal. You'll find it in a variety of thicknesses, or gauges. The higher the gauge number, the thinner the sheet metal. For shop projects like this one, 22-gauge steel is about right. It's easy to cut and bend but still has plenty of strength.

Layout. With your sheet metal in hand, it's time to lay out the project. For this, I like to use a fine-point permanent marker. (You may have to remove oil and dirt from the metal with solvent first.)

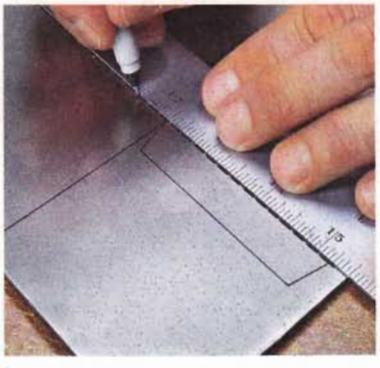
Figure 1 and the pattern above will give you all the dimensions you need. Since all four corners are the same, you can repeat the dimensions at each corner. Using the drawings as a reference, mark the cut lines with a continuous line. For indicating where to bend the metal, you'll want to use a different type of line so you won't cut along this line by accident. I like to use a dashed line. You can see what I mean in the photo at left.

To lay out the tabs that form the corners of the box, a 45° plastic drafting triangle works perfect and makes the task easy. An accurate line here helps ensure that the flanges will align after all the bends are made.

Cut It Out. With the layout done, it's time to grab the tin snips and get to work. While cutting sheet metal is an easy task, there are a couple of things to keep in mind. The first is to put on a pair of gloves to protect your hands from cuts and scrapes.

When making a cut, open the snips wide and make the longest cut you can with one stroke. And if a cut requires more than one stroke, keep the jaws of the snips in constant contact with the cut line. Following these simple tips gives you the smoothest cut without leaving sharp, jagged edges (bottom photos below).

Filing. After cutting out the pattern, I like to run a file along all of the cut lines to ease any sharp edges. It's easier to do this now than after the box is put together.



► ***Layot.*** *Use continuous lines to identify cuts. Dashed lines indicate where to form bends.*

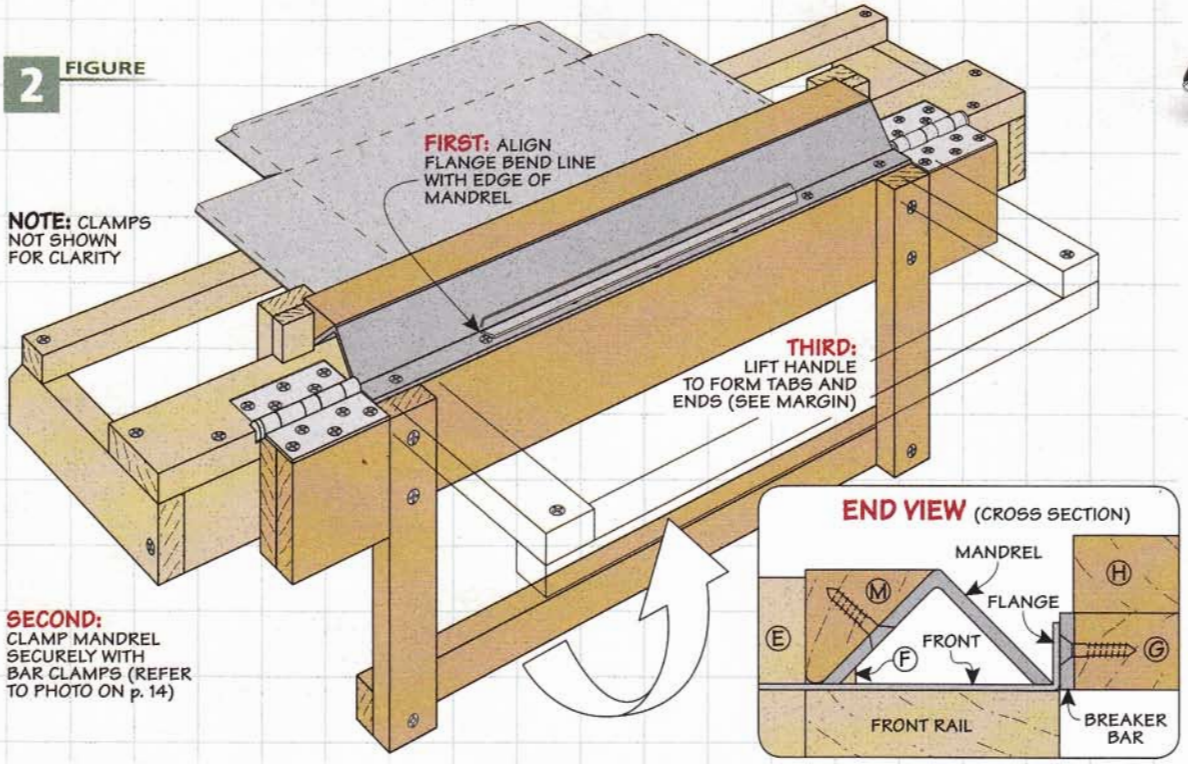
► ***Long Cuts.*** *Make the long cuts first (left photo), followed by the shorter cuts (far right photo).*

BENDING

With the blank in hand and the metal bending brake securely clamped to your benchtop, you're ready to form the box. I'll step you through the process of making the bends in the right order. You'll be surprised at how quick and easy it is to make the box.

Some Pointers. When using the metal brake, there are some tips I want to point out. The first is to make sure the metal is clamped tightly all along and underneath

FIGURE 2



▲ ***Flanges.*** *The first bends to make are the ones that form all four flanges.*

the clamp bar. This is a situation where you almost can't have too many clamps. You don't want the metal to creep out of position as you apply pressure during the bending operation. You can get an idea of how the clamps work in the main photo on page 14.

Bend the Flanges. The first bends to make are the ones that form the flanges. You can see the flanges in Figures 1 and 2. The key to a straight bend is to make sure the bend line is aligned with the front edge of the mandrel as you tighten down the clamps.

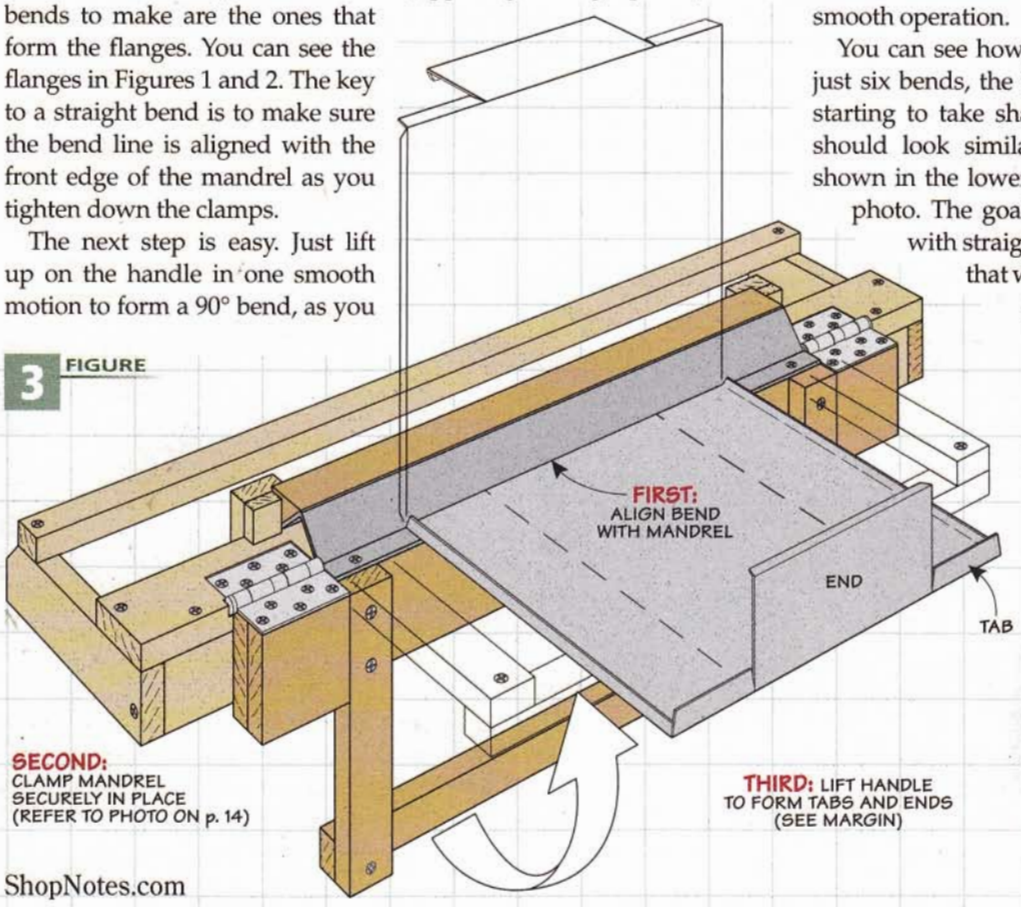
The next step is easy. Just lift up on the handle in one smooth motion to form a 90° bend, as you can see in Figure 2. Note: It doesn't hurt to go a little past 90° because the metal has a tendency to spring back. Once you make a couple of bends, you'll get the hang of it. Work your way around the blank to form all four flanges before moving onto the tabs and ends (upper right margin photo).

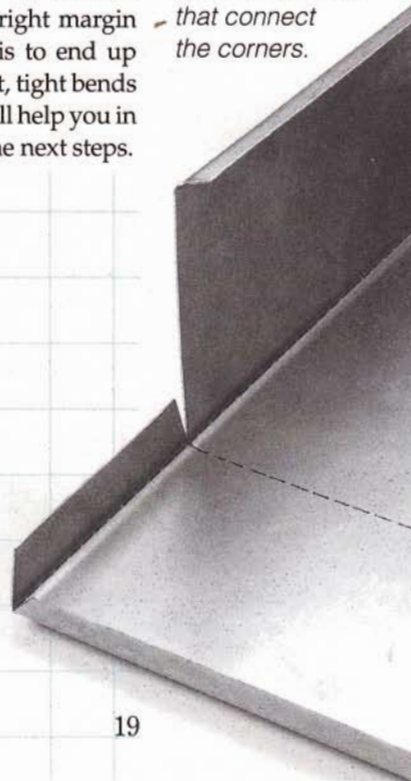
Tabs and Ends. The next two bends extend all the way across the blank. These form the ends of the box and create the tabs that tie the corners together. You can see how this is done in Figure 3. The process is the same as before: line up the bend line, clamp it tight, and then make the bend in one smooth operation.

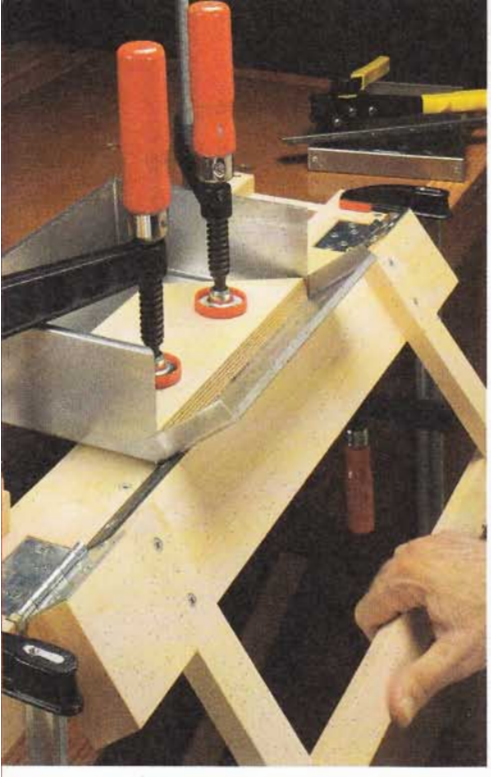
You can see how, after making just six bends, the box is already starting to take shape. Your box should look similar to the one shown in the lower right margin photo. The goal is to end up with straight, tight bends that will help you in the next steps.

▼ ***Ends & Tabs.*** *All it takes is two bends to form the ends of the box and the tabs that connect the corners.*

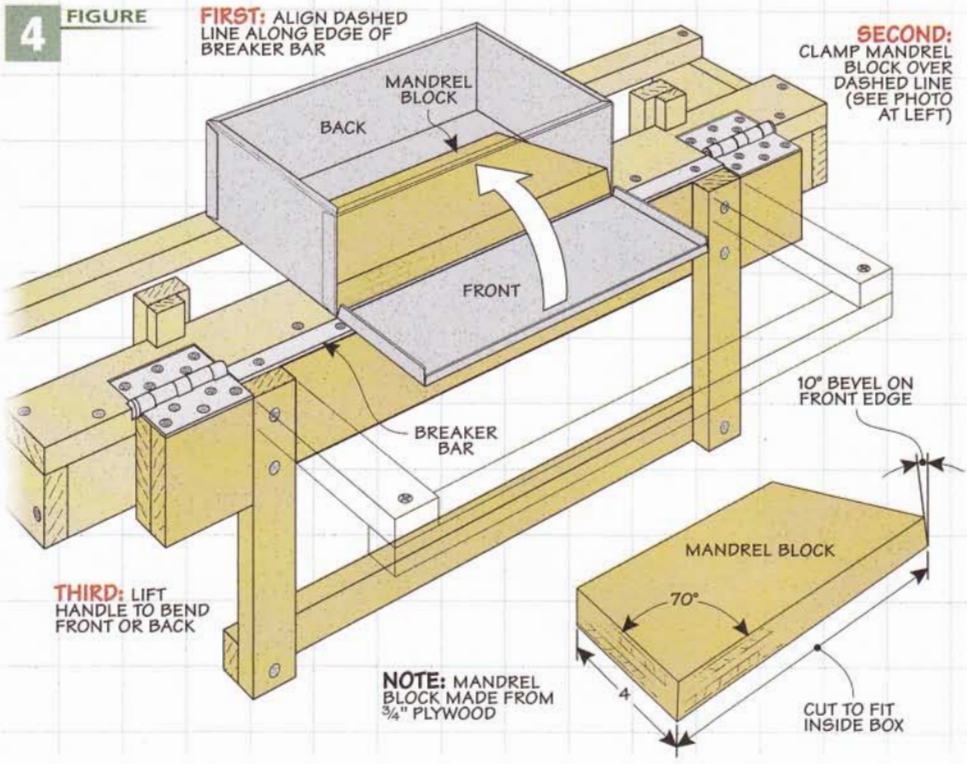
FIGURE 3







▲ **Clamping.** *Plywood mandrel blocks replace the steel mandrel when making the final bends.*



final box Assembly

There are just a couple of bends to make to complete the box bottom. But these bends require a little different technique. If you take a look at the partially formed box, you'll notice there's no way to fit it under the clamp bar of the bending brake to make the next bends.

Instead, you'll make a couple of mandrel blocks out of plywood. These fit inside the box to take the place of the clamp bar and mandrel assembly (Figure 4).

Mandrel Blocks. There are a couple of things I need to point out about the mandrel blocks. First of all, the edge that forms the corner of the box is beveled at about 10°. This creates a tight corner when bending the sheet metal and allows you to bend a little past 90°. To make it easier to fit the blocks inside the box, I tapered the sides. Finally, I made the length of the blocks about ¼" shorter than the inside dimension of the box.

Final Bends. With the mandrel blocks in hand, you're ready to make the final two bends to complete the box. The key here is to make sure the mandrel blocks are clamped securely with the edge aligned along the bend line.

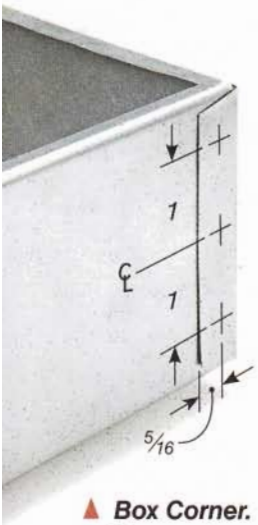
Don't worry if you slightly bend the flanges as you complete these last two bends. You can easily straighten them with pliers.

Rivets. Now you're ready to install the rivets that tie the corners together. It's best to work on one corner at a time, install the rivets, and then move on.

With all of the tabs on the outside of the box, add a couple of bar clamps across the box to hold the corners tight. After laying out the rivet locations (margin photo), tap them with a center punch. Then use an ⅛"-dia. twist bit to drill the rivet holes (left photo below).

After the holes are drilled, you can install the rivets, as shown in the right photo below. Move on to the opposite corner and repeat the process all around the box.

Finally, you can remove the clamps and inspect the flanges. You'll want them nice and straight so the lid will fit tight. Straighten any kinks with pliers.

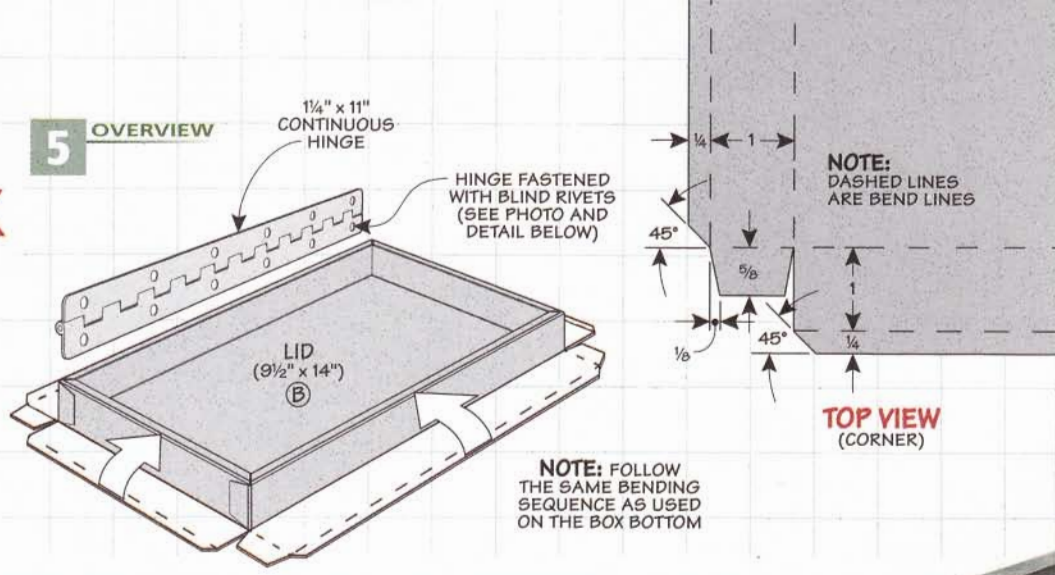


▲ **Box Corner.** *After the final bend, the corner should fit tight.*

▲ **Punch & Drill.** *After laying out the rivet locations, punch the centerpoints and then drill for rivets.*

▲ **Blind Rivets.** *With the box still clamped, install the rivets through the tabs for a secure connection.*

finishing the Lid & Box

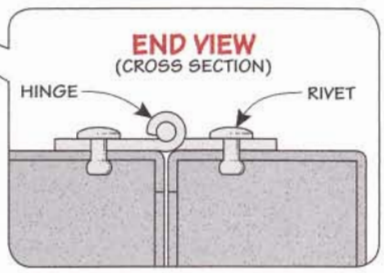


If you take a look at Figure 5, you can see that the lid is created the same way as the box. You'll start with the flanges, then the ends, and finally the front and back. A single rivet in each corner is all you need to make the lid solid.

After taking a little time to ensure the flanges are straight, it's time to marry the lid with the box. To do this, I started with the hinge.

Hinge. All of the hardware is installed with rivets, including the continuous hinge. And to make sure the lid fit tight with the box, I clamped them together to lay out the holes for the rivets (photo at left). To make sure the hinge stayed parallel to the joint, I installed a rivet in each leaf at each end. After installing the remaining rivets in between, you're ready to decide on a paint color.

▲ ***Easy Installation.*** *Using the hinge as a layout guide, you can punch and drill the rivet holes.*



Paint. Before getting out the aerosol can of paint, it's a good idea to wipe the box and lid with solvent to remove oil and grime. And I like to take the extra step of blowing off any remaining lint with compressed air. Then you're ready to apply a couple of light coats of enamel. After letting the paint cure, you can finish installing the hardware.

Handle. The toolbox handle is easy to install and is centered on the lid. You can use the handle hardware to locate the rivet holes. Just remember to lightly punch them before drilling to keep the bit from wandering off-center.

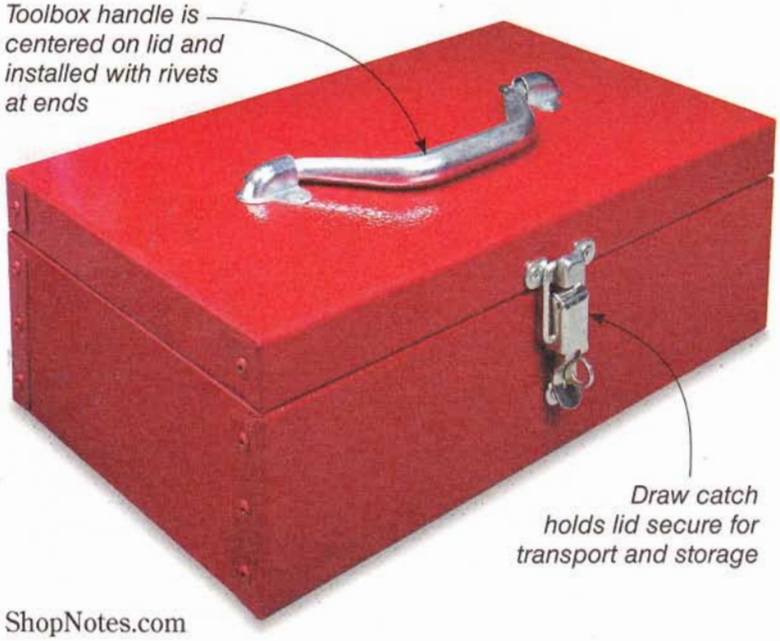
Draw Catch. Next comes the draw catch that secures the lid. To install the catch, you'll find it goes a lot smoother if you clamp the lid to the box like you did when installing the hinge. After placing the closed draw catch on the center line of the box, align the bottom edge of the catch with the bottom edge of the lid. You can see what this looks like in the photo below. Like before, punch and drill the holes and install the rivets.

Final Thoughts. By now I'm sure you can see how quick, easy, and enjoyable it can be to make a project out of sheet metal. Remember to go to *ShopNotes.com* and check out the other projects you can make for your shop.

▲ ***Lid Corner.*** *After the final bend, the corner should fit tight.*

ShopNotes GO ONLINE EXTRAS

To see more patterns for sheet metal projects, go to: ShopNotes.com



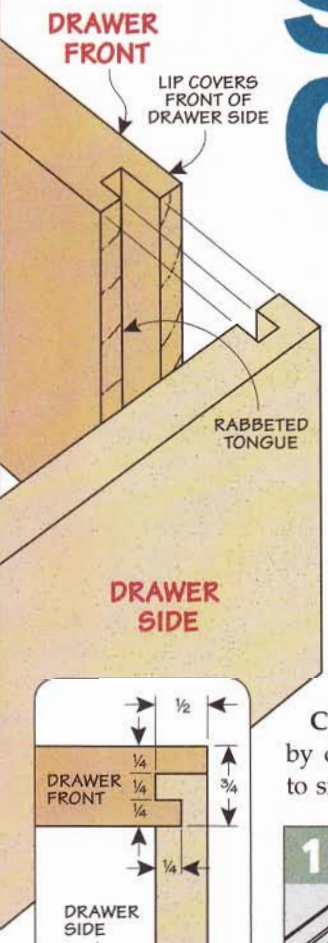
Materials & Hardware

CASE

A	Box (1)	13½ x 18 - 22 Ga. Sheet Metal
B	Lid (1)	9½ x 14 - 22 Ga. Sheet Metal

- (1) Draw Catch
- (1) Toolbox Handle
- (1) 1¼" x 11" Continuous Hinge
- (36) ⅛" Blind Rivets

Shop Short Cuts



Locking Rabbet Joint

The drawer front in the hobby bench on page 24 uses a locking rabbet joint. The drawing and inset at left show how the drawer front and side fit together with a rabbeted tongue on the drawer front. The tongue fits into a dado (sized to fit the tongue) in the drawer sides.

Cut the Drawer Pieces. Start by cutting all the drawer pieces to size, plus a couple test pieces. You can use the test pieces to set up the table saw.

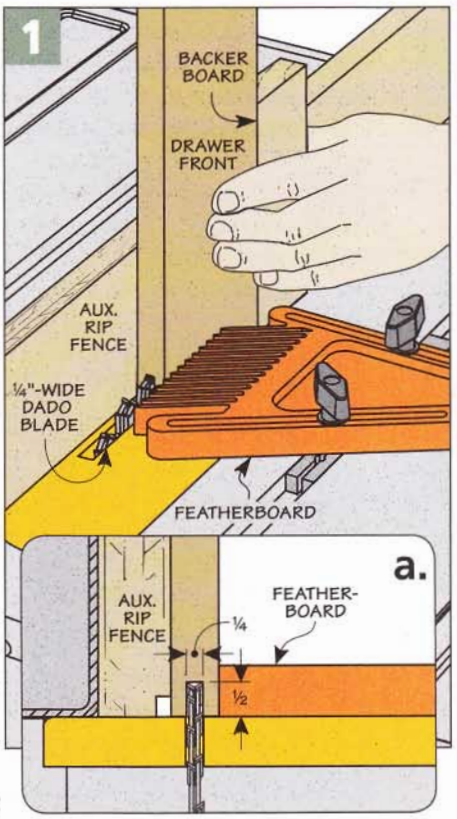
Rabbeted Tongue. To make the tongue on the drawer front, you'll first stand it on end and pass it over the dado blade to make a groove along the end. A tall auxiliary fence and featherboard make this job easy, while a backer board reduces chipout (Figure 1).

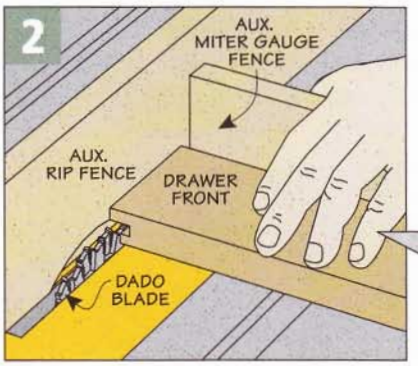
Figure 1a gives the dimensions for the groove. Once you have the setup adjusted, go ahead and cut the groove in the front.

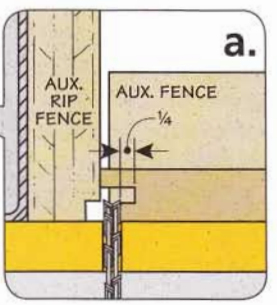
The next step is to create the tongues by cutting back the lip on the inside face of the drawer front, as shown in Figures 2 and 2a.

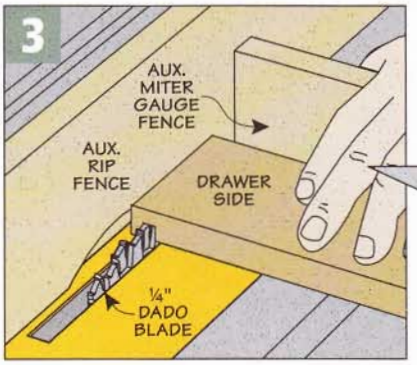
Dadoes. With the tongue completed, you can cut the dado in the sides. Size the depth and width of the dado to match the size of the tongue. Again, use a test piece to make the setup simpler, as shown in Figures 3 and 3a.

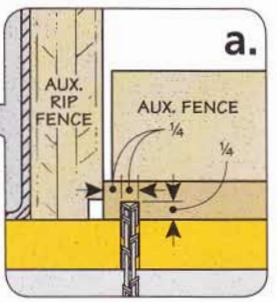
Your goal is to have the end of the side piece fit snugly into the rabbeted front of the drawer, as seen in the inset photo above.







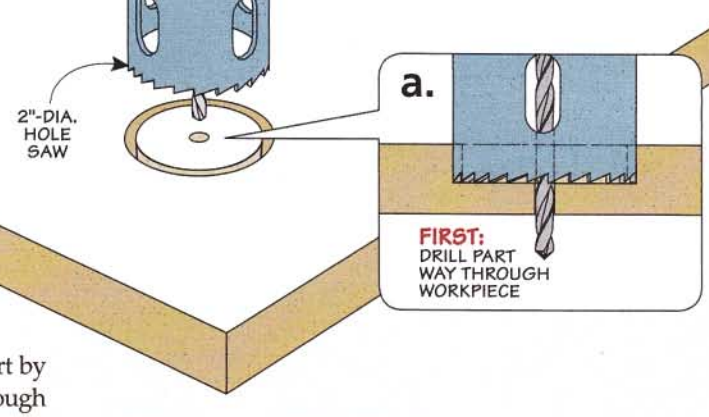




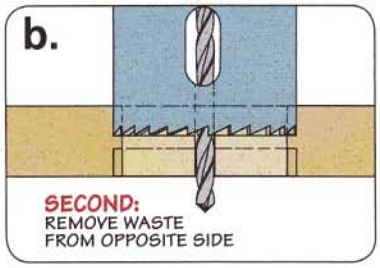
Large Holes

One of the best ways to drill large holes is with a hole saw. The center guide bit starts a pilot hole and the sawtooth edge brings the hole to full diameter, as you can see in the drawing and detail 'a' above. These "bits" cut through plastic laminate, as well as wood, so they're perfect for drilling the large access holes in the melamine back of the hobby bench on page 24.

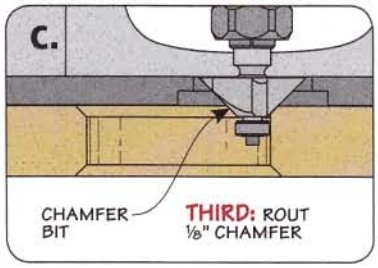
There's one drawback to using a hole saw, though. As you can see in the drawing above, this type of bit has rough, deep-set teeth which can cause lots of chipping, especially when the bit is exiting the backside of a workpiece, where blowout can be a problem.



So I like to use a simple, two-step method for drilling large holes. First, I start by drilling part of the way through from one side. Then, I flip the workpiece over and complete the hole from the back side, as shown in the drawing above and detail 'b'.



Finally, to keep any cords from catching on a sharp edge, I eased the edges of the hole by adding a chamfer on both sides (detail 'c').

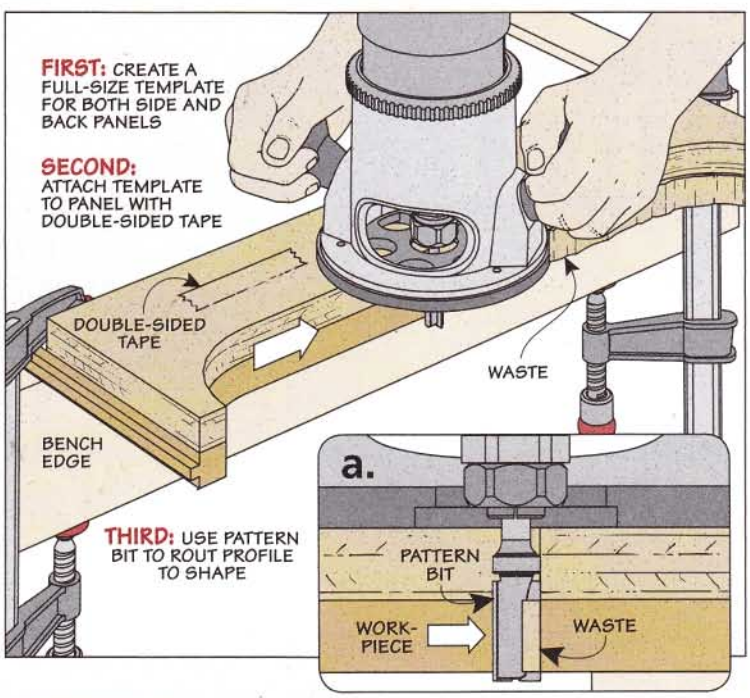


Easy Template Routing

For the hobby bench on page 24, part of the process of making "legs" is to add a cutout on the side and back panels.

Making identical cutouts on all three pieces is a challenge, though. I made this easier by first rough cutting the pieces with a jig saw. Then, I came back to clean up the finished profile using a template and a hand-held router equipped with a pattern bit, as shown in the drawing below.

As you can see in the drawing, I used a full-size template as a guide. Use the dimensions shown on page 26 to make the template. Then, clamp the workpiece to your bench and attach the template with double-sided tape before cleaning up the edges with the pattern bit (detail 'a').



Filing Angle Iron

STEP 1

To make the bending mandrel for the sheet metal brake on page 14, you'll need to file off the rounded edges of the angle iron. To do this, first make a "cradle" to hold the angle iron as shown. Then fasten the angle iron in place with a few screws to keep it from shifting while filing. Finally, clamp the assembly to the benchtop.

STEP 2

Using a large, coarse-cut file, start to work removing material until the edges of the angle iron become crisp, as shown at right. To do this, pass the file across both edges of the angle iron while pushing it slightly along its length. To create smooth, straight edges, finish up by drawing the file along the entire length.

storage solutions

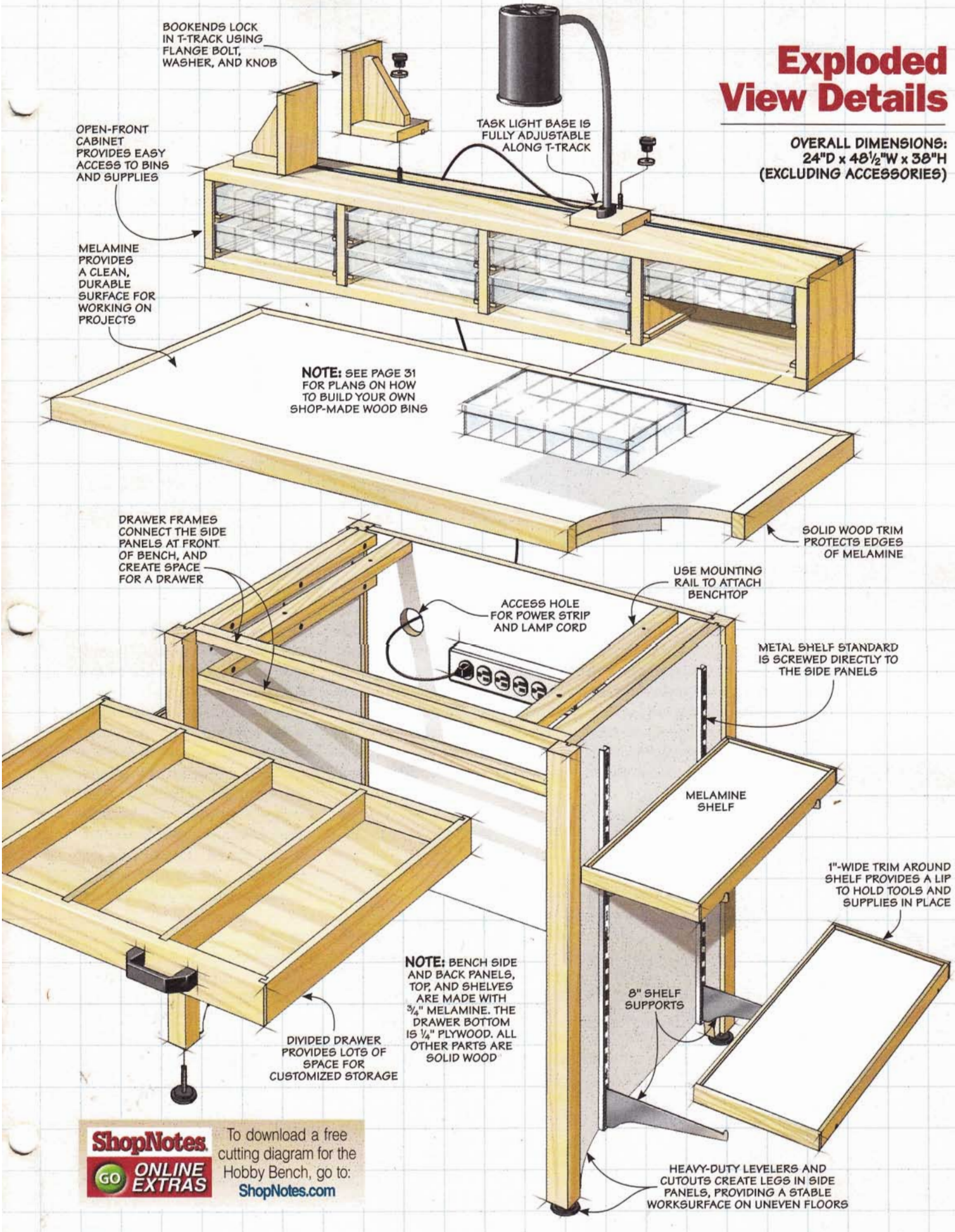
hard-working Hobby Bench

This compact bench has storage galore, plus plenty of room to spread out and get to work.

Most workbenches are great for building furniture. But, they're often too large for smaller hobby activities. Plus, they often lack storage for both large and small items. That's why I really like this hobby bench. Its small size allows you to put it anywhere, but it features a lot of storage options, like the open-front cabinet shown above. The cabinet holds eight storage bins that are ideal for organizing small parts. It also has a few other handy features like a built-in lamp and adjustable bookends.

Exploded View Details

OVERALL DIMENSIONS:
24"D x 48½"W x 38"H
(EXCLUDING ACCESSORIES)



ShopNotes GO ONLINE EXTRAS

To download a free cutting diagram for the Hobby Bench, go to: ShopNotes.com

construct the Base

One of the first things you'll notice about this bench are the clean, white panels in the base and top. You could use plywood or MDF for this project, but I chose to use melamine. It's made of particleboard that's coated with a plastic resin on both faces, so it's super durable. Best of all, it's inexpensive and available at most home centers.

Melamine does have one drawback, though. Avoiding chipout when you cut it can be a challenge. But don't worry, I've spelled out a few guidelines for success in making clean, chip-free cuts in the box on the next page.

Base. Unlike a traditional bench with four large legs, this base has end assemblies made up of two hardwood legs connected by a panel. Then a third panel connects the end assemblies to form a back.

The construction of the base is pretty straightforward. The panels are connected to the legs with tongue and groove joinery. You can get started by making the legs.

Legs. The legs are made from 1½"-square stock (Figure 1). Each leg has a groove for a side panel, plus the back legs have a second groove for the back panel. And, as you can see in Figure 1b, the grooves are centered on the legs.

The next step is to drill holes in the bottom of the legs for T-nuts and add the leg levelers (Figure 1a).

Melamine Panels. Now, it's time to make the side and back panels. Start by cutting the panels to rough size. Then come back and make a cleanup pass, trimming the parts to finished size. To learn about the specialty blade I used to make clean cuts in melamine, see the box on the next page.

Cutouts. In order to create a good, solid foundation for the base, I added cutouts to the bottom edge of each panel (Figures 1 and 1a). Along with the legs and levelers, the cutouts help keep the bench level on uneven floors.

To make the cutouts, use a jig saw to rough them out. Then, clean up the edges using a template and

FIGURE 1

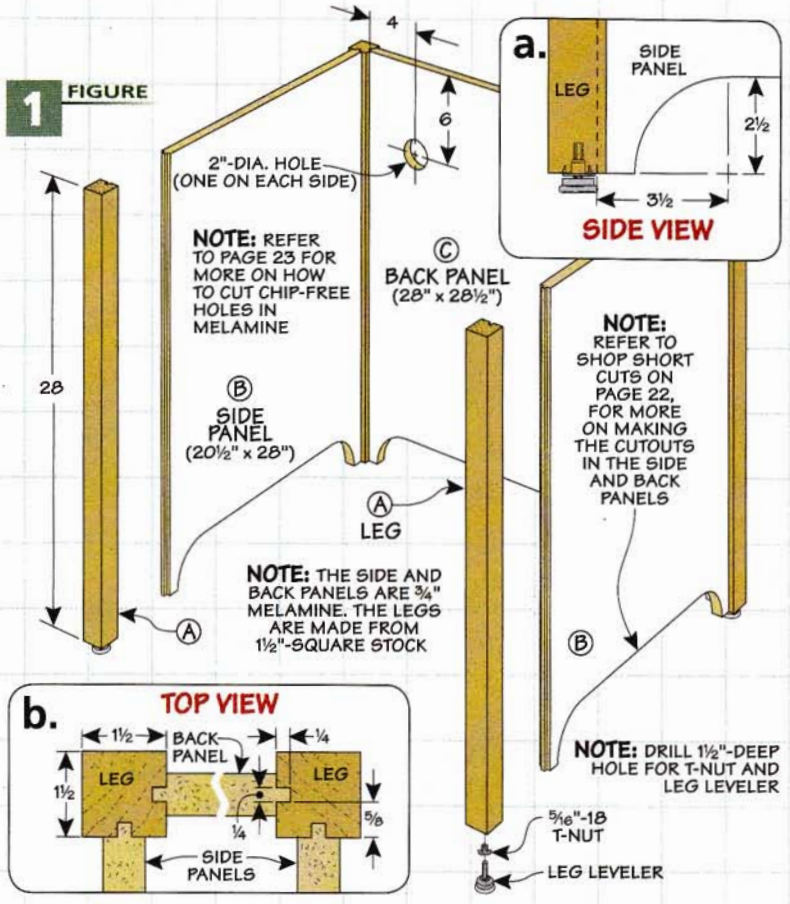
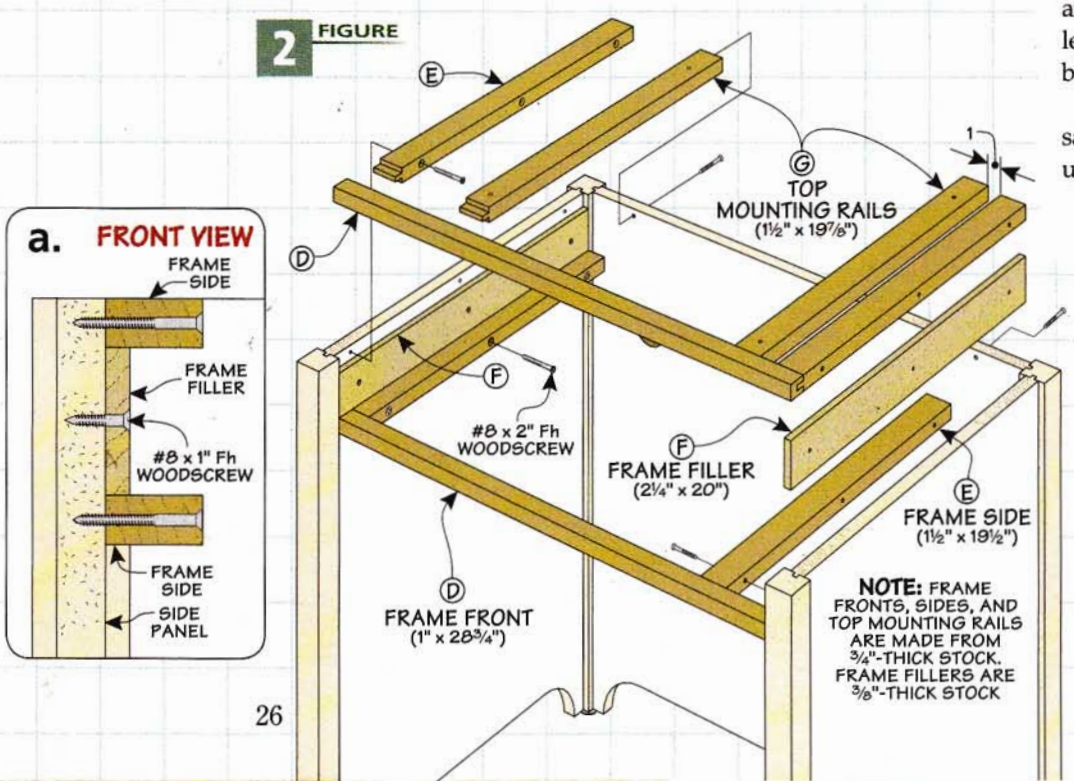


FIGURE 2



a hand-held router equipped with a pattern bit. You can learn more about how I made the cutouts in Shop Short Cuts on page 22.

Next, you'll need to cut tongues on the panels to fit the grooves in the legs. To do this, use a dado blade to cut them and set the height of the blade to establish the thickness of the tongue. I like to get it close, then sneak up on the thickness until I have a snug fit.

Before assembling the base, there's one more thing to do. And that's to cut a couple of holes in the back panel for cord access (Figure 1). To get a clean cut, I used a hole saw, drilling from both sides. Turn to page 23 for more details.

Assembly. Now you can attach the panels to the legs with glue, then apply clamps.

Drawer Frames. To provide space for a drawer, I added a pair of drawer frames. As you'll notice in Figure 2, the frame fronts are trapped between the side panels.

The frame fronts have a centered groove to accept stub tenons that are cut on one end of the frame sides. You can use a table saw and dado blade to cut the grooves first (Figure 2b). Then, cut the stub tenons to match the grooves.

Between the two frames, you need to add some frame fillers. If you take a look at Figure 2, you'll see how everything goes together. The frame fillers keep the drawer aligned between the legs and are screwed directly to the side panels, as shown in Figure 2a.

Finally, to provide an easy way to attach a top later, I made two mounting rails with countersunk screw holes (Figure 2).

Once the frames and fillers are in place, install the mounting rails by cutting stub tenons like the ones on the frame sides and add screws through the back panel.

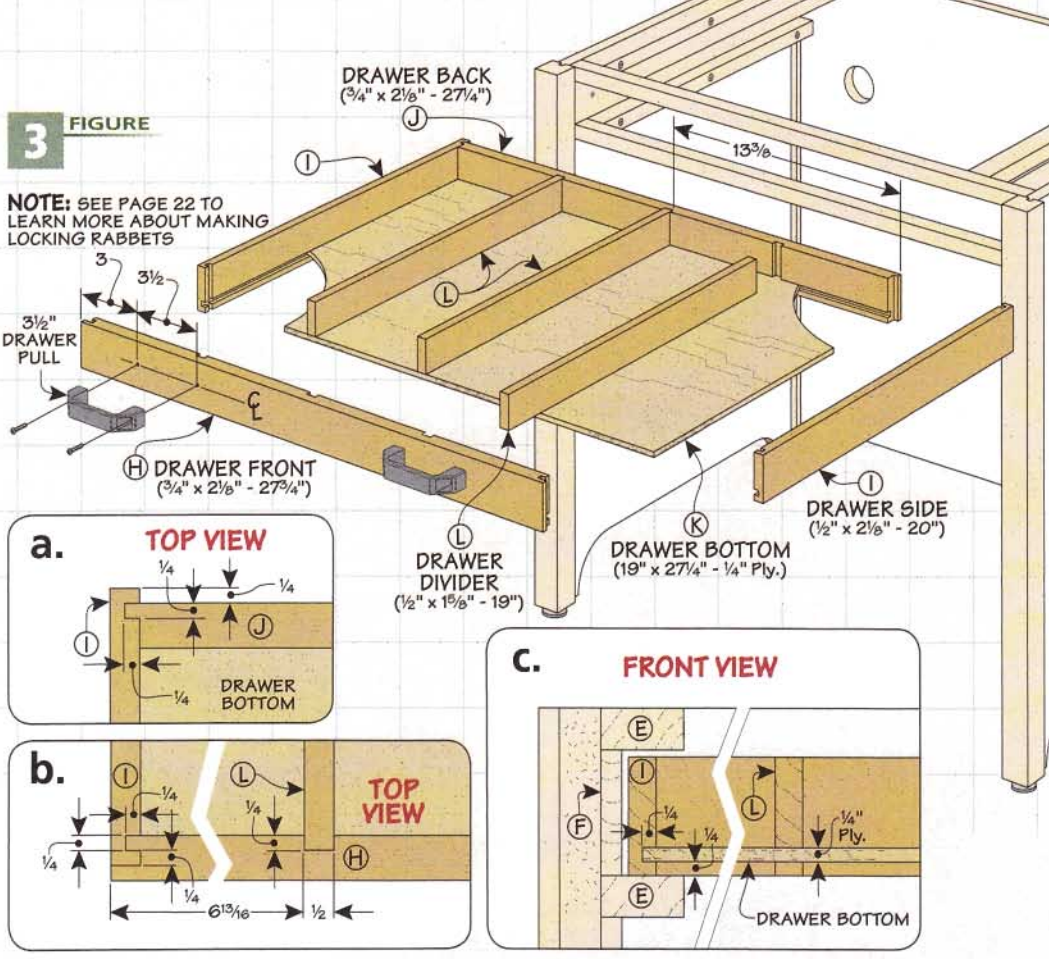
ADDING STORAGE

With the base of the bench completed, you can now focus on the drawer. The drawer front is connected to the sides with a locking rabbet joint (Figure 3b). Refer to Shop Short Cuts on page 22 for tips on making locking rabbets. And, the drawer back uses a simple tongue and dado joint (Figure 3a). Plus, grooves on the inside faces of all these pieces hold the bottom.

After all the joinery is cut, you need to also cut some dadoes for the dividers, as shown in Figure 3b. The dividers give you an opportunity to customize the drawer for your own needs.

Once the dividers are cut to size, go ahead and assemble the drawer, as shown in Figure 3. Now you can get started on the benchtop and shelf system.

FIGURE 3

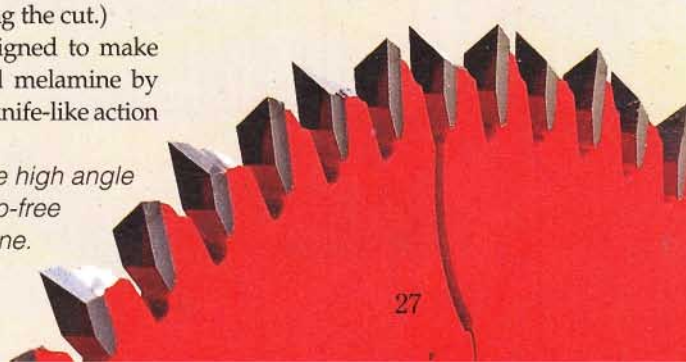


Cutting Melamine

When cutting melamine on a table saw, chipout can be a real problem. So to get the cleanest cuts possible, I like to do a couple things. First, I always use a zero clearance insert to support the workpiece along the cut line. Plus, I like to use an 80-tooth HiATB (High Alternate Tooth Bevel) blade, like the one shown below. (The cleanest face will be the one that is facing up during the cut.)

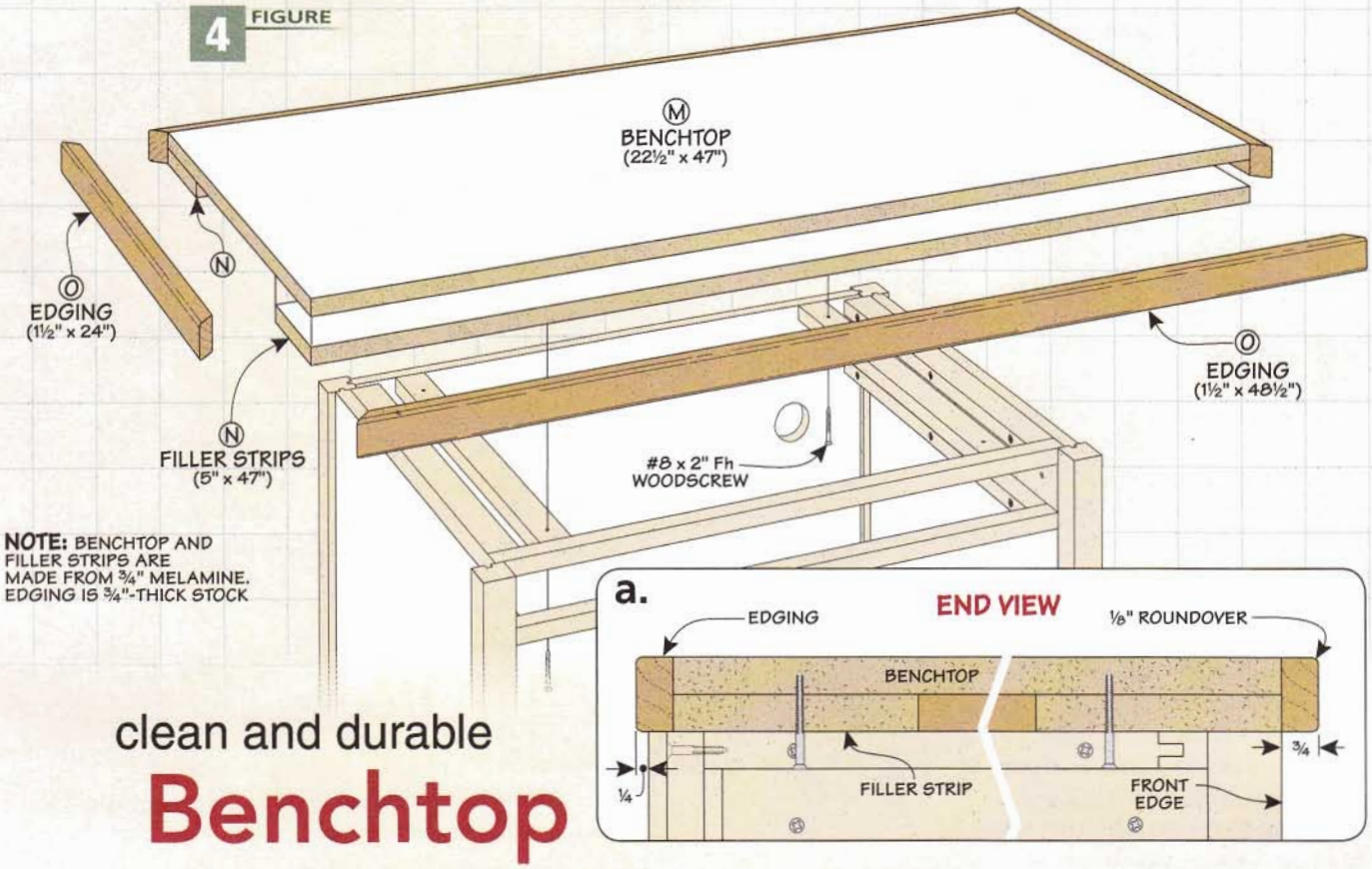
This blade is specially designed to make smooth cuts in plywood and melamine by scoring the workpiece with a knife-like action at the edge of the blade. Its teeth have alternating bevels that are ground at a steep angle with a negative hook. You'll get the smoothest cuts by using a slow, steady feed rate.

Joinery. For cutting dadoes and rabbets in melamine, I use a dado blade. The teeth on the outside cutters provide the same scoring action as the specialty melamine blade.



► ***80-Tooth Saw Blade.*** *The high angle of the teeth make clean, chip-free cuts in plywood and melamine.*

FIGURE 4



clean and durable

Benchtop

Now that the base is complete, you can turn your attention to the benchtop. It's hard to imagine a better material for the top of the hobby bench than melamine. It's a durable surface that doesn't need a finish, so it's easy to keep clean.

Alternate Top. But, if you're seeking a more traditional look for your hobby bench, a good option is the solid-wood, laminated benchtop shown below. It's the same size as the melamine top, but it's 1½" thick to match the overall thickness of the built-up melamine benchtop.

Build the Benchtop. As you can see in Figure 4, the benchtop starts as a solid layer of melamine. Then, a couple of filler strips add strength and thickness to the top.

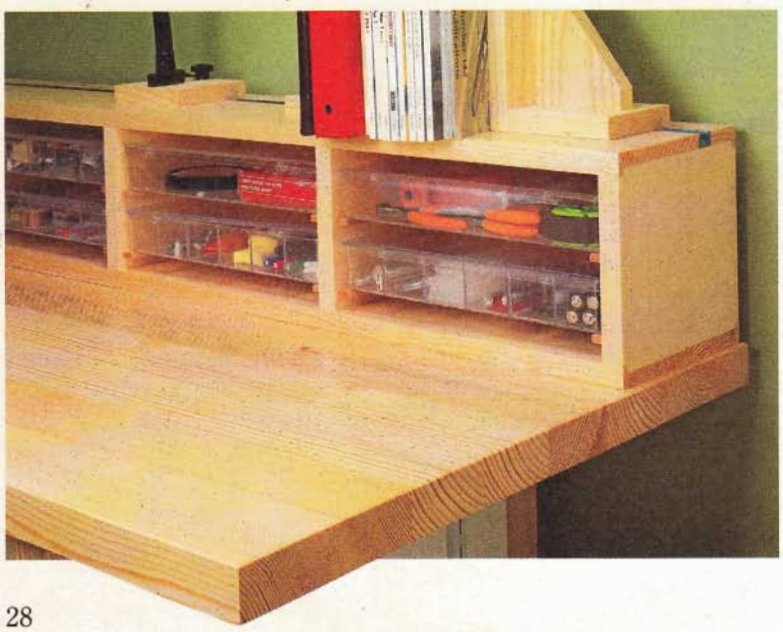
This is the most visible part of the project, so take some care to avoid chipout. Once the pieces are cut to size, attach the filler strips to the top with contact cement. The difficult part is getting the strips to align with the top. I solved this problem by gluing on oversized filler strips, then trimmed them up with a router and flush trim bit.

Mitered Edging. The top and bottom faces of the melamine are pretty durable, but the core is not. So to avoid damaging it, I wrapped the benchtop with ¾"-thick edging that's mitered on all four corners.

Now, cutting and fitting mitered edging is one of those tasks that can be a real challenge. But don't worry, you'll find some great tips and techniques for getting perfect mitered edging every time in the article starting on page 12.

Once the edging is attached, you can soften the edges on the top and bottom by adding a small, ⅛" roundover (Figure 4a).

Attach the Top. The top is attached to the base with screws. If you take a look at Figures 4 and 4a, you can see how it's done. I used the holes drilled in the mounting rails and positioned the top according to the dimensions in Figure 4a.



► ***Top Option.*** *Instead of using melamine for the benchtop, you can make a solid-wood top for a more traditional look.*

SHELF STORAGE

The bench is great as is, but to make it even more useful, you may want add some extra storage to the side panels. As you can see in the drawing at right, there's a pair of shelves on each end panel.

The shelves are pretty basic. As shown in Figure 5, you can tell that I've used metal shelf standards and metal supports to hold them in place. The important thing to remember here is that the shelves are sized to fit snug on the supports from front to back. And the shelf length should match the space between the legs (Figure 5a)

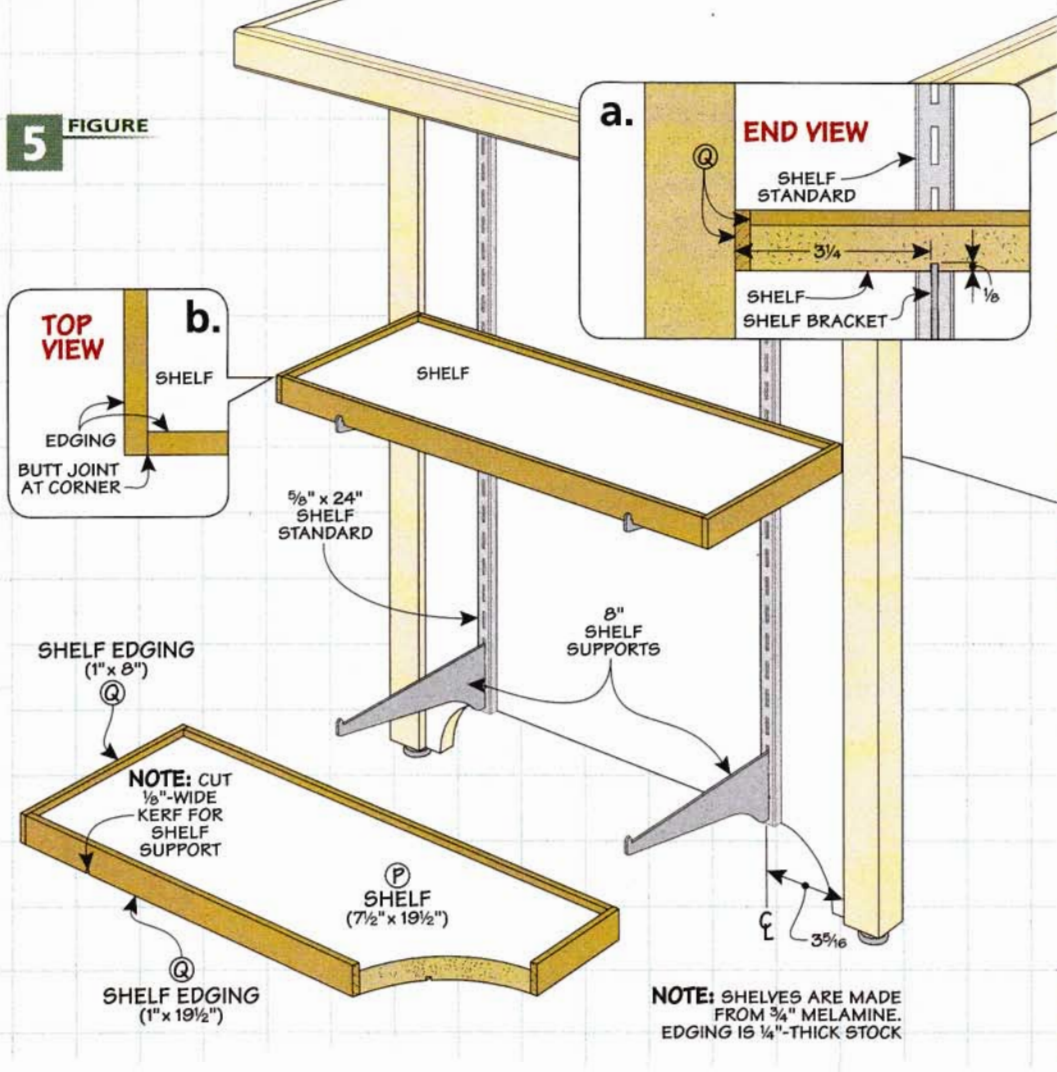
Simple Edging. Once the shelves are cut to size, you can wrap them with solid-wood trim. The extra-wide trim provides a lip around the top of the shelf to keep things in place. Butt joints make sizing the parts a snap, as shown in Figure 5b. And gluing them in place is quick and easy.

Metal Shelf Standards. Once the shelves are complete, they're ready to be installed onto the sides of the hobby bench. As I mentioned earlier, I used sturdy metal shelf standards and supports to hold the shelves. They're available at most hardware stores and home centers (Figure 5).

The thing is, you don't want the shelves sliding around on the brackets. To avoid this, I used a standard kerf saw blade to cut ⅛"-deep grooves from front to back in the bottom of each shelf. These grooves are for the shelf supports to fit in (Figures 5 and 5a).

Now, when the shelves are installed, they'll slip over the supports and lock into place.

FIGURE 5

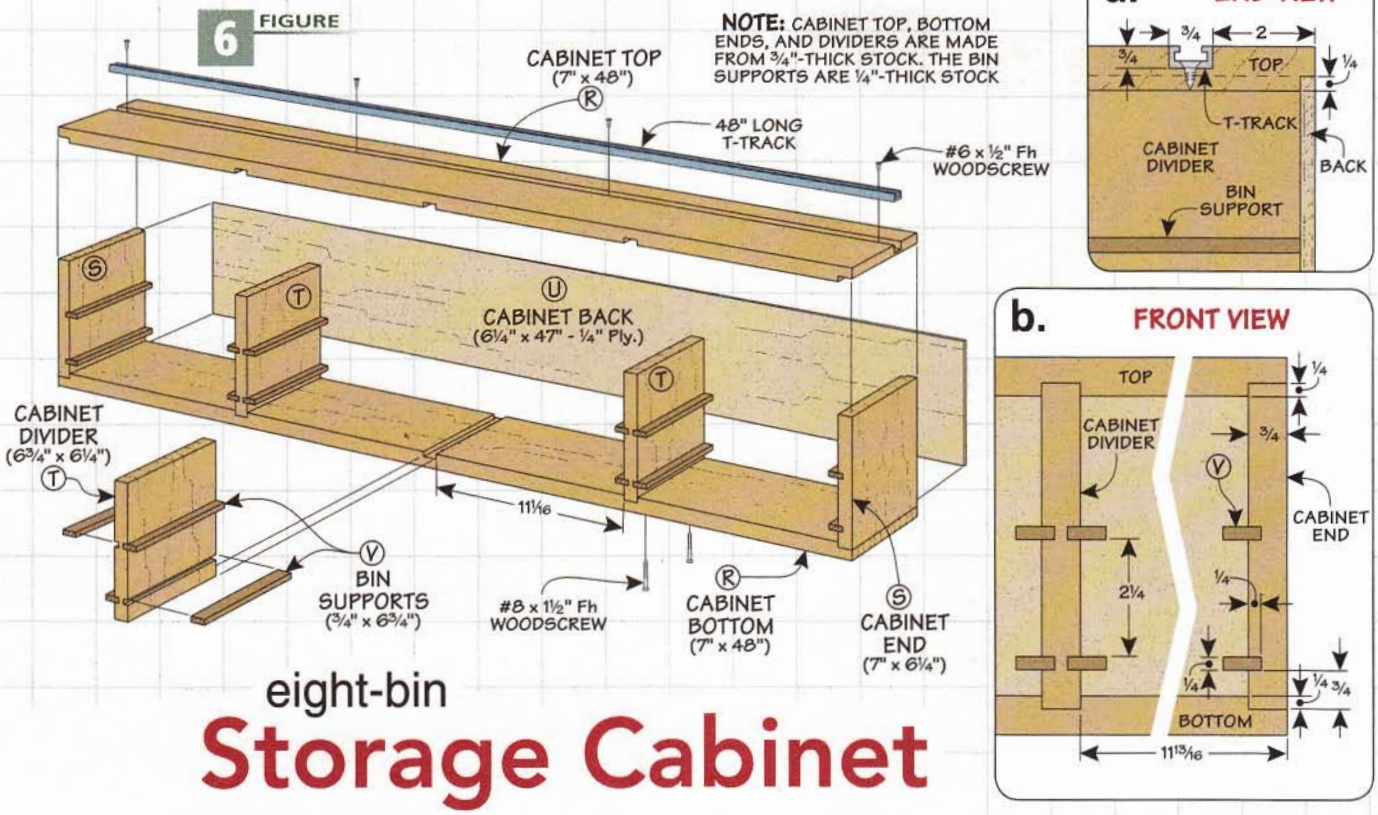


At this point, you could get to work at the bench. But you still need a place to store tools and supplies so they're always close by. The solution is an open-front cabinet that holds eight storage bins for small parts. You'll find plans for the cabinet on the next page.

Materials & Hardware

BASE		
A	Legs (4)	1½ x 1½ - 28
B	Side Panels (2)	20½ x 28 - ¾ Melamine
C	Back Panel (1)	28 x 28½ - ¾ Melamine
D	Frame Fronts (2)	¾ x 1 - 28¾
E	Frame Sides (4)	¾ x 1½ - 19½
F	Frame Fillers (2)	⅜ x 2¼ - 20
G	Top Mounting Rail (2)	¾ x 1½ - 19⅞
DRAWER		
H	Front (1)	¾ x 2⅛ - 27¾
I	Sides (2)	½ x 2⅛ - 20
J	Back (1)	¾ x 2⅛ - 27¼
K	Bottom (1)	19 x 27¼ - ¼ Ply.
L	Dividers (3)	½ x 1⅝ - 19
TOP		
M	Benchtop (1)	22½ x 47 - ¾ Melamine
N	Filler Strips (2)	5 x 47 - ¾ Melamine
O	Edging	¾ x 1½ - 156 Rgh.
SHELVES		
P	Shelves (4)	7½ x 19½ - ¾ Melamine
Q	Shelf Edging	¼ x 1 - 240 Rgh.
STORAGE CABINET		
R	Cabinet Top/Bottom (2)	¾ x 7 - 48
S	Cabinet Ends (2)	¾ x 7 - 6¼
T	Cabinet Dividers (3)	¾ x 6¾ - 6¼
U	Cabinet Back (1)	6¼ x 47 - ¼ Ply.
V	Bin Supports (16)	¼ x ¾ - 6¾
W	Cabinet Edging	¼ x ¾ - 240 Rgh.
ACCESSORIES		
X	Bases (3)	¾ x 4 - 4
Y	Keys (3)	5/16 x ⅜ - 4
Z	Bookend Plates (2)	¾ x 4 - 6
AA	Braces (2)	¾ x 3½ - 4½

- (10) #8 x 1½" Fh Woodscrews
- (14) #8 x 2" Fh Woodscrews
- (4) 5/16"-18 T-Nuts
- (4) Plastic Leg Levelers
- (2 pr.) 24" Shelf Standards
- (4 pr.) Shelf Supports, 8" Long
- (2) 3½" Drawer Pulls w/Screws
- (1) ⅜" x ¾" - 48" T-Track w/Screws
- (8) Plastic Storage Bins
- (1) Task Light w/Screws
- (3) ¼"-20 x 1½" Flange Bolts
- (3) ¼"-20 Knurled Knobs



eight-bin
Storage Cabinet

Just about every hobbyist ends up with drawers full of small supplies that get used on a daily basis. So it's a real benefit to have an easily accessible place for everything. The bin cabinet that sits on top of the bench provides the solution.

The cabinet has four side-by-side bays. Each bay has space for two plastic storage bins, as shown in the photo at lower right. The bins slide on solid-wood supports, and the front is open for easy access.

Note: If you'd rather build your own wood storage bins, the plans for how to build them are in the box on the next page.

Another unique feature of this cabinet is the two accessories that are mounted on top — a task light and bookends. I'll talk about each of them a little later.

Build the Cabinet. The storage cabinet is basically just a box divided into four compartments. It's made from solid wood with solid wood edging. You can start by cutting the top, bottom, sides, and dividers to size.

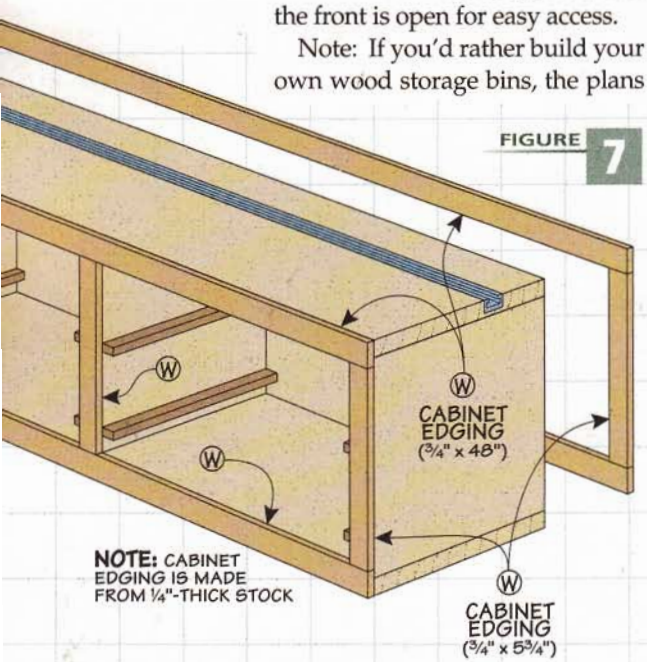
Top and Bottom. There are three evenly spaced dadoes in the top and bottom pieces sized to hold the dividers, as you can see in Figure 6. A table saw equipped with a dado blade makes quick work of cutting them. I started by making the center dadoes, then adjusted the rip fence to complete the two other sets of dadoes.

The next thing to do is cut a rabbet along the back edge of the top, bottom, and sides to hold the cabinet back (Figure 6a).

► ***Bins.*** *Plastic bins provide customized storage for small parts and accessories.*

Dividers & Sides. As I mentioned earlier, each bin rests on a pair of bin supports. The supports are actually thin strips that fit in dadoes cut in the sides and dividers. To make the supports, I first cut the dadoes. Then, I ripped the strips from the edge of ¾"-thick stock to match the width of the dadoes (Figure 6b).

T-Track. There's one last step to take before you can assemble the cabinet. And that's to cut the groove for the T-track that will hold the accessories. The location of the groove is shown in Figure 6a, and I used the table saw and



a dado blade to cut it. With the groove cut, you can get started putting the cabinet together.

Cabinet Assembly. Like the bench base, the cabinet goes together pretty easily. Start by gluing up the top, bottom, sides, and dividers. Then glue the supports in place before adding the back.

Once the cabinet is complete, you can hide the joinery on its front and back faces by adding some trim, as shown in Figure 7. I glued the trim in place and used masking tape to hold it until the glue dried.

ACCESSORIES

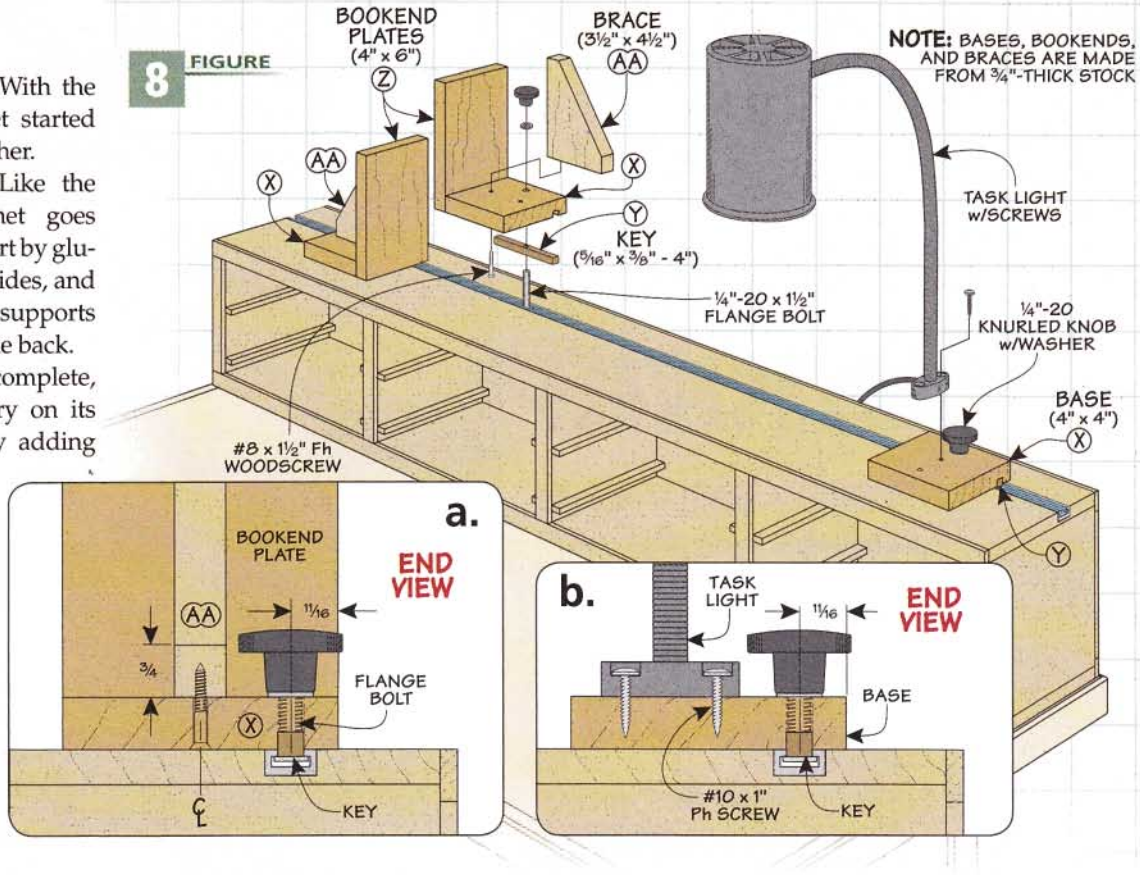
Now you can get started building the two accessories: a task light and a pair of bookends. They're very similar in construction and they're held to the top of the cabinet with a flange bolt, washer, and knob that rides in some T-track. The track rests in the groove you cut earlier.

Cabinet Add-Ons. The light is mounted to a solid-wood base. (Refer to Sources on page 51 for information on where to find the task light.) The base has a key that keeps it aligned in the T-track (Figures 8 and 8b). A hole, drilled through the base and centered on the key accepts a flange bolt. To lock everything in place, I added a knob and washer.

The bookends use the same base design as the lamp. To keep the books upright, glue and screw a bookend plate to the base and reinforce it with a triangular brace (Figure 8a). Now, all that's left is to add the hardware.

With the accessories built, simply place the storage cabinet on top of the base. After finding a nice spot to set the bench up, you can round up your supplies, pull up a chair, and enjoy some time working on your favorite hobby.

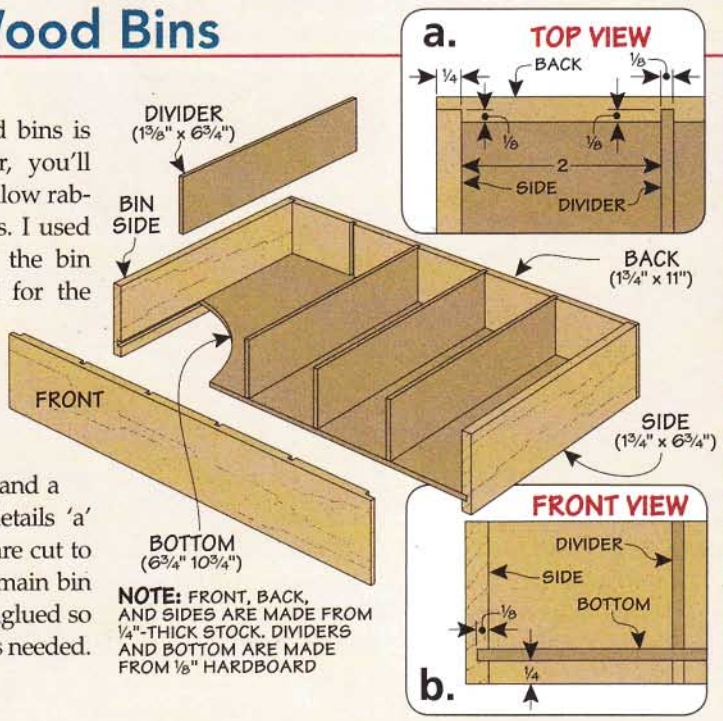
FIGURE 8



Optional Wood Bins

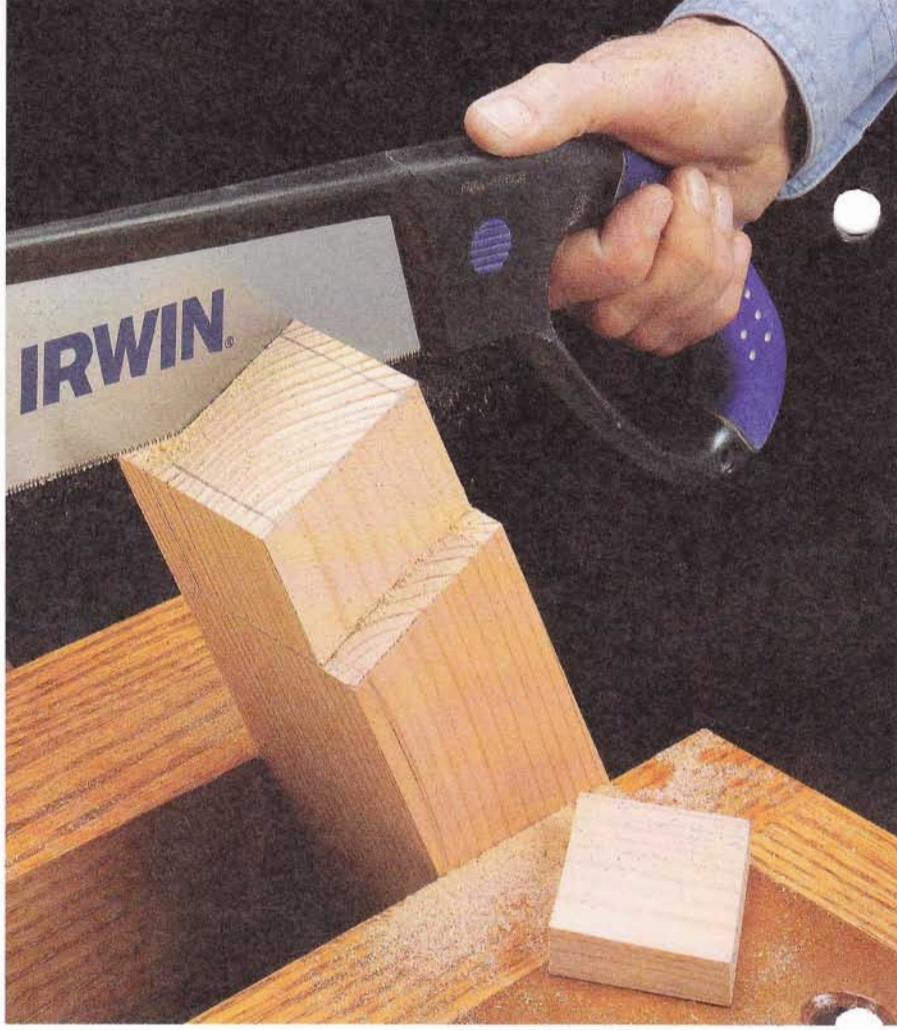
Building your own wood bins is simple. Like the drawer, you'll need to cut a series of shallow rabbets, dadoes, and grooves. I used ¼"-thick solid wood for the bin parts and ⅛" hardboard for the bottoms and dividers.

The rabbets are cut in the bin front and back (detail 'a'). Then cut dadoes in the front and back to hold the dividers and a groove for the bottom (details 'a' and 'b'). Once the pieces are cut to size you can glue up the main bin parts. I left the dividers unglued so they can be repositioned as needed.



hand-cut Tenons

Here's an easy technique for building your hand tool skills and making tight-fitting joints.



When it comes to hand-cut joinery, most woodworkers think of dovetails. But there's another traditional joint that's less intimidating to master — tenons. Cutting tenons by hand builds skills like making accurate layouts and cutting straight and square.

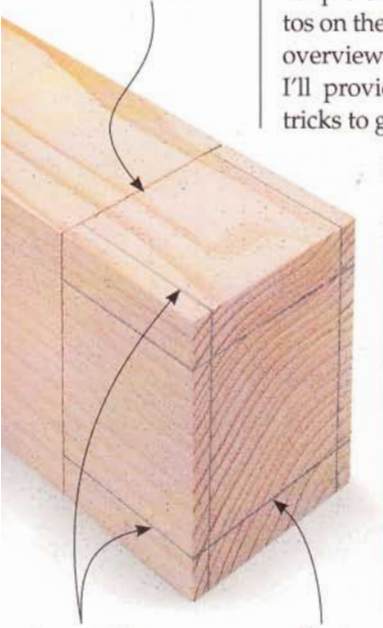
The sawhorse project on page 34 provides a perfect opportunity for practice since there are only a couple of tenons to cut. The photos on these pages give you a good overview of the steps. In addition, I'll provide some other tips and tricks to get the best results.

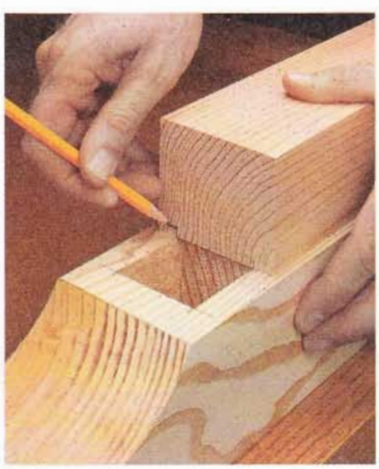
Layout. Cutting a tenon begins with an accurate layout. The layout serves as a road map for the saw cuts. It's a good idea to have the mortises complete before you get started. This way, you have a reference to lay out each tenon.

Thickness & Width. Begin by marking the thickness and width of the tenon on the end of the workpiece (photos below). It's a good idea to lay out the marks so the tenon ends up just a hair larger than the mortise. This avoids the problem of ending up with a tenon that's too small. And it won't take much time to fine-tune the tenon for a perfect fit later on.

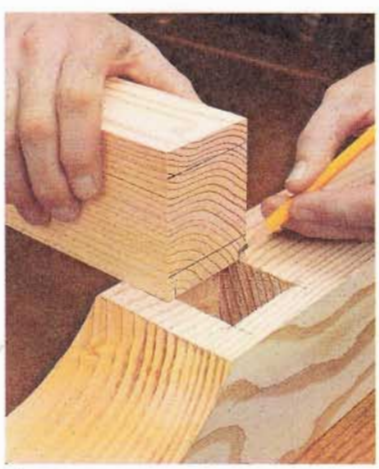
Tenon Length. The next step is to mark the length of the tenon. Here I do things a little different. I like to use a cutting gauge (upper left photo on the opposite page). The scored line creates a starting point for the saw. This results in a cleaner line at the shoulder when the joint is assembled.

The final layout step is to carry the marks from the end of the workpiece across the faces and edges (upper right photo on the facing page).





▲ ***Thickness.*** *Line up the tenon piece with the edge of the completed mortise. Then mark the thickness of the tenon.*



▲ ***Width.*** *Rotate and turn the workpiece to mark the width on the other edge. Extend the marks across the end with a square.*

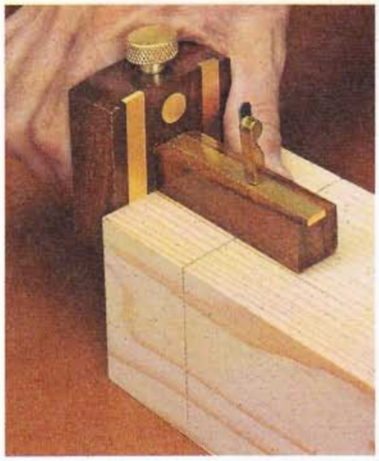
Cut the Shoulders. With the layout complete, you can start cutting. And the tool for this job is a medium-sized back saw. The stiff back helps keep the blade traveling straight during the cut. Although you can buy an expensive, specialty saw, an inexpensive pull saw like the one shown here will do the job just fine.

The first cuts define the shoulders, as in the lower left photo. The scored lines make it easy to align the saw. Place the saw in the scored line and start cutting. Keep the saw level to avoid cutting past the layout lines. Stop when the saw teeth just contact the layout lines on the front and back.

Cheek Cuts. The next cuts will form the cheeks. It's best to cut these with the workpiece held securely in a vise. The key to great results is getting a good start.

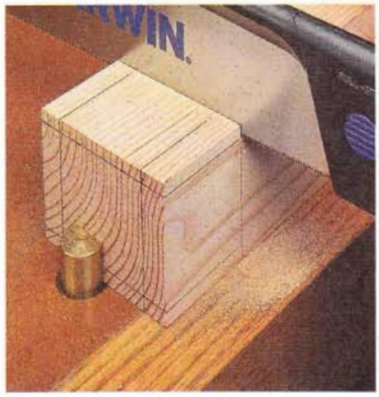
The way I do this is shown in the main photo on the opposite page. By tilting the workpiece, I can use the layout lines on the end and face to cut straight *and* square.

Once the kerf is established, lower the front of the saw and cut parallel to the shoulder line. Bring the saw down in long, even strokes. As you approach the shoulder line, slow down and make a few light strokes until the waste piece just falls away. Repeat the process for the opposite tenon cheek.



▲ ***Shoulders.*** *With a cutting gauge, score the shoulders to establish the tenon length.*

▲ ***Cheeks.*** *Transfer the marks on the end of the workpiece down each of the faces.*



▲ ***Shoulder Cuts.*** *Clamp the workpiece to the bench and cut all four shoulders.*

▲ ***Cheek Cuts.*** *Level the saw to complete the cheek cut. Take it slow to avoid over cutting.*

After making two cuts, you'll need to re-mark the layout lines on the freshly cut faces. Then after two more cuts, the tenon is complete.

Now it's time for a test fit. Since the tenon was cut slightly oversize, you'll need to do some fitting. Take a look at the box below for some tips. Your goal is a tenon that can be slipped into the mortise with hand pressure.

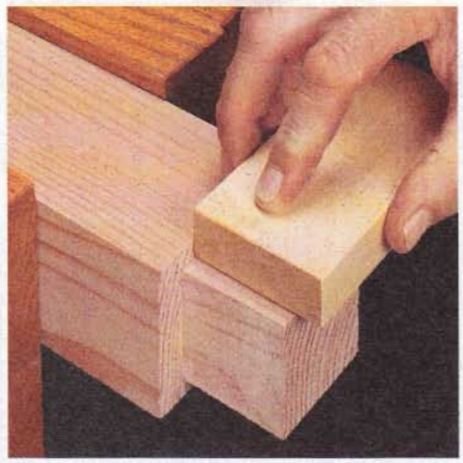
▼ ***Perfect Tenon.*** *Crisp shoulders and smooth cheeks ensure a strong joint that also looks great.*

fine-tuning Tenons

It would be nice if the tenon fit snugly in the mortise right off the bat. And the more practice you get, the easier this is to do. But it's best to cut the tenon a little oversize. This way, all it takes is a some fine-tuning for the tenon to slip snugly in place.

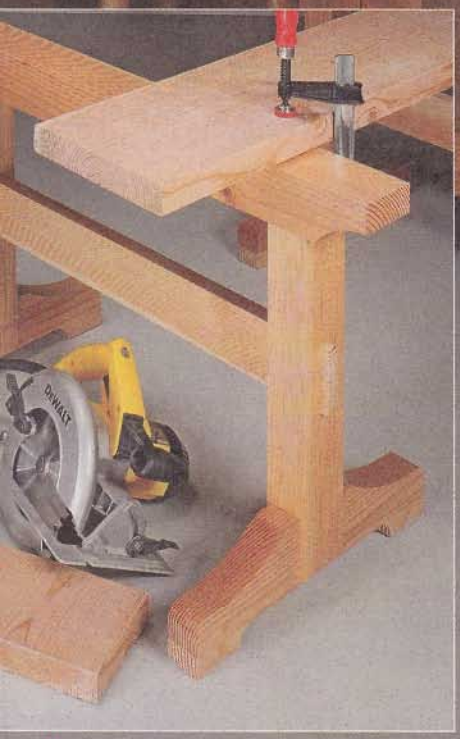
The first thing to do is to compare the tenon to the mortise to see where the fit is too tight (first photo at right). From there, you can use a hardwood sanding block to touch up the faces, as in the second photo. Be sure to sand equally on both faces to keep the tenon centered on the workpiece.

Test Fit. *Angle the tenon and compare it to the mortise to find out where the tenon needs more work.*



▲ ***Sanding Block.*** *A hardwood block with sandpaper on one face makes quick work of fine-tuning the fit of the tenon.*

weekend
project



▲ **Short Version.** *Reducing the length of the posts creates a shorter sawhorse that's more comfortable for some tasks.*

super Sawhorses

Traditional joinery and a heavy-duty trestle design add up to a sawhorse that's built to last.

start with the Bases

A pair of sawhorses is a must-have for any workshop. The trouble is most designs are more suited for knocking together at a job site.

For an alternative, take a look at the sawhorses shown in the photos on the opposite page. It's clear this isn't a cobbled together design. But behind the sturdy look are some great features.

For starters, these sawhorses are made from hefty, solid lumber. And the trestle design is stout enough to support a huge amount of weight. Finally, they're quick to build, and give you a chance to hone your skills with some traditional, rock-solid joinery.

Solid Support. I began by making a solid base for the sawhorse. You can see how it's shaped in Figure 1. But what's more important is how each base is attached to the posts. I used an interlocking bridle joint for a solid connection.

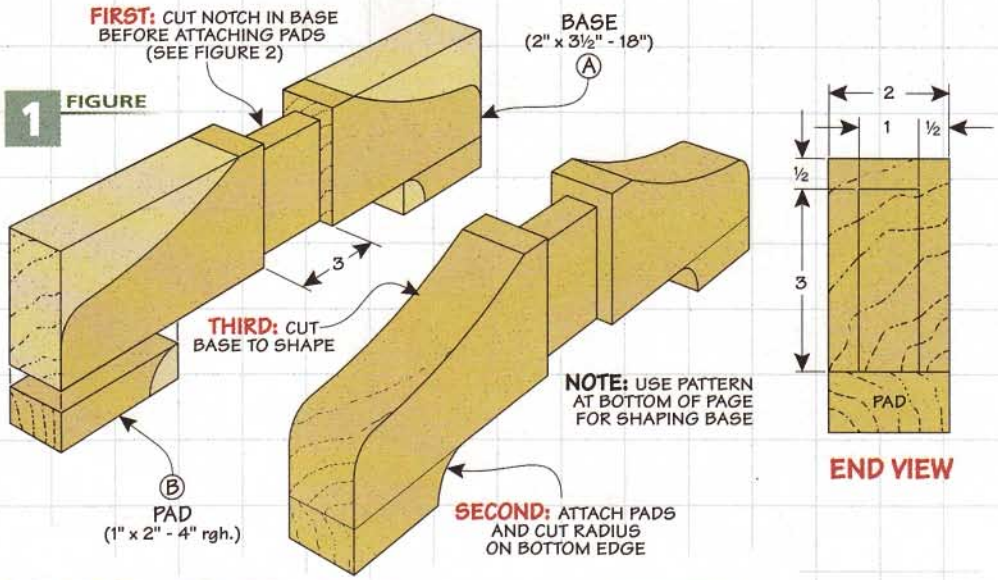
This requires cutting a notch on the top and two side faces of the base. I cut the notches on the base before shaping it. You can see the table saw setup I used in Figure 2.

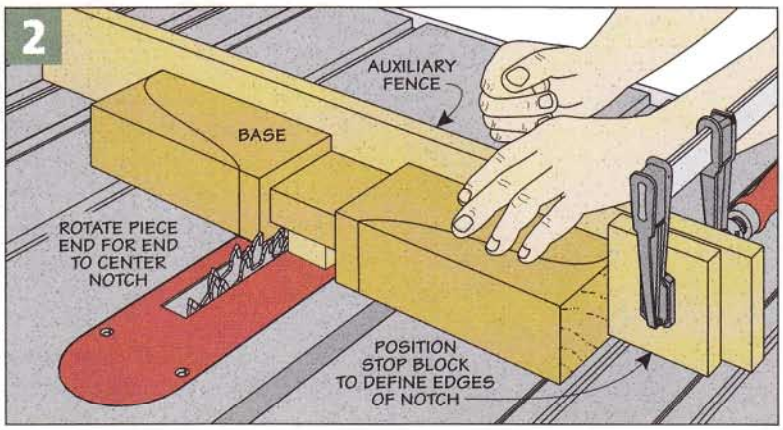
Since the notches are wider than my dado blade, I set up a stop block attached to a long auxiliary fence on the miter gauge. The stop block helps define the outside shoulders of the notches. After making one pass, flip the workpiece end-for-end and make another pass. This automatically centers the notch on the base. Once the shoulders are defined, you can remove the remaining waste.

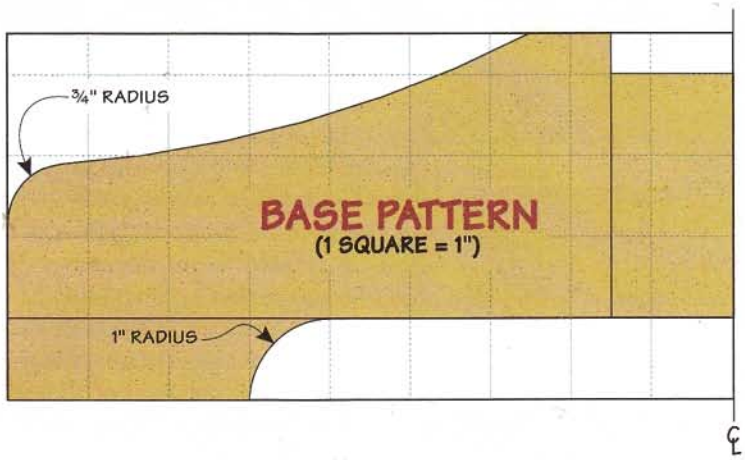
Attach Pads. After cutting the notches, the next step is to cut the base to shape. But before doing this, you need to cut and glue a pad to each end of the base (Figure 1). The thin pads create two feet which gives the sawhorse more stability on uneven shop floors. Once the pads are glued on you can cut a radius on the inside edge.

At this point, the base is ready to shape using the pattern below. The shaping is done in two steps. The first step is roughing out the base at the band saw.

The band saw blade often leaves a rough surface. So the last step is to smooth the curves and remove the saw marks. For this, I used a sanding drum in the drill press.







Materials

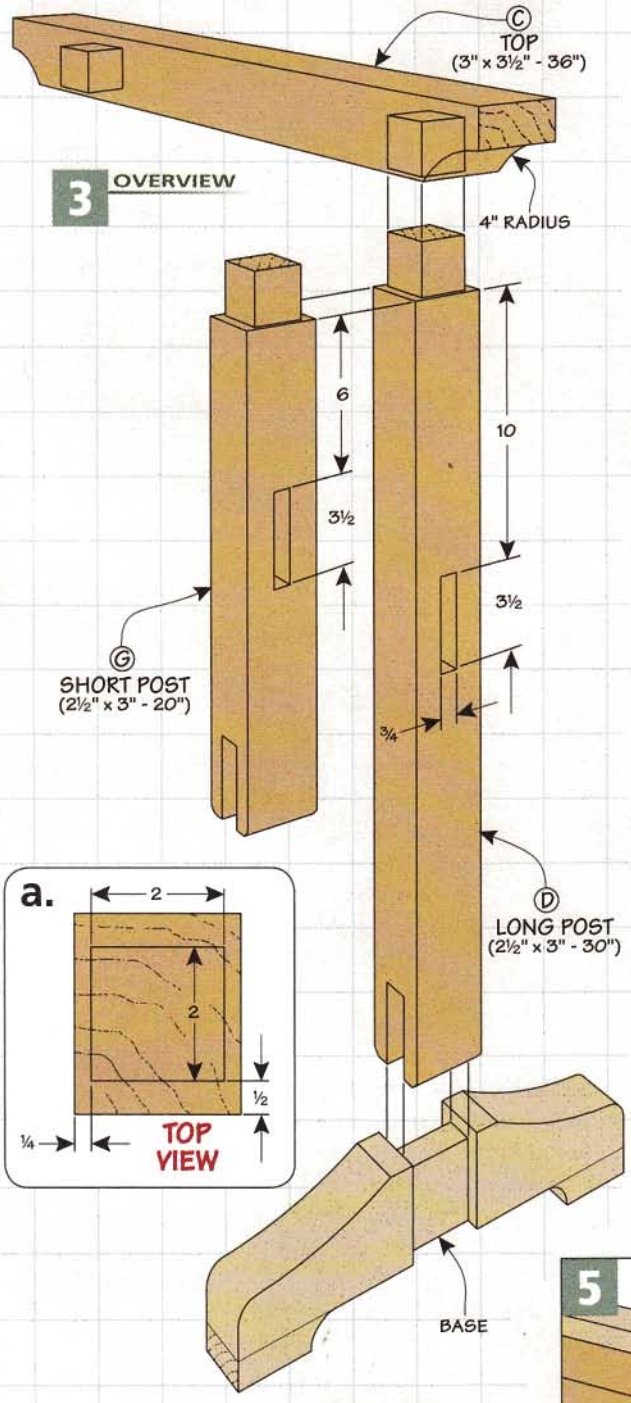
TALL SAWHORSE (1 pair)

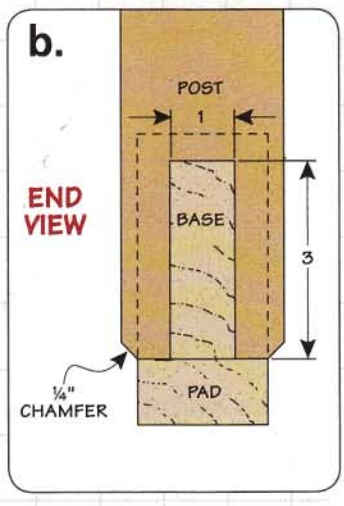
A	Bases (4)	2 x 3½ - 18
B	Pads (8)	1 x 2 - 4 rgh.
C	Tops (2)	3 x 3½ - 36
D	Long Posts (4)	2½ x 3 - 30
E	Stretchers (2)	1 x 3½ - 29½
F	Beams (3)	2½ x 3 - 60

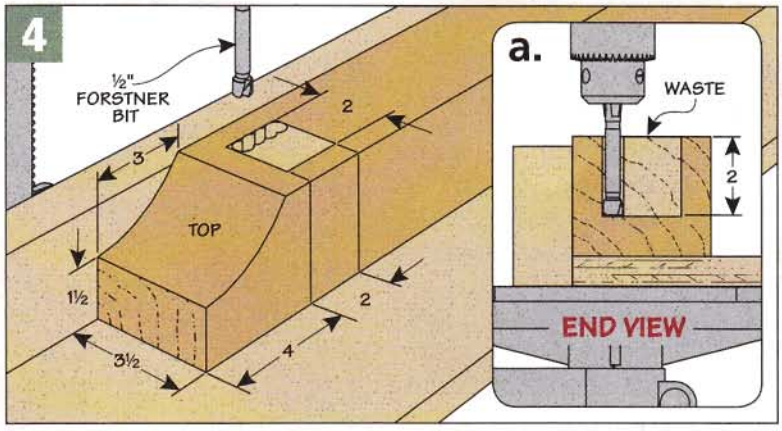
SHORT SAWHORSE

G	Short Posts (4) *	2½ x 3 - 20

* Replaces Long Posts (D)







top, stretcher, & Posts

After the bases, the next part of the sawhorse to focus on is the top. The reason for this is simple. The posts are connected to the top with mortise and tenon joinery, as shown in Figure 3. I find it's easier to cut the mortises first and then fit the tenons to them.

Making the Top. The top of the sawhorse starts out as a pretty stout blank (3" x 3½") so it will stand up to the heaviest loads. I eased each end with a curve that complements the curves on the base.

Then I cut a large mortise near each end to accept a leg. After laying out the mortise, I took the piece over to the drill press and drilled out most of the waste with a Forstner bit, as you can see in Figure 4. It's a good idea to use a fence to position the workpiece so the mortise is centered and parallel to the edge of the top.

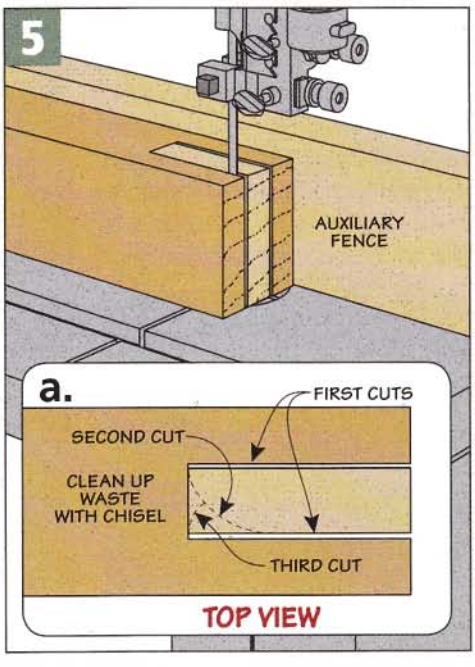
Even with careful drilling, the mortise will still have some remaining waste to clean out and the corners to square up. To do this, clamp the top to your workbench and use a wide chisel to bring the mortise to final shape.

Now, the Posts. At this point, you're ready to connect the bases and top by making the posts. But you have a decision to make — and that's the length of the posts.

Figure 3 shows dimensions for two sizes of posts. The longer posts will make a sawhorse that's 32" tall. This is a good working height for most tasks. The shorter post length makes a 22"-tall sawhorse — just right to create a low assembly or finishing table. Once you make your decision, you can cut the post pieces to final size.

Joinery. The next step is to cut some joinery on the post. There's an open mortise to receive the notched foot at the bottom of the post. In the middle is a through mortise to accept the stretcher. And the top of the post has a tenon to match the mortise cut in the top.

I decided to cut the tenons on the top of the leg first. Usually, I use a dado blade in the table saw to cut tenons, but since there are only two, it was a perfect opportunity to cut the tenons by hand.



It doesn't take much time and the material I used for the sawhorse (Douglas fir) is easy to cut. You can read a step-by-step technique for how to do this on page 32.

The open mortise at the bottom uses a different approach. Here, I turned to the band saw. With the help of a fence, I made the long, straight cuts to define the sides of the mortise, as shown in Figure 5.

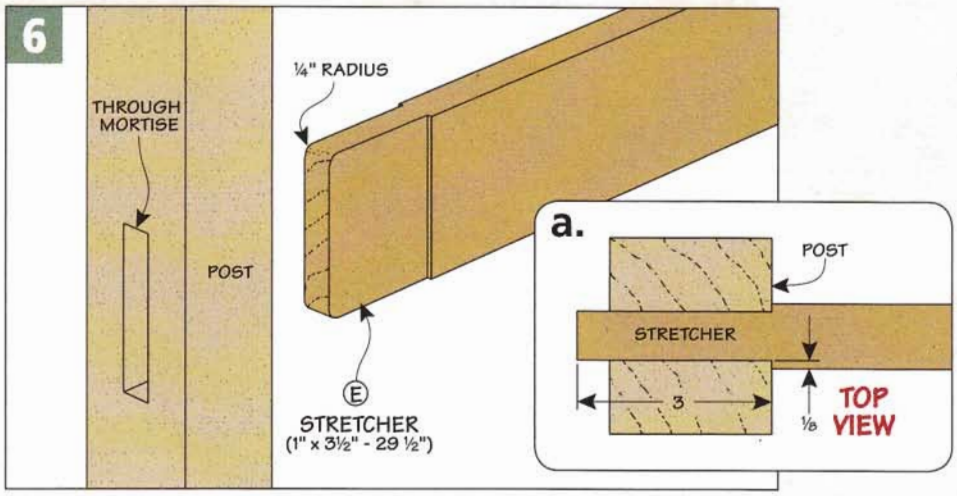
Then I removed the fence and made a sweeping cut from one side to the opposite corner to define the end of the mortise. A final cut from the opposite direction cleans up the other corner.

The remaining joint to take care of on the post is the through mortise (Figure 3). As you drill out and clean up the mortise, keep a couple goals in mind. First, the walls should be smooth and square to the face. And you want both faces of the mortise to be free of tearout.

There's one last detail to complete on the post. And that's to rout a chamfer on the inside and outside face of the lower end, as illustrated in Figure 3b. You can do this at the router table. Just be sure to use a backer board to prevent tearout.

Stretcher. The final piece of the sawhorse to make is the stretcher. This piece provides side-to-side rigidity to the sawhorse. The stretcher attaches to the legs with a through mortise and tenon joint, as in Figure 6.

With the mortises complete, you can dry-assemble the posts into the top to determine the final length of the stretcher as well as its shoulder-to-shoulder length. You can see in Figure 6a how the ends of the stretcher extend through the post and are rounded over on the top and bottom edges.



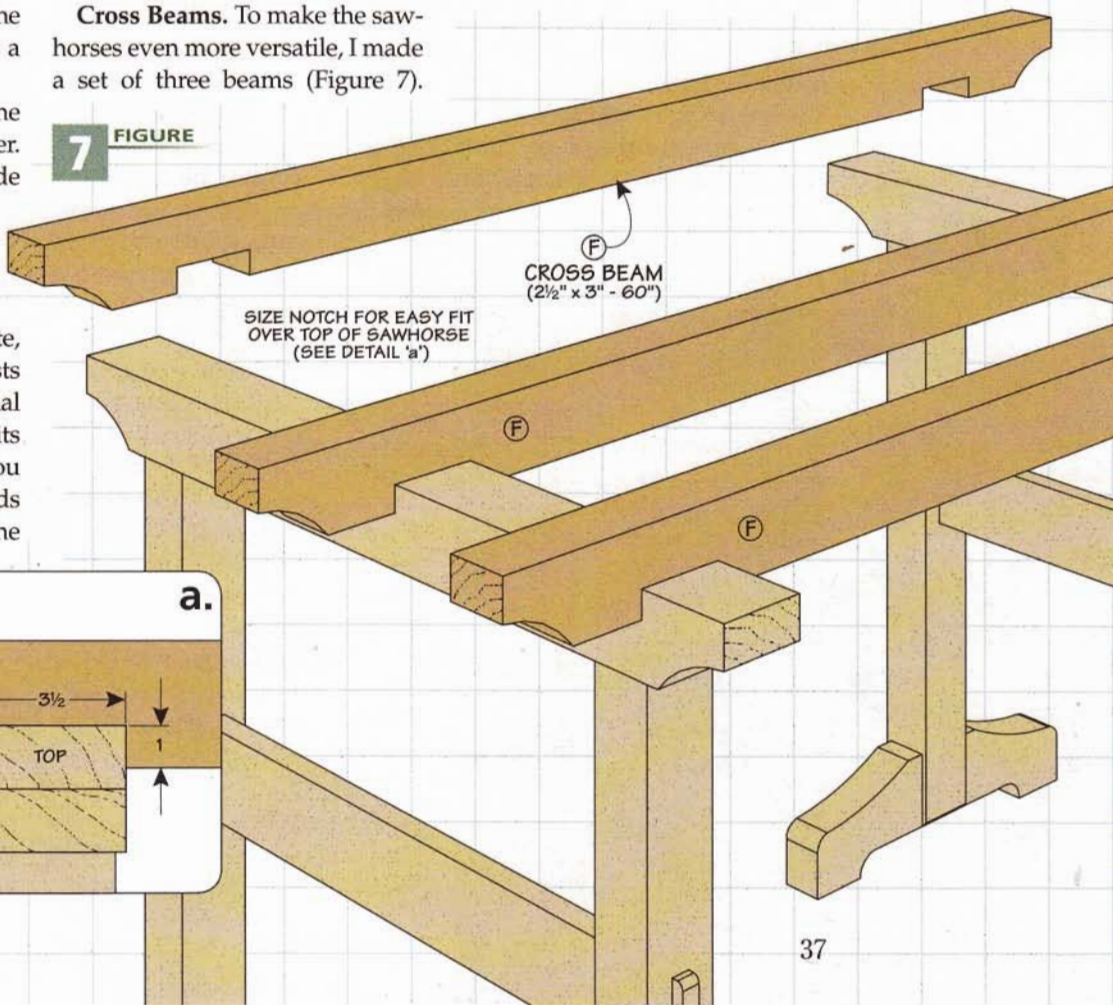
There's one other thing to note about the tenon on each end. There are only shoulders cut on the wide cheeks — not the top and bottom.

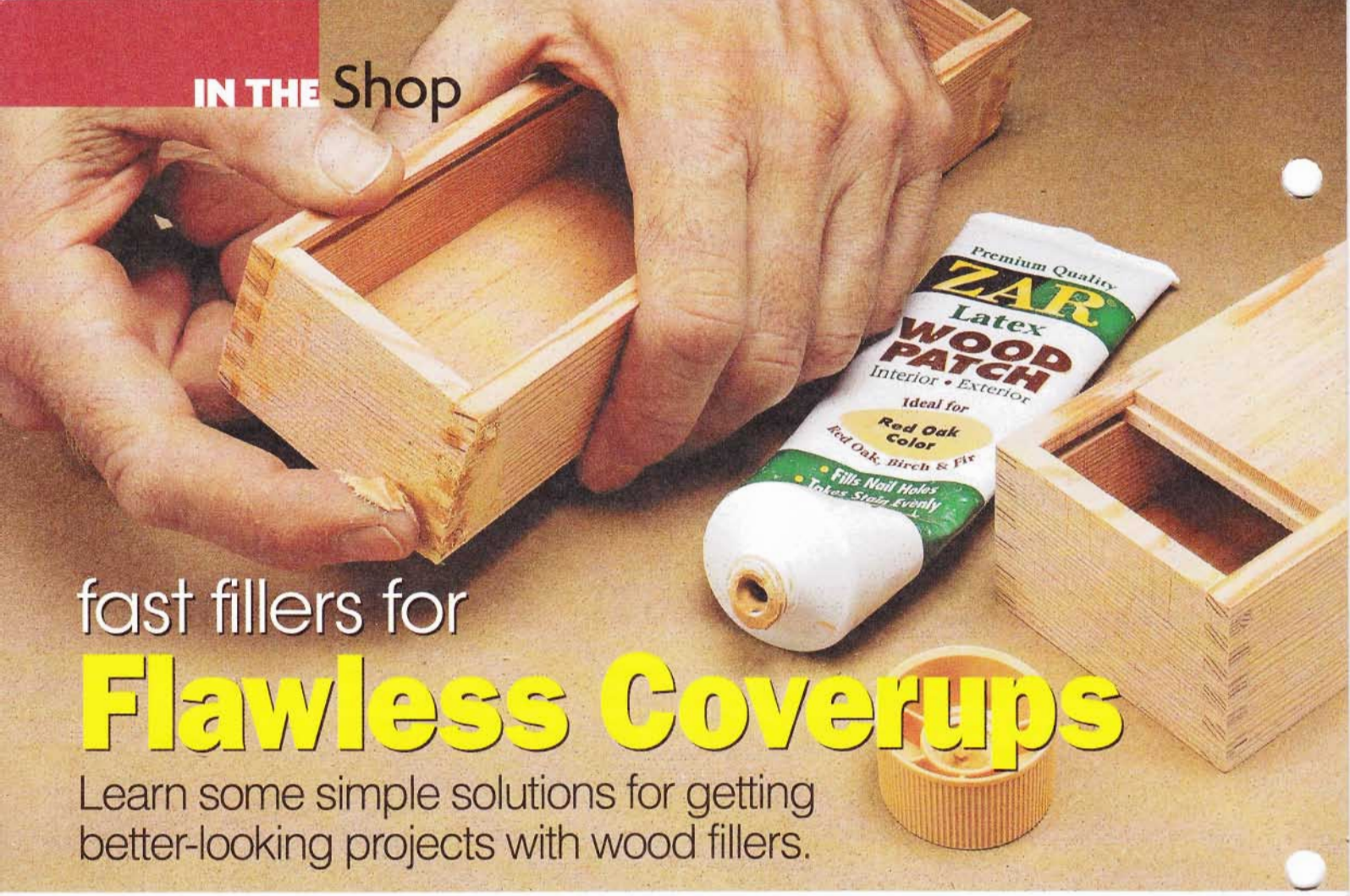
Some Assembly. At this point, you can do a little assembly on the sawhorse. First, you can glue a base to each post. I applied a clamp across the joint so the sides of the mortise were in firm contact with the notches on the base.

Cross Beams. To make the sawhorses even more versatile, I made a set of three beams (Figure 7). The beams simply rest on the top of the sawhorses and are sized to support a sheet of plywood to create an assembly or finishing table.

I cut a notch near each end of the beam to fit over the top of the sawhorse. Finally, the beams have a curve cut on each end to match the top of the sawhorse.

It doesn't matter what size sawhorses you build, you're sure to find them a handy addition to your workshop.





fast fillers for Flawless Coverups

Learn some simple solutions for getting better-looking projects with wood fillers.

I have one overall goal in mind when I'm building a project. And that's to make it look the best I can. That involves everything from materials to joinery and finish. But I also rely on a few "secret ingredients" to make sure the results are top-notch — wood fillers.

Filler & Putty. Throughout the building process, I'm sure to find small gaps, holes, or other blemishes that I want to camouflage. To do that, I use wood fillers and putties. There are three types — latex wood filler, wood putty, and epoxy filler (photo below). Each one has characteristics to meet different needs. Best of all, you can find them at most paint stores, hardware stores, or home centers.

LATEX WOOD FILLER

The problem solver I turn to most is wood filler. It's made from finely ground wood and a binder and has the consistency of toothpaste. You can find it in tubs or tubes. I prefer the tubes, because the filler is less likely to dry out in the container.

Gap Filler. What makes latex filler so versatile is that it's so easy to use. All you need to do is apply a dab of filler over the gap. After working it in a bit, wipe away the excess. Wood filler hardens quickly so you can sand the filler flush with the surrounding wood.

I use wood filler most often to cover small gaps in joinery, as shown in the photo above. I also use it to conceal tiny gaps where molding meets a case.

There's one thing I'd like to note: On wood with open pores like red oak, latex filler can plug the pores and create a visible spot once a finish is applied. The solution is simple. Mask off the blemish with tape and apply filler in as small an area as possible.

Color Choices. You can find latex fillers in a variety of colors. Here, things can get a little confusing. The colors are named after different wood species like pine, birch, and cherry. So you'd think that to fix a gap in a pine project, you grab the tube of "pine" filler.

◀ ***Problem Solvers.*** *Latex wood filler, putty, and epoxy filler are all you need to fix minor problems.*

But that isn't necessarily the best choice. Instead, I try to have a range of colors and use the wood filler that matches best.

Color Matching. This brings up the question of how to choose the right color since wood is made up of a range of tones. I have a couple of guidelines to help me decide.

If the piece will get an oil or "natural" finish, I choose a filler that's a shade lighter than the primary color in the wood. The reason is the filler will absorb oil and darken more than the wood.

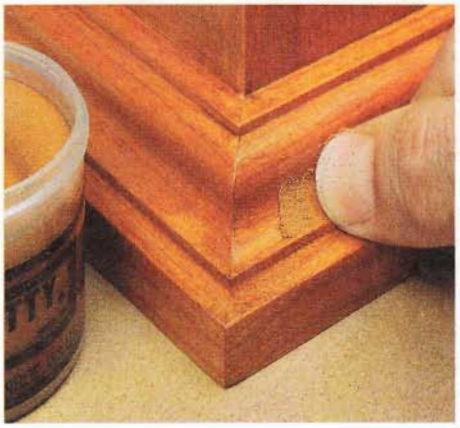
You can do the opposite if the project is going to be stained. In this case, the stain will not penetrate the filler as well as the wood. So I choose filler that's a shade darker to match the final color better. If you're unsure, it's best to try it out on a sample board.

WOOD PUTTY

Another handy cover-up in my cabinet is a few cans of wood putty. At first glance, wood putty looks a lot like filler. The key difference is that putty doesn't really dry out and harden.

After Finishing. That may not seem like much of a benefit. But putty is designed to be used after a finish is applied to a project. The photos above show one common use — covering nail holes after attaching molding. I wipe on a small amount of putty over the hole. Then using a soft cloth, I wipe away the excess. The putty stays in the hole but it's easy to buff off the surrounding finish.

Since the putty is applied after finishing, it's important to match the color as closely as possible. Like filler, putty comes in a range of colors. You can usually find the color your need. But you can also mix two or more colors together to match your project (margin photo).



▲ ***Apply the Putty.*** *Press a small dab of putty over the nail hole. Work it in so the hole is completely filled.*

▲ ***Wipe Away Excess.*** *With a soft cloth remove the excess putty and buff away any residue from the surrounding surface.*

EPOXY FILLER

The third type of filler is a relative newcomer — epoxy filler. You can see what it looks like in the left photo below. Like standard epoxy, it has two parts — resin and hardener. But instead of being liquid, it's soft like modeling clay. When the two different-colored components are kneaded together, the filler begins to harden similar to latex wood filler (middle photo below).

Super Hard. The main advantage of epoxy filler is it's much harder than wood filler. So it can be used in places that are subject to wear and tear, like the door edge shown in the lower right photo.

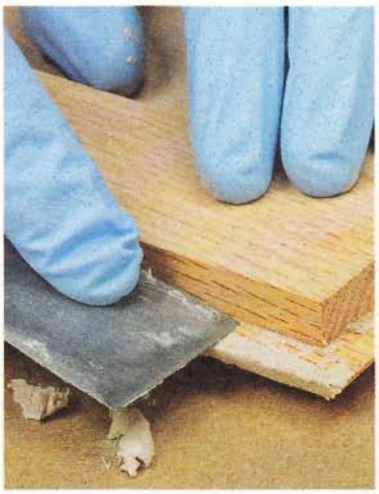
Once dry, the epoxy filler is rock hard and waterproof. It can be sanded, routed, or even drilled to accept screws. If there's a downside, it's that epoxy filler won't accept stain. So you need to match the color closely right off the bat. To get around this, you can add a small amount of artist's oil color while mixing the filler.

These problem-solving fillers and putties are inexpensive, too. But you'll get big time results and your projects will look better.

▲ ***Mix & Match.*** *Mix colors of putty to create a custom match to your finished project.*

▲ ***Cut A Slice.*** *With a knife, slice off a piece of epoxy filler. Wear gloves to protect your hands.*

▲ ***Knead Together.*** *Use your fingers to combine the two parts until the color is uniform.*



▲ ***Apply.*** *You have about five minutes to apply the filler. Once it's hard, sand or rout it to shape.*

through Dovetails

Cut through dovetails on the table saw? You bet. It's quick, easy, and accurate.

A table saw isn't the first tool you think of when it comes to cutting through dovetails. Okay, maybe it's not a tool you think of using at all. So it might surprise you to learn that you can use your table saw to make perfect-fitting through dovetails, like the ones shown in the inset photo at right.

All you need is a simple shop-built jig and a saw blade ground to leave perfectly angled corners. Best of all, this technique results in through dovetails with that distinct, "hand-cut" look.

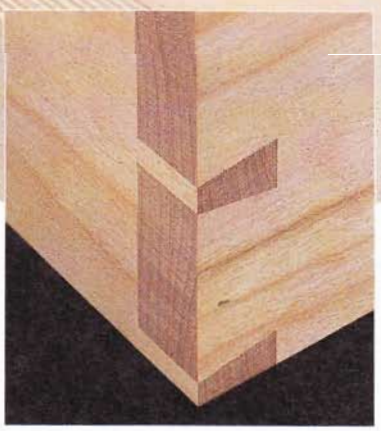
The jig is similar to a crosscut sled but the fence is adjustable to allow for cutting both the pins and tails. (For more on building the jig, turn to page 46.) Besides the jig, you'll also need a special saw blade to cut dovetails on the table saw.

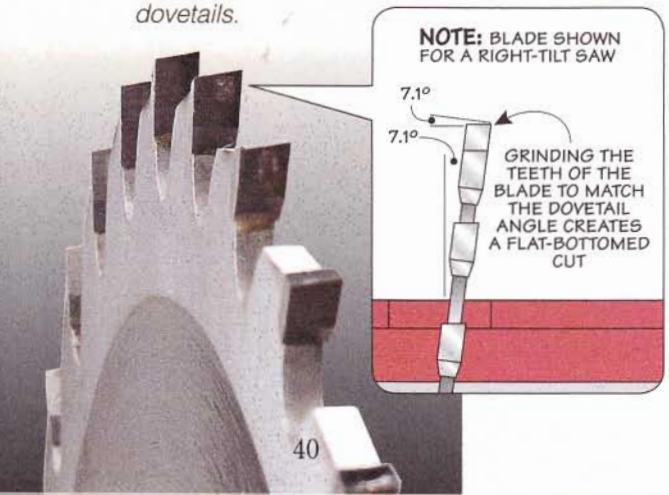
The Blade. If you use a regular blade to make the angled cuts needed for the dovetails, you'll end up doing a fair amount of hand work to clean up the inside corners. The conventional tooth configuration just doesn't make for a good result.

On the other hand, a sharpening service can grind the teeth of a saw blade to match the angle of the dovetail (lower left photo). This means you'll have very little clean-up work to do later.

Most sharpening services will regrind a saw blade for a reasonable fee. But you will need to provide very specific information when requesting this service.

The photos and drawing at left show the relationship between a right-tilt saw and the saw blade grind angle. The grind you'll need





▼ ***Angled Grind.*** *Have a general-purpose blade ground to cut dovetails.*

◄ ***Setting the Blade.*** *A digital angle gauge makes quick work of adjusting the saw blade to match the desired dovetail angle.*

for a left-tilt saw would simply be the opposite.

Once you've determined the direction for the custom grind, you'll also need to specify an angle. And this is really just a matter of the slope you like in your dovetails. For most of my work, I prefer an 8:1 tail ratio. This means the grind angle needs to be 7.1°.

TAILS FIRST

This technique starts with cutting the tails first. You can then use them to accurately lay out the pin positions. Like any method of cutting dovetails, this table saw technique depends on your stock being perfectly flat and square.

While you're milling your stock, go ahead and make a couple of test pieces as well. The test pieces will give you a chance to practice the technique and become familiar with the overall process.

Layout. Once you've finished preparing your workpieces, you can start laying out the tails, as in photo 1 above. The nice thing is, you only need to do this on one end of one workpiece.

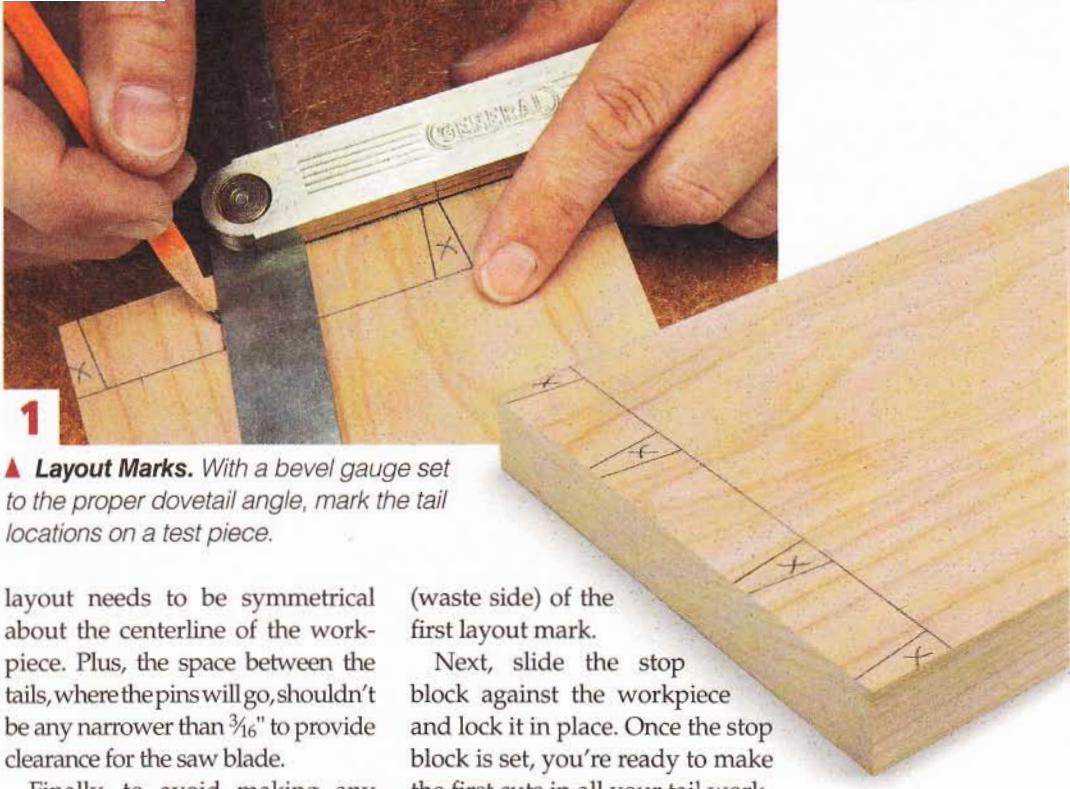
Keep in mind that you can vary the size of the tails, but the overall layout needs to be symmetrical about the centerline of the workpiece. Plus, the space between the tails, where the pins will go, shouldn't be any narrower than 3/16" to provide clearance for the saw blade.

Finally, to avoid making any mental mistakes as you work, mark the waste areas with an "X".

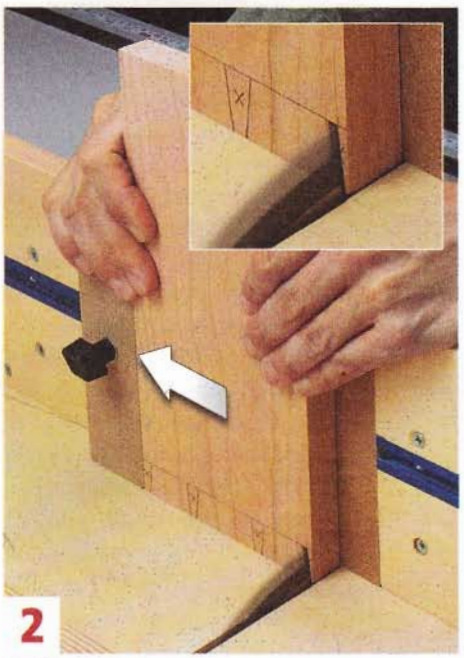
First Cuts. After tilting the blade on your saw, as shown on the previous page, you're ready to make the first cut. Start by putting the jig into position on the table saw with the fence positioned square to the blade to make the tails. Holding the workpiece vertically against the fence, slide the jig forward to align the blade to the outside (waste side) of the first layout mark.

Next, slide the stop block against the workpiece and lock it in place. Once the stop block is set, you're ready to make the first cuts in all your tail workpieces (photo 2 and inset at lower left). Be sure to set the blade height to match your layout line. In fact, I like to go just a hair deeper than the overall stock thickness to be on the safe side.

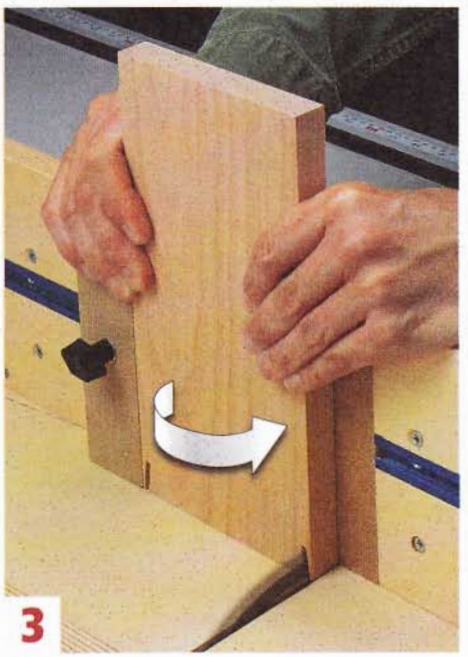
Photos 3 and 4 below show you how I use a simple, cut-and-flip sequence to make four cuts. You just need to make sure to hold the workpiece securely against the stop block and fence.



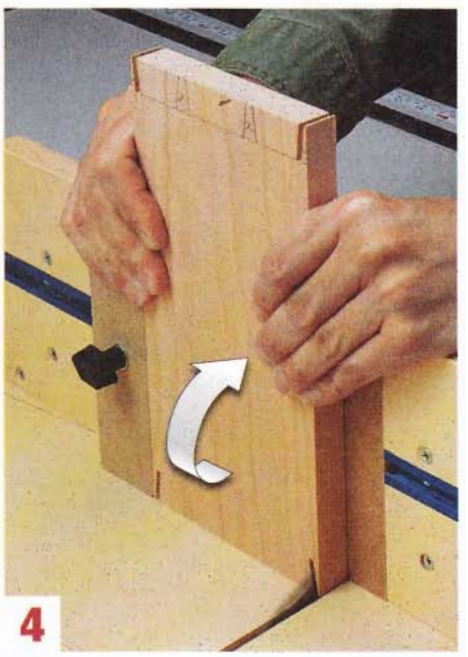
▲ ***Layout Marks.*** *With a bevel gauge set to the proper dovetail angle, mark the tail locations on a test piece.*



▲ ***Set the Stop Block.*** *After aligning the layout mark with the blade, lock the stop block into position and make the first cut.*



▲ ***Cut and Turn.*** *Rotate the workpiece to make a matching cut on the opposite side. This technique ensures uniform spacing.*



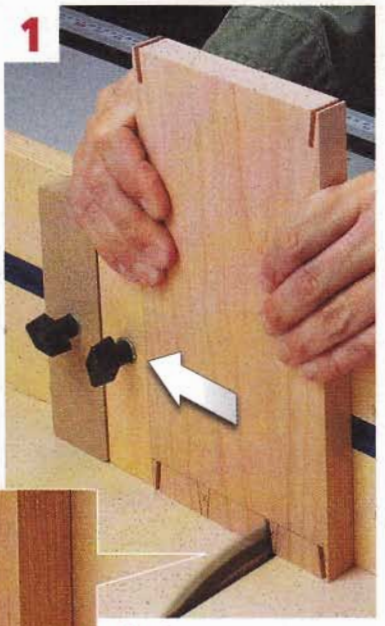
▲ ***Both Ends.*** *Flipping the workpiece end-over-end allows you to make identical cuts on the opposite end.*

completing the Tails

Now that you've made the first set of cuts that define one edge of the outside tails, you have a good understanding of how the jig and overall technique work. You'll repeat this process to complete the rest of the tails on all your remaining workpieces.

The nice thing is you won't need to worry about working to any layout lines for the rest of the work on the tails. That's going to be taken care of by a set of spacers, like the ones you see in the box below. They're the key to accurate tails — and tight-fitting pins, as you'll find out later.

Spacers. The trick is sizing the spacers. For the technique to work, the spacers must be sized accurately. The box below shows the relationship between the spacers and the layout already completed on the tail workpiece.



▲ ***Second Cuts.*** *At this point, the spacer accurately controls the position of the workpiece for the next cut.*

▲ ***Both Ends.*** *As before, flip the workpiece over and repeat the cuts on both ends.*

Completing the Tails. At this point, completing the tail cuts starts with inserting the first spacer into the T-track, sliding it up against the stop block, and then locking the spacer in place (photo 1).

To verify the correct spacer is installed, simply set the workpiece with your layout lines in place. Then just slide it up to the saw blade and double check that the blade will cut into the waste area between the tails.

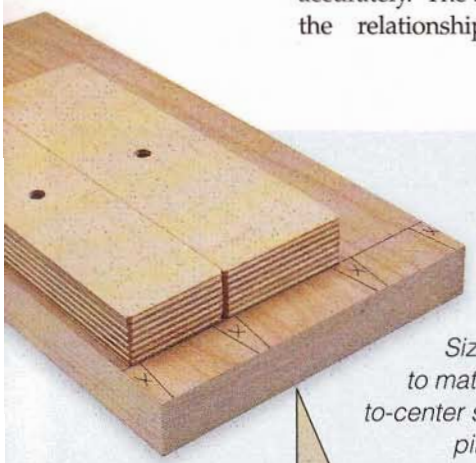
Stay Organized. Once that's complete, you're ready to use the same process to make four cuts in all of your tail workpieces. One note of caution: It's easy to lose your concentration as you repeat the cuts four times on each workpiece, especially if you're making a big project with a lot of parts (like a set of drawers, for instance).

While the jig takes care of properly positioning the workpiece in relation to the distance from the blade, you still need to make sure you're keeping it tight against the fence and stop block/spacer setup. Keep an eye out for sawdust building up on the jig as well, since this can also throw off the position of the workpiece.

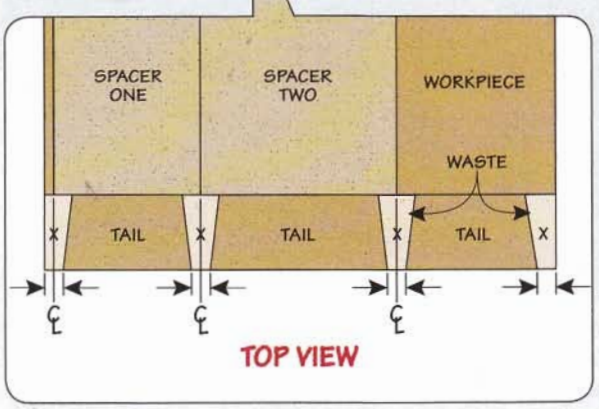
In photos 1 and 2 above, you can see the cuts being made with the first spacer in place. Adding the second spacer results in completing the shape of the tails, as you can see photos 3 and 4 at the top of the opposite page.

After wrapping up all the cuts on all of the tail workpieces, you're

sizing the Spacers



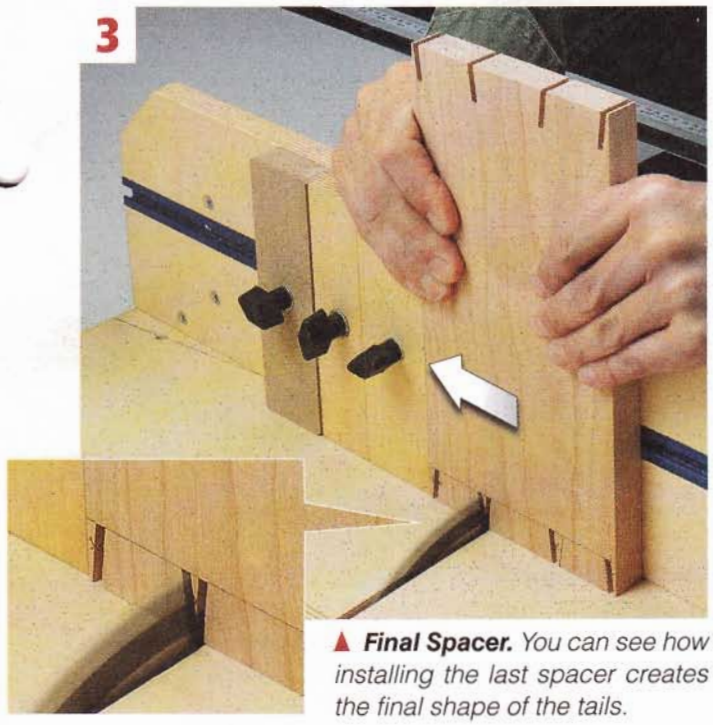
◀ ***Spacers.*** *Size the spacers to match the center-to-center spacing of the pins (Top View).*



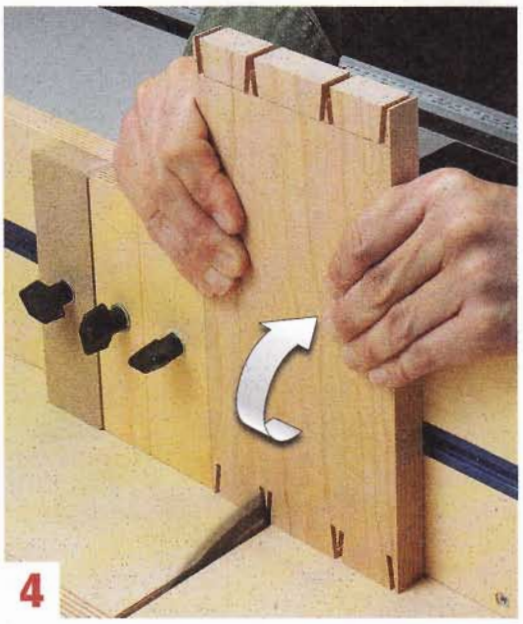
When it comes to sizing the spacers, the drawing at left covers what you need to keep in mind.

Basically, to position the workpieces correctly for each cut, you'll need the same number of spacers that you have full pins. In the example here, there are two full pins (the two center pins), so two spacers are required.

Sizing the width of each spacer is just a matter of starting at the center of the half pin at one edge and measuring to the center of the first full pin. Then you continue across the workpiece, measuring from pin center to pin center. You don't need a spacer for the last half pin on the workpiece.



▲ ***Final Spacer.*** *You can see how installing the last spacer creates the final shape of the tails.*



▲ ***Finishing Up.*** *To complete the tails on the other end of the workpiece, flip and rotate everything one more time.*

▲ ***Clean Up Work.*** *A sharp chisel makes short work of removing the waste between the tails.*

ready for a little bit of cleanup work to finish the tails.

Clean Out the Waste. Depending on your dovetail layout, the amount of cleanup work may vary. So you have some options on how to accomplish this task.

If there's a lot of waste to clear out, simply remove the stop and spacers from the jig. Then you can simply cut away the waste with the saw blade, positioning the workpiece by eye.

The thing to make sure here is that you don't cut into any of the tails. You can also use a fret or coping saw to remove the bulk of the waste.

For removing small amounts of waste and final cleanup, I turn to a freshly sharpened chisel, like the one you see in photo 5. A sharp chisel helps prevent tearout as you work across the grain.

Start by cutting down at the layout mark. Then cut in from the end to remove small pieces of waste. Be sure to flip the workpiece over to make the initial cuts on both faces rather than just cutting through from one side.

Lay Out the Pins. Once you've finished removing all of the waste, you're halfway to a complete dovetail joint. Now you can turn your attention to the other half of the joint — the pins.

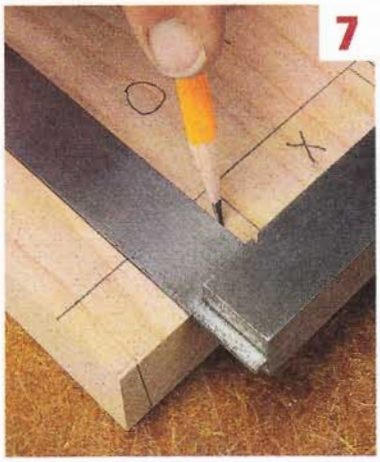
You can see how to lay out the pin workpiece using a completed tail piece in photo 6 at the lower left. Here again, you'll only need to lay out the pins on one workpiece. The spacers will position the rest of the pin workpieces properly after the initial cut is made for the first pin.

These layout marks will only be used to initially position the stop block. Plus, it helps during the actual cuts so you know which spots are the waste areas. I make sure to sharpen my pencil and make the marks as accurately as possible.

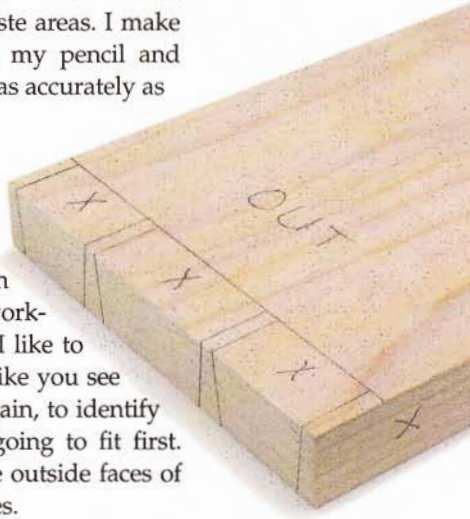
Now, using a square, transfer the layout marks for each pin down both faces of the workpiece (photo 7). I like to mark the edge, like you see in the margin again, to identify which pin I'm going to fit first. Finally, mark the outside faces of all the workpieces.

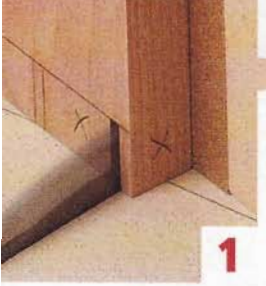
At this point, you're ready to start cutting the mating pins. For more on this, turn to the next page.

▲ ***Locate the Pins.*** *Use the completed tail workpiece with the original layout to locate the pins on the mating workpiece.*

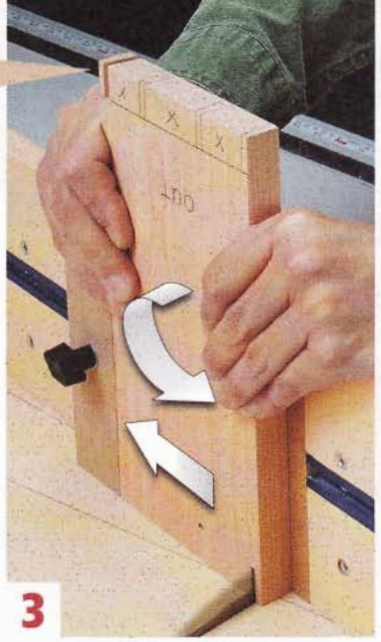


▲ ***Transfer.*** *Transfer the layout marks down the front face of one workpiece. Finally, mark the outside face of all the pin workpieces.*

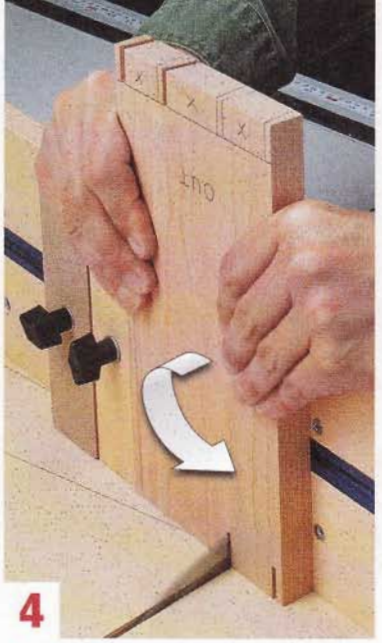




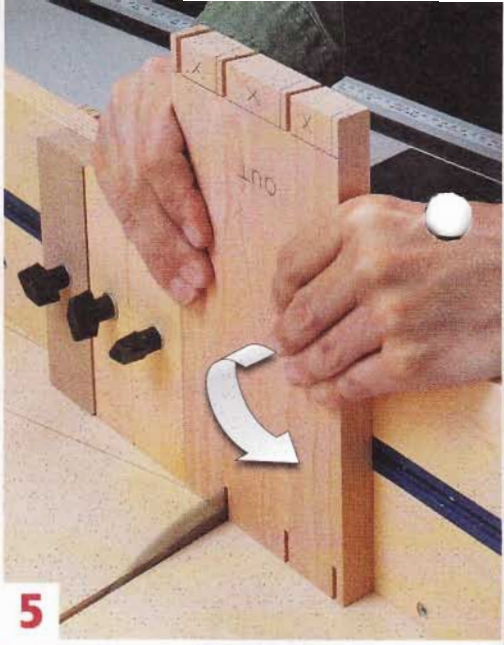
First Pin. *Position the stop block so the size of the first pin matches the tail workpiece. Then, make a cut on both ends of all the workpieces.*



Reposition & Cut. *Flip the workpiece and make a cut for the pin at the opposite corner.*



Add a Spacer. *Just like with the tails, add a spacer and make the next set of cuts.*



Final Cut. *With the last spacer in place, cut all the workpieces to complete one angle on all the pins.*

fitting & fine-tuning the Pins

With the layout complete, you're just about ready to start cutting the pins. But there are a couple adjustments you'll need to make to the jig and your table saw. Plus, there's a slight change to the overall process of cutting the pins. But I'll get to that in a bit.

Adjustment. The first thing to do is reset your table saw blade to 90°. Unlike the tails, the pins are cut with the blade square to the table. Instead of tilting the blade, you'll set the angle of the jig to match the tail angle.

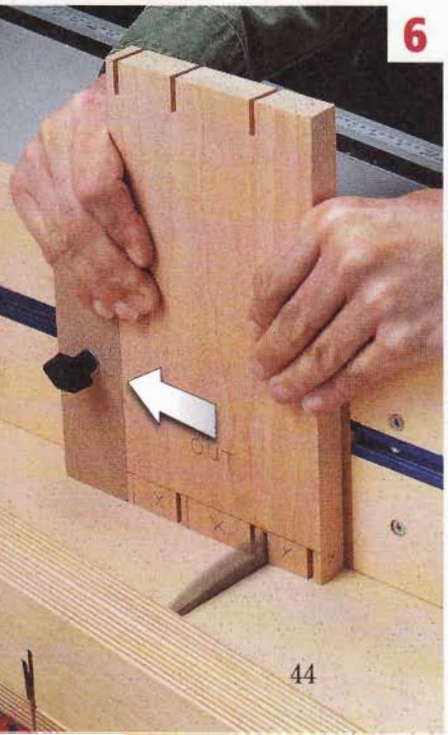
The last thing you'll need to do is remove the dovetail blade you used to cut the tails. To get a flat bottom as you make the cut and minimize any extra clean-up work, you'll want to use a rip blade. A dado blade does make removing the waste go quicker, but I've found I get the best results with a rip blade.

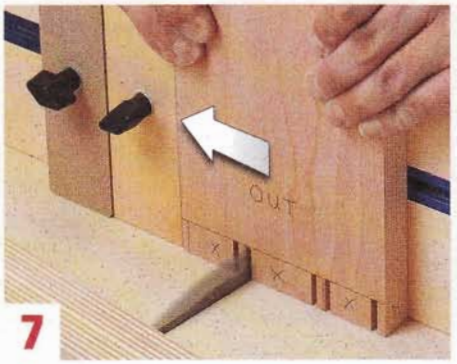
Sizing the First Pin. The key to locating and sizing all of the pins lies in carefully matching the first pin with the tail piece. For the edges of the workpieces to end up flush, the first pin needs to match its mating opening in the tail piece exactly.

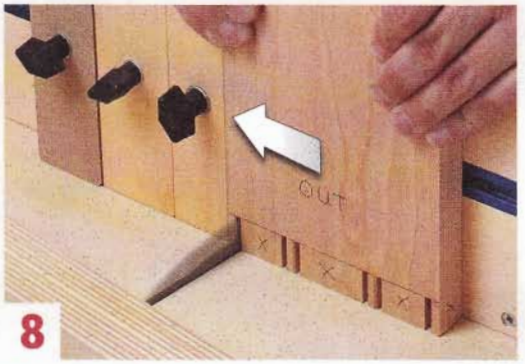
The nice thing is, the process for doing this is just a matter of sneaking up on the final size. After that, completing the rest of the pins involves using the spacers once again. Then you'll do some fine-tuning right on the table saw for a perfect fit.

Sizing the Pin. *Sneak up on the final size of the first pin until it matches its mating opening in the tail workpiece.*

Making the Cut. First things first, though. Pull the indexing pin and angle the fence on the jig back







Oversized Pins. *After adjusting the fence to angle forward, reposition the stop block to form an oversized pin on the workpiece (photo 6). Then, install each spacer in turn to complete the remaining pins, as shown in photos 7 and 8.*

to match the dovetail angle. Then reinstall the indexing pin. And be sure that the depth of cut of the saw blade matches the layout line on the pin workpiece. At this point, you're ready to create the first pin (photo 1).

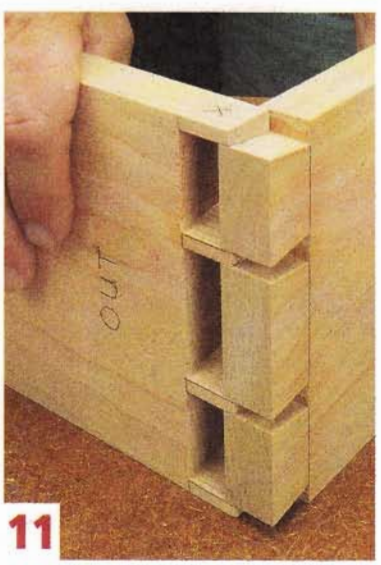
Check the Fit. What you're looking for here is that the pin matches its mating tail piece. Since you can't actually slide the pieces together, checking the fit means comparing both next to each other, as in photo 2 on the opposite page.

Cutting All the Ends. Once you have a good "fit," you can lock the stop block in place and cut both ends of all the pin workpieces for this position. Note: The outside face will always be out for the entire pin-cutting process.

As you can see in photos 4 and 5 on the opposite page, you'll continue the process using the spacer blocks. Again, use your layout lines to be sure you're only cutting into the waste areas.

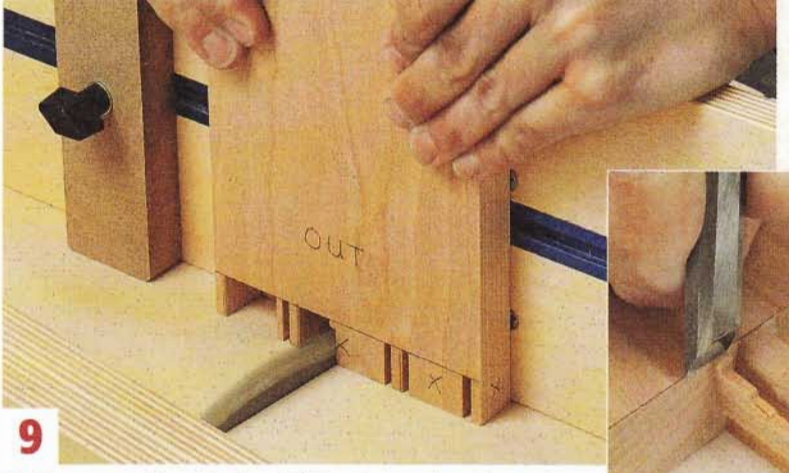
Shaping the Pins. To form the final shape of the pins, you'll need to cut the opposite sides of the pins. This means angling the fence forward and locking it in place.

You'll also need to reset the stop block for these cuts. The goal here is to cut the pins slightly oversize.



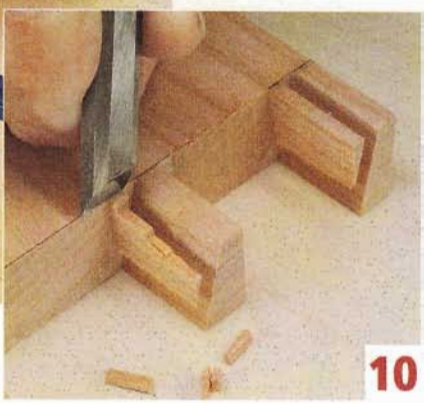
11

▲ ***Checking the Fit.*** *The pins should be sized so they just slide into the tails. If they're too tight, you'll need to fine-tune the fit.*



9

▲ ***Remove the Waste.*** *Without moving the stop block, remove as much waste as possible, then complete the rest of the task with a chisel (photo 10).*



10

This way, you can sneak up on the final fit (more on this later).

For now, simply use your layout line as a guide to set the stop block to cut oversized pins, as shown in photo 6 at the bottom of the opposite page. Once the stop block is set, complete the cuts across the bottom of one pin piece, using the spacers as necessary, like you see in photos 7 and 8 at the bottom of the facing page.

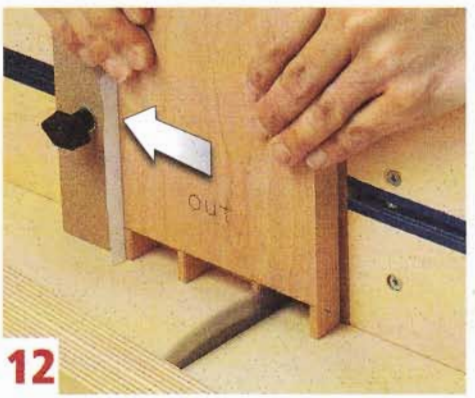
Checking the Fit. At this point, you're ready for a test fit. Since the pieces won't slide together because of the waste, you'll need to remove that. I use the table saw to remove as much as I can (photo 9). Be sure to avoid accidentally cutting into any of the pins as you do this. Then, clean up any remaining waste with a chisel (photo 10).

Once you've finished cleaning up the pins, it's time to test the fit of the joint. What you're looking for here is a fit that just slides together, as pictured in photo 11 below.

Fine-Tuning. Since the pins were oversized, they probably won't fit together. So you'll need to fine-tune the fit by trimming one side of all the pins. This is just a matter of making another cut with a thin paper shim between the stop block and workpiece. Now, leave the shim in place and use the spacers to trim the other pins.

Simply sneak up on the fit by adding shims until the pins just slide into the tails. With the shim thickness set, you can complete all the cuts on the remaining pin pieces. After removing the waste, every joint will slide together with an identical, smooth fit.

As you can see, a shop-built jig and step-by-step process make cutting through dovetails pretty straightforward. And you can't beat the "hand-cut" look.



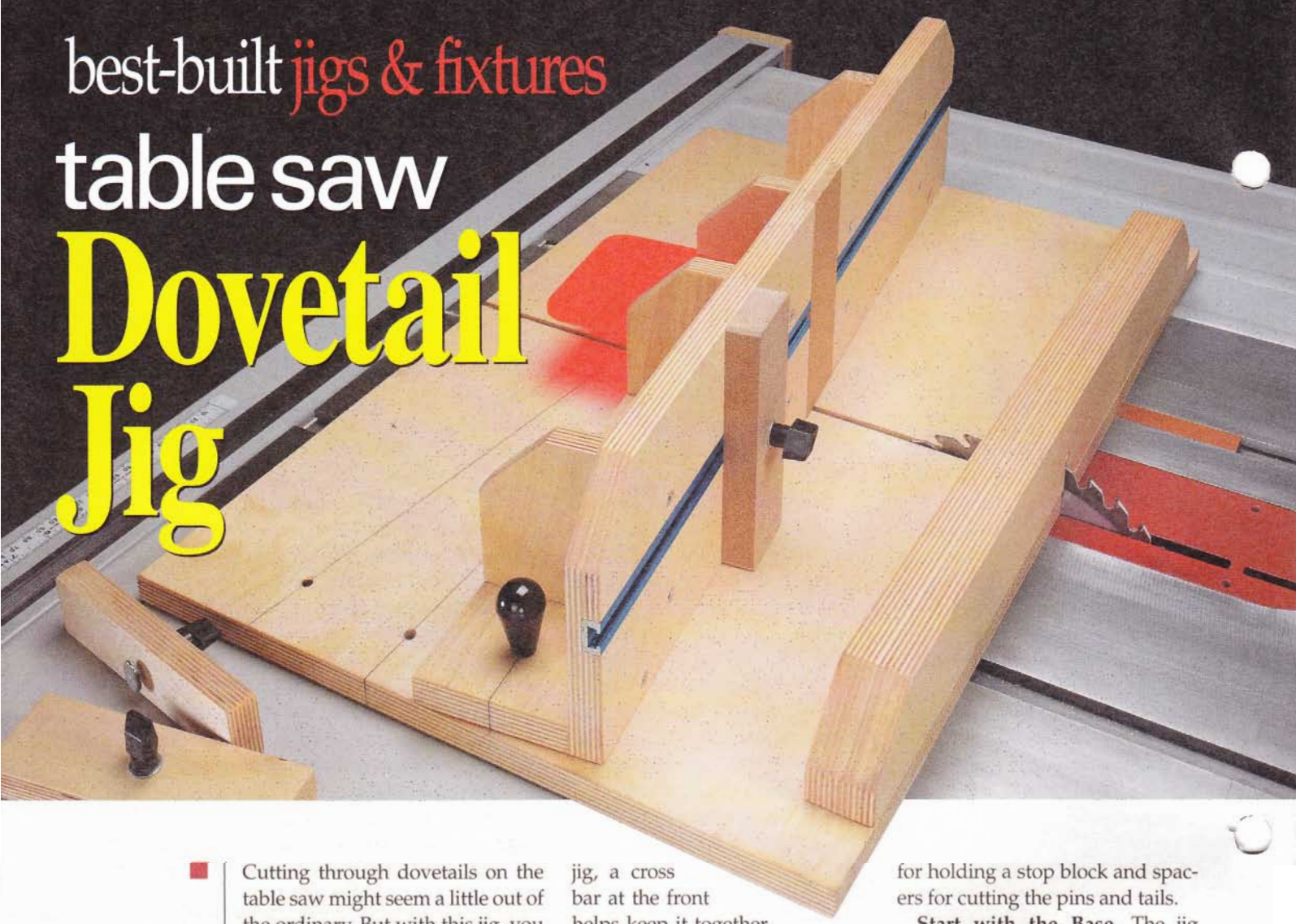
12

▲ ***Fine-Tuning.*** *Zeroing in on the fit is just a matter of slipping in a shim and repeating the cuts with each spacer (photo 13) to shave a small amount off each pin.*

13

best-built jigs & fixtures

table saw Dovetail Jig



Cutting through dovetails on the table saw might seem a little out of the ordinary. But with this jig, you can get perfect-fitting joints every time without a lot of effort. The article starting on page 40 walks you through the process.

The Jig. As you can see, the jig is made of ¾" plywood. Since you'll be cutting through the base of the jig, a cross bar at the front helps keep it together and stable.

To cut both the tails and the angled pins of the dovetail joint, the fence can be indexed. It pivots at one end and locks in place at the other to set the proper angle. The face of the fence has a T-track for holding a stop block and spacers for cutting the pins and tails.

Start with the Base. The jig isn't very complicated to build. It starts with a plywood base (Figure 1). After cutting it to size, I first marked out the centerline that will align with the blade.

The next thing to do is draw several lines you'll use later to install and locate the fence. Figure 1 shows you how to do this. Note: The lines shown are for cutting dovetails with an 8:1 ratio.

Cross Bar & Runner. Next, I added the cross bar at the front. And then to fit the jig to the saw, you can add the runner. I used a strip of phenolic I had lying around, but a hardwood strip or manufactured miter bar would work just as well.

To locate the runner, position the jig so the blade is aligned with the centerline of the base. Then mark the location of the miter slot to attach a runner. Be sure to keep the base square to the saw blade.

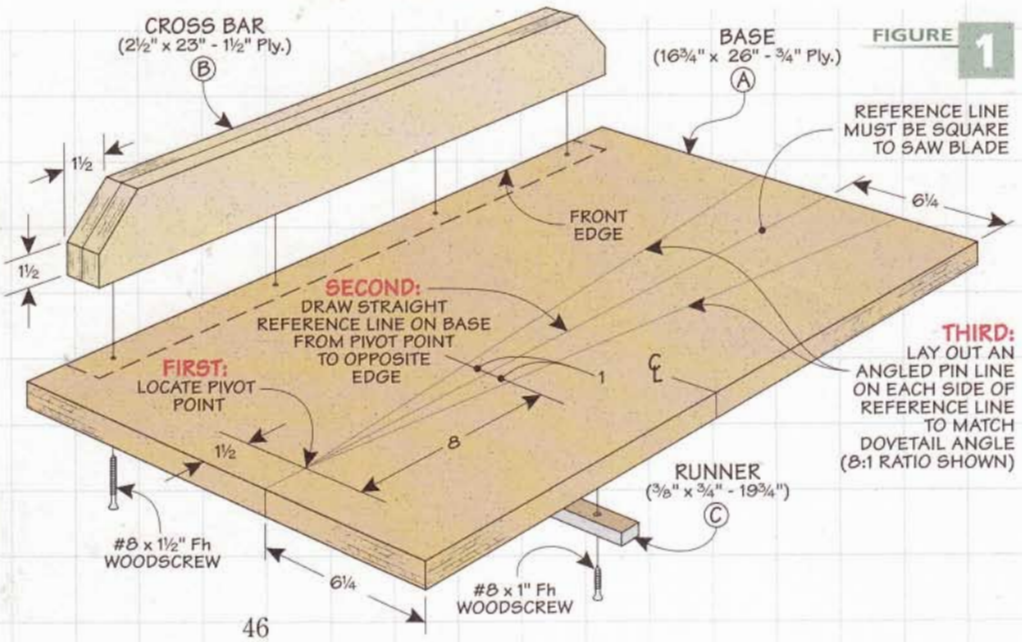


FIGURE 1

Fence. You can turn your attention to building the fence. The first thing you'll need to do is cut a wide but shallow, centered dado that holds a replaceable insert, as in Figures 2 and 2b. The insert backs up the cut to prevent chipout. I used my custom-ground dovetail blade to cut the beveled sides of the dado and remove the waste. Then, cut the ¾"-wide groove for the T-track and ease the top, outside corners of the fence face.

Once that's complete, you can make the fence base. To secure the fence to the jig, you'll need to drill a hole at each end (Figure 3). Go ahead and extend the centerline to the end of the base, as you can see in the lower right photo. This helps align the fence for drilling the indexing holes in the base.

To keep the fence face square to the fence base, I added a set of braces. After trimming them to size, cut dadoes in the two middle braces to hold a blade cover. Finally, screw the fence face, base, and braces together, and then slip the blade cover in place.

Fence Installation. To install the fence, drill a counterbored hole at the pivot point on the bottom, as in Figure 3a. Then, secure the fence in place with a carriage bolt, washer, and lock nut. At the opposite end, align the centerline on the base with one of the layout lines on the base of the jig. After clamping the fence to the jig, drill through the base, using the hole in the fence as a guide. Simply repeat the process for the other two holes.

Finally, you can make the stop block and fence indexing knob (Figures 2 and 3). For more on using the jig, turn to page 40.

FIGURE 2

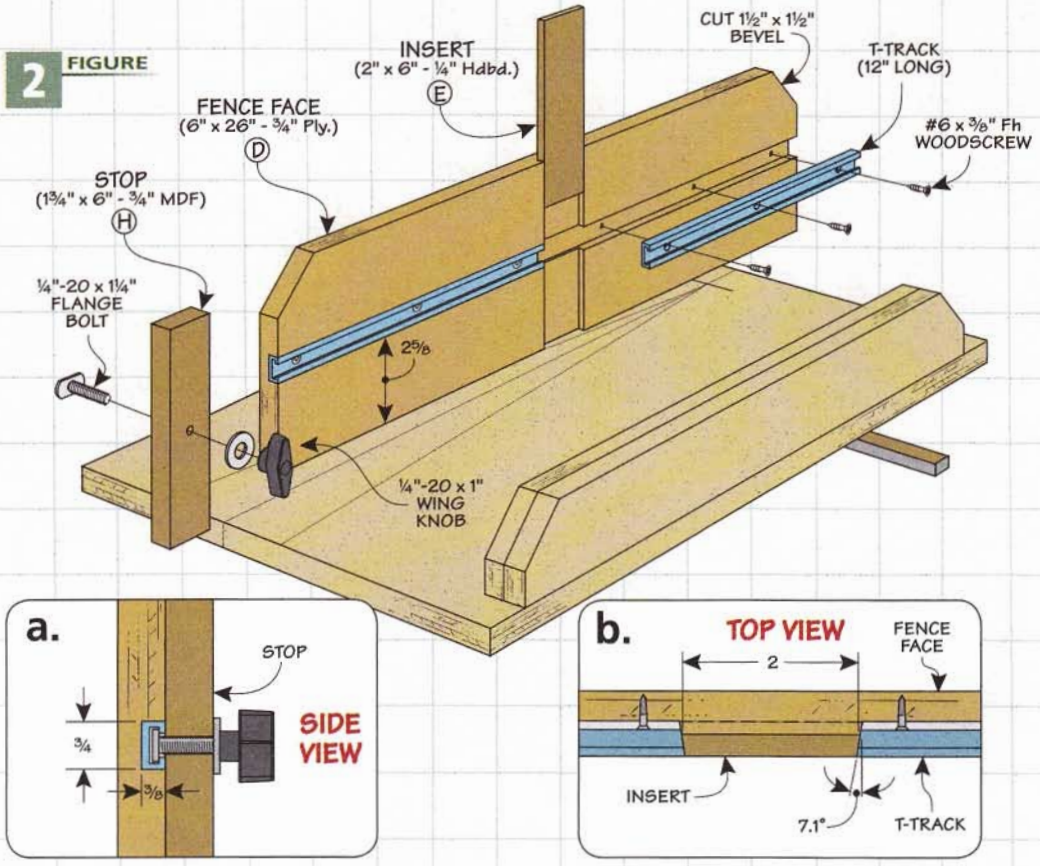
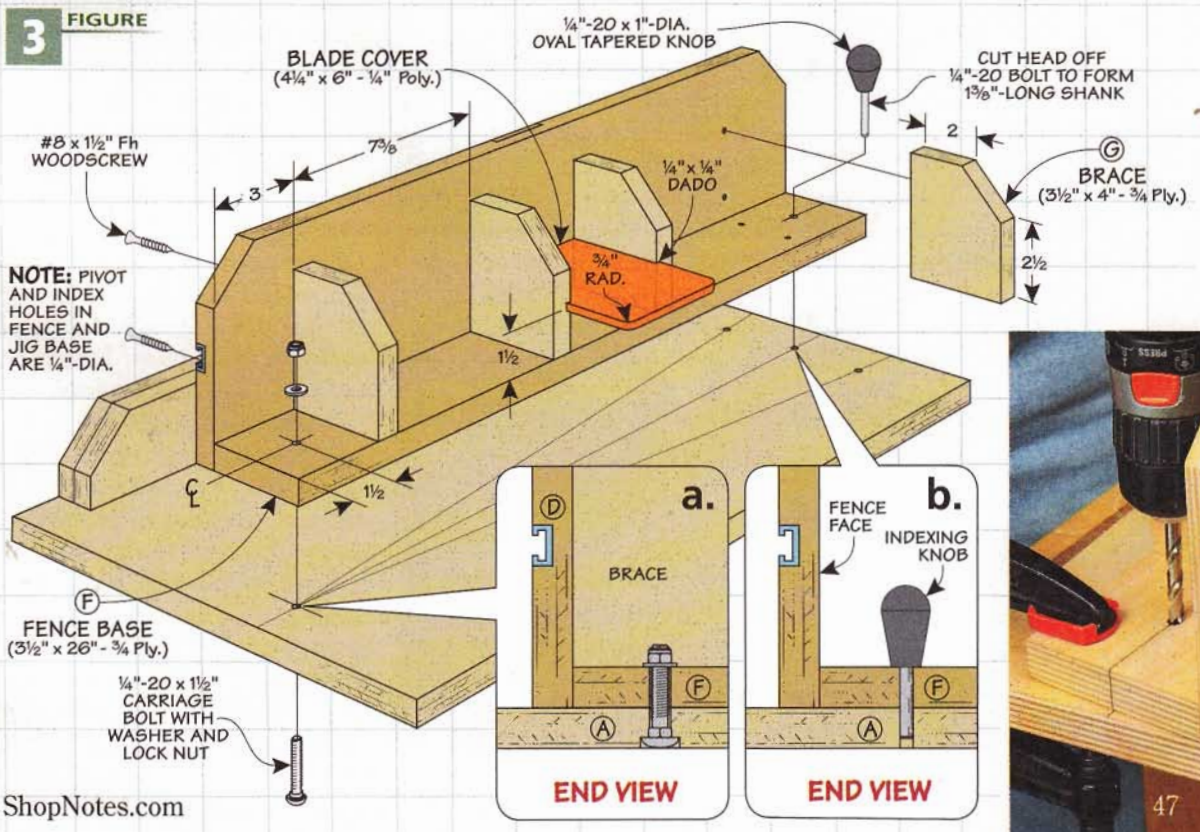


FIGURE 3



▼ ***Index Holes.*** *Use the layout lines to position and drill the index holes in the base of the jig.*

GREAT Gear

new products For Your Shop

Multipurpose. *Turn your combination square into a panel marking gauge.*

Just when you think there can't be anything really new for woodworkers, manufacturers come out with some surprises. Here are a few items worth taking a look at. Refer to Sources on page 51 to find out where to buy them.

FLAT-LYING TRAMMEL HEADS

When it comes to drawing large arcs and circles, a traditional beam compass or trammel can be a little awkward to set up and use. As you draw the arc, it has a tendency to tip, making it difficult to get a consistent arc or circle. The new *Tri-Scribe* trammel heads shown in the photos above by *M-Power Tools* step up to the plate with some unique and innovative features.

Versatility. The first thing to note about the trammel heads in the kit is that they can be attached to any metal rule, straightedge, or square. This gives you a wide range of options for layout work.

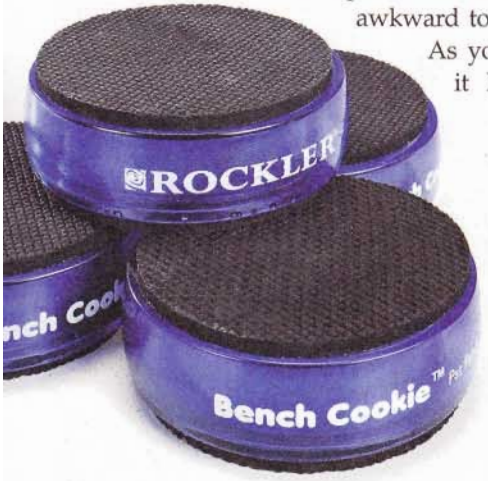
But what's even better about these heads is that they lie flat. The low center of gravity gives you more control so your layouts will be more accurate. The angled points do the work as you slide the heads along the workpiece.

The kit shown above comes with a steel scribe and pencil. You can also purchase an optional cutter with replaceable blades.

BENCH COOKIES

What do you get when you cross a router pad with a hockey puck? You get the *Bench Cookie* by *Rockler* (photos at left). Each disk is fitted with a soft rubber pad on both sides. It's a great concept for which you'll find a number of uses.

Grip and Elevate. The textured rubber pad grips your bench and the workpiece. And the more pressure you put on it, the tighter it grabs. If it starts to lose its grip because of sawdust, all you need to do is give them a quick wipe with a damp cloth. The soft pads also protect your workpiece from scratches and dings.



▼ ***Gripping.*** *Rubber pads grab your workpiece and hold it securely.*

▲ **Clean, Accurate Holes.** *The sharp cutting spurs and cutting edges allow you to drill crisp, clean holes with little or no tearout.*

The *Bench Cookies* also elevate your work about an inch. This works great for edge-routing operations. Or for slipping some clamps underneath an assembly when it's time for glueup.

MAXI-CUT DRILL BITS

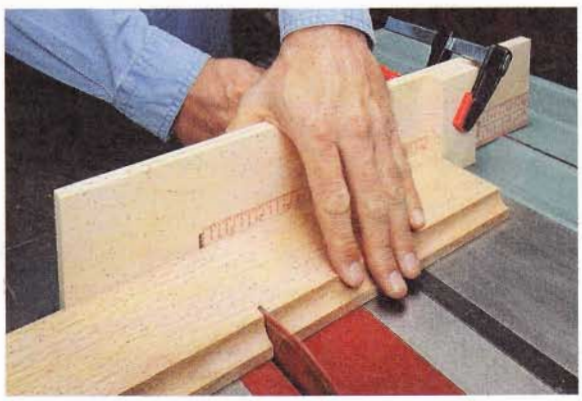
If you study the *Maxi-Cut* drill bits in the photos above, you may not notice much difference from a traditional Forstner bit. But these bits have a feature that sets them apart from the rest — the chip-breaking grooves on the cutting edges.

At first, these might seem insignificant (upper right margin photo). But after using them to drill holes in a variety of hardwood, softwood, MDF, and plywood, you'll see the benefit. These grooves break up the long curls that would normally clog up a bit or climb up the shaft. Instead, these bits generate smaller chips.

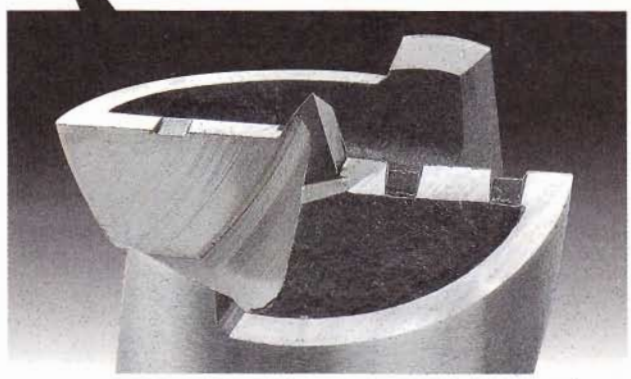
Besides this beneficial feature, I found the ultra-sharp spurs do a superb job of drilling smooth holes without tearout. There's no doubt these bits would be a worthy addition to your shop.

RED TAPE

For some measuring and marking tasks, you almost need an extra pair of hands to hold the measuring tape and workpiece while making the mark with a pencil. Inventor Chris Messina answered this frustration by combining two workshop staples (packaging tape and a measuring tape) into one handy layout tool. The result is the *Red Tape* you see below.



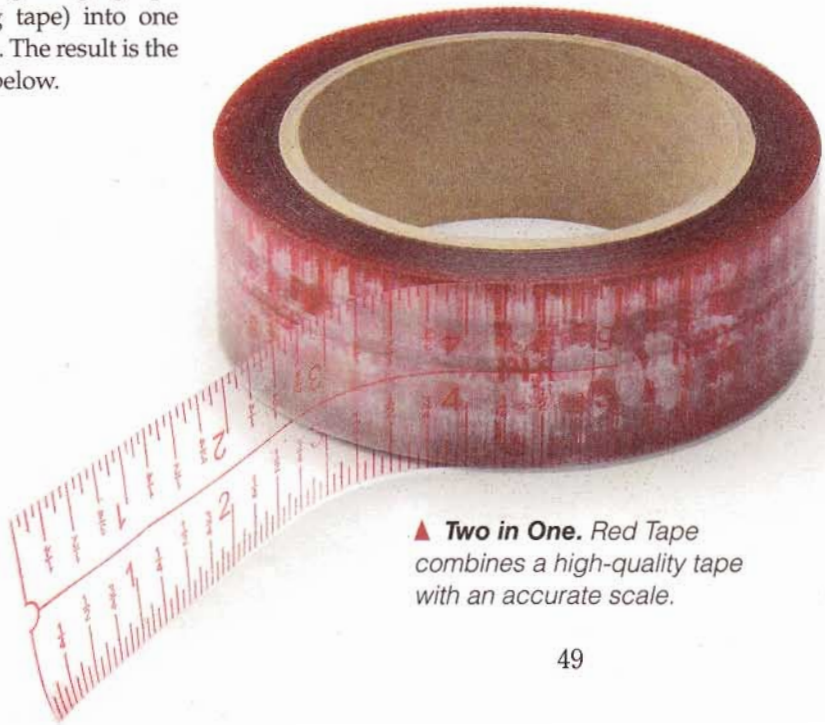
▲ **Multiple Uses.** *You won't have trouble finding a use for this double-duty tape. It comes in handy as a reference scale on temporary or one-use jigs.*



▲ **Anti-Clogging.** *Shallow grooves in the cutting edges break up chips while drilling.*

This unique, self-adhesive tape is printed with a measuring scale that repeats every foot. The divisions are in sixteenths of an inch. And there's a line printed down the center that proves useful for a lot of layout tasks like locating shelf pin holes, for example.

The possibilities for this product are wide and varied: from marking workpieces for cutting to adding a measuring scale on shop-built jigs and fixtures. A quick check with my steel rule proved the scale on the tape to be plenty accurate for any use around the shop.



▲ **Two in One.** *Red Tape combines a high-quality tape with an accurate scale.*

Q&A

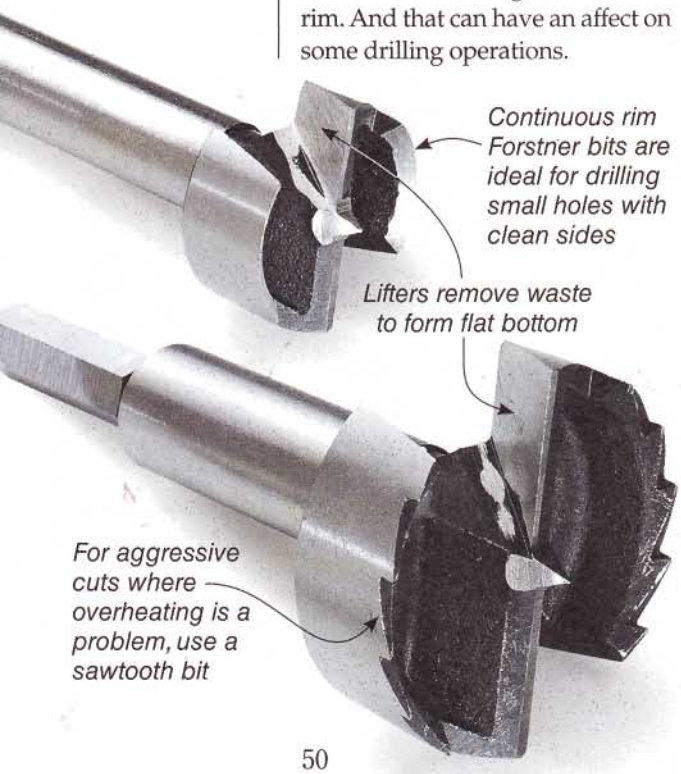
questions from
Our Readers

choosing the Right Drill Bit

I have several holes to drill that need flat bottoms. I know I need to use a Forstner bit, but I'm confused. I've seen two styles — one with a solid rim and one with multiple teeth. Which is best?

Kermit Hess
Bend, Oregon

The two most common types of Forstner bits, continuous rim and sawtooth, essentially do the same thing. They both drill holes with flat bottoms. The biggest difference is found in the design of the outer rim. And that can have an affect on some drilling operations.



There are some common traits that are important though (photos below). They both have a small centerpoint that makes it easy to align the bit. And a pair of chisel-like lifters on each of these bits plane away the wood, producing a nice, flat bottom.

Both designs are great at drilling overlapping holes, too. A feature that comes in handy when you're roughing out a mortise like the one in the photo above.

Use a Drill Press. These bits are designed to be used in a drill press. This way, you can maintain a slow speed and avoid overheating. Plus, unlike regular drill bits, there aren't any long flutes on a Forstner-style bit. So that means you'll have to raise the bit often from the hole to clear away the wood chips.

Both bits have traits that make them a great choice for any shop. But to choose the one that's right for you, you'll need to look at the differences in the rim.

Continuous Rim Bits. The traditional style of Forstner bit has a continuous rim (upper photo at left). This solid rim scores the outside of the hole, forming a super-clean edge. It also makes it easy to drill angled holes in a workpiece without wandering. But it's this rim design that makes it the perfect choice for drilling partial holes on the edge of a workpiece.

The big drawback to this type of bit is the fragile rim — you can overheat or dull one in no time if you use a speed that's too high or apply too much pressure.

Sawtooth Bits. That's where a sawtooth bit can help out (lower photo at left). This bit gets its name from the saw-like teeth that line its rim. They're usually found on large-diameter bits.

Breaking up the rim into teeth forms gaps that help dissipate any heat buildup. Since a sawtooth bit is less likely to heat up, it's going to stay sharp longer.

In most cases, a sawtooth bit works great for drilling overlapping holes. And you'll still end up with a flat bottom. But you're likely to be disappointed any time you try to drill a hole at an angle or drill a partial hole along an edge. That's because the teeth tend to catch and tear the wood as you try to start the hole.

Which One? In the end, the bit you use will depend on the situation. If you're drilling a number of large-diameter holes (over 1"), a sawtooth bit works best. But for any hole where clean sides and edges are a priority, a continous rim bit is the best choice.

Sources

Most of the materials and supplies you'll need for the projects are available at hardware stores or home centers. For specific products or hard-to-find items, take a look at the sources listed here. You'll find each part number listed by the company name. See the right margin for contact information.

The *Woodsmith Store* in Des Moines, Iowa is an authorized *Rockler* dealer. They carry many of the hardware items used in our projects. And they ship nationwide. Their customer service representatives are available for your calls from 8am – 5pm Central Time, Monday through Friday.

SHEET METAL TOOLS *(p.10)*

Several styles of general purpose sheet metal snips are available at most local hardware stores and home centers, as well as a few of the sources listed at right.

- **McMaster-Carr**
  Sheet Metal Snips 3902A6

BENDING BRAKE *(p.14)*

The angle iron and steel bar stock needed for the bending brake can be found at a local hardware store or home center. A few of the sources listed at right also stock these products.

TOOL BOX *(p.17)*

The hardware required to build the tool box includes blind rivets, a rivet gun, and a continuous hinge. You can find these items at most hardware stores or at some of the sources listed at right.

- **ALRO Metals**
  22ga. Steel . . . . 00030-CRS-24"x24"
- **Lee Valley**
  9/16" Tool Box Handle 00S03.20
  Draw Latch 00S55.40

HOBBY BENCH *(p.24)*

- **Reid Supply**
  3½" Drawer Pulls KHO-5
  Clear Plastic Bins FSC-606
  24" Task Lamp MOF-95050
  ¼"-20 Star Knob RST-94
  Nylon Plastic Leveler AG-15
- **Woodworker's Supply**
  Shelf Standard 906-048
  8" Shelf Bracket 906-244
- **Rockler**
  ⅜" x 4' Universal T-Track . . .20054
  5/16"-18 T-Nut 26062

WOOD FILLERS *(p.38)*

You'll find a wide variety of wood fillers at hardware stores and home centers and from a few of the sources listed at right.

TABLE SAW DOVETAILS *(p.40)*

You should be able to find a saw blade sharpening shop in your area that will custom grind your blade for cutting dovetails. Or, if you prefer, *Forrest Blade Company* offers dovetail saw blades for either left or right tilt table saws. The blades are available with a 7°, 9.5°, or 11.5° bevel angle. Materials for the blade cover and runner are available from *McMaster-Carr*. They could also be made out of hardboard or plywood if you prefer.

- **Rockler**
  ⅜" x 4' Universal T-Track . . .20054
- **Reid Supply**
  Tapered Knob BD-6
  Wing Knob DK-228
- **McMaster-Carr**
  ¼" Polycarbonate Sheet . . 85935K28
  ⅜" Phenolic Strip 9322K17

GREAT GEAR *(p.48)*

Lee Valley offers a complete line of *Maxi-Cut Forstner* drill bits, as well as drill bit extensions.

- **Rockler**
  Bench Cookies 26357
  Red Tape Measuring Tape . . .39387
- **Hartville Tools**
  Tri-Scribe 32915
  Tri-Blade Accessory 32917

MAIL ORDER SOURCES

Woodsmith Store
800-444-7527

Rockler
800-279-4441
rockler.com

ALRO Metals Plus
877-668-0676
asapsource.com

Forrest Blades
800-733-7111
forrestblades.com

Hartville Tool
800-345-2396
hartvilletool.com

Lee Valley
800-871-8158
leevalley.com

McMaster-Carr
630-600-3600
mcmaster.com

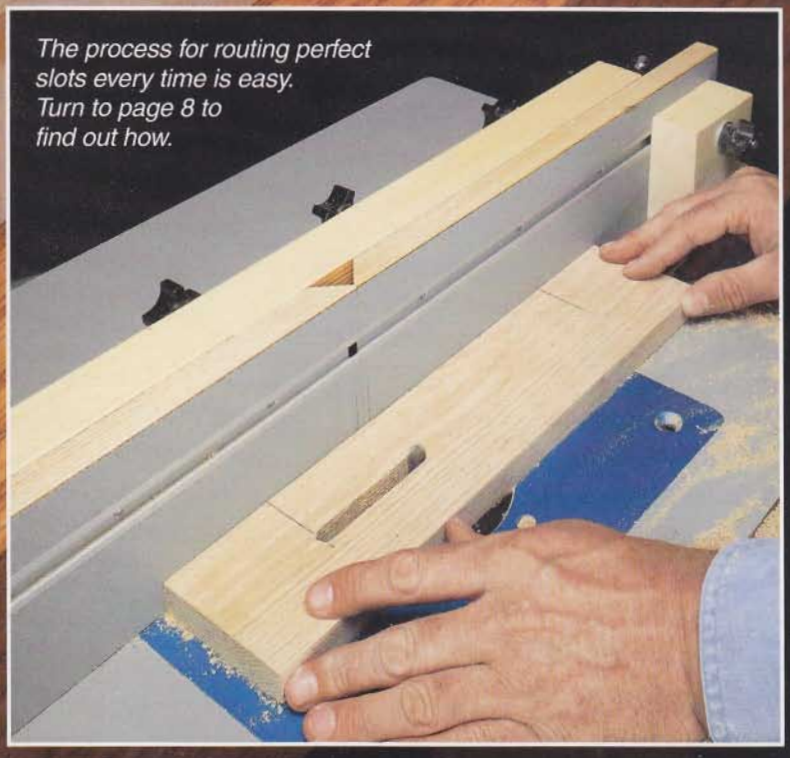
Reid Supply
800-253-0421
reidsupply.com

Woodworker's Supply
800-645-9292
woodworker.com

Scenes from the Shop

Building projects with sheet metal only requires a few basic tools and a sheet metal brake. Learn all about the tools on page 10 and then use the plans beginning on page 14 to build the brake.

▲ *These sawhorses feature a simple design and stout construction. Best of all, they look great and will last a lifetime. For detailed plans turn to page 34.*



The process for routing perfect slots every time is easy. Turn to page 8 to find out how.