

SPECIAL TABLE SAW ISSUE
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7 TOP TABLE SAW
UPGRADES



EDITOR'S NOTES

What's the first tool I should buy for my shop? That's the question I hear most often from folks who are just getting started in woodworking. And by now, my answer is automatic — a table saw. No other tool does so much, so well, with so little effort.

It's a given that a table saw excels at ripping and crosscutting, but that just scratches the surface of its true capabilities. It's also a "breakdown" tool for rough lumber and sheet material, a mass production tool for making identical parts, and a precision joint-making machine. In short, it's the cornerstone of a shop that improves the quality of every project you build.

Special Table Saw Issue — That said, there's no reason you can't take a great tool like a table saw and make it better. Which is precisely the idea of this issue — getting the most out of your table saw to make building projects easier, safer, and more satisfying than ever.

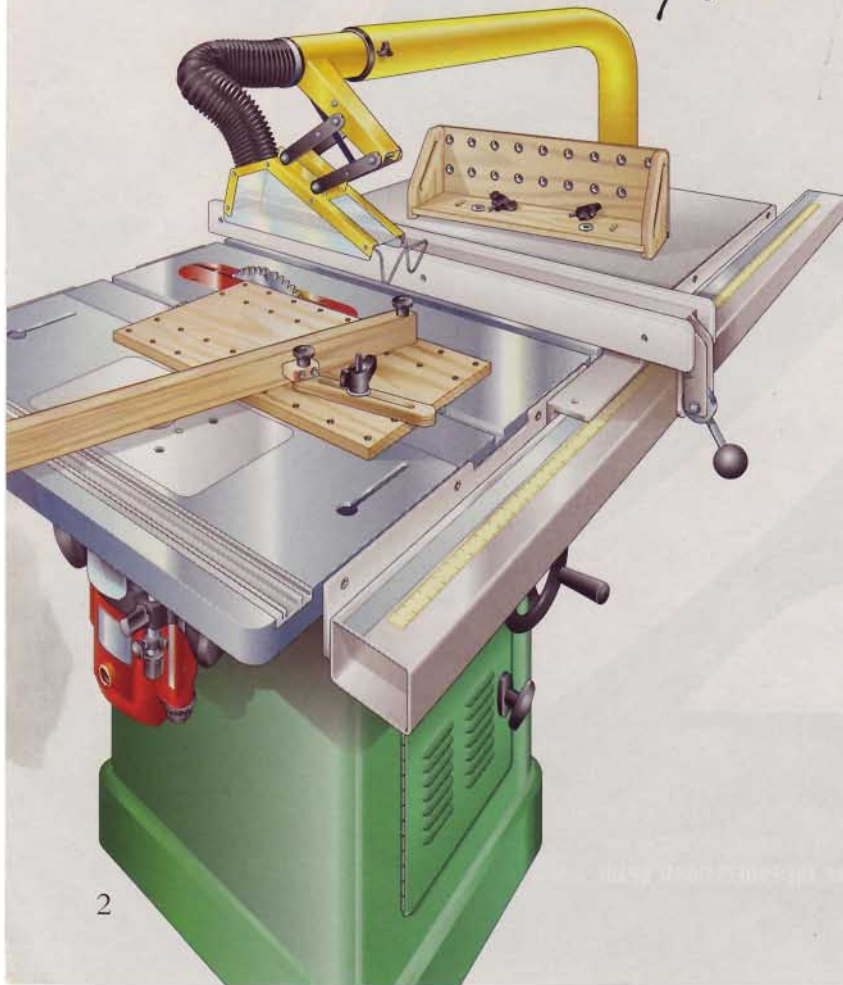
For starters, try our simple five-step table saw tune-up (page 50). It's a pre-flight check, so to speak, that will get your saw running as good as new.

Then check out the multipurpose crosscut sled on page 42. It's an incredibly easy "build," but don't be fooled by its simplicity. The sled allows you to make crosscuts, miters, and tenons with pinpoint accuracy.

There's also a primer on the most fundamental table saw technique — ripping (page 38). Whether you're using a table saw for the first time or you're a seasoned woodworker, these hints are sure to give you ripping good results.

Finally, we look at the upgrades *Workbench* editors have made to the table saws in their own shops (page 54). These accessories offer a quick, simple way to improve the performance of your saw.

Tim



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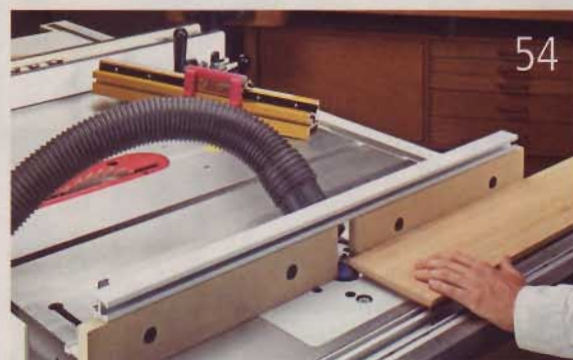
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42



50



54



58

CONTENTS

WORKBENCH® August 2005

FEATURES

Turbocharge Your Table Saw

Table saw tips, techniques, accessories, and even a shop-made sled for making precision crosscuts, miters, and tenons.

pg. 38 Perfect Rip Cuts

pg. 42 Multipurpose Table Saw Sled

pg. 50 5-Step Table Saw Tune-Up

pg. 54 7 Favorite Saw Accessories

Outdoor Kitchen Set

You can build this sturdy cedar table and chair set in a weekend or less. They make great projects on their own, or they can complement the grilling center and serving bar presented in our June 2005 issue.

pg. 58 Cafe-Style Table

pg. 64 Curved-Back Bar Chairs

70 Tool Test: Laser Levels

The next generation of levels is here — are you ready for one? We test 15 new models to see which ones work best for your home improvement projects.



70



36

CONTENTS

IN EVERY ISSUE

READER'S WORKSHOP

26 Small-Shop Panel Saw

Crosscutting large panels to finished length can be tricky — but this simple shop-made jig lets you make smooth, accurate cuts with a circular saw.

WORKBENCH SHOP TIPS

30 "Joint" Boards with a Router

Even without a jointer, here's a simple method for getting a straight, true edge on a board. Plus: How to make custom knobs for shop-built jigs.

BENCH BASICS

36 Creating Perfect Parts

Learn how to break your boards down into well-matched parts for great-looking projects. The secret lies in finding the right grain.

TOOL CLOSE-UP

84 Jointech's SmartLift Digital

Accuracy becomes automatic with Jointech's newest router lift. Its integrated digital readout ensures that your cuts will be dead-on each and every time.



26



30



84

DEPARTMENTS

- 8 Questions & Answers
- 12 Tips & Techniques
- 18 Finishing Fundamentals
- 22 The Cutting Edge
- 76 Modern Materials
- 88 Tools & Products
- 94 Craftsmanship Close-Up

Questions & ANSWERS

tips for mounting a ROUTER TABLE INSERT

Q I plan to mount my router on my table saw to save a little space, but I don't know whether to locate the router on the left end of the saw table or the right. Is one side better than the other?

Kurt Statton
Des Moines, IA

A Where you place the router on the saw table depends largely on the type of saw you have, where it's located in the shop, and how often you use the router and saw together when building projects.

Saw Style Can Dictate Location — If you have a cabinet-style saw with a left-tilting blade, the motor cover will probably sit in the way of a router mounted in the left extension wing (*Illustration, below*). The same idea holds true for right-tilting saws, but cabinet saws usually have a long extension table on the right side, so there's plenty of clearance for a table-mounted router.

On contractor- and hybrid-style saws, motor interference isn't an issue, since the motor hangs off the back of the saw or is enclosed in the cabinet.

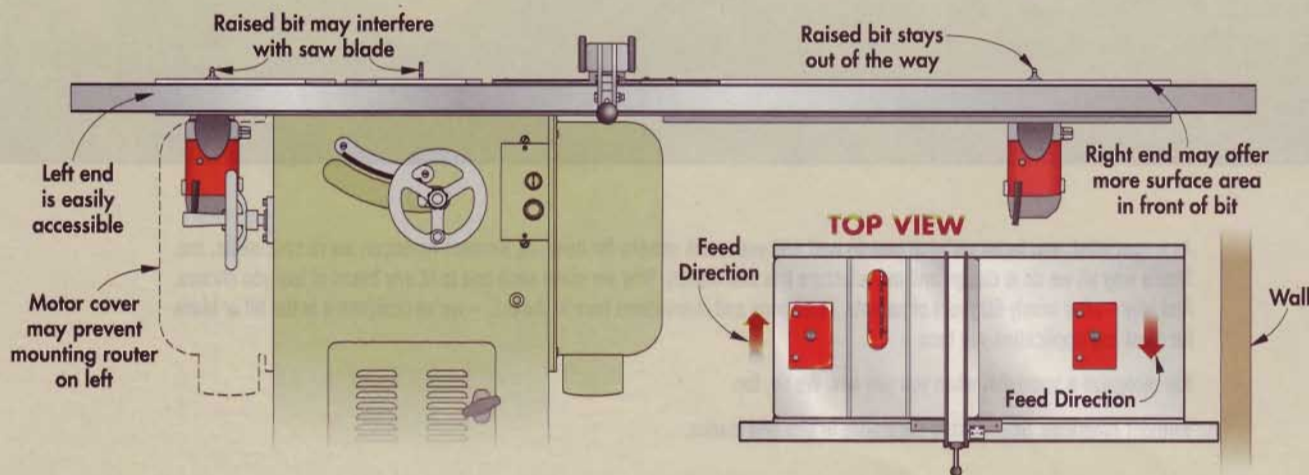


▲ Incorporating a router table onto your table saw makes a lot of sense. There are dozens of tables available that can save precious shop space without sacrificing features.

Where the Saw Sits Makes a Difference — In a small shop, the table saw consumes a lot of space. In my old basement shop, I kept the right end of my saw tucked against the wall. That meant a router mounted in the right end would be inaccessible without dragging the saw out into the middle of the room.

Also, remember that your workpieces move from right to left on a router table. If the router is mounted on the right, then, you feed workpieces from the outfeed side of the saw (*Illustration*). You'll need to keep this area clear of obstructions, such as tools and cabinets.

Some Operations Cause Dueling Setups — When building projects, it's common to go back and forth between operations on the router table and the saw. If a router is mounted on the left, it can mean breaking down one tool setup in order to use the other tool.



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avoid chipout when ROUTING CURVES

Q I was routing the edge of a round tabletop, and it came out smooth except one area where the wood fibers chipped out badly. What happened, and how can I prevent it?

Matthew Archer
Chicago, IL

A The chipout you experienced is common when routing curves. The problem occurs most often in the areas where the wood grain meets the edge at an angle (Photo, above).

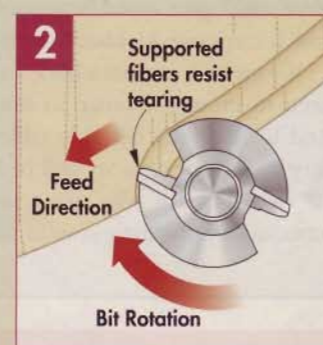
As Figure 1 shows, a router bit spins clockwise. So as you move the router counterclockwise around the tabletop, you'll run into two areas where the cutters on the bit strike against unsupported wood fibers. The force of the impact can tear the fibers before the cutter slices through.

Fortunately, there are several things you can do to prevent chipout. First, make sure to use a sharp bit. Also, use a fast router speed setting and a slow feed rate. That way, the bit takes very small bites, which puts less stress on the wood fibers. You can also "sneak up" on the final depth of cut, taking a very shallow final pass.

Another way to prevent chipout is to "back-route" the trouble spots (Fig. 2). As the name implies, that means moving the router clockwise (the opposite of standard feed direction). With this technique, the bit tends to pull the router along, so you'll need to make several shallow passes and keep a firm grip on the router.



▲ The edge of this tabletop came out smooth everywhere except where the wood grain meets the edge at a steep angle. There, the bit tore out the unsupported wood fibers.



▲ As a router bit spins, it puts a lot of force on the wood fibers. When routing normally, unsupported fibers are prone to chipout (left). When back-routing (right), the fibers are supported.



◀ This test joint was glued on one edge, clamped for 30 minutes, then dried for 24 hours. Under pressure, the wood failed, not the glue.

one edge or two FOR PANEL GLUING?

Q I'm still a little stumped about proper gluing techniques. Specifically, when gluing up a panel, do I need to put glue on the edges of both boards or just one?

Kevin Dixon
Lawrence, KS

A Glue-joint strength isn't dependent on whether you coat both mating surfaces or just one. You simply have to apply enough glue in the joint, and clamp it with proper pressure. For proof, look at the Photo of the broken joint at left.

When gluing panels, I stand the boards on edge and apply glue to just the edges that are facing up (Photo, top left). This means only one edge of each joint gets glue, which creates a lot less mess than trying to coat both edges.

I spread on just enough glue so that I can't see the wood through it. You'll know you have the right amount of glue when small, consistent beads squeeze out under clamping pressure.

safe fence setup for RIPPING BEVELS

Q The project I'm working on calls for ripping a 45° bevel. Should I set the fence so the blade tilts toward it or away from it?

Paul Thompson
Denver, CO

A You should *always* position the fence so the blade tilts away from it when ripping a bevel (*Correct Fence Setup*). This ensures that the workpiece won't get trapped between the fence and the blade, which can cause kickback (*Incorrect Fence Setup*).

If your table saw has a blade that tilts to the *right*, you'll need to move the fence to the *left* side of the blade. And because the left-side tables on most saws aren't very large, your capacity will be limited to pieces about 12" wide. This is why many saw manufacturers have introduced left-tilting saws in recent years.



▲ With the blade tilted away from the fence, the workpiece can't get trapped in between.



▲ If a piece gets trapped between the blade and the fence, it can cause a dangerous kickback.

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an easy repair for LOOSE CHAIR RUNGS

Q Several of my dining chairs have loose rungs due to glue failure. Can I reglue just the problem joints without disassembling the chairs?

Dale Diehl
Lakewood, CO

A I had chairs with this same problem and scratched my head about how to fix them. All they needed was more glue, but I couldn't get glue into the mortise without pulling the tenon out. And doing this was going to break another glue joint, or worse yet, part of the chair.

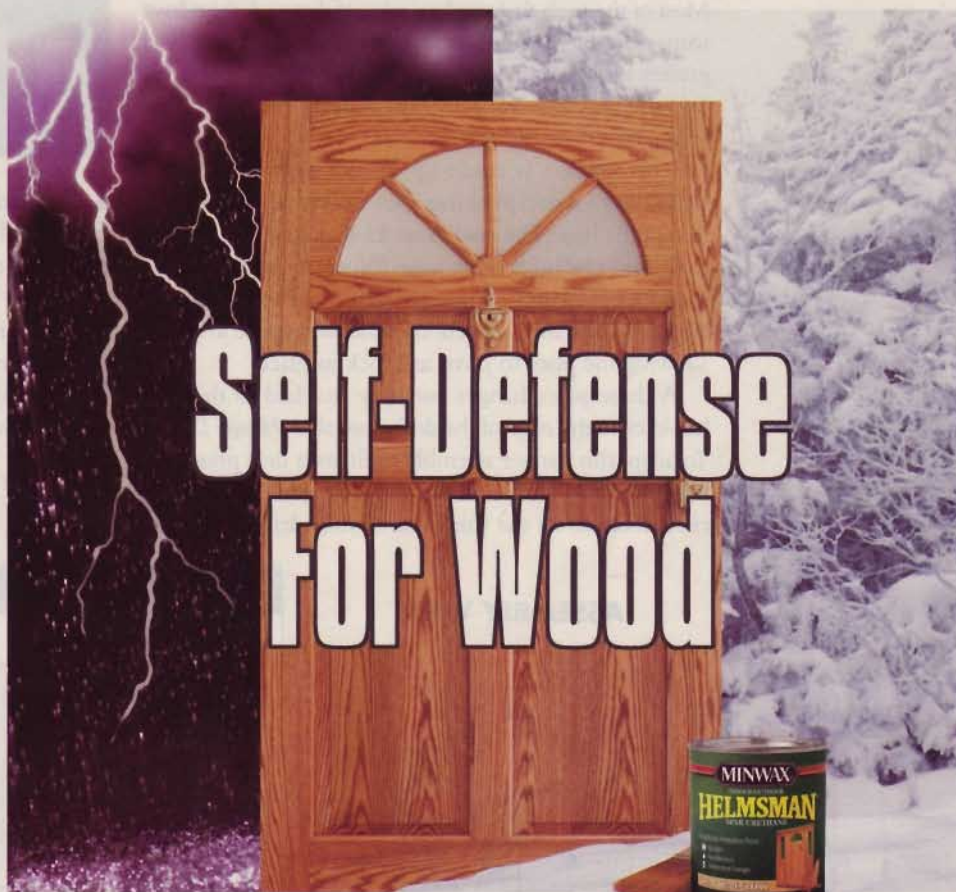
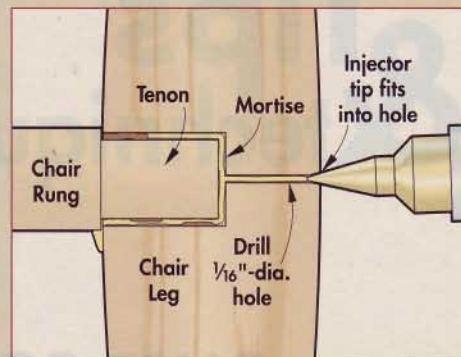
Then I found this high-pressure glue injector from Woodworker's Supply (Woodworker.com). It's solidly built and has O-ring seals that let it develop tremendous pressure (Photo, below).

To use the injector, just drill a $\frac{1}{16}$ " hole through the chair leg and into the mortise in an inconspicuous spot (Illustration). Then inject glue until it starts to ooze out. Finally, wipe off the squeeze-out, and clamp the joint. 



▲ Sturdy construction, O-ring seals, and a durable metal tip make it possible for this glue injector to force glue in with 600 psi of pressure.

► A tapered brass tip seals the injector against a hole drilled into the leg mortise. Pushing the plunger forces glue under high pressure into gaps in the joint.



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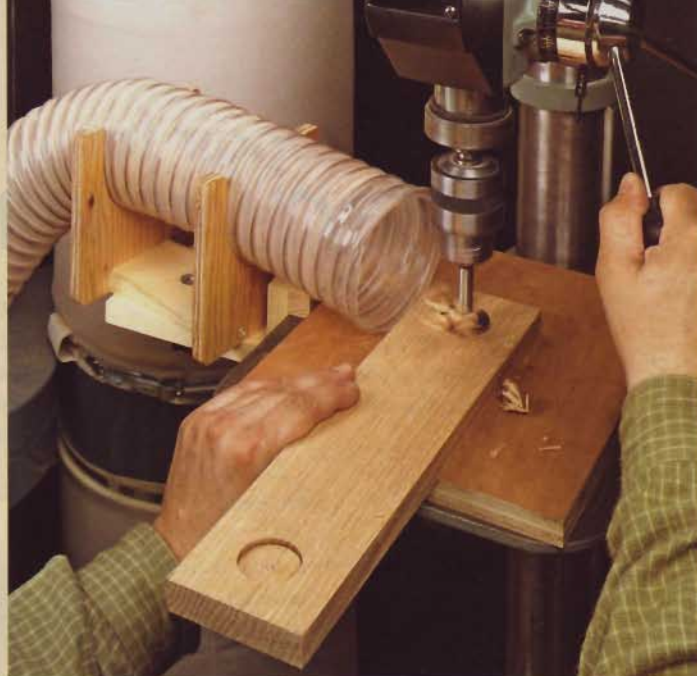
Tips & techniques

drill press DUST COLLECTION

Most of the tools that produce a lot of dust and chips have some sort of dust collection these days. But not drill presses. So I built an adjustable bracket that lets me position the flex hose from my dust collector right up close to the bit (Photo, right).

This bracket is made up of two plywood cradles attached to a swivel plate that allows me to adjust the position of the hose. The cradles are U-shaped (Cradle Detail) to fit the "ribs" of the flex hose. (Note: If you use a shop vacuum hose, cut $2\frac{1}{2}$ " notches in the cradles instead.) A threaded knob and T-nut connect the swivel plate to a base, allowing the plate to pivot and lock in place.

A three-piece hanger assembly attached to the base hooks onto the edge of the drill press table (Hanger Detail). To adapt this hanger assembly to fit your drill press, you may need to alter the sizing of these pieces. The hanger riser needs to be the thickness of your drill press table,

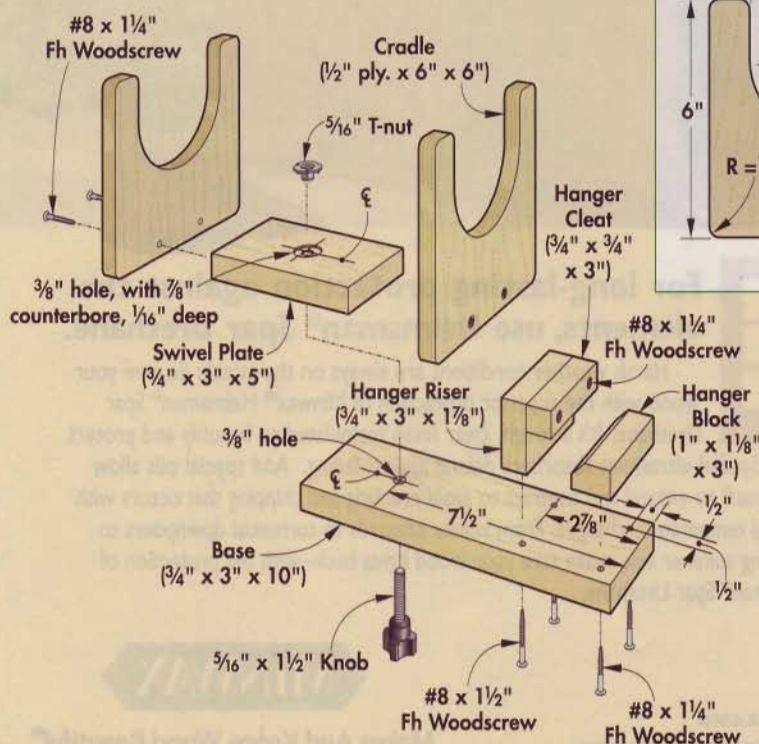


▲ This adjustable bracket hooks onto your drill press table and holds the flex hose from your dust collector at the source of dust and chips.

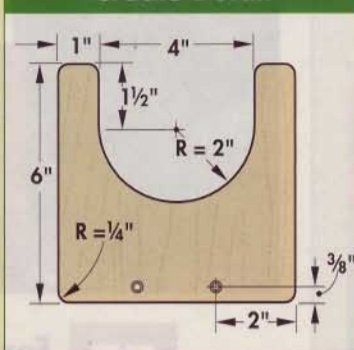
plus the hanger cleat thickness. Also, the distance between the riser and the hanger block may vary to position the block behind the table web. By the way, the hanger block is chamfered to make it slip into place easily.

David Perata
Ruthven, IA

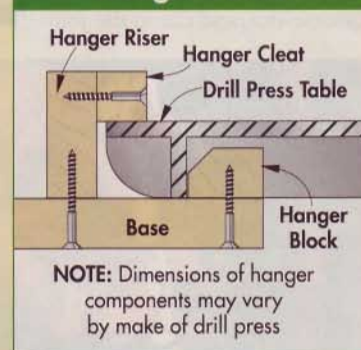
ASSEMBLY VIEW



Cradle Detail



Hanger Detail



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Tips & TECHNIQUES



◀ Clamping a panel to the cast-iron "web" wing of my table saw prevents bowing during glue-up.

"web" wing glue-up FOR FLATTER PANELS

I clamp panels against the flat "web" wing of my table saw to keep them from bowing during glue-up.

To do this, position the clamps across the top of the panel (instead of the usual over-and-under arrangement). Then lay the panel on the table saw wing, and insert clamps through

the webs to flatten the panel against the wing, as shown in the *Photo* above. Wax paper between the wing and the panel prevents stains on the wood and keeps the glue off my saw table.

Robert Nielsen
North Hills, CA

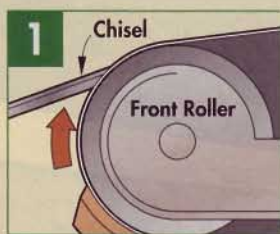
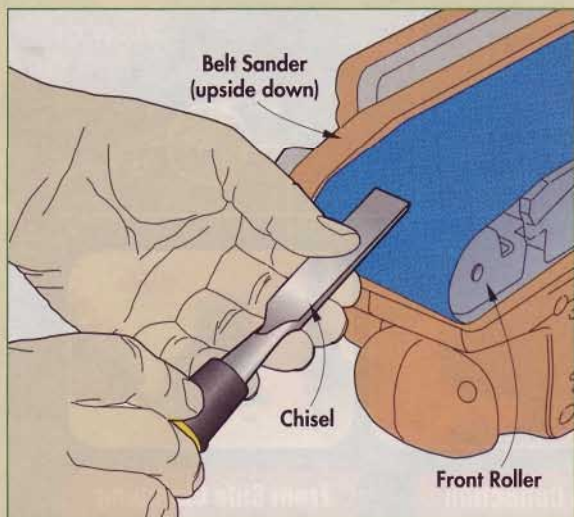
sharper in TWO STEPS

I read the jobsite sharpening article in the February 2005 issue of *Workbench* that explained how to sharpen a chisel with a belt sander. As you said, this is effective for a fast sharpening job. But I use my belt sander for the first step in a two-step method that achieves an even keener edge.

First, I hold the bevel of the blade against the front roller of the running sander (*Illustration, above left*), rather than flat against the platen. This creates a curved, or "hollow-ground" bevel (*Fig. 1*).

The second step is to hone the bevel on a sharpening stone (*Fig. 2*). Because of the hollow grind, you only need to remove a small amount of material to put a keen edge on your chisel. You can accomplish this quickly with just a few strokes on the stone.

Bob Stimson
Sedona, AZ



◀ First, hold the chisel blade against the front roller of the running belt sander. This creates a hollow-ground bevel.



◀ Then, hone the bevel on a sharpening stone to produce a keen edge. Because of the hollow grind, this only takes a few strokes.

Quick Tips



Magnetic Hardware Holder

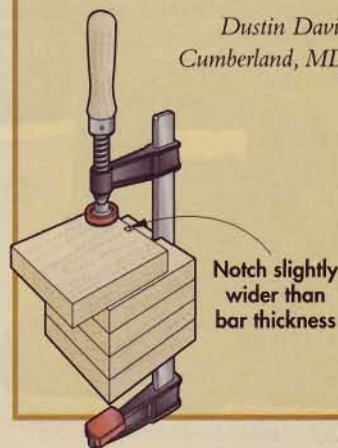
To keep nails and small hardware within easy reach while I'm working, I use a magnetic clip. By clipping it to my clothing or the project I'm working on, I no longer lose screws — or have to hold them in my teeth.

Nick Koelkebeck
Chagrin Falls, OH

Glue-up Tip for Turning Blanks

Gluing pieces face to face to make a turning blank can be tricky because of their tendency to slip around when you tighten the clamps. I solved this problem by cutting notches in the waste portion of the pieces. The notches are sized so the clamp bar fits snugly. This way, the bar prevents the pieces from rotating out of alignment when you clamp up the blank.

Dustin Davis
Cumberland, MD



extend clamp "reach" WITH A SPACER & A LEVER

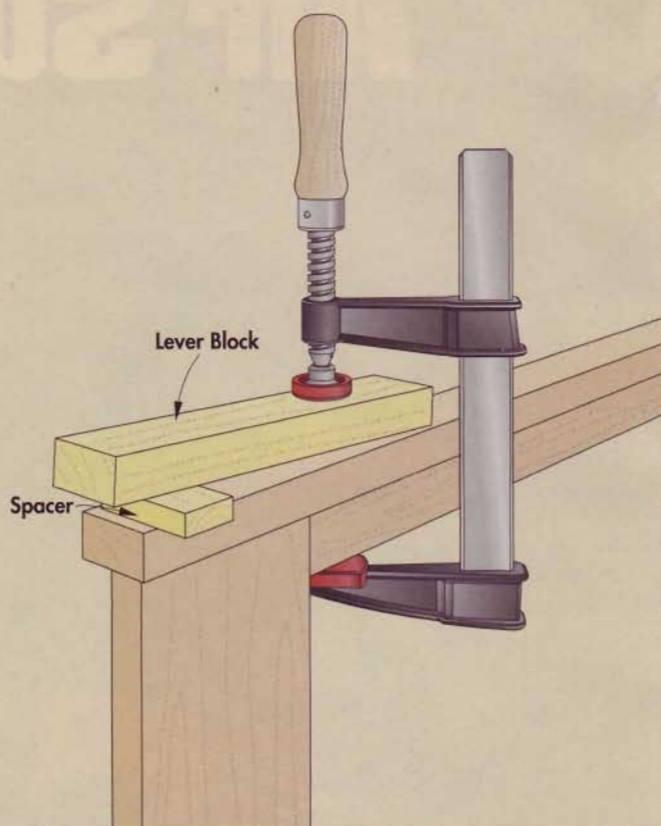
It seems I'm always running into situations where the jaws of my bar clamps don't have enough "reach." That's when I use a spacer and a lever block to extend the reach of my clamps.

This technique is just a variation on the basic lever principle. As you can see in the *Illustration* at right, it starts with simply placing a spacer on the part you want to exert clamping pressure on. Over the spacer, lay a block long enough to extend to an area the clamp will reach. Then position the clamp.

Tightening the clamp will flex the block and push down on the

spacer, as indicated in the *Clamping Detail*. This extends the clamping pressure out where you need it.

Joe Grady
New Orleans, LA



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trick to align LAMINATE

Attaching laminate to a narrow edge (like the front of a countertop) is not as easy as it looks. You need to cut it over-size ($\frac{1}{4}$ " wider than the edge it will cover), so it overhangs the gluing surface on both sides. And since contact cement (which I typically use in this situation) bonds instantly, there's only one chance to get it right.

That's why I use spacer blocks to align the laminate. These are just blocks with strips of $\frac{1}{8}$ " hardboard glued to them. I stick these blocks to the substrate with double-sided tape to automatically register one edge of the extra-wide laminate. Then I set the laminate on the blocks and press it into place (see Fig. 1). Once that's done, I remove the spacer blocks and trim the laminate flush as usual (see Fig. 2).

Tom Chance
Billings, MT

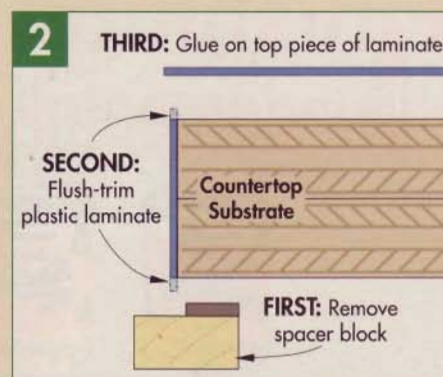
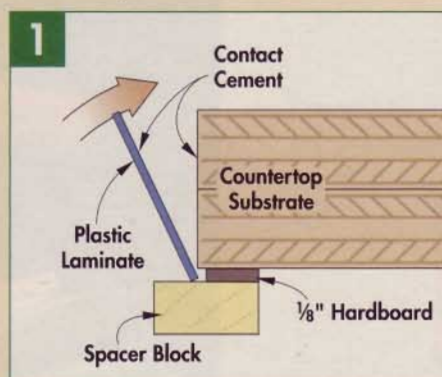
Quick Tip



Can Opener Plaster Aid

I found that an old can opener comes in handy when preparing cracked surfaces for plastering. Simply use the pointed end to scrape the crack. This removes crumbling plaster chips and opens up the crack to accept enough joint compound to form a good bond.

Sarah O'Dell
Reasnor, IA



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Finishing Fundamentals



finishing with shellac: CANNED OR FLAKES?

▲ Finishing a project with canned shellac is convenient, but mixing your own from flakes and denatured alcohol gives you greater control over the color and thickness of the finish.

Q I built a Shaker wall clock, and I want to use shellac as a finish. Should I buy canned shellac, or get some shellac flakes and mix my own?

Lou Jeanfreau
Belle Chase, LA

A For convenience, it's tough to beat shellac in a can. Canned shellac has been pre-mixed and is ready to use right away. It generally comes in two colors, clear or amber (see Photo, above left).

And it's inexpensive (a pint is around \$6).

Canned shellac does have a limited shelf life, however. You don't want to use it if it's more than a few years old, as the finish could be soft and dry slowly.

Also, canned shellac is mixed to a 3 "pound cut," which means 3 lbs. of flakes are dissolved in one gallon of alcohol. This is fairly thick for a woodworking finish.

To get around these limitations, you can make your own shellac finish. This takes a little more work upfront, but the trade-off

is a greater variety of colors to choose from and better control over the thickness.

Making your own shellac is not difficult: You just mix flakes and denatured alcohol to achieve the pound cut you desire and stir occasionally over the next few hours until the flakes dissolve (Photo, above). I mix mine to a 2-pound cut for a smooth finish (2 lbs. of flakes per 1 gallon of alcohol).

And with shellac flakes, you can mix just the amount you need and save the rest in "dry storage" for another project.



salvaging an old CAN OF VARNISH

Q I found a partial can of varnish in my shop with a thick, rubbery "skin" over the top of the finish. Can I use it, or should I throw it out and buy a new can?

Andy Reynolds
San Diego, CA

A You can use the varnish, but you'll want to take some precautions beforehand. First, carefully remove the skin (Photo, left). Just in case some of the solids have fallen into the finish, it's a good idea to pour it through a paper paint strainer.

This skin forms in the first place because air in the can causes the varnish to begin curing. As a result, the remaining finish may be thicker, in which case you could add some mineral spirits to thin it.

One way to prevent this skin from forming in the future is to store leftover varnish in a container sized to hold the amount you have left. This way, there's no room for air to get in.

▲ When air gets trapped inside a can of varnish, the varnish begins to cure, causing a rubbery skin to form. After removing the skin, though, the finish can still be used.

Finishing Fundamentals

the truth about WIPING VARNISH

Q I've seen both regular and "wiping" varnishes on store shelves. What's the difference between these two finishes? Does one have any advantage over the other?

Gary Anderson
San Diego, CA

A Varnish is a finish that's formulated by cooking oil with resin. Wiping varnish is simply regular varnish thinned with mineral spirits (*Photo, above right*). In fact, you can make your own by mixing varnish and mineral spirits in a 1:1 solution.

The advantage of regular varnish is it goes on thick, so two or three coats usually gives you a good build. The downside is it dries slowly, so dust will settle in the finish. This requires sanding between coats to smooth the finish.

Dust is less of a problem with wiping varnish because it dries faster. And you apply it by wiping it on, so you don't have to worry about brush strokes, runs, or drips. Of course, it will take more coats



▲ Turn any varnish (or polyurethane) into a "wiping" varnish by mixing equal parts of varnish and mineral spirits together.



▶ Wiping varnish flows better, making it great for top coats. You can even use a brush if you prefer.

to get the same build as regular varnish. And since each coat is thin, it's easy to accidentally sand through.

In a nutshell, both varnish and wiping varnish have their advantages and disadvantages. To get the best of both worlds, I sometimes use regular varnish for the first few coats to build the finish, then wiping varnish as the top coat (*Photo, above*).

a "no-finish" finish for AROMATIC CEDAR

Q What method would you use to finish a thin layer of aromatic cedar in a chest without losing the cedar scent?

Janel Dale
Via email

A Actually, *no* finish is best for aromatic cedar if you want to retain the scent. Any finish you put over it will mask the scent you likely chose the cedar for in the first place.

However, there is a product that can renew the scent in an older aromatic cedar project. It's called Cedar Oil, a natural extract of cedar wood. An 8-oz. can is available for \$16 through Woodcraft (Woodcraft.com, 800-225-1153). It's easy to apply as shown at left.



▲ This 100-percent cedar oil extract renews the scent of older aromatic cedar projects. Simply pour a small amount on a rag, and wipe it onto the surface of the wood.



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The Cutting EDGE



BEFORE SHARPENING



AFTER SHARPENING

revive your dull ROUTER BITS

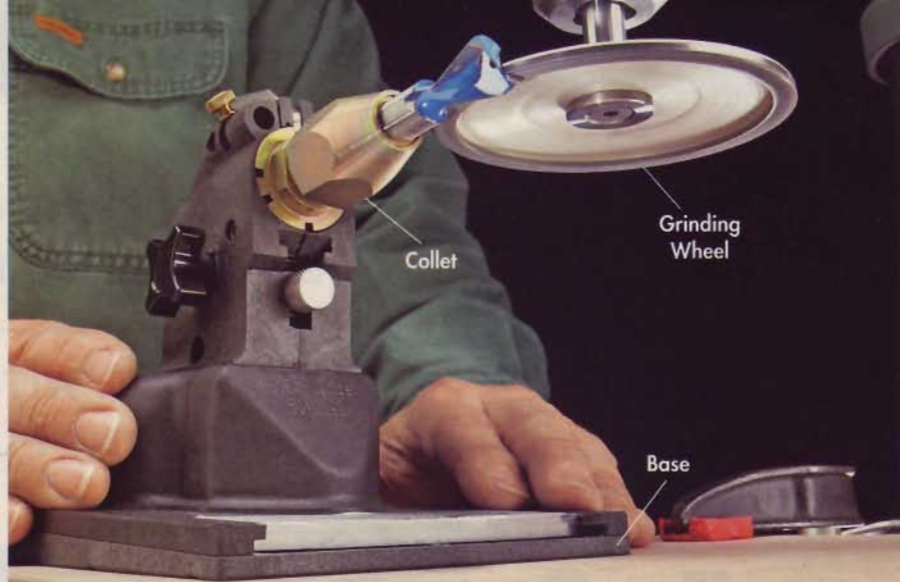
For most woodworkers, the solution to a dull router bit is to either buy a new one or pay for professional sharpening. This Versa Grinder changes all that. It allows you to sharpen dull bits with a drill press. That's accomplished with a horizontal grinding wheel that mounts in the drill press and a base unit that holds and positions the router bit in relation to the wheel (*Photo, above right*).

Setup — The base unit has a collet that lets you chuck a bit just like you would in a router. Then, the base adjusts in three different ways to allow you to precisely align the cutting edge of the bit with the grinding wheel (*Illustration, right*). The grinding wheel is simply chucked in the drill press and set at a height so that the wheel just grazes the bit's cutting edge.

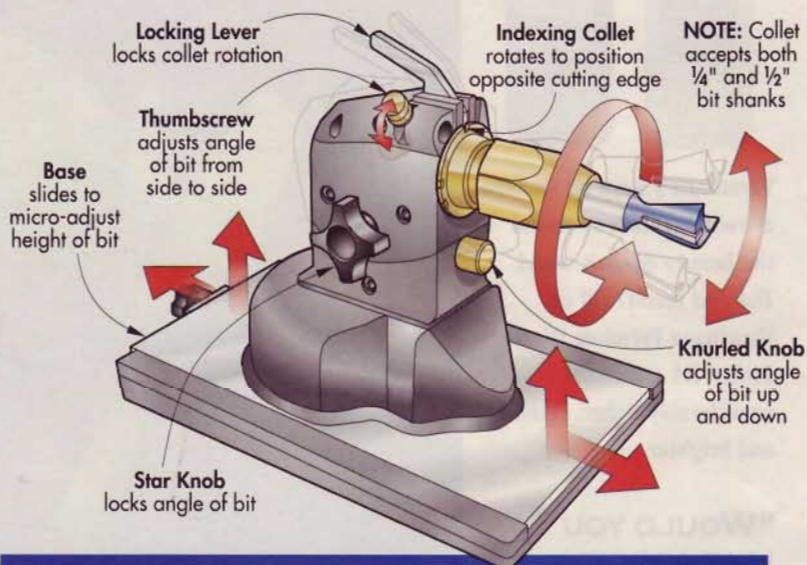
Sharpening — Once the drill press table is square with the chuck (*Box, right*), and the height and angle of the router bit are aligned with the grinding wheel, you're ready to sharpen the bit. Turn on the drill press, firmly grip the base of the Versa Grinder, and slowly slide the base so the bit contacts the grinding wheel (*Photo, above*). Continue sliding the base until the wheel has contacted the entire surface of the bit's cutting edge. Once one edge of the bit is sharpened, the base has an indexed collet that lets you position the opposite cutting edge for sharpening.

Tool Testing — I used the Versa Grinder to sharpen a number of bits. Across the board, the system was easy to set up and adjust, and it did a great job of sharpening dull and burned router bits (*Photos, above*).

The Versa Grinder system is available through Woodworker's Supply for \$200. Consider that a new router bit can cost anywhere from \$30 to over \$100, and this system could save you some serious money. For more information about the Versa Grinder, visit Woodworker.com or call 800-645-9292.



▲ The Versa Grinder breathes new life into dull router bits. It includes a base and grinding wheel for sharpening them on your drill press.

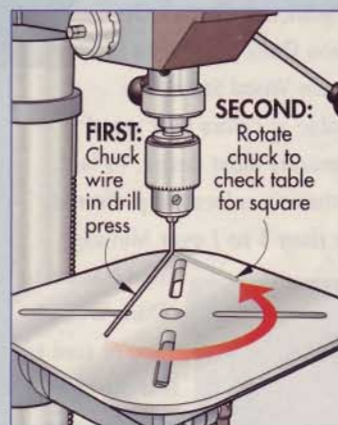


SHOP TIP: SQUARE A DRILL PRESS TABLE

For the Versa Grinder to work properly, it's important that your drill press table be adjusted so it sits at exactly 90° to the chuck.

One easy tip for checking the squareness of your drill press table is to chuck a bent piece of stiff wire into the drill press, as shown at right.

With the wire chucked in the drill press, simply bend it so one end touches the table. Then, turn the chuck by hand to see if the wire touches as it rotates around the table. If it doesn't (or if it binds on the table), adjust the angle of the table to bring it into alignment with the end of the wire.



▲ By bending a piece of wire and chucking it into the drill press, you can check a drill press table for square.

The Cutting EDGE

Groove-Cutting
Bit

Tongue-Cutting
Bit

an easier way to MAKE EDGING

The typical procedure for adding edging to a plywood project goes something like this: Cut thin strips of hardwood, attempt to glue the strips to the plywood without having them slip around, and then carefully trim the edging flush with the surface without gouging the plywood.

Simple Edging Solution — For \$90, you can buy a set of router bits that will eliminate both the slipping and flush-trimming dilemmas. One bit cuts a Y-shaped groove in the plywood, and the other cuts a mating tongue in a piece of hardwood. By using these bits on plywood and hardwood that are the exact same thickness, you

create an interlocking joint that won't slip out of alignment (*Inset Photo, left*).

Testing the Bits — When using the bits, each one has to be centered precisely on the thickness of the workpiece. This is easy to accomplish by making a few test cuts.

These bits remove quite a bit of material, so you'll want to use them with a router table and fence. Make a series of passes by adjusting the fence between cuts to achieve the final depth of the profile (*Photo, left*). Also, be sure to rout the tongue on a wide hardwood blank to keep your fingers out of harm's way. The blank can be ripped to final width later.

Visit Eagle-America.com or call 800-872-2511 for information.

▲ This matched set of router bits from Eagle America creates an interlocking joint between plywood and edging that ensures perfect alignment.

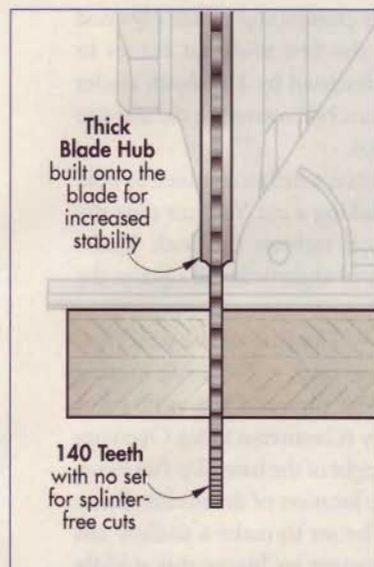
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DOW

plywood-cutting CIRCULAR SAW BLADES



No matter how careful I am, I always seem to get at least some tear-out when cutting plywood with a circular saw. But then I tried an inexpensive plywood-cutting blade (*Photo, right*). This type of blade is a cut above the rest when you need a smooth, finished edge on plywood with a circular saw (which is the case with the shop-made panel saw featured on page 26).

It's All in the Teeth — The teeth on these blades are steel, rather than carbide-tipped, and there are 140 to 150 of them for splinter-free cutting. I tested several of the blades, and some had minimal tooth set, while others had none. I determined

that the blades with no tooth set (like the Dewalt shown at right) produced the cleanest cuts (*Illustration, left*).

Thin Body — Many of these blades are very thin at the cutting edge for smooth cuts, and the "hub" of the blade is thicker for increased stability (*Illustration, left*). This means you'll need to set the depth of your cut so the hub isn't engaged in the workpiece. Cuts set too deep run the risk of burning and binding.

The Dewalt blade shown here sells for under \$10. For more information about the blade, visit DeWalt.com, or call 800-433-9258.



▲ This plywood-cutting circular saw blade from Dewalt has 140 teeth with no set for smooth, splinter-free cuts in plywood.



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small-shop PANEL SAW

When it comes to accurately crosscutting a wide plywood panel, a circular saw isn't the first tool that comes to mind. But this panel saw designed by *Workbench* reader George Wilson of Whitesboro, NY, converts a circular saw into a precision cutting tool.

The saw is guided by a fence, which is also used to hold the panel in place when making a cut. You just slide the panel under the fence and tighten the lock knobs (*Crosscutting Close-up*). A metal alignment rail squares the panel to the fence.

Begin with the Base — The base of the panel saw provides a large, flat surface with a 20"-wide cutting capacity. It consists of a large plywood top with a 2x4 frame underneath for rigidity (*Construction View*). Openings cut in the top reduce the weight of the base (*Top Part View*).

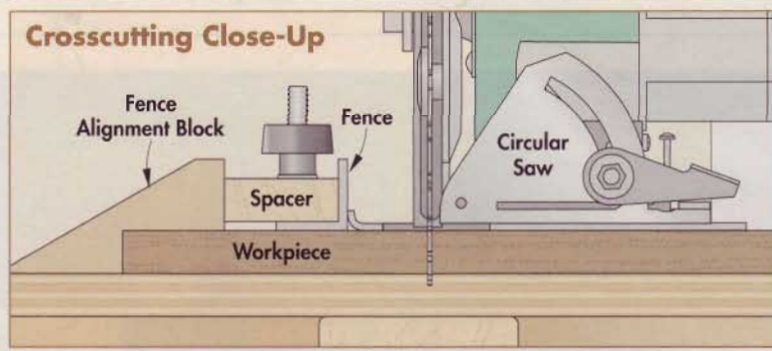
One thing to note is the location of the middle frame piece. In use, the saw will be set to make a shallow cut into the base. So it's important to locate this middle frame piece directly under that area to beef up the base and to add extra support in the event you accidentally cut all the way through the top. Once that's done, glue and clamp the frame pieces to the top.

Form the Fence — The fence is composed of a piece of aluminum angle with a 3/4" plywood spacer screwed to the lower leg. The spacer provides some knuckle room between the lock knobs and the aluminum angle.

The fence is attached to the base with carriage bolts and knobs (*Mounting Detail*). Drill counterbores in the bottom of the frame to form pockets for the bolt heads. Another pair of counterbores in the top receive hex nuts

▲ This panel saw has an adjustable fence that guides a circular saw and holds the panel down. A metal alignment rail squares the panel to the fence.

Crosscutting Close-Up



PANEL SAW SETUP

Once built, preparing the panel saw for use is easy. The first step is to square the alignment rail with the fence. Here's where those adjustment slots come into play. With a framing square as a guide, set the rail at 90° to the fence as shown in *Figure 1*.

To make a cut, align the layout line on the panel with the registration kerf (*Fig. 2*). After tightening the knobs to lock the panel in place, make the cut.

◀ A special plywood-cutting blade lets you get smooth, finished edges with a circular saw. (See page 25 for more.)



▲ The adjustment slots in the alignment rail allow you to square it accurately with the fence.



▲ To set up the cut, align the panel's layout line with the far side of the kerf, then lock the fence.

that secure the carriage bolts. Then drill the shank holes for the bolts.

The fence can be raised and lowered to accommodate panels of different thickness, so there has to be a way to keep it aligned. That's the job of a pair of wedge-shaped alignment blocks cut from scrap 2x4s. These blocks are glued to the top behind the fence.

Add the Alignment Rail — The last part of this panel saw is the alignment rail. It's a piece of aluminum angle with slots cut in it that let you adjust it to square the rail to the fence (Slot Detail). An easy way to form

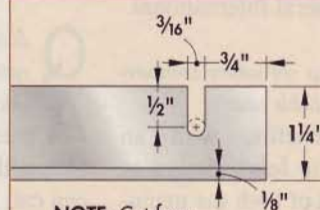
these slots is to drill end holes and then complete the slots with a hacksaw or jig saw.

Registration Kerf — Before you use the panel saw, you'll need to cut a kerf to align the workpiece on it. This kerf is specific to the blade, so consider using a dedicated blade like the one shown on page 26.

To cut this kerf, lock the fence, set the saw for a $\frac{1}{8}$ "-deep cut, and cut across the base, holding the saw firmly against the fence.

With this registration kerf cut, you're ready to make the final adjustments (see Box, page 26).

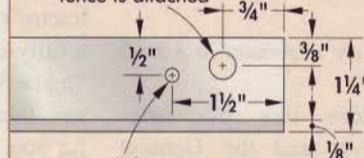
Slot Detail



NOTE: Cut four slots, $7\frac{1}{2}$ " apart

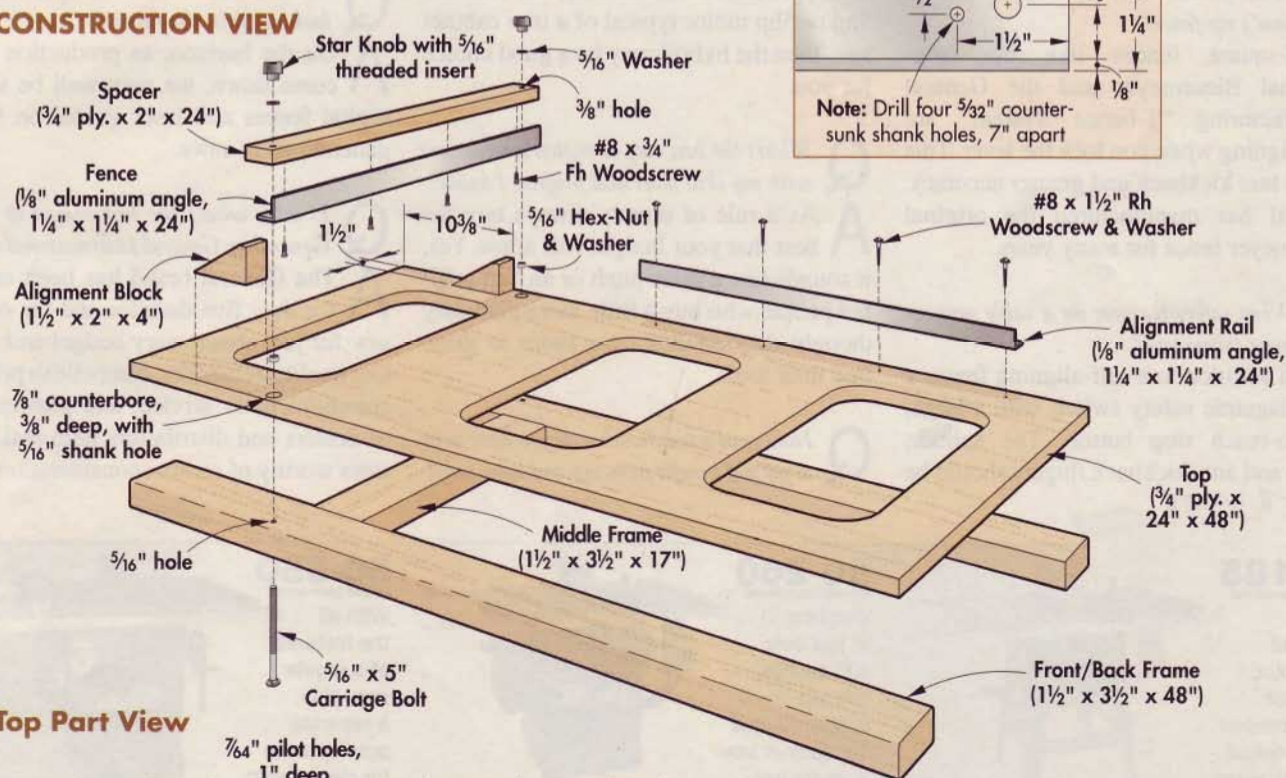
Fence Detail

Note: Drill $\frac{3}{8}$ " hole after fence is attached

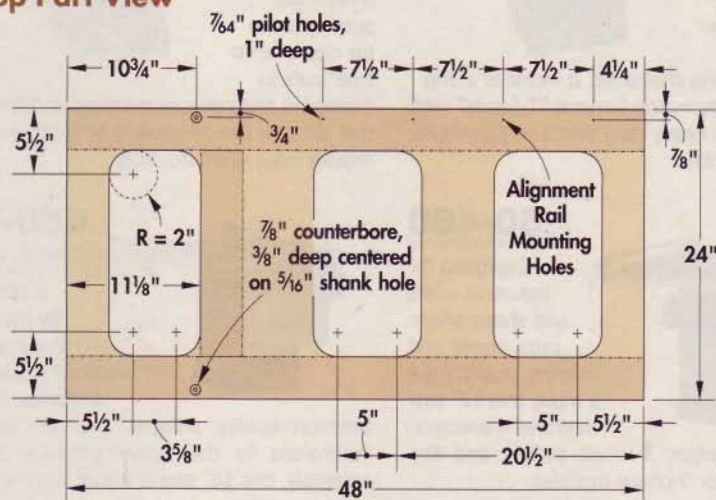


Note: Drill four $\frac{5}{32}$ " counter-sunk shank holes, 7" apart

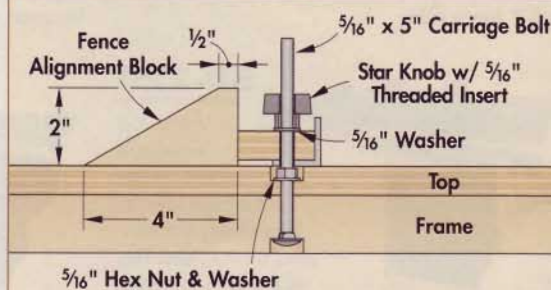
CONSTRUCTION VIEW



Top Part View



Mounting Detail



edge-jointing WITH A ROUTER

Before ripping any board (as outlined on page 38), the first step is to create one straight edge to run against the rip fence on the table saw.

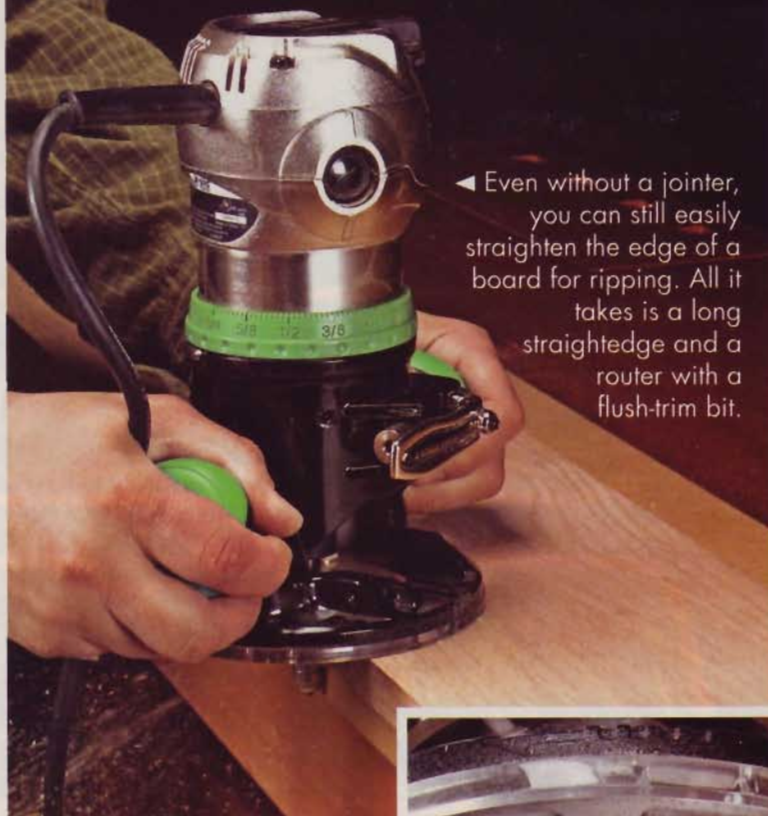
Jointer Not Required — A jointer is the ideal tool for straightening this edge. But if you don't have a jointer, there's still an easy way to do it: Use a straightedge and a handheld router equipped with a flush-trim bit.

Setup — For a straightedge, the factory edge of a long piece of MDF works fine. To set up for the cut, just place this straightedge so it's slightly over the edge of a bench. Next, position the workpiece above it, so it overhangs the edge by no more than $\frac{1}{8}$ " (see *Illustration, right*). Then clamp both pieces securely to the bench.

Now adjust the height of the flush-trim bit so the bearing rides along the straightedge. I like to use a spiral downcut flush-trim bit for this cut to achieve a smoother routed edge (see the *Box below*).

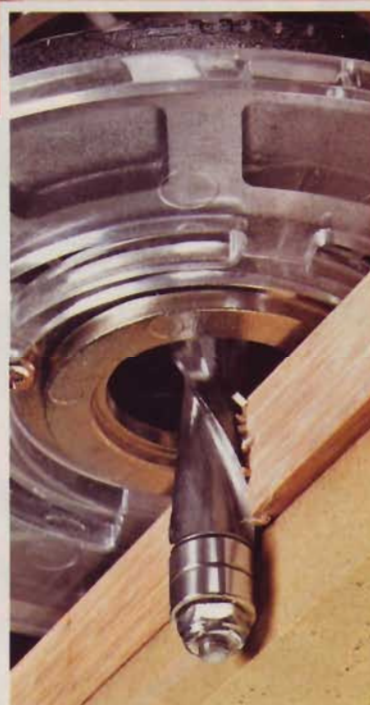
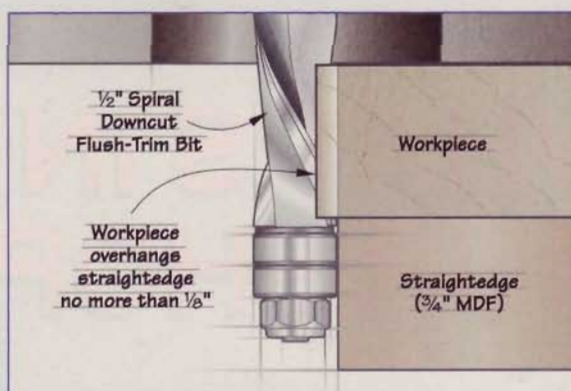
Rout It Straight — Now turn on your router, and rout from left to right. Maintain a steady pace as you rout along the edge of the workpiece (*Photo, above*). After just one pass, your board should have a straight edge to place against the rip fence of the table saw for a safe, accurate rip cut.

Note: If the edge of your workpiece is too rough to flush-trim, see the tip on page 32.



◀ Even without a jointer, you can still easily straighten the edge of a board for ripping. All it takes is a long straightedge and a router with a flush-trim bit.

▶ The board needs to protrude past the straightedge by no more than $\frac{1}{8}$ ". Then the flush-trim bit rides along the straightedge to straighten the board.

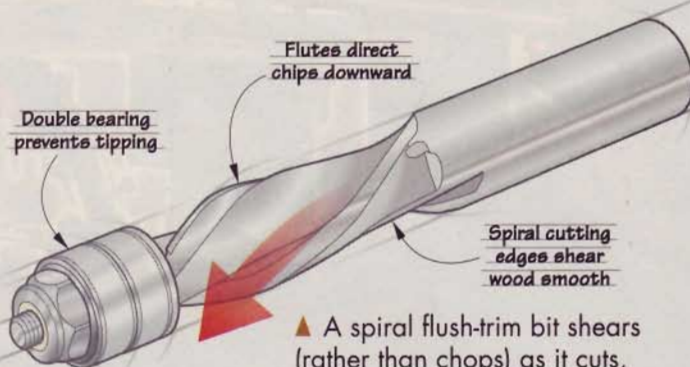


A BETTER FLUSH-TRIM BIT

A regular flush-trim bit will work fine for the tip shown above. But for an even smoother routed edge, I use a spiral flush-trim bit (*Illustration, right*).

This bit has several advantages over a standard bit. For one, the spiral cutting edges shear wood at an angle, rather than chopping it, to create a smoother surface. And the flutes direct chips downward toward the straightedge, which reduces chipout on the bottom face of the board.

This particular bit also has two bearings, so it's less likely to tip and gouge the workpiece.



▲ A spiral flush-trim bit shears (rather than chops) as it cuts, creating a smooth routed edge.

saw guide tames ROUGH EDGES

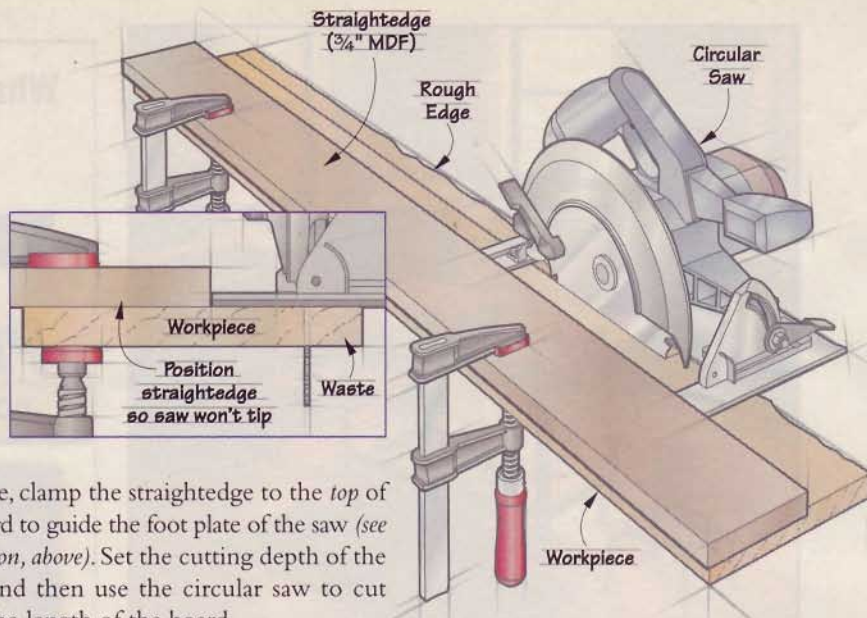
The tip on page 30 is intended for truing up the edge of a board that's already fairly straight. But some boards have very rough edges (or bows) that need to be removed before the straightening process can begin.

If this is the case, it's easy to clean up that edge using a circular saw guided by the same MDF straightedge shown on page 30. Only

this time, clamp the straightedge to the *top* of the board to guide the foot plate of the saw (see *Illustration, above*). Set the cutting depth of the blade, and then use the circular saw to cut down the length of the board.

After trimming the edge, follow the procedure outlined on page 30 to true up the edge with a router.

▲ If a board has a very rough edge, you'll want to trim it with a circular saw before routing it.



custom-length SHOP-MADE KNOBS

For a lot of jigs (like the table saw sled featured on page 42), I use knobs with threaded studs to secure the adjustable parts of the jig. The only problem is that the studs on these knobs come in preset lengths that often won't work for my project.

An easy solution is to make your own knobs. To do that, you'll need the type of knob with a threaded insert and a piece of all-thread cut to the appropriate length (*Photo, left*).

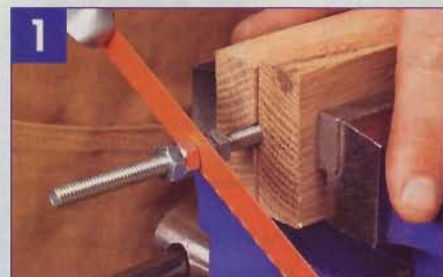
Making Knobs — Start by measuring the length of threaded rod you'll need for the stud. Don't forget to take into account the part of the rod that will actually thread *into* the knob.

Next, cut the rod to length with a hacksaw. A vise is great for holding the rod while you cut it, but the only problem is the metal jaws can mar the threads. To get around that, attach wood jaws with V-shaped notches cut in them to the vise. It also helps to use nuts to guide the saw blade (*Fig. 1*).

The nuts serve a second purpose, as well. With the rod cut, threading the nuts off the rod will clean up the threads (*Fig. 2*). Next, use a file to chamfer the cut edge of the rod, so it will thread more easily (*Fig. 3*).

After that, apply epoxy to the rod, and then thread the rod into the knob to complete the job.

▲ To make knobs with studs that are the correct length for your jigs and fixtures, just cut a piece of all-thread rod to length, and secure it in a knob with epoxy.



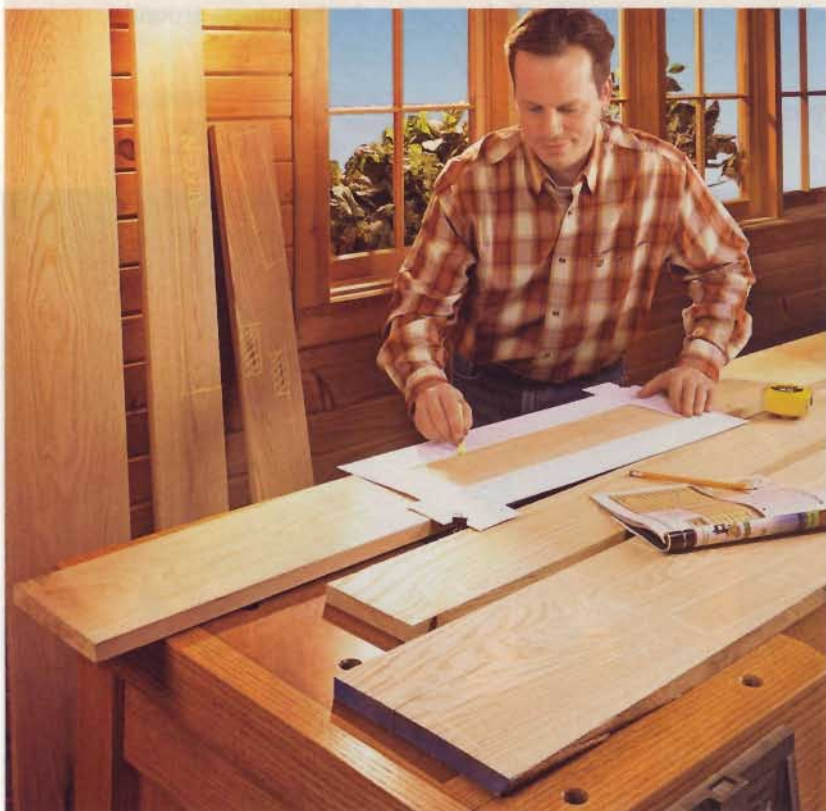
▲ Clamp the rod between wood jaws in a vise, and cut it with a hacksaw. Use nuts on each side to guide the saw blade.



▲ After cutting through the all-thread rod, remove the nuts to clean up the threads around the cut line.

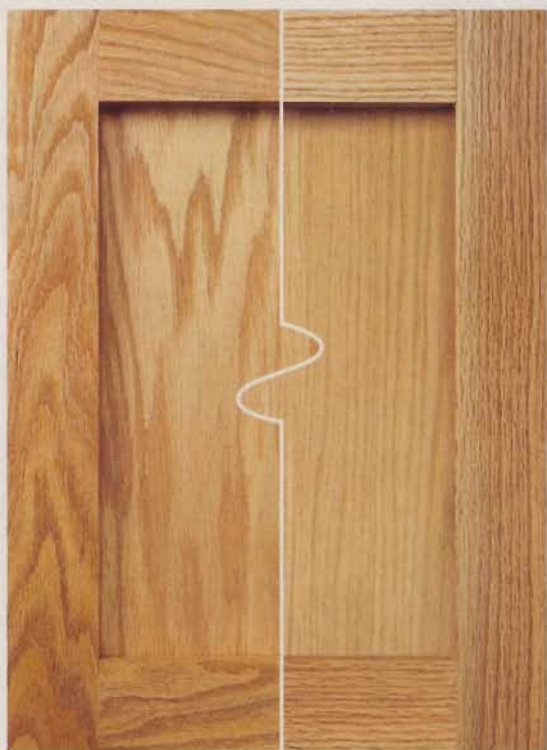


▲ Before adding the knob, use a file to ease the cut edge of the rod. The wood jaws hold it securely in the vise.



HOW TO TURN RAW LUMBER INTO **PERFECT PROJECT PARTS**

Learn how to find the best-looking wood in every board as you break rough lumber down into project parts.



▲ **Follow the Lines.** The wildly figured grain on the door at left is very distracting. Using straight-grained stock for the parts, right, gives the door a more professional look.

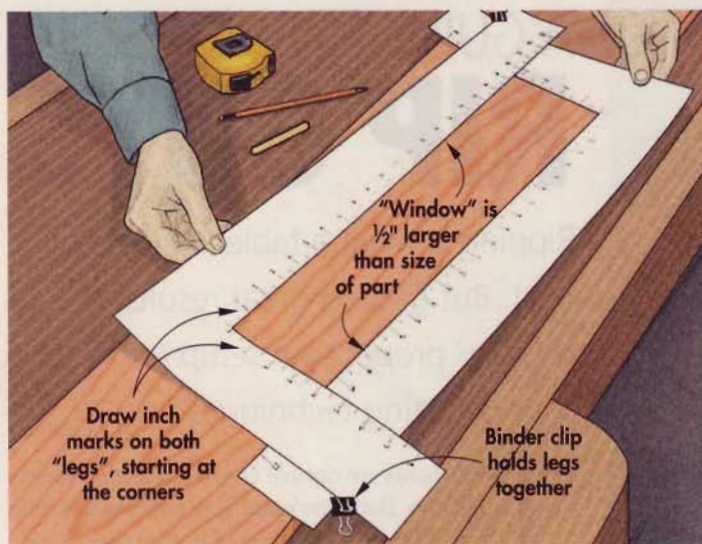
Bringing home lumber for a new project is always exciting. With plans in hand, you're ready to start slicing those raw boards into parts that you'll machine and assemble into something beautiful. But don't let this excitement get the better of you. Instead of just randomly cutting parts from the boards, you can use a few simple methods to help you pick the best piece for every project part.

If you simply cut the parts from wherever they happen to fit on a board, you may end up with mismatched grain patterns on parts of your project. To improve the appearance of your projects, you need to carefully select what area of the board each part should be cut from. This extra effort makes a dramatic difference in how the finished product will look (*Photos, left*).

Here, we'll show you how it's done. You only need a few "tools," below, and a good eye to get the best from every board.

WHAT YOU'LL NEED:

- 1 **Materials List.** Whether from a set of plans or homemade, this list should detail the quantity and dimensions of each project part.
- 2 **Tape Measure.** When laying out your parts, you only need approximate, oversize dimensions. But a tape measure is still indispensable.
- 3 **Chalk.** Unlike pencil marks, chalk is highly visible on rough stock and wipes off easily. You can even color-code different assemblies.
- 4 **Sight Gauge.** This shop-built tool (*Illustration, page 37*) makes it easy to select the best grain by highlighting only what you want to see.



◀ Seek Great Grain.

A sight gauge makes it easy to see what grain figure will look like on a part by blocking out the surrounding area. Move the gauge until you see the best-looking grain figure in the opening.

▶ Then Chalk It Up.

Use chalk to outline defects and parts. If you need to change a part location, you can just wipe off the marks with a rag and start again.

Mark knots, splits, and other defects, so you can avoid them easily

Work around checks at ends to minimize waste

Lay out pieces at an angle if that follows the best grain

Cut narrow parts from straight-grain areas of board

STEP-BY-STEP BOARD BREAKDOWN

The first step in creating perfect project parts is to select the best boards. In our June 2005 issue we showed you how to choose boards based on grain figure, color, and defects. Now you need to take this strategy a step further by selecting where each part will come from on the board to give the project the best overall appearance.

The *Illustration* above shows how I use a shop-built "sight gauge" to lay out many parts. The gauge is just two L-shaped pieces of posterboard clipped together. I adjust the opening to be about $\frac{1}{2}$ " wider and longer than the part, and then lay the gauge on the board.

Get the Big Picture — When you start laying out parts, you may be inclined to just grab a board, mark out parts until it's "full," and then move on to the next. This leads to mismatched grain and wasted wood. Instead, place all the boards for that project side by side, so you can choose the best part location from any board.

Highlight the Good, Bad, and Ugly — With the boards laid out, examine all of them and mark defects or other areas to avoid, as well as any interesting grain features you may want to highlight (*Photo, far right*).

Start with the Obvious — Now you can start to lay out the parts. But don't just do this in order of the materials list. These lists generally follow the construction sequence, so you could end up using the best stock to make the least visible parts. And cutting diagrams can't account for grain figure and defects in the boards.

A better idea is to select the highly visible parts, such as tabletops, rails and stiles, door panels, and drawer fronts, first. Then work your way to the least visible parts. Hidden parts can have the least desirable grain.

Seek Similarities — When making more than one of any part, cut them from areas with similar grain. If you don't, the differences really stand out. Take all of these parts from the same board if possible. You can cut them from different boards, though, if that provides the best match.

Review, Cut, and Categorize — Once all of your parts are marked, review the materials list and boards to make sure you have all parts accounted for. Then cut out the parts, and stack them in a logical order.

Look From a New Angle — Keep in mind that the best grain sometimes runs across the board at an angle instead of parallel to the board edges. Just cut these parts following the grain as shown in the *Photo* below.



▲ **A New Angle.** You can use a jig saw or band saw to rough-cut parts that run across the board. Then true one edge (see page 30), and cut the part to final size.



BENCH BASICS

FUNDAMENTAL SKILLS FOR BETTER WOODWORKING

A GUIDE TO SUCCESSFUL RIP CUTS

Ripping is what a table saw does best. But getting great results requires proper saw setup and sound cutting techniques.

Table saws are capable of making a wide variety of cuts. But there's probably nothing this shop workhorse is better suited to than slicing wide boards into narrow pieces — better known as ripping. Thanks to its powerful motor and long rip fence, the table saw can rip more safely and accurately than any other tool.

But that doesn't mean successful ripping is automatic with a table saw. To rip well, a saw has to be set up properly, equipped with the right blade and accessories (*bottom left*), and operated by a woodworker who understands the proper techniques for ripping wood.

It Starts with the Setup — To ensure good results, you first need to make sure your saw performs to its full potential. This starts with a thorough tune-up, which you can learn how to do on page 50.

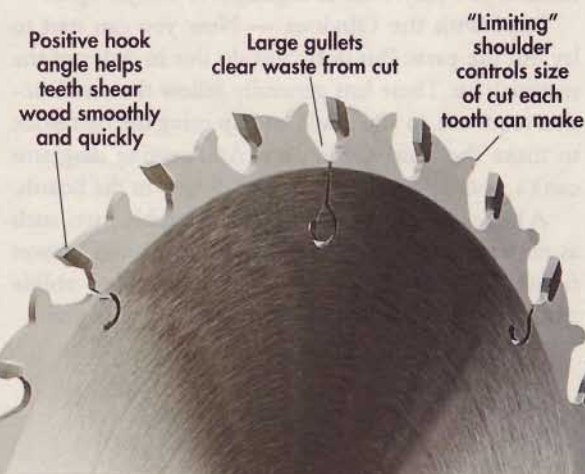
Then, you need to install a blade that's up to the task. A combination blade (designed for both ripping and crosscutting) can produce great results, especially if you keep it well sharpened. If you're building more than a couple of projects a month, though, or if you have one big project that will involve a lot of stock preparation, you should consider investing in a rip blade (*Photo, below*). You can get a good one for about \$50.

On the Straight and Narrow. Of all the jobs a table saw can perform, there's none it does better than ripping boards into narrower pieces. That's thanks to the sturdy fence that guides the workpiece while the blade slices through.

EQUIPMENT CHECKLIST

- 1 Proper Blade.** For the best performance, invest in a blade designed for ripping (*right*). A good rip blade leaves edges smooth enough for glue-up.
- 2 Push Stick.** To keep your hands safely away from the blade, use a push stick to guide the workpiece all the way past the blade as you cut (*Photo, above*).
- 3 Featherboard.** This accessory applies steady pressure to hold stock against the fence (*Photo, above*).
- 4 Outfeed Support.** Use a roller or platform placed in line with the blade to support long boards.
- 5 Splitter.** This device sits behind the blade to hold the saw kerf open and prevent kickback (*see page 55*).

Rip Blade Anatomy. A rip blade has only about 24 teeth (for a 10" blade) with an aggressive hook angle for quick cutting. Deep gullets between the teeth shed waste.



READY THE **RIP FENCE**

The fence is the single biggest factor that influences the accuracy and safety of rip cuts. It's responsible for guiding the workpiece smoothly past the blade. To do this, as well as get the accurate, repeatable cuts that the fence is designed for, it has to be adjusted properly. See page 52 to learn how to check and adjust your fence.

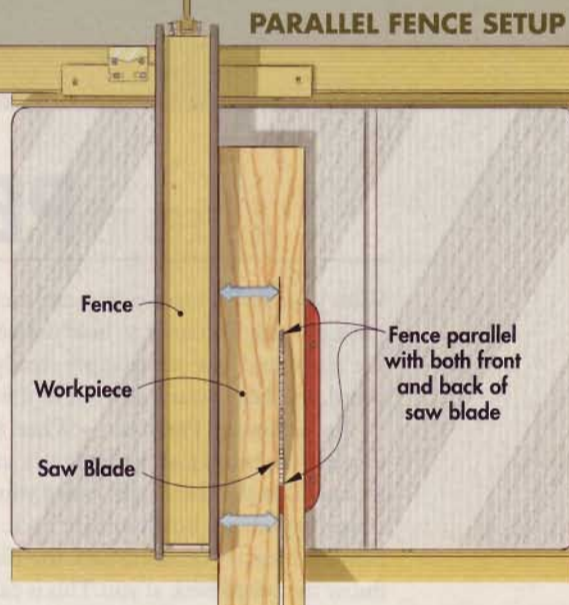
Keep It in Line — The fence should be adjusted so it sits *exactly* parallel with the blade (*Parallel Fence Setup, right*). In our experience, this provides the best results.

You may have heard some woodworkers and even saw manufacturers advocate setting the fence so the outfeed end is a few thousandths of an inch farther from the blade. As you rip a board, this creates a gap between the board and fence at the outfeed end of the blade (*Illustration, near right*). Fans of this setup say the little bit of extra clearance prevents burning and binding without being large enough to affect the accuracy or quality of the cut.

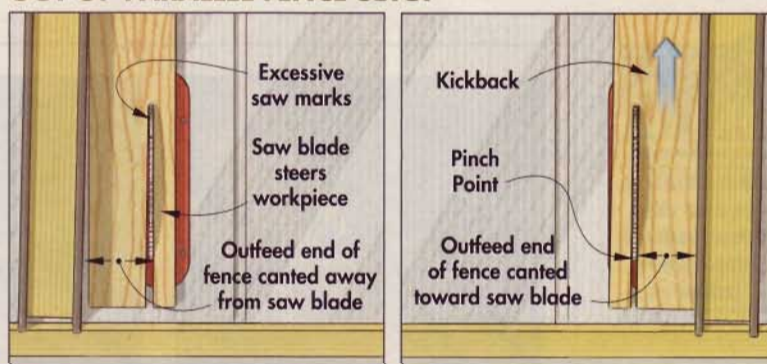
But if you move an out-of-parallel fence to the other side of the blade, the outfeed end will be *closer* to the blade than the infeed end, which pinches the board (*Illustration, far right*). This could cause the board to kick back. I often switch the fence from one side to the other and don't want to readjust it every time.

Align the Fence.

A parallel fence (*right*) produces smooth, burn-free edges when used on either side of the blade. An out-of-parallel fence creates problems.



OUT-OF-PARALLEL FENCE SETUP



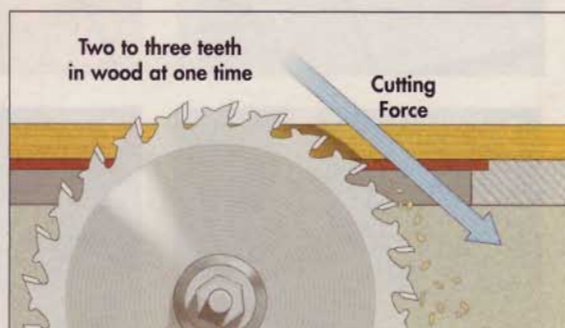
SET THE **BLADE HEIGHT**

Another debate centers around how high to set the blade when ripping. In my opinion, it depends on the speed and quality of cut you are after.

Go Low for a Smooth Edge — To get the smoothest edge when ripping, set the blade height so that the bottom of the teeth just clear the top of the board (*Illustration, top right*). This low tooth angle shears the wood fibers cleanly. The downside is that several teeth are in the wood at one time, which creates friction that can burn the wood. Also, the force applied pushes the board back toward you as you guide it, which slows the cut.

Go High to Cut Fast — If you are ripping to rough width and plan to joint or trim the edge later, then you can set the blade about an inch above the board (*Illustration, bottom right*).

When set high, there are fewer teeth in the blade at any one time, so there's less friction and the teeth stay cooler. And the force applied by the blade is directed downward, which reduces the tendency to push the wood back toward you. The downsides are a rougher cut as the teeth "chop" through the board and, of course, the greater safety hazard due to the exposed teeth.



The Low Road.

A low blade height allows the teeth to slice through the wood cleanly, which helps prevent chipout along the edges of the cut.



The High Road.

When the blade is high above the board, the teeth "chop" into the wood. This can increase chipout, especially on the bottom surface of the board.

4 STEPS TO PERFECT RIP CUTS

With your saw set to rip, you can focus on feeding the stock properly. You need to hold the board tightly against the fence and saw table, apply steady pressure on the board, and keep your body out of the “kickback zone.”

Apply Steady Pressure — When ripping, the goal is to move the board past the blade in a smooth, continuous motion. But, the blade spins *toward* you, meaning it keeps trying to push the board straight back. If you fail to keep forward pressure on the board, the blade may grab and throw the board back at you. This is called kickback, and can occur with enough force to cause serious injury.

Even if the board doesn't kick back, you'll end up with a poor cut. The friction of the saw blade spinning in one location can generate enough heat to burn the wood.

To minimize the chance of injury should a kickback occur, make sure you never stand directly behind the board as you rip. Instead, stand to one side, so there's a gap about the width of the board between you and the fence.

Use a Systematic Approach — The *Illustrations*, below, show you how to handle the board as you rip to make sure none of these mishaps occur. You can also check out an online video at WorkbenchMagazine.com.

**BENCH
BASICS
ONLINE**

www.WorkbenchMagazine.com

GO ONLINE FOR:

• A short video demonstration of proper ripping techniques.



1 The Approach. Set the edge of the board against the fence in front of the blade. Grip the end of the board with your right hand, and push it straight forward into the blade. Use your left hand to push forward and toward the fence.

2 The Cut. Continue pushing steadily with your right hand as the blade cuts. Stop moving your left hand forward before it reaches the blade, and use it to guide the board, still applying pressure against the fence.

3 The Push. As the end of the board nears the blade, hold the corner with your left hand and push forward. At the same time, grab the push stick with your right hand, and use it to push the board. Keep moving the board forward as you do this.

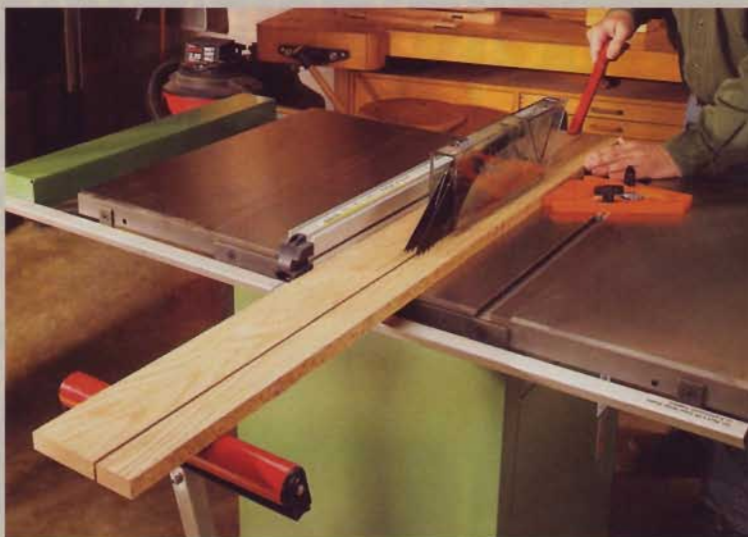
4 The Follow-Through. Just before the blade cuts completely through the board, move your left hand out of the way, and push with the push stick in your right hand until the workpiece clears the blade. Turn off the saw, and let the blade stop before removing the cut pieces.

TECHNIQUES FOR SPECIAL CUTS

LONG BOARDS

The hardest part of long rip cuts often is maintaining control of the board. They tend to wander away from the fence, which can cause a rough cut or kickback. And the weight of the board acts like a lever as it leaves the saw table, raising the uncut portion off the table. When this happens, the blade can gouge or kick back the board.

To control long boards, mount a featherboard before the blade to hold the stock against the fence. Add a splitter behind the blade to hold the kerf open. And support the board with an outfeed roller set $\frac{1}{4}$ " below table height.



NARROW STRIPS

When cutting a large number of thin strips, such as when making edging for plywood, I prefer to set the fence to match the thickness of the strip, and then rip all the strips to width. This technique is fast and consistent, but on many saws, the blade guard is too wide to allow the fence to slide close enough.

You can rip thin strips safely, though, by removing the guard and guiding the workpiece with a wide push block (Photo, right). This one, cut from a scrap 2x4, is 10" long and has a heel to push the board (Inset Photo). The blade remains buried in the push block, and the height of the block keeps your hand safely away from the blade.



THICK STOCK

Even with a sharp blade, thick boards often end up with a rough, burned edge. To smooth it, first rip the piece about $\frac{1}{16}$ " extra-wide, and then "joint" the ripped edge with a thin skimming cut (Photo, below). Guide the board with a push block, and use a pair of featherboards to hold the stock on both the infeed and outfeed sides of the blade.



THIN STOCK

When ripping thin boards ($\frac{1}{2}$ " thick or less), the blade can lift the board off the saw table or bounce it around as you cut. To prevent this, guide the board with a jointer push block or a grout float instead of a push stick (Photo, below). The large rubber foot grips the board and holds it firmly against the table.



MULTIPURPOSE TABLE SAW SLED

Make incredibly accurate crosscuts and miters, and even cut tenons with ease, all using this precision shop-built system.

Here's a great way to increase the cutting performance of any table saw. Just replace the undersized miter gauge with this integrated, multi-function system. You can make one to fit your saw, and all you need is bit of plywood, a handful of hardware and a weekend's worth of shop time.

It Starts With a Sled — The heart of the system is a plywood sled that supports your workpiece as you cut. The sled rides in the miter gauge slot, and can be

used on the left or right side of the blade. In either case, the edge of the sled hugs tight against the saw blade, so aligning your cut line is automatic. To achieve this tight tolerance, you need to custom-fit the sled to your saw, but we'll make that easy.

Accessories Add Accuracy — The sled is equipped with rows of T-nuts that accept an adjustable fence system for making accurate crosscuts and miters, plus hold-downs to secure your stock (see page 44). You can even build and attach an optional tenon jig (page 48).

Adjustable Fence
locks in at exactly
90° and pivots for
cutting
accurate miters

Tenon Jig
turns sled into
a precision
tenoning tool

Hold-Downs
lock workpieces
to sled for
increased
cutting
accuracy

Sled
supports
narrow or wide
workpieces and
slides smoothly
on saw table

Adjustable Miter Bar
ensures a smooth-
running sled

Cutoff Support
holds cutoffs away
from blade, or
can be used
on other side of
sled to support
long workpieces

CROSSCUT WITH CONFIDENCE

Combining the sled and fence ensures crosscutting accuracy. That's because the 2-ft. long fence locks onto the sled at *exactly* 90° every time (*Art, below*). And the fence can be reversed to work with the sled on the right or left side of the blade.

Because the sled rides against the blade, you can cut pieces to length accurately. Just align the cutline on the workpiece with the edge of the sled.

To give the sled more capacity, a long support can sit next to the blade to catch cutoffs, or on the other side of the sled to hold long stock.

Precision 90° Cuts



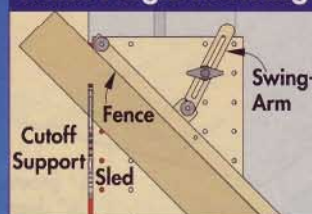
MASTER MITER CUTS

You'll also appreciate the fence system when cutting at angles other than 90°. By adding a swing-arm to the back of the fence, you can pivot the fence to hold a workpiece at almost any angle (*Art, below*). Then lock it down securely in one of the T-nuts in the sled to maintain the setting cut after cut. As always, you just align the workpiece with the edge of the sled

and miter the piece to length.

Just as when crosscutting, you can miter on either side of the blade thanks to the two-position sled and reversible fence.

Multi-Angle Mitering

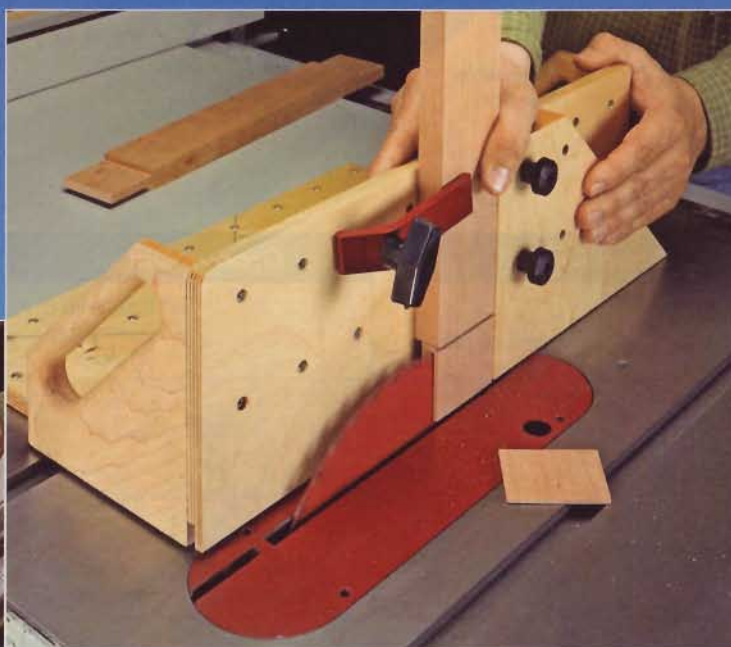


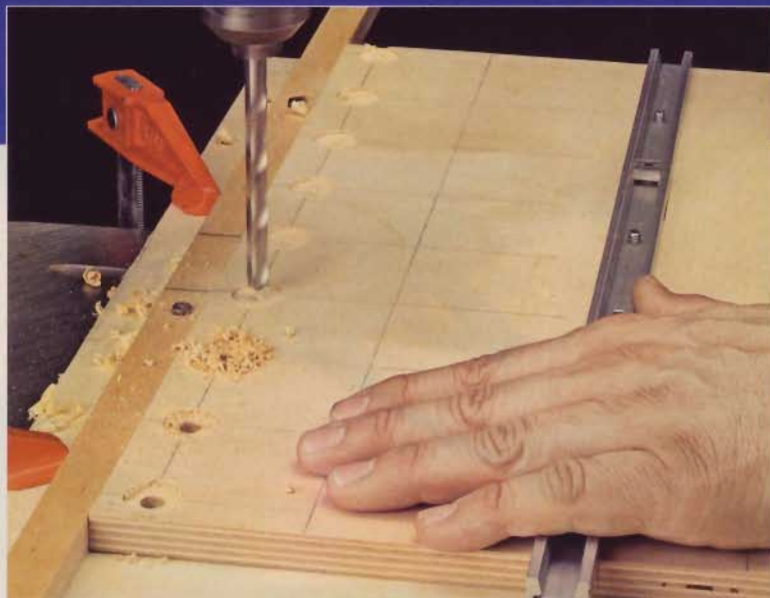
ADD TENON-CUTTING ABILITY

This system goes beyond the capabilities of other sleds that can only crosscut and miter. By building an optional jig, you can turn it into a tenoning sled.

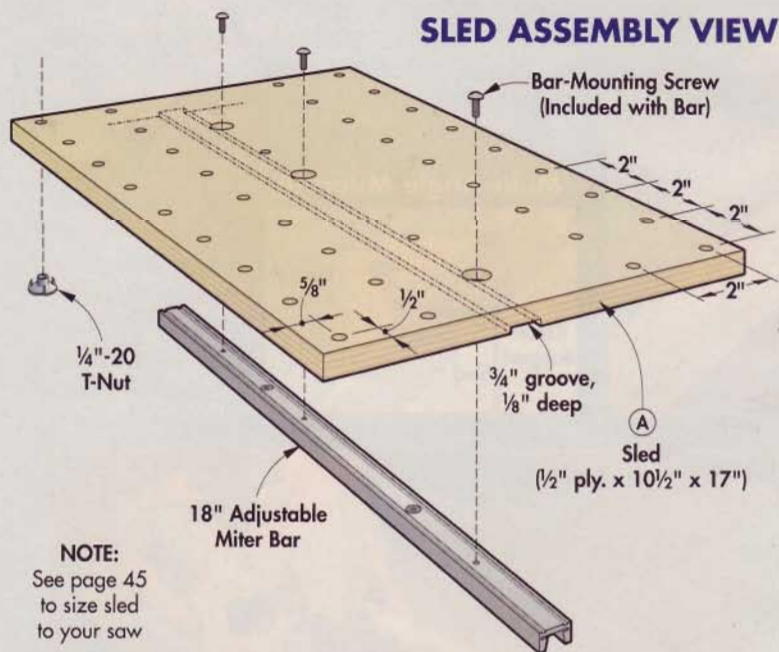
To do this, you just rotate the sled *end-for-end* and position it in the miter-gauge slot that is farthest from the blade. This creates a gap between the edge of the sled and the fence so you can slip the tenon jig in place (*Photos, right*).

Next, clamp your workpiece to the jig, (where a back stop holds pieces at 90° or 45°), and slide the jig toward or away from the blade to set the cut. Then lock the jig to the sled, and make the cut.

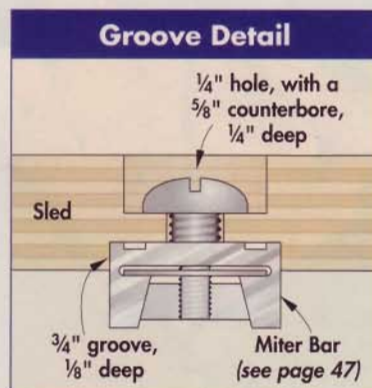
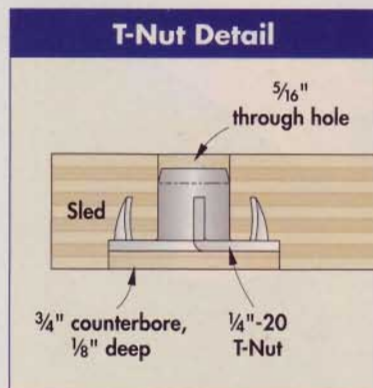




▲ To drill holes for the T-nuts, mount a fence to your drill press, and bore counterbores for both outer rows. Swap bits, and then drill the through holes. Next, reposition the fence, and bore the inner holes.



NOTE:
See page 45
to size sled
to your saw



accuracy rides on A SIMPLE SLED

Before you begin building the sled, you need to make sure your saw is tuned up and properly aligned. After all, if your saw doesn't cut accurately, the sled system won't either. So check and adjust your saw using the tips that start on page 50. It's especially important that your blade and fence be set parallel to the miter-gauge slots in the saw table.

Start Out Big — Once your saw is up to snuff, you can begin building the sled (A). Made from 1/2" Baltic birch plywood, it gets cut to a final length of 17", but it starts out extra-wide. The sled gets cut to final width later, after you mount an aluminum miter bar that guides it on the saw table (*Sled Assembly View*). Look at Fig. 1 on the next page to determine how wide your plywood should be to start with.

When you take this first measurement, notice that one of the miter-gauge slots is closer to the blade than the other. You'll still be able to use the sled on either side of the blade, though, because of the way you cut it to width later. Plus, it's these different distances that allow you to *reverse* the sled to accommodate the tenon jig.

After cutting the sled to length and rough width, it's a good idea to label the ends of the sled — one for crosscutting, the other for tenoning. That way, you'll avoid confusion as you're building and using the sled. At this point, it doesn't matter which end is which.

Add the Miter Bar — The next step is to cut a groove in the base to receive an aluminum miter bar that guides the sled. We used an adjustable bar from Inca. See page 47 to learn more about it.

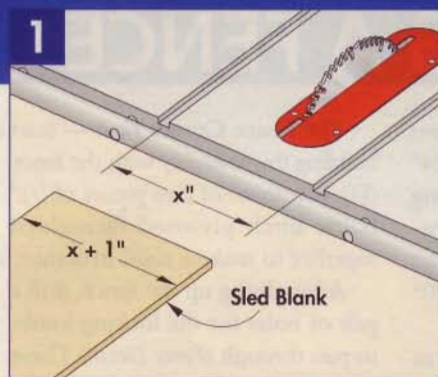
To cut the groove, start by measuring from the *left* miter-gauge slot to the blade. Then position your rip fence (Fig. 2). Next, mount a dado blade in your saw, set to the width of the miter bar. Cut the groove in the sled, leading with the end marked "crosscut" (Fig. 3).

Now you can mount the miter bar in the groove. The bar is 18" long, which is an inch longer than the sled base. I mounted the bar so that the extra length protruded from the "crosscut" end. This makes it easy to see the bar when guiding it into the miter-gauge slot.

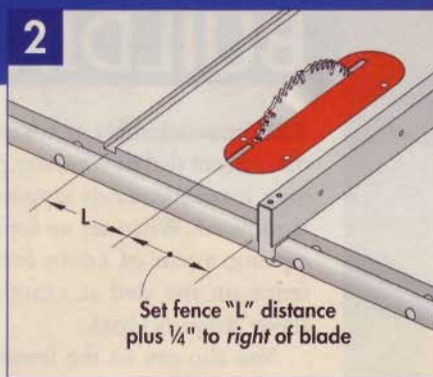
To mount the bar, first lay out the locations of the bar's mounting screws, as well as a pair of holes that allow access to the bar's adjusting screws. See the *Sled Assembly View*, left, and page 47. Once they're marked, drill the holes (Fig. 4). Then screw the bar in place.

Trim the Sled to Width — Now you can trim the sled to final width by making two passes, as shown in Figs. 5 and 6. The trimmed edges now become the references that show the cutting path of the blade. That means you just have to align the cutline on the workpiece with the edge of the sled for an accurate cut.

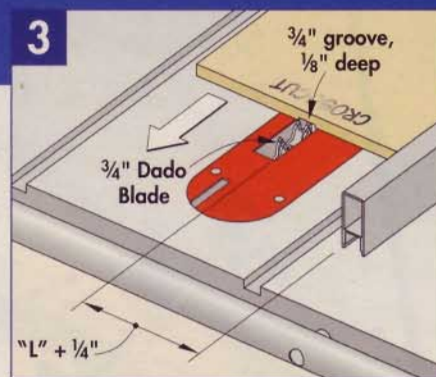
CUSTOM-FIT THE SLED TO YOUR SAW



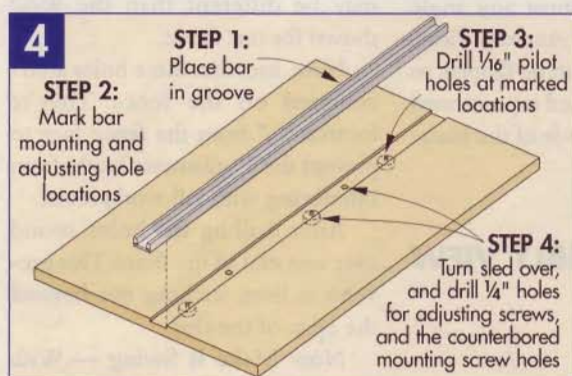
▲ To get the rough width for the sled, measure the distance between the miter-gauge slots, and then add 1".



▲ To locate the groove, measure from the left slot to the blade. Add 1/4" and set the fence that far right of the blade.



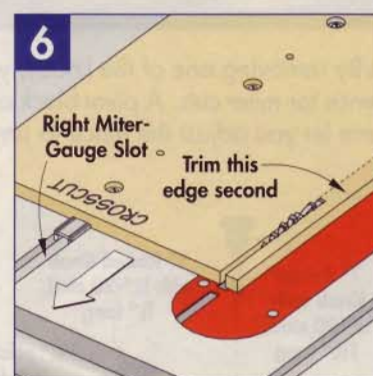
▲ Cut the groove, making sure to keep the sled base tightly against the fence and saw table for accuracy.



▲ To mount the bar, drill 1/16" pilot holes at the mounting and adjustment hole locations. Flip the sled to drill the counterbores and through holes.



▲ To trim the right edge, place the sled, "crosscut" end first, in the left slot, and then cut.



▲ Now trim the sled's left edge by placing it "crosscut" end first in the right slot.

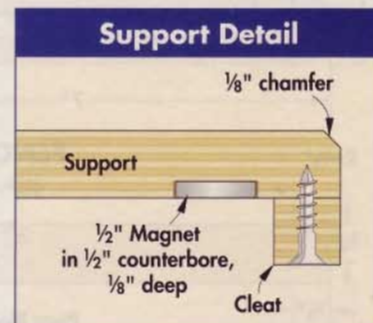
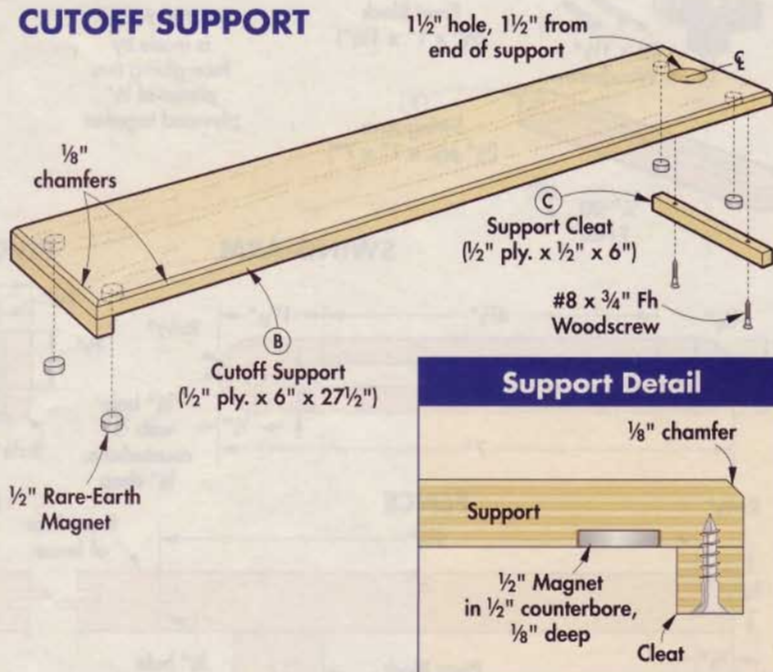
Add the T-Nuts — With the sled cut to width, you can lay out the four rows of counterbored holes that receive the T-nuts used to secure accessories to the sled.

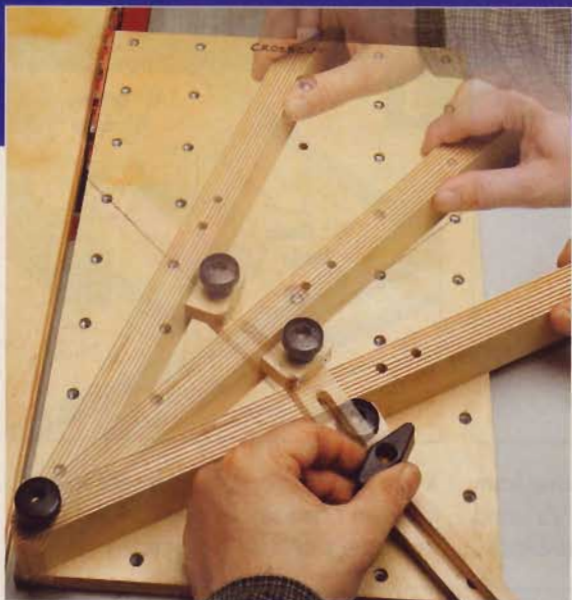
There are 36 counterbored holes to drill, but you can do it quickly and accurately on the drill press using a fence (Photo, page 44). Make sure the bit you use to drill the through holes matches the barrel on the T-nuts. That way, the T-nuts will be perfectly centered in the holes when you install them. Use a backboard to prevent tearout as the bit exits the face of the sled.

With the holes done, tap the T-nuts into the sled. Make sure to sink the T-nut flanges below the bottom surface of the sled, so they won't drag on the saw table.

Form a Support — Before moving to the fence assembly, I made a dual-purpose cutoff support (B). It's just another piece of 1/2" plywood that straddles the saw table and is held in place by a pair of cleats (C) and four rare-earth magnets (Illustration, right). The support works two ways. It can be positioned next to the blade to "catch" cutoffs or placed on the other side of the fence to hold long workpieces level as you cut.

CUTOFF SUPPORT





▲ By removing one of the knobs, you can pivot the fence for miter cuts. A pivot block and slotted swing-arm let you adjust the fence to any angle.

cover all the angles by BUILDING A FENCE

The fence assembly is what gives the crosscut sled its versatility. At 24" long, it can adequately support long workpieces. When set up for cross-cutting, a pair of knobs lock the fence on the sled at exactly 90° (*Fence Assembly View*).

You also can set the fence at an angle. On the back, there's a pivot block that receives a slotted swing-arm (*Pivot Block Detail*). This setup allows you to pivot the fence and lock it down at almost any angle (*Photo, left, and Fence Assembly View*).

This fence also can be flipped, so it works when the sled is positioned on the left or right side of the blade.

The Fence Comes First — Start building this assembly with the fence (D). It consists of two pieces of 1/2" Baltic birch plywood face-glued together to make a rigid structure.

After gluing up the fence, drill a pair of holes for the locking knobs to pass through (*Fence Detail*). These are located to align exactly with the two outer rows of T-nuts in the sled. **Note:** Because you custom-fit the sled to your saw, your measurement may be different than the 9 1/4" shown for our fence.

Note, too, that these holes aren't centered on the fence. They're located 5/8" from the fence face to prevent the 1"-diameter knobs from interfering with tall workpieces.

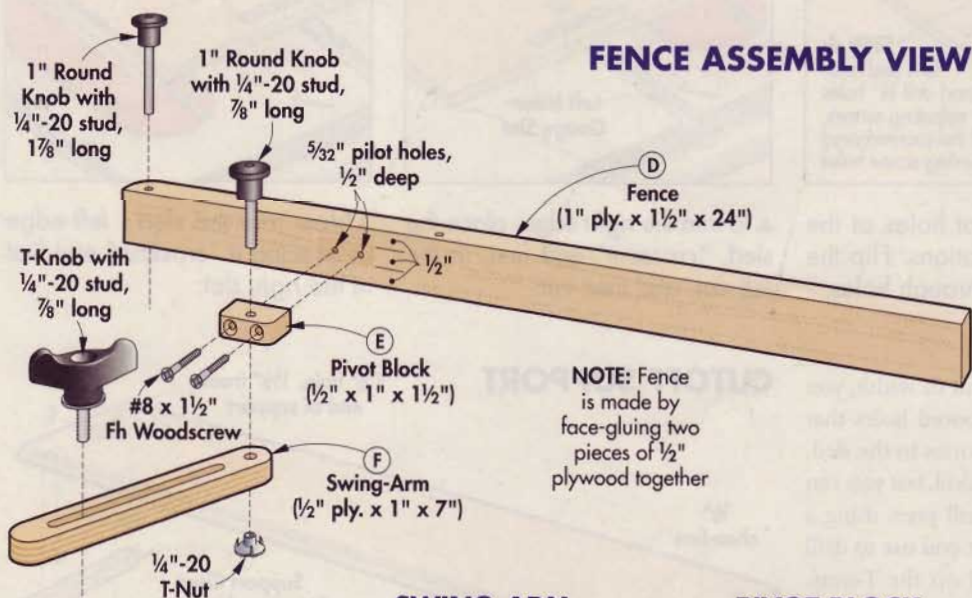
After drilling the holes, round over one end of the fence. This prevents it from sticking out beyond the edge of the sled.

Now Make it Swing — With that done, you can get started on the pivot block and swing-arm. I made the pivot block (E) from scrap maple. This block needs a hole for a mounting knob to pass through, plus a pair of mounting holes (*Pivot Block Detail*). Rather than try to drill them in a small piece, I started with an oversize blank and cut it to size after drilling the holes. Then I sanded off the two outer corners and mounted the block on the back of the fence.

To complete the fence assembly, make the swing-arm (F). It's made from 1/2" Baltic birch plywood. Again, I started with an oversize piece. I routed an adjustment slot and then drilled a counterbored hole in one end for a T-nut. Then I cut the swing-arm to size and sanded it to shape.

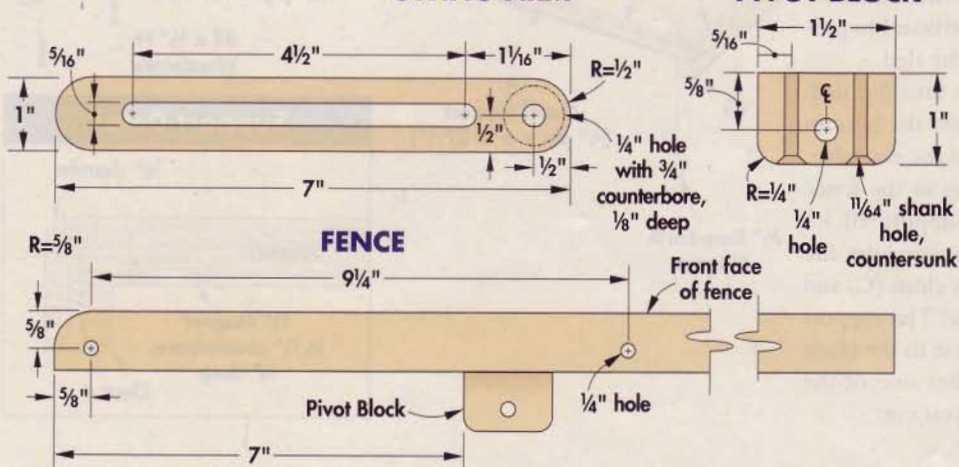
The fence assembly gets attached with studded knobs. I couldn't find any with studs of the correct lengths for this project, so I bought knobs with threaded inserts, plus a length of threaded rod, and made my own knobs. Learn how on page 32.

FENCE ASSEMBLY VIEW



SWING-ARM

PIVOT BLOCK



mark & adjust the sled for FOR ACCURACY

To take the guesswork out of setups when I use the sled assembly, I decided to add a few permanent markings to the face of the sled.

First, I went over the "crosscut" and "tenoning" labels with a permanent marker. This reminds me at a glance which end of the sled goes onto the saw first.

Before going any farther, I made sure the sled moved smoothly with no play in the miter-gauge slot. This is easy with the adjustable miter bar (Details and Photo, below).

Next, I set up the fence to cut a 45° angle. When it was exactly right, I scribed an alignment line on the

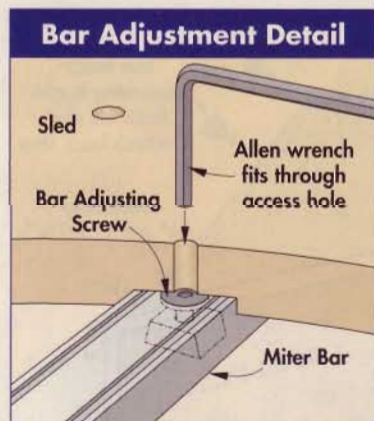
sled (Photo, right). Then I moved the sled to the other side of the blade and repeated the process. You can mark any angles you commonly use.

Finally, I covered all the parts with two coats of polyurethane. I plan on using this fixture for a long time, so the finish keeps the surfaces clean and preserves the markings. Plus, it seals the wood to keep everything flat and straight as humidity conditions change in my shop. I rubbed a coat of wax onto the underside of the sled to keep it sliding smoothly.

With this done, I decided to take the sled up a notch by adding a tenon jig. You'll find it on page 48.



▲ To simplify setting up for miter cuts, scribe the sled with a chisel, and then darken the line with a pencil to mark the angles you commonly use.



▼ The Incra Miter Slider features a tapered recess with a mating wedge-shaped nut. Tightening the adjustment screw pulls the nut up, which expands the bar against the miter-gauge slot for a snug fit.



MATERIALS & HARDWARE

Part	Qty	T	W	L	Material	Hardware
Sled/Support						
A Sled	1	1/2"	10 1/2"	17"	Baltic Birch Plywood	
B Cutoff Support	1	1/2"	6"	27 1/2"	Baltic Birch Plywood	
C Support Cleats	2	1/2"	1/2"	6"	Baltic Birch Plywood	
Fence						
D Fence	1	1"	1 1/2"	24"	Baltic Birch Plywood	
E Pivot Block	1	1/2"	1"	1 1/2"	Maple	
F Swing-Arm	1	1/2"	1"	7"	Baltic Birch Plywood	
Tenon Jig						
G Face	1	1/2"	6 1/2"	18 1/2"	Baltic Birch Plywood	
H Base	1	1/2"	6"	17 1/2"	Baltic Birch Plywood	
I Handles	2	3/4"	6"	6 3/8"	Maple	
J Back Stop	1	3/4"	6 1/2"	9 3/4"	Maple	

- (1) 18" Incra Miter Slider (#454233)*
- (54) 1/4"-20 T-Nuts (#454233-8 pack)*
- (3) 1" Round Knobs with 1/4"-20 insert (#454714)*
- (3) T-Knobs with 1/4"-20 insert (#454732)*
- (4) 1/2" x 1/8" Rare-Earth Magnets (#456305-10 pack)*
- (2) Aluminum Hold-Downs (#721312)*
- (1) 1/4"-20 Threaded Rod, 12"-long
- (2) #8 x 1 1/2" Fh Woodscrews
- (4) #8 x 3/4" Fh Woodscrews

*To order these items, please call
The Woodsmith Store at 800-444-7002

TENON JIG

The tenon jig makes this system unique by adding capabilities that normally require a separate jig. It's simply a vertical face and a horizontal base with handles that hold it together (*Tenon Jig Assembly*).

The jig is held in place with two knobs that thread into the T-nuts in the sled. To accommodate workpieces of different thickness, these knobs pass through slots in the base so that you can move the jig in relation to the blade (*Mounting Detail*).

In use, you push the jig and sled past the fence together to guide your workpiece (see Fig. 4 on page 49).

The jig has T-nuts that let you add a back stop that holds workpieces at 90° or 45° (*Stop Detail*). The stop works as a blade guard, too, since the blade gets buried in it as you cut.

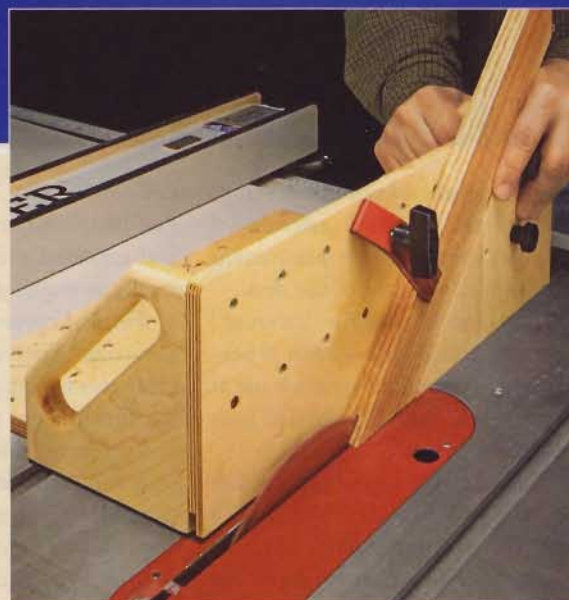
Make the Jig — Get started by making the jig face (G) and base (H) from 1/2" plywood. Then lay out and drill the holes in the jig face.

Next, rabbet the bottom edge of the face. This allows the jig to slip farther over the edge of the sled to accommodate thick stock.

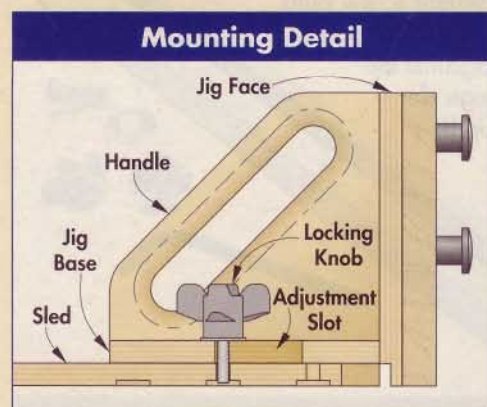
Now cut the two handles (I) and back stop (J) from 3/4" solid stock. To add strength, I laid out the handles so the grain runs parallel to the angled top edge (*Handle Detail*).

After shaping each handle, cut a groove in the inside face to receive the jig base. Then make the cutout by drilling two holes and cutting between them with a jig saw.

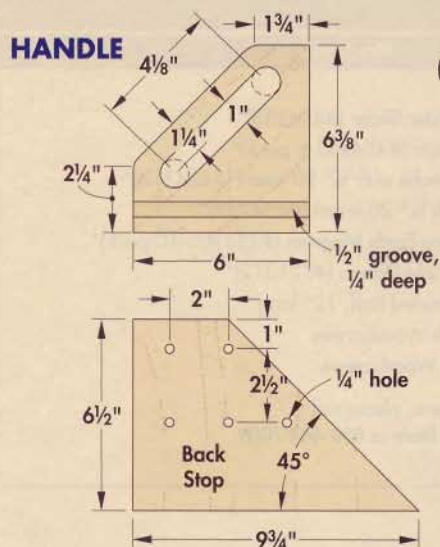
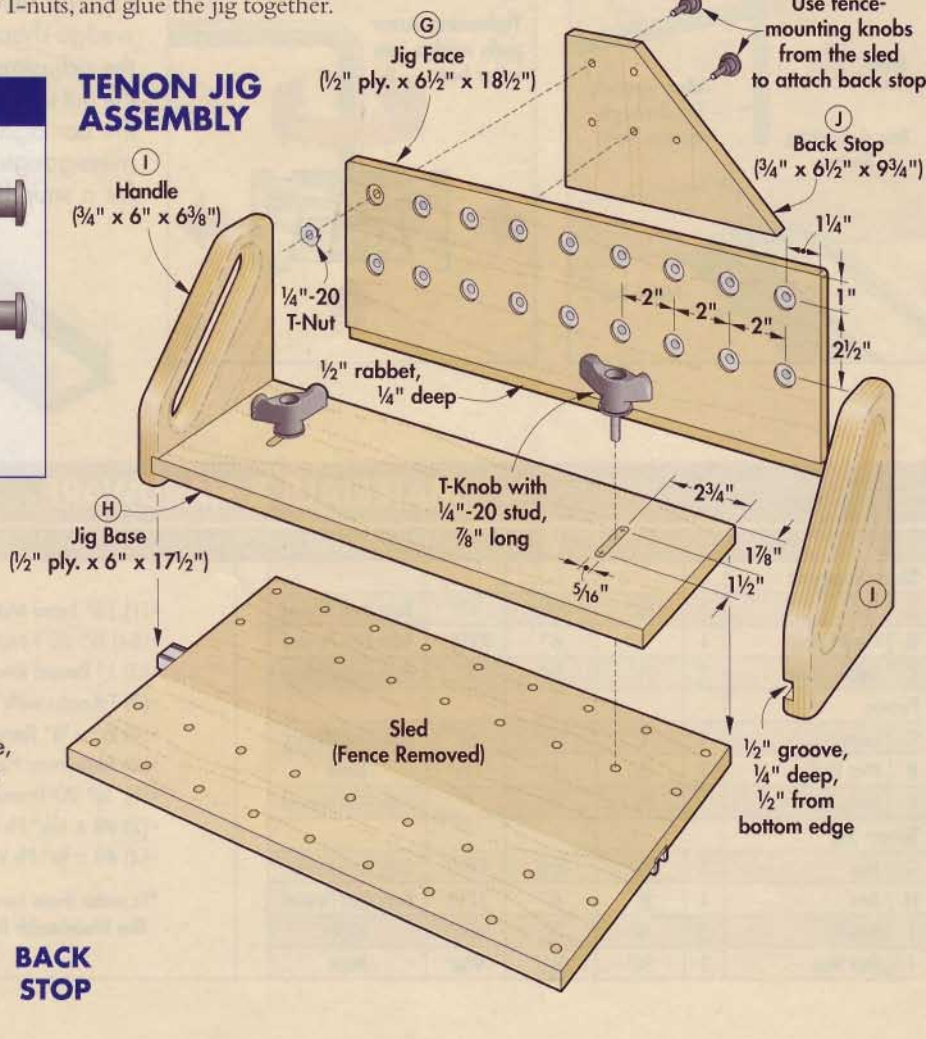
Finally, round over all but the bottom edges of the handles, tap in the T-nuts, and glue the jig together.



▲ The tenon jig holds stock at 90° (page 49), or 45° (above), which allows you to make tricky cuts such as a groove for a splined miter joint.



TENON JIG ASSEMBLY



put the tenon jig INTO ACTION

Cutting tenons gives you a chance to put all the features of this sled system to work. You can use the sled to crosscut the pieces to length and to establish the shoulders of the tenons. Then, mount the tenoning jig, and you can form the rest of the tenon by following the easy steps on this page.

After cutting the piece that will receive the tenon to size, use the sled in the "crosscut" mode to establish the shoulders of the tenon (Fig. 1).

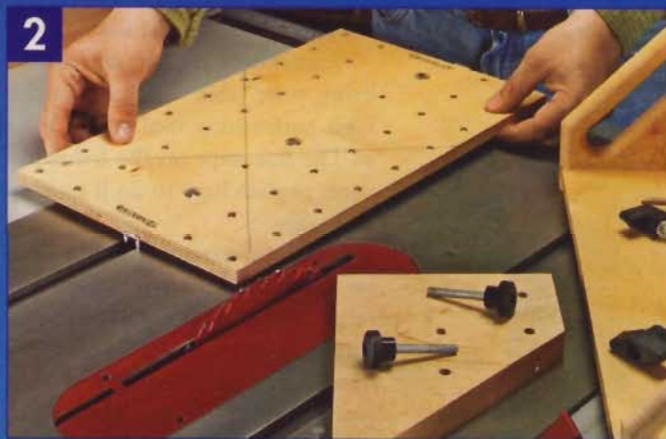
Next, remove the fence assembly from the sled. Then rotate the sled end-for-end, and place it on the saw table (Fig. 2). Now mount the tenoning jig (Fig. 3).

Secure your workpiece against the back stop using a hold-down, and then cut the sides, or "cheeks," of the tenon (Fig. 4).

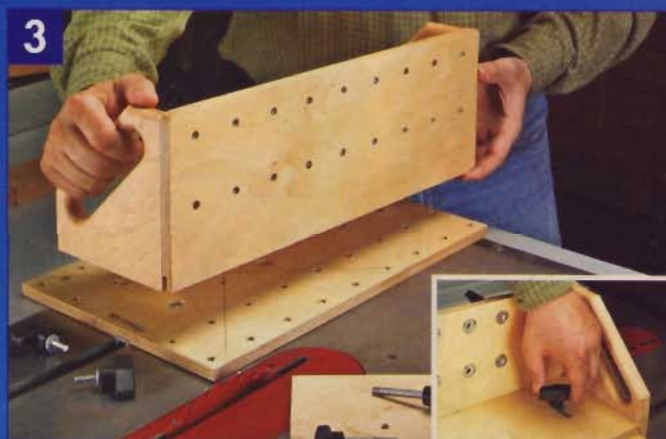
If the tenons need to be narrower than the workpiece, cut them to final size at the band saw (Fig. 5).



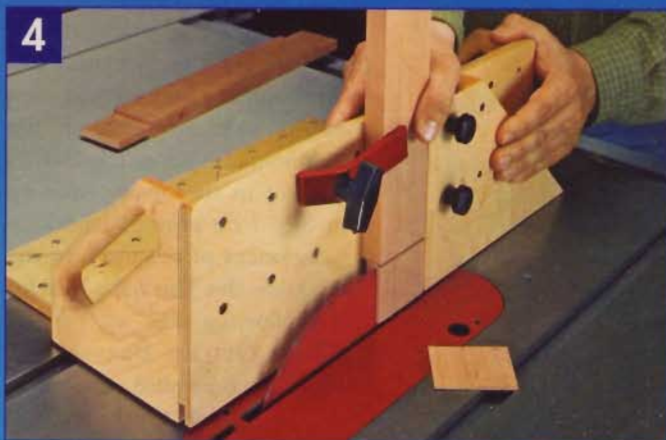
▲ Align the shoulder location with the edge of the sled, and make passes, flipping the piece in between. A stop block speeds setups.



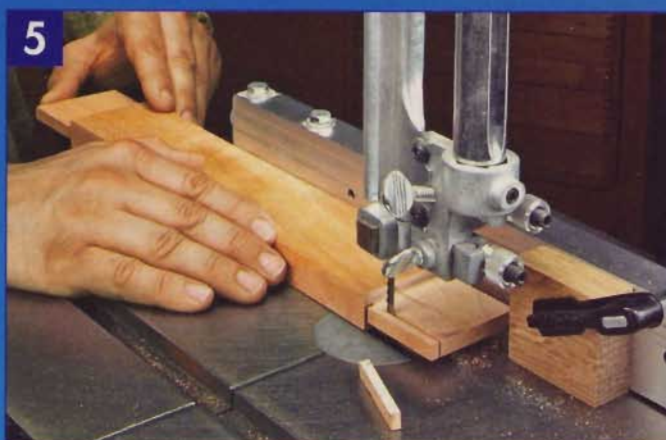
▲ Place the sled, "tenoning" end first, into the miter slot farthest from the blade. This creates a gap on the blade side.



▲ Set the jig on the sled with the face toward the blade, and thread the locking knobs in loosely (Inset Photo).



▲ After adjusting the jig from side to side, lock it to the sled and cut the cheek. Pull the sled back after the waste falls.



▲ You can make narrow tenons by first making four shoulder cuts (Fig. 1). Then cut the tenon edges with a band saw.

STEP 5 TABLE SAW TUNE-UP

If your saw's performance isn't up to snuff, a tune-up often can cure what ails it. Diagnose your saw with our troubleshooting guide, and complete the following prescription to get your saw back on its feet.

NOTE: Always unplug saw before maintenance

True Up the Miter Gauge at both 90° and 45° using a drafting triangle and the cutoff from a workpiece (see Step 5)

Align the Blade to the saw table at both 90° and 45° using a combination square and a shop-made triangle (see Steps 3 & 4)

Align the Blade with the miter-gauge slot by adjusting the rear trunnion (see Step 1)

Clean & Lubricate moving saw parts to prevent maintenance problems in the future

Align the Rip Fence with the blade using the miter-gauge slot (see Step 2)

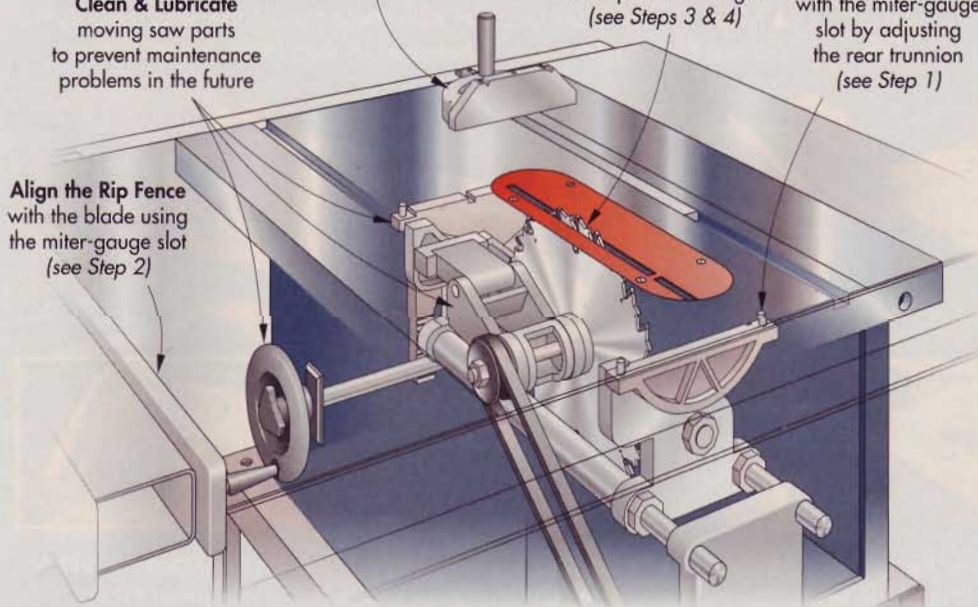


TABLE SAW TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
- Rip cuts burn or bind	- Dull or unbalanced blade	- Clean or sharpen blade
	- Board is warped	- Joint and plane board
	- Feed rate too slow	- Adjust feed rate
	- Blade not parallel with miter-gauge slot	- See Step 1
- Workpiece difficult to feed	- Rip fence out of alignment	- See Step 2
	- Dull or unbalanced blade	- Clean or sharpen blade
	- Feed rate too fast	- Slow down feed rate
	- Blade not parallel with miter-gauge slot	- See Step 1
- Crosscuts/miter cuts are not true	- Rip fence out of alignment	- See Step 2
	- Blade not parallel with slot	- See Step 1
	- Miter gauge fits loosely in slot	- See Step 5
	- Miter-gauge stops not set correctly	- See Step 5
- Crosscuts/bevels are not 90°/45°	- Bevel scale not set correctly	- Reset stops (see Saw Manual)
	- Blade not aligned with saw table	- See Steps 1, 3, and 4

Few tools get more use in your shop than the table saw. And usually, this shop workhorse doesn't get a second thought, until it stops working properly.

With as much use as your saw gets, though, things *will* go wrong eventually. The constant stopping, starting, and cutting takes its toll on the saw's accuracy and alignment.

Fortunately, it's not difficult to bring your table saw back to the high-performing tool you're used to. The five steps on the following pages explain how to do it quickly and easily.

Saw Maintenance — But first, be aware that many problems can be prevented with regular maintenance. In fact, sometimes all that's needed is to give your saw blade a good scrubbing to get rid of built-up pitch and resin. It also helps to clean dust out of the saw cabinet regularly and clean and lubricate the moving parts of the saw.

Any number of problems can affect your saw's performance, and we have outlined the most common ones for your reference in the *Troubleshooting Guide* at left. But it's important to start every tune-up with *Step 1* on page 51: checking the alignment of the blade to the miter-gauge slot. This is the basis for all the following steps.

Check Out the Box — Once this step is accomplished, simply refer to the *Guide* to identify the problem that your saw is experiencing. Then, check out the applicable step on one of the next three pages to revive your saw.

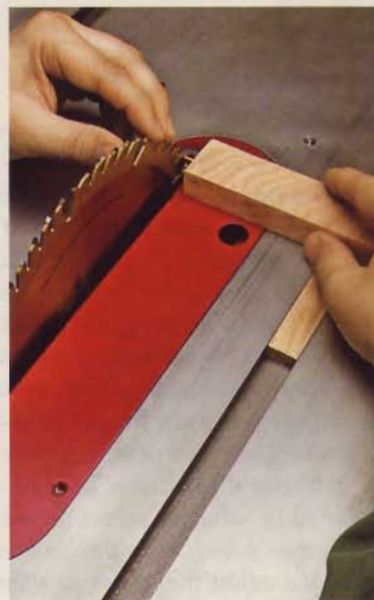
align blade to MITER-GAUGE SLOT

The first step in any tune-up is to align the blade with the miter-gauge slot. Starting here is important because the blade must be parallel to the slot if the other tune-up steps are to be effective. A quick way to check this alignment is with a simple T-shaped jig (Photos, right).

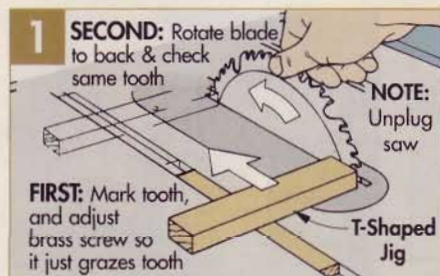
The jig has a runner that fits in the miter-gauge slot. This runner is screwed to a block that has a roundhead brass screw installed in one end.

To check alignment, mark one tooth of the blade. Then set the jig in the slot near the front of the blade, rotate the blade by hand, and adjust the screw so that it just grazes the edge of the marked tooth. When you turn the blade by hand, it should make a “tinking” sound.

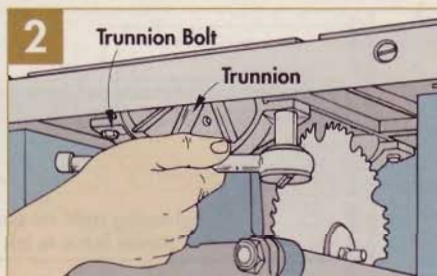
Now slide the jig to the back of the blade, and rotate the blade to check the marked tooth again (Fig. 1). If the tooth does not touch the screw, or it binds against the screw, then you’ll have to adjust the trunnions to bring the blade into alignment (see Figs. 2 and 3 below). Continue checking the blade until it aligns properly.



▲ This T-shaped jig provides a simple way to check the alignment of the blade with the miter-gauge slot. The brass screw allows you to check both the front (Photo, left) and back (right) of the blade.



▲ Mark one tooth, and then use the jig to check the alignment of this tooth at the front and back of the blade.



▲ If the blade is misaligned, loosen three of the four trunnion bolts. One front bolt acts as a pivot point.

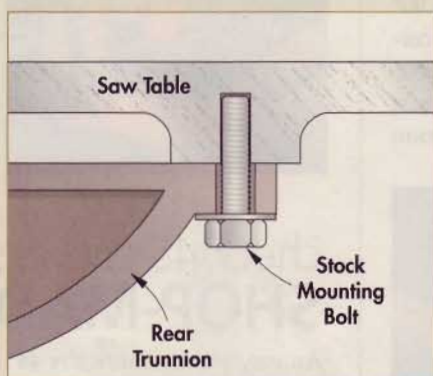


▲ Use a scrap and mallet to pivot the trunnion. Repeat steps in Fig. 1, make adjustments, and then tighten the bolts.

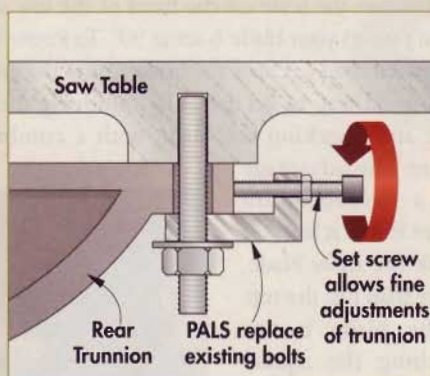
TO TAME TRUNNIONS, RELY ON YOUR “PALS”

Instead of adjusting the trunnion bolts, you may want to consider replacing the bolts with this PALS (Precision Alignment and Locking System).

The set screws and “L” brackets on the PALS allow you to make fine adjustments to the rear trunnion, rather than hitting it with a mallet (Fig. 3, above). A pair is available for around \$20 from In-LineIndustries.com.



▲ The mounting holes in a table saw’s trunnion are slightly oversize. Because of this, tightening the bolt can cause the trunnion to slip out of alignment.



▲ PALS brackets have set screws that let you both align the trunnion and lock it in place. This way, the trunnion can’t shift as you tighten it.

check & align RIP FENCE

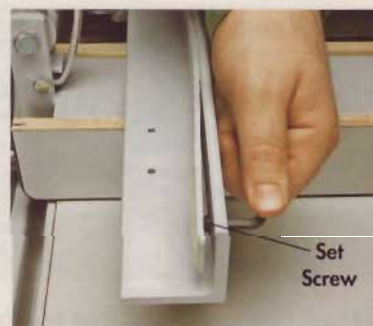
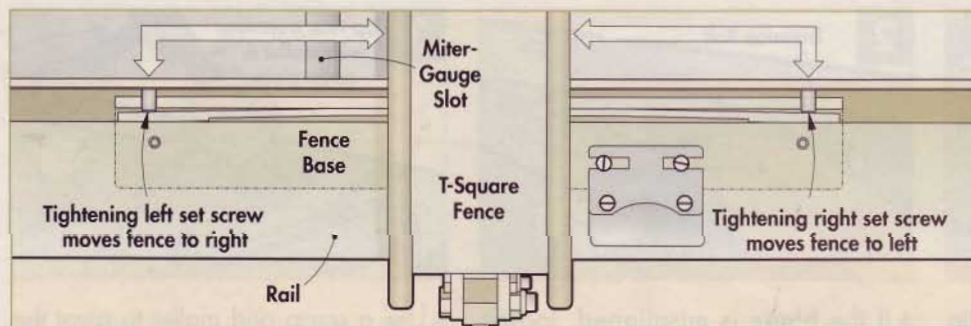
When it comes to safety and accuracy, few saw components are as important as the rip fence. The key to accurate rip cuts is for the fence to be parallel with the blade across its entire surface area. If it's not, the results can be burning, binding, or even kickback.

The easiest way I've found to check the fence alignment is to use the miter-gauge slot. Lock the fence down flush with the edge of the slot, and first "eyeball" the fence to see how square it looks. Then, feel along the edge with your fingers to make sure it's dead-flush with the slot across the entire face of the fence (see *Photo, right*).

If it's not aligned, most T-square style fences can be adjusted by using set screws on the base of the fence (*Illustration, below*). To do this, remove the fence, turn it over, and adjust the screws to align the fence (*Photo, below right*). Continue checking the fence against the slot until it's just right. (Note: If your fence is not a T-square style fence, check the owner's manual for adjustment instructions.)



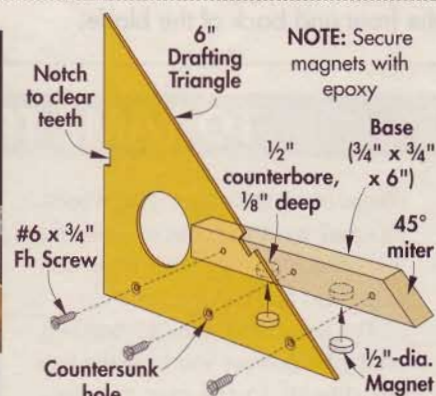
► To align a rip fence, feel how flush the face is with the miter-gauge slot. T-square fences have set screws for adjustment (*below*).



square blade to SAW TABLE

Just because the scale on the front of the saw says 90° doesn't mean your blade is set at 90°. To know for certain, you'll need to check the blade against the saw table.

A good way to do this is by removing the throat plate and checking the blade with a combination square. The advantage of a combination square is that it lets you check the *entire* blade, rather than just the top. If the blade is not touching the square across its entire face, simply adjust the blade until it does. Then, reset the 90° stop as it's explained in your saw's instruction manual.



NOTE: Secure magnets with epoxy

check 45° bevel setting with a SHOP-MADE TRIANGLE

An easy way to check the 45° bevel setting of the blade is to make this simple jig from a scrap of hardwood and a drafting triangle (see *Illustration*). Magnets in the scrap keep the triangle sitting flat on the saw table, and the notches provide clearance for the blade teeth.

After raising the blade and tilting it to 45°, set the triangle next to the blade to check the angle. Adjust it until the triangle makes full contact. Then, set the saw's 45° stop based on the instructions in the saw's manual.

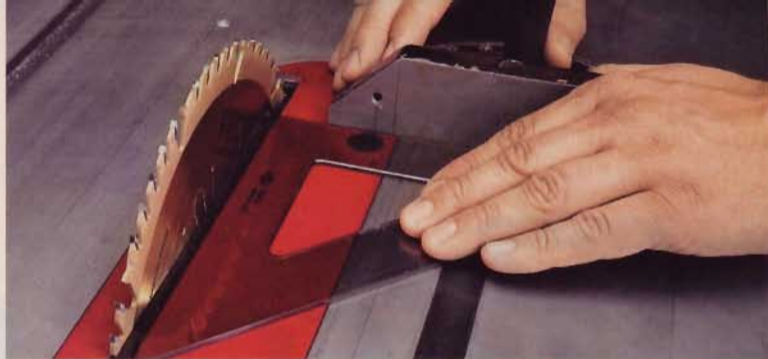
use a triangle & cutoffs to SET MITER GAUGE

The final item that affects the accuracy of your table saw cuts is the miter gauge. If you're getting inconsistent crosscuts and miter cuts, it's more than likely that the stops on the miter gauge are not set properly.

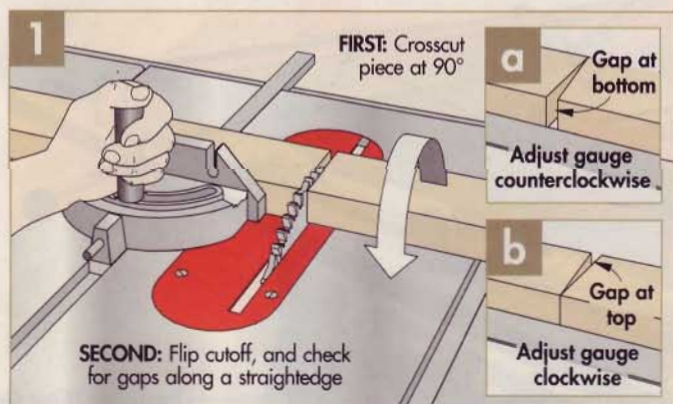
Use a Triangle — The easiest way to check the miter-gauge stops at both 90° and 45° is to use a drafting triangle. First, set the gauge at 90°, and place the triangle between the gauge and the blade (Photo, top right). The objective here is for the triangle to touch the blade across its entire face. If it doesn't, adjust the miter gauge, and then reset the miter-gauge stop.

Then, check the miter gauge at 45° the same way by using the other side of the triangle (Photo, bottom right).

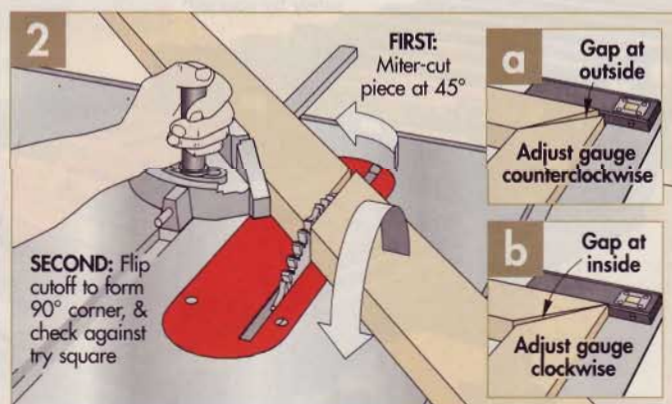
Check the Cutoff — Of course, you'll still need to make some test cuts to double-check the miter-gauge settings. The easiest way to do this is to flip over the cutoff from a workpiece, and check it against the cut end of the piece. This can be done to check the settings at both 90° and 45°, as outlined in Figs. 1 and 2 below. Then, see the Details below to adjust the miter-gauge stops to make precision crosscuts and miters.



▲ To check the accuracy of the miter-gauge stops at both 90° and 45°, place a drafting triangle between the miter gauge and the blade. If the triangle doesn't touch the blade across its entire face, you'll need to adjust the stop to bring the two into alignment.

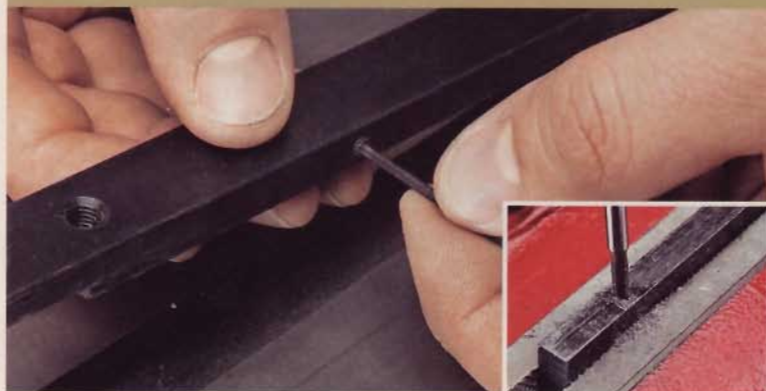


▲ To check the 90° stop, crosscut a piece, flip over the cutoff, and hold both pieces against a straightedge. Adjust the gauge based on whether there's a gap at the top or bottom.



▲ For the 45° stop, check the 90° corner formed by the piece and its cutoff against a try square. Then adjust the gauge as shown if there's a gap between pieces.

STOP "SLOP" WITH SET SCREWS



Another cause of inconsistent miter cuts is a miter-gauge bar that doesn't fit tightly in the slot. To check if your bar has any "slop," just place the miter gauge in the slot, and rack it from side to side to see if it moves.

To eliminate this slop, install a couple of set screws in the side of the bar. First, drill a pair of holes in one edge of the bar, and then use a tap to thread the holes to accept the screws (Inset Photo). After installing the set screws, it's easy to adjust them so the bar fits snugly in the slot (Main Photo).

7 SUPER TABLE SAW ACCESSORIES

The *Workbench* editors select their seven favorite table saw accessories. Add one or more of these shop-tested upgrades to your saw and get safe, smooth, accurate cuts every time.



dust-busting BLADE COVER

The blade guards that come with many table saws are clunky, hard to align, and in the way as often as not. So many woodworkers remove the guard, sacrificing safety for convenience, even though we know better.

To overcome these problems, I upgraded my saw with an overarm blade cover. Unlike a stock guard that mounts to the saw table behind the blade, this unit mounts to the far right side of the table and uses a long arm to suspend a fully adjustable cover over the blade (*Photo, right*).

There are several overarm guards available, but I chose the Excalibur BladeCover System, which sells for about \$400. That price might sound steep, but this blade cover is filled with features that made it easy for me to justify.

First, you can raise the blade cover for dadoes and other non-through cuts. And the cover is wide enough to use with the blade tilted. It slides from side to side, too, so I can use the cover even with the fence close to the blade.

For times when raising the cover doesn't get it out of the way, the whole arm can be disconnected at its base using a quick-release pin. That lets me either swing the arm aside (*Photo, lower right*) or remove it from the saw completely. And I can reinstall it just as easily.

But the feature I like most is the Excalibur's extremely effective dust-collection system. The arm is actually a hollow tube that accepts a 4" flexible hose from the dust collector. Another flex hose connects the blade cover to the arm. This setup picks up all the chips and dust that the blade used to throw at me.

With this cover on my saw, I feel much safer. And with the added bonus of the dust collection, I'll never go back to using a saw without a guard.

Kate Busenbarrick
Assistant Editor



▲ With the adjustable blade cover lowered, the Excalibur system provides effective dust collection and puts a barrier between you and the blade — without sacrificing workpiece visibility.



◀ When the blade cover interferes with the cut, you can raise it up or swing it completely out of the way.

A SIMPLE, EFFECTIVE SPLITTER



▲ A splitter is a must for safe rip cuts because it keeps the wood from pinching the blade and causing kickback. One of the simplest splitters I've used is this one from Grip-Tite. It's just a pin that screws into an insert in the throat plate. Pins are included for both standard and thin-kerf blades. This splitter costs about \$7, which I consider a bargain for effective kickback protection.

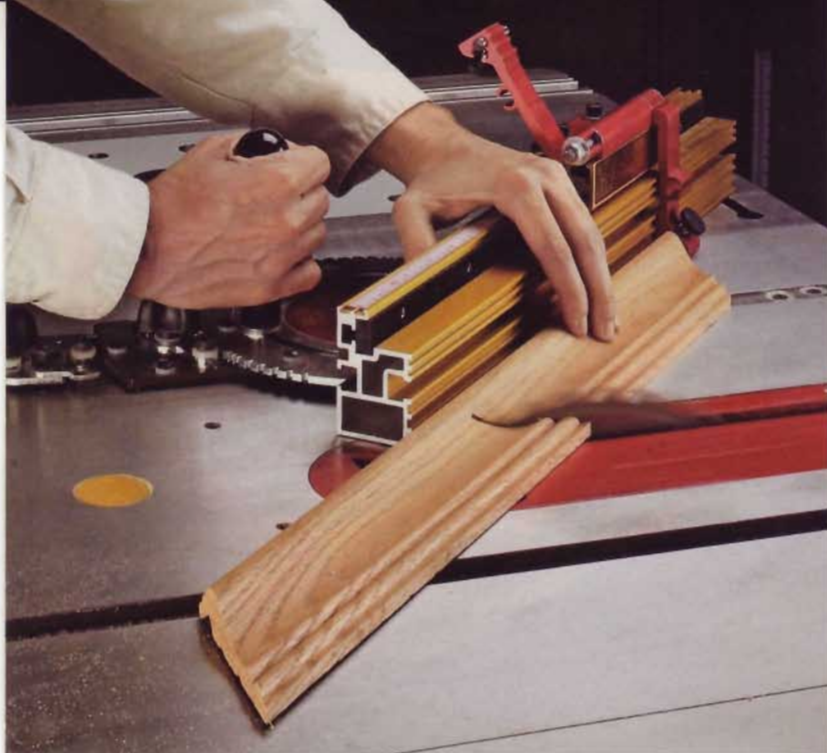
Tim Robertson
Editor

QUICK-FIT MOBILE BASE



▲ The dilemma about mobile bases is that they are usually either custom-fit and pricey, or come as a collection of parts that are hard to assemble. This Jet Universal Mobile Base, on the other hand, is only \$60. Yet it can be adapted to fit most saws easily, since it locks together with spring-loaded pins. In use, it rolls smoothly and locks securely.

Doug Appleby
Senior Graphic Designer



▲ The long fence and two-armed flip stop on this Incra miter gauge accurately set and maintain two different setups.

high-precision MITER GAUGE

I used to get aggravated trying to set my miter gauge to any angle other than 90° or 45°. And if I did hit the angle I wanted, I was hard-pressed to repeat it later. That's why I upgraded to the Incra 3000 miter gauge. Its precise locking scale lets me hit any angle exactly — one time or a dozen times.

The AngleLOCK indexing system is what really sold me on this miter gauge. With this slick system, positive angle stops mean there's no guesswork on repeat setups. There are just two easy steps to getting your setting dialed in exactly. First, you lock in the angle you want on the large protractor head that has stops every 5° (*Photo, lower left*). Then, use the indexing scale to fine-tune that setting in half-degree or one-degree increments (*Inset*).

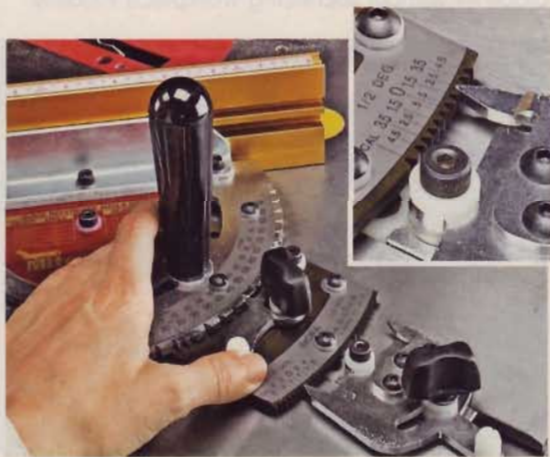
I also like that the Incra 3000 lets me be as precise when cutting boards to length as with setting angles. This is thanks to its long fence and flip stops. The stop has two arms that let me go back and forth between settings without changing either one. Tiny nylon teeth between each stop and the fence lock in stop settings every 1/32". This makes it easy to align the stop with the sliding rule on the fence.

Of course, none of this precision would be much use if the miter-gauge bar didn't fit snugly in the table saw's miter-gauge slot. Incra solved this problem with expansion disks built into the bar that adjust to fit your miter-gauge slot, eliminating slop.

There are a lot of other good miter gauges on the market, but the Incra 3000 has all the features to deliver the repeatable precision I need. It sells for \$230, and for me, it's worth every penny.

Jim Downing
Senior Design Editor

► To set your angle, first lock the large protractor head at the closest 5° increment. Then fine-tune your setting to the exact degree or half-degree with the smaller indexing scale.



STOCK SUPPORT WHEREVER YOU NEED IT



◀ I cut a lot of sheet goods and long stock in my shop, and handling these pieces by myself can be a real challenge. To get the support I need both beside and behind the saw, I use the Flexible Conveyor manufactured by General International. It has heavy-duty rollers connected by an accordion-like system of plates that lets me expand it anywhere from



16½" to 51" long. The roller assembly is attached to sturdy, adjustable-height legs with easy-to-read scales. And the whole thing rolls around on heavy casters that are easy to lock down securely.

For \$200, you couldn't build yourself a roller table that could rival the General International in terms of safety and convenience. Plus, this setup is built like a tank and can support 300 lbs. It sure beats waiting around for an extra pair of hands to help with an awkward cut.

Wyatt Myers
Associate Editor

router power for YOUR SAW

Replacing one wing of a table saw with a router table has become a fairly common way to make a saw more versatile and save shop space. There are a lot of router table extension wings available, but I chose the ProMAX Cast-Iron Router Table from Bench Dog (\$320) for my cramped shop. It has all the features of a top-notch router table and expands my table saw's capacity to boot.

Right off the bat, the thing that impresses me about the ProMAX is its sheer mass. Such a solid cast-iron surface virtually eliminates vibration both when you're routing and when you're sawing. That's great for "big" routers like my 3½ HP Milwaukee. And this router table extension is as smooth, flat, and large as the table saw wing it replaced. Plus, it has an adjustable miter gauge slot, a T-track for accessories, and a pre-drilled phenolic router plate that makes it easy to install your router (*Photo, above right*). And because the router isn't enclosed in a cabinet, it's easily accessible for bit changes and height adjustments.

This would be a great setup for a stand-alone router table. But as part of the table saw, the ProMAX has the additional benefit of a much larger worksurface. And as a nice bonus, I'm also able to use the table saw's fence when I need more capacity, such as for cutting grooves in large panels (*Photo, lower right*).

The ProMAX comes with Bench Dog's 28" ProFence, which features sliding faces that close the gap around the bit. One face even accepts shim bars to give you two jointer settings. The fence also has a track for a bit guard or other accessories, and a dust port for a 2½" shop vacuum hose.

Bill Link
Senior Editor



▲ The ProMAX cast-iron router table extension wing turns your table saw into a heavy-duty routing station that's hefty enough to use with big, high-horsepower routers.



◀ Attaching this router table to your table saw increases the worksurfaces of both tools. You can use the saw's rip fence for routing large workpieces that would be awkward on a stand-alone table.

DUAL-ACTION FEATHERBOARD



◀ When I need a featherboard, I reach for this Grip-Tite (\$40). Unlike other featherboards that fit only in the miter-gauge slot, this one is magnetic, so it mounts quickly *anywhere* on the saw table. Plus, it has side fins and a hold-down to press the stock against the fence and the table at the same time.

David Stone
Senior Editor

SOURCES

Overarm Blade Cover
Excalibur
800-357-4118
Excalibur-Tools.com

Mobile Base
Jet
800-274-6848
WMHToolGroup.com

Anti-Kickback Splitter
Grip-Tite
800-475-0293
Grip-Tite.com

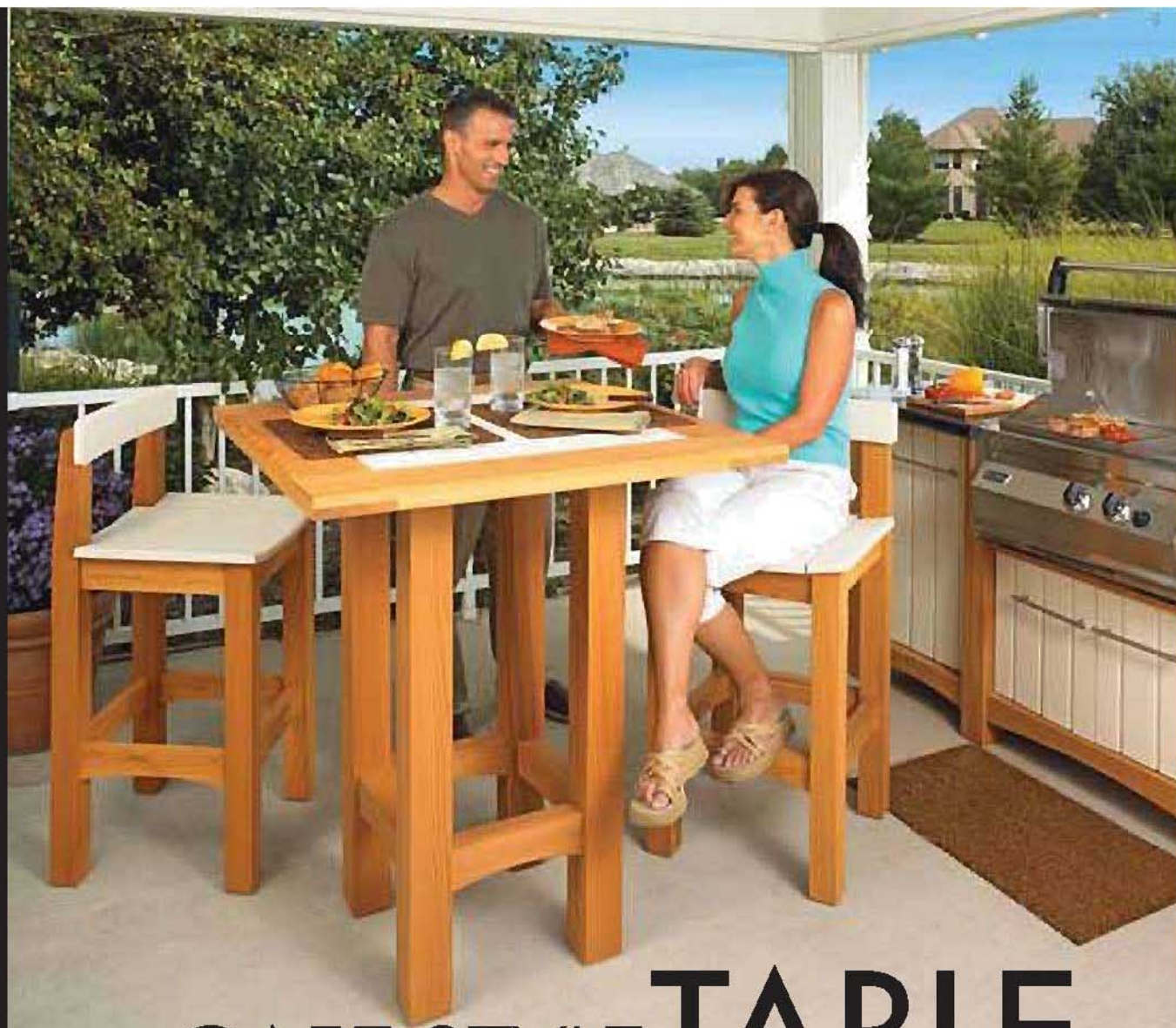
Miter Gauge
Inkra
972-242-9975
Inkra.biz

Roller Table
General International
514-326-1161
www.General.ca

Router Table Extension
Bench Dog
800-786-8902
BenchDog.com

Featherboard
Grip-Tite
800-475-0293
Grip-Tite.com

To order any of these items, call the **Woodsmith Store** at 1-800-444-7002



CAFE-STYLE TABLE

Six different parts, a few screws, and one weekend. That's all it takes to add this great looking cedar table to your patio. With sturdy mortise and tenon joints, it'll stand up to years of use.

There are a lot of outdoor table styles. But for some reason, I've always liked the look of tall cafe tables. So when it came time to build a table as part of our outdoor kitchen, "going tall" was a natural choice. The high top on this table, and the high seats of the matching chairs on page 64, give your deck or patio a step up from most other table and chair sets you'll find.

Sturdy Construction — But this table has more than just great looks going for it. I knew it had to withstand the weather, so I chose cedar, which is resistant to moisture. I also

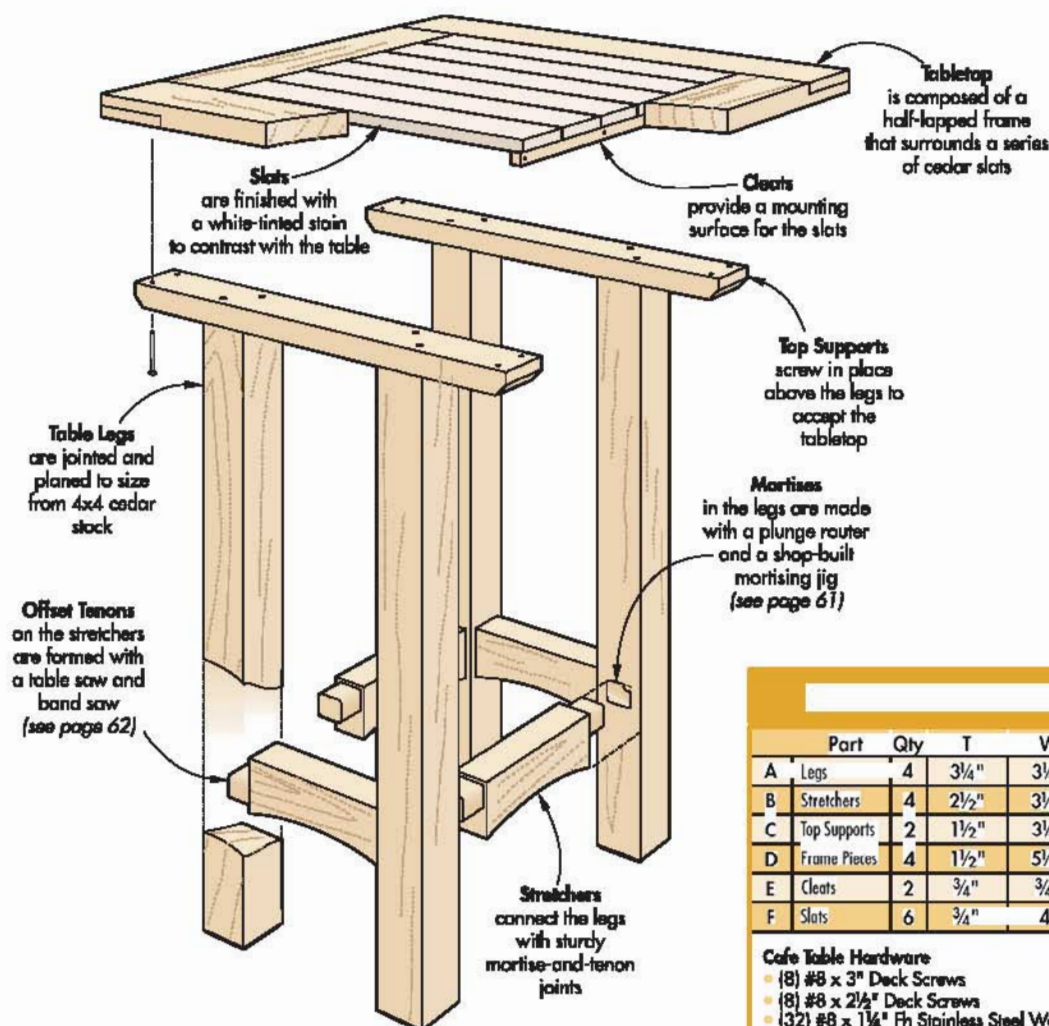
used polyurethane glue as the adhesive to ensure that the joints would not come apart.

Of course, tables are also subject to being kicked, slid, and generally knocked around. To ensure that this table would stay together, I beefed up the base with mortise-and-tenon joints. As you can see in the *Construction Details* at right, these are thick tenons, and the mating mortises are large and deep.

I know, it sounds like this could require a lot of time-consuming tool setups. To make it simple, I used a shop-made jig and a plunge router for the mortises, and a table saw and band saw to make the tenons. The techniques for doing this are outlined on pages 61 and 62.

Construction Details

Overall Dimensions: 36" W X 36" D X 42" H



Part	Qty	T	W	L	Material
A Legs	4	3 1/4"	3 1/4"	39"	Cedar
B Stretchers	4	2 1/2"	3 1/2"	15"	Cedar
C Top Supports	2	1 1/2"	3 1/4"	30 1/2"	Cedar
D Frame Pieces	4	1 1/2"	5 1/2"	36"	Cedar
E Cleats	2	3/4"	3/4"	25"	Cedar
F Slats	6	3/4"	4"	25"	Cedar

Cafe Table Hardware

- (8) #8 x 3" Deck Screws
- (8) #8 x 2 1/2" Deck Screws
- (32) #8 x 1 1/4" Fh Stainless Steel Woodscrews

To finish up, the tabletop is a half-lapped frame that's easy to make, as shown on page 63. Then, a series of pre-stained slats fit into place inside the frame.

Complete the Set — On their own, this table (and the chairs on page 64) will definitely dress up your deck or patio. But actually, they're just two of five projects that make up our set of outdoor kitchen furniture (see Photo, right). Plans and instructions for building the other three projects (the gourmet grilling center, food prep and serving bar, and weekend planter box) appeared in our June 2005 issue. To find complete plans for building these three projects, visit www.PlansNow.com.

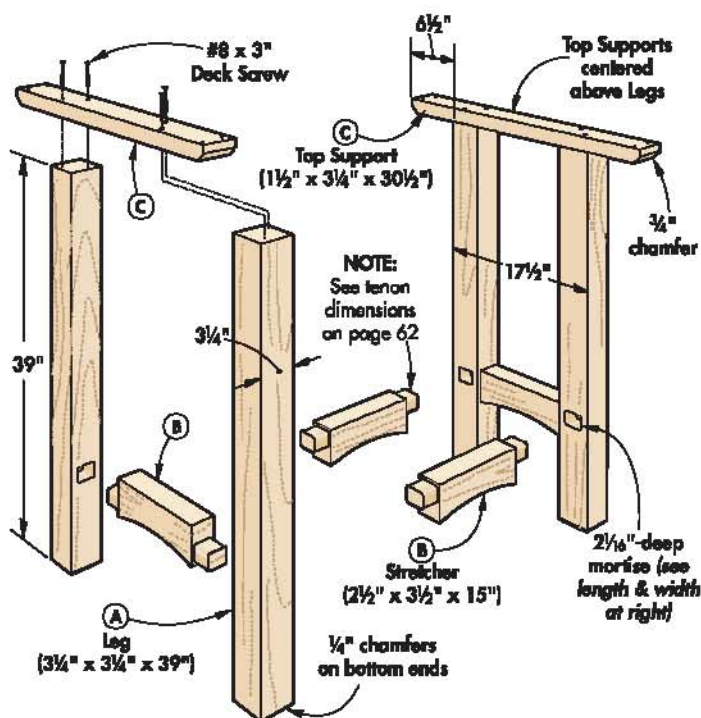
WWW.WORKBENCHMAGAZINE.COM





▲ With all the table base parts machined, it's best to dry-assemble them first to ensure a snug fit. Then, dab water and brush polyurethane glue on the mating parts to create a strong bond.

BASE ASSEMBLY VIEW



start by building a TABLE BASE

The base of this table is an assembly of cedar 4x4 and 2x4 parts. Specifically, it's composed of four sturdy legs joined by stretchers around the bottom, and supports at the top (see *Base Assembly, below*). Strong mortise-and-tenon joints connect the stretchers to the legs.

Start with Legs — The legs (A) begin as 4x4 cedar posts. Start by cutting these pieces to length. Then joint and plane them to width and thickness. Once the legs are sized, it's time to lay out and cut the mortises.

As the *Illustration* below shows, the mortises on the adjoining faces of the legs are *offset* from one another — and so are the tenons on the stretchers. This way, all the stretchers will align around the perimeter of the table, while still allowing space for the large tenons.

To prevent cutting a mortise on the wrong side of a leg, label each leg and carefully lay out the mortises. Then cut them as shown on page 61.

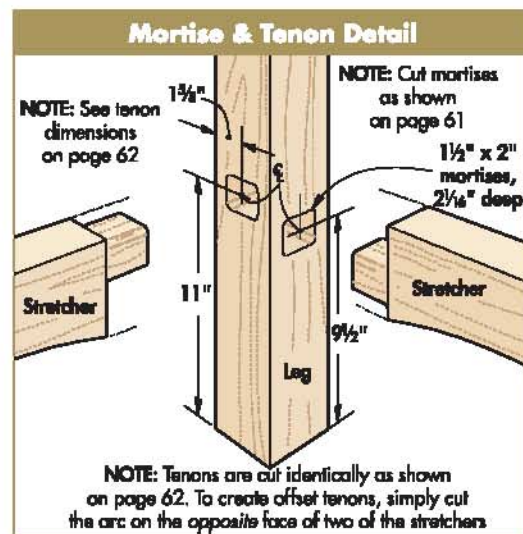
Next, rout chamfers on the bottom end of each leg. This eliminates sharp corners that might get split.

Add Stretchers — As for the stretchers (B), they also start out as 4x4 stock that's jointed and planed to width and thickness. They have thick tenons on each end to fit the mortises in the legs. You can make quick work of these with a table saw and band saw (page 62).

With the tenons done, cut an arc on each stretcher with a band saw. These stretchers may all look the same, but you cut the arc on the *opposite* face of two of them (*Detail, below*). This way, the stretchers align around the table.

Top Supports — The top supports (C) are made from cedar 2x4s that are cut to width and length. They have a chamfer on each end that's cut on a table saw.

The table is now ready for glue-up, as shown at left. The top supports simply screw in place, centered above the legs.



CUTTING ACCURATE MORTISES

To cut the mortises on the table legs, I used a plunge router equipped with a spiral upcut bit and a guide bushing (Illustration, right). These mortises are fairly deep ($2\frac{1}{16}$ "), so I used a bit with a 2"-long cutting edge.

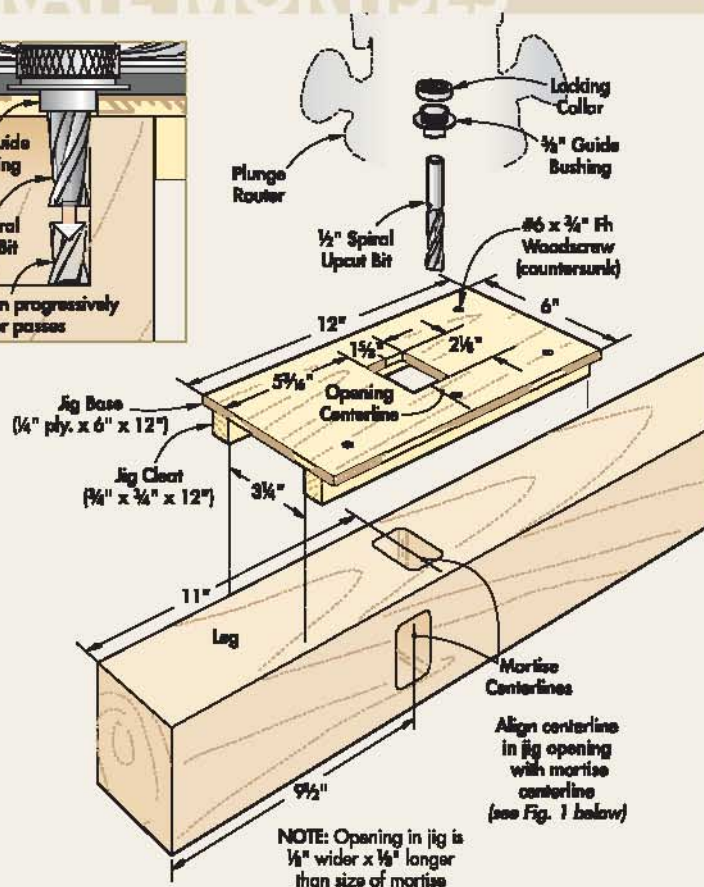
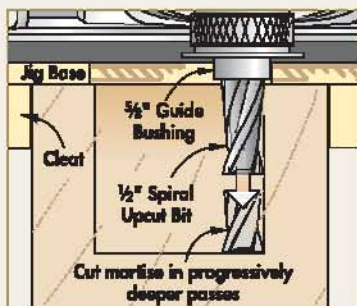
A mortising jig made from scrap material helps ensure that the mortises are accurate. An opening in this jig works along with the guide bushing to guide the router as it cuts the mortises.

The base of the jig is a piece of $\frac{1}{4}$ " plywood, and two wood cleats are spaced apart so that the jig straddles the leg (see Illustration, right). As for the jig opening, it's $\frac{1}{8}$ " larger all around than the mortise itself. This allows for the offset between the bit and the guide bushing (Illustration, above).

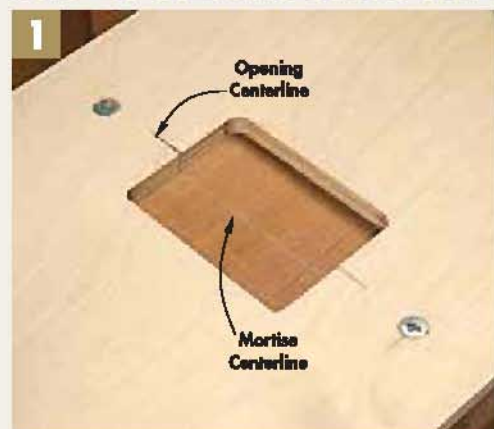
Building the Jig — After laying out this opening on the jig base, drill holes in the corners, cut it out with a jig saw, and then sand the edges smooth. Next, drill countersunk holes in the base, and attach the cleats to the base with screws.

To make it easy to align the jig, mark a centerline on the opening. This way, you can also mark the mortise centerline on the legs, and align the two marks to locate the mortises accurately (Fig. 1).

Routing Mortises — Once the jig is aligned properly on the leg, clamp it in place. Then, rout the mortise with the plunge router by making a series of progressively deeper passes until reaching the final depth (see Fig. 2).



STEP BY STEP: ROUTING THE MORTISES

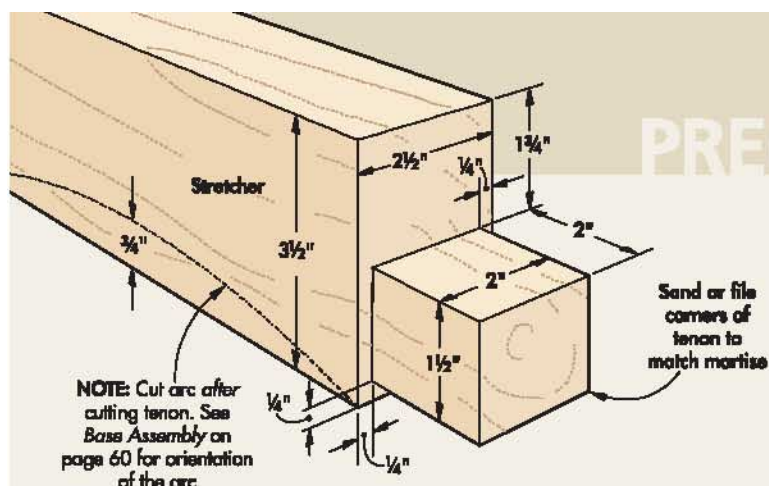


▲ Position the jig so it straddles the leg, and align the centerline on the jig opening with the centerline for the mortise. Then clamp the jig in place.



▲ Equip your plunge router with a guide bushing and a long spiral upcut bit, and set it in place in the opening in the jig. Make a series of progressively deeper passes to rout the mortise to its final depth.

PRECISION TENONS



STEP BY STEP: CUTTING TENONS



▲ Cut three shallow "shoulder" kerfs for each tenon. Use the fence and miter gauge to guide the piece.



▲ Then raise the blade, and make the deep shoulder kerf on each tenon in the same fashion.



▲ Remove the waste with a band saw by setting the fence and cutting until you reach the saw kerf.



▲ To remove the thick waste block from each tenon, reset the fence and make another pass.



▲ Finish up by using a wood rasp to round the corners of the tenons to fit snugly inside the mortises.

With the mortises routed, you can turn your attention to making the tenons that fit inside them. Like the mortises, the tenons are offset on adjacent stretcher pieces (*Mortise & Tenon Detail*, page 60). But at this point, you can cut all the tenons the same. The offset will be created by cutting an arc on the top face of two stretchers and the bottom face of the other two, as shown on page 60.

Shoulders on the Table Saw — Though there are a total of eight tenons to cut, making them only requires two table saw and two band saw setups, as shown at left. To ensure that the shoulders of the tenons are as straight and true as possible, start by using a table saw to cut them. (A band saw blade has a tendency to "wander" when making cuts like this.) To do this, make the three shallow shoulder cuts for each tenon (*Fig. 1*). This way, you only have to raise the blade to cut the deep shoulder on each tenon (*Fig. 2*).

Remove Waste on the Band Saw — With the shoulders cut, the last step is removing the waste on the band saw to form the tenons. Here again, you can make the three "thin" cuts on each stretcher first. To do this, set the fence on the band saw the proper distance from the blade, and cut into the piece until you reach the kerf formed by the shoulder cut (*see Fig. 3*). After cutting all the "thin" sides of each tenon, reset the fence to remove the thick waste block from each tenon, as shown in *Fig. 4*.

Shape Tenons to Fit — The router bit used to cut the mortises leaves them with rounded corners. So to make these square pegs fit into the rounded holes, you need to shape the tenons to fit. The most effective way I've found to do this is with a rasp. Just use the rasp to round the corners of the tenons to match the mortises (*Fig. 5*). Test the fit as you work, and continue shaping the tenons until you achieve snug joints. With the tenons complete, finish up the base assembly as explained on page 60.

MITERED TENONS FOR THE CHAIRS

While the chairs shown on page 64 have a lot in common with the table plans presented here, one big difference is that the tenons need to be *mitered* to meet at a 90° angle in the center.

Adding a 45° miter to the chair stretchers only adds one step to the procedure outlined above. After completing the tenons, tilt the table saw blade to 45°, and make a pass over the blade.



finish by adding THE TABLETOP

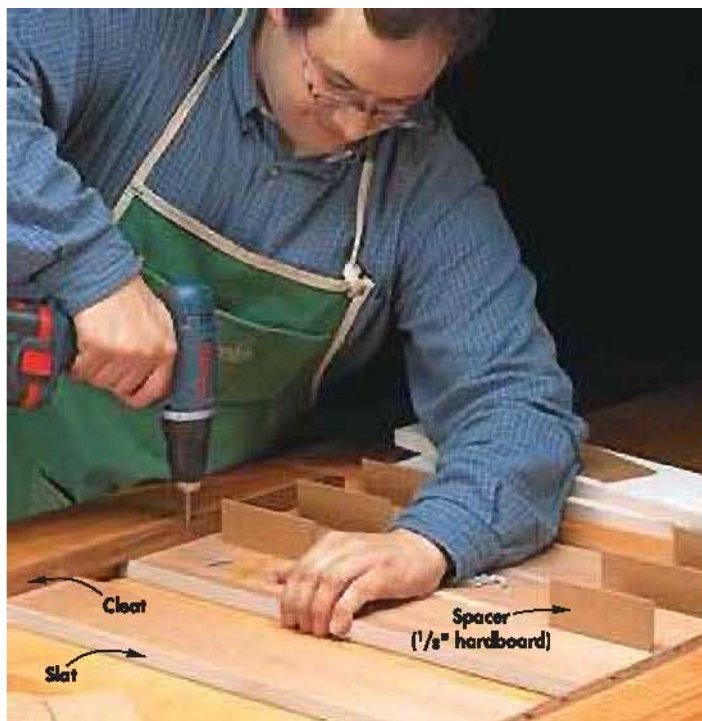
The top of this table is a quick build once you complete the base. It consists of a half-lapped frame that surrounds six slats. These slats are simply mounted to two cleats that are attached to the frame (see *Top Assembly, below*).

Half-Lapped Frame — Begin by cutting the frame pieces (D) to size from 2x6 cedar stock. The next step is to cut the half-laps. This is easy to accomplish by making multiple passes with a dado blade mounted in the table saw. Then glue up the frame with polyurethane glue, and clamp it together.

Cleats & Slats — While the glue is drying, cut a couple of cleats (E) to size from 1x6 cedar. Screw them in place flush with the underside of the frame, as shown in the *Illustrations* below.

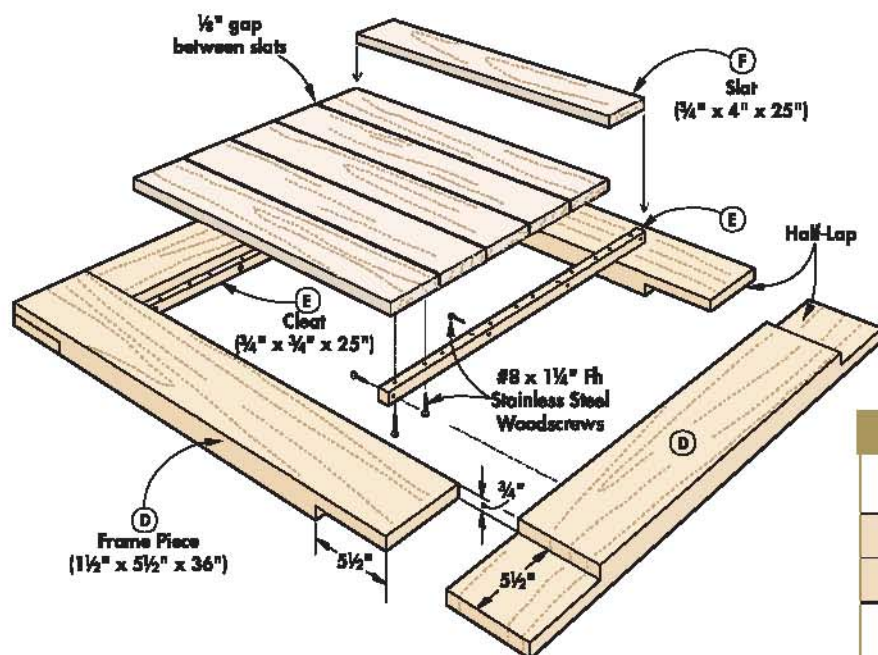
The slats (F) are also cut to length out of 1x6 cedar to fit inside the frame. Rip them to width to create a $\frac{1}{8}$ " gap between each slat across the tabletop. Then, assemble the tabletop as shown in the *Photo* at right. I stained the slats with a solid-color white stain before screwing them in place.

Now attach the top to the base by driving screws through the top supports and into the underside of the top frame (see *Mounting Detail, below*). 

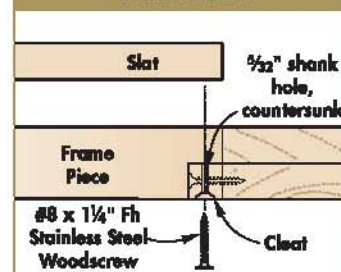


▲ It's easy to assemble the top upside down on a workbench. Align the pre-stained slats inside the frame with hardboard spacers, and attach them by driving screws through the cleats and into the slats.

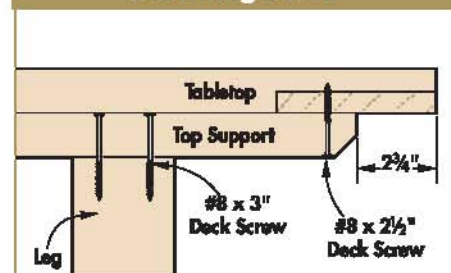
TOP ASSEMBLY VIEW



Slat Detail



Mounting Detail



MATERIALS LIST

MATERIALS & HARDWARE						
	Part	Qty	T	W	L	Material
A	Legs	4	3 1/4"	3 1/4"	39"	Cedar
B	Stretchers	4	2 1/2"	3 1/2"	15"	Cedar
C	Top Supports	2	1 1/2"	3 1/4"	30 1/2"	Cedar
D	Frame Pieces	4	1 1/2"	5 1/2"	36"	Cedar
E	Cleats	2	3/4"	3/4"	25"	Cedar
F	Slats	6	3/4"	4"	25"	Cedar

Cafe Table Hardware

- (8) #8 x 3" Deck Screws
- (8) #8 x 2 1/2" Deck Screws
- (32) #8 x 1 1/4" Fh Stainless Steel Woodscrews



CUTTING DIAGRAM



3 1/2" x 3 1/2" x 96" Cedar



3 1/2" x 3 1/2" x 96" Cedar



3 1/2" x 3 1/2" x 96" Cedar



1 1/2" x 3 1/2" x 96" Cedar



1 1/2" x 5 1/2" x 96" Cedar



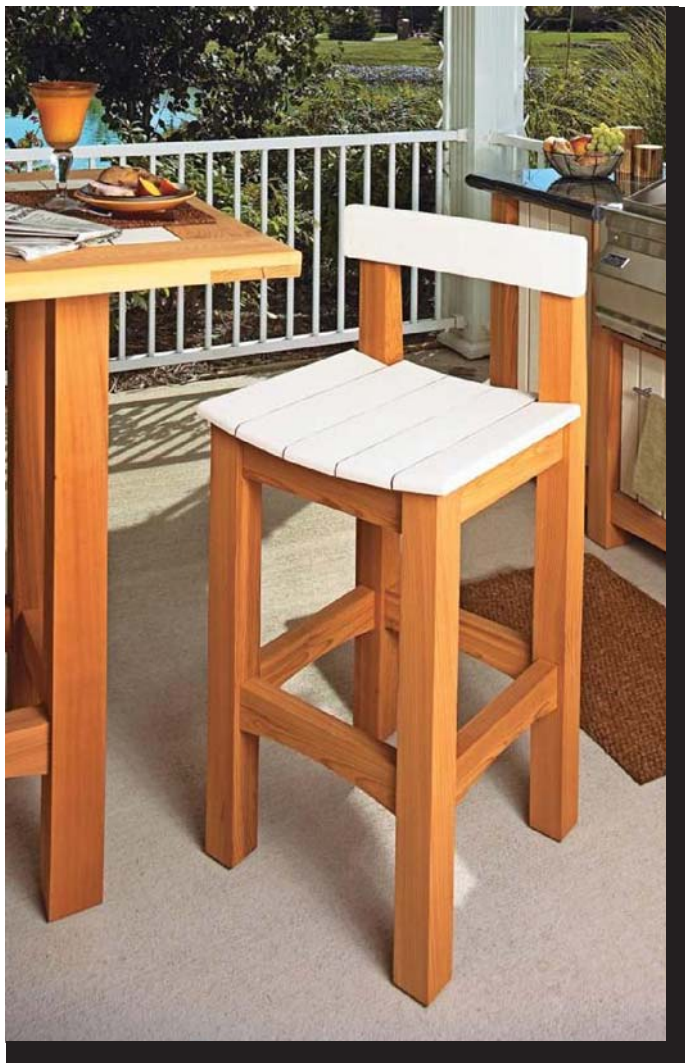
1 1/2" x 5 1/2" x 96" Cedar



3/4" x 5 1/2" x 96" Cedar



3/4" x 5 1/2" x 96" Cedar



CURVED BACK BAR CHAIRS

Although built for casual outdoor dining, the construction of these chairs is anything but relaxed. Durable cedar, solid joinery, and contoured seating combine in this sturdy, though still cozy, outdoor furniture.

The final installment of our outdoor kitchen project is this set of four tall, curved-back chairs. They share several details from the other kitchen pieces, including solid cedar construction and a two-tone finish. However, because they are chairs, they offer the unique challenge of building a piece of furniture that is equal parts attractive, comfortable, and durable.

Some of the chair's good looks can be attributed to the natural beauty of cedar and the two-tone finish we applied to it. But there are other details that also contribute. For instance, notice that the lower stretchers each have a pronounced arc cut in the lower edge. This makes these structural pieces seem less clunky and more elegant, without sacrificing any rigidity.

Along the same lines, the thick profile of the rear legs is softened with a long taper at the top end.

The chair is a comfortable perch because we designed it with a contoured seat and curved back rest. There are some special techniques for creating these parts, and I'll walk you through each one as we come to it.

As for durability, we once again count on mortise-and-tenon joinery to create a sturdy, weatherproof framework for the chair.

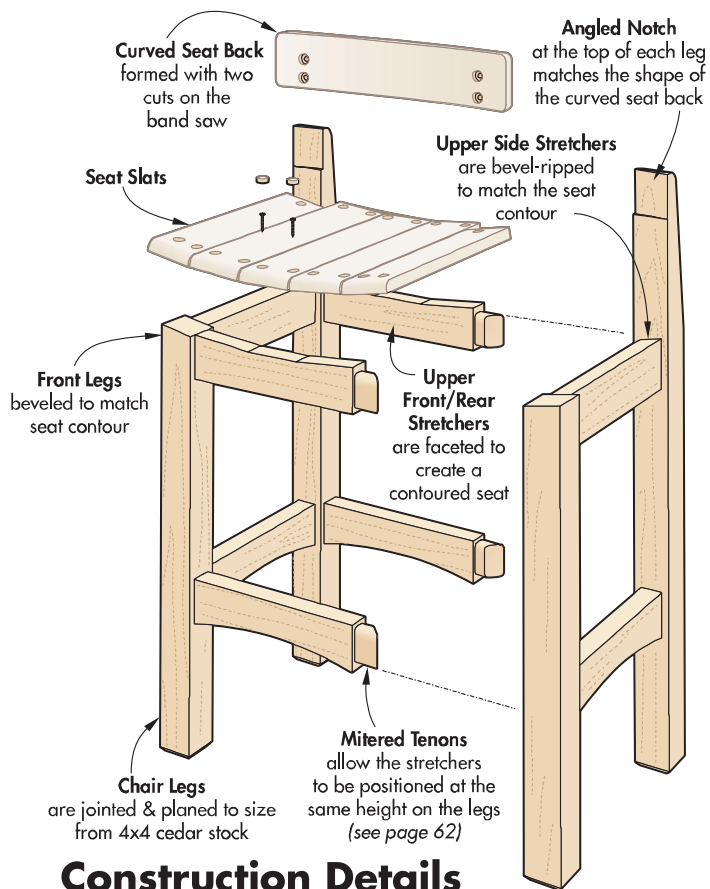
We did, however, take a slightly different tack with the joinery for the chair than the table. This time, we used *mitered* tenons, rather than offset tenons. This is because we started with narrower stock for these stretchers. Offset tenons in these pieces would've been too small to really be sturdy. This means there are a couple differences in how you cut

the mortise and tenon this time. But we'll come to that in a moment.

Getting the Legs Under It — Before we can worry about the joinery, you first need to get the leg blanks ready. That should look pretty familiar if you've already built the other kitchen pieces.

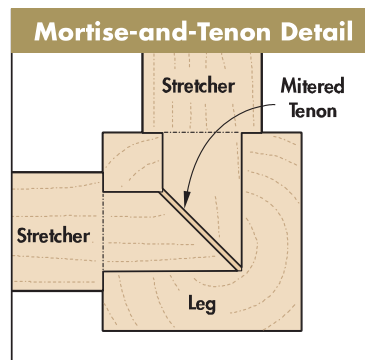
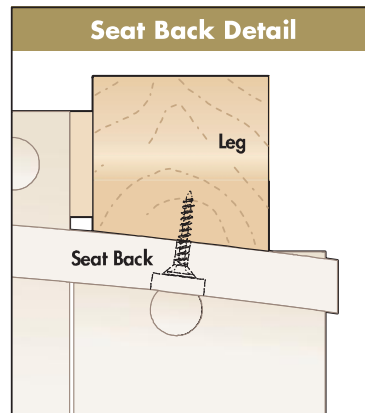
Just as before, the legs (A, B) start as 4x4s that you need to joint and plane to size (*Leg Blanks Illustration, right*). You can review this technique in the June issue of *Workbench*.

With that done, we can get back to the business of the mortises and tenons. The first thing you need to know is that the opening in the mortising jig for the table is too large. So you'll need to make another jig with a smaller opening (*Router Mortise Jig Illustration, right*). Fortunately, the technique is the same. So you can once again follow the instructions on page 61.

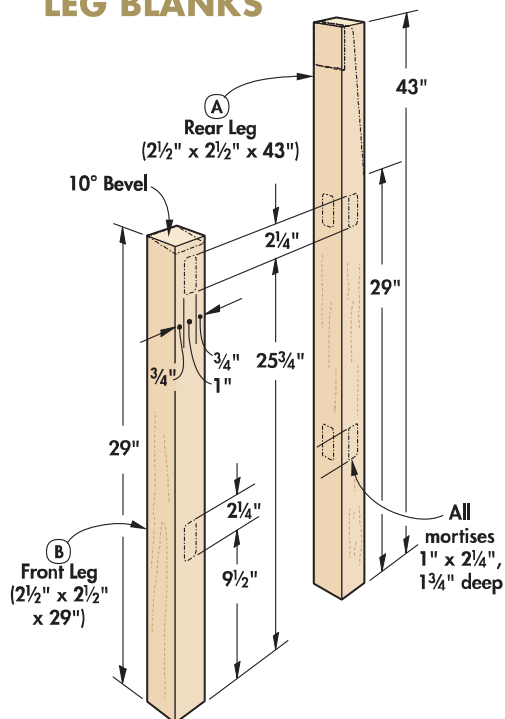


Construction Details

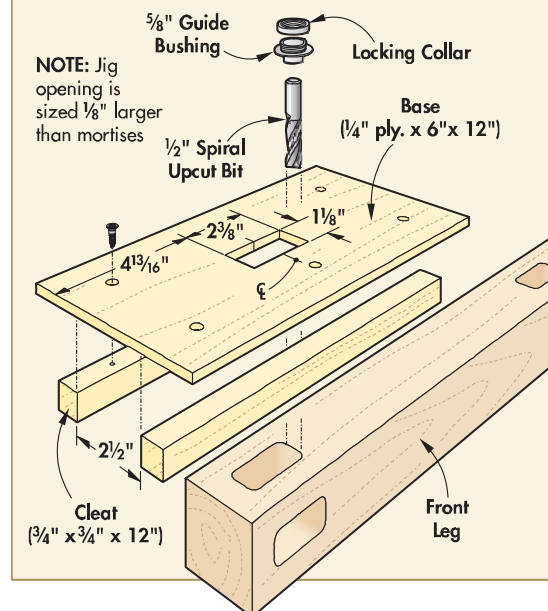
Overall Dimensions: 20" W X 18½" D X 44" H



LEG BLANKS



ROUTER MORTISE JIG





build & assemble the CHAIR FRAME

Now that the mortises are cut, it's time to focus on the details of the legs (*Chair Frame Assembly*). Those include a bevel cut on the front legs for the contoured seating, plus a long taper and an angled notch on the rear legs. The taper gives the leg a slightly thinner profile. The notch accepts the curved seat back.

After that, you can make the stretchers that tie the legs together and, in the case of the upper stretchers, support the seat.

Leg Details — The first thing you need to do is cut the 10° bevel on the top of the front legs. Do this on the miter saw.

The next step is to cut the angled notch on each rear leg (*Rear Leg*

Detail). The angle of this cut is important, so the curved seat back will connect firmly against the legs with as much contact area as possible.

Making the cut accurately is a two-step process for each leg. The first step is make the lengthwise cut on the band saw (*Fig. 1*). Start by setting up your saw as shown in the *Right Leg Illustration* on page 67, with the table tilted to 7°. Use a stop block to control the length of the cut.

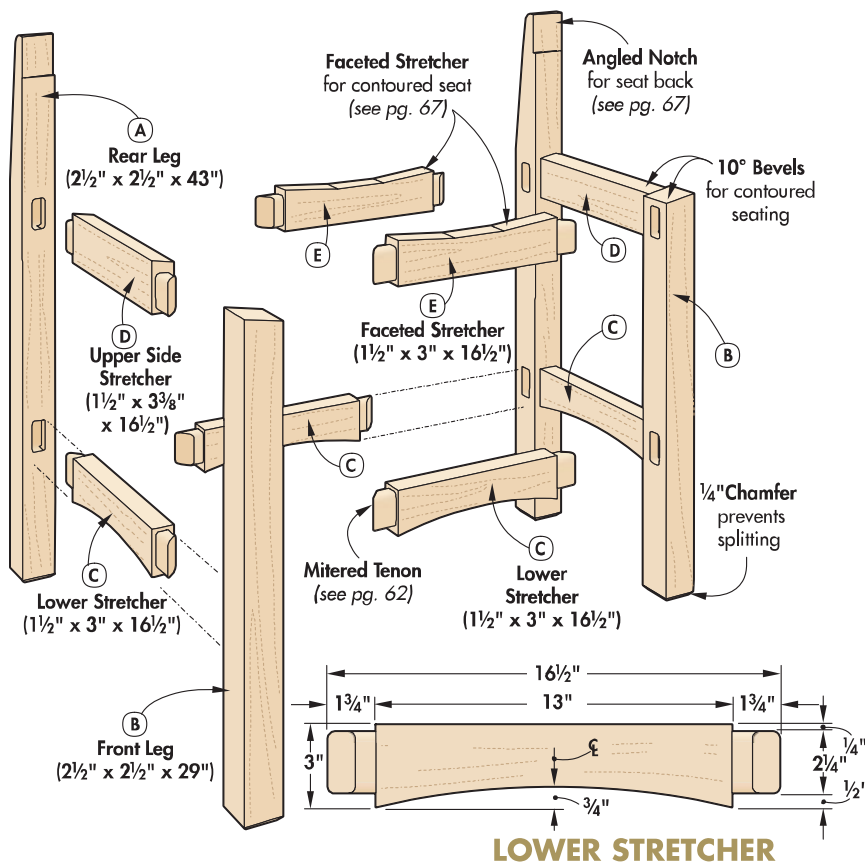
Now, in order to make the mirror of that cut on the left leg, you'll have to tilt your band saw table 7° the other way (*Left Leg Illustration*). For this cut, you won't be able to see the layout line, but you can simply align the blade to cut right at the corner of the leg.

To complete these notches, use a backsaw with a wood guide block to make the cross-grain cuts (*Fig. 2*).

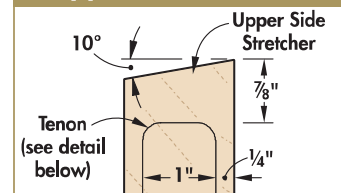
Next is the taper cut at the top of each rear leg. This can simply be laid out on the workpiece and cut free-hand on the band saw (*Fig. 3*). Then you can sand away any blade marks, and at the same time, file and sand the roundover at the top corner.

▲ Construct the end assemblies first, then join them to complete the chair frame. Be sure to dampen the joints with water to activate the polyurethane glue.

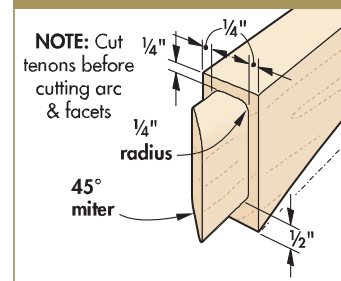
CHAIR FRAME ASSEMBLY



Upper Side Stretcher



Lower Stretcher Detail



The final detail of the legs is to rout a chamfer on the bottom edges. This prevents the cedar from splitting as you slide the chairs around.

Three Distinct Stretchers — There are actually three different stretchers in the chair frame (*Chair Frame Assembly*). The lower stretchers, are distinguished by an arc in the bottom edge. Then there are the upper side stretchers, which have a beveled top edge for the seat contour. Finally are the faceted stretchers that, as their name suggests, are faceted on their top edge. This is also for the seat contour.

We'll handle each of those details, but first, let's focus on the common features. All of the stretchers (C, D, E) need to be cut to size from 2x4s. (Note that the upper side stretchers are wider than the others.) Then, they all get mitered tenons cut at each end. Use the dimensions shown in the *Stretcher Details* and the instructions on page 62 to cut the tenons.

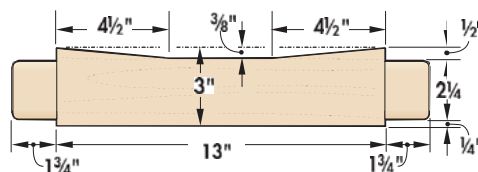
Now about those details. The bevel on the upper side stretchers couldn't be simpler (*Upper Side Stretcher*, page 66). Tilt your table saw blade to 10°, and make a "skim" cut on the top edge. The goal is to make the bevel cover the full thickness of the stretcher without removing any of the width.

The arcs on the lower stretchers are just as simple. Cut them on the band saw, and sand the edge smooth.

Last are the faceted stretchers. These require a couple steps. The first step is to cut the flat, bottom facet using a dado blade (*Fig. 4*). Then complete the shape by making the angled cuts on the band saw (*Fig. 5*). Finally, sand the cut edges smooth.

Assembly — Assembly is the next step. This is another two-step process. Start by assembling the ends of the chair (a front and rear leg connected with two stretchers). Then complete the chair by joining the two end assemblies with the remaining stretchers (*Photo*, page 66).

FACETED STRETCHERS

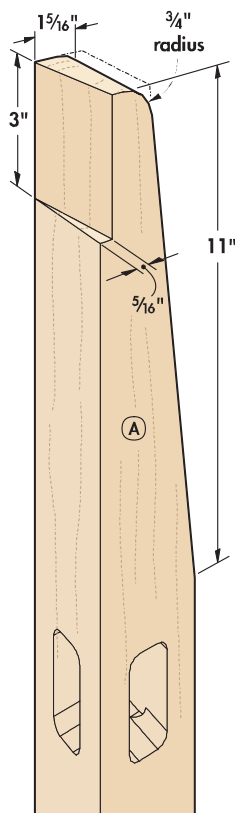


▶ Cut away the flat section, beginning at each end of the cut and then removing the material in between.



▶ Complete the faceted contour of the stretchers by making the angled cuts on the band saw.

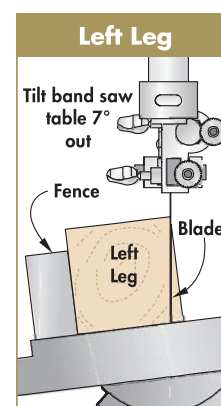
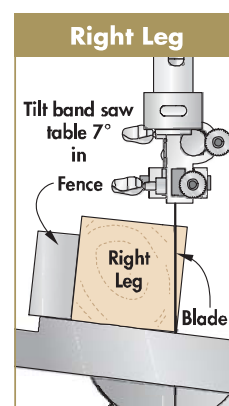
REAR LEG DETAIL



▶ To cut the angled notch, tilt the band saw table to 7° and make the lengthwise cut. Use a stop block to ensure consistent cuts.



▶ Use a backsaw to finish cutting away the waste material to form the angled notch. An L-shaped scrap block helps guide the saw.



▶ To make the long taper cut on the legs, square the band saw table, lay out the cut line, and make the cut freehand. Then round the top with a rasp.



▲ Place the curved seat back into the notches at the top of the rear legs, and attach it with woodscrews. Fill each of the counterbores with cedar plugs. Sand the plugs flush after the glue dries.



▲ After drilling pilot holes and counterbores in each of the seat slats, position them over the upper stretchers with $\frac{1}{8}$ " space between the slats and drive woodscrews into each hole.

MATERIALS & HARDWARE

	Part	Qty	T	W	L	Material
A	Rear Legs	2	2½"	2½"	43"	Cedar
B	Front Legs	2	2½"	2½"	29"	Cedar
C	Lower Stretchers	4	1½"	3"	16½"	Cedar
D	Upper Side Stretchers	2	1½"	3¾"	16½"	Cedar
E	Faceted Stretchers	2	1½"	3"	16½"	Cedar
F	Curved Seat Back	1	1½"	4"	20"	Cedar
G	Edge Slats	2	¾"	3½"	16"	Cedar
H	Field Slats	3	¾"	4"	18"	Cedar

Curved Back Bar Chair Hardware

- (22) #8 x 1¼" Fh Stainless Steel Woodscrews

contoured SEATING

Now that the structure of the chair is complete, it's time to add those comfort features — the curved seat back (F) and the seat slats (G, H). There's only one real challenge in this mix, and that's cutting the curved seat back from a cedar blank. We do have a solution for this, but the first step is to make the blank from a 2x6 (*Back Detail*). Then simply follow the four-step procedure shown in *Cutting Smooth Arcs* below.

When the seat back is cut, round over the corners with a rasp. Then drill pilot holes and counterbores to attach it to the rear legs (*Photo, left*).

The seat slats are the final part of this chair. Notice that there are actually two sizes of slat here. To make the slats, simply cut them to size from 1x4s. Now drill the pilot holes and counterbores for the mounting screws. Attach the slats with glue and screws (*Photo, left*), and then fill the counterbores with wood plugs.

The next detail is to soften the leading edge of each slat. If you've got a roundover bit with a large enough radius, you can accomplish this quickly with your hand-held router. Otherwise, the cedar is easily filed and sanded to the desired contour. 

When cutting the curved seat back from a 2x6 blank, there are two goals: smooth cuts and consistent thickness. To accomplish both, I used this single-point band saw fence (*Illustration, page 69*).

The single-point fence allows you to swing the workpiece as you're making the cut, which results in a much smoother, more consistent cut.

As easy as that sounds, there is one hitch. The cut you make using a single-point fence is only going to be as good as the face that's touching the fence, in this case, the inside face of the seat back. So getting that face true is very important.

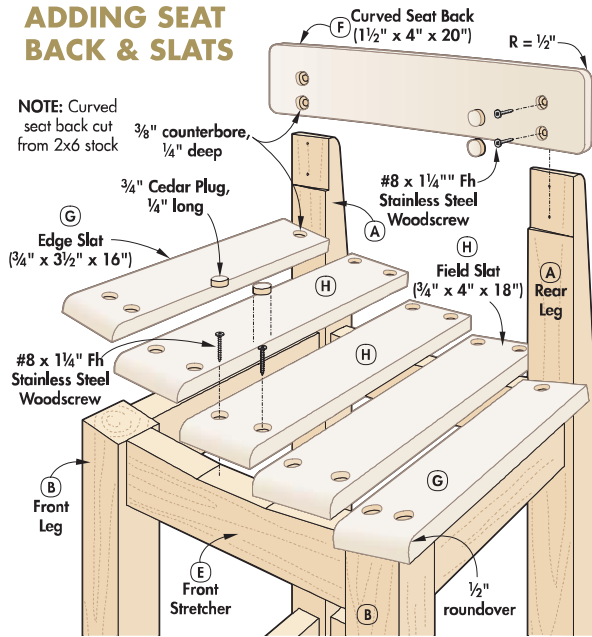
My technique is to take my time and make that cut as accurately as I can (*Fig. 1*). But even then, I can always make the face just a little smoother by sanding it (*Fig. 2*).

Then, to lay out the outside arc, I use the waste piece along with a scribing block to draw an arc that perfectly matches the one I just cut (*Fig. 3*).

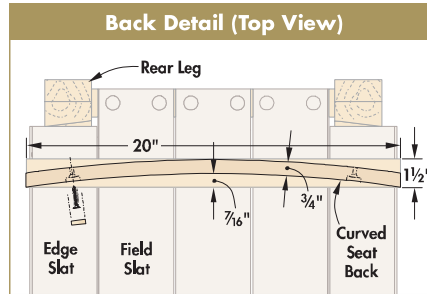
This is where the single-point fence comes into play. By positioning the fence exactly $\frac{3}{4}$ " away from the band saw blade, consistent thickness is automatic (*Top View Detail, page 69*). Then I just guide the blank through the cut, using the pivot point on the fence to gently swing the workpiece along the cut line.

ADDING SEAT BACK & SLATS

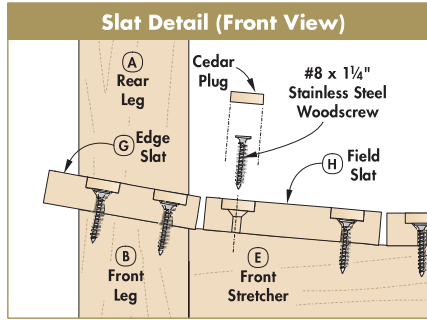
NOTE: Curved seat back cut from 2x6 stock



Back Detail (Top View)



Slat Detail (Front View)



CUTTING SMOOTH ARCS



▲ Lay out and cut the inside arc as precisely as you can. Save the waste piece for the next step.



▲ The cutoff comes in handy as a sanding block for the inside face of the seat back.

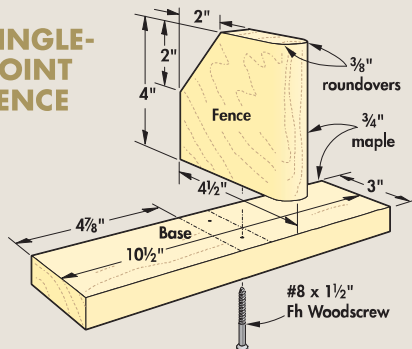


▲ The cutoff helps again as a guide to transfer the arc to the back face of the blank.

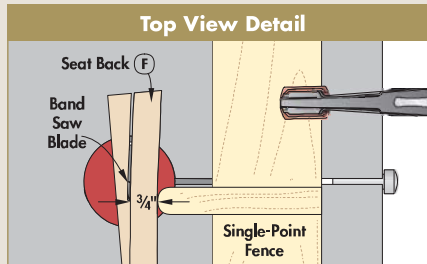


▲ Finally, use a single-point fence to guide the workpiece as you cut the outside arc.

SINGLE-POINT FENCE



Top View Detail



MATERIALS LIST

MATERIALS & HARDWARE						
Part	Qty	T	W	L	Material	
A	Rear Legs	2	2½"	2½"	43"	Cedar
B	Front Legs	2	2½"	2½"	29"	Cedar
C	Lower Stretchers	4	1½"	3"	16½"	Cedar
D	Upper Side Stretchers	2	1½"	3⅝"	16½"	Cedar
E	Faceted Stretchers	2	1½"	3"	16½"	Cedar
F	Curved Seat Back	1	1½"	4"	20"	Cedar
G	Edge Slats	2	¾"	3½"	16"	Cedar
H	Field Slats	3	¾"	4"	18"	Cedar
Curved Back Bar Chair Hardware						
• (22) #8 x 1¼" Fh Stainless Steel Woodscrews						



CUTTING DIAGRAM



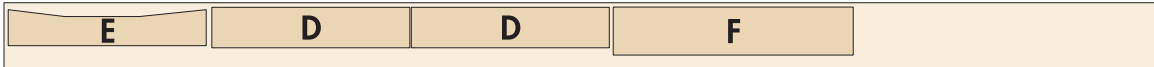
3½" x 3½" x 96" Cedar



3 ½" x 3 ½" x 96" Cedar



1½" x 3½" x 96" Cedar



1½" x 5½" x 96" Cedar



¾" x 5 ½" x 96" Cedar



LASER STORM

TAKING PRECISION TO A NEW "LEVEL"

Just a few years ago the floodgates opened on consumer lasers. The result has been a torrent of laser levels, laser pointers, and laser kerf indicators, all promising to bring more speed and accuracy to our DIY projects.

It's been such a torrent, in fact, that covering them all in these few pages would be impractical, if not impossible. So we've limited our coverage here to the type of laser we feel most DIYers will find truly useful: laser levels.

These are the lasers that project a level or plumb line (in some cases both) to keep you on track when hanging a picture, installing chair rail, or laying tile, to name just a few common applications.

Our goal in this article isn't to evaluate every laser level currently on the market. Rather, we simply spent one afternoon shopping for laser levels at three major home centers, where we purchased 15 laser levels ranging in price from \$20 to \$150. We then invested a couple more days to familiarize ourselves with the operations and capabilities of this rather large laser collection.

We found several fundamental differences between the lasers. The most important of which are their accuracy (in other words, whether the level line is truly level), their mounting and adjustment mechanisms, and the quality and type of line they project. We'll cover each of these considerations in greater detail over the next few pages.

ACCURACY

Somewhere along the way, the words "laser" and "accuracy" became nearly synonymous. Maybe it's the result of a steady diet of science fiction films, wherein even the most casually aimed laser blaster somehow finds its mark (provided it's wielded by one of the good guys). Or perhaps it's because we just expect something as seemingly technologically advanced as a laser to be inherently accurate. Whatever the reason for this myth, it is indeed a myth.

As it turns out, accuracy among these levels varies immensely (based on manufacturer's claims). The closest tolerance we found was plus-or-minus $\frac{1}{4}$ " at 100 feet. That provides a total

margin of error of $\frac{1}{2}$ " over that distance. The greatest margin of error we noted is plus-or-minus $\frac{3}{4}$ " at just 20 feet, for a total margin of error of $1\frac{1}{2}$ " in a relatively short distance.

Clearly, smaller is better when weighing this margin of error. But that doesn't necessarily mean you should reject any laser with more than $\frac{1}{2}$ " margin of error at 100 feet.

If, for instance, you're planning to use the level for nothing more than hanging artwork on the wall, and you can place the laser within a foot or two of where you need the line, then even the greatest margin of error won't be significant over that short span.

It's only when you need to project a level line on multiple walls, or even

all the way around a room (such as when installing chair rail), that the margin of error becomes the definitive measure of a laser's worth.

For that reason, manufacturers are pretty forthcoming with accuracy numbers and print that information right on the box.

MOUNTING OPTIONS

How these levels actually mount in order to project the laser line is one of the most limiting factors of the tools (Photos, below). For example, a level that can only be mounted to the wall is of absolutely no use if you need a straight line for laying a tile floor.

Fortunately, most of these tools have at least two mounting options.



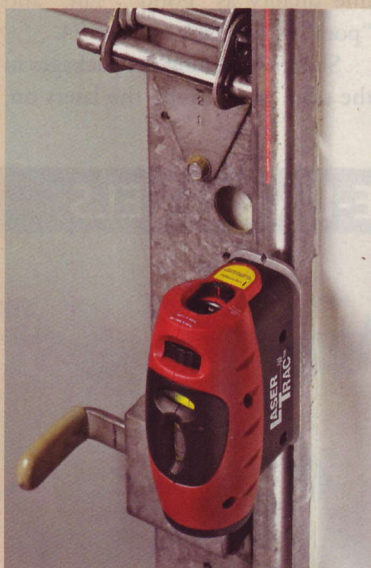
TRIPOD. Mounting a laser level on a tripod extends the reach, versatility, and accuracy of the tool.



PINS. Pins that push into drywall are the most common means of mounting these levels on a wall.



VACUUM. This level uses the novel approach of a small vacuum-powered suction cup for hole-free wall mounting.



MAGNETIC. A magnetic base extends a level's usefulness to metal studs, ducts, and garage doors.



TAPE. Tack tape and tack strips let you mount the laser without marking the wall.

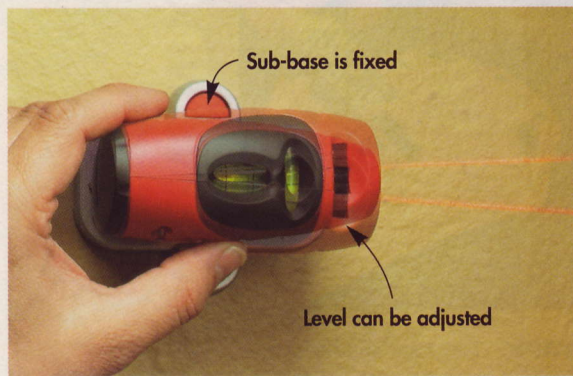


HANGING. This laser can be hung by a hook-and-loop strap, which is a quick way to elevate the line.

MOUNTING OPTIONS



▲ The Stanley S2 Laser Square must be held level as you mount it because there is no way to adjust the line once the level is secured to the wall.



▲ This Craftsman LaserTrac allows adjustment *after* it's mounted. The level attaches magnetically to a sub-base, which uses pins to attach to the wall.

And although no single mounting option is necessarily superior to another, you certainly need to know what options are open to you before you settle on a laser for your project. After all, a laser with a tripod mounting option isn't much good to you if you don't own a tripod.

ADJUSTMENT MECHANISMS

Just as important as how you mount these lasers is how you level them. Some must be level *before* you mount them (Photo, left). That's because once they're secured to the wall, there's no way to adjust them without removing them from the wall.

Many of the models we looked at, however, allow you to mount the laser *approximately* level, and then fine-tune it to *exactly* level (Photo, below left).

The most forgiving models are those that either self-level after you mount them or have a sub-base that lets you dial in a perfectly true setup.

LINE QUALITY

When you buy a laser level, it's reasonable to expect that the line it casts will be thin, sharp, and easy to see. Unfortunately, you can't take that for granted based on our tests. We found that line quality varied widely among these levels (Photo, page 73). We graded line quality as "good," "fair," and "poor" in the Table on page 74.

Short of opening the packages in the store and turning the lasers on,

this is the best indicator of line quality you'll have. That's because there's no correlation between power (size and number of batteries) and line quality. Nor is the classification of the lasers any indication. (Almost all of these lasers are class IIIA; see the *Laser Safety Sidebar* on page 75 for more information on laser class.) Rather, line quality is determined by the quality of the diodes and optics inside the tool, which are impossible to compare on a store shelf.

The good news is that most of the levels from well-known brand names have lines that we considered "good" or "fair." By sticking with these brands, you shouldn't be disappointed.

As an aside, the three Craftsman lasers and the Companion laser (another Sears brand) came with a set of red glasses that enhance the laser line. This allows you to see more of the line (or see it at all in bright conditions). This is a worthwhile addition to these laser level kits and should be considered when making a purchase decision.

LINE PROJECTION

Another characteristic to consider about these laser levels is how, and where, they project a line (Photo, page 73). A line that dead-ends at a corner means you'll have to move the laser from one wall to another if your work covers more than one wall.

SINGLE-LINE LEVELS



SEARS Companion
Affordable level with limited capabilities.



STANLEY IntelliLaser Pro
Combination laser level and stud finder.



STANLEY FatMax Torpedo Laser Level
No wall-mount option, but includes mini tripod.



STRAIT-LINE Laser Level 30
A decent laser for under \$20.



RYOBI Airgrip Laser Level
The "air grip" works only on smooth surfaces.

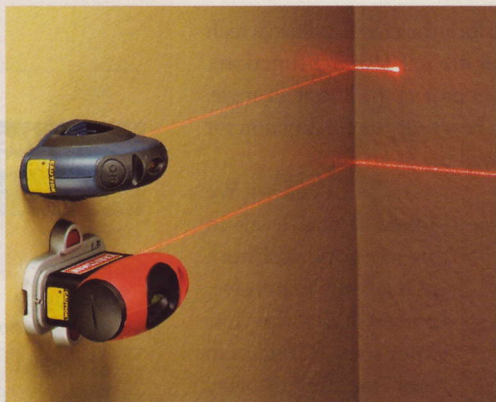
Lasers that project around inside corners allow you to leave the laser in one spot while working on at least two surfaces.

You can generally determine a level's line projection by simply reading the package. Laser levels that project a line on multiple surfaces will state it quite clearly on the packaging. Those that won't project a line around corners don't mention it.

LINE TYPE

These lasers also vary quite a bit in terms of what type of line they project. By far, the most common laser level is the type that projects a single line that can be directed either horizontally or vertically. The second largest group are those that project a vertical *and* horizontal line at the same time. These typically form a crosshair, but not always. Finally, we tried out two levels that project a 360° laser line. This allows you to work on all four walls in a room with the laser in one place.

The value of these various line types again depends entirely on your intended use. For simple decorating jobs, the single-line levels are almost always up to the job. For tile work, or any other job that involves matching horizontal and vertical lines, the dual-line or crosshair type is a good choice. For installing a chair rail, dropped ceiling, or wallpaper border, there's no substitute for a 360° laser line.

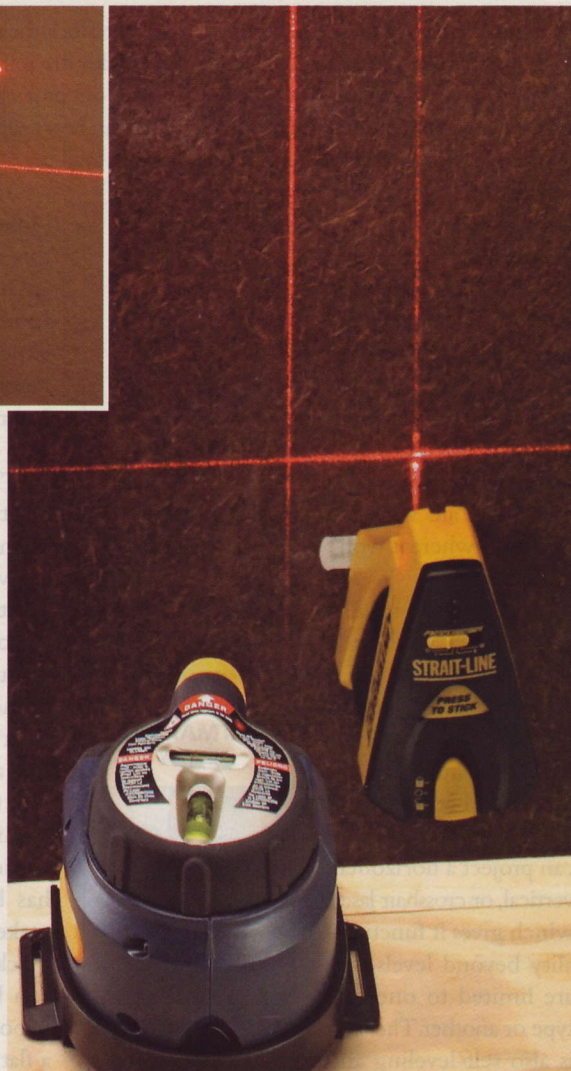


▲ The best levels project lines on multiple surfaces to avoid having to move the laser from wall to wall.

Of course, more lines mean more money. The single-line levels are the most affordable variety (\$20 to \$80). Dual-line lasers cost slightly more (\$50 to \$100), and 360° levels represent the top of the price range of consumer laser levels (\$130 to \$145).

FINAL THOUGHTS

As I said at the beginning, this is not a full-fledged test to determine the most accurate, brightest, best-built laser. Our goal was to learn more about the category and offer some direction for you to choose the best laser for your purposes. Nonetheless, it was impossible not to form some opinions about the lasers we evaluated. And we think these opinions might be of some help to you as you shop for your own laser level.



▲ A thin, bright, crisp line is easier to see in all conditions, but especially in well-lit rooms or when working outside. A line that is a consistent thickness along its full length also reduces the margin of error.

Black & Decker Laser Level with Rotating Base

Very versatile, if you can keep track of the pieces.



Black & Decker Bull's Eye

One of the originals, and still one of the best.



Black & Decker Sight Line

The adjustable base is nice. The wall mount is a bit shaky.



CRAFTSMAN LaserTrac

The most versatile, affordable laser level currently available.



So, if I had to choose one level of each type (single-line, dual-line, and 360°-line) to use in my own projects, I'd choose the following models:

Single-Line Level — The Craftsman LaserTrac Level casts a bright, thin line and includes a pair of laser-enhancing glasses, so you can make the most of it. And because this level can be mounted to the wall, on a tripod, to a magnetic surface, or on its own adjustable base, there are very few situations where it won't do the job.

Given that it also comes packaged in a durable nylon case, this is an unbeatable value at just \$30.

Dual-Line Level — Stanley's FatMax CL2 Cross Line Laser Level can project a horizontal, vertical, or crosshair laser, which gives it functionality beyond levels that are limited to one line type or another. The laser is also self-leveling and offers excellent accuracy. It can be set on any flat surface that's within 5° of level or mounted to a tripod.

One more interesting feature of this level not found on others is the

ability to lock the crosshair line (which overrides the self-leveling function), so you can project the line at an angle. This can be a really useful function for setting wall tile at an angle.

360° Level — We looked at two levels in this category, and both are relatively expensive. Interestingly, the less expensive Craftsman LaserTrac 360° Rotary Laser Level (\$130) is the easy choice.

This laser level offers outstanding accuracy, a bright, super-fine line, and an overall quality of construction that give it a professional-grade feel at a consumer price.

Additionally, the level has a sturdy, built-in base that allows you to position the level to project the line horizontally or vertically. The base also has built-in vials that make leveling the laser quick and easy. The level can be mounted on a tripod or simply set on a flat surface.

Finally, the LaserTrac 360° level also allows you to select between projecting a line all the way around the room, or a single line, in three different lengths, onto one wall.



LASERTRAC
Craftsman



FATMAX CL2
Stanley



LASERTRAC 360°
Craftsman

Manufacturer & Model

Price

Laser Class

SINGLE-LINE LEVELS

SEARS Companion	\$30	IIIa
STANLEY IntelliLaser Pro	\$50	IIIa
STANLEY FatMax Torpedo	\$70	3R
STRAIT-LINE Laser Level 30	\$20	IIIa
RYOBI AirGrip Laser Level	\$40	IIIa
BLACK & DECKER Laser Level with Rotating Base	\$80	IIIa
BLACK & DECKER Bull's Eye	\$70	IIIa
BLACK & DECKER Sight Line	\$30	IIIa
CRAFTSMAN LaserTrac	\$30	2

DUAL-LINE LEVELS

STRAIT-LINE Intersect with Stud Finder	\$70	IIIa
BLACK & DECKER Crossfire	\$100	IIIa
STANLEY FatMax CL2	\$100	2M
STANLEY S2 Laser Square	\$50	3R

360° LEVELS

BLACK & DECKER Bull's Eye 360°	\$145	IIIa
CRAFTSMAN LaserTrac 360°	\$130	2

DUAL-LINE LEVELS

STRAIT-LINE

Intersect Laser Level with Stud Finder

Poor line quality at such a high price.



BLACK & DECKER Crossfire

Self-leveling, with a lot of mounting options.

STANLEY FatMax CL2

Self-leveling, sturdy, and versatile. Our top pick for a dual-line level.



STANLEY S2 Laser Square

Limited mounting options. No adjustability.

laser level COMPARISON

Power Source	Line Quality	Line Projection	Accuracy	Mounting & Bases
2-AAA	Good	Single Surface	+ or - 1/2" @30 ft.	Wall
1-9.0v	Fair	Single Surface	+ or - 1/2" @20 ft.	Wall
3-AA	Poor	Single Surface	+ or - 1/4" @50 ft.	Tripod; Magnet
2-AAA	Fair	Single Surface	+ or - 3/8" @15 ft.	Wall
2-AA	Good	Multiple Surfaces	+ or - 3/4" @20 ft.	Wall; Tripod; Strap
3-AAA	Good	Multiple Surfaces	Unavailable	Adj. Base; Magnet; Strap
1-9.0v	Good	Single Surface	Unavailable	Wall
2-AA	Good	Single Surface	Unavailable	Wall; Tripod; Adj. Base
2-AA	Good	Multiple Surfaces	Unavailable	Wall; Tripod; Magnet; Adj. Base
4-AAA	Poor	Single Surface	+ or - 1/8" @15 ft.	Tabletop; Wall
1-9.0v	Good	Multiple Surfaces	+ or - 1/8" @20 ft.	Tabletop; Tripod; Wall; Hanging
3-AA	Good	Multiple Surfaces	+ or - 1/4" @30 ft.	Tabletop; Tripod
3-AA	Fair	Single Surface	+ or - 1/2" @30 ft.	Wall; Floor
1-9.0v	Good	Multiple Surfaces	+ or - 1/4" @100 ft.	Tabletop; Tripod; Hanging
2-D	Good	Multiple Surfaces	+ or - 1/4" @100 ft.	Tabletop; Tripod



BLACK & DECKER
Bull's Eye 360°

The built-in tripod is a little shaky, but otherwise a capable level.

360-DEGREE LEVELS



CRAFTSMAN
LaserTrac 360°

Nearly professional grade with a lot of unique features.

LASER SAFETY

Along with the convenience of laser levels comes concerns over eye injuries that could result from laser exposure. These concerns first surfaced when inexpensive laser pointers showed up for sale in virtually every convenience store across the country.

Those lasers, just like these, are classified as Class 2 or Class IIIa by the American National Standards Institute (ANSI) or Class 2M or 3R by the International Electrotechnical Commission (IEC). The classifications



are based on the intensity of the laser beam and its potential to harm the human eye. And while the classes from the two agencies aren't exactly interchangeable, there

are some basic principles that do apply to both.

In the case of Class 2 or 2M lasers, a person's natural blink reflex is considered adequate eye protection. Retinal injury is only possible with these lasers if a person can deliberately overcome that reflex. Under the ANSI standards, these lasers are required to carry a "CAUTION" label.

Class IIIa and 3R lasers can produce a beam as much as five times brighter than Class 2 lasers. These may be labeled with "CAUTION" or "DANGER" under ANSI regulations.

Despite the additional power of Class IIIa and 3R lasers, countless government and public health agencies have concluded that, while retinal injury is possible from these lasers, it is highly unlikely.

Nonetheless, common sense dictates that lasers be used responsibly and that users should never direct laser beams toward themselves or another person.

One final word of caution deals with the red glasses that are included with some laser levels. These are not safety glasses. These glasses simply enhance your ability to see a laser line in bright conditions.



ANSI
"CAUTION" label

IEC
Class 2M label

ANSI
"DANGER" label

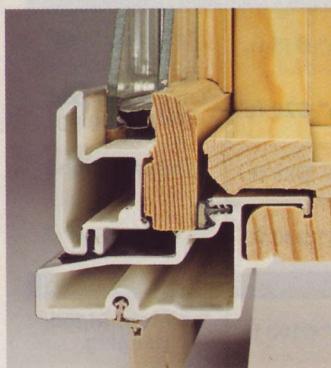
▲ Labels are generally placed near where the laser line emanates from the tool. Power and laser class information are mentioned here.

FIBERGLASS WINDOWS



Photograph courtesy of Marvin Windows

▲ The exceptional strength of fiberglass that makes it ideal for framing large areas of glass (above) is due to pultruded components (right).



If you're window shopping, consider fiberglass. The benefits of this strong, durable frame material certainly make these windows worth looking into.

Ever since man first knocked a hole in the top of the cave to let the smoke out, we've been searching for the perfect window. The early efforts were made of wood. These were nice looking, but couldn't always withstand the rigors of the weather.

Next came vinyl — very strong against the elements, but not much to look at. And vinyl also has the unfortunate tendency to sag if used in large windows.

Later, aluminum seemed like a good choice. It's more weather resistant than wood and stronger than vinyl. But it has absolutely no insulating value.

That brings us to fiberglass. It's too soon to tell if this is the perfect window material, but it's a huge leap forward.

Fiberglass is strong, weather resistant, low maintenance, and actually makes for a very nice looking window.

Exceptional Strength — The greatest strength of fiberglass is, well ... its strength. Although manufacturers' claims vary, it's generally agreed that fiberglass window frames are at least eight times stronger than vinyl and twice as strong as aluminum. This is due almost entirely to the manufacturing process used to create fiberglass frames. The process is called "pultrusion" (Illustration, left).

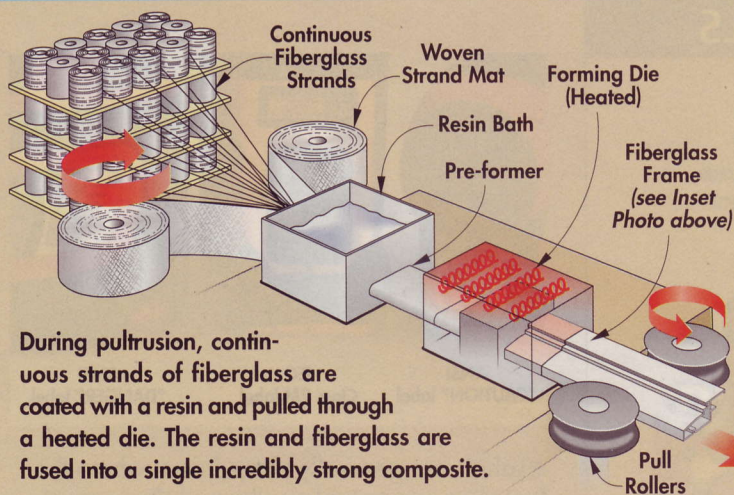
What this means for your house is that even the largest windows can have relatively thin, lightweight frames that don't obscure the view.

Dimensional Stability — A fiberglass frame also has the advantage of expanding and contracting at almost exactly the same rate as the glass. This means there's less chance for broken seals, cracked glass, or gaps in the frames.

Universal Installation — Another climate-related benefit of fiberglass is that it won't become brittle in the frigid temperatures of the North, and it won't warp or

(continued on page 78)

THE PULTRUSION PROCESS



Modern MATERIALS

distort in the sweltering heat of the South. And coastal climates are no problem for fiberglass, either, since it's quite corrosion resistant.

Thermal Efficiency — One of the easiest ways to compare windows is to look at their R-values. The "R" stands for resistance to heat flow, and the higher the R-value the better. Time after time, fiberglass frames receive higher R-values than their wood, aluminum, and even vinyl counterparts.

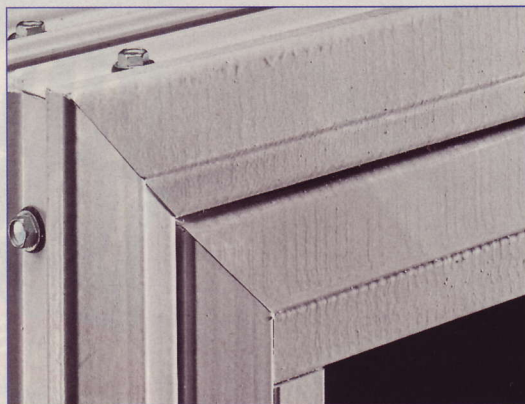
Good Looks — This is the clincher. And I'll be the first to admit it: I talk a good story about wanting low maintenance and thermal efficiency, but an easy-to-clean, airtight window that's really ugly isn't going in my house.

Fortunately, fiberglass windows strike a nice balance between the practical considerations (maintenance, thermal efficiency) and more cosmetic concerns.

There are already several colors to choose from, with promises of more to come. On the other hand, if you'd rather customize the color and don't mind having a low-maintenance window rather than no-maintenance, there are a number of fiberglass windows that can be painted or stained (*Photo, right*).

But just as important as the color is the *texture* that many fiberglass windows have. This is a small difference, but an important one. This subtle texture actually gives the windows an almost wood-like appearance when painted (*Photo, above right*). And it also eliminates the high-gloss sheen that is the bane of vinyl and aluminum windows.

Conclusion — Windows have evolved immensely over the years, and for the time being, fiberglass is at the top of the food chain. This emerging material has all the qualities of those that came before with seemingly none of the weaknesses. And yet, you'll find them priced competitively with other premium windows. 



▲ A subtle matte finish that's common on fiberglass window frames eliminates sheen and gives the windows a more wood-like appearance.



▲ Although fiberglass windows don't require painting, it is an option if you'd like to trade "no-maintenance" for a custom look.

Sources:

MARVIN WINDOWS & DOORS

IntegrityWindows.com
888-537-8265

PELLA CORPORATION

PellaImpervia.com
800-374-4758

MILGARD WINDOWS

Milgard.com
800-645-4273

THERMOTECH

ThermoTechWindows.com
888-930-9445

FIBERLINE

FiberlineWindows.com
800-218-5209

COMFORT LINE, INC.

ComfortLineInc.com
800-522-4999

	Fiberglass	Vinyl	Wood	Aluminum
Structural Strength	Best	Poor	Good	Better
Thermal Performance	Best	Good	Good	Poor
Stability	Best	Poor	Good	Poor
Corrosion Resistance	Best	Good	Good	Good
Low Maintenance	Best	Better	Poor	Good
Energy Efficiency	Best	Good	Good	Poor
Paintability	Good	Poor	Best	Poor
Climate Durability (Hot)	Best	Poor	Good	Better
Climate Durability (Cold)	Best	Better	Better	Good

TOOL Close-Up

digital, direct-drive ROUTER LIFT

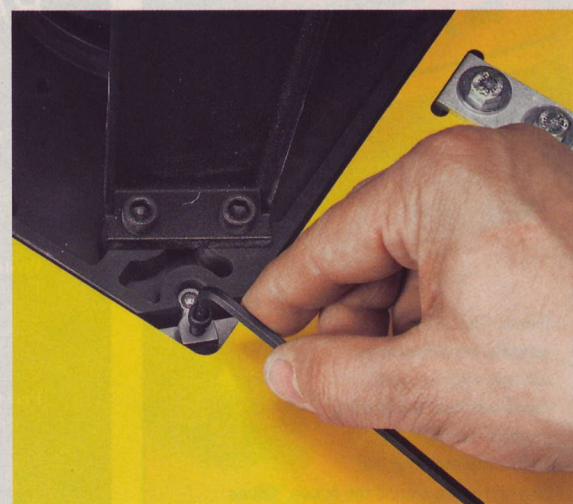
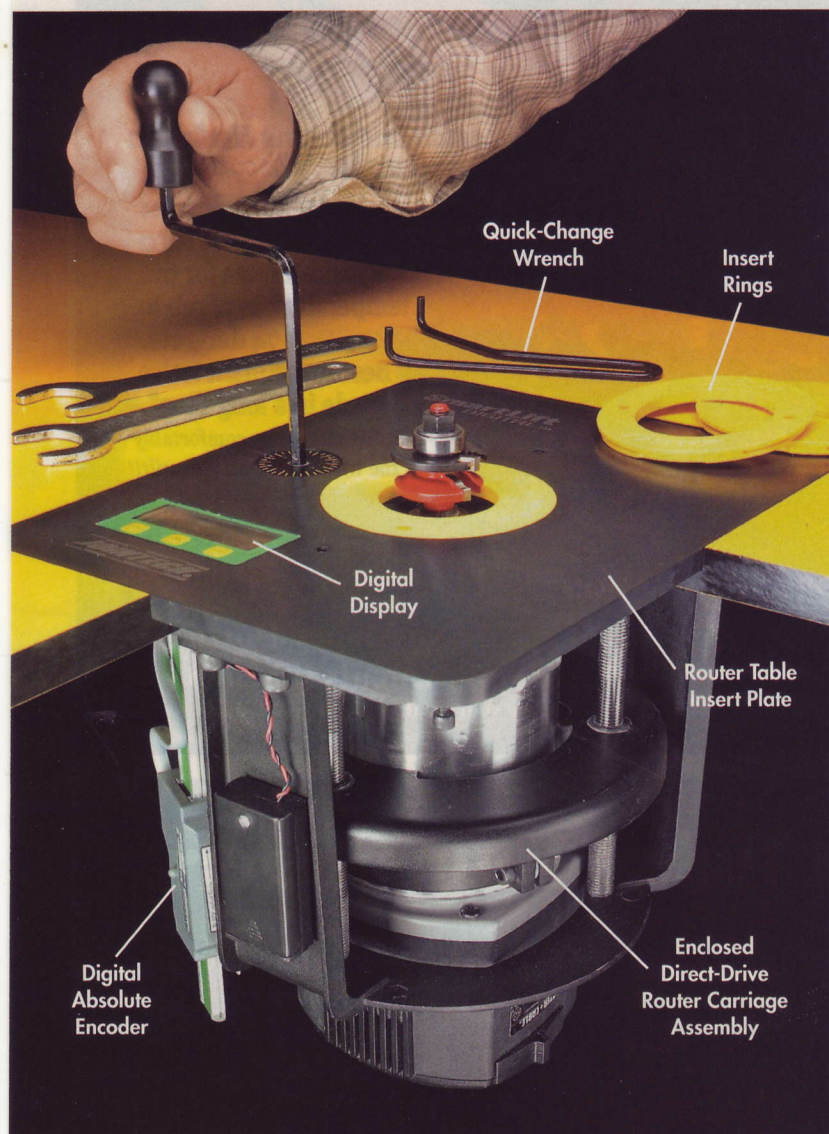
If you're in the market for a high-end router lift for your router table, then you'll definitely want to give serious consideration to the new SmartLift Digital router lift from Jointech (*Photo, left*).

You may already be familiar with Jointech by way of their exceptionally accurate and sturdy router table and table saw fences. Now they've taken that same penchant for precision and applied it to a router lift that is currently without equal.

The most noticeable difference in this router lift is the digital display that's set into the router table insert plate (*Photo, below left*). This is a great feature, to be sure, but it's only one small reason that this lift is so outstanding.

More meaningful is the fully-enclosed direct-drive mechanism. Because this is a direct-drive system, it doesn't suffer from backlash (the play that results from loose connections in the drive system) that plagues so many belt-and-pulley- or chain-and-sprocket-driven systems. This means the router lift is capable of making and maintaining adjustments as fine as .001". And, of course, those are accurately displayed in the digital readout. This allows for a level of precision that was previously unachievable on a router table.

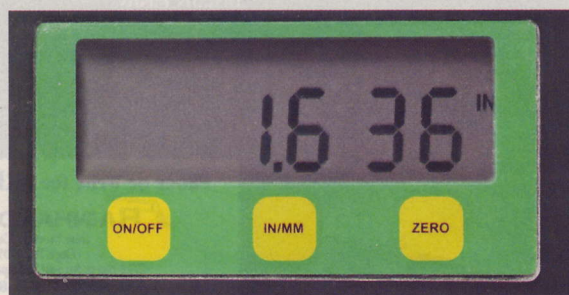
(continued on page 86)



▲ Leveling pads are built right into the insert plate of the SmartLift. This makes it easy to adjust the insert for a perfectly flush installation. The insert fits a standard 9¹/₄" x 11³/₄" opening.

▲ With an Absolute Encoder from Accurate Technology attached directly to the router carriage and a digital display recessed into the insert plate, precision height adjustments as fine as .001" are standard fare for the Jointech SmartLift Digital.

► The digital display can be set to indicate inches or millimeters, and it can be "zeroed out" at any height.



TOOL Close-Up

And because this system is fully enclosed, there's no danger of dust building up on the lift mechanism and adversely affecting the smooth operation and accuracy of the lift.

Right out of the box, the SmartLift accepts either a Porter-Cable model 7518 or 7519. A reducing ring is available to adapt the lift to several other popular routers.

Test Run — As it were, I just happened to have a 7519 on hand. It took no time to unpack the lift and mount the router body. From there, I spent just a couple more minutes fine-tuning the lift assembly in my Jointech router table using the snugging and corner leveling pads that are built right into the lift (*Photo, page 84*).

That done, I was ready to start routing. So I grabbed a three-piece router bit set that I frequently use to build frame-and-panel doors. I knew this particular mini-project would give me a good feel for the operation and accuracy of the SmartLift Digital.

My test process was simple. I built one door using my typical method of visual alignments and test cuts. The only difference was that as I changed from one bit to the next, I carefully "zeroed out" the bit before making any adjustments. (Zeroing the bit is a simple matter of aligning the highest cutting surface of the bit with the top of the insert plate and pressing the "Zero" button on the display pad.)

Then, as soon as I'd set the perfect height for the door part I was working on, I wrote down the reading from the digital display. Using that information, I built a second door, using only the settings I had recorded to set the bit heights (*Photo, below right*). The second door fit together just as perfectly as the first.

What I really like about this feature is that, as long as I zero the bit the same way every time, I can reproduce this door at any time using those very same numbers.

Other Features — Accuracy and repeatability notwithstanding, there are a couple of other worthwhile features to the SmartLift Digital.

First is its above-the-table bit-changing capability (*Photo, upper right*). By simply raising the lift as far as it will go, the collet can be reached with the lift still in the table. This is much quicker than pulling the lift out of the table or removing the router from the lift. And it ensures that the insert plate maintains its flush position with the tabletop.

Another nice feature is a set of quick-release insert rings that come with the SmartLift Digital (*Photo, center right*). These allow you to match the opening in the insert plate to the diameter of the router bit. It's an important safety feature that ensures good stock support where you need it the most, right up against the bit.

The SmartLift Digital sells for \$429 on Jointech.com. You can also call the company at 800-619-1288.



▲ With the SmartLift raised to its maximum height, the collet nuts are easily accessible for above-the-table bit changes.



◀ The SmartLift includes three insert rings and a quick-change wrench. Additional sizes of insert rings are available for even greater flexibility.



◀ By using the SmartLift Digital's "zero" feature and recording the height of each setup as it appears in the digital display, elaborate projects such as this raised-panel door can be easily repeated.

Tools & PRODUCTS

WORKBENCH
APPROVED

Milwaukee breaks THE BATTERY BARRIER

To date, the most limiting factor for cordless tools has been that any significant increase in power brings with it a corresponding increase in weight. That's why the most practical application for NiCad and NiMH batteries has been the 18-volt platform; 24-volt batteries are just too heavy for daily use.

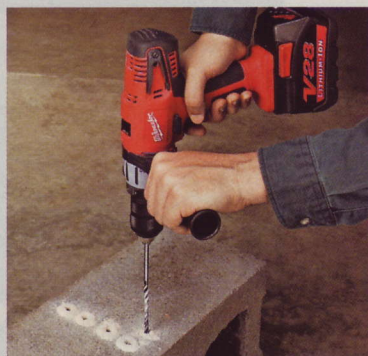
Milwaukee, however, has shattered the weight/power barrier with a lithium-ion battery. The new battery, dubbed the V28, delivers an unprecedented 28 volts of power but still weighs less than an 18-volt battery.

The benefits of additional voltage are substantially more power and run time than 18-volt batteries.

The advantages of lithium ion are "fade-free" power (the last cut is as powerful as the first), better performance in extreme hot or cold weather, and a measurable reduction in self-discharge rate (the rate at which a battery discharges while simply sitting on the shelf).

Tool Test — We had an opportunity to test out the "increased performance" claims when Milwaukee provided us with both a V28 and standard 18-volt cordless kit for a side-by-side comparison. Both kits included a circular saw, reciprocating saw, hammer drill, and worklight, along with two batteries, a charger, and blades for the saws.

◀ The Milwaukee V28 system significantly outperformed 18-volt tools in three demanding applications: The circular saw made exactly twice as many cuts in 2x10 stock. The recip saw made almost one-third more cuts in steel conduit. The hammer drill more than doubled the number of holes drilled in a concrete block.



▲ More power, longer run time, and lighter weight are three key advantages of Milwaukee's new V28 lithium-ion cordless tools.

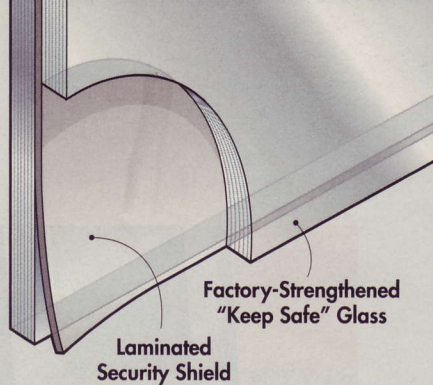
We put the tools through some simple tests to measure what advantage the 28-volt platform offered (*Photos, below*). The V28 circular saw and drill outperformed their 18-volt counterparts nearly two-to-one and the 28-volt reciprocating saw completed about 30 percent more cuts than the 18-volt version.

The most interesting difference, though, was the temperature of the batteries when we finally exhausted them. The 18-volt batteries were noticeably hotter to the touch than the 28-volt batteries. We confirmed this with an infrared thermometer that showed a NiCad battery was almost 50° hotter than a lithium-ion battery at the point of full discharge.

Analysis — This cooler temperature means less downtime waiting for a battery to cool so it can recharge. In fact, the lithium-ion battery we tested was almost fully charged before the NiCad battery even began charging.

Secondly, a battery that generates less heat as it discharges can be expected to have a much longer lifespan. That's because heat degrades the battery cells.

Of course, all of this comes at a cost. The V28 kit we tested is expected to sell for \$700 or more. For more information about the new V28 cordless tools, call 800-729-3878 or visit MilwaukeeTool.com.



safe & secure STORM DOOR

If you're concerned about your home's security (and who isn't these days?), you'll be intrigued by this new storm door and glass technology from Larson. The company's Secure Elegance line offers real security without the "iron bar" look.

The main component is a type of glass called Keep Safe (*Illustration, above*). This "glass sandwich" has two panes of tempered glass fused to an inner membrane of extremely tough plastic. The result is a glass pane that is impervious to even sledgehammer blows. The glass will crack on the surface but remains intact as a solid barrier.

In addition to the Keep Safe glass, Secure Elegance storm doors also incorporate a sturdy metal frame, hidden hinges, and a triple locking system to ensure that every part of the door is as impenetrable as the glass.

The doors cost approximately \$300. For more information, call 800-352-3360, or visit Lowes.com/Larson.



▲ Security aside, these doors are also available in an array of colors and styles for an attractive installation.

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Starrett ProSite PROTRACTOR

The Starrett ProSite Protractor takes error-prone calculations out of the process of cutting miters. Simply use the protractor to measure a corner, and then set your saw to the angle that you read.

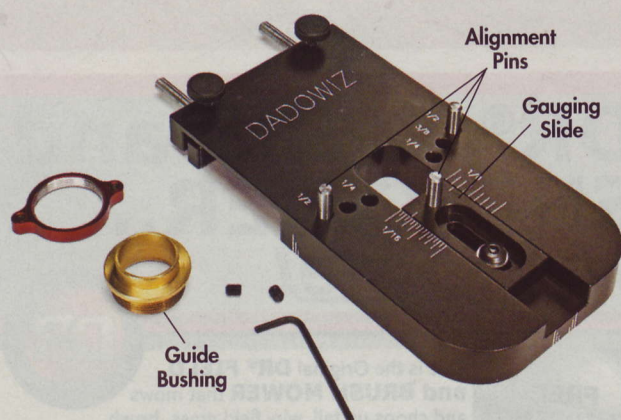
The protractor has two scales. The red scale shows half the measured angle. So setting your saw to this number lets you cut two mating pieces. The black scale shows the actual angle measured. So you can set your saw to this number and cut a single piece to match that angle.

The protractor should withstand years of use. It's built with durable aluminum and has a teflon O-ring that ensures smooth operation.

The ProSite Protractor sells for about \$40. Visit Starrett.com or call 978-249-3551 for more information or to locate a dealer in your area.



▲ Whether matching the angle of an existing workpiece or trying to fit a piece into a corner that's not quite square, the ProSite gives you the precise miter setting.

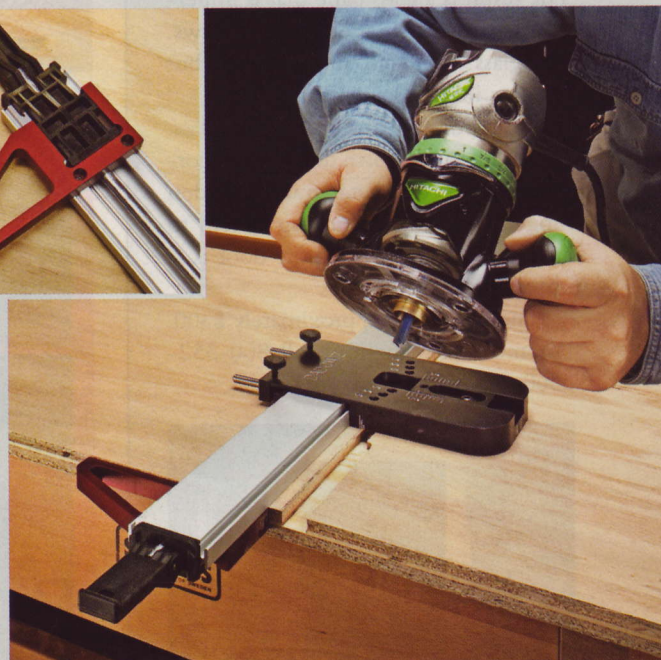


Woodline DADOWIZ

The Dadowiz from Woodline is a precision jig that lets you make accurate dado cuts in a few simple steps. The real beauty of the jig is that you use the actual workpiece to establish the width of the dado, so you know the joint will be a perfect fit.

To set the Dadowiz to match a particular piece of stock, simply place the workpiece between the three alignment pins. Then adjust the gauging slide so the workpiece is touching all three pins, and tighten the screw in the slide. The opening in the Dadowiz is now sized so you can make two passes for a custom-fit dado.

To use the Dadowiz, mount it on a Clamp-N-Tool Guide. Woodline sells these along with a right-angle attachment to ensure square setups, (*Inset Photo*). Finally,



▲ Woodline's Dadowiz is the surest method available for custom-fit dados. A right-angle guide attached to a Clamp-N-Tool Guide (*Inset*) makes setup even easier.

install the guide bushing in your handheld router and chuck up the appropriate bit (the Dadowiz works with $\frac{1}{4}$ ", $\frac{3}{8}$ ", and $\frac{1}{2}$ " straight bits).

The Dadowiz sells for \$160. The right-angle attachment goes for \$25. For more information on either, call Woodline at 800-472-6950.



dust-busting GORILLA

Oneida Air Systems has just added the Dust Gorilla to their lineup of cyclonic dust collectors. The Gorilla is perfect for small shops where size, noise level, and cost are just as important as performance.

Even at the relatively modest price of \$845, the Gorilla includes many of the features that have earned Oneida's larger units rave reviews. Among those are a 230-volt, 2-HP motor, a non-sparking cast-aluminum fan wheel, a pleated, high-efficiency filter, an internal sound silencer, and a durable powder-coated finish on the cyclone itself.

The unit draws an impressive 1,405 CFM of air which is more than enough to keep up with even the largest dust-producing tools in your shop. And because of an internal silencer, it still operates at a comfortable 79 to 81 decibel range.

Standard equipment with the Dust Gorilla is the cyclone, fan, 35-gallon dust bin, filter, internal silencer, starter switch, and mounting brackets.

Beyond just the hardware, though, Oneida also includes their design service with every Gorilla purchase. This gets you a custom-designed ductwork plan that shows you how to build your system for maximum efficiency. An itemized parts list of all the elbows, branches, and fittings required to construct the ductwork is also part of the package.

Learn more about the Dust Gorilla by visiting Oneida-Air.com or calling 800-732-4065.

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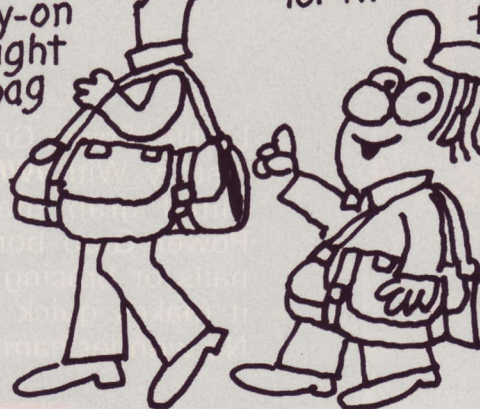
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Product Information Number 361

Woodworking That's a Real BLAST

Craftsman Brent Manley combines delicate handwork and a powerful sandblaster to create stunning entry doors with intricate "carved" details.

Take a look at the beautiful panel in the *Photo* at left, and you may at first think you're seeing the result of many hours of delicate hand carving. The foreground image stands out crisply above the textured backdrop, and the tiny details look as if they surely required sharp carving tools and even sharper eyes.

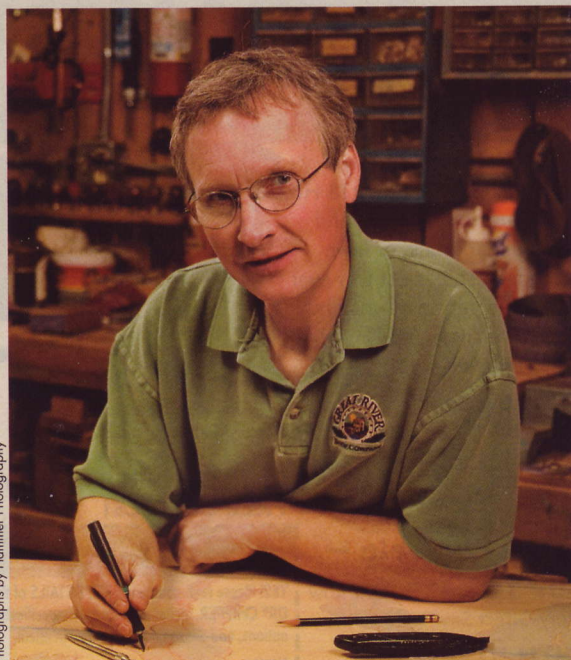
But, believe it or not, the relief carving is done not with chisels and knives, but with sand. More specifically, these amazing images are sandblasted by Brent Manley of Great River Door Company in Brainerd, Minnesota.

Now, if you think that sandblasting sounds like a quick and easy way to avoid the painstaking work of carving by hand, think again. Sure, actually blasting away the wood takes only minutes. But it can take weeks to dream up a panel design and then prepare the intricate patterns that determine which wood gets blasted away and which gets left behind.

Most of Brent's designs, by the way, reflect his surroundings on the edge of the Great North Woods. The area is dotted with dozens of lakes that are surrounded by thick forests and abundant wildlife. Brent's door panels recreate these scenes with amazing realism and attention to detail.

When the sandblasted panels are complete, they are installed into doors (custom-made by another local craftsman) that are built with traditional mortise-and-tenon construction. This ensures that the doors will look great and perform well in the entryways of the rustic homes and vacation getaways where they are installed.

You can see how Brent creates his sandblasted panels in greater detail on page 96. And if you want to see more examples of Brent's craftsmanship, take a look at his website: GreatRiverDoor.com.



Photographs by Hammer Photography

▲ Brent begins creating a panel by applying a rubber "resist" to the wood and transferring the design from a full-size pattern. Then he cuts out the design by hand.



▲ By combining relief “carving” and varied colors, Brent creates door panels of scenes filled with detail and three-dimensional depth.

fine details that are **HARD TO RESIST**

Brent’s creative process begins with talking to his clients in order to determine what door and panel styles would be best suited to their home. They also discuss what type of scene they want in the panel or panels.

After this, Brent sketches ideas. He draws the designs small, on sheets printed with outlines of different panels. This template helps Brent ensure that the image will fit the size and shape of the panel.

Supersizing the Design — After refining the design with the client, Brent completes the sketch. Then comes time to enlarge it. To do this, he places the drawing in an opaque projector that shines an enlarged image onto the wall, where Brent tapes a large piece of pattern paper.

Again, Brent outlines the panel on this pattern, then sizes and aligns the image for the best fit. He can then trace the projected lines to draw the full-size pattern. Fine details get added during this process.

Preparing the Pattern — Rather than cut out the pattern, Brent goes over the lines with a spiked roller that perforates them. Smaller areas get cut out by hand.

Meeting Resistance — With the pattern complete, Brent applies a thick self-adhesive rubber membrane to the wood panel. This is called a “resist,” and it’s designed for sandblasting. The resist is thick enough to stop the sand anywhere it’s applied.

Pouncing the Pattern — Now Brent lays the pattern on the resist and transfers the image by tapping the perforated lines with a powder-filled bag. Called “pouncing,” this leaves a dotted outline of the image when the pattern is removed. This technique is faster than tracing, and it allows the pattern to be reused or reversed to create a mirror image.

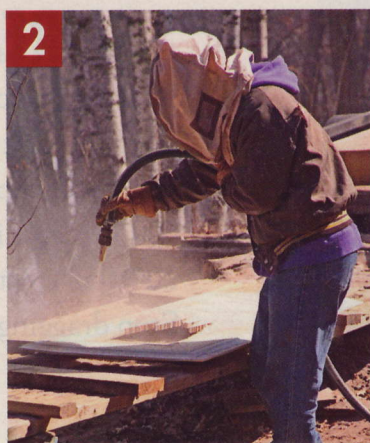
Cutting to the Chase — With the image transferred, Brent can begin cutting away parts of the resist (Fig. 1). This can take eight hours or more on a complex design.

In the Blasting Zone — Now Brent “carves” the design (Fig. 2). In just a few minutes, he may go through 300 pounds of sand pushed by a 25-HP compressor.

Peeling & Revealing — Finally, the resist gets carefully peeled away to expose the full image (Fig. 3). Sanding completes the process. ■



▲ After cutting around the “resist,” the areas to be sandblasted are peeled away to reveal the bare wood. Any cutouts are made with a jig saw or scroll saw.



▲ Sandblasting takes place outdoors. The process goes quickly but requires great care for consistent results.



▲ After blasting, the resist is carefully peeled away to reveal the raised, smooth areas.