STORAGE IDEAS FOR EVERY SHOP!

ShopNotes

ShopNotes.com Vol. 20 Issue 118

HEIRLOOM WORKBENCH

Simple Construction • Versatile Storage
Heavy-Duty Vise • Built-In Tool Rack

PLUS!

Miters Made Easy —Two Simple Jigs

Surprising Way to Create Sliding Dovetails

Shop-Built Router Jigs for Precision Cuts

A Publication of August Home Publishing

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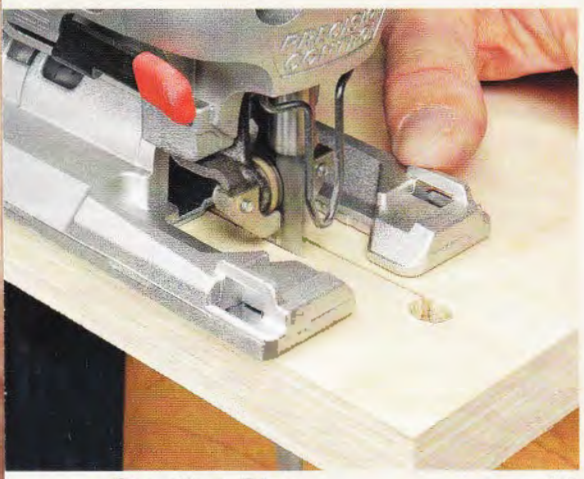

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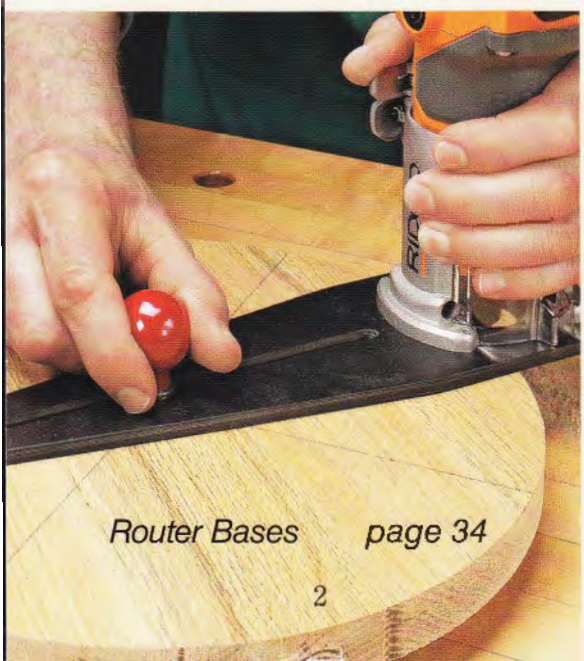

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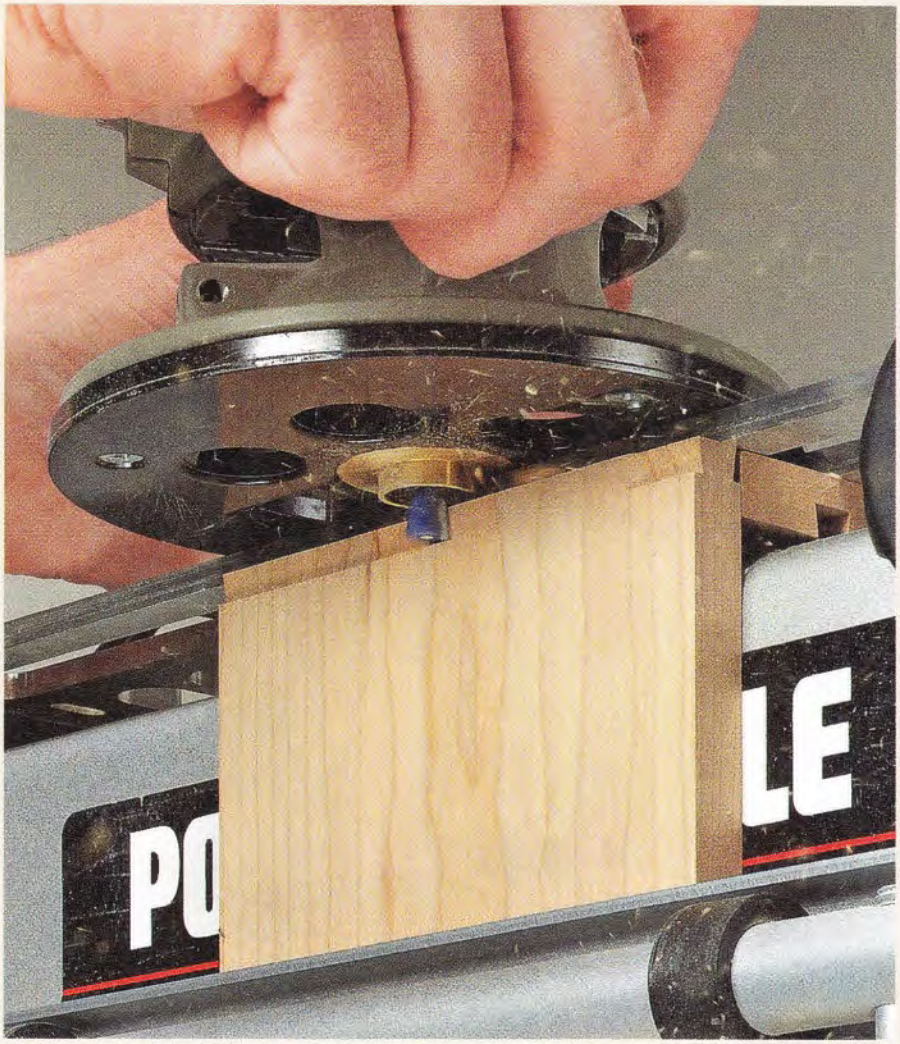

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Cutoffs

I can't really explain it, but I've always been fascinated by workbenches. I've never been without at least one (and have had three in my shop at one point). Honestly, every new design I see makes me want to build another one. That's the case with our latest workbench design.

The heirloom workbench in this issue (page 12) features interesting details and capabilities. For starters, it has a unique style. From the beading on the legs to the riftsawn oak, you can't beat its overall look.

But don't worry, this bench has more going for it than appearance. It's a rock-solid workhorse suitable for any shop. It all starts with a sturdy base built using mortise and tenon joinery. To make it easy to build, we took a simplified approach to creating the joinery. The top of the bench is just as solid as the base, so it's ready to handle the most demanding tasks.

This bench doesn't lack for storage options either. There's a lower cabinet consisting of drawers and an enclosed compartment for easy organization. And to keep your most-used tools close at hand, there's a convenient rack at the back of the bench.

Of course, this issue is packed with a lot of other great information, from projects, to tips and techniques you can start using right away. After checking out what's inside, you'll be ready to head to the shop and start putting them to use. For me, it's time to think about where I can put a new workbench.

Bryan

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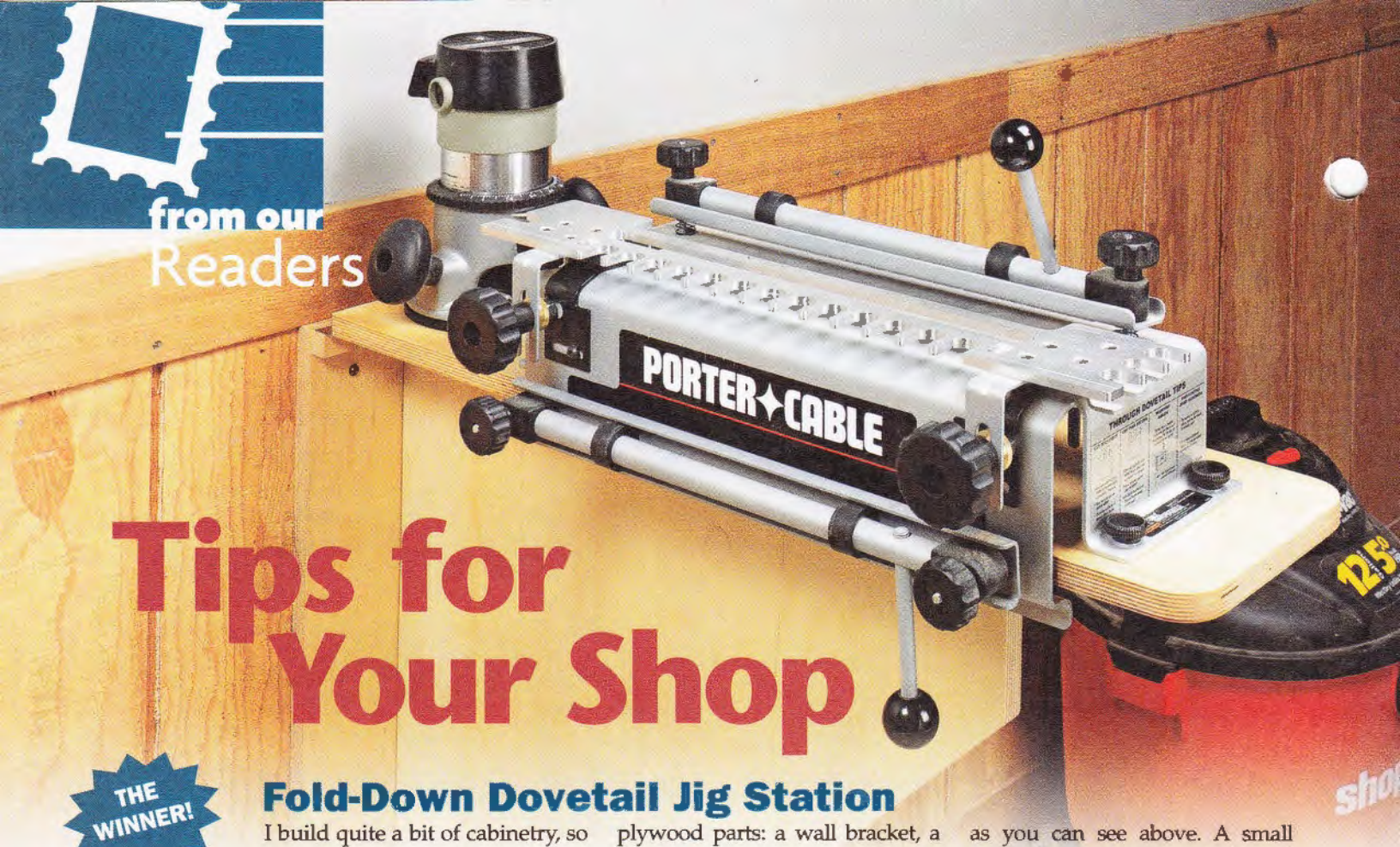
from our Readers



Tips for Your Shop

THE WINNER!

Fold-Down Dovetail Jig Station

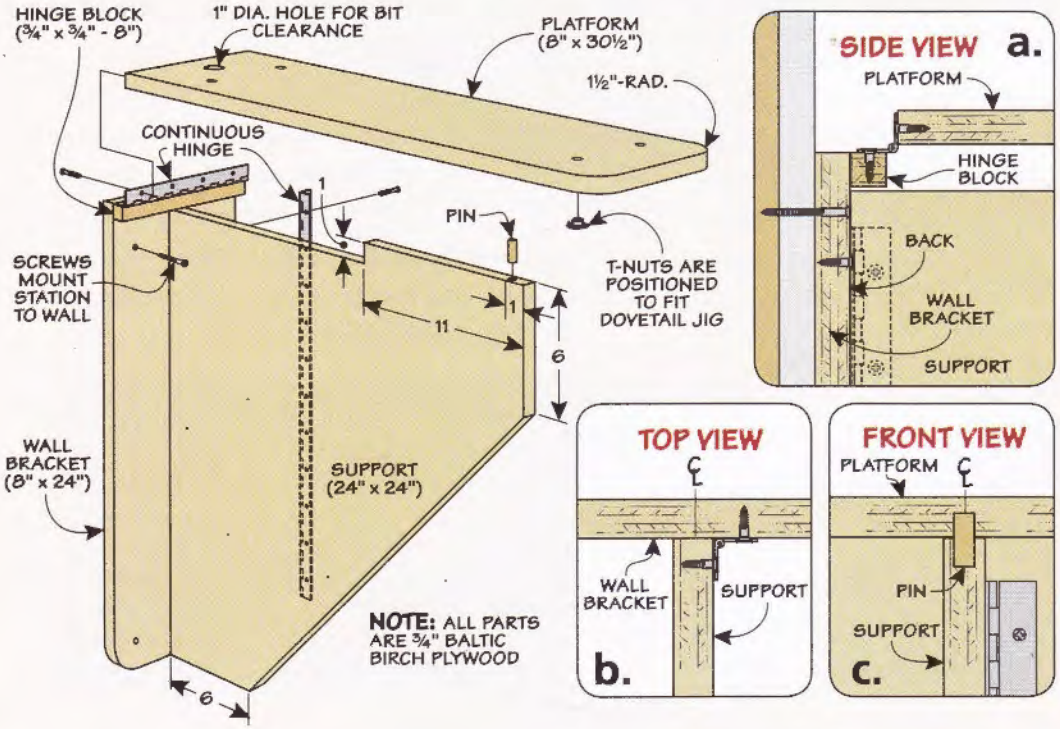
I build quite a bit of cabinetry, so a dovetail jig is one of my go-to tools. The problem is where to store it when it's not being used.

My solution is the folding, wall-mounted station you see here. It's simple to build but sure makes setup and storage easy. As you can see in the drawings below, the station consists of three basic plywood parts: a wall bracket, a folding support, and the jig platform. The platform is attached to the wall bracket with a hinge block and continuous hinge. The folding support is also attached to the bracket with a hinge.

I sized the platform long enough to accommodate my dovetail jig and still leave room for the router, as you can see above. A small hole provides clearance for the bit when resting on the top.

After securely mounting the wall bracket, you can attach the rest of the parts. The assembled height should allow you to work at the jig comfortably without making you stoop over. Finally, you can mount your dovetail jig and get to work.

David DiRanna
Fountain Valley, California

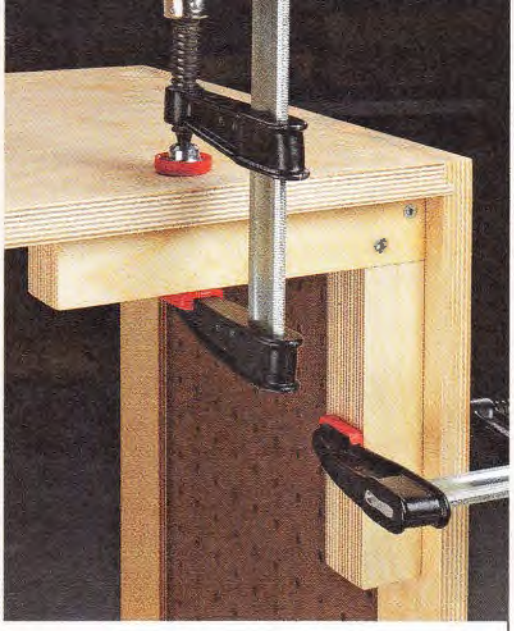


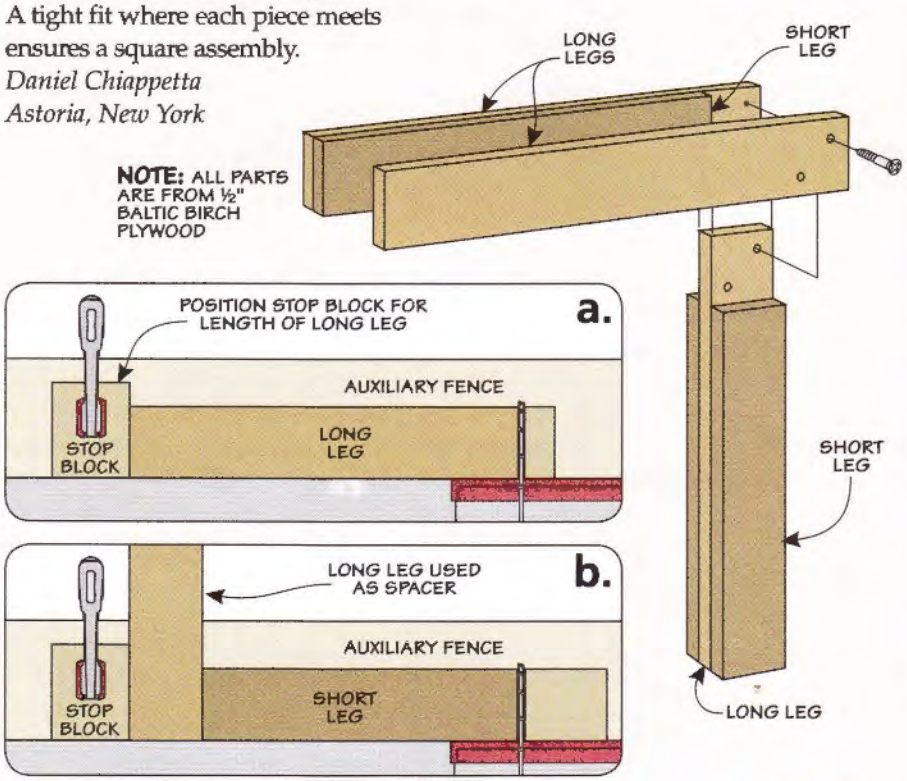
Simple Squares

I found an easy, accurate way to make clamping squares out of ½" Baltic birch plywood. And the way they're cut and assembled automatically makes them square.

As you can see in the drawings below, I ripped several pieces of plywood to width, leaving them extra long. With a stop on an auxiliary miter gauge fence, I cut the three long legs to length (detail 'a'). Then I took one of these long pieces and used it as a spacer to cut the three shorter pieces (detail 'b'). Now apply the glue and screw the sections together. A tight fit where each piece meets ensures a square assembly.

Daniel Chiappetta
Astoria, New York





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

ShopNotes

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Overhead Cabinet

Years of woodworking have taught me several lessons about working efficiently. One of the lessons is taking advantage of the unused space over my workbench. The cabinet you see on the right is the combination of several handy storage tips and tricks.

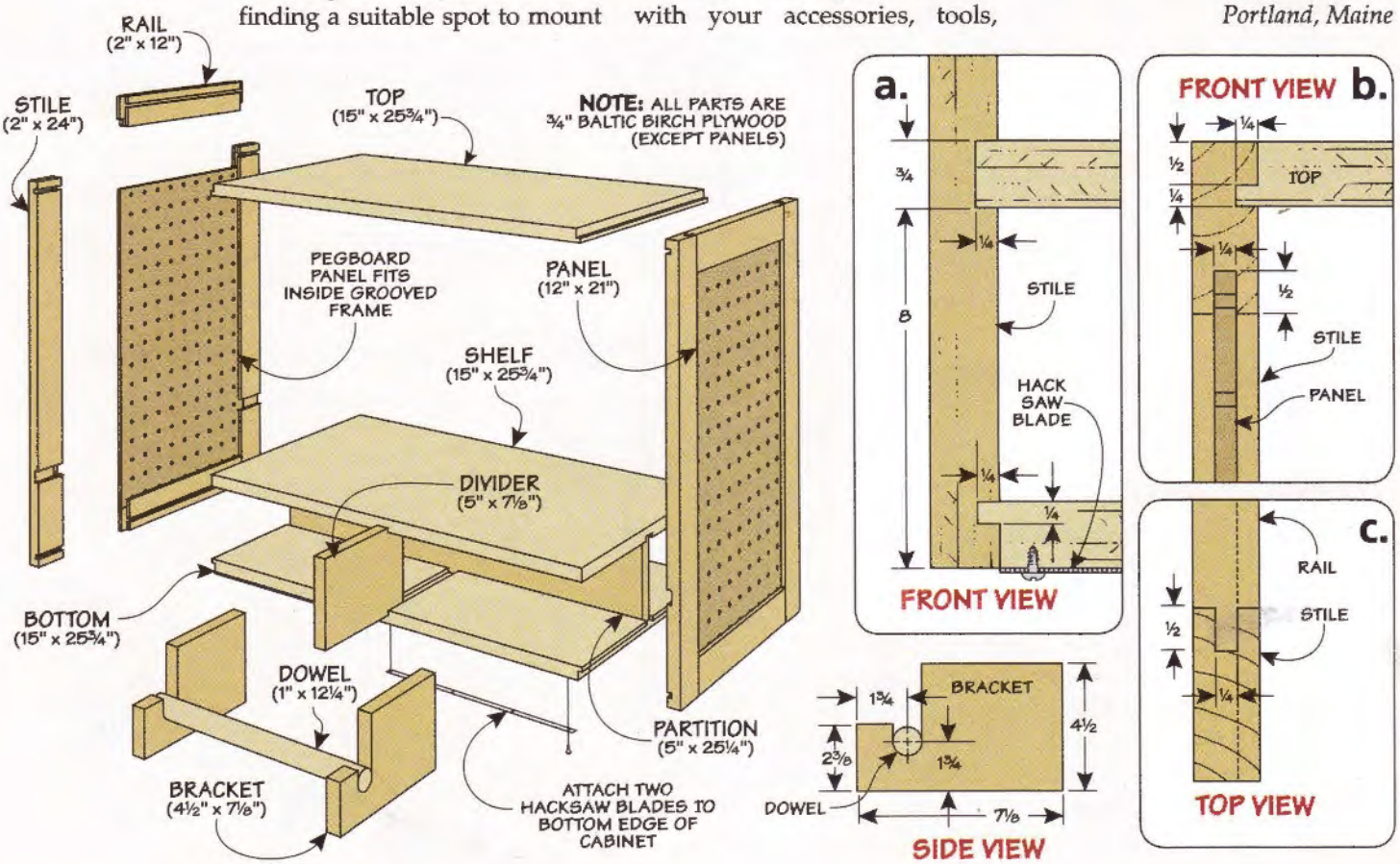
The idea for the cabinet started as a place to store my cordless drills and drivers. It turned out to be so handy that I kept adding features to store other items like adhesive-backed sandpaper and paper towels.

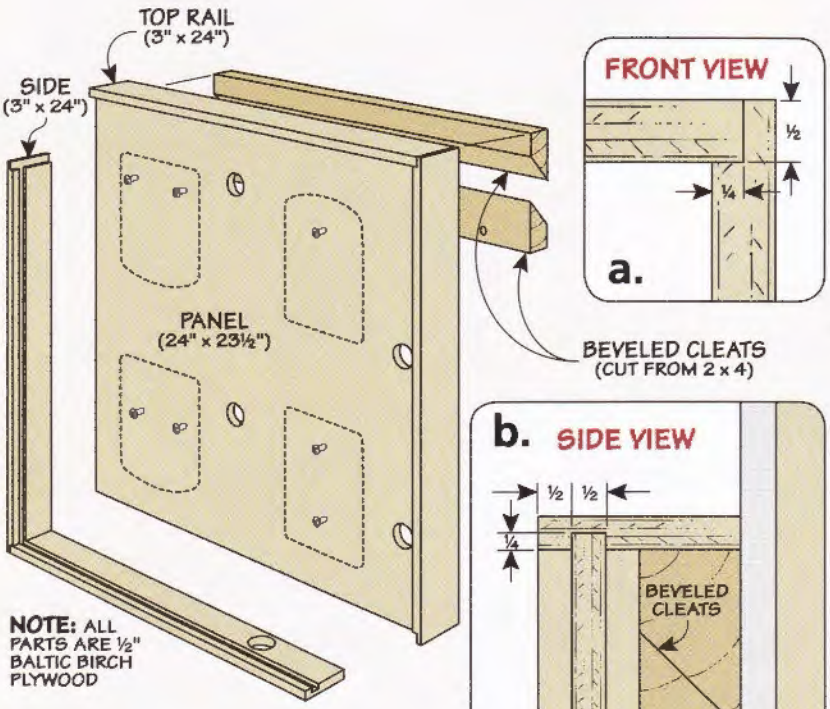
The drawings below show you the basic construction details, but you may want to modify the dimensions to suit your space and storage needs. The assembly starts with two pegboard panels framed with ¾" plywood. You can cut the dadoes for the top, bottom, and shelf next. Before gluing the shelf and bottom in place, cut a dado and groove for the two center dividers (drawing below).

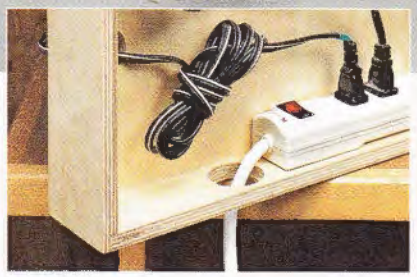
After gluing all the components together, it's just a matter of finding a suitable spot to mount it securely. It's best to drive the mounting screws into the ceiling joists. Then you can add an inexpensive paper towel rack and power strip at convenient locations within your reach.

Finally, load up the cabinet with your accessories, tools, sandpaper, and other items you find yourself reaching for often. You can even add a task light. You'll soon wonder how you ever got along without this additional space.

Jack Vreeland
Portland, Maine







Charging Rack

Since I own a number of cordless tools, I wanted a central location for all of the battery chargers. And it was important to keep all their cords contained too. My solution (shown above) took almost no time to build yet it solved both these problems.

As you can see, it's a simple plywood panel with a deep frame. The charging units are mounted on the front of the panel. The cords are routed through holes in the panel to a power strip mounted to the frame on the back side. The excess cord is bundled neatly behind the panel.

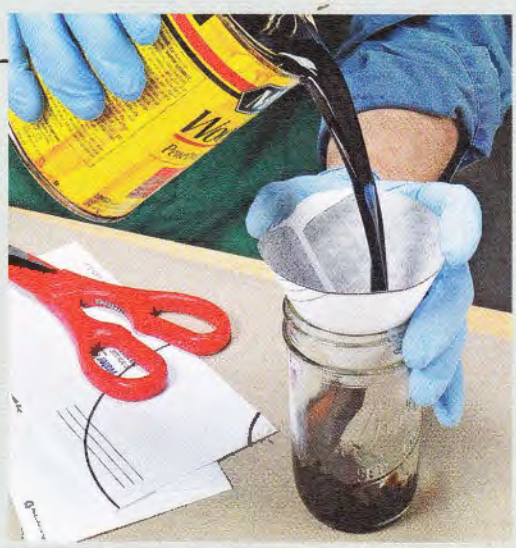
Grooves in the frame pieces hold the panel in place (drawings above). The rabbeted joints in the corners are simply glued. And a beveled cleat makes it easy to mount the rack securely to the wall yet still remove it if needed.

This simple solution frees up valuable bench space in my shop. Plus, my batteries are always charged because I know exactly where my chargers are located.

Dale Oroszi
Clifton Park, New York

Quick Tips

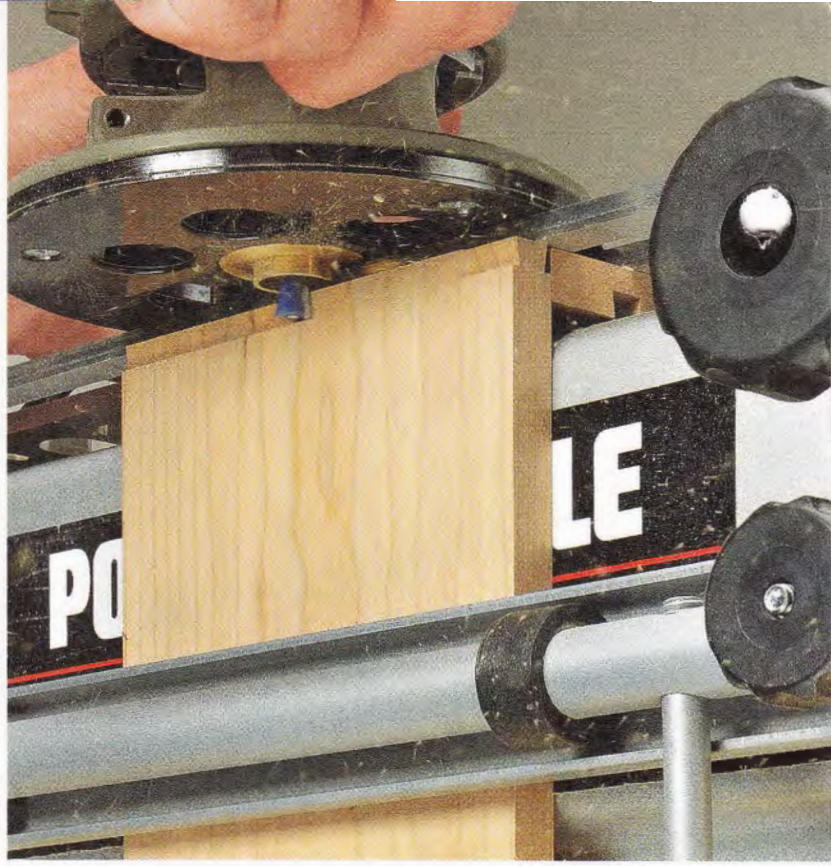
▲ **David Robbins** of Westminster, MD writes the maximum open length on the end of each of his clamps. You'll never reach for the wrong clamp again.



▲ After **Elvin Perry** of Valley Springs, CA reads his mail, he creates disposable funnels from the envelopes. Just draw a couple of arcs and cut along the lines.

a new way to rout Sliding Dovetails

Create this strong, versatile joint using your Porter-Cable dovetail jig.



Sliding dovetails combine good looks with sturdy construction. Unlike a dado joint, a sliding dovetail automatically pulls the mating parts into alignment and creates a strong mechanical connection that virtually eliminates the need for glue. This versatile joint can be used for making wall shelves, cabinets, and drawers.

On the surface, it looks simple to make. But looks can be deceiving. It often takes a lot of fussing to make a joint that comes together without binding or showing gaps. As a result, many woodworkers avoid it altogether.

Recently, I came across a surprising way to cut this tricky joint — using a dovetail jig. And I found the process is nearly hassle free. The secret is the jig itself.

The dovetail jig I used is the *Porter Cable 4210* (the *4212* works the same). The basic half-blind dovetail template has everything you need to rout sliding dovetails in workpieces up to 12" wide.

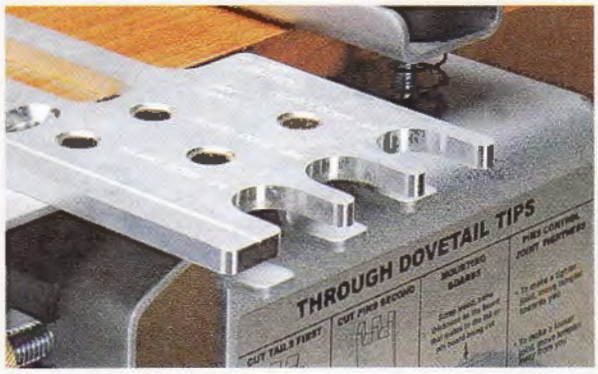
A slot in the middle of the template captures a guide bushing, allowing you to rout dovetail-shaped sockets. A straight edge along one side of the template is used to create the mating tails. And the built-in clamps hold the workpieces rock steady.

Set Up the Jig. Setting up the dovetail jig to rout sliding dovetails is pretty effortless. The only thing you need to do is flip the template around so that the fingers used for routing half-blind dovetails are facing the back of the jig. This exposes the straight edge along the back of the template that you'll use to rout the tails.

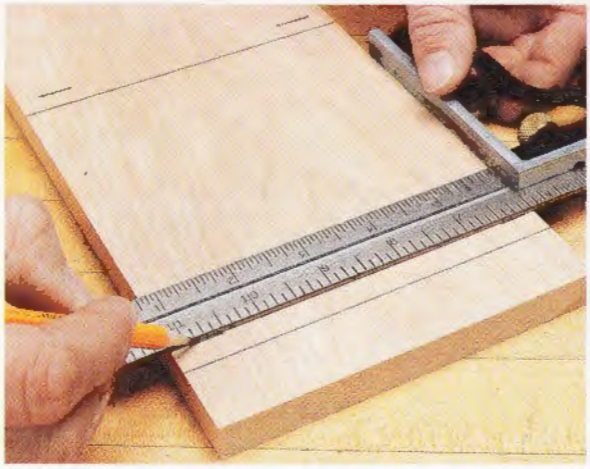
The Router. Next, you can get your router set up. This starts with installing a ¾" O.D. guide bushing in the baseplate. (The bushing collar should protrude no more than ¼".) As for the bit, you can use any size and angle dovetail bit to make sliding dovetails so long as it fits in the bushing. A depth gauge on the template makes it easy to set the bit to common depths (near left photo). You'll use this setting for cutting both the sockets and the tails.

The Workpieces. The next step in the process is to get your workpieces ready. In addition to basic stock preparation, you need to do a little layout work. On the pieces that will receive the sockets, start by marking the centerline of each joint. There's one other set of marks to make — a pair of index marks ⅜" away from one side of the centerline (upper left photo on the next page). You'll use these

▲ ***Strength & Style.*** *A sliding dovetail pulls parts into perfect alignment without clamps.*



▲ ***Bit Depth.*** *Three depth stop notches on the end of the template allow you to quickly set the bit for cutting ¼"-, ⅜"-, and ½"-deep sliding dovetails.*



▲ ***Simple Layout.*** *After marking the center of each dovetail socket, draw the index marks used to position the workpiece 3/8" away from the centerline.*

▲ ***Routing Sockets.*** *When routing the sockets, the dovetail bit is guided by a bushing captured in a slot in the top of the dovetail template.*

▲ ***Backer.*** *A small backer board prevents tearout on the back edge of the workpiece.*

marks to position the workpiece in the dovetail jig. Be sure to make the index marks on the same side of the layout lines. This way, you'll set up and rout the joints consistently from piece to piece.

Sockets First. Since you need the sockets to accurately size the tails, it's necessary to cut them first. To begin, slide the socket board into the top of the jig and under the template. Align the index marks on the workpiece with one edge of the slot in the jig so the layout line is centered.

Along with the workpiece, I slide a small scrap piece (the same thickness) up to the right side of the workpiece (right margin). This backer board prevents the socket from tearing out as the bit exits. Then clamp the boards in place.

Before turning on the router, I clamp one of the tail boards in the front of the jig (upper right photo). It provides additional support that keeps the socket board from flexing.

At this point, you can rout the socket, moving the router across the workpiece from left to right. The only thing you need to do is keep the router flat on the template. Routing the other sockets is just a matter of repositioning the workpiece and repeating the cut.

Routing Tails. The process for routing the tails involves only slightly more work. That's because you need to do some fine-tuning to get a good fit in the socket. The main photo on the previous page shows the setup. The tail board is clamped in the front of the jig and snug against the template. Here again, I clamped a board behind the tail board for support. (I used one of the socket boards.)

Next, you can adjust the front-to-back position of the template to determine the size of the tail. To do this, move the template forward so the bit will only graze the edge of the workpiece. This way you can sneak up on the width of the tail for a good fit.

Now, you're ready to make a pass along one edge of the tail board. To prevent tearout here, I made a short, backwards cut on the right side of the workpiece, as in the photo below. Then complete the cut by moving the router from left to right. Finish the tail by flipping the board around in the jig and making a second cut along the opposite face.

From here, you can test the fit of the tail in one of the sockets. This is where using the dovetail jig really shines. The template adjustment knobs on the front of the jig give you precise control to dial in a good fit. Since you're removing material from both sides of the joint, it's a good idea make small adjustments between test cuts. The key thing to keep in mind is making sure the edge of the template remains parallel with the edge of the workpiece.

Once the setting for the tails is locked in, you can go ahead and make the remaining tail cuts. The result is a strong and good-looking joint that slides together with simple hand pressure.

► ***Routing Tails.*** *Backrout the opposite end of the tail board to prevent tearout.*

With little effort you can maintain your hands to ensure a lifetime of trouble-free service.

simple solutions for Saving Your Hands

As a woodworker, my hands are my most valuable asset. So I do my best to keep them safe. Even so, they take a lot of abuse while working on a project. You can protect your hands from the typical dangers of woodworking, but there are other concerns that also deserve attention.

Wood and sawdust act like sponges, wicking moisture away from the skin leaving hands dry and cracked. Finishing products can stain the skin. And the cleaning solvents to remove them can cause irritation. Fortunately there are a few products that can help protect, clean, and restore hard-working hands. Sources on page 51 shows you where to find them.

PROTECTION

The primary step in caring for your hands is keeping them safe in the first place. Work gloves are an option, but when working on projects, I don't generally wear them for a number of reasons.

Besides the safety concerns of wearing gloves around power tools, I find them to be clumsy. And they reduce finger sensitivity.

Finger Guard Tape. A better solution for tasks that can take a toll on fingers is finger guard tape. This breathable gauze tape is inexpensive and easy to use. You simply wrap it around your fingertips as shown in the inset photo above. And since it only sticks to itself, it can be easily removed.

The flexible, non-slip material allows you to retain fine control and improves your grip. It also helps protect fingers from slight abrasions and from heat build up, like when using a card scraper.

Gloves in a Bottle. Hands also need to be protected when applying stains and finishes. I generally wear nitrile gloves, but they can sometimes make my hands feel clammy. And on more than one occasion, the loose-fitting gloves have resulted in smear marks on my finished projects.

▲ **Before.** *Hands protected with Gloves in a Bottle are exposed to dark gel stain.*

▲ **After.** *A simple washing with plain water removed any trace of the stain from the skin.*

The simple solution I often turn to is a shielding lotion called *Gloves in a Bottle*.

Applied like a typical lotion, this product actually bonds with the outermost layer of skin. This creates an invisible barrier that resists absorption of stain or other liquids into the skin. I've used this product with success while applying both oil- and water-based stains.

To show how well this product works, I applied gel stain to a workpiece with nothing more than *Gloves in a Bottle* on my hands. You can see the results in the photos on the bottom of the opposite page. The stain came off completely using only water to wash my hands. Dye stains come off just as easily. An added benefit of the product is that it helps retain moisture in the skin which keeps it from drying out.

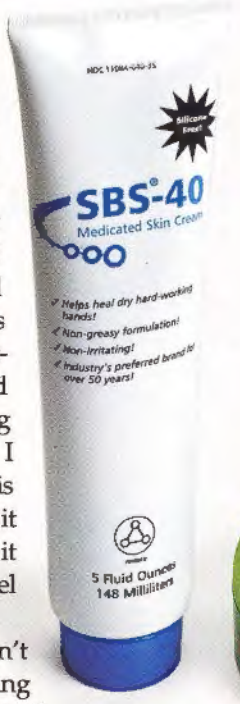
Sometimes though, I do get stain on my skin. Instead of using harsh chemical cleansers, there are other options. The box below gives a couple of safe alternatives.

RESTORE DRY HANDS

Despite all efforts to protect them, you can still end up with dry hands. In the winter, they sometimes even crack. The solution to this is using moisturizer to keep them from drying out. I've tried countless products over the years, and there are a couple I like for hard-working hands.

O'Keeffe's. The first is a product called *O'Keeffe's Working Hands*. This product works especially well for hands that are extremely dry and cracked. Its water and glycerin formula does a great job of penetrating into and around cracked skin, bringing much-needed relief. I like that the product is odorless, but because it contains paraffin wax it leaves a slight waxy feel to my hands.

For this reason, I don't use it while I'm working on my projects. Instead I'll apply it in the evenings and let it work overnight.



▲ ***Finger Smears.*** *Wax- or oil-based moisturizers can leave residue on your projects.*

SBS-40. When I'm in the shop, I use *SBS-40* by *Deb USA*. You can tell by the name that it's geared more toward industry needs rather than individuals. But you can still find it at some retailers.

It goes on like a lotion and dries fast. And while it does have a mild scent, it disappears quickly. What I like most is that it leaves no noticeable residue once it dries. And since there's no residue on my hands, there are no waxes or oils to transfer to projects, which can cause problems when applying a finish.

The photo above shows the results of three different types of moisturizers applied to a workpiece. On the left is the barely noticeable remnant left from *SBS-40*. The smudge on the right is from *O'Keeffe's Working Hands* and the one in the middle is from a common oil-based moisturizer.

The results are clear: If you are concerned about residue on your projects, limit the use of wax- or oil-based moisturizers when handling your workpieces.

Whatever products you use, by protecting and maintaining your hands, you help ensure that they will be healthy and ready to work the next time you're in the workshop.

hard-working Cleaners

It's easy to reach for solvents when its time to remove stain or topcoat from your hands. But this is not a good idea since these solvents can have a damaging effect on your hands and skin.

A better solution is *WORX All-Natural Hand Cleaner*. I'm generally a bit skeptical when it comes to the effectiveness of all-natural products, but this stuff really does work for removing tough stains.

Another option is *The Gardener's Soap*. This soap-impregnated clay bar works like a pumice stone to remove stains from the roughest skin.

▲ ***All-Natural Clean.*** *A little WORX goes a long way towards cleaning the toughest grime.*

dream shop project

heirloom Workbench

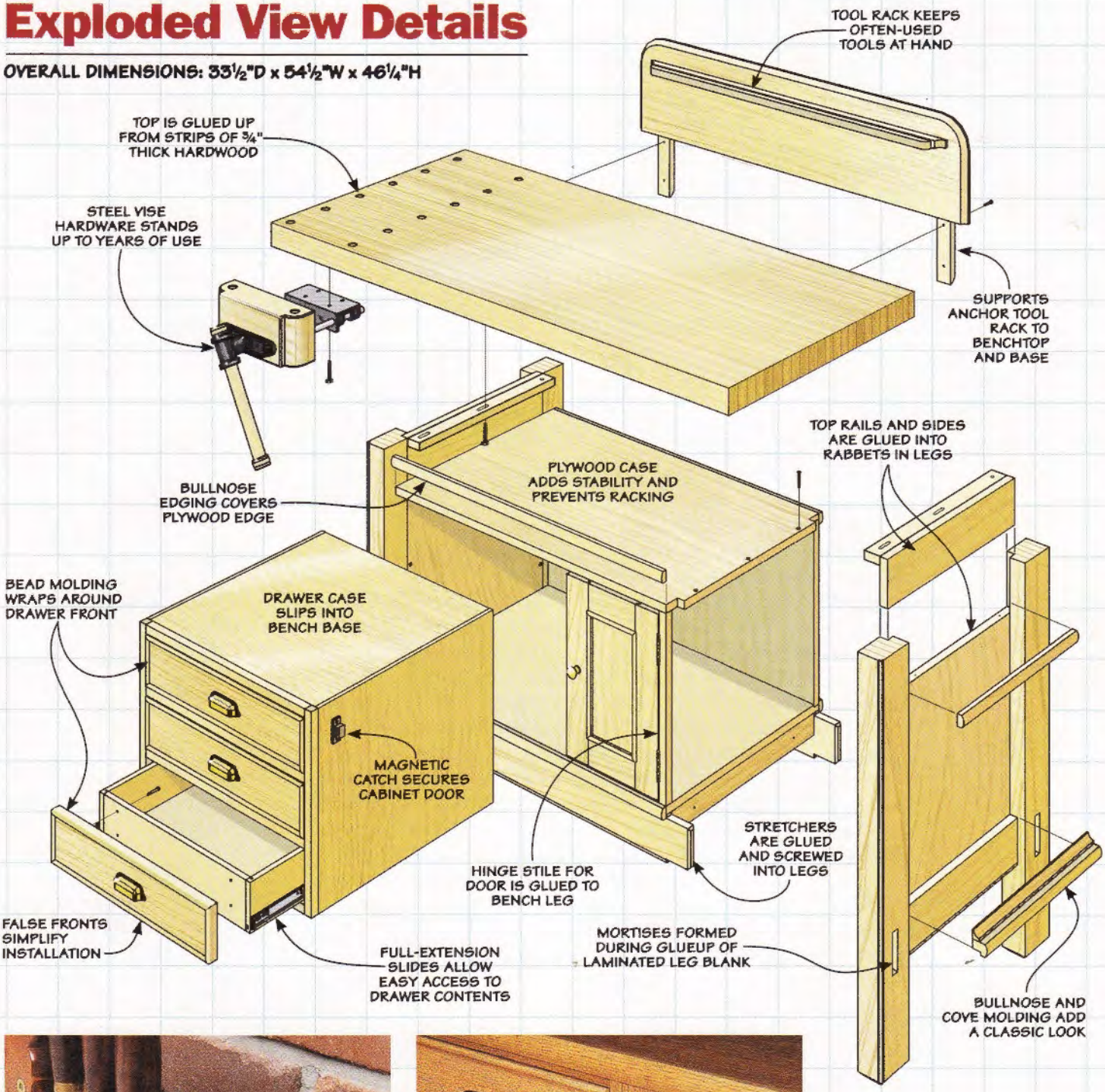
This compact bench will fit in any shop, but that doesn't mean it's light on features.

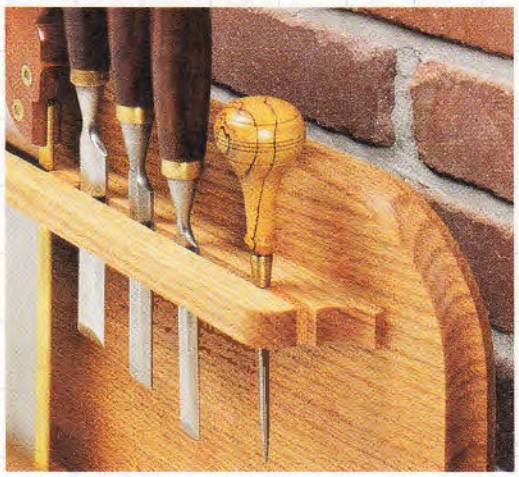
The workbench you see above sure got a lot of attention in our shop. But in spite of its decorative appeal and small size, it's meant to be used hard. It's similar to the benches you'd find in trade schools over 100 years ago. This version sticks to the classic design but takes advantage of modern materials like plywood and full-extension drawer slides.

In spite of the modern touches, the traditional through-tenon joinery guarantees the bench can withstand heavy use. And the solid-wood top adds the mass and strength to stand up to any woodworking task. And it can be built using ¾"-thick material. These elements combine to provide a rock-solid bench that's sure to last for generations.

Exploded View Details

OVERALL DIMENSIONS: 33½"D x 54½"W x 46¼"H





▲ ***Handy Tool Rack.*** *The simple design makes it easy to build. But having your tools always at the ready is the big bonus.*

▲ ***Classic Lines, Modern Touches.*** *Bead molding adds pleasing detail while full-extension slides add practical function.*

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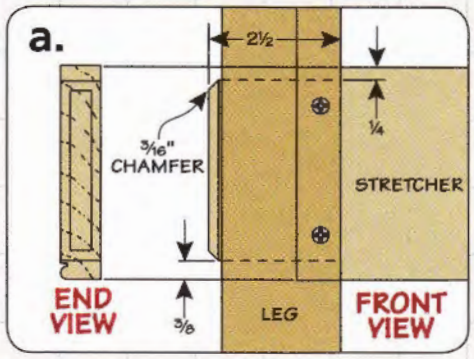
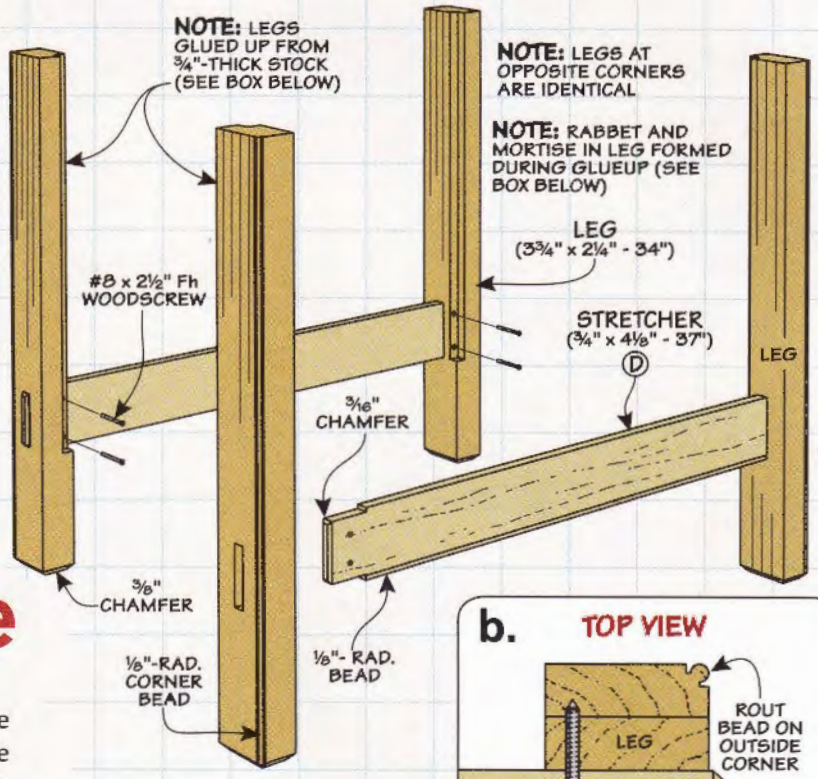
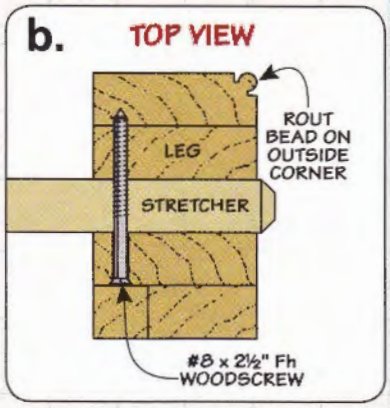
FIGURE 1







assembling the Base Frame

To build a sturdy base for the bench, I started by gluing up the stout leg blanks. A through mortise formed during the glue up accommodates the stretchers that tie the end assemblies together. Plywood panels add rigidity for a solid base frame.

Leg Laminations. Each of the four legs of the bench is glued up from five layers of ¾"-thick stock. (I used red oak.) Figure 1 and the box below provide the details.

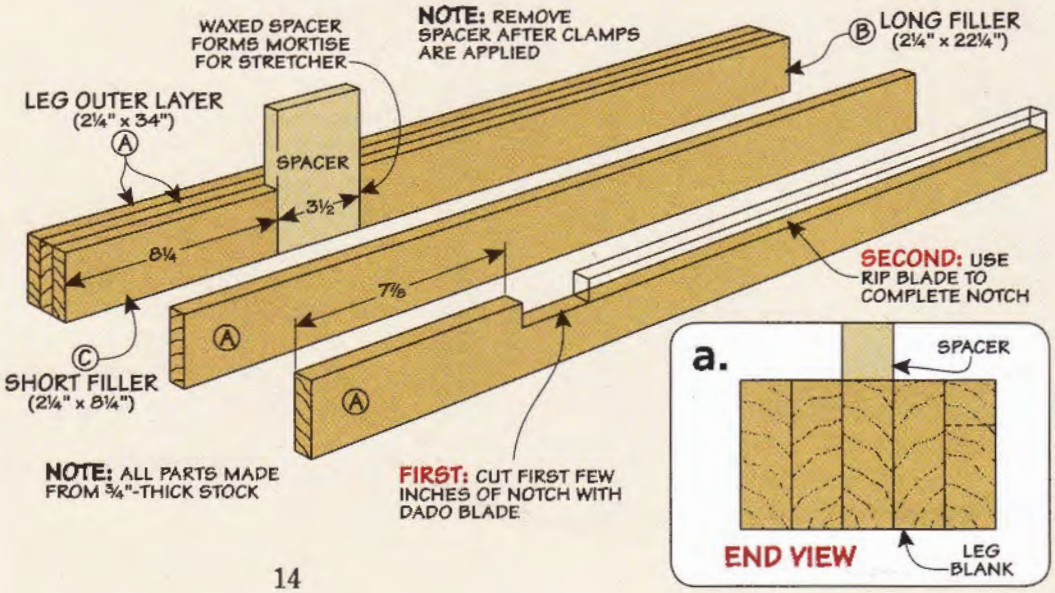
Match the Grain. Before you power up the table saw, there are a couple of tips I want to point out. To get the best appearance on the legs, it pays to sort through the stack of lumber to match the leg pieces for color and grain. The goal is to minimize the joint lines. The photo below shows how I chose straight-grained workpieces and oriented them to make the glue lines less visible.

Plane to Thickness. Once you have the stock selected, there's another step you can take that will help you later on. Plane all the stock for the legs parts and stretchers to the same thickness. This ensures that the stretcher will fit into the mortise later on.

When cutting the pieces for the legs, I left them extra wide. This way, after the glue dries and the clamps come off, you can joint the faces smooth and square.

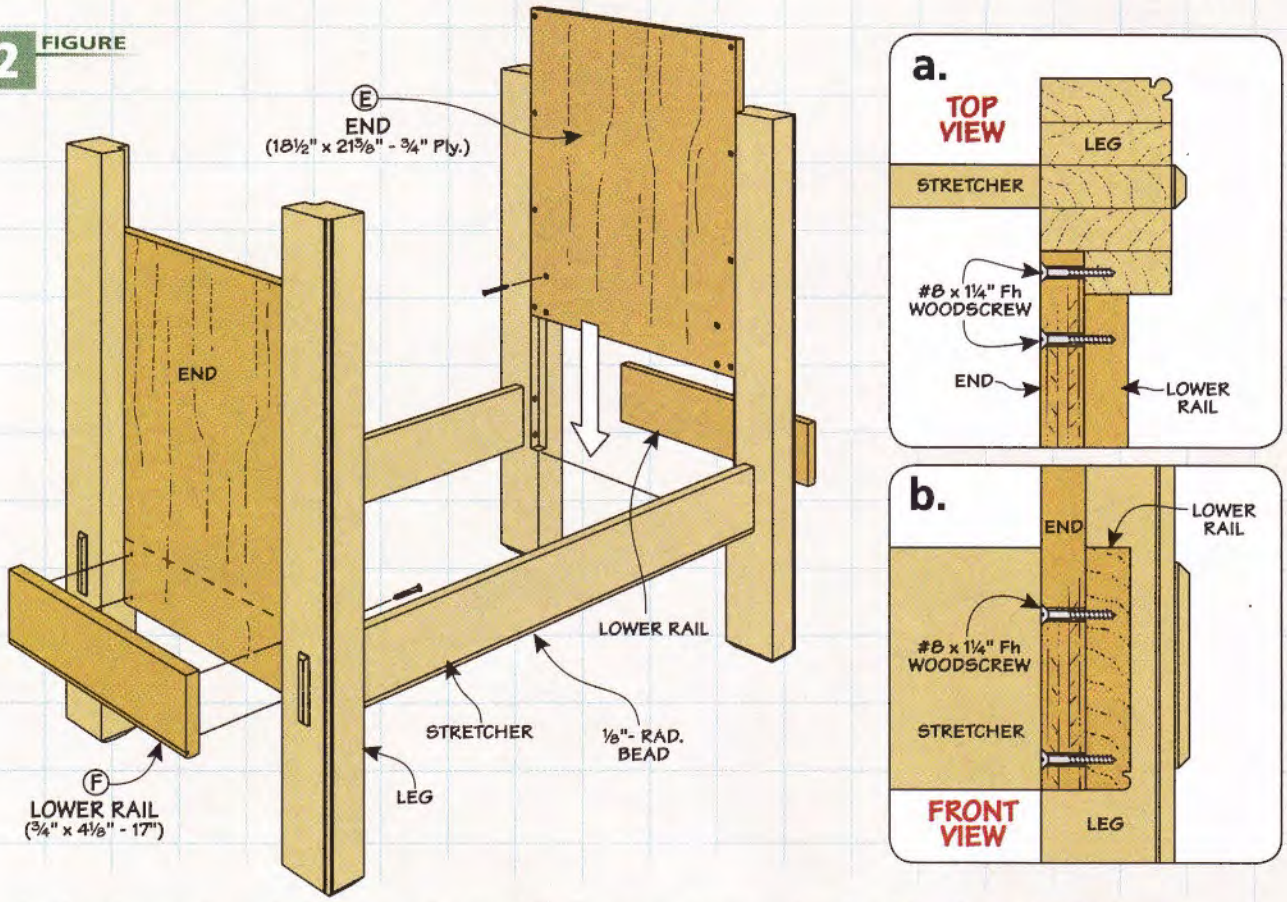
Mortise & Rabbet. As you can see in the drawing below, the two-piece middle layer of the leg forms the mortise for the stretcher. You can also see how one outer layer of each leg is notched to form a rabbet for the end panels. The goal is to keep all of the layers even as you

Gluing Up a Leg Blank



▲ ***Details.*** *A good color and grain match creates the appearance of a single piece.*

FIGURE 2



apply the clamps. I used short clamping blocks across the glue lines to keep the pieces flush. To locate the two center pieces that form the mortise, I used a waxed spacer sized for the length of the mortise. Once all of the clamps are tightened down and before the glue sets, remove the spacer.

Corner Bead & Chamfer. Once you joint the faces smooth, you can head over to the router table. The first thing to do here is rout a chamfer on the bottom of each leg. Then, to soften the outside corner and add a decorative detail, I routed a corner bead just on the outside corner, as shown in the box below.

Stretchers. Now you can turn your attention to making the two stretchers that connect the legs. Figure 1a provides the details for making the tenons. Note that the upper shoulder height is different than the lower shoulder.

There are a couple of other details to add — a chamfer and bead. To prevent tearout when chamfering the ends, I used a sanding block instead of the router. And the stretchers have a bead profile along the lower edge (Figure 2). You can use the same beading bit as before (right drawing in the box below).

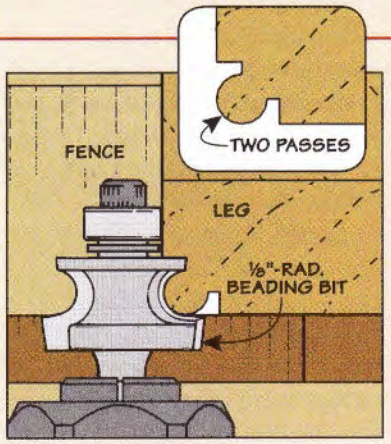
To fasten the stretchers to the legs, I glued them into the mortises. A pair of screws reinforces each joint, as shown in Figure 1b.

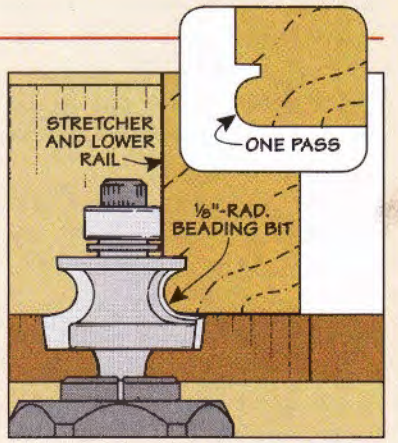
End Panels. The panels that connect the leg assemblies are cut to size and fastened with glue and screws (Figure 2a). The screws are hidden by the drawer case and door you'll make later.

Lower Rails. A pair of lower rails come next, as in Figure 2. After adding the bead detail you can fasten them to the end panels with a few screws.

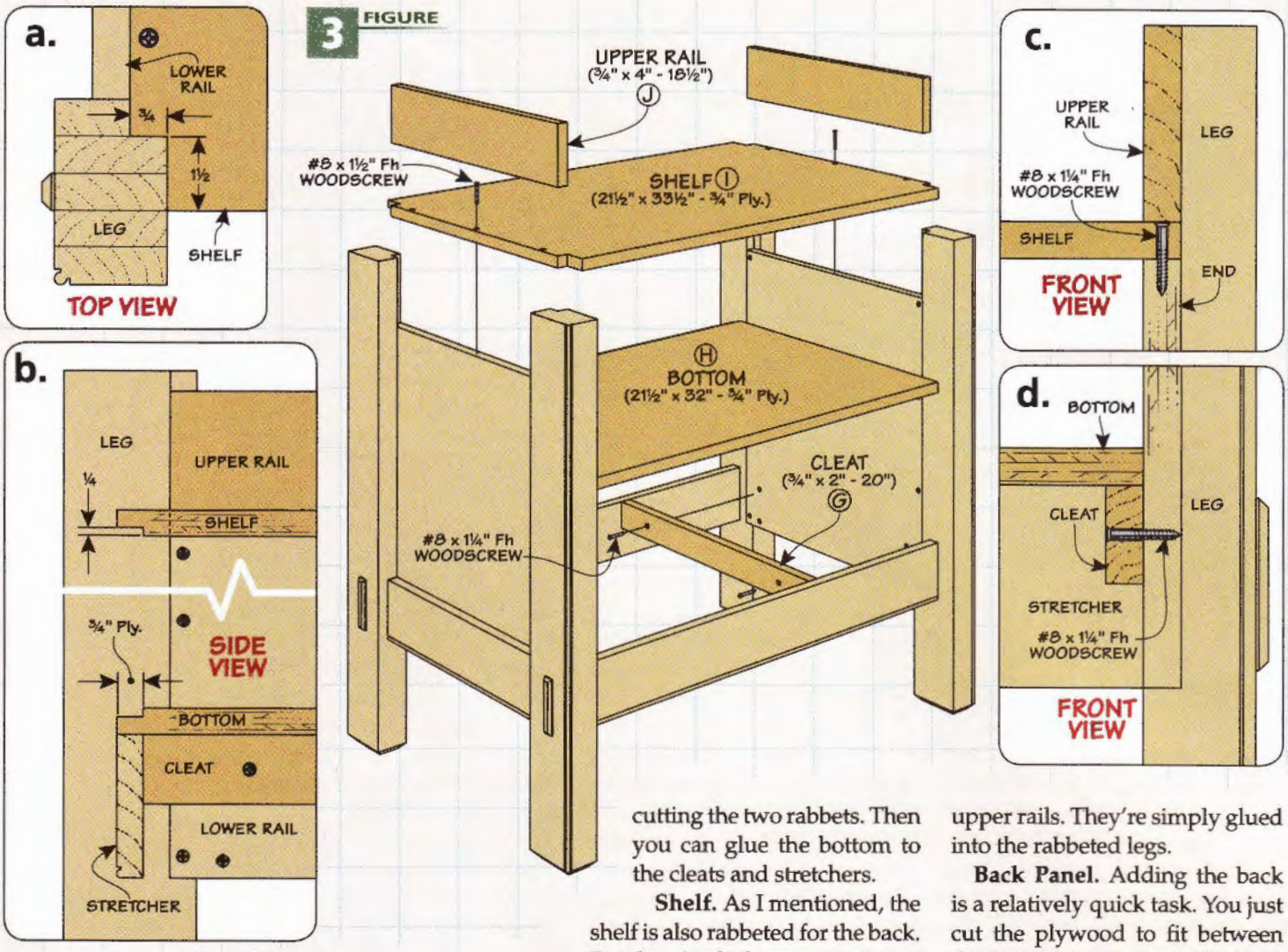
Bead Details

The edge and corner beading details can be created with the bit you see in the margin. To rout the corner bead on the legs, rout one edge, flip the workpiece end-over-end, then rotate it to the adjacent face to complete the bead (left drawing). The edge bead on the stretchers and rails can be made in a single pass, as shown in the right drawing.





▲ ***Beading Bit.*** *A common, ⅛"-radius beading bit is all you need to add classic details to the bench.*



closing up the Base

The foundation of the workbench is complete. Now you can work on adding the bottom, shelf, back, and molding to dress it up.

Bottom Panel. In Figures 3 and 3d you can see how the bottom panel sits on top of the stretchers and two cleats. The cleats can be cut to fit between the stretchers and fastened to the end panels with screws. Then you can work on the bottom panel.

Both the bottom panel and the shelf are rabbeted on the back edge to accept the plywood back (Figure 3b). The bottom is cut to fit between the ends and is flush with the outside faces of the stretchers. A pass over a dado blade makes quick work of cutting the two rabbets. Then you can glue the bottom to the cleats and stretchers.

Shelf. As I mentioned, the shelf is also rabbeted for the back. But there's a little more work you need to do. As you can see in Figure 3a, the shelf is notched to fit into the rabbets on the inside corners of the legs. This is so the shelf can rest on the top edge of the end panels. I made these cuts with a fine-tooth hand saw but you could also use a band saw.

The key is to lay out the notches accurately. Then, as you cut them, sneak up on the fit so that the shelf fits snugly into the rabbets and between the legs. If there are any gaps, they'll be a noticable distraction once the workbench is completed.

After the notches are cut, you can set the shelf in place. The ends of the shelf should be flush with the outside face of the end panels, as in Figure 3c. I used a few screws along the ends to secure the shelf in place.

Top Rails. To enclose the top ends of the bench, I added the upper rails. They're simply glued into the rabbeted legs.

Back Panel. Adding the back is a relatively quick task. You just cut the plywood to fit between the legs and into the rabbets on the bottom and shelf (Figure 4c). Note that the grain runs vertically. I then glued the back into the rabbets. The bullnose molding you'll make next secures it and covers the edges of the plywood shelf and bottom.

Bullnose Trim. The details in Figure 4 and the box on the opposite page show you what you need to know to make the bullnose edging and molding.

▲ ***Trim Details.*** *Simple molding completes the classic look of the workbench.*

The edging covers up the edges of the plywood on all four sides of the bench. The bullnose molding shown in Figure 4b is rabbeted to wrap around the top edge of the lower end rails.

There are a couple of things I need to mention about making the rabbeted bullnose molding and edging safely. The edging is made from ¾"-thick stock. This means you need to rip it to the 1" width before routing the bullnose profile. To rout the profile safely, I used a featherboard and push block, as you can see in the left drawing in the box below.

The bullnose molding is thicker and needs to be glued up from ¾"-thick stock and ripped to final thickness. You can use the same technique to rout the bullnose profile on the edge. Then, to form the rabbet, set up a dado blade and auxiliary rip fence (right drawing in the box below).

To fasten the edging and molding, I simply glued and clamped them. Note: Leave off the front upper edging until after the drawer case is installed (page 18). While the glue dries, you can work on the cove molding.

Cove Molding. The piece of cove molding on each end creates a nice visual transition between the bullnose molding and the vertical end panel. Figure 4b provides the details. I routed this profile on both edges of a wide blank, then ripped them free.

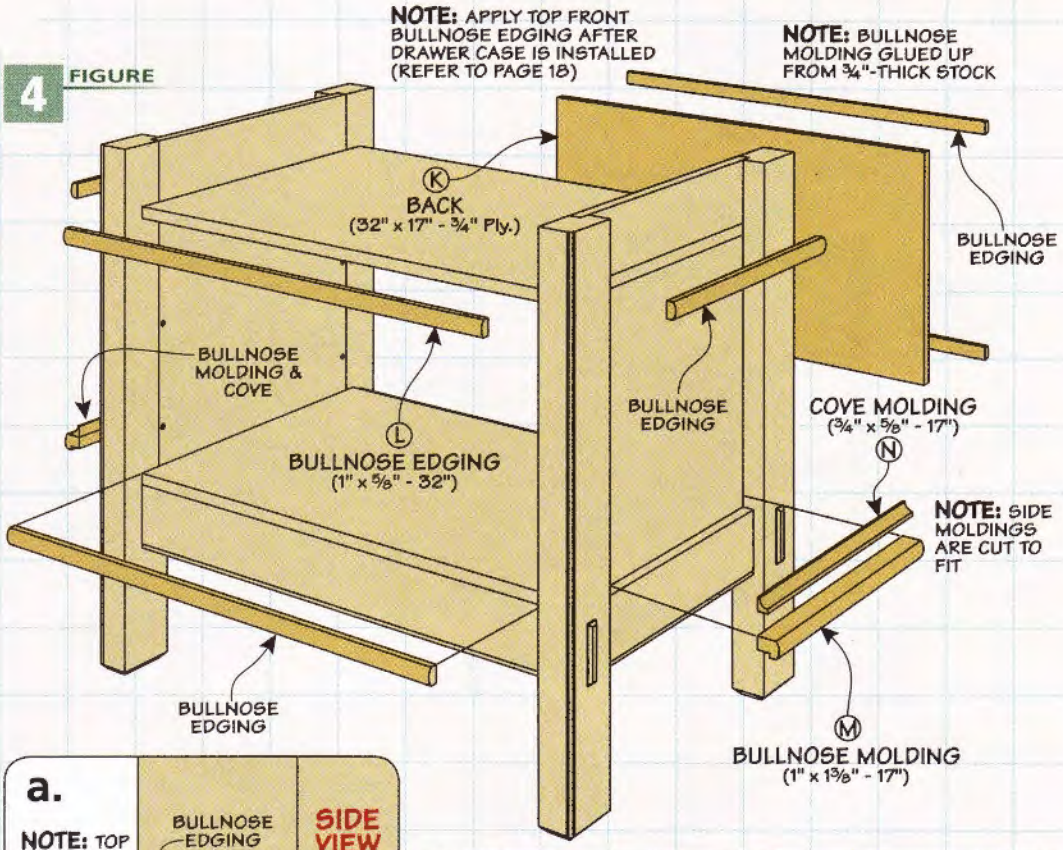
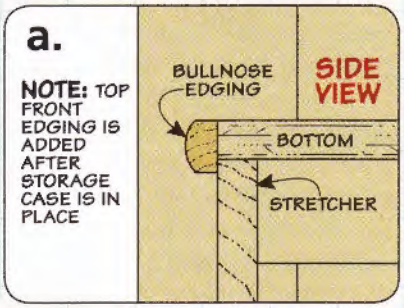
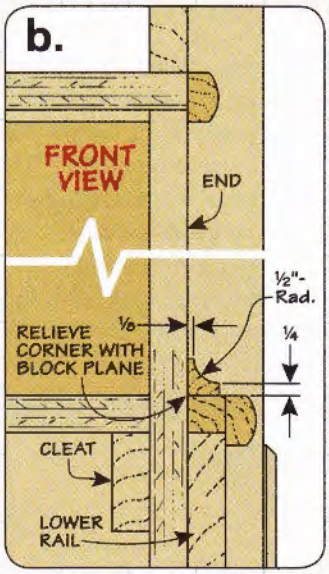


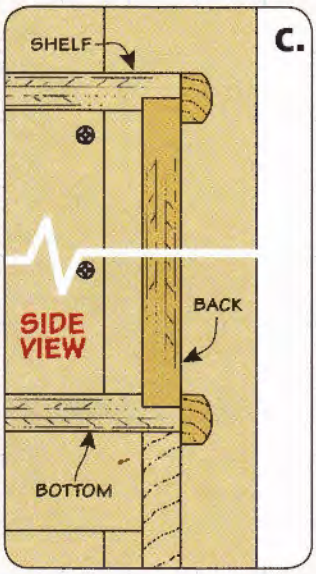
FIGURE 4



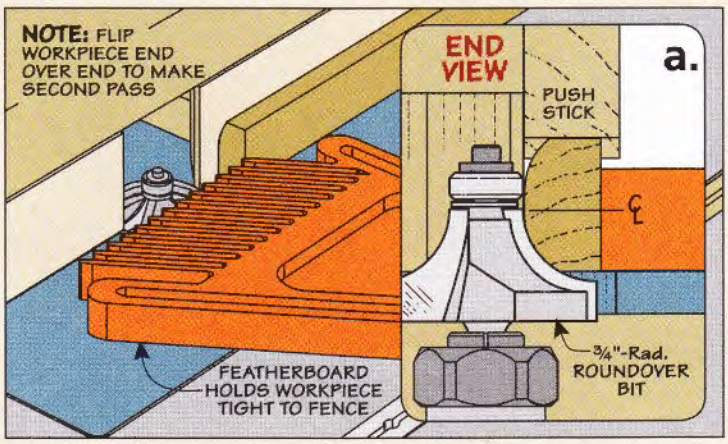
The molding is cut to length to fit snugly between the legs.

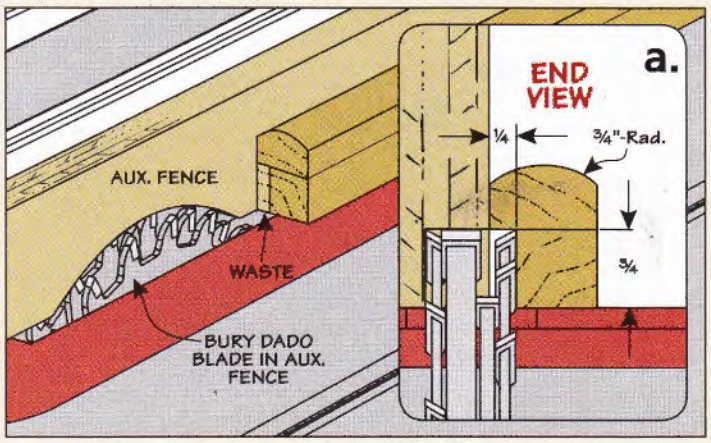
There's one trick I use to make sure the outer edges of the molding fit tight without gaps. You can relieve the back corner slightly with a block plane to create a narrow chamfer (Figure 4b). This ensures the molding fits tight into the corner for a seamless fit.

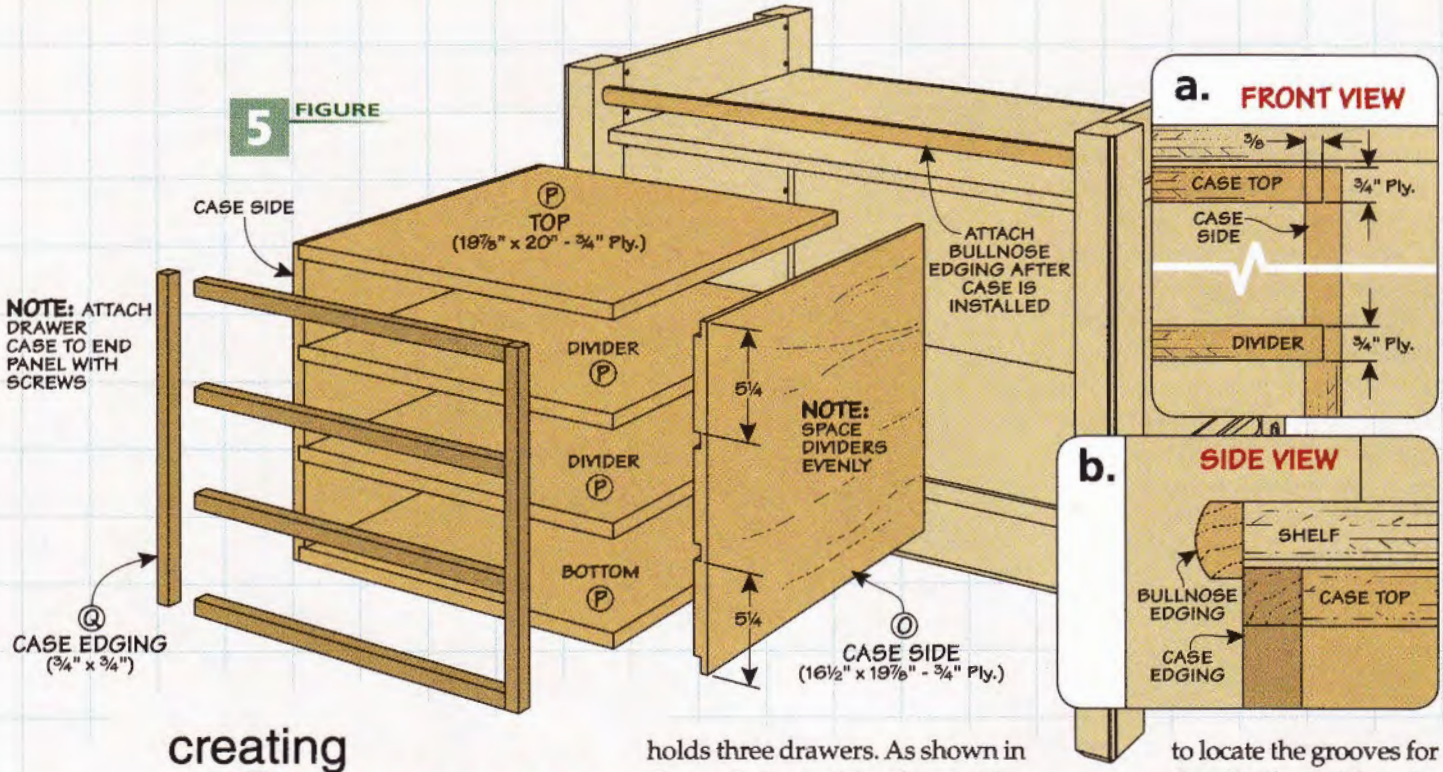




Making Bullnose Edging & Molding







creating Storage

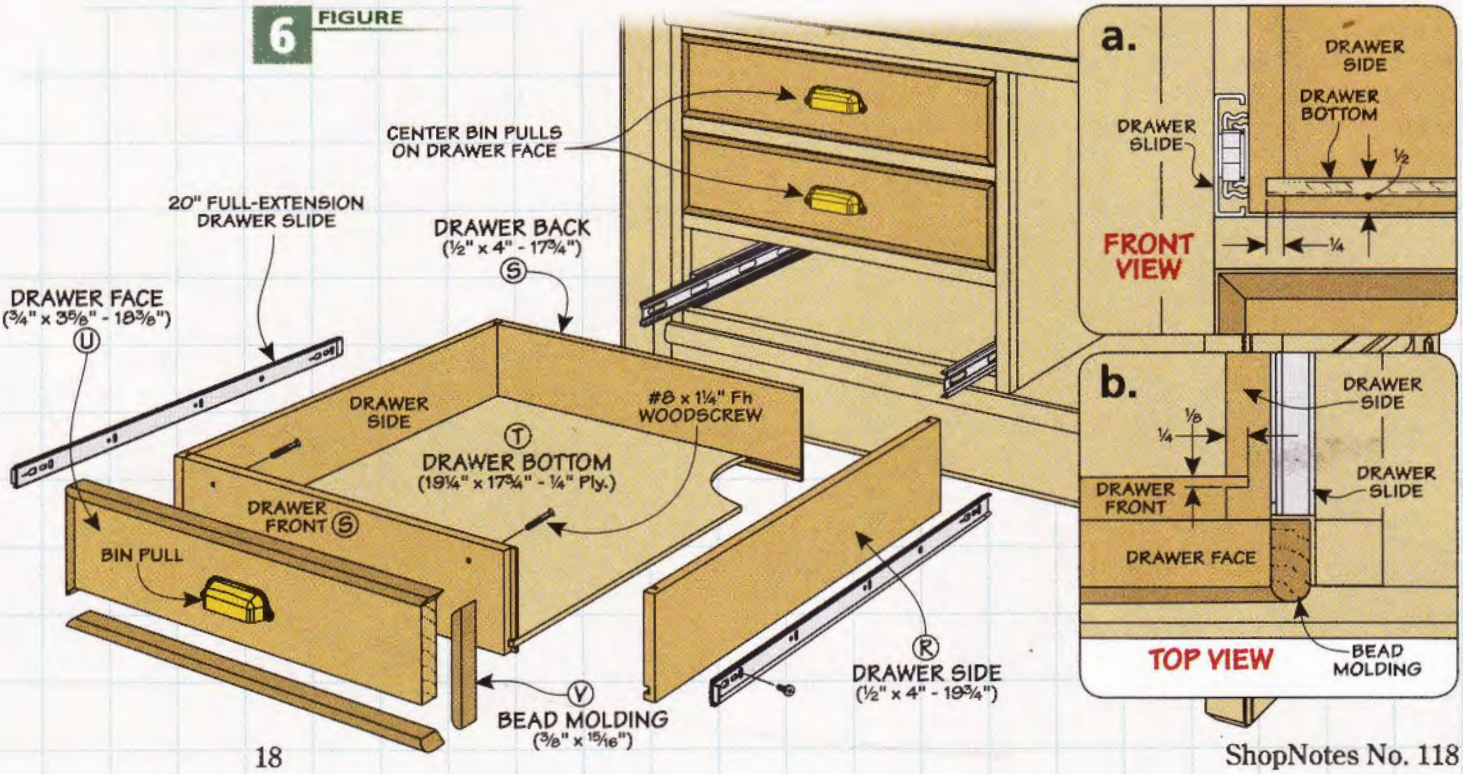
Besides adding much-needed storage space under the bench, the drawers and door provide another opportunity to show off your woodworking skills. The beaded drawer fronts and door frame add to the bead details on the legs, rails, and stretchers, creating a unified look for the bench.

Start with a Case. Making the storage space starts with building a simple plywood case that holds three drawers. As shown in Figure 5, it consists of two sides with rabbets and grooves to hold the top, bottom, and dividers. The sides are cut to width for a slip fit between the shelf and bottom. After cutting them to length, it's time to install the dado blade on the table saw to cut the rabbets and grooves. These are sized for the thickness of the plywood, as shown in Figure 5a.

Layout. After cutting the rabbets, I took some time to do a little layout work. The goal is to create three drawer compartments of equal height. This helps to locate the grooves for the dividers. After the grooves are cut, you can set the two sides out of the way while you work on the rest of the case.

The next task is an easy one. And that's to cut the identical top, bottom, and dividers to size. After that, you can grab a few clamps and glue the case together, making sure it's square.

Case Edging. Figure 5 shows the simple edging I used to hide the edges of the plywood on the drawer case. The width of the edging matches the thickness of the plywood. To make it, first



plane a board to thickness. Then rip this board to width to create the edging strips. They're cut to length and glued onto the case front. I started by gluing on the vertical edging first.

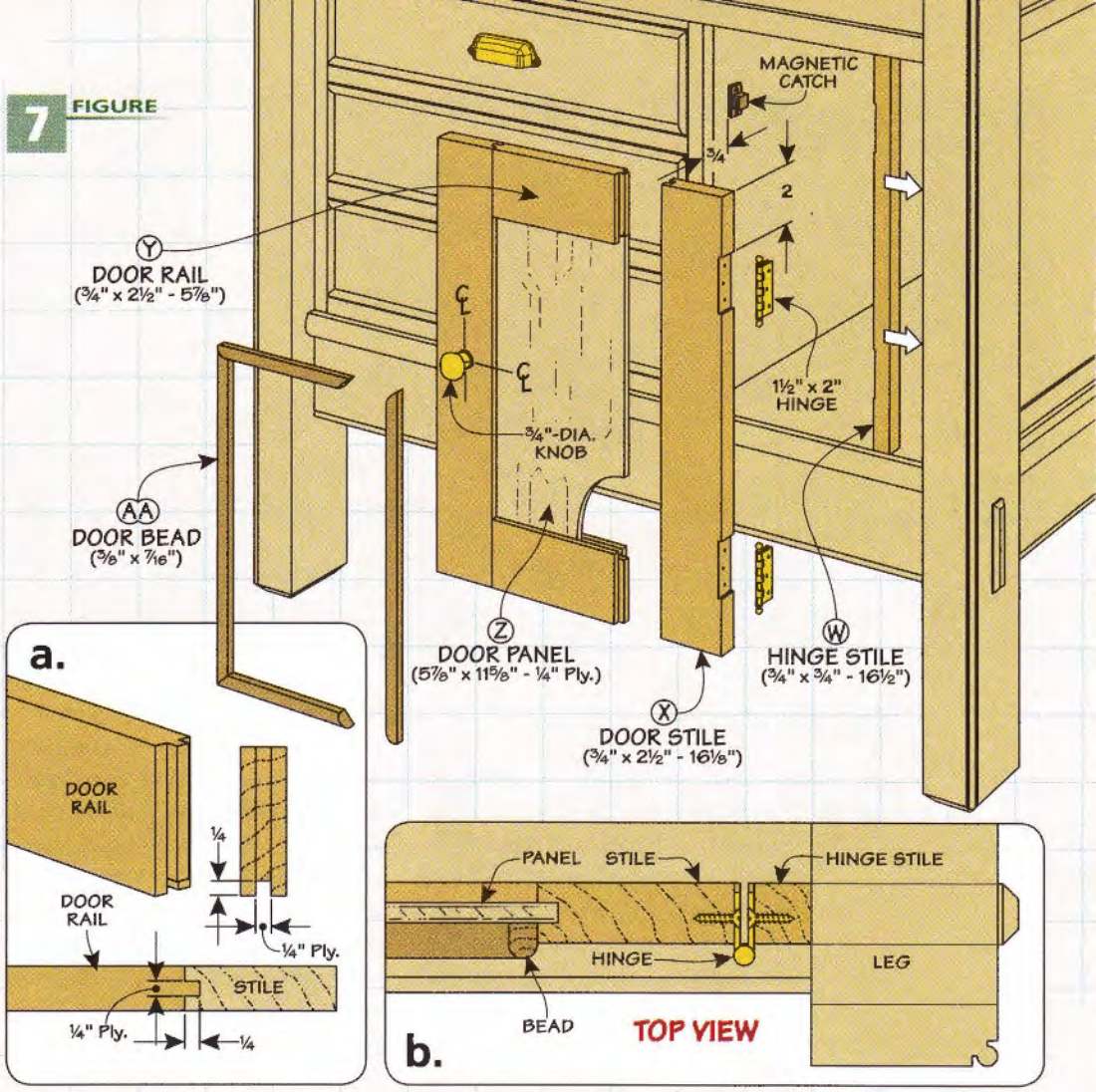
Install the Case & Slides. You can install the cabinet portion of the drawer slides and then slip the case into the bench. I fastened it to the end panel with a couple of screws. When you do this, the edging should be flush with the front edge of the shelf. Now, the final piece of bullnose edging can be glued in place before starting on the drawers.

Drawer Boxes. The drawer boxes are made from ½"-thick hardwood with ¼" plywood bottoms. A beaded false front completes the drawer.

The tongue and dado joinery shown in Figure 6 is pretty straightforward. After cutting the groove for the drawer bottom, the glueup and assembly goes pretty quickly.

False Fronts. You can see in Figure 6 how the drawer fronts are simply hardwood blanks wrapped with mitered bead molding. The goal when sizing the drawer fronts is to end up with a 1/16" gap all around when the drawer is installed. The box below shows how I went about making the molding for the drawers and door. Cutting and fitting the molding for gap-free joints a takes a little patience, but the result is worth it.

FIGURE 7

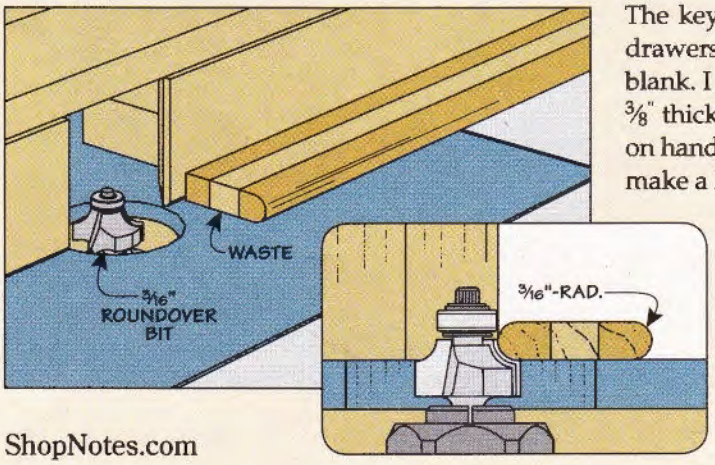


Beaded Panel Door. After completing and installing the drawers, the next task is building the door. I started by making the hinge stile and gluing it to the bench leg (Figure 7). Finally, the stile and the door are both mortised to accommodate the hinges.

The door frame is made with stub tenon and groove joinery. The tenons and groove are sized for the thickness of the plywood panel, as in Figure 7. I like to aim for a 1/16" gap all around between the door and the opening.

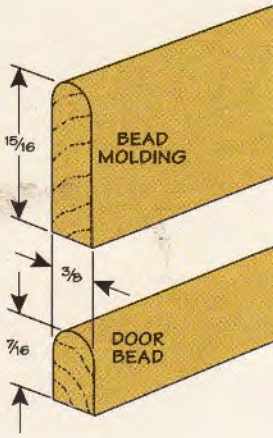
Details. After assembling the frame and panel, you can miter the bead molding to fit around the inside edge of the frame. With the drawers and door complete, it's time to install the drawer pulls, knob, and catch.

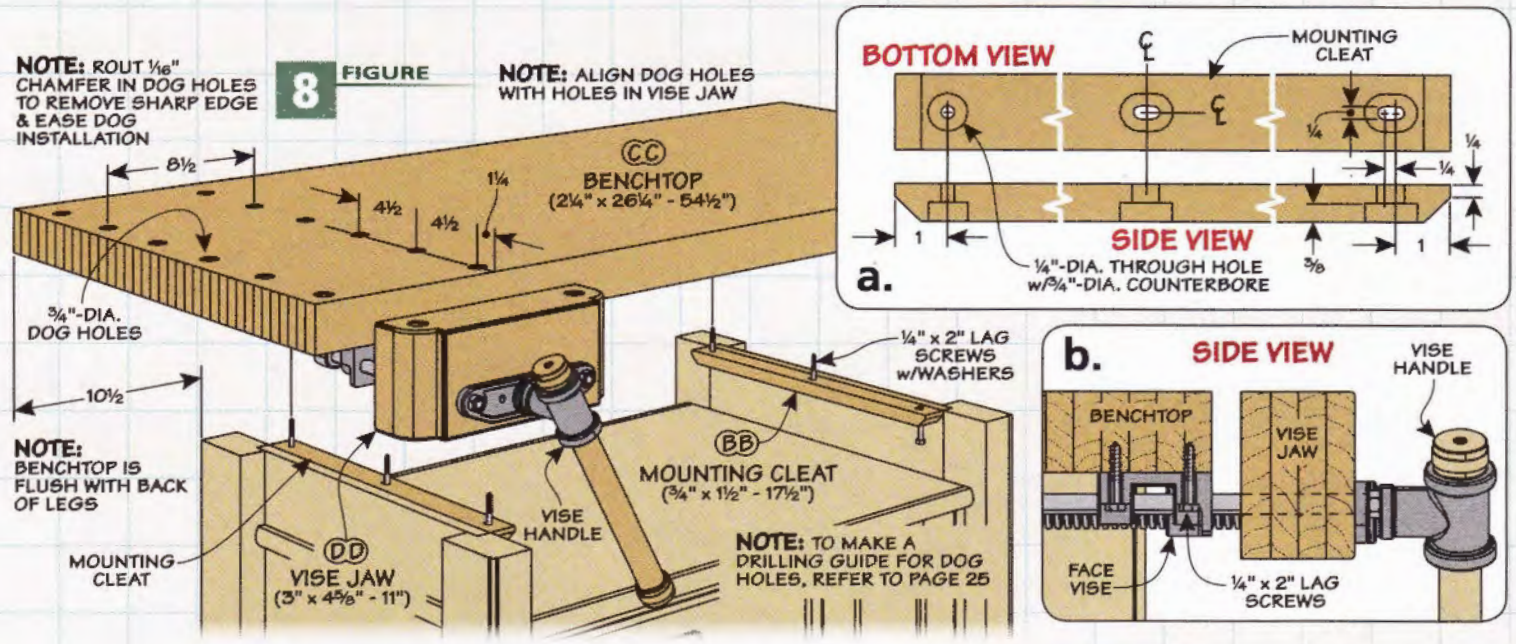
Drawer & Door Beading



The key to making the thin bead molding for the drawers and door safely is to start with a wide blank. I started with an extra-wide board planed to 3/8" thick. You'll want to make sure to have enough on hand for all of the drawers and the door. I like to make a little extra for added insurance.

To form the bead on both edges, you'll make a total of four passes to round over each edge, as you can see in the drawings. After that's done, you can head over to the table saw and use a push block while ripping the molding to width.





adding the Top & Rack

After all the work you've put into the base of the bench, you can now focus on the parts that will see the most use — the top and tool rack. The thick, hardwood top adds the mass needed to create a rock-solid worksurface. You'll cap it off with an easy-to-build yet handy tool rack.

Glued-Up Top. I'll be straight with you — assembling a smooth, flat top is going to require some time and patience. To make building the top easier to manage, I glued it up in narrow sections just wide enough to run through my planer. This helps ensure the top will be flat.

As you did with the legs, it pays to spend some time sorting through the stack of boards for the best grain and color match. After all, this is a workbench that will last for generations. So the time you spend here will be appreciated for years to come.

Ripping Strips. The process starts by ripping all of the strips needed to glue up the top. (I cut a few extra to have on hand.) I also left them a few inches long so I could trim the top to length later.

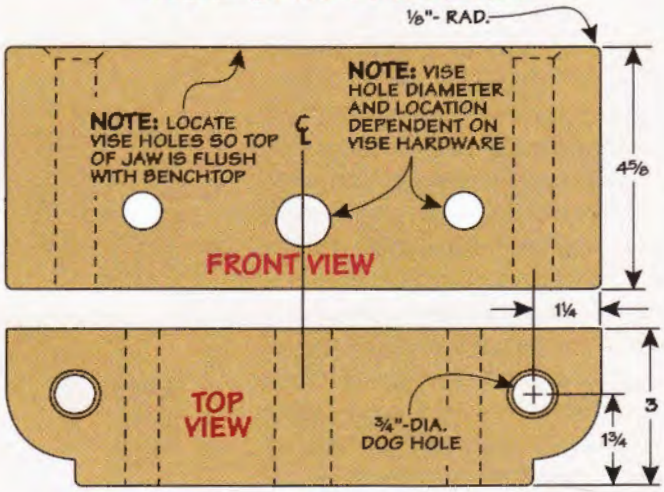
Now you can set all of the strips on edge and start arranging them for the best appearance. And you'll want to pay attention to the direction of the grain, too. The grain along the top edges of the strips should all be going in the same direction. This will help prevent tearout as you're planing sections of the top during the assembly process.

After gluing up each individual section to complete the top, scrape off the excess glue. Now, you have some choices when it comes to flattening the top.

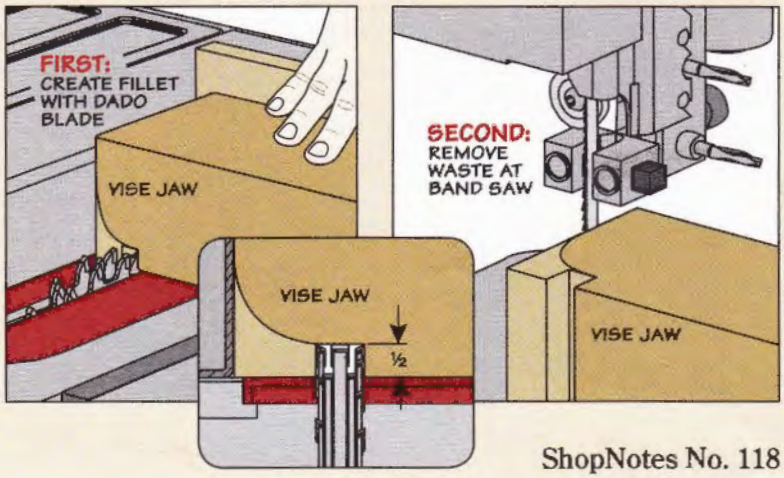
One option is to check with a local cabinet shop to see if they'll sand the benchtop for you using a wide drum sander. It's a quick way to a smooth, flat top. If that's not an option, you can use a belt sander or hand plane, checking your progress with a straightedge as you go.

Trim the Ends. To trim the ends of the top, I tacked a runner to the bottom face, making sure it was square to the front of the benchtop. The runner fits in the miter gauge of the table saw. Then it's a matter of having

VISE JAW PATTERN



Shaping the Vise Jaw



someone lend you a hand to help guide the top through the cut.

Face Vise. I turned the top upside down to install the vise hardware. But before I did that, I painted my vise hardware black for a more traditional look.

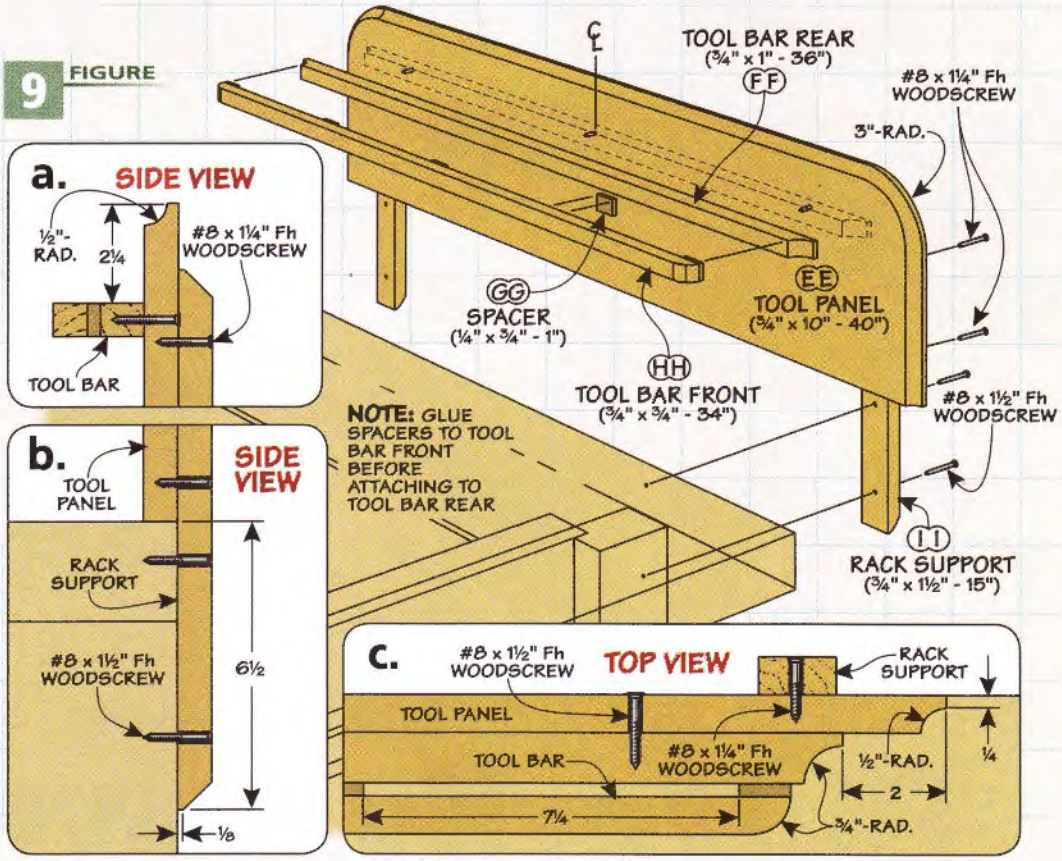
To make the vise jaw, take a look at the bottom of the opposite page. It's glued up from ¾"-thick stock, shaped on the table saw and band saw, then sanded smooth. A couple of dog holes complete the jaw before you install it on the vise.

Dog Holes. After easing all the sharp edges of the top with sandpaper or a block plane, it's time to drill the dog holes. Shop Short Cuts on page 25 shows a method to guarantee that the opposite holes align with each other.

Mounting the Top. The benchtop is fastened to the bench with lag screws and washers through a couple of mounting cleats. The cleats have oversized holes with counterbores to allow for expansion and contraction (Figure 8a). To make it easier to install the lag screws, I set the top in place, marked the holes, then removed the top to drill pilot holes.

Tool Rack. The final part of the bench to complete is the tool rack (Figure 9). It's made from a wide panel fastened to two vertical supports. The three-layer horizontal bar that holds your tools

FIGURE 9



is easy to make with a few basic router bits and the table saw.

I made the tool panel first. It's cut to size and the top two corners are rounded. Routing the cove profile on all but the bottom edge completes the panel.

The tool bar that holds the tools is made from three basic parts — a front and a rear bar with spacers between them, as shown in Figures 9a and 9c. I started with the front bar gluing the spacers to the back of it before attaching the rear bar. Finally, you can fasten the bar to the panel before installing the tool panel.

Simple Finish. In keeping with tradition, I applied a couple coats of oil finish. It's easy to renew when you need to. With the bench complete, you may be hesitant to put it to use. After all, it looks almost like a piece of furniture. But don't be afraid to load it up with tools and get to work. You'll soon appreciate its beauty *and* its function.

Materials & Hardware

A	Leg Outer Layers (16)	¾ x 2¼ - 34
B	Long Fillers (4)	¾ x 2¼ - 22¼
C	Short Fillers (4)	¾ x 2¼ - 8¼
D	Stretchers (2)	¾ x 4⅛ - 37
E	Ends (2)	18½ x 21⅜ - ¾ Ply.
F	Lower Rails (2)	¾ x 4⅛ - 17
G	Cleats (2)	¾ x 2 - 20
H	Bottom (1)	21½ x 32 - ¾ Ply.
I	Shelf (1)	21½ x 33½ - ¾ Ply.
J	Upper Rails (2)	¾ x 4 - 18½
K	Back (1)	32 x 17 - ¾ Ply.
L	Bullnose Edging (1)	1 x ⅝ - 170 Rgh.
M	Bullnose Molding (2)	1 x 1⅜ - 17
N	Cove Molding (2)	¾ x ⅝ - 17
O	Case Sides (2)	16½ x 19⅞ - ¾ Ply.
P	Top/Btm. Dividers (4)	19⅞ x 20 - ¾ Ply.
Q	Case Edging (1)	¾ x ¾ - 120 Rgh.
R	Drawer Sides (6)	½ x 4 - 19¾
S	Drawer Fronts/Backs (6)	½ x 4 - 17¾
T	Drawer Bottoms (3)	19¼ x 17¾ - ¼ Ply.
U	Drawer Faces (3)	¾ x 3⅝ - 18⅜
V	Bead Molding (1)	⅜ x 15/16 - 160 Rgh.
W	Hinge Stile (1)	¾ x ¾ - 16½
X	Door Stiles (2)	¾ x 2½ - 16⅛
Y	Door Rails (2)	¾ x 2½ - 5⅞
Z	Door Panel (1)	5⅞ x 11⅝ - ¼ Ply.
AA	Door Bead (1)	⅜ x 7/16 - 36 Rgh.
BB	Mounting Cleats (2)	¾ x 1½ - 17½
CC	Benchtop (1)	2¼ x 26¼ - 54½
DD	Vise Jaw (1)	3 x 4⅝ - 11
EE	Tool Panel (1)	¾ x 10 - 40
FF	Tool Bar Rear (1)	¾ x 1 - 36
GG	Spacers (5)	¼ x ¾ - 1
HH	Tool Bar Front (1)	¾ x ¾ - 34
II	Rack Supports (2)	¾ x 1½ - 15

- (38) #8 x 1¼" Fh Woodscrews
- (13) #8 x 1½" Fh Woodscrews
- (8) #8 x 2½" Fh Woodscrews
- (6) ¼" x 2" Lag Screws
- (6) ¼" Washers
- (3 pr.) 20" Full-Extension Drawer Slides
- (3) 4" Bin Pulls
- (1) ¾"-dia. Knob
- (1 pr.) 1½" x 2" Hinges
- (1) Magnetic Catch
- (1) Face Vise Hardware
- (1) Vise Handle

adding custom Butterfly Keys

Beautiful repairs and added style are simple with a few straightforward steps and proven techniques.

▼ ***Custom Repair.*** *Creative design is possible with custom-shaped butterfly keys.*

Using a board that is cracked or split may not be the first thing that comes to mind when building a project. But with a little work, you can turn a "flaw" into part of the design.

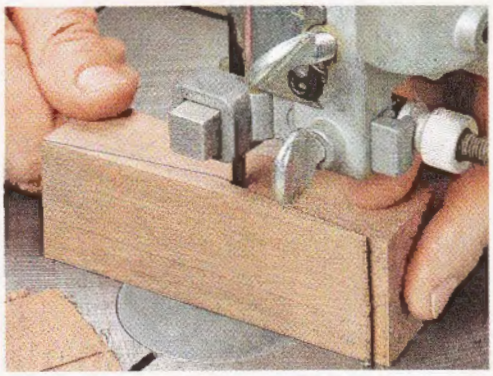
Before doing so, it's important to stabilize the workpiece from further movement. Decorative butterfly keys are a great way to accomplish this. A butterfly key is just a spline that spans the width of an opening and limits any further separation.

To make them work, you simply create your own custom-shaped key and then cut a matching mortise in the workpiece. The best part is you don't need any special tools or jigs.

MAKING THE KEY

The size and proportion of the key is determined by the workpiece to be repaired. The key should be large enough to limit any further wood movement, but not so large that it's overpowering in appearance. And the choice of wood you use will either make the key stand out or blend in with the rest of the project.

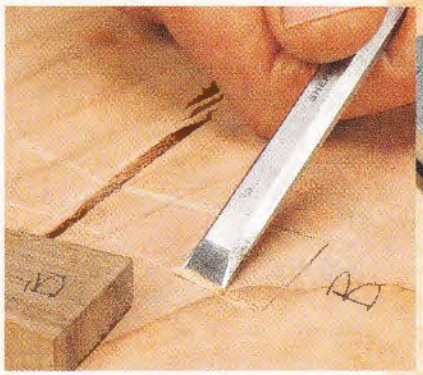
Whatever wood you choose, its best to use straight-grained pieces. This helps minimize seasonal wood movement.



▲ ***Shape Key.*** *Cut multiple keys to shape at the same time using a band saw and an extra-thick blank.*

▲ ***Rip Multiples.*** *Cut the individual keys free from the blank using a fence and a push block on the band saw.*

▲ **Scribe Key Location.** *Use a marking knife to scribe the location of each key.*



▲ **Clear Inside Edge.** *Minimize chipout by removing the outer waste with a chisel.*

▲ **Rout Mortise.** *A hand-held router and straight bit make quick work of removing the bulk of the mortise waste.*

Layout & Shape. For the example here, I used a length of $^{13}/_{16}$" thick walnut for the key. The blank was ripped extra wide and the shape of the key was marked on its edge. This makes it easy to get straight grain and allows for making multiple keys from the same layout. With the shape of the key marked, go ahead and cut the blank to overall length at the table saw.

The next step is to cut the blank to shape at the band saw. Then you can cut the individual keys free (bottom photos, opposite page). To minimize seasonal movement, it's best to keep the keys between $^1/_4$" - $^1/_2$" thick. Clean up the edges of the key using a chisel or sanding block. This will help ensure a seamless fit.

CREATING THE MORTISE

To create a matching mortise, position the key over the crack in the workpiece. Double-sided tape will help keep it from moving. In the photo above, you can see that I used a marking knife to scribe the outline of each key on the workpiece.

After removing the key, use a chisel to clear the waste around the inside perimeter of the mortise (center photo above). This minimizes chipout when removing the bulk of the waste with a palm router, as in the far right photo above.

Rout Waste. A straight bit makes it easy to remove the bulk of the waste in two passes. The final depth should be about $^1/_{32}$" less than the thickness of the key. This ensures that you'll be able to plane the key flush.

▲ **Clean the Edge.** *Use a chisel to clean the corners and inside walls of the mortise.*

Clean Edges. The final step to finish the mortise is to clean up the edges with a chisel. The key needs to fit snugly, so be sure that the walls of the mortise are square and smooth.

FITTING THE KEY

To help fit the key in the mortise, it's best to create a slight back bevel along the bottom edge of the key. This provides room for excess glue as well. I used a chisel as shown in the inset photo below. After completing a test fit, remove any waste from the key or mortise to ensure the key fits securely.

Once you've achieved a snug fit, apply a thin layer of glue inside the mortise. A mallet and block of wood help to fit and seat the key fully.

The final step is to plane or sand the keys flush with the workpiece surface, as in the main photo. The end result is a strong repair that adds style and character to your project.

▲ **Back Bevel & Insert.** *Bevel the bottom edge of the key (inset) and insert it into the mortise with a mallet and wood block.*

TIPS FROM
Our Shop

Shop Short Cuts

Shaping Sturdy Legs

The legs for the miter saw station on page 26 taper at the top and have a wide stance for maximum stability. A couple of cutouts lighten the weight and create the feet to improve balance.

Getting a smooth, consistent shape on these large parts can be a real challenge.

The secret is to use a routing template. Using the dimensions on page 29, you can quickly make a template from ¼" hardboard.

Leg Blank. With the template complete, I glued two layers of plywood together to create an oversized blank for the legs. You can use the template as a pattern to trace the shape of the legs on the blank, as shown in Figure 1.

The next step is to cut the legs to rough shape with a jig saw. I used a spade bit to create a starter hole for the blade.

Flush Trim. Now you'll use the template to trim each leg to final size and shape. Attach the template to the leg blank with double-sided tape and trim the edges flush at the router table, as you can see in Figure 2.

Stable. *The A-shape of the legs gives the miter saw station a stable stance.*

FIGURE 1

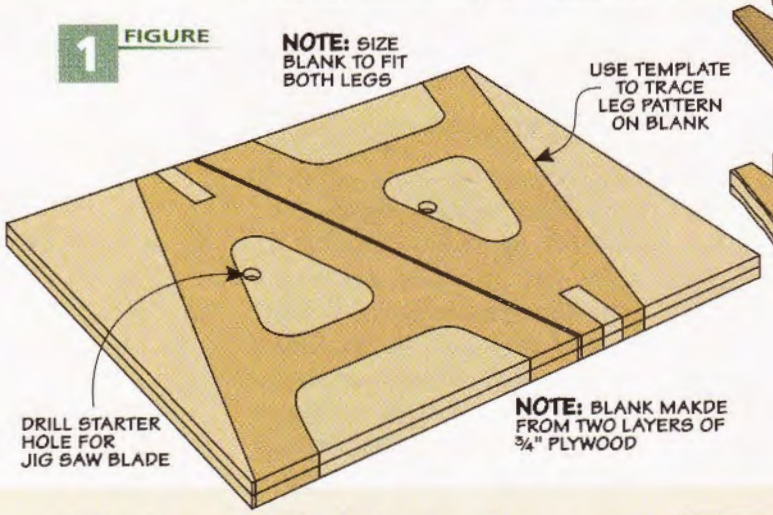
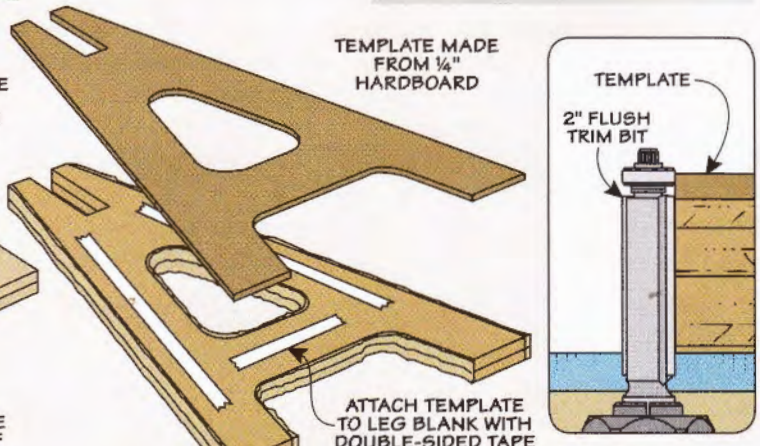


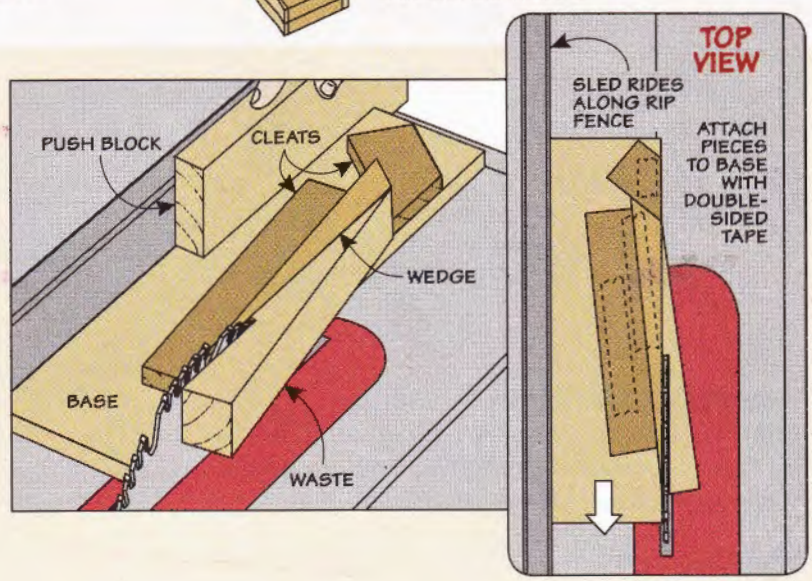
FIGURE 2



Making the Wedges

The wedges inside the main beam of the miter saw station (page 26) are key to holding the extension beam in place. And at first, it may seem like they're difficult to make accurately. In reality, it only takes a few cuts at the table saw to get the job done.

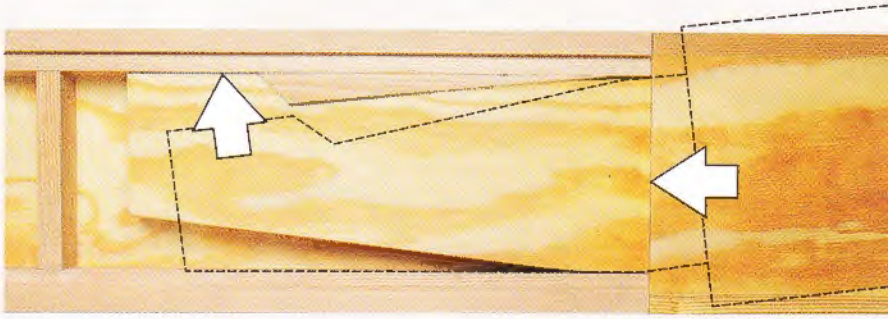
After cutting the blanks to length, I tilted the saw blade to make the angled cut on the end. Then to make the long, tapered cut, I used the sled you see in the right drawings. A pair of cleats on the sled trap the blank. And to keep it from shifting, I added a strip of double-sided tape.



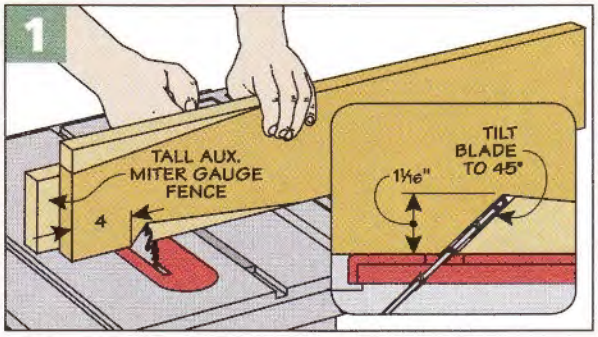
Locking Arms

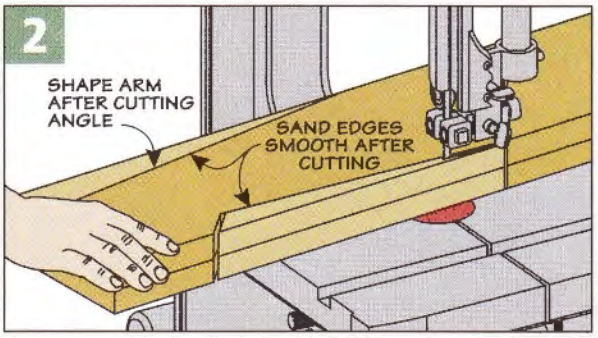
The wedges on the previous page form half of the interlocking system that keeps the extension beams in place on the miter saw station. The other component is the arm on the end of each extension.

There are two main considerations in shaping each arm. First, it needs to slide in and out of the main beam easily and quickly. And it needs to lock tightly against the wedge so the beam stays level. To accomplish these goals, the lower edge of the arm is tapered and a notch in the upper arm mates with the wedge and locks against its angled end. The most important step is to cut the end of the notch to match the angle on the wedge. You can see how I did this in Figure 1. The rest of the notch and taper don't need to be as precise, so I made the cuts at the band saw (Figure 2). After smoothing the cut edges, the arm is ready to be installed.



▲ ***Solid Fit.*** *Tilt the beam to slip the arm under the wedge and then lower it to lock in place.*





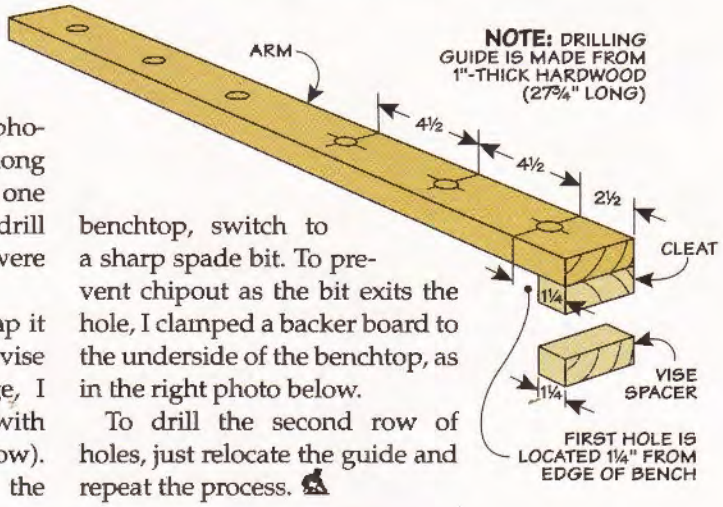
Dog Hole Drilling Guide

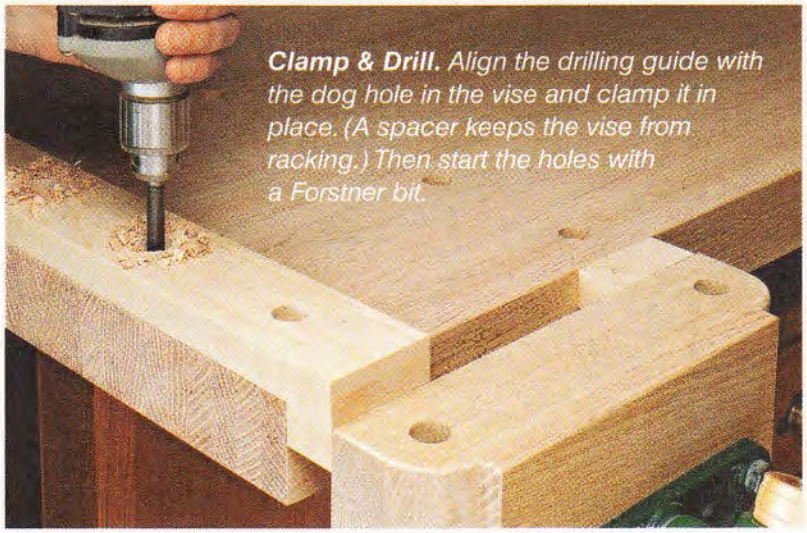
When drilling holes for bench dogs in a benchtop, there are several goals to keep in mind. First, the rows of holes should be parallel with each other. Second, the rows should aligu with the corresponding holes in the vise jaw. And finally, the holes need to be spaced evenly across the bench.

To meet these goals on the workbench on page 12, I made a simple drilling guide, as shown in the drawing at right and photos below. It consists of a long arm with a short cleat on one end. I drilled the holes at the drill press to help ensure they were square to the face.

To use the jig, simply clamp it in line with the hole in the vise jaw. To create a clean edge, I drilled about ½" to ¾" deep with a Forstner bit (left photo below). To finish drilling through the benchtop, switch to a sharp spade bit. To prevent chipout as the bit exits the hole, I clamped a backer board to the underside of the benchtop, as in the right photo below.

To drill the second row of holes, just relocate the guide and repeat the process.

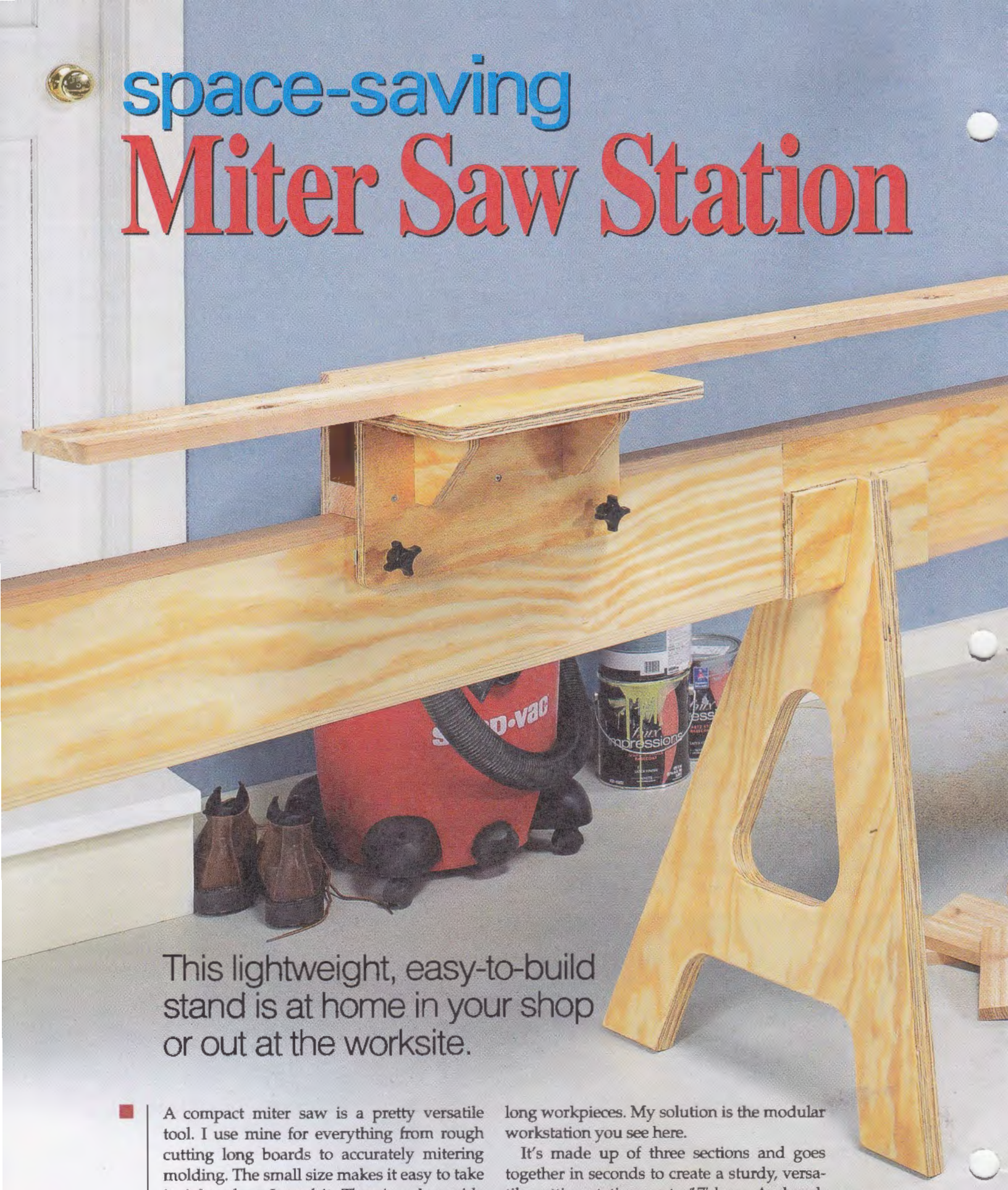




Clamp & Drill. *Align the drilling guide with the dog hole in the vise and clamp it in place. (A spacer keeps the vise from racking.) Then start the holes with a Forstner bit.*

◀ ***Drill Through.*** *With a backer board clamped to the underside of the benchtop, switch to a sharp spade bit to complete the dog holes.*

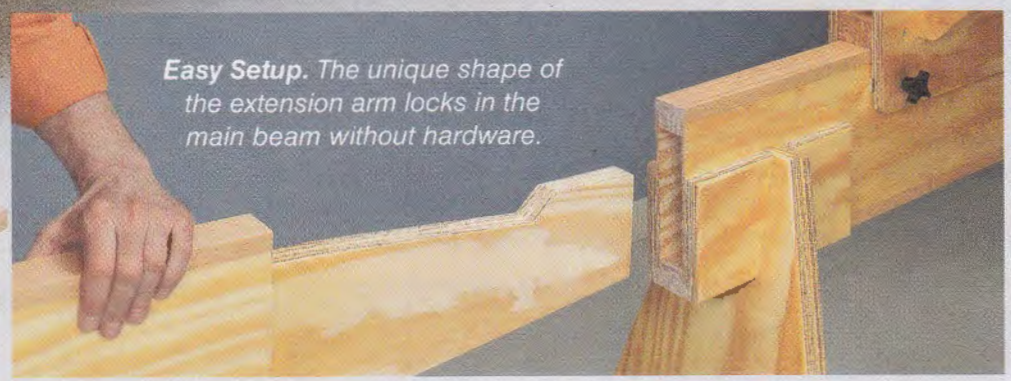
space-saving Miter Saw Station



This lightweight, easy-to-build stand is at home in your shop or out at the worksite.

A compact miter saw is a pretty versatile tool. I use mine for everything from rough cutting long boards to accurately mitering molding. The small size makes it easy to take it right where I need it. There's a downside to that small size, however. On its own, the saw table is too small to adequately support long workpieces. My solution is the modular workstation you see here.

It's made up of three sections and goes together in seconds to create a sturdy, versatile cutting station up to 17' long. And each section is lightweight so you can set it up anywhere from your garage to the backyard.



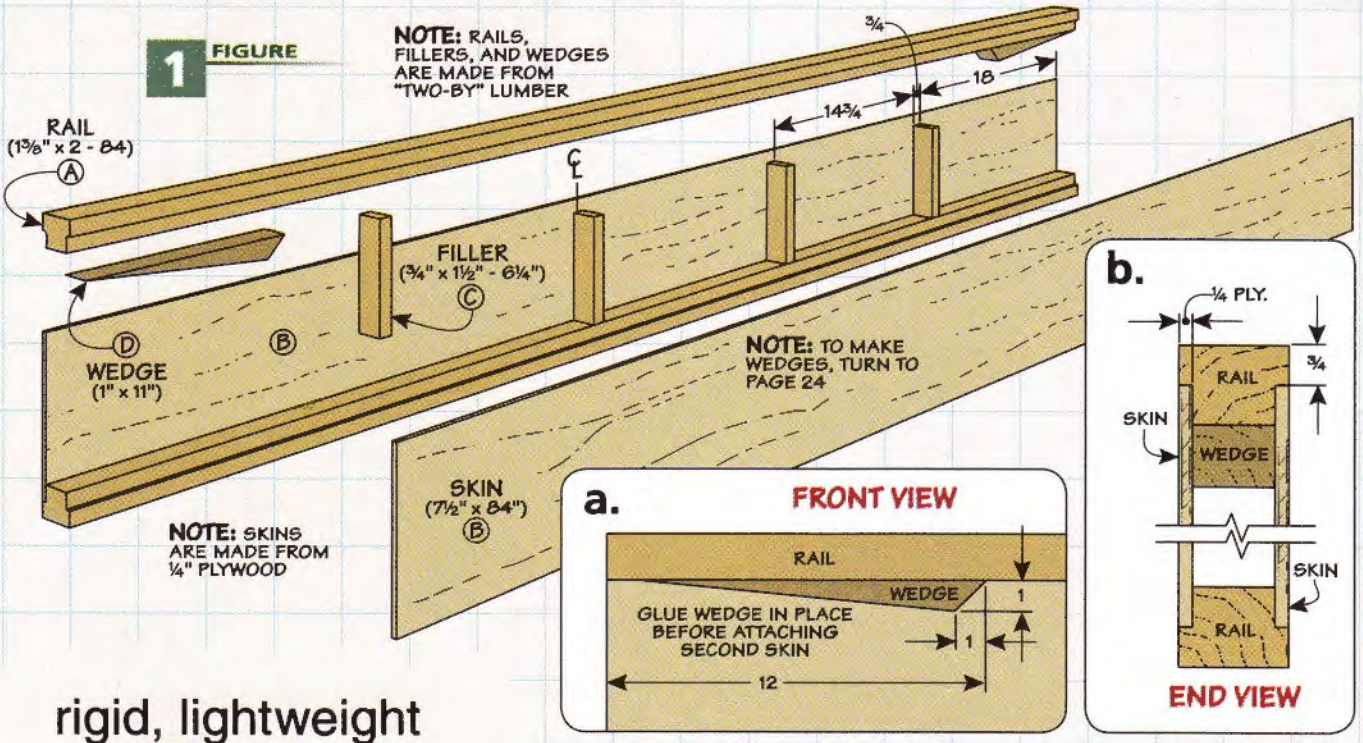
Easy Setup. *The unique shape of the extension arm locks in the main beam without hardware.*

ShopNotes
GO ONLINE EXTRAS

To download a cutting diagram for the miter saw station, go to:
ShopNotes.com

Materials & Hardware

A	Rails (2)	1⅜ x 2 - 84	K	Saw Base (1)	18 x 22 - ¾ Ply.	U	Spacers (2)	1½ x 2 - 14
B	Skins (2)	7½ x 84 - ¼ Ply.	L	Front/Back (2)	9 x 22 - ¾ Ply.	V	Fences (2)	¾ x 1¼ - 14
C	Fillers (8)	1½ x ¾ - 6¼	M	Long Lock Bar (1)	¾ x 22 - ⅛ Alum.	• (65) #8 x 1½" Fh Woodscrews		
D	Wedges (2)	1½ x 1 - 11	N	Shelf (1)	6 x 16 - ¾ Ply.	• (6) #5 x ⅝" Fh Woodscrews		
E	Upper Side Rails (2)	1⅜ x 2 - 60	O	Shelf Sides (2)	5 x 5½ - ¾ Ply.	• (8) #8 x 2" Fh Woodscrews		
F	Lower Side Rails (2)	1⅜ x 2 - 54½	P	Large Braces (2)	6 x 6 - ¾ Ply.	• (10) 5/16"-18 T-Nuts		
G	Side Webs (4)	7½ x 60 - ¼ Ply.	Q	Outfeed Bases (2)	13¾ x 14 - ¾ Ply.	• (6) 5/16"-18 x 1" Studded Knobs		
H	Arms (2)	6¼ x 34 - 1½ Ply.	R	Fronts/Backs (4)	7⅜ x 14 - ¾ Ply.	• (4) 5/16"-18 x 2" Hex Bolts		
I	Legs (2)	25 3/16 x 33 - 1½ Ply.	S	Short Locking Bars (2)	¾ x 14 - ⅛ Alum.	• (4) 5/16" Flat Washers		
J	Brackets (8)	5 x 5¾ - ¾ Ply.	T	Small Braces (4)	4 x 4 - ¾ Ply.	• (1) ¾" x 72" - ¼ Aluminum (for Locking Bars)		



rigid, lightweight
Beams

At the heart of this miter saw station are three beams that carry the sliding saw and outfeed platforms. The center beam is 7' long. Each end is open to accept a 5'-long extension. You can position the saw and outfeed platforms anywhere along the beams.

To create a strong and stable workstation, the beams should be straight, flat, and rigid. Then, when they lock together, the sections will be level, perfectly aligned, and able to support the saw and workpiece without sagging. To meet these goals, I used a "box beam" construction. Each beam is made up of thin plywood skins glued to solid wood upper and lower rails. With some internal blocking added, the result is a surprisingly rigid and light assembly, as in Figure 1.

Rails. The process of making the beams begins with the rails. Just be sure to select straight, flat boards to make the rails. With the rails cut to size, cut a rabbet along each side. The width of the rabbet should match the thickness of the ¼" plywood, as in Figure 1b.

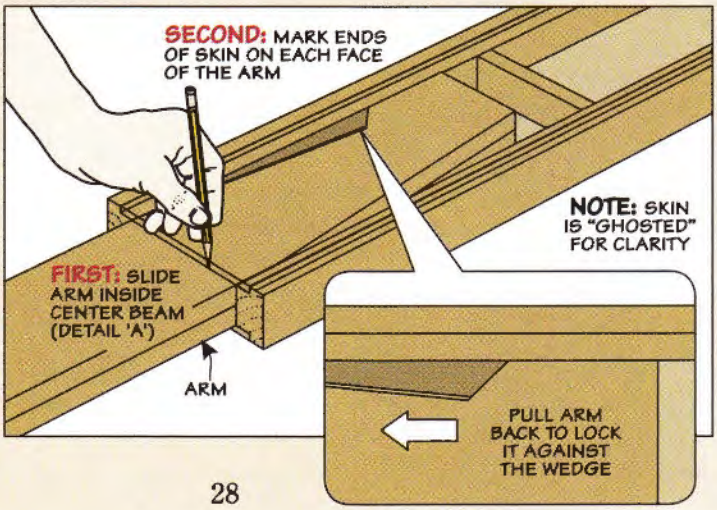
Skins. There's not much that goes into making the skins. They're simply cut to size. At this point, you can glue one skin to the upper and lower rails. But before attaching the opposite skin piece, you need to take care of a few internal details.

The first is adding some fillers to stiffen the beam. This consists of a few pieces sized to fit between the rails (Figure 1).

Wedges. The other detail is to make two wedges that will be used to secure the extensions, as shown in Figure 1a. You can see how I made the wedges in Shop Short Cuts on page 24.

The wedges are simply glued to the upper rail and skin at the location shown in Figure 1a. Then add the second skin to complete the main beam.

Installing the Arms



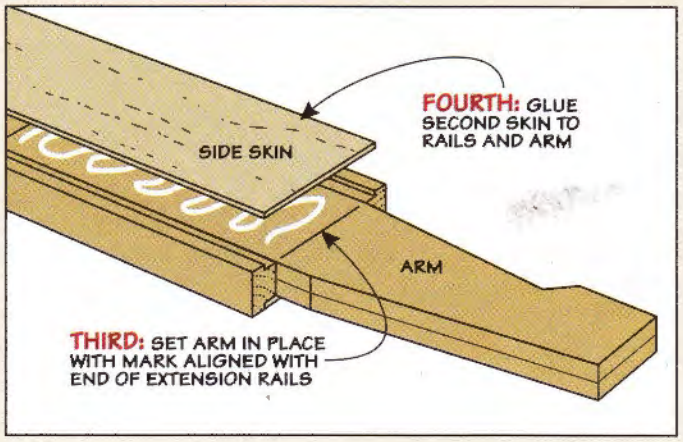
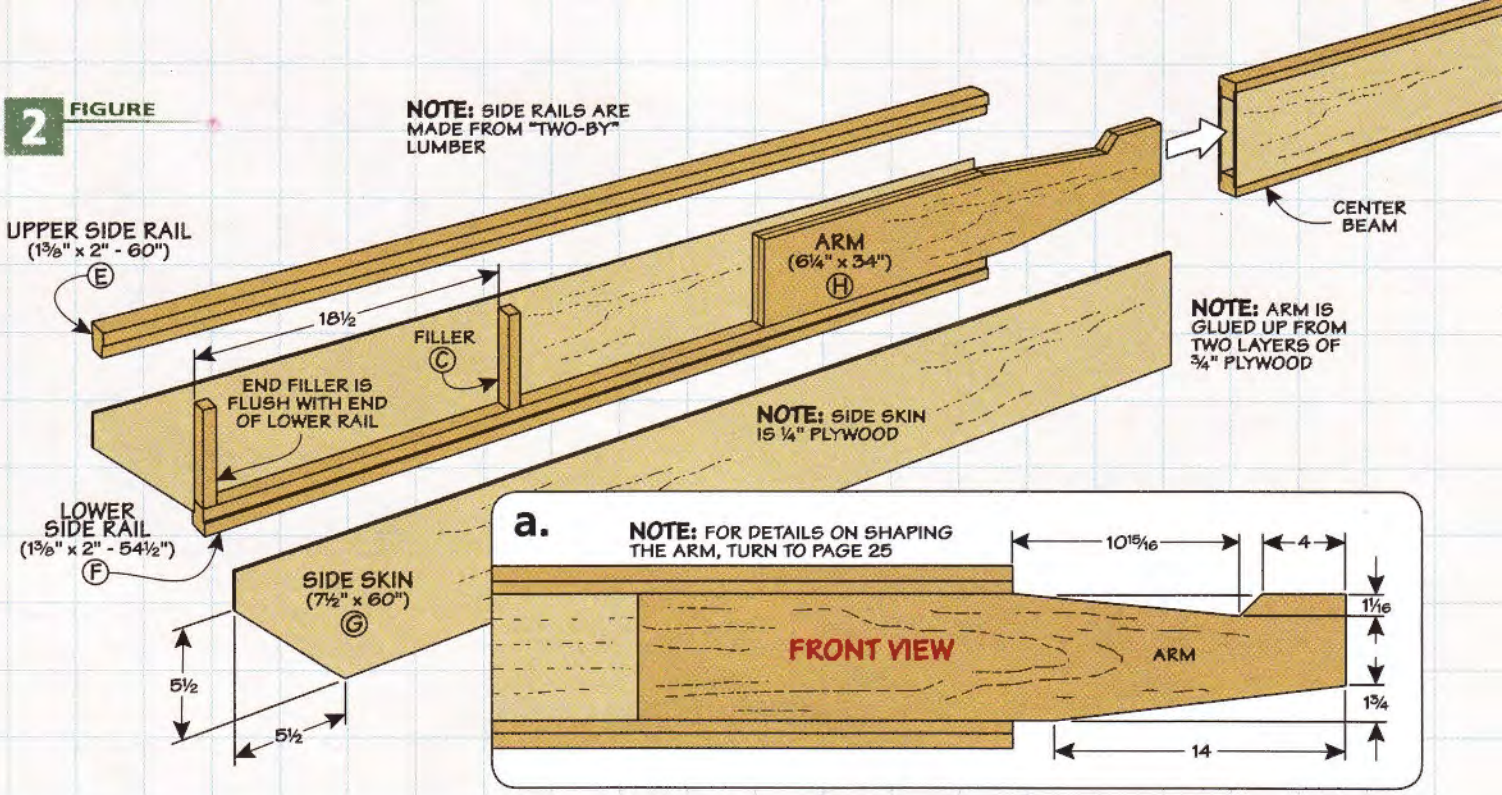


FIGURE 2



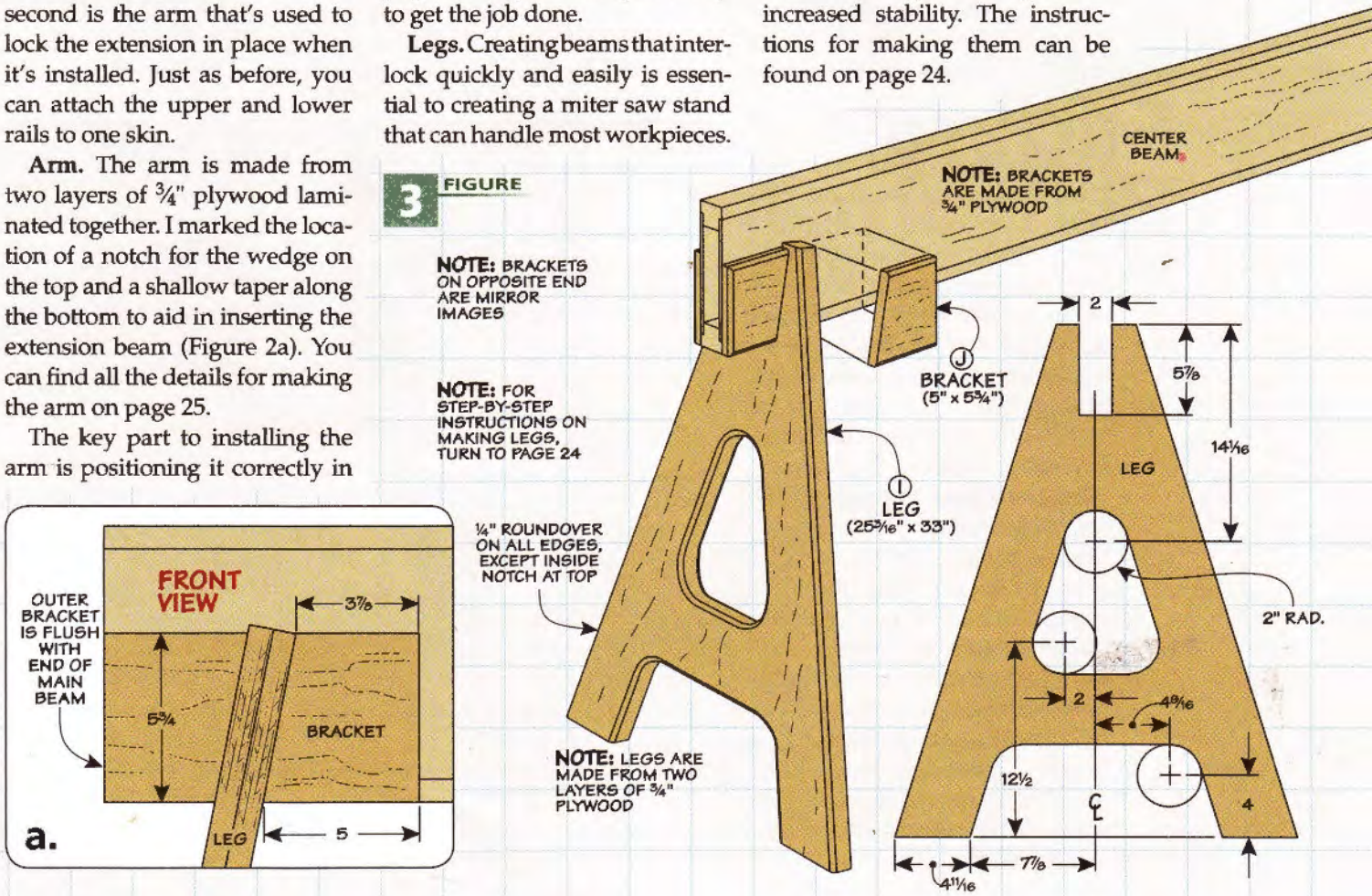
Extension Beams. In Figure 2, you'll notice that the overall construction for the two extensions is similar to the main beam. However, other than the length, there are two main differences. The first is the bevel on one end. The second is the arm that's used to lock the extension in place when it's installed. Just as before, you can attach the upper and lower rails to one skin.

Arm. The arm is made from two layers of ¾" plywood laminated together. I marked the location of a notch for the wedge on the top and a shallow taper along the bottom to aid in inserting the extension beam (Figure 2a). You can find all the details for making the arm on page 25.

The key part to installing the arm is positioning it correctly in the extension beam. It needs to lock securely on the wedge with the ends of the two beams seating tightly together. This will keep the assembly from sagging. The box on the bottom of the opposite page shows you a foolproof way to get the job done.

Legs. Creating beams that interlock quickly and easily is essential to creating a miter saw stand that can handle most workpieces. But also important is adding legs to bring the worksurface up to a comfortable height. You can see how I did this in Figure 3. A pair of stout legs fit into plywood brackets on each end of the main beam. The legs are angled for increased stability. The instructions for making them can be found on page 24.

FIGURE 3



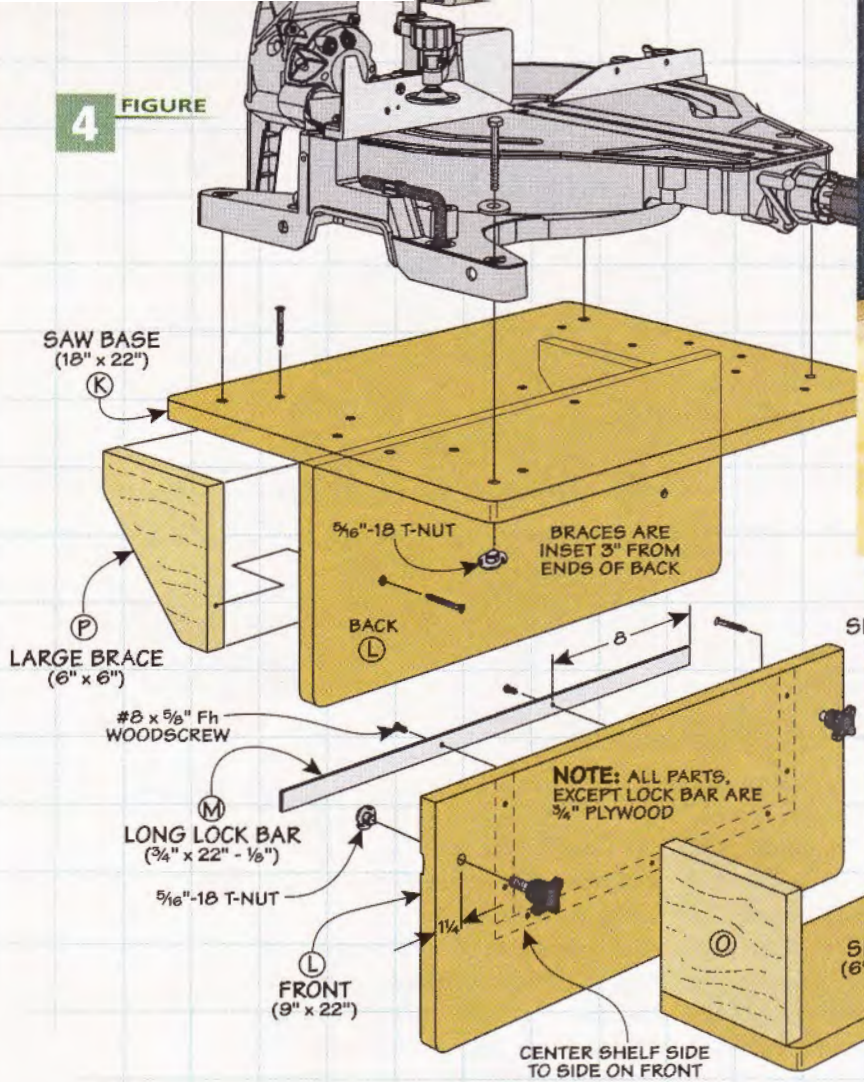
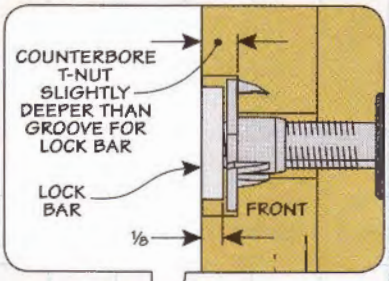
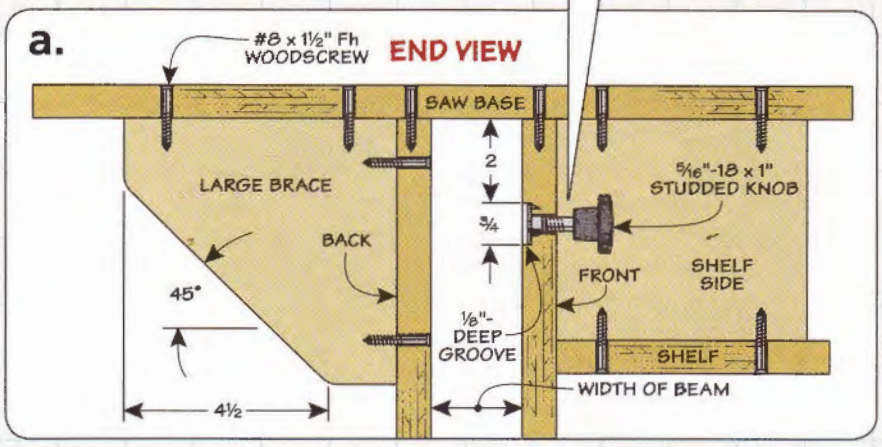


FIGURE 4

▲ ***Handy Shelf.*** *A shelf below the saw base is a great place to hold layout tools and cut lists.*

NOTE: SOFTEN CORNERS ON BASE, FRONT, BACK, AND SHELF WITH 1/2" RADIUS CURVE





adding three Sliding Platforms

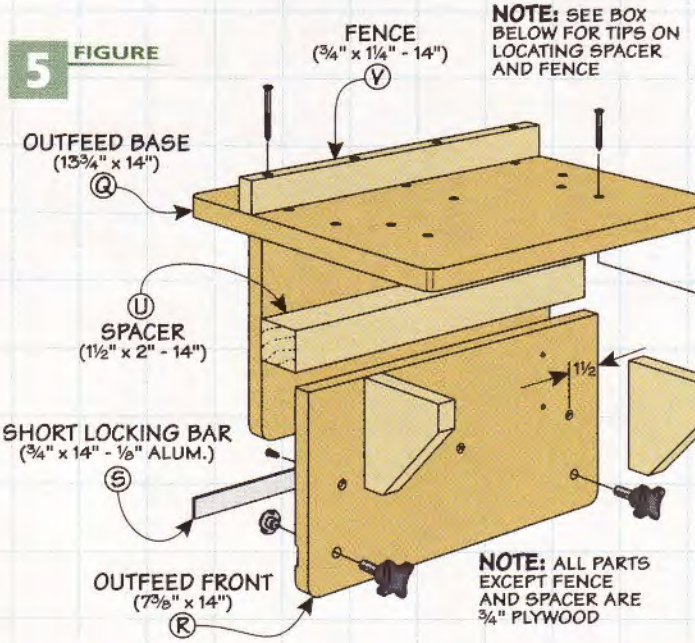
The interlocking beams and legs make up the main part of the miter saw station. The remaining parts provide a mounting point for your miter saw and a pair of side platforms to support a workpiece while it's being cut.

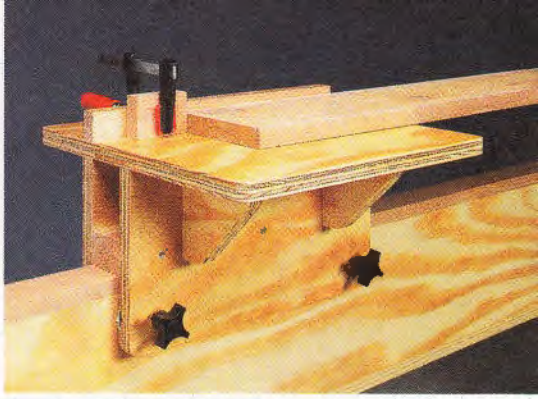
There's a little more going on here, however. One of the goals in making this station is portability. So the platforms need to slip on and off without hassle. I also wanted the platforms to be adjustable, too. So the three platforms you see on these pages can slide along the beams and be locked in place anywhere. This way, you can configure your saw setup to match the materials you're working with.

Saw Platform. I started with the saw platform. This assembly starts out as a base piece sized to hold your miter saw, as shown in Figure 4. The corners are rounded to soften them. A set of T-nuts in the base allows you to attach your saw with studded knobs and washers.

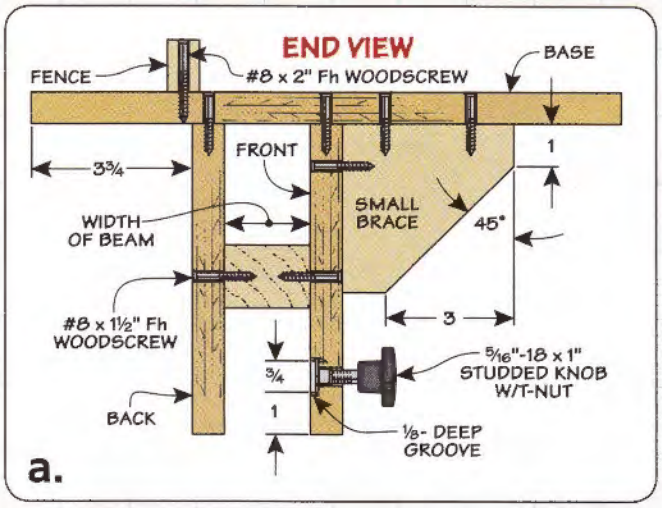
The base is screwed to a front and back piece. There are a couple of things to point out on the front. To lock the platform in place without marring the beam, I came up with a simple clamping system. First, I cut a groove along the inside face of the front to accept an aluminum bar, as in Figure 4a. The middle section of the bar is screwed into the groove. At each end, a studded knob and T-nut flex the bar to apply pressure to the beam and secure the platform (Figure 4b).

Before you can attach the front and back to the saw base, you





Accurate Cuts. *A fence on the outfeed support provides a place to attach a stop block.*



need to add a few supports. In the front, a U-shaped shelf assembly not only keeps the wide base from flexing, it provides some handy storage, too.

On the back, I added some angled plywood braces to support the top. The front and back are screwed to the top and spaced to just slip over the beam.

Outfeed Platforms. Other than being smaller, the outfeed platforms are built much like the saw platform, as illustrated in Figure 5. And they clamp in place to the beams the same way, too.

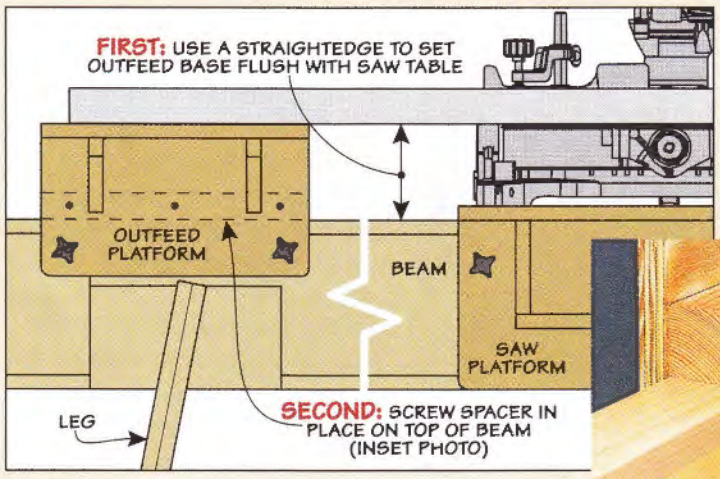
A couple of differences I'd like to point out are the size of the front and back and the location of the groove for the locking bar shown in Figure 5a. To position the outfeed platforms anywhere along the beams, the front and back need to ride high enough to clear the leg and brackets. In addition, you'll need to align the outfeed base with your saw's table. (The size of the outfeed front and back should work for most saws.) Consequently, the groove for the locking bar is located near the lower edge of the front to grip the beam.

Spacer and Fence. The task of keeping the outfeed platforms in line with the table on the miter saw falls to a solid wood spacer. It's meant to slide along the top of the beams. So the location of the spacer depends on the height of your saw table. In the box below, you can see how to locate the spacer using a straightedge.

Finally, I added a small fence to the base. Not only does it keep a workpiece in position, it allows you to clamp a stop block for making multiple, identical cuts. Here again, a straightedge comes in handy to make sure the fence is aligned with the fence on the saw.

In just a minute or two, you can set up the stand and attach your saw to the platform. Then you'll be ready for any task.

Set Up the Platform & Fence



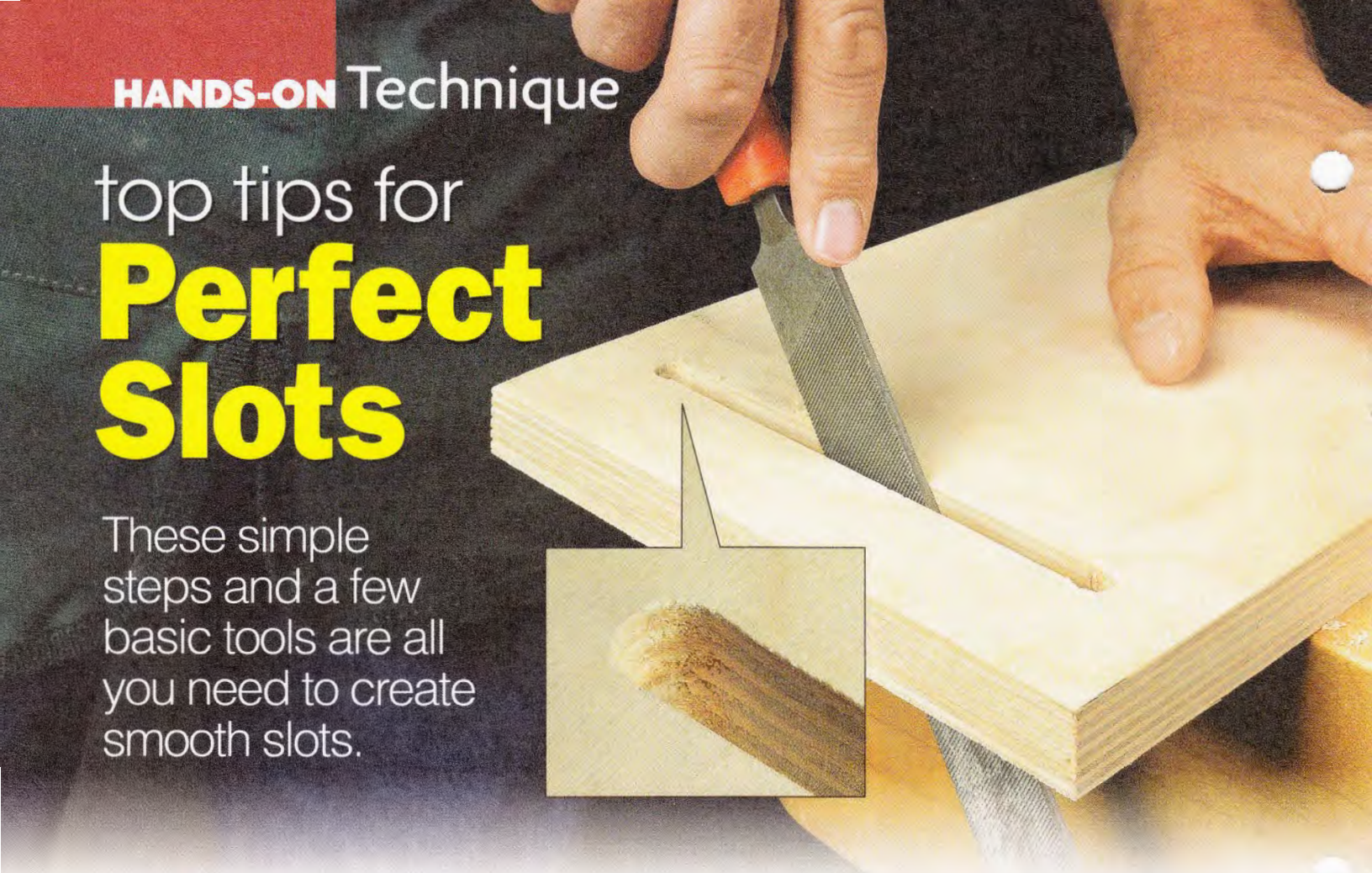
Attach Spacer. *A wood spacer positions the outfeed platform flush with the saw table and is attached with screws.*

Align Fence. *Clamp a straightedge to the fence on the miter saw. Then align the outfeed fence and attach it to the base.*

HANDS-ON Technique

top tips for Perfect Slots

These simple steps and a few basic tools are all you need to create smooth slots.



Whether it's to create a simple hand hold or to add some adjustability to a jig, making slots is an essential shop skill. The goal in your efforts is a crisp, straight slot with a consistent width. The obstacle standing in your way is determining the right mix of tools and techniques to get the job done with a minimum of fuss.

In the past, I've used both a router table and drill press to make slots. While those tools work well, there's another way that I keep coming back to. This method relies on good layout and a handful of common tools. As you can see in the inset photo above, the results are hard to beat. The process boils down to three basic steps: layout, removing the waste, and cleanup.

Layout. Of course, laying out the slot defines where it will be located on the workpiece. But a good layout serves double duty. It can also create registration points to guide the tools used later on. If you take care here, you save time down the road and get better results.

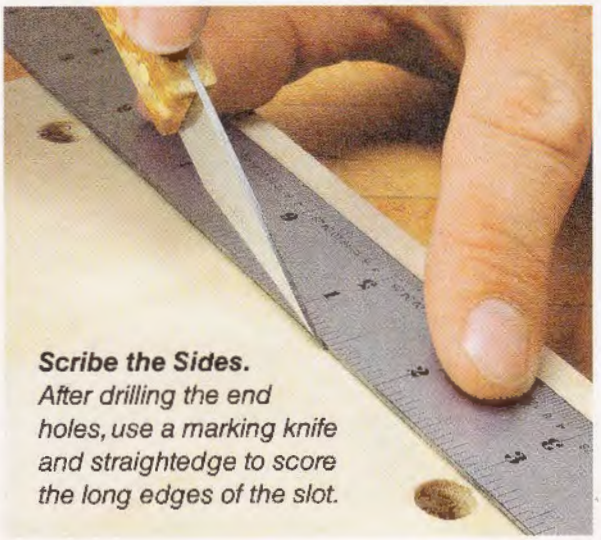
I like to start by marking out the centerpoint for each end of the slot with a pencil. This dictates the length of the slot. Then I use an awl to create a dimple that will serve as the starting point for a drill bit, as in the far left photo.

Before going any further with the layout, take a minute to drill a hole at each end that matches the width of the slot. A brad-point bit will give you the cleanest hole.

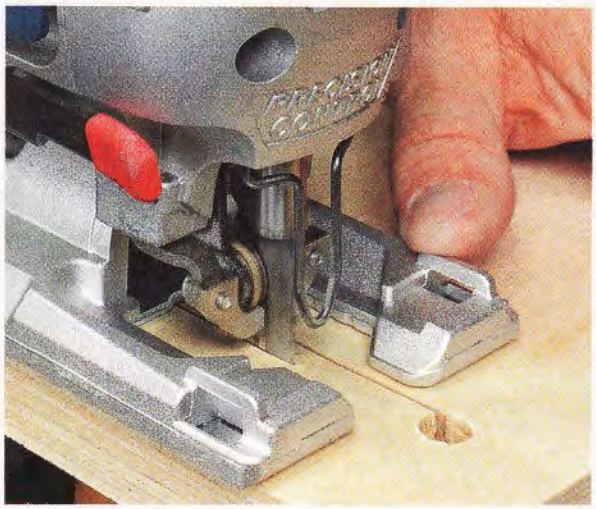
I know this blurs the line between layout and actually making the slot, but the holes are an important guide for the next step in the layout. And as a side benefit, the holes create a smooth, round end for the slot that requires no additional work.

The final layout step is to mark the width of the slot. To do this,

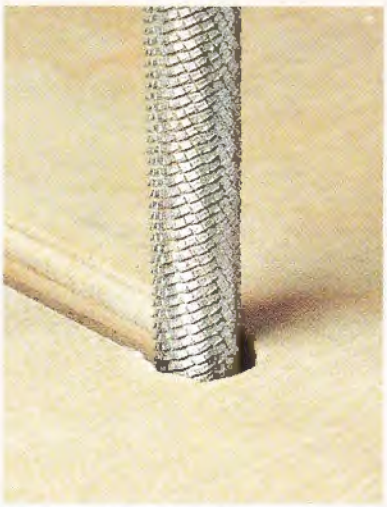
▲ ***End Points.*** *The first step is to mark the centerpoint for each end of the slot with an awl.*



Scribe the Sides. *After drilling the end holes, use a marking knife and straightedge to score the long edges of the slot.*



▲ ***Cut Out the Waste.*** *A jigsaw makes quick work of removing the waste in the slot. The closer you cut to the line, the less cleanup work you'll have.*



▲ ***Smooth Transition.*** *Use a round file to blend the saw cut into the end hole.*

▲ ***Ease the Edges.*** *Soften the edges of the slot with some sandpaper to prevent splintering.*

first line up a straightedge with the outer edges of the end holes, as you can see in the lower right photo on the opposite page. (For some tips on making curved slots, take a look at the box below.)

You have a couple of options for marking the edges of the slot. If I'm making the slot in MDF or hardboard, I'll simply use a pencil to draw in the lines.

For hardwood and especially the plywood shown here, I like to score the lines with a marking knife. The advantage of scoring is that it reduces tearout by forming the final edge of the slot on the surface of the workpiece. In the following steps, you'll simply work up to this line.

One more thing. Score both faces of the workpiece if they'll be visible in the completed project.

Cutting the Slot. The second step is to cut away as much of the waste between the holes as you can. Since a slot is a trapped cut, my tool of choice is a jig saw.

There are two keys when cutting. Although, I don't want to spend a lot of time at this task, I want to get the smoothest cut possible. To do this, turn off the orbital action (or use the lowest setting). And select a blade designed for making smooth cuts (refer to Sources on page 51).

The other key is to be bold. Cut as close to the line as you can. Doing this will save time cleaning up the edges in the next step. You can see in the upper left photo how I use my other hand to keep the saw on track during the cut.

You'll remove the waste in two passes. First, cut along one layout line and then back on the other side. Take care as you start and end each cut so you don't mar the end holes you drilled.

Cleaning up the Slots. The final step in creating the slot is cleanup. For this, you'll turn to a little hand work. How much time you spend on this step depends on the slot's use and location in the completed project.

I like to start by using a flat, coarse file to quickly remove the saw marks and work up to the scored layout line. Near each end of the slot, I reach for a round file to feather the straight cuts into the round ends, as you can see in the middle photo above.

The files leave a pretty smooth surface inside the slot. But if you want, you can follow it up with some sandpaper wrapped around a thin stick. This makes the walls perfectly smooth.

Finally, I complete the slot by easing the sharp edges. This keeps the edges from chipping, as in the upper right photo.

A slot is a small part of building a project. But taking the time to do it right will ensure smooth operation over the long haul.

the straight story on Curved Slots

Building jigs with parts that pivot or tilt often requires making curved slots. It's important that the curve is even and the walls are smooth so that the piece operates without catching or binding.

Just like with a straight slot, a good layout will start you off on the right foot. Here, you'll mark the starting and ending point. In addition, you'll need to know the inner and outer radii of the curve. Then you can lay out the curve with a compass (photo at right). If you have one, use a set of dividers to score the sides of the slot. Otherwise, you can carefully do the job with a marking knife. After cutting out the waste, smooth the walls with a half-round file.

▲ ***Smooth Curves.*** *Use a compass to lay out curved slots. Then score the lines with a fine marking or craft knife.*

palm Router Bases

Improve control and expand the utility of small routers with these versatile upgrades.

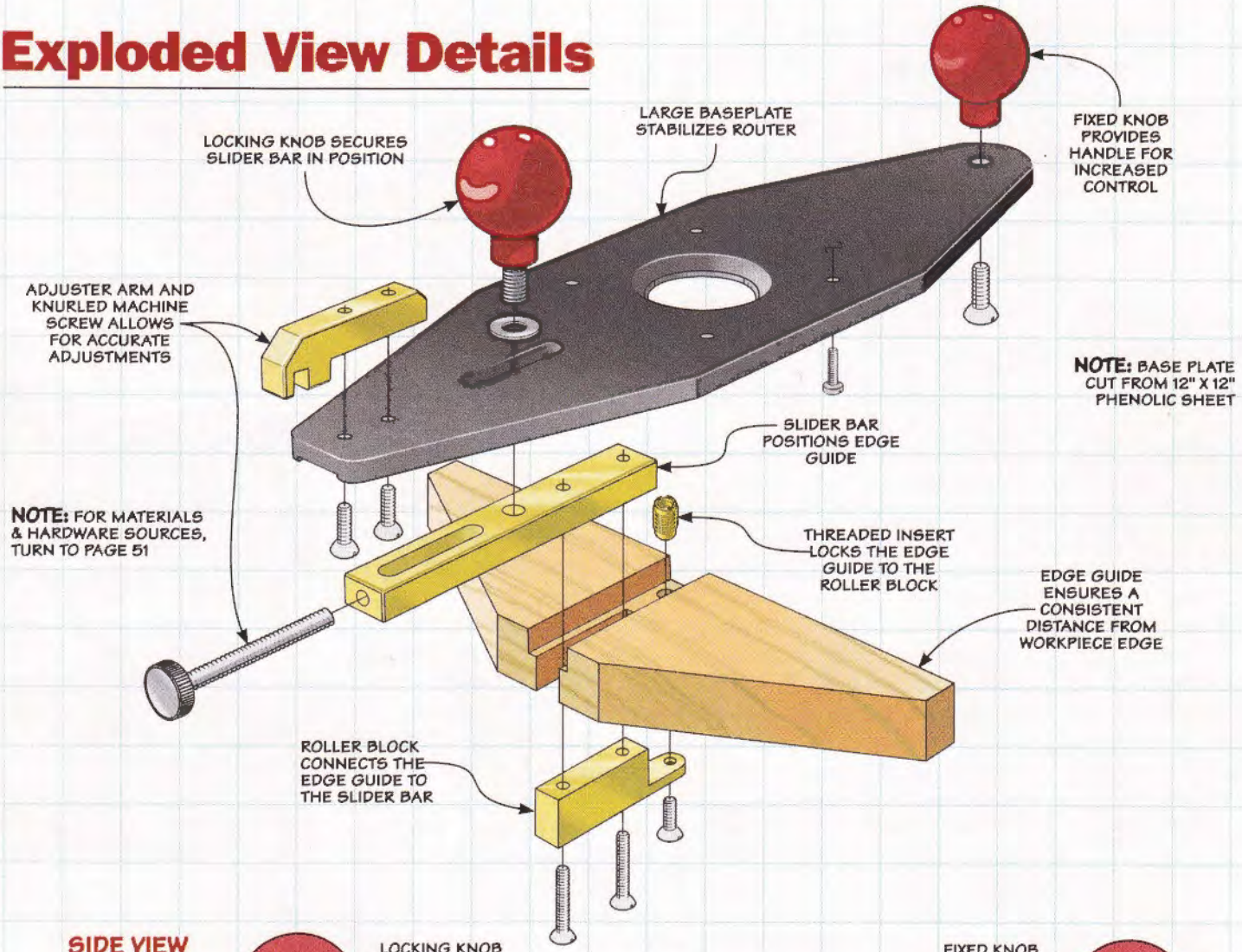
My palm router has become the go-to tool for many routing tasks in my shop. It's light, and easy to control, but powerful enough for most jobs. The only problem is that the base is small and provides limited support when working close to the edge of a workpiece.

The base you see above is designed to address this issue. The wide baseplate provides stability, which helps keep the router from tipping during use. And to ensure an accurate cut, there's a micro-adjustment feature that allows you to fine tune the bit location. There's even an option for routing along contoured edges (photo, next page). Some simple shop-made hardware is the key.

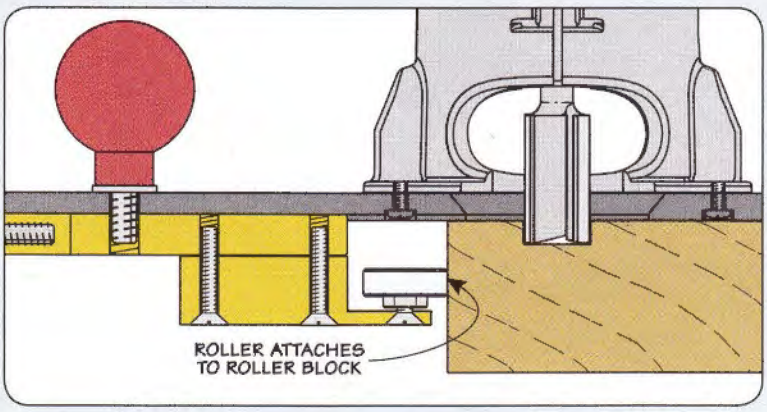
And as a bonus, you'll find plans for a shop-made router trammel on page 39. Perfect, accurately sized circles will be a snap.

▲ ***Straight Edge.*** *Routing parallel to a straight edge is easy. The wood edge guide provides the steady support you need for accurate work.*

Exploded View Details



Optional Roller Edge Guide



▲ ***Roller Edge.*** *The roller edge guide's single point of contact allows you to maintain a consistent distance from the contoured edge of a workpiece.*

shaping the

Brass Parts

▲ ***Metal-Cutting Blade.*** *It's best to use a metal-cutting blade on the brass, but any carbide-tipped blade with flat-topped raker teeth will work.*

Building the base begins with making some custom hardware and a wood edge guide. The hardware consists of a brass slider bar, roller block, and adjuster arm. When attached to the baseplate these parts let you position the router bit accurately.

You'll begin by drilling holes in a long brass bar. After removing the waste for each part, you'll cut the parts free from the extra-long blank. The brass is easy to work, so I doubt you'll have any trouble.

Layout. Start by marking the outline of each part along the length of the bar stock. A scribe is perfect for the layout, and a center punch will help locate the holes. The patterns on the opposite page give the dimensions.

Centered Holes. Holding the brass bar in place while you drill is difficult. A simple jig made from ¾" MDF with a groove cut along its length helps keep it secure. You need a ⅝"-wide groove when drilling the slider bar and a ⅜"-wide groove for the two other parts.

Using the jig is simple, just align and clamp the MDF on the drill press table so that it's against a fence and the brass stock is centered under the bit. Drill the parts by removing the clamp from the jig and sliding it along the fence.

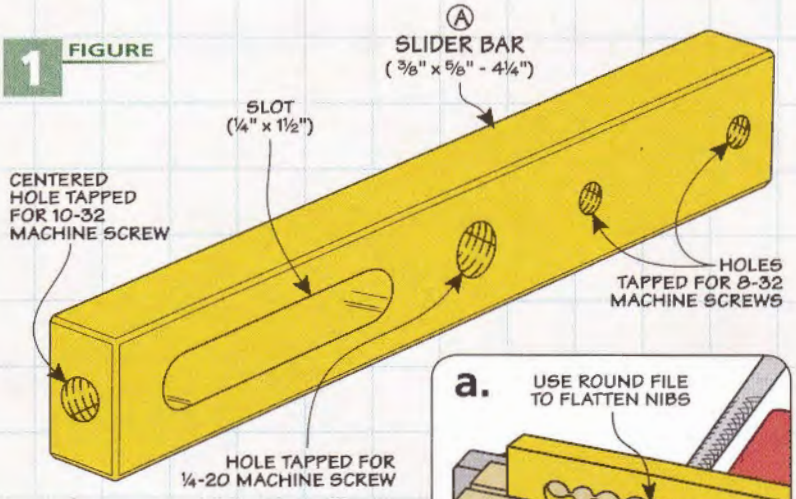
Slider Bar. I started with the holes for the slot in the slider bar. This slot allows for about 1½" of travel from the micro-adjust screw.

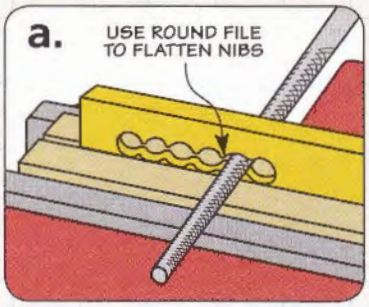
You can see in the illustrations to the right that it's just a series of overlaping holes drilled at the drill press. The holes are then squared using both round and flat files. Boards clamped on both sides of the brass help create a slot with smooth, straight walls.

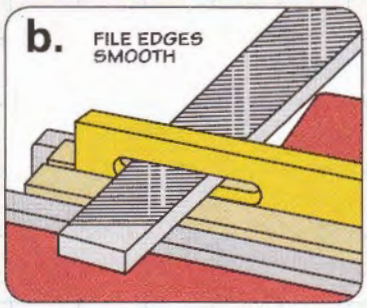
A locking knob attaches in the large hole at the center of the slider bar. And the roller block is secured by the two small holes near the end of the bar. These holes will need to be tapped to accept screws, so refer to your tap and die set for the correct hole size to drill. The hole in the end of the slider bar will be drilled later, so you can move on to the other parts.

Roller Block & Adjuster Arm. The holes for the roller block are simply drilled and countersunk for 8-32 screws, while the adjuster arm holes need to be tapped.

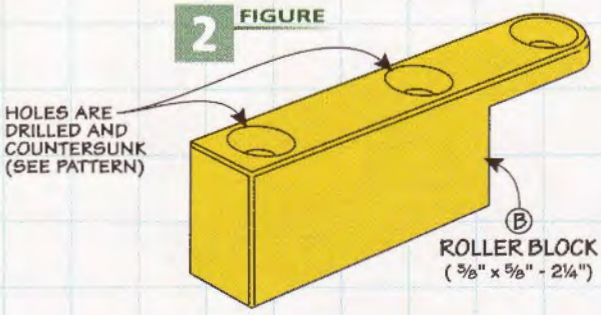
1 FIGURE



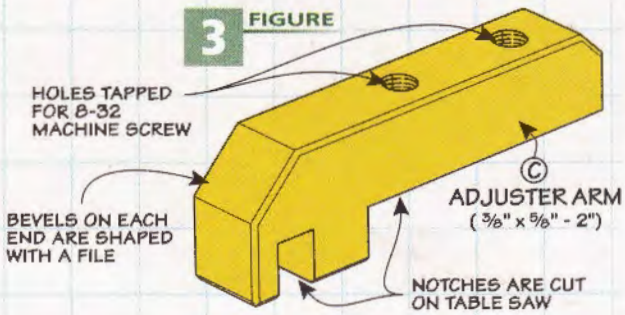




2 FIGURE



3 FIGURE

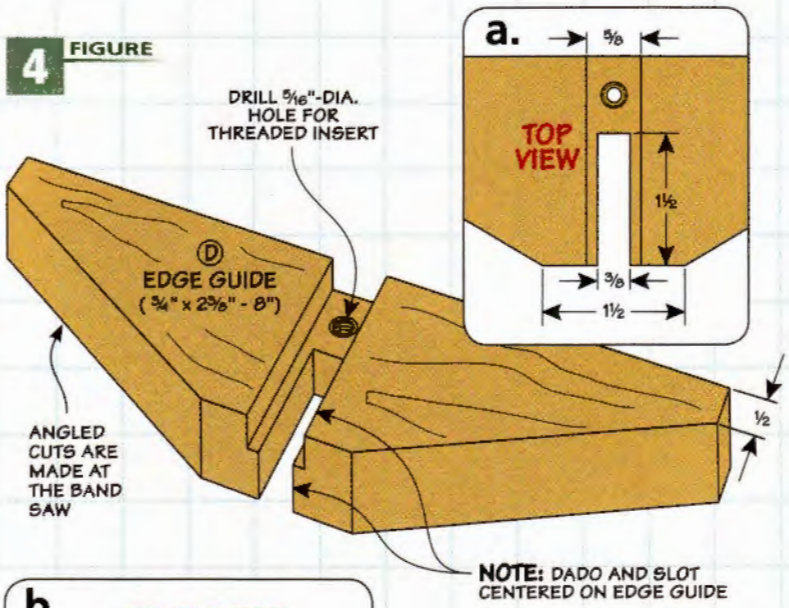


bar stock

Drilling Jig

► ***Centered Holes.*** *A groove cut in MDF secures the bar stock during drilling. Once the brass is centered on the bit, the jig can slide along the fixed fence to ensure centered holes every time.*

FIGURE 4



Once the holes are drilled, you can cut the notches for each part. Multiple passes at the table saw will remove the waste. Then go ahead and cut the parts free from the bar.

All that's left is to drill the hole in the end of the slider bar for the micro-adjust screw. The best way to do this is to clamp the bar stock between two tall, square wood blocks as you drill the hole in the end at the drill press.

Shape the Parts. Once you tap the remaining holes, the brass parts can be filed to final shape. Just clamp the adjuster arm in the vise and file the bevel on each end. The rounded end on the roller block can be shaped using the same method.

EDGE GUIDE

The next step is to make the wood edge guide. By riding against the edge of the workpiece, the guide helps stabilize the base while routing. It's simple to make, but there's a dado and a slot located in the center of the guide that deserves close attention.

The roller block slides into the slot, so it needs to be a snug fit. The same is true with the dado, which secures the slider bar. Additionally, the slot needs to be centered in the dado so that both parts can easily slide in place.

I started the guide at the table saw using my miter gauge and an auxiliary fence. A couple passes with a dado blade takes care of the dado and slot. Two angled cuts at the band saw create the tapers that form the shape of the guide. The illustrations above give you the details you need.

The last step is to drill a hole and add a threaded insert (Figure 4b).

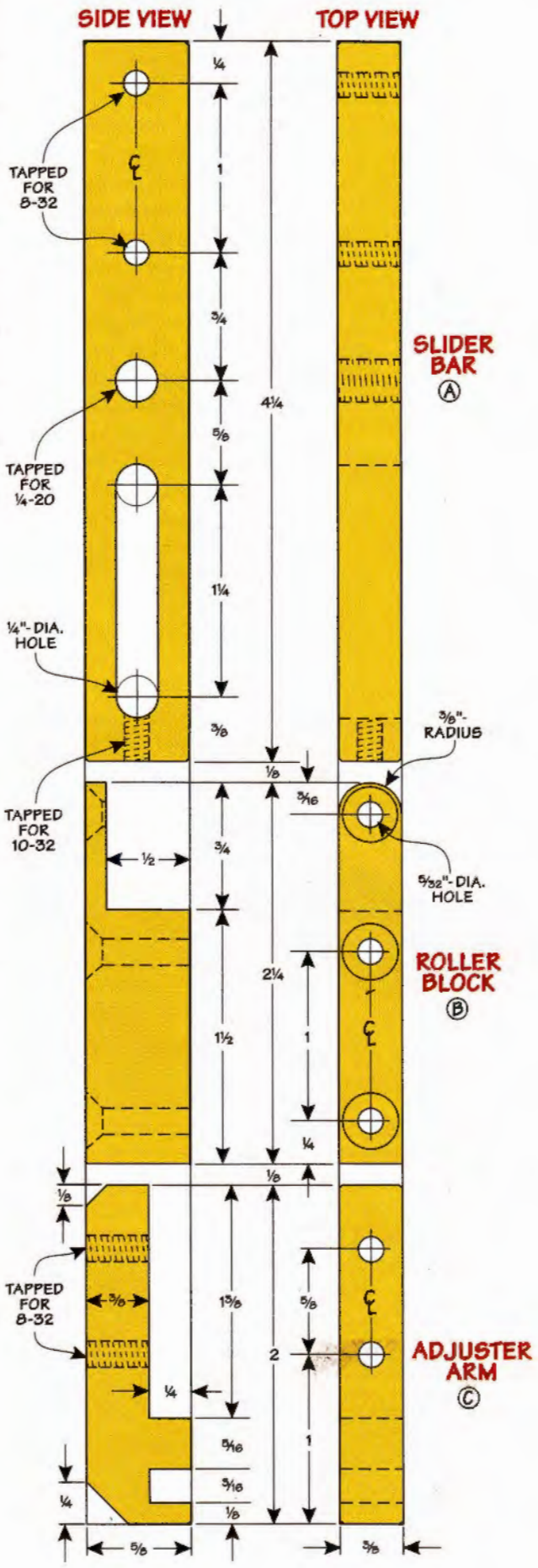
Materials & Hardware

A	Slider Bar (1)	⅜ x ⅝ - 4¼ Brass
B	Roller Block (1)	⅜ x ⅝ - 2¼ Brass
C	Adjuster Arm (1)	⅜ x ⅝ - 2 Brass
D	Edge Guide (1)	¾ x 2⅜ - 8
E	Phenolic Plate (1)	¼ x 3½ - 12

- (3) #8-32 x ½" Fh Machine Screws
- (2) #8-32 x 1" Fh Machine Screws
- (1) #8-32 Threaded Insert
- (1) #10-32 x 2" Knurled Machine Screw
- (1) ¼-20 x ½" Fh Machine Screw
- (2) ¼-20 Round Knobs
- (1) ¼-20 x 1" Threaded Rod
- (1) ¼" Washer
- (1) ¾" Shower Door Roller

PATTERN

(SHOWN ACTUAL SIZE)



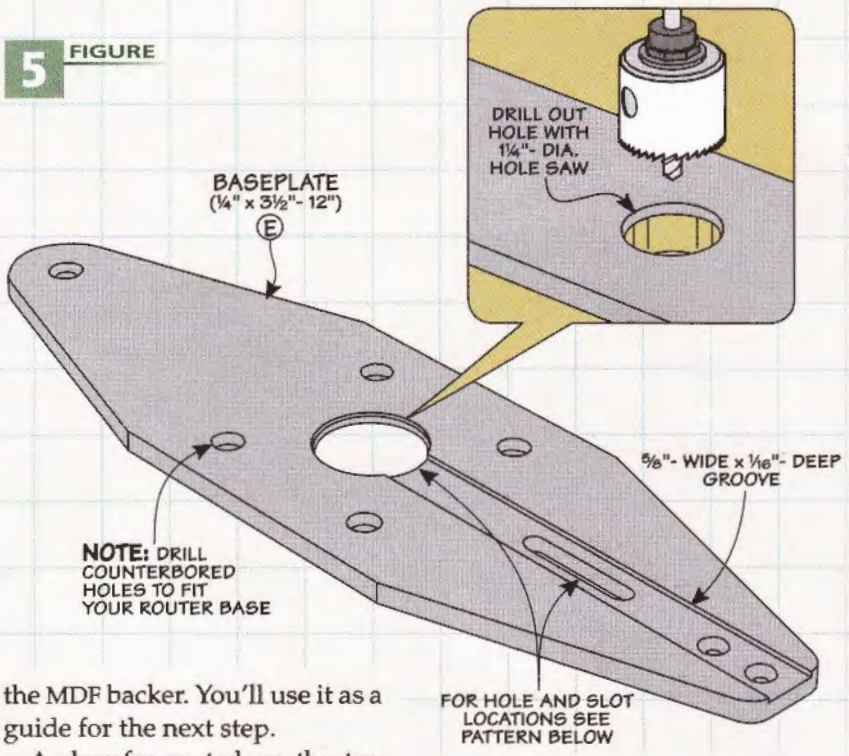
making the Baseplate

Compared to what you've done so far, making the baseplate is a breeze. You simply cut it to size then drill the hole for the bit. Use a router to chamfer the hole and to make a groove and slot. Then drill holes to attach the parts and your router. Taper the edges, and your new base will be complete.

Size. The size and shape of the baseplate isn't critical, though the locations for the slots and holes are. To help with the layout, use the pattern below as a guide.

Center Hole. The hole in the center of the plate is best made using a 1¼" hole saw in the drill press. To back up the workpiece, I attached the blank to a piece of ¾" MDF using double-sided tape. When you cut the hole, be sure to drill all the way through the MDF backer. You'll use it as a guide for the next step.

FIGURE 5



A chamfer routed on the top edge of the hole is the next step. This detail improves visibility and helps clear the chips from the hole when routing. There isn't much support for the router bit bearing though, so the MDF backer is a big help here.

Groove & Slot. To secure the slider bar you made, rout a centered groove on the underside of the base and add a slot to secure the locking knob. Once you remove the MDF from the plate, you can make both at the router table.

The groove is sized to match the width of the slider bar, and extends from the center hole to the end of the plate. The slot for the locking knob goes through the entire thickness of the plate.

Drill Holes. In order for the micro-adjust feature to operate smoothly, it's important that the location of the brass adjuster arm is centered and square. A quick way to do this is to center the part over the end of the groove and use the adjuster arm as a template to mark the hole locations.

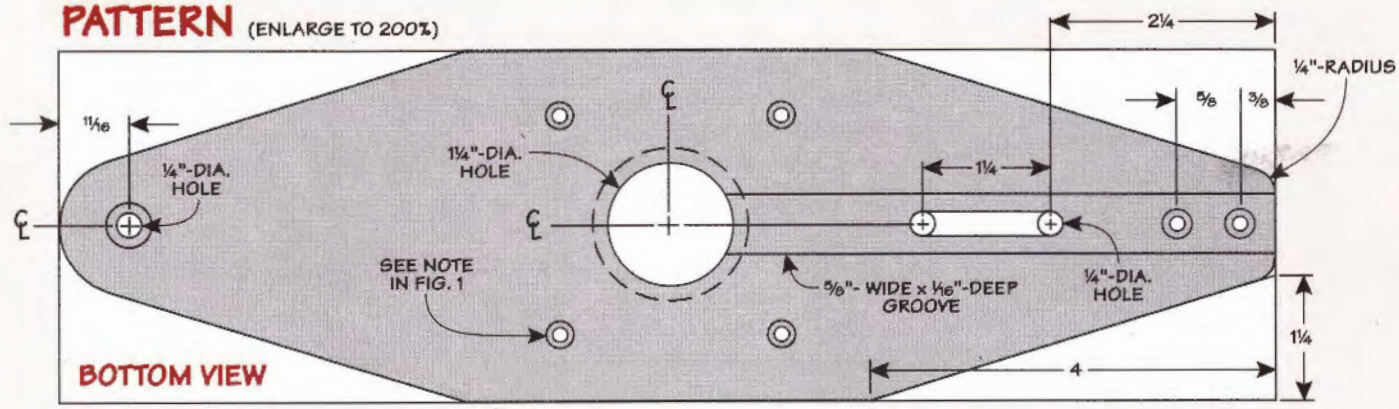
Once the holes for the adjuster arm are drilled and countersunk, you can do the same for the fixed knob and your router.

Shape. The base can be cut to shape at the table saw. I made a simple sled to help cut the angles. You can see in the left photo that I attached two small strips of wood to a piece of ¾" MDF. These angled strips secure the base while making each cut.

After you soften the corners with a file, you can attach the hardware and your router and put your new base to work.

▲ ***Taper Sled on Table Saw.*** *Two small strips of wood glued to MDF secure the phenolic plate at an angle when cutting to shape.*

PATTERN (ENLARGE TO 200%)



Router Trammel

After finishing the edge guide there was plenty of phenolic plate left over. So I decided to put it to use by making a trammel base for routing circles and arcs. Both bases are similar in size and shape, so making it was an easy decision.

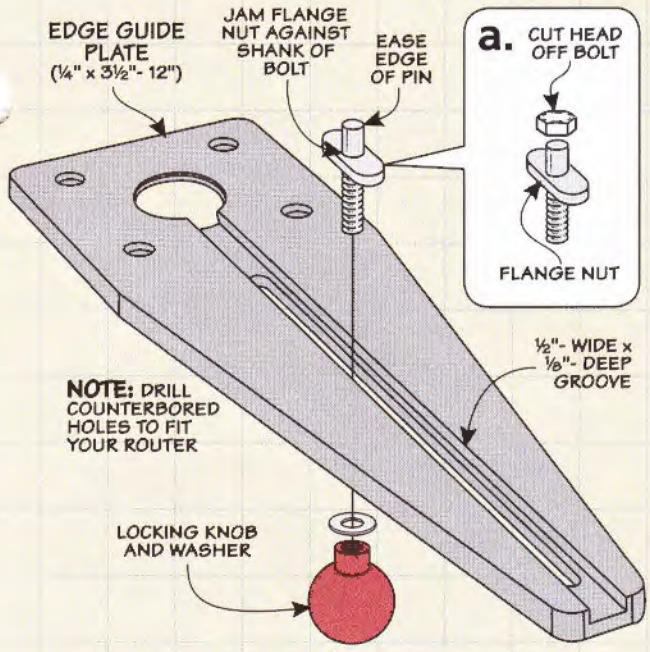
A trammel is the perfect solution for cleaning up the edge of a circular workpiece cut at the band saw. You can see in the photo at right that a router is mounted at the end of the trammel's base. The guide's centering pin, which is adjustable to the radius of the workpiece (9½" maximum), is secured by a hole drilled in the bottom of a round workpiece. This allows the router to pivot around a stationary center point, creating a perfectly round circle.

This guide is made with some of the same techniques used for the edge guide. There is one additional step necessary for the shop-made centering pin though. It's a simple process however, using a couple off-the-shelf hardware items.

Cleaning up saw marks from the edge of a round workpiece is easy with a router trammel.

MAKING THE TRAMMEL

You can start by shaping the baseplate from the pattern below. I used the same overall dimensions of the edge guide when making this base. The hole for the router bit is also cut and chamfered the same way. The only difference is that it's located at one end of the base instead of the center.



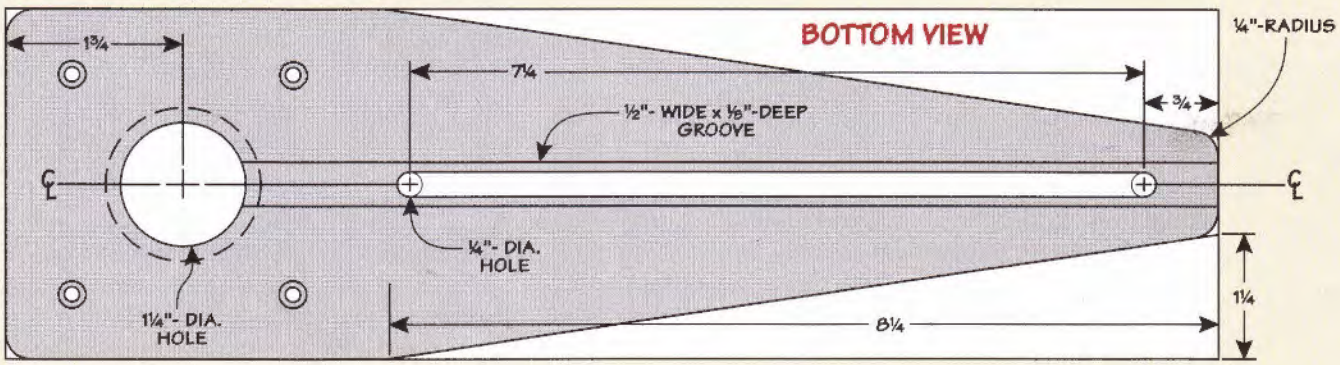
Like the edge guide, the trammel baseplate has a groove and slot, but they're quite a bit longer. (See the illustration below for details.) The purpose of the groove is to capture a flange nut that locks the knob (and pin) in place.

I made the small, thru-slot the same way as before. I drilled ¼" holes at each end of the slot, then removed the waste between them at the router table.

As I mentioned, the centering pin is made from simple hardware items. It's just a 1½"-long ¼-20 bolt and a flange nut. To make it, clamp the bolt in a machinist's vise with the threads facing up. Then thread the flange nut all the way down to the smooth part of the shank. Using a wrench, tighten the nut securely. The goal is to keep the nut from loosening. Complete the pin by cutting the head off the bolt with a hacksaw and cleaning up the cut edge with a file.

Now you can drill the holes for your router and cut the base to shape using the same methods you used before. Go ahead and thread the centering pin into the locking knob, as shown in the illustration. With the base fully assembled, you're able to create perfect circles in a short time.

PATTERN (ENLARGE TO 200%)



tools for Perfect Miters

With this pair of shop-made accessories for hand planing, gap-free miter joints are guaranteed.

Even experienced woodworkers can struggle when it comes to fitting perfect miters. Whether it's molding that wraps around a cabinet, a small box with mitered corners, or a picture frame, getting gap-free joints can sometimes be a frustrating trial-and-error process.

In spite of all the care and time it takes to set up a miter saw or table saw, getting perfect miter joints can still be a challenge. For me, the revelation was learning to blend the use of power tools with some hand work. The key is learning to use a couple of traditional tools and techniques craftsmen used over 100 years ago. The tools include a hand plane, the miter jack shown in the photo above, and the miter shooting board (page 42).

The Traditional Method. In the past, craftsmen didn't have the luxury of power saws for cutting joinery. Their tool of choice was an old-fashioned miter box with a back saw. But this hand-cut joinery was just the first step. The woodworker would then reach for his hand plane to fine-tune the cut edge for a perfect match to its

▲ ***Position the Workpiece.*** *When you clamp the workpiece in the miter jack, leave it slightly proud for trimming.*

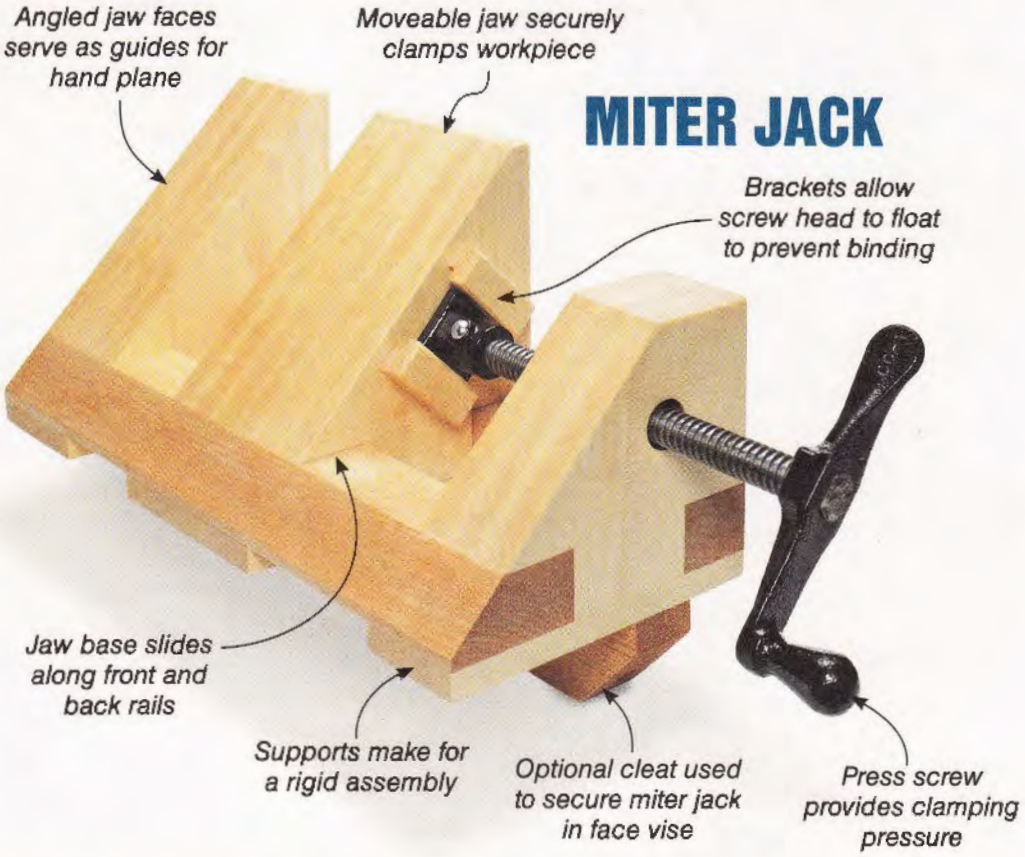
mating workpiece. For mitered frames and casing around windows and doors, he might have used a miter jack similar to the one shown at right to help guide his hand plane to get a perfectly smooth surface for a tight joint.

Wide Jaws. As you can see in the photo at right, the miter jack is made with wide, angled jaws that secure the workpiece. The fixed and movable jaws are cut at 45° to provide a guide surface for the sole of the hand plane. The press screw allows you to tightly clamp the workpiece between the two jaws. You can get detailed plans for building the miter jack online at *ShopNotes.com*.

Setup. Setting up the miter jack for use is pretty easy. The optional cleat allows you to clamp it in the face vise of your workbench. When locating the cleat you'll need to make sure the path of the plane is unobstructed. If your bench has a tail vise and dog holes, you can skip the cleat and simply clamp the miter jack between a pair of bench dogs.

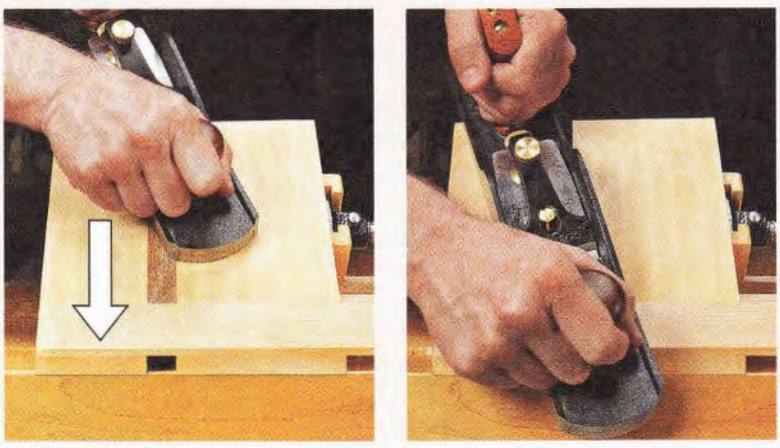
Plane Choice. Before I explain the technique of using the miter jack, I want to talk about the hand plane. You can really use any hand plane as long as the iron is razor-sharp.

But I like to use a plane with a low cutting angle. To find out why, turn to page 43. The *Veritas* low-angle jack plane shown in the photos is a good choice.



A block plane is perfectly suited for smaller moldings. Whatever your choice of planes, it should be long enough to span across both jaws with the workpiece clamped in place.

Technique. When clamping the workpiece in the miter jack, the mitered end should sit slightly proud of the jaw faces. (The photo on the bottom of the opposite page shows this slightly exaggerated for clarity.) This way, the plane trims the workpiece without cutting into the jaws.



▲ ***Several Passes.*** *Start at the top edge of the workpiece (left photo) and make a full pass across the end grain (right photo). After a few light passes, check the fit of the workpiece.*

With the plane iron set to take a very light cut, start trimming the mitered end. I do this by starting the cut with the plane at the top of the miter jack and the iron centered on the workpiece (left photo below). I like to skew the plane to ensure the front and rear of the sole are riding on the faces of the jaws. Then make a pass across and down the workpiece, as shown in the right photo below. You're aiming to make the end grain as smooth as glass.

It takes a little practice to learn how to control the plane for a consistent cut across the end of the workpiece. And you'll learn when to stop planing before cutting into the surface of the jaws. The key to smooth, square cuts is to let the faces of the jaws guide the hand plane as you make repetitive cuts across the piece.

Test Fit. After truing up the miter, check the fit of the joint on your project. If it needs a little more tweaking, clamp the workpiece back in the miter jack to fine-tune the fit. I'll talk later about some tips and techniques for creating seamless joints.

ShopNotes GO ONLINE EXTRAS

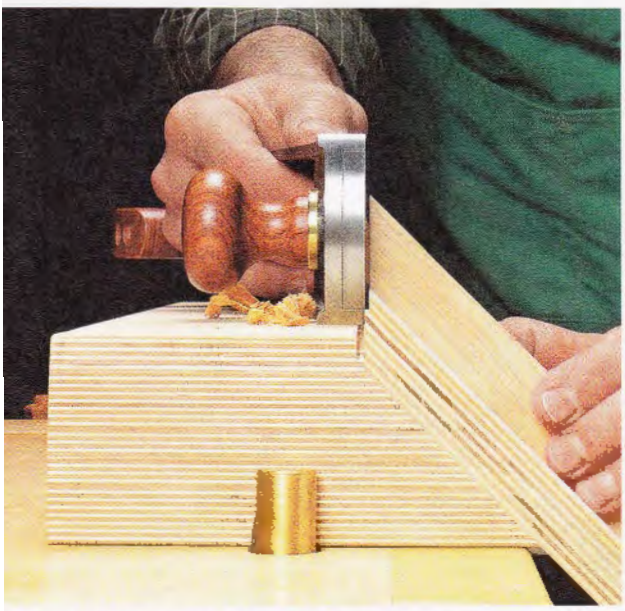
To find detailed plans for the miter jack & donkey's ear, go to:
ShopNotes.com

trim miters with a

Donkey's Ear

The accessory shown above is a modern adaptation of a traditional miter shooting board, sometimes called a "donkey's ear." It's designed for trimming the ends of wide miters, like those on a small box or the molding that wraps around a cabinet.

My version is made from Baltic birch plywood for strength, straightness, and stability. The photo at the top of the opposite page points out the important features. To download plans for building the donkey's ear, go online to *ShopNotes.com*.



▲ ***Setting Up the Cut.*** *Using the sole of the plane as a stop, slide the workpiece up until it contacts the plane. Then you can trim the end.*

▲ ***Shooting the Miter.*** *With a sharp iron set to take a fine cut, make several passes to clean up the miter.*

Angled Shooting Board. The donkey's ear is a close cousin of the shooting board. The difference is that the bed supports the workpiece at 45° so that the plane's iron can trim the miter. But the technique for using it is the same as for a shooting board. The plane is laid on its side and pushed to slice the end grain, as you can see above.

Technique. The photos at left show you how to get started when positioning the workpiece for the cut. I use the sole of the hand plane as a stop. To do this, slide the plane up against the edge of the bed of the donkey's ear. Then place the workpiece against the cleat and slide it up until it contacts the plane's sole.

A Light Cut. When making end-grain cuts like this, I set the plane to take a fine shaving. It requires less effort to slice through the wood fibers.

The first time you use the donkey's ear, the plane's iron will cut away a small section of the bed and a thin section from the end of

the cleat. This is normal and isn't cause for concern.

GENERAL TIPS & TRICKS

There are a few things I want to point out that will get you on your way toward creating seamless miter joints. These tips apply whether you're using the miter jack or donkey's ear.

Sharp Plane. The first thing you'll need to do is make sure the iron on your plane is razor sharp. A few minutes spent honing the edge makes shaving end grain almost effortless.

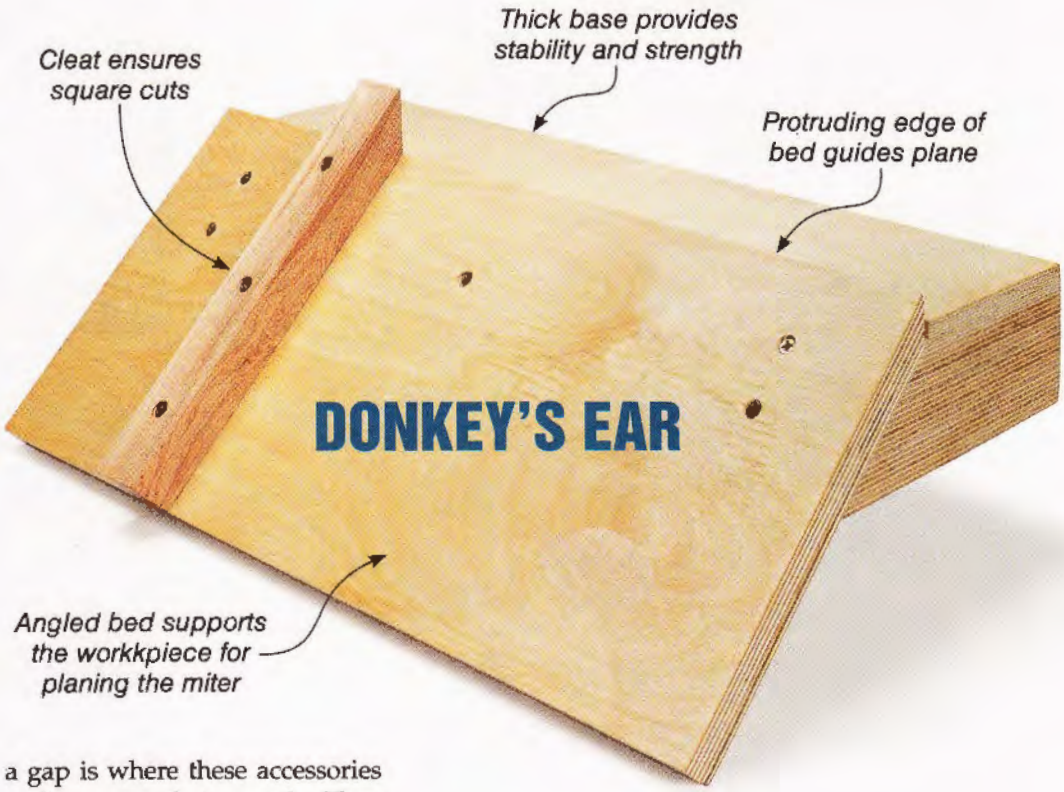
Low-Angle Plane. As I mentioned before, you can use a standard hand plane, but I prefer a low-angle plane as shown in the box below. The lower cutting angle works better on end grain.

Wet the End Grain. If it's a struggle to trim the end grain, you can use a trick some of the old-timers used. And that's to wet the surface to soften the wood fibers. Water, denatured alcohol, or mineral spirits work well.

Shim to Fit. As you've probably experienced, there always seems to be a gap in at least one of the joints when assembling a mitered frame. Closing up such a gap is where these accessories really prove their worth. They make it easy for you to shave off the heel or toe of the miter until the joint fits perfectly.

To do this with the miter jack, simply tilt the workpiece slightly as you tighten the jaws to clamp it. Your goal is to leave the heel or toe proud so you can easily trim it. To accomplish this on the donkey's ear, place a thin shim under the workpiece where needed to allow trimming the heel or toe of the miter to fit.

Perfect Results. For me, the mystery of seamless miter joints was solved once I learned how to use these time-tested accessories. I think you'll agree that the results you get are worth the investment in making them.

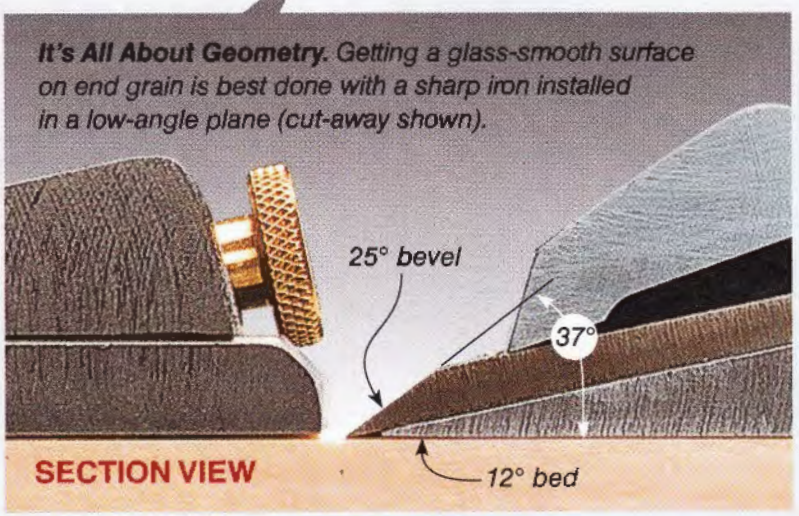


an inside look at a Low-Angle Plane

When faced with the task of shaving the end grain of a workpiece to create a perfect joint, I rely on a low-angle hand plane. Sometimes referred to as a "bevel-up" plane, it's particularly suited for this task because of its low cutting angle. Low-angle planes are available from several manufacturers.

As you can see in the detail photo, the plane iron is bedded at 12°. Combined with a 25° bevel on the iron, this results in a 37° cutting angle. This lower angle means there's less effort required to slice across the wood fibers of end grain. The end result is a smoother cut that shaves the end grain clean.

Low-angle planes range in size from small block planes to 15"-long jack planes and larger. For trimming miters using a shooting board or donkey's ear, you'll want to look for a plane with sides machined flat and square to the sole.



It's All About Geometry. *Getting a glass-smooth surface on end grain is best done with a sharp iron installed in a low-angle plane (cut-away shown).*

adding Workbench Storage

Here are a handful of practical ways to maximize the storage space of your bench.

My workbench is the center of my workshop in more ways than one. It's the place I spend most of my time in the shop. And it serves a variety of purposes from a hand tool work area and assembly table to a finishing station.

With all the roles my bench takes on, I want easy access to a range of tools and supplies. But not every bench has built-in storage like the heirloom workbench on page 12. My workbench started out as a basic, table-style bench. Over time, I've upgraded it with a variety of storage features. Now I have the things I use most often within arm's reach.

On these pages, you'll find a few options for increasing the amount of storage space in your workbench. They range from the simple to the more involved. But there's sure to be something you can put to use in your shop.

DRAWERS

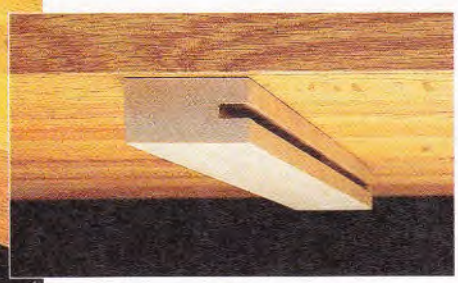
The most obvious place to add storage is the large open space beneath the top. It just begs to be put to better use. One way to do that is to add some drawers.

Drawer Case. You can take a couple of approaches to adding drawers. The photo above shows the *Cadillac* version. A plywood case holds drawers in a range of sizes to help you organize your tools and make the most of the space. (This arrangement includes a pair of compartments on the ends.) Even though the drawers vary in size, in general, they're fairly shallow. This allows you to see what's inside at a glance. And items aren't likely to get buried at the bottom.

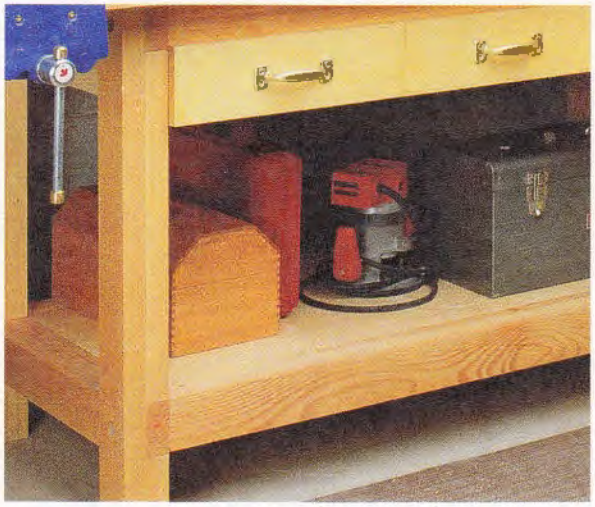
The drawers ride on full-extension metal slides. The slides give you access to the entire contents of the drawer. In addition, they're easy to open and close when loaded with heavy tools.

There are a couple things to keep in mind when adding a drawer case like this. If your bench has dog holes, it's a good idea to leave a little space above the case to provide access from below. As an added precaution, attach the case to the bench structure so it won't tip from the weight of an open drawer.

Pull-Out Trays. Adding drawers doesn't have to be this involved, though. For a much simpler option, take a look at the left photos. This drawer is just a baking pan that slides on a pair of grooved cleats (inset photo). It tucks right under the benchtop



◀ ***Piece of Cake.*** *A baking pan makes a handy drawer. The stiff rim slips in grooved cleats attached under the benchtop.*



▲ ***As Easy As It Gets.*** *Cut a piece of plywood or MDF to fit across the lower stretchers of your bench to create instant storage space.*

▲ ***Organized Supplies.*** *Frequently used supplies and small tools tuck conveniently on a set of shallow, adjustable shelves.*

and is the perfect place to store small layout tools, a few pencils, and a pad of paper.

Another benefit of this drawer is that you can pull it out and set it on your bench as a tray to keep items corralled. Best of all, you can add this drawer to your bench in less than an hour.

Location matters when attaching the cleats under your bench. Steer clear of dog holes and make sure the drawer won't be blocked by items clamped in the face vise.

SHELVES

Drawers are handy for storing tools, but for other items, especially larger power tools, drawers just don't make sense. Shelves are another direction you can take to add storage to your workbench, as shown in the photos above.

Shelves allow you to easily and quickly get at the items stored there. And adding a shelf or two is a pretty quick task.

A Big Shelf. The quickest way to add a shelf is shown in the upper left photo. Most workbenches have lower stretchers that will support a simple shelf made from ¾" plywood or MDF.

Narrow Shelves. The upper right photo highlights another type of shelving. This bank of narrow shelves on the back of a workbench is a great place to store shop supplies like hardware, sandpaper, or glue.

RACKS

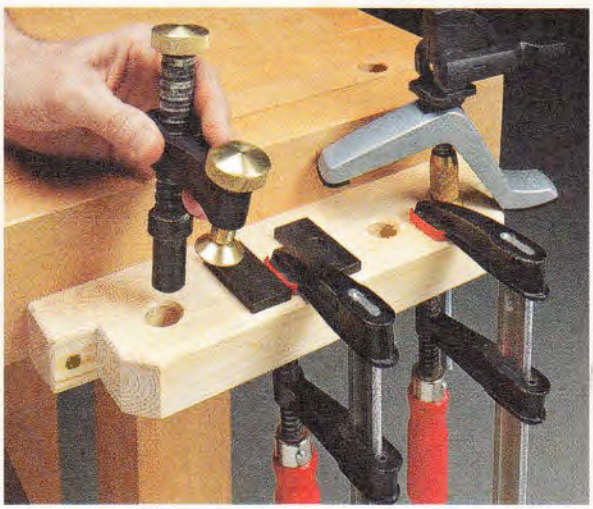
One final storage option to consider is a tool rack. The emphasis here is convenience.

The pegboard rack in the lower left photo takes advantage of space at the end of a workbench. And customizing it is simple.

In the lower right photo, you can see a rack designed for holddowns, bench dogs, and a few clamps. But it could just as easily be made to hold chisels and other hand tools. It's made from a piece of two-by lumber.

Adding storage to your bench can save steps and time tracking down the things you need. And that can make your time in the shop more enjoyable.

▲ ***Versatile Pegboard.*** *Don't overlook the space at the end of your bench. This rack is simple to customize with different types of hooks.*



▲ ***Scrap Wood Rack.*** *This small rack can be screwed to the end or back of the benchtop to hold the tools you reach for most often.*

safer cuts with a Riving Knife

New table saws feature safety gear that helps you make clean, accurate cuts every time.

In order to make smooth, precise cuts on my table saw, I make sure the saw is set up right. This includes everything from the blade and fence settings to tuning up my saw from time to time. I even build jigs to make particular cuts accurate and foolproof.

The safety equipment that comes with a table saw is another ingredient in making quality cuts. And it's something that's easy to overlook. But some new table saws come equipped with improved blade guards and riving knives make it easier than ever to cut accurately *and* safely.

We recently added a new saw to our shop and it seemed like a good idea to talk about how the new equipment works. But first, a little background is in order.

Old vs. New. Up until a few years ago, table saws came with a splitter and blade guard assembly. The system is designed to prevent kickback and hand contact with the blade. In practice, many guards obscure the blade and cut line. Since the steel splitter is fixed, the gap between the blade and splitter varies depending on the blade height. A wider gap can allow the kerf to close and pinch the blade.

Furthermore, the splitter and guard need to be removed for grooves, rabbets, and dadoes. Since they're often difficult to reattach, they're rarely used.

The riving knives found on new saws work differently — and better. What makes a riving knife different is how it's attached to the saw. Instead of being fixed, the knife travels up and down with the blade. This means the gap between the blade and riving knife is small no

Tight Gap. *A small gap between the blade and riving knife prevents a workpiece from pinching the blade, which can lead to kickback.*

Up & Down. *The riving knife travels with the blade so the gap remains small no matter what the blade height is.*

matter the blade height (lower photos on the previous page). In addition, a riving knife can be set so you don't need to remove it for most cuts (more on this later).

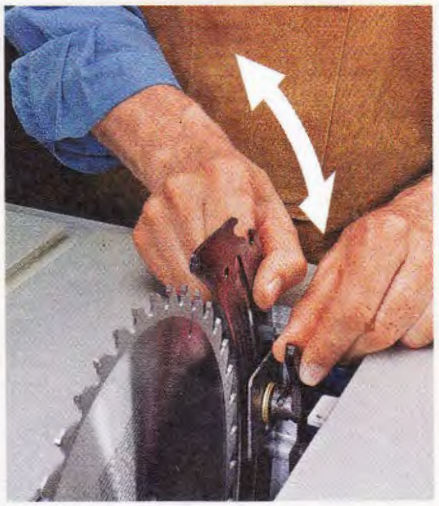
Overall, the blade guards are improved, too. They're designed to quickly snap on and off without any fussy adjustments, as in the near right photo. So you're more likely to use them.

New Regulations. Since 2008, all new-model table saws are required to have a riving knife system. Starting in 2014, this regulation will apply to all table saws on the market. Riving knife designs vary among table saw manufacturers. Regardless of the design, all riving knives have capabilities similar to the one shown here.

Full-Protection. The standard setup is shown in the main photo on the facing page. This assembly consists of the steel riving knife, the blade guard, and a pair of spring-loaded pawls that stop a workpiece from travelling backwards. This setup handles most rip, bevel, and crosscuts.

Low Profile. However, these aren't the only cuts I make. For example, I often use my saw for cutting grooves. Rather than remove the riving knife, you can unclip the blade guard and pawls and set the knife to a low-profile position. (On some table saws, you need to remove the standard riving knife and replace it with a shorter one.)

▲ ***Easy On & Easy Off.*** *The blade guard and pawls quickly snap into (and out of) notches in the top of the riving knife.*



▲ ***Flip the Lever.*** *Release the lever to set the height of the riving knife, to one of three positions.*

To do this on our saw, you flip a lever behind the blade and lower the knife, as shown in the upper right photo. In this position, the top of the riving knife is below the top of the saw blade.

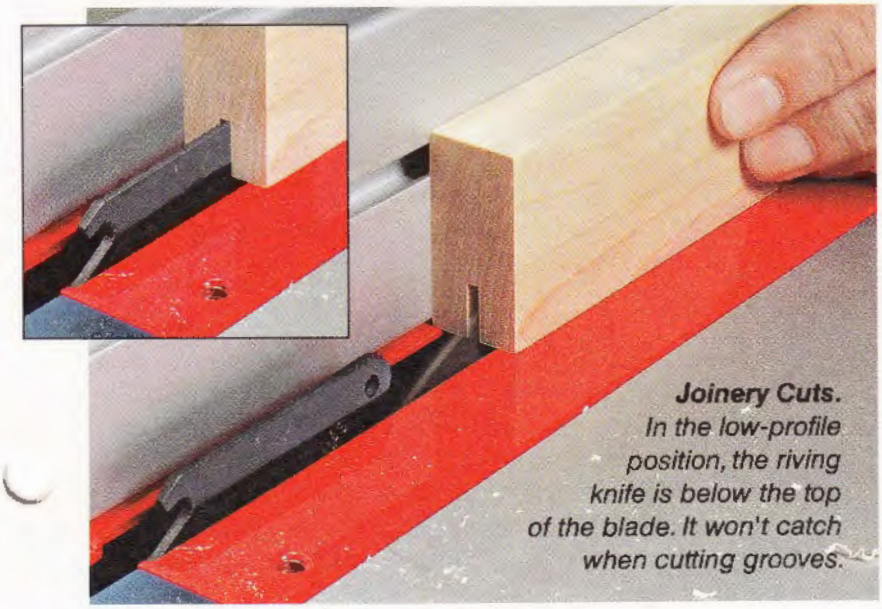
You can see how this allows you to cut grooves in the lower left photo. While a groove like this isn't likely to close up, the knife keeps the workpiece on track and prevents it from drifting away from the fence.

The low-profile position comes in handy for other cuts. For example, when ripping thin strips. The standard riving knife and blade guard won't allow you to set the fence close enough to the blade while still maintaining enough clearance for a push block.

Here, the low-profile knife keeps the narrow strip from drifting against the blade, which can cause score marks or burning (lower right photo). And I can use a push block that rides over the blade to control both the strip and the remaining blank.

Remove It. The only situation where either knife setting won't work is when using a dado blade. So you'll need to lower the knife below the table (or remove it).

The versatility of a riving knife increases the chance you'll keep it on the saw. And you'll end up with better and safer cuts.



Joinery Cuts. *In the low-profile position, the riving knife is below the top of the blade. It won't catch when cutting grooves.*

Narrow Cuts. *The low-profile setting steadies thin strips for clean cuts.*

easy-to-use Workshop Solutions

Getting the job done right doesn't have to be expensive, time-consuming, or cumbersome.

I'm always on the lookout for better, easier, or less expensive ways to get common jobs done in my shop. Fortunately I'm not the only one. New products for the workshop are being developed with these same goals in mind. I recently discovered a couple of new products that fit the bill and rediscovered an old one as well.

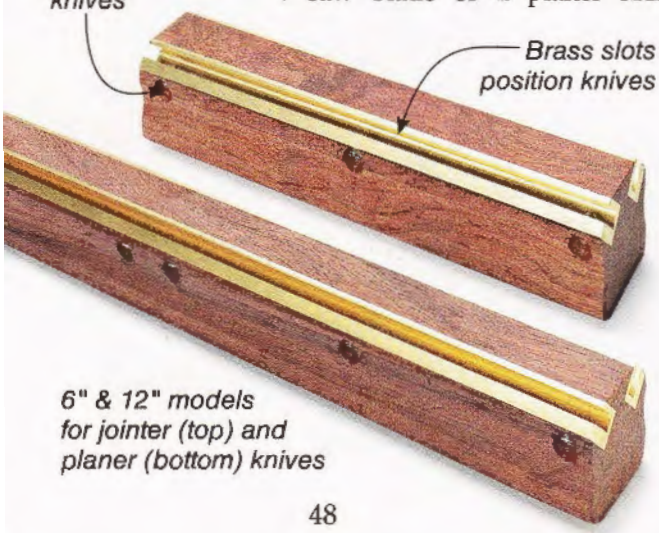
DEULEN SHARPENING SYSTEM

A sharp edge gives superior results whether it's on a saw blade or a planer knife. After continued use however, any edge becomes worn. The first indication of a dull edge on planer or jointer knives is the tool working harder or bogging down while making a cut.

Until recently, the most common solution for dull planer or jointer knives was to have them professionally sharpened. But that means downtime in the shop. I would rather be working on a project than waiting around.

A better solution is the new *Deulen Jointer & Planer Knife Sharpening System*. This straightforward jig allows you to get an extremely sharp edge on your knives in almost no time. And best of all, you don't need any previous sharpening experience to get great results.

This is because of the way the jig works. You can see in the main photo and in the left margin that the sharpener consists of two brass slots embedded in a wood handle. Set screws secure your knives in the slots at the appropriate angle for sharpening.

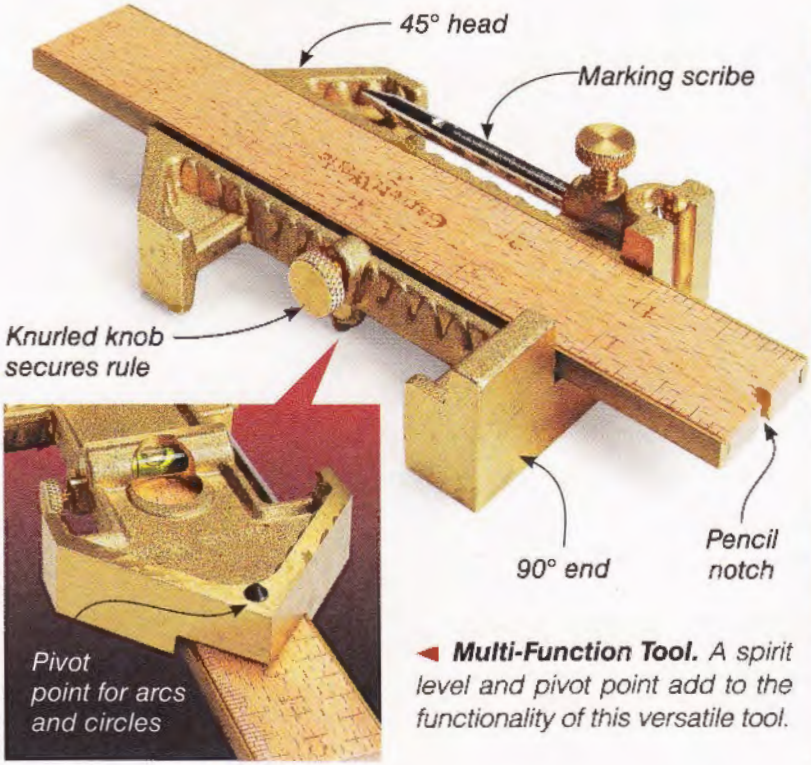


With the knives in place, sharpening them is as simple as making a series of passes across different grits of sandpaper (120, 150, 180, 220, 320, 400). I used adhesive-backed sandpaper attached to ¾" MDF. And since the brass used in the slots won't damage the sharp edge, the sharpeners can be used with single- or double-edged knives.

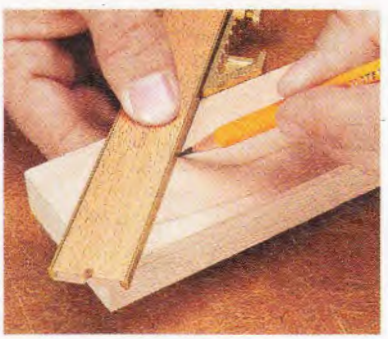
Sharpening two knives is a snap. But the sharpeners can handle three knives as well, which is common on many new tools. Detailed steps are included with the easy-to-follow instructions and how-to video that comes with each sharpener.

#1 ODD-JOBS TOOL

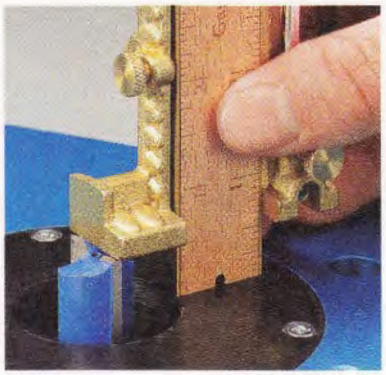
Accurate measurements and layouts are critical to a successful project. Most woodworkers have a number of layout tools in their shop, each with its own specific purpose. While not a huge problem, this can get cumbersome and expensive. There's one multi-purpose layout tool



◄ **Multi-Function Tool.** *A spirit level and pivot point add to the functionality of this versatile tool.*



◄ **Layout Tool.** *Mark miters from one end of the tool and 90° lines from the other.*



◄ **Height Gauge.** *Quickly set bit or blade heights with the tool's unique features.*

however, designed to help eliminate the tool clutter.

Based on a 19th-century *Stanley* design, the *#1 Odd-Jobs Tool* nearly does it all. The body of this layout tool is made of solid brass and ground with both 45° and 90° reference edges. The included 6", 12", or 18" rule and unique design allow it to function as a miter square, try square, or T-square, as well as a height/depth gauge. The photos above show a couple examples.

Additionally, a recessed set screw with a sharp point can be exposed, acting as a pivot point for marking arcs and circles. As if that wasn't enough, marking mortise locations and tenon layouts are a breeze with the attached scribe.

To round out the tool's many features, a spirit level is included, ensuring that your carpentry projects are level and plumb.

Finally, the small size of the *#1 Odd-Jobs Tool* makes it a perfect fit for an apron pocket.

QUICK 220 CONVERTER

When it comes to power tools, more horsepower is generally a good thing. But high horsepower motors can draw more electrical current than what's supplied by a standard 110-volt circuit. That's why many high-powered tools operate on 220 volts.

Many workshops however, are in garages or basements that may not be wired with 220-volt outlets. And the cost of adding these outlets can be prohibitive.

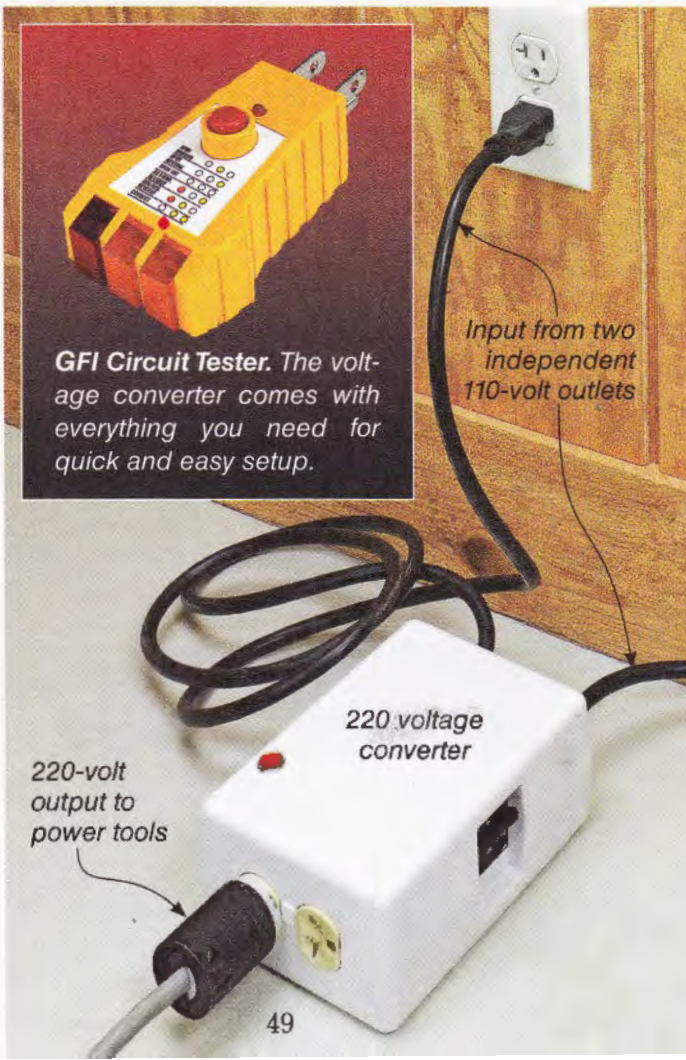
I recently discovered the *Quick 220 Voltage Converter*. This handy product offers an inexpensive way to safely power 220-volt equipment from two ordinary 110-volt outlets. Both 15A & 20A versions are available.

To work, the converter requires two outlets that are on independent circuits. In addition, neither of the outlets can be on GFI circuits.

You don't need to be an electrician to make it work, though. The unit comes with a GFI circuit tester and an indicator light that lets you know if the two selected outlets will work.

Plus, simple instructions help you set it up quickly. It took all of five minutes to get it plugged in and working in my shop.

For more information and where to buy any of these products, see Sources on page 51.



► **Simple Connection.** *Two 110-volt outlets are all you need to power your 220-volt power tools.*

Q&A

questions from
Our Readers

sorting out Lumber Terms

Some project plans list boards that are 5/4 and 8/4 followed by a certain number of "board feet." What do these numbers mean?

Todd Callihan
Lexington, Kentucky

A good part of woodworking involves understanding terminology and numbers. It's almost like another language. Besides learning terms like mortise, rabbet, and dado, a woodworker is confronted with a lot of fractions and the numbers you mention.

In a nutshell, these numbers are used to sell hardwood lumber based on the thickness and volume of wood in a board. In project plans, these numbers are used to give you an idea of the amount of wood needed to build the project and the size of boards individual parts come from.

Buying Lumber. You aren't likely to see these designations if you buy lumber from a home center. To simplify the pricing, consumer retailers size boards to common thicknesses, widths, and lengths. This way you know the exact cost of a board at a glance.

On the other hand, a commercial lumberyard sells hardwood lumber in a wider range of thicknesses, widths, and lengths. So the price of a board is a function of all three dimensions.

Thickness. The first number to look at is the rough thickness of a board. It's expressed in ¼" increments. For example, a 4/4 (pronounced four quarter) board is four quarters of an inch thick. An 8/4 board is eight quarters of an inch thick. The trouble is this number doesn't necessarily indicate the actual thickness.

Let me explain. When a tree is milled into lumber, the boards are cut into specific rough thicknesses (4/4, 6/4, etc). This is the thickness the price is based on. But the wood is still fairly wet and the saw marks can be pretty rough, as shown in the photo above. So after drying and initial planing, the board is noticeably thinner than the stated thickness (lower board shown above). The left chart below gives the finished thickness of common boards used by woodworkers.

Board Feet. Once you know the thickness, to determine the cost of a given board, you need to calculate how much wood the board contains. This value is expressed in board feet. And here is where the width and length come into play. The right chart shows the formula for calculating board feet.

In general, you multiply the rough-cut thickness of the board, in inches (4/4 equals 1"), by the width and length (also in inches). This number represents the volume of wood in cubic inches. To convert the number to board feet, you need to divide by 144. (The number of cubic inches in a board foot.) So based on this formula, the two boards above have the same board feet — even though one is thicker.

Exceptions. This formula works for stock sizes from 1" thick and up. For thinner boards, you always use 1" for the thickness and the resulting number is expressed in square feet.

With this information, you can estimate how much wood a project requires and compare prices to find the best deal.

Standard for Hardwood Lumber

Rough Thickness	Quarter Designation	Surfaced Thickness
1"	4/4	~13/16"
1 1/4"	5/4	~1 1/16"
1 1/2"	6/4	~1 5/16"
2"	8/4	~1 3/4"

Stock less than 1" is listed in standard fractions

Figure Board Feet

$$\frac{\text{Thickness} \times \text{Width} \times \text{Length (in inches)}}{144} = \text{Board Feet}$$

Example: $\frac{1" \times 12" \times 12"}{144} = 1$ Board Foot

NOTE: Anything less than 1" thick is figured as 1" and expressed as sq. feet

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.

HAND CARE *(p.10)*

- **Lee Valley**
  Finger Guard Tape 22R69.91
  Gloves in a Bottle 25K90.20
  O'Keeffe's AB704
  Worx Hand Cleaner . . . 25K90.31
  The Gardener's Soap. AB770
- **Amazon.com**
  SBS-40 . . . . . B0006GDATQ

WORKBENCH *(p.12)*

- **Lee Valley**
  Face Vise Hardware . . . 70G08.01
  Vise Handle. 05G12.03
  Beading Bit 16J43.52
- **Rockler**
  20" Drawer Slides 39541
  Magnetic Catch 26559
  Beading Bit 91826
  Seal-A-Cell Finish 56507
  3/16" Roundover Bit. 21026
- **Horton Brasses**
  Bin Pulls (Antique) BN-3
  3/4" Knob (Antique) K-12
  1½" x 2" Hinges PB-407B
- **Highland Woodworking**
  Steel Bench Dogs 163562
- **Woodsmith Store**
  Amana Beading Bit 272092
  Freud Beading Bit. 230862

MITER SAW STAND *(p.26)*

- **Reid Supply**
  Studded Knobs DK-680

PERFECT SLOTS *(p.32)*

- **Woodworker's Supply**
  Jig Saw Blade 153-854

SMALL ROUTER BASES *(p.34)*

- **McMaster-Carr**
  Phenolic (Garolite) . . . 85315K114
  Brass Bar. 8954K195
  Knurled Screw 90200A264
  Red Ball Knobs 6146K43

PLANE ACCESSORIES *(p.40)*

- **Lee Valley**
  Press Screw. 13F17.01
  Low-Angle Jack Plane . .05P34.51

TABLE SAW SAFETY *(p.46)*

- **Woodsmith Store**
  Bosch Table Saw 268691

GREAT GEAR *(p.48)*

- **Woodcraft**
  6" Knife Sharpener. 152867
  12" Knife Sharpener. 152868
- **Garrett Wade**
  #1 Odd-Jobs Tool. 23N02.01
- **Quick 220 Systems**
  220 Voltage Converter .A220-15D

MAIL ORDER SOURCES

Woodsmith Store
800-444-7527

Rockler
800-279-4441
rockler.com

Amazon.com

Garrett Wade
800-221-2942
garrettwade.com

Highland Woodworking
800-241-6748
highlandwoodworking.com

Horton Brasses
800-754-9127
horton-brasses.com

Lee Valley
800-871-8158
leevalley.com

McMaster-Carr
630-600-3600
mcmaster.com

Quick 220 Systems
800-347-0394
quick220.com

Reid Supply
800-253-0421
reidsupply.com

Woodcraft
800-225-1153
woodcraft.com

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

ShopNotes

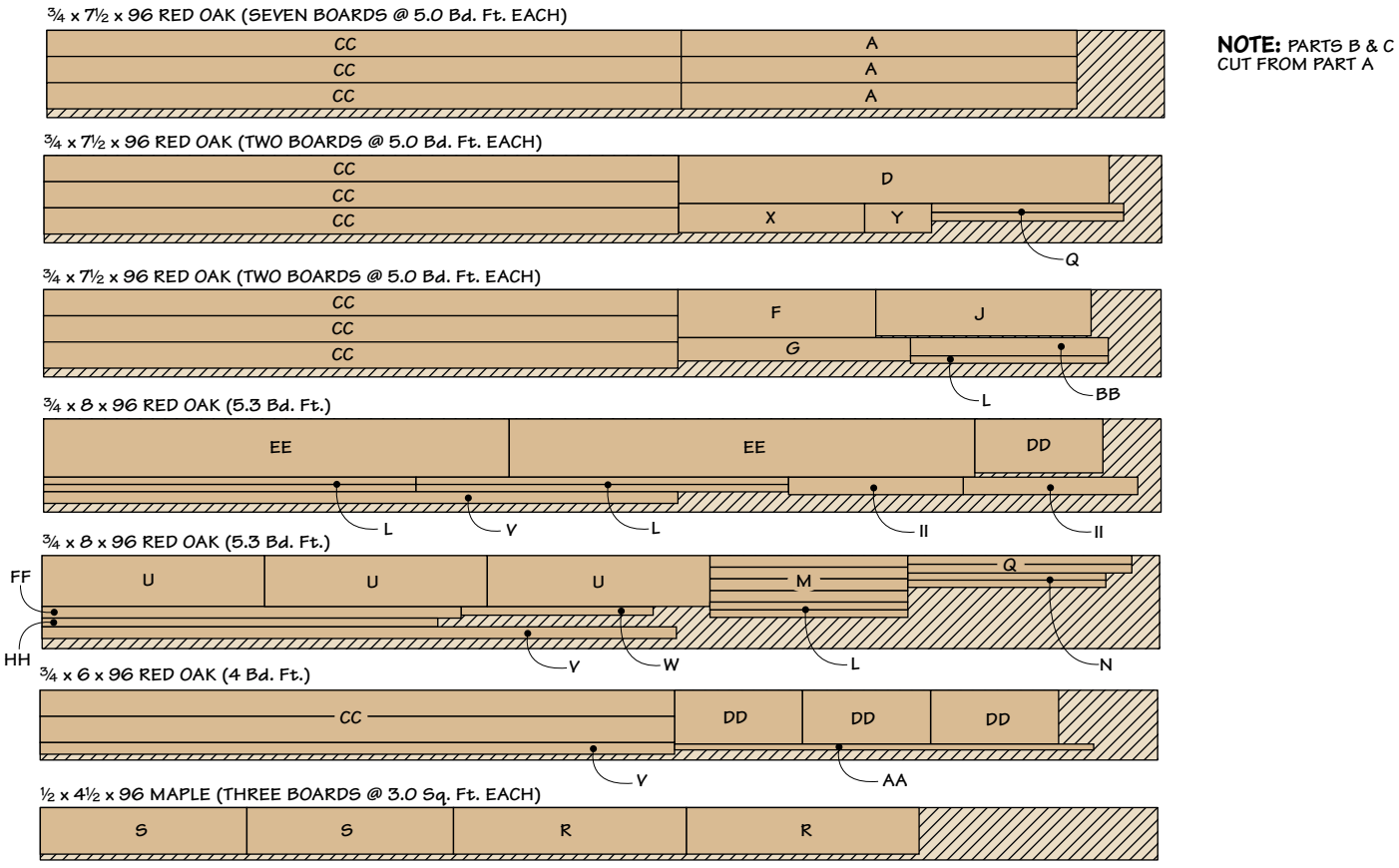
heirloom Workbench

Materials List

A	Leg Outer Layers (16)	¾ x 2¼ - 34
B	Long Fillers (4)	¾ x 2¼ - 22¼
C	Short Fillers (4)	¾ x 2¼ - 8¼
D	Stretchers (2)	¾ x 4⅛ - 37
E	Ends (2)	18½ x 21⅜ - ¾ Ply.
F	Lower Rails (2)	¾ x 4⅛ - 17
G	Cleats (2)	¾ x 2 - 20
H	Bottom (1)	21½ x 32 - ¾ Ply.
I	Shelf (1)	21½ x 33½ - ¾ Ply.
J	Upper Rails (2)	¾ x 4 - 18½
K	Back (1)	32 x 17 - ¾ Ply.
L	Bullnose Edging (1)	1 x ⅝ - 170 Rgh.
M	Bullnose Molding (2)	1 x 1⅜ - 17
N	Cove Molding (2)	¾ x ⅝ - 17
O	Case Sides (2)	16½ x 19⅞ - ¾ Ply.
P	Top/Btm./Dividers (4)	19⅞ x 20 - ¾ Ply.
Q	Case Edging (1)	¾ x ¾ - 120 Rgh.
R	Drawer Sides (6)	½ x 4 - 19¾
S	Drawer Fronts/Backs (6)	½ x 4 - 17¾
T	Drawer Bottoms (3)	19¼ x 17¾ - ¼ Ply.
U	Drawer Faces (3)	¾ x 3⅝ - 18⅜
V	Bead Molding (1)	⅜ x 15/16 - 160 Rgh.
W	Hinge Stile (1)	¾ x ¾ - 16½
X	Door Stiles (2)	¾ x 2½ - 16⅛
Y	Door Rails (2)	¾ x 2½ - 5⅞
Z	Door Panel (1)	5⅞ x 11⅝ - ¼ Ply.
AA	Door Bead (1)	⅜ x 7/16 - 36 Rgh.
BB	Mounting Cleats (2)	¾ x 1½ - 17½
CC	Benchtop (1)	2¼ x 26¼ - 54½
DD	Vise Jaw (1)	3 x 4⅝ - 11
EE	Tool Panel (1)	¾ x 10 - 40
FF	Tool Bar Rear (1)	¾ x 1 - 36
GG	Spacers (5)	¼ x ¾ - 1
HH	Tool Bar Front (1)	¾ x ¾ - 34
II	Rack Supports (2)	¾ x 1½ - 15

- (38) #8 x 1¼" Fh Woodscrews
- (13) #8 x 1½" Fh Woodscrews
- (8) #8 x 2½" Fh Woodscrews
- (6) ¼" x 2" Lag Screws
- (6) ¼" Washers
- (3 pr.) 20" Full-Extension Drawer Slides
- (3) 4" Bin Pulls
- (1) ¾"-dia. Knob
- (1 pr.) 1½" x 2" Hinges
- (1) Magnetic Catch
- (1) Face Vise Hardware
- (1) Vise Handle

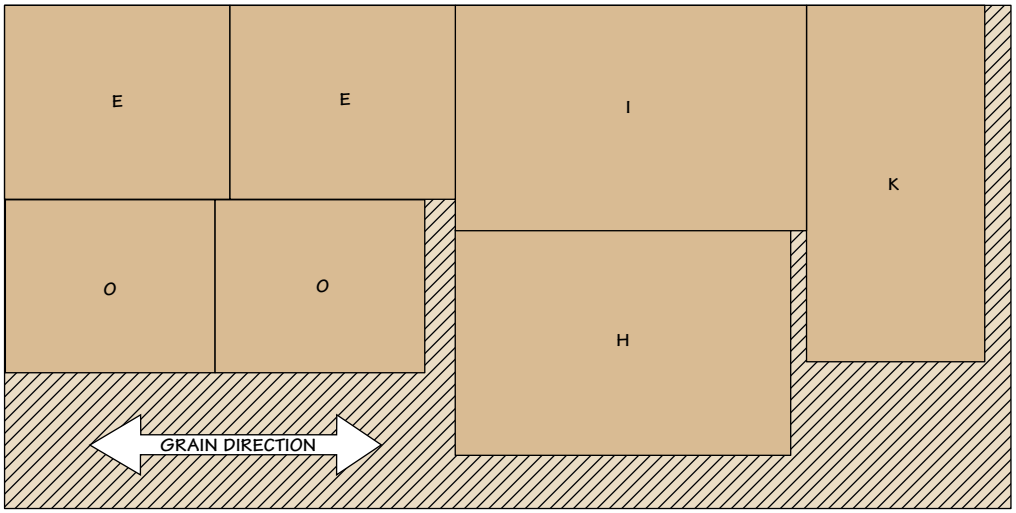
Cutting Diagram



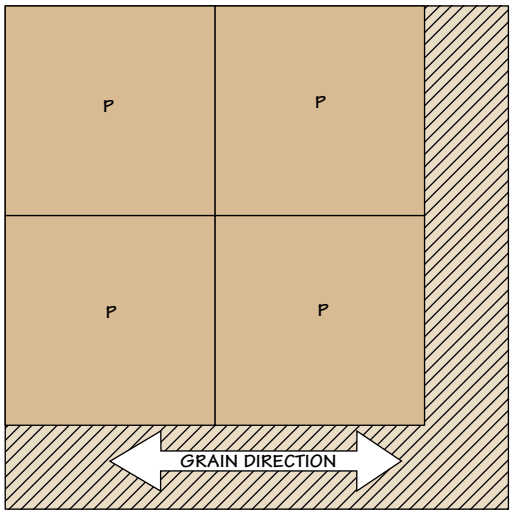
NOTE: PARTS B & C CUT FROM PART A

Cutting Diagram

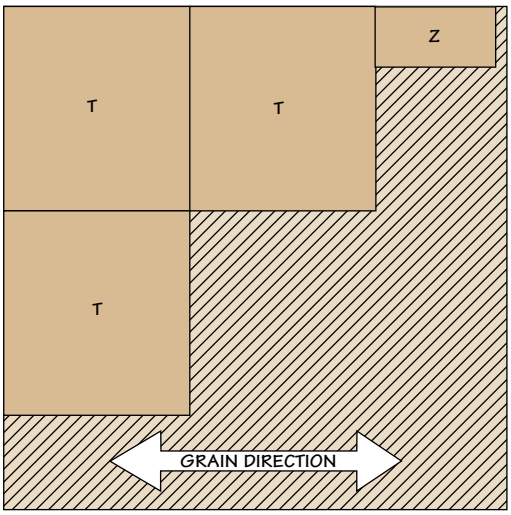
¾ x 48 x 96 RIFTSAWN RED OAK PLYWOOD



¾ x 48 x 48 PLYWOOD



¼ x 48 x 48 RIFTSAWN RED OAK PLYWOOD



ShopNotes

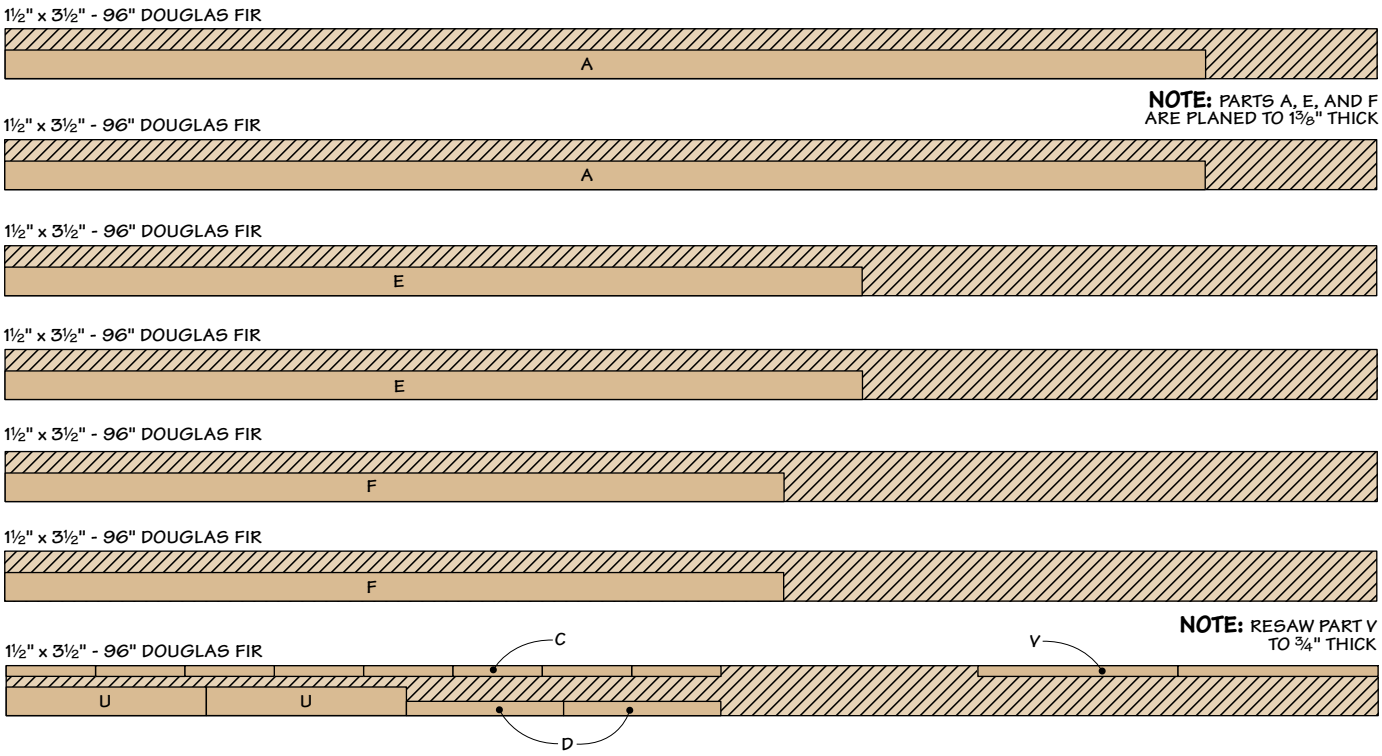
space-saving Miter Saw Station

Materials & Hardware

A	Rails (2)	1⅜ x 2 - 84
B	Skins (2)	7½ x 84 - ¼ Ply.
C	Fillers (8)	1½ x ¾ - 6¼
D	Wedges (2)	1½ x 1 - 11
E	Upper Side Rails (2)	1⅜ x 2 - 60
F	Lower Side Rails (2)	1⅜ x 2 - 54½
G	Side Webs (4)	7½ x 60 - ¼ Ply.
H	Arms (2)	6¼ x 34 - 1½ Ply.
I	Legs (2)	25 3/16 x 33 - 1½ Ply.
J	Brackets (8)	5 x 5¾ - ¾ Ply.
K	Saw Base (1)	18 x 22 - ¾ Ply.
L	Front/Back (2)	9 x 22 - ¾ Ply.
M	Long Lock Bar (1)	¾ x 22 - ⅛ Alum.
N	Shelf (1)	6 x 16 - ¾ Ply.
O	Shelf Sides (2)	5 x 5½ - ¾ Ply.
P	Large Braces (2)	6 x 6 - ¾ Ply.
Q	Outfeed Bases (2)	13¾ x 14 - ¾ Ply.
R	Fronts/Backs (4)	7⅜ x 14 - ¾ Ply.
S	Short Locking Bars (2)	¾ x 14 - ⅛ Alum.
T	Small Braces (4)	4 x 4 - ¾ Ply.
U	Spacers (2)	1½ x 2 - 14
V	Fences (2)	¾ x 1¼ - 14

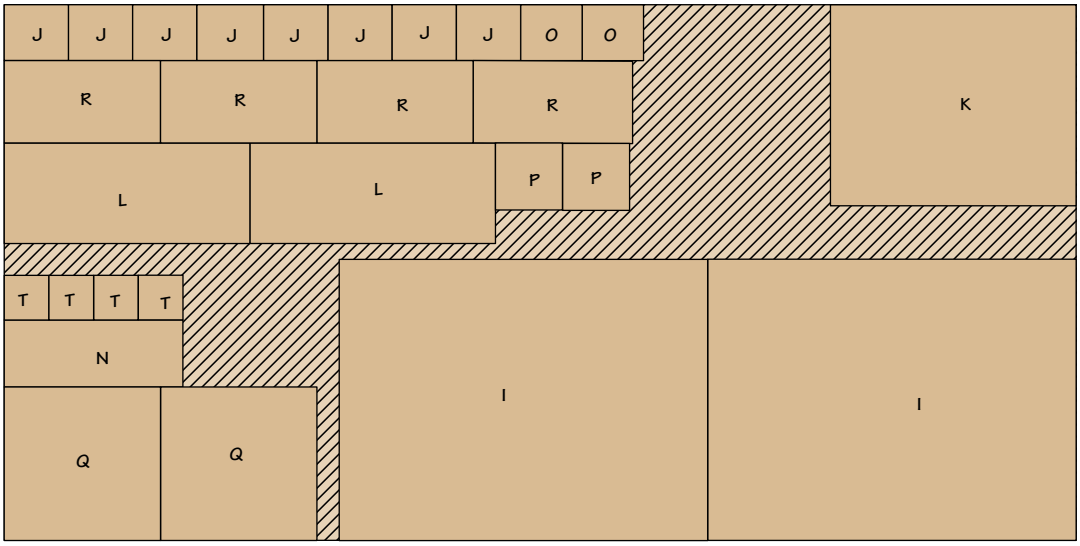
- (65) #8 x 1½" Fh Woodscrews
- (6) #5 x ⅝" Fh Woodscrews
- (8) #8 x 2" Fh Woodscrews
- (10) 5/16"-18 T-Nuts
- (6) 5/16"-18 x 1" Studded Knobs
- (4) 5/16"-18 x 2" Hex Bolts
- (4) 5/16" Flat Washers
- (1) ¾" x 72" - ⅛" Aluminum (for Locking Bars)

Cutting Diagram

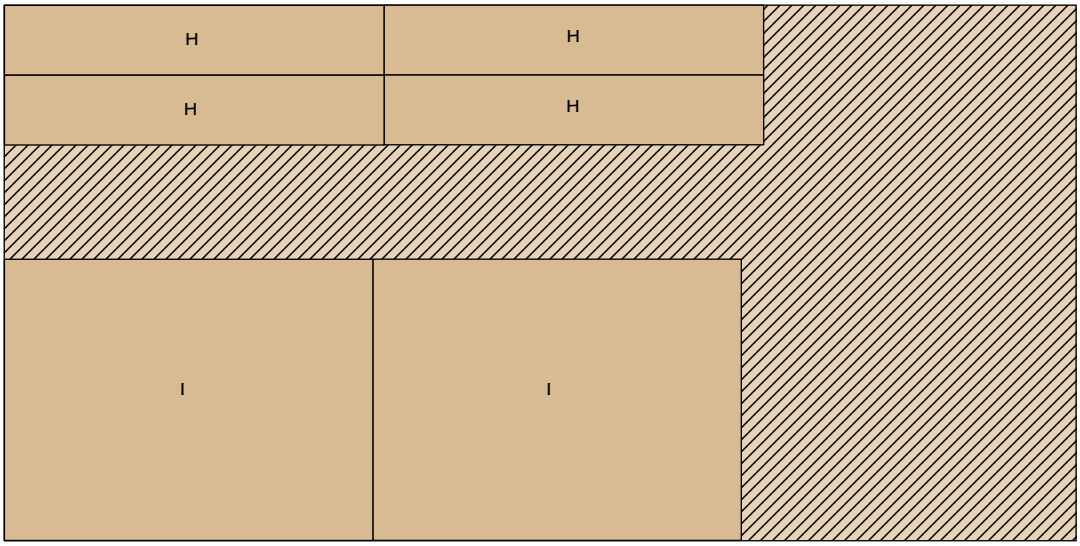


Cutting Diagram

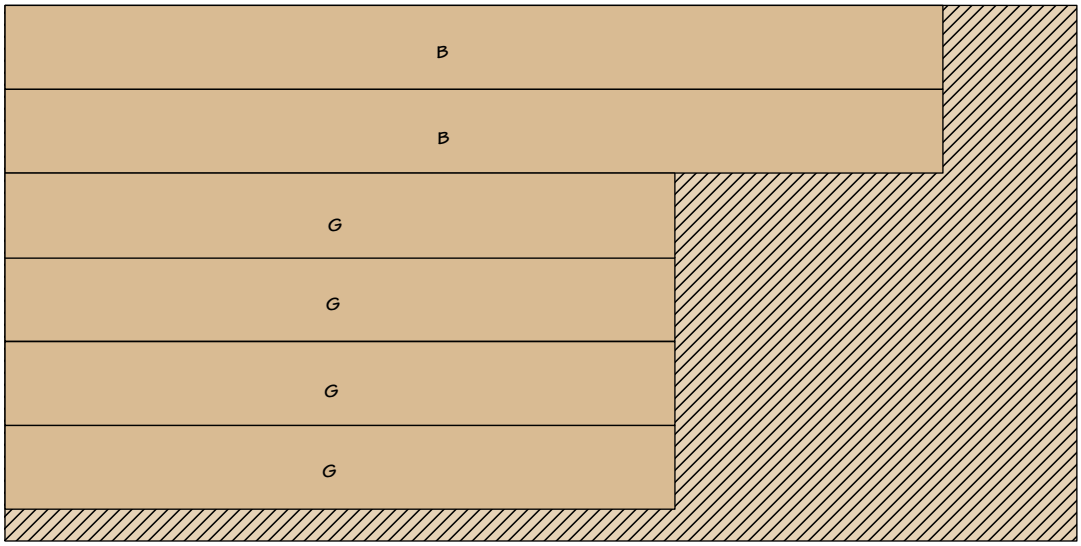
48" X 96" - ¾" Plywood



48" X 96" - ¾" Plywood



48" x 96" - ¼" Plywood



ShopNotes

2 tools for Perfect Miters

Building this pair of shop-made accessories is a great way to guarantee gap-free miters.

Miter Jack

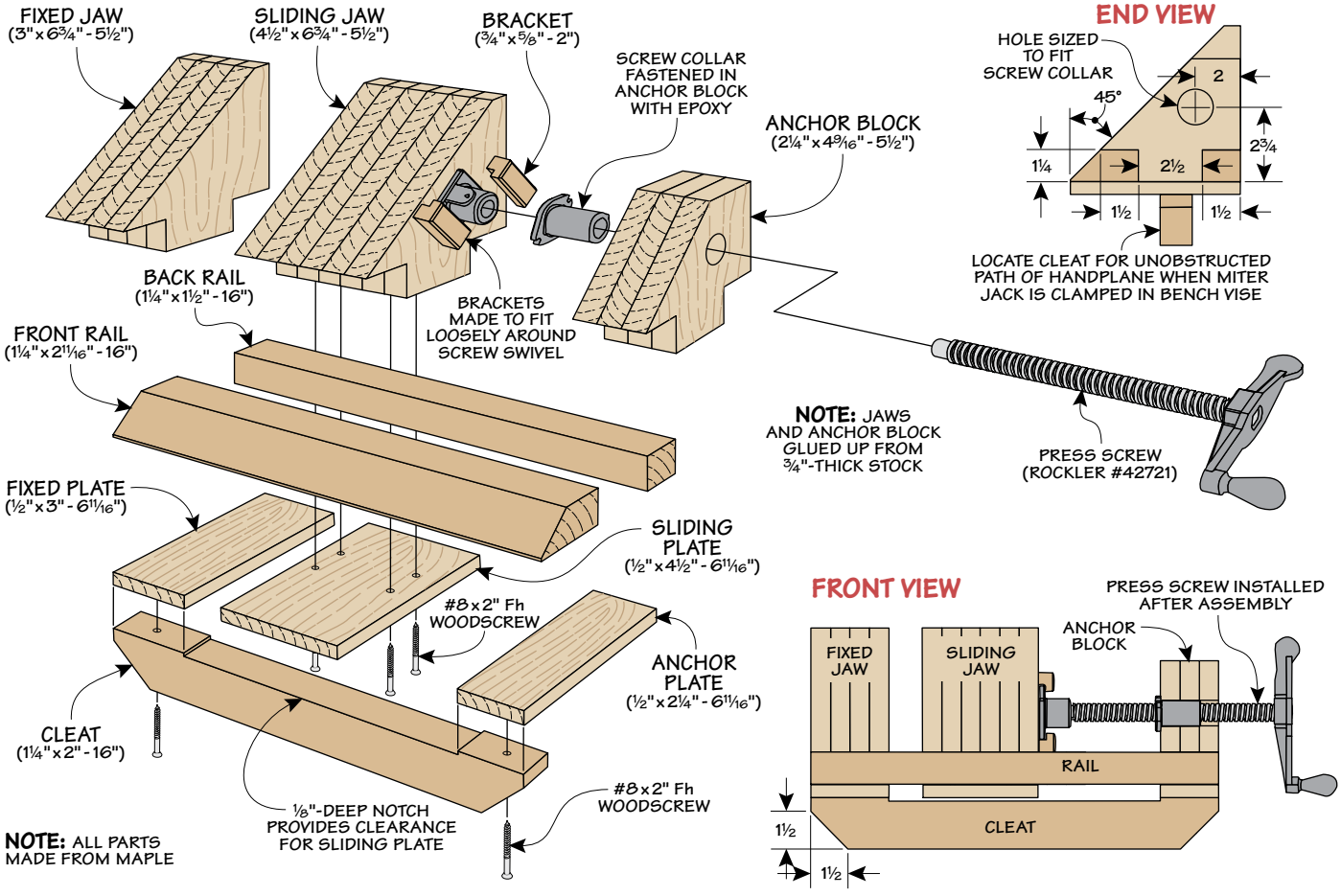
Building the miter jack isn't difficult but it does require some time to fine-tune the parts for accurate planing of miters. The drawings below provide all the details.

I started with the two rails. The front rail is beveled at 45°. Then I went to work gluing up the stock for the two jaws and anchor block. To make it easier to cut the angled face on the sliding jaw, I glued it up in two sections, cut the 45° angle, then glued the two sections together. Then you can cut the two notches on the bottom of the three pieces to fit the rails.

After drilling a hole in the anchor block for the press screw's collar, glue the fixed jaw and anchor block to the rails. I secured each of them with a bottom plate glued to the rails and blocks.

The sliding jaw is secured to the rails with a plate attached with screws. This assembly should slide smoothly along the rails. Now you can set the screw collar into the anchor block with epoxy and install the screw and brackets onto the sliding jaw.

Attach the optional cleat if you want to clamp the miter jack in your face vise.



Donkey's Ear

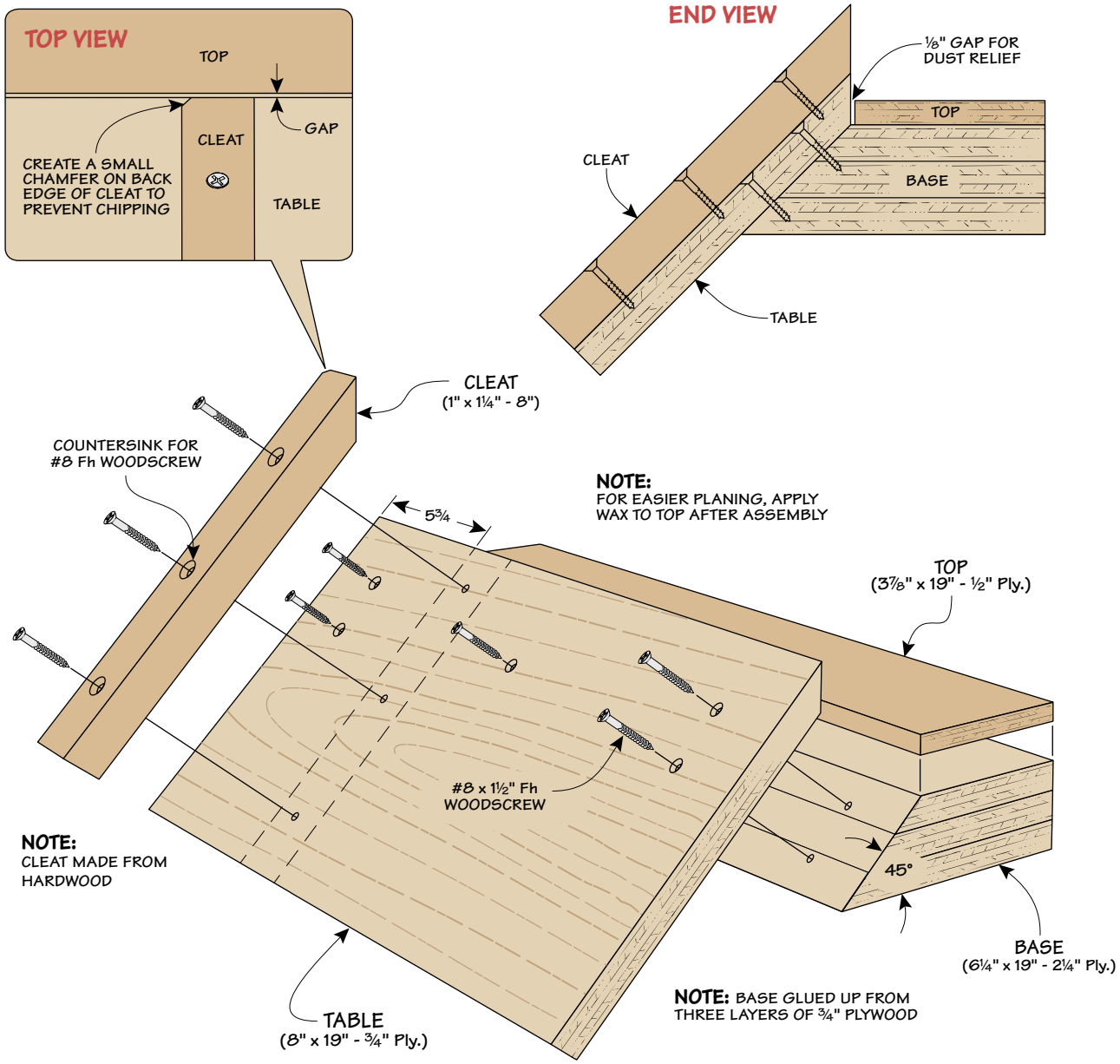
The donkey's ear is a simple device you can build in an evening. I made mine from Baltic birch plywood (drawings below).

The first step is to glue up three layers of ¾" plywood for the base. Then you can trim it to size and bevel one face at 45°.

The table comes next. Like the base, it's trimmed to size with one edge ripped at 45°. I attached it to the base with screws, making sure the edges of the bevels aligned.

To complete the base, I added a layer of ½" plywood. The width is sized to leave an ⅛" gap along the table for dust relief. It's simply glued in place.

Finally, you can add the cleat. I used hardwood for this part. One end is beveled, as you can see below. Before fastening the cleat to the table, I sanded a small chamfer on the back, vertical edge of the bevel. This prevents tearout on the back side of the cleat as the plane cuts into it during the first few passes. Then fasten the cleat to the table. Just make sure it's square to the table's beveled edge.



Scenes from the Shop

Perfect-fitting miters are within reach using this traditional hand plane accessory. You'll find shop-tested tips on using this miter jack starting on page 40.

Butterfly keys combine strength and style to stabilize cracks and splits in a workpiece. To learn how to put this technique to use, turn to page 22.