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Vol. 18 Issue 107

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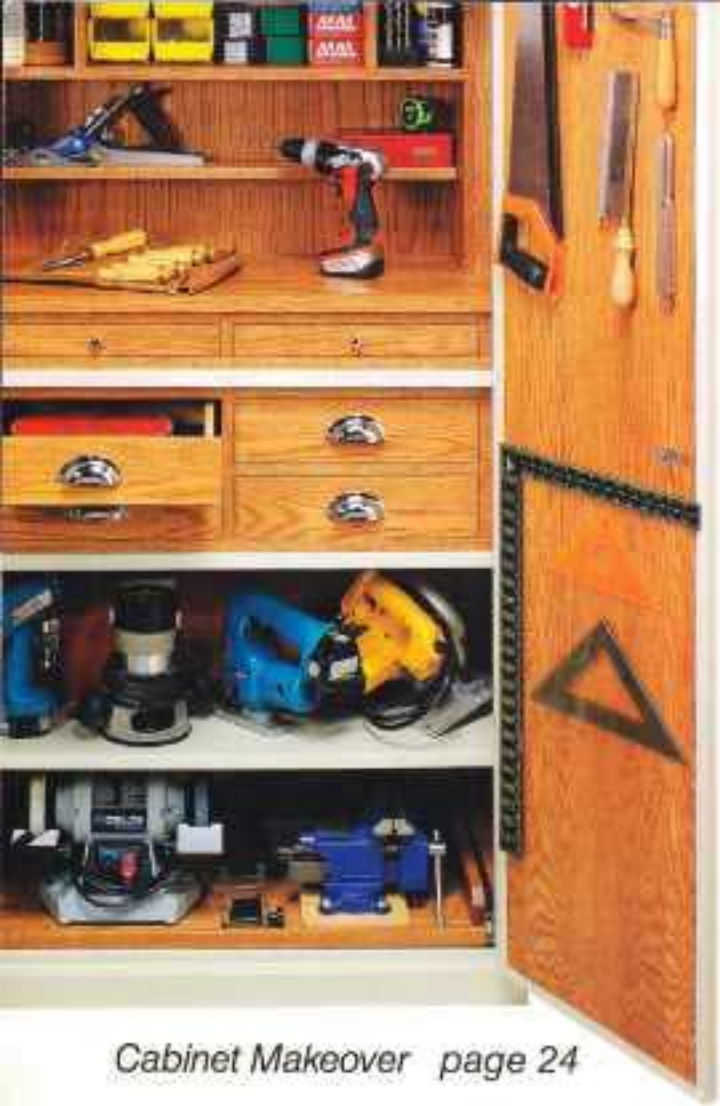

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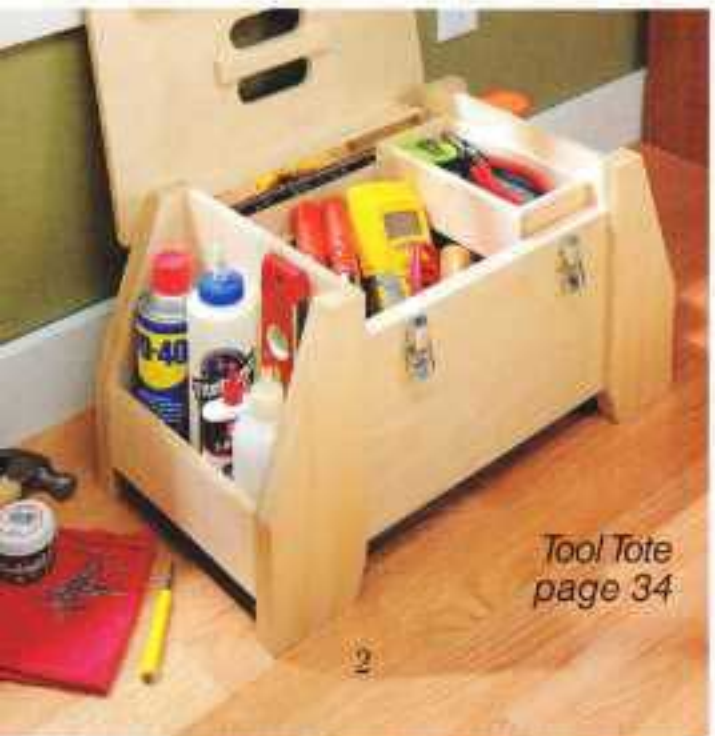

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Cutoffs

When I head back into the shop in the fall, I usually spend some time getting back to the basics: like tuning up my tools and making sure everything is stored right where I can find it.

After that's done, I can focus on all the projects I plan to build. To help you get back into the groove in your shop, this issue is loaded with a lot of great information to improve your shop and your woodworking.

For starters, check out the photo at left. It's a great solution for sharpening the edge on any chisel or plane blade. Best of all, this machine is powered by your drill press. And the sandpaper-covered disks can be swapped out in seconds, so it won't take long to get to the razor-sharp stage on any tool.

Another great project you'll want to check out is the cabinet makeover on page 24. We took an ordinary metal cabinet and added a few shop-made components, turning it into a tool cabinet that any woodworker will find useful.

Besides projects, you'll find a number of helpful back-to-basics articles — from routing perfect profiles at your router table to getting better cuts at your table saw by making a zero-clearance insert.

And all this is just the tip of the iceberg. There's even more great information inside. And after thumbing through the pages of this issue, be sure to check out the additional information available online at *ShopNotes.com*.

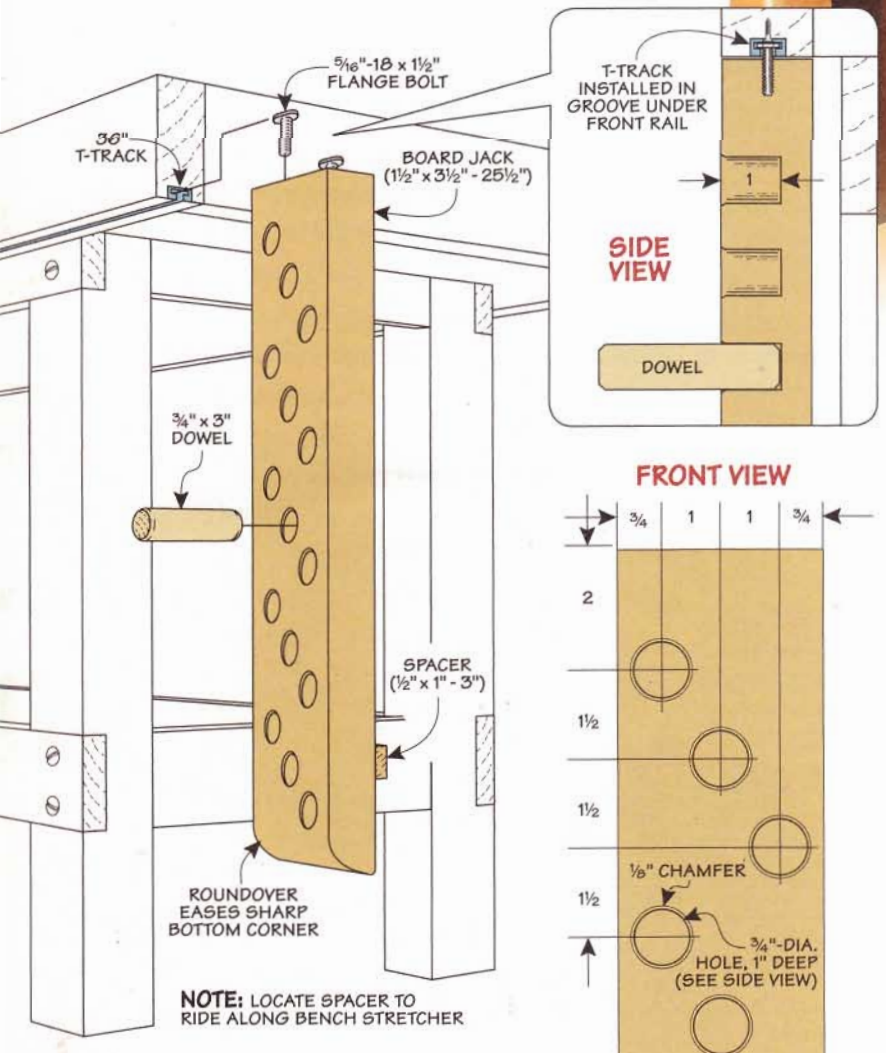
Terry

ShopNotes GO ONLINE EXTRAS

This symbol lets you know there's more information available online at ShopNotes.com

from our Readers

Tips for Your Shop



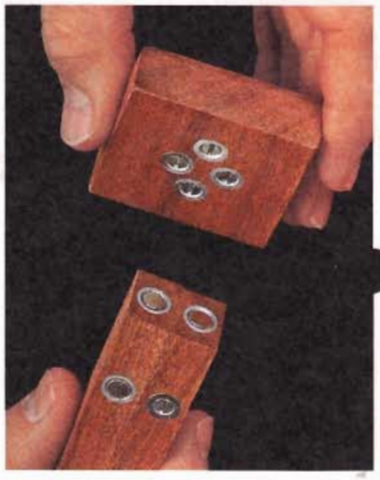
T-Track Board Jack

I have a small workbench that is the center of activity in my shop. But it lacked one nice feature you find on many traditional workbenches — a board jack. A board jack comes in handy for supporting the tail end of a long workpiece while clamped in the face vise. I came up with a way to add one to my existing bench, as the photos above and drawings at left show.

To house a T-track, I removed my benchtop and routed a groove on the bottom edge of the front rail. The board jack hangs from the T-track by two flange bolts installed using epoxy.

The Side View at left and inset above shows the series of staggered holes for a piece of ¾" dowel that supports the workpiece. Then, to hold the board jack plumb and parallel to the face of the bench, I added a spacer on the back side that rides along the bottom stretcher of the bench. Finally, a large roundover on the bottom edge makes it easy on my shins.

Bryan Nelson
ShopNotes Staff



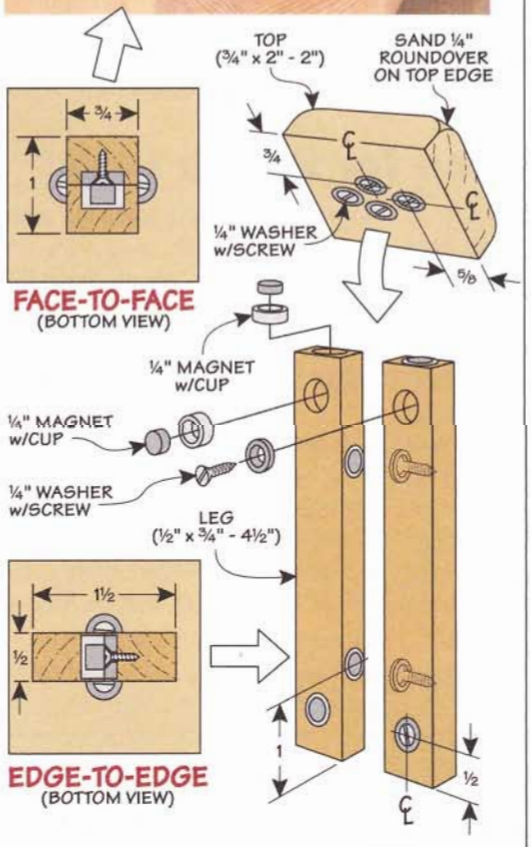
Anti-Racking Block

One of the problems I have with a traditional face vise is its tendency to rack when a workpiece is clamped on only one side. To eliminate this problem, I used a few scraps of wood to make an adjustable, anti-racking block.

You can see in the photos and drawing how to configure the legs for the common stock thicknesses of ½", ¾", 1", and 1½". You do this by turning the legs face-to-face or edge-to-edge (Bottom Views at right). The top holds the legs in position and keeps the assembly from slipping through the vise as you tighten it on the workpiece.

I used commonly available rare-earth magnets, cups, washers, and screws and installed them flush to the surface. Just make sure the magnets mate with the washers on the opposite workpiece.

Catherine Seiser
ShopNotes Staff



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SUBMIT A TIP

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.

ShopNotes

Issue 107 Sept./Oct. 2009

ShopNotes® (ISSN 1062-9696) is published bimonthly (Jan., March, May, July, Sept., Nov.) by August Home Publishing, 2200 Grand Ave., Des Moines, IA 50312.
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Subscriptions: Single copy: $4.95. One year subscription (6 issues): $27.95. Canada/International add $10 per year, U.S. funds.
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Periodicals Postage Paid at Des Moines, IA and at additional mailing offices.
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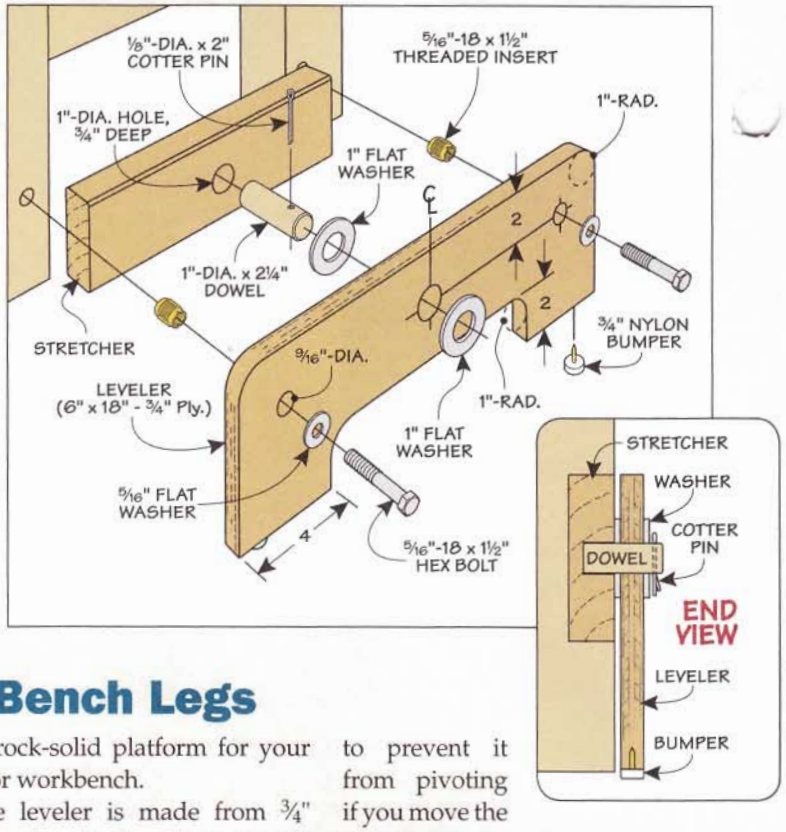


Leveling Device for Bench Legs

The floor in my workshop is uneven and it's difficult to keep my tool stands and benches from wobbling. So I've been using the leveling device you see above for over ten years. It works on almost any size bench or stand.

The pivoting leveler attaches to the lower stretcher of your tool stand. (You can install a stretcher if needed, as shown above.) The leveler automatically adjusts to any unevenness in the floor, resulting in a rock-solid platform for your tool or workbench.

The leveler is made from ¾" plywood and shaped as shown above. Of course, you'll need to adapt the dimensions to suit your tool stand or workbench. The leveler is mounted to a stretcher with a 1"-dia. dowel, washers, and cotter pin that act as a pivot point, as shown in the drawing above.

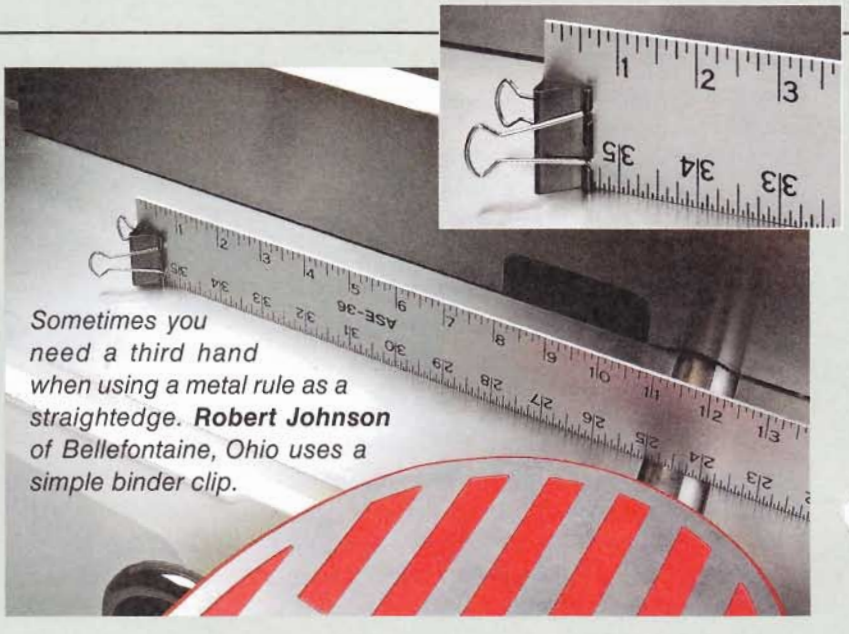
I added a threaded insert and hex bolt on each end of the leveler to prevent it from pivoting if you move the tool. Drilling an oversized hole for the bolt allows the leveler to adjust up to ¼" for an uneven floor. The bolts don't need to be tightened.

Finally, I added a nylon bumper at each end of the leveler. They also help reduce friction when it comes time to move the tool.

Clarence Engebretson
Fridley, Minnesota

Quick Tips

▲ ***Paul Bing*** *of Ohakune, New Zealand made the discovery that bulk O-ring material from the hardware or plumbing supply store keeps the lip of a paint can clean. He says that ¼"-dia. is about right to fit the rim of a gallon-size paint can.*



Sometimes you need a third hand when using a metal rule as a straightedge. ***Robert Johnson*** *of Bellefontaine, Ohio uses a simple binder clip.*

Knot-Free Extension Cord Storage

Most folks prepare an extension cord for storage by coiling it around their arm. The problem comes the next time you want to use it. You're almost guaranteed to have a rat's nest of knots to deal with.

I use a technique I learned from my grandfather he called "daisy-chaining," like you see in the photos. It's a fast and knot-free way to store the cord. But the best part is, it just takes a snap or two to uncoil when you're ready to use it.

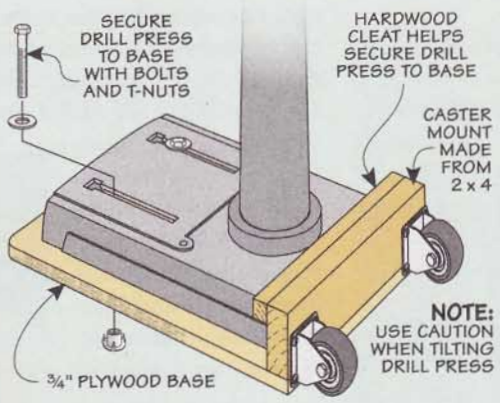
The photos step you through this easy technique. Start with both ends in one hand and make a loop (Step 1). Then reach through the loop to grab the cord and pull it back through (Steps 2 and 3). Reach through the newly created loop and repeat the process until you get to the end (Steps 4 through 6).

When you get to the end, pull the looped end of the cord through the last loop, as you can see in Step 7. Now you can store the cord safely on a wall hook, in a bucket, or toolbox without ending up with a tangled spaghetti mess.

Now, here's the cool part: To uncoil the cord, all you need to do is pass the looped end back through the last loop and give the cord a couple good shakes. It will "untangle" right before your eyes without any knots or twists.

Wendall Lucas
New Port Richey, Florida

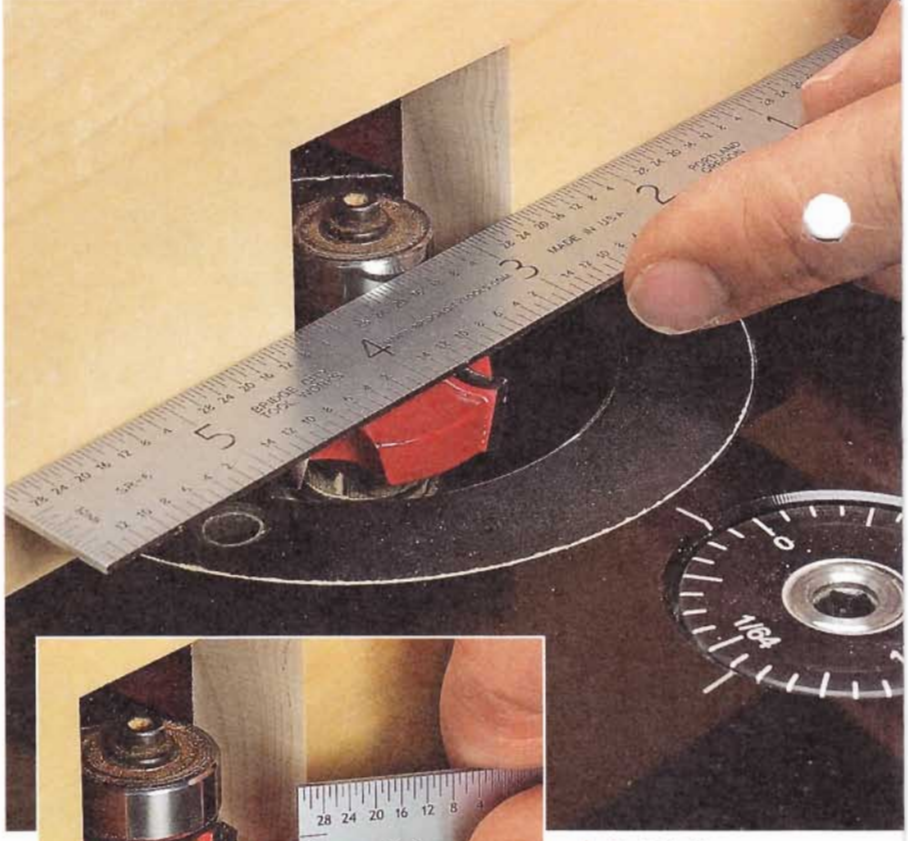
Ralph Tyler *of Woodland Hills, California makes centering points on his drill press using an aluminum or brass rod and filing it to a point.*



▲ *Moving a floor-model drill press can be a challenge.* ***John Noland*** *of Columbus, Ohio made a mobile base similar to those on portable basketball hoops. You tip the drill press back until the casters engage.*

foolproof Profile Routing Tips

These simple steps help eliminate chipout and burned edges, and give you better results.



▲ ***Set-Up Gauge.*** *A 6" metal rule comes in handy to set the fence and depth of cut for a profile bit.*

Mounting a router in a table allows you to do many things. But one of its bread-and-butter tasks is routing profiles on the edge of a board. In fact, that's one of the main reasons I built a router table in the first place. But there's more to routing profiles than simply putting a bit in the router and pushing a workpiece across the table.

There are several problems you can run into. Some complex profiles are tricky to set up properly. Routing the edge can also result in burn marks and chipout, as shown in the margin photo at left. Over time, I've learned a few simple tips that help eliminate these problems for good.

▼ ***Clean Profiles.*** *A few simple steps will prevent burning and chipout.*

SET-UP TIPS

Even though you can use most profile bits in a hand-held router, I like to use a router table for better workpiece support. But like I mentioned, getting the bit set up in the router table can be a challenge. The key to a quick and accurate setup is an ordinary metal rule.

Set the Fence. Even though most profile bits come with bearings (for use with curved workpieces or in hand-held operations), I like to use the fence whenever I can. The fence gives me more control of the workpiece as I guide it through the cut. In the main photo above, you can see how I use the rule to set the fence flush with the bearing.

Bit Height Gauge. The 6" rule I keep in my shop apron has graduations on the end. This way, the rule spans the opening so I can set the graduated end right up against a reference point on the bit, as you can see in the inset photo above.

► ***Featherboard.*** *A featherboard holds, thin, narrow stock firmly against the table for consistent cuts.*

ROUTING TIPS

Setting the bit in the router table is only one part of getting top-notch results with a profile bit. There are some tips and techniques that make the actual routing process easier and more consistent.

Take Small Bites. One common problem when using profile bits is

taking too big of a "bite." This can cause chipout. Plus, the tendency is to slow your feed rate, which can then lead to burn marks. So the advice is often to rout the profiles in several, shallow passes.

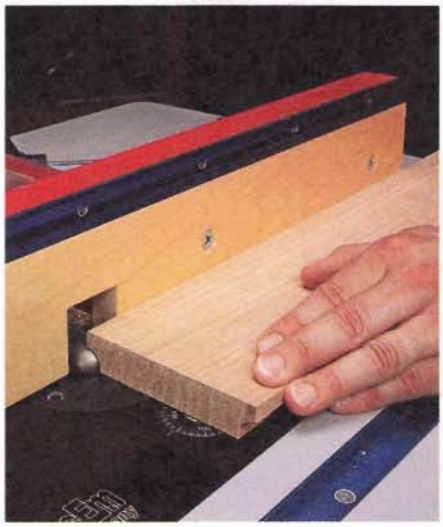
However, not every profile bit needs this approach. It all depends on how much material is being removed. I usually rout most roundovers and small chamfers in a single pass since the bit isn't removing a lot of material.

Routing a cove profile, on the other hand, removes much more wood. So taking multiple, small passes is the right way to go.

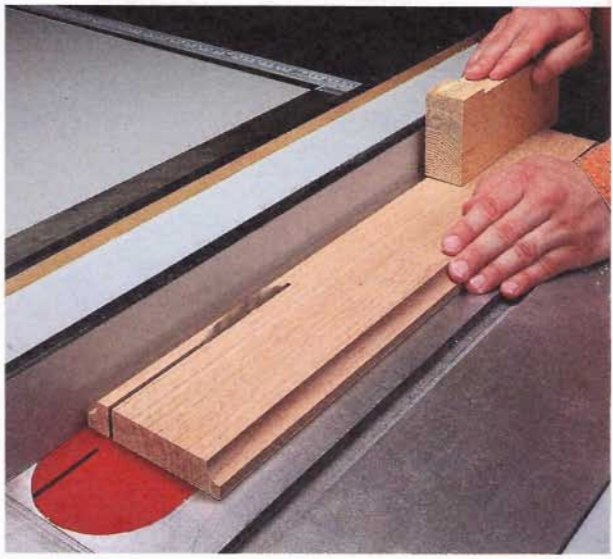
In most cases, I rout profiles like this in three passes. The first two passes remove most of the waste. The final cut is a very light skim cut that cleans up the edge and establishes the final profile.

Adjust the Fence. There are two approaches you can take to accomplish this task. The first is to adjust the fence position. Here, you set the bit to the final height (inset photo on the opposite page). Then bring the fence forward to cover most of the bit and make a pass. You continue to shift the fence back between passes until the bearing is flush with the fence.

Adjust the Bit. The other method for making multiple passes starts with setting the fence flush with the bearing (main photo on opposite page). Next, lower the bit so only a portion of the profile is exposed. Then, raise the bit after each pass until you reach the final height.



▲ ***Start Wide.*** *It's safer to rout a profile on both edges of an extra-wide blank. This gives you more control and keeps your fingers away from the bit.*



▲ ***Rip to Size.*** *You can cut the molding pieces to final width at the table saw. Use a push block to control the workpiece.*

Consistent Profiles. Another problem that you can run into is an inconsistent cut. A long or thin workpiece may spring away from the bit slightly, which could spoil some profiles. So keeping the board in contact with the bit and the top of the table is a must.

In these cases, I use a featherboard, as in the lower photo on the opposite page. Plus, I find it helpful to make a second pass at the final bit setting to be sure the profile is smooth and even.

Work Wide. One common use for a routed profile is to make molding for a project. But routing a profile on a narrow strip of wood places my hands too close to the bit for comfort.

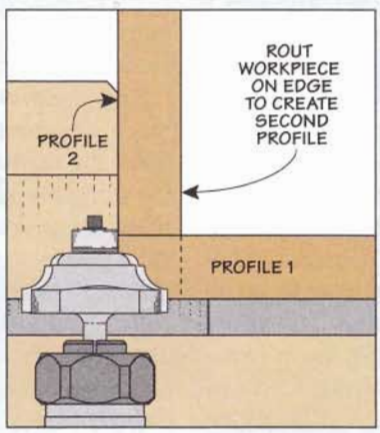
A safer technique is to start with an extra-wide blank, as shown in the middle photo above. This way, you can rout the profile along each edge. To make the molding strips, head over to the table saw and rip them to final size, as you can see in the right photo above. On a wide enough blank, you can repeat the process a couple of times.

By using one or more of these tips every time you rout profiles you can expect great results. And if you take a look at the box below, you can learn how to get two different looks from one bit.

one bit: Two Looks

Basic profiles like a cove or a roundover look the same from the face or edge. On the other hand, more complex profiles, like the bit shown in the photo at right, can give you a second "bonus" profile by changing how you rout the board, as shown by the two examples in the right margin photo.

The drawing at right shows you what I mean. Typically, I rout a board face down on the router table (profile 1). This gives you the primary profile. But if you stand the board on edge and make a cut, the profile is reversed (profile 2).



▲ ***Two-in-One.*** *Some bits offer a second profile by routing the piece on edge.*

hinge mortise Router Jigs

From simple to advanced, any of these jigs make routing perfect-fitting hinge mortises a snap.

Creating a hinge mortise is one of those "It's gotta' be right" tasks. In order for the hinge to work correctly and the door to hang straight in the opening, the mortise needs to be square to the edge, perfectly level, and the right depth.

For a long time, I used a handheld router and a straight bit to rough out the mortise. That made it easy to get the right depth. However, working freehand still left a lot of clean up work. And balancing a router on the narrow edge of a workpiece can be tricky.

Since the overall task was pretty tough, it's often better to use a jig to make the mortise. A jig clamps to the workpiece and both guides the router for an accurate cut and provides greater support for the router.

Several Types. In the photo above, you can see several commercial jigs that are available. Each jig allows you to make a clean, smooth mortise. The only cleanup work to do is square up the corners of the mortise with a chisel.

That doesn't mean the four models shown here are identical or work the same. The chart on the opposite page highlights the features of each jig. (For sources, turn to page 51.)

Jig Capacity. One thing to note is that there are two types of hinge mortising jigs — fixed or adjustable. A fixed jig can only create a single-sized mortise. You can see

▲ **Router Bits.** *Bearing guided bits can be either offset (two bits at left) or flush-cutting (Rockler). The ART cuts a mortise using a plunge router with a straight bit and a guide bushing.*

this in the *Woodhaven* jig on the previous page. It's basically just a phenolic plate with a hole.

The advantage of this jig is there are no settings to fall out of adjustment. And best of all, this jig is inexpensive. The downside is you need a different jig for each size of hinge you use.

In an adjustable jig, you can set it to match the size of nearly any hinge you may need to use. In fact, most adjustable jigs can be used for everything from small box hinges to entry and passage door hinges.

Length & Width. If you're considering an adjustable jig, take a look at how easy it is to make adjustments to both the length and width of the mortise. The *Rockler JIG-IT* mortising jig, for example, uses knobs to lock in both the width and length of the mortise.

On the *Hinge-Mate*, knobs are only used to set the length of the mortise. But to adjust the width, you need to insert shims between the fence and workpiece.

The other jig that allows for different sizes of hinge mortises is the *Adjustable Router Jig* (*ART*). You'll need to use an Allen wrench to adjust the cap screws that secure the width and length stops on the jig.

Router Bits. The other main difference between the jigs is the type of router bit used to cut the hinge mortise. They're shown in the left photo above. Most of the jigs are either supplied with or recommend a bearing-guided bit. But these bits are a little unusual. The bearing is wider than the diameter of the bit. This creates an offset between the edge of the jig and the actual mortise. So you'll need to take the offset into account when locating the jig on the workpiece. Since the *ART* works with a guide bushing and a straight bit, you'll need to account for an offset as well.

The *Rockler* jig takes a different approach. The bit that comes with this jig has a bearing that matches the bit. The benefit of this is that the jig can be positioned right on the layout lines for the mortise.

Jig Setup. There's one other feature of two of the jigs that I want to mention. The *Hinge-Mate* and *Rockler* jig let you use a hinge as a set-up gauge (photos above right).

▲ ***Set-Up Gauge.*** *A brass pin in the Hinge-Mate jig accounts for the bit offset. The Rockler jig uses the hinge to set the mortise length (right).*

This makes setting the length of the hinge mortise fast and foolproof.

Choosing a Jig. With all these options, it can be a little overwhelming to choose the jig that's right for you. It boils down to weighing the options that are important to you. One thing is certain, you won't be disappointed with the results you get from any of these jigs.

Brand Name	Woodhaven Hinge Mortise Jig	ART Adjustable Router Template	Rockler JIG-IT Mortising System	Hinge-Mate HM-1100-W Door Hinge Template
Cost	$17.99	$69.99	$91.99	$199.99
Type	Fixed	Adjustable	Adjustable	Adjustable
Length	1½" shown	1" - 4½"	1" - 4½"	½" - 5"
Bit	Separate offset bit required	Separate guide bushing and straight bit required	Flush trimming bit (included)	Offset bit (included)
Accessories	Index pins for keeping jig square to workpiece	Recommended for use with plunge router only	Acrylic inserts are available for butler and sewing table hinges	Indexing blocks, pins, and shims for fine-tuning mortise size and location
Shop-Made Parts	Make a fence	Make a fence	None	None
Other Features	2" and 2½" jigs are also available	Can be used to rout traditional mortises	Hinge used as a set-up gauge	Hinge used as a set-up gauge

HANDS-ON Technique

changing Planer Knives

Follow an easy set process to get smooth, flat boards from your planer every time.

▲ **Dull Knives & Tearout.** *Nicked, dull knives result in ripples and tearout in workpieces.*

▲ **Smooth Results.** *With a good cleaning and sharp knives, you can expect smooth cuts.*

My first thickness planer really changed the way I worked. It allowed me to make my own thin stock. And I could purchase less-expensive rough stock and end up with smooth, straight lumber.

The key to getting great results is making sure the knives are clean, sharp, and well-adjusted. As the cutting edges get nicked and dull, they leave noticeable ripples, tracks, and even tearout, as in the left inset photo above.

Swapping out dull knives for new ones might seem troublesome, but if you take a few minutes and follow some simple steps, you can be certain to get glass-smooth cuts every time (right inset photo above). It's a good idea to check the owner's manual for your planer for other specific instructions, as well.

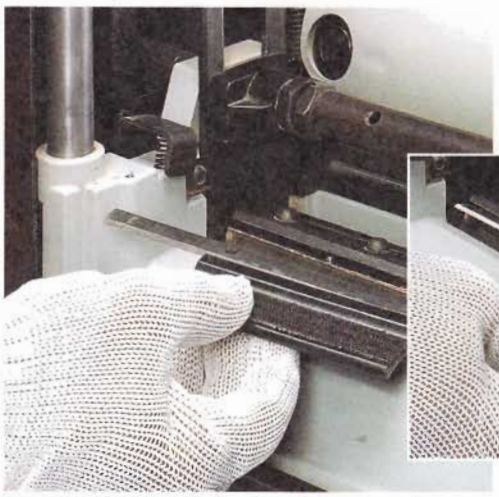
Clean First. Over time, planing boards results in a buildup of chips and caked-on grime. So the first step is a good cleaning. This may not seem like a big deal, but loose chips can cause trouble. Quite often, they get stuck to the feed rollers and cause dents in the workpiece. Or a chip can get lodged in the cutterhead and bow the knife.

I start by unplugging the planer and opening it up as much as possible, including removing the

▼ **Clean First.** *Use compressed air to blow out loose chips. Loosen grime with a rag and some solvent.*

▲ **Lock Cutterhead.** *Remove the cover and rotate the cutterhead until it locks in place.*

▲ **Remove the Knives.** *T-handle wrenches provide enough clearance to keep your hands away from the knife and plenty of torque to loosen stuck bolts.*



▼ ***Removal "Tool."*** *An ordinary paper clip helps pull a knife out of the cutterhead.*

▲ ***Magnetic Removal Tool.*** *Some planers come with a magnetic tool to help remove and later install a knife back in the cutterhead.*

New Knife Goes In. *After cleaning the knife bed area and wiping down the new knife, use the magnetic tool to slip it into place.*

cutterhead cover. A few blasts of compressed air makes quick work of blowing out the loose debris, as shown in the first photo on the bottom of the opposite page.

Follow the initial cleaning with some spray solvent, brushes, and rags to loosen any caked-on grime. Just be careful while you do this. Dull planer knives are still sharp enough to cause a nasty cut. To prevent this from happening, I like to wear a pair of reinforced carving gloves when I'm working around the cutterhead.

Remove the Old Knives. The next step is to remove the old knives. Most planers have a mechanism that locks the cutterhead while you change knives. You'll need to rotate the head until it locks in place, as in the middle photo on the opposite page.

Instead of loosening the bolts with the small Allen wrench that came with my planer, I've switched to a long, T-handled wrench (right photo on the facing page).

The cushioned handle is more comfortable and lets me apply enough torque to loosen stuck bolts. But more importantly, the added length keeps my fingers safely away from the knife.

When the bolts are backed off, you can pull the knife out. Your planer may have a magnetic tool to help you do this, but some don't work all that well for this task. A better "tool" is often a paper clip. Creating a thin wire "hook" allows you to get under the knife and pull it out, as you can see in the left photo and inset above.

Clean Again. Once the knife is out, you may find chips packed in the knife bed. You'll need to clean this area out before moving on.

Reverse or Replace. At this point, you have a decision to make. Does the knife need to be replaced or does it have a cutting edge on the opposite side that can be used?

Reversible knives can simply be flipped end for end and reinstalled. I like to mark the used edge with a marker so that I know later when I need to get a new set of knives.

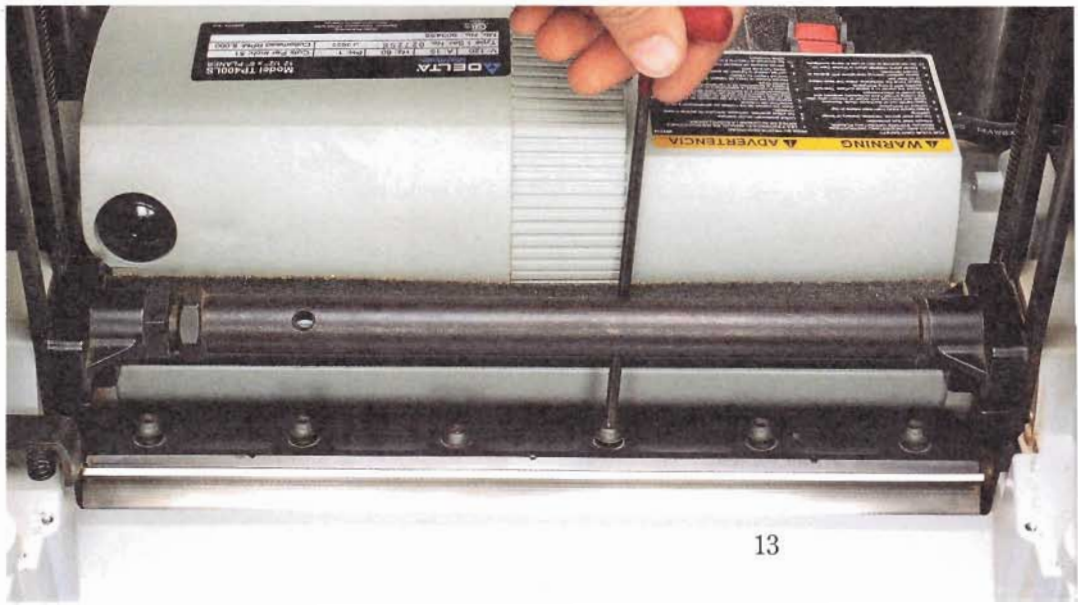
If new knives are required, carefully wipe them down with a rag and some solvent to remove any protective film. You can then slip the knife in place with the magnetic tool until it seats in the correct position, as you can see in the right photo above. (The tool usually works great for this.) Most newer knives are indexed so getting them set in the correct position is a pretty foolproof operation.

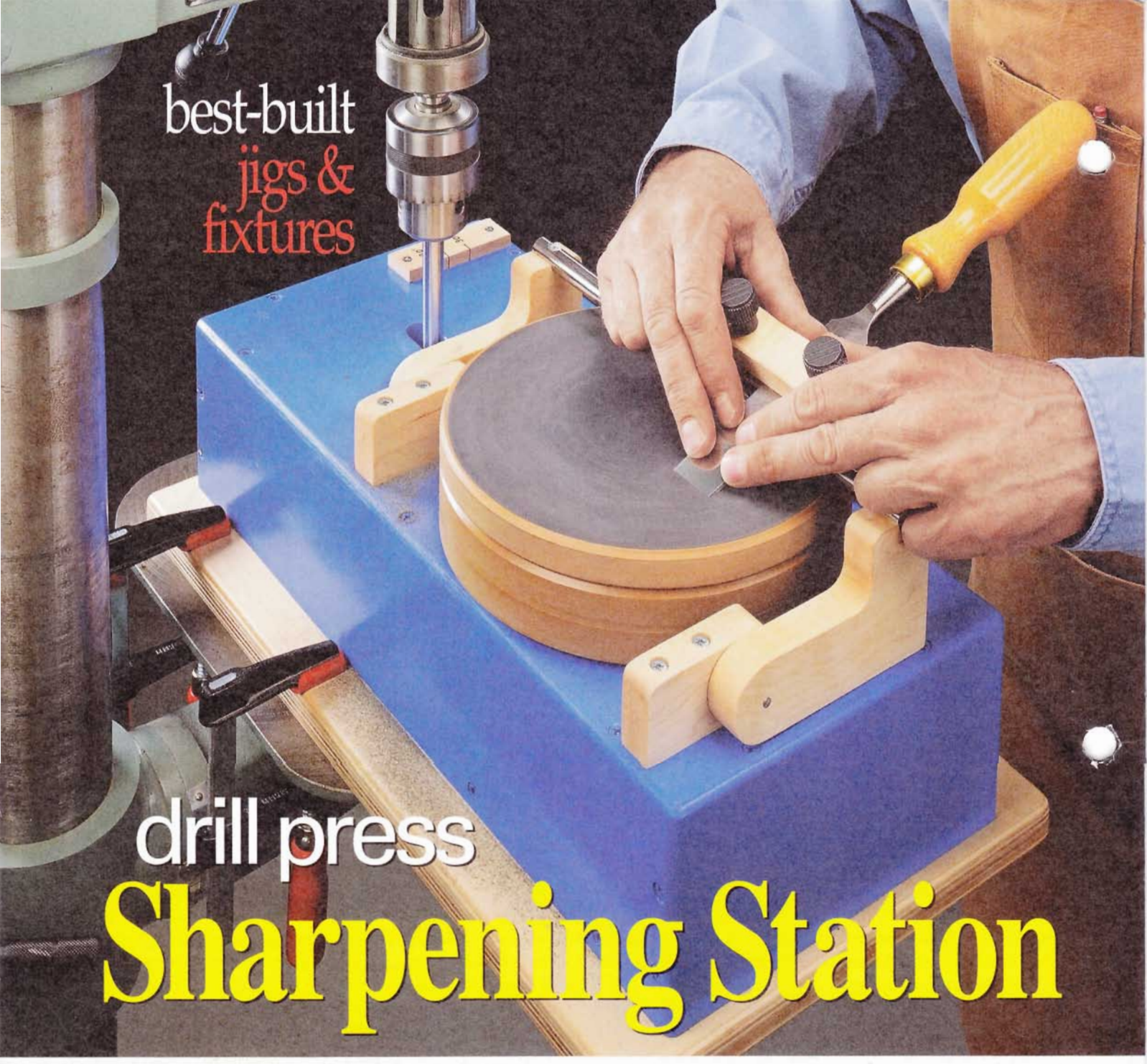
Tighten the Bolts. The final step in the process is to secure the knife by tightening the bolts. You don't want to try and lock the bolts down tight in one pass. It's possible this could cause the knife to bow.

Start by snugging up the center bolts just enough to hold the knife in place. After working your way out to each end, as shown in the photo below, go back with two or three more passes. With each pass, tighten down the bolts a little more.

Repeat. From here, you can repeat the process on the other knife in the cutterhead. The payoff comes when a rough board comes out glass smooth.

▼ ***Tightening.*** *Snug up the center bolts, then work out to each end. Repeat the process two more times to make sure all the bolts are tight.*





best-built jigs & fixtures

drill press Sharpening Station

Powered by a drill press, this sandpaper sharpening system guarantees a keen edge on your tools.

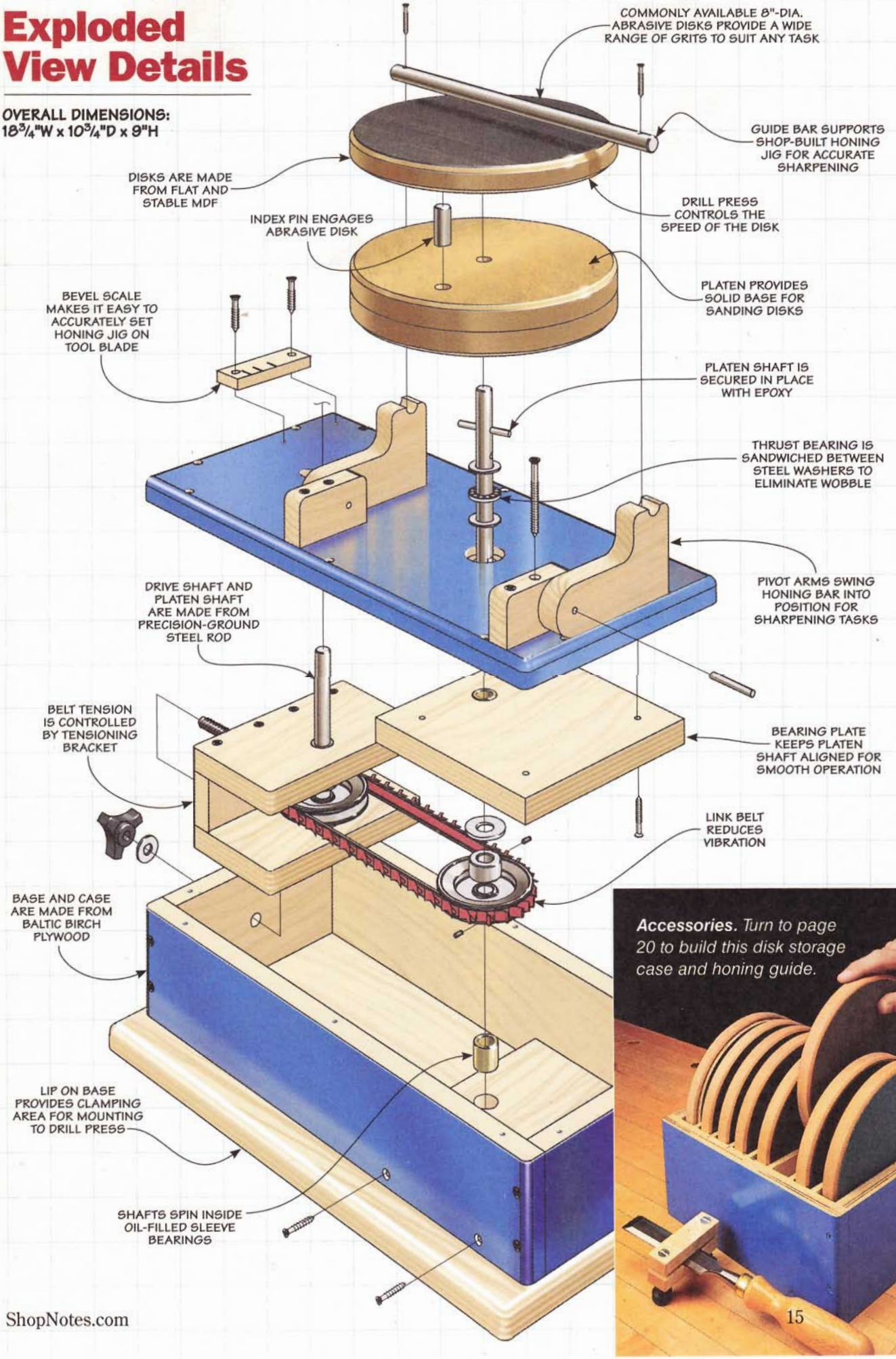
Making sure your chisels and hand planes are razor-sharp is one of the best ways to improve your woodworking. You can concentrate on the task at hand without having to fight a dull tool.

With the sharpening station you see above, keeping a tool sharp becomes a quick task that doesn't take time away from your project. The system is powered by your drill press, so there's no expense for an extra motor. The simple belt-drive mechanism means smooth, vibration-free operation. And with your drill press set at its lowest speed (mine runs at 250 RPM), you won't generate excessive heat and ruin an edge.

The platen and sharpening disks are made from flat and stable MDF. This, combined with commonly available self-adhesive abrasive disks, offers the ultimate razor-sharp edge and easily repeatable results. And with multiple sharpening disks, each with a different grit, you can quickly switch abrasives as you work. It's a project that's easy to build and when completed, you'll never have a dull tool in your shop.

Exploded View Details

OVERALL DIMENSIONS:
18¾"W x 10¾"D x 9"H



Accessories. *Turn to page 20 to build this disk storage case and honing guide.*

building the disk

Assembly

The construction of the sharpening center is really pretty simple. It's basically a plywood box with off-the-shelf hardware components inside to make it all work.

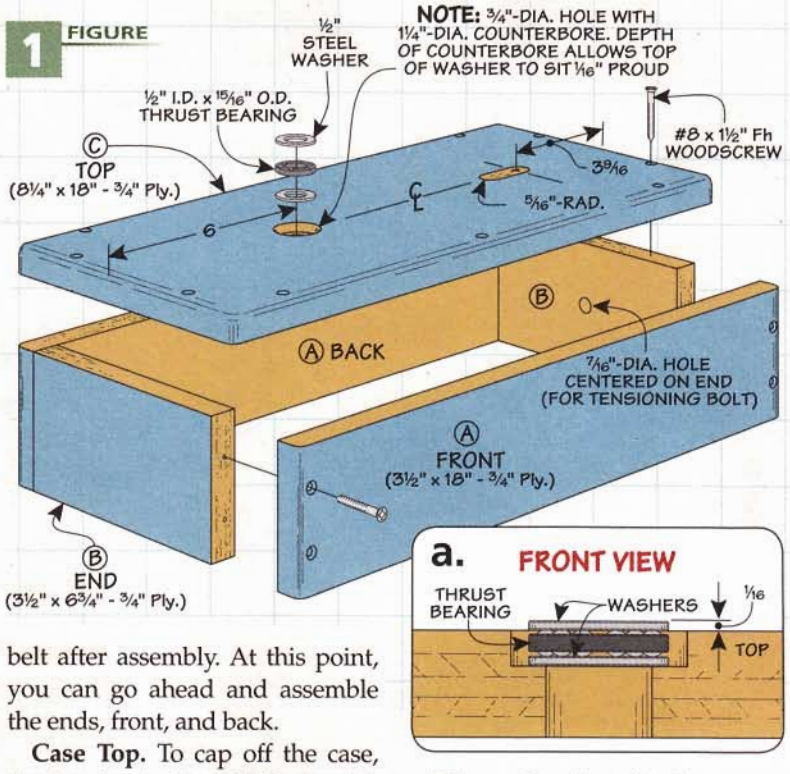
The principle behind it involves a horizontal, abrasive disk on top of a platen rotating at low speed. The drive shaft fits into the chuck of your drill press. And a belt and pulley transfers power to the platen shaft that spins the disk.

The drive and platen shafts fit into sleeve bearings to keep them square to the case and spinning freely. Finally, a thrust bearing under the platen helps counteract the downward pressure you apply as you sharpen a tool.

MAKING A CASE

The case is made from ¾" plywood and is assembled with simple butt joints using glue and screws. You can start by cutting the front, back, and two ends to size. Drill a hole in one of the end pieces for the carriage bolt used to tension the drive belt after assembly. At this point, you can go ahead and assemble the ends, front, and back.

FIGURE 1



Case Top. To cap off the case, the top is sized to fit flush with the outside edges. But before you can attach it, there are a couple of things you need to do.

Adjustment Slot. The first thing to do is create an opening for the drive shaft. Since the position of the drive shaft determines the tension on the belt, the opening is slotted to allow for some adjustment. To create the slot, I drilled a series of holes using a Forstner bit then cleaned up the slot using a rasp and sandpaper.

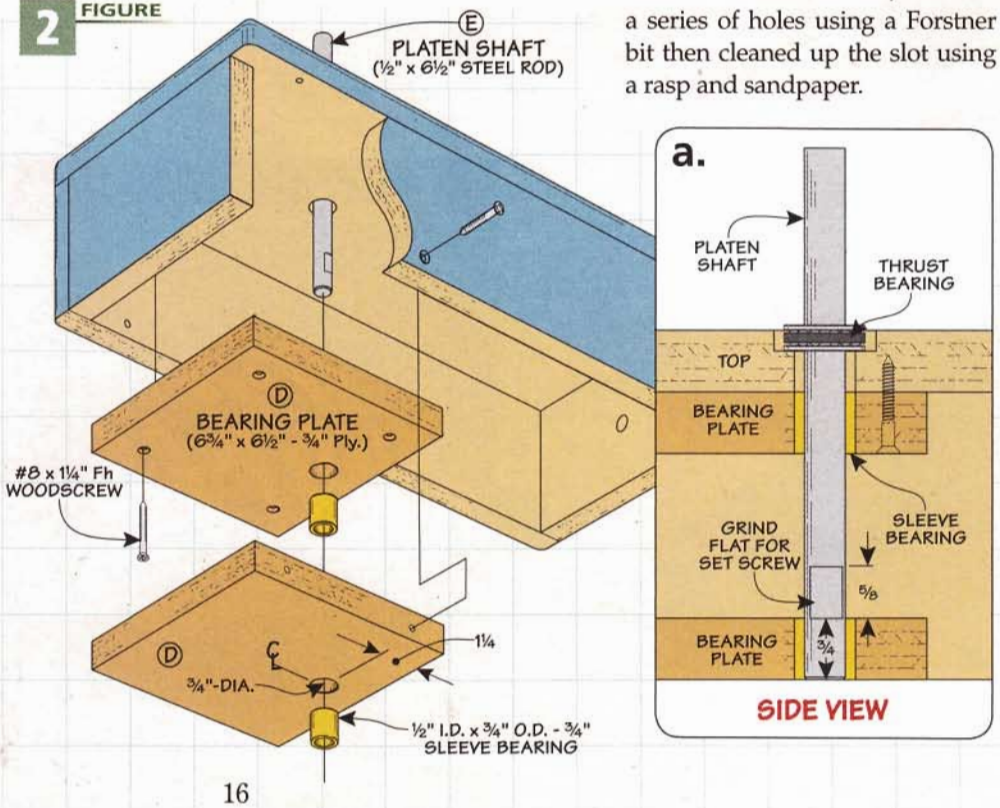
Thrust Bearing. At the opposite end of the top, you can work on the hole for the platen shaft. The rotation of the platen shaft is the key to the sharpening system. So it needs to turn smoothly without any wobble or excessive vibration. A simple solution to accomplish this goal is to use a thrust bearing.

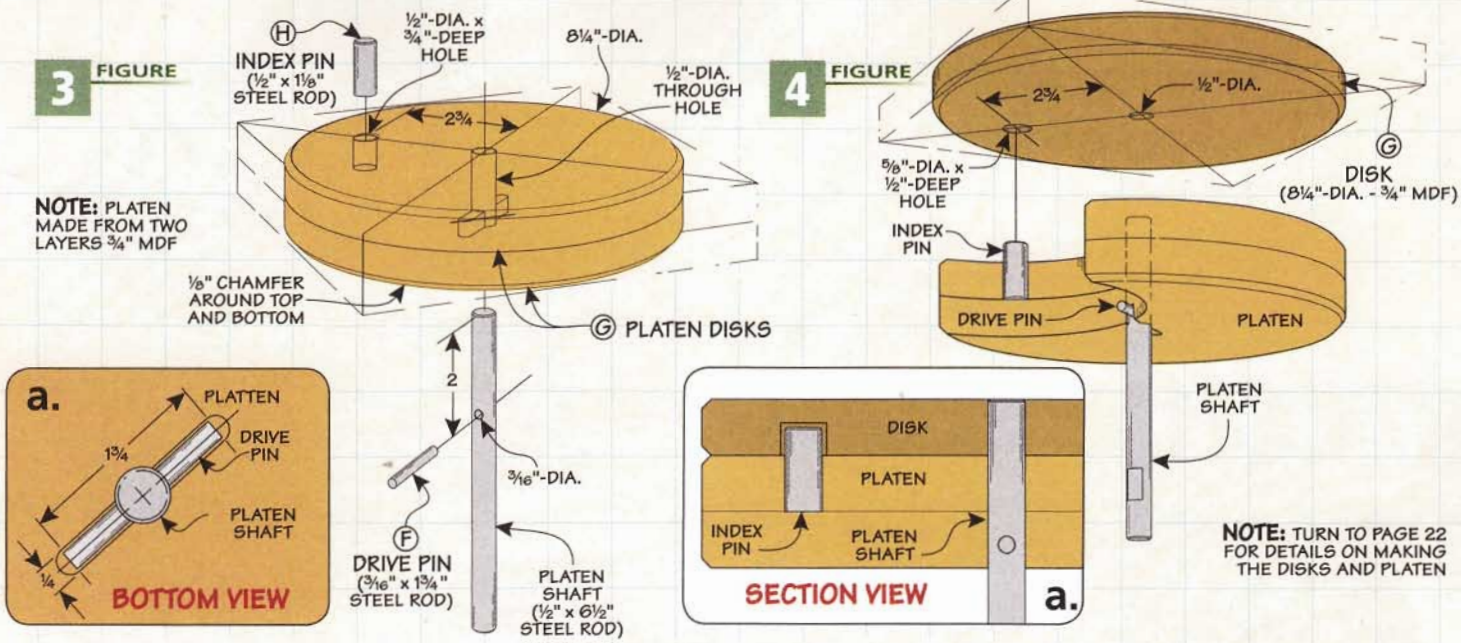
Making a Sandwich. As you can see illustrated in Figure 1a, the bearing is sandwiched between two steel washers and sits in an oversized counterbore. This makes it easier to align the platen shaft later when it's installed.

The top washer of this "sandwich" should sit just proud of the top to allow the platen to spin freely without rubbing on the top of the case. Once the counterbore is completed, you can drill the through-hole for the shaft and attach the top to the case with glue and a few screws.

Sand & Paint. Before moving on to the platen and disks, I rounded over all the outside edges of the case. I also took the time to spray on a couple coats of paint. Sharpening can be a messy task and painting all of the exposed surfaces makes cleanup a little easier.

FIGURE 2





PLATEN & DISK ASSEMBLY

Now that the case is complete, you're ready to turn your attention to the internal components, platen, and sanding disks. For now, you can concentrate on the fixed shaft assembly that spins the platen and sanding disks.

Before you get started, I need to mention one thing. You'll be drilling a lot of holes that are key to the sharpening center running smoothly. So it's a good idea to make sure your drill press table is square to the drill bit before you begin making all the parts.

Bearing Plates. The platen shaft is held in place by two bearing plates with sleeve bearings. The sleeve bearings help keep the platen shaft square and the platen running true without wobbling. You can see what I mean in Figures 2 and 2a on the opposite page.

There's something else you need to be aware of. Since these bearings are impregnated with oil, the oil can leach out over time. To prevent this, I sealed the inside of the holes with lacquer before installing the bearings. You can install the upper bearing plate with the bearing in the case at this point and set the bottom bearing plate aside while you work on the platen.

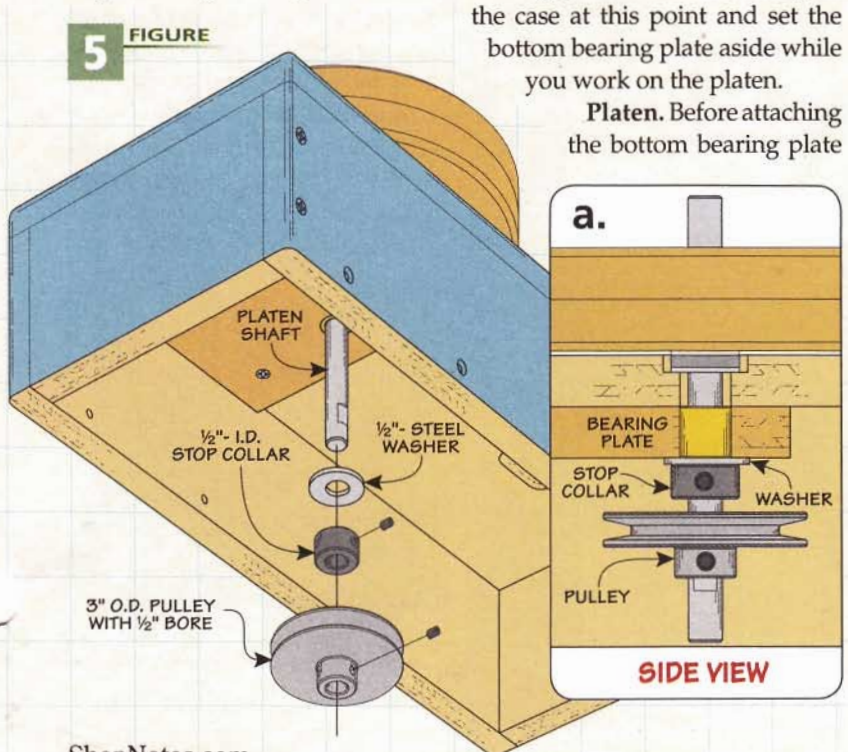
Platen. Before attaching the bottom bearing plate and bearing assembly, it's a good idea to have the platen and platen shaft in hand to help with alignment. The platen is made from two layers of MDF. Shop Short Cuts on page 22 shows the technique I used to make the platen and the disks that hold the abrasives.

I used the drill press to create the shallow slot in the bottom platen disk for the drive pin. As you can see in Figures 3 and 4, you'll also need to drill a through hole in the top platen disk for the index pin.

Platen Shaft. Next, you can work on the platen shaft. Figure 2a provides all the details for grinding a flat spot on the shaft for the pulley set screw. A through-hole in the opposite end holds the drive pin that's glued into the platen.

Shaft Assembly. With the platen and shaft in hand, use epoxy to glue the drive pin and shaft assembly into the shallow slot at the bottom of the platen.

Looking at Figure 5, you can see the order of assembly for installing the shaft in the case. First, the platen shaft passes through the thrust bearing "sandwich," case top, and top bearing plate. Then you can add the rest of the hardware shown in Figure 5a. You can leave the bottom bearing plate off for now. It won't need to be screwed in place until after the drive shaft and belt are installed.



finishing up the System

Now that the "business end" of the sharpening system is complete, you can start to work on the drive shaft and belt tensioning mechanism. Figures 6 and 7 show how it all goes together. The first thing to work on is the drive shaft. You'll use it to align the rest of the components during the assembly process.

▲ ***Link Belt.*** *Getting the perfect belt size is easy with a smooth-running, vibration-free link belt.*

Drive Shaft. The drive shaft is similar to the platen shaft, except that it's longer. The extra length allows you to slip it into the chuck of your drill press. And like the platen shaft, you'll need to grind a flat spot for the pulley's set screw (Figure 6a).

Tensioner. The bracket that controls the amount of tension on the drive belt is easy to build. It's just a U-shaped assembly, as shown in Figure 6. The top and bottom house a sleeve bearing, just like those in the bearing plates. A hole for a carriage bolt that aligns with the hole in the end of the case is drilled in the end piece.

You can assemble the tensioner with screws, using the drive shaft to ensure the top and bottom stay aligned. Then slip the drive shaft out to install the carriage bolt.

Drive Assembly. When it comes time to install the tensioner bracket in the case, you'll want to pay attention to the order of assembly. The first thing to do is slip the bracket into the case, fitting the carriage bolt through the hole in the end and adding the washer and knob. Feed the shaft through the slot in the top of the case and through the top sleeve

FIGURE 6

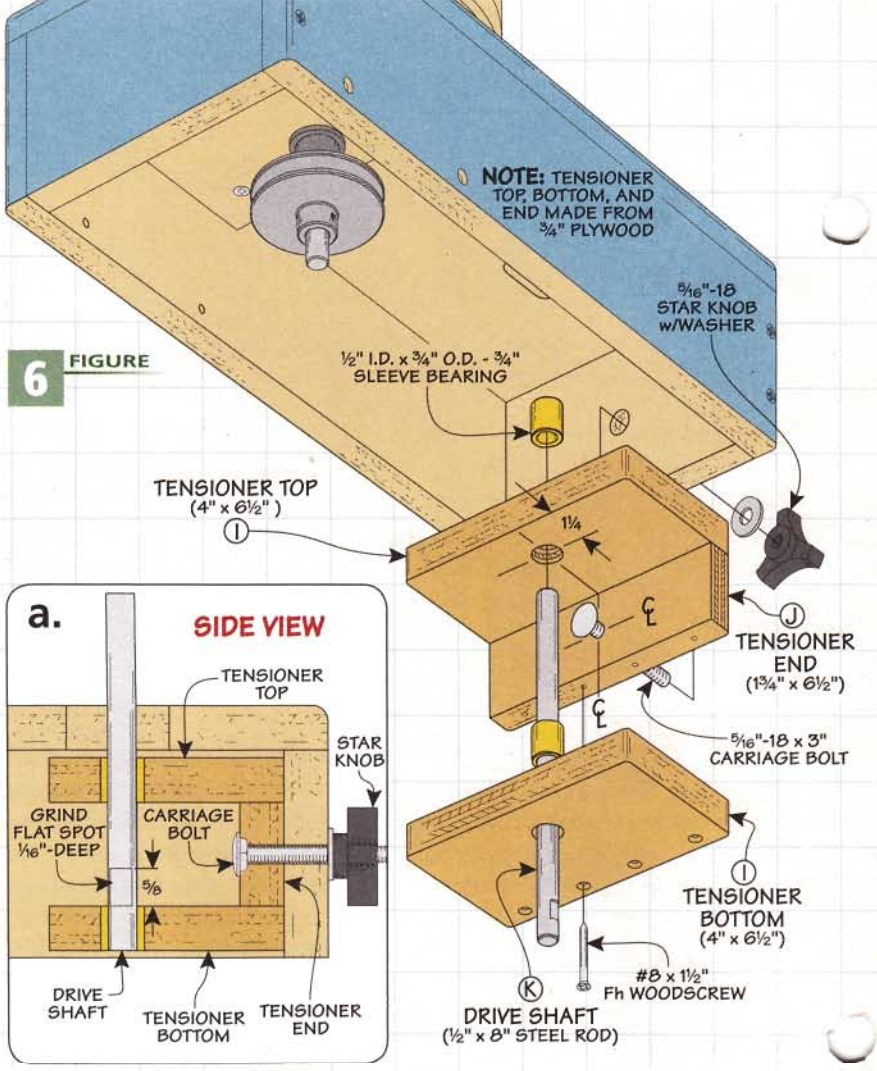
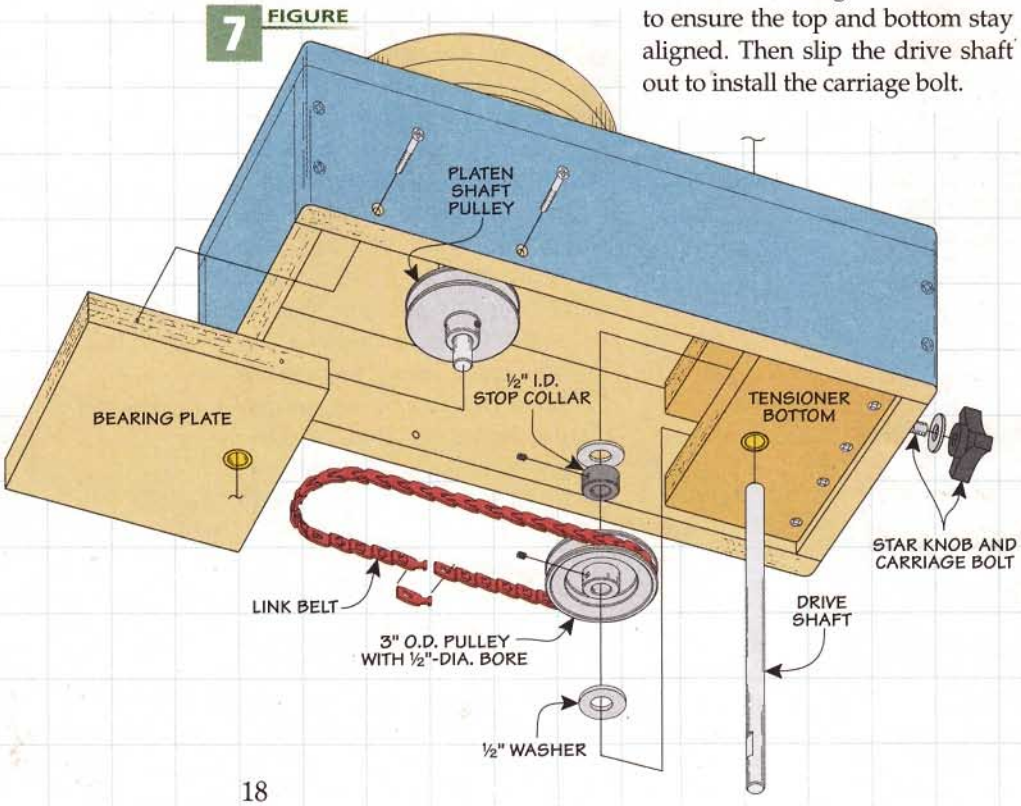
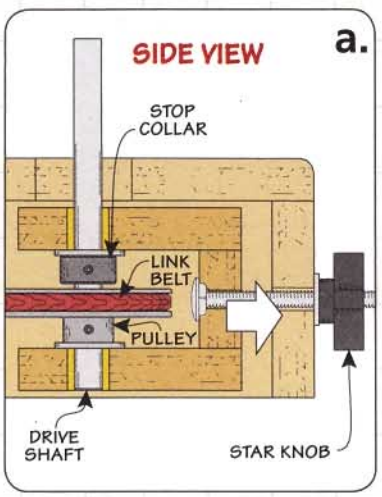


FIGURE 7





bearing in the bracket. Then install a washer, stop collar, pulley and belt, and finally, another washer onto the shaft (Figure 7a).

Install the Belt. At this point, I took some time to figure out the length of belt I needed. You can use the slot in the top (for the drive shaft) as a guide. The belt should be loose with the drive shaft closest to the platen shaft. Then as you tighten the belt, it should be snug at about the halfway point in the slot.

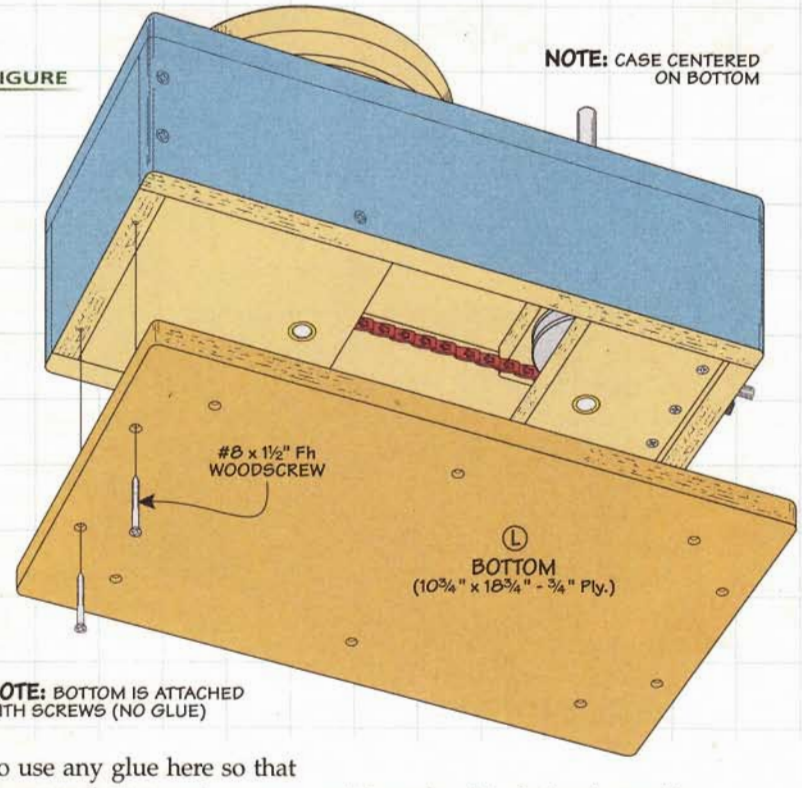
To make it easy to customize the length, I used a link belt, like you see in the margin photo on the opposite page. After a little trial and error, I found that it took about 39 links to get the right length. Then you can slip the belt around the pulleys. (You may need to realign the pulleys.)

Continue to thread the shaft through the bottom sleeve bearing in the tensioner bracket until the end of the shaft is flush with the outside of the tensioner bracket.

Tension the Belt. The last thing to do before closing up the case is to tighten the knob until the belt is seated on both pulleys. And don't worry if the shaft assembly and tensioner move around a bit. You'll lock everything down and adjust the tension on the belt later when you use the sharpening system.

Close Up the Case. Finally, you can cut the bottom of the case to size and install it with screws, centering it on the case. You don't want to use any glue here so that you can get to the internal components for adjustments later.

FIGURE 8



Abrasive Disks. If you haven't made the sharpening disks already, you can do so now (refer to Figure 4). At this point, you have a functional sharpening system. All you need to do is attach a self-adhesive abrasive disk to each of the MDF sharpening disks. To make it easier to replace an abrasive disk as it wears, I sprayed a couple coats of lacquer on the disks first.

Freehand Sharpening. As it is, the sharpening system is great for flattening the backs of chisels and plane irons. And, if you're comfortable holding a tool freehand without the aid of a honing guide, you can create a flat bevel for a razor-sharp edge on your tools. It's great for sharpening carving tools and gouges, too. For help setting up the sharpening station on your drill press, you can turn to page 21 for a step-by-step guide.

Final Details. To make the most out of the sharpening system, I added a shop-built honing jig and guide system. This way, it's easy to accurately hone just about any beveled tool without a lot of fuss. And to store all the abrasive disks, I made a storage box. You can find out how to build these by turning to the next page.

Materials & Hardware

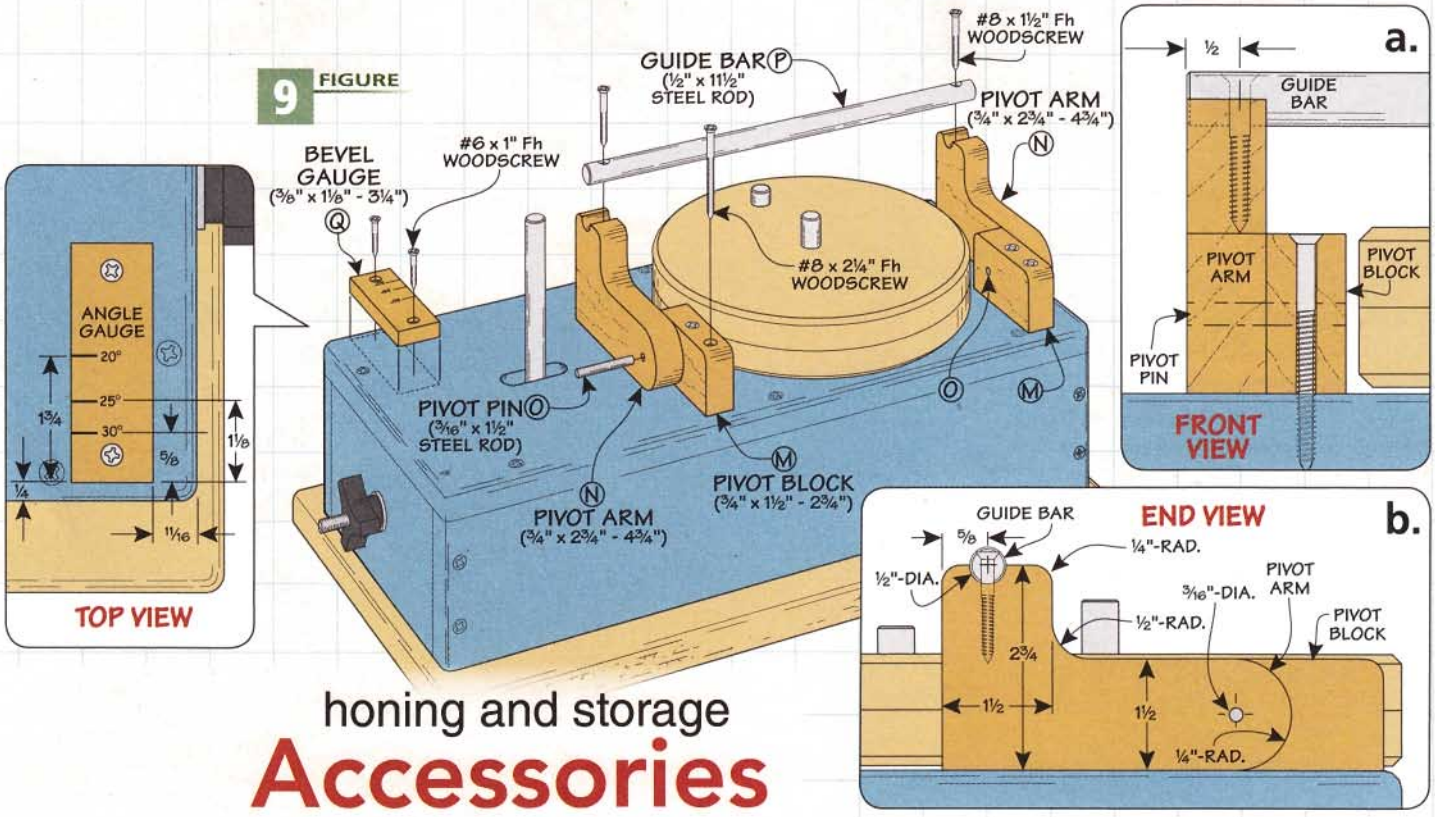
SHARPENING STATION

A	Front/Back (2)	3½ x 18 - ¾ Ply.
B	Ends (2)	3½ x 6¾ - ¾ Ply.
C	Top (1)	8¼ x 18 - ¾ Ply.
D	Bearing Plates (2)	6¾ x 6½ - ¾ Ply.
E	Platen Shaft (1)	½ x 6½ Steel Rod
F	Drive Pin (1)	3/16 x 1¾ Steel Rod
G	Platen/Disks (9)	8¼-Dia. - ¾ MDF
H	Index Pin	½ x 1⅛ Steel Rod
I	Tensioner Top/Bottom (2)	4 x 6½ - ¾ Ply.
J	Tensioner End (1)	1¾ x 6½ - ¾ Ply.
K	Drive Shaft (1)	½ x 8 Steel Rod
L	Bottom (1)	10¾ x 18¾ - ¾ Ply.
M	Pivot Blocks (2)	¾ x 1½ - 2¾
N	Pivot Arms (2)	¾ x 2¾ - 4¾
O	Pivot Pins (2)	3/16 x 1½ Steel Rod
P	Guide Bar (1)	½ x 11½ Steel Rod
Q	Bevel Gauge (1)	⅜ x 1⅛ - 8¼
R	Clamp Blocks (2)	⅝ x ¾ - 4

DISK STORAGE CASE

S	Front/Back (2)	5 x 11¼ - ¾ Ply.
T	Ends (2)	5 x 8½ - ¾ Ply.
U	Bottom (1)	8½ x 9¾ - ¾ Ply.
V	Dividers (7)	4¼ x 9 - ¼ Ply.

- (1) ½"-Dia. x 36" Precision Steel Rod
- (1) 3/16"-Dia. x 6" Steel Rod
- (1) ½" I.D. x 15/16" O.D. Thrust Bearing
- (2) ½" Washers
- (4) ½" I.D. x ¾" O.D. - ¾" Sleeve Bearing
- (5) ½" Steel Washers
- (2) ½" I.D. Stop Collars
- (2) 3" O.D. Pulley with ½" Bore
- (1) 5/16"-18 Star Knob
- (1) 5/16"-18 x 3" Carriage Bolt
- (1) 5/16" Washer
- (4) #8 x 1¼" Fh Woodscrews
- (40) #8 x 1½" Fh Woodscrews
- (4) #8 x 2¼" Fh Woodscrews
- (1) ½"-Wide x 36" Link Belt
- (2) ¼"-20 Knobs w/Inserts
- (2) ¼" x 1¾" Fh Machine Screws
- 8"-Dia. PSA Abrasive Disks



honing and storage

Accessories

The key to a sharp edge on a tool is a flat back and bevel. You can easily flatten the back on the disk freehand. But getting repeatable, accurate results when honing the bevel is often a challenge. To solve this problem, I added a honing guide assembly and jig (Figures 9 and 10). The jig clamps securely to a blade and rides along the guide bar for accurate honing.

Simple Guide Bar. As you can see in Figure 9, the guide bar consists of a steel rod fastened to a pivot arm at each end. These arms allow you to swing the bar out of the way to change disks. The first thing to do is to start on the pivot blocks and arms.

Pivot Blocks. The two, rectangular pivot blocks are made of hardwood and anchor the pivot arms and guide bar to the top of the case. It's a simple matter to cut them to size, round over the top corners, and drill the countersunk mounting holes. You can set these block aside to work on the arms.

Pivot Arms. The L-shaped arms that secure the steel bar to the pivot blocks involve a little more work. I found it easier to start with an oversized, rectangular blank. I drilled the inside corner radius and notch for the guide bar first, then cut out the shape at the band saw. Then it just takes a little sanding to smooth the edges and corners.

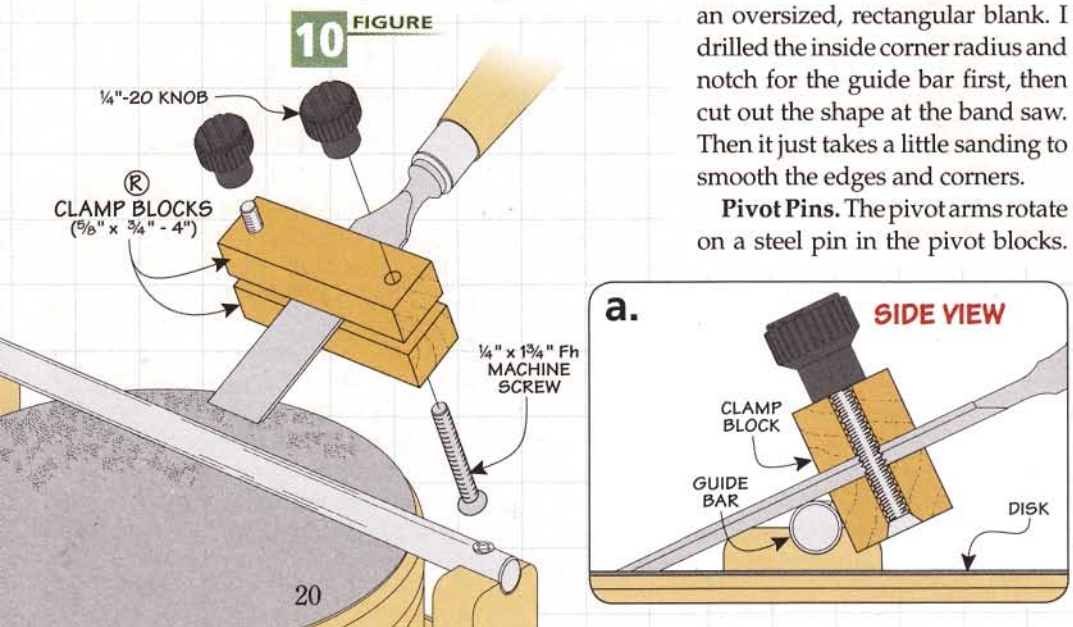
Pivot Pins. The pivot arms rotate on a steel pin in the pivot blocks. To ensure accurately aligned pivot holes, I stacked each mating pair of parts and drilled them at the drill press. But before attaching the blocks to the case, I went to work on the steel guide bar that connects the pivot arms.

Honing Guide Bar. The only tricky part in making the guide bar is drilling a countersunk hole at each end. To make this easier, I clamped the rod in a V-block attached to my drill press.

With all the parts made, you can go about attaching the guide assembly to the case. I used the guide bar to help locate the arms and blocks. They're positioned on the case to get the most use out of the disk for sharpening. Once the pivot blocks are in place, install the pivot pins and pivot arms. Finally, fasten the guide bar with screws to lock the entire assembly together.

Honing Jig. To hold the chisel at a consistent angle, I made a simple clamping jig (Figure 10). You can size it to accommodate your widest tool blade. A pair of screws and knobs are all it takes to clamp a blade between the blocks.

Bevel Gauge. There's one more simple addition I made to the

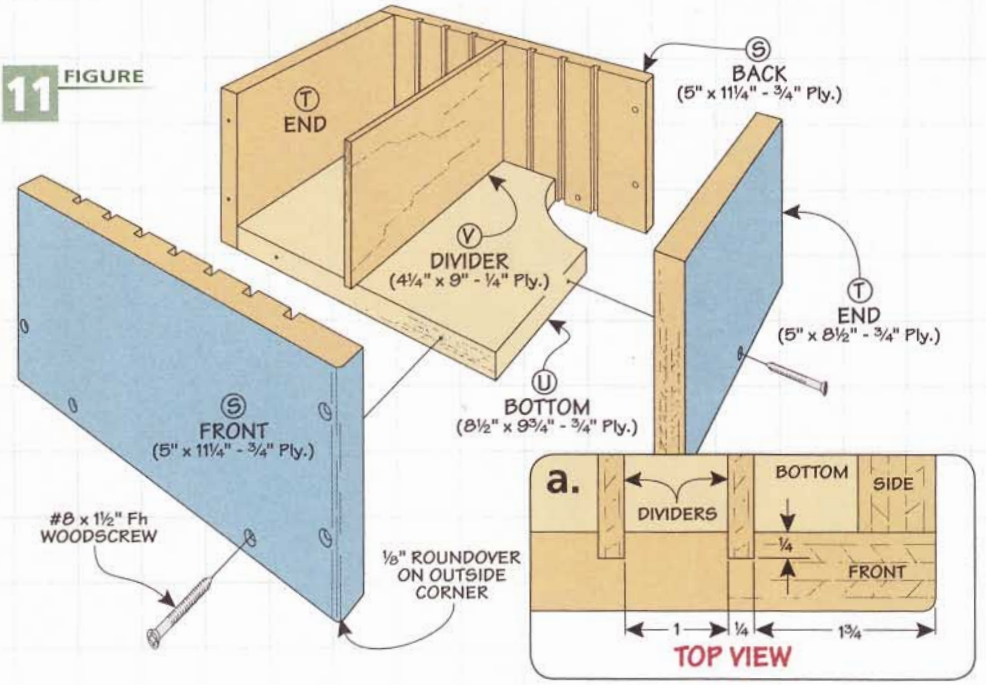


sharpening system. And that's to add a bevel gauge, as detailed in Figure 9. The box below shows how it's used to set the proper angle on the tool when sharpening.

Storage Case. After using this system for awhile, it became apparent I needed a place to store all the sanding disks. The answer is the handy storage case you see in Figure 11. It's a sturdy box with plywood dividers to keep the disks separated for easy access.

Setup for Sharpening. By now, you're probably ready to take the sharpening system for a spin. The box below provides all the details on how to get a razor-sharp edge on all your tools.

FIGURE 11



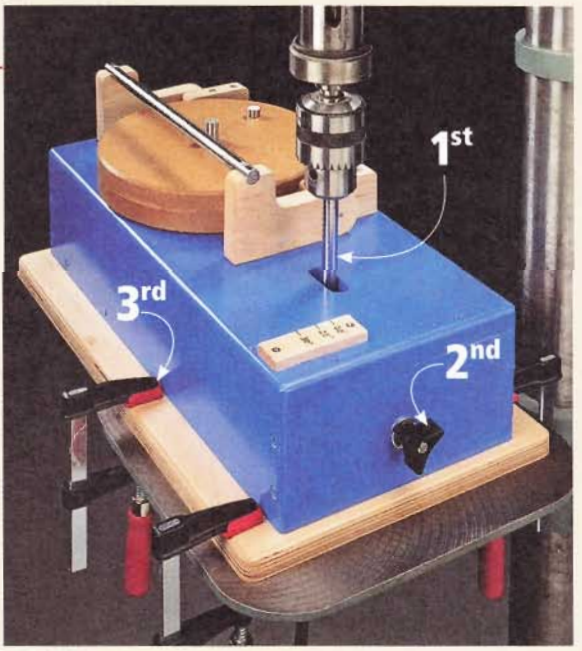
Setup & Use

Setting up and using the sharpening system couldn't be easier. The photos you see here guide you through the process.

First, set the sharpening system on the drill press table, aligning the drive shaft under the chuck. Loosely clamp the base to the drill press table then adjust the table height. Now, tighten the shaft in the chuck. Next, loosen the clamp and adjust the belt tension then clamp the system down.

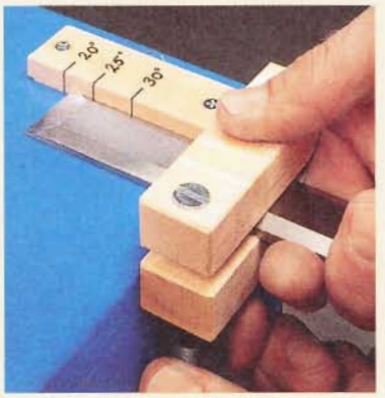
After choosing the appropriate sharpening disk for the task, install it on the platen (left photo below). Then, loosely clamp the tool to be sharpened in the honing jig. Use the bevel gauge to set the jig and firmly tighten the knobs, as you see in the middle photo below.

At this point you can turn on the drill press set at low speed. Place the honing jig against the bar at the end where the disk is spinning *away* from the tool (right photo below). Light pressure on the tool while moving it side-to-side is all you need to get a sharp edge.



► ***Setup.*** *To use the sharpening system, chuck the shaft into the drill press, tension the belt, and then clamp it securely.*

▲ ***Choose a Disk.*** *Installing a disk is as simple as placing it on the platen shaft and aligning the hole on the bottom with the index pin in the platen.*



▲ ***Bevel Setup.*** *Align the heel of the tool's bevel with the mark to position the honing jig.*

▲ ***Light Pressure.*** *With the drill press doing the work, it doesn't take much to get a sharp edge.*

Shop Short Cuts

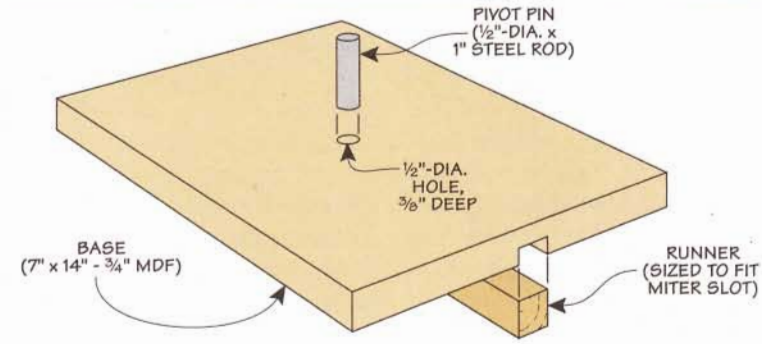
Cutting Disks

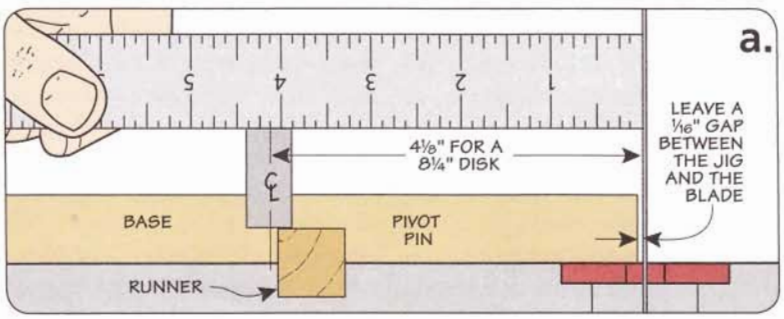
Cutting the platen and sanding disks for the drill press sharpening station might seem like a daunting task. But with a simple jig for your band saw, you'll be able to quickly cut out all the disks.

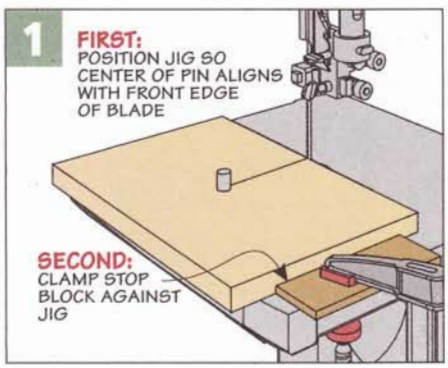
The Jig. The jig consists of three parts: a base, a runner to fit the miter slot, and a short pivot pin to hold the blank. The drawings at right show how they work together to size the disks accurately.

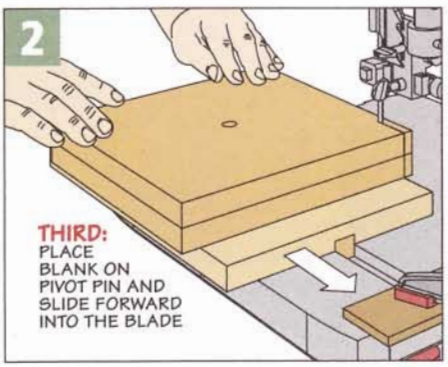
To make the jig, cut a runner for a smooth sliding fit in your miter slot. Then you'll need to cut a matching groove on the underside of the base. Cut the groove so the edge of the base near the blade has about 1/16" clearance (detail 'a'). But before you glue the runner in the groove, you'll want to drill a hole for the pivot pin. The distance from the centerpoint of the hole to the blade equals the desired radius of the disk.

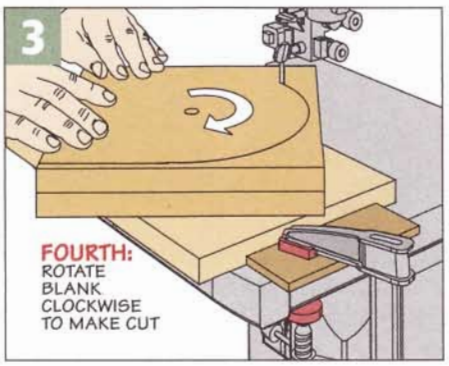
Using the Circle-Cutting Jig. The drawings below show the process for cutting a disk. Start by positioning the jig so the center of the pivot pin aligns with the leading edge of the blade. Then, clamp a block to the table to stop the jig at that point. After placing the blank over the pivot pin, slide the jig forward until it contacts the stop. Now, rotate the blank clockwise to cut a perfect disk.









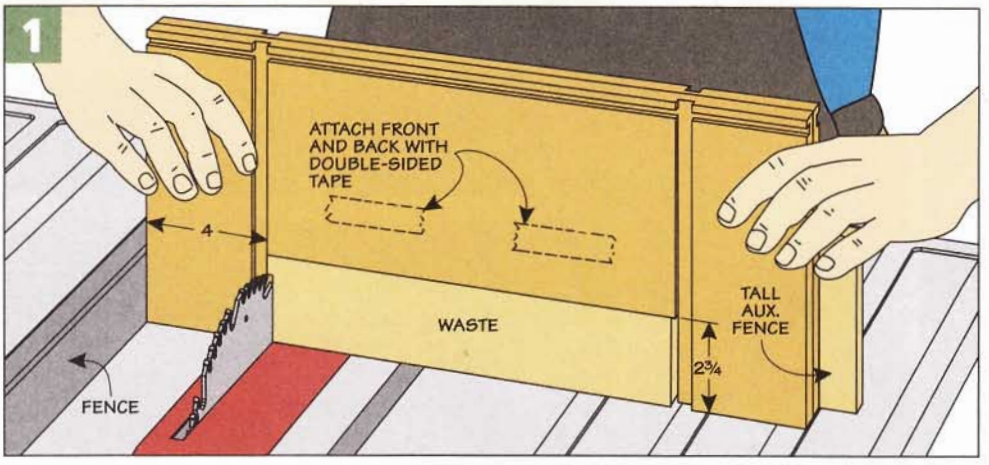


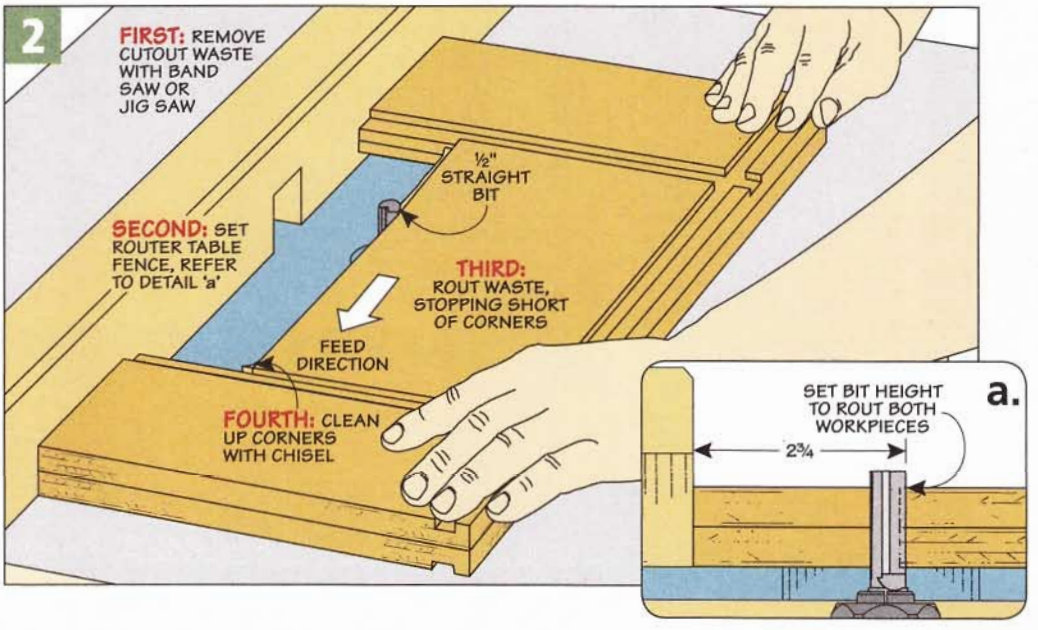
Creating a Large Cutout

The front and back pieces of the tool tote on page 34 require a large cutout along the top edge. For the lid to fit properly, it's important for the cutouts to line up precisely in both pieces. Fortunately, there's an easy way to make the cutouts and keep the edges clean and square.

You'll need to start by ganging the workpieces together with double-sided tape and marking the location of the cutout. This way, you're guaranteed that the pieces will be exact duplicates. Now add a tall auxiliary fence to the miter gauge and cut along the layout lines (Figure 1).

After cutting up to the layout line to remove most of the remaining waste with my band saw, I moved to the router table and installed a straight bit. Figure 2 shows how you can set the router table fence to make a trimming pass right up to the layout line, leaving a smooth, straight surface. All that remains is to remove a small amount of waste near the corners using a sharp chisel.

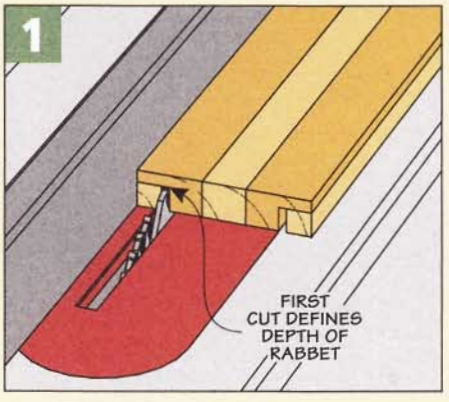


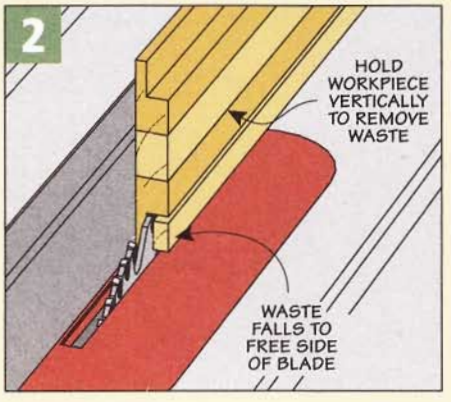


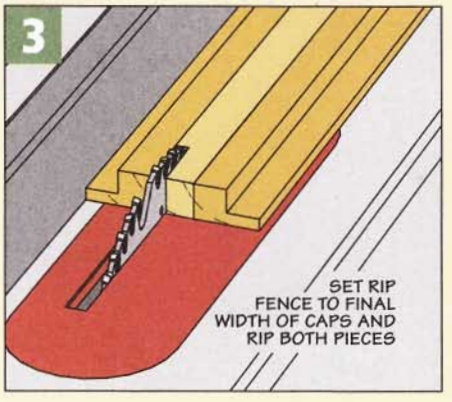
Cut Rabbets Safely on Small Parts

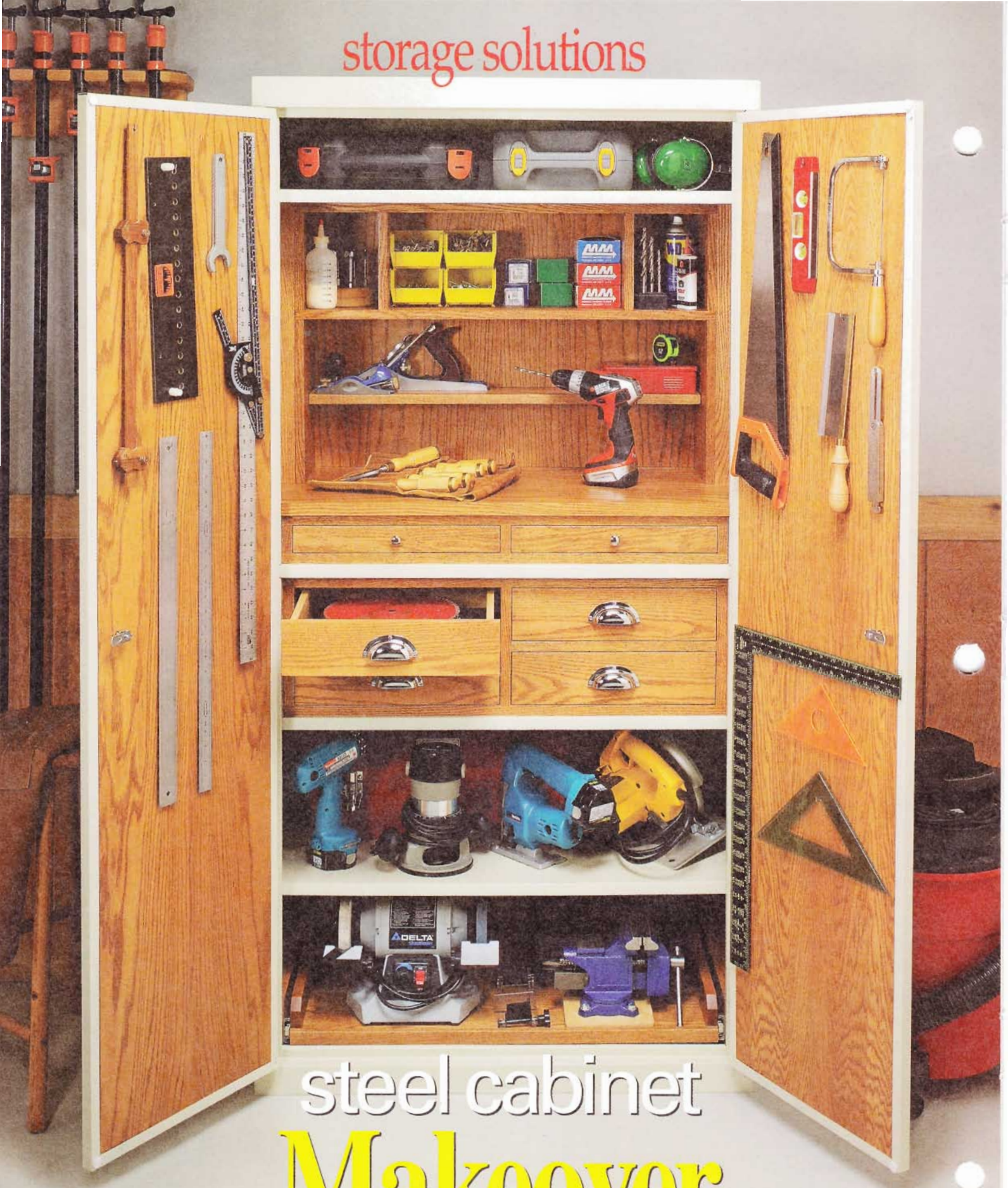
The tool tote needs a solid base for attaching hardware. So I added hardwood caps on the front and back assemblies. The caps are rabbeted to fit flush with the outside face of the plywood. The problem is, when making a cut like this on such a narrow workpiece, it can be difficult to do it safely.

A safer way to cut the rabbets is to start with an oversized blank. This gives you a more stable workpiece to hold on to as you make the cut. The drawings below walk you through the sequence. The first cut defines the depth of the rabbet, as in Figure 1. The second pass, made with the workpiece held vertically, defines the width (Figure 2). Finally, rip the individual caps from the blank (Figure 3).







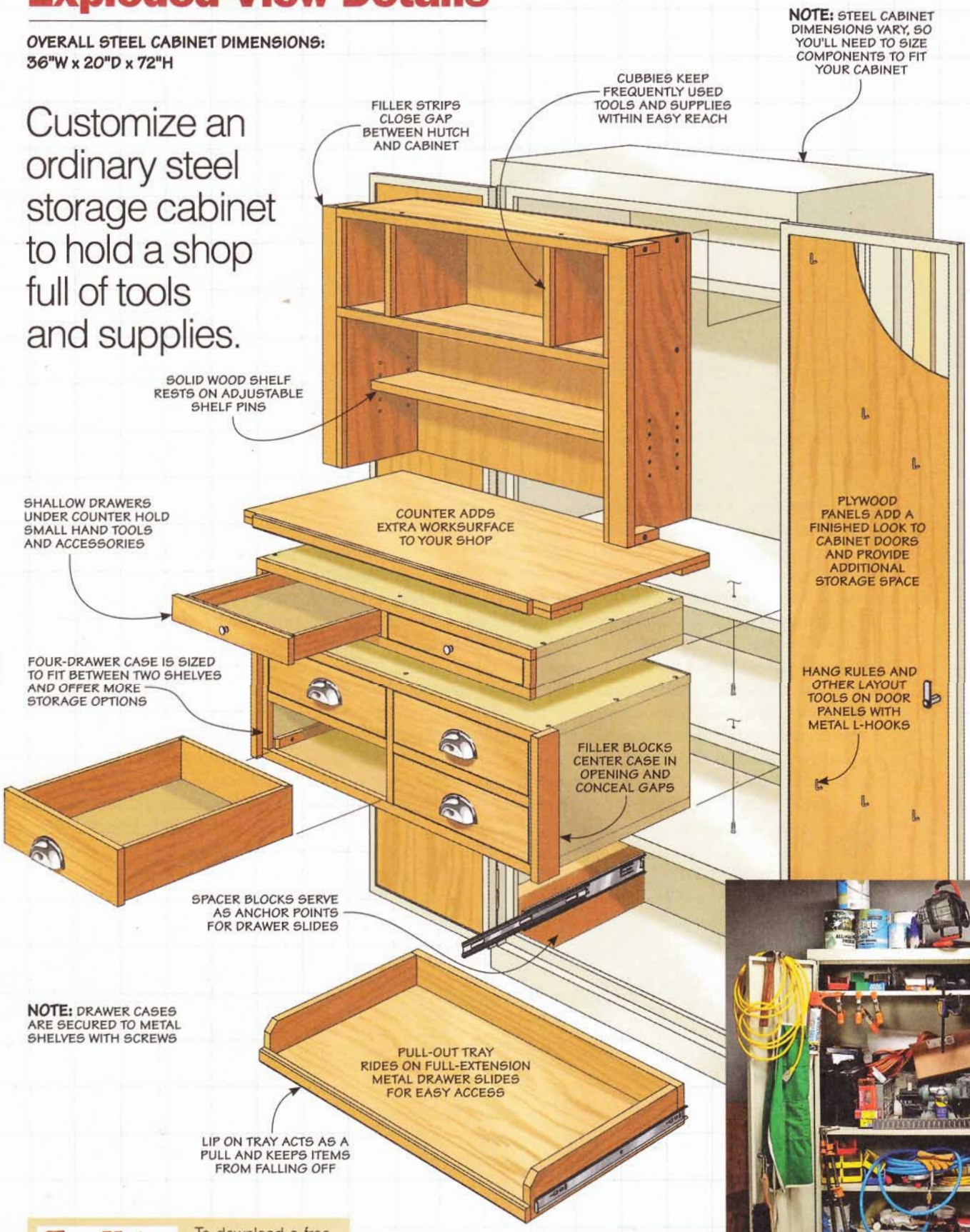


steel cabinet Makeover

Exploded View Details

OVERALL STEEL CABINET DIMENSIONS:
36"W x 20"D x 72"H

Customize an ordinary steel storage cabinet to hold a shop full of tools and supplies.

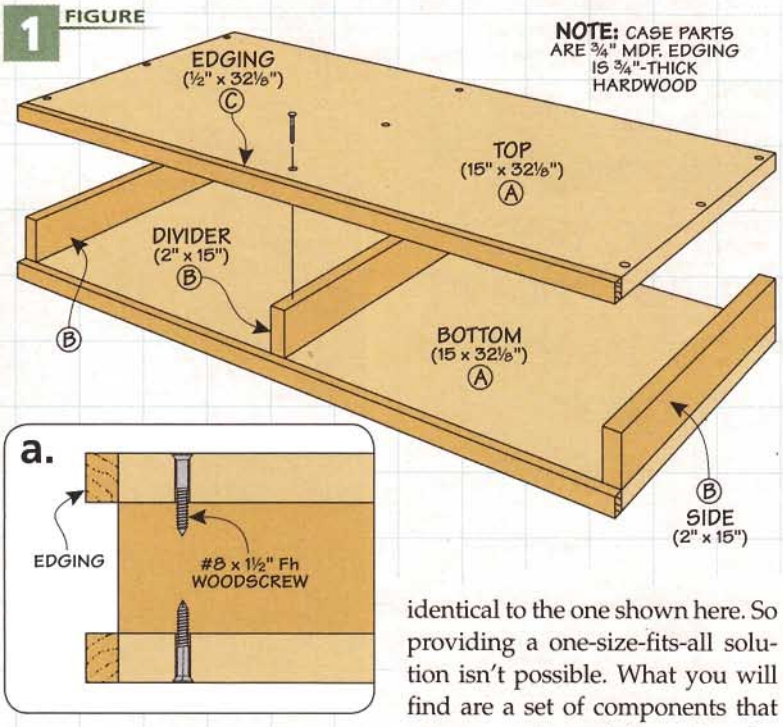


ShopNotes GO ONLINE EXTRAS

To download a free cutting diagram for the Tool Cabinet, go to: ShopNotes.com

► ***No Options.*** *A steel cabinet may hold a lot, but the space is very tough to organize well.*

two-drawer Case



I've always admired antique cabinetmakers' tool chests. From the outside, they're just ordinary painted boxes. But when you open one up, you see the inside is completely customized to house all the hand tools a traditional cabinetmaker needed to build furniture.

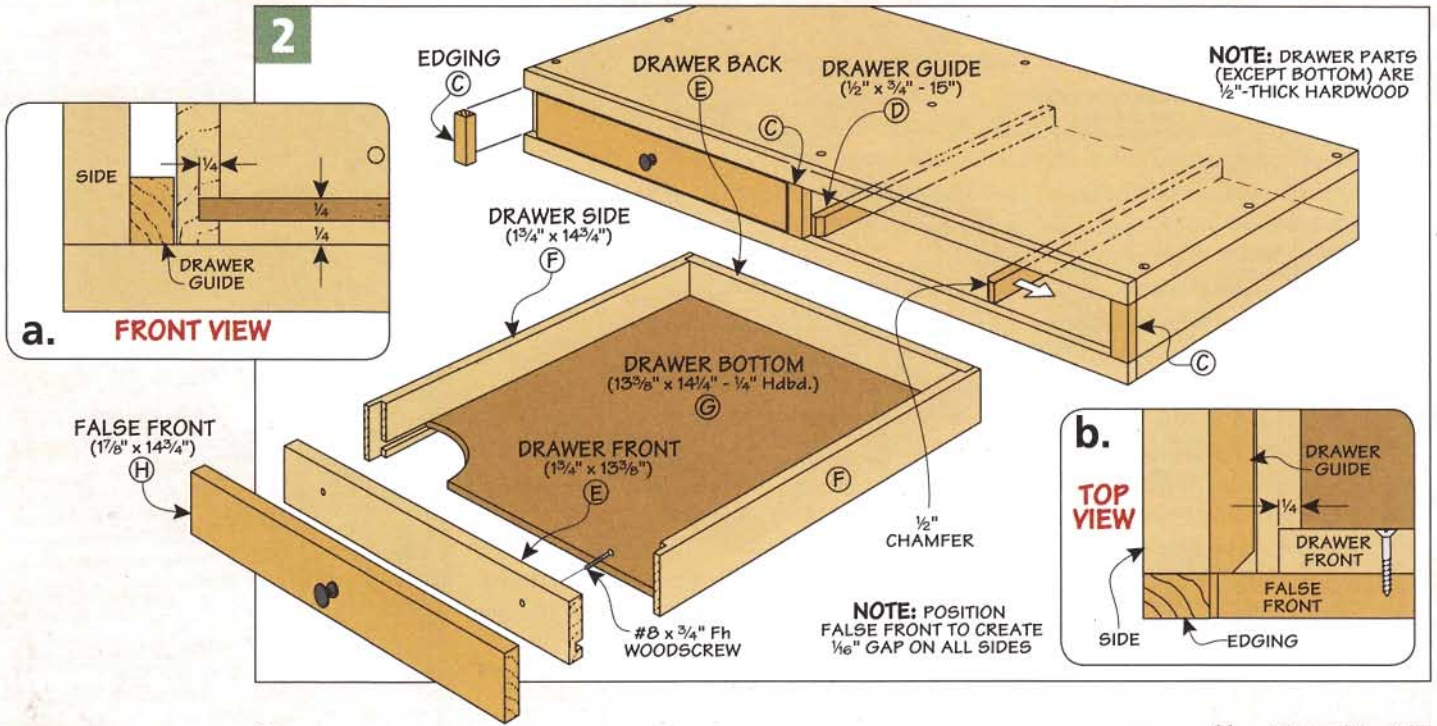
This project reminds me of one of those chests. It starts out as a plain "box" — a common steel cabinet. Then, instead of relying on the cabinet's metal shelves alone, I added an array of custom storage solutions to organize the hand and power tools I use most often.

Customizing a steel cabinet saves the time and hassle of building a large box. Plus, it offers one advantage that wasn't needed by traditional cabinetmakers — room for storing portable power tools and their accessories.

Worksurface. One of the things that I like best about this project is the counter and hutch in the upper portion of the steel cabinet. It rests on a fixed shelf in the center of the cabinet and makes this project stand out as more than just a plain storage cabinet. The counter provides a small worksurface to lay out plans, or keep hardware and supplies close at hand. On top of the counter sits an upper hutch that you'll build later.

Finding a Cabinet. New steel cabinets are pretty common and relatively inexpensive to buy. And you can also find used cabinets at office furniture stores. The trouble is they may not be identical to the one shown here. So providing a one-size-fits-all solution isn't possible. What you will find are a set of components that you can mix, match, and resize to suit your needs. Before getting started though, make sure you have the cabinet on hand and use the dimensions shown as a starting point for your own upgrade.

Small Case. The foundation for the counter and hutch is a two-drawer case, as shown in Figure 1. The ¾" MDF case is assembled with glue and screws. And, I sized it so that it just slides into the opening of the cabinet. The depth of the



case is slightly (1") shallower than the depth of the cabinet.

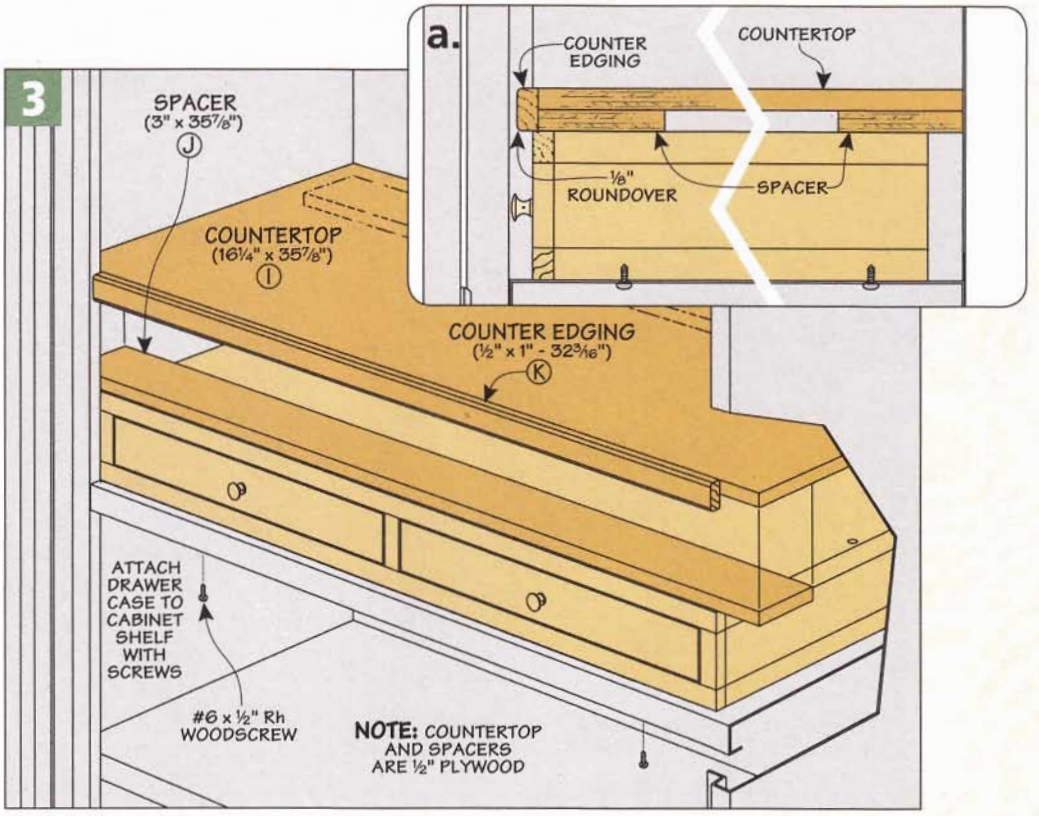
You can start by cutting the case top and bottom to size. Then cut the sides and divider panels. At this point, the case can be assembled. The next step is to cover the front, exposed MDF edges with hardwood edging. (I chose red oak.) The edging is ½" thick and is simply glued in place, as you can see in Figures 1 and 2. You can use strips of masking tape to act as a clamp while the glue dries.

A Pair of Drawers. The drawers come next. For these parts, I used ½"-thick poplar since it's lightweight and inexpensive. The drawer parts are joined with rabbets cut in the drawer front and back (Figure 2). And a groove in all four parts is sized to hold a ¼" hardboard drawer bottom.

Guides. Hardwood drawer guides center the drawer in the opening and keep it from racking and binding as it slides in and out. The guides are simply glued to the sides and divider of the case (Figures 2a and 2b).

To conceal the drawer joinery and drawer guides, I attached a false front to each drawer. Size the pieces to create a 1/16" gap on all four sides of the false front and attach it to the drawer with screws.

The drawer case is now ready to be installed in the cabinet. To do this, simply slide the case into the opening and make sure it's centered side to side and flush with the back edge of the "face frame" of the cabinet, as you can see in Figure 3. Then drive a few screws through the metal shelf from below to anchor the case in place.



Counter. On top of this case sits the counter. It's made up of two layers of ½" plywood to create a more solid worksurface.

As you can see in Figure 3, the lower layer is made up of two wide strips, one each at the front and back of the panel. The counter is sized to fit snugly in the cabinet side-to-side and front-to-back.

Hardwood Edging. Like the drawer case, you need to cover the exposed front edges of the counter with edging. Just note that it doesn't run the whole length of the counter. Instead, the length matches the cabinet opening.

The counter rests on top of the drawer case. The weight and size of the counter "locks" it in place.

Materials & Hardware

TWO-DRAWER CASE & COUNTER

A	Top/Bottom (2)	15 x 32 ⅛ - ¾ MDF
B	Sides/Divider (3)	2 x 15 - ¾ MDF
C	Edging (1)	¾ x ½ - 314 rgh.
D	Drawer Guides (12)	½ x ¾ - 15
E	Drawer Fronts/Backs (4)	½ x 1¾ - 13⅜
F	Drawer Sides (4)	½ x 1¾ - 14¾
G	Drawer Bottoms (2)	13⅜ x 14¼ - ¼ Hdbd.
H	False Fronts (2)	½ x 1⅞ - 14¾
I	Countertop (1)	16¼ x 35⅞ - ½ Ply.
J	Spacers (2)	3 x 35⅞ - ½ Ply.
K	Counter Edging (1)	½ x 1 - 32³⁄₁₆

HUTCH

L	Hutch Sides (2)	7½ x 21¼ - ¾ Ply.
M	Hutch Top/Bottom (2)	7½ x 31⅜ - ¾ Ply.
N	Hutch Dividers (2)	7½ x 8½ - ¾ Ply.
O	Hutch Back (1)	32⅛ x 21¼ - ½ Ply.
P	Shelf (1)	¾ x 5 - 30⅝
Q	Support Blocks (4)	¾ x 1½ - 3
R	Filler Pieces (2)	¾ x 1⅞ - 21¼

FOUR-DRAWER CASE

S	Top/Bottom (2)	15 x 32⅛ - ¾ MDF
T	Sides/Divider (3)	8½ x 15 - ¾ MDF
U	Shelves (2)	15 x 15⁷⁄₁₆ - ¾ MDF
V	Drawer Fronts/Backs (8)	½ x 3½ - 13⅜
W	Drawer Sides (8)	½ x 3½ - 14¾
X	Drawer Bottoms (4)	13⅜ x 14¼ - ¼ Hdbd.
Y	False Fronts (4)	½ x 3¾ - 14¾
Z	Case Fillers (2)	¾ x 2 - 10

TRAY

AA	Tray Front (1)	½ x 1 - 31⅛
BB	Tray Back (1)	¾ x 3 - 31⅛
CC	Tray Sides (2)	¾ x 3 - 15
DD	Tray Bottom (1)	15¼ x 30⅛ - ½ Ply.
EE	Tray Supports (2)	1⅞ x 6 - 16¼

DOORS

FF	Door Panels (2)	15⅜ x 65⅞ - ¼ Ply.
GG	Door Cleats (4)	½ x 2 - 65⅞

- (1) 36"W x 20"D x 72"H Steel Storage Cabinet
- (50) #8 x 1½" Fh Woodscrews
- (6) #6 x ½" Rh Woodscrews
- (4) #8 x 2" Fh Woodscrews
- (2) ¾" x ⅝" Knobs w/Screws
- (4) ¼" Shelf Pins
- (4) Cup Pulls w/Screws
- (1 pair) 16" Full-Extension Drawer Slides
- (1 pkg.) ½" L-Hooks
- (1 pkg.) ¾" L-Hooks
- (12) #8 x ¾" Fh Woodscrew

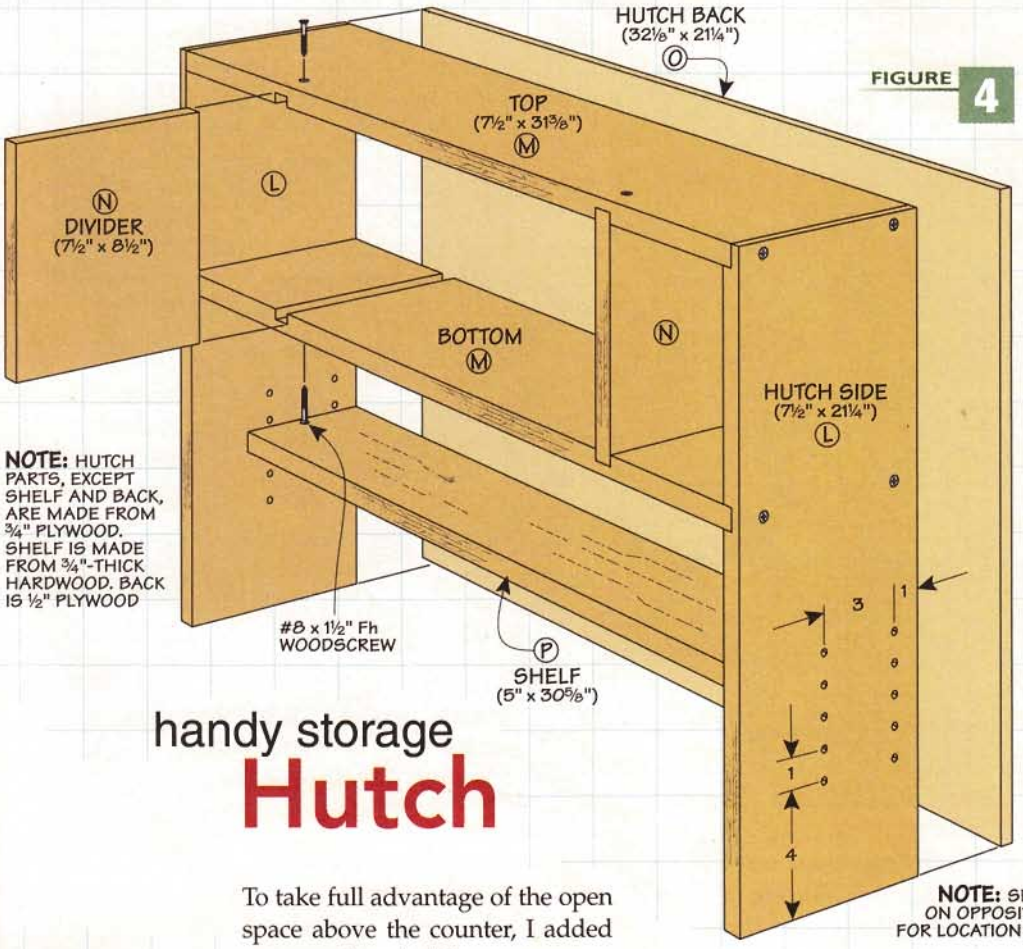
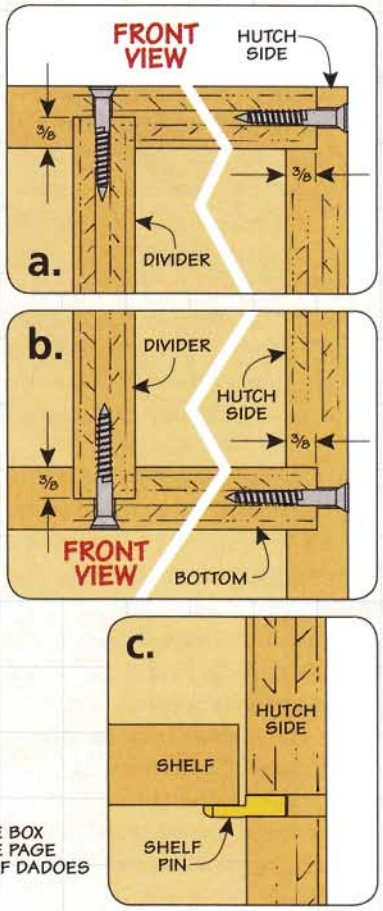


FIGURE 4



handy storage Hutch

To take full advantage of the open space above the counter, I added an open-bay hutch, as you can see in Figure 4. It provides a few storage cubbies and an adjustable shelf for easy access to frequently used tools and supplies.

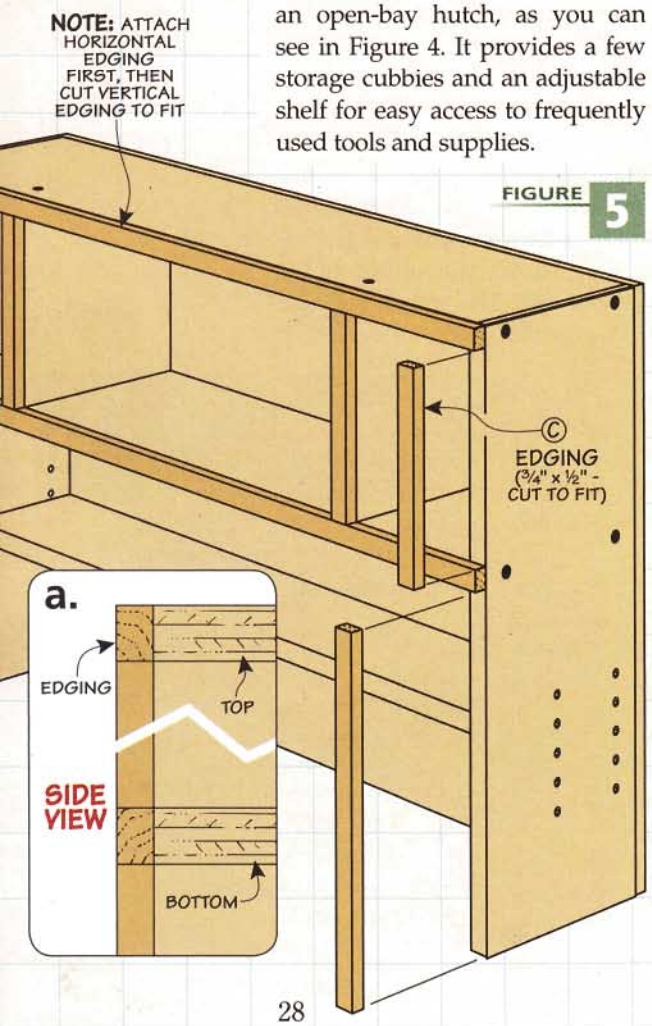


FIGURE 5

Size It Right. Just like the drawer cabinet, I made the overall width of the hutch a bit narrower than the cabinet opening. This will create some gaps on the sides once it's installed, but a couple of filler pieces will take care of that. There's one other thing to note: The hutch isn't the full depth of the cabinet. The shallow depth keeps the counter as open as possible.

Plywood Construction. Unlike the drawer case, the hutch pieces are visible, so instead of using MDF, the hutch is made mostly of ¾" red oak plywood.

I used rabbets and dadoes to assemble the hutch, as you can see in Figure 4. At the top of each side there's a rabbet to hold the top. A dado farther down the side accepts the bottom panel. Each of these joints can be cut at the table saw with a dado blade.

Oversize Blanks. When building the hutch, it's important that the joinery in each piece aligns perfectly with its mating part. To guarantee that this happens, I cut the joinery on extra-wide blanks for the sides as well as the top and bottom pieces. You can read more about this technique in the box on the bottom of the opposite page.

After cutting the large hutch pieces to size, you can drill shelf pin holes in the sides to support an adjustable shelf (Figure 4). Just like the dadoes, the shelf pin holes need to line up. To do this, I stacked the two sides together and drilled through holes. Since the outside faces aren't visible, you don't have to worry about the holes showing.

Dividers. The two dividers that form the cubbies come next. The dividers need to fit snugly in the dadoes in the top and bottom. To determine the size for these pieces, I dry assembled the hutch and measured the distance between the dadoes, as shown in Figures 4a and 4b. After the dividers are cut to size, you can assemble the hutch. To save some time, and since they won't be visible, I used screws to acts as clamps and secure the joints.

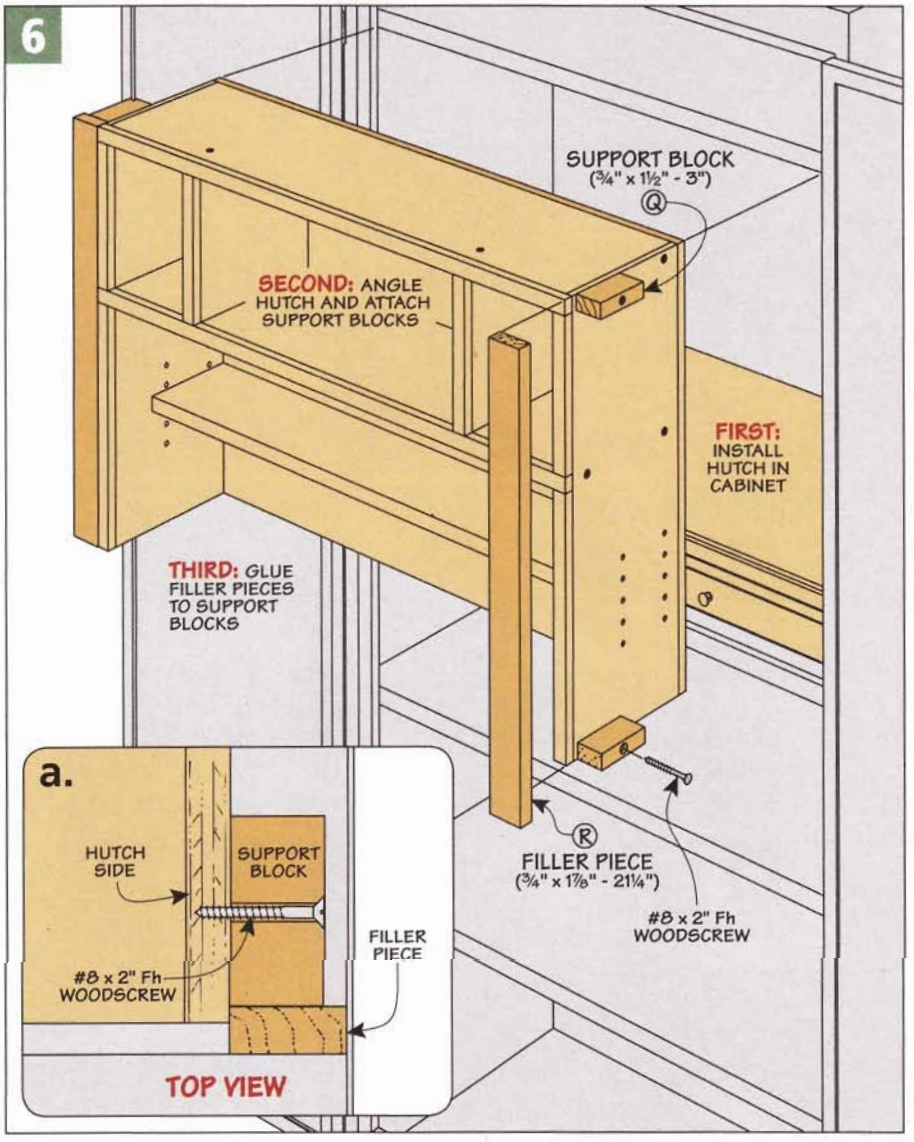
Now The Back. To provide added rigidity, I cut and attached a ½" plywood back to the hutch. It also adds a finished look to the hutch instead of seeing the bland painted back of the steel cabinet.

Finally, just like the drawer case and counter, the exposed plywood edges of the hutch need to be covered with hardwood strips, as illustrated in Figure 5.

Shelf. The adjustable shelf is the final piece to make for the hutch. The shelf is made from solid wood to minimize any sag (Figure 4c).

Installing. At this point, you can slide the hutch into the cabinet and make and attach the filler pieces I mentioned earlier. The filler pieces are glued to blocks on each side of the hutch, as shown in Figure 6. Although it seems as if you're building a ship in a bottle, the process is straightforward.

After determining the size of the filler pieces, you can cut and attach a narrow support block at the top and bottom of each side of the hutch. Just angle the hutch to access the side to add the blocks. Then position each block so the filler piece is flush with the front of the hutch, as you can see in Figure 6a. Then cut and glue the filler pieces to the blocks.

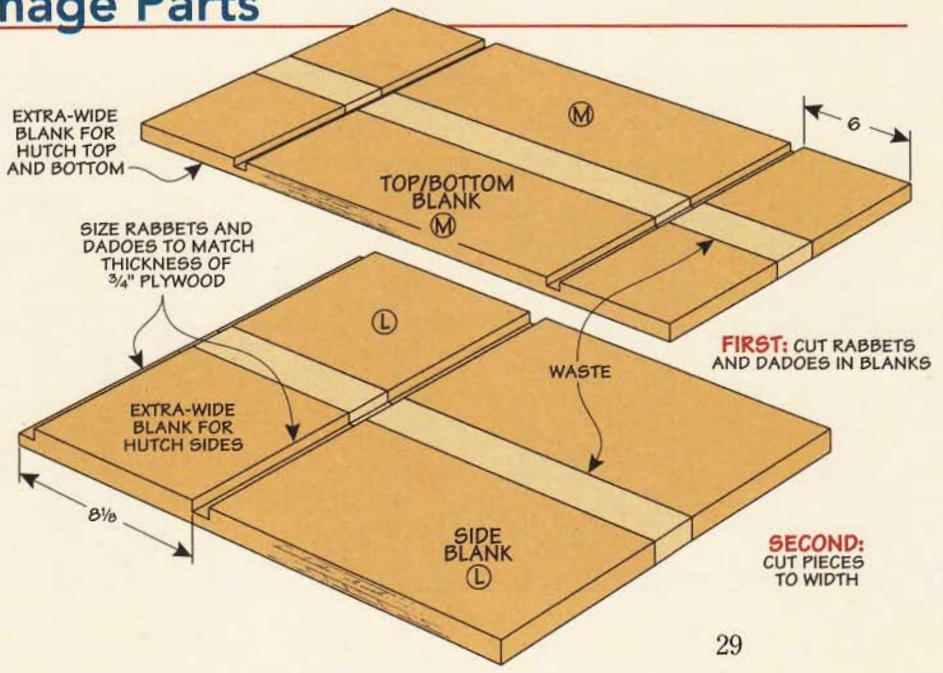


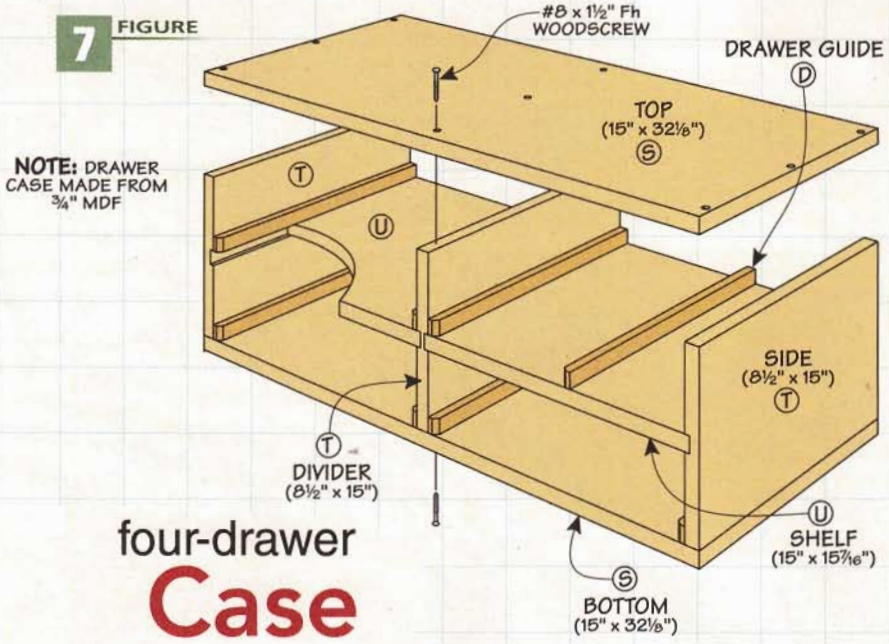
Creating Mirror Image Parts

One way to make sure the dadoes and rabbets are aligned in the hutch pieces is to cut the joinery before cutting the parts to size. The drawings at right show how the technique works.

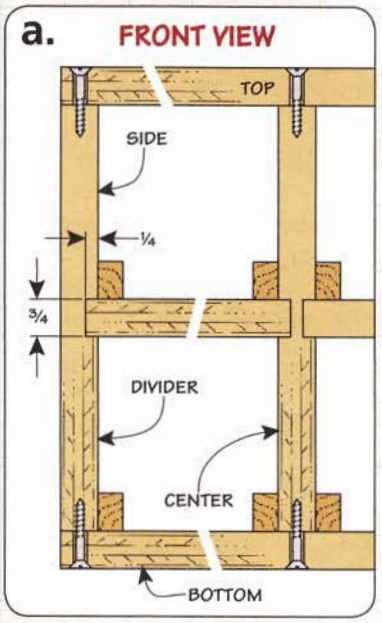
The plywood blanks are cut to the final length and are a little more than twice the final width of the pieces. Then you can cut a rabbet and dado in the side blank.

The blank for the top and bottom has a pair of dadoes. After setting the rip fence on the table saw to make one dado, you can flip it around and make the second cut. Finally, cut the pieces to final width.



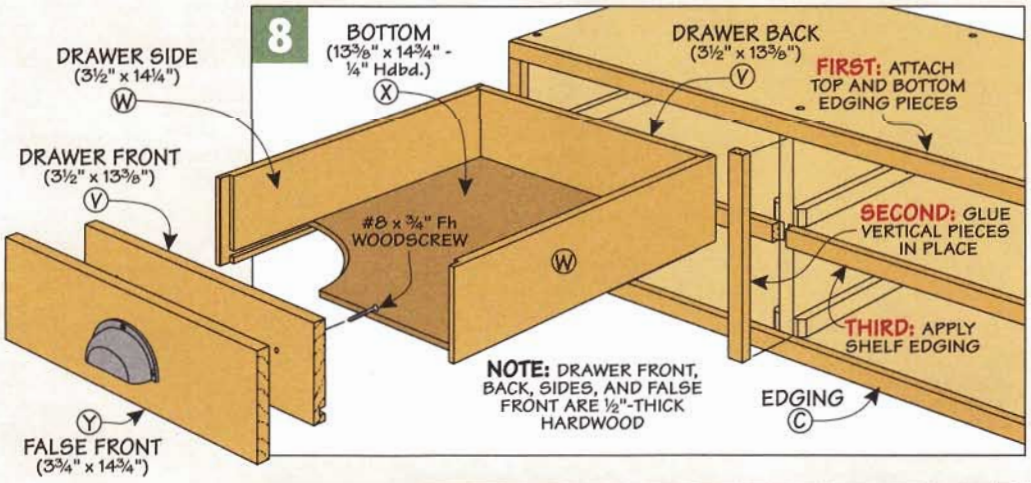


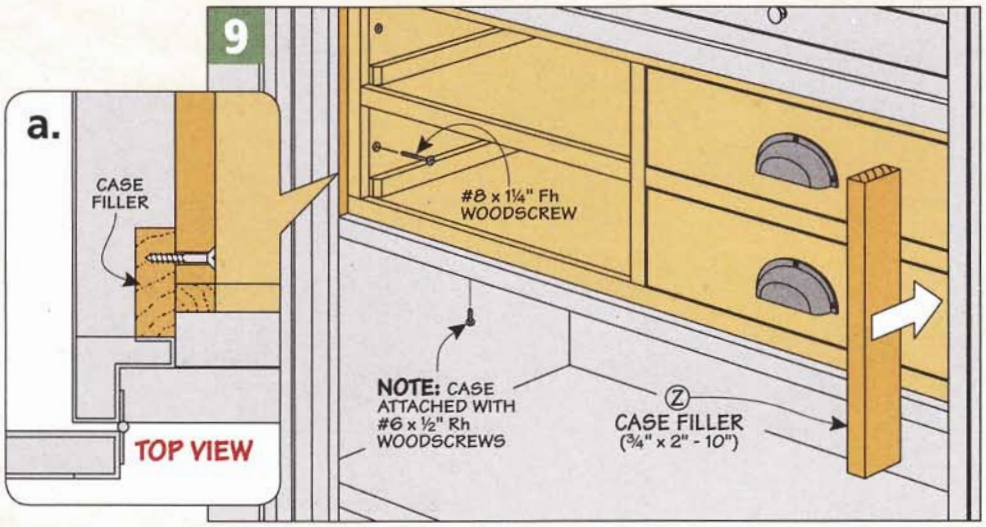
four-drawer Case



Another way to make better use of the existing shelves in a steel cabinet is shown in Figure 7. Here I filled the space between two shelves with a case of drawers.

Overall, this drawer unit is similar to the small one you built earlier. In fact, the size of the top and bottom of this case is identical to the shallow case. Like before, it's made from ¾" MDF and is assembled using simple joinery.





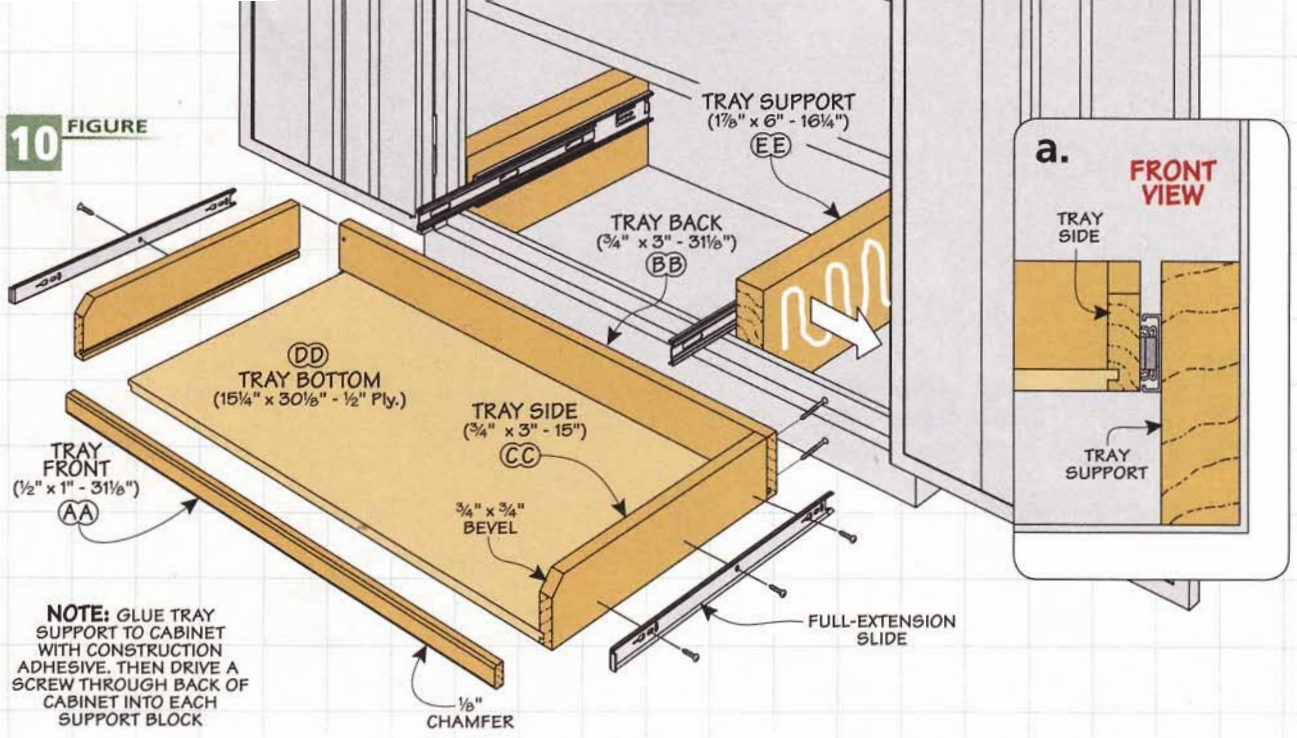
Sides, Divider, & Shelves. Where this case is different is in the sides and divider. For one, these pieces are taller. And they have dadoes to accommodate shelves that support another pair of drawers. Note that the divider also has a ¼" dado on each face to hold the shelves, as shown in Figure 7a.

The drawer case can now be assembled and the shelves cut to fit and installed with glue and screws. Once that's completed, you can cover the exposed MDF edges with hardwood edging, as illustrated in Figure 8.

Drawers. The four identical drawers come next. The drawers and guides are made just like the earlier ones. You can find the dimensions in Figure 8.

Installing the Case. I placed the drawer case in the middle of the cabinet. In this location, the case needs to be positioned so it won't interfere with the door latch. But setting the case back creates a gap between the front of the case and the face frame of the cabinet.

Once again, you need to make a pair of filler pieces to close the gap, as shown in Figure 9a. The 2"-wide strips are screwed to the drawer unit from inside the case. (You'll need to remove the drawers.)



The drawer unit can then be centered in the opening and locked in place from below with screws driven through the metal shelf and into the bottom of the case.

SLIDE-OUT TRAY

At the bottom of the cabinet, I added a slide-out tray. This makes it easy to access items stored at the back where things can get lost.

Build the Tray. The tray bottom is made from ½" plywood and has a tongue on the sides and back. This tongue fits in a matching groove cut in the wide, hardwood tray sides and back pieces.

The front of the tray covers the plywood edge and extends above the tray to form a lip. This keeps things from falling off the tray and acts as a pull to slide the tray out, as illustrated in Figure 10.

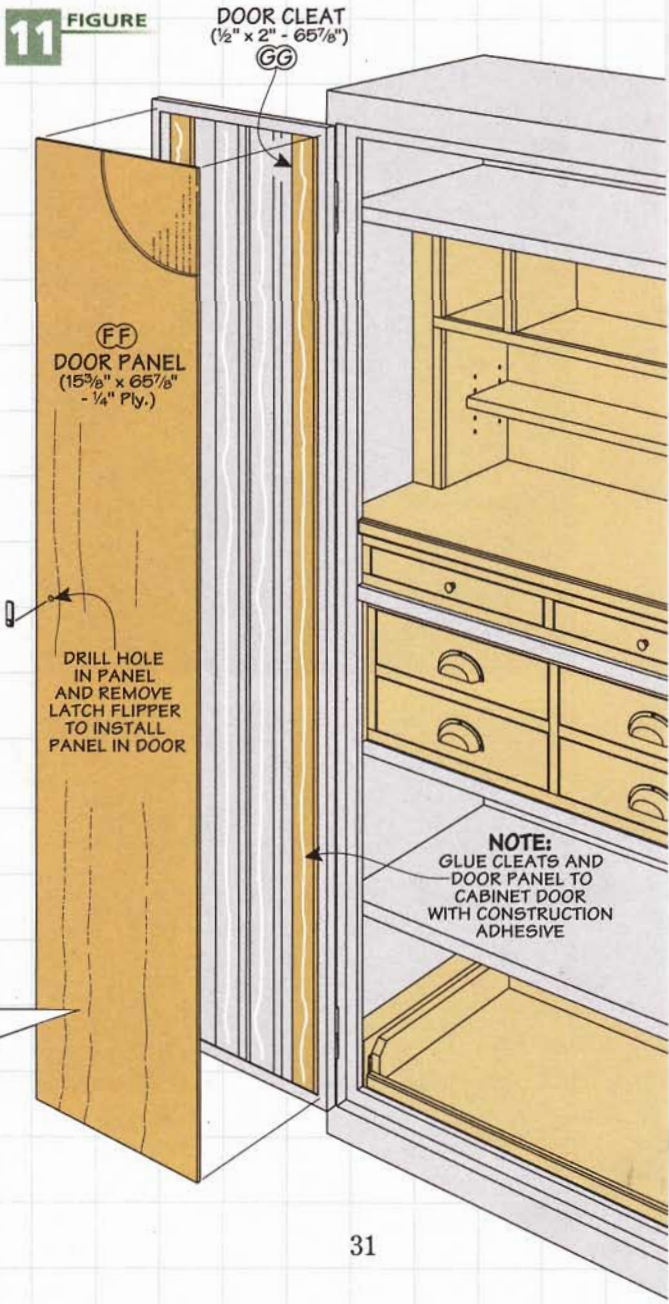
Solid Support. A pair of thick, support blocks are anchored to the inside of the cabinet with construction adhesive. I also drove a screw through the back of the cabinet and into the filler blocks to keep them from lifting out when the loaded tray is pulled out. These blocks fit from front to back and full-extension slides for the tray are anchored to them (Figure 10a).

DOOR PANELS

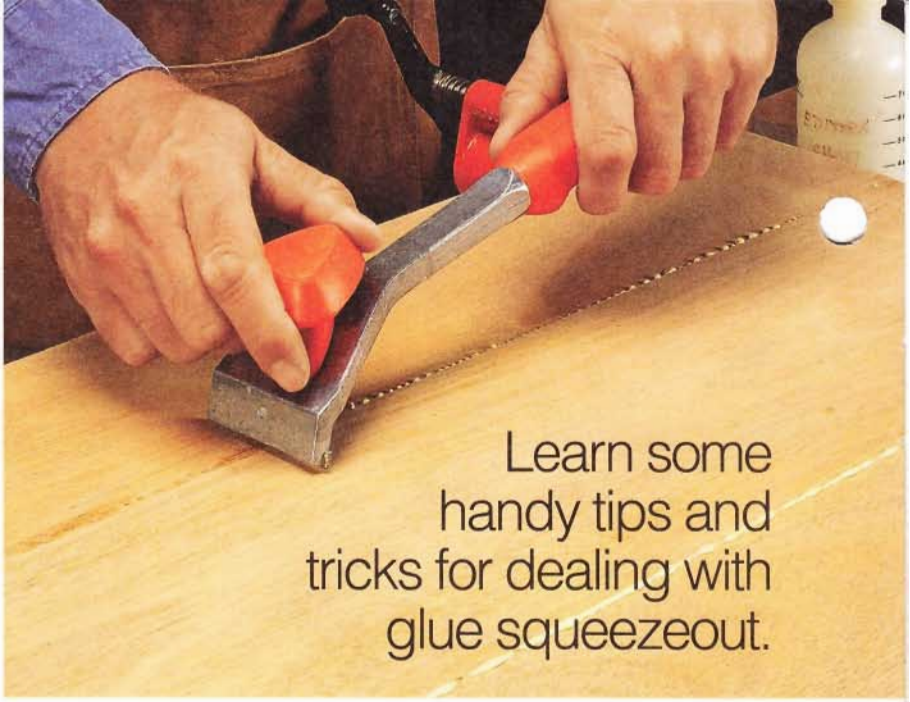
The final components of the cabinet makeover are the door panels. The ¼" plywood give the doors a finished look. They're cut to fit inside the folded frame of the door, as shown in Figure 11.

The doors on my cabinet have a pair of braces in the middle of each door. So, to support the panels, I cut a pair of cleats to match the thickness of the braces (Figure 11a). The panels and cleats are fixed in place with construction adhesive. Finally, to hang layout tools and other items on the panels, I installed small, metal L-hooks.

After a few coats of finish, the cabinet makeover is complete. And you can load it up with tools to get your shop organized.



dealing with Excess Glue



Learn some handy tips and tricks for dealing with glue squeezeout.

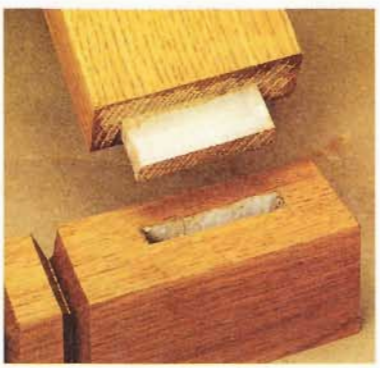
If there's one thing I've learned in woodworking, it's that glue squeezeout is inevitable. Since squeezeout is a necessary evil of woodworking, what's the best way to deal with it? Here are a few tips that will help you avoid the headaches during assembly.

BEFORE THE GLUE GOES ON

One way to deal with squeezeout is to protect the surface of the workpiece to make it easier to remove the glue later on.

Prefinishing. An effective way to do this is to prefinish the parts whenever possible before assembly, as you can see in the photo at left. After applying a stain and a topcoat of varnish or lacquer, any excess glue on the surface will just pop right off, leaving behind a glue-free surface.

Masking. Another technique to prevent glue from sticking to the surface is to head it off at the pass. You can do this by masking off the joint before assembly (top left photos on opposite page). I usually only do this in a hard-to-reach area like the inside of a cabinet. I'll apply the masking tape firmly along the joint line. After the glue begins to set up, it's an easy task to peel away the glue with the tape. For areas that are hard to mask or if prefinishing isn't an option, check out a product called *Waxilit* in the box below.



► ***Prefinish.*** *Apply finish to each part before glue-up and excess glue simply pops off.*

WHILE THE GLUE IS WET

When it's finally time to apply the glue to a project, there are a few things to consider.

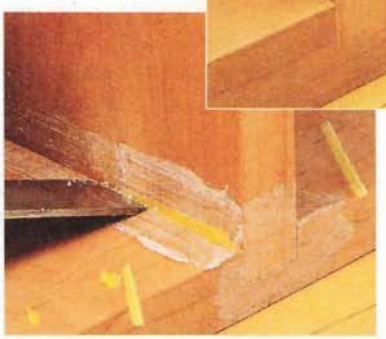
The Right Amount. Modern glues only need a thin film between the workpieces to work effectively. So the first step is to make sure the joint fits tight. Then when it comes time to apply the glue, the trick is to spread a thin, consistent film of glue evenly on the surfaces to be joined.

Avoid Water. To deal with any

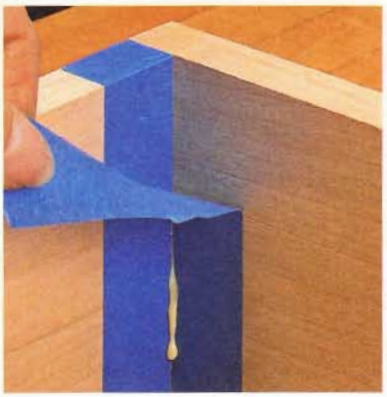
before gluing: Waxilit

To minimize the hassles of glue squeezeout, you can "pretreat" the joint with *Waxilit*. It's a wax-based material you use to mask off a joint and prevent excess glue from sticking. After the glue dries, it just pops off. Then, prior to applying a finish, remove the *Waxilit* with a solvent. For sources, turn to page 51.

▲ ***Brush On.*** *Waxilit's soft paste is easy to brush on to a joint that's been dry-assembled. It acts as a barrier against squeezeout.*



▲ ***Cleanup.*** *After the glue dries, simply pop off the excess then wipe off the Waxilit with a solvent for a clean surface (inset).*



▲ ***Mask & Peel.*** *Apply masking tape firmly along the joint line to help minimize cleanup. After the glue begins to set up and gel, carefully peel away the tape for a clean joint.*

▲ ***Scraping with the Grain.*** *When removing excess glue, scraping with the grain will help avoid tearout and require less sanding for a smooth surface.*

squeezeout, you may be tempted to use a damp or wet rag to wipe away any excess glue. But doing this causes a couple of problems. First, water will raise the grain of the wood (which means more sanding). But the bigger problem is that water can seep into the joint and weaken the glue bond.

Let It Gel. Now I use a different tactic and all it requires is a little patience. All you need to do is wait 20-30 minutes after applying the glue and assembling the joint. This gives most yellow woodworking glues time to gel, or "skin over." Then it's a simple matter to "slice" off the glue with a sharp chisel or scrape it off (main photo).

It's important to keep your tool clean as you do this. To prevent smearing the surrounding area with glue, I use a damp rag to wipe off the tool. And you'll want to be sure to scrape with the grain to avoid tearout, as you can see in the photos at the upper right.

AFTER THE GLUE IS DRY

After your project is assembled and sanded, you're almost ready to apply a finish. But first, there are a couple of things I do to make sure no dried glue escapes notice and spoils the finish.

Wipe-Down. One of the things you should do after sanding is wipe down your project with mineral spirits (paint thinner). This will highlight any spots of glue you may have missed, as shown in the left photo below.

Targeted Sanding. Sometimes the only way to remove a small glue spot is with some careful sanding. Start with a coarse grit to remove most of the glue, then work your way through finer grits to prepare the project for a finish.

For areas that are more than just a thin spot (like a dried bead of glue), you can use a product like *De-Glue Goo*, shown in the box at right. It softens the glue for easy removal with a scraper or chisel.

With all the sanding done, a final wipe with mineral spirits is in order. This is your last check to make sure all the glue is removed before the finish goes on.

Planning & Prep. When it comes to dealing with the inevitable excess glue during assembly, you'll find that a little planning and preparation goes a long way. The end result is less frustration and a project to be proud of.

removing Dried Glue

When I asked our shop craftsman how he deals with glue squeezout, he filled me in on a little secret. For dried beads of glue that he missed or couldn't get to right away, he uses *De-Glue Goo*. It's a gel product that "sticks" where it's applied. *De-Glue Goo* contains a weak acid solution that softens any dried, waterbased glue. After a few minutes, the glue turns white and is soft enough to easily scrape away. Turn to *Sources* on page 51 to find out where you can buy it.

▲ ***Finding Glue Spots.*** *Wiping down your project with paint thinner before you apply a finish will reveal hidden glue smears.*

◀ ***Dried Glue.*** *The weak acid solution in De-Glue Goo softens hardened glue.*

weekend project

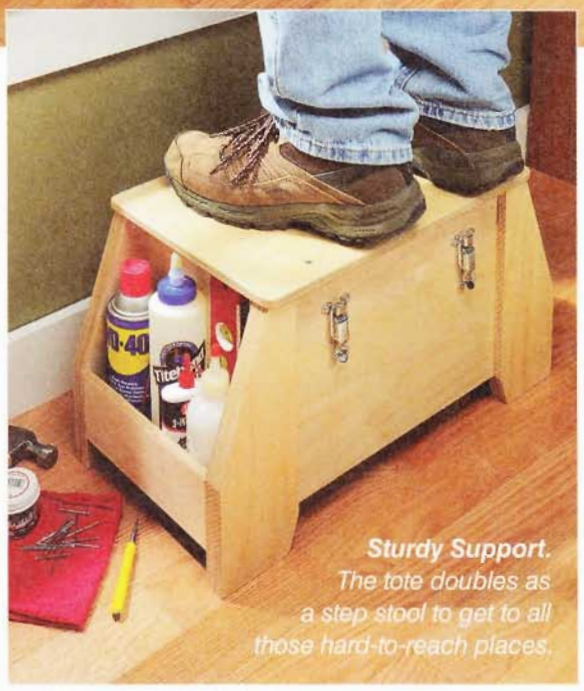
Utility Tool Tote

This combination tool tote and step stool is easy to build and a handy addition to any shop.

Working on a project in the shop is a breeze. All your tools are within easy reach. But what do you do if you need to take your tools outside the shop? A great solution is the tool tote shown in the photo above.

As you can see, this versatile tote has a lot of room for tools. And, with a sliding tray and a couple of "cubbies" for things like a glue bottle, a tape measure, or hardware, it really helps keep everything in order.

But that's not all it has to offer. Thanks to a wide, flat top and reinforced construction, the tool tote can also be used as a sturdy step stool for those times when



Sturdy Support. *The tote doubles as a step stool to get to all those hard-to-reach places.*

you need an extra few inches to get to those hard-to-reach areas.

FRONT & BACK ASSEMBLIES

The tool tote is a simple box with open cubbies to provide different storage options. Cutouts and tapers on the front and back allow easy access to all areas.

To make the tote, start by building two front and back assemblies. These assemblies are made up of front and back pieces with a set of legs and foot blocks added to lift the tote up off the floor. You'll cut the two tapers after assembly.

Front and Back. As you can see in Figure 1, the front and back are identical. After cutting them to size from ½" plywood, I went ahead and cut the joinery. The table saw makes quick work of this.

I used a dado blade to cut the dadoes for the dividers, which are added later. Then I switched to a regular saw blade and made a couple of passes to cut the grooves for the ¼" hardboard bottom.

Make the Cutouts. The front and back have a wide cutout at the top to provide easy access to the main storage area. To make these cuts straight and square, I followed a simple technique using the table saw and a router table. You can learn more about this in Shop Short Cuts on page 23.

Add the Legs & Foot Blocks. A look at Figure 2 shows how I added a second layer of plywood to the outside faces of the front and back panels. These are just pieces of ½" plywood that are glued on to form "legs." The legs raise the box off the floor, allowing it to be used as a convenient step stool (inset photo on previous page). And to reinforce the bottoms of the legs, I added four "foot" blocks (Figure 2).

Tapers. The next step is to cut the tapers on the two assemblies. They soften all the sharp angles. But more importantly, they help provide easy access to the cubbies on the ends of the box. After laying out the tapers according to Figure 2, you can cut them with a jig saw or band saw. Then, sand them smooth and square.

Bevel. To complete the front and back assemblies, there's one last step. And that's to cut a 15° bevel on the top outside edge of the back legs (Figure 2). These bevels provide clearance when opening and closing the top. Now you can work on the dividers and ends.

FIGURE 1

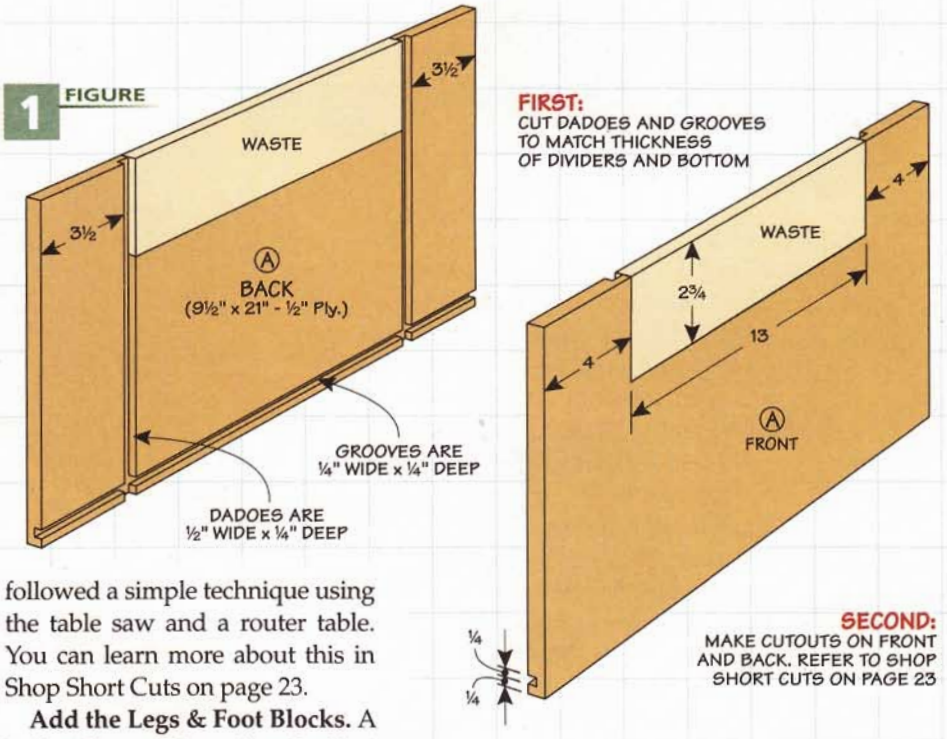
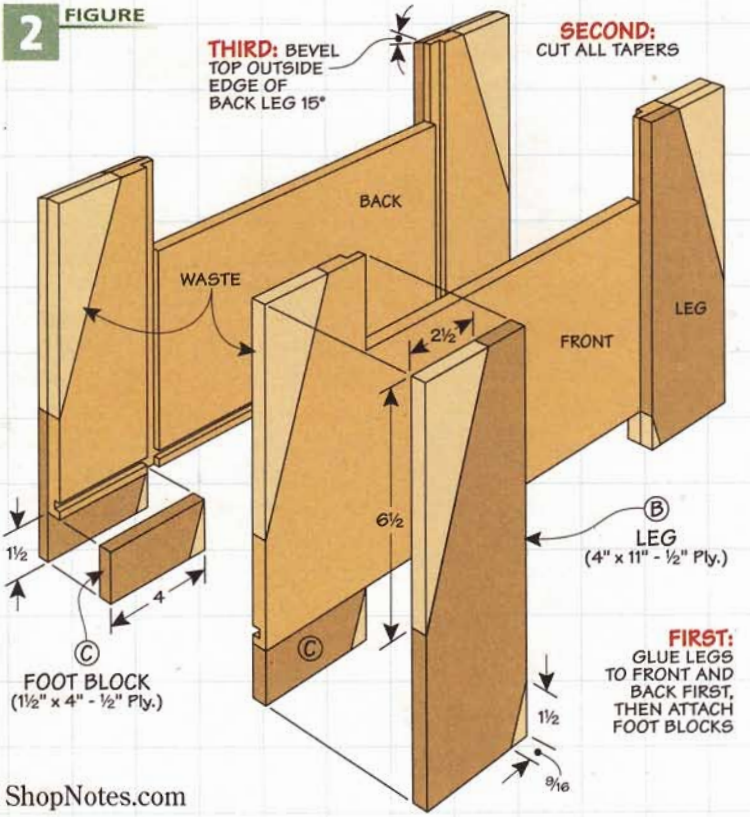


FIGURE 2



Materials & Hardware

A	Front/Back (2)	9½ x 21 - ½ Ply.
B	Legs (4)	4 x 11 - ½ Ply.
C	Foot Blocks (4)	1½ x 4 - ½ Ply.
D	Dividers (2)	9 x 9 - ½ Ply.
E	Cubby Ends (2)	3 x 8½ - ½ Ply.
F	Bottom (1)	9 x 20½ - ¼ Hdbd.
G	Caps (2)	¾ x 1½ - 13
H	Runners (2)	¼ x ½ - 13
I	Tray Sides (2)	⅜ x 2½ - 7⅞
J	Tray Ends (2)	⅜ x 2½ - 3⅝
K	Tray Bottom (1)	3⅝ x 7½ - ¼ Hdbd.
L	Top (1)	11 x 16½ - ½ Ply.
M	Handle Support (1)	½ x 1 - 6
N	Front Rail (1)	¾ x 2 - 12⅞
O	Back Rail (1)	¾ x 1 13/16 - 12⅞

- (1) 1½" x 13" Continuous Hinge w/Screws
- (2) 1⅝" x 2 9/16" Locking Draw Catches w/Screws

cubbies & cap

Assembly

With the front and back assemblies completed, you're ready to finish building the rest of the tote. To do this, you'll need to make a bottom, a pair of dividers, two cubby ends, and the top.

Bottom & Dividers. I started by cutting the ¼" hardboard bottom and ½" plywood dividers to size. The dividers fit in the dadoes you cut earlier and rest on top of the bottom (Figure 3).

Cubby Ends. Next, cut the cubby ends to final size from ½" plywood, adding grooves to match the ones cut earlier in the front and back. Once that's complete, it's time for some assembly.

Assembly. Figure 3 gives you an idea of how the tool tote goes together. I started by gluing the dividers and bottom into the dadoes and groove on the back. Then, I attached the cubby ends to the bottom and back with glue, adding clamps to hold them in place. Now all you need to do is fit the front assembly in place and clamp it up. After the glue dried, I used pieces of scrap plywood to plug the grooves, as shown in Figure 3.

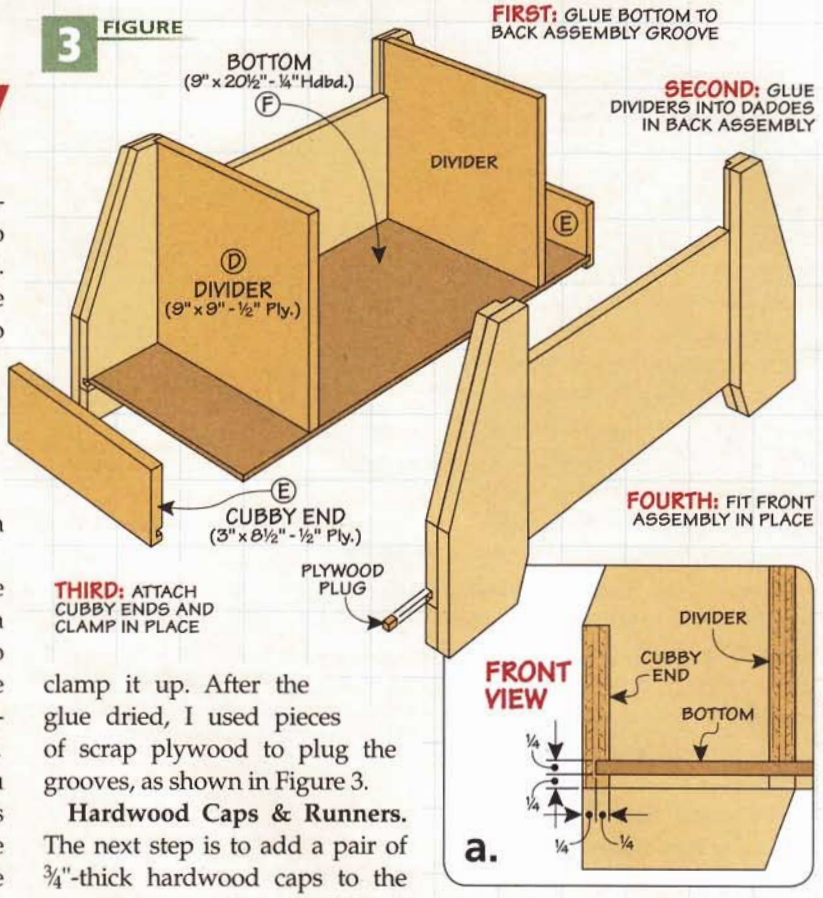
Hardwood Caps & Runners. The next step is to add a pair of ¾"-thick hardwood caps to the cutouts in the front and back assemblies. The caps hide the plywood edges and provide a solid surface for mounting the hinges and catches later. To make sure the outside faces of the caps fit flush with the front face, you'll need to rabbet one edge (Figures 4 and 4b). Since the rabbet is fairly wide, cutting them on a narrow workpiece can be difficult.

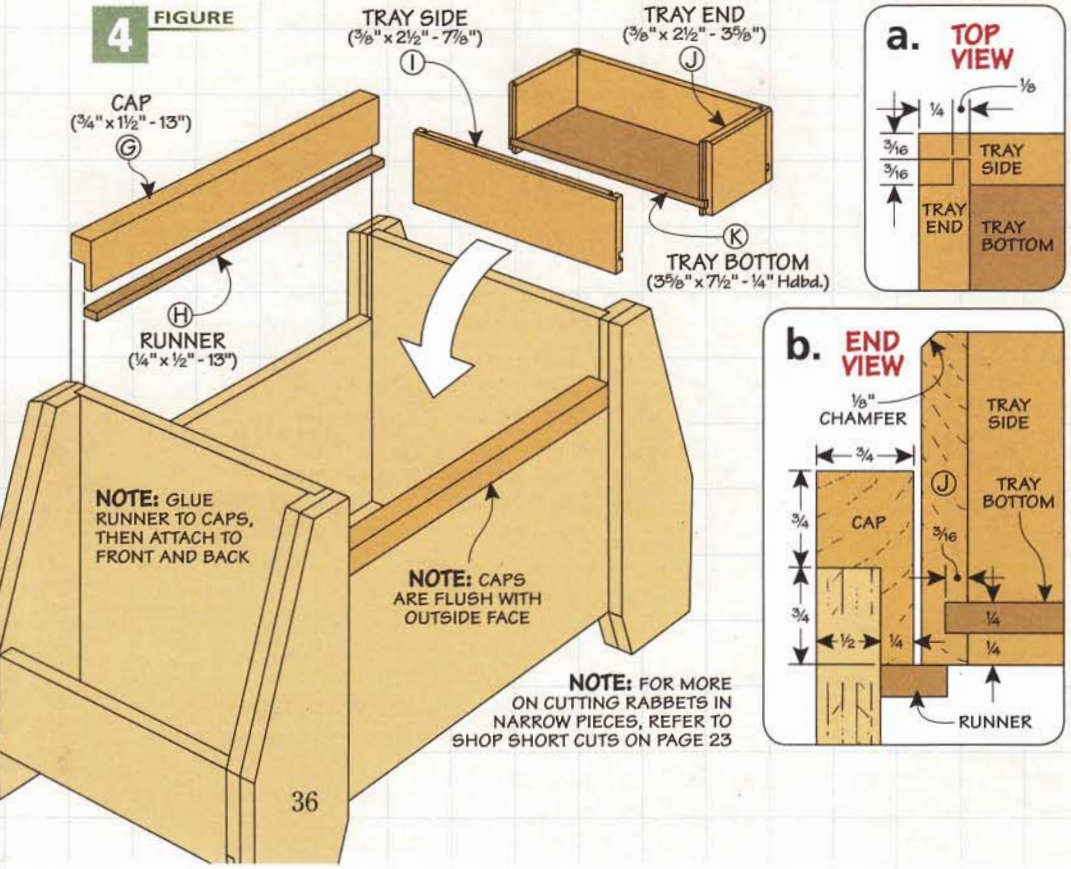
A better way to do this is to cut the rabbets on an extra-wide workpiece first. Then, you can safely rip the caps to width. To learn more about how to do this, check out Shop Short Cuts on page 23.

Once the caps are cut, you can add the hardwood runners that support the tray. Then, glue the caps in place (Figure 4).

Tray. While waiting for the glue to dry, you can build a tray to hold small items like a tape measure and pliers. It's assembled with simple tongue and dado joinery, as shown in Figures 4 and 4a. First, cut the tray ends and sides to size, then add the grooves for the ¼" hardboard bottom.

After assembling the tray with glue, rout a ⅛" chamfer around the top, outside edge. Later on, you'll see how these chamfers create a little extra room for the front rail.





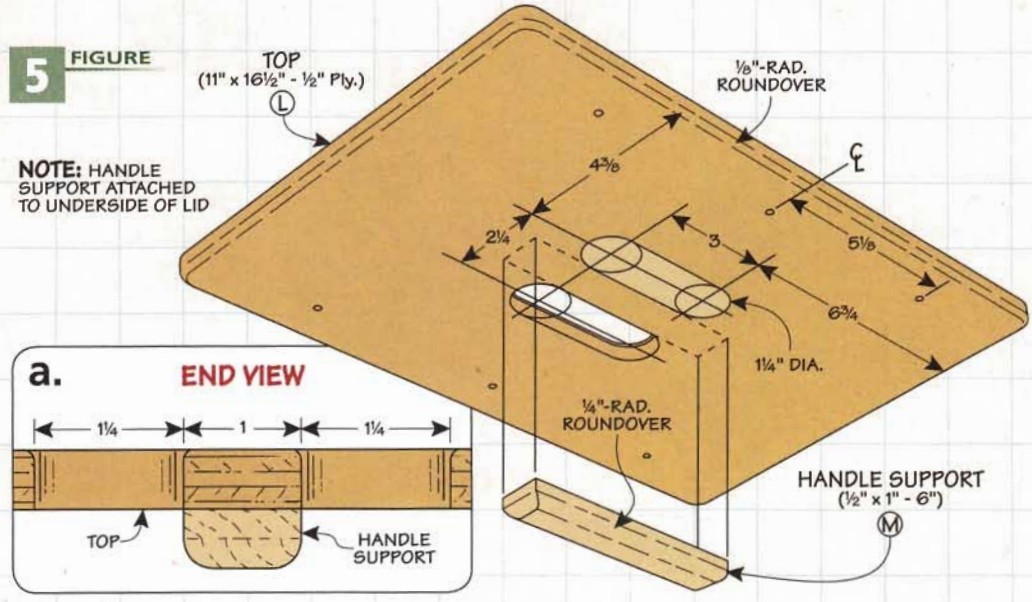
MAKE THE TOP

All that remains to complete the tote is to add the top assembly. This assembly serves three purposes. First, the top and rails enclose the tools inside the tote. It also provides a place for a convenient handhold. Most importantly though, by adding the rails, it acts as a sturdy step for the tote.

Top. The top is cut to size from a piece of ½" plywood. To ease all the sharp corners and edges, sand a small radius on each corner and round over the top and bottom outside edges.

Handhold. The handhold is created by cutting a couple of parallel slots in the top (Figure 5). To form each slot, simply drill two starter holes and remove the waste between them with a jig saw.

To reinforce the handhold and make it more comfortable, I added a small handle support on the underside of the top. After cutting the support to size, round over the bottom edges with sandpaper.



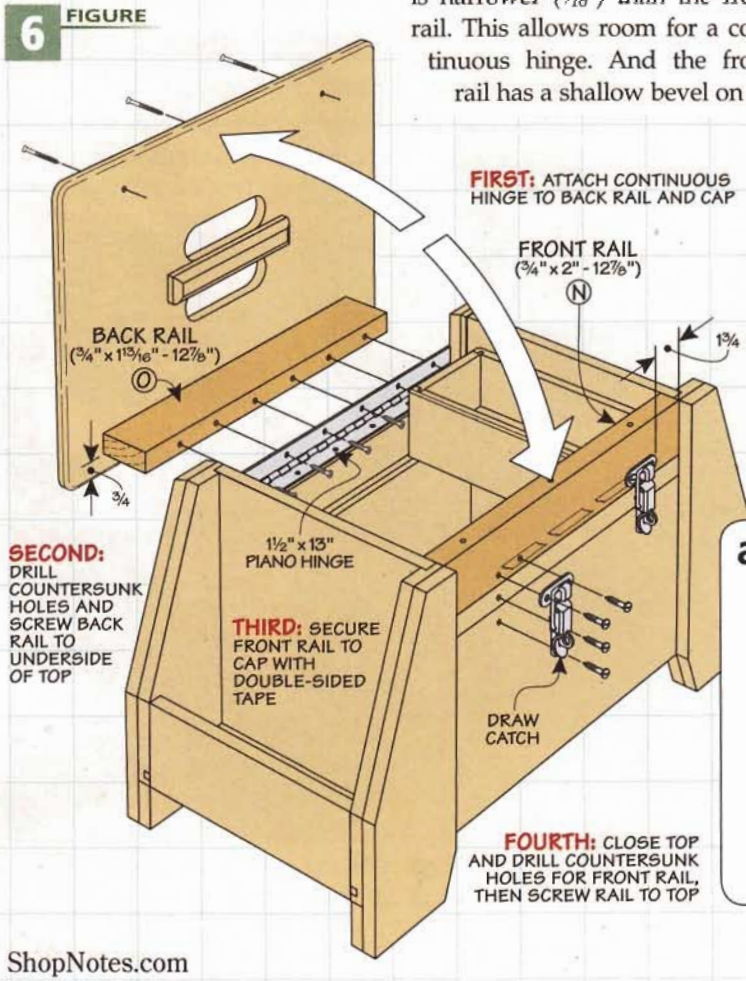
Then, glue the handle support in place on the underside of the lid, as shown in Figure 5. Finally, add a small roundover on the top edges of the handhold slots.

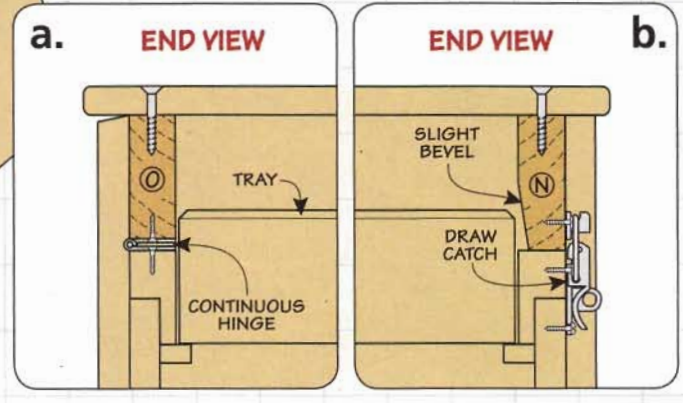
Rails. A pair of hardwood rails enclose the tool tote and reinforce the top. The first thing to do is cut the rails to size (Figure 6). You'll notice that the back rail *is narrower* (3/16") than the front rail. This allows room for a continuous hinge. And the front rail has a shallow bevel on its inside edge. Along with the chamfer on the tray, this bevel adds a little clearance so the lid opens and closes easily.

Install the Rails. When adding the rails, the goal is to align their outside faces with the outside faces of the caps. To do this, I added the hinge first. Then, I used the dimensions given in Figures 5 and 6 to drill countersunk holes for the screws used to attach the back rail to the underside of the top.

The next step is to set the front rail on top of the cap (Figure 6). Use strips of double-sided tape to hold the rail in place. This way, the rail won't move around while you drill countersunk holes. Then, you can screw the front rail to the top.

All that's left now to complete the tool tote is to add a pair of draw catches. Once the tote is filled with tools, you can get to work on all those projects around the house you've been putting off.





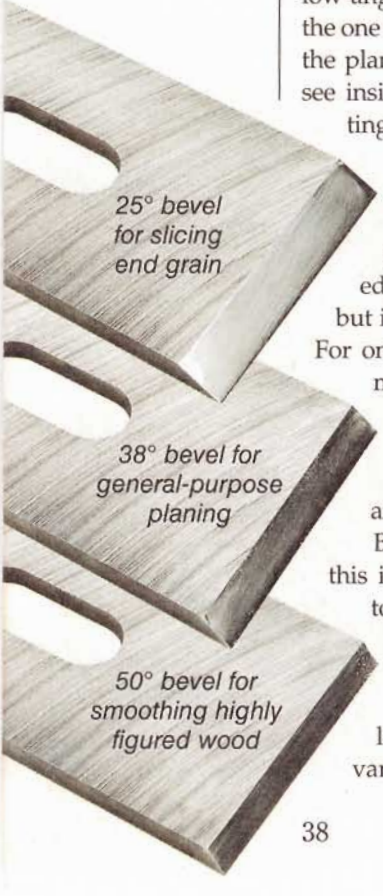
looking at Bevel-Up Planes

Find out how you can get better results with your hand plane by choosing the right bevel angle.

A hand plane is one tool I use on almost every project. The glass-smooth surface left by a sharp hand plane can't be beat. And while a traditional-style plane suits most tasks, I've recently come to appreciate the advantages of a low-angle, "bevel-up" plane, like the one you see above. (The side of the plane is cut away so you can see inside.) It's all about the cutting angle of the blade.

Most traditional planes have a cutting angle fixed at about 45°. This works great for straightening an edge and some smoothing, but it does have its limitations. For one, this high cutting angle makes it difficult to slice through end grain. And there's no convenient way to change the cutting angle to suit other tasks.

But with a bevel-up plane, this isn't a big deal. Switching to a different cutting angle simply means changing out the blade. As you can see in the photos at left, purchasing blades with various bevel angles means you can turn your bevel-up plane into a multipurpose tool.

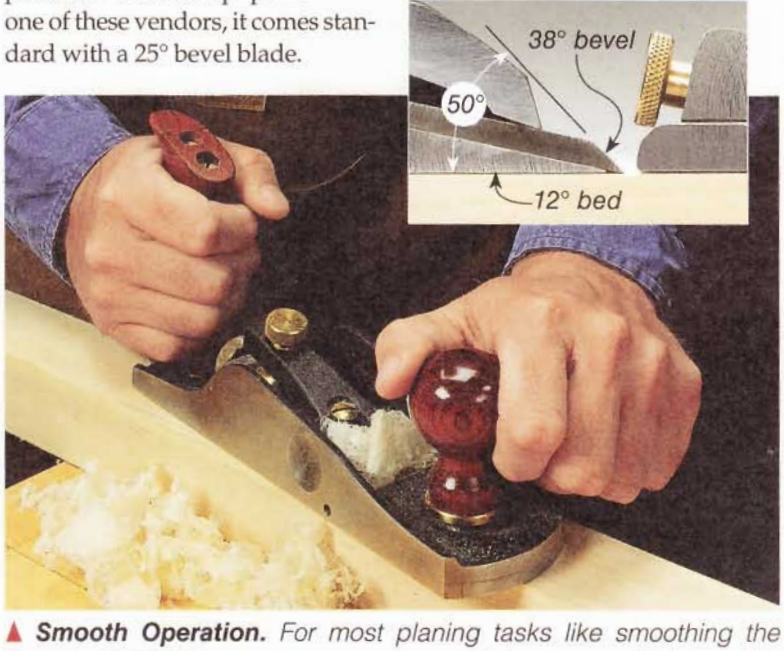


You can grind your own spare blades, or woodworking suppliers like *Lie-Nielsen* and *Hock Tools* will custom grind blades to fit your planes. *Lee Valley* makes blades available for their planes with the three bevel angles shown at left (refer to Sources on page 51). If you purchase a bevel-up plane from one of these vendors, it comes standard with a 25° bevel blade.

The key to getting the most out of your bevel-up plane is knowing which bevel angle is best suited for the job at hand.

GENERAL-PURPOSE PLANING

When I'm building a project, I use a hand plane to remove machining marks left by my table saw, jointer, or planer. This means that every



▲ ***Smooth Operation.*** *For most planing tasks like smoothing the faces or edges of a workpiece, a 38° bevel does a good job.*

visible face on the completed project is touched by a hand plane.

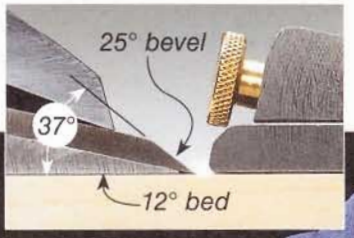
For these tasks, a 38° bevel angle (combined with the 12° bed angle) most closely matches the cutting angle of a traditional plane I most often used. As you can see on the previous page, this angle is perfect for working the edges and faces of a workpiece. And for panel glue-ups (like a tabletop or door panel), a 38° bevel angle will handle minor changes in grain direction without causing tearout.

DEALING WITH END GRAIN

Any time you're working on end grain, it's time to swap out the blade for one with a lower bevel angle. Slicing through end grain can be a challenge and it requires a very sharp blade to get good results.

For this job, I use a blade with a 25° bevel, like you see in the inset photo below. This blade acts like a knife to shear through end grain with the least effort. Since you're shearing the wood fibers cleanly, the resulting surface requires no sanding. And, as you can see below, it's great for fine-tuning miters for a gap-free fit using a shooting board.

Like I said before, most bevel-up planes are supplied with a 25° bevel blade. I use it for most planing tasks without any problems. But when you start to experience tearout, it's time to step up to a blade with a higher bevel angle.



▲ **Perfect Miters.** *An iron ground with a 25° bevel is ideal for shaving the end grain of a workpiece to fine-tune a joint.*

REDUCING TEAROUT

Nothing dresses up a project more than incorporating wood with interesting figure, as you can see in the photo at right. The challenge is getting a smooth surface on the workpiece. Using a blade in your hand plane with a low bevel angle can cause tearout, as you can see in the lower photo at right.

With wild or highly figured wood, a higher cutting angle will give you better results. This is when I switch to a blade with a 50° bevel. This angle makes the cutting edge act more like a conventional card scraper or scraper plane. At this high angle, the wood is less likely to be wedged or split by the blade which is what causes tearout.

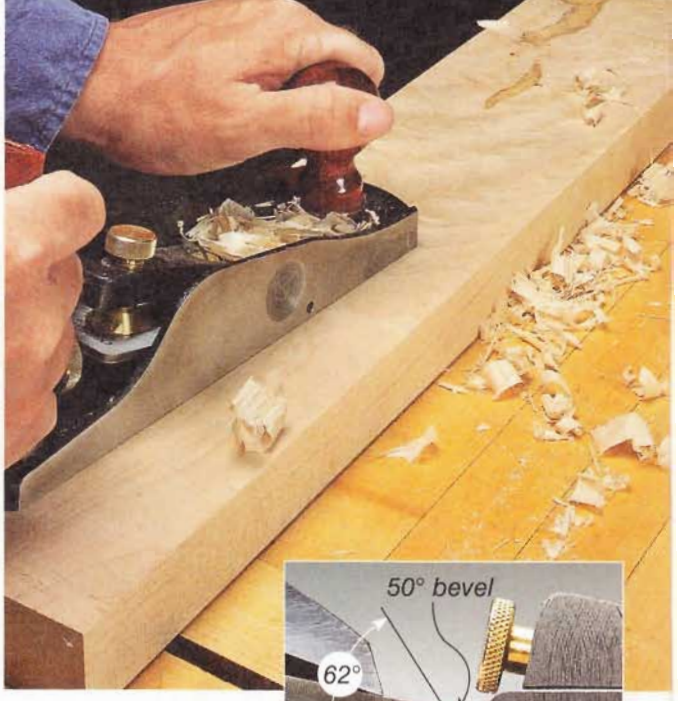
The key to getting a smooth surface on a workpiece with changing direction is to use a freshly sharpened blade set to take a very thin shaving. If you still experience some tearout, you can try planing from another direction.

VERSATILITY

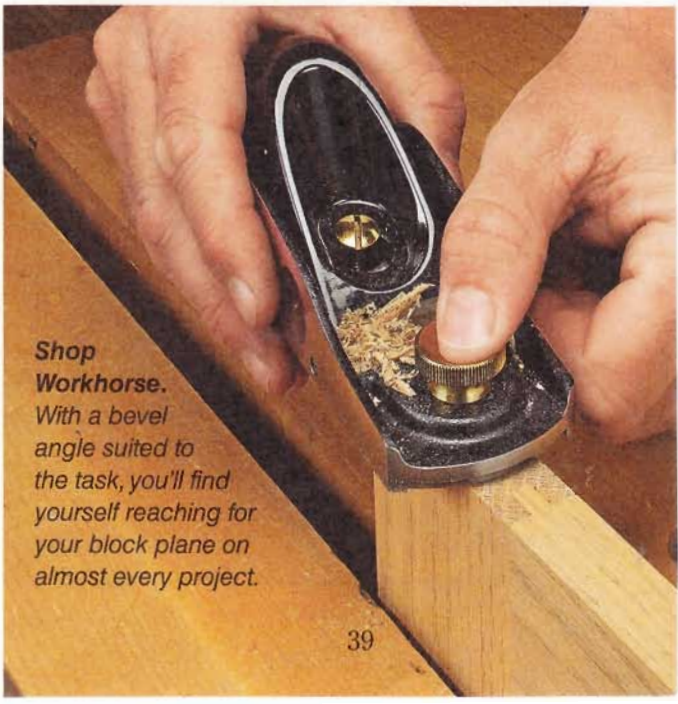
A bevel-up bench plane is a great tool to have on hand. It's easy to use and adjust. And owning multiple blades with different bevel angles will make it one of the most versatile tools you'll own.

Plus, there's more good news. You can get the same benefits with your block plane. Since it's also a bevel-up plane, you can switch the blade to one with a bevel angle that suits the task (photo below). It's great for working on small workpieces or for those tasks that are too cumbersome to tackle with a larger plane.

All it takes is a small investment in additional blades to turn your plane into your go-to tool.



▲ **No Tearout.** *A low cutting angle may produce tearout (lower photo). Switching to a higher bevel angle (50°) yields smoother results.*



Shop Workhorse. *With a bevel angle suited to the task, you'll find yourself reaching for your block plane on almost every project.*

2 shop-built Layout Gauges

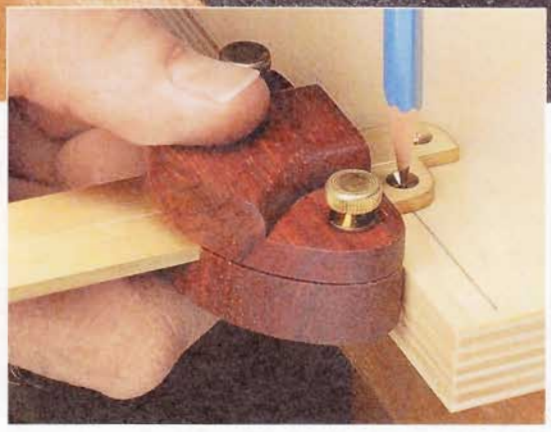
Exotic wood and polished brass come together in a pair of handy layout tools.

Layout is one of the first tasks in any woodworking project. The two shop-made layout gauges you see in the photo above can help make that task easier and more accurate.

The two gauges work as a team to handle both straight and curved layout work (photos at right). The pencil point fits into small countersunk holes in the end of each adjustable brass bar for making quick, accurate layouts.

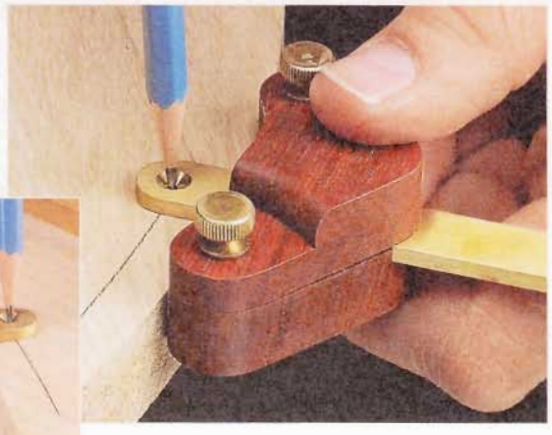
They're a great way to use up small pieces of scrap you just couldn't throw away. Plus, you can start on them in the morning and be using them on a new project in the afternoon.

Layers & Small Parts. Each gauge consists of a top that attaches to a body with a pair of brass thumbscrews. You can see how things fit together in Figure 2 on page 43. The thumbscrews fit into



◄ ***Straight Lines.*** *Adjust the gauge bar, then set the tip of your pencil in place to draw even layout lines quickly and easily along any straight edge.*

► ***Curves.*** *Easily follow an outside curve (right) or a changing inside curve (inset).*



threaded inserts installed in the body and pinch the brass gauge bars to lock in your measurement. Adding a cap to each of the tops provides a finished look.

Oversized Blanks. Because all these pieces are rather small to work with safely, it's best to start with oversized blanks. This way, you can complete most of the tasks on workpieces that are easier and safer to manage. Plus, it makes it easy to build both gauges at the same time (Figure 1).

Patterns. Once you have the blanks sized, the next step is to lay out the location of the holes for the threaded inserts, the dadoes for the gauge bars, and the overall shape of each of the pieces. An easy way to do this is to use the patterns shown at right.

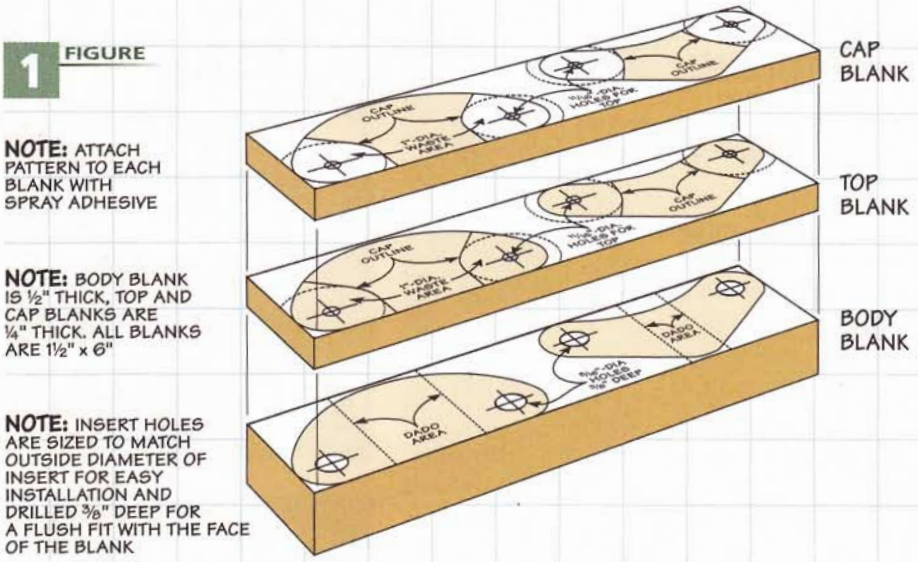
You'll need two of the lower right pattern, one for the top blank, and a second one for the cap blank. Spray adhesive makes quick work of attaching the patterns.

Identical Drilling. Even with the patterns, drilling the holes identically in mating pieces can be a challenge. To ensure accurate and consistent alignment, I used my drill press fence and positioned a stop block to drill the first stopped hole for the insert hole at the outer edge (lower left photo).

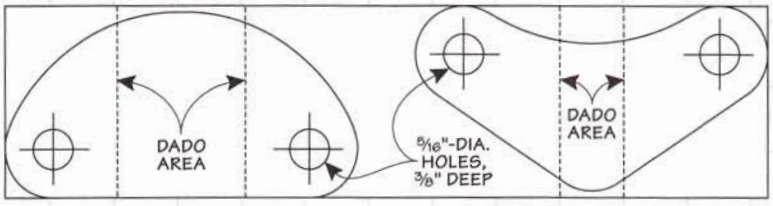
To drill the hole for the other insert, just slip in a spacer (center photo below). Then, simply repeat the steps to drill the holes for the inserts at the opposite end of the blank. After swapping out drill bits, you can use the same steps to drill mating holes in the top blank.

This procedure keeps the top aligned with the body for final shaping. And you can rest assured that the top and body will stay aligned during use. You can use this same setup later to begin shaping the caps, so don't make any changes. For now, you can turn the page and focus your attention on cutting the dadoes for the brass gauge bars.

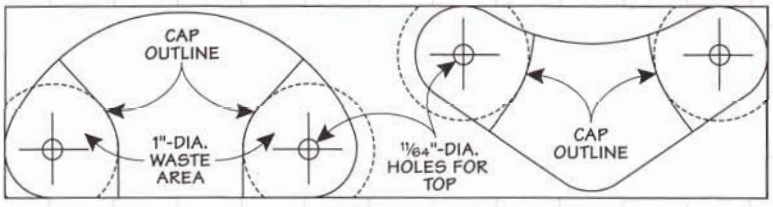
1 FIGURE



NOTE: Enlarge patterns to 150%



◀ ***Body Blank.*** *Use this pattern to locate the holes for the inserts and the dadoes for the brass bars.*



◀ ***Top/Cap Blanks.*** *This pattern guides the work on both the top and cap blanks, along with final shaping.*

▲ ***Setup.*** *After setting the fence and stop, drill the stopped hole at the outside edge of the body blank for the threaded insert.*

▲ ***Reposition.*** *A 2" spacer repositions the blank for the other insert hole. Repeat the procedure for the other end of the blank.*

▲ ***Top Holes.*** *Use the same setup to drill perfectly aligned holes for the thumbscrews that hold the top in place.*

completing the
Gauges

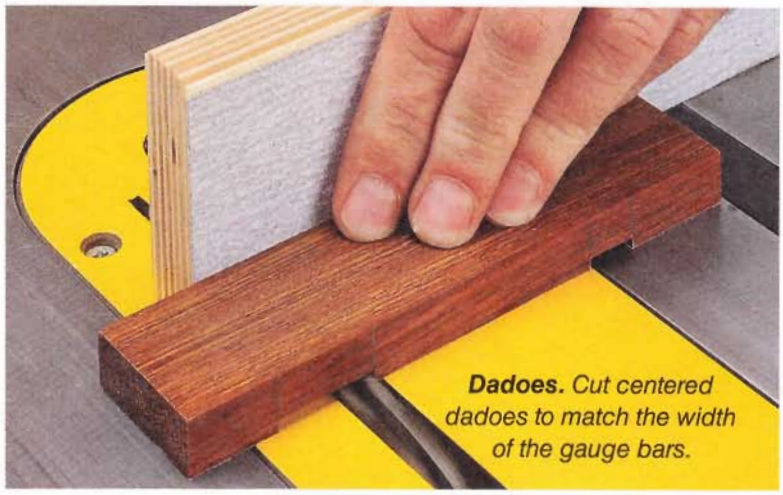
Locating the holes in each blank is the most critical part of building the layout gauges. With that step complete, you can start on the last few steps: creating dadoes for the brass gauge bars, adding a cap to the top, and final shaping.

Cutting the Dadoes. The brass gauge bars used to guide a pencil during layout work fit into dadoes cut into the body of each gauge. As you can see in the upper photo, I used a dado blade in the table saw to cut these shallow dadoes.

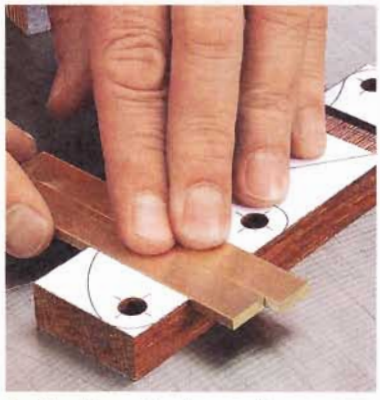
The goal here is a smooth, sliding fit. So before you cut the dadoes, be sure to have your brass bar stock in hand. This way, you can check the width of the dado and sneak up on a perfect fit, like you see in the photo at right.

You'll also want to make sure that the dadoes are shallow enough so that the bars stick up above the surface slightly (about $\frac{1}{32}$"). This way, when the knobs are tightened, the top pinches the bars to lock them in position.

Each dado is centered between the two holes you drilled earlier for the threaded inserts. You don't need to be perfect here, it won't affect the use of the gauge. Just be sure to size the dado for the straightline gauge to accept two bars. You'll only need to cut a dado for a single bar in the body of the curved gauge. The two bars in the straightline gauge allow you to keep a pair of commonly used measurements always at the ready or use the gauge for laying out a mortise or groove along the edge of a workpiece.



Dadoes. *Cut centered dadoes to match the width of the gauge bars.*



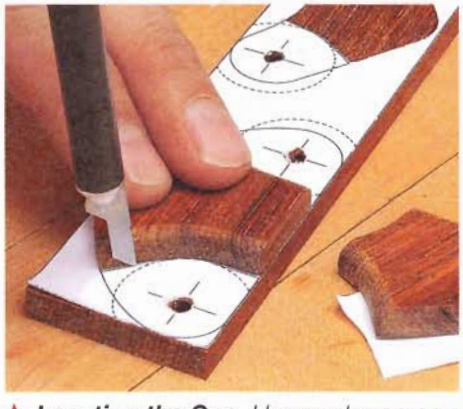
▲ ***Shallow Dadoes.*** *The gauge bars should project slightly above the dado and slide smoothly.*

▲ ***Install the Inserts.*** *Use epoxy to secure the threaded inserts in the stopped holes in the body.*

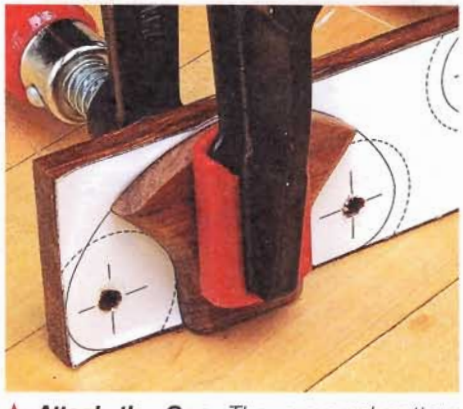
Install the Inserts. With the dadoes complete, you're ready to install the threaded inserts. When I drilled the holes for the inserts, I sized them to match the *outside* diameter of the threads. This way, installing them won't crack the body. But you will need to use epoxy to hold them in place (lower right photo above).

Shaping the Caps. While the epoxy sets, you can work on the caps. They're added to each top to provide a finished look to the gauge. Plus, it makes each gauge

▲ ***Shape the Cap.*** *Form the inside radius of the cap first, then trim the remaining waste away at the band saw.*

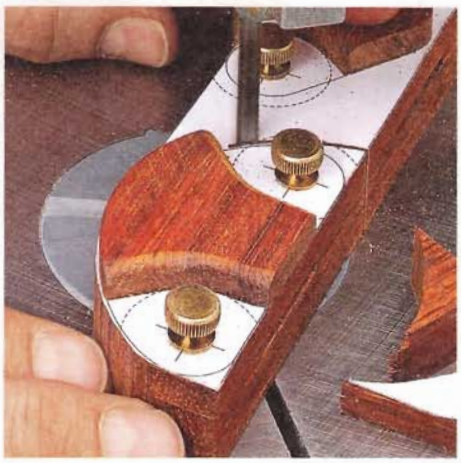


▲ ***Locating the Cap.*** *Use each cap as a guide to score the pattern, then remove those pattern pieces from the top.*



▲ ***Attach the Cap.*** *The removed pattern provides a reference for gluing and clamping the cap in the correct location.*

▲ ***Assemble the Blanks.*** *Join the top plate (and caps) to the body blank using the knurled brass thumbscrews.*



▲ ***Shape the Gauges.*** *Using the pattern as a guide, trim each gauge to rough shape at the band saw.*

▲ ***Final Shaping.*** *All it takes is a few minutes of sanding to complete the final shaping and smoothing of each gauge.*

more comfortable to hold during use. Although you could head straight to the band saw and cut each cap to final shape I started with my drill press.

Using the same setup as before, drill out the inside curved edge of each cap (lower left photo on the opposite page). This way, you only had to make a couple easy straight cuts to complete the inside curves. After cutting the outside edges to final shape, sand a small roundover on the top, inside edge of each cap to provide a little finger clearance.

Attach Cap. With the caps shaped, they're ready to be attached to the top blank. To make it easy to align the caps and glue them in place, I removed some of the paper pattern on the top. You can see how I did this in the center and right photos at the bottom of the opposite page.

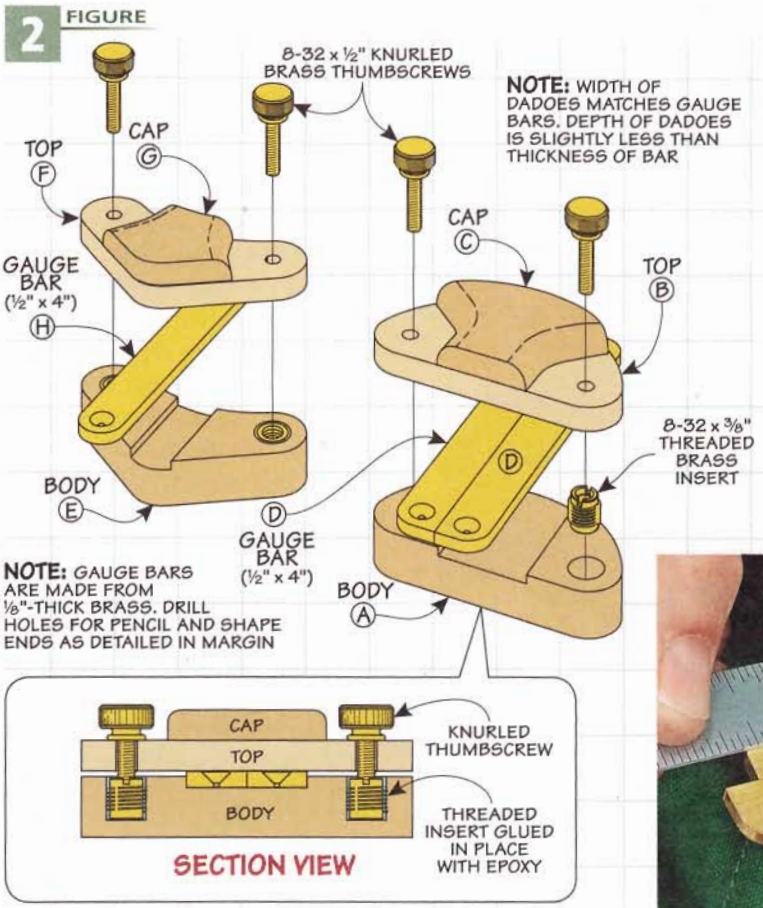
Final Shaping. Your next task is to make sure the outside shape of each gauge is smooth and even. For this, you can set the top blank in place and use the knobs to secure it to the body, as shown in the photo at the upper left.

Now all you need to do is a little work at the band saw to remove most of the waste (center photo above). Then, some hand sanding takes care of smoothing out the final shape (upper right photo). Once this is done, remove the rest of the pattern. Any adhesive residue can be wiped off with a rag and some lacquer thinner.

Brass Gauge Bars. The layout gauges are really coming together at this point, but you still need a way to accurately guide the pencil during use. For that, you'll need to make a set of brass gauge bars. You'll find all the information for making them in Figure 2 and the margin drawing at right.

To "trap" the pencil in the gauge bar during use, I drilled some small holes near the ends of each bar. The bars for the straightline gauge have a single hole at one end, but you'll need to drill a hole at each end of the bar for the curved gauge. To complete the bars, I drilled countersinks for clearance around each hole and then rounded the ends with a file.

After completing the layout gauges, you'll find they're easy to set up (lower right photo). So don't be surprised if they end up being a couple of layout tools you reach for every day.



NOTE: FILE A FULL RADIUS ON ENDS OF CURVE GAUGE AND DRILL PENCIL HOLES AT BOTH ENDS

▼ ***Easy Setup.*** *To set a layout gauge, rest a ruler against the body and adjust a gauge bar to match the desired measurement.*

saw blade Storage

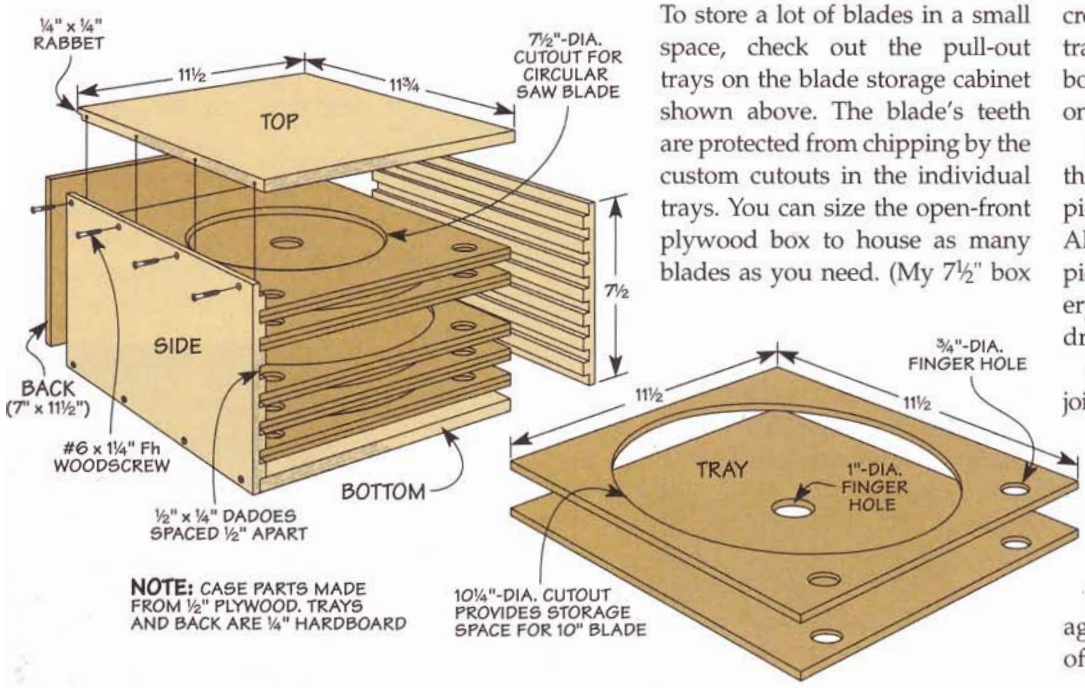
Here are three storage systems that protect your saw blades while keeping them well organized.

If you take good care of your saw blades, they'll take good care of you. The best way to ensure that your blades last a long time is to always store them in a safe place when they're not being used.

The three storage racks shown here offer a lot of protection against dings and nicks. Plus, the construction techniques used to build them are simple enough to complete in a weekend. And they all do two things really well — they keep your saw blades organized, while they stay well protected.

STORAGE CABINET

To store a lot of blades in a small space, check out the pull-out trays on the blade storage cabinet shown above. The blade's teeth are protected from chipping by the custom cutouts in the individual trays. You can size the open-front plywood box to house as many blades as you need. (My 7½" box holds six saw blades, as shown in the photo above.)



Make the Box. To determine the height of your box, allow 1" for each blade plus an additional 1½" for joinery and spacing. Then, cut a series of ½"-wide dadoes spaced ½" apart in the sides. These dadoes create the slots to hold the sliding trays. And to accept the top and bottom of the box, rabbets are cut on the ends of the sides.

The last step is to cut a rabbet on the back edges of the four workpieces for the back of the cabinet. All of the dimensions for these pieces and the details on the joinery techniques are shown in the drawing at left.

Assemble the Box. With the joinery complete, you can assemble the storage box. The box is held together with glue and screws. Once that's done, you can get started on making the trays that hold each saw blade.

Hardboard Trays. Each storage tray is made from two layers of ¼" hardboard, as you can see

in the drawing on the opposite page. A cutout in the top layer is used to hold the blade. The easiest way to make the cutout is to use a circle-cutting jig and a hand-held router. Size the holes on the trays slightly larger than the saw blade. This makes it easier to remove the blade from the tray. Note: In addition to making cutouts for your table saw blades, you could also made a tray or two for circular saw blades.

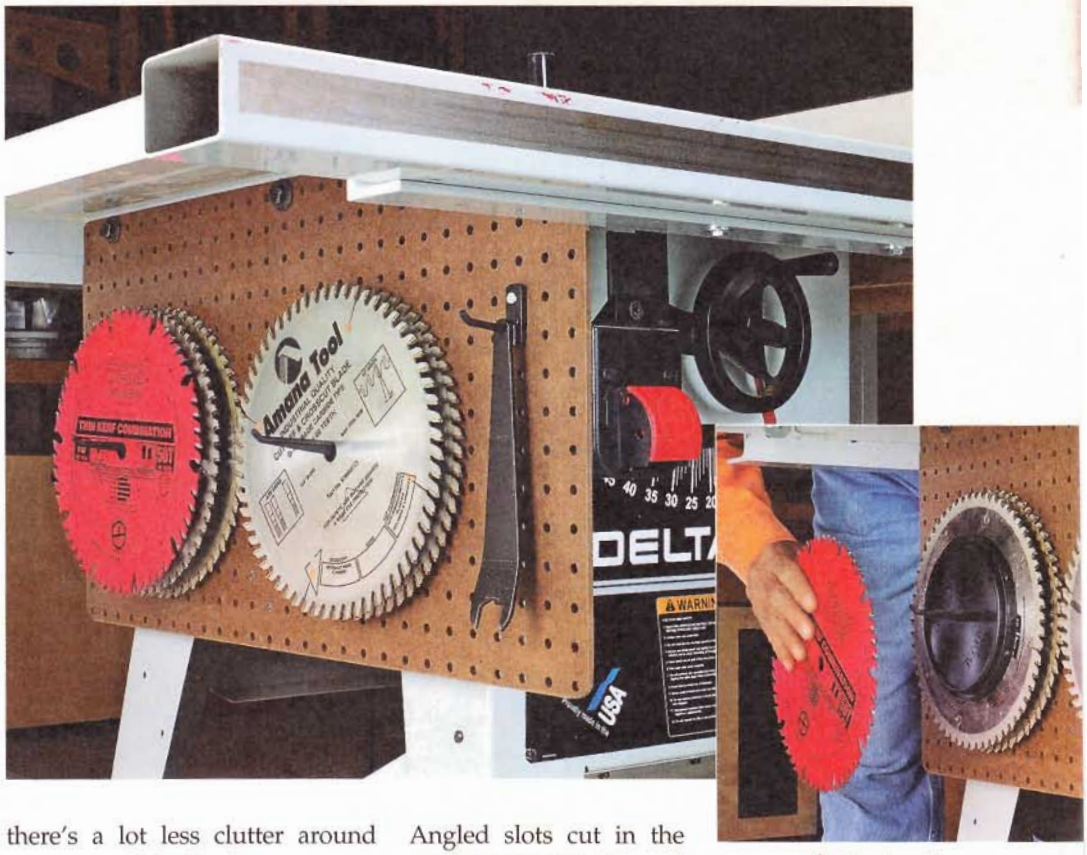
Once the top layer is completed, you can glue the bottom layer to it. When the glue dries, drill a 1"-dia. hole in the center of the bottom layer. This hole is used to remove the blade from of the tray. Two ¾"-dia. finger holes, drilled at the front edge of each tray, make it easy to slide the tray out of the box.

PEGBOARD STORAGE

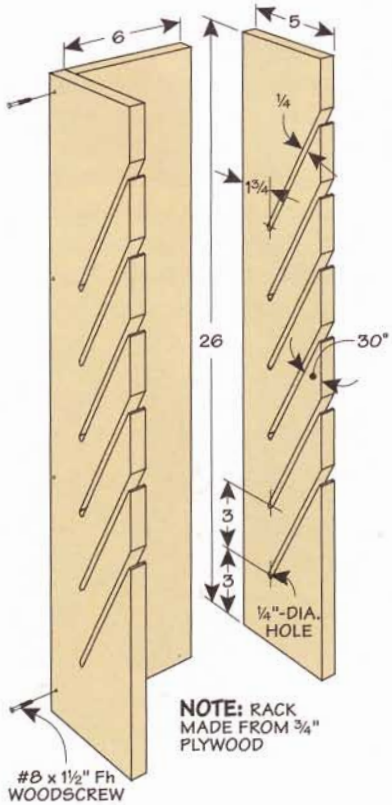
For blade storage right by my saw, I came up with a simple solution. As you can see in the photo above, I placed a panel directly under the wing of my table saw. This way, there's a lot less clutter around my saw and the blades are always within easy reach. I was also able to make room on the panel for a hook to hold my blade wrench.

This simple storage panel is just a small section of ¼" pegboard that's held in place using the same bolts that attach the wing to the table. The panel has plenty of space for two sets of blades. Each set hangs from a heavy-duty plastic hook (I limited the number of blades on each hook to three).

To avoid chipping the carbide tips on the blades when I hang them up, I keep them separated with a plastic lid, as you can see in the inset photo above right.



▲ ***Protection.*** *Plastic lids separate the blades and keep the carbide tips from being damaged.*



STORAGE RACK

The best storage systems make it easy to choose the right blade for any situation. The plywood storage rack, shown in the photo at right, does just that. It works as a kind of filing system for your saw blades and lets you identify and access any blade quickly and easily. Best of all, it keeps your blades from banging into one another, and chipping their teeth.

The rack consists of two sides and a back that form a "U" shape, as shown in the drawing at left. Angled slots cut in the sides hold the blades and make it easy to see exactly which blade you're choosing.

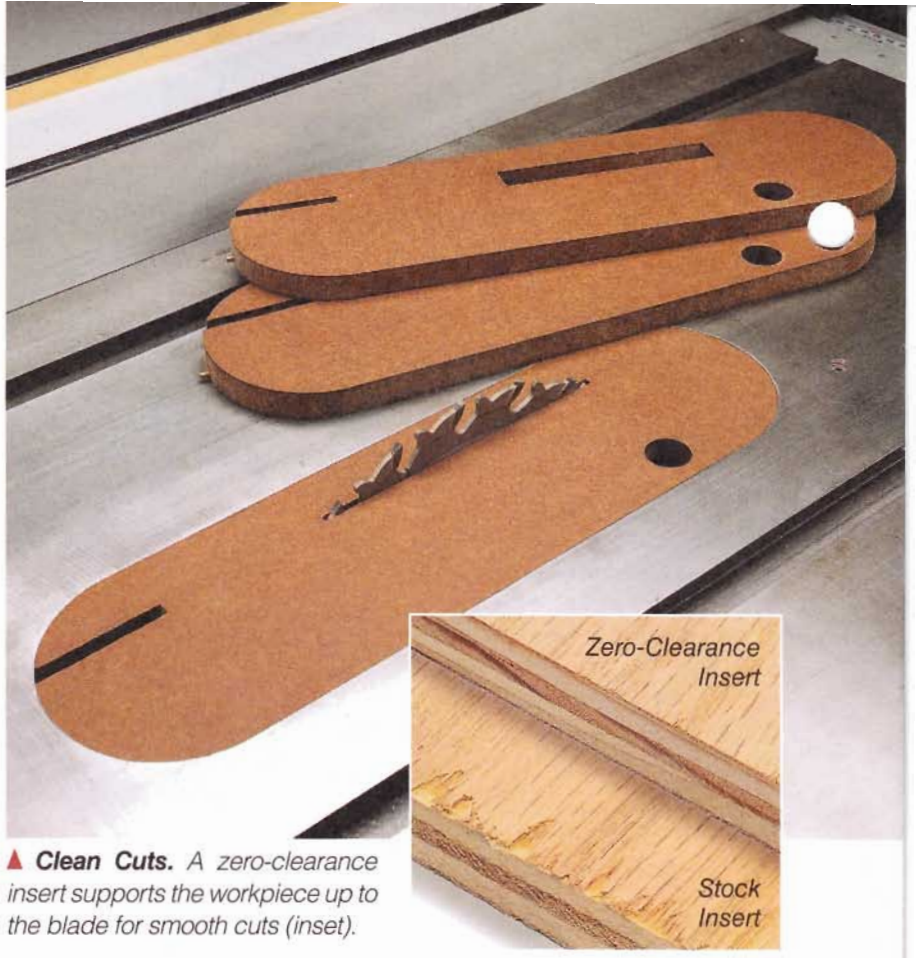
The only tricky part is getting the slots to match up. To do this, first join the sides with double-sided tape. After marking the slots on one piece, drill a hole to locate the end of each slot. Then cut the slots with a jig saw or band saw. Finally, attach the sides to the back with glue and screws and hang the rack on the wall near your saw.

Take the time to build a blade storage rack for your shop — the results will be worth the effort.

◀ ***Angled Slots.*** *Storing your blades at an angle keeps them separated and in plain sight, making it easy to choose the correct blade.*

making a Throat Insert

All it takes is an afternoon to make a set of zero-clearance inserts and get cleaner table saw cuts.



▲ ***Clean Cuts.*** *A zero-clearance insert supports the workpiece up to the blade for smooth cuts (inset).*

I rely on my table saw for everything from crosscutting and ripping boards to cutting joinery like dadoes and rabbets. No matter what the operation is, a clean, splinter-free cut is a must.

The trouble is even if your saw is tuned up, you can still end up with a ragged edge, as in the inset photo above. Thankfully, the solution is simple and inexpensive — a shop-made, zero-clearance insert.

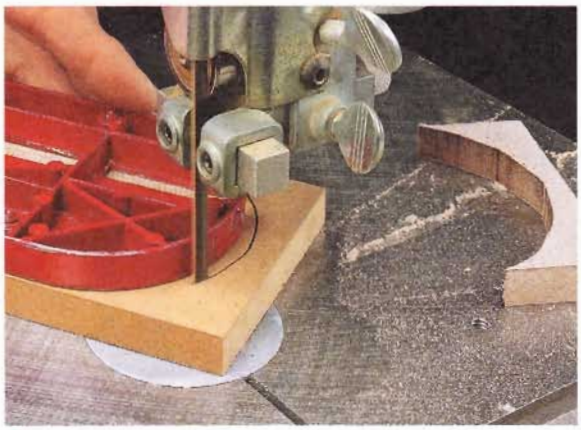
How it Works. The reason you get better cuts with a zero-clearance insert is shown in the main photo above. You can see that the opening in the insert exactly matches the thickness of the blade. This fully supports the workpiece as it's cut so fibers can't tear away.

Make or Buy. I bought my first zero-clearance insert at a cost of $10. And right away, I saw a dramatic improvement in the quality of my cuts. But I quickly realized that just one insert wasn't enough — I needed a set. That's because an insert is fit to a specific blade. If you switch to a thin-kerf blade or change the size of your dado blade, the benefits would be lost. Since buying several inserts can add up, I started making my own instead.

Simple Process. Making a zero-clearance insert is a pretty simple task. The photos you see here give you a good overview of the process. It starts with an oversized blank and then you fine-tune it to match the opening in your saw.

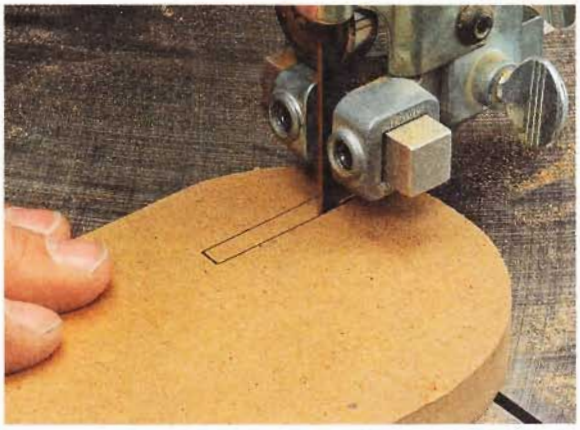
Cutting the Blank. The first step in making the insert is to cut

▲ ***Cut to Width.*** *Start making the insert by cutting a blank to match the width of the throat opening.*



▲ ***Rough Cut Ends.*** *Attach the stock insert with double-sided tape to the blank. Then remove most of the waste at the band saw.*

▲ ***Trim It Flush.*** *Using the insert as a template, trim the new insert to size at the router table.*



▲ **Blade Guard.** *When making a set of generic inserts, I cut out a notch for the blade guard and splitter even though it may not be used.*

▲ **Relief Cut.** *The blade on some saws won't retract far enough into the saw for the insert to sit flush. Use a dado blade to create a relief area in the bottom.*

the blank to width. I use ½" MDF because it's inexpensive, flat, and easy to work with. I aim for an easy slip fit in the opening with no side-to-side play (lower left photo on the opposite page).

By the way, I usually make several inserts at a time. Then I always have one on hand.

With the blank cut to the final width and rough length, I attach the stock insert with double-sided tape. The stock insert will act as a template for the next few steps.

Cutting the rounded ends is a two-step process. The first step takes place over at the band saw, as you can see in the center photo on the bottom of the opposite page. Follow the curve of the stock insert and cut away most of the waste.

Trim the Blank. The second step is to trim the blank flush with the template. It's a quick job at the router table (lower right photo on the opposite page). But you want to skip around the retaining pin and the notch for the blade guard. I sand these bumps away later.

Add Details. At this point, you can add a few details. The first is to drill a ¾"-dia. finger hole to make the insert easy to remove.

Then I cut a notch to accommodate the blade guard. This isn't needed for every insert (dadoes, for example), but since I'm just making generic inserts, it saves some hassle down the road.

Another detail to add is a retainer to keep the insert from lifting out during use. Use the stock insert as a guide for making your own. You can see two options at right.

In addition to a secure fit, the insert should be flush with the saw table. If it isn't, take a look at the box below for some solutions.

Starter Kerf. The last detail to add is a wide kerf in the bottom face (right photo above). This provides clearance for some saw blades that won't retract enough for an uncut insert to rest in the opening. Then, to create the blade kerf, clamp a board across the insert to hold it in place. Finally, turn on the saw and slowly raise the blade.

After a few coats of finish, you're ready to take advantage of this low-cost upgrade.

▲ **Hold-Down.** *A washer or cut-off screw lock down the back edge of the insert in the saw table.*

tips for a Flush Fit

A zero-clearance insert should be perfectly flush with the saw table. If it's proud, a workpiece will catch on the edge. A recessed insert can lead to dadoes, grooves and rabbets with an inconsistent depth. And the workpiece can catch on the back edge of the opening.

Proud. For an insert that's proud, you can rabbet the edge of the insert at the router table. Routing the rabbet in a couple of passes allows you to sneak up on a flush fit, as shown in the left photo.

Recessed. To level an insert that sits too low, check out the far right photo. A set screw installed in each corner lets you adjust the insert until it's flush.

▲ **Thin Edges.** *The insert plates on some table saws are thinner than ½". Use a rabbeting bit in the router table to create a thin lip on the zero-clearance insert so it sits flush with the top of the saw table.*

Set Screws. *Small set screws let you fine-tune the height of an insert.*

getting a grip on Sheet Goods

Tired of lifting and moving heavy sheets around your shop? Here are a few products that make the task a whole lot easier.

Sheet goods, like plywood and MDF, see a lot of use in my shop. They're a great choice for many projects, but I sure don't enjoy having to move large, awkward sheets around by myself.

Fortunately, the products you see here provide practical solutions. They're all under $50 and each one addresses the problems of moving and handling sheet goods in a shop. You can find information on sources for these products by turning to page 51.

Super Grip. *A tenacious hold that won't let go is the best way to describe the Gorilla Gripper.*

GORILLA GRIPPER

One of the biggest challenges with any type of sheet good is simply lifting it up off the ground. A sheet of ¾" MDF tops out at almost 100 lbs. And trying to get a good grip on something that weighs that much and then maneuver it around the shop is simply asking for trouble.

A great way to minimize the strain and get a better, safer grip is to use the *Gorilla Gripper* (photo at left). As the name implies, you'll be able to grip any kind of sheet material with extraordinary power.

The *Gorilla Gripper* accomplishes this by the use of two plates attached to a stout, curved handle, like you see in the margin at left. The plates pivot, allowing the *Gorilla Gripper* to accommodate materials ⅜" to 1⅜" thick.

To use the *Gorilla Gripper*, just set it in place on top of the sheet. As you lift, the plates trap the material in place by pressing tightly against each face. The heavier the material, the stronger the grip. The inside face of each plate is coated with a non-slip rubber pad to protect the surface and prevent the sheet from sliding out.

The panel actually feels "lighter" than if you were trying to carry and move it around the shop with your bare hands. And since your hands never touch the material, you don't have to worry about scraping them up or getting a sliver.

TROLL PANEL HANDLER

The *Gorilla Gripper* is a good way to hoist a large, difficult-to-grasp sheet and move it around. But you still need to have the strength to lift that much weight and support it.

Another solution that lets the weight of the material do most of the work is a product called the *Troll Panel Handler*. You can see it shown in the photo at the top of the opposite page. Okay, it's an odd name.

But when it comes to moving sheet goods around the shop, it's a great little helper. In fact, you may find yourself taking the longest route you can just to use it.

With the *Troll*, you rest the sheet in the U-shaped support at the bottom of the handle. The shape of the support forces the handle against the sheet, keeping the *Troll* in place automatically. This way, you can position yourself anywhere along the material to easily move it around the shop, as you can see in the far right photo.

The large, dual wheels provide stability. And rolling over debris or a power cord on the floor isn't a problem. Simply push down a bit on the end of the sheet and you'll "pop a wheelie" right over any obstruction. And when you have to maneuver around a tight corner, it's easy to pivot the sheet in place.

Finally, if you need to lift the sheet to get over the threshold of a doorway or up a step or two, just grab the handle and lift. Be sure to steady the top of the sheet with your other hand as you do this.

LEGUP

Carrying and moving plywood is the first challenge, but then getting a heavy, cumbersome sheet up on a table saw to make a cut is another matter altogether.

To make the whole process easier and safer, give the *LegUp* a try (photos below). The *LegUp* is nothing more than a long metal strap with a "hook" on the end. With just a single bolt, you can attach it to the end of a fence rail or the extension wing of your table saw (no drilling required).

Once the *LegUp* is in place, using it is simple. You start by resting the sheet in the hook at the bottom of the *LegUp* (photo at lower right).

▲ **Rail Mount.** *The LegUp mounts securely to the left end of a table saw fence rail (upper inset).*

▲ **Pad.** *An included pad attached to the rail prevents the corner of the rail from marring a workpiece.*

▲ **Wing Mount.** *Another option for mounting the LegUp is to attach it to the wing of your table saw.*

► **Mobile.** *After loading your sheet, the Troll stays in place automatically, making it easy to maneuver a sheet around the shop.*

Getting the sheet into position on the top of the saw is just a matter of working your way to the back of the sheet and tipping it onto the table (main photo on opposite page). The *LegUp* keeps the sheet from sliding off the table. As the sheet disengages from the hook, the *LegUp* drops back into position.

The only downside is that I occasionally catch my pant leg or bang my ankle against the hook while walking around the end of my saw. But it's a small price to pay for the help it provides when I'm cutting sheet goods.

Engage the Hook. *Using the LegUp starts by resting one end of your material in the hook at the bottom of the strap.*

Q&A

questions from
Our Readers

better Drilling & Tapping

It's not unusual for a project in *ShopNotes* to involve drilling and tapping metal. In this issue, you'll need to do some metal drilling if you plan to build the sharpening station on page 14 or the layout gauges shown on page 40.

That's been the case with some past projects as well. Recently, a couple of readers questioned our recommendation of the use of an oil, like *3-in-1*, for drilling and tapping operations. They suggested that it was counterproductive to use an oil and to "never put an oil on a tap or die." So why do we use *3-in-1*? Simple. It's always available and ready for use in our shop.

▲ ***Multiple Choices.*** *Metalworking fluids and compounds come in a wide range of options including liquid, spray, and rub-on versions.*

Metalworking Fluids. In most cases, the proper "oil" for use when working with metal is a metalworking fluid. In the industry, they're also called cutting oils or compounds. These fluids are designed to accomplish three things. First, they provide lubrication to make the tool cut more efficiently. Second, the cooling action of the fluid reduces heat. And finally, the fluid carries the metal chips (and heat) away from the operation. This makes metalworking fluids a critical part of a production or machine shop operation, since they help promote longer tooling life and yield better results.

The fluids and compounds shown at left are just a sampling of what's available for cutting, drilling, and tapping metals. Most of the products can be used on a wide range of metals. Others are marketed for use on a specific type of metal, like aluminum.

Production operations also have to contain, collect, and recycle the fluid being used. Plus, some of these products are toxic and require specific disposal procedures.

▲ ***Easy Application.*** *You just rub Tap-Ease on the bit like a crayon before you start drilling.*

In the Workshop. Now it may sound like using a metalworking fluid in your shop is a big hassle. But in reality, there are environmentally friendly products you can buy that provide the same benefits.

A couple options that are readily available are *Tap Magic* and *Tap-Ease* (photos above). They're easy to use and work great on most of the metals you'll work with in the shop, like aluminum, steel, and brass. Just apply the product at the point of contact with the drill or tap and use as needed.

We're going to keep both of these on hand in our shop from now on. They'll provide better results for just about any drilling and tapping task. But if all you have on hand is *3-in-1* oil, it'll work fine in a pinch.

Sources

Most of the materials and supplies you'll need for 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.

HINGE MORTISING JIGS *(p.10)*

- **Rockler**
  JIG IT Mortising System 32457
- **Woodcraft**
  Hinge-Mate II. 06Y01
- **Woodhaven**
  1½" Small Hinge Jig 8515
  ¼" Mortise Bit 8500
- **JustTryingToMakeALiving.com**
  Adjustable Router Template. . ART

SHARPENING STATION *(p.14)*

- **Red Hill Corporation**
  8" PSA Abrasive Disks . . . . Varies
- **McMaster-Carr**
  ½" Steel Drive Shaft 1346K19
  Thrust Bearing 6655K17
  Bronze Sleeve Bearings. . . 6391K223
  Steel Washers 90108A033
  Shaft Collars 9414T11
  Pulleys. 6245K516
  Knobs w/Inserts 57715K74
- **Reid Supply Company**
  ¼"-20 Knurled Knobs GK-115
- **Rockler**
  Power Twist Link Belt 52233

CABINET MAKEOVER *(p.24)*

- **Lee Valley**
  16" Drawer Slides. 02K42.16
  Polished Nickel Knobs. . . 02W43.43
  Chrome Cup Pulls. 00W30.61
  ½" (Square) L-Hooks 00S56.11
  ¾" (Square) L-Hooks 00S56.12

EXCESS GLUE *(p.32)*

- **Rockler**
  De-Glue Goo 36643
- **Lee Valley**
  Waxilit 56Z99.61

TOOL TOTE *(p.34)*

The only hardware required for the tool tote are some screws, a hinge, and a pair of catches to keep the top closed. You can find these at most hardware stores or some of the sources listed at right.

BEVEL-UP BLADES *(p.38)*

Lee Valley/Veritas provides plane blades with various bevel angles for both their bevel-up planes and low-angle block plane. *Lie-Nielsen Toolworks* and *Hock Tools* will custom grind blades upon request.

LAYOUT GAUGES *(p.40)*

- **McMaster-Carr**
  Brass Thumbscrews . . . 92421A194
  Brass Threaded Inserts. 90016A009
  ⅛" Brass Bar 9122K212

GREAT GEAR *(p.48)*

- **Amazon**
  Troll Panel Handler . . .B0000224PA
  Gorilla Gripper B0007TYCA8
  LegUp B001Q3L23Y
- **Landon Innovations**
  Gorilla Gripper 44010
  LegUp 54008
- **Lee Valley**
  Gorilla Gripper 03K18.10
- **Rockler**
  Troll Panel Handler 24574

MAIL ORDER SOURCES

Woodsmith Store
800-444-7527

Rockler
800-279-4441
rockler.com

Amazon.com

Hock Tools
888-282-5233
hocktools.com

Just Trying To Make A Living.com

Landon Innovations LLC
800-423-5008
gorillagripper.com

Lee Valley
800-871-8158
leevalley.com

Lie-Nielsen Toolworks
800-327-2520
lie-nielsen.com

McMaster-Carr
630-600-3600
mcmaster.com

Red Hill Corporation
800-822-4003
supergrit.com

Reid Supply
800-253-0421
reidsupply.com

Woodcraft
800-225-1153
woodcraft.com

Woodhaven
800-344-6657
woodhaven.com

Scenes from the Shop

These unique layout gauges are easy to build in just an afternoon. But they'll perform perfectly in your shop for a lifetime. Step-by-step plans begin on page 40.

Bevel-up hand planes excel at creating a glass-smooth surface. On page 38, you'll find out how you can take advantage of this versatile design to minimize tearout in difficult woods.