ELECTRICITY ESSENTIALS
For Your Shop

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Made Easy

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Vol. 23 Issue 134

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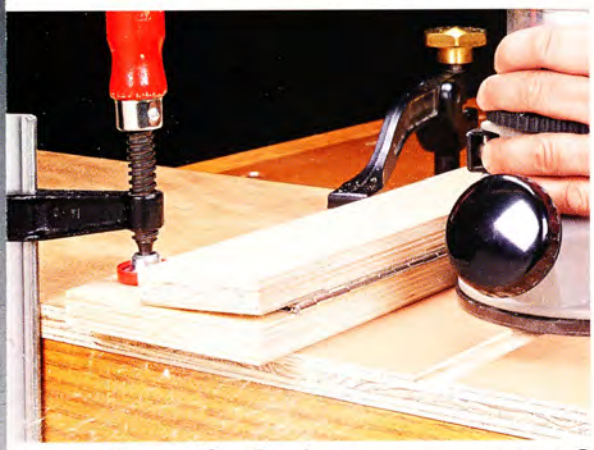

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Cutoffs

One of the things I like most about my job is seeing the shops of other woodworkers, whether it's an actual visit or simply a glimpse via the photos that many of you send in. Besides seeing the latest projects you're working on, I also get to see the layout of your shops, the tools you use, and the ways each one of you find to make your space work best for you.

Speaking of shops, in the last issue we featured the tips and tricks that one of our editors uses to create a woodworking shop in a two-car garage. He shares the space with the family car, home and garden tools, and the like — something most of us can relate to.

In this issue, we're taking a look at a completely different space, an old coal room in the basement of the house of one of our graphic designers, Bob Zimmerman. There's no coal any more, and it's about a third of the size of a two-car garage, but the simple storage ideas and workspace setup make it work like a much larger shop. Take a look at the article starting on page 44 and pick up a few great ideas for your own shop.

One last thing on the subject of shops: The *Woodsmith Shop* completed the airing of its seventh season on public television. That means we're making this latest season available on DVD. Like before, all 13 episodes are included on a pair of DVDs. And a separate CD contains all the plans, articles, and videos mentioned on the show. You can find out how to order it (along with package options for the other seasons) by turning to page 51 or online at *WoodsmithShop.com*.

Bryan

ShopNotes GO ONLINE EXTRAS

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

from our Readers

Tips for Your Shop

Drill Press Dust Collection

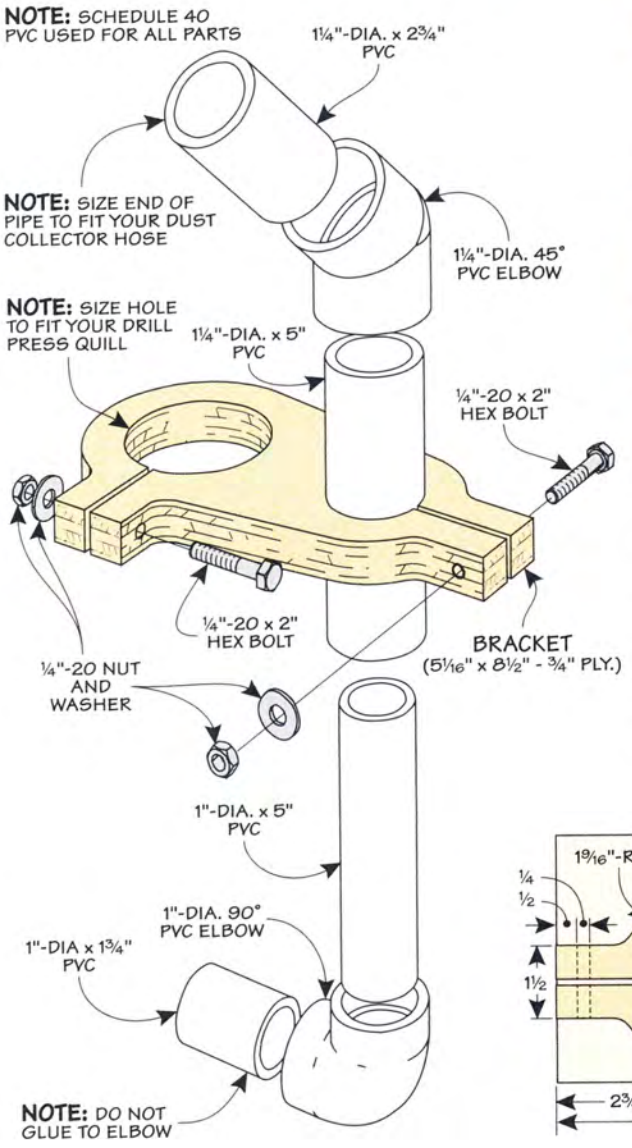
Managing chips and sawdust when using the drill press is always a challenge. The problem is where to locate the vacuum hose for maximum effectiveness.

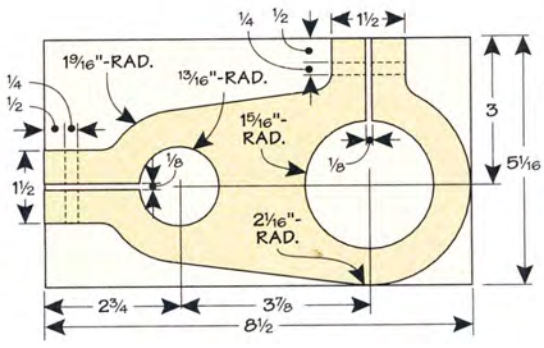
The solution I came up with is the attachment you see above. It consists of a bracket and telescoping pipe assembly that attaches to the quill of your drill press. The bracket secures the fixed portion of the telescoping PVC pipe. A pipe with a smaller diameter slips inside the fixed pipe. This allows it to move up and down with the drill press quill, always keeping the suction near the drill bit. An elbow on the end directs the suction toward the bit.

I used 1¼"-dia. pipe for the fixed portion of the assembly. A 45° elbow fitting at the top is used for attaching the hose from my shop vacuum. You may need to sand the outside diameter to fit your vacuum's hose.

The internal, sliding portion of the pipe assembly is made from 1"-dia. pipe. A 90° elbow and short length of pipe allow it to reach near the drill bit. I didn't glue this in place in case I need to remove it for additional clearance.

Gerry Meereboer
Broek op Langedijk, Netherlands





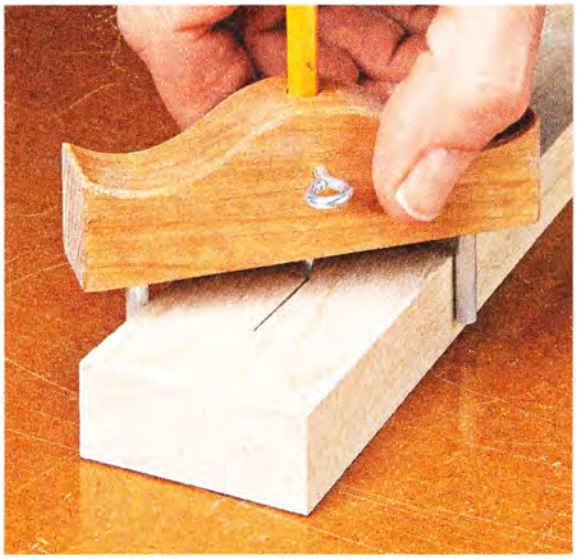
Small Center-Finder

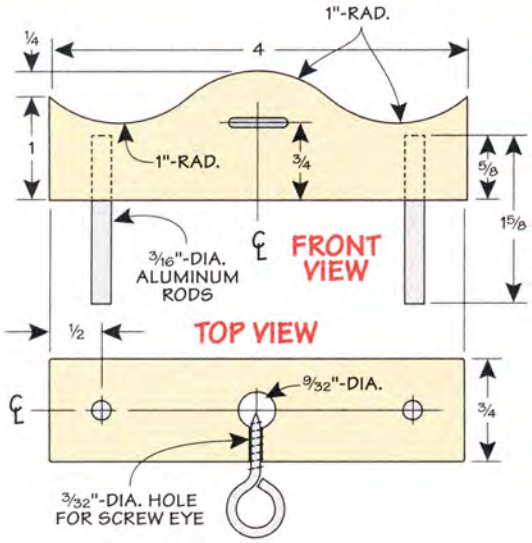
In issue No. 86 of *ShopNotes*, you had plans for building a center-finder. The body of that tool is about 11" long. It was designed for a range of workpiece widths. Realizing that most of my work involves narrow workpieces, I made a smaller tool, as you can see at right.

To make it, start with a hardwood blank cut to final size. Before cutting it to shape, I drilled the holes for the pencil and aluminum rods. Careful layout work ensures the three holes are in alignment. The pencil hole must also be centered between the pair of holes for the rods. Then you can cut the body to shape.

I cut the aluminum pins to length and secured them in the holes with epoxy. The pencil is held in place with a screw eye.

William Collett
Bettendorf, Iowa





Submit Your Tips Online!

If you have an original shop tip, we would like to consider publishing it. Go to

ShopNotes.com

and click on the link

SUBMIT A TIP

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

ShopNotes

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Shop Stool Add-On

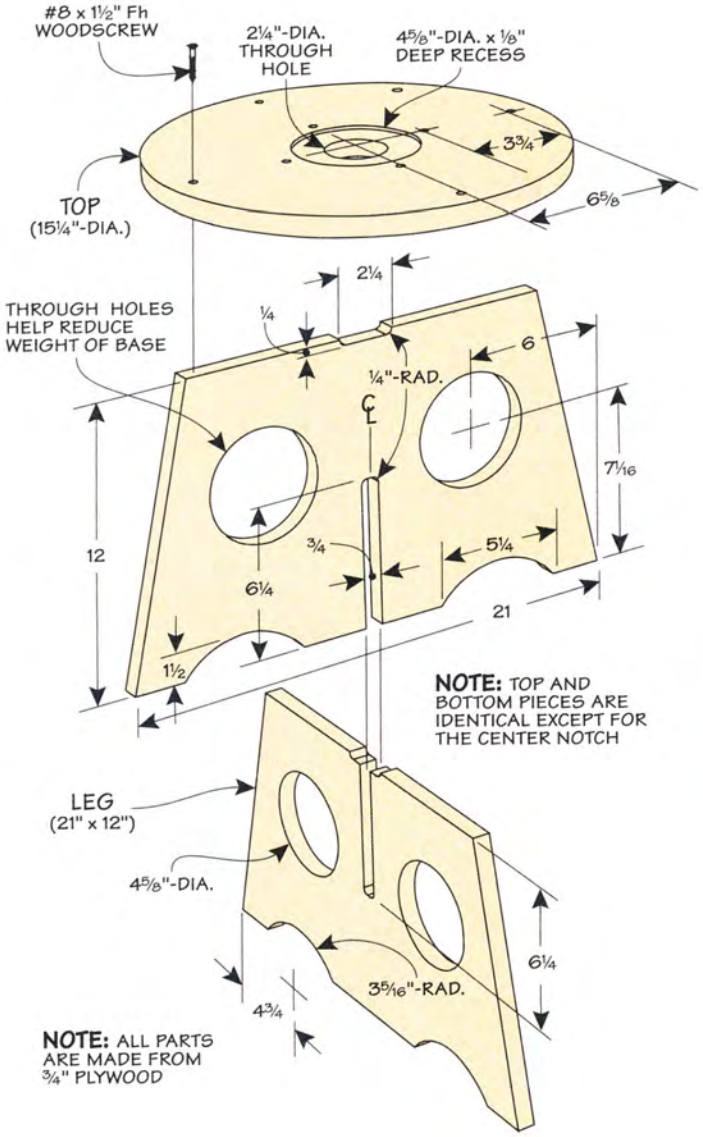
THE WINNER!

My wife got tired of me stealing one of our bar stools to use in the shop. While perusing a tool catalog, I ran across this mechanic's stool. You can find them at *Northern Tool* and *Harbor Freight* for about $30. The adjustable-height stool includes a storage tray underneath. But the problem is, it's not tall enough for use in my woodworking shop.

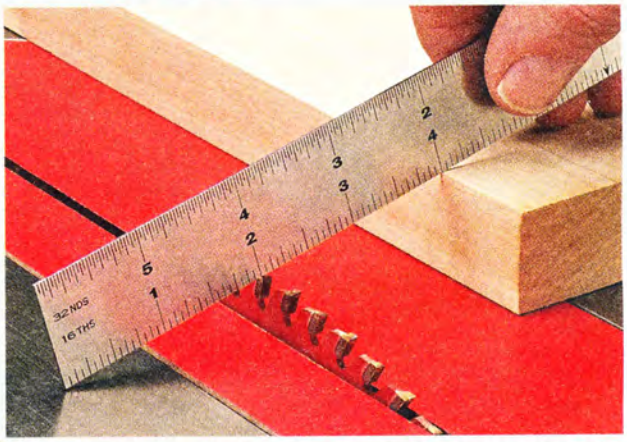
After thinking about how to solve this issue, I came up with the plywood base you see here. The drawing below shows how it goes together. The three parts create a sturdy base while elevating the seat to a comfortable height for working at my bench.

All you need to do is remove the casters from the base of the seat and fasten it to the round top of the plywood base. The interlocking plywood legs ensure stability and many years of use in my shop.

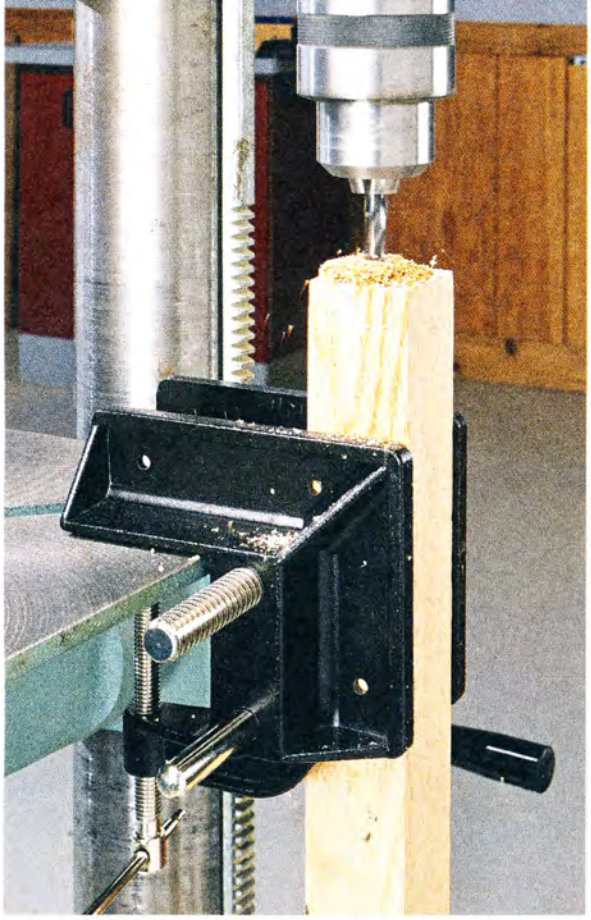
Tom Shapley
Flower Mound, Texas



Quick Tips



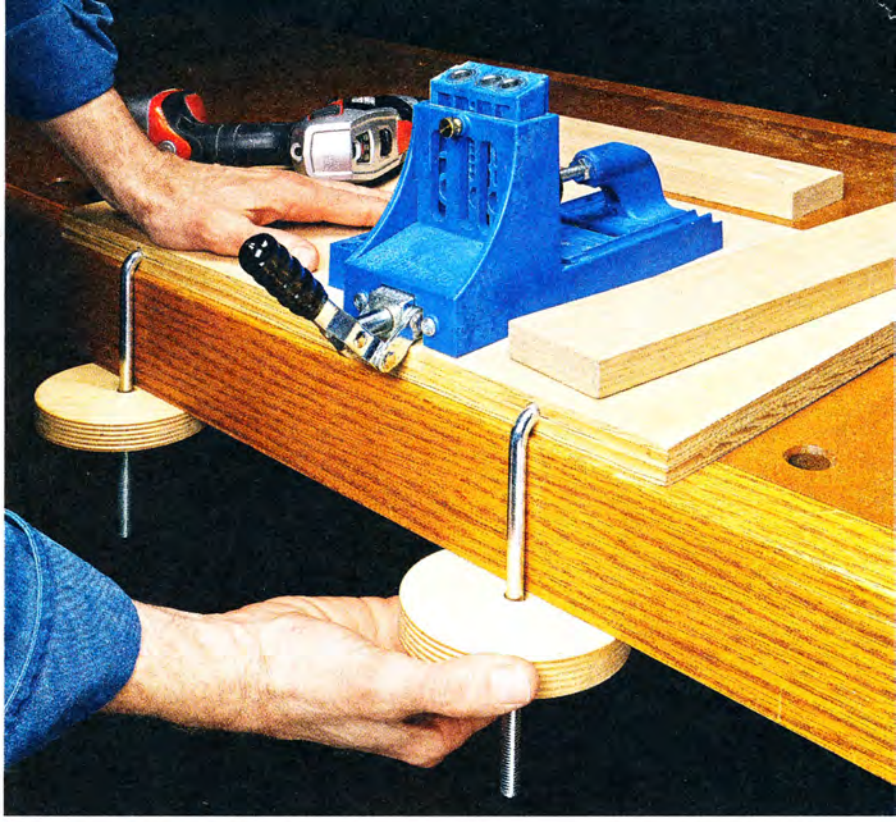
▲ *To make a cut at exactly half the thickness of a workpiece,* ***Jeffrey Martel*** *of Seattle, WA, aligns a ruler over the blade and workpiece as shown. The blade height is adjusted at half the distance.*



Vertical Drilling Jig

Clamping a long piece on the drill press to drill the end can be a challenge. My solution is an in-line vise like the one shown above (*Lee Valley*, 60F06.01). It's secured to the drill press table with a clamp screw. Then the workpiece can be clamped in place. Simply swing the drill press table and reposition the vise as needed to align the workpiece with the bit.

Serge Duclos
Delson, Québec



U-Bolt Clamps

Square U-bolts are available in a variety of sizes. I've discovered that by cutting them in half, they make excellent clamps for attaching tool bases to my benchtop. They also work for attaching auxiliary fences to my table saw rip fence.

I first cut the U-bolt in half to create two clamps. Then I cut a plywood disk to act as a clamp head. A threaded insert installed at the center of the disk allows the disk to be fastened and tightened to the U-bolt. A few turns of the disk locks it in place.

Doug Huffman
Easley, South Carolina

▲ ***Doug Broadhurst*** *of Holbrook, NY, found that scraps of composite decking material are ideal for making miter slot runners for jigs. They remain stable and slide easily.*

▲ *A white dot painted on the ground side of a plug helps* ***Kelly Churchill*** *of Medford, OR, install them in the proper orientation.*

routing Dadoes & Grooves

Create smooth, accurate joints with a hand-held router and this unique jig.

Dadoes and grooves are essential joints for many projects. Using a hand-held router and a straight bit is just one of several ways to create smooth, crisp joints. The thing is, you need a way locate the router accurately and a method to guide the router during the cut. The router jig you see here solves both of those issues.

Here's how the jig works in a nutshell. You line up a hinged fence on the jig with the centerline of the joint and clamp the jig in place. Fold the fence back and the router runs along the jig base, with the bit right on target.

It's the hinged fence that sets this jig apart. On a typical straightedge guide, you need to measure the offset from the edge of the router baseplate to the edge of the bit in order to locate the guide. Here, the hinged fence is aligned with the layout line, so there's no offset to worry about. The width of the fence is based on the distance between the edge of the router's baseplate and the center of the bit.

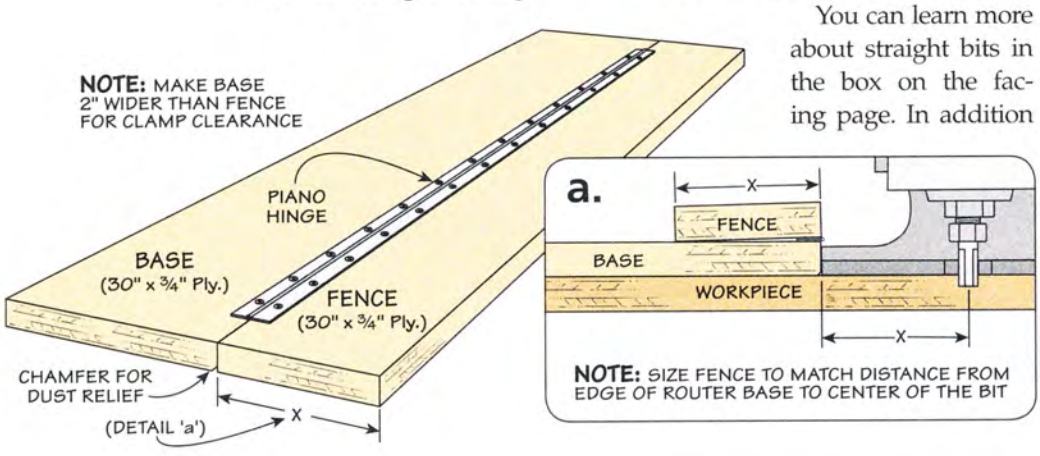
This means that setting up the jig isn't tied to a specific bit. So it'll work the same no matter what size straight bit you use.

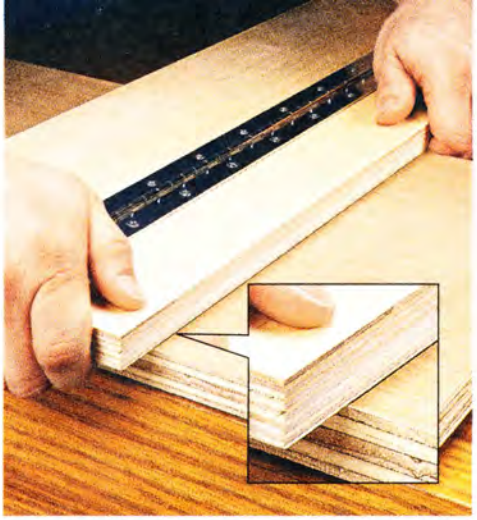
You can learn more about straight bits in the box on the facing page. In addition you aren't limited to straight bits. The jig would work great for routing sliding dovetails, flutes, or V-grooves, too.

Jig Details. The key to making the jig is sizing the folding fence. Like I said, it needs to match the distance from the edge of the baseplate to the center of the bit, as you can see in detail 'a' below. (Since the router baseplate may not be centered on the bit, it's a good idea to mark your router and use the same side of the router against the jig every time.)

The base is wide enough so that when the fence is folded back, it won't get in the way of the clamps that hold the jig in place. I cut a small chamfer on the lower edge of the base to keep dust and chips from getting between the base and router, which could spoil the cut.

The two pieces are joined with a continuous hinge. I clamped the fence and base together while attaching the hinge to keep the parts parallel. Center the hinge on the two parts.





▲ ***Align the Jig.*** *Position the edge of the fence so it's right on the marked centerline of the joint.*

▲ ***Clamp the Jig in Place.*** *Clamps secure the jig to the workpiece and the workbench for stability.*

▲ ***Fold the Fence Back.*** *Now all you have to do is flip the fence out of the way and start routing.*

On Your Mark. By taking the time to accurately make the jig, using it will be pretty straightforward. It begins with marking the centerline of the joint, instead of an edge. Keep this in mind when laying out your cuts.

Get Set. The edge of the hinged fence on the jig aligns with the layout marks, as in the upper left photo. Set the jig so that you will be routing left to right across the jig. This way, the rotation of the bit pulls the router towards the base of the jig.

Clamp the fixed base in place on the workpiece (middle photo). I like to double check the placement of the jig and use gentle taps from a mallet to fine-tune the position of the jig if necessary.

Rout. Flip the fence back onto the base and you're ready to rout, as shown in the upper right photo. Set the router on the workpiece and against the base, but keep the bit clear of the workpiece. Then turn on the router and move the router along the base at a steady rate (main photo on the facing page). The density and hardness of the material dictates how fast you can rout.

That's really all there is to it. However, I want to add a couple extra tips for getting the best results with this jig.

Matching Parts. Many times, you need to rout dadoes in pairs on corresponding parts. To make sure they're aligned, I like to clamp the workpieces together and rout them at the same time, as you can see in the right photo.

Stopped Cuts. Another situation you're likely to run across is cutting stopped dadoes. The simplest option is to mark the end of the dado and rout to the mark.

A better option is to use a fixed stop. Clamp a block to the workpiece so the bit aligns with the end of the cut when the router base contacts the block. Once you turn off the router and clear away the chips, you can see the results of your efforts.

A smooth, crisp dado creates a solid joint with great glue surfaces. Once you try this jig and technique, I'm sure it's something you'll turn to often.

▲ ***Two at a Time.*** *You can clamp narrow pieces together to save setup time and ensure that the dadoes are perfectly aligned.*

straight bits
Sized for Plywood

Straight bits are inexpensive workhorses in my shop for cutting smooth rabbets, dadoes, grooves, and slots.

Chances are you already have a few standard fractional sizes (¼", ½", ¾") in your set. But if you work with plywood, you know it rarely (if ever) measures its stated thickness. So a ¾" bit will cut a dado that's too wide for ¾" plywood.

Instead, you can get plywood bits that are undersized to be a closer match to the actual thickness of plywood. Plywood thickness varies, so the fit may not be perfect from sheet to sheet.

Plywood bits don't match up well with Baltic birch plywood. Recently though, I found metric plywood bits that do a good job (right two bits).

15/32" bit (½" ply.) | *23/32" bit (¾" ply.)* | *12mm bit (½" Baltic birch ply.)* | *18mm bit (¾" Baltic birch ply.)*

combination Router Base

This multipurpose accessory turns your router into a precision tool for completing a variety of tasks.

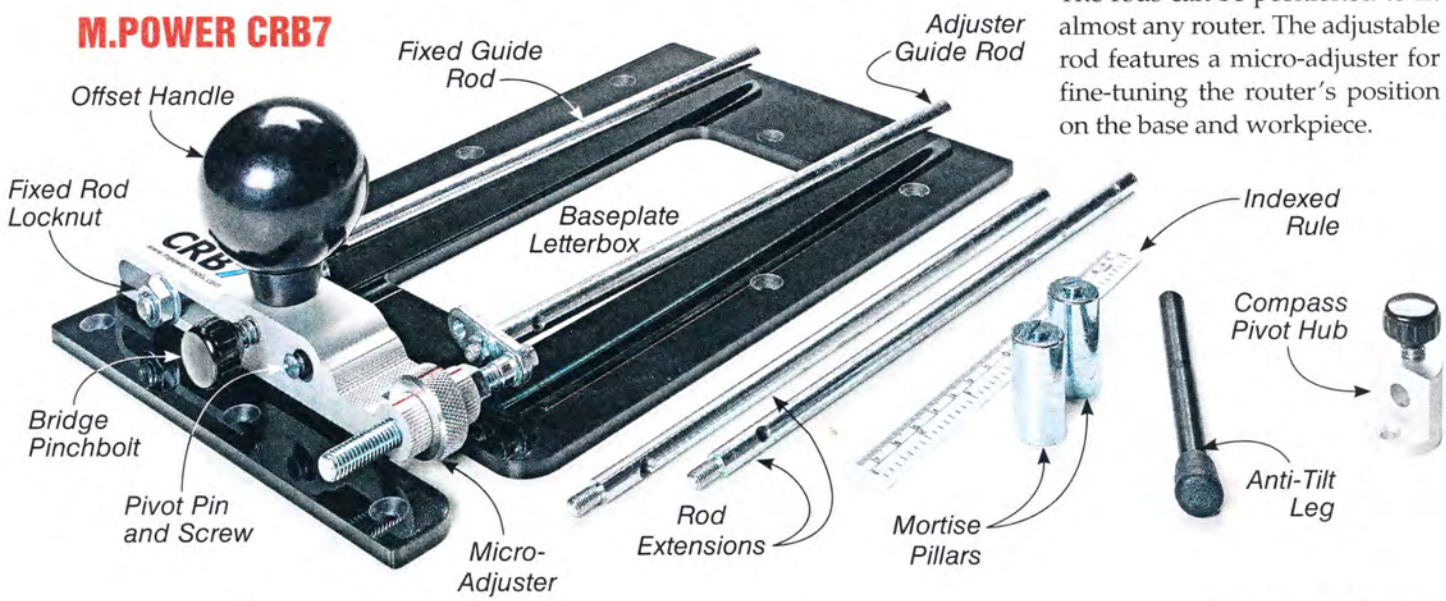
No other tool in the shop can perform as many functions as a router. So when an accessory comes around that makes my router more accurate or provides even more functionality, I take notice. The combination router base by *M.Power* does a great job of extending your router's capabilities. And it does so with micro-adjustable precision.

OVERVIEW

The *CRB7* router base comes packaged as shown below. It runs about $80 and also includes a pivot hub and additional guide rods for routing large circles, as shown in the main photo above. There are also two accessory kits available: An edge guide ($20) and an edge-trimming base with roller bearing ($30), that are shown on the opposite page. You can find out where to buy the combination base and optional kits in Sources on page 51.

Universal Base. The plastic base of the *CRB7* fits on any router with a base that accepts guide rods for an edge guide. The base of the *CRB7* has a machined aluminum block on one end. It holds a fixed and adjustable guide rod. The rods can be positioned to fit almost any router. The adjustable rod features a micro-adjuster for fine-tuning the router's position on the base and workpiece.

M.POWER CRB7



▲ ***Straightedge.*** *The edges of the router base make it ideal for use with a straightedge guide. The router's position on the base can be fine-tuned for accuracy.*

▲ ***Mortising.*** *Two pins on the underside of the base ride against opposite faces of the workpiece to rout a mortise. The micro-adjuster lets you dial in the exact mortise location.*

There's one thing to note: There are no knobs included in the kit to fasten the base to your router. If your router doesn't include these knobs, you'll need to order them to fit your router base.

BASIC FUNCTIONS

Between the basic kit on the opposite page and the two optional attachments, there are a variety of tasks you can perform with the *CRB7*.

Circles. As shown in the main photo, the *CRB7* can be configured to work as a trammel. There are two ways to do this. For small circles (less than 8¾" radius), the kit includes a pivot pin. It fastens with a screw in one of three holes on the base, depending on the desired radius. It fits into a ¼" pivot hole in the workpiece.

For larger circles (up to 25" radius), you use the pivot hub and guide rod extensions, as used in the main photo. The guide rods can be threaded together to make a long trammel.

Use a Straightedge. The square shape of the *CRB7's* base makes it ideal for use with a straightedge guide, as in the left photo above. The included knob makes it easier to control the router and keep the base firmly against the straightedge. The micro-adjust feature allows you to fine-tune the bit position.

Mortising. Routing mortises in the edge of a workpiece is easy with the included mortise pillars. This pair of steel pins fastens to the underside of the base. They ride along each face of the workpiece as you rout a mortise (upper right photo).

Routing centered mortises using a similar technique is nothing new. But with the *CRB7*, you can also rout offset mortises. In either case, you slide the router along the guide rods to get close to the location of the mortise on the workpiece. The micro-adjuster allows you to zero in on the exact position before routing.

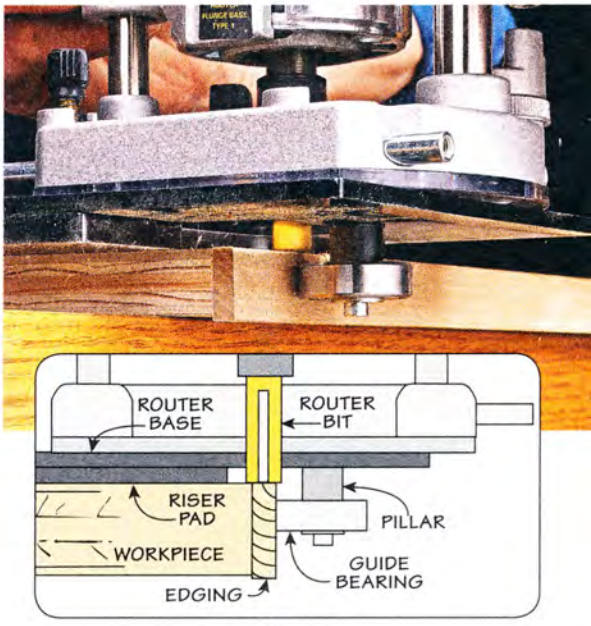
Basic Routing. It's easy to overlook that the *CRB7* is great for everyday routing tasks, too. Its large base provides stability and makes your router easier to control. The anti-tilt leg works as an outrigger to stabilize the base during some operations. And the index rule can serve as a guide when adjusting the router's position along the guide rods. All in all, the *CRB7* makes it easy to turn your router into a precision, multipurpose tool.

▲ ***Edge Guide.*** *This optional attachment allows you to rout dadoes, grooves, and other profiles parallel to the edge of a workpiece with precision.*

edging Trim Kit

The optional edging trim kit for the *CRB7* allows you to trim edging and plugs flush. The kit comes with a riser pad and bearing assembly that attaches to the bottom of the *CRB7*.

To position the router bit over the edging, the guide bearing rides along the edge of the workpiece. The bit's depth is set to trim the edging flush. To trim plugs flush to the surface, remove the bearing assembly. The riser pad provides clearance for the base so the bit can do its job.



review of Shop Plastics

Choosing the right plastic for shop projects boils down to form, function, and safety.

When a jig or project calls for plastic, the tendency is to run to the home center and grab whatever is least expensive. But there's good reason to give some more thought to your choice.

Acrylic. If the design of your project is more about the form, or look, the first choice is acrylic (*Plexiglas*), as in the main photo. It's inexpensive and available in a variety of colors and thicknesses. Clear acrylic is in abundant supply at most home centers and hardware stores.

Acrylic is more durable than glass, so it's a good choice for doors on shop cabinets. It's also great for templates and patterns. (Another option for making patterns is shown in the box on the opposite page.)

Polycarbonate. When the first consideration for your project is safety, plastics are a common go-to item for things like bit and blade guards. So you'll want to choose a plastic that is impact resistant. If a piece of steel or wood happens to break off and fly into the guard, you don't want it to shatter to pieces.

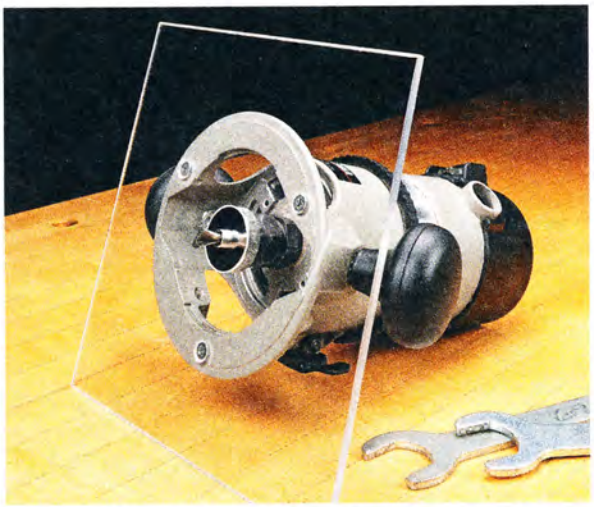
The best and most readily available plastic for impact resistance is polycarbonate. You might know it better by the trade name *Lexan*. I prefer to use polycarbonate over acrylic for router bases, as in the left photo.

Polycarbonate costs a little more (about 20%) than the commonly available acrylic. But it's the best choice wherever there's a spinning bit or blade that has the potential to cause a direct impact.

Phenolic. A durable, hard plastic that stands up to heavy shop use is phenolic (top left photo, opposite page). It's made by saturating layers of paper with resin under high heat and pressure. The result is an extremely durable composite.

Phenolic is strong and stable and maintains its shape over a wide range of temperatures and humidity levels. Since it's unaffected by humidity and is long-wearing, it's great for router table plates and miter slot runners.

UHMW. Another plastic that's suitable for runners on jigs is



▲ ***Polycarbonate.*** *Use polycarbonate for its impact resistance. It's great for see-through router bases for hand-held routing tasks.*

▲ **Phenolic.** *Strong and stable, phenolic is a good choice for a number of shop accessories like router table insert plates. It's unaffected by humidity and stands up to heavy use.*

▲ **UHMW.** *Soft UHMW is kind to bits and blades (main photo). Reprocessed UHMW is a less expensive alternative, as shown in the inset photo.*

ultra-high molecular weight (UHMW) plastic. It's the same kind of polyethylene plastic used in kitchen cutting boards.

The biggest benefit UHMW brings to the table for shop projects is it's slippery. This makes it great for auxiliary fences and other applications where a low-friction surface is desired.

While UHMW is impact resistant, it has less tensile strength than other plastics. So it's not the best choice for an insert plate in a router table, for example. It will sag under the router's weight.

You can also find reprocessed UHMW. It's made of recycled UHMW with a bit of black pigment added (inset photo above). It's slightly less expensive than the original, white UHMW.

HDPE. Also found in the polyethylene family is high-density polyethylene (HDPE). It's stronger than UHMW but is more brittle. It's also a good solution for low-friction applications like runners and auxiliary fences. Unlike UHMW and other plastics, the thickness of HDPE is consistent, so it's a good choice for use as shims or spacers.

Cutting. As I mentioned, you can cut and drill plastic with your woodworking tools. On the table saw, a combination blade with a triple-chip grind gives a clean cut. And a band saw works great for cutting curves.

Most plastics (except for phenolic), tend to melt from the friction of a fast-moving blade. You can compensate for this by using a faster feed rate, so the material is in contact with the blade for as short a time as possible. A slow speed when drilling can also help avoid melting Files and sandpaper are perfect for smoothing the edges and removing any burrs that remain.

Choosing the right plastic can make your project look and function better. The key is choosing the right one for the task.

▲ **HDPE.** *This material makes ideal spacers with its precise thickness.*

new material
PLA

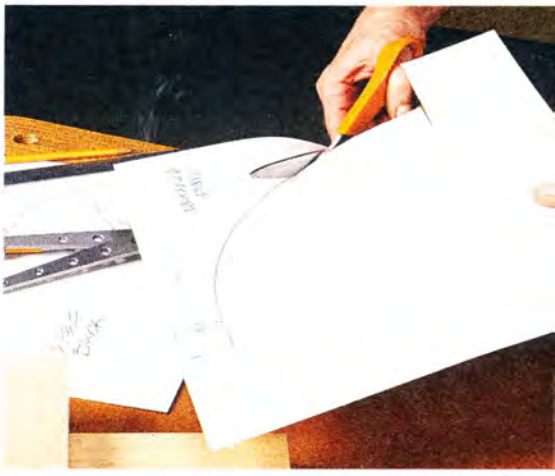
When I was taking a look at a few of the plastics that would be good for shop use, I ran across the material you see in the photo at right. Its generic name is polylactic acid, or PLA for short.

Unlike most plastics made from petroleum products, PLA is made from starchy material from plants such as corn and wheat. Regardless of how it's made, it has a couple of features that make it ideal for shop use.

PLA is a durable, flexible plastic that has a matte finish. This finish makes the plastic easy to write on. It takes pen and pencil marks easily, as you can see in the photo.

While the plastic isn't thick enough to use as a router template, it's durable enough to serve as a pattern for layout work. You can cut it with scissors and then use a pencil or pen to trace the shape onto your workpiece. It's ideal for making permanent templates and patterns that can be filed away.

I found PLA at *McMaster-Carr*. They sell sheets of it in a range of thicknesses from 1/128" to 1/32". A square foot ranges from about $1.65 to less than $6.00.



▲ **Durable & Flexible.** *PLA plastic is a long-lasting material for creating stencils and patterns.*

on-the-go Antique Toolbox

With some basic materials and simple techniques, you can build this handy box with a classic design.

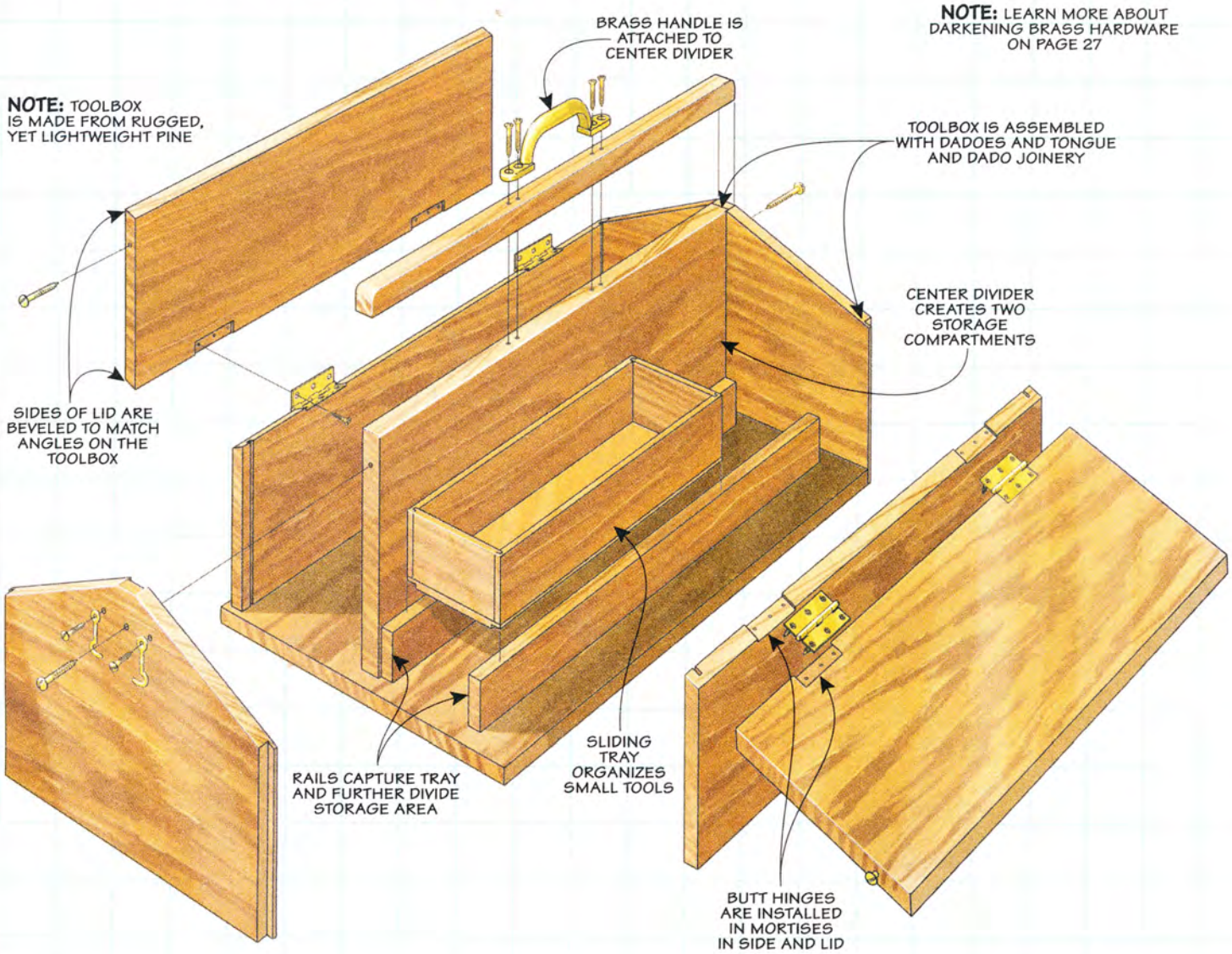
Even though I do most of my woodworking in my shop, there are still times when I need to take a few tools on the road, so to speak, to help out a friend or tackle a project on site. That's where the compact toolbox you see here really shines.

The inspiration for this toolbox is based on an old *Stanley* toolbox. While the design is more than 100 years old, its sturdy construction and practical storage make it ideal for a modern shop.

The box has two generous, lidded compartments that can accommodate a wide variety of tools. A sliding tray on one side allows you to store and organize smaller items that would otherwise get lost or damaged in the bottom.

Exploded View Details

OVERALL DIMENSIONS: 12½"W x 20½"L x 9½"H



NOTE: FOR HARDWARE SOURCES, TURN TO PAGE 51

► ***Closed In.*** *Flip-open lids keep dust and debris out of the toolbox. Simple hooks hold them closed.*

Materials & Hardware

A	Sides (2)	½ x 5⅛ - 20	• (2) #8 x 1¼" Rh Brass Woodscrews
B	Ends (2)	½ x 7¼ - 11½	• (4) #8 x ¾" Rh Brass Woodscrews
C	Divider (1)	¾ x 7¼ - 19¼	• (2 pr.) 1⅛" x 2" Brass Butt Hinges
D	Cap (1)	¾ x ¾ - 20	• (24) #4 x ⅜" Fh Brass Woodscrews
E	Bottom (1)	½ x 12½ - 20½	• (4) Brass Latch Hooks w/Screws
F	Rails (2)	½ x 1½ - 19	• (1) Heavy-Duty Brass Handle w/Screws
G	Tray Sides (2)	¼ x 2 - 12	• (6) #8 x 1½" Fh Woodscrews
H	Tray Ends (2)	¼ x 2 - 3¾	
I	Tray Bottom (1)	¼ x 4 - 12	
J	Lids (2)	½ x 6⅝ - 20	

building the Toolbox

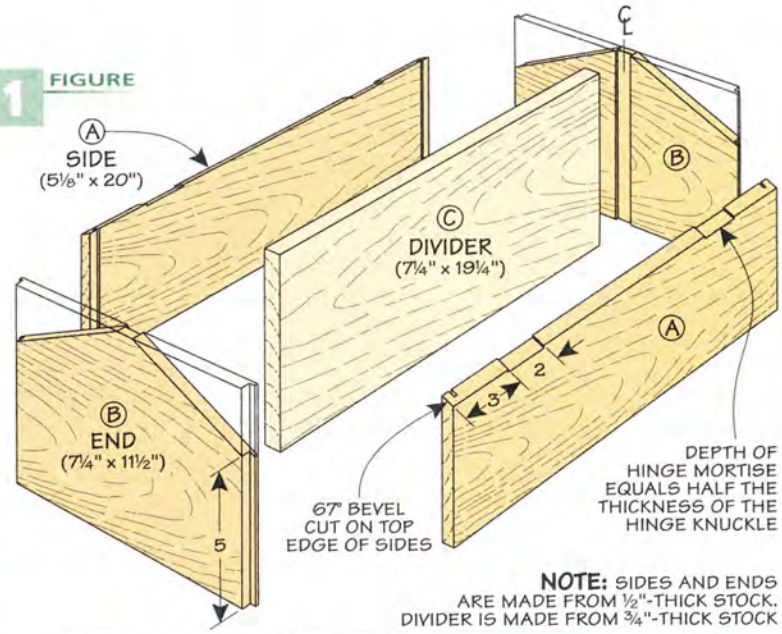
The main purpose of a toolbox is portability. It needs to be tough enough to stand up to on-the-go use. But it also needs to be light. This way, the box won't be too heavy to carry once it's loaded up with tools and gear.

I used construction-grade pine I bought at the home center to make this toolbox. That, on its own, is a good way to keep the weight down. Then, to lighten it up even more, I planed most of the stock to ½" thick.

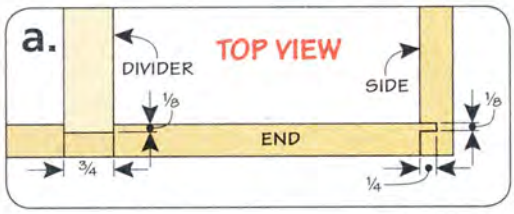
Another part of making a durable box is the joinery. Here I balanced simplicity with stoutness. Dadoes and tongues register parts and increase the glue surface. Then in a few key areas, I added some screws to increase the mechanical strength.

Sides. One place to see how this works out is in the sides. The ½"-thick sides have a dado cut at each end that captures a mating tongue cut on the ends of the toolbox, as you can see in Figure 1a. The upper edge of each side is beveled to establish the overall sloped profile. In addition, each side has a pair of mortises to hold butt hinges for the lid (Figure 1). It's a good idea to have your hinges on hand before cutting the mortises so that you can get the size just right.

FIGURE 1



NOTE: SIDES AND ENDS ARE MADE FROM ½"-THICK STOCK. DIVIDER IS MADE FROM ¾"-THICK STOCK



Ends. A pair of ends tie the sides together and create the overall framework of the box body. Figure 1 shows how the top of the ends are angled to match the sides, but that's really the final step. Before we get to that, you need to cut some joinery.

The first step is cutting a rabbet on each end of the ends. This forms a tongue that locks into the dado cut in the sides. Here again, Figure 1a has the dimensions you need. Take some time to get a good, snug fit.

The second joinery element to cut is a centered dado that holds the divider. Since the handle for the box is attached to the divider, I used ¾"-thick material for a stouter assembly.

At this point, you're ready to make the beveled cuts on the ends. The bevel begins at the edge of the center dado and runs to the sides of the tool box for a smooth slope. Assemble the ends and sides without glue and mark where the sides meet the ends. Cut just to the waste side of the line at the band saw. You can use a block plane (or sanding block) to smooth out the cut edge.

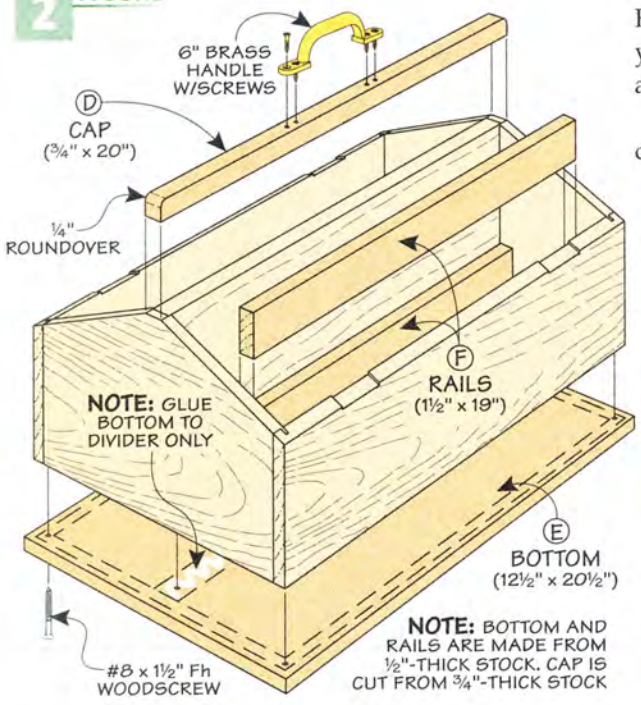
Divider. The divider is pretty simple. It's nothing more than a board cut to fit into the dadoes in the ends. It's sized to match the width (height) of the ends.

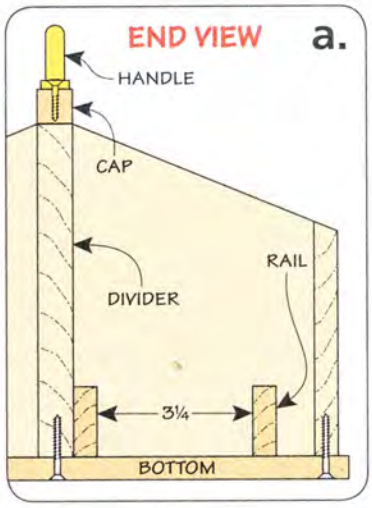
I glued up the sides, ends, and divider at this point. Take care to keep the assembly square as you apply the clamps.

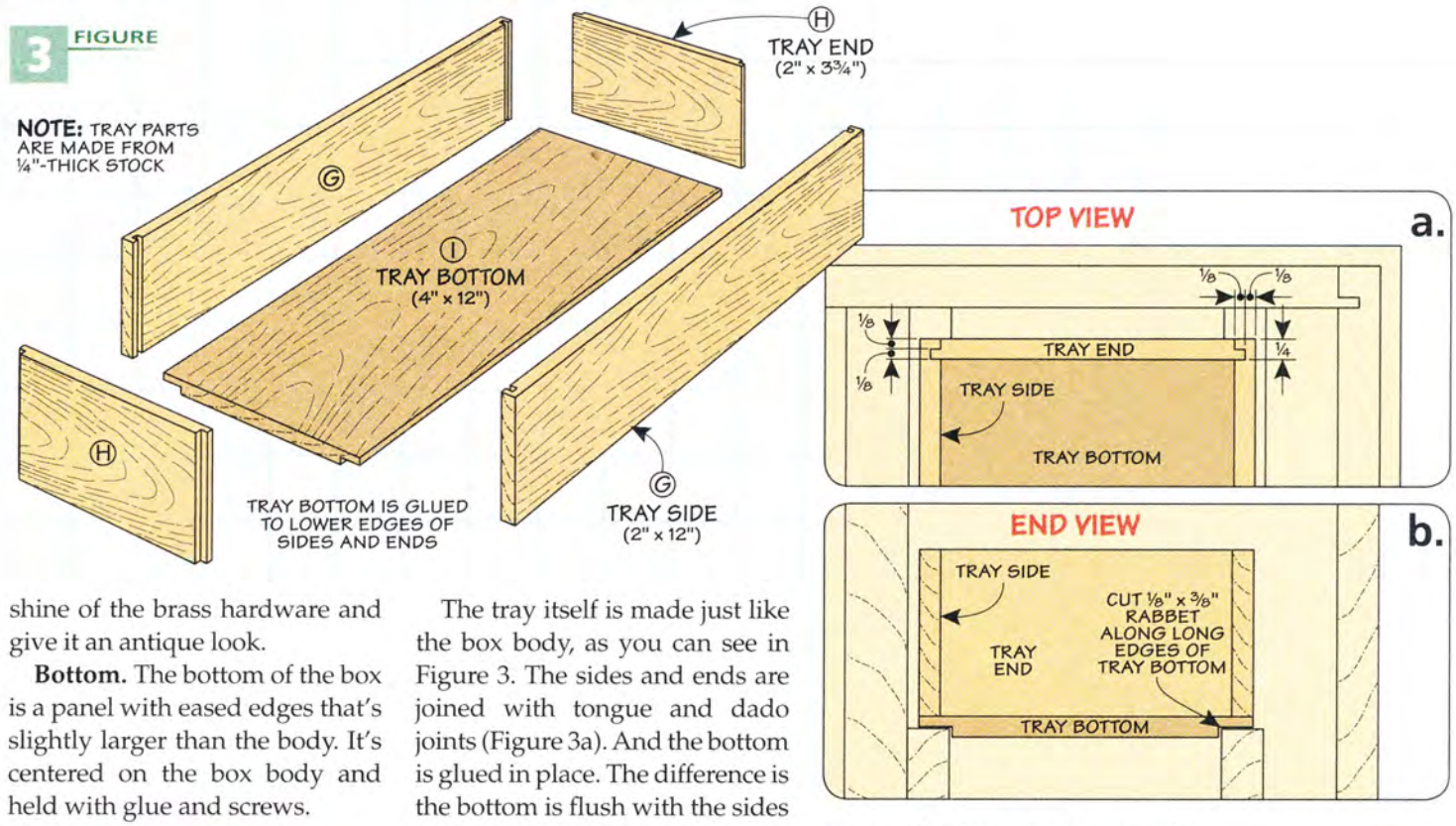
Cap. The top of the divider has a cap that extends across the length of the divider and covers the ends, as illustrated in Figure 2. A radius on each end softens the corners. I attached a brass handle to the top.

Shop Short Cuts on page 27 shows how to tone down the

FIGURE 2







shine of the brass hardware and give it an antique look.

Bottom. The bottom of the box is a panel with eased edges that's slightly larger than the body. It's centered on the box body and held with glue and screws.

SLIDING TRAY

Inside the box, I added a tray to hold smaller items. The tray rides on a pair of rails. One rail is glued flush to the divider. The other is set out from the side, as in Figure 2a. This rail also divides the compartment for smaller items. I used spacers to keep the rails parallel while the glue set up.

The tray itself is made just like the box body, as you can see in Figure 3. The sides and ends are joined with tongue and dado joints (Figure 3a). And the bottom is glued in place. The difference is the bottom is flush with the sides and ends of the tray body.

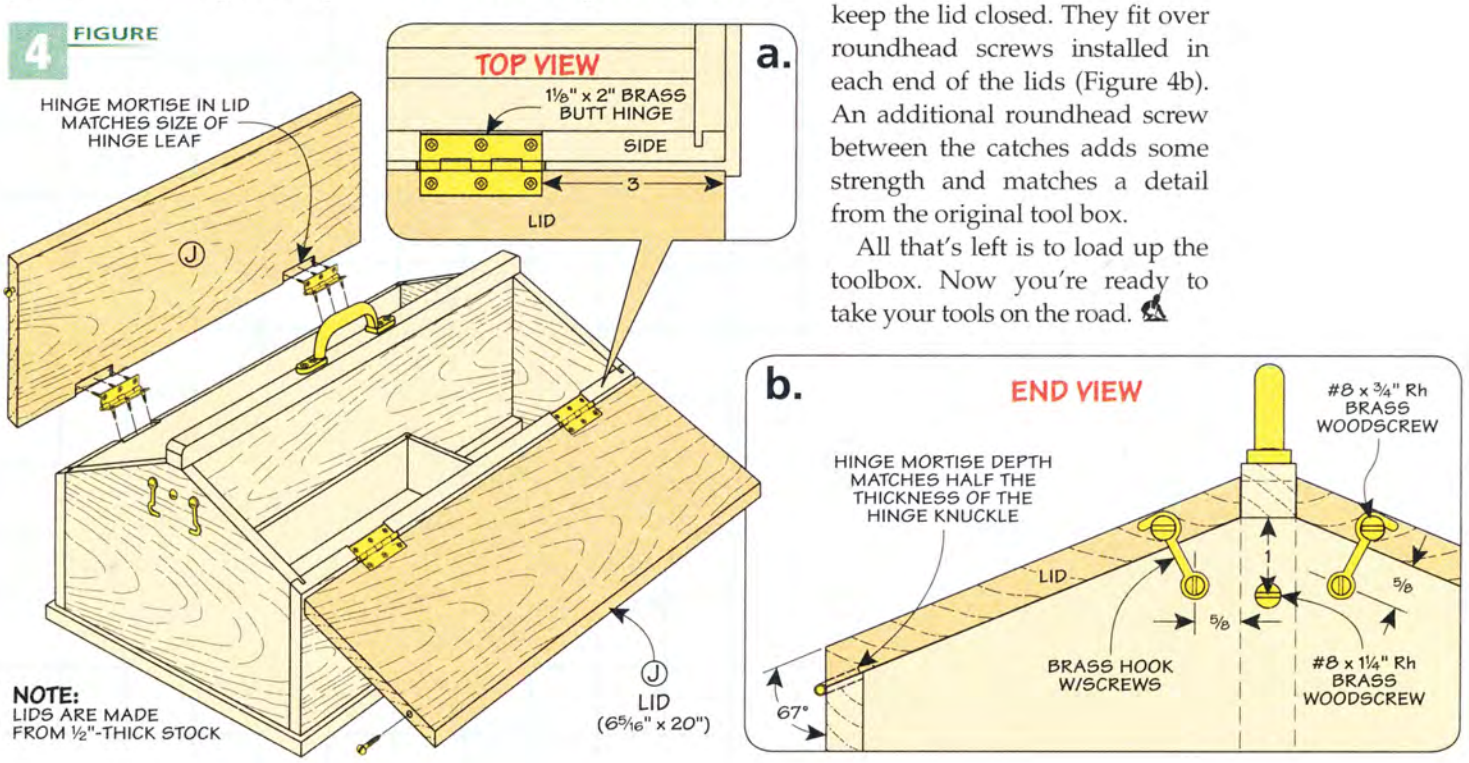
Once complete, I cut a rabbet along each edge of the tray bottom so that it would nestle down over the rails and help it stay in place. This is shown in Figure 3b.

Lids. The final components to add are the lids. These are beveled along each edge to match the slope of the ends and sides, as shown in Figure 4b. The bevels are parallel to each other so take care when orienting your cuts.

Hardware. The lids open on brass butt hinges. As I mentioned earlier, the hinges are recessed in the box sides. In addition, you need to cut matching mortises in the underside of the lid, as illustrated in Figures 4a and 4b.

I found some simple hook catches at the hardware store to keep the lid closed. They fit over roundhead screws installed in each end of the lids (Figure 4b). An additional roundhead screw between the catches adds some strength and matches a detail from the original tool box.

All that's left is to load up the toolbox. Now you're ready to take your tools on the road.



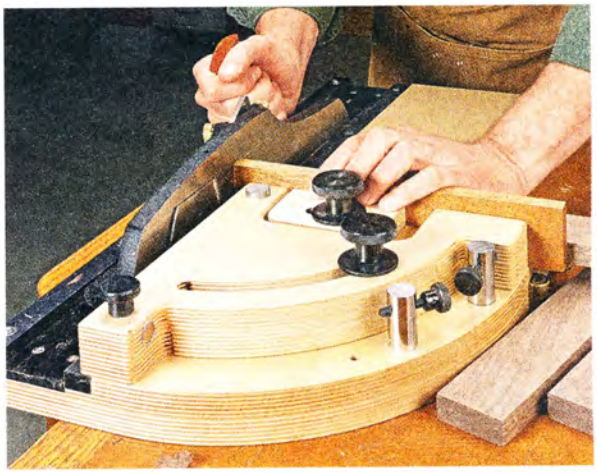
best-built
jigs & fixtures

micro-adjustable Shooting Board

Fine-tuning joinery is a cinch with this precision bench accessory.

Shooting boards used to be a staple in most woodworking shops. And for good reason — there's no better tool for trimming workpieces for gap-free joinery. All you need is a sharp hand plane.

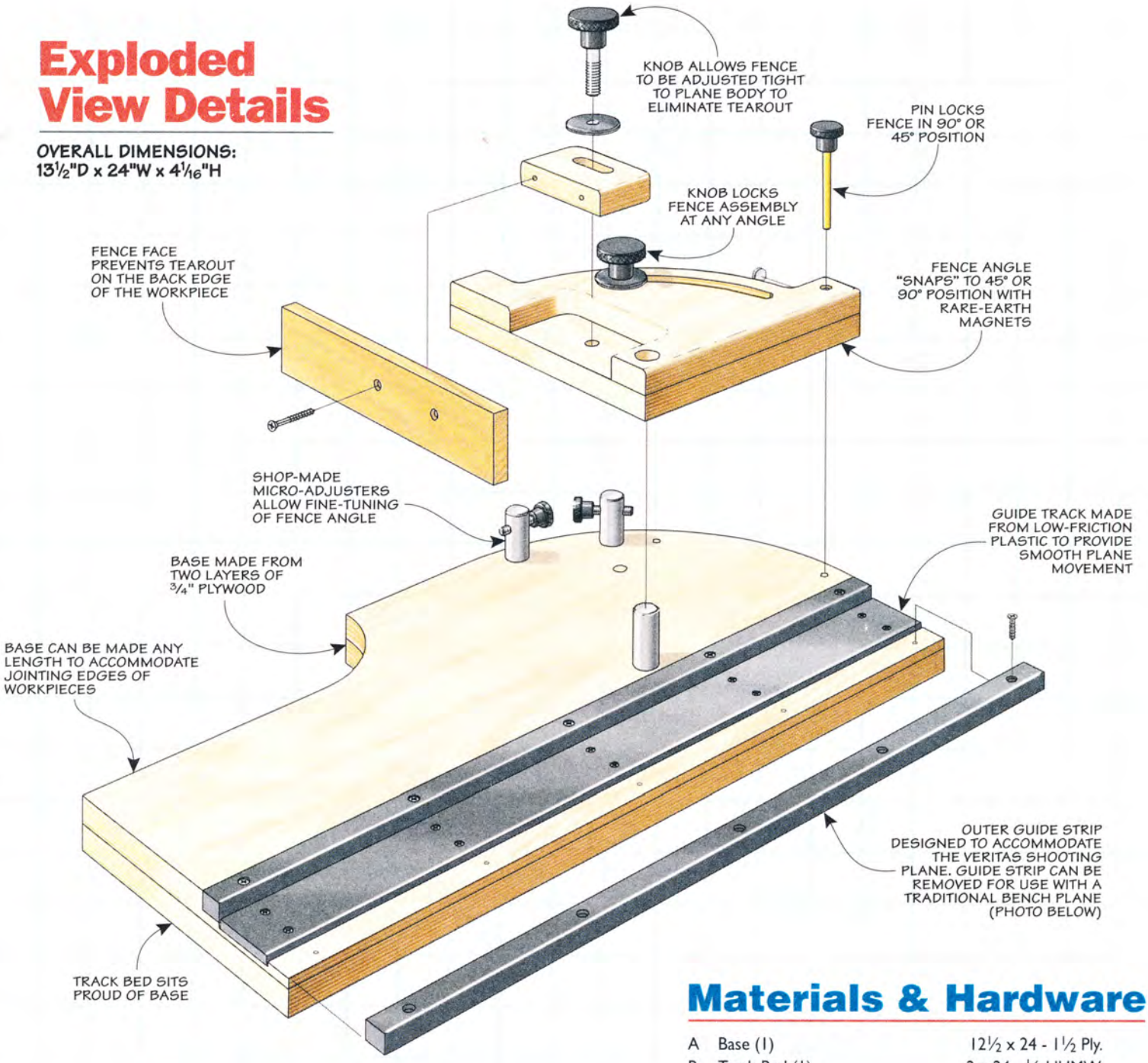
With the design of the shooting board you see here, you gain the ability to "tweak" the angle of the workpiece as you trim it. This is made possible with the two micro-adjusters. There's one each for 45° and 90° cuts. You can make very small adjustments within a range of a few degrees. And this makes it easier to improve your craftsmanship.



▲ ***Adjustable.*** *When trimming miters or squaring up a workpiece, the built-in micro-adjusters allow you to fine-tune the angle for a precise fit.*

Exploded View Details

OVERALL DIMENSIONS:
13½"D x 24"W x 4 1/16"H

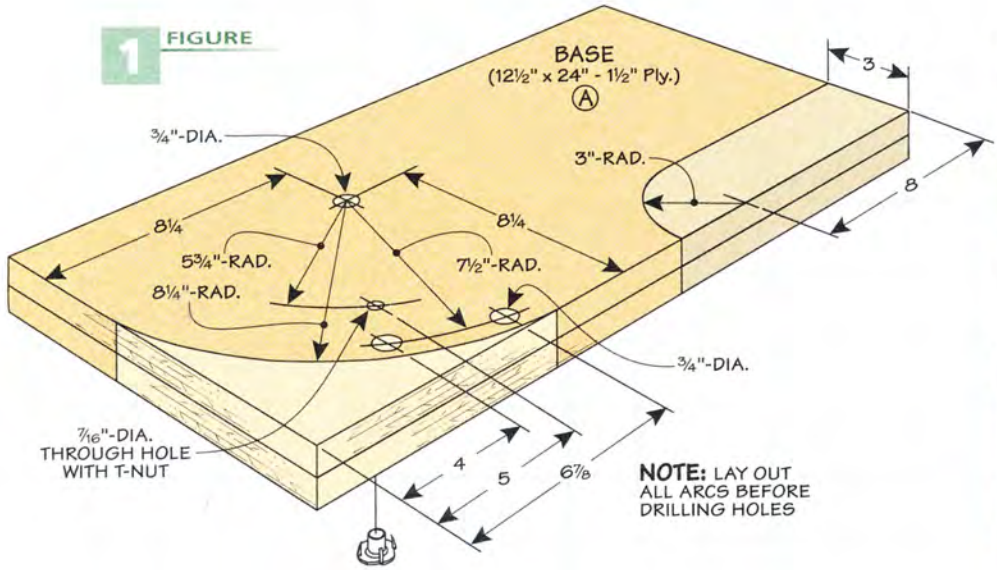


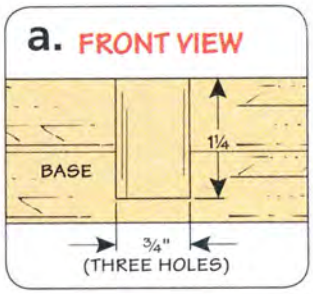
▲ ***Use Any Plane.*** *You can use a specialized shooting plane, like the one in the main photo, or any standard bench plane such as a low-angle smoothing plane or the No. 5 shown here.*

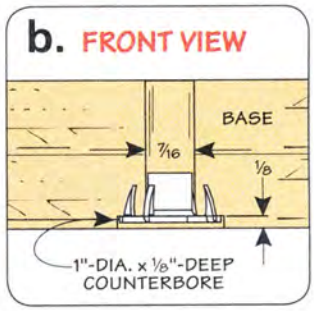
Materials & Hardware

A	Base (1)	12½ x 24 - 1½ Ply.
B	Track Bed (1)	2 x 24 - ¼ UHMW
C	Guide Strips (2)	¾ x 24 - ½ UHMW
D	Steel Pins (3)	¾-dia. x 3 Steel Rod
E	Fence Base (1)	9 x 9 - 1½ Ply.
F	Fence Mount (1)	2¼ - 3⅝ - ¾ Ply.
G	Fence (1)	½ x 2 - 10

- (2) ¾"-dia. Knurled Knobs w/ ¼"-20 x 1¼" Stud
- (2) 1½"-dia. Knurled Knobs w/ ⅜"-16 x 3" Stud
- (1) 1"-dia. Knurled Knob w/ ¼"-dia. Hole
- (2) ⅜"-16 T-Nuts
- (2) ¼"-dia. x 3" Brass Rod
- (1) ¾"-dia. x 12" Steel Rod
- (2) ⅜"-dia. Rare-Earth Magnets w/Cups & Screws
- (2) ⅜" x 1¼" O.D. Black Oxide Washers
- (2) #8 x 1½" Fh Woodscrews
- (5) #6 x 1¼" Fh Woodscrews
- (10) #6 x ¾" Fh Woodscrews
- (5) #6 x 1¼" Rh Woodscrews
- (5) #6 Washers







building a Base

The base of the shooting board forms the foundation for all of the working components, so it's important to take your time in building it. It's made from two layers of Baltic birch plywood.

Glue First. To start on the base, I cut a piece of plywood for one of the layers to final overall size. You can cut the other layer slightly oversized, glue the two layers together, then trim the layers flush (Figure 1).

It's a good idea to lay out all of the hole locations while the blank is still square. And you can draw the outside shape of the base so you can cut it to final shape later.

Drilling. There's a T-nut on the bottom of the base that's used for the locking knob on the pivoting fence base you'll make later. After drilling a shallow counterbore and through hole, tap the T-nut in place (Figures 1 and 1b).

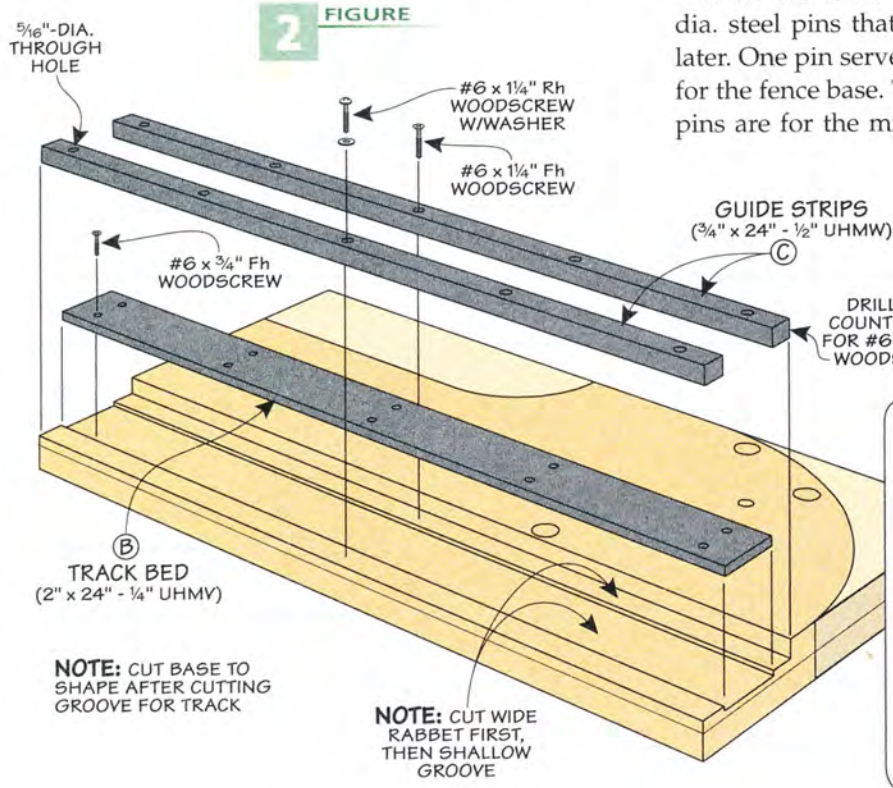
There are three holes for ¾"-dia. steel pins that you'll install later. One pin serves as the pivot for the fence base. The other two pins are for the micro-adjusters. A Forstner bit is ideal for drilling these holes since it creates smooth sides and a flat bottom to seat the pins.

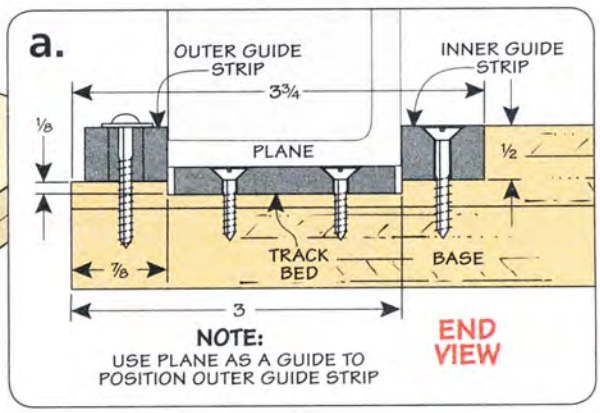
Rabbet & Groove. There's another task you can complete before cutting the base to its final shape. And that's to cut a stepped groove along one edge of the base blank. This groove holds the strips of UHMW for the guide track. Take a look at how these all fit together in Figure 2.

I started by cutting a wide rabbet first (Figure 2a). Then lay out the narrower groove, reset the height of the dado blade, and cut the shallow groove.

Cut to Shape. Before moving on, now is the time to cut the base to shape and sand it smooth. I applied a clear finish to the base.

Plastic Strips. As you can see in Figure 2, there are three plastic strips to install. The wide strip serves as a smooth-gliding





surface for the hand plane. The inner strip guides the sole of the plane during use. The outer strip is used to create a track for the *Veritas* shooting plane. If you wish to use another bench plane on the shooting board, simply leave the outer guide strip off.

To install the plastic strips, I drilled countersunk screw holes. You'll want to make sure that the screws on the wide strip for the track bed are recessed below the surface to avoid the heads protruding and scratching up the sides of the plane.

Micro-Adjusters. The unique and most useful parts of the shooting board are the micro-adjusters. They allow fine movements of the fence angle to sneak up on the fit of a workpiece. As shown in Figure 3 and the photos below, they're easy to make.

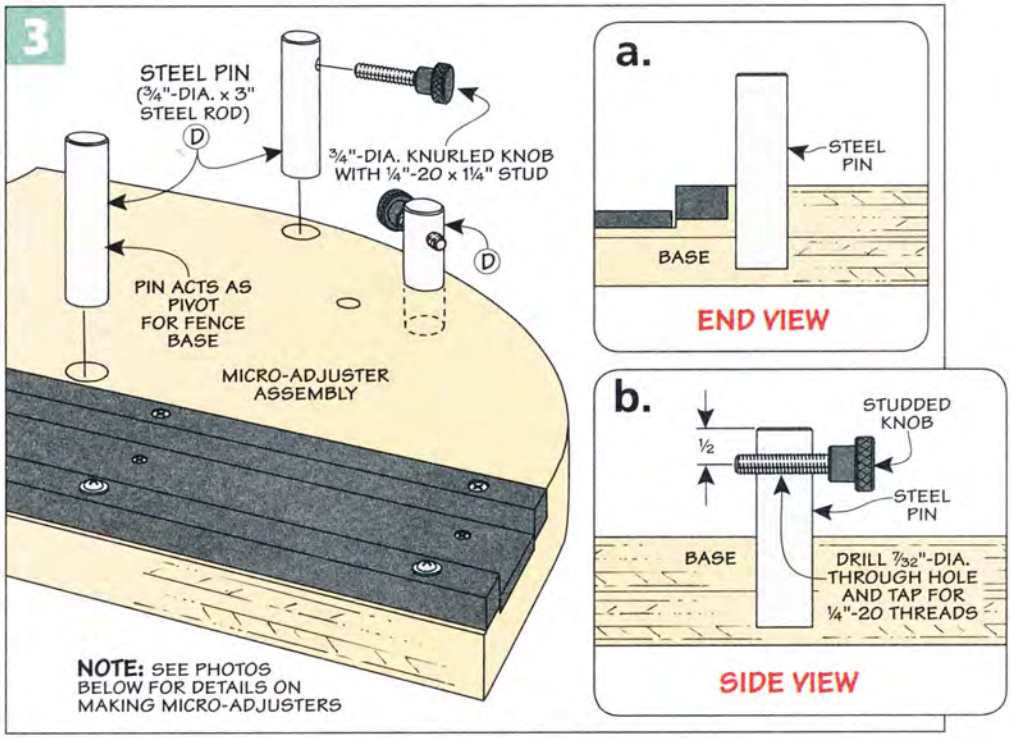
You start by cutting the steel rod to length. Then step over to the drill press to drill the clearance hole for tapping threads all the way through the rod, as illustrated in Figure 3b.

To make it easier to cut the rod square with a hack saw and hold the rod in position for drilling, I made a small holding jig. You can see how it works in the box below. It's simply a wood block with a ¾"-dia. hole drilled 3" deep in the end and split down the middle by a saw kerf. The saw kerf allows you to securely clamp the rod for cutting. The end of the block serves as a guide for your hack saw to get a square cut.

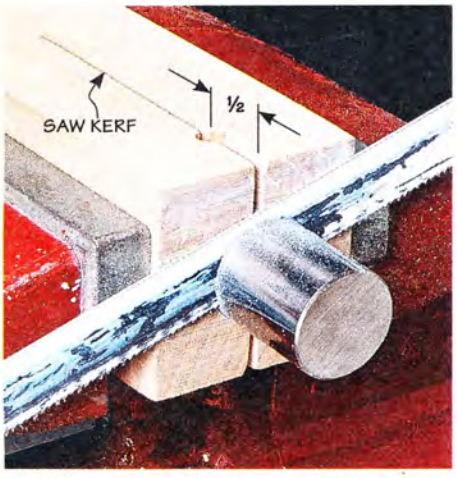
The holding jig also provides a convenient way to drill and tap the threaded through hole. Drill a 7/32"-dia. hole through the kerf in the block, ½" from the end. Use a punch before drilling through the rod. At that point, pull the rod out enough to clamp it in a vise and use a tap. A few drops of oil will make drilling and tapping a little easier.

Once you have the pins made for the micro-adjusters, cut a third pin to serve as a pivot for the fence base. File or grind a small chamfer on the ends of each pin. I used epoxy to secure the pivot pin into the base.

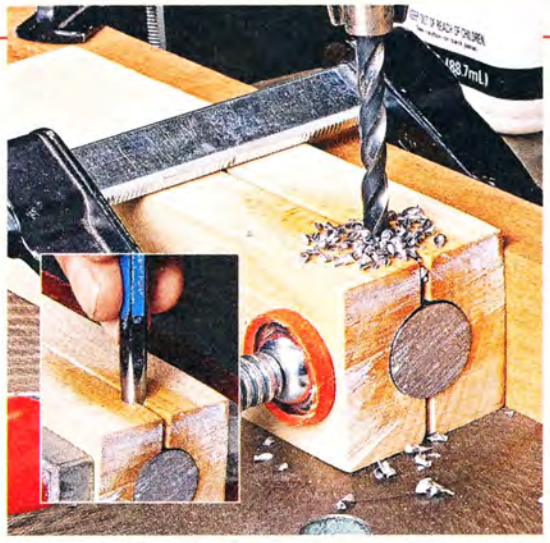
You can thread a studded knob into each micro-adjuster and slip them into their holes. You don't need to glue them in place yet.



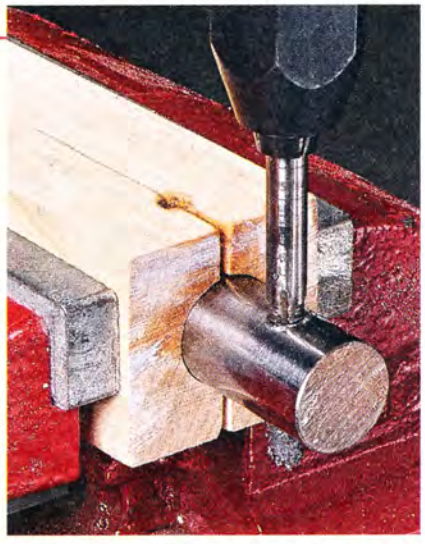
Cut, Drill & Tap



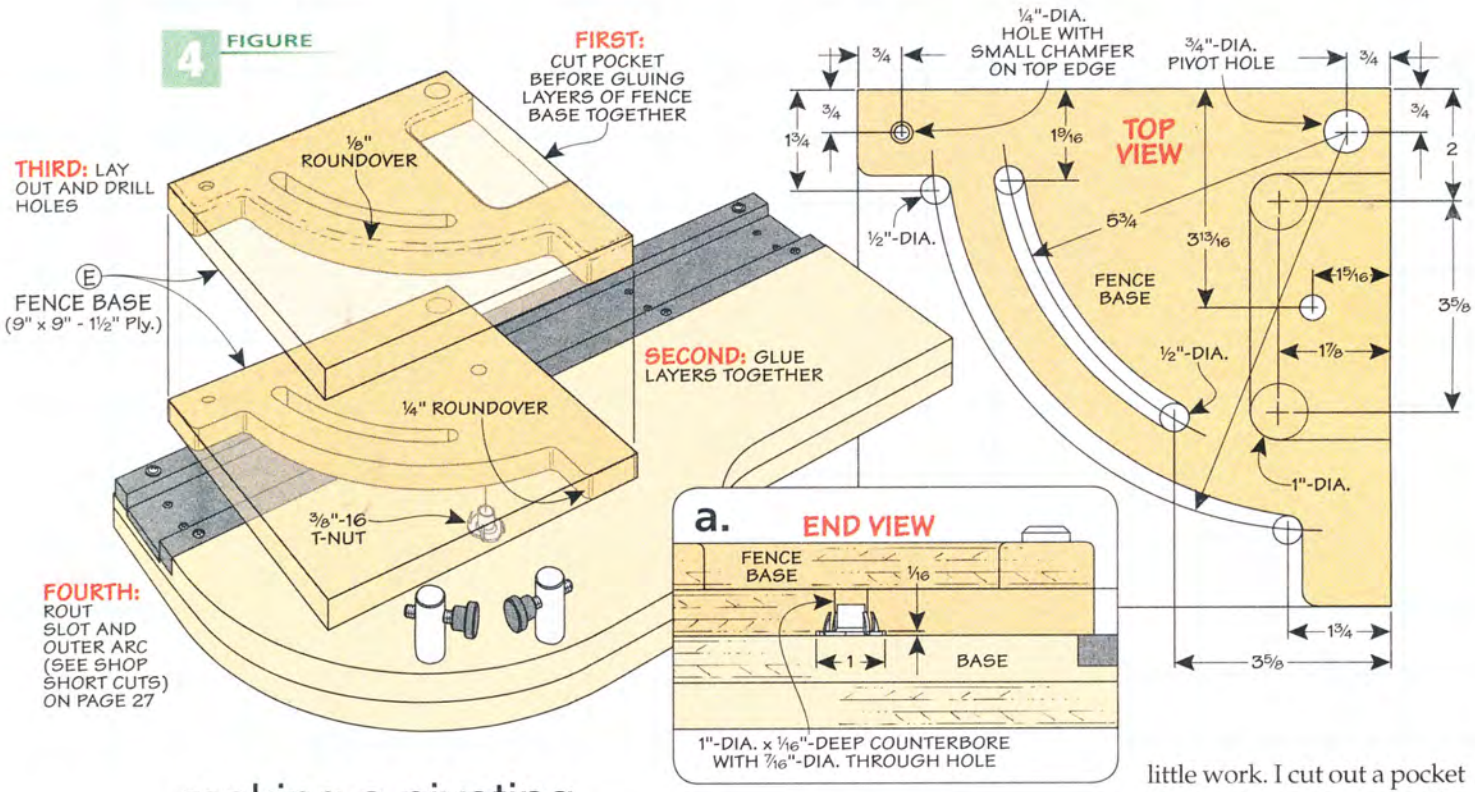
▲ ***Cutting.*** *A block of wood can be made into a jig for holding the steel rod while cutting and drilling.*



▲ ***Punch, Then Drill.*** *A punch helps to keep the bit centered (inset). Then use a gentle touch to keep the bit from wandering.*



▲ ***Tapping.*** *Use the block and a vise to secure the steel pin while tapping the threads of the hole.*



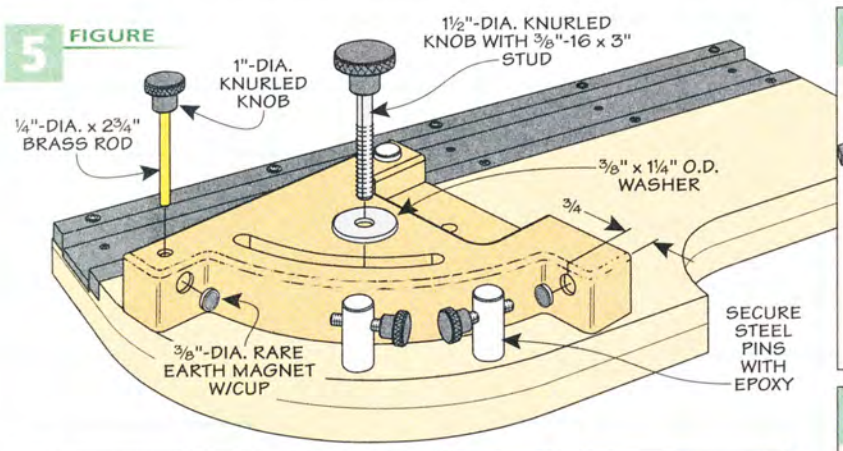
making a pivoting Fence

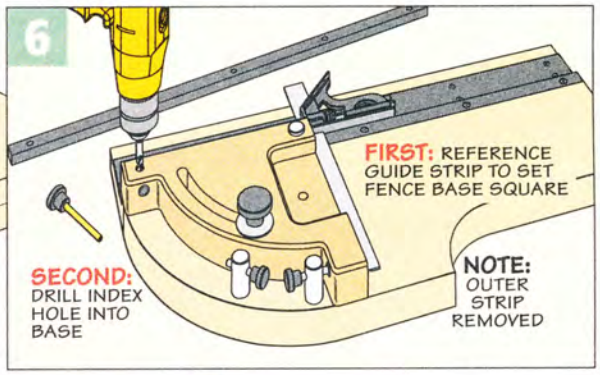
The pivoting fence base teams up with the pair of micro-adjusters and a locking pin to provide precise angle settings. A sliding fence helps to minimize tearout when using the shooting board.

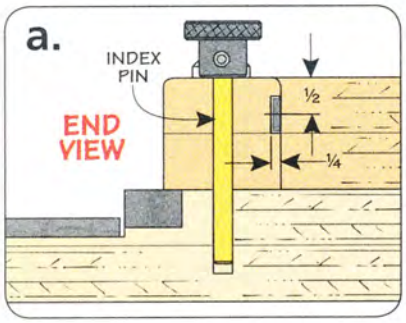
Fence Base. The pivoting fence base is also made up of two layers of plywood. I started by cutting two square blanks to size (Figure 4). It's important to make sure the edges are square to each other since the accuracy of the shooting board depends on this.

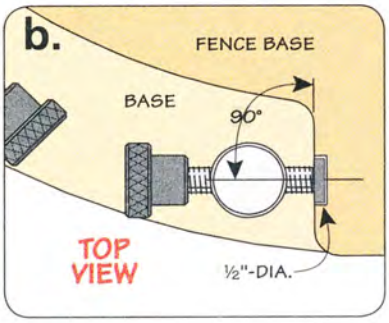
Before gluing the two layers together, the top layer needs a little work. I cut out a pocket for the adjustable fence. The only trick to the glueup is keeping all the edges flush while the glue dries. Clamps spanning the glue lines in both directions will help.

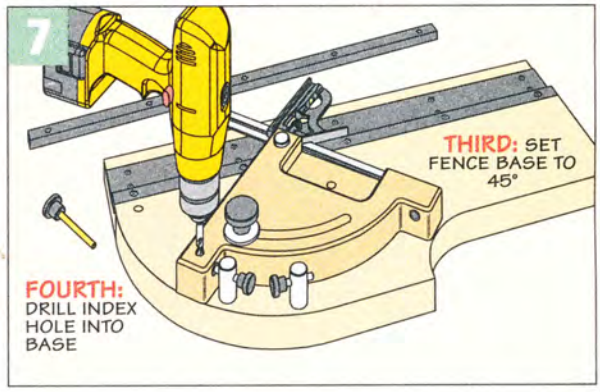
After cleaning up the edges, you can drill the hole for the index pin, as shown in Figure 5a. And there's a counterbored through hole on the underside for a T-nut (Figure 4a).











Now you're ready to start shaping the fence base. I drilled the pivot hole and then used a router with a trammel base to cut the outer arc and curved slot. Refer to Shop Short Cuts on page 27 for details on how to do this.

To create clean starting and stopping points for the arcs, I first drilled holes at the ends. After routing the shape, the band saw makes quick work of cutting the "tabs" on the two corners to remove the waste. Follow that up by rounding over the top edges and sanding everything smooth.

I installed the fence base on the pivot pin to determine where to drill holes for the rare-earth magnets (Figure 5). Pivot the fence in each direction to butt each tab against the end of the threaded stud on the micro-adjuster. Mark the vertical centerline of the stud on the tab, remove the fence base, and drill the shallow counterbores for the magnet cups.

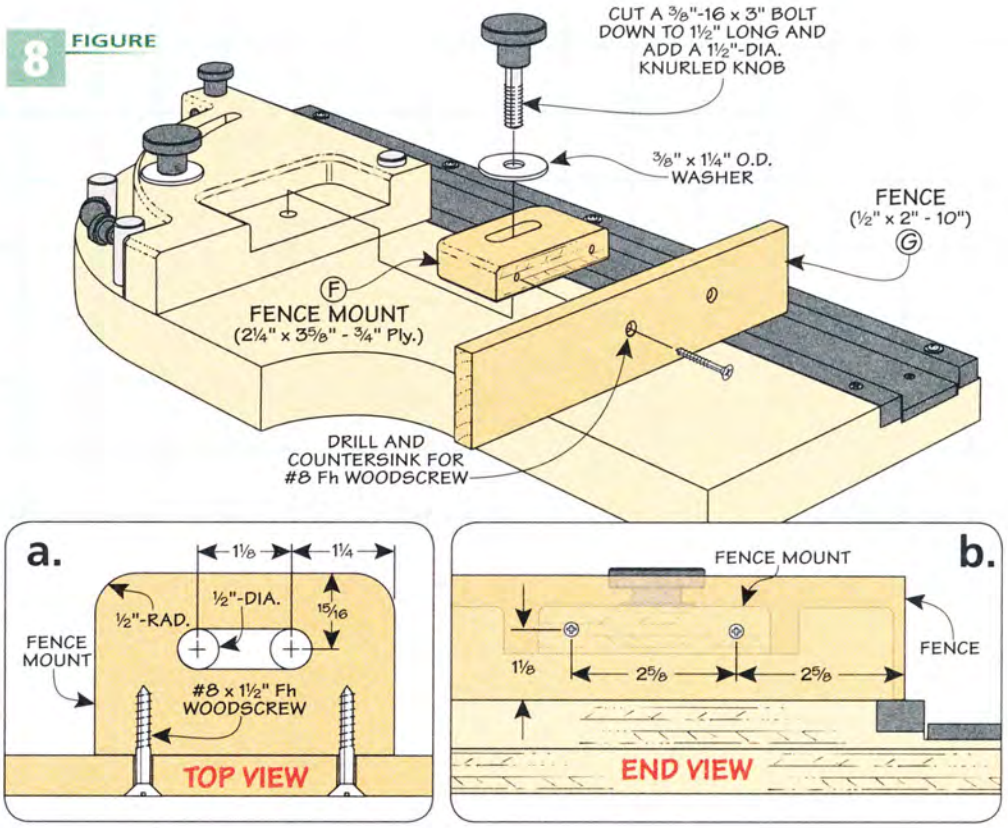
Indexing. To align the fence base onto the base of the jig, use a combination square, as in Figures 6 and 7. Once you have the fence base rotated to both the 45° and 90° positions, use the hole for the locking pin as a guide to drill into the base.

Index Pin. The next logical step is to make the index pin, as shown in Figure 5a. I used a length of brass rod and a knob. The knob has a set screw for holding the rod in place.

Sliding Fence. All that's left to do now is make the sliding fence assembly (Figure 8). It's made up of a slotted fence mount and a simple fence. The slot allows it to be adjusted tight to the plane body to eliminate tearout as the plane iron exits the workpiece.

The fence face is a replaceable piece of hardwood. It's fastened to the fence mount with a couple of screws (Figure 8a).

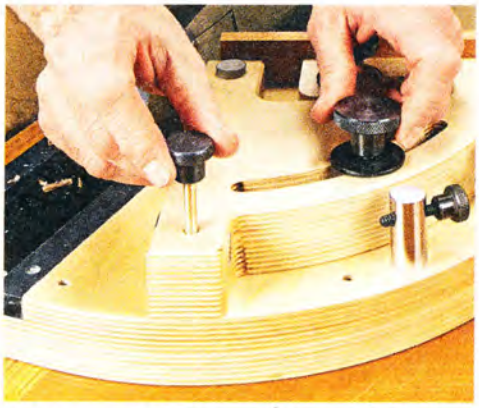
FIGURE 8



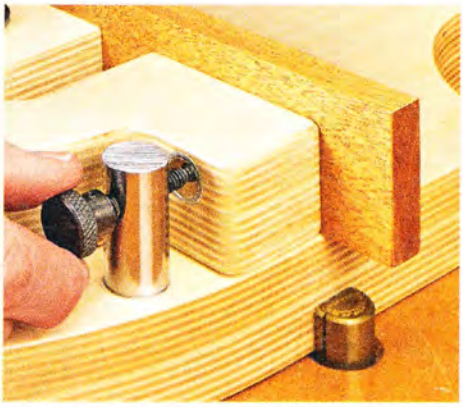
Using the Shooting Board. The photos below show some tips for setting up the shooting board. The key is to set your plane for a thin shaving. And since you'll usually be shaving end grain, it's important to make sure the blade is very sharp.

After making a few swipes with the plane, you'll immediately see the benefits of using a shooting board. And you're well on your way to making gap-free joints on all your projects.

Using the Shooting Board



▲ ***Coarse Adjustment.*** *Loosen locking knob and lift the index pin to pivot the fence base to the desired position.*



▲ ***Fine Adjustment.*** *With the locking knob loosened, fine-tune the angle of the fence by turning the micro-adjuster.*

▲ ***Adjust the Fence.*** *Loosen the knob to butt the adjustable fence up against the sole of the plane.*

creating perfect Hinge Mortises

Get tight and precise hinge mortises using these simple techniques.

Correctly installed hinges are one of those last-minute details that often go unnoticed on a finished piece. But if the hinges aren't installed with care, the lid or door won't fit right or operate properly. It all starts with how you prepare the hinge mortises. A properly fitting hinge mortise is a sign of good craftsmanship.

The good news is, there are several ways to get the job done. It's all a matter of which technique you're most comfortable with. Plus, this gives you the opportunity to learn some new techniques and put them to use.

No Measuring. The first thing to do is set aside your ruler. For all of the techniques shown here, the best layout tools are the hinges, a knife, and a marking gauge. I like to wrap the hinge around the edge of the workpiece and score the outline of the leaf with a knife (left photo below). It's best to make several passes, especially across the grain. This helps prevent tearout when removing the waste. It also creates crisp edges for the mortise.

It's also helpful to mark a guideline for the depth of the mortise. My favorite tool for this task is a marking gauge. Use the leaf of the hinge as a guide to set the fence of the marking gauge, then score the workpiece, as shown in the right photo below.

With those two tasks done, you can use one of the techniques shown here to create the mortise.

▲ ***Mark the Outline.*** *A sharp knife makes quick work of scoring deep lines for crisp mortise edges.*

▲ ***Mark the Depth.*** *I like to use a marking gauge to score the final depth of the hinge mortise before removing the waste.*

CHISEL

A chisel is one of the simplest tools for creating hinge mortises. The drawings at the top of the opposite page show the quick and easy process I use.

Score & Pare. The first step is to make a series of light, cross-grain cuts by using a mallet to tap the chisel. This severs the long grain into shorter segments,

making it easier to pare away the waste to the proper depth.

Then it's time to switch to more of a slicing action to remove the chips. Here, it pays to go slow and make several passes, going deeper with each pass. Use the leaf of the hinge to gauge your progess on the depth of cut. The goal is for the leaf to sit flush with the surface. And it's important to maintain control of the chisel during this step to avoid cutting beyond the mortise.

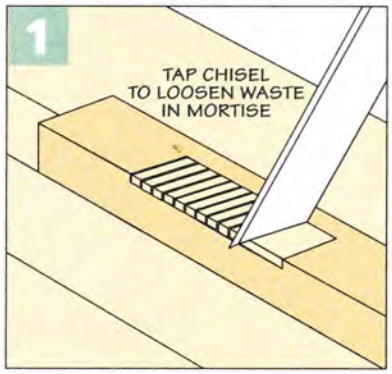
HAND-HELD ROUTER

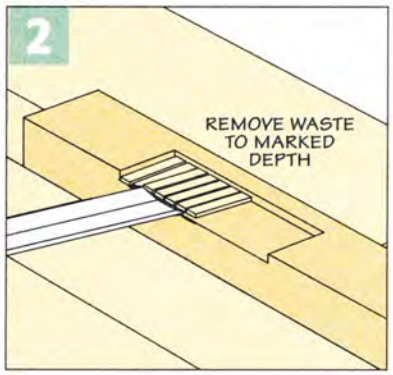
Another tool that's great for removing the bulk of the waste is a compact router. You can see how it's done in the main photo and in the illustrations below.

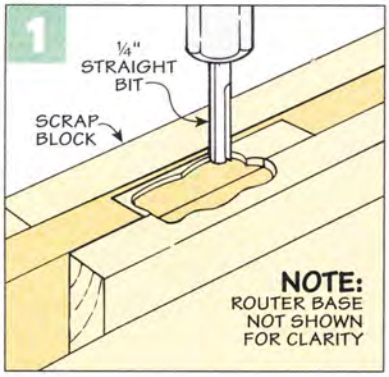
Router Setup. After marking the outline of the mortise as before, install a ¼" straight bit in the router. Use the hinge leaf as a guide to set the bit depth.

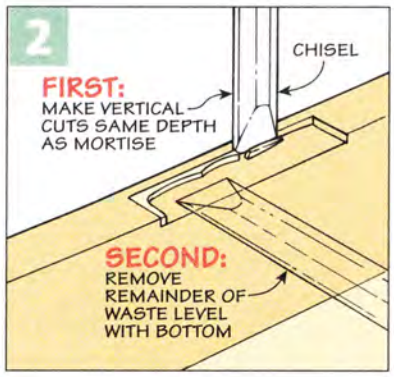
To help support the router on the edge of a workpiece, it's a good idea to clamp scrap pieces to the sides of the workpiece. You'll want to keep them flush with the workpiece for routing to a consistent depth.

Then it's a matter of plunging the router into the waste area of the mortise and carefully working close to your scored lines. A chisel makes easy work of cleaning up the rest of the waste.









ROUTER PLANE

A final hand tool that can be used for creating hinge mortises is a small router plane. It's ideal for removing thin shavings to sneak up on the perfect depth of the mortise (left photo below).

Mark & Score. After scoring the outline of the mortise, I like to go a step further. I use a chisel to deepen the ends of the mortise. This provides a clean edge for the router to break away chips when removing the waste.

Slow & Steady. To set the depth of the blade in the router plane initially, I set the body of the plane on a couple thicknesses of paper with the blade resting on the bench. Then slice away the waste inside the scored lines.

I start by working carefully into each end of the mortise then removing the remaining waste in between. Take it slow and easy while maintaining tight control of the plane. It's easier going if you remove thin shavings instead of large chunks. Make progressively deeper passes until you reach the final depth.

If you find that you enjoy the process of cutting mortises with hand tools, see the box below. No matter which technique you decide to use, the results will speak for themselves.

▲ ***Make Shallow Cuts.*** *Use the router plane to carefully remove the waste, making several passes to final depth.*

hinge mortise Plane

Hinge mortise planes have been around for over a century. They excel at paring away the waste to create a hinge mortise. This *Veritas* plane works a lot like a router plane. As a matter of fact, it uses the same blades.

The pair of knobs on the plane make it easy to control. And you can easily fine-tune the depth for a perfect fit every time.

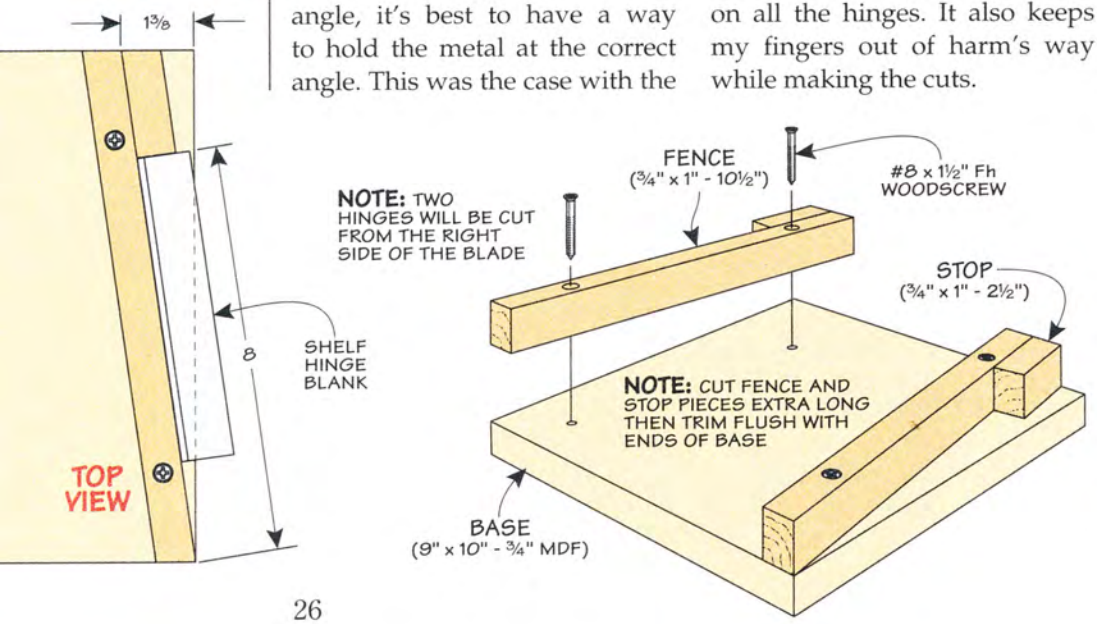
▼ ***Control.*** *Dual knobs allow you to maintain tight control when removing waste.*

Shop Short Cuts

Taper-Cutting Jig

Cutting aluminum at the table saw is pretty straightforward. Just use a carbide-tipped blade and make the cut. But when you need to cut a taper in aluminum angle, it's best to have a way to hold the metal at the correct angle. This was the case with the shelf hinges for the multifunction table on page 28.

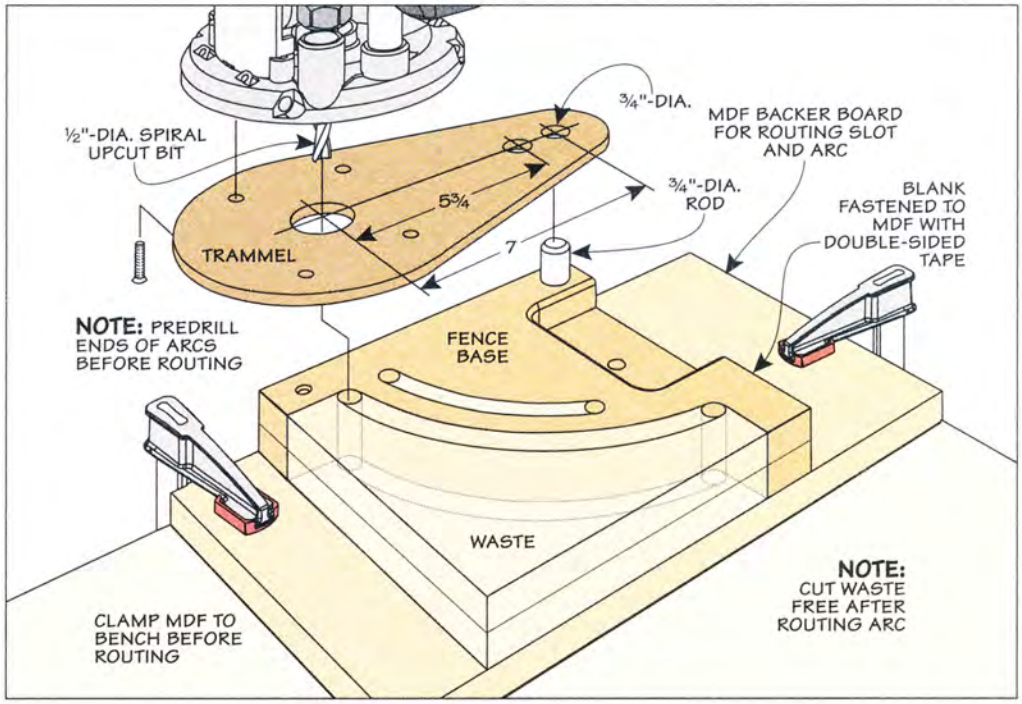
That's why I built the taper-cutting jig you see here. It helps make sure the taper is consistent on all the hinges. It also keeps my fingers out of harm's way while making the cuts.



You can see in the photo above and the drawings to the left that the base of the jig is made from a piece of ¾" MDF. The table's four hinges are made in mirror image pairs. So the base has two sets of hardwood fences and stops to make each pair of hinges. These allow you to position and clamp the aluminum blanks at the correct angle for each cut.

The jig rides against the rip fence during use (photo above). Positioning the fence is just a matter of placing the jig between your fence and blade. Slide the fence toward the blade until the edge of the base just touches the blade's teeth. Then you can clamp the aluminum angle in place and cut the taper on each hinge.

2-in-1 Trammel



Cutting the curved outer profile and slot on the fence base for the shooting board (page 18) is easy to do with a trammel and a plunge router. The trammel is just a piece of hardboard fastened to the base of the router.

I first drilled a ¾"-dia. pivot hole in the glued-up blank for the fence base and installed a length of steel rod. This becomes the pivot point for the trammel.

The trammel has two corresponding holes — one for cutting the outside arc and another for cutting the curved slot. These holes fit over the steel rod.

Before routing the blank, I predrilled the ends of the two arcs with a ½"-dia. bit. To protect my benchtop when routing, I fastened the blank to an MDF backer board with double-sided tape. Simply clamp the MDF to your bench before firing up the router.

To get the best results when cutting through the thick blank, I recommend using a spiral upcut bit. It removes chips faster. And you'll want to make several passes no deeper than about ¼" per pass. Routing direction really doesn't matter here since the cuts are internal to the workpiece.

After routing the slot and outside curve, remove the blank from the backer board and head over to the band saw. A couple of quick cuts are all you need to remove the waste and form the tabs at the corners of the fence base.

antiquing Brass Hardware

Brass hardware adds a classic look to any project. But for something like the toolbox on page 14, the bright finish can stick out like a sore thumb. Instead, an antique look is more appropriate. Thankfully, you don't need to wait years and years for the brass to darken. You can do the job with a chemical solution. The photos below outline the process.

Start by removing the protective finish on the hardware. Soak the parts in lacquer thinner or sand off the finish (left photo). Then you can apply the darkening solution. I like to use a foam brush to apply it (center photo). This gives me more control over the final color than just soaking the hardware.

The dried solution leaves a chalky residue on the hardware. Buff it off and, if you'd like, you can reapply a couple coats of spray lacquer to lock in the look.

▲ ***Remove the Finish.*** *Fine sandpaper and an abrasive pad remove the finish and create a satin sheen.*

▲ ***Darkening Solution.*** *Brush on the solution to darken the brass. Reapply until you get the color you want.*

▲ ***Buff It Out.*** *A fine abrasive pad removes any dry residue and reveals a rich, aged look on the hardware.*

Get the job done, wherever you are, with this handy, go-anywhere worksite essential.

multifunction Worktable

I rely on my workbench for the majority of my woodworking. But some projects require an extra worksurface. That's when I need a strong, portable worktable that will stand up to heavy use.

The worktable you see here fills the bill perfectly. The sturdy, A-frame base supports a large top that folds down for easy transport and storage. And an integrated shelf near the bottom of the base provides just enough storage to keep a few tools and hardware items close at hand.

The shop-made aluminum hardware adds rigidity and is simple to make. And a length of T-track on each leg helps lock everything in place. The best part is that you can easily build this project in a weekend.

Exploded View Details

OVERALL DIMENSIONS:
30"D x 36"W x 28¾"H (EXTENDED)
7⅝"D x 36"W x 32¼"H (STORED)

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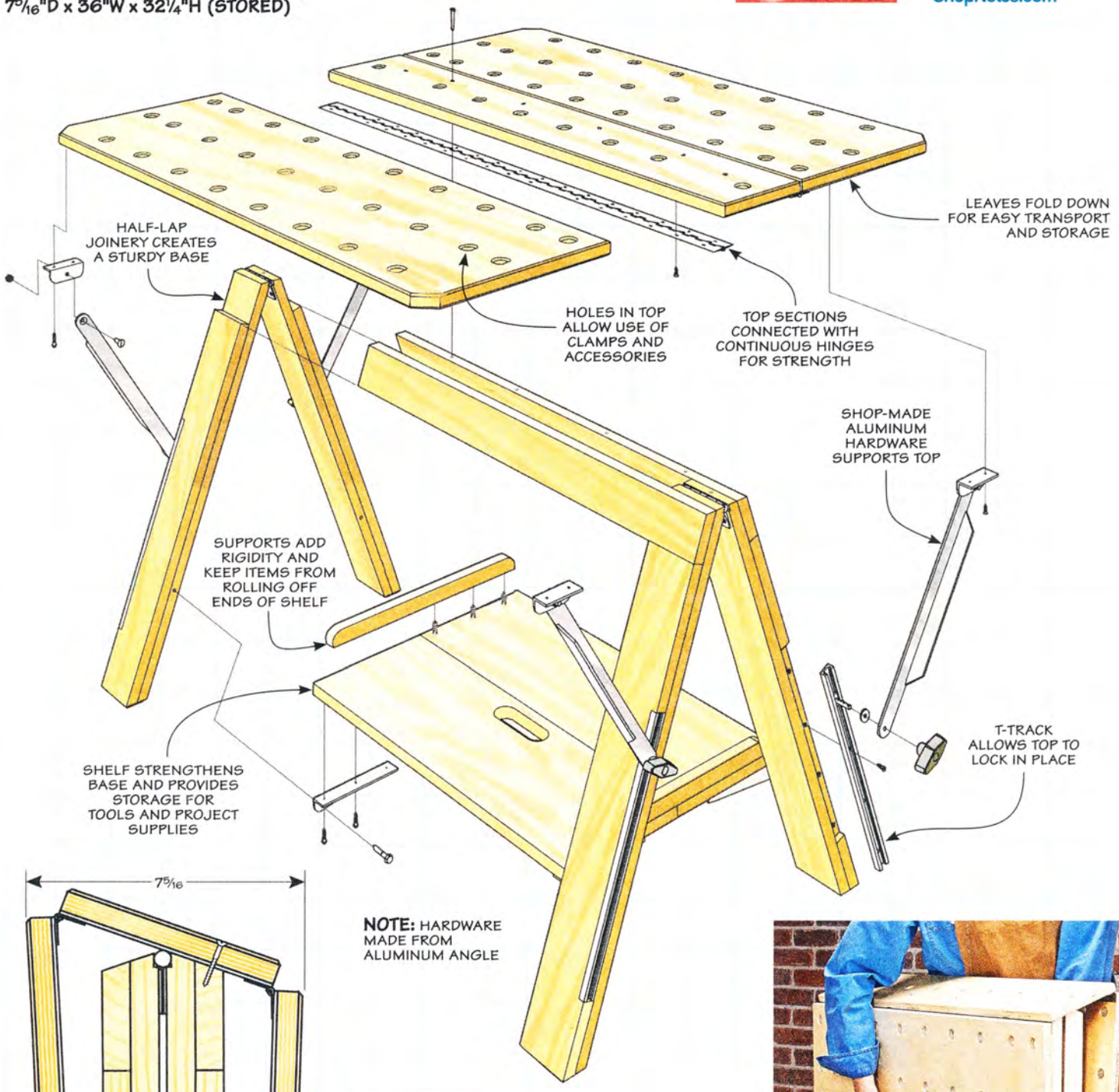
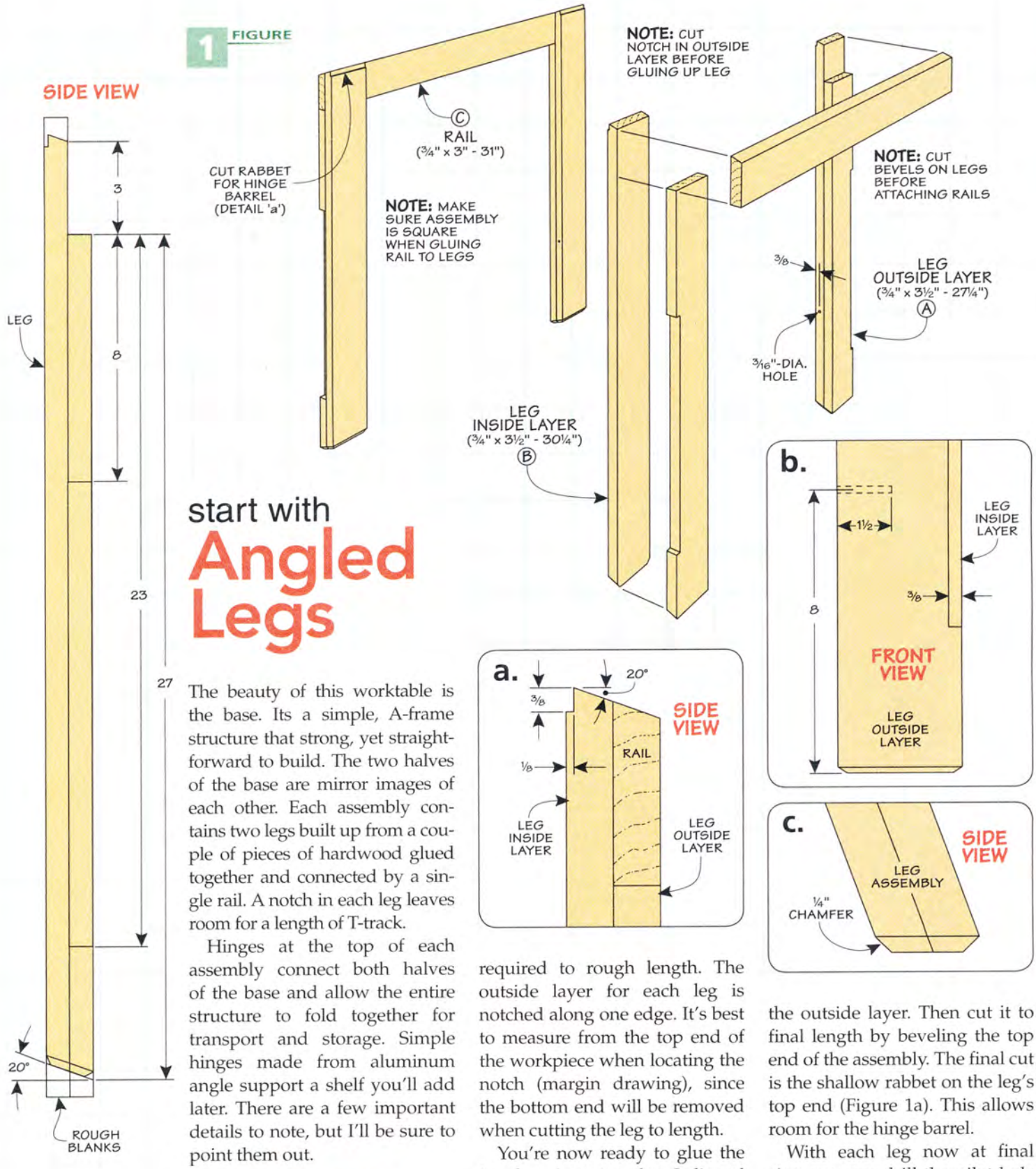
To download a free cutting diagram for the Worktable, go to: ShopNotes.com



► ***Portable.*** *Transporting the table is a breeze when folded and locked in place.*



start with Angled Legs

The beauty of this worktable is the base. Its a simple, A-frame structure that strong, yet straightforward to build. The two halves of the base are mirror images of each other. Each assembly contains two legs built up from a couple of pieces of hardwood glued together and connected by a single rail. A notch in each leg leaves room for a length of T-track.

Hinges at the top of each assembly connect both halves of the base and allow the entire structure to fold together for transport and storage. Simple hinges made from aluminum angle support a shelf you'll add later. There are a few important details to note, but I'll be sure to point them out.

GLUED-UP LEGS

As mentioned, the legs start out as two individual workpieces. I did this because I found that it was the easiest way to create the recess for the T-track.

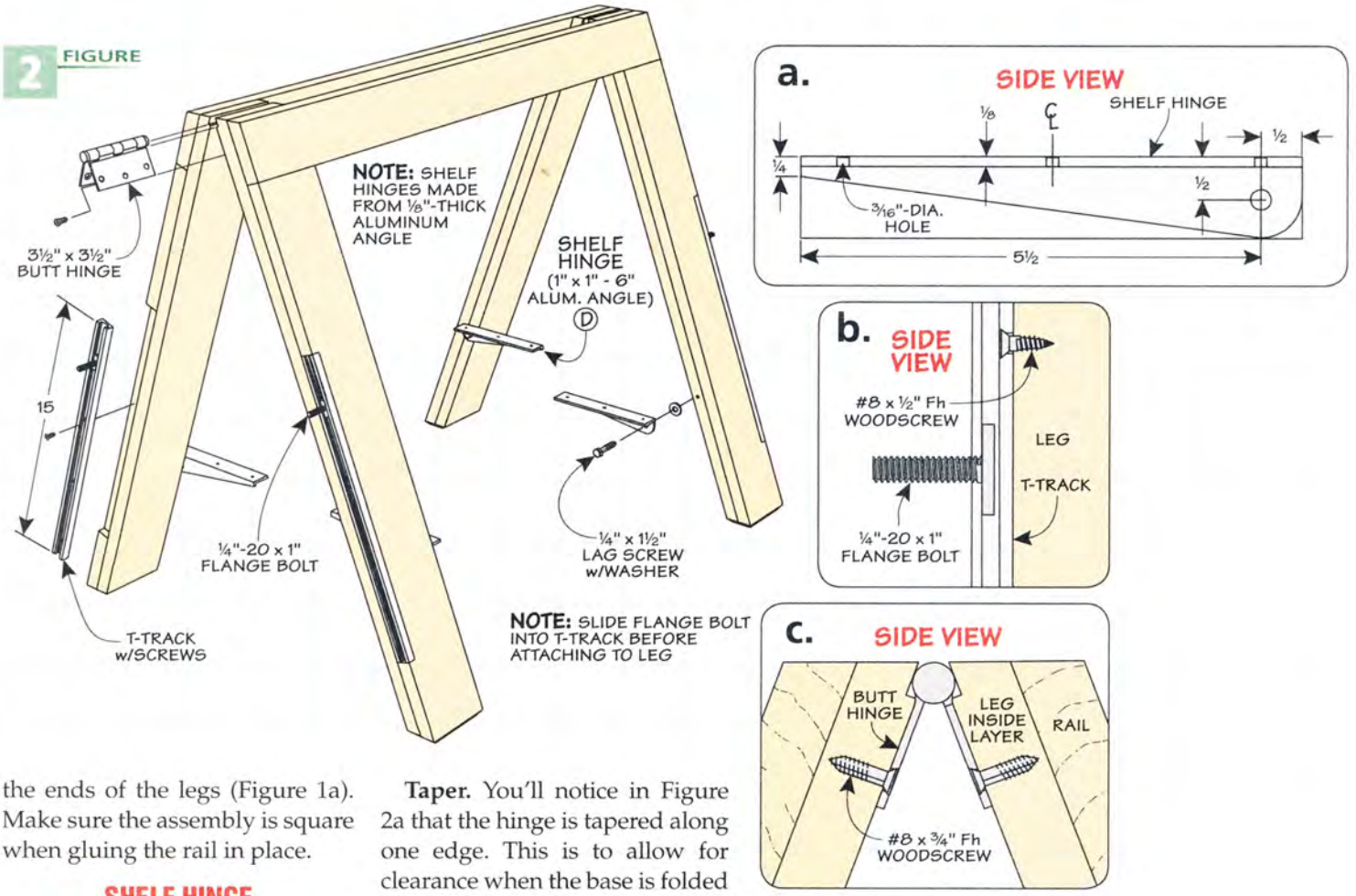
After ripping stock to width for the legs, I cut the eight pieces required to rough length. The outside layer for each leg is notched along one edge. It's best to measure from the top end of the workpiece when locating the notch (margin drawing), since the bottom end will be removed when cutting the leg to length.

You're now ready to glue the two leg pieces together. I aligned the bottom end of each piece as well as both edges before clamping them in place.

Cut to Size. Once the glue is dry, you can cut the leg to length by making a bevel cut on each end. Cut the bottom end first, measuring from the top end of the outside layer. Then cut it to final length by beveling the top end of the assembly. The final cut is the shallow rabbet on the leg's top end (Figure 1a). This allows room for the hinge barrel.

With each leg now at final size, you can drill the pilot hole for the shelf hinge screw you'll add later. Figures 1 and 1b show the location details. I finished off each leg by adding a chamfer on the bottom end with a hand plane (Figure 1c). The rail that connects the two leg sections is beveled along one edge to match

FIGURE 2



the ends of the legs (Figure 1a). Make sure the assembly is square when gluing the rail in place.

SHELF HINGE

One of the unique features of this worktable is the shop-made hardware used to keep everything in place. And with the main structure of the base complete, you're ready to concentrate on making this hardware.

While this may seem intimidating at first, it's actually pretty easy. The key is to use ⅛"-thick aluminum angle. You should be able to find it at most hardware stores. The aluminum cuts easily at the table saw and can quickly be brought to shape with a power sander or file.

Taper. You'll notice in Figure 2a that the hinge is tapered along one edge. This is to allow for clearance when the base is folded together. Cutting the taper isn't difficult, but I made a jig to simplify the process. Turn to page 26 for more details.

Curve. The curve at the hinge's pivot point was made at the disk sander. I marked a center point for the pivot hole and used a compass to draw an arc connecting both edges. This serves as a guide when removing the waste at the sander (photo below).

With the hinge sanded to shape, you're ready to drill the pivot hole and mounting holes, and then attach each hinge to a leg using a lag screw.

HARDWARE

The folding table sections you'll add later are locked in place using T-track. Now is a good time to install it in the recess on each leg. Like the aluminum angle for the hinges, the T-track can easily be cut to length at the table saw. Before screwing each section in place, be sure to slide a flange bolt into the track (Figure 2b).

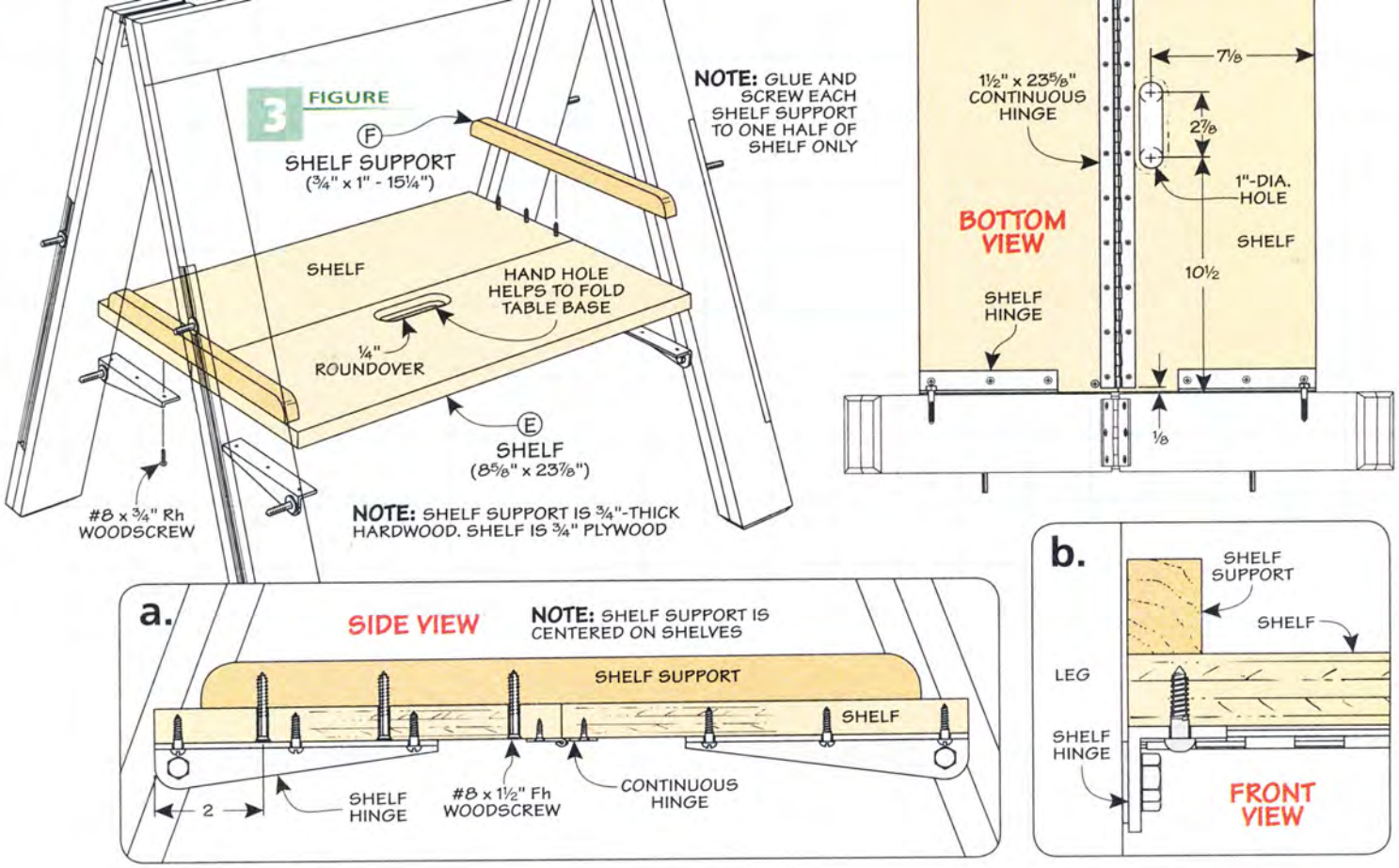
At this point, you can attach the two halves of the base together. I used ordinary 3½" butt hinges from a hardware store. Figure 2c shows how to mount them.

Materials & Hardware

A	Leg Outside Layers (4)	¾ x 3½ - 27¼
B	Leg Inside Layers (4)	¾ x 3½ - 30¼
C	Rails (2)	¾ x 3 - 31
D	Shelf Hinges (4)	1 x 1 - 6 Alum. Angle
E	Shelves (2)	8⅝ x 23⅞ - ¾ Ply.
F	Shelf Supports (2)	¾ x 1 - 15¼
G	Table Center (1)	6 x 36 - ¾ Ply.
H	Table Leaves (2)	12 x 36 - ¾ Ply.
I	Braces (4)	1 x 1 - 15 Alum. Angle
J	Brackets (4)	1 x 1 - 2½ Alum. Angle

- (2) 3½" x 3½" Butt Hinges
- (4) 15" T-track w/ Screws
- (4) ¼"-20 x 1" Flange Bolts
- (4) ¼" x 1½" Lag Screws
- (8) ¼" Washers
- (1) 1½" x 24" Continuous Hinge
- (1) 1½" x 36" Continuous Hinge
- (20) #8 x ¾" Rh Woodscrews
- (12) #8 x 1½" Fh Woodscrews
- (4) ¼"-20 x ¾" Fh Machine Screws
- (4) ¼"-20 Lock Nuts
- (4) ¼"-20 Bar Knobs

Sand Corners. *A disk sander quickly brings the corners of the shelf hinge to shape.*



adding the Shelf & Top

The shelf hinges you made earlier attach to a two-piece shelf that's great for keeping tools and other supplies off the tabletop, but still within reach. Supports located on each end of the shelf add rigidity and help keep items from rolling off the ends.

The two shelf halves are connected with a continuous hinge for added strength. A hand hold in one of the shelf halves allows the table to be folded easily. The photo below gives you an idea of how it works.

SHELF

The two-piece shelf won't take long to complete. Both halves are the exact same size, so once you cut them to size you can concentrate on the hand opening. Figure 3 provides the details.

Hand Hold. The hand hold is essentially a large slot. So I drilled holes at each end of the opening and removed the waste between them with a jig saw. A ¼" roundover bit softens the sharp edges of the opening, making it more comfortable to use. Then I cut a continuous hinge to length and connected both halves of the shelf together.

Supports. The two hardwood shelf supports can be cut to size and shaped on each end at the band saw. When attaching the supports to the shelf, be sure to glue and screw them only to the shelf without the hand hole. Figure 3a shows what I mean. Roundhead woodscrews hold the shelf hinges to the shelf (Figures 3a and 3b).

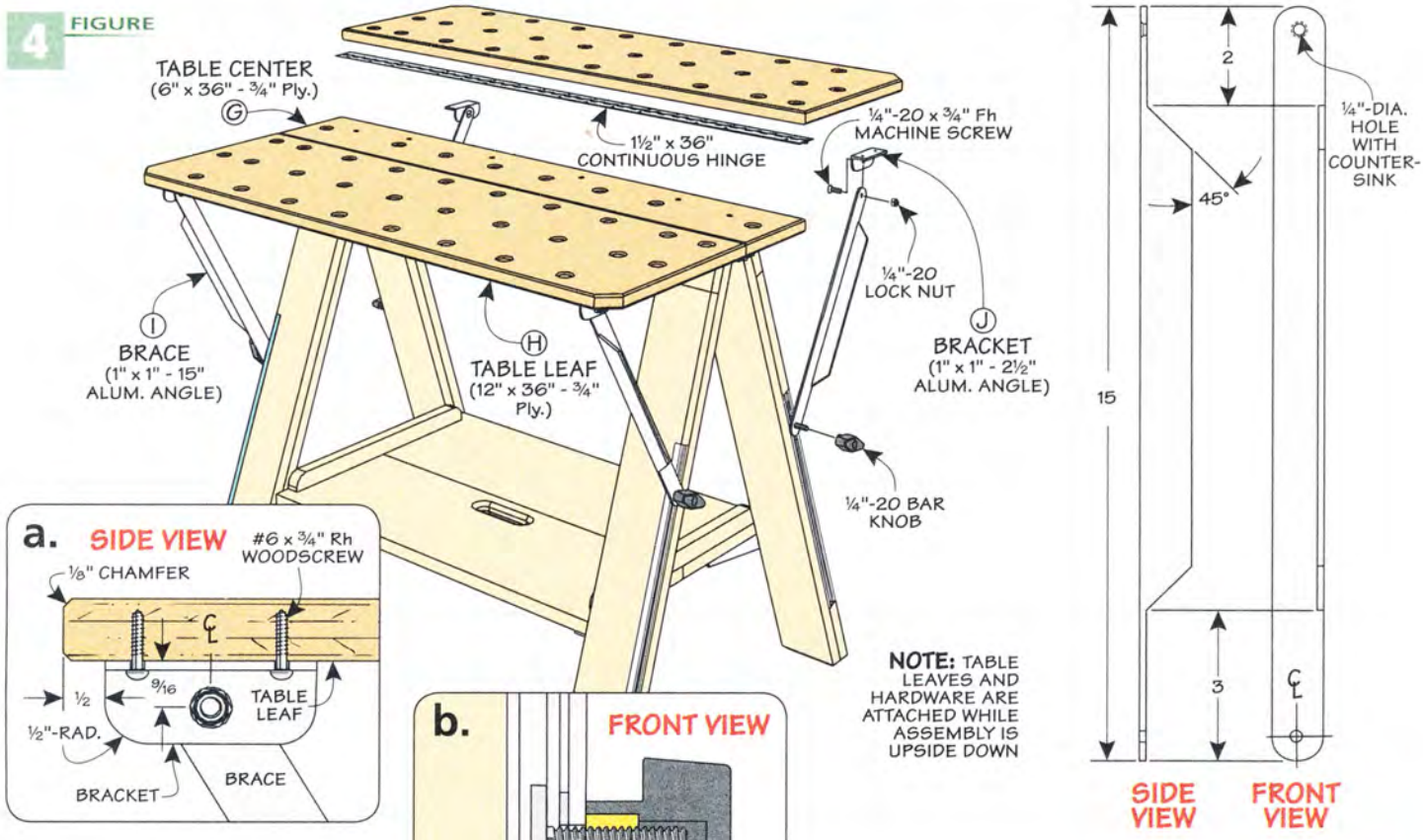
FOLDING TOP

With the shelf complete, you can concentrate on the top and the hardware that holds it in place. The tabletop is a three-piece assembly that includes one narrow, center section with a large, folding leaf on each side. Shop-made aluminum braces and brackets allow the two leaves to fold down easily, yet quickly lock in place with knobs for a rigid worksurface.

Constructing the pieces for the top is just a matter of cutting each piece to size. I also trimmed off the outside corners of each leaf and chamfered the edges. You can

► ***Folding.*** *Use the hand hole to help lift the two-part shelf and fold the worktable.*

FIGURE 4



see what I mean in Figure 4a and in the lower right drawings.

Holes. One of the distinctive features of this table is the set of holes in the top. These holes allow you to use special clamps, bench dogs, and other accessories when working on your project. The drawings below right give you the details for locating the holes in each workpiece. Chamfers on the top edge of each hole prevent splintering during use.

Now is a good time to connect continuous hinges to each edge of the top's center section. Then you can attach that section to the base, as shown in Figures 4 and 4c. Attaching the leaves is just a matter of flipping the entire assembly upside down. You may need to clamp the shelf support to the shelf to keep the assembly fully open. Place the two leaves on either side of the center section and fasten the hinges in place with screws.

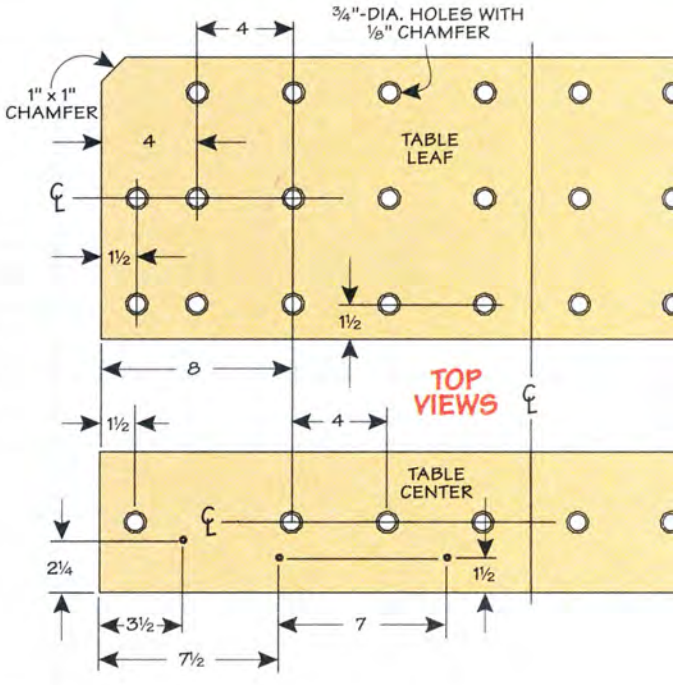
BRACES & BRACKETS

All that's left is to make the hardware for the folding top. Once again, I used aluminum angle for these parts. Figures 4 and 4a show the details of the two parts you'll need to make. The bracket attaches to the bottom of each leaf and the long brace connects the bracket to the T-track in the base.

I used a hacksaw to cut the brace to rough shape, then cleaned up the cuts at the sander. The bracket is simple. Just cut the angle to length and shape the curves at the sander.

Assembly. It's easiest to attach the hardware with the table assembly upside down and the leaves extended. Loosely attach each brace to the T-track in the base with a knob and washer (Figure 4b). Then you can position each bracket on the underside of the top and screw it in place.

A machine screw and lock nut connect the brace and bracket. When you flip your table upright, you'll be ready to put your new multifunction table to use.



versatile Storage Cart

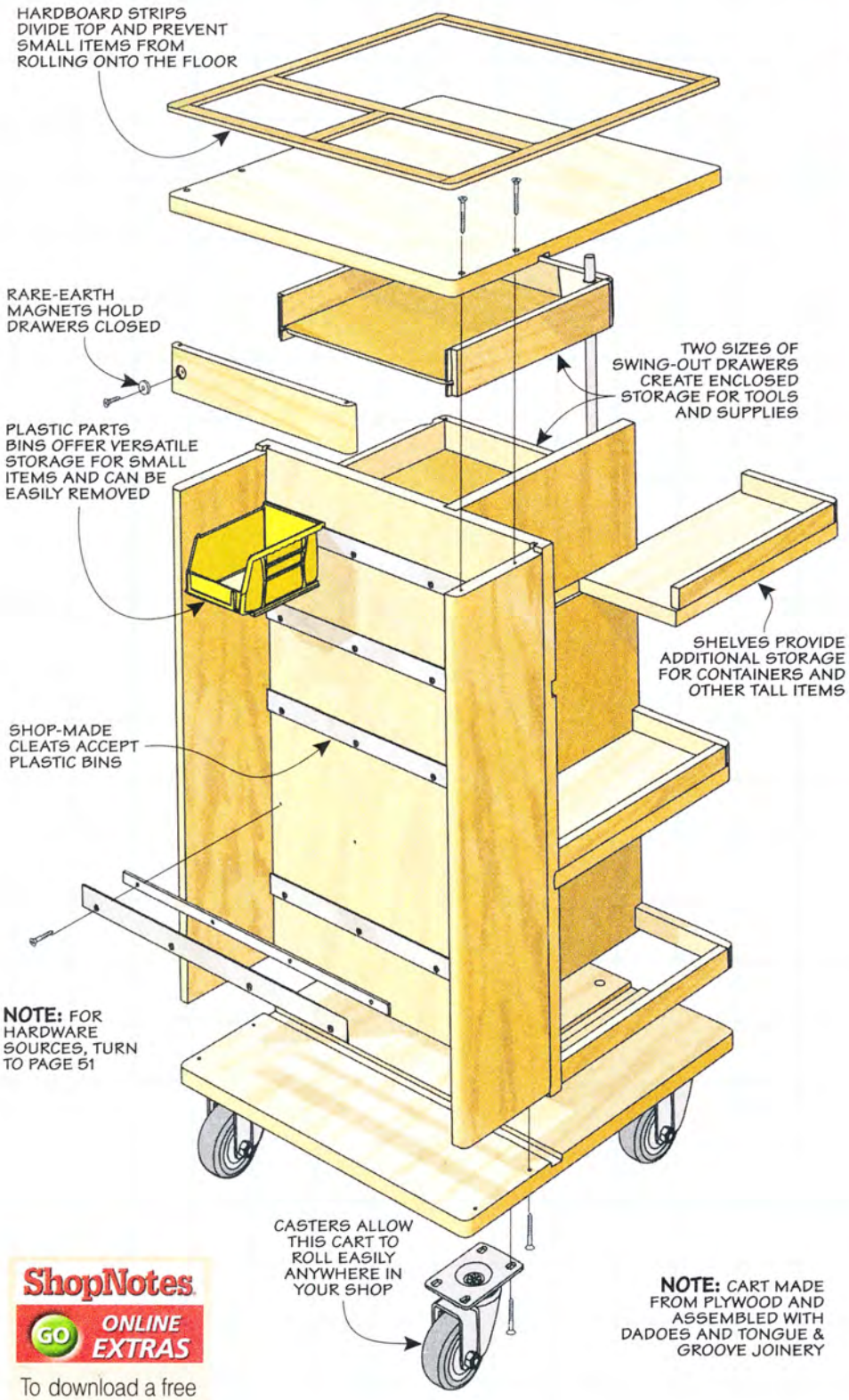
Unique pivoting drawers, a set of shelves, and simple bins pack a lot of storage potential into this easy-to-build shop cart.

The most surprising thing about this cart is how much you can store in it. The pivoting drawers stand out as a clever storage feature. But when you add the fixed shelves and an array of parts bins, you end up with a top-notch supply station.

As you can see, the cart is small enough to tuck under a tool or the end of your workbench. Finally, plywood and simple joinery means you can build one for your shop in a short time.

Exploded View Details

OVERALL DIMENSIONS: 18½"D x 18½"W x 30⁷⁄₁₆"H



NOTE: FOR HARDWARE SOURCES, TURN TO PAGE 51

NOTE: CART MADE FROM PLYWOOD AND ASSEMBLED WITH DADOES AND TONGUE & GROOVE JOINERY

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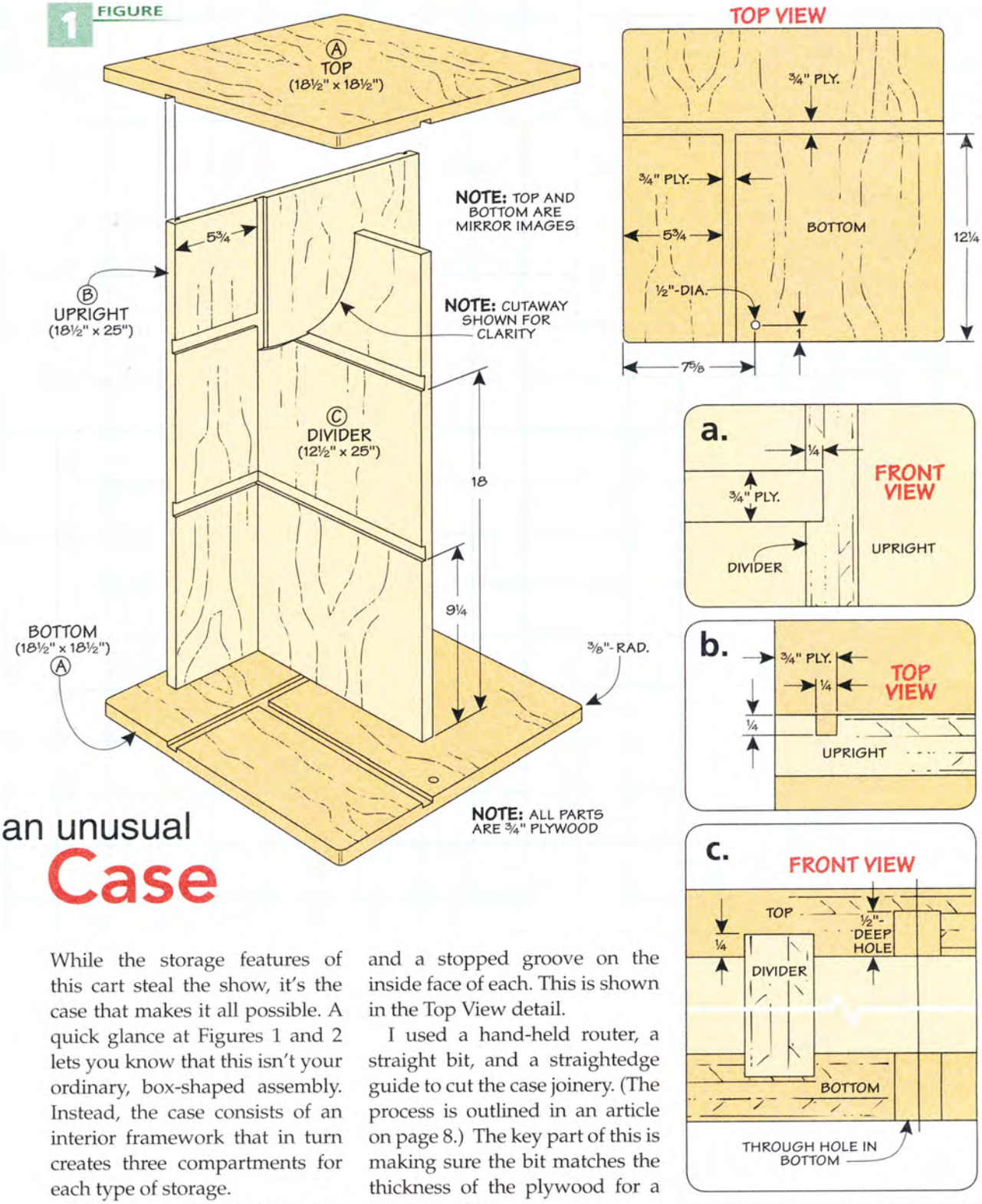
▲ ***Compact Storage.*** *You can hold a surprising amount of hardware, tools, and supplies in this small cart.*

Materials & Hardware

A	Top/Bottom (2)	18½ x 18½ - ¾ Ply.
B	Upright (1)	18½ x 25 - ¾ Ply.
C	Divider (1)	12½ x 25 - ¾ Ply.
D	Sides (2)	5¾ x 24½ - ¾ Ply.
E	Lip (1)	¾ x 94 rgh. - ¼ Hdbd.
F	Shelves (2)	6 x 12½ - ¾ Ply.
G	Shelf Ends (3)	½ x 1 - 5¾
H	Shelf Sides (3)	½ x 1 - 11¾
I	Small Drawer Ends (8)	½ x 2³⁄₁₆ - 11⅞
J	Small Drawer Sides (8)	½ x 2³⁄₁₆ - 11⅜
K	Drawer Bottoms (7)	11¼ x 11⅜ - ¼ Hdbd.
L	Corner Blocks (14)	½ x 3 - 3
M	Large Drawer Ends (6)	½ x 4⅝ - 11⅞
N	Large Drawer Sides (6)	½ x 4⅝ - 11⅜
O	Magnet Strip (1)	³⁄₁₆ x 2 - 24½
P	Plate (1)	³⁄₁₆ x 1 - 2

- (8) #8 x 1½" Fh Woodscrews
- (4) 3" Locking Swivel Casters
- (16) #12 x ¾" Sheet Metal Screws
- (16) #12 Flat Washers
- (5) ½" x 17" - ⅛" Aluminum Bars
- (5) 1" x 17" - ¹⁄₁₆" Aluminum Bars
- (22) #6 x ⅝" Fh Woodscrews
- (20) 4" Plastic Parts Bins
- (1) ½"-Dia. x 25¾" Steel Shaft
- (14) ½" I.D. x ½" Sleeve Bearings
- (7) ½" Thrust Bearings w/Washers
- (7) ⅝" Rare-Earth Magnets, Cups, and Washers

FIGURE 1



an unusual Case

While the storage features of this cart steal the show, it's the case that makes it all possible. A quick glance at Figures 1 and 2 lets you know that this isn't your ordinary, box-shaped assembly. Instead, the case consists of an interior framework that in turn creates three compartments for each type of storage.

All this makes building the case for this cart unique. But there isn't anything here that's more complicated than you'll find in a traditional case.

Top & Bottom. I began with the plywood top and bottom panels and worked my way in. These square pieces capture the other parts of the casework. To do this, you need to cut a dado and a stopped groove on the inside face of each. This is shown in the Top View detail.

I used a hand-held router, a straight bit, and a straightedge guide to cut the case joinery. (The process is outlined in an article on page 8.) The key part of this is making sure the bit matches the thickness of the plywood for a solid assembly.

The top and bottom panels also serve as the supports for the swing-out drawers. The drawers pivot on a steel shaft that's installed in the top and bottom. So you can drill these holes at this point. A good way to make sure the holes are perfectly aligned in each piece is to tape them together and drill the holes in both pieces at the same time. Figure 1c shows an important detail. The hole in the bottom panel is a through hole, while the hole in the top is stopped.

The final detail to add on the top and bottom is to ease the corners with a gentle radius.

The Inside. The task of connecting the top and bottom, as

well as creating the storage compartments, falls to the upright and divider panels, as you can see in Figure 1.

The upright is the bigger of the two pieces and the more involved. A groove on one face holds the smaller divider panel. It aligns with the stopped dadoes in the top and bottom (Top View) In addition, narrower grooves on the opposite face accept a pair of sides added later, as in Figure 1b.

The other bit of joinery to take care of is cutting a pair of stopped dadoes. These hold one end of a couple of fixed shelves. Figure 1 shows the locations for these.

The divider is the same length as the upright, and its width is sized so that it's flush with the edge of the top and bottom. Two dadoes align with those in the upright to hold the back edge of the shelves (Figure 1a).

Assembly. I assembled these four case pieces at this point. The grooves and dadoes register the parts and make the gluing and clamping process less hectic.

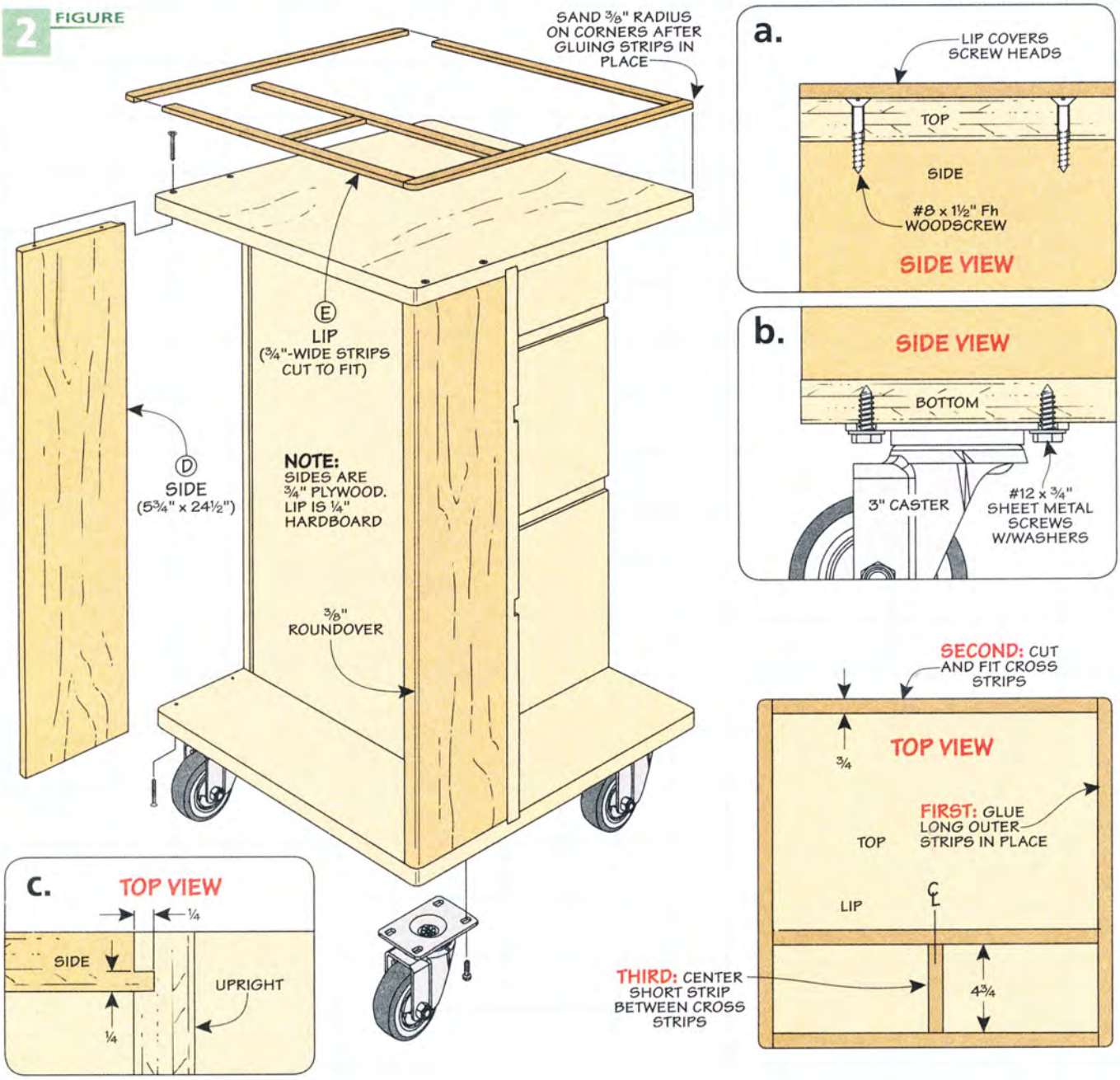
Sides. The assembled case provides a good reference point for sizing the length of two sides, as shown in Figure 2. A tongue along one edge interlocks with the groove in the upright, as in Figure 1b. The other edge of the side has a roundover to match the radius of the top and bottom.

The tongue and groove joinery is glued and the sides are screwed and glued to the top and bottom (Figure 2a).

Divided Top. The top of the cart makes a handy worksurface or staging area. To keep small parts organized and prevent them from falling to the floor, I added a gridwork of hardboard strips to the top, as detailed in the Top View, below.

Adding a set of 3" casters to the bottom completes the case of the cart, as in Figure 2b.

FIGURE 2



add Storage

Completing the case sets the stage for adding the storage to the cart. Versatility is the name of the game, here.

Bin Rack. Over the years, I've come to appreciate how handy plastic parts bins can be. The compartment formed by the upright and sides provides space for up to twenty 4" bins. The bins hang on the simple cleat system that's shown in Figures 3 and 3a. The cleats are made from two strips of aluminum bar stock. A lip on the back of the bins fits over the cleat. I glued the two strips together with some super glue. This holds the pieces together while drilling the mounting screw holes. The Side View below shows the spacing for the cleats.

Fixed Shelves. Moving to the next side of the cart, you can add two shelves. They fit into the dadoes routed in the upright and divider. The shelves are sized to be flush with the ends of the upright and divider when glued into the dadoes. The outside corner of each shelf is eased just like the radius on the top and bottom, as you can see in Figure 3b.

To keep items stored on the shelves from falling off while moving the cart, I added hardwood strips to form an end and side for each shelf. The end is profiled to match the shelf radius. The pieces are simply glued to the top face of the shelf, flush with the edges.

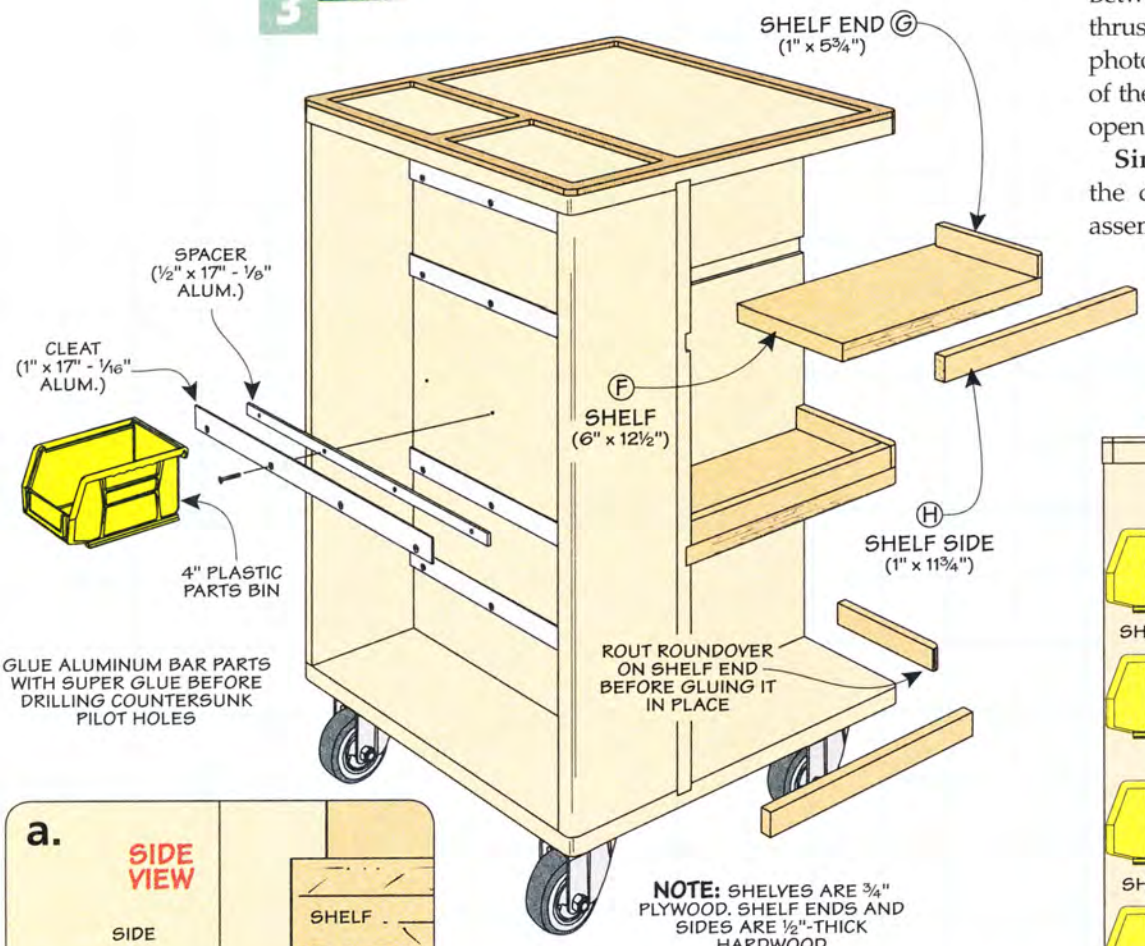
I also added an end and side to the case bottom. This creates a third shelf, as shown in Figure 3.

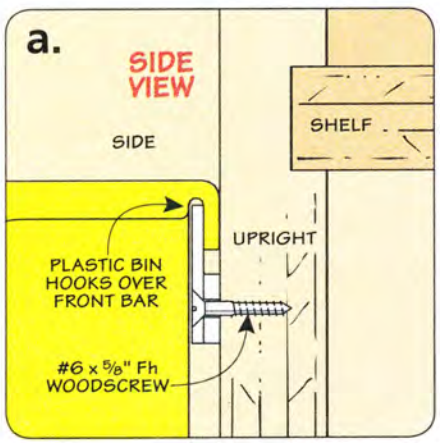
Pivoting Drawers. The drawers give this cart its unique twist. The idea was inspired by the small supply carts used by artists. Pivoting on a steel shaft allows for total access to the drawer without the need for metal slides.

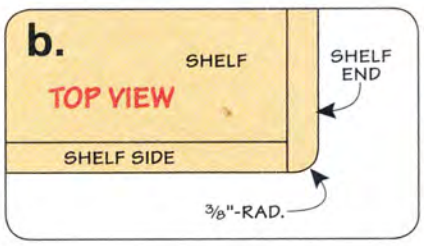
To keep the drawers from sagging, there's a pair of sleeve bearings in one corner of the drawer. Between the drawers, I used thrust bearings (right margin photo). These support the weight of the drawers and allow them to open and close smoothly.

Simple Joinery. You make the drawer boxes first. They're assembled with tongue and dado joinery, as illustrated in Figure 4a. Note: the groove that houses the drawer bottom is exposed

FIGURE 3







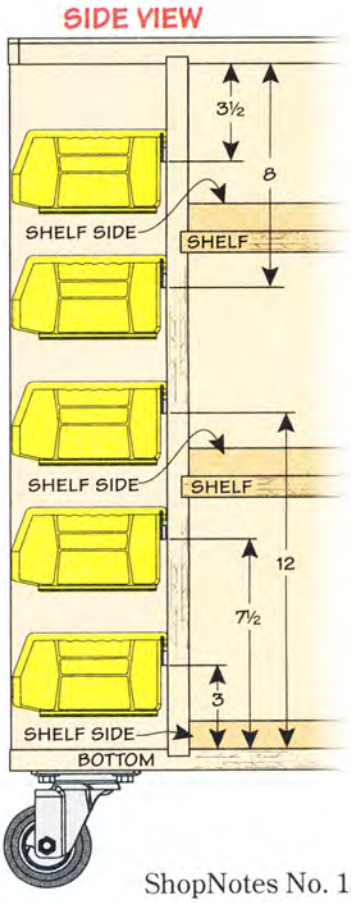
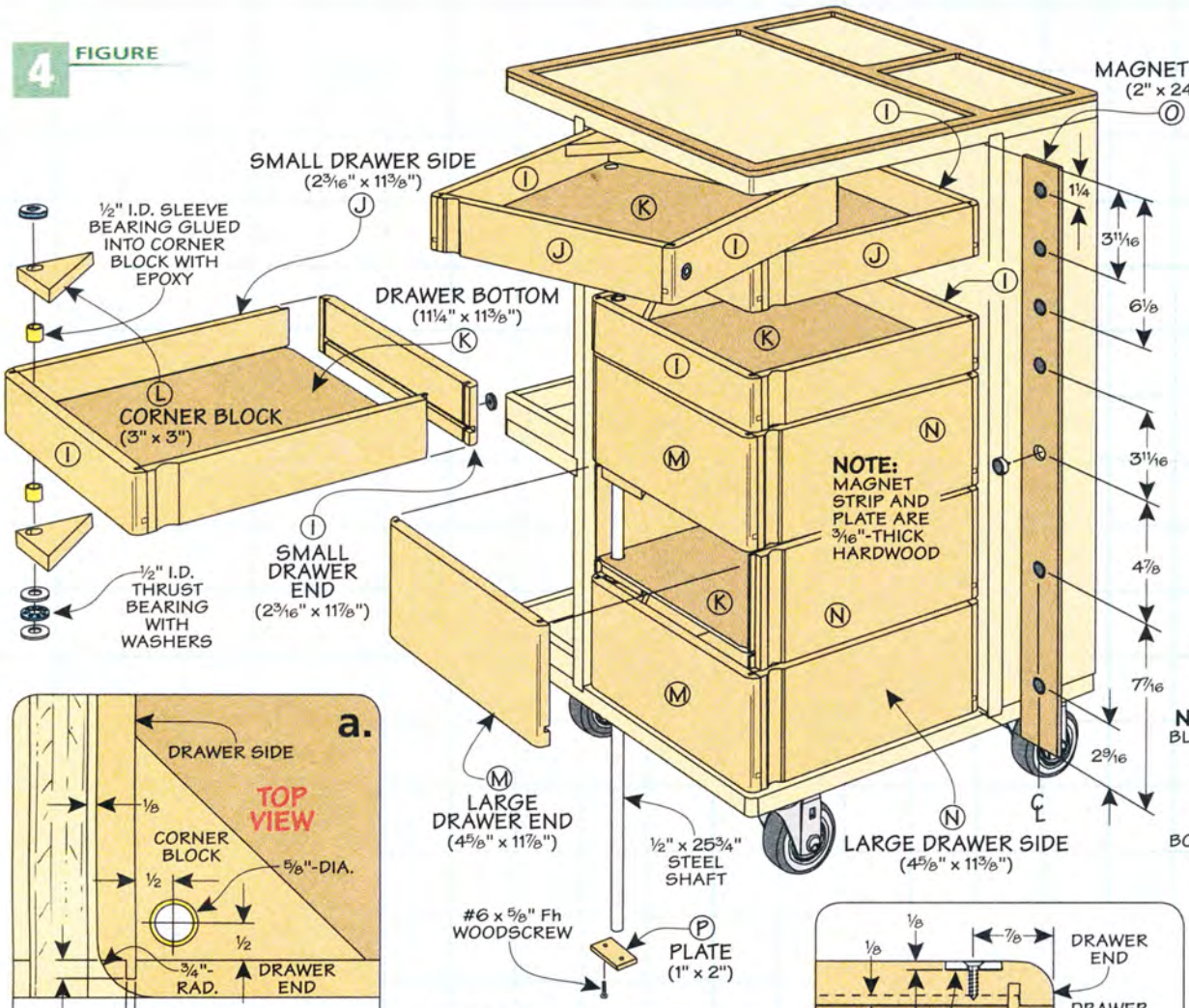
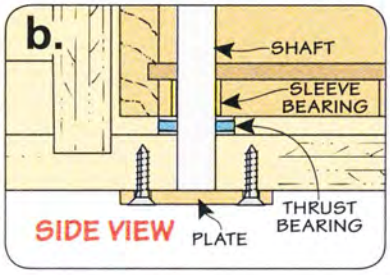
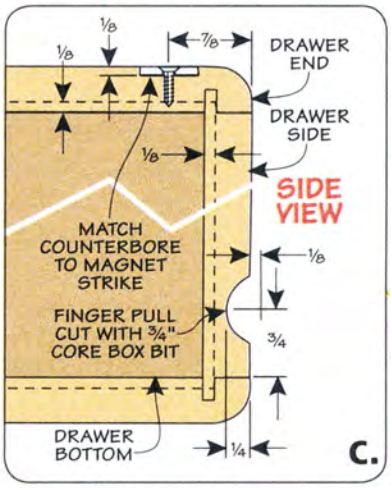


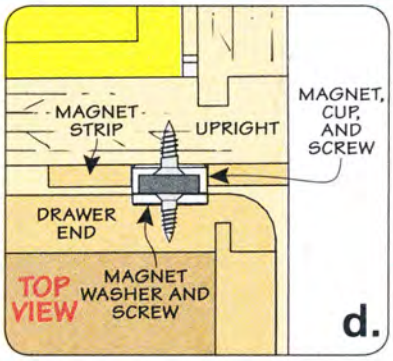
FIGURE 4

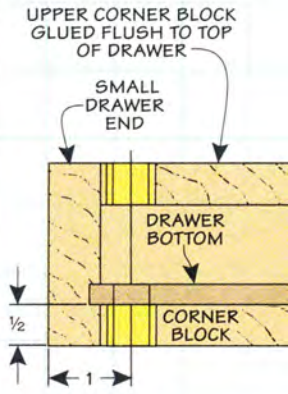


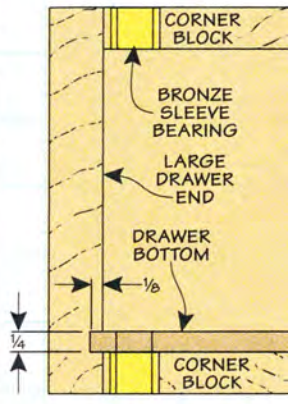
Thrust Bearings. *A thrust bearing and pair of washers create a low-friction surface between the drawers.*











SIDE VIEWS

on the drawer sides. I cut small plugs to fill the gap after assembling the drawer.

Three of the corners have a roundover that matches other details on the cart, as in Figure 4c. The pivoting corner has a larger radius so the drawer won't catch as it opens or closes (Figure 4a).

I used a core box bit in the router table to form a finger pull on one side, as in Figure 4c. A magnet strike installed on one side completes the drawer.

Corner Blocks. The next step is to add corner blocks so the drawers can fit onto the steel shaft. Drill the hole for the sleeve bearing at the drill press so the blocks are consistent (Figure 4a).

After gluing the sleeve bearings into the corner blocks, glue the lower block to the underside of the drawer. Before you add the upper corner block, you need to drill through the drawer bottom at the drill press. It's a good idea to make a backing block to fit inside the drawer. This prevents tearout as the bit exits the workpiece. Then you can glue the upper corner block flush with the top of the drawer (Side View at right).

Installing the drawers is a matter of sliding the shaft in from the bottom, adding one drawer at a time. Just be sure to install a thrust bearing and washers between each drawer. A hardwood plate keeps the shaft in place (Figure 4b).

The final piece of the puzzle is a thin magnet strip. It houses rare-earth magnets that hold the drawers closed and is glued in place.

A few coats of wiping varnish adds a little color and protection. Considering how much stuff this cart can hold, you're sure to end up with a neater shop.

get the best-looking Plywood Panels

Tips to make plywood look like solid wood.

In many ways, plywood is a great material for building cabinets, cases, and even tabletops. The sheets make it easy to create large, flat panels. Plywood is stable, too. So you don't need to worry about the workpiece expanding and contracting due to seasonal changes in humidity.

Other than the challenge of dealing with the large size of full sheets, cutting the pieces you need is pretty straightforward. What isn't as obvious is how to make plywood parts look as much like solid wood as possible.

I'll admit that my first plywood projects *looked* like plywood. But over time, I've picked up a few tricks for getting the most out of this versatile material.

Creating Parts. There are two main areas to focus on when making project parts from plywood. First, the appearance of the face of the panels. The box on the facing page shows how to break down sheets of plywood so the face of each part looks like a solid wood panel.

The second aspect is covering the exposed plies on the edges and ends. It's something that's often an afterthought. So that's the area I'd like to focus on.

Edging Options. Besides the appearance, there's another reason for covering up the edges: The thin veneer can chip or get dinged up without some protection.

The trick to covering up the edges is doing it without calling attention to the edging. Two methods are shown here.

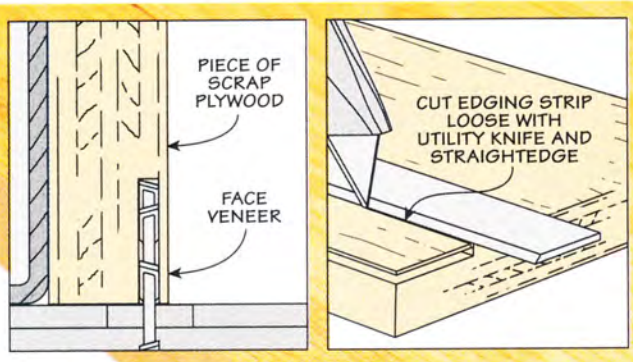
Thin Edging. One key to blending the edging and plywood is to make sure the color and grain are as similar as possible. A surefire way to do this is to cut the edging from the same plywood as the rest of the project. You can buy commercially made veneer edging, but the long rolls don't always provide an exact match.

The photo and drawings at left show my solution. At the table saw, you cut a kerf along the edge of a piece of plywood leaving only the face veneer. This is kind of like resawing.

All you need to do is cut the veneer free from the blank with a utility knife and straightedge and it's ready to be glued in place. The result is a perfect match.

Hardwood Edging. Veneer edging provides good looks but not much edge protection. For an edge that needs to stand up to more wear and tear, I like to glue a thin strip of hardwood (⅛" to ¼" thick) to the edge of a plywood panel. By taking some time and care in selecting the stock for the edging, you can get a good match.

To conceal things even more, I add a simple profile to the edging, as shown in the main photo above. A slight chamfer



► ***Custom Edging.*** *Edging made from the same plywood provides a dead-on match.*

or roundover that begins at the joint line helps blend the parts together visually.

Ends Matter, Too. It can be tempting to treat the ends of a plywood workpiece the same as you would the edges. The problem with this is that the grain of the top surface doesn't flow across to the ends. Visually, you would expect to see the end grain of a solid panel. Thin, long-grain edging strips stand out.

Creating thin, end grain edging strips may seem like the path to take. But gluing up panels to cut into strips is a lot of work and the strips are very fragile.

A better option is to take cues from traditional, solid-wood construction. The photos at right show two approaches I use.

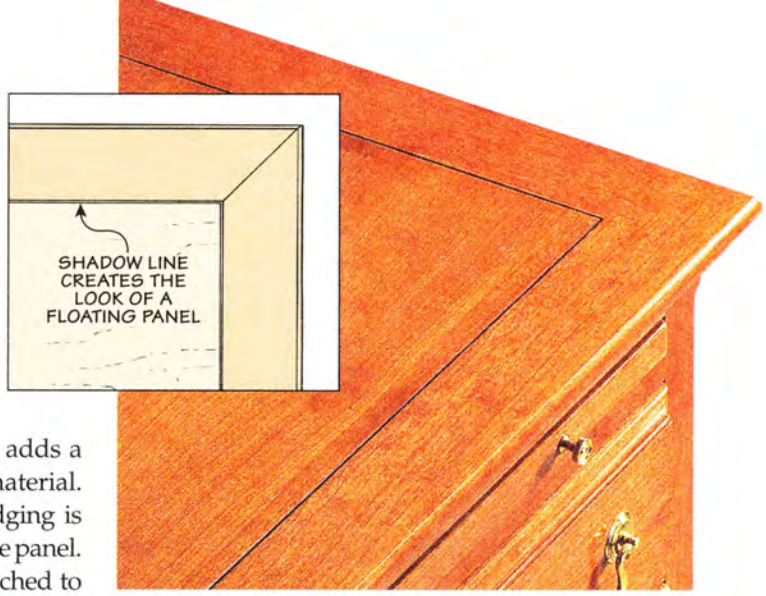
Frame & Panel. One way to deal with wood movement in a solid-wood panel is to enclose it in a frame. The upper right photo shows how this works with plywood. A wide, mitered wood frame wraps around all sides of the plywood panel.

A shallow rabbet cut along the edges and ends of the panel mimics the gap a solid-wood raised panel would need for expansion and contraction, as in the drawing at right.

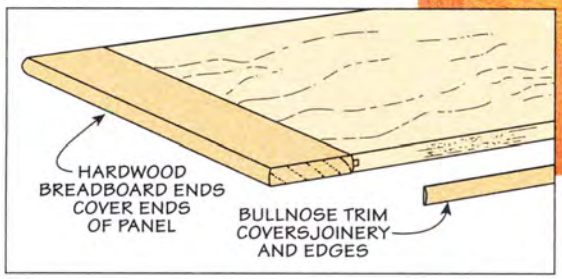
Breadboard Ends. Another way to hide the ends of a plywood panel is to use breadboard ends, as in the lower right photo. In solid wood, breadboard ends help keep a wide panel flat. Here it adds a classic look to a modern material.

To get this look, thin edging is glued to the long edge of the panel. Then wide boards are attached to the ends, as in the drawing below. A bullnose profile blends the edging to the panel.

Plywood is a relatively inexpensive way to make good-looking projects. And paying attention to key details like these is one way to take your woodworking abilities up a notch. The results are sure to be noticed.



▲ ***Wrap It in a Frame.*** *A mitered frame surrounds the plywood panel, giving it a traditional look. A shadow line adds some detail.*



▲ ***Breadboard Ends.*** *Wide strips conceal the ends of a plywood panel to give it the look of solid wood.*

ignore the Cutting Diagram

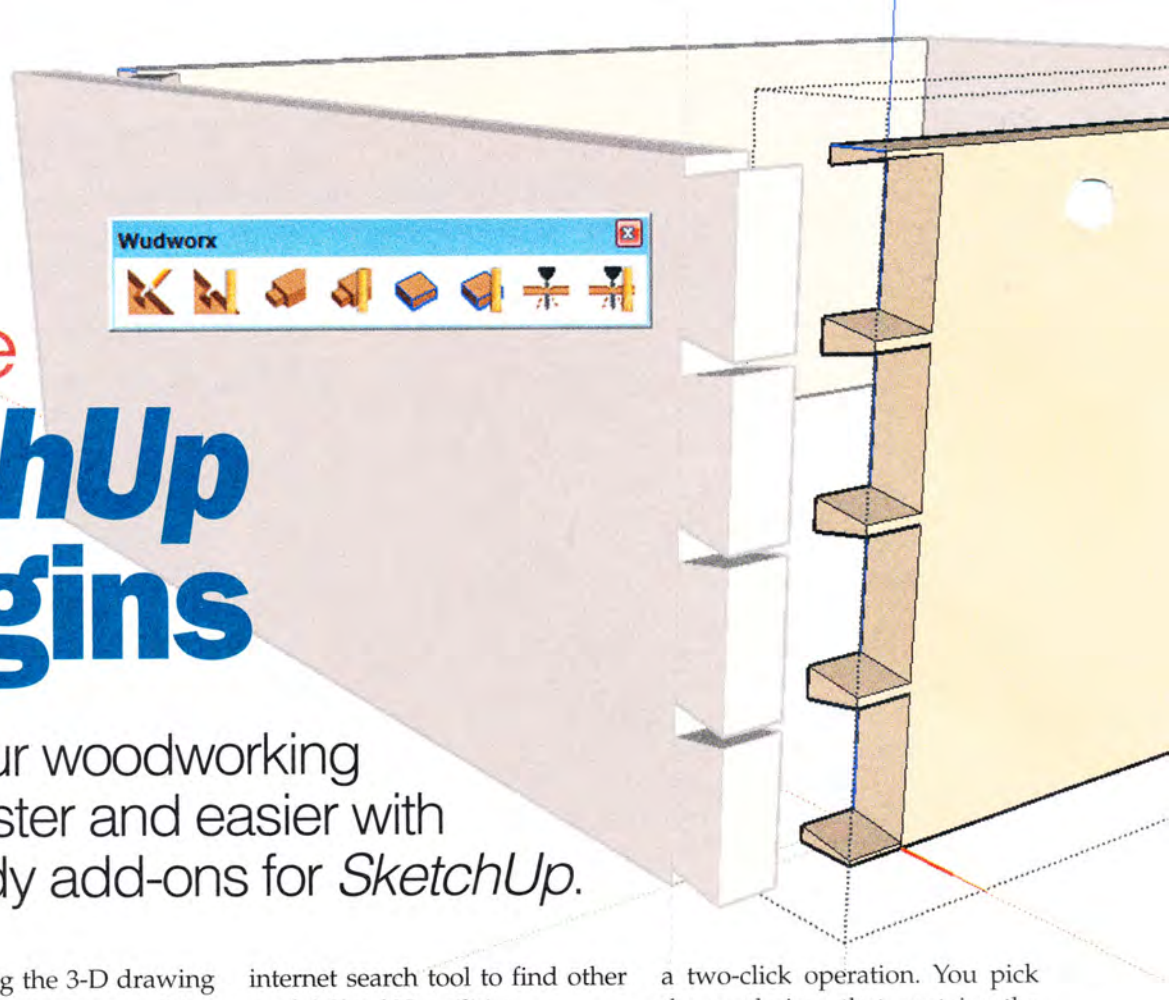
The first step in getting plywood project parts to resemble solid wood comes when you start breaking down the sheet. The tendency, though, is to cut parts from the plywood sheet in the most efficient manner, as shown in the near right photo. But the parts don't have consistent grain patterns.

The solution is to be as choosy with laying out plywood project parts as you would with parts cut from hardwood boards. The result shown in the far right photo produces a little more waste, but the overall look of each panel is much better.

▲ ***Efficient.*** *Cutting pieces for the most yield from a sheet sacrifices the appearance of the parts.*

▲ ***Best-Looking.*** *Consider the grain patterns and seams and the result is parts that look more like solid wood.*

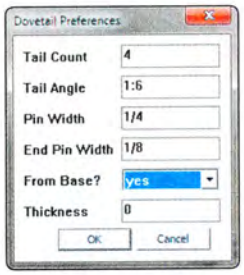
must-have SketchUp Plugins



Design your woodworking projects faster and easier with these handy add-ons for *SketchUp*.

I've been using the 3-D drawing program *SketchUp* for years. It's a great tool for designing projects. Best of all, you can download it free from *sketchup.com*.

SketchUp by itself is an excellent program, but it can be made even better through add-ons called "plugins." These third-party utility programs add a number of additional functions. You can find out where to get plugins in the box on the opposite page. Just use your favorite internet search tool to find other useful *SketchUp* utilities.

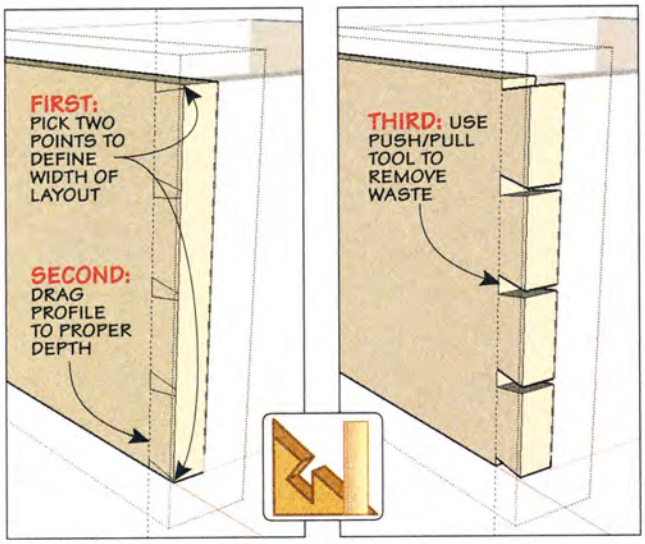


I found a few plugins that speed up the drawing process for woodworking projects. One is a collection of tools by *Wudworx*. The other plugin is *Profile Builder* used to create moldings.

Wudworx. The *Wudworx* plugins consist of four functions: Dovetails, Mortise & Tenon, Board Maker, and Drill Array. I purchased the bundle for $30, but you can buy them separately.

Dovetails. The images above and to the left show how to create dovetails. You first specify the parameters for sizing the dovetails (left margin photo). To lay out the dovetails, you edit the component board, pick the two endpoints at the end of the board, then specify the thickness of the tails. Then you simply use *SketchUp's Push/Pull* tool to remove the waste. Use the same process to create pins on the mating workpiece.

Mortise & Tenon. Drawing mortises and tenons in *SketchUp* can be a tedious task. However, with the *Mortise & Tenon* tool, it's a two-click operation. You pick the workpiece that contains the mortise, then select the mating tenon piece. That's it. *Wudworx* takes care of the rest (upper right screenshot, opposite page).

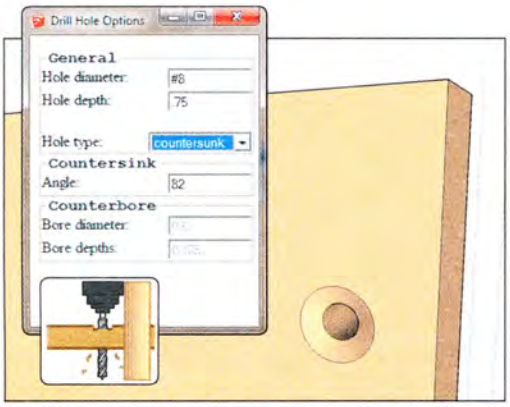


Board Maker. Another useful, time-saving tool is the *Board Maker* tool. It creates a board by combining *SketchUp's Rectangle* command with the *Push/Pull* command in one operation. In other words, you specify the length, width, and thickness and then *Board Maker* creates a component representing a board.

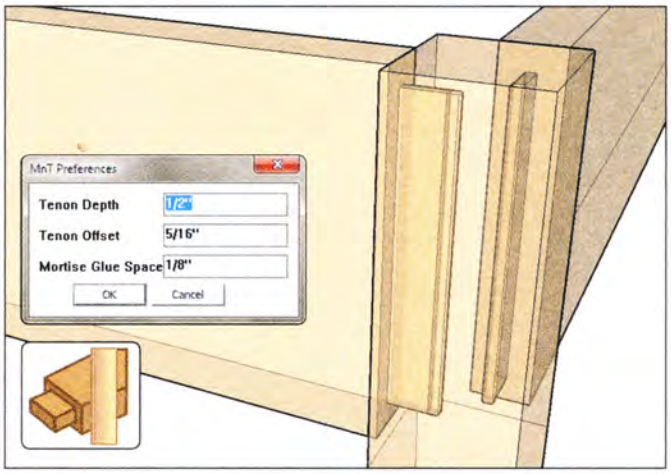
Drill Array. One of the most frustrating things to do in *SketchUp* is to create drilled holes, especially countersunk holes. For this reason, the *Drill Array* tool is a real godsend for woodworkers.

As shown on the upper left of the opposite page, you set the parameters first, and then locate the holes on your workpiece. It recognizes standard screw sizes as well as fractional inches. You can drill standard, countersunk, and counterbored holes.

The *Drill Array* tool also takes advantage of *SketchUp's* multiple



▲ ***Drill Array.*** *Drilling holes has never been easier. Specify the hole parameters first, then pick points to locate them.*



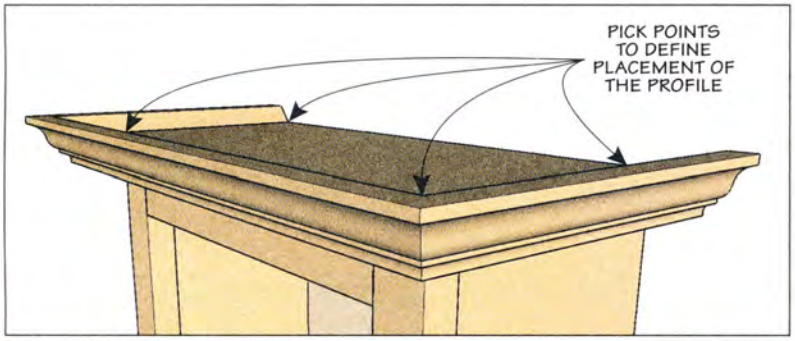
◄ ***Mortise & Tenon.*** *Adding mortise and tenon joinery to your project design is hassle-free.*

copy function. It's a simple task to use the *Drill Array* tool to quickly place shelf pin holes by specifying the distance between them and the quantity of holes.

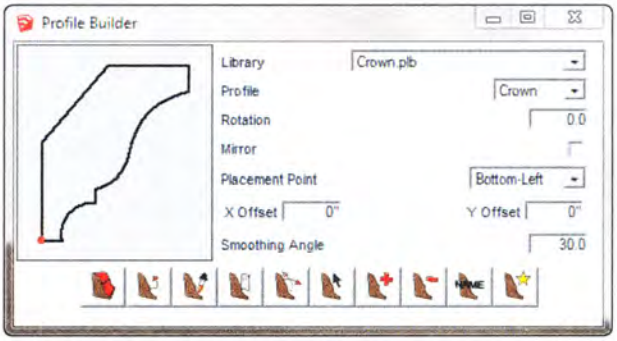
Profile Builder. Creating moldings is a common task when designing projects. A separate plugin makes it a snap. The free version of *Profile Builder* comes with dozens of standard profiles. For $20, the pro version allows you to create and save your own custom profiles.

As illustrated below, you simply specify the shape and anchor (placement point). Creating the profile on the cabinet took only three clicks to define the endpoints of the profile.

If you're a fan of *SketchUp*, you'll find that spending a few bucks on plugins and searching for useful, free plugins will save you time and frustration. And that means you'll get into the shop that much sooner.



▲ ***Profile Builder.*** *Adding molding profiles like crown molding is quick and easy with the Profile Builder plugin. All you do is pick points to define the lengths of the profile around the project.*



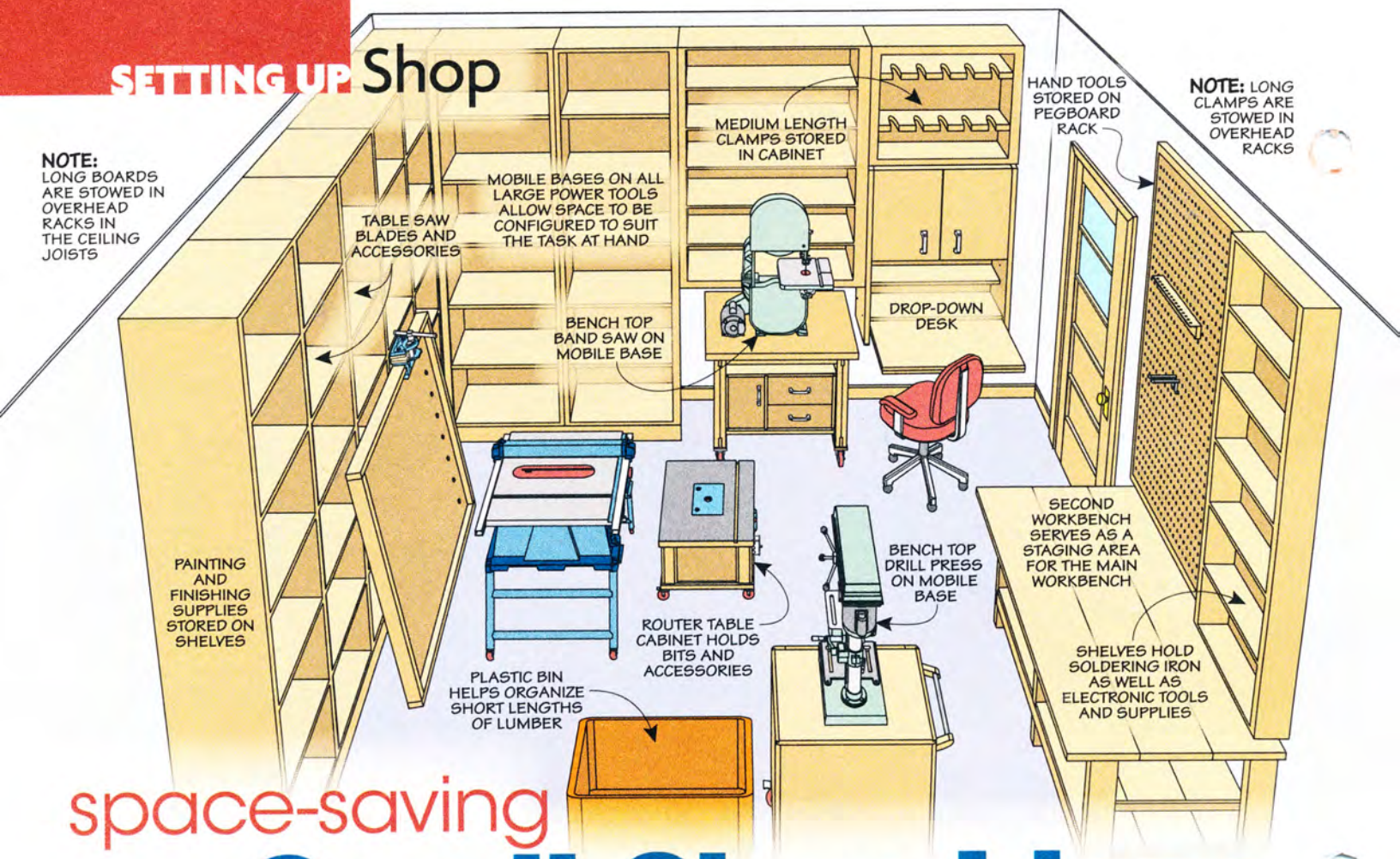
▲ ***Profile Options.*** *With hundreds of shapes to choose from, you can specify every detail and dimension of the profile on your project.*

access to more Plugins

The collection of *Wudworx* tools can be downloaded from *sites.google.com/site/wudworx*. The *Profile Builder* plugin and dozens of others are at *smustard.com*.

You'll find other useful plugins at *sketchucation.com* and through the *SketchUp Extension Warehouse*. The *Extension Warehouse* is found under the *Window* menu at the top of the screen inside *SketchUp*.

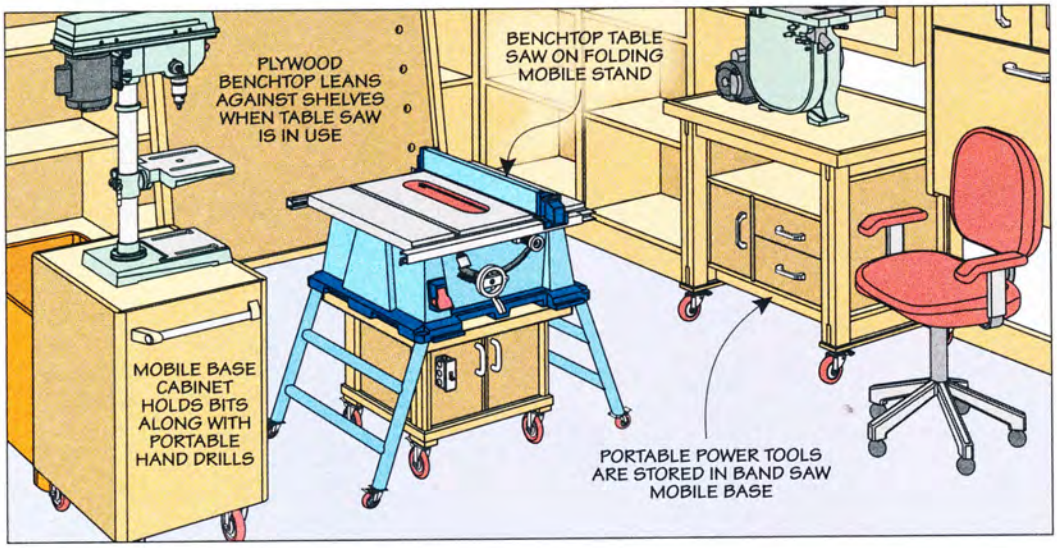
Each plugin needs to be installed before *SketchUp* recognizes it. Usually this just means copying the plugin files to the *Plugins* folder of your *SketchUp* installation on your computer. The *Extension Warehouse* automatically installs most plugins. But there are some you may have to install manually by copying files.



space-saving Small Shop Ideas

This compact basement workshop takes storage and versatility to a whole new level.

Most woodworkers will describe their workshop as small. And nearly every woodworker will tell you that they could use some more space. But one look at Bob Zimmerman's workshop redefines what a hard-working shop is. I know it did for me.



Coal Room. Bob's house was built back when homes needed dedicated rooms to store coal to feed the furnace. In most houses, the old basement coal room became a storage space. For Bob, the 12' x 12' room was the only place where he could set up shop.

While there are many ways to make the most of a tiny shop space, they fall into two broad categories. One is a minimalist approach that maximizes the open floor space. The other method finds clever ways to fit as many tools and supplies into the space available.

It's the second strategy that's on full display here. As the drawings on these pages show, just about every square inch of wall

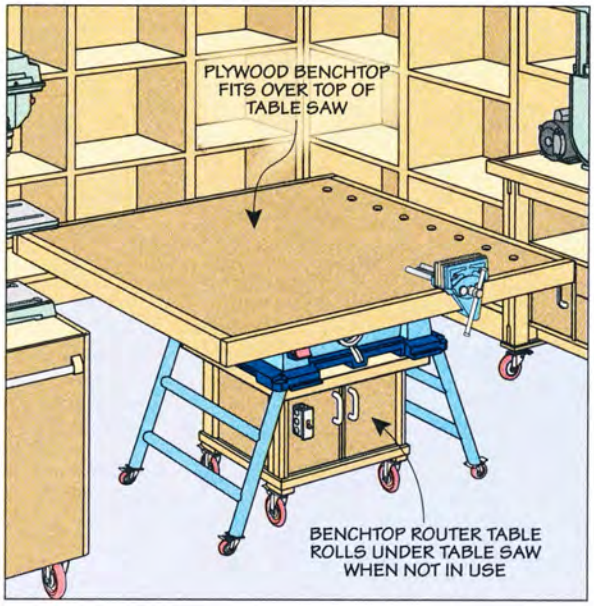
and floor space is taken up by storage, workbenches, or tools. At first glance, it may seem cramped. But talking with Bob, I soon saw how versatile and handy the space is.

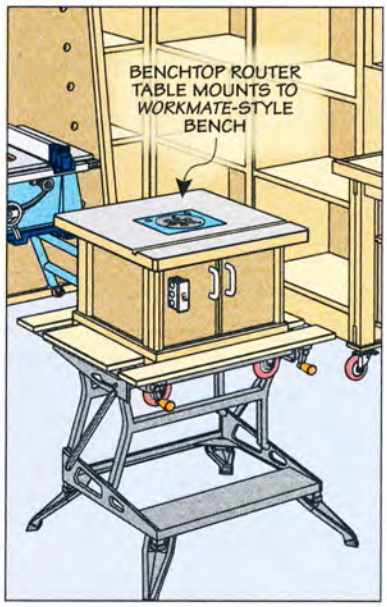
Many Interests. In spite of the small space, some big-time projects have come out of this shop. As part of a kitchen remodel, Bob made a built-in booth with storage cabinets and a tall pantry cabinet. Large projects like these have taught him valuable lessons on planning and working with smaller subassemblies.

Besides woodworking, the shop serves as the repair station for furniture, toys, and other home maintenance jobs.

As if that weren't enough, Bob enjoys building and flying radio-controlled model airplanes and birds. So he keeps electronics tools and supplies in here as well.

Multipurpose Island. As you might expect, a table saw occupies center stage in the shop. It's a portable, jobsite saw on a folding stand. The small size of the shop makes a portable saw a good choice. But another reason Bob chose it was that he can take it out of the shop for on-site tasks without too much effort.





Most of the time, the saw is topped with a large plywood cover and serves as the main workbench. A row of dog holes along the front provides plenty of options for securing a workpiece. In addition, there's a clamp-on vise along one side of the removable benchtop.

There's more to this setup than a double-duty bench and saw combination. A benchtop router table tucks under the saw stand. Casters on the router table allow Bob to easily roll it out from under the saw. Then he sets it up on a folding, *Workmate*-style bench.

Storage Galore. The walls surrounding the table saw are lined with shelves, cabinets, and pegboard panels. Altogether, they hold all his tools and supplies.

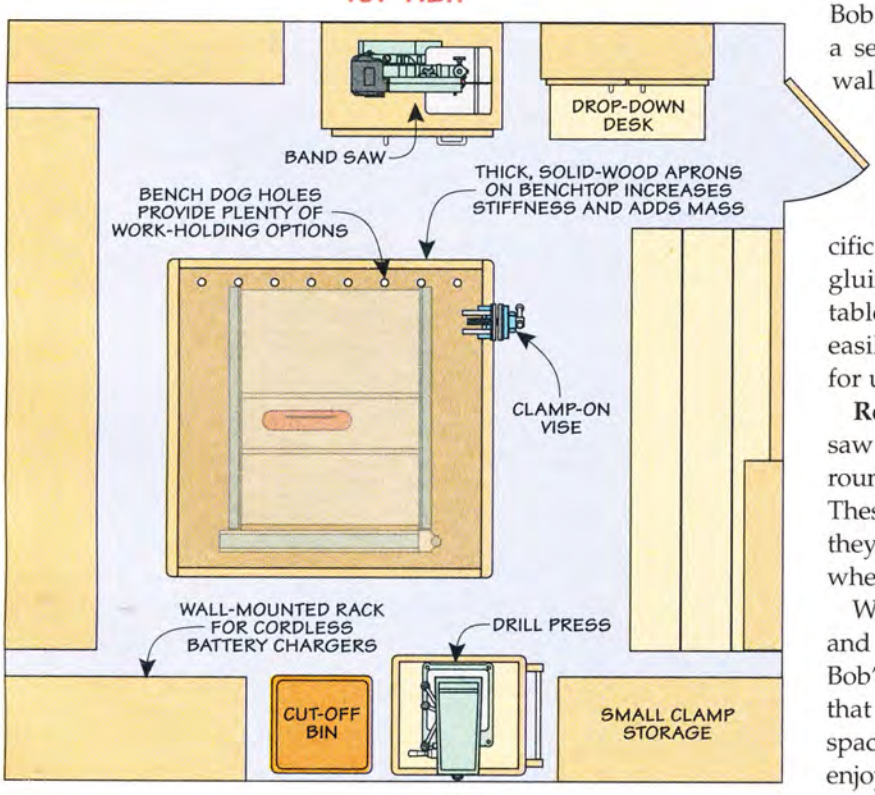
Here's where having a small space really pays off. Just about everything he might need while building a project is within arm's reach — or just a few steps away. Bob even managed to squeeze in a second workbench along one wall to serve as a staging area.

Many items are stored in toolboxes and canvas bags. These are used to organize tools around specific tasks (plumbing, electrical, gluing, etc). And just like the table saw, Bob can quickly and easily gather up what he needs for use outside the shop.

Room for Extras. A small band saw and a benchtop drill press round out the larger power tools. These are on mobile bases so they can be stored out of the way when they aren't needed.

Woodworkers are a creative and resourceful group. And Bob's basement shop is proof that you can take just about any space and turn it into a place to enjoy your favorite hobby.

TOP VIEW



MASTERING THE
Table Saw

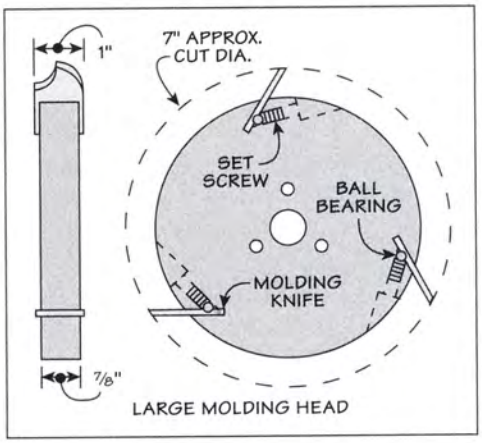
create Custom Profiles

A molding head and a selection of knives are all you need for shop-made molding.

The table saw isn't the first tool that comes to mind when you need to make moldings or profiles. But with the addition of a molding head and interchangeable knives, the table saw proves, once again, that it is one of the most versatile power tools in the workshop.

Table saw molding heads are not new. They've been around for decades. And a molding head is nothing more than a heavy, steel disk with slots for securely mounting replaceable knives. But with the vast number of router bits currently available, however, molding heads aren't as popular as they once were.

But router bits can be expensive, especially when purchasing those with large profiles. So when it comes to larger-scale profiles or long lengths of molding, these heads and their interchangeable knives are hard to beat.



HEADS & KNIVES

The molding heads shown here are from *Corob Cutters*. (Turn to page 51 for purchasing information.) The heads are milled from solid steel blanks and have a substantial feel. This weight helps to maintain momentum while making the cut.

You can see in the photo to the left that the molding heads come in two different sizes. The larger of the two heads was originally designed for saws with limited blade height adjustment.

But because of the way the knives seat in the smaller head, the larger head is necessary when working with a left-tilt table saw.

Knives. What makes molding heads so versatile are the interchangeable knives. *Corob Cutters* makes forty-eight profiles. You can buy them individually or as kits that include up to five different knife profiles.

The kits allow you to combine knife profiles to create complex moldings or stile and rail joinery for cabinet doors. The right margin photo is an example of an ogee crown molding made using three different knives.

Making complex molding isn't necessarily difficult, but establishing the appropriate order for each cut and determining workpiece orientation can be tricky. I'll walk you through making an ogee crown molding as an example.

CUSTOM PROFILES

Creating unique, custom profiles starts with a drawing. That's because working with multiple knives requires establishing where one knife profile ends and another one begins. This determines the overall shape of the final profile. So it helps to use the knives as templates to lay out the final profile on paper first.

Layout. Use that drawing to determine the overall size of the completed profile and then cut the workpiece to rough width. For the ogee crown molding, I left the workpiece extra wide to allow room for clamping the workpiece to a rip fence saddle (main photo, opposite page).

Before making the first cut, lay out the outside dimensions of the profile on the end of your workpiece. Also make a mark indicating the depth of the profile. Adjust the molding head height and rip fence until the knife edges align with the layout lines (Figure 1). Then lock the fence in place.

cutting smoother Cove Moldings

It's not uncommon for a project to require custom cove molding. And making this molding at the table saw is a common task. With the help of a couple of fences to guide your workpiece, you just feed it at an angle over the spinning saw blade. After making several shallow passes, you have what resembles a cove. But the profile generally needs quite a bit of sanding to smooth the curve.

The problem is that a standard saw blade has sharp corners. Using a molding head with cove knives greatly reduces the amount of sanding necessary (photo right). The gentle curve of the knife edge leaves a much smoother finished surface.

► ***Cove Knives.*** *The curved edge of these knives leaves a smooth cut requiring little sanding afterwards.*

Process. The large knives remove a lot of waste, so lower the molding head and make several passes until you reach the final depth. Each cut should be no more than ⅛" deep.

Another thing to keep in mind is that if you need the same profile on multiple workpieces, it's best to cut them all at the same time. This way, you can be sure the profile is consistent on every piece.

The second cut is made with the face of the workpiece flat against the table (Figure 2). You also need to flip the workpiece around end-for-end.

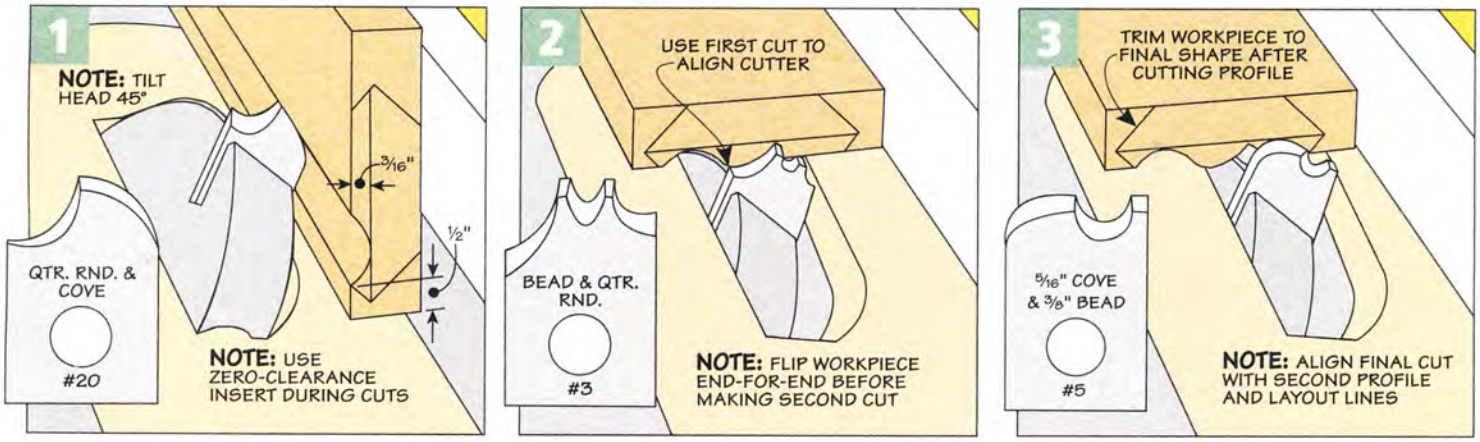
The setup is the same as in the first step with one minor change. This time, you'll use the profile cut from the first knife to help set the rip fence and knife height.

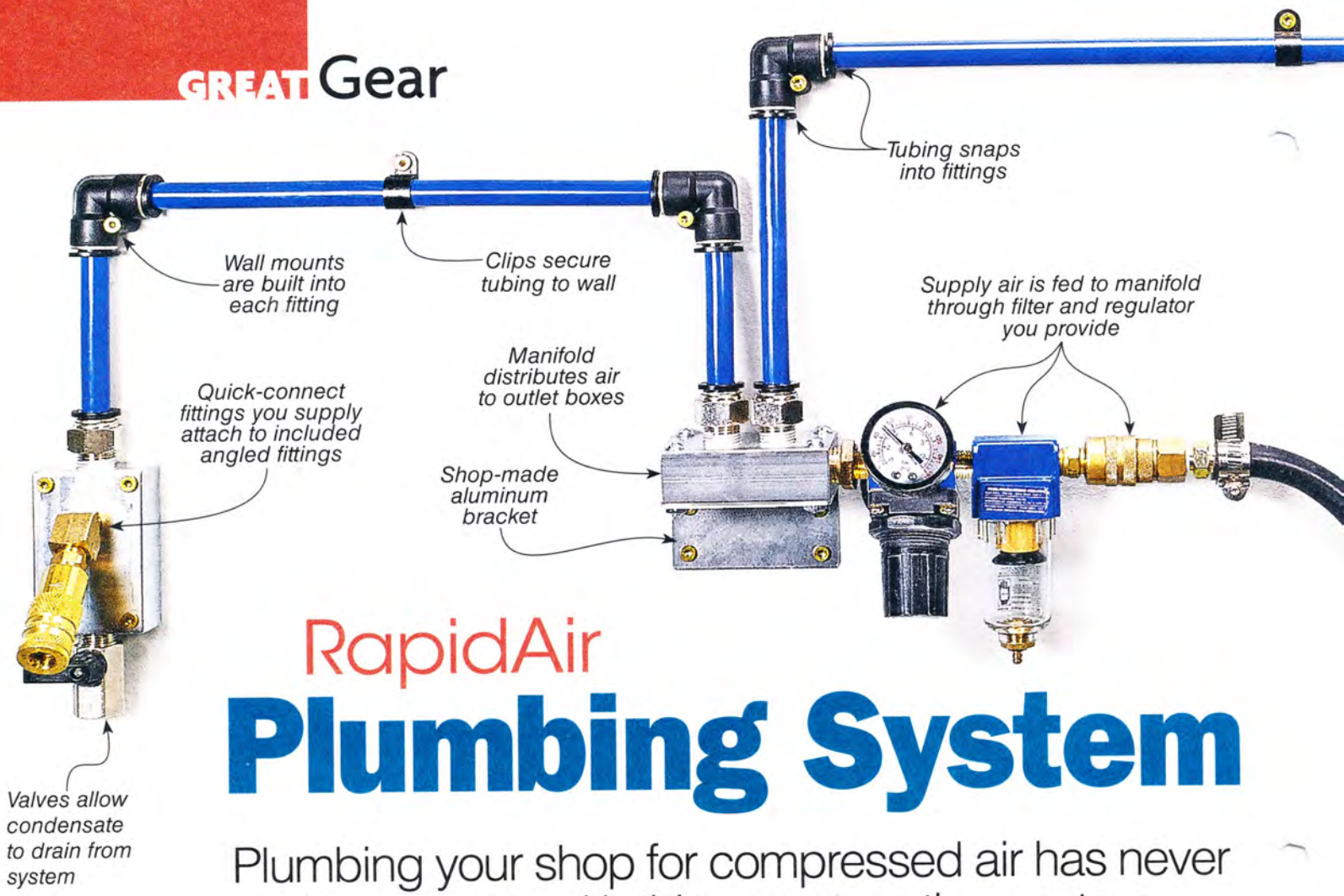
At this point you probably have the hang of the setup process. So follow the same procedure for the last knife, as shown in Figure 3.

The knives generally leave a smooth cut, but the final profile may need a little sanding to remove some of the mill marks.

These heads allow you to mix and match knives to create countless profile variations. This means you can design and make unique molding for your next project.

▲ ***Ogee Crown.*** *Use multiple molding knives to create complex profiles.*





RapidAir Plumbing System

Plumbing your shop for compressed air has never been easier with this snap-together system.

If you use pneumatic tools like nailers, having compressed air right where you need it used to involve a lot of plumbing work. Now, there's an easy and affordable way to plumb your shop for compressed air.

Easy Installation. *RapidAir Products* markets several lines of plumbing systems. These systems range from the inexpensive *RapidAir* system shown here to more robust systems for high-demand applications (see the box on the next page). You'll find a comparison of the tubing in the upper margin photo on the opposite page. All of their systems are easy for one person to install without special tools (refer to Sources, page 51).

RapidAir Master Kit. The system you see here was designed for home workshops and small commercial shops. It's rated for up to 150 PSI. You can buy a master kit that includes a manifold

▲ **Cutter.** *An included tool makes it easy to cut the tubing square for an air-tight fit.*

▲ **Push to Connect.** *To install the tubing, simply push the squared-up end into the fitting until it's firmly seated.*

and two outlet blocks. These are milled from solid aluminum.

The aluminum manifold distributes air to the outlet blocks. The manifold and outlet blocks are predrilled for screws to attach them to the wall.

The kit also includes 100 feet of ½" O.D. (⅜" I.D.) tubing and a variety of fittings. The clips used to secure the tubing to the wall are sold separately. Extra outlets and fittings are also available separately as needed.

In-Wall or Surface-Mount. What I like about this system is that it can be mounted on the wall or inside the wall. So it's easy to install in an existing shop. And if you're building a new shop, you can hide the plumbing for the compressed air system.

The manifold and outlet blocks have ports on the back to use when the plumbing is installed inside the wall. For surface-mounting, simply use the included plugs to plug the hole on the back side of the block.

Start with the Manifold. When installing a compressed air system, I like to start working from the compressor end. So the first order of business is mounting the manifold block near the compressor. As shown in main photo, I made a bracket from aluminum angle to mount the manifold. But before securing it to the wall, I added a regulator, filter, and quick-connect fitting for the compressor hose that supplies the system. If you need to regulate the pressure at each outlet, it's a good idea to install a regulator before each outlet instead of a regulator at the manifold.

Once the manifold is in place, it's an easy task to branch to the outlets using the two ports. I used the straight fittings included in the kit. To prevent leaks, *RapidAir* recommends wrapping the threads with *Teflon* tape and then applying a pipe sealant.

Push to Connect. Since your tools connect to the outlet boxes, I like to mount them in convenient spots around the shop. Then you can go back and plumb between them using the tubing and included fittings. The best part is, the design of the fittings eliminates the hassles of typical plumbing jobs, like sweating copper or threading black pipe.

To install the tubing, all you need to do is first use the supplied cutter to cut the ends of the tubing square. You can see the cutter in the lower left photo, oppposite page.

The tubing is simply pushed into the fitting. Small "teeth" inside the fitting engage the outside of the tubing to lock it in place. The end of the tubing seats against an internal rubber seal. That's why the end of the tubing needs to be cut square and pushed all the way into the fitting (about ¾") to ensure a good seal.

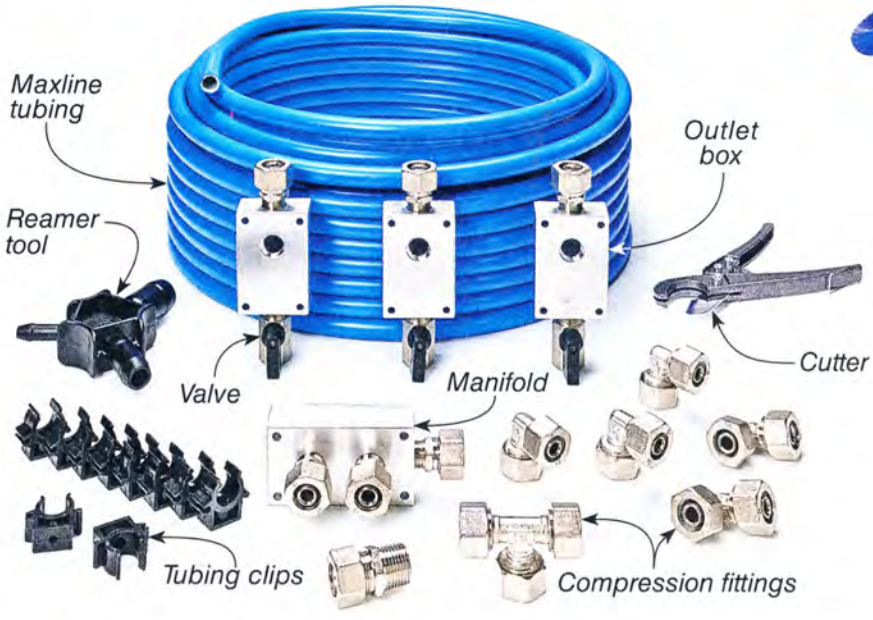
The *RapidAir* kit shown here costs around $140. And the best part is, you can install it in your shop in just a few hours.

▲ ***Tubing.*** *Maxline tubing (below) can handle higher pressure than RapidAir tubing (above).*

a step up
Maxline

If your shop tools consume large volumes of air, you may want to consider the *Maxline* system from *RapidAir Products*. It's available in ½", ¾", and 1" tubing sizes. The system is rated for up to 175 PSI. The 100-ft. ½" Master Kit you see at right starts at around $180. The 100-ft. ¾" Master Kit is $250. The components for a 1" system aren't sold in kit form but are sold separately.

The compression fittings are easy to install with common tools. The kit includes a heavy-duty cutter and a reamer for cleaning up the inside edge of the tubing. This ensures a tight seal on the O-ring on each fitting.



questions from
Our Readers

workshop Rewire

I have the opportunity to rewire my garage shop. What things should I consider beforehand?

Danny Ray Allison, Jr.
Palestine, Texas

Outlet Placement. *Spacing wall outlets evenly along the length of each wall allows you to easily rearrange the location of your tools. And locating them high on the wall provides easy access above most worksurfaces.*

Rewiring a garage or any other space for a shop can be a daunting task. There are a number of factors to consider. And when it comes to electricity, you want to make sure it's done right.

Whether you're doing the work yourself or hiring an electrician, the first step is to plan the electrical layout of your shop. Here are a few details to keep in mind.

Electrical Usage. A key consideration is determining the total electrical usage needs of the shop. This refers to the electrical draw of each power tool and accessory, and will help your electrician determine the amp-service requirements for the shop. In some cases, this may mean that you need to increase the service amps available.

Adding Circuits. Even if the total amps available are sufficient for your shop, you may still need to increase the number of circuits in your existing service panel or add a sub-panel. This is because more than one machine may be in use at the same time. For example, your dust collector will generally be on when using a tool. So you'll want to make sure it's on a separate circuit.

Other items you may want to have on separate circuits include an air compressor and a heater or air-conditioning unit. It's always best to have your shop lighting on a separate circuit as well. You don't want to be left in the dark if you happen to trip a breaker while using a power tool.

This is also a good time to incorporate any 220-volt circuits. Even if your current tools don't require it, there's a good chance that you'll want one in the future.

Locating Outlets. Ultimately, each circuit will include one or more wall outlets. Where to locate these outlets, and how to divide them among your circuits, can require some forethought.

The goal is for each tool to have an outlet nearby. But if you don't have an established layout for all your tools, then where to begin? And what if you decide to rearrange your shop in the future? (It'll happen, trust me.)

The solution that's worked for me is to evenly space the outlets every 4' along the length of each wall (photo above). Another good idea is to locate them high enough up the wall to clear the top of most worksurfaces and stationary tools. 42" is a good height for this.

I also like to include an outlet in the ceiling for a pull-down extension cord reel as shown in the photo at left. And since a future redesign may shift tools from one wall to the next, you may want to include at least one 220-volt outlet on each wall.

Once you have your basic game plan, consult your electrician. He may be able to give you other ideas and advise you on any local codes to consider.

Ceiling Outlet. *A ceiling outlet can be handy for installing an extension cord reel.*

Sources

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

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

ROUTING DADOES *(p.8)*

- **Router Bit World**
  - *15/32" Plywood bit* 45223
  - *23/32" Plywood bit* 45231
  - *12mm Plywood bit* 04-524
  - *18mm Plywood bit* 04-548

CRB7 ROUTER BASE *(p.10)*

- **Rockler**
  - *Router Base* 45924
  - *Edging Trim Kit* 45052

PLASTICS *(p.12)*

You can find a variety of plastics at home centers, hardware stores, or online at *U.S. Plastic Corp.* and *McMaster-Carr.*

TOOLBOX *(p.14)*

I wanted to give the toolbox a look that closely matched the color of the antique version it was based on. So I stained it with *Varathane's Gunstock* stain. Then I applied a couple coats of spray lacquer to protect it.

- **Lee Valley**
  - *Brass Handle* 00W58.90
  - *Brass Hinges* 00D02.01
  - *Brass Hinge Screws* 91Z04.02
  - *Brass Screws* 91X06.09
- **Rockler**
  - *Darkening Solution* 34477

SHOOTING BOARD *(p.18)*

- **McMaster-Carr**
  - *1/2" x 3/4" UHMW* 8702K493
  - *1/4" x 2" UHMW* 8702K467
  - *3/4" Studded Knob* 6079K14
  - *1 1/2" Studded Knob* 6079K23
  - *1" Threaded Knob* 6333K2
  - *3/8" Black Washer* 92140A118
  - *3/4"-dia. Steel Rod* 5227T282

MULTIFUNCTION TABLE *(p.28)*

- **Lee Valley**
  - *1/4" T-track, 3'* 12K79.24
  - *1/4"-20x1 1/2" Flng. Bolts* 12K79.71
  - *2" Bar Knob* 00M55.10
  - *36" Piano Hinge* 00N01.31
  - *2 3/8" Bench Pups* 05G04.04
  - *Wonder Pup* 05G10.02
  - *Hold-Down Clamps* 16F02.10

SHOP CART *(p.34)*

- **McMaster-Carr**
  - *3" Swivel Casters* 2426T55
  - *Steel Shaft* 1346K19
  - *Thrust Bearings* 6655K17
  - *Sleeve Bearings* 2868T9
  - *Rare-Earth Magnets* 3506K25

MOLDING HEADS *(p.46)*

- **Corob Cutters**
  - *Small Head* MHKHD50
  - *Large Head* MHKHD75
  - *Knife Combo Kit* LO2

AIR SYSTEMS *(p.48)*

- **Rockler**
  - *1/2" RapidAir Master Kit* . . 42908
  - *1/2" Tubing Clips* 42921
  - *3/4" MaxLine Master Kit* . . 46287
  - *3/4" Tubing Clamps* 44666
- **The Home Depot**
  - *1/2" MaxLine Kit* 203478264

MAIL ORDER SOURCES

Woodsmith Store
800-444-7527

Rockler
800-279-4441
rockler.com

Corob Cutters
800-745-9895
corobcutters.com

The Home Depot
800-466-3337
homedepot.com

Lee Valley
800-871-8158
leevalley.com

McMaster-Carr
630-600-3600
mcmaster.com

RapidAir
800-954-3310
rapidairproducts.com

Reid Supply
800-253-0421
reidsupply.com

Router Bit World
888-688-2260
routerbitworld.com

U.S. Plastic Corp.
800-809-4217
usplastic.com

Woodcraft
800-225-1153
woodcraft.com

ShopNotes

Multifunction Worktable

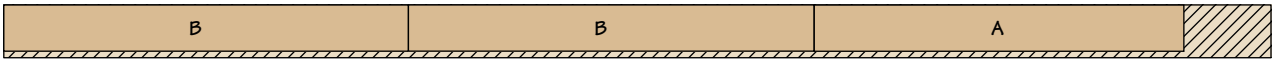
Materials List

A	Leg Outside Layers (4)	¾ x 3½ - 27¼
B	Leg Inside Layers (4)	¾ x 3½ - 30¼
C	Rails (2)	¾ x 3 - 31
D	Shelf Hinges (4)	1 x 1 - 6 Alum. Angle
E	Shelves (2)	8⅝ x 23⅞ - ¾ Ply.
F	Shelf Supports (2)	¾ x 1 - 15¼
G	Table Center (1)	6 x 36 - ¾ Ply.
H	Table Leaves (2)	12 x 36 - ¾ Ply.
I	Braces (4)	1 x 1 - 15 Alum. Angle
J	Brackets (4)	1 x 1 - 2½ Alum. Angle

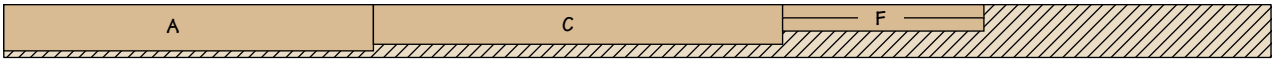
- (2) 3½" x 3½" Butt Hinges
- (4) 15" T-track w/Screws
- (4) ¼"-20 x 1" Flange Bolts
- (4) ¼" x 1½" Lag Screws
- (8) ¼" Washers
- (1) 1½" x 24" Continuous Hinge
- (1) 1½" x 36" Continuous Hinge
- (20) #8 x ¾" Rh Woodscrews
- (12) #8 x 1½" Fh Woodscrews
- (4) ¼"-20 x ¾" Fh Machine Screws
- (4) ¼"-20 Lock Nuts
- (4) ¼"-20 Bar Knobs

Cutting Diagram

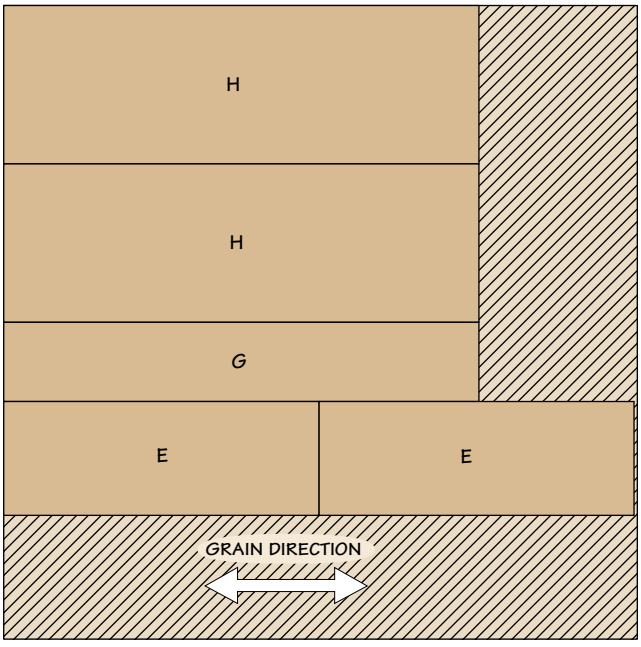
¾" x 4" - 96" HARD MAPLE (TWO BOARDS @ 2.67 Bd. Ft. EACH)



¾" x 4" - 96" HARD MAPLE (TWO BOARDS @ 2.67 Bd. Ft. EACH)



48" x 48" - ¾" BIRCH PLYWOOD



ShopNotes

Storage Cart

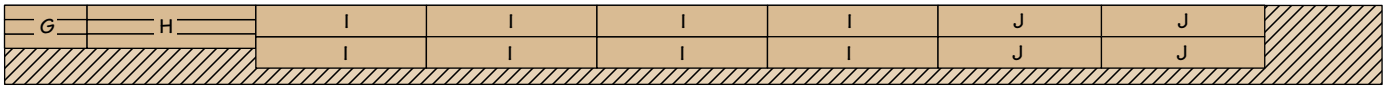
Materials List

A	Top/Bottom (2)	18½ x 18½ - ¾ Ply.
B	Upright (1)	18½ x 25 - ¾ Ply.
C	Divider (1)	12½ x 25 - ¾ Ply.
D	Sides (2)	5¾ x 24½ - ¾ Ply.
E	Lip (1)	¾ x 94 rgh. - ¼ Hdbd.
F	Shelves (2)	6 x 12½ - ¾ Ply.
G	Shelf Ends (3)	½ x 1 - 5¾
H	Shelf Sides (3)	½ x 1 - 11¾
I	Small Drawer Ends (8)	½ x 2³⁄₁₆ - 11⅞
J	Small Drawer Sides (8)	½ x 2³⁄₁₆ - 11⅜
K	Drawer Bottoms (7)	11¼ x 11⅜ - ¼ Hdbd.
L	Corner Blocks (14)	½ x 3 - 3
M	Large Drawer Ends (6)	½ x 4⅝ - 11⅞
N	Large Drawer Sides (6)	½ x 4⅝ - 11⅜
O	Magnet Strip (1)	³⁄₁₆ x 2 - 24½
P	Plate (1)	³⁄₁₆ x 1 - 2

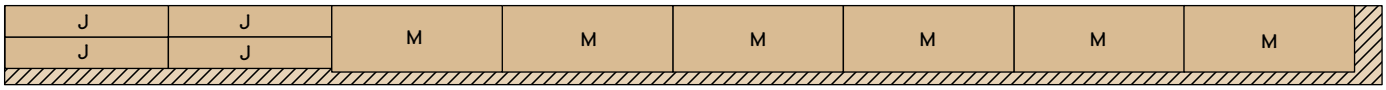
- (8) #8 x 1½" Fh Woodscrews
- (4) 3" Locking Swivel Casters
- (16) #12 x ¾" Sheet Metal Screws
- (16) #12 Flat Washers
- (5) ½" x 17" - ⅛" Aluminum Bars
- (5) 1" x 17" - 1⁄16" Aluminum Bars
- (22) #6 x ⅝" Fh Woodscrews
- (20) 4" Plastic Parts Bins
- (1) ½"-Dia. x 25¾" Steel Shaft
- (14) ½" I.D. x ½" Sleeve Bearings
- (7) ½" Thrust Bearings w/Washers
- (7) ⅝" Rare-Earth Magnets, Cups, and Washers

Cutting Diagram

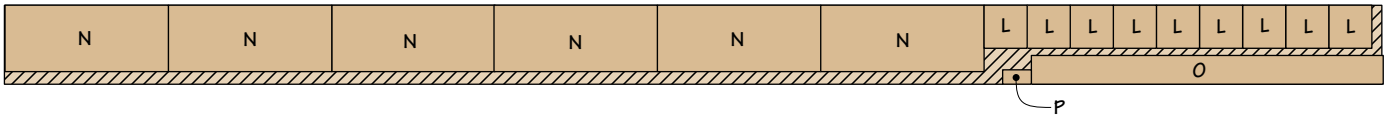
½" x 5½" - 96" HARD MAPLE (3.7 Sq. Ft.)



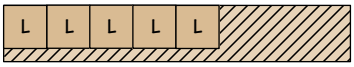
½" x 5½" - 96" HARD MAPLE (3.7 Sq. Ft.)



½" x 5½" - 96" HARD MAPLE (3.7 Sq. Ft.)



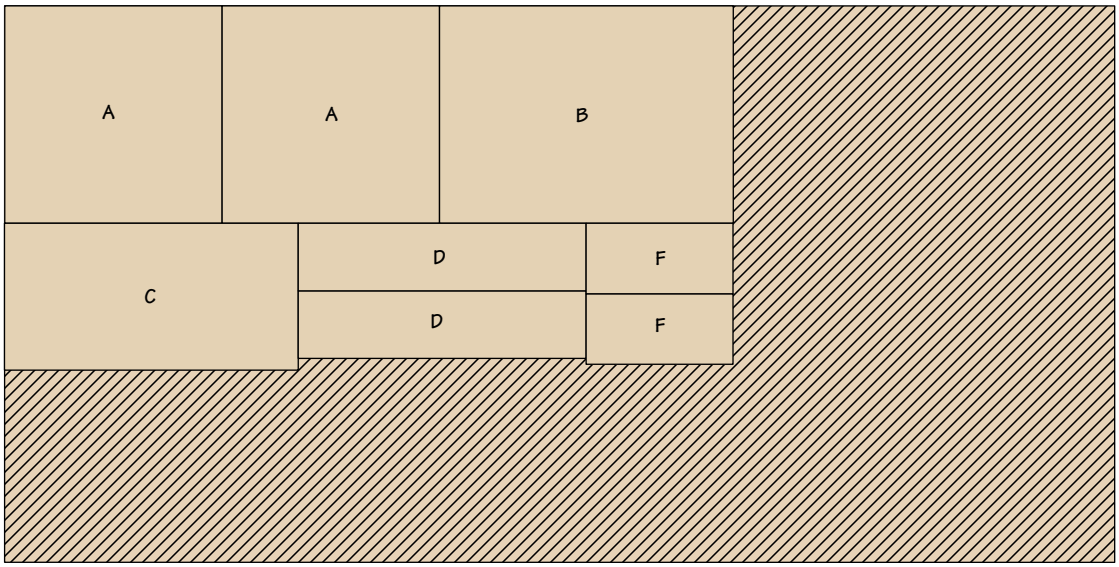
½" x 4" - 24" HARD MAPLE (.7 Sq. Ft.)



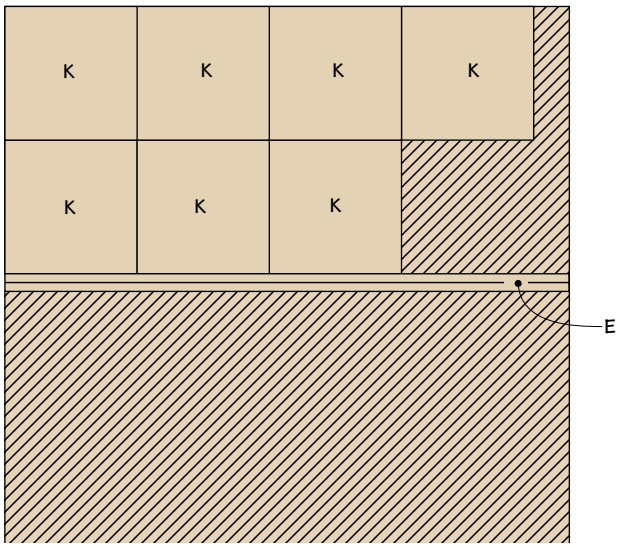
NOTE: PARTS O AND P ARE PLANED TO ³⁄₁₆" THICK

Cutting Diagram cont.

48" x 96" - ¾" BIRCH PLYWOOD



48" x 48" - ¼" HARDBOARD



Scenes from the Shop

Like a workshop sidekick, this small cart holds all the tools, accessories, and supplies you need while building a project. You'll find detailed plans starting on page 34.

Here's a new take on the standard sawhorse. Lift the leaves on each side to create a large worksurface. The whole thing folds up for compact storage. Plans start on page 28.