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ShopNotes

Vol.18 Issue 105

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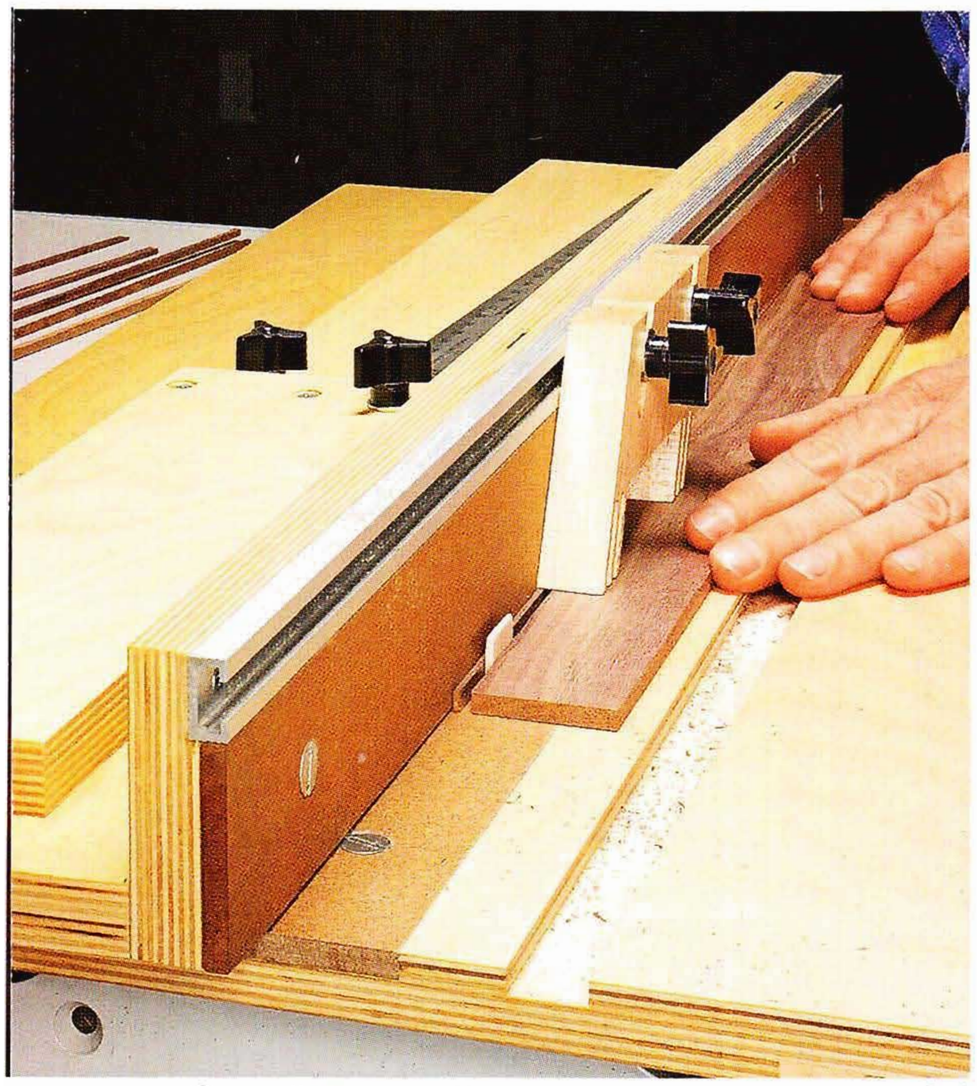

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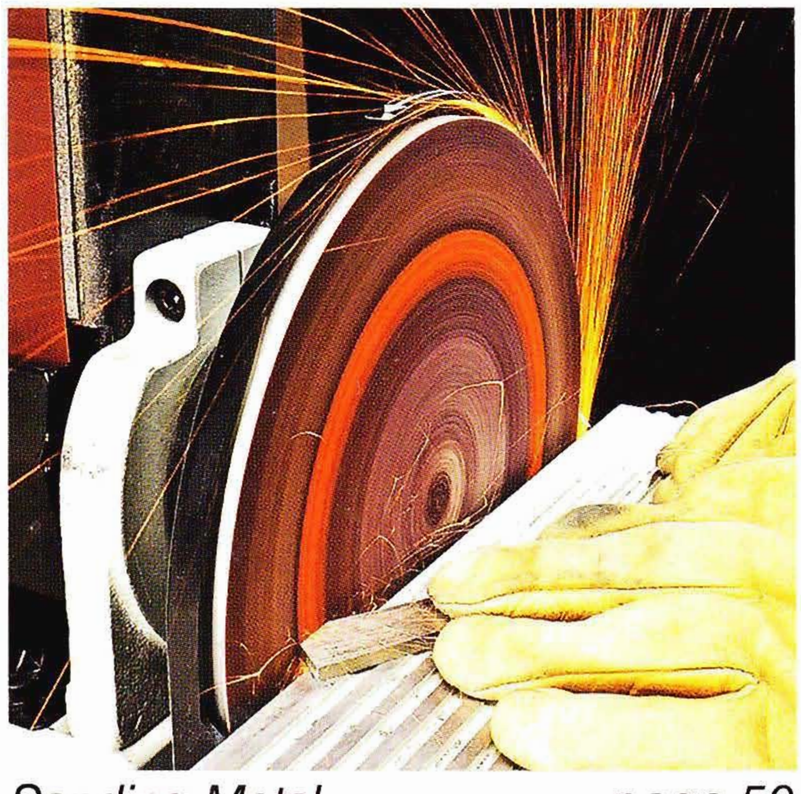

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Cutoffs

It's no secret that storage projects generate a lot of interest among woodworkers. It's a simple fact, we could all use more storage. In this issue, you'll find a couple of solutions to the problem — for large or small needs.

Take a look at the photo at left for a versatile approach. The concept behind this modular storage system is to create easy-to-build components that you can mix and match. This way, you build what you need to suit the space at hand. And if your needs change, simply add a new component (or two). Plus, the heavy-duty worksurfaces are a great addition to any shop.

We didn't leave small needs unanswered either. Chris Fitch, one of our designers, came up with a great way to store sharpening stones. You know, the ones you have sitting on a shelf or in a drawer where they can get chipped or cracked. Well, his solution (page 42) only requires a couple scraps of wood and an afternoon to make. And it's easy to customize the look of each box.

On page 34 you'll read about a unique jig for your table saw that allows you to accurately cut small-scale workpieces. And speaking of accuracy, check out the shop-made layout and measuring tools starting on page 16. These classic tools answer big-time needs. The construction is easy, but they will last for generations.

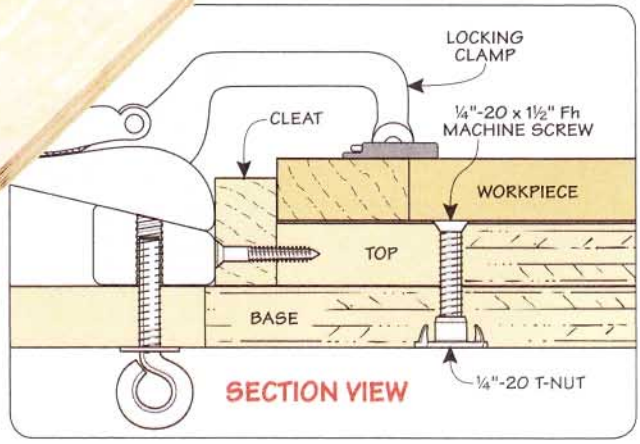
There's a lot going on and we wanted to include even more. Our solution? We've provided the extras online at *ShopNotes.com*.

Terry

ShopNotes GO ONLINE EXTRAS

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

Tips for Your Shop



Easy Clamping Station

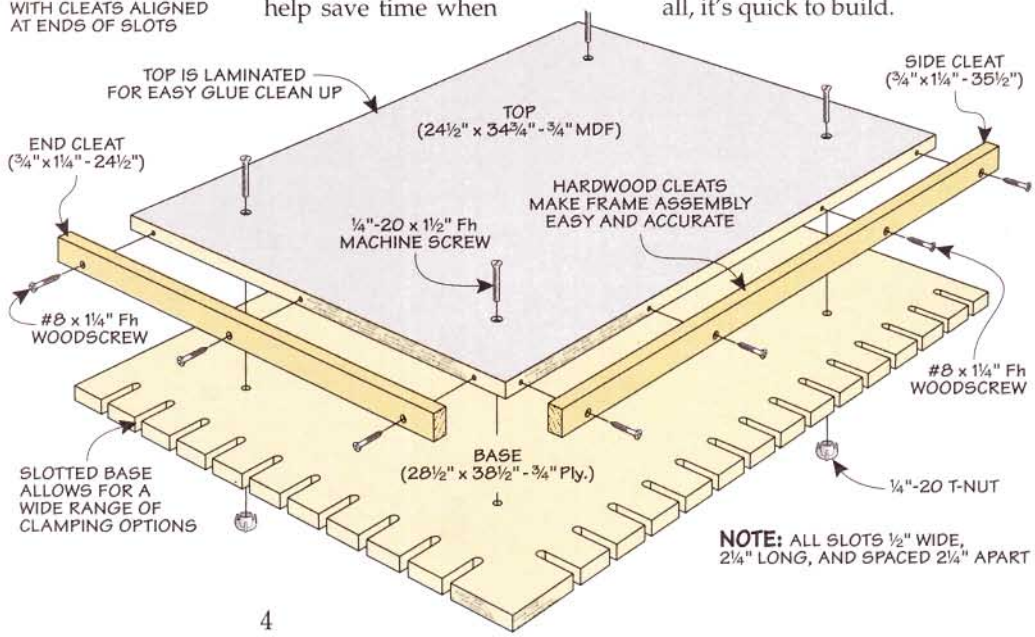
Over the years, I realized that I spend a lot of time doing repetitive tasks, like clamping and unclamping the workpieces or project I'm working on. Recently, I sat down to design something that would help save time when building a project that involves a lot of clamping. The result is shown in the drawings and main photo. This clamping station has proven to be versatile and a big helping hand in the shop. Best of all, it's quick to build.

It starts with a plywood base. Slots along two edges are designed to house bar clamps or locking clamps typically used on a drill press table (photo and detail above). I cut the slots using a router and a shop-made template for consistent size and spacing.

Next comes the top. For this, I used plywood with laminate for a smooth, easy-to-clean worksurface. A couple of hardwood cleats on two edges finish it up. The cleats make it easy to assemble and square up frames of all types.

To use the clamping station, I set it on my benchtop so the slots overhang the edges of the bench. The slots accommodate a wide range of clamps, including bar clamps, for seemingly endless clamping options.

Serge Duclos
Delson, Québec



Work Sharp Disk Storage

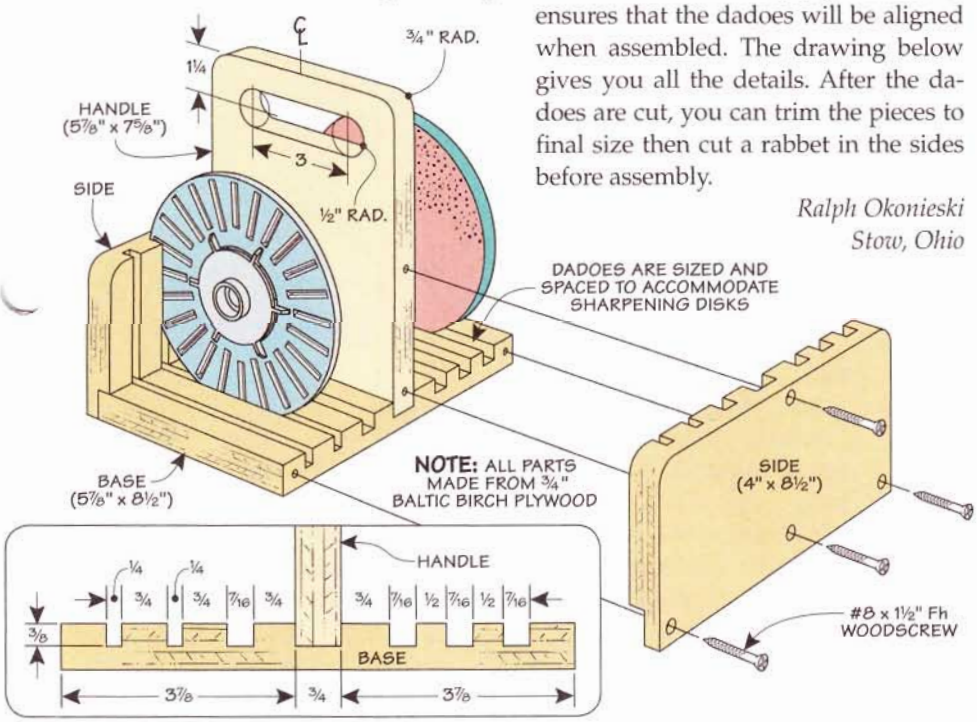
Since purchasing a *Work Sharp 3000* sharpening system, it rarely leaves my benchtop. I use it all the time to touch up the edges of my chisels and plane irons.

The only problem I've had is where and how to store all of the sharpening disks. I don't want to risk chipping or breaking the glass or slotted plastic disks. The holder you see above solves the problem. It stores the disks safely and securely.

The holder consists of a bottom, two sides, and a handle for portability. Dadoes are sized to hold the disks securely and protect them from damage. The center dado captures the handle.

To build the holder, I started with an extra-wide blank of ¾" plywood. This ensures that the dadoes will be aligned when assembled. The drawing below gives you all the details. After the dadoes are cut, you can trim the pieces to final size then cut a rabbet in the sides before assembly.

Ralph Okonieski
Stow, Ohio



Submit Your Tips Online!

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

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SUBMIT A TIP

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

ShopNotes

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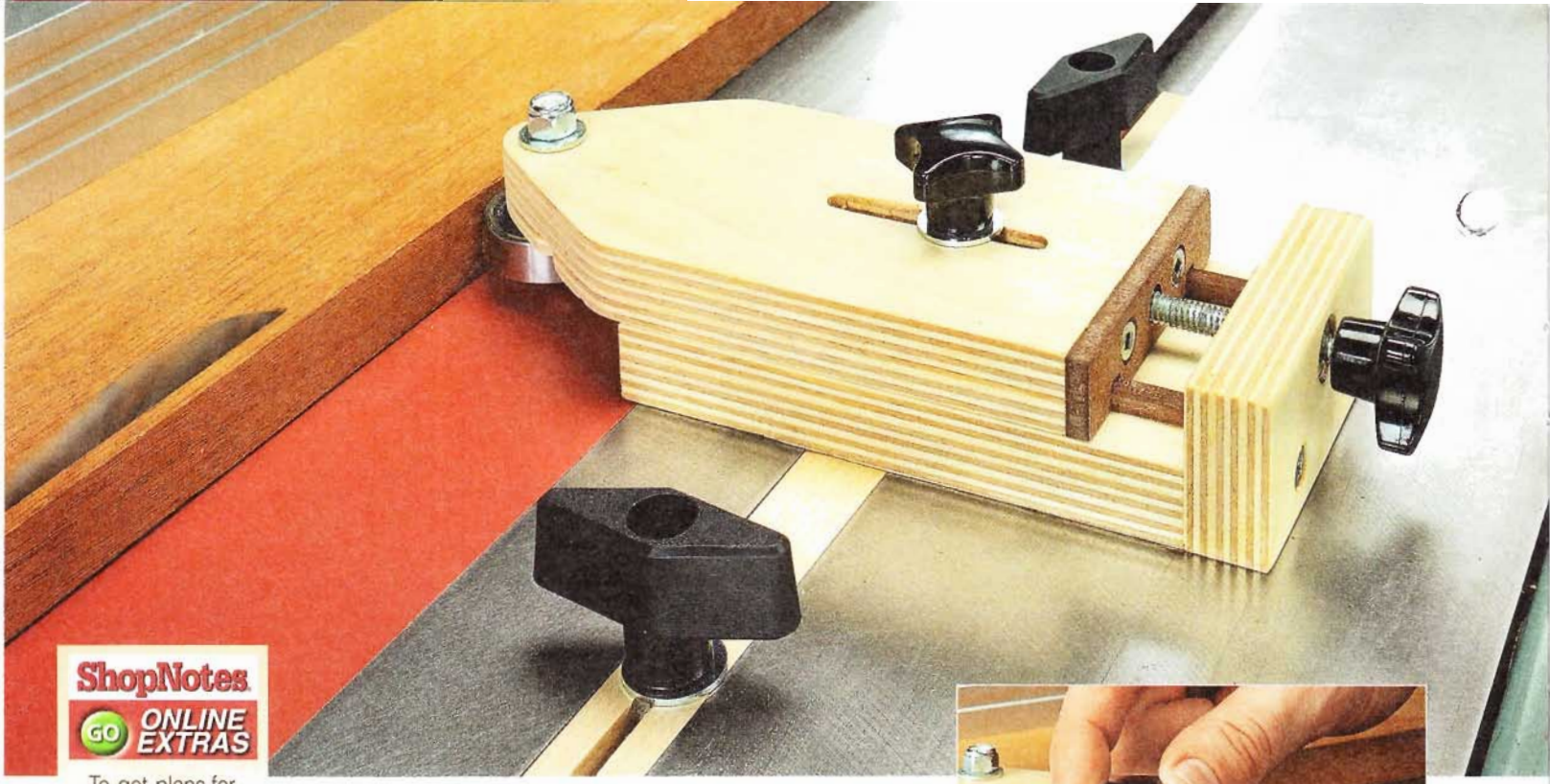

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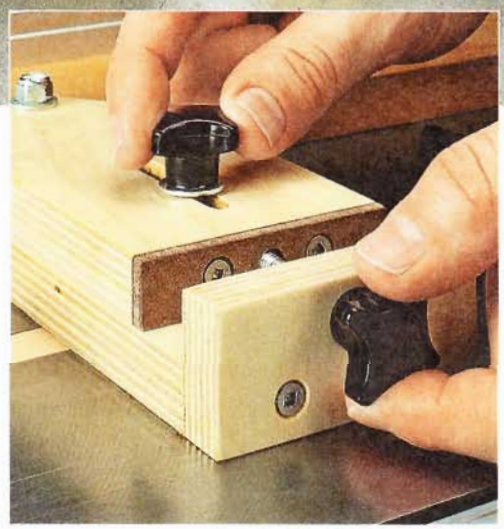
To get plans for the original jig from Issue 94, go to: ShopNotes.com

Micro-Adjust Thin Strip Jig

In *ShopNotes* No. 94, you featured a handy shop-made jig used for ripping thin strips to a consistent width. It's a great jig and I use it all the time. But I wanted a way to easily adjust and fine-tune the thickness of my workpiece. I modified the design to add a micro-adjust feature. Some simple hardware is all you need to make it work.

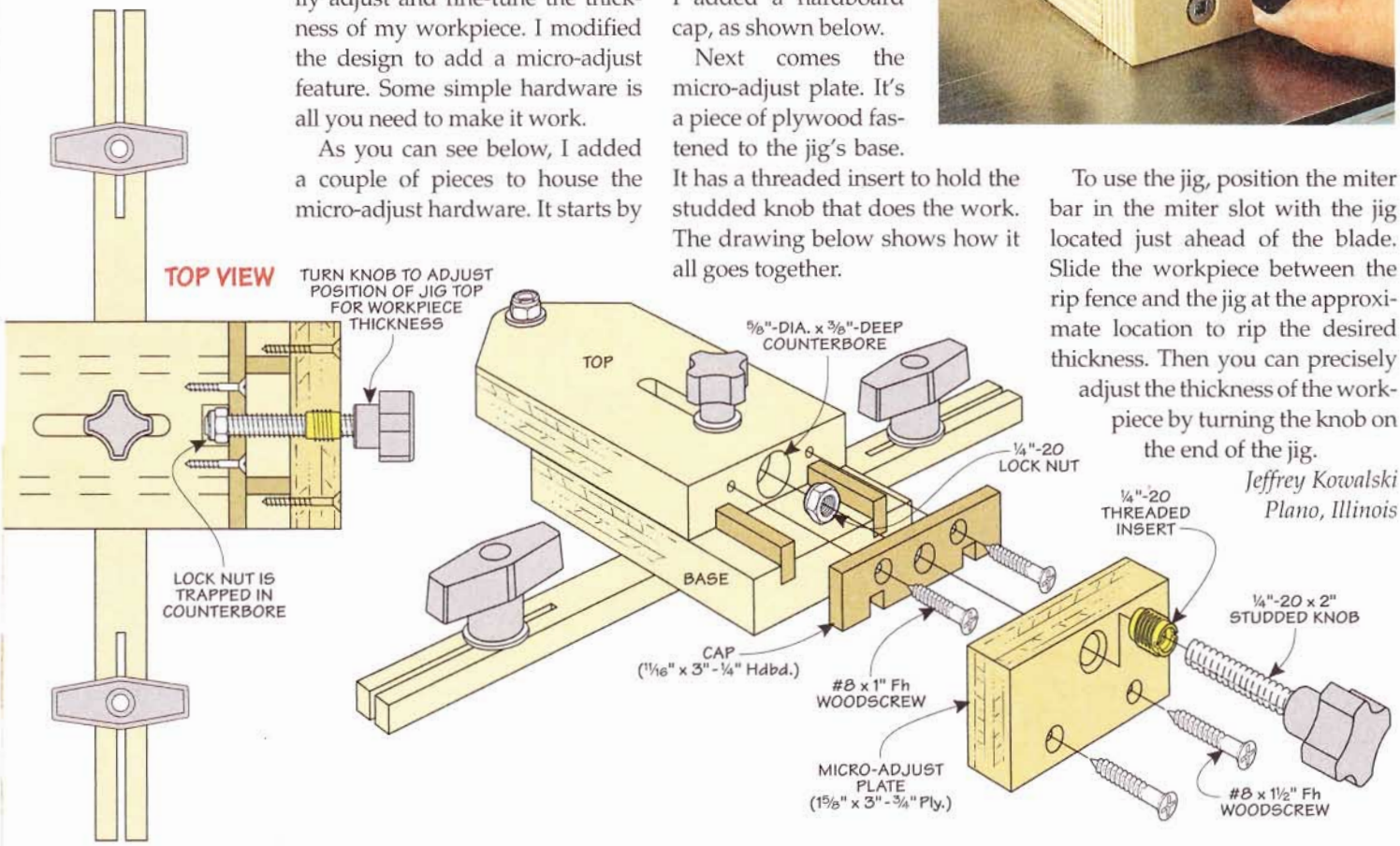
As you can see below, I added a couple of pieces to house the micro-adjust hardware. It starts by drilling a counterbore in the back of the jig's top. This houses a lock nut that spins freely. To trap the nut in place, I added a hardboard cap, as shown below.

Next comes the micro-adjust plate. It's a piece of plywood fastened to the jig's base. It has a threaded insert to hold the studded knob that does the work. The drawing below shows how it all goes together.



To use the jig, position the miter bar in the miter slot with the jig located just ahead of the blade. Slide the workpiece between the rip fence and the jig at the approximate location to rip the desired thickness. Then you can precisely adjust the thickness of the workpiece by turning the knob on the end of the jig.

Jeffrey Kowalski
Plano, Illinois



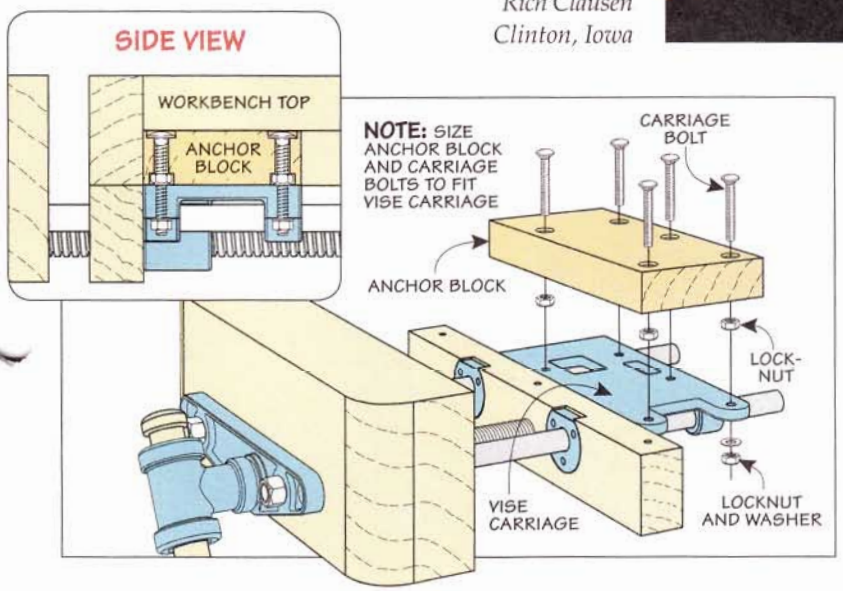
Baking Pan Drawers

My small shop was quickly running out of storage space. I was scratching my head trying to come up with some way to add more storage cubbyholes or drawers on or near my workbench. I settled on the idea of hanging drawers under the benchtop.

About this time my wife was replacing some of her baking pans. That's when it occurred to me that these were the ideal solution to my storage problem.

Almost all metal baking pans have lipped top edges. So I made two runners with a groove that captures the lip of the pan and fastened them under the bench top (inset photo). I've discovered they make ideal tool drawers, as you can see in the photo at right. I've filled them up with pens, pencils, layout tools, and other miscellaneous items. Best of all, the drawers didn't cost me a dime.

Rich Clausen
Clinton, Iowa



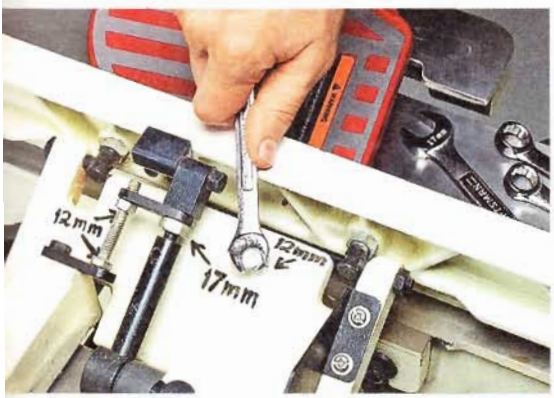
Face Vise Anchor Block

After building a workbench, I was faced with the task of adding a face vise. Typically, it's attached to the underside of the benchtop with lag screws. But lag screws tend to work loose over time.

Instead, I made an "anchor block" like you see at left. Carriage bolts and nuts fit into through holes and counterbores in the top and bottom of the block. They're positioned to mate with the holes in the vise carriage. The block is fastened with glue and screws to the underside of the benchtop. Slip the vise over the bolts and secure it with washers and lock nuts.

Jim Reynolds
Clive, Iowa

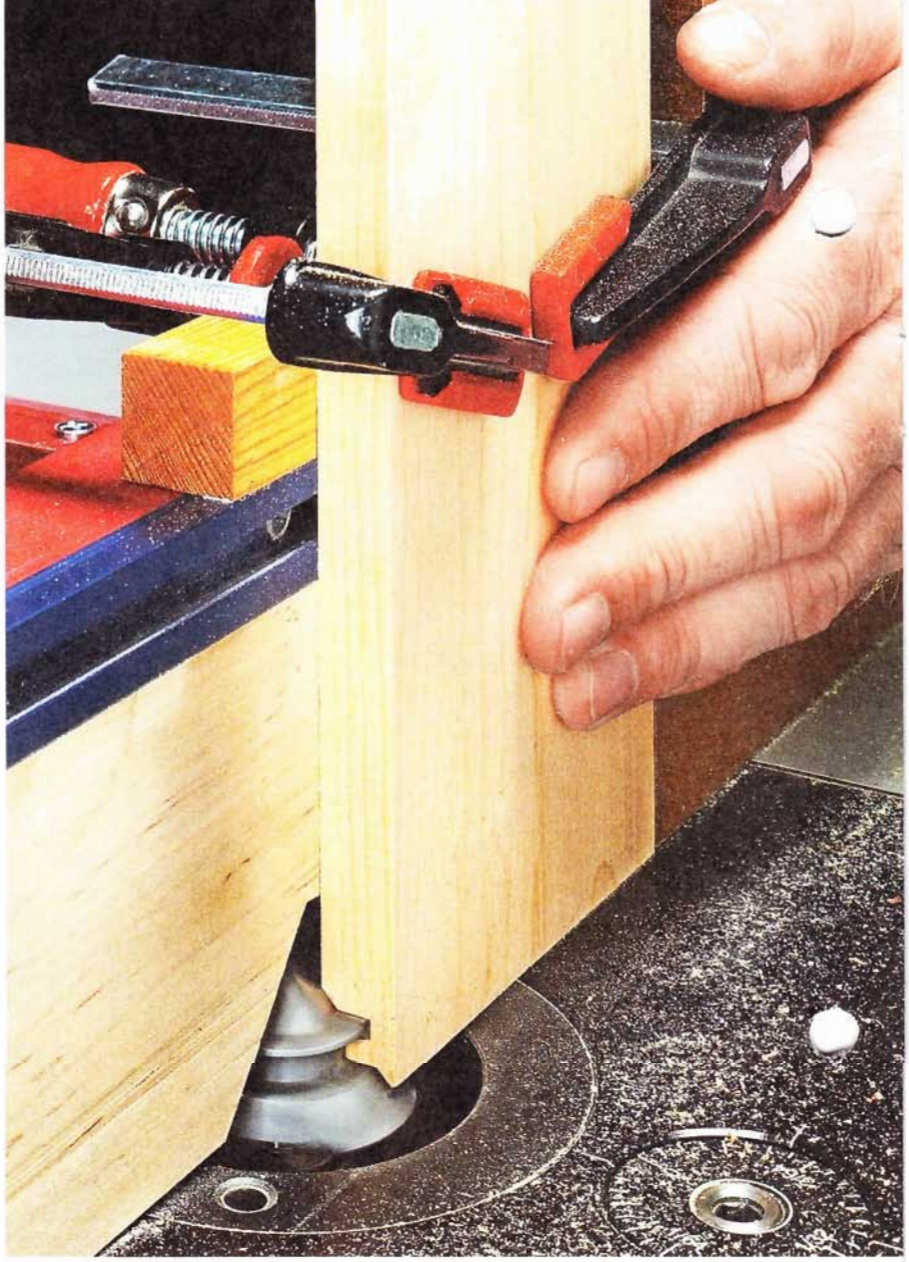
Quick Tips



▲ *To end the guesswork of which wrench fits a bolt or nut on a machine,* ***Ross Henton*** *of Frisco, Texas uses a permanent marker to label the fastener with the proper wrench size.*

Christine Maxey *of Westerville, Ohio uses a paint can opener as a flat-blade screwdriver when working in tight areas.*

mastering Lock Miter Bits



Miter joinery is deceptively simple. All you have to do is make a 45° cut on the ends of a couple of workpieces and glue them together. The result is supposed to be a clean joint line where the grain seems to wrap around the corner.

Miter Troubles. But there are a couple of challenges you may run into. The first is cutting the miter at a perfect 45°. If the angle is off — even a small amount — the joint won't close tightly.

Another trouble spot is gluing the joint together. Since the mating edges are flat, they can slide around once you apply the glue. Plus, it always seems to take a lot of clamps and assembly aids to hold the corners square.

Router Solution. In the end, even though miter joints look great, many woodworkers avoid using them. If that's your experience, a lock miter bit and a router table could change your mind.

To get an idea of how this bit solves miter joint problems, take a look at the photos at left. Like a chamfer bit, it cuts a perfect 45° miter automatically. (This bit can be used on stock up to ¾" thick.)

What really sets the bit apart is the zig-zag "tongue and groove" section in the middle. This feature creates a self-aligning joint with a good mechanical lock and increases the glue surface. Since ordinary miter joints form rather weak, end-grain joints, the added surface strengthens the joint.

Secret is Setup. To create the mating profiles, each workpiece is cut in a different orientation. Half of the joint is cut with the workpiece lying flat on the router table.

For the other half, the workpiece is held vertically and routed using the same fence and bit setting. And the setup process can be broken down into two steps.

SETTING THE BIT HEIGHT

I find it's easier to dial in the bit height first and then tackle the fence setting. To get things started, you'll need to roughly set the bit and fence and then make a test cut.

To do this, I set the bit so that the centerline of the bit is roughly centered on the thickness of the workpiece. The fence is positioned so that it leaves a small flat on the end of the workpiece.

A Stronger Miter Joint. *The interlocking tongue and groove profile creates a self-aligning joint.*

Lock Miter Bit
(For bit sources, turn to page 51)

Now comes the test cut. Start with two pieces that match the thickness of your project. Then rout a profile on one end with both pieces lying flat on the table, as shown in the photo at right.

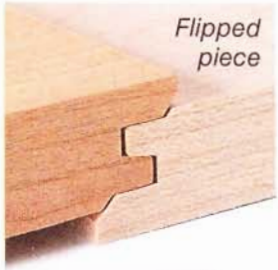
Flip one of the pieces over and fit the joint together. You're looking for the faces to be flush. If this works on the first try, you might want to go out and buy a lottery ticket. Because more than likely, the faces won't be flush. The detail photos in the upper right margin show the two possible outcomes.

From here, you simply adjust the bit height and make another test cut. Keep in mind that any adjustment you make is "doubled" when you fit the joint together. So make small adjustments to the bit height and make another set of test cuts.

Chances are you'll get the pieces fitting after making one or two more adjustments. Once this is done, you can move on to fine-tuning the fence.

Set Bit Height, First. *To set the bit height, rout a profile on two test pieces held face down on the router table.*

BIT TOO HIGH



BIT TOO LOW

ADJUSTING THE FENCE

The process to tweak the fence is similar to setting the bit. The only difference is instead of routing the workpieces flat on the table, they're held vertically against the fence.

Since I intentionally positioned the fence too close to the bit, the result should look like the first detail photo below. And to hold the workpiece steady, I like to use the sled shown in the lower left photo and the box at the lower right.

Once again, adjust the fence position in small increments until the faces are flush and you have a fine, razor edge on the end of each piece. (You'll know the fence is set too far back if the cut shortens the length of the workpiece.)

I like to double-check my setup by cutting a complete test joint, as shown in the margin photo on the opposite page. These pieces can then serve as setup blocks the next time you use the bit.

The payoff for going through the setup process comes when routing the actual workpieces. But before you do, be sure to mark the inside face of each piece. The inside face is held down against the table or against the fence. It's easy to get things mixed up while routing — trust me, I know.

Also be sure to rout each end of a workpiece in the same orientation. For example, cut the front and back of a drawer with both ends face down on the table. Rout the sides vertically against the fence.

Finally, keep the workpiece firmly pressed against the fence or table. This guarantees the cut will be consistent. The end result is a drawer or box with perfect-fitting locking miter joints.

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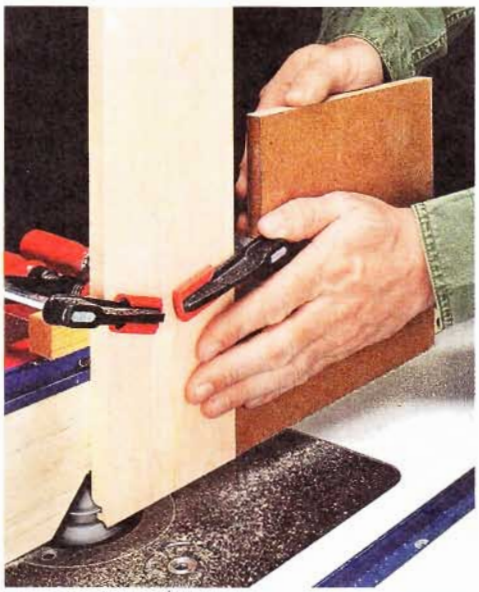
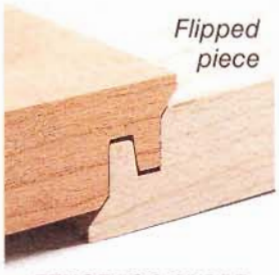
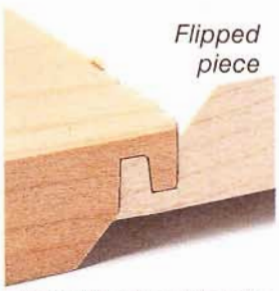


Fine-Tune Fence. *Rout a pair of test pieces vertically to adjust the fence setting.*



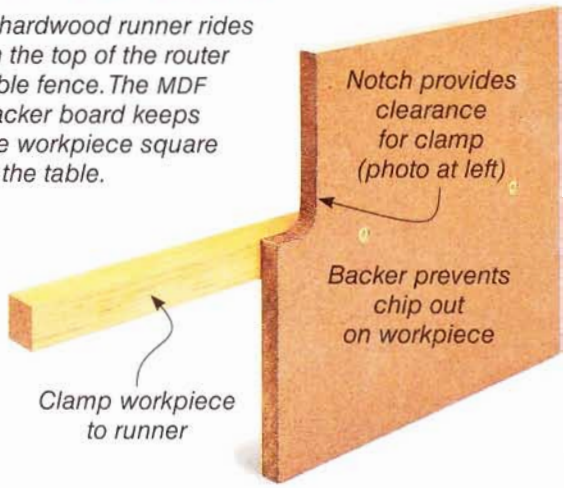
FENCE TOO CLOSE



FENCE TOO FAR BACK

Fence Sled

A hardwood runner rides on the top of the router table fence. The MDF backer board keeps the workpiece square to the table.



The right knobs for your shop-made projects can make all the difference.

must-have Jig & Fixture Knobs

When building a jig for the shop, it's not uncommon to go to the "junk drawer" and use whatever hardware you have on hand. And that includes the knobs used on jigs and fixtures. But taking the time to choose the right knob for the application can make a good jig a lot better. Here are a few things to keep in mind for your next jig.

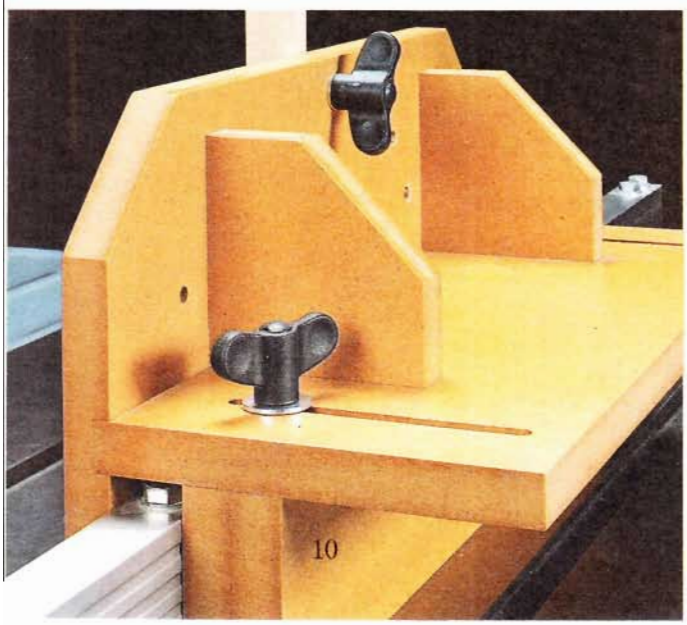
ERGONOMICS

When choosing a knob, one of the considerations is how "user-friendly" the knob is. If the knob is uncomfortable to use, it will only lead to frustration.

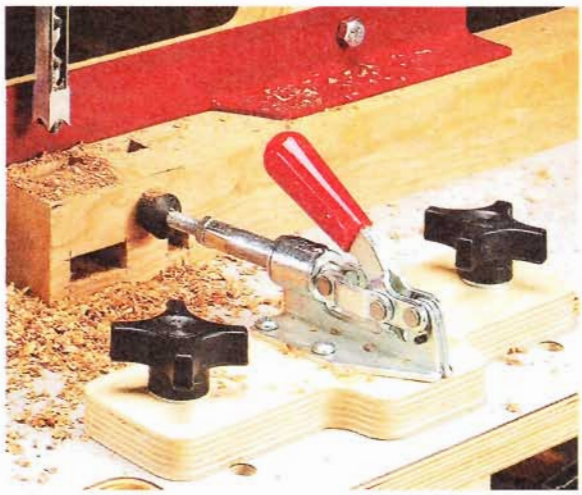
The Right Size & Shape. Take the large wing knobs shown in the lower left photo, for example. They allow you to apply a lot of torque to securely position the jig and the workpiece. The same goes for the five-star knob shown at the back of the router fence in the photo above. It's large size means I can tighten the fence securely to keep it from creeping as I work.

In the photo of the featherboard on the opposite page, you'll see a pair of wing knobs there, as well. They allow you to tighten the featherboard so it maintains adequate pressure against the face of the workpiece without slipping.

Contrast the wing knobs with the four-star knobs shown on the stop block above and the clamp base below. Here, you don't need a lot of torque, so their size and shape is perfectly adequate for the job. They're available in a range of sizes, but the smaller ones don't take up a lot of space on your jigs or get in the way.



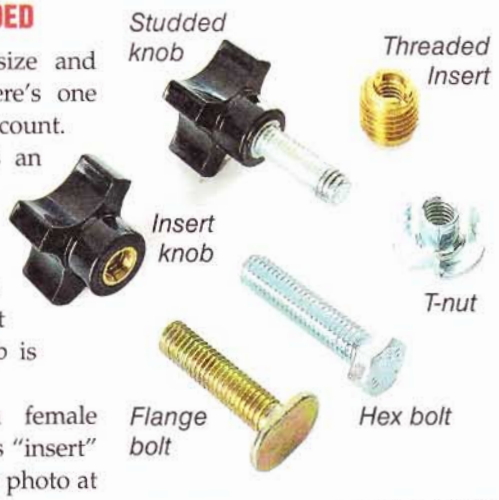
▼ ***Torque.*** *Wing knobs allow you to apply plenty of torque for a lot of clamping pressure.*



◄ ***Common.*** *Four-star knobs are commonly available in a wide range of sizes.*

INSERT VS. STUDDED

After considering the size and shape of the knob, there's one more thing to take into account. And that's whether it's an insert (female) or studded (male) knob. You can see some examples at right. The choice depends on the task at hand and how the knob is attached to your jig.



Inserts. Knobs with female threads are referred to as "insert" knobs (the left one in the photo at right). That's because they have a steel or brass threaded insert molded into the plastic.

Insert knobs are ideal for applications that require fastening to a hex bolt, carriage bolt, or flange bolt. I use these most often where I need to attach something to a T-track. The featherboard shown at right is a perfect example.

Studs. The other type of knob you'll find is a "studded knob" with threads. These have a short length of brass or steel threaded rod molded into the plastic. You can see one in the photo above.

A studded knob goes into action when you need to fasten a part using a threaded insert or T-nut. The knobs you see on the clamp base in the lower right photo on the opposite page are studded. The threads on the stud pass through the clamp base and into threaded inserts in the table.

The Right Length. There is one downside to studded knobs. They're often only available in limited stud lengths. And it seems that I can never find one that's the exact length I need for the job.

In the past, I've worked around this problem by making my own studded knobs. All it takes is a piece of threaded rod glued to an insert knob with epoxy. But it can be a hassle to cut the rod to length and clean up the threads.

▲ ***Insert.*** *Knobs with threaded inserts allow you to install jig parts and accessories to T-track using flange bolts.*

I've since discovered an easier solution for custom-length studded knobs. There are specialized knobs designed to use a hex bolt as the stud. You can read all about them in the box below.

Sources. Most vendors that cater to woodworkers will carry a wide variety of knobs. But if you're looking for a unique knob for a special look or task, check out *Reid Supply* (refer to Sources on page 51). They have an extensive selection of knobs to match almost any application in the shop.

making custom-length Studded Knobs

Finding a studded knob that has just the right length can be frustrating. The typical problem is that the stud on most knobs is never long enough for some of my needs. Now there's an easy solution.

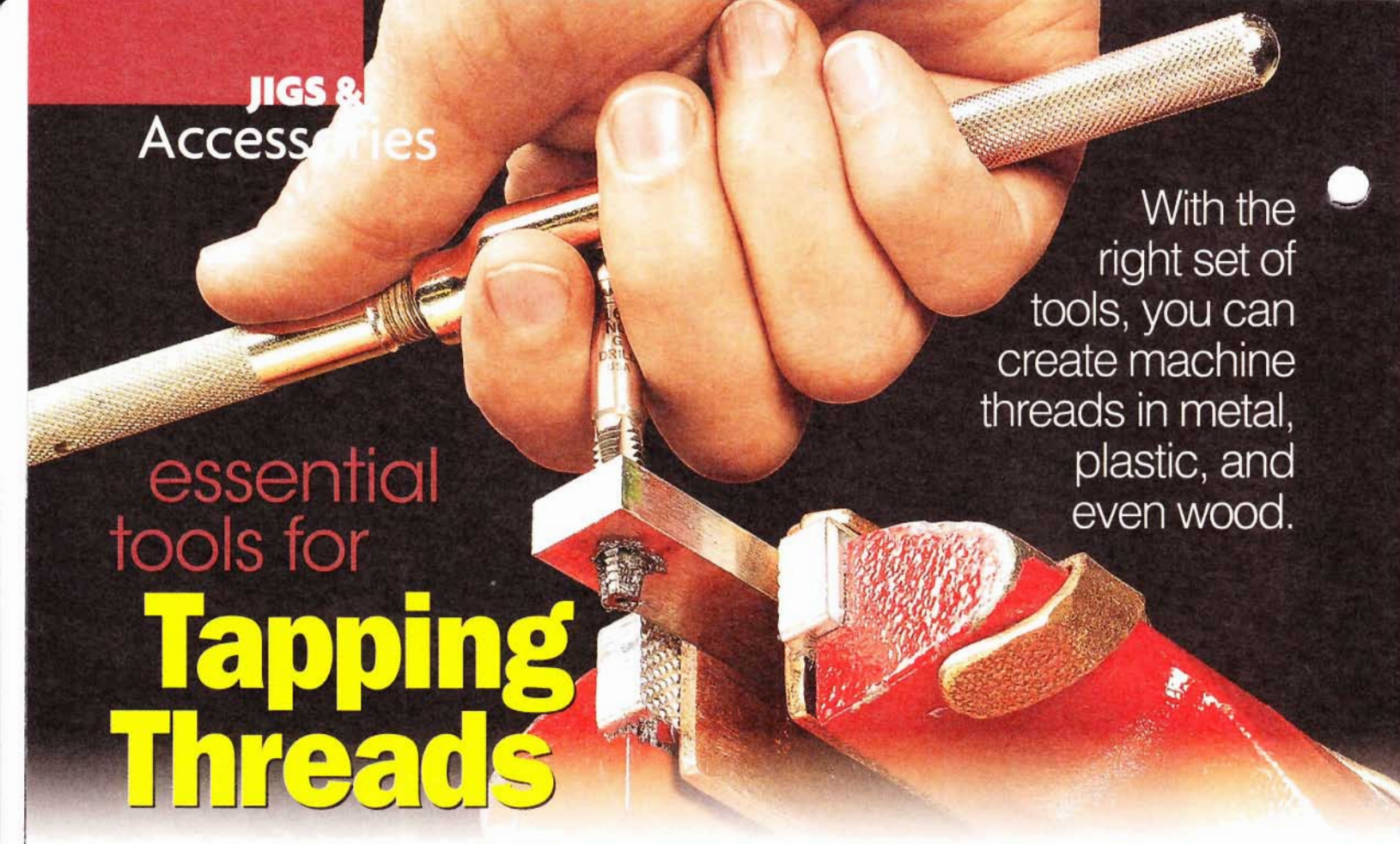
Lee Valley and *Reid Supply* have a selection of knobs that use a hex bolt as the stud. To use them, all you need to do is find a bolt the length you need and press it into the knob. The knobs from *Reid Supply* have a cap that locks the bolt in place (photo below). A bolt slipped into the *Lee Valley* knobs actually "snaps" into place for a secure connection. These are shown on the right.

▲ ***Snap In.*** *Choose from a variety of shapes to create your own studded knobs.*

There is one other advantage to these knobs. You can get double duty out of them by using them as insert knobs. Just drop in a hex nut instead of a bolt.

The knobs from *Lee Valley* are available for bolts with ¼"-20 or 5/16"-18 threads. These are the two most common sizes for jigs and fixtures in the shop and the accessories that go on them.

The knobs you order from *Reid Supply* are available for bolts ¼" through ½" diameter. They also supply knobs for metric sizes M6 through M12.



With the right set of tools, you can create machine threads in metal, plastic, and even wood.

essential tools for Tapping Threads

For a woodworker, I do a surprising amount of work with metal. This can be as simple as adding T-track to a shop jig, modifying a piece of hardware, or making tools like the compass, calipers, and dividers on page 16.

To accomplish some of these tasks, I have a collection of metalworking tools and accessories that includes a hacksaw, a few files, and twist bits. But there's one set of accessories that I consider a must-have — metal-threading taps. These allow me to add machine screw threads to a piece of metal so that it can serve as a nut or an anchoring point for assembling parts.

How It Works. In the photo below, you can see several taps and a pair of tap wrenches. A tap looks like a cross between a drill bit and a machine screw. But instead of drilling a smooth-sided hole, it cuts precise threads on the inside a pre-drilled hole.

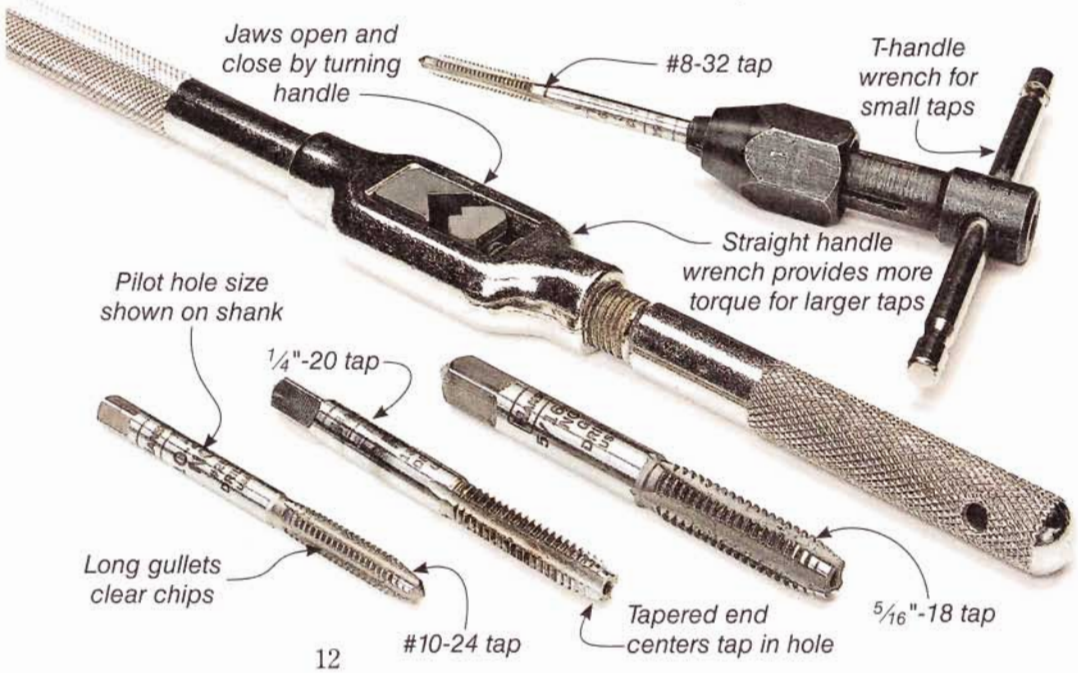
The size of the pilot hole you need is stamped on the shank of the tap. Unlike a screw, the "threads" on a tap are separated by gullets that form the edges of the threads. This reduces friction while cutting threads. And it provides clearance for the metal chips that form during the process.

Cutting threads by hand must be done carefully to avoid breaking the tap. The wrenches grip the square shank of the tap and let you twist the tap into the pilot hole.

Build Your Own Set. You can buy a large tap and die set at a hardware store or home center. (For more on dies, take a look at the box on the opposite page.) A full-size set is ideal for an auto mechanic or metalworker. But for a woodworker, it seems like overkill.

A better solution in my opinion is to build your own set. You can purchase high-quality, individual taps for just a few bucks. The main

A Tap Set For Woodworkers



benefit to this is that you buy only what you need, when you need it. Since I typically use a few common machine screw sizes, my "set" consists of the four taps shown in the photo. Having two wrenches allows you to get the right amount of torque to suit the material.

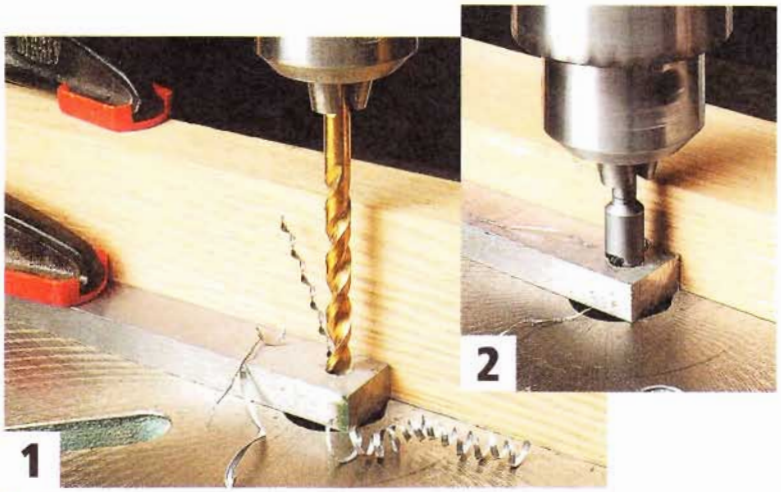
TAPPING THREADS

Cutting threads in metal is an essential skill that's easy to master. Once you do, you'll find numerous occasions when adding threads is useful. I've even found that you can tap threads in plastic and dense hardwoods like maple, white oak, and tropical woods.

The photos at right do a good job of highlighting the major steps in the process. But I want to add a few key points that will help you get the best results.

Layout. The first step in the process is laying out the location of the threaded hole. After marking this with a pencil or scribe, I use a spring-loaded punch to make a dimple for the bit. This prevents the drill bit from wandering when it makes contact with the metal.

Pilot Hole. Head to the drill press for the next step. What's important here is drilling a clean and properly sized hole square through the workpiece. To do this, set the drill press to a slow speed and secure the workpiece with clamps and a fence, as shown in photo 1. Then to keep the workpiece from overheating and the bit cutting smoothly, I apply a few drops of light machine oil as I feed the bit.



▲ ***Drill.*** *Drill the appropriate pilot hole at the drill press. Lubricate the bit with a few drops of oil.*

◀ ***Chamfer.*** *A slight chamfer on the edge helps center the tap in the hole.*

Now, before picking up the tap, it's a good idea to chamfer the edge of the pilot hole. This deburrs the hole and lets the tap "bite" easier. This is shown in photo 2.

Cutting the Threads. At last, you're ready to create the threads. Clamp the workpiece in a metal vise, and fit the tap to the wrench. As you start turning the tap into the workpiece, concentrate on keeping it square (photo 3).

You can feel the resistance increase as the tap bites into the hole. To avoid snapping the tap, don't try to tap the hole all at once. Instead, after every half turn, back off the tap a quarter turn. (Here again, adding some oil will reduce friction.) Repeat this two-step motion until you cut all the way through the workpiece.

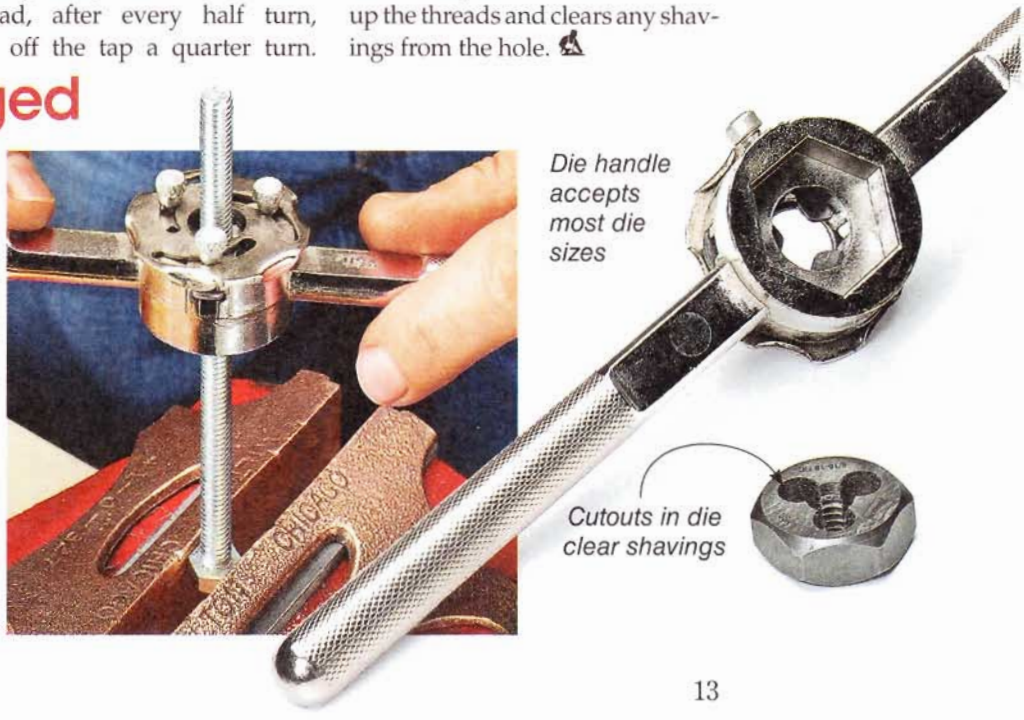
▲ ***Turn In & Back Off.*** *After each half turn, back the tap out a quarter turn to clear the waste.*

Finally, run the tap down the hole a couple of times. This cleans up the threads and clears any shavings from the hole.

restoring damaged Threads

A tap cuts threads on the inside of a hole. To thread the outside of round stock, you use a die (far right photo).

As easy as it is to find screws, bolts, or threaded rod to suit my needs, I rarely need a die. But one place they come in handy is to quickly clean up damaged threads, as you can see in the right photo. The same "turn and back-away" process for using a tap works with a die, too. When starting a die, take care to align the teeth with the threads to prevent cross-threading.



HANDS-ON Technique

shaping a Smooth Curve

Learn a few easy tips and techniques to get a perfect radius or a smooth roundover.

It seems almost every project I build requires shaping a roundover or radius. And for many of us, whether we're just easing an edge or creating a large curve, our first inclination is to reach for a router or a power sander. But power tools aren't always the only solution, especially for small jobs. Whenever it makes sense, I like to use a sanding block, hand plane, or rasp instead. I get great results with all three methods and without ever plugging in a tool.

Of course, there are times when a power sander can be handy. I'll talk about one situation later. But ultimately, you'll get the best results by keeping things simple.

ShopNotes GO ONLINE EXTRAS

To download a free radius dimension chart, go to: ShopNotes.com

Layout Tools. *Lots of common items like the ones shown at left work well for laying out a radius. The radius of a quarter is close to ½" (photo above).*

Laying Out a Radius. Most plans call for a specific size radius or roundover, but being exact isn't that critical in some cases. For example, rather than use a compass or circle template to lay out a curve, often all you need is a common item found in almost every shop (left photo below).

I've been known to pick up a can to lay out large curves. Or, an easy way to lay out a small radius is to use a coin, as you can see in the right photo below.

A quick check with a ruler reveals that a quarter is very close to a ½" radius, while a dime is more like ⅜". Or, pull out a socket wrench set. I have sockets as small as ¼"-dia. and as large as 2" in diameter (with the outside radius ranging from ⅛" to 1").

To help keep track of radius dimensions for readily available items, go to *ShopNotes.com*. You'll find a handy radius chart there.

Whenever possible, lay out the radius on both faces of a workpiece. This way, you'll have a good visual reference on each face and avoid the problem of an unevenly rounded corner.

SHAPING CURVES

Adding a small radius to the corner of a workpiece is usually pretty straightforward, but there can be some challenges. It's all too easy to get overly aggressive with power tools. And, if you're not careful, you may end up rounding over the edges. For this reason, I like to use a hardwood sanding block.

I stay away from cork or foam sanding blocks. They work well on flat surfaces, but they tend to roll the sandpaper around the edge of a workpiece, making it hard to get a smooth, even radius. With a hardwood sanding block, all it takes is a couple of passes back and forth to do the job.

Rabbeted Sanding Block. If you're still having a problem maintaining a crisp edge (especially on thin stock), try using a rabbeted sanding block like the

Sanding Block. *A rabbeted hardwood block works best for hand sanding a small radius.*

◀ **Notch.** *A notch in the corner makes room for a wide strip of sandpaper, allowing you to sand the full thickness in a single pass.*

one shown in the photo above. The ledge formed by the rabbet keeps the block square to the edge while you're sanding. A small notch added to the inside corner of the rabbet allows you to apply an extra-wide strip of sandpaper. This way, you can sand the entire edge of a workpiece in a single pass.

Large Radius Curves. A few swipes with some sandpaper may work fine for a small radius curve, but on a large curve, I find it's best to cut it down to size first.

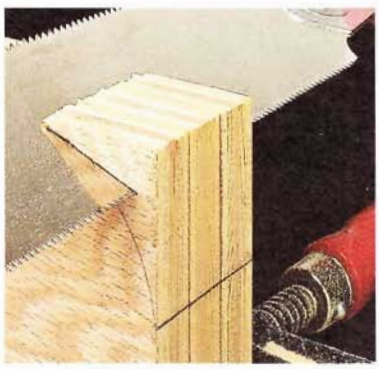
Start With a Rough Shape. A band saw is ideal for rough cutting a radius to shape. But if you don't have access to one, a hand saw works well, as you can see in the two photos below. If you have several workpieces to shape, go ahead and clamp them together before you get started.

Once you've removed the bulk of the waste, sanding the radius to final shape is simple with a sanding block. It gives you the most control on a narrow edge.

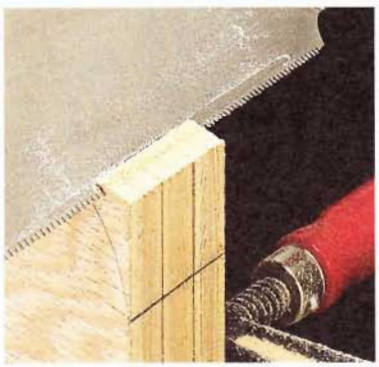
On rare occasions, I clamp multiple pieces together and use a random orbit sander. Just keep it moving to avoid flat spots, and check your layout lines often.

Roundovers. To round over an edge, I use some different tools, but pretty much the same techniques — first remove the bulk of the waste, then do some final shaping. For these jobs, I like to use a block plane or rasp. Then, I use a little sandpaper to smooth things out. You can read more about this in the box at right.

As you can see, the best solution for almost any radius or roundover, may be to do it by hand.



▲ **Shape the Radius.** *After laying out a radius, pick up a hand saw to cut it to rough shape.*



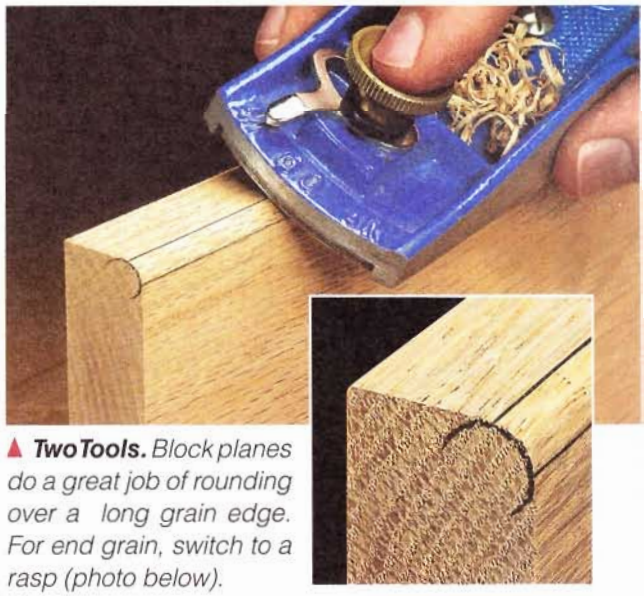
▲ **Complete the Shaping.** *Get it close by following the contour of the radius with a couple of cuts.*

two great tips for Roundovers

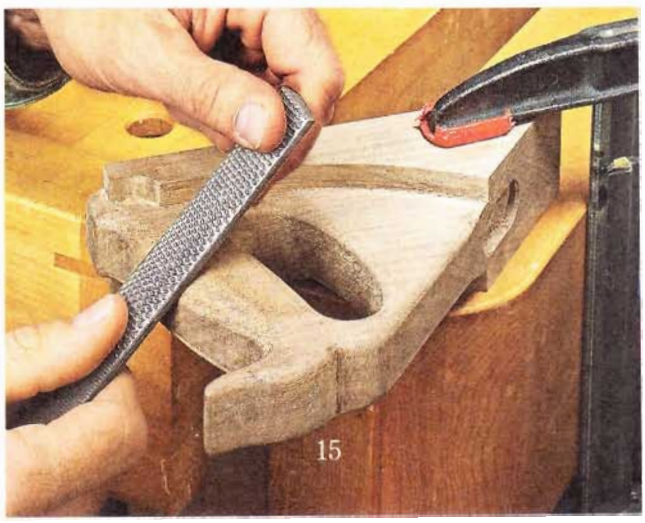
There are two tools found in most shops that are perfect for roundovers. Block planes work great on long grain edges. And, for rounding over end grain, the tool I pick up most often is a rasp.

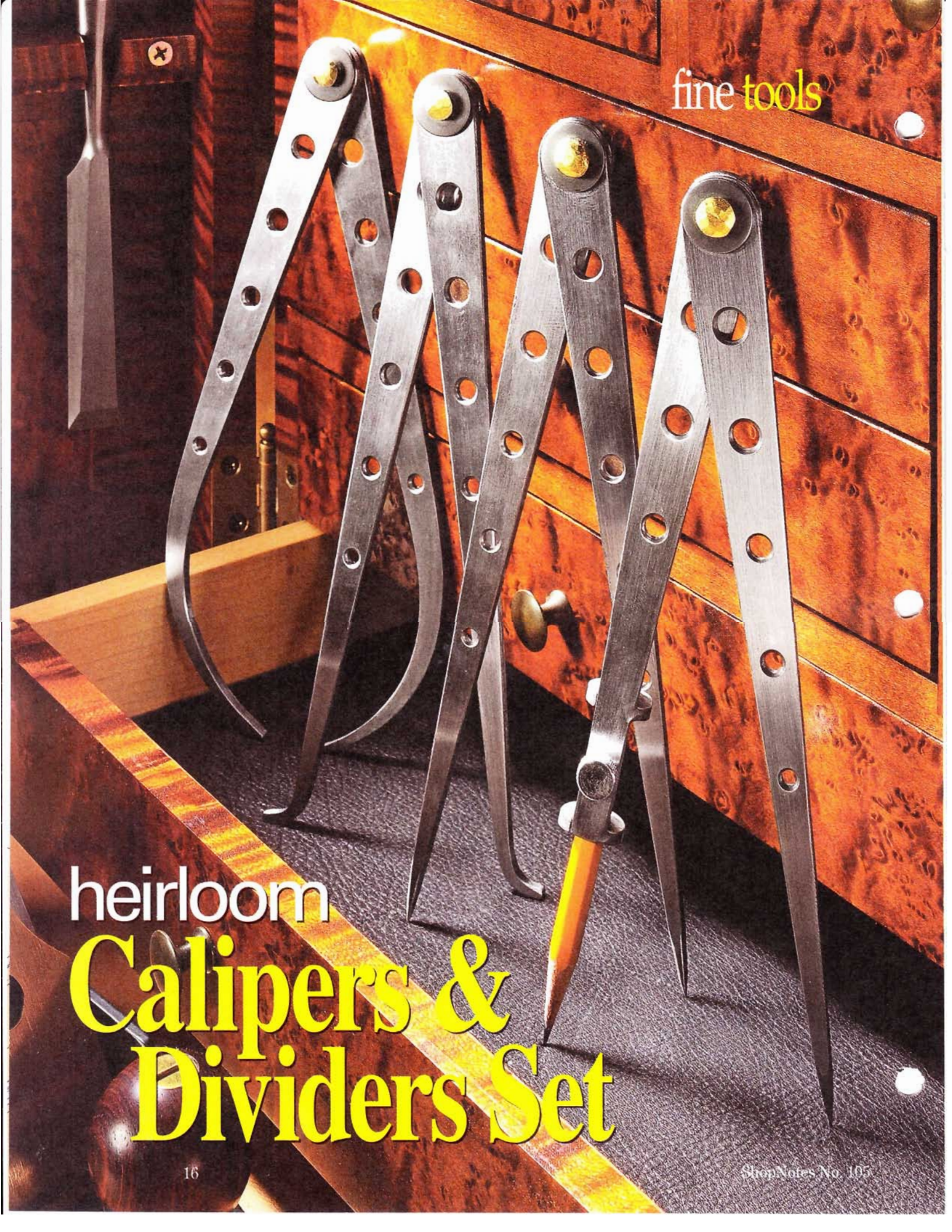
Block Planes. A block plane's wide, flat base provides a good reference surface for rounding over long-grain corners. I start by drawing a radius on the end of my workpiece, plus lines on the edge and face to mark the boundary of my roundover (photo and inset below). Angle the plane while making multiple passes, removing the bulk of the waste at the center. Then, work your way outward to feather out the roundover.

Rasps. When shaping an end grain roundover, a rasp is a good bet. (I like to use a 4-in-hand.) This versatile rasp has two profiles (flat and half-round) with coarse and fine teeth for each profile. I find I get better results with a two-handed grip. Concentrate on getting the radius close with the coarse edge, before switching to the fine edge. Then use sandpaper to smooth things out.



▲ **Two Tools.** *Block planes do a great job of rounding over a long grain edge. For end grain, switch to a rasp (photo below).*





heirloom Calipers & Dividers Set

With some simple tools and a little time, you can build a complete set of quality layout tools.

As I was strolling through the shop, I noticed one of our designers, Chris Fitch, busily filing and drilling some steel. It's not unusual to find Chris tinkering and what he came up with this time was a set of layout tools. They got a lot of attention and I knew I had to build a set.

The main reason they're so popular is that they're so easy to make. All it takes is some basic tools you probably already have: a hacksaw, a few files, and a drill press. Cutting, filing, and drilling the steel blanks isn't a big deal. And some final polishing with sandpaper gives them a nice, satin finish.

But there's more going on here. And that's how to connect the two legs so they hold their set position for measuring and layout. Some traditional tools use a threaded rod with a knurled nut for adjustment. Others use a simple wingnut to tighten the legs of the tool.

Instead, Chris used a simple, but effective technique: a friction joint. A pair of disc springs and a simple brass rivet apply just the right amount of pressure to keep the legs from slipping. It works beautifully. Read on to find out how to make your own set of layout tools.

ShopNotes GO ONLINE EXTRAS

To download 3-D models of the layout tools, go to:
ShopNotes.com

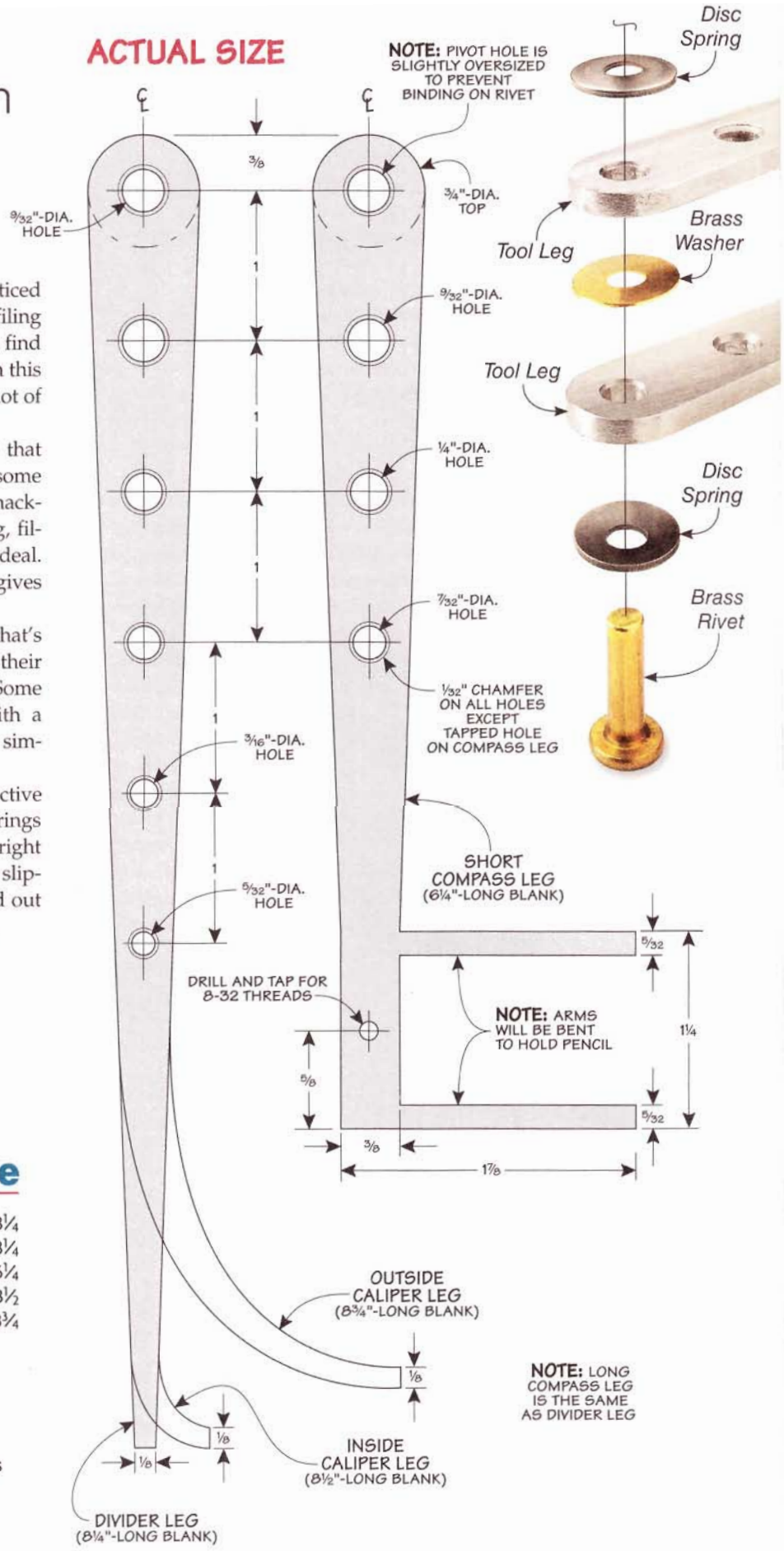
Materials & Hardware

A	Divider Legs (2)	5/32 x 3/4 - 8 1/4
B	Long Compass Leg (1)	5/32 x 3/4 - 8 1/4
C	Short Compass Leg (1)	5/32 x 1 7/8 - 6 1/4
D	Inside Caliper Legs (2)	5/32 x 3/4 - 8 1/2
E	Outside Caliper Legs (2)	5/32 x 3/4 - 8 3/4

Required for Each Tool:

- (1) 5/32" x 2" - 18" rgh. Grade 1018 Steel
- (1) 1/4" I.D. x 5/8" O.D. Brass Washer*
- (1) 1/4"-dia. x 3/4" Brass Fh Rivet
- (2) .265" I.D. x .687" O.D. x .052"-thick Disc Springs
- (1) 8-32 x 1/4" Thumb Screw

* Washer cut from .020"-thick brass sheet

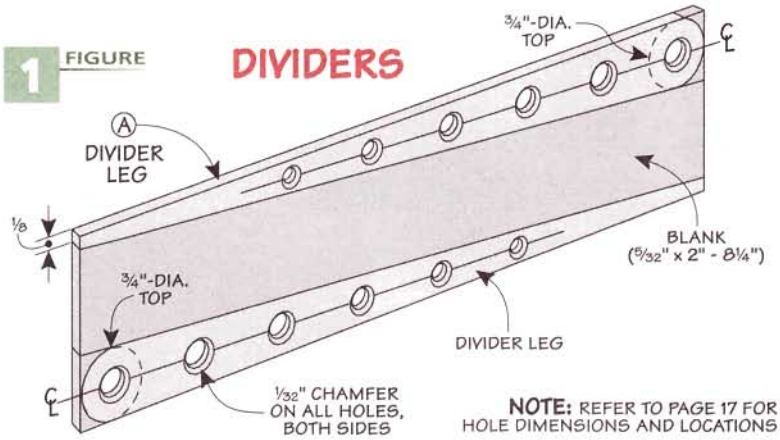


making a basic Leg

The set of layout tools consists of an inside calipers, an outside calipers, a compass, and a set of dividers. Since the legs of the dividers are the easiest to make, it's a great way to learn the basic techniques that apply to each of the tools. I'll point out any differences as I go along, but each one starts with a mild steel blank.

A Little About Steel. When purchasing the steel (Grade 1018) to use for the layout tools, I chose precision-ground stock that was 2" wide and 5/32" thick. This thickness just "feels right" — not too heavy and clunky, yet not too flimsy. The precision-ground stock is just a few dollars more than raw stock, but it means less filing and sanding to get a smooth surface. And I'm willing to pay a little more to eliminate all that extra work. You can find out where to buy the steel and all the other supplies I used in Sources on page 51.

FIGURE 1 DIVIDERS



Layout. The key to working with metal is an accurate layout. To accomplish this goal, I used blue layout dye to color one face of the steel blank (upper photos at left). The dye provides a nice contrast for the layout lines you scratch in with a sharp scribe. This leaves you with clean, crisp lines to work to when drilling and shaping.

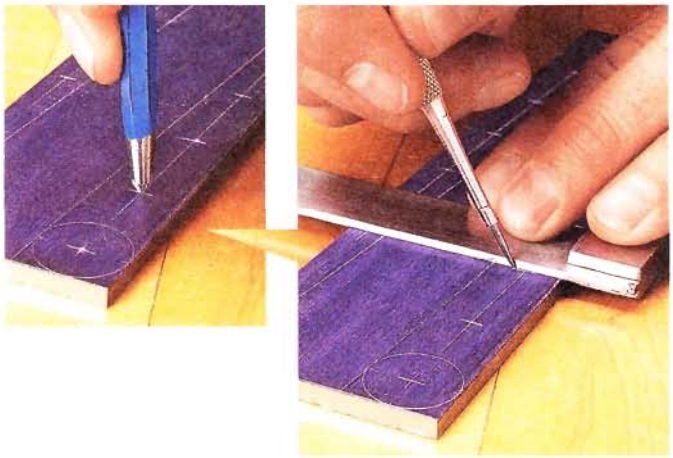
Centerline Reference. The first mark I made on the blank was the width of each leg at the bottom measured from each factory edge, as shown in Figure 1. This way, you'll only need to cut and shape one side of each leg.

The next important measurement is the centerpoint of the pivot hole at the top of each leg. With this located, you can draw a centerline for the leg and the top radius. Then lay out the centers of all the holes and draw the other side of the leg. I used a center punch to mark the hole centers (left margin photo).

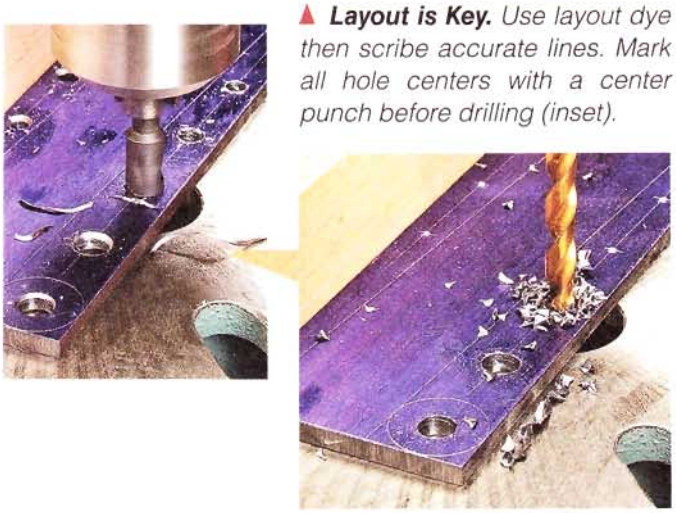
Drill & Countersink. It's time to head to the drill press to drill all the holes and create a decorative chamfer (lower left photos). The chamfered holes give the tools a high-tech, modern look.

There are a couple of things worth mentioning here. For safety, make sure the workpiece is against a fence clamped to the drill press table. Another tip is to have a small bottle of light oil handy. (I like to use *3-in-1* oil.) This helps lubricate the drill bit as you're drilling and minimizes heat buildup. Other than that, it's a simple matter of drilling a hole in each leg then switching bits for each size hole.

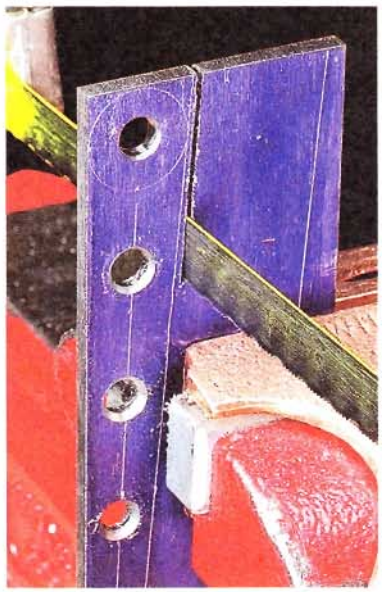
After all the holes are drilled, I switched out the drill bit for a small countersink, as shown in the left margin. It not only creates an eye-catching chamfer on all the holes, but removes any burrs on the pivot hole that might interfere with smooth operation. The goal is to make all the chamfers a consistent width. Just remember to chamfer the holes on both sides of the blank before moving on.



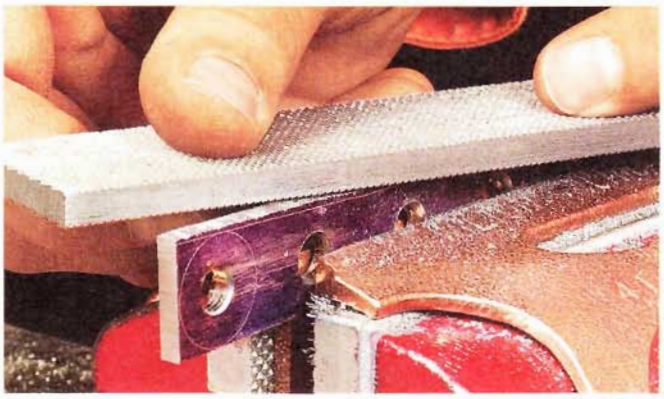
▲ ***Layout is Key.*** *Use layout dye then scribe accurate lines. Mark all hole centers with a center punch before drilling (inset).*



▲ ***Drilling.*** *A few drops of oil will keep the bit cool. Follow up with a slight chamfer using a countersink (inset).*



▲ ***Cutting to Shape.*** *Use a sharp hacksaw blade to cut the legs free. Jaw liners protect the workpiece from marks.*



▲ ***Filing to Shape.*** *The layout lines serve as a reference when filing the legs to shape. Use the full length of the file to create a straight, smooth edge.*

▲ ***Satin Finish.*** *For a smooth, satin finish, use 220-grit sandpaper. A rivet works as a "handle" to grip the workpiece.*

A Hacksaw Workout. I'm not going to kid you — cutting the legs free from the blank will take a little muscle. But it goes fairly quickly.

Before you clamp the blank in your machinist's vise, it's a good idea to line the jaws. This protects the workpiece from the dimpled pattern on the jaw faces. You can use commercial liners, like you see in the photo at above. Or you could use aluminum or brass sheets and cut them to wrap around the jaws.

File Until Smooth. After the legs are cut free from the blank, there's a little more effort required for final shaping. Use a coarse file to start with and work to the layout line (upper left photo). And while you're at it, you can file the sharp point on each leg, as shown in the photo below. You can finish up the edges with a smooth file.

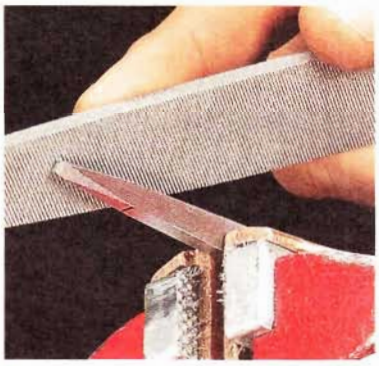
For final polishing, I used adhesive-backed 220-grit sandpaper fastened to a piece of MDF. Take some time to sand all the straight edges and the rounded end. A brass rivet makes a nice "handle" for smoothing each face, as you can see in the upper right photo.

Brass Washer. To keep the legs of the dividers from rubbing against each other during use, I separated them with a thin, brass washer. A ⅝"-dia. hole saw is the perfect size to cut the washer from a brass sheet (left photo below).

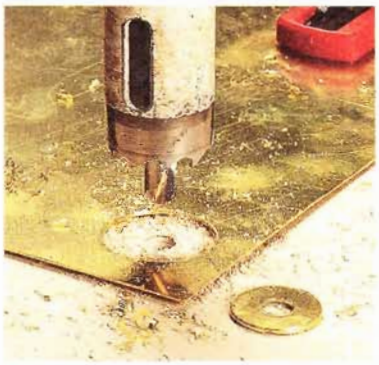
Assembly. You're almost ready to assemble the dividers. When assembling the disc springs, brass washer, and two legs (Figure 2), you'll want the rivet to extend about ⅛" beyond. This gives you just enough material to peen over the end of the rivet. The problem is the brass rivet I used was a little long. So I ground about ⅛" off the length before moving on.

The only trick to assembling the dividers is the orientation of the cone-shaped disc springs. The smaller end of each cone should face away from the legs.

Now peen over the end of the rivet with light, angled taps all around (right photo below). Keep checking the amount of friction in the joint as you go. When the legs are snug, your work is done.

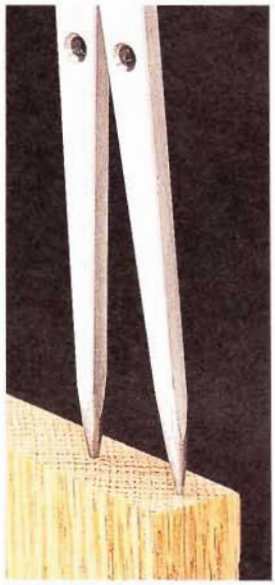


▲ ***Filing Points.*** *Start with a coarse file to shape the points of the dividers. Follow up with a smooth file and sandpaper.*



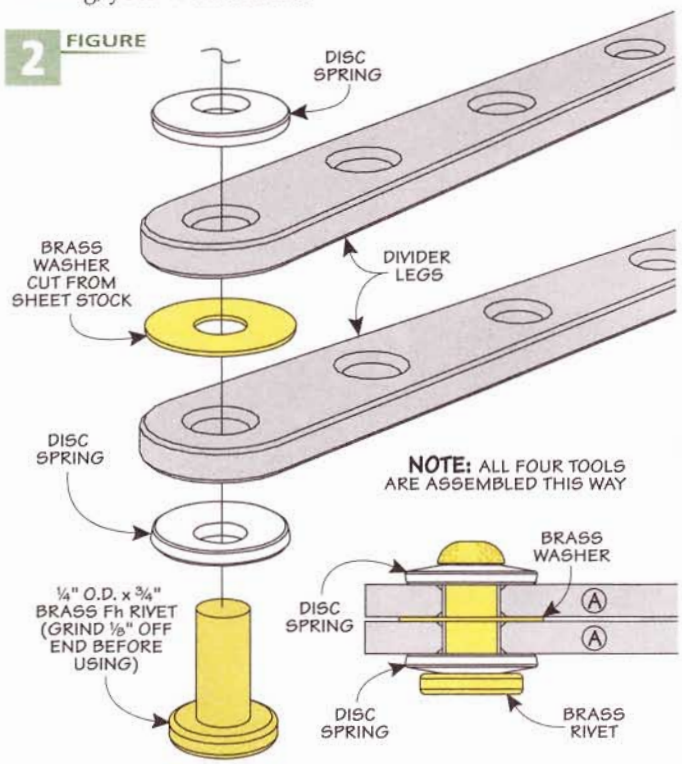
▲ ***Shop-Made Washer.*** *A hole saw creates a perfectly sized brass washer. Sand both sides and all edges to remove burrs.*

▲ ***Mushroomed Rivet.*** *Light, angled taps are all it takes to peen the rivet. Check frequently for the right amount of friction.*



▲ ***Practical.*** *Dividers are a staple in any shop for stepping off even spacing and layout work.*

FIGURE 2



building the Compass & Calipers

You need a compass, an inside calipers, and an outside calipers to complete the set of layout tools. As I mentioned earlier, the basic techniques for layout and assembly are the same as the dividers.

But there's a little more to shaping the legs of the calipers and compass. The calipers require some bending so that the points are curved. And one leg of the compass has to hold a pencil in order for it to do its job. This compass leg is a little more involved, so I'll explain it first.

COMPASS

The nice thing about building the compass is that one leg (the "pivot") is the same as the legs on the dividers. The other leg is made to hold a pencil. Figure 3 above and the pattern on page 17 give you the details. The photos below show how to cut an "F" shape on the end with just a few cuts. The resulting "arms" are what you'll shape to hold a pencil.

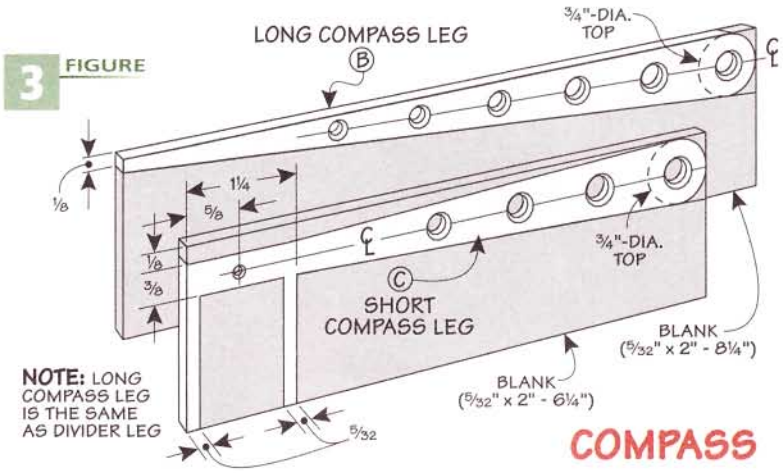


FIGURE 3 COMPASS

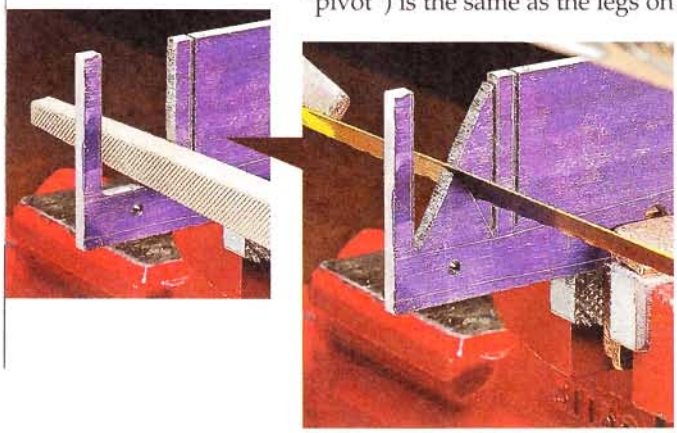
Forming a Pencil Holder. The first thing to do is clamp the shaped piece in a vise as shown below. The idea is to bend over the arms at a sharp, 90° angle.

In the lower left photo below, you can see how a 5/16"-dia. bolt is clamped in the vise along the centerline of the workpiece. (This diameter is just right for fitting a pencil.) All it takes is are few mild taps to gently bend the arms around the bolt. Now you can test the fit of a wood pencil and make any adjustments. The goal is to create a sliding fit. If the pencil slides through too easily, just tap the arms a little tighter, as you can see in the lower left margin photo.

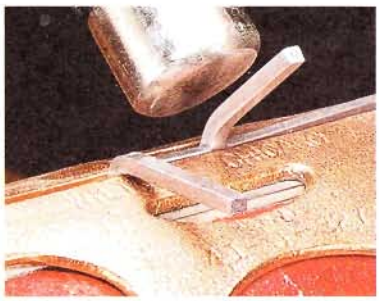
The arms will be a little long, but that's okay. You can cut and file them to match the shape of the bend on the opposite side.

The last thing to do before assembly is to tap the hole for the thumbscrew that holds the pencil in place. (Refer to the article on page 12 for help on tapping.)

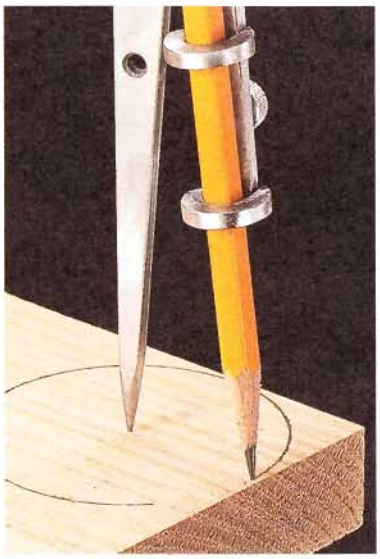
Compass Assembly. You can assemble the compass just like you did with the dividers. Just make sure that the pencil holder is on the *outside* of the leg during assembly.



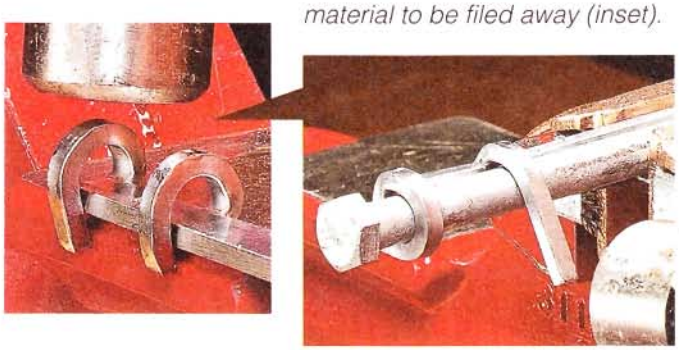
▲ ***Removing Waste.*** *Diagonal cuts will leave a small amount of material to be filed away (inset).*



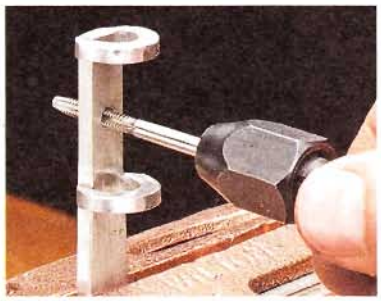
▲ ***90° Bends.*** *Give the arms a tight bend by clamping the leg in the vise and tapping them over.*



▲ ***Perfect Circles.*** *Creating a circle on a workpiece is easy with your shop-made compass.*

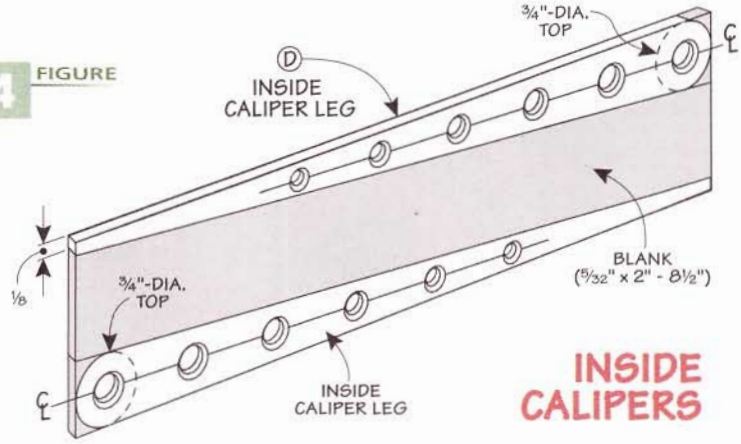


▲ ***Creating a Curl.*** *Use a bolt as a mandrel to form the arms that hold a wood pencil (inset).*



▲ ***Tap Threads.*** *A tapped hole houses the knurled thumbscrew that holds the pencil securely.*

FIGURE 4



CALIPERS

Like the dividers, making the two sets of calipers begins with a pair of straight legs. The difference is the length of the steel blanks. The legs are a little longer to account for the bends at the bottom end.

Tight Radius. After drilling, cutting to shape, and final smoothing, you can work on bending the ends. For the inside calipers, you'll form a tight radius, as you'll notice in the margin photo above.

Here again, a 5/16"-dia. bolt is the perfect size. The key is to securely clamp the bolt in the vise. Then lay the leg on edge across the bolt to start forming the radius.

I found that it really didn't take a lot of force to shape the leg. You'll start at the top of the radius and work your way out to the end of the leg. This provides the smoothest curve with the least amount of effort. You can use the pattern on page 17 to check your progress as you gently create the curve.

Once you're happy with the final shape, you may need to do some finish sanding to get rid of the small dents and dings from the hammer. From here, the assembly process is the same as before.

Large Radius. For making the outside calipers, I used a larger radius so that the points would "reach" around objects. Forming this radius was a little trickier for two reasons. First, it takes a little effort to make sure both legs are shaped the same. Here again, the pattern will help you out with this. The other thing to note is that it takes time to get a smooth curve. It doesn't pay to be in a hurry.

Pipe Mandrel. To help create a smooth, gradual curve, I used a 1½"-dia. steel pipe fitting. Clamped tightly in the vise, the pipe serves as an ideal form or anvil for creating the large radius.

▲ ***Large Radius.*** *A pipe fitting makes a perfect anvil for creating the larger radius.*

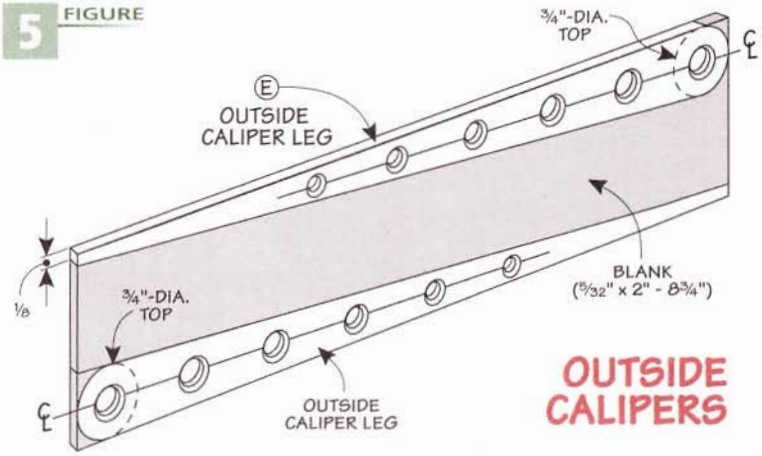
▲ ***Tight Radius.*** *A bolt comes to the rescue as an anvil for forming the small radius.*

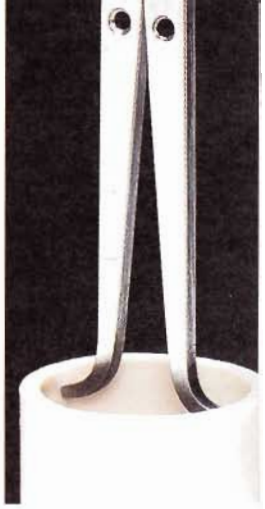
The procedure is the same as before — start at the top of the curve and gently work your way to the end. Again, gentle, consistent taps are the key. You'll get a feel for the right amount of force in a short while. After final shaping, you can smooth out any dings and kinks with sandpaper.

Twisted Points. Once the calipers are assembled, you'll need to "twist" each leg until the points align. I found the best way to do this was to clamp the last couple of inches in the vise then use pliers for leverage to gently twist the leg. (Be sure to protect the legs with padding to keep the pliers from marring the surface.) It won't take much effort and it pays to take it slow. Keep checking your progress until the points align.

Heirloom Quality. Building and using this set of tools will give you a lot of satisfaction. The best part is, you'll have a set of tools that will last for generations.

FIGURE 5

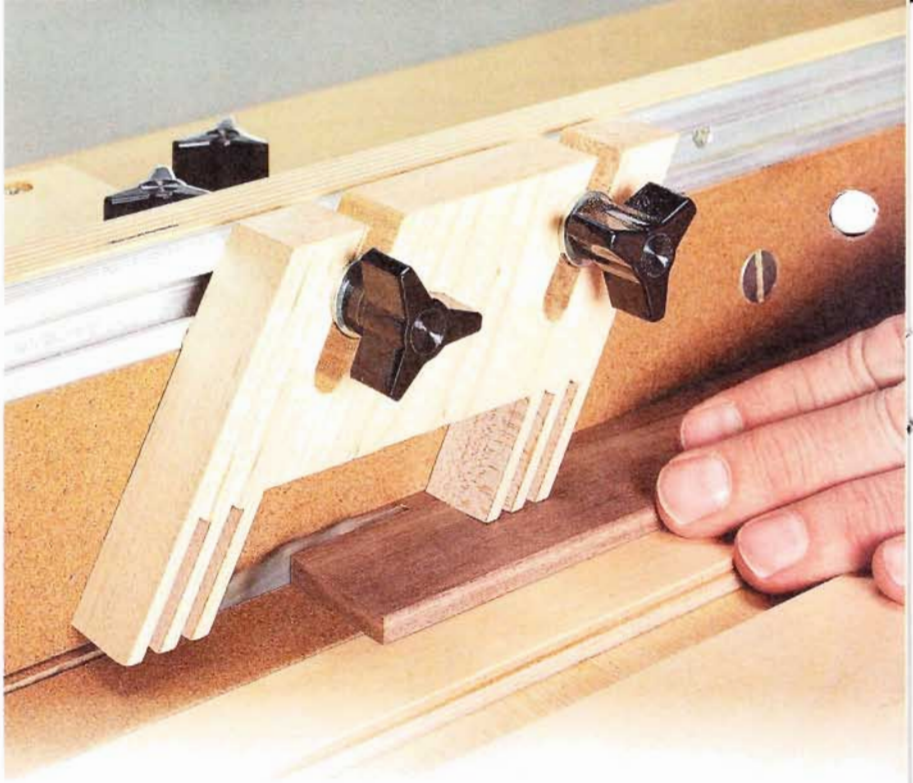




▲ ***Inside.*** *Take the guesswork out of measuring pipe and hole diameters.*

▲ ***Outside.*** *These calipers are handy to have near a lathe to check your progress on turnings.*

Shop Short Cuts



Making a Featherboard

When it comes to ripping a very thin workpiece, I like the added control a featherboard offers. But it's not a good idea to locate a conventional featherboard directly over the blade for rip cuts. That's because the blade would quickly cut up the "feathers."

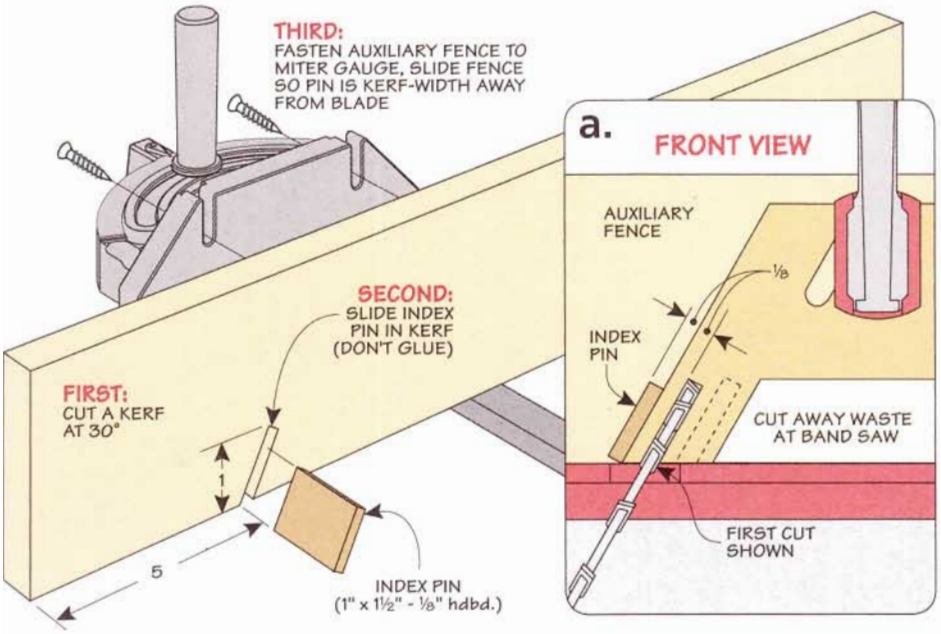
To solve this problem for the table saw jig on page 34, I made a notched featherboard (photo above). What sets it apart is the gap in the middle. This allows you to place the featherboard directly over the blade. The feathers ahead of and behind the blade keep the workpiece firmly on the table.

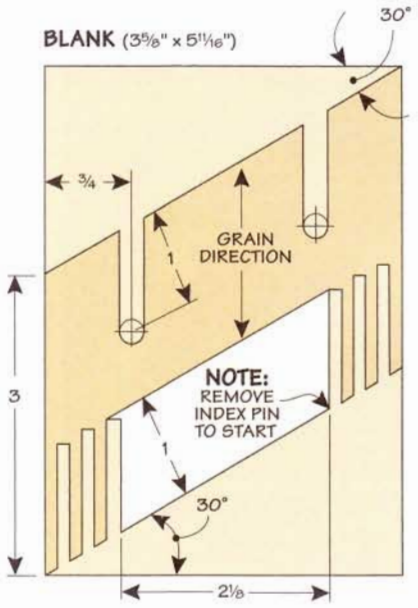
Making the featherboard is a pretty straightforward process. Start by cutting a blank to width, as shown in the lower right drawing. Making an angled cut on the top and bottom brings it to final length. You can then go ahead and cut the mounting slots in the top edge of the featherboard.

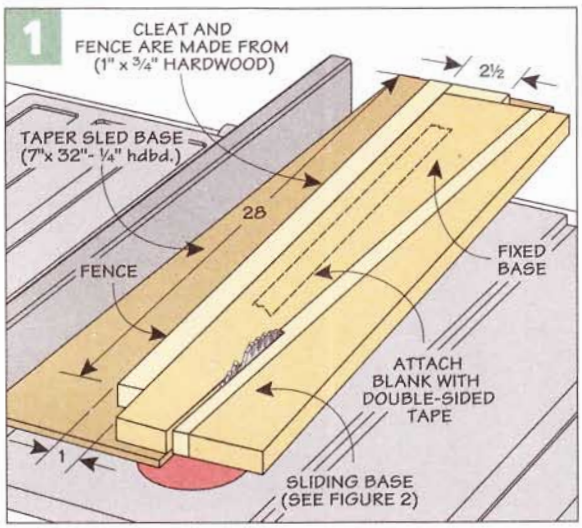
The key to making consistent feathers is to use the miter gauge jig shown in the lower left drawing. The jig is basically a long auxiliary fence with an angled kerf fastened to the fence of your miter gauge. After fitting a removable index pin into the kerf, you're ready to start cutting.

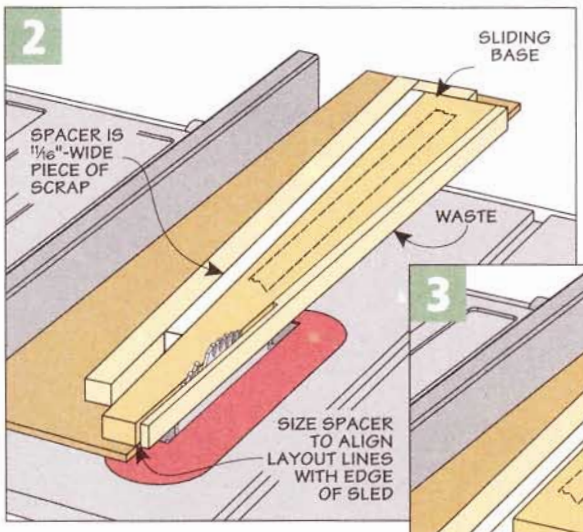
You'll start by cutting feathers along the end of the blank. Later, you'll cut out the middle feathers to create the notch.

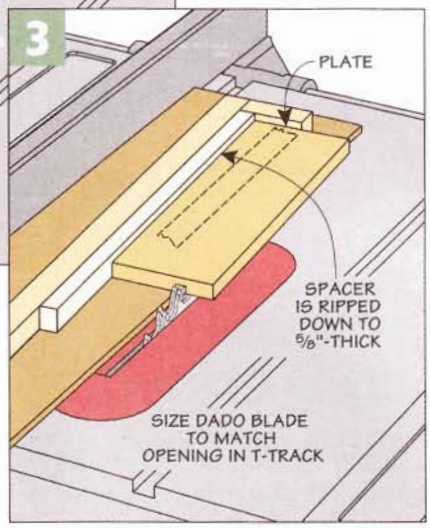
To make the feathers, butt the blank against the pin and cut a kerf. For the next feather, slip the kerf over pin and make another cut. Repeat this process to cut feathers across the end of the blank. At the band saw, cut away the center fingers for the notched area.











Multi-Purpose Taper Sled

One of the main features of the table saw jig on page 34 is the unique, sliding rip fence. Its two tapered bases give you fine control for adjusting the fence position. In order to keep the fence parallel to the blade, the tapers on each piece need to be identical.

Basic Sled. To do this, I made a simple taper sled. It consists of a hardboard base with a hardwood fence and stop. These hold the workpiece at the correct angle to cut the taper. I located the fence and stop to cut the fixed base to final size, as shown on page 36. To keep the workpiece from shifting during the cut, I used double-sided tape to hold it to the sled, as shown in Figure 1.

Sliding Base. To make the narrow sliding base, I marked end points of the taper on the workpiece. Then I cut a spacer to fit against the fence and position the layout lines on the edge of the sled, as illustrated in Figure 2. (Mine was 11/16" wide.)

Groove. There's one final use for the sled. And that's to create the groove in the lock plate (Figure 3). Cut another spacer that positions the inner edge of the groove at the edge of the sled. (You may need to move the rip fence.) And be sure to match the size of the dado stack to the opening in the top of the T-track in the sliding base.

Painting MDF

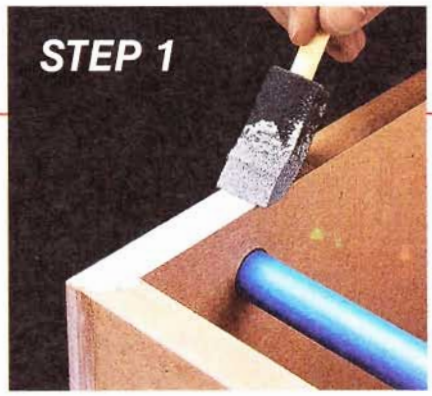
If you really want to add some "shine" and extra durability to a project made from MDF, you can apply a couple coats of latex paint. This is what I used on the shop cabinets on page 24.

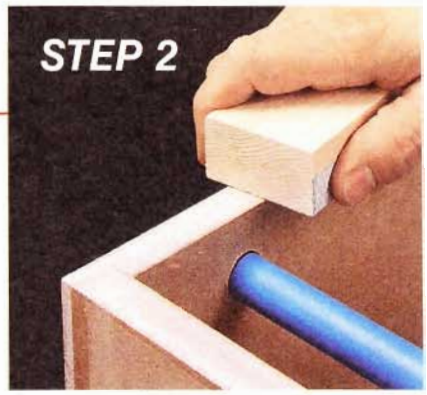
You won't need to do much in the way of preparing the flat surfaces of the MDF to get good results. Unfortunately, the porous edges are a different story.

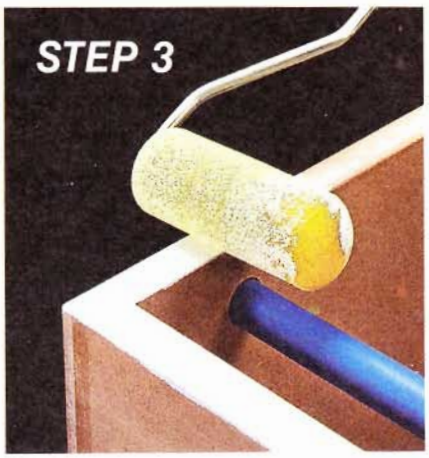
The problem here is the cut edges of MDF look rough and readily absorb paint. So it's not unusal to end up with a noticeable contrast between the smooth, flat faces and the exposed edges. Solving this problem only takes a couple steps.

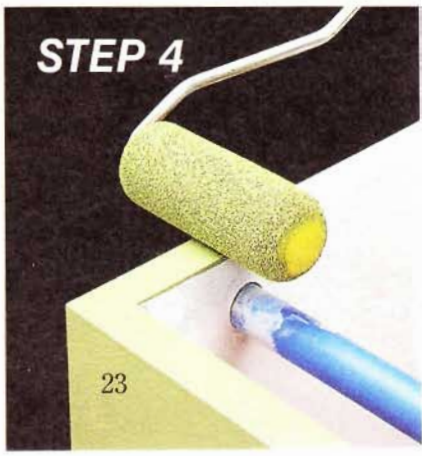
The first step is to seal all the exposed edges with diluted white glue, as shown in Step 1. I mix the glue 50/50 with water. Once it's dry, sand it smooth to match the faces, as you can see in Step 2.

Then after applying a primer to seal the surfaces, as illustrated in Step 3, all that's left to do is add a couple coats of paint to build a durable finish (Step 4).









storage solutions

modular Garage Storage

Inexpensive and easy to build, this wall-mounted system is a great way to add versatile storage.

The key to getting the most out of any storage space is designing a system that's versatile enough to meet both current and future needs. What's even better is a system that's low-cost and simple to build.

In the photo at right, you'll see a solution that meets all those needs perfectly. It features a pair of sturdy bench units with virtually indestructible metal-capped tops and shelves, plus handy storage drawers. They mount to the wall with heavy-duty metal hardware you can find at most home centers.

Above the bench are two different size wall cabinets that can be closed off with simple doors or left open for easy access. And for those difficult-to-store items, check out the open cabinet at the far left of the photo. The metal bars provide a convenient storage option. Best of all, you can mix and match any of the components to suit your needs.


Drill Doctor
Johnson
PASTE WAX
April 2009

start with a

Benchtop

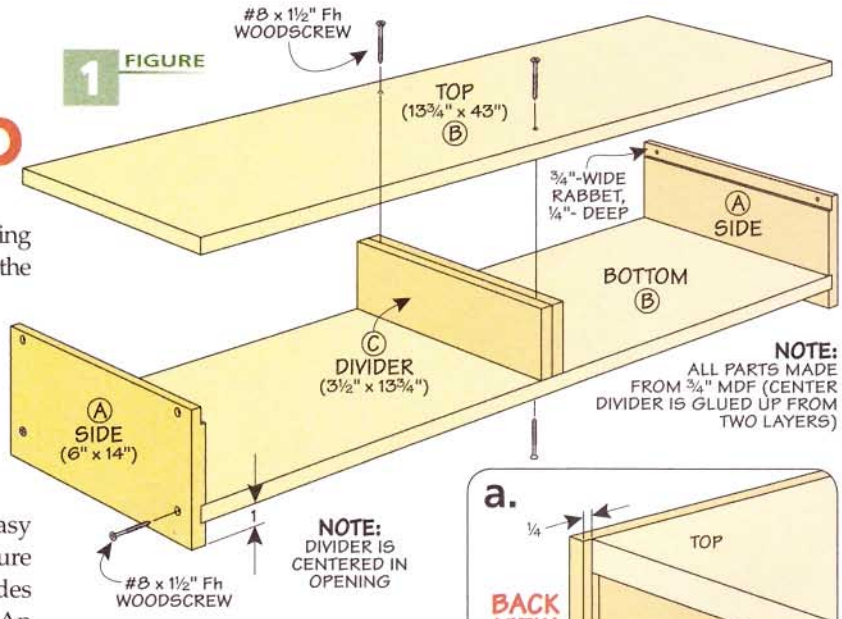
Although you can start building this storage system with any of the components, I decided to begin with the benchtop unit. The nice thing about doing this is that once it's complete, you can install the benchtop and have a solid worksurface as you complete the rest of the system.

The benchtop unit is quite easy to build. As you can see in Figure 1, it starts out as a pair of sides attached to a top and bottom. An extra-thick divider centered in the assembly creates two identical openings for some storage drawers you'll build later.

THE BASIC BENCHTOP

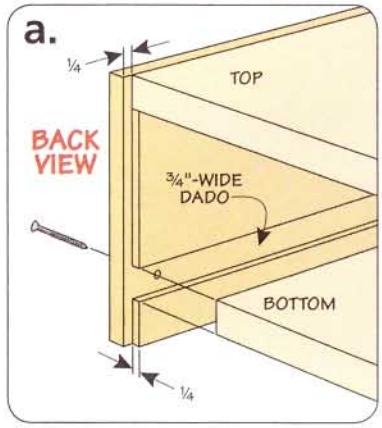
You have a couple of material choices when it comes to building any of the components. Plywood and medium-density fiberboard (MDF) are both good options, but I chose to use ¾" MDF for a couple of reasons. First, it's inexpensive. You can build a whole set of components without spending a lot of money. And second, MDF has a flat, smooth surface. It looks great whether you just give it a coat of oil or paint (like I did).

FIGURE 1



Size the Parts. Once you've decided on a material, the first step is to cut the sides to size and complete a little basic joinery. To attach the top, you'll need to cut a rabbet along the upper edge of each side, as in Figure 1. And a dado cut near the lower edge accepts the bottom, as illustrated in Figure 1a. Finally, to hold a plywood back you'll add later, there's a narrow rabbet along the back edge of each side, which is shown in Figures 1 and 1a.

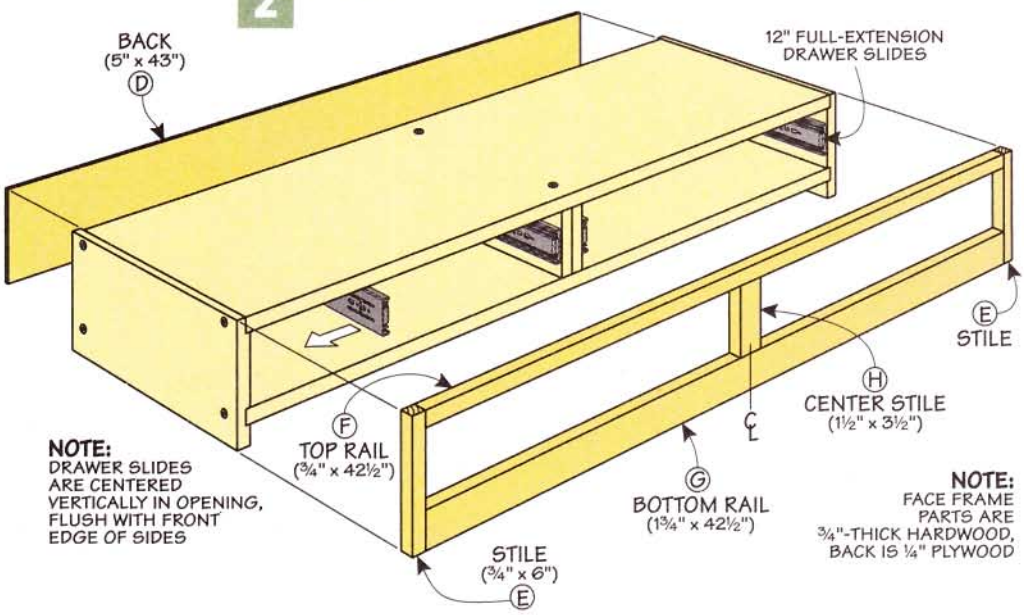
Installing the Top & Bottom. With the sides complete, you can turn your attention to the top and bottom. Making these two parts won't take much work. Simply cut them to final size (Figure 1).

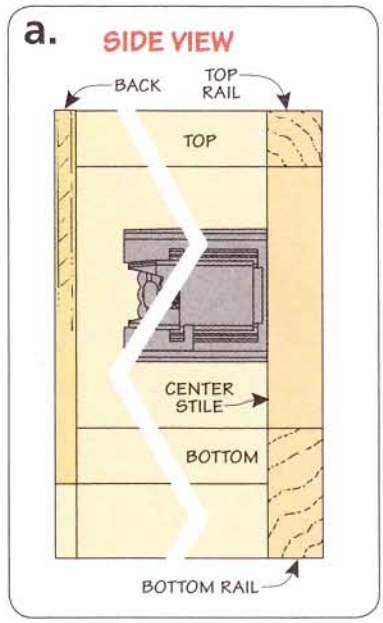


All that's left before assembling the benchtop case is to make the divider. It's just two layers of MDF glued together. You'll need to size it to fit between the top and bottom and flush at the front and back edges.

The assembly itself is pretty straightforward. The top and bottom are glued and screwed to the sides. Just be sure to drill pilot

FIGURE 2





holes for the screws and locate the holes away from the edge to avoid splitting the top and bottom. And as you do this, be sure you glue and screw the divider in place so it's centered in the opening.

At this point, you can cut the back to size. But set it aside for now. You'll install it later. You'll need to have easy access to the inside of the drawer compartments for installing the drawer slides.

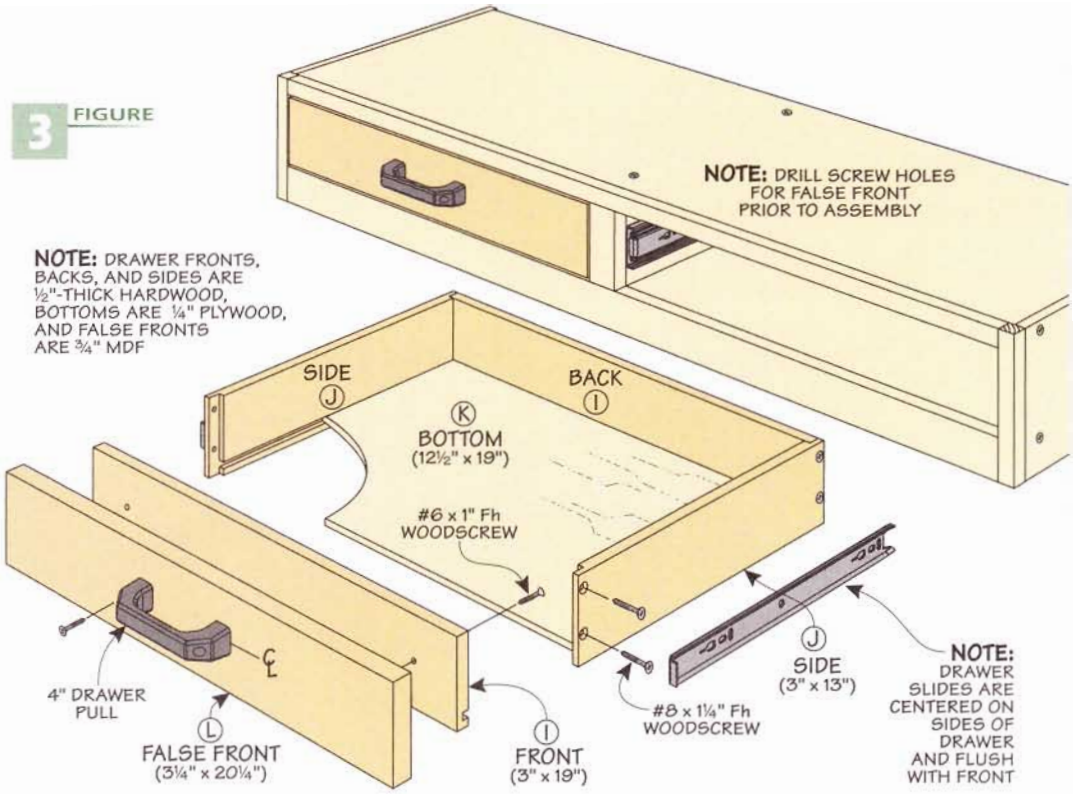
Protecting the Edges. MDF is a dense material, but the edges don't always hold up to a lot of abuse. To protect the edges at the front of the benchtop case, I added a solid-wood face frame. Nothing fancy here, any inexpensive hardwood will do. (I used poplar.)

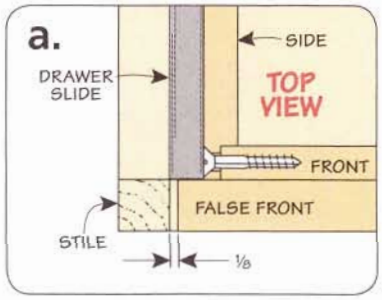
The outside stiles are sized to match the thickness of the MDF and then glued in place. Now you're ready to add the upper and lower rails. Like the stiles, the upper rail matches the thickness of the MDF, but the lower rail is wider. This way, it will cover up the front edge of the mounting system that supports the benchtop. Finally, cut and glue the center stile in place, as shown in Figure 2.

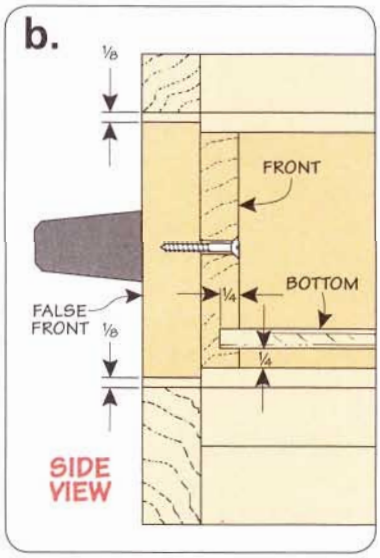
QUICK & EASY STORAGE

The openings in the benchtop unit provide pretty handy storage. But to make better use of the open space, I installed a pair of drawers, as shown in Figure 3 and the photo you see below.

FIGURE 3







The drawers are simple to build. Each one is just a pair of sides with rabbets cut in them to accept a front and back (Figure 3a). The rabbeted sides make it easy to assemble the drawer. Reinforcing the corners with screws ensures they'll hold up over time.

There are three things to keep in mind when sizing the drawers. First, provide clearance for the drawer slides. (I used full-extension slides, like the ones shown in the photo at left.) Second, be sure to account for the rabbets in the sides when sizing the front and back. And finally, allow for the addition of a false front.

After cutting the front, back, and sides to size, complete the rabbets and then cut a groove in all the pieces for the drawer bottom. Once that's done, you can assemble the drawers and then install them.

To cover up the drawer slides, I installed false fronts. Like most of the benchtop unit, they're made from ¾" MDF and sized for a ⅛" gap all around (Figures 3a and 3b).

All that's left to do at this point is attach a handle to the front of each drawer and glue the back in place. And if you're thinking about painting the benchtop (and the rest of the components), check out Shop Short Cuts on page 23 for some handy tips on getting the best look on MDF.

◀ ***Solid Support.*** *Full-extension slides provide smooth movement and complete access to the contents of each drawer.*

completing the Bench

With the basic bench complete, there are a couple of things left to do before it's ready to mount to the wall — add a heavy-duty worksurface and a shelf.

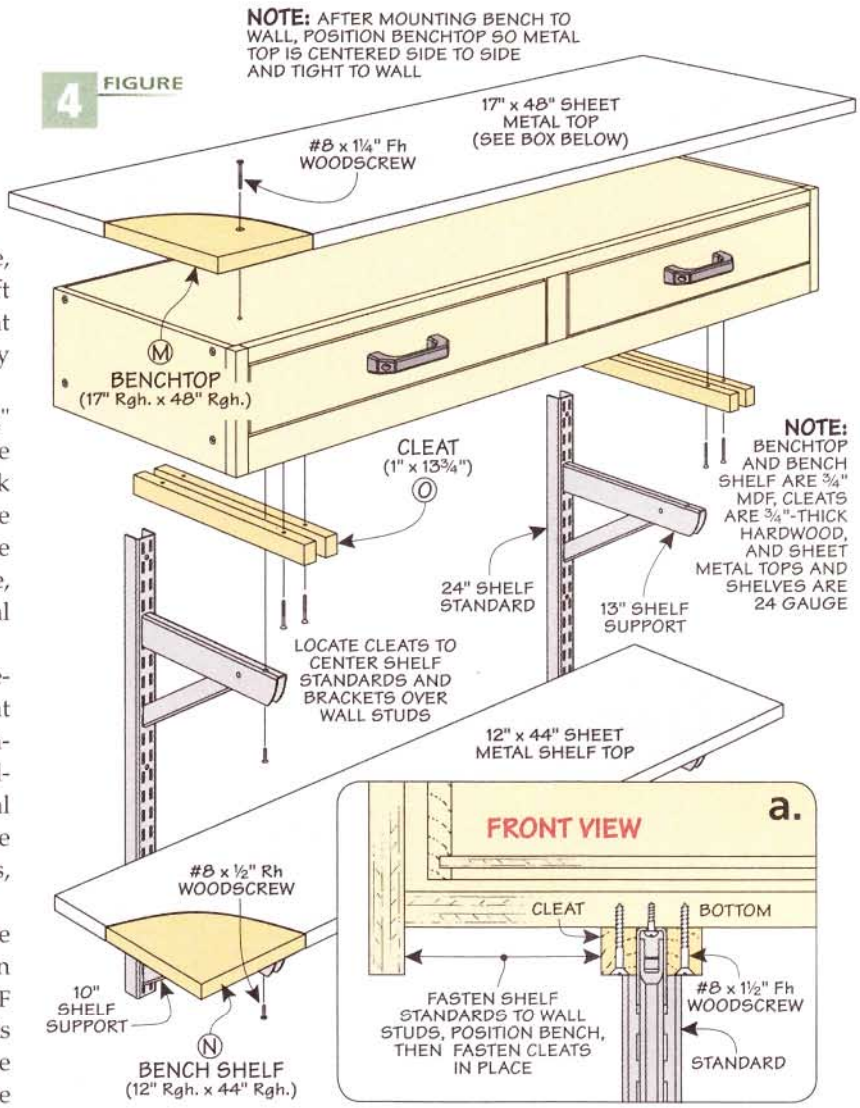
Covering the Top. A simple ¾" MDF benchtop would provide great service for just about any task you might run across. But to create a virtually indestructible surface that would stand up to a lot of use, I chose to add a wrap-around metal top, as shown in Figure 4.

Now the metal top isn't something you're going to run across at a hardware store. I had it custom-made at a local heating and cooling company, along with the metal shelves you see here and on the opposite page. For more on this, check out the box below.

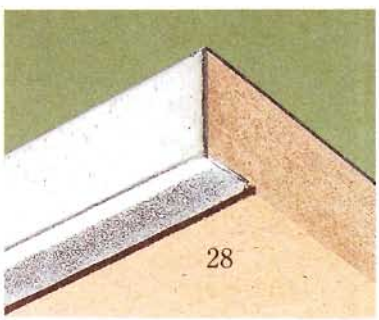
Make the Benchtop. Be sure you have the metal top and shelf in hand before working on the MDF benchtop and bench shelf. This way, you can custom fit each one by trimming them to size so the metal top just slips over the edges.

Once you have the metal tops made and the benchtop and shelf complete, you're ready to install them. This is handled by sturdy metal shelf standards available at most home centers and hardware stores (Figure 4).

FIGURE 4



For a secure installation, be sure to attach the standards to wall studs. I located my standards and support brackets to position the top of the bench 36" from the floor. The benchtop unit simply butts against the standards. A pair of hardwood cleats traps the bench on the bracket and a couple of screws secure it in place, as shown in Figure 4a. All that's left to do here is attach the benchtop and bench shelf in place with enough clearance at the back so the metal tops can drop right over the top.



Metal Tops & Shelves

◀ ***Sturdy Tops.*** *Rolling the bottom edges and tacking the corner creates a clean look for the metal tops of the benchtop and shelf.*

◀ ***Wrap Around.*** *For the shelves, the metal wraps around a beveled rabbet for a smooth transition along the bottom edge.*

The metal tops and shelves are a great solution for creating a heavy-duty worksurface. Finishes, stains, and glues won't damage them. And cleanup is a breeze — just wipe them down. Finally, you can't beat the clean look.

Of course, the challenge is having the tops and shelves made. I found a local heating and cooling contractor to take care of the work. They're well equipped to handle the job of bending the shelves (lower left photo). And they can fold and spot weld the corners of the tops with ease (upper left photo). With the photos and sizing information detailed above, you shouldn't have any trouble having them made. And as to the cost, it ran me about $160 for two metal benchtops, two bench shelves, four narrow shelves, and six wide shelves.

everything in its Place

The bench is a great addition to any shop, but to meet all your storage needs, take a look at the two wall cabinets shown here. Both cabinets feature identical joinery and construction and they're both two feet wide. This way, you can mix and match any number of them to suit your space and storage needs.

The Differences. There are a few differences between the two cabinets I should point out. The large cabinet is taller (36"). And it accepts three shelves instead of two. Finally, the large cabinet is deeper (8"), as shown in Figure 6.

As I mentioned, the joinery and construction are identical. Simply cut the tops, bottoms, and sides to size, accounting for the rabbets in the sides. Then, to accept a ¼" plywood back, you'll need to cut a wide, shallow rabbet along the back edge of each piece (Figures 5a and 5b). The last thing to do before assembling the cabinets is to drill the holes for the shelf pins.

Hanging Cleats. After fastening the top and bottom to the sides of the cabinet, you can cut a pair of cleats for mounting the cabinet to the wall. They fit between the sides and are glued to the top and bottom so they're flush with the shoulders of the rabbets you cut earlier (Figure 5b). With the cleats in place, you can glue the back to the cabinet.

All that's left at this point is to add a pair of stiles. The ¾"-thick hardwood stiles provide a solid mount for the hinges and screws used to hang the doors. The stiles are simply glued to the edges of the cabinet, as in Figures 5 and 6.

Finally, cut the MDF shelves to size and rabbet the edges to fit the metal shelves (Figure 5e).

FIGURE 5

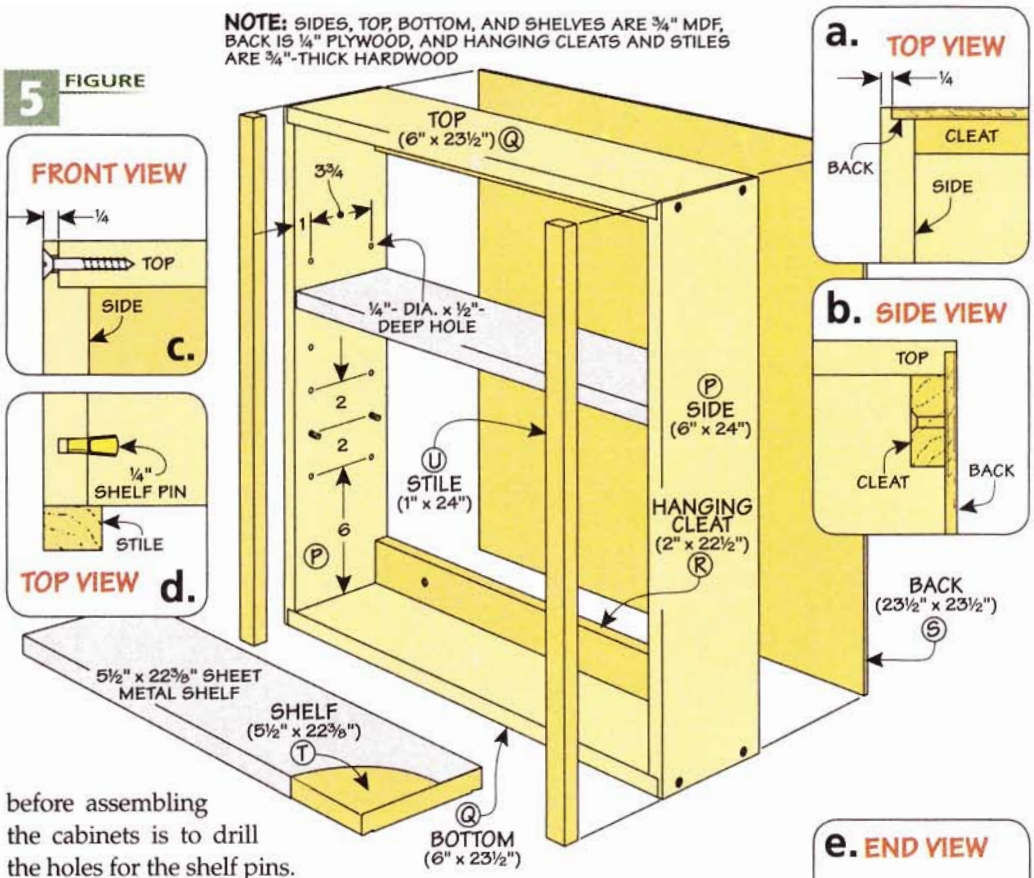
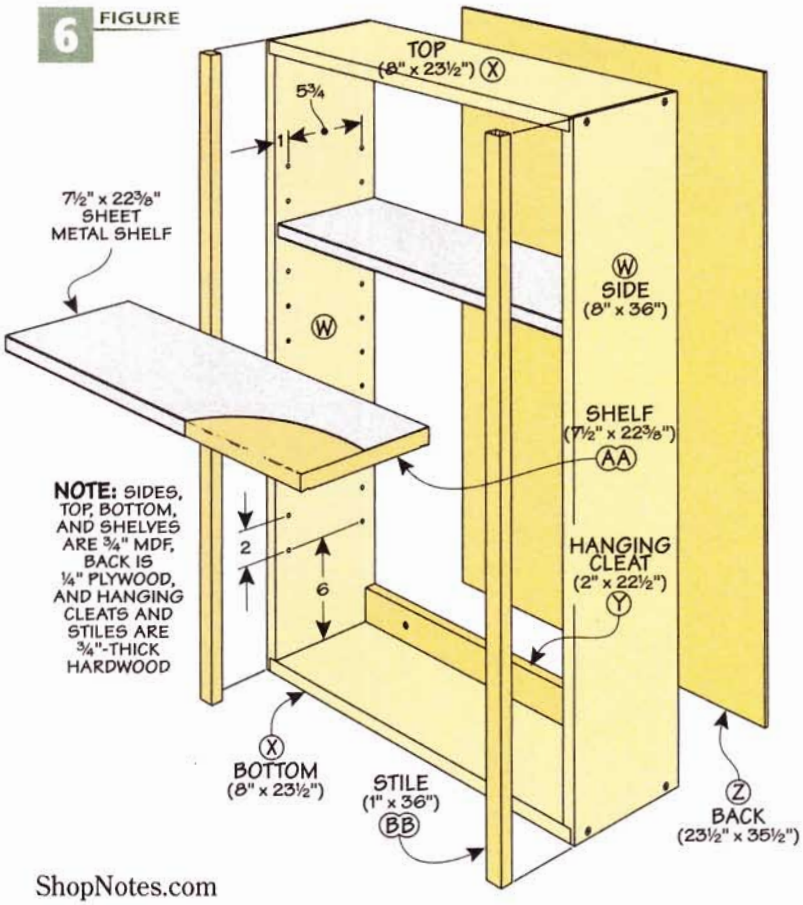


FIGURE 6



Open Access. *Without doors, a the wall cabinet provides quick and easy access to the contents.*

Clean & Sleek. *Adding doors to the cabinets provides a clean look and dust-free storage.*

▲ **Odds & Ends.** *The metal rods of this open cabinet provide a place for difficult-to-store items.*

adding the final Details

Although basic, easy-to-access storage is great, there are times when I don't want all the clutter visible. Plus, it's an open invitation to collect dust and dirt.

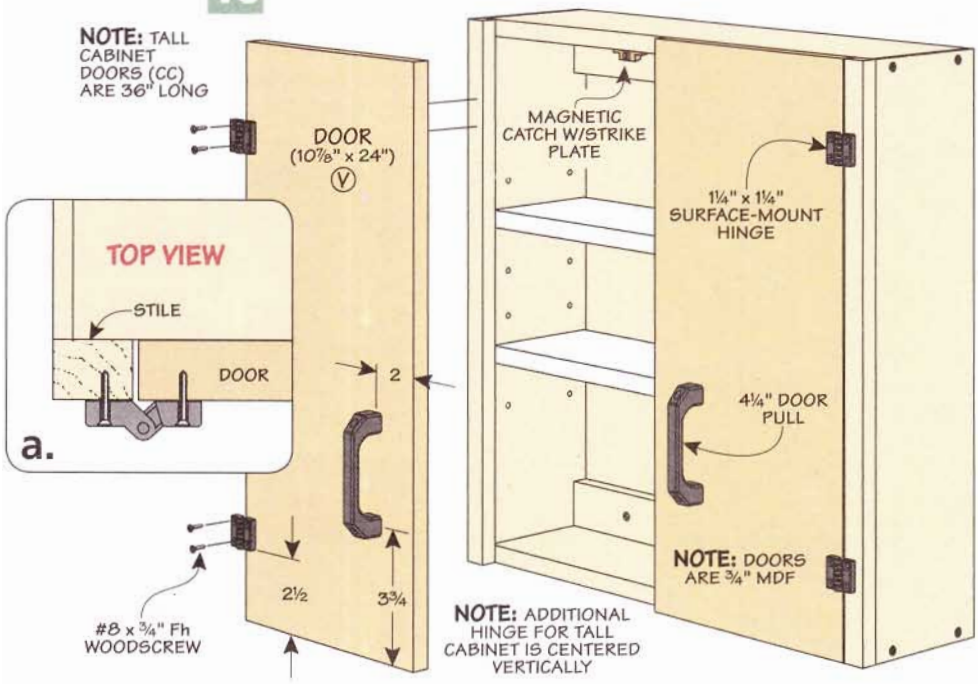
To solve that problem, you can add doors to the wall cabinets, like the ones you see in the photo above. There's nothing complicated here. The doors are simple, flat panels made from ¾" MDF, as illustrated in Figure 10.

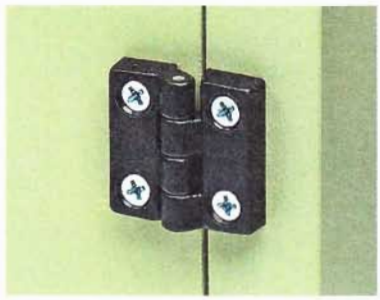
The doors are sized in length so they're flush with the top and bottom of the cabinet. To determine the width of the doors, I started by measuring the spacing between the stiles (22" in my case). Then, after subtracting ¼" for clearance around the doors, I split the remaining measurement and cut both doors to width. (My doors ended up 10⅞" wide.)

When it came to installing the doors, I simply laid each cabinet on its back and spaced the doors to create identical gaps between the edges of the doors and stiles as well as between the two doors. Finally, I used surface-mounted hinges to attach the doors, like the ones shown in the photo below.

For the tall cabinet, I added a third hinge to each door, centering it between the top and bottom.

FIGURE 10





▲ **Surface-Mount Hinge.** *Installing these hinges is just a matter of screwing them to the surface.*

A magnetic catch installed at the top of the cabinet keeps the doors securely closed. And simple, plastic pulls complement the style of the hinges, as you can see in the main photo on the opposite page.

HANGING ROD CABINET

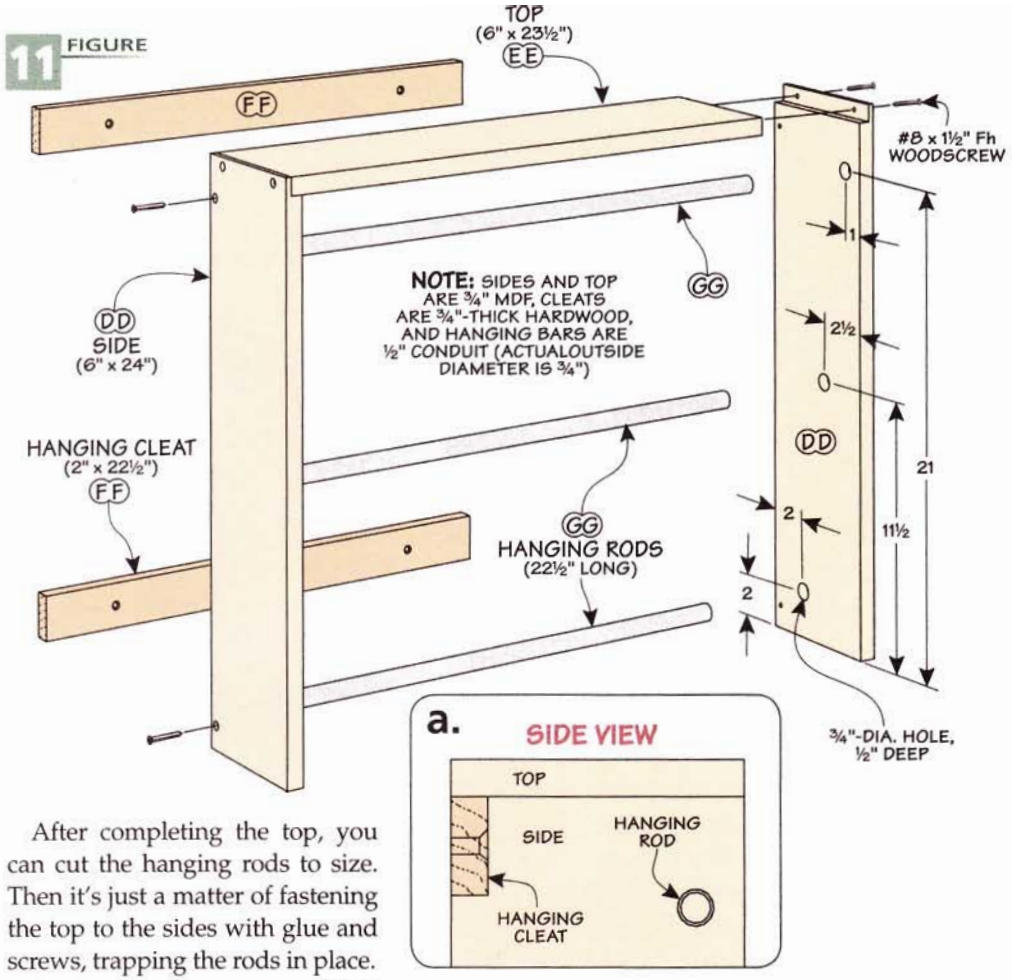
The bench and wall cabinets will suit just about any storage need you have. But for some items, you may want to consider the cabinet you see in the right photo at the top of the opposite page.

What makes this cabinet unique is the set of three metal rods that span its width. It's a great solution for keeping oily rags off your bench or to hang up finishing rags to dry before you throw them out. Plus, it's a handy way to dry out brushes after they've been cleaned.

There isn't all that much to making the cabinet. As you can see in Figure 11, it starts out as a pair of sides. Then, to accept the conduit used for the hanging rods, I drilled a series of stopped holes.

Once you have the holes drilled for the conduit, you can cut rabbets along the top ends of each side to accept the top. The top is cut to length so the overall width of the cabinet is 24". (To allow you to hang items from the lower rod, there's no bottom.)

FIGURE 11



After completing the top, you can cut the hanging rods to size. Then it's just a matter of fastening the top to the sides with glue and screws, trapping the rods in place.

Since the hanging rod cabinet is only going to see light duty, I didn't add a back. And it doesn't need doors, so I skipped the stiles as well. As before, mounting it to the wall is taken care of by a pair of hanging cleats (Figure 11).

That completes the last of the storage system. Your only problem at this point might be gathering up all your tools and shop supplies and figuring out exactly where to store everything.

Materials & Hardware

BENCH (Per Unit)

A	Sides (2)	5 x 14 - ¾ MDF
B	Top/Bottom (2)	13¾ x 43 - ¾ MDF
C	Divider (1)	3½ x 13¾ - 1½ MDF
D	Back (1)	5 x 43 - ¼ Ply.
E	Stiles (2)	¾ x ¾ - 6
F	Top Rail (1)	¾ x ¾ - 42½
G	Bottom Rail (1)	¾ x 1¾ - 42½
H	Center Stile (1)	¾ x 1½ - 3½
I	Drawer Front/Back (4)	½ x 3 - 19
J	Drawer Sides (4)	½ x 3 - 13
K	Drawer Bottoms (2)	12½ x 19 - ¼ Ply.
L	False Fronts (2)	3¼ x 20¼ - ¾ MDF
M	Benchtop (1)	17 rgh. x 48 rgh. - ¾ MDF
N	Bench Shelf (1)	12 rgh. x 44 rgh. - ¾ MDF
O	Cleats (4)	¾ x 1 - 13¾

SMALL WALL CABINET (Per Unit)

P	Sides (2)	6 x 24 - ¾ MDF
Q	Top/Bottom (2)	6 x 23½ - ¾ MDF
R	Hanging Cleats (2)	¾ x 2 - 22½
S	Back (1)	23½ x 23½ - ¼ Ply.
T	Shelves (2)	5½ x 22⅜ - ¾ MDF
U	Stiles (2)	¾ x 1 - 24
V	Doors (2)	10⅞ x 24 - ¾ MDF

TALL WALL CABINET (Per Unit)

W	Sides (2)	8 x 36 - ¾ MDF
X	Top/Bottom (2)	8 x 23½ - ¾ MDF
Y	Hanging Cleats (2)	¾ x 2 - 22½
Z	Back (1)	23½ x 35½ - ¼ Ply.
AA	Shelves (3)	7½ x 22⅜ - ¾ MDF
BB	Stiles (2)	¾ x 1 - 36
CC	Doors (2)	10⅞ x 36 - ¾ MDF

HANGING ROD CABINET (Per Unit)

DD	Sides (2)	6 x 24 - ¾ MDF
EE	Top (1)	6 x 23½ - ¾ MDF
FF	Hanging Cleats (2)	¾ x 2 - 22½
GG	Hanging Rods (3)	¾-Dia. x 23½

- (36) #8 x 1½" Fh Woodscrews
- (16) #8 x 1¼" Fh Woodscrews
- (8) #8 x ½" Fh Woodscrews
- (4) #6 x 1" Fh Woodscrews
- (2 Pr.) 12" Full-Ext. Drawer Slides w/Screws
- (6) Drawer/Door Pulls w/Screws
- (5 Pr.) Hinges w/#8 x ¾" Fh Woodscrews
- (20) ¼" Shelf Pins
- (4) Magnetic Catches/Strike Plate w/Screws
- (1) ½" Electrical Conduit (72" Long for parts GG)
- (2) 24" Galvanized Metal Shelf Standards
- (2) 10" Shelf Supports
- (2) 13" Shelf Supports

ShopNotes ONLINE EXTRAS

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

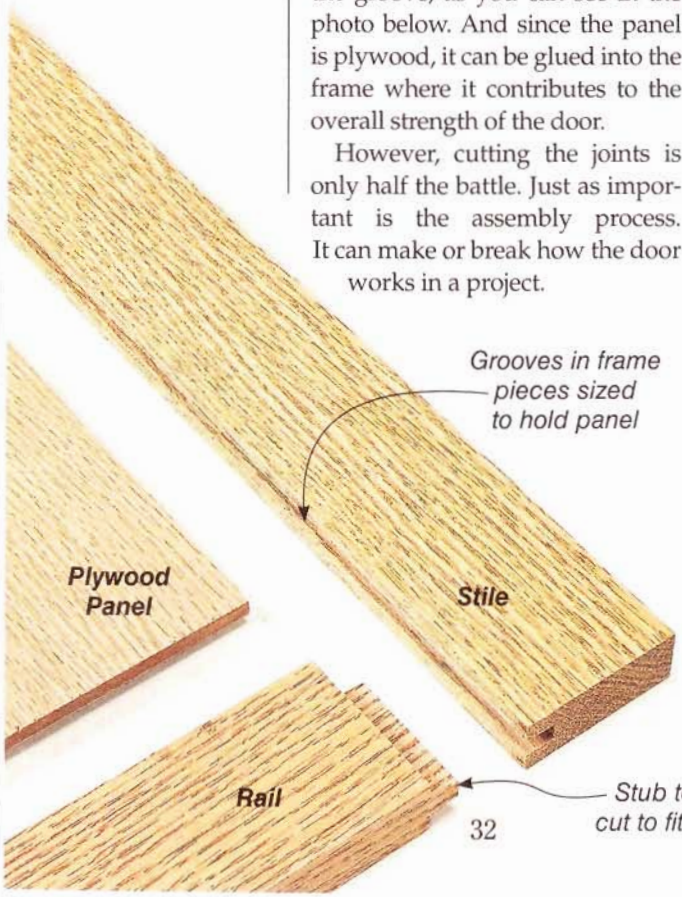
HANDS-ON
Technique

Follow this simple plan to get flat and square doors every time.

assembling Frame & Panel Doors

Using stub tenon and groove joinery to build doors is a mainstay technique in my shop. A big reason is the joints are easy to cut at the table saw. A centered groove cut in all the frame parts is sized to hold a plywood panel. A stub tenon on each end of the rails also fits in the groove, as you can see in the photo below. And since the panel is plywood, it can be glued into the frame where it contributes to the overall strength of the door.

However, cutting the joints is only half the battle. Just as important is the assembly process. It can make or break how the door works in a project.



DRY ASSEMBLY

Overall, there are two primary goals in assembling a door. It needs to be both flat *and* square. To accomplish this, there are a few details to consider before you even pick up a glue bottle and clamps.

The first thing to do is check the fit of all the joints and panel of every door you're making. The idea here is to sniff out any problems before it's too late.

The Frame. I begin by looking at the frame joinery. The stub tenons should have a "just right" fit in the groove. When glue is applied, they tend to swell a bit. Sand or plane them if the joint takes more than simple hand pressure to close.

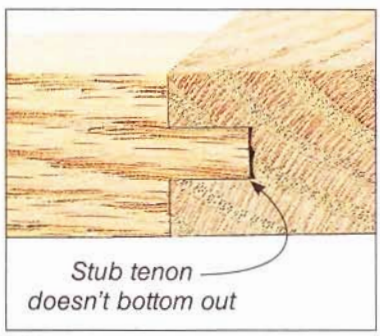
Then check to make sure that the joints close tightly at the shoulders. One way to make sure this happens is to trim the tenon so it doesn't bottom out in the groove, as shown in the left photo below.

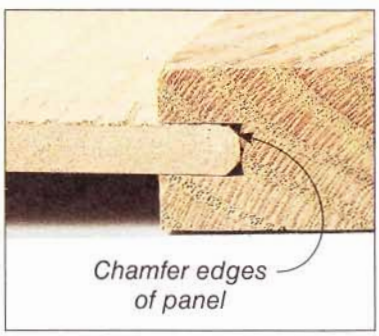
The Panel. Now, open up the frame and fit the plywood panel in place. As you reassemble the frame, there are a couple of things to be on the lookout for.

First, is the panel flat and does it slide easily into the grooves? A ¼" plywood panel has an annoying tendency to warp like a potato chip. If the panel is too distorted, you may need to set it aside and remake the part.

The other thing to look at is whether the frame joints still close up tightly. If not, it means the panel is too large. So you may need to trim it down at the table saw.

I like to chamfer the edges of each panel, too, as you can see in





the lower right photo on the previous page. This eases the fit of the panel into the grooves. And it prevents the face veneer from splintering. The gap it creates provides a reservoir for excess glue as well.

GLUE IT UP

When you're satisfied with the fit, you're ready to start assembly. There are two things to think about at this stage: Applying the right amount of glue in the right places and assembling the frame and panel in a logical order. But before you begin, it's a good idea to clear your worksurface and "preset" your clamps to the width of the door.

Spreading Glue. The two photos at the top of the page show how I apply glue. A brush allows you to spread a thin even, layer on the cheeks of the stub tenons.

For the grooves, simply run a thin bead along the edge straight from the glue bottle — there's no need to spread it around. The key is to use the right amount of glue. Cleaning up squeeze out in a frame and panel is tedious work.

▲ ***Stub Tenons.*** *With a brush, apply a thin coat of glue to just the cheeks of the stub tenons.*

▲ ***Grooves.*** *A thin bead of glue is all it takes in the groove. Inserting the panel spreads it around.*

There's one more thing about the glue I'd like to mention. Using a slow-setting glue can give you some added working time while you get the parts arranged.

The Right Order. To end up with a square and flat final assembly, I follow a specific routine.

The assembly process starts with turning a stile on edge. Then insert a rail into the groove. Make sure to keep the rail flush with the end of the stile. Next, I slip the panel into place (top photo below).

Now, fit the other rail at the end of the panel. Finally, add the remaining stile over the panel and stub tenons (lower left photo).

Clamps. I set the door flat on a pair of spacers, and apply the clamps across the ends, as you can see in the main photo on the facing page. This keeps the clamps from bowing the frame. Just snug the clamps up for now. It's your chance to check final alignment of the rails with the ends of stiles.

At this point, you can use a square to check the frame, as in the upper right photo below. (Or compare corner to corner measurements.)

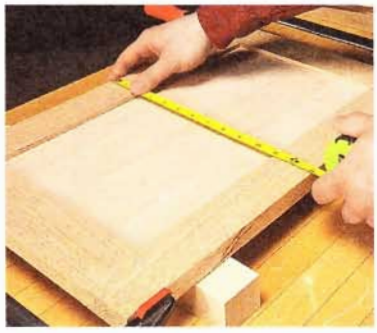
It's a good idea to measure across the middle of the door, too (lower photo). The panel may cause the stiles to bow out slightly. So you may need to add a clamp to draw the stiles straight.

At last, tighten down the clamps. In a few hours, you can take the clamps off and be confident that the door is ready to go.

Stile, Rail, Then Panel. *Align the rail with the end of the stile before fitting the panel.*

◀ ***Check for Square.*** *Lightly tighten the clamps and make sure the assembly is square.*

Finish Up. *Top off the assembly with the remaining stile. Now you're ready for clamps.*



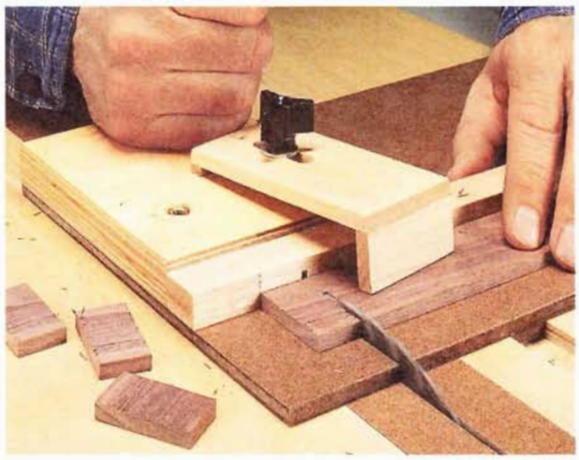
◀ ***Across the Middle.*** *Compare the middle to the ends to see if the stiles are bowed.*

precision-cutting Small Parts Jig

This easy-to-build project makes it a snap to cut thin and small parts accurately and safely.

It's no surprise that the table saw handles most of the cutting chores in my shop. It's a powerful and accurate tool for heavy work. But when it comes to cutting very small parts, it's just not nearly as well suited to the task. The reasons are simple. First, the rip fence isn't designed for easy adjustment in very small increments (less than $\frac{1}{32}$"). And even if you can dial in that level of accuracy, you still have the problem of controlling a workpiece before, during, and after the cut.

The jig shown in the photo above handles these tasks by incorporating a small-scale "replacement"



▲ ***Crosscut Sled.*** *This crosscut sled rides in a slot in the platform for accurate cuts in small parts. A hold-down keeps the workpiece in place safely.*

table on your saw. Along with the table comes a couple of handy accessories designed to take you to a whole new level of accuracy.

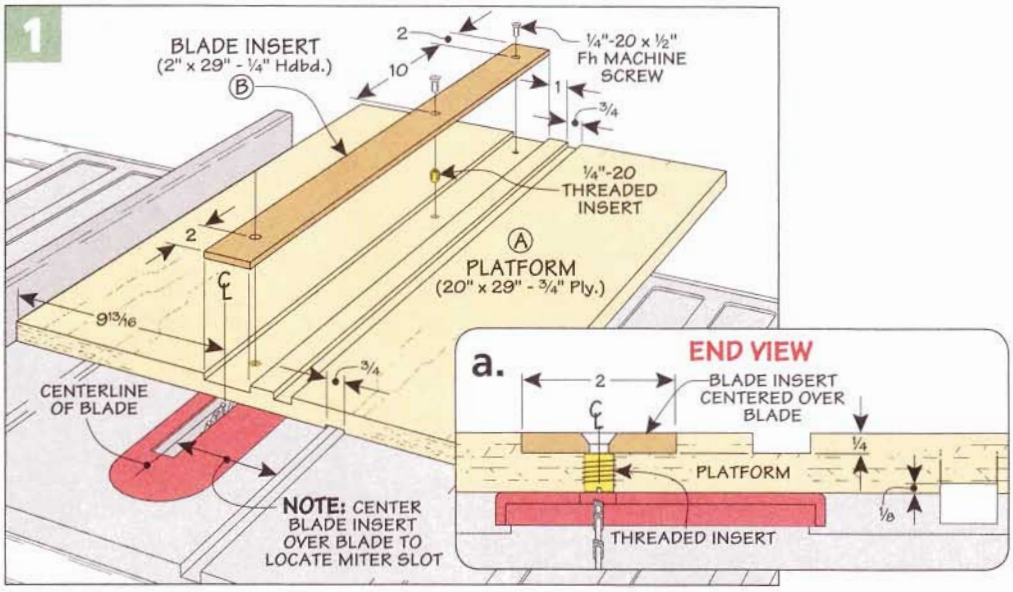
The main feature of this jig is the micro-adjusting rip fence. It consists of two, tapered sections that slide against each other. Sliding the adjustable section forward or backward also shifts the fence toward (or away from) the blade in very small, repeatable amounts.

Some of the other features included with this jig are a crosscut sled, a zero-clearance insert, and a unique hold-down.

The Right Blade. There's one other addition to your table saw that will help when cutting small parts — the blade. I replaced my standard blade with a 40-tooth, 7¼"-dia. combination blade. Using a smaller blade reduces the tooth speed which makes cutting small pieces smoother and provides more accurate results.

START WITH THE PLATFORM

The jig is made up of three assemblies. It begins with the platform, which serves as a base for the other assemblies: the rip fence and the crosscut sled. What's important here is the platform is flat and smooth. To ensure this, I used a piece of Baltic birch plywood for the platform.



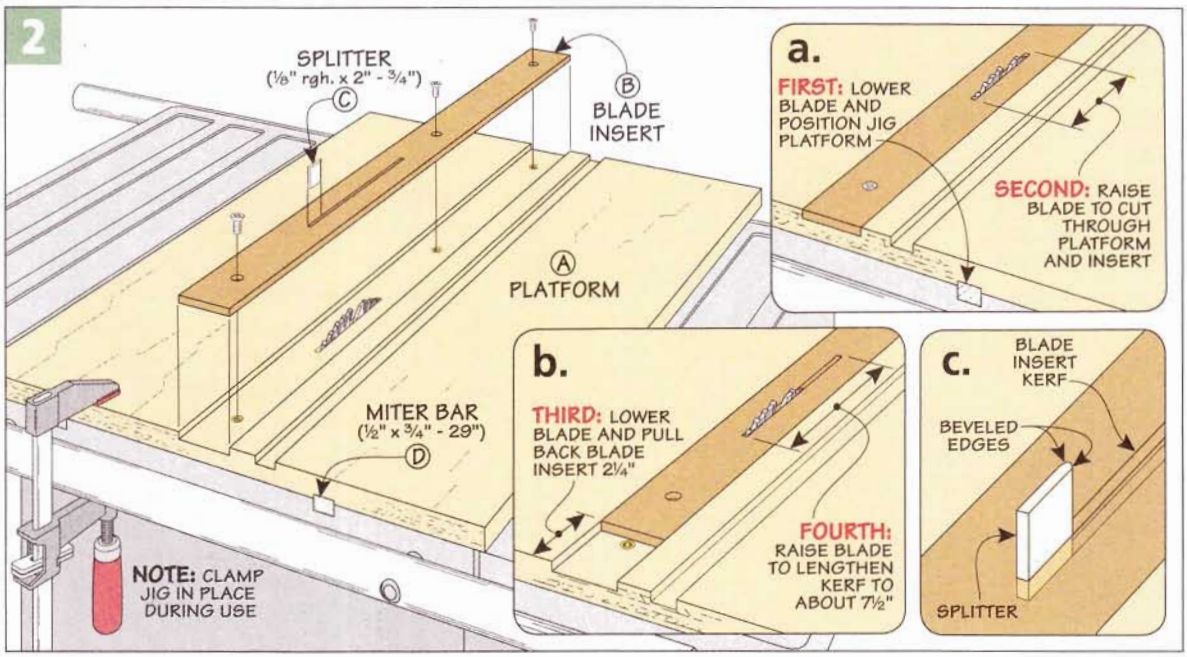
Three Grooves. There's a little more to it than a plain piece of plywood, though. The platform has three grooves cut in it (Figure 1). A wide groove in the top holds a hardboard insert. It allows you to create a zero-clearance opening for the blade (Figure 1a). A second groove cut in the top serves as a miter gauge slot for the crosscut sled shown on page 39.

The final groove is cut in the bottom face. This groove accepts a runner to register the jig in the miter gauge slot of the saw table.

Miter Bar. With the details of the platform complete, you can make a few parts that attach to it. The first is the miter bar shown in Figure 2. Size it for a snug fit in both the groove and slot in the saw table. Just don't glue it in place yet.

Hardboard Inserts. The other part to make is the zero-clearance insert I mentioned earlier, as shown in Figures 1 and 2.

Go ahead and make a few of these. The insert will eventually get chewed up. And you will use one as a fence insert later on. Finally, Figure 2 shows you how to add a splitter to a zero-clearance insert. This comes in handy when ripping very narrow strips.



micro-adjusting

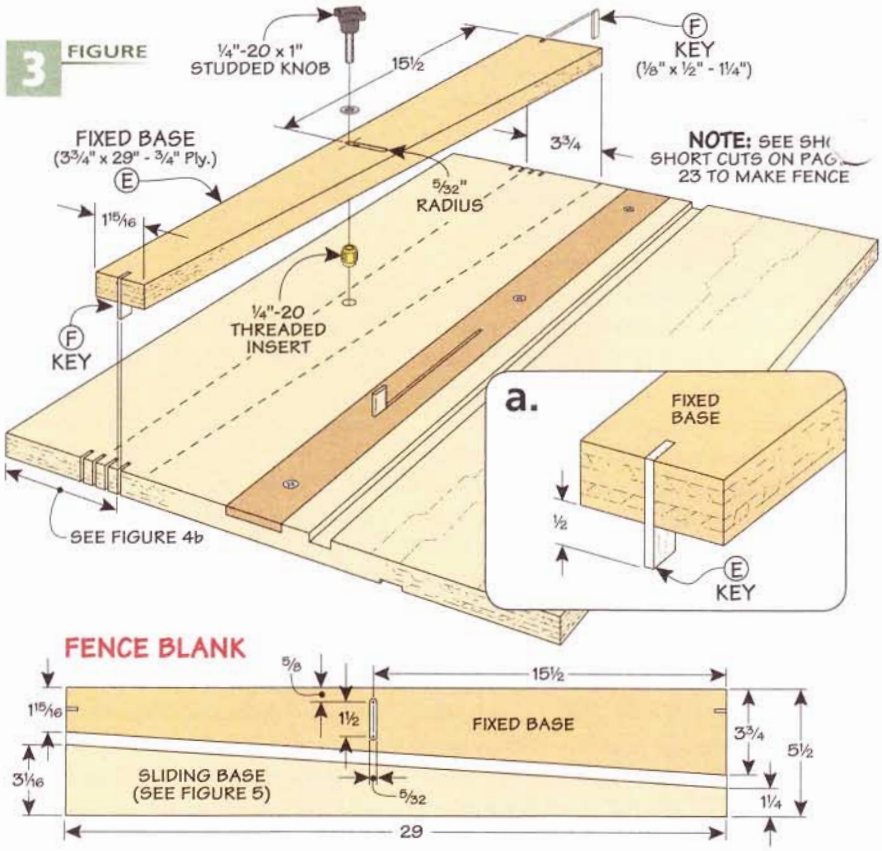
Rip Fence

The next part of the jig to make is the rip fence. It's made up of two, tapered components — one fixed and the other adjustable to slide against it. The two tapers work together to make very small, incremental adjustments easy.

Sliding Taper. The fixed base of the rip fence assembly registers in a series of notches in the platform. The notches provide a rough adjustment. To fine-tune the position, you move the sliding fence face forward or backward — not side to side.

The key is the long taper on the mating faces of the fence parts I mentioned earlier. If you slide the fence face away from you, it also moves away from the blade a small amount. For example, sliding the rip fence forward 1" moves the fence face away from the blade only ⅛".

Tapered Bases. Making the tapered portions of the rip fence is the place to get started. The most important thing about making these pieces is the taper on each edge should be identical. This way, the fence stays parallel to the blade as you adjust the fence. To make these cuts, I used a sled at the table saw. You can read more about the sled in Shop Short Cuts on page 23.



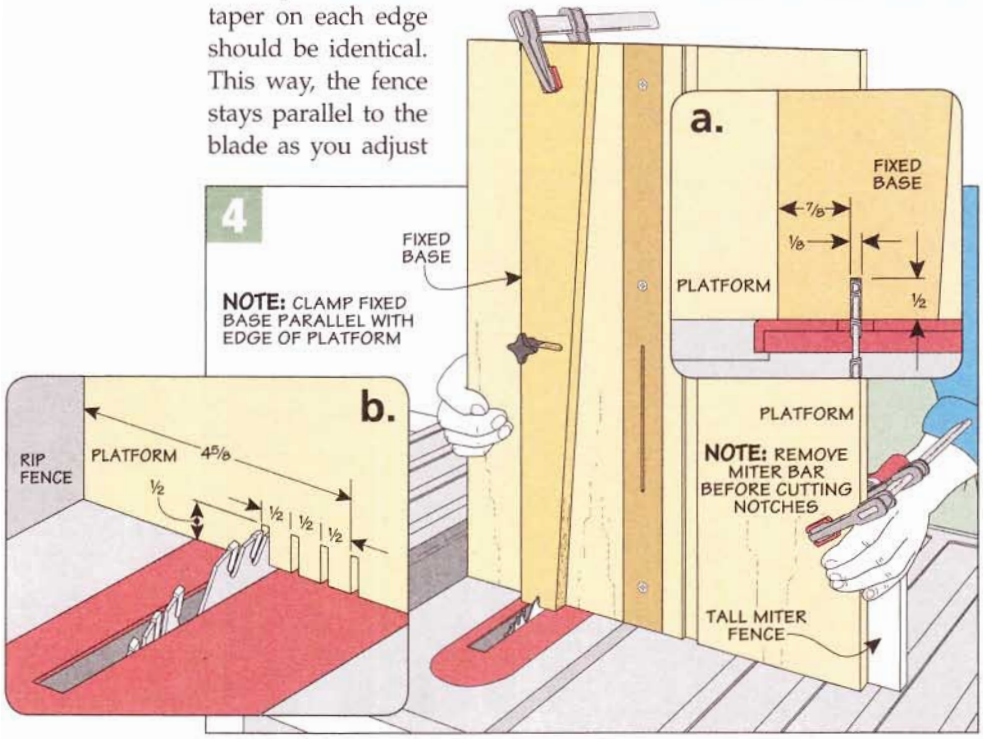
Fixed Base. Figure 3 shows how you can make the tapered pieces from a single blank. The fixed base now has a couple of details to take care of. The first is a slot that's used to set the rough position of the fence. The slot serves as a guide to install a threaded insert in the platform.

The other detail is a notch cut in each end. These notches hold hardwood keys, as shown in Figure 3a. The keys slip into a matching series of notches in the platform.

Cutting The Notches. The setup I used to cut all these notches is shown in Figure 4. Begin by cutting the first notch in the platform and fixed base at the same time. The notches are cut with these pieces held on end.

Since this could be a little unsteady, you'll want to take a couple of steps to keep the pieces under control. Start by attaching the fixed base to the platform with a studded knob and a clamp. Figure 4a shows you where to position the fixed base for the cut. Then attach a tall auxiliary fence on the miter gauge to keep things stable.

To locate the notches accurately, I used the rip fence as an end stop. After making a notch at one end, flip the assembly end for end and cut a notch on the opposite end Note: You'll need to move the



clamp to the other end of the platform to make this cut.

To create the remaining notches in the platform, remove the fixed base and adjust the rip fence, as shown in Figure 4b.

Hardwood Keys. Once you cut the notches in the fixed fence base, you can make and glue the hardwood keys in place, as illustrated in Figure 3a. Your aim is for the keys to fit snugly in the notches in the platform, but not be too difficult to insert or remove. I used some sandpaper to ease the edges and fine-tune the fit.

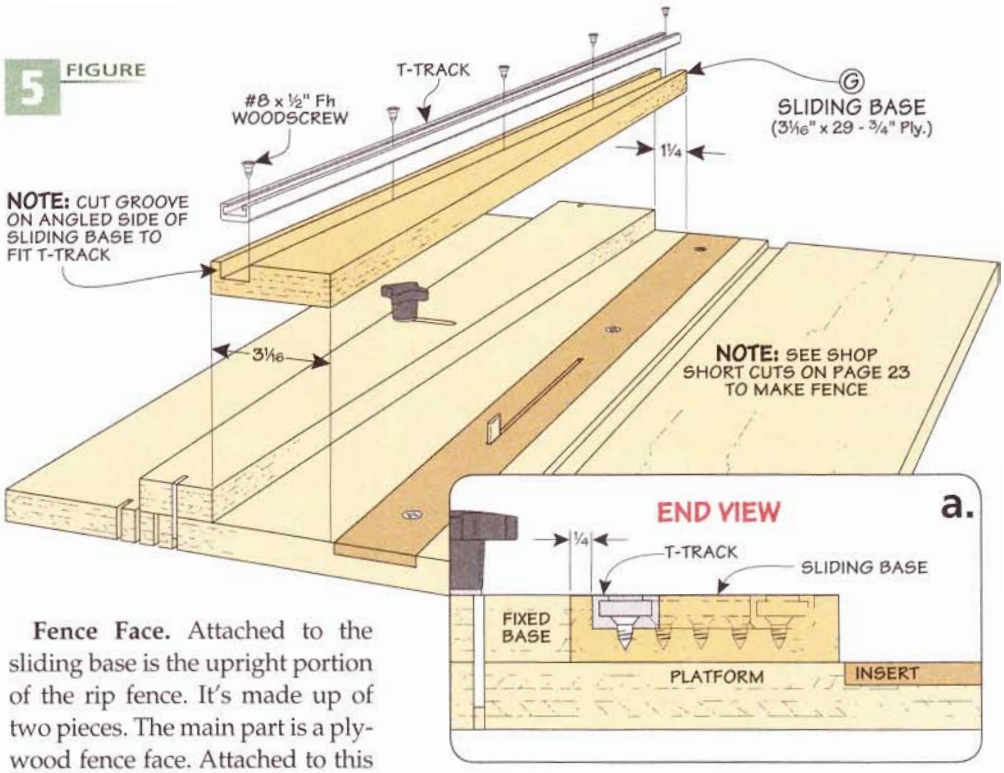
Sliding Assembly. Now, you can turn your attention to the sliding L-shaped portion of the rip fence. The pieces for this assembly are shown in Figures 5 and 6.

The sliding base has a matching taper that slides along the fixed base. After using the tapering sled to cut the sliding base to size, the only other thing you need to do is cut a groove near one edge.

As illustrated in Figure 5, the groove is sized to hold a length of aluminum T-track. This track is used to secure the sliding part of the fence once it's in position.

When cutting this groove, make sure to cut it parallel with the tapered edge of the workpiece. Then screw the T-track in place, as shown in Figure 5a.

FIGURE 5



Fence Face. Attached to the sliding base is the upright portion of the rip fence. It's made up of two pieces. The main part is a plywood fence face. Attached to this is a replaceable hardboard insert.

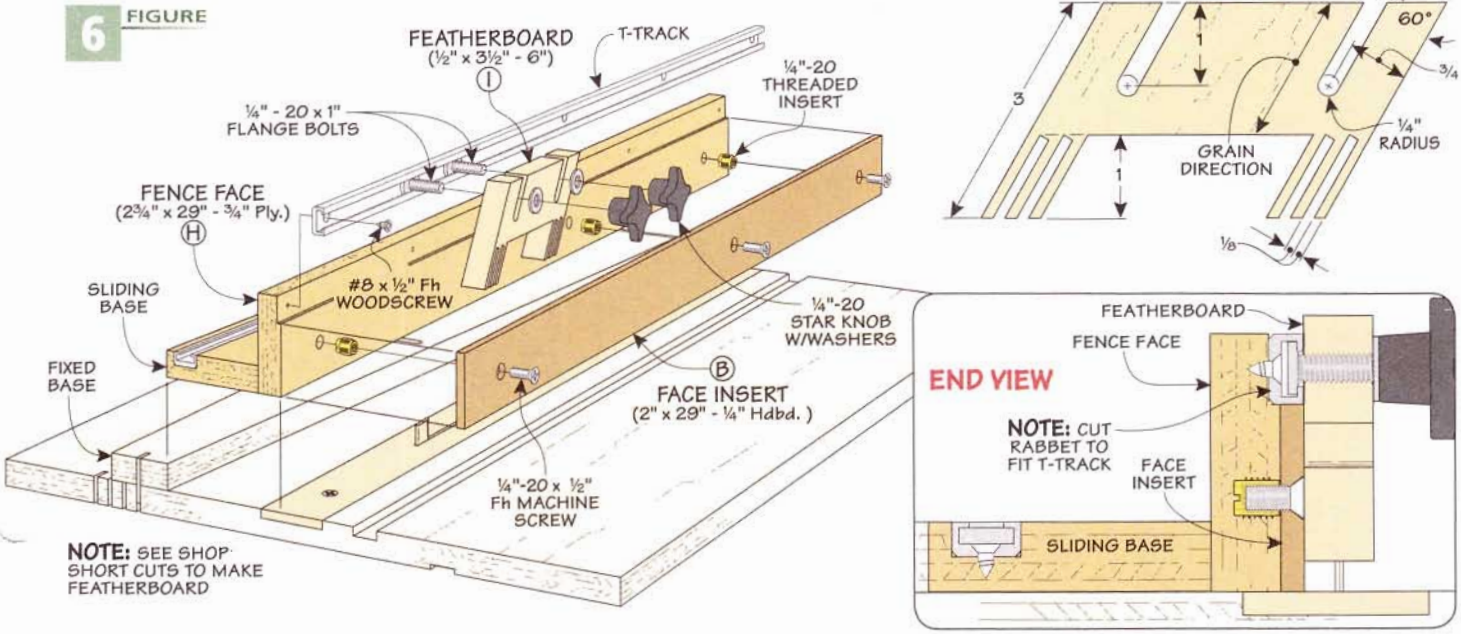
The insert is identical to the blade inserts you made earlier. And it's attached the same way — with screws and threaded inserts.

The plywood fence face also has a section of T-track mounted to it. This allows you to attach a featherboard or hold-down.

If you look at Figure 6a, you can see that the T-track is flush with the fence insert. So I had to cut a shallow rabbet along the top edge of the fence face to accommodate the T-track. At this point, the upright portion of the fence can be glued to the sliding base. Just take care to keep the fence face square to the jig platform.

Featherboard. One of the accessories for the fence I mentioned is a featherboard. My version is detailed in Figure 6. It's designed to straddle the blade and hold the workpiece down both ahead of and behind the blade. You'll find instructions on page 22.

FIGURE 6



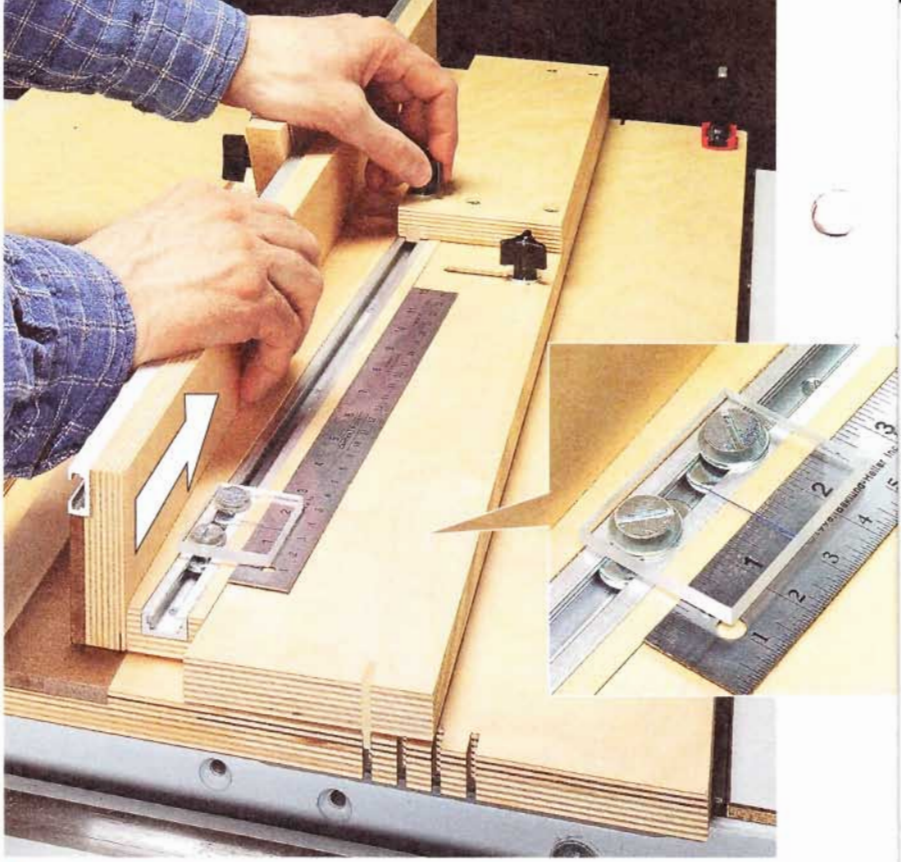
lock plate & Indicator

At this point, the two sections of the rip fence are essentially complete. What's left is to connect them so the fence can be locked in position to make a cut.

Locking Plate. You can see how this is accomplished in Figure 7. It's nothing more than a plywood plate with a hardwood runner. The plate is attached to the fixed base and the runner hooks into the T-track in the sliding portion of the fence, as shown in the photo at right. A flange bolt, washer, and knob hold everything in place.

The trick is that the runner in the plate sits in an angled groove. This allows it to mate with the tapered fence. The good news is that you can use the same taper sled you used earlier to cut the groove. The details are on page 23.

When sizing the groove, the goal is to match the width to the slot in the top of the T-track, as shown in Figure 7a. Then you can cut a hardwood runner to fit and glue it in place. The last step is to drill a hole to accommodate the flange bolt, as in Figures 7 and 7a.

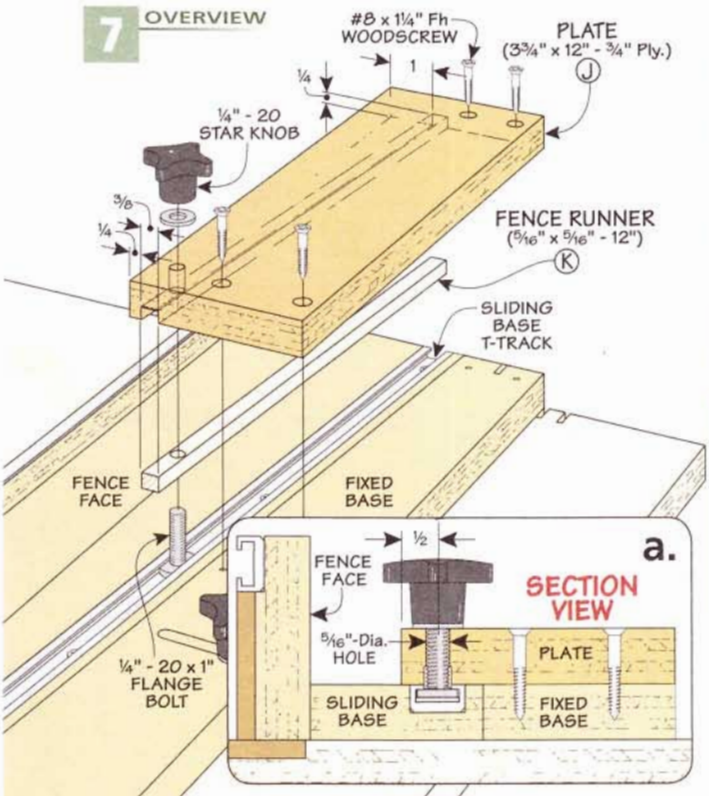


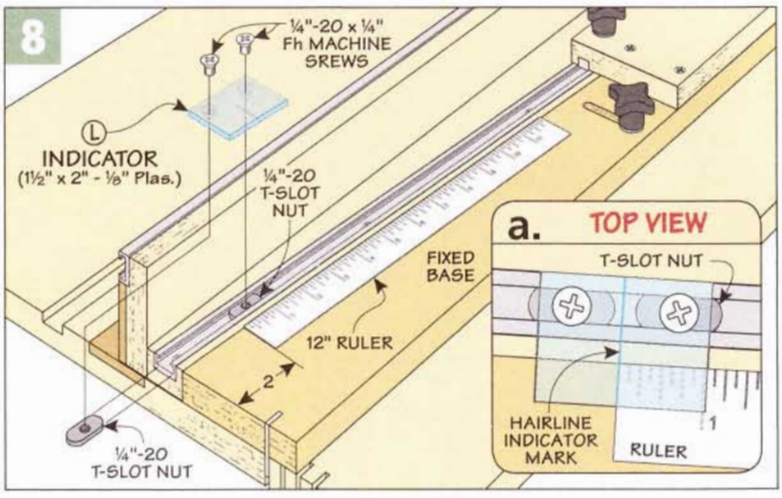
▲ ***Adjusting the Fence.*** *A ruler and indicator help you fine-tune the position of the sliding fence. Then lock it in place with a knob.*

Indicator. You could put the jig to use as is, but I added one other feature — a hairline indicator. I use it as a gauge to adjust the position of the fence face. The tapered fence design gives you finer control for adjusting the fence. The ruler allows you to move the fence in precise, small increments. For example, an ⅛" of movement on the ruler moves the fence 1/64" closer or farther from the saw blade.

Making the indicator is a pretty simple task, as you can see in Figure 8. Attach a ruler to the fence base with screws or double-sided tape. Then cut a piece of acrylic to size and drill mounting holes.

To create the hairline, I used a utility knife and square to scratch a line on the back face. Filling in the line with a fine-tipped marker makes it stand out. Now, you can clamp the jig to the saw table and set up to rip thin strips. To handle crosscutting on the jig, take a look at the sled on the next page.





small parts

Crosscut Sled

The platform and rip fence allow you to make precise, small-scale rip cuts. For crosscutting a small part, you need an alternative to a miter gauge. There are a couple of challenges. The first, of course, is cutting the piece accurately. The second is controlling the workpiece and the cutoff piece.

The crosscut sled lets you do both. It has a hardboard base and hardwood fence to keep a workpiece steady as it's cut. A runner on the bottom slides in the groove you cut in the top of the platform.

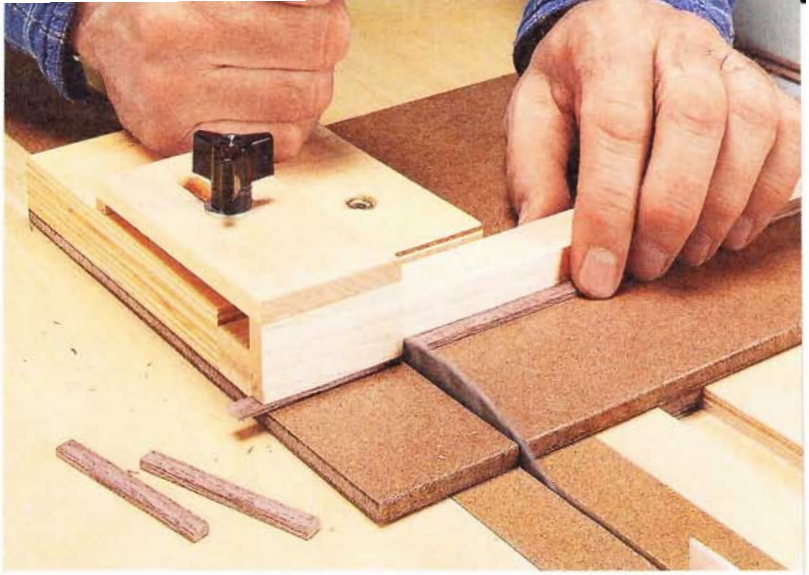
The sled has a hold-down to prevent a piece from shifting or getting thrown by the blade. And it keeps your fingers safely away from the cut. Threaded inserts in the sled allow the hold-down to be positioned on either side of the blade.

Figure 9 provides the details for building the sled. I started with a base then added the fence and a plywood blade guard.

The blade guard also houses three threaded inserts. As I mentioned earlier, two are for the hold-down and the third accepts a tall plastic handle.

The critical part of making the crosscut sled comes when you attach the runner to the underside of the base. It needs to be perfectly square to the fence in order to make accurate crosscuts.

When that's done, you can set it in place on the platform and cut a kerf in the base. This kerf makes it a snap to line up a cut.

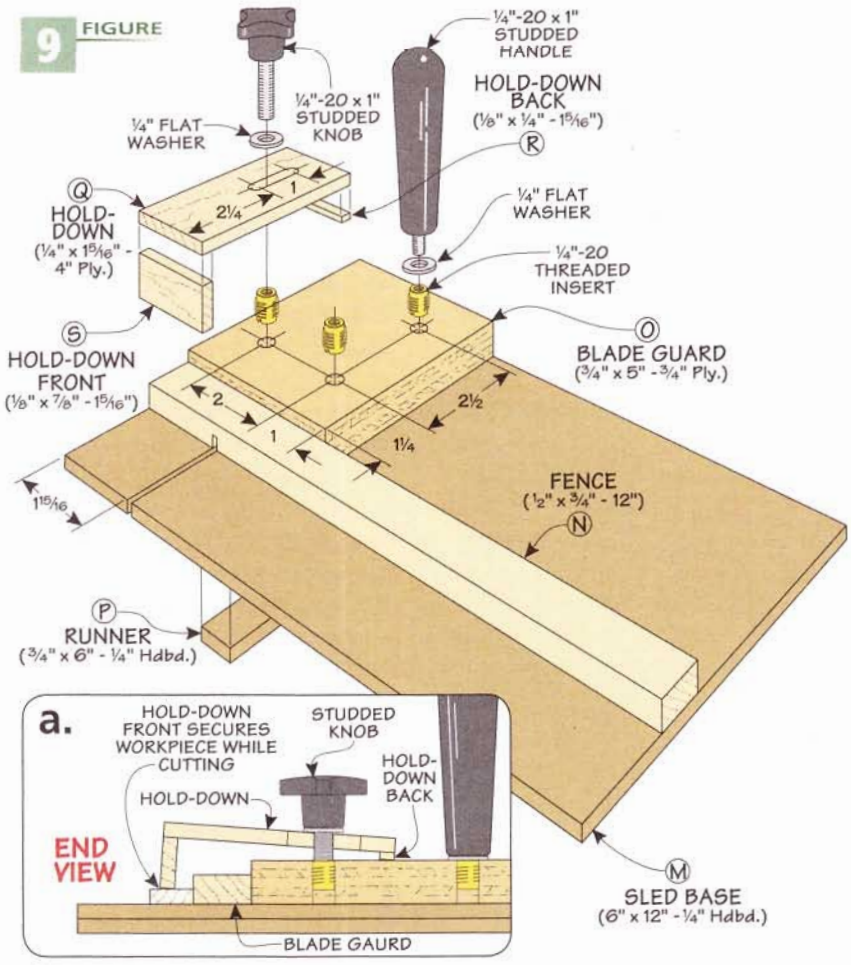


▲ ***Crosscut Sled.*** *The sled gives you solid control while making an accurate crosscut on a small part.*

Hold-Down. The final thing to make is the hold-down. It consists of three thin pieces of hardwood (Figure 9a). It's secured with a studded knob and washer.

Now the jig is complete. And the results are new capability and versatility for your table saw.

FIGURE 9



Materials & Hardware

CASE

A	Platform (1)	20 x 29 - ¾ Ply.
B	Inserts (2)	2 x 29 - ¼ Hdbd.
C	Splitter (1)	⅛ rgh. x 2 - ¾
D	Miter Bar (1)	½ x ¾ - 29
E	Fixed Base (1)	3¾ x 29 - ¾ Ply.
F	Keys (2)	⅛ x ½ - 1¼
G	Sliding Base (1)	3⁄16 x 29 - ¾ Ply.
H	Fence Face (1)	2¾ x 29 - ¾ Ply.
I	Featherboard (1)	½ x 3½ - 6
J	Plate (1)	3¾ x 12 - ¾ Ply.
K	Fence Runner (1)	5⁄16 x 5⁄16 - 12
L	Indicator (1)	1½ x 2 - ⅛ Plastic

CROSSCUT SLED

M	Sled Base (1)	6 x 12 - ¼ Hdbd.
N	Fence (1)	½ x ¾ - 12
O	Blade Guard (1)	¾ x 5 - ¾ Ply.
P	Runner (1)	¾ x 6 - ¼ Hdbd.
Q	Hold-Down (1)	¼ x 1 15⁄16 - 4
R	Hold-Down Back (1)	⅛ x ¼ - 1 15⁄16
S	Hold-Down Front (1)	¼ x ⅞ - 1 15⁄16

- (2) 36" T-Tracks
- (5) ¼"-20 x 1" Flange Bolts
- (2) ¼"-20 T-Slot Nuts
- (10) ¼"-20 Threaded Inserts
- (5) ¼"-20 Star Knobs
- (2) ¼"-20 x 1" Studded Knobs
- (1) ¼"-20 x 1" Studded Handle
- (1) 12" Ruler
- (1) 1½" x 2" - ⅛" Plastic for Indicator (L)
- (2) ¼"-20 x ¼" Fh Machine Screws
- (6) ¼"-20 x ½" Fh Machine Screws
- (9) ¼" Washers
- (10) #8 x ½" Fh Woodscrews
- (4) #8 x 1¼" Fh Woodscrews

120 vs. 240 volts
Motor Wiring

Is there an advantage to running your power tools at 240 volts? Here's what you need to know to decide what's right for you.

If you ask a woodworker about which voltage is better for the motors on stationary power tools (120 or 240), you're likely to get some strong opinions. Some say it doesn't make any difference. Others swear that their motors are more powerful since they made the switch to 240 volts. A few will tell you that you'll save money on your utility bill by switching your tools over to 240 volts. So what's the truth? Read on to find out what option is best for your shop.

240 volts. *This 20-amp receptacle will accept 15-amp or 20-amp plugs.*

Shop Wiring. One of the first things in determining what's the best voltage for your tools is your shop wiring. If your shop already has 240-volt circuits available, you'll find receptacles like the one shown at left.

But if your shop is like mine, there are only 120-volt circuits. So the decision comes down to a few other factors you need to consider.

Electrical Work. When thinking about adding circuits in my shop, I like to rely on the help and advice of an electrician. He can tell you if your breaker box can handle the additional load and required breakers. He'll also help you decide which type of cable is required and how to install it.

Motor Labeling. Besides the shop wiring, there's the issue of whether your tools can run at 240 volts. Looking at the nameplate or label on most power tool motors (top of the next page) you may see a reference to two voltages, in this case "120/240." This designation means the motor can be wired for either voltage.

Note: The voltage listed on a motor is the nominal voltage it's rated to run at. You'll see references to 110/220, 115/230, or 120/240. But when referring to household or residential voltage, "120/240" is an accepted term.

Making the Decision. Once you've determined whether or not the motor is capable of running at 240 volts, you have to decide if it has any benefits for you. I contacted a friend who's an electrician to help me out. Without getting into a technical discussion, he gave me some valuable information.

Saving Money? The first thing to get straight is that you won't save a nickel on your utility bill by converting your motors to run at 240 volts. The total power used by the motor is the same at 240 volts as it is at 120 volts.

More Power? Here's another thing that surprised me. The motor doesn't develop any more muscle at 240 volts. The horsepower rating on most motors is the same at either voltage.

Dual Rating. After clearing up these misconceptions, it's good to

This designation means the motor can be wired to run at either 120 or 240 volts

The amperages tell you the amount of current draw at low voltage/high voltage

HP	1 1/2	RPM	3450
VOLTS	120/240	AMPS	12.8/6.4
HZ	60	PH 1	ENC. -DP
SERVICE FACTOR	1.0	FRAME	56
INSUL. CLASS	3	MAX. AMBIENT	40°C
TIME RATING	CONT.	TYPE	B
DESIGN LETTER		KVA CODE LETTER	H

know there are some some benefits to making the switch 240 volts. The first is whether your tool's motor is "dual-rated." The motor could be designed to run with more horsepower at a higher voltage. If this is the case, you'll see *two* horsepower ratings on the motor's label. For example, 1.5/2.0. In this case, you would see a 33% increase in power by converting to 240 volts.

High Amperage Draw. You'll also see an improvement by converting to 240 volts if all the lights in your house dim when you turn on the table saw. This is caused by the "inrush" or starting current required by the motor. Going to 240 volts reduces the operating current with a side benefit of reducing the startup current as well.

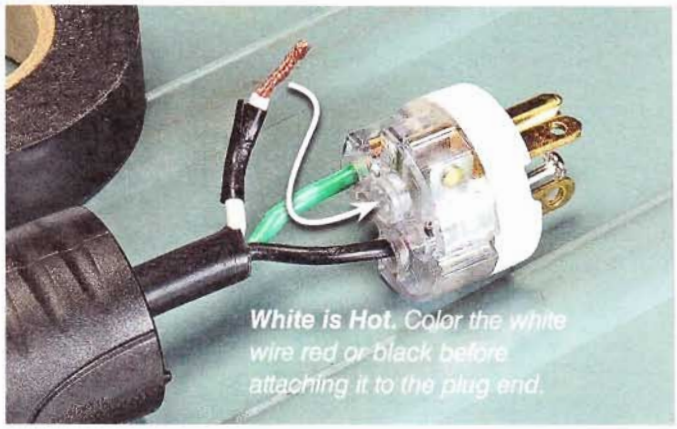
Rules of Thumb. When it comes to electricity in the shop, the first recommendation is to put your tools on a 20-amp circuit if possible, regardless of the voltage. But it's because of the startup load that it might make sense to convert to 240 volts. That will depend on the full-load amperage draw shown on your motor's label. If the motor is rated over 16 amps at 120 volts and you have the option, go ahead and make the switch to 240 volts.

Multiple Tools. If you're like most woodworkers, you probably run a dust collector and a major tool like a table saw or planer at the same time. Here, it makes sense to operate them at 240 volts, if possible. There's not enough capacity on a 120-volt circuit, even at 20 amps, to handle the load of both motors at the same time. (Your electrician can help you calculate the load of your tools and type of circuits required.)

Making the Switch. Once you've decided to switch to 240-volts, you'll need to move a couple of wires on the motor. Your motor should have a diagram to help you out with this. You can see a sample in the drawing below. You'll find the wires behind a plate on the motor (photo on opposite page).

▲ ***Wiring Diagram.*** *A label on your motor or a diagram in your owner's manual will show you how to switch the wiring for 240-volt use. After that, you'll have to install the appropriate plug on the tool's cord.*

◀ ***Plug Change.*** *When converting a motor to 240-volt operation, you'll need to change the plug on the cord, as shown below.*



White is Hot. *Color the white wire red or black before attaching it to the plug end.*

The next thing to do is change the plug to a 240-volt plug like you see above. When you do this, you should color the white wire black or red to indicate it's a "hot" wire.

Extension Cord. Chances are, your power tool won't always be near a 240-volt outlet. But with a pair of cord ends (plug and receptacle), you can make your own extension cord (photo below).

As you can see, once you decide it's the right move, converting your tools to 240 volts is easy.

SAFETY NOTE
If you are not comfortable performing electrical work, consult with a licensed electrician.

▼ ***Extension.*** *You can easily make an extension cord for your 240-volt tools.*

Sharpening Stone Storage Box

These sharp-looking boxes provide protection for your stones while keeping them handy whenever you need them.

I use my oilstones almost every day, so it's important to keep them close at hand. The problem is, if I leave them out, they can get damaged or broken. The solution is a simple box to keep them safe.

The inspiration for the boxes you see here came from a small oilstone box owned by one of our editors. I liked the concept, so I made some changes to fit my own oilstones and waterstones. Three examples of my boxes are shown in the photos on this page.

Two-Piece Box. These handy boxes are easy to build from just a couple of pieces of scrap wood. What's interesting about the design is that a portion of the inside of the lid and base workpieces have been hollowed out to hold the sharpening stone.

Rout a Recess. To create the opening for the stone, I routed a shallow recess. And, to get a nice, clean bottom at a uniform depth, I used a dado cleanout bit with a guide bearing and a simple shop-made template. Learn more about how I did it starting on page 44.

Decorative Profiles. The boxes also look great, thanks to a variety of profiles added to both the lid and base with a table saw, hand-held router, and a band saw.

BOX BLANKS

Most stones are around 3" wide by 8" long, so it's easy to find cutoffs and scrap pieces to use for a box. My three boxes are made from cherry, white oak, and Lyptus, but just about any species of hardwood will do. For more box design options, check out the patterns online at *ShopNotes.com*.

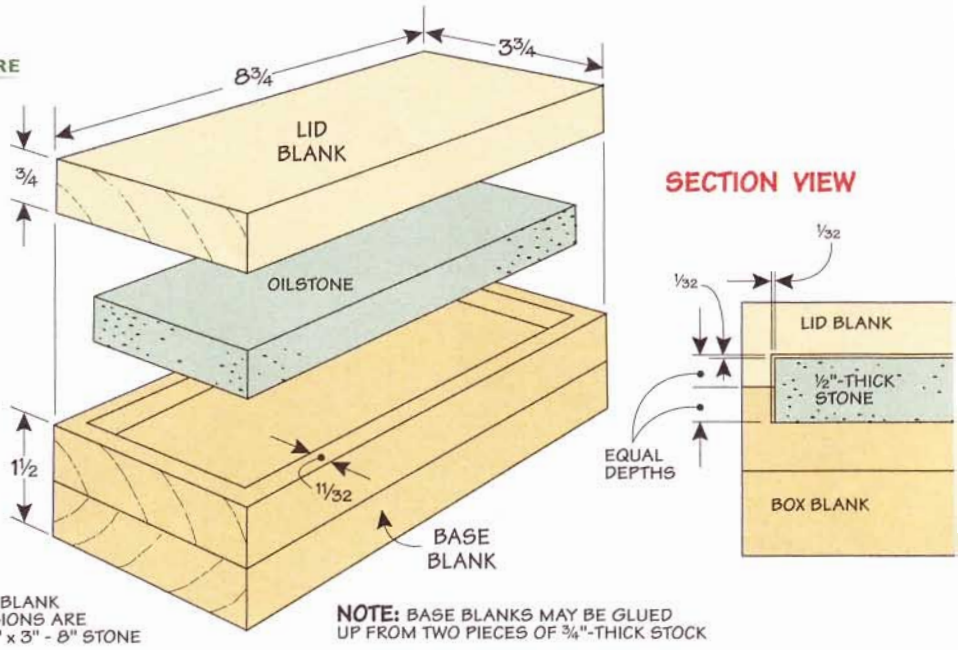
Pick a Pattern. You'll see the three patterns I used for my boxes in the box below. Each one is made slightly different. For example, two of the patterns show an extra-thick base with a band-sawn cutout. The thick base raises the stone up a bit, making it easy to use the stone in the box if you choose to.

The third pattern can also be cut with the band saw, but I decided it would be easier to mill the two "feet" on an extra-long blank, then cut them to length and glue them to the bottom of the base.

I also used varying details on the top face and sides of the boxes. To learn more about the patterns I used, see the box below.

Using the Box. Before you get started making blanks, let's talk a little about using the box. I occasionally use mine to hold an oilstone while I do some honing. After all, it's designed for this purpose.

FIGURE 1



But, if you decide to build a box or two for your waterstones, I suggest you remove them from your box and do all your sharpening on a flat, well-drained surface. Then, allow your stones to dry completely before storing them back in the storage box. This way, the boxes will be sure to give you years of service.

Size the Blanks. The first step for making a box is to start by sizing a couple of blanks to fit your stone. The blanks I made are ¾" wider and longer than the actual stone. And when I routed the recess, I added a little extra play (1/32") to allow for seasonal expansion and contraction. This way, you'll end up with roughly a ⅜"-thick wall around the stone after you've routed the recesses.

Sharpening stones can be anywhere from ½" up to 1" thick, so a ¾"-thick blank will leave plenty of room for just about any stone. I routed the recess depth to equal a little more than one half the thickness of the stone.

Now that your blanks are ready, turn to the next page for more on creating the recess and profiles.

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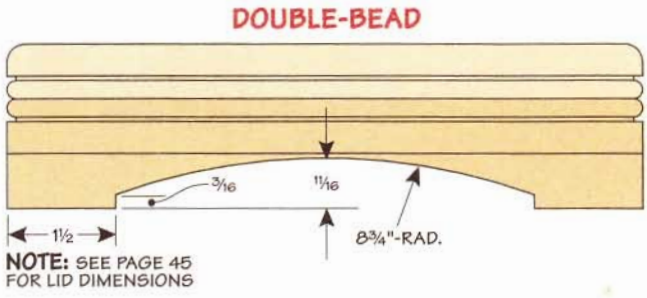
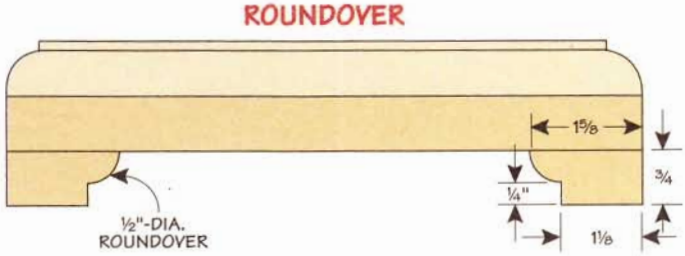
To see more design options for storage boxes, go to: ShopNotes.com

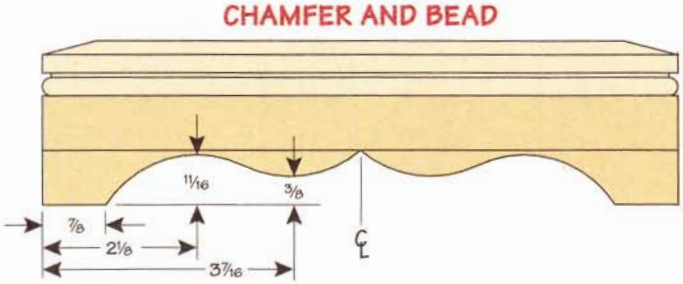
Three Stylish Looks

All it takes to dress up these simple boxes is to cut and rout some details. The double-bead style at right has a wide arch cutout on the base. The beading helps disguise the lid and base joint.

A simple chamfer and bead detail decorates the lid on the second box (bottom right). Use a band saw to form the curved detail on the base. Finally, add a roundover with a wide shoulder to the top of the last box (bottom left). For more on how I made the feet on the base of this box, turn to page 45.







start with the

Template

Since there's no joinery, these boxes are pretty easy to build. To make the recesses, all you'll need are a router, a special router bit, and a shop-made template. I suggest routing the recesses first. This way, you avoid problems later, when adding the base and lid details.

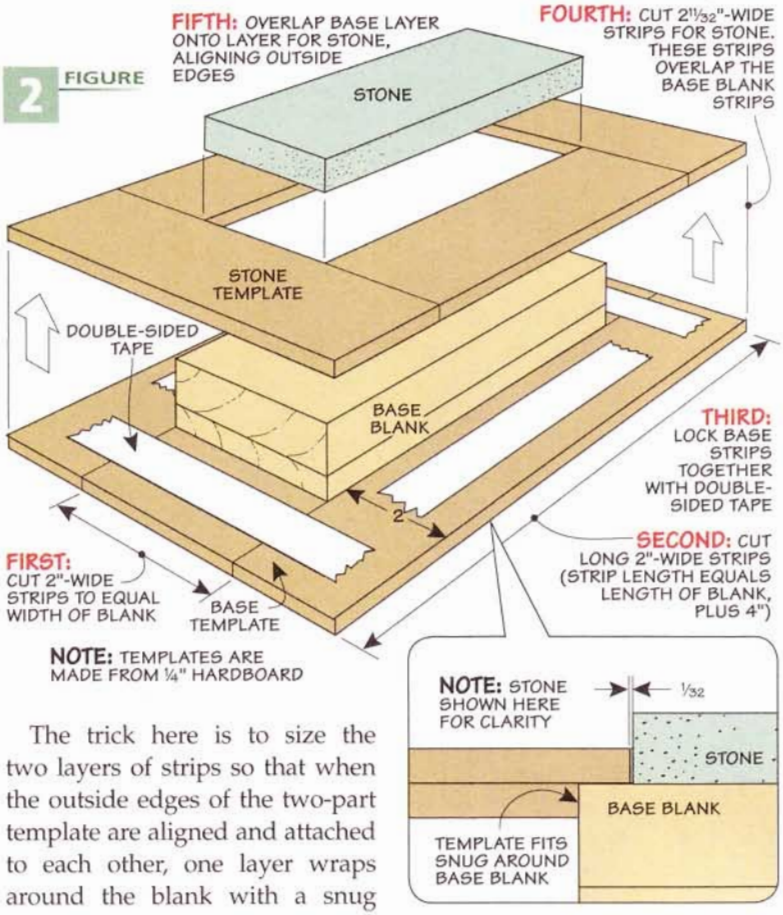
▲ ***Clean-Out Bit.*** *This bearing-guided dado bit has cutters on both the side and bottom.*

Special Bit. To begin, let's talk about the router bit. I used a dado clean-out bit, like the one in the margin photo at left. Its special cutters are designed to create a nice, flat bottom. And, a bearing on top guides the bit around a template which rests on top of the blank.

Router Template. Figuring out how to size the template is the key to this process. It's made up of two layers of ¼" hardboard strips. One set of strips "captures" the blank, as shown in Figure 2. The second set of strips creates an opening to guide the router bearing.

To make the router template, the strips are joined to each other with double-sided tape. Figure 2 shows how they're overlapped to lock the two layers together.

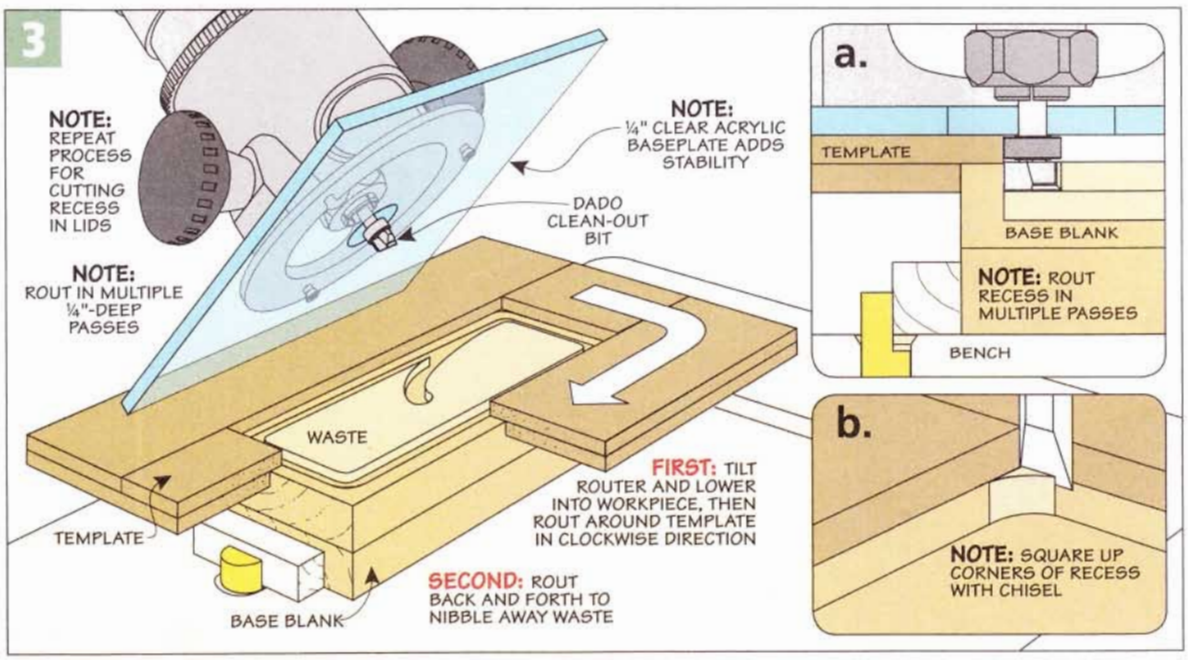
FIGURE 2



The trick here is to size the two layers of strips so that when the outside edges of the two-part template are aligned and attached to each other, one layer wraps around the blank with a snug fit, and the second layer creates an opening for routing the stone recess (Figures 3 and 3a). The template also provides a wide, flat surface for the router base to ride on.

Blank Strips. The strips I made to surround the blank are 2" wide. The length of the strips is determined by the size of the blank. The length of the short sections matches the width of the blank, while the long sections are cut to match the length of the blank, plus the two, short strips (mine were 12¾").

Stone Strips. For the second layer of strips, add a little less than ⅜" to their width (2 11/32"). As I mentioned earlier, this leaves a 1/32" gap all around (Figure 2a). When the



strips are attached to each other with the outside edges flush, the template ends up with an opening sized for routing the recess.

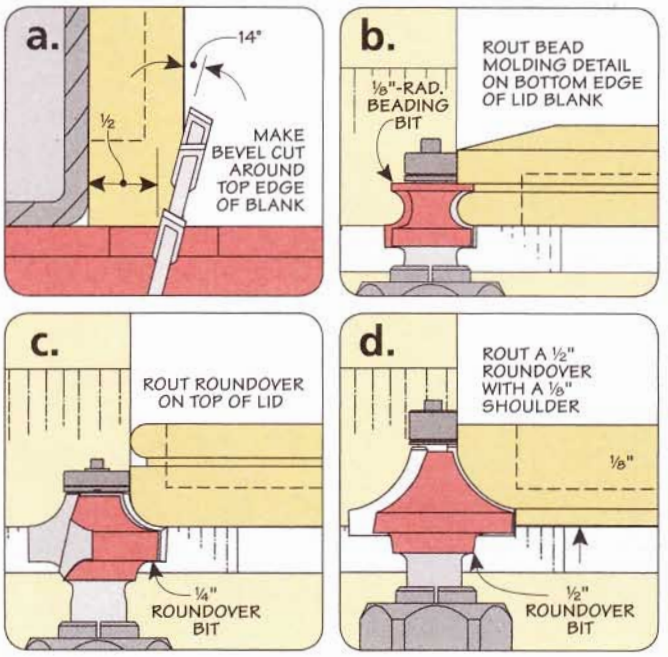
ROUTING THE RECESS

With the template completed, you're just about ready to rout the recesses. But before you start, you'll want to add a wide, auxiliary base to replace the baseplate that comes with your router. The auxiliary base allows the router to ride on the template without tipping into the opening. I made mine from ¼" acrylic (*Plexiglas*).

Secure the Blank. Now, you can secure the blank to your workbench and place the router template on top of the blank. The weight of the router and the lip will hold the template in place.

Rout the Recess. Once the blank is secured, set the bit to take a shallow (¼") cut. To rout the recess, tip your router up on edge, turn it on, and lower it onto the workpiece. This way, once the bit cuts a small pocket, you'll be able to set the router base flat on the template and use the bearing to guide the bit around the inside edge of the template, as shown in Figure 3.

Now, carefully rout back and forth, nibbling away at the waste (Figure 3). And to easily monitor your progress, clean out the chips frequently with a shop vacuum. Finally, square up the corners with a sharp chisel (Figure 3b).



ADD SOME DETAILS

All that's left now is to add the decorative details. This is a great time to experiment a little. Just be sure to take the depth of the recess into account when laying out the feet. This way you'll avoid cutting a hole in the bottom of your box.

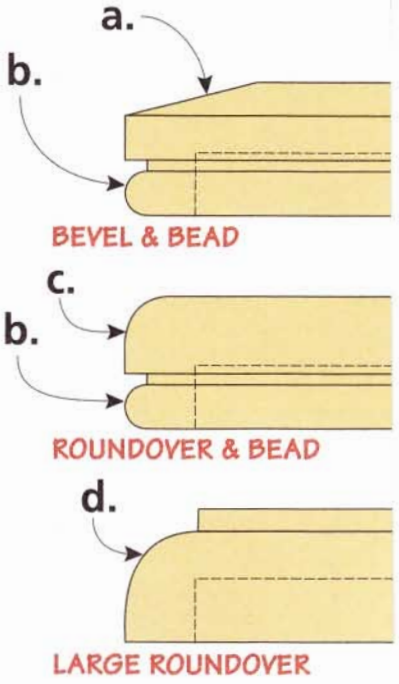
Lid Details. There's nothing complicated about adding the lid details. The first lid, shown in the upper right margin drawing, is made by cutting a wide bevel on the table saw (detail 'a'), followed by a bead made at the router table (detail 'b'). In the middle drawing, simply combine the bead detail with a shallow roundover (detail 'c').

The third lid has a roundover with a wide shoulder (bottom drawing). Here, use a ½" roundover bit, raising it just enough to create the shoulder (detail 'd').

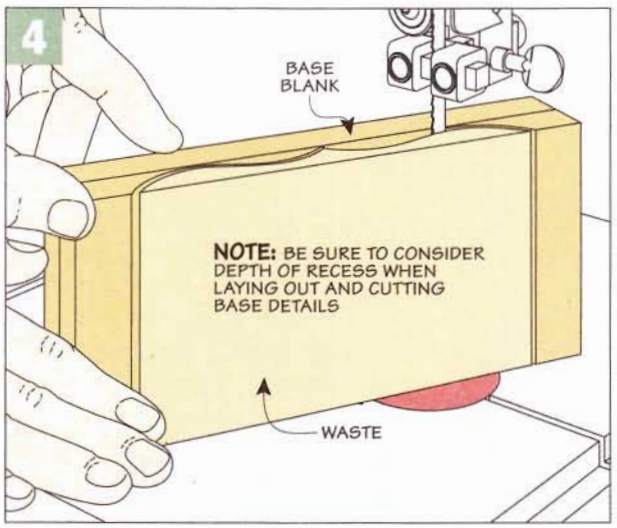
Base Details. I used a band saw to cut most of the base details (Figure 4). But I approached one of the base details differently.

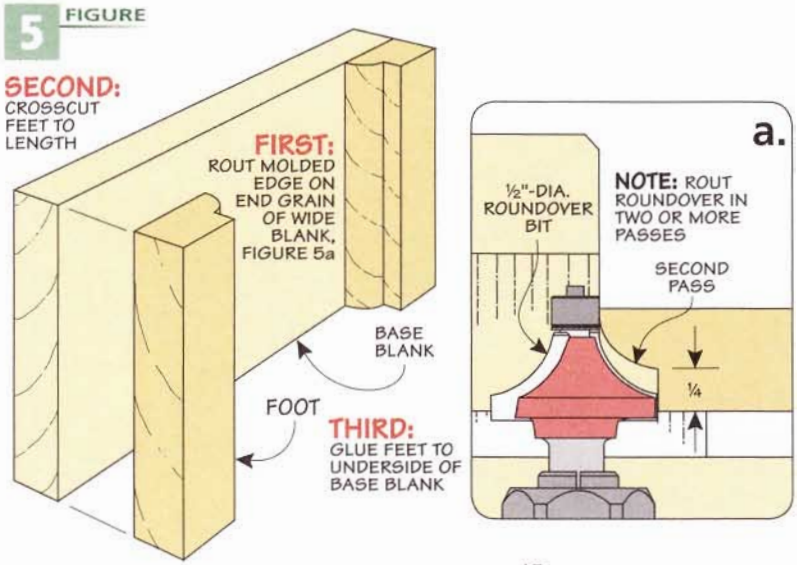
In Figures 5 and 5a, you'll see how I routed a molded edge on a pair of "feet." Then, I cut them from the blank and glued them to the bottom of the base.

There's only one drawback I can think of about these boxes. They're so easy to build, you're bound to run out of stones before you get tired of making them.



▲ ***Lid Details.*** *Use the lid details provided above or come up with your own molding style.*





avoiding Kickback

Learn a few easy steps that will help you rip stock safely and accurately.

Outfeed Support. *Outfeed rollers are especially helpful for controlling wide or long workpieces.*

When you look at a table saw, it's easy to see why a spinning saw blade is a danger to your fingers. But problems occur much more often when a workpiece you're ripping pinches the back of a blade causing the piece to be "kicked back" towards you. Fortunately, this problem is easy to avoid if you follow a few simple rules.

Set Up. The most important factor in preventing kickback is to be sure your table saw is set up properly. The blade should be aligned with the miter slot and the rip fence aligned with the blade (drawing at left). If they're not aligned, consult the owner's manual for your saw.

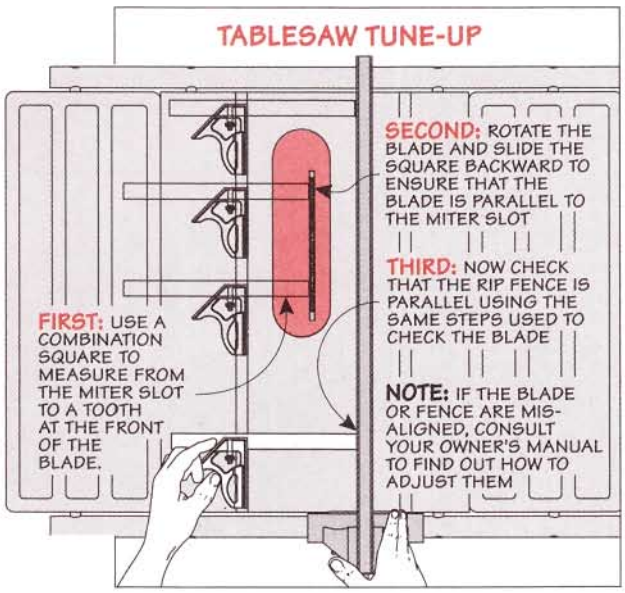
Another consideration is the height of the saw blade. The higher the blade is raised, the fewer teeth are in the stock at any one time. This means the force of the blade is directed downward, not back, so there's less chance the workpiece gets pushed back toward you.

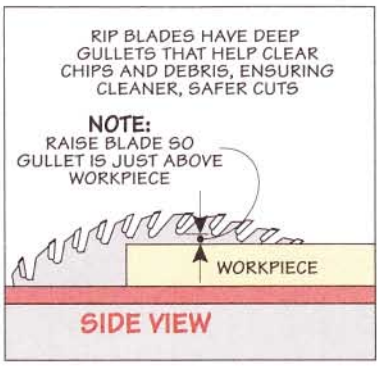
But, there is a drawback to raising the blade. You may get rougher cuts from the "chopping" action of the teeth. So I compromise and set the blade with the bottom of the gullets just above the top of the workpiece (right drawing below).

Straight and Flat. Another secret to avoiding kickback is to always use flat stock with a straight edge. Straight and flat stock is less likely to shift away from the rip fence or rock on the saw table.

Blade Guard. Even with perfectly milled pieces, kickback can still happen when the saw kerf closes in on the back edge of the blade. The key to preventing this from happening is to use the factory blade guard assembly that comes with your table saw.

Not only do most blade guard assemblies have a built-in splitter, but they also have a pair of





Push Block. *When ripping thin strips and narrow workpieces a push block is invaluable.*

◀ **Splitter.** *When a blade guard can't be used, a shop-made splitter works best.*

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To see a video on how to build your own insert, go to: ShopNotes.com

spring-loaded pawls that are specifically designed to keep a workpiece from kicking back.

Shop-Made Splitter. There are times when using the factory blade guard isn't possible (as when ripping really narrow pieces). In that case, it makes sense to use a splitter like the one shown above.

This shop-made splitter is milled to match the thickness of the saw blade, preventing the kerf from closing up and pinching the back of the blade. As an added benefit, the splitter is also part of a zero-clearance insert. To see a video on how to make an insert with a splitter, check out *ShopNotes.com*.

Safety Accessories. In addition to the blade guard or splitter, there are a few additional safety accessories you can use. These include a good featherboard, outfeed support, and a push block.

Featherboards provide extra control. It's like having a third hand to hold the workpiece up against the rip fence. The best thing about a featherboard is that the "fingers" only allow the workpiece to move in one direction, greatly decreasing the chance that the workpiece will be kicked back.

Another accessory I use, especially when working with long or wide workpieces, is a roller stand. You can see an example in the inset photo on the opposite page.

Finally, a push block helps you maintain firm control over a workpiece while keeping your hands and fingers up out of harm's way. The one shown in the photo above is made from scrap two-by stock.

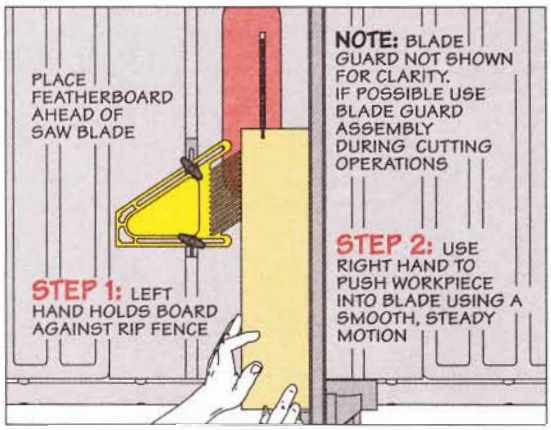
Proper Technique. The position of your body, where you place your hands during the cut, and how you hold the workpiece, are all extremely important. For example, never stand directly behind a workpiece while making a cut. Not only does this keep you safe, but it also dictates the position of your hands as you push a workpiece up to and past the blade. Learn more about the proper feed technique in the box at right.

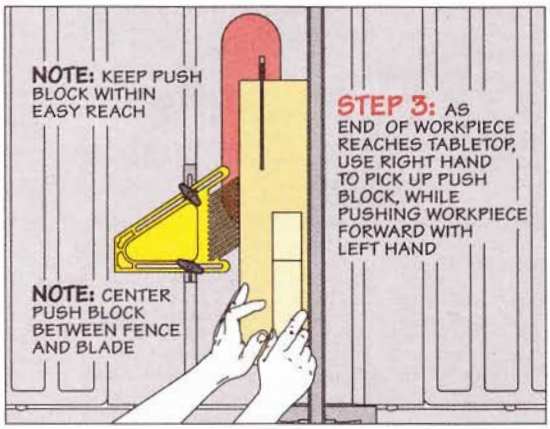
The good news is kickback can be eliminated. Especially if you use these simple steps.

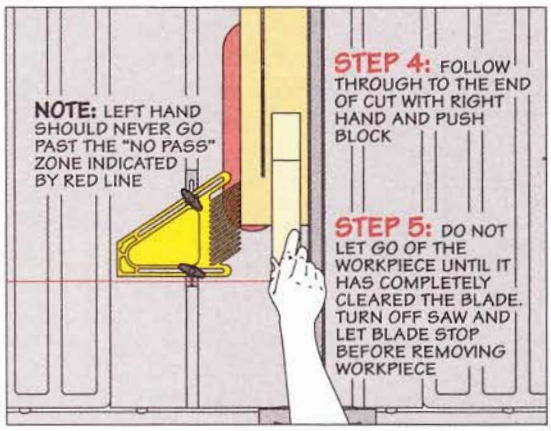
safe ripping Techniques

To make safe, accurate cuts you need to maintain constant control of the workpiece while moving it past the blade in a smooth, steady motion.

The step-by-step process shown in the three drawings below should clear up questions about how to achieve this goal. The first drawing explains how to use both hands to start the cut. Then, use a push block to control the workpiece past the blade. Finally, to safely finish the cut, don't let go of the workpiece until it is completely clear of the blade.







► **Dual-Tooth Combination.** *A unique tooth design on the upper teeth ensures a smooth, clean cut on the top face of a workpiece.*

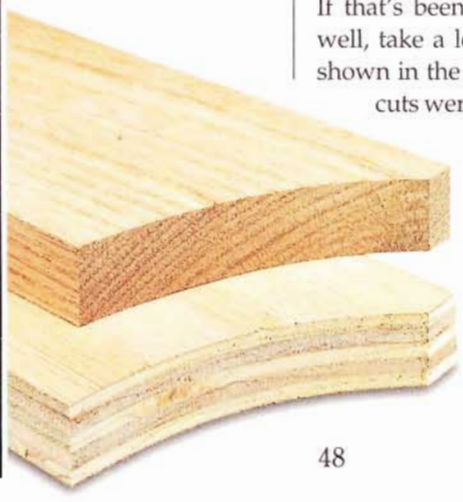
the latest Cool Tools

Take a look at some new products that help make better use of the time you spend in your shop.

The editors at *ShopNotes* enjoy trying out new products. What's even better is being able to feature a few, like the ones here, that are truly useful and worth the money. For sources, turn to page 51.

XTRA-CLEAN JIG SAW BLADES

I've always thought of a jig saw as a tool for roughing out a shape. If that's been your experience as well, take a look at the cut edges shown in the photos at left. These cuts were made with the new *Xtra-Clean for Wood* blade from *Bosch*. This new blade leaves a smooth surface and little or no chipout, even in plywood.



In the inset photo above you can see what the fuss is all about. The blade features two different tooth shapes. *Bosch* calls the design on the lower half of the blade "scalpel" teeth. The upper half of the blade features sharp, "pointed" teeth. This unique combination generates a smooth, nearly chip-free cut.

Even though the Bosch blade minimizes chipout overall, you'll get the best results by turning off the orbital action. Sure, it may take a little longer to complete the cut, but the results can't be beat.

The blade is also stiffer and longer than most jig saw blades, so getting straight cuts in thicker material isn't as much of a challenge.

About the only real downside to the *Xtra-Clean* blade is its width. At ⅜", you won't be making very tight turns, but it's a trade-off I'm more than willing to make to get smoother cuts and better results with a jig saw.

— Bryan Nelson, Managing Editor

LEIGH HOLD-DOWN CLAMPS

Securing a workpiece to a benchtop or table is a common task. And one of the newest methods of doing this comes from *Leigh Industries*. They've come up with a couple of handy hold-down clamps that use the quick-action cam design from their popular dovetailing and mortising jigs. You can see what I mean in the photo above and at the top of the opposite page.

The basic operation of the two clamps is identical. Simply flip the lever at the top of the clamp to tighten the hold-down against the workpiece. Each clamp adjusts to secure a workpiece up to 3" thick, which is adequate for most tasks.

▲ **Surface Mount.** *Slip the clamp into the flush-mounted bench anchor and it's ready to go.*

▲ **Bench Use.** *A long threaded rod and a speed nut allow you to use this clamp on any surface with a through hole (see detail).*

Bench Version. Where the two clamps differ is how they mount to your workbench. If you have holes drilled in your benchtop for bench dogs, you can use the bench version shown at the upper right. A long, threaded rod slips through the dog hole and is held in place with a speed nut from underneath (inset photo at right).

The bench clamp works with benches up to 4¼" thick. (You can even use it on your drill press table.) And the clamp works with bench holes sized anywhere from 7/16" up to 1⅛"-dia.

Surface Model. The second type of hold-down clamp from *Leigh* slips into an anchor that's mortised into the surface of a bench, as you can see in the upper left photo. It can be installed or removed in seconds.

What's really nice about this design is that you can also use the clamp with T-track. This adds a great clamping option for many jigs and fixtures around the shop.

— Phil Huber, Senior Editor

TITEBOND INSTANT ADHESIVES

Franklin has been a leader in making woodworking adhesives for years. Their latest line, *Titebond Instant Bond Adhesives*, is shown below. They're designed for those times when you need really fast or "instant" adhesion. They're great for quickly building a jig that's ready to go once the last piece is in place (lower left photo).

New Benefits. At first glance, they don't look much different than any other bottle of cyanoacrylate (CA) glue. But according to *Franklin*, they do have a few differences. For starters, there's a two-year shelf life. That's a nice feature for a glue you're probably not going to be using every day.

And the glue is advertised as having more strength, and better impact resistance than other CA glues. After a few test glueups in the shop, I'd have to agree.

To suit your shop needs, the glue comes in a range of viscosities (from thin to gel), as you see below. You can buy just the amount you need in 2, 4, or 8 oz. bottles. Finally, if the quick set time isn't fast enough for you, *Franklin* makes an optional bond activator to speed up the set and cure time by 50%. These are CA glues every woodworker should have on hand.

— Randy Maxey, Associate Editor

▲ **Speedy Assembly.** *With a couple of drops of adhesive and a shot of accelerator, you can assemble a jig that's ready to use in seconds.*

A Family of Adhesives

Q&A

questions from
Our Readers

sanding Metals

When it comes to shaping metals in the shop, it seems like using a stationary sander would be quick and easy. Are there concerns with using my belt or disk sander?

Kennis Riley
Lillybrook, West Virginia

I shape and grind metals — mild steel, brass, and aluminum — quite often on my sander. Today's abrasives are certainly up to the task. (I typically use 80-120 grit.) It's a great way to smooth up an edge, grind a bevel, or create a shape on these common metals.

Good Housekeeping. Using your sander for these tasks is usually not a problem, but you do need to be concerned about dust. And in a woodshop, there's plenty of dust around. But I'm also talking about the fine dust generated by sanding metal.

For this reason, I make sure I don't use my dust collector when shaping metals, especially steel. Brass and aluminum won't generate sparks but steel does. I don't need to risk one of those sparks igniting the dust in my collector.

Wood dust in the surrounding area is also a concern for the same reason. Sparks and wood dust don't mix. So make sure your work area is clean. It only takes a few minutes to sweep up and blow out any sawdust that has accumulated in the area before you start.

There's another thing to think about, and that is shaping steel on the sander after you've used it to shape aluminum. Aluminum dust and iron mixed together in high concentrations with heat can react to create a fire hazard. It's not likely to happen in a small workshop but it is something to be aware of.

The simple solution to avoid any problems is to clean up your work area. And that includes taking the time to clean the sanding belt or disk with a brush or crepe rubber stick to remove metal particles.

Technique. With the housekeeping done, there are a couple of other safety issues you'll need to address. The first is protecting your hands from the heat buildup when grinding metal. For large pieces, a pair of leather gloves is usually all you need. But for smaller parts, I often rely on locking pliers to hold the workpiece securely.

And don't forget to protect your eyes. A good pair of safety goggles is a must when grinding metal.

From here on out, the rules are about the same as with woodworking. When using a disk sander, work on the side of the disk spinning downward (photo above). The rotation of the disk holds the workpiece tight against the table for better control.

For smoothing out a long edge on metal, I turn to my belt sander. I find it easier to control the workpiece when the belt is in the vertical position, like you see in the photo at left. Again, the downward direction keeps the workpiece tight to the table.

Following these simple guidelines, using your belt or disk sander is a quick and easy way to shape and smooth metals.

▲ ***Straight Edges.*** *To get a straight edge on a workpiece, slow and steady is the way to go. Check your progress frequently as you work.*

Sources

Most of the materials and supplies you'll need for the projects are available at hardware stores or home centers. For specific products or hard-to-find items, take a look at the sources listed below. 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.

LOCK MITER BITS *(p.8)*

- **Rockler**
  45° Lock Miter Bit 22627
  Freud Lock Miter Bit 35810
- **Woodsmith Store**
  Amana Lock Miter Bit 272148

KNOBS *(p.10)*

You'll find a variety of knobs available from woodworking suppliers and hardware stores. *Lee Valley's Snap-Lock* knobs are available for ¼"-20 and 5/16"-18 threads. *Reid Supply* carries a variety of the fluted knobs for making your own studded knobs. We used AP-30 (¼"-20) and AP-35 (5/16"-18).

CALIPER SET *(p.16)*

The jaw liners (with extensions) shown in the article are available from *McMaster-Carr* in a variety of sizes to fit your vise. They're available in copper or aluminum.

- **McMaster-Carr**
  Precision-Ground Steel . . . 9517K17
  Disc Springs 9712K412
  Brass Flat Rivets 97500A180
- **Reid Supply**
  Knurled Thumb Screw AJ-521
  Blue Layout Fluid DX-100-4
- **Enco**
  82° Countersink 380-1816

GARAGE WORKCENTER *(p.24)*

The cabinet rods are made from ½" EMT conduit (¾" outside diameter). You can find it at most home centers. The metal tops for the bench and shelves were made at a local sheet metal fabrication shop.

- **Lee Valley**
  10" Support Brackets 17K32.11
  13" Support Brackets 17K32.14
  24" Shelf Standards 17K30.02
  12" Full-Ext. Slides 02K36.12
- **Reid Supply**
  Through-Hole Hinges . . . JCL-312
  Pull Handles KHO-5
- **Benjamin Moore Paints**
  Regal Eggshell
  "Misted Fern" 482

SMALL PARTS JIG *(p.34)*

- **Lee Valley**
  36" T-Track 12K79.24
  ¼"-20 T-Slot Nuts 05J21.15
  ¼"-20 x 1" T-Bolt 12K79.70
  ¼"-20 Inserts 00M90.01
  ¼"-20 Knob w/1" Stud . . . 00M51.02
  ¼"-20 Knob w/Insert . . . 00M51.01
  Tapered Handle w/Stud . . . 00M53.02
  12" Centering Rule 60N46.02

SHARPENING STONE BOXES *(p.42)*

- **MLCS**
  Dado Clean-Out Bit 5382

GREAT GEAR *(p.48)*

- **Woodcraft**
  Leigh Bench Clamp 149059
  Leigh Surface Clamp 149060
- **Woodsmith Store**
  Bosch Jig Saw Blades 269097
- **Rockler**
  Titebond Instant Bond Adhesives

MAIL ORDER SOURCES

Woodsmith Store
800-444-7527

Rockler
800-279-4441
rockler.com

Benjamin Moore
benjaminmoore.com

Enco
800-873-3626
use-enco.com

Freud
800-334-4107
freudtools.com

Lee Valley
800-871-8158
leevalley.com

McFeely's
800-443-7937
mcfeelys.com

McMaster-Carr
330-342-6100
mcmaster.com

MLCS
800-533-9298
mlcswoodworking.com

Reid Supply Company
800-253-0421
reidsupply.com

Woodcraft
800-225-1153
woodcraft.com

Scenes from the Shop

Classic layout and measuring tools like this set are a pleasure to use and make layout tasks more accurate. Best of all, you can build each one in just a couple of hours. Turn to page 16 for complete plans.

These sharpening stone boxes are a practical, weekend project. And you can use up some of your prized small pieces. You can find the plans on page 42.

ShopNotes

modular Garage Storage

Materials & Hardware

BENCH (Per Unit)

A	Sides (2)	5 x 14 - ¾ MDF
B	Top/Bottom (2)	13¾ x 43 - ¾ MDF
C	Divider (1)	3½ x 13¾ - 1½ MDF
D	Back (1)	5 x 43 - ¼ Ply.
E	Stiles (2)	¾ x ¾ - 6
F	Top Rail (1)	¾ x ¾ - 42½
G	Bottom Rail (1)	¾ x 1¾ - 42½
H	Center Stile (1)	¾ x 1½ - 3½
I	Drawer Front/Back (4)	½ x 3 - 19
J	Drawer Sides (4)	½ x 3 - 13
K	Drawer Bottoms (2)	12½ x 19 - ¼ Ply.
L	False Fronts (2)	3¼ x 20¼ - ¾ MDF
M	Benchtop (1)	17 rgh. x 48 rgh. - ¾ MDF
N	Bench Shelf (1)	12 rgh. x 44 rgh. - ¾ MDF
O	Cleats (4)	¾ x 1 - 13¾

SMALL WALL CABINET (Per Unit)

P	Sides (2)	6 x 24 - ¾ MDF
Q	Top/Bottom (2)	6 x 23½ - ¾ MDF
R	Hanging Cleats (2)	¾ x 2 - 22½
S	Back (1)	23½ x 23½ - ¼ Ply.
T	Shelves (2)	5½ x 22⅜ - ¾ MDF
U	Stiles (2)	¾ x 1 - 24
V	Doors (2)	10⅞ x 24 - ¾ MDF

TALL WALL CABINET (Per Unit)

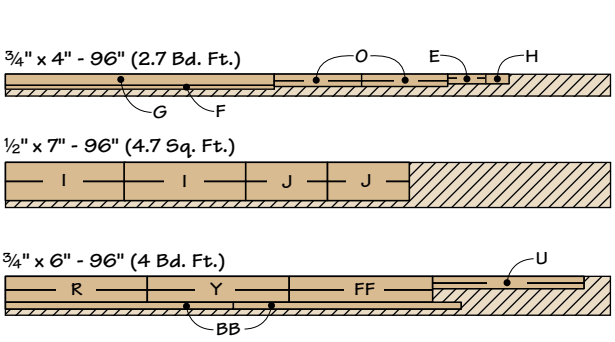
W	Sides (2)	8 x 36 - ¾ MDF
X	Top/Bottom (2)	8 x 23½ - ¾ MDF
Y	Hanging Cleats (2)	¾ x 2 - 22½
Z	Back (1)	23½ x 35½ - ¼ Ply.
AA	Shelves (3)	7½ x 22⅜ - ¾ MDF
BB	Stiles (2)	¾ x 1 - 36
CC	Doors (2)	10⅞ x 36 - ¾ MDF

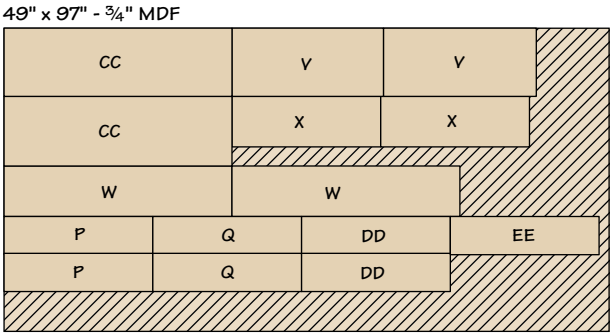
HANGING ROD CABINET (Per Unit)

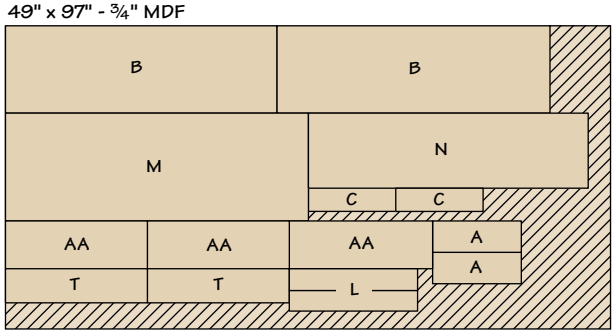
DD	Sides (2)	6 x 24 - ¾ MDF
EE	Top (1)	6 x 23½ - ¾ MDF
FF	Hanging Cleats (2)	¾ x 2 - 22½
GG	Hanging Rods (3)	¾-Dia. x 23½

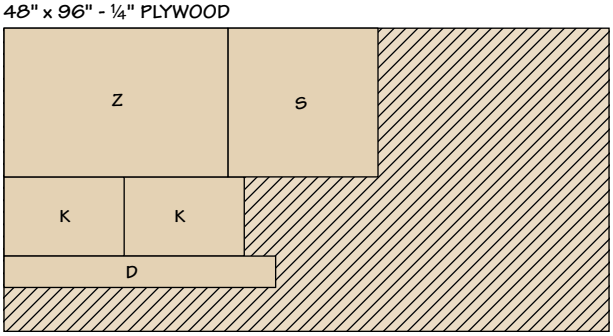
- (36) #8 x 1½" Fh Woodscrews
- (16) #8 x 1¼" Fh Woodscrews
- (8) #8 x ½" Fh Woodscrews
- (4) #6 x 1" Fh Woodscrews
- (2 Pr.) 12" Full-Ext. Drawer Slides w/Screws
- (6) Drawer/Door Pulls w/Screws
- (5 Pr.) Hinges w/#8 x ¾" Fh Woodscrews
- (20) ¼" Shelf Pins
- (4) Magnetic Catches/Strike Plate w/Screws
- (1) ½" Electrical Conduit (72" Long for parts GG)
- (2) 24" Galvanized Metal Shelf Standards
- (2) 10" Shelf Supports
- (2) 13" Shelf Supports

Cutting Diagram (one of each unit)









ShopNotes

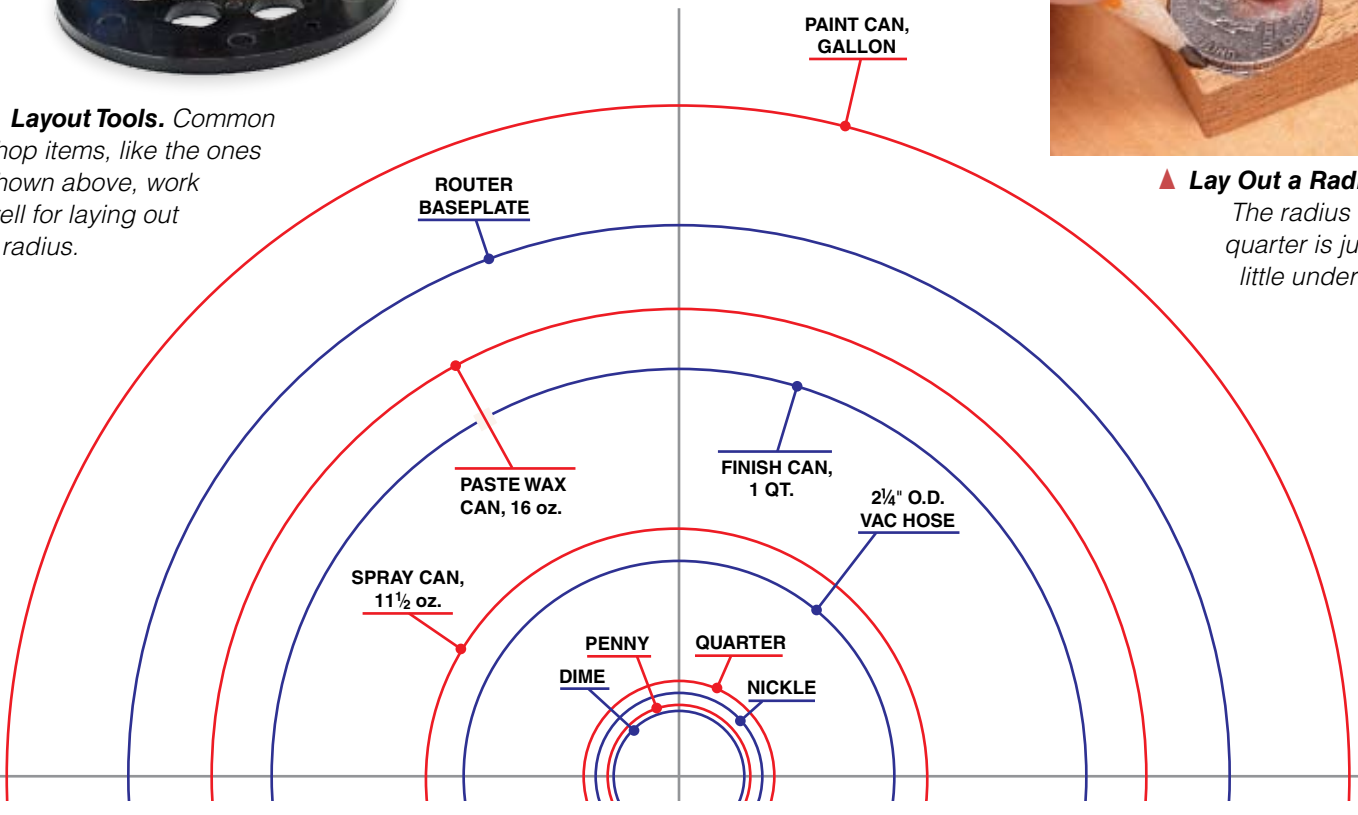
Radius Chart

for common shop & household items

RADIUS CHART (dimensions are approximate)	
1. DIME	11/32"
2. PENNY	3/8"
3. NICKLE	7/16"
4. QUARTER	1/2"
5. 2¼" O.D VAC HOSE	1⅛"
6. SPRAY CAN, 11½ oz.	1 5/16"
7. FINISH CAN, QUART	2⅛"
8. PASTE WAX CAN, 16 oz.	2⅜"
9. ROUTER BASEPLATE	2⅞"
10. PAINT CAN, GALLON	3½"

▲ ***Layout Tools.*** *Common shop items, like the ones shown above, work well for laying out a radius.*

▲ ***Lay Out a Radius.*** *The radius of a quarter is just a little under ½".*



ShopNotes

sharpening stone storage box
Design Options

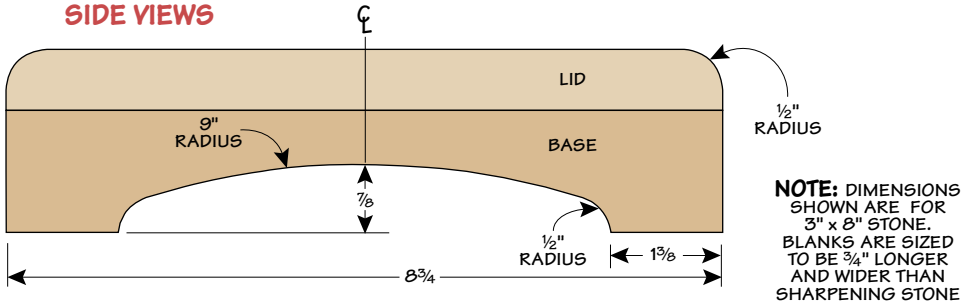
Each of these sharp-looking storage boxes provide protection for your stones while keeping them handy whenever you need them.

These handy boxes are easy to build from just a couple pieces of scrap wood. You'll find six, unique design options on the next page for both the lid and base. Or, you can mix and match a pattern for any lid to go with any base to come up with the look you want.

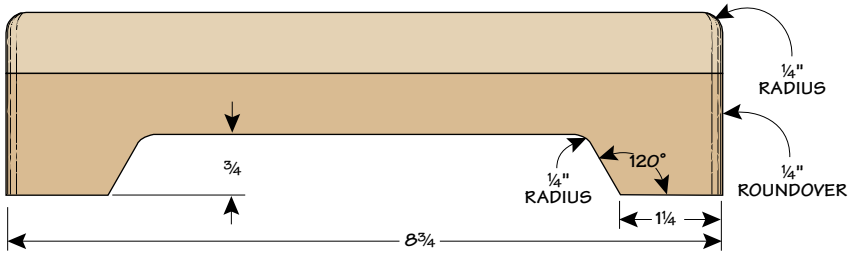
All of the profiles can be made using just a table saw, a hand-held router, or a band saw.

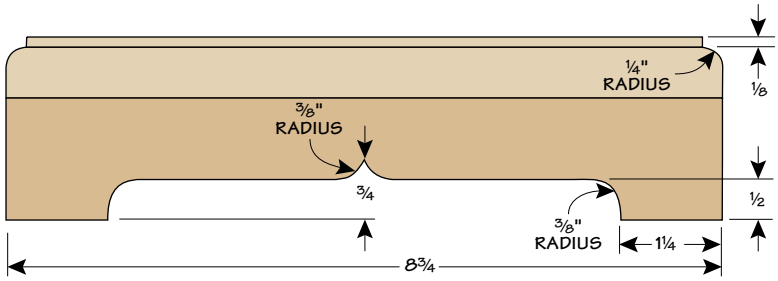
The dimensions given are for stones that are 3" x 8". But, you can make a box blank any size as long as you add ¾" to its length and width to fit your stone.

SIDE VIEWS

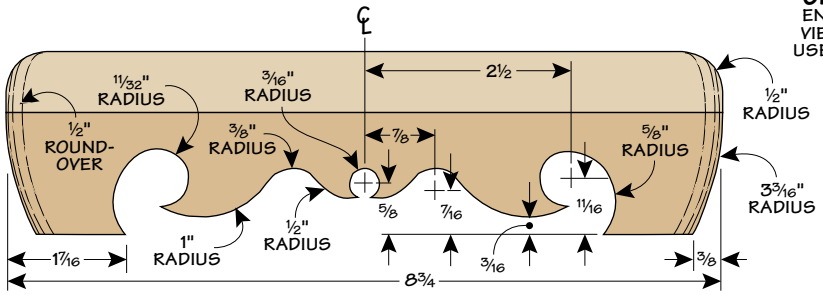


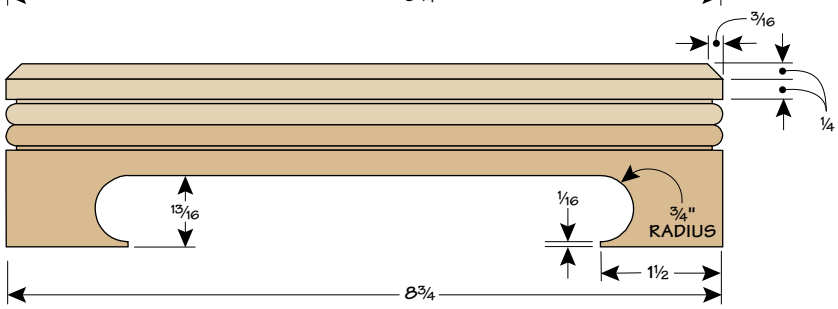
NOTE: DIMENSIONS SHOWN ARE FOR 3" x 8" STONE. BLANKS ARE SIZED TO BE ¾" LONGER AND WIDER THAN SHARPENING STONE

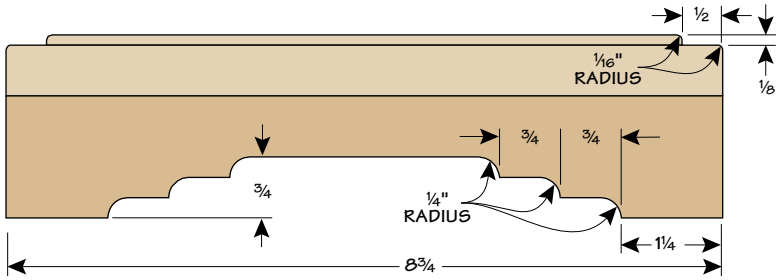




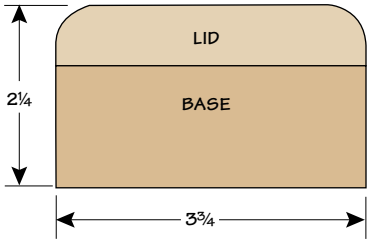
OPTION: CAN ENLARGE SIDE VIEWS 235% TO USE AS PATTERN

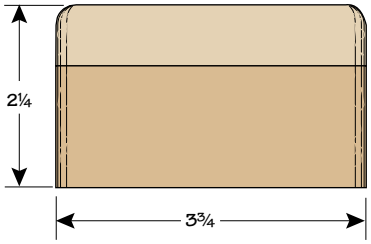


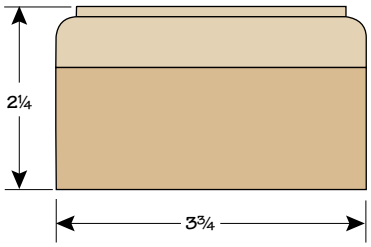


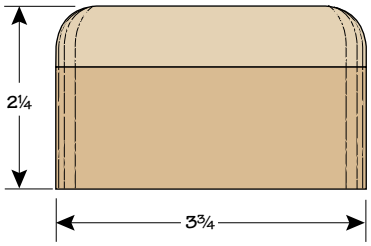


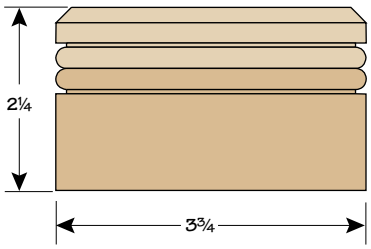
END VIEWS

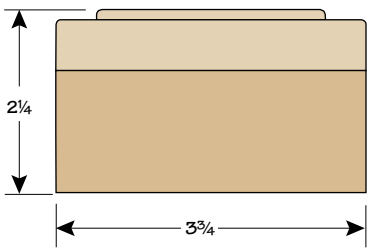












ShopNotes

thin strip Ripping Jig

Improve accuracy and get consistent results with this handy ripping jig.

▲ ***Zero the Gauge.*** *The key to the accuracy of this set-up gauge is to rest the bearing against a tooth on the saw blade and "zero out" the scale.*

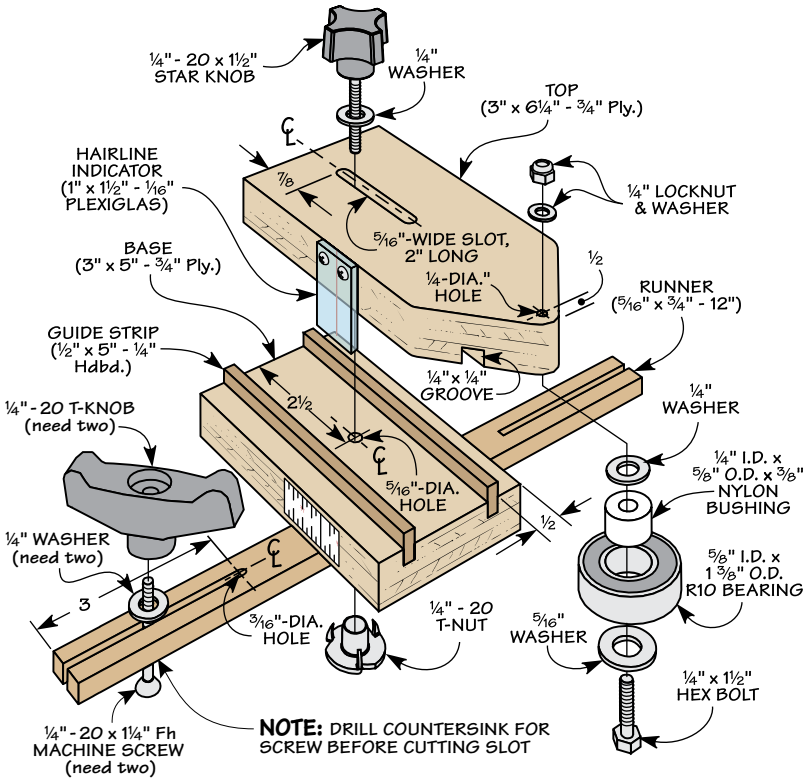
Ripping multiple thin strips to a consistent width at the table saw is tricky at best. It's hard to reset the rip fence after every cut for the exact thickness you need. The jig you see here solves the problem.

Details. As you can see, this jig locks into the miter slot to the left of the saw blade. A "rub" bearing fixed to the end of a sliding top is used to gauge the thickness of the strips. The drawing below shows how everything goes together.

The bearing allows the workpiece to slide without binding. By adding a scale and an adjustment slot in the top of the jig, you can set the exact thickness of the strip you want to rip after zeroing out the gauge (photo above).

Using the Jig. To rip long, thin strips, lock the jig into the miter slot just ahead of the blade (photo below). Then set the workpiece against the bearing and slide the rip fence up against the workpiece.

After locking down the fence, you can make your cut, like you see below. Before cutting each additional strip, just repeat the process. Once your workpiece is down to about 1" wide, it's time to start over with a new one.



▲ ***Ripping a Long, Thin Strip.*** *Position the jig in front of the blade and tighten it in place. The bearing gauges the workpiece thickness.*

