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WORKBENCH

VOLUME 60 NO. 3

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EDITOR'S NOTES

There's a lot to be said for front porches. Not the least of which is fond memories of being a Kool-Aid-drinking, lightning-bug chasing, porch-swinging kid. More and more, though, I've come to appreciate the unique opportunity a porch provides to visit with passersby, catch up on what's happening in the neighborhood, and just plain relax.

Well, aside from nostalgia, what's all this talk about front porches anyway? It has to do with a porch we built recently, an addition to an 1885 two-story house a few blocks from the *Workbench* shop. As you can see in the *Photos* below, the porch made a huge improvement, visually "tying" the house to the landscape and creating a warm, welcoming feel.

All in all, I couldn't be more pleased with how this porch turned out. It's not the type of project to tackle lightly, however. Designing and building the main structure of a porch — in particular the framing for the floor and roof — can get quite complicated. To be honest, it's a job that's best left to a professional. Then, once the structure is in place, you can add the distinctive details that make the porch unique.

Transforming a Porch — So what *are* those transforming details? In short, they're the porch flooring, columns, and railings. These are the projects we've detailed in the article beginning on page 38. They're the most visually interesting aspects of a porch. They're also the most expensive if you were to hire the work done. Fortunately, adding these elements is well within the reach of most any woodworker. And whether it's a new or an existing porch, doing the work yourself saves a bundle. Plus it gives you something to chat about when neighbors stop to visit.

Tim

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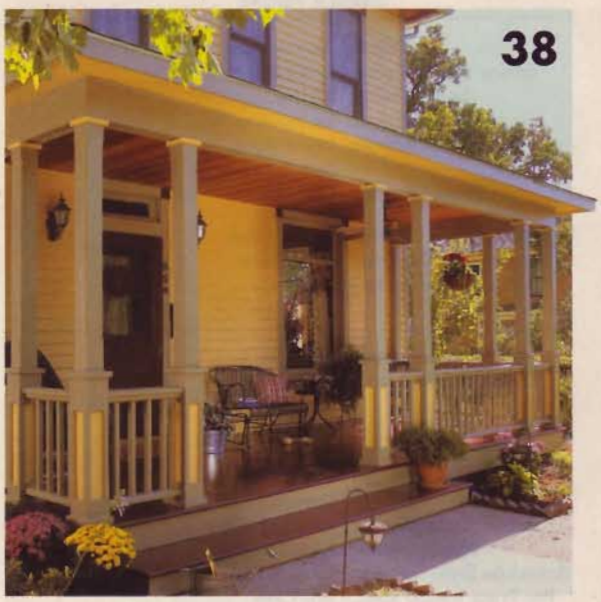
WORKBENCH® June 2004



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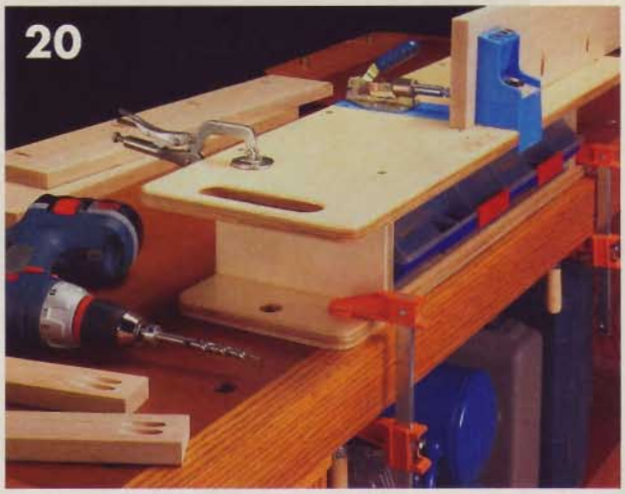

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Questions & ANSWERS

mortising on a ROUTER TABLE

Q *I would like to make mortise and tenon joints in my shop, but I don't own a drill press. Is there any way I could make mortises with a fixed-base router?*

Joel Breidenbach
Via email

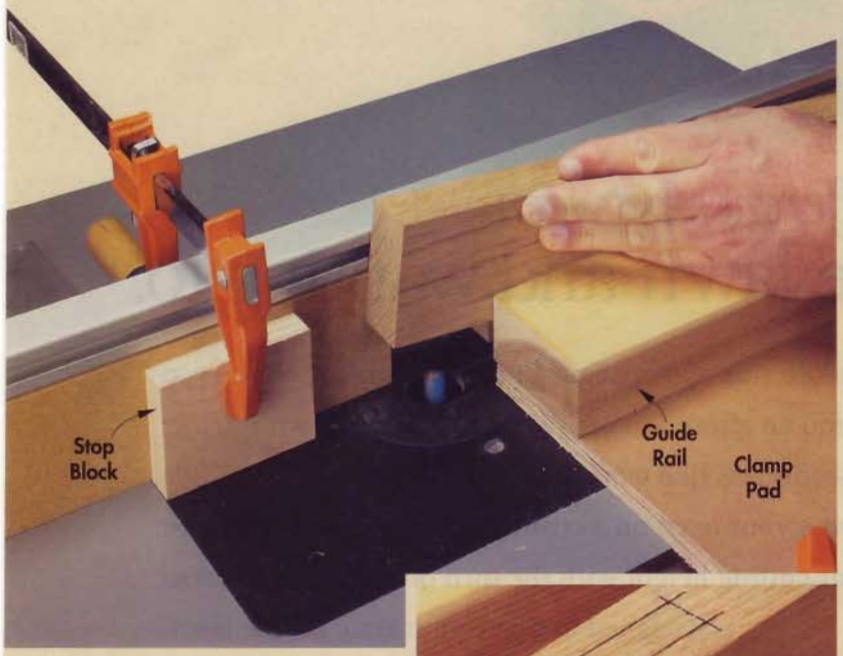
A You can make mortises with a fixed-base router mounted in a router table. To make a mortise this way, you have to lower a workpiece onto a spinning bit. It takes a little bit of setup to do this safely and correctly.

You'll need three things for the technique: two stop blocks clamped to the router table fence, and a guide rail to keep the workpiece from kicking out from the fence.

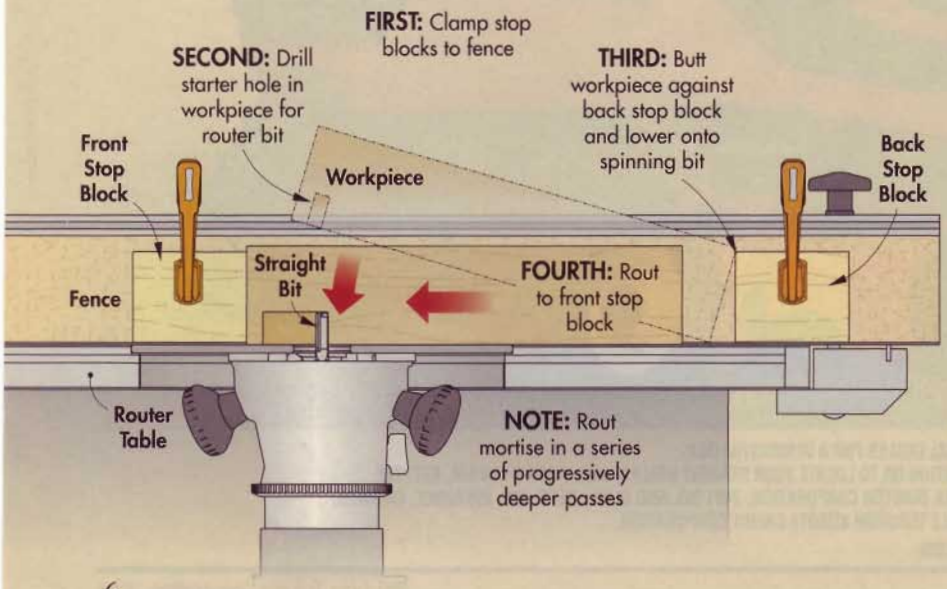
Stop Blocks — The location of the stop blocks is important, so take some time to position them correctly. The idea is to clamp them in place so that when the workpiece is butted against them, the bit is aligned with one end of the mortise or the other *(see Illustration)*.

Guide Rail — As for the guide rail, it's just a scrap 2x4 glued or screwed to a plywood clamp pad *(Main Photo)*. Position the clamp pad so that the workpiece can slide smoothly between the rail and router table fence, and clamp it firmly in place.

Rout Mortise — Before routing, drill a starter hole at the front of the mortise *(Inset Photo)*. This creates a pocket that fits down over the router bit. Then, cutting the mortise is as simple as butting the workpiece against the back stop block, lowering it onto the spinning bit, and pushing it forward until it hits the front stop block. Rout the mortise in a series of progressively deeper passes until reaching the desired depth.



▲ It's easy to cut mortises on a table-mounted router. The key is to set stop blocks to establish the ends of the mortise and use a guide rail to keep the workpiece from kicking out. A starter hole *(Inset)* creates a pocket that fits down over the router bit.



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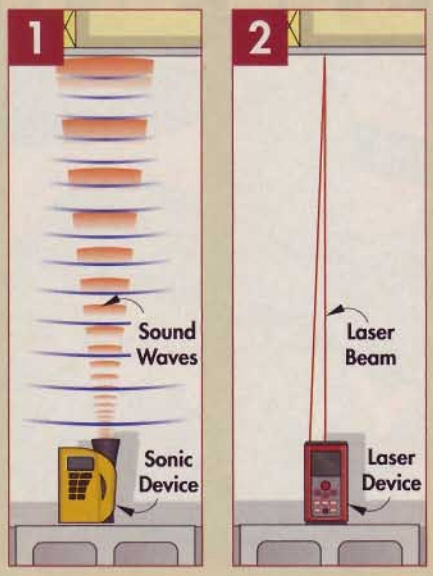
a measuring mystery

SONIC VS. LASER

Q *I'm confused by all the new measuring devices on the market. Can you tell me what the difference is between a laser measuring device and a sonic measuring device?*

John Watkins
Concord, NH



▲ While sonic devices calculate distance with sound waves, laser devices use a concentrated beam of light, making them more accurate.

A Sonic measuring devices (such as those from Zircon) calculate distance by bouncing sound waves off an object and measuring the time it takes them to return. (The "laser dots" are simply a targeting device.)

Sound expands as it travels, so the further away a target is, the less reliable the measurement *(Fig. 1)*. This makes sonic devices great for estimates rather than accuracy. The units retail for $30 to $60.

Laser measuring devices (such as those from Leica and Spectra) work in a similar fashion, only they measure the path of a laser beam rather than sonic waves *(Fig. 2)*. Light is more focused than sound, and the speed of light is more reliable, so laser measuring devices can boast accuracy to within 1/8" over a distance of several hundred feet. This technology comes at a price, however. Expect to pay at least $300 for one.

Rust Removal & Prevention

Q *A fine layer of rust has developed on my band saw tabletop. What's the best way to remove the rust?*

Kevin Schmuecker
Via email

A There are a number of products out there to combat rust. One I've had particular success with is Bull Frog Rust Remover (www.Bull-Frog.com).

All you do is apply a layer of remover to the tabletop and let it soak in for about 15 minutes *(Top Photo)*. Then wipe the surface clean with a rag. It takes a rusty table down to a shiny, almost new surface.

For additional protection, spray the table with a sealant such as Bostik TopCote to prevent further rust *(Bottom Photo)*.

3 easy ways to REMOVE GROUT

Q *The grout on my tile countertop is crumbling and falling out in places. How can I remove the grout without damaging the tile?*

Randall Phillips
Trenton, NJ

A I select a tool for grout removal based on the size of the area I'm working on. The larger the area, the more powerful the tool I choose. Of the tools available for removing grout, three of the best options for doing it are shown at right.

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Grout Removal Solutions

▲ Grout Saw

This tool works great for a small job. Just place the tungsten carbide cutting edge on the grout line, apply pressure, and make straight strokes.

▲ Rotary Tool

For larger jobs, Dremel makes a grout-removal kit for rotary tools. Two guides keep the bit centered in the grout line as you pull it toward you.

▲ Rotary Saw

Dremel's kit for rotary saws cuts a wider grout line than the rotary tool kit shown above. And this kit can adjust to remove grout from corners.

Finishing Fundamentals

finish fix makes INVISIBLE REPAIR

Q *I scratched the surface of my dining table in a recent move. Now I lose my appetite looking at that awful scratch. Any tips on how I can fix it?*

Chris Cascalenda
Laguna Beach, CA

▲ A nasty scratch such as this one presents two refinishing challenges: First, matching the stain color, and second, duplicating the original finish.

A One of the greatest finishing challenges is matching a repair to the surrounding wood. The first challenge is matching the stain color, and the second is duplicating the original finish.

Stain the Scratch — If the scratch has penetrated the finish and changed the color of the wood *(Photo at left)*, then begin by restoring the color. The easiest way I've found to do this is by using a stain marker *(Fig. 1)*. Eight colors of stain markers are available from Minwax or Olympic. Sometimes, a combination of two colors will do the trick, so you may want to experiment on a scrap piece.

Replace the Finish — After letting the stain dry for four hours, the next step is repairing the finish. The idea is to carefully "paint" a fine line of finish directly on the scratch *(Fig. 2)*. Wipe off any finish that lands outside the scratch.

Match the Sheen — When the polyurethane dries (4-6 hours later), chances are the sheen of the repair won't match the table exactly. To address this, apply a thin layer of finish to the entire tabletop *(Fig. 3)*.

If you can still feel the scratch, lightly sand the area while the finish is wet to smooth it out *(Fig. 4)*.

After smoothing, take a cloth and remove as much finish as you can from the tabletop. The thin layer of finish that remains creates a nice, uniform sheen on the entire table.

Workbench and **Bruce Johnson**, Minwax finishing expert, are teaming up to answer your questions about finishing.

Send your finishing questions to:

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Email: editor@workbenchmag.com

Winners receive a **FREE** Minwax Finishing Kit!

▲ Once you find a color match, rub the tip of the stain marker along the scratch. Use a cloth to remove excess stain.

▲ When the stain has dried, use an artist's brush to apply Minwax Fast-Drying Polyurethane to the scratch.

▲ To match the sheen of the repair to the table, wipe a thin layer of Minwax Wipe-On Poly over the entire tabletop.

▲ With the finish still wet, gently sand the scratch with 600-grit sandpaper to smooth it. Then remove excess finish.

Tips & Techniques

high-capacity DUST SEPARATOR

Emptying the bag on a dust collector is a dirty job. That's why many woodworkers use a separator, a specialized plastic cover that fits on a trash can. It separates large chips and deposits them into the trash can so only fine particles go to the dust collector. Since the bag doesn't fill as quickly, you don't have to empty it as often.

These separators work okay, but they have one drawback. When the trash can is about two-thirds full, *all* the chips go to the dust collector bag, so it still has to be emptied fairly often. To solve that problem, I made my own high-capacity separator *(see Photo)*. It allows the trash can to fill completely with chips, so I don't have to empty the trash can — or the dust bag — as often.

The separator is a 20-gallon, plastic tub attached to a plywood mounting ring that sits on the trash can *(Illustrations, below)*. A smaller alignment ring, sized to fit inside the trash can, makes it easy to reposition the separator after you empty the trash can.

To connect the separator to the dust collection system, you'll need to remove the bottom of the plastic tub and add a plywood top. Two holes in the top hold metal pipe fittings that connect to flexible hoses. For an airtight seal, caulk around the fittings and attach self-adhesive weatherstripping to the large ring.

Mike Harris
London, Ontario

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For sending us his tip, Mike Harris wins a Black and Decker cordless tool kit!

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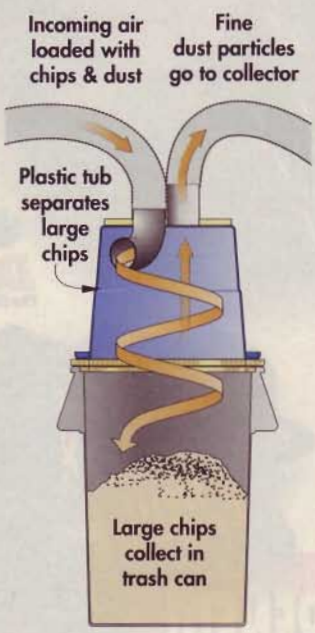

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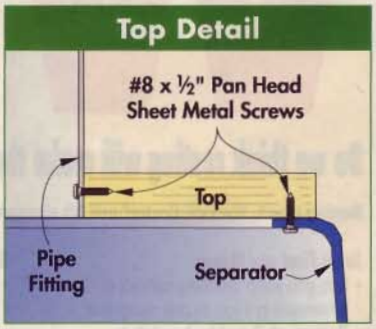

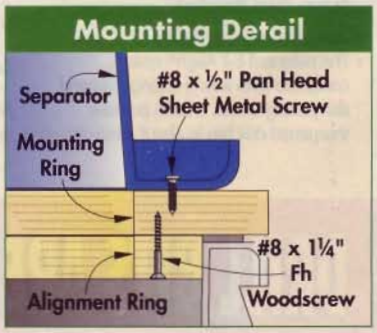

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All costs, expenses, and/or taxes associated with any element of the prizes not specifically addressed herein are the sole responsibility of the respective prize winners. The specifics of all aforementioned elements of any prize in the sweepstakes shall be solely determined by DIY. Prizes are awarded "as is", with no warranty or guarantee, either expressed or implied. Any and all warranties and guarantees are subject to the respective manufacturer's terms and conditions. Winners of the Grand Prize will receive a Form 1099. Prizes cannot be transferred, substituted or redeemed for cash except at DIY's sole discretion, in which case a prize of equal or greater value shall be awarded. All prizes will be awarded. **4. 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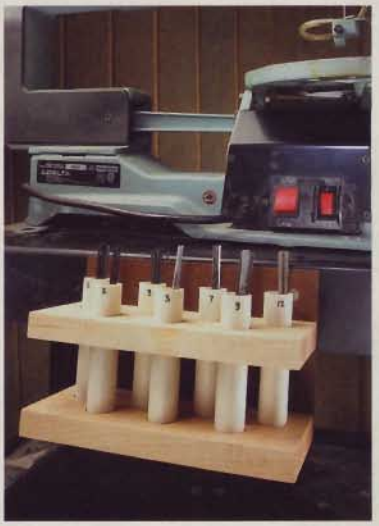
Product Information Number 274

Tips & TECHNIQUES

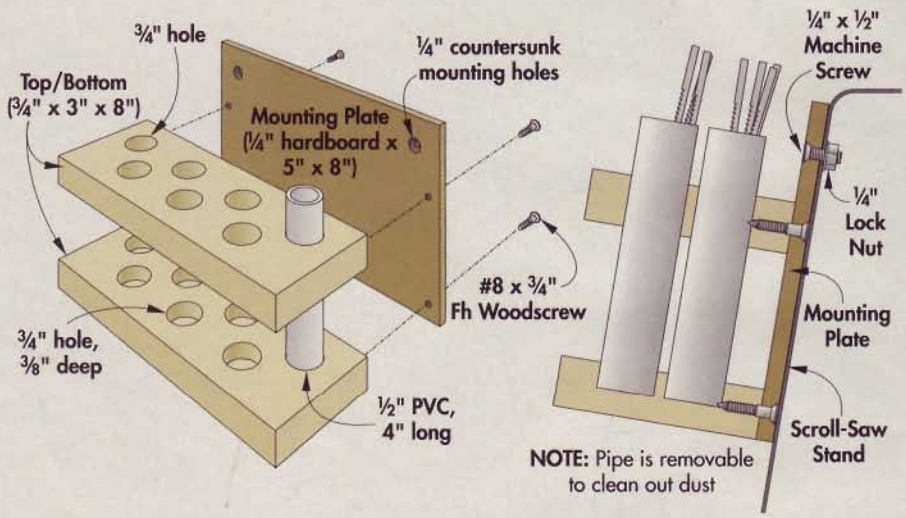
scroll saw BLADE STORAGE



To keep my scroll saw blades organized and in easy reach, I made a simple rack that attaches to my saw. Similar to a chemistry test-tube rack, the blades are "filed" in short lengths of PVC plastic pipe.

The pipe fits into holes in the top and bottom of the rack. To keep blades from falling out, "stop" the holes in the bottom piece. Then add a hardboard mounting plate.

Paul A. Turay
Sand Springs, OK

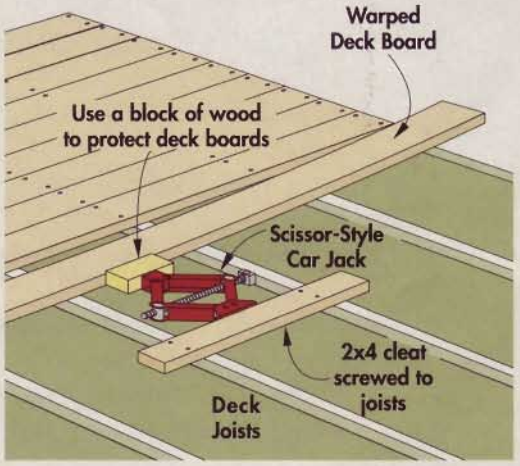


scissor-style car jack rescues WARPED DECK BOARDS

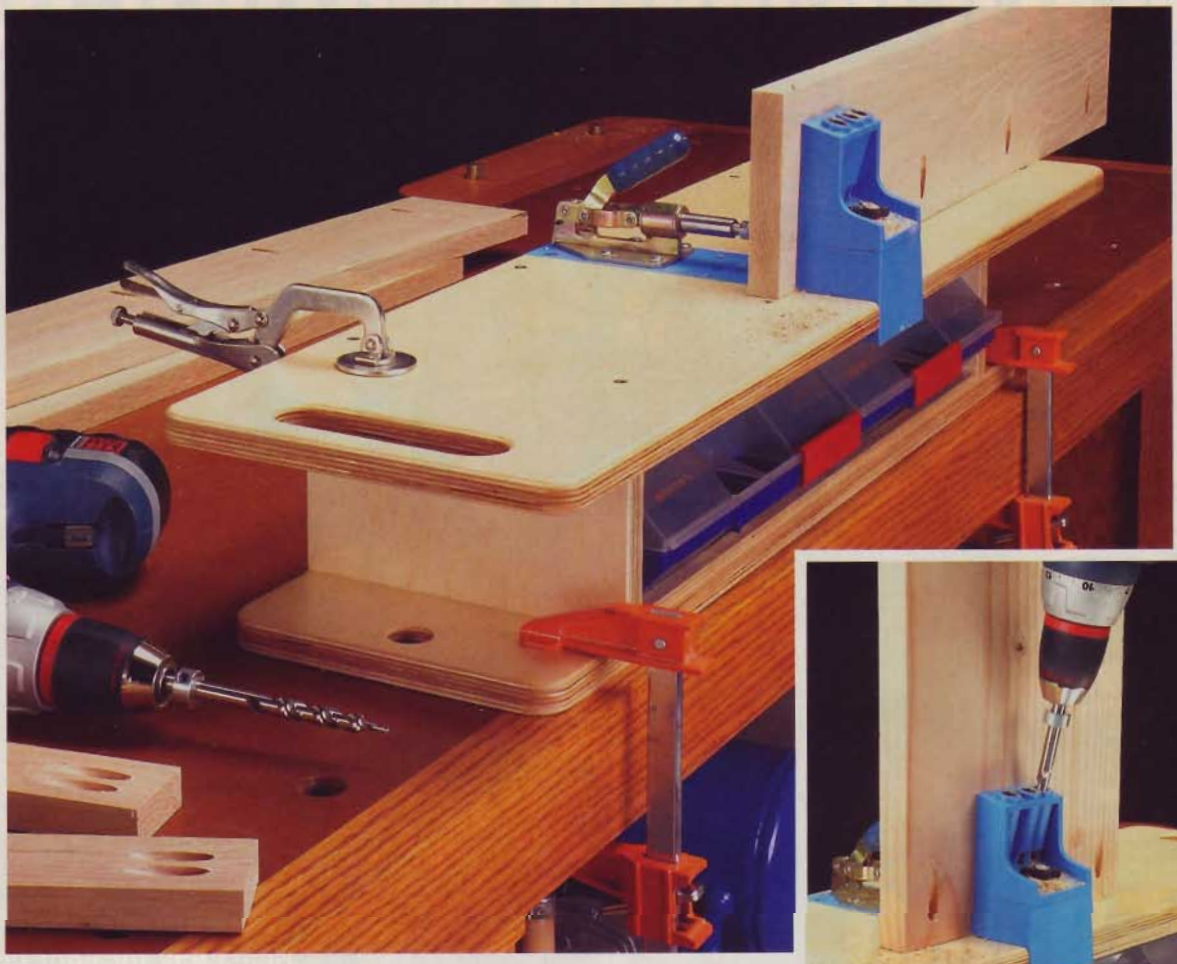
Try as I might to pick all straight deck boards for a project, a few inevitably warp before I'm ready to use them. However, it's possible to straighten a warped board — even when working by yourself — with the aid of a scissor-style car jack.

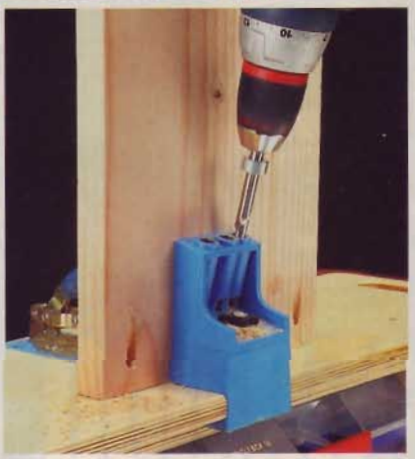
A 2x4 cleat screwed to the supporting joists allows you to exert enough force with the jack to straighten the board. Then screw the board in place.

Craig Huber
Marengo, IL



Note: As clever an application of mechanical advantage as this is, the jack will not do you one bit of good in the event of a flat tire unless you remember to return it to the car when you're finished with your deck project.





a workstation for POCKET JOINERY

It's hard to beat a pocket-hole jig for making strong, accurate joints —*and* for doing it *fast*. You simply clamp a workpiece in the jig, drill an angled hole (or holes, as the case may be), and screw the pieces together.

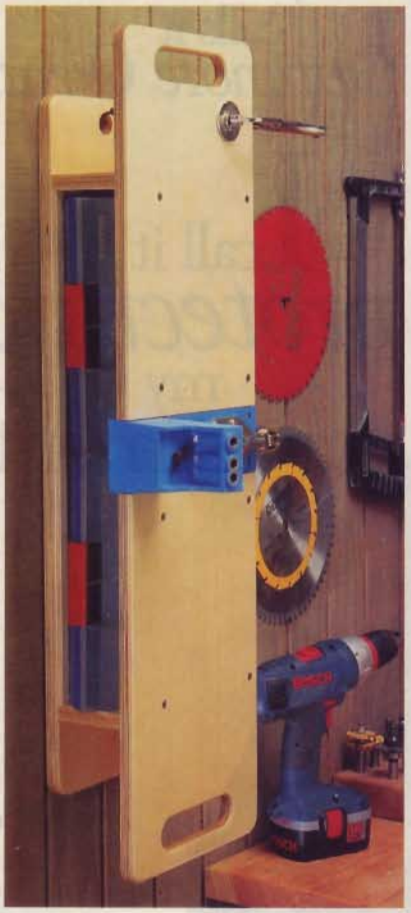
To make pocket-hole joinery even more efficient, Don Carlsen of Centennial, CO incorporated his jig into a simple workstation *(see Photo above)*. **Note**: The jig shown here is manufactured by the Kreg Tool Company (Model #K2). For a Kreg Tool dealer near you, visit their web site at KregTool.com

Side Supports — This workstation is particularly suited to handling large workpieces. That's because of a large "wing" on each side of the jig that provides plenty of support for long workpieces *(Photo, above)* and large panels *(Inset Photo)*.

Built-in Storage — Another handy thing about this station is a pair of plastic storage trays housed in a compartment below the worksurface. These trays keep drill bits, pocket screws, plugs, and all the necessary accessories at arm's reach *(Photo, right)*.

Portability — Finally, the entire workstation can easily be carried to the job site. A pair of handholds provide a comfortable grip. And once the job is completed, you simply stow everything in the station and hang it on the wall *(Photo, page 22)*.

▲ Plastic storage trays keep pocket-hole accessories organized. We purchased these trays (Akro-Mils #14316) from True Value Hardware.



▲ A mounting hole in the base of the workstation lets you hang it on the wall for storage. Wood stops keep the plastic trays from slipping out.

building the station

If you're building this workstation, it's a sure bet you already have the most important thing — a pocket-hole jig. To make assembling the workstation quick and easy, you can use the jig itself to create the joinery. It's also used as an alignment tool when building the workstation.

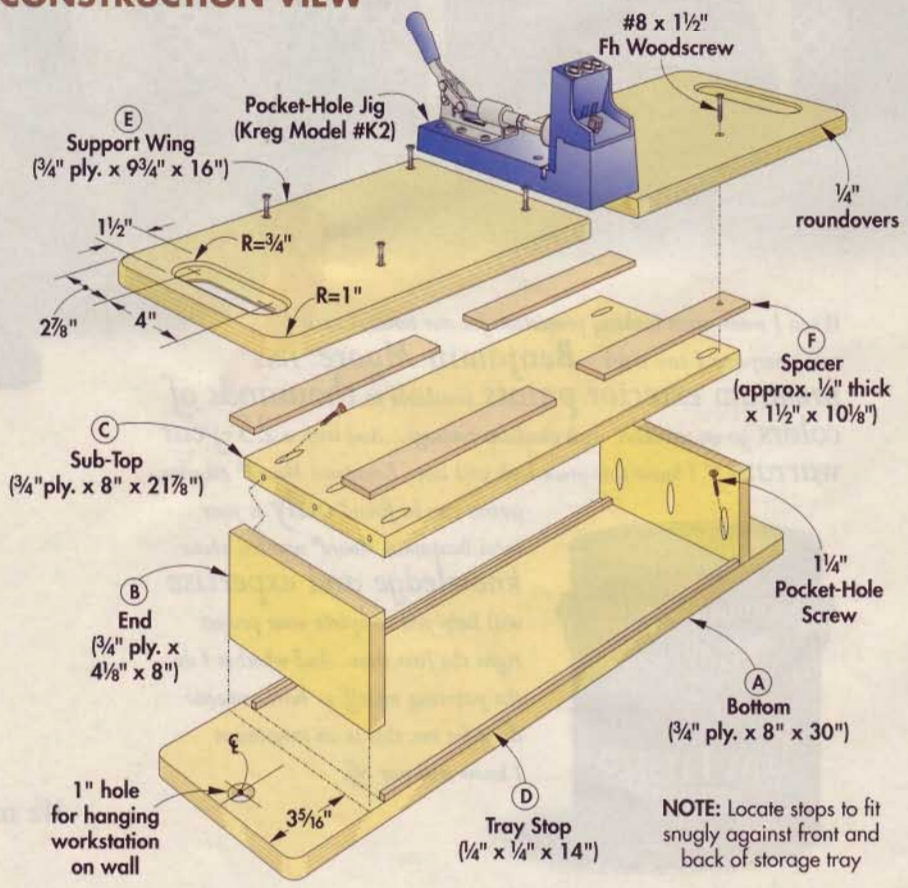
Build the Base — The first step is to build the base of the workstation *(Construction View)*. It provides the main support for the two wings and houses the plastic storage trays.

The base consists of a $^3/_4$" plywood bottom (A), two end pieces (B), and a sub-top (C). The ends and sub-top form an inverted U-shaped assembly that creates an opening for the trays. To make it easy to slide the trays in and out, size the opening so it's $^3/_8$" wider than the combined width of the trays. This provides $^1/_8$" clearance on the sides of the trays, and also between each one.

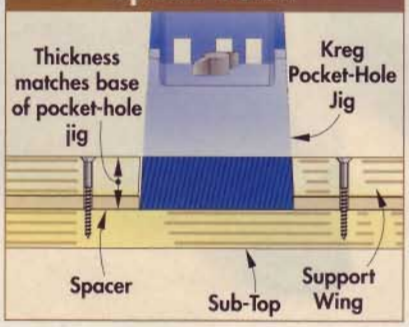
After cutting the base pieces to size, it's just a matter of drilling pocket holes and screwing them together *(Front View Detail)*. Then, to prevent the trays from slipping out when transporting the workstation, add a couple of stops (D). These narrow strips of wood butt against the front and back of the trays and are glued in place.

Support Wings — The next step is to add the two support wings (E). They "sandwich" the pocket-hole jig between them, forming a large, continuous worksurface. To end up with a flat, level surface, the wings must be flush with the jig base. A set of four spacers (F) elevate the wings to accomplish that *(Spacer Detail)*. Plane the spacers to the appropriate thickness. Then use the pocket-hole jig to position the spacers and glue them to the sub-top. In the same way, use the jig to position the wings and attach them with screws.

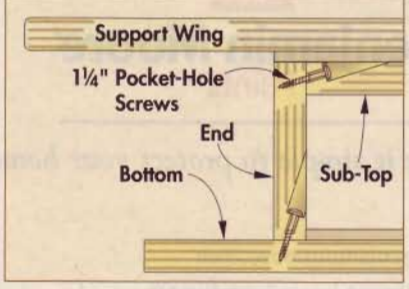
CONSTRUCTION VIEW



Spacer Detail



Front View Detail



TIPS FROM THE WORKBENCH SHOP

laying out an OGEE PROFILE

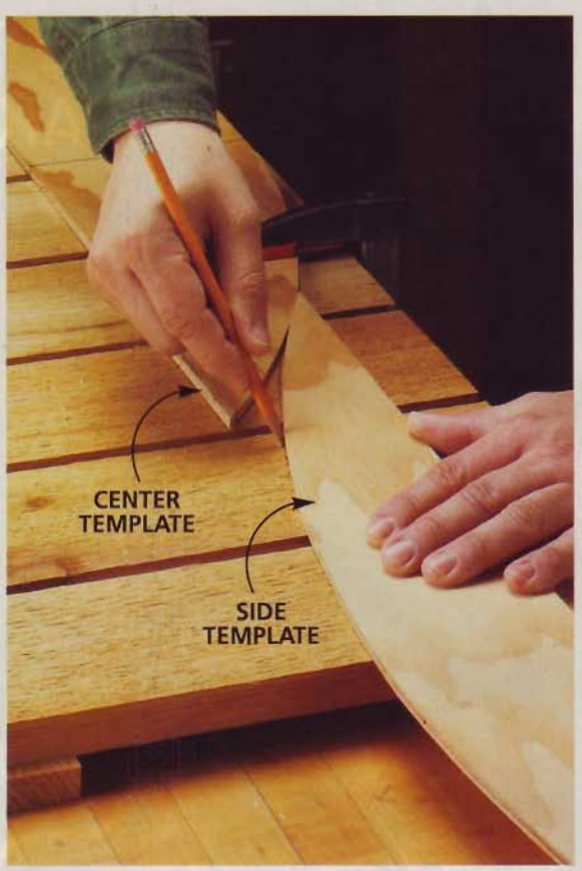
A cathedral arch, identified by its ogee profile (a double curve in the shape of an elongated 'S') is often used as a design element for cabinet doors, mirror frames, and headboards. It's also a distinctive feature on the back panel of our potting bench *(page 58)*. For appearance, the arch must be symmetrical. Therein lies the challenge — laying out a perfect ogee profile.

▲ When laying out the ogee profile for the cathedral arch on this potting bench, the trick is to use two templates. This will ensure a smooth curve.

Two Templates — To do that, I used two templates: one for the center of the arch and one for the sides *(see Photo at right)*. Since the curve is symmetrical, the side template is used to lay out each half of the arch.

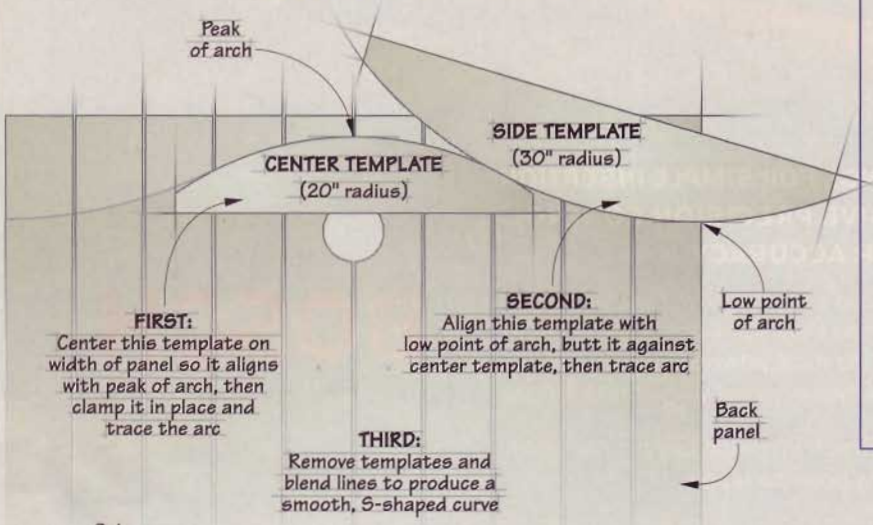
A template doesn't require any special material. I used 1/4" plywood, but hardboard or even posterboard would also work. The shape of the template is laid out using a narrow strip of 1/4" plywood as a compass *(Making a Template)*. Note that the distance between the pivot point of the compass (a nail) and the pencil is equal to the radius of the template. (The back panel of the bench requires a 20"-radius template for the top and a 30"-radius template for the side.)

Lay Out Arch — It's easy to lay out the arch on the back panel. Align the center template with the peak of the arch, clamp it in place, and trace around it *(Illustration, below)*. For the sides, lay out a line indicating the "low" point of the arch. Then align the side template with this mark, butt it against the center template, and trace the arc *(Photo, above right)*. Repeat this process on the other side of the panel. Then remove the templates and "blend" the lines together to produce a smooth curve.

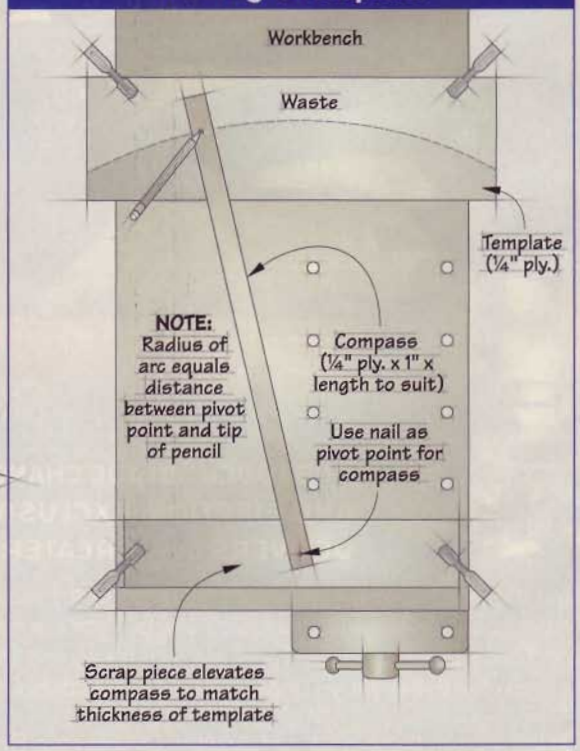


▲ Two templates make it easy to lay out a cathedral arch. Trace around the templates, then "blend" the lines together to form a smooth, symmetrical curve.

LAYING OUT THE ARCH



Making a Template



TIPS FROM THE WORKBENCH SHOP

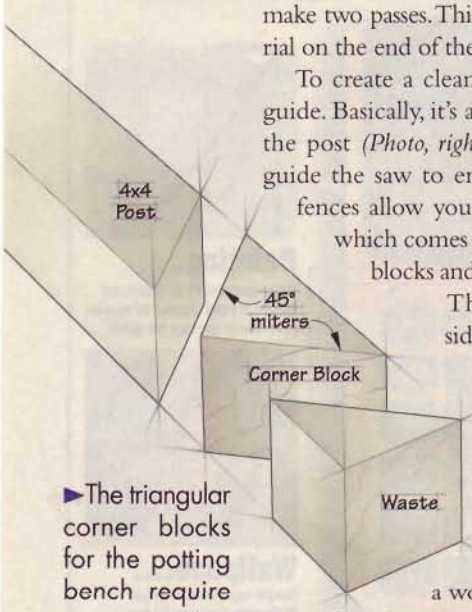
circular saw CUTTING GUIDE

Using a circular saw to crosscut a 4x4 post is a common operation. To cut all the way through the post, you have to make two passes. This often leaves a small ridge of material on the end of the post where the cuts aren't aligned.

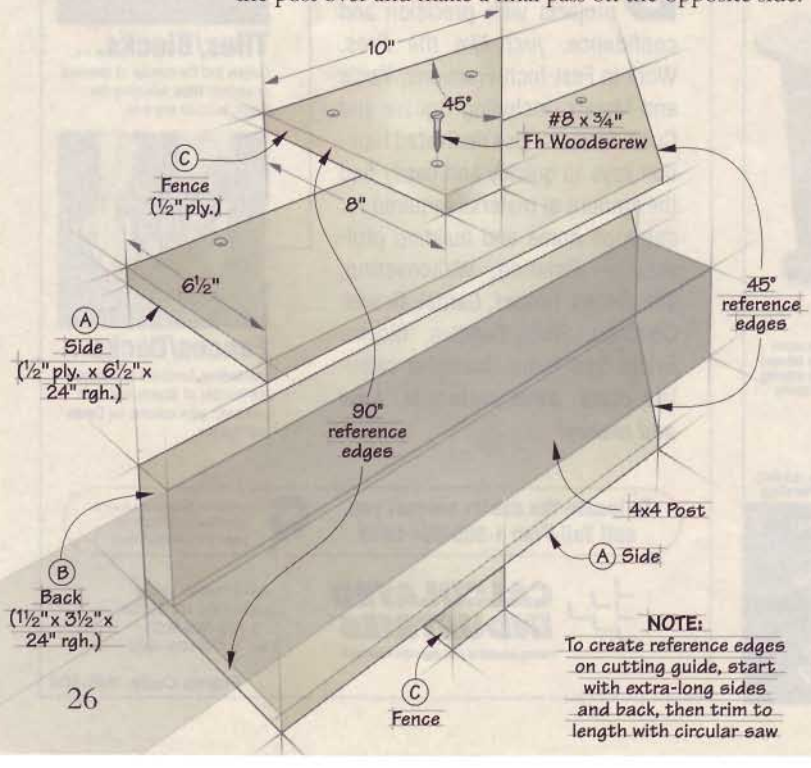
To create a clean, accurate cut, I use a shop-made guide. Basically, it's a U-shaped "saddle" that clamps to the post *(Photo, right)*. Two fences, one on each side, guide the saw to ensure perfectly aligned cuts. These fences allow you to make either 45° and 90° cuts, which comes in handy for cutting the 4x4 corner blocks and legs of our potting bench *(page 58)*.

The cutting guide consists of two sides (A), a back (B), and two identical fences (C), each with a 90° and a 45° edge. Start with extra-long pieces for the sides and back. They'll be trimmed to length later with the circular saw, forming reference edges that will be used to position the guide on a workpiece. Carefully lay out the locations of the fences on each side of the guide so they align with each other. Then attach the fences and trim the waste with a circular saw to create the reference edges.

To use the guide, align the appropriate reference edge with a layout line on the post, clamp the guide, and make a cut. Then, without removing the guide, turn the post over and make a final pass on the opposite side.



►The triangular corner blocks for the potting bench require accurate miter cuts — on both sides of a 4x4. Our shop-made guide makes that a simple task.



NOTE: To create reference edges on cutting guide, start with extra-long sides and back, then trim to length with circular saw

▲When using a circular saw to crosscut or miter a 4x4 post, this U-shaped cutting guide lets you make two perfectly aligned cuts — one from each side.

Miter & Crosscut

45° MITERS

To miter the thick corner blocks for the potting bench, slip the cutting guide around a 4x4 post. Then, using the 45° fence to guide the base of the saw, make two passes, one from each side.

CROSSCUTS

The cutting guide also simplifies the job of trimming the 4x4 legs of the potting bench to length. Only this time, after you clamp the guide to the post, use the 90° fence to guide the base of the saw.

TOOL Close-Up

MicroFence
ROUTER EDGE GUIDE

Humor me for just a moment and think of your router as a workhorse. In order to get anything out of your workhorse, you're going to need a good bridle. So to stretch this metaphor a little further, let me just say that MicroFence makes one of the best router "bridles" going.

The Micrometer Edge Guide System (MicroFence for short) is an incredibly precise, microadjustable router fence that delivers repeatability, accuracy, and versatility beyond conventional fences.

The version I evaluated is the MicroFence Total Package. This package includes everything for precise joint making and circle cutting in diameters from 6" to 24". It sells for about $260, which is in the low end of the $160 to $1,200 price range of MicroFence packages.

The more inclusive packages contain accessories for cutting ellipses, attachments that expand the circle-cutting range from as small as 1" in diameter to as large as 48", and various other attachments too numerous to list here. (Visit www.MicroFence.com to see the entire line.)

Straight Line Basics — One of the first places the MicroFence proves its worth is in the relatively simple operation of cutting rabbets and dadoes *(Photos at left)*. At some point, you've probably noticed that a ¾"-thick sheet

► Thanks to its precision *adjustment mechanism (Inset)*, the MicroFence takes the guesswork out of routing perfectly-sized dado joints. It's shown *Above* with a low-profile fence for routing dadoes at exact intervals.

Advanced Class: Inlays

When router work needs to be incredibly precise, such as when routing grooves for inlay work *(Fig. 1)*, the MicroFence's super-fine adjustment offers pinpoint accuracy.

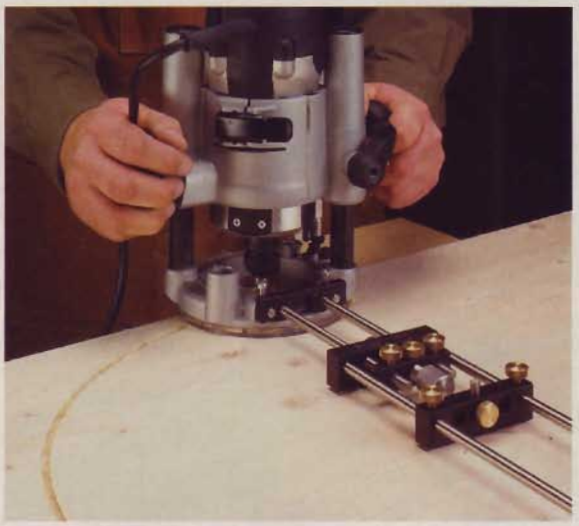
The best accuracy is achieved by using a router bit that's smaller than the desired width of the groove. After making a first pass with the undersized bit, use a dial caliper to measure the inside dimension of the groove *(Fig. 2)*. Then compare that to the width of the inlay material *(Fig. 3)*. Subtract the width of the groove (.250 in this example) from the width of the inlay material (.330). The difference (.080) tells you exactly how far to adjust the MicroFence.

of plywood isn't quite 3/4" thick, but a 3/4" straight bit really is 3/4". So if you cut a dado with a 3/4" bit, it will be slightly oversized for the plywood, resulting in a poor fit. The secret is to cut the joint in two passes with a bit smaller than the plywood (a 5/8" bit is a good choice).

With the MicroFence, adjusting the router for the second pass (the one that really counts) is a simple matter using the onboard microadjuster. The MicroFence is adjustable in increments of .001", so my approach was to "sneak up" on the settings until I found the perfect two-pass positioning. Once those were established, I set stop collars so I could quickly cut multiple dadoes. (The stop collars are a $25 accessory).

Circle-Cutting Basics —The circle-cutting ability of the MicroFence is one more way this system distinguishes itself from off-the-rack router fences *(Photo, top right)*. By attaching the circle-cutting jig to the MicroFence, circles ranging in diameter from 6" to 24" can be cut with the same laser-like precision.

Another interesting feature of the MicroFence is its ability to accurately follow irregular shapes (such as the curve shown in the *Photo* at right). For operations such as this, attach the half-round inserts that come with the basic kit *(Photo, right)*. The inserts provide two constant contact points for better directional control.

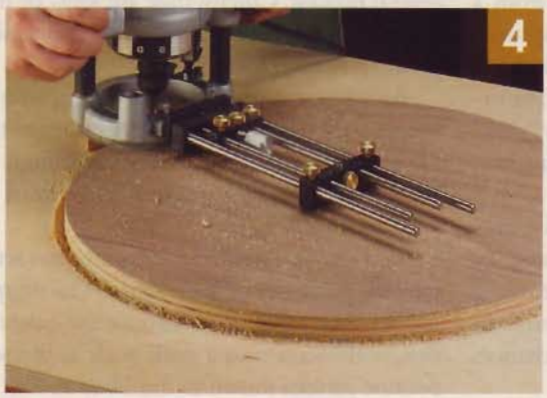


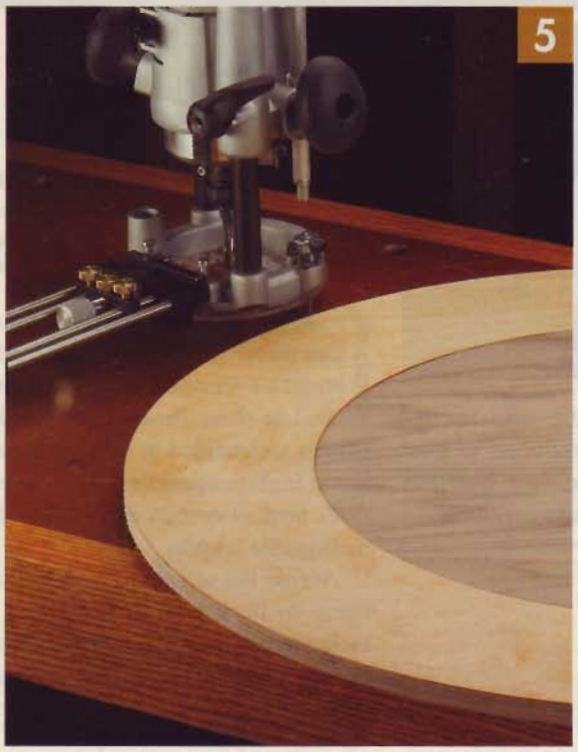
◄ The circle jig accessory kit turns the MicroFence into an incredibly accurate circle jig for diameters ranging from 6" to 24".

◄ Half-round inserts on the MicroFence make it capable of following contours, such as when routing a groove parallel to a curved edge.

Advanced Class: Circle within a Circle

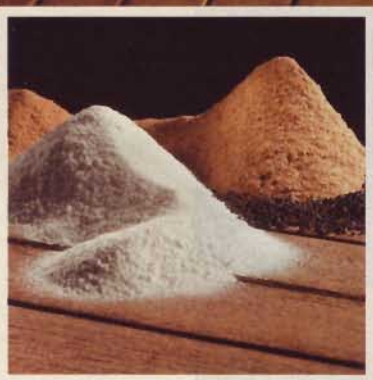
The MicroFence goes well beyond just everyday circle cutting with operations like circle-in-circle cuts. In this example, I cut a large ring from a sheet of maple plywood. After cutting the inner part of the ring, I used the microadjuster to increase the diameter of the setup by exactly the diameter of the router bit. Then I cut a final circle from a sheet of walnut plywood *(Fig. 4)*. The result was a seamless, two-part circular tabletop cut in a few simple steps *(Fig. 5)*.





COMPOSITES

WHEN PLASTIC MEETS WOOD



▲ Recycled plastic and recaptured wood are reduced to dust or pellet form and then blended to create composite products.

Photos courtesy of TimberTech (above) and Trex (top)

In the simplest of terms, composites are an alternative to natural wood made from a blend of recycled plastic and recaptured sawdust *(Inset Photo)*. These unlikely bedfellows are blended in roughly equal quantities at high temperatures. The molten "goo" that's formed is then extruded and cut into manageable lengths.

At first, this technology was applied exclusively to deck boards. Today, the category includes deck boards, handrails, balusters, fascia boards, molding, and even fence material. In short, whatever your outdoor project, chances are there's a place for composites.

Composites are an excellent choice for several reasons. Chiefly, they are low- or no-maintenance materials. In most cases, an annual cleaning is all that's required.

Another reason to select composites is longevity. Most manufacturers estimate the life expectancy of their product at around 75 years (interestingly, warranties range from 10 years to lifetime).

And one final argument for composites is the intrinsic flexibility of the material. This unique trait makes it easier to incorporate eye-catching design elements into a deck, such as the serpentine pattern shown in the *Photo* above.

Are All Composites CREATED EQUAL?

Dozens of composite products are currently available, but the offerings have as many differences as similarities.

Texture — Most manufacturers offer composites in at least two of the three common textures (smooth, brushed, and woodgrain, shown at far right). Some even offer reversible boards, which have woodgrain on one face and a brushed finish on the opposite face. The textures vary from one brand to another, so some brushed or woodgrain textures are more pronounced than others.

Color — Color selection also differs slightly from one brand to another. Generally speaking, most manufacturers offer their products in various shades of gray, tan (often marketed as "cedar" or "natural"), and reddish brown (most often called "redwood") *(Inset Photo)*. Gray is the most readily available color, though shades vary dramatically between brands.

Claims of colorfastness also differ widely. Some manufacturers tell us to expect the color to fade to gray after a few years, while others claim only minimal color fading.

Another color option is to use a composite that accepts paint. Again, there are significant differences to be aware of here. Some manufacturers say it's fine to paint their product; others expressly forbid it by voiding the warranty if their product is painted.

One product that deserves a specific mention here is Tendura Classics. This is a unique composite that *requires* paint and comes preprimed. While this is a bit of a compromise on the no-maintenance appeal of composites, it's still an excellent choice for a porch project where authentic or historical character is a high priority *(see page 38)*.

Solid or Hollow — Hollow composite products typically cost less and are lighter than solid composite products. But there are some trade offs to working with hollow composite products that you'll want to weigh *(Photos, below)*.

▲TEXTURE VARIETIES
Smooth, brushed, and woodgrain are the three basic textures of composites. Brushed and woodgrain textures vary in depth between manufacturers.

◄POSTS
Hollow composite posts (or sleeves) cost less than solid composite posts initially, but require an inner wood post, which adds to the cost.

DECK BOARDS►
Hollow composite deck boards are lighter than solid composite deck boards, but require an end cap for a finished appearance.

BEYOND Deck Boards

RUNNING WIRE ►
ChoiceDek's railing is easy to assemble and complete, right down to built-in wire chases for low-voltage lighting or outdoor speakers.

◄ WHITE RAIL
A *white rail is a nice* complement to any deck or porch. TimberTech offers the only 100% composite white railing.
(Photo courtesy of TimberTech)

A deck is much more than just deck boards. Skirting, molding, stairs, and of course, railing, are important components of a complete deck.

Composite Variety — Just how many of these design demands can be met with composites will depend on the brand you choose. Some composite companies offer only deck boards. Others have comprehensive product lines that include everything for a deck except the structural pieces.

The best example of a full line is Trex, which includes four types of deck board, five choices of fascia, risers, and trim, as well as a complete rail system that includes a couple choices each for balusters, handrails, and post caps. Trex also offers other outdoor elements such as landscape timbers and edging.

Running a close second to Trex in options available is GeoDeck. An example of a complete project utilizing GeoDeck composite products is shown in the *Photo* below.

Most manufacturers fall somewhere between the "deck board only" end of the spectrum and the full complement offered by Trex *(see the Buyer's Guide on page 37)*.

Railing — One decking element that deserves a closer look is the railing. The most basic composite railing systems include 2x2 balusters and use deck boards for handrails. By contrast, ChoiceDek's railing system uses specifically designed components, including a unique turned spindle, to create an attractive and easy-to-construct rail that will complement just about any deck *(Photos, upper left)*.

This railing also has wire chases built into the posts and handrails for concealing wire inside the railing system. This is a great feature if your deck design includes lighting.

One more railing that merits individual mention is TimberTech's Whitesand railing system *(Photo, middle left)*. This is the only one hundred percent composite white railing available. White rails offered by other companies are actually a PVC shell over a substrate of aluminum or composite. The high sheen of the plastic shell makes these much less attractive than the more natural appearance of TimberTech's product.

FASTENING Systems

In most cases, composites can be machined just like wood. One important difference is the fasteners used to install them.

Deck Screws — Conventional deck screws *do not* work well with composites. The coarse thread on deck screws tends to tear and lift the fibers of composites, which results in an unsightly "volcano" around the screw head *(Conventional Deck Screw Photo, below)*. Drilling pilot holes does little to eliminate these eruptions.

Composite Screws — Specially designed composite screws, on the other hand, eliminate this volcano effect. These screws have a length of coarse thread at the bottom and a section of fine thread at the top. This fine thread captures any "mushrooming" material and pulls it back down into the screw hole. *(Composite Screw Photo, below)*.

Composite screws also come in colors that match the various shades of composite materials *(Photos, left)*.

Hidden Fasteners — Another option is hidden fasteners. Most composites are compatible with the many hidden-fastening systems available from companies such as Eb-Ty, Grabber, Tiger Claw, and others.

Some composite manufacturers have gone one step further and designed a hidden-fastening system into their product.

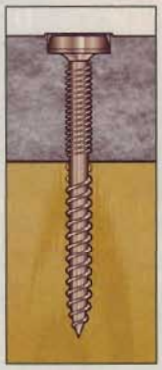
LifeLong Decking, for instance, uses a screw-and-clip system that nestles between the deckboards. Another example is Tendura Solids, which is pre-drilled for nailing through the tongue *(see Integral Hidden Fasteners, below)*.

Conventional Deck Screw

▲ Conventional deck screws tear the composite fibers and create a scar on the surface.

Composite Screw

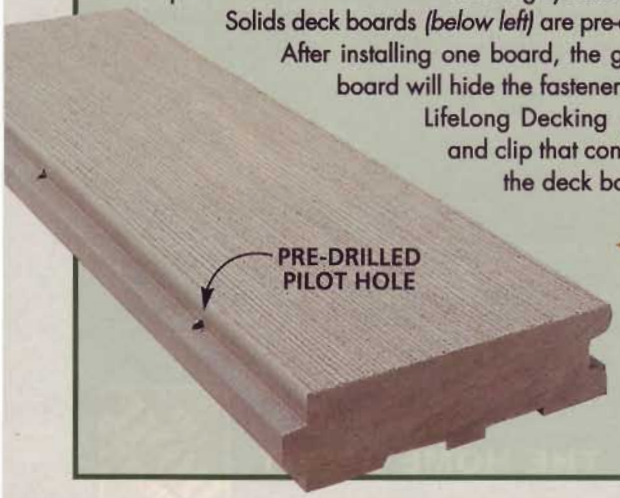
▲ Dual-threaded composite deck screws hide the torn fibers by pulling them into the screw hole.



Integral Hidden Fasteners

Hidden fasteners are an excellent way to ensure clean, blemish-free installation of deck boards. Shown here are two examples of composites that have a hidden fastening system built right in. Tendura Solids deck boards *(below left)* are pre-drilled at 4" intervals. After installing one board, the groove of the mating board will hide the fastener.

LifeLong Decking *(right)* uses a screw and clip that conform to the profile of the deck board.



◀ PRE-DRILLED
Tendura Solids' pre-drilled tongue makes for easy nailing and a cleaner finished look.

▲ HIDDEN CLIP
LifeLong Decking's screw-and-clip system is a secure hidden-fastening system that also provides uniform spacing.

How To CHOOSE MATERIALS

Given all this information on composites, and particularly the differences that exist between these seemingly similar products, choosing the composite that best suits your needs may seem like an overwhelming task. The best advice I can offer is to apply an organized process of elimination.

Design First — The first step is to design your deck just the way you want it, without regard to whether or not there are composites available to do everything you hope to. Later in the process you can decide whether you want to make any compromises to your design to accommodate composites.

Shop Around — Next, and this is where the elimination begins, you'll need to determine which composites are available in your area. Although this is a rapidly growing category, you'll find that many of the products listed in the *Buyer's Guide (page 37)* just aren't available in your region.

Check the Features — Having shortened the list to products you know you can get, you're ready to start comparing product lines to your design. The first thing you'll want to consider is the completeness of the available composite lines. If your deck includes a matching railing, you might want to eliminate the products that don't offer composite railing systems.

Likewise, if you can't find the color, colorfastness, or texture within a given product line, then you can probably eliminate them from the short list. Also keep in mind that some products allow painting, and one in particular requires it. Are you okay with the occasional maintenance this entails, or do you prefer to "build it and forget it?"

Be sure to consider how you'd like to construct the deck. For example, would you save money by using deckboards that span 24" instead of 16"? And is it important to you that you be able to use hidden fasteners?

Compare Warranties — You'll also want to compare the warranties offered on the various products. Longer is better, obviously. But if you foresee selling your home, a warranty that can be transferred to the new owner might be a valuable selling point.

Mix and Match — As you apply this criteria, consider where you are willing to compromise. For instance, if you must have the authentic wood look offered by EverGrain, but want a fancier railing than they offer, are you willing to use a wood rail? Or perhaps you can partner EverGrain deck boards with the railing system from another manufacturer.

Hopefully these guidelines will get you close to finding the product or combination of products to construct exactly the project you desire. And having chosen to use composites, you're not likely to have to make this decision again in your lifetime.

Contact Information

Boardwalk
www.CertainTeed.com
800-782-8777

ChoiceDek
www.ChoiceDek.com
800-951-5117

CorrectDeck
www.CorrectDeck.com
888-290-1235

EverX
www.UFPI.com
608-326-0900

EverGrain
www.EverGrain.com
800-405-0546

GeoDeck
www.GeoDeck.com
877-804-0137

LifeLong Decking
www.BriteMfg.com
905-857-6021

NexWood
www.NexWood.com
888-763-9966

Tendura
www.Tendura.com
800-836-3872

TimberTech
www.TimberTech.com
800-307-7780

Trex
www.Trex.com
800-289-8739

WeatherBest
www.WeatherBest.com
800-343-3651

Buyer's Guide

Which one is right for you?

		Boardwalk	ChoiceDek Classic	ChoiceDek Plus	ChoiceDek Premium	CorrectDeck	Everex	EverGrain	GeoDeck	Lifelong Decking	Nexwood	Tendura Classics	Tendura Solids	TimberTech	Trex	WeatherBest
AESTHETICS	Colors	G,T	R,T	G,T	G,T	ALL	G,T	R,G,T	G,T,B,	G,T	R,G,T	NA	G	R,G,T	ALL	R,G,T
	Textures	S	S	B	B,W	W	B	W	B	B	B	B	B	B,W	S,W	B,W
	Paintability	Y	Y	Y	Y	Y	Y	N	Y	N	N	R	N	Y	Y	Y
DECKING	1x4, 1x6							◆				◆	◆		◆	
	5/4x6	◆	◆	◆		◆	◆		◆	◆				◆	◆	◆
	2x6									◆	◆			◆	◆	
FASCIA, RISERS, TRIM COMPONENTS	Ogee Nosing											◆	◆			
	Half Round											◆	◆			
	Quarter Round											◆	◆			
	Corner Moldings													◆		
	End Cap													◆		
	2x3 Trim Rail										◆					
	2x4	◆					◆	◆			◆				◆	◆
	2x6	◆						◆						◆	◆	
	1x4, 1x6, 1x8														◆	
	2x8, 2x10														◆	
	1/2x10	◆												◆	◆	
	1/2x12					◆		◆						◆		
	1 3/8 x 1 3/8 Balusters														◆	
RAILING COMPONENTS	2x2 Balusters	◆	◆	◆		◆	◆	◆	◆		◆				◆	◆
	Spindles		◆	◆												
	Flat Handrail	◆	◆	◆			◆				◆				◆	
	Decorative Rail		◆	◆		◆			◆					◆	◆	◆
	Solid Posts	◆	◆	◆		◆									◆	
	4x4 Post Sleeves						◆		◆	◆	◆			◆		◆
	6x6 Post Sleeves								◆							
	Post Caps	◆	◆	◆			◆		◆	◆				◆	◆	◆
	Post Skirts	◆	◆	◆					◆						◆	◆
OTHER	3x6, 4x6 Timbers														◆	
	1/2 x 4 Edging														◆	
	Warranty	10	20	20	L1	25	20	10	20	10	10	L2	L2	10	10	10

User Key

Colors
R=Redwood
G=Gray
T=Tan
B=Brown

Textures
S=Smooth
B=Brushed
W=Woodgrain

Paintability
Y=Yes
N=No
R=Required

Warranty
10, 20, etc.= Warranty (yrs.)
L1=Lifetime (transferable)
L2=Lifetime (orig. purchaser)

658

perk up a PORCH

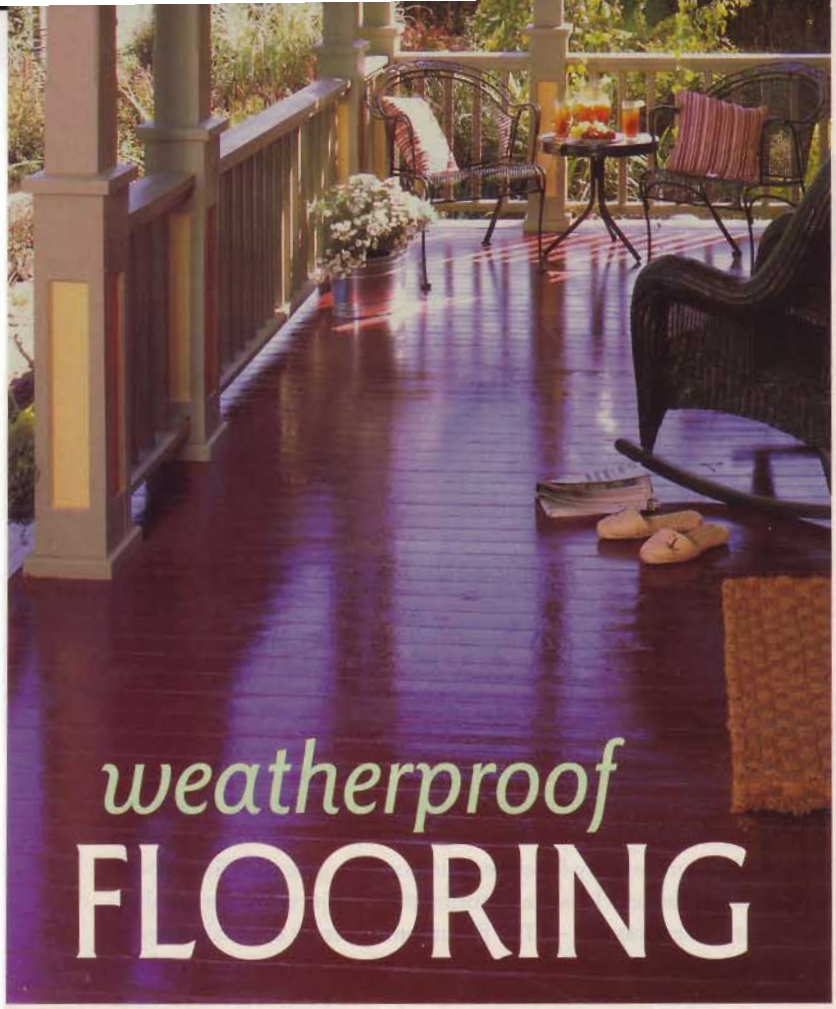
3 simple ways to improve your home's curb appeal

Nothing says "welcome" like a front porch — unless it happens to be an old porch that has fallen into disrepair, or one of those tacked-on afterthoughts with spindly posts you sometimes see on newly constructed houses. One sure remedy for either situation is to give your front porch a "facelift." In this article, we're featuring three projects that do just that.

Composite Flooring — The first improvement is to install tongue-and-groove flooring made from a durable, low-maintenance, weather-resistant composite material. And the best part of all — it looks just like old-fashioned porch flooring. *(See article beginning on page 40.)*

Post Cladding — The second upgrade is to add cedar cladding to "beef up" the 4x4 posts that are typical on many porches. This will make them look more like architectural porch columns *(page 42)*.

Porch Railings — Finally, we explain how to build a simple railing and add decorative trim that integrates it into the columns *(page 44)*.



weatherproof FLOORING

One dramatic improvement you can make to a front porch is to install new flooring. For this project, I wanted to re-create the feel of an old-fashioned porch. If you look at the *Photo* at left, I think you'll agree this painted flooring gives it that warm, inviting appeal of yesteryear.

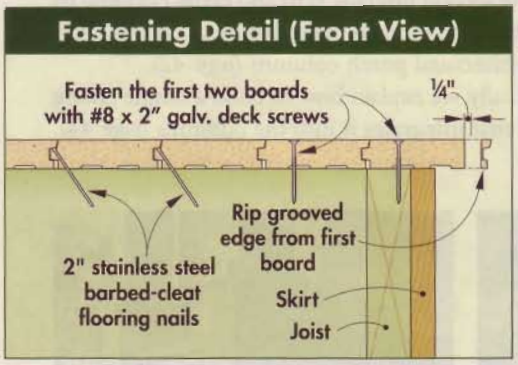
A Solid Foundation — Aesthetics aside though, the floor must be solid without any "give" when you walk on it. That stability comes from the footings and framing beneath the porch *(Illustration, below)*.

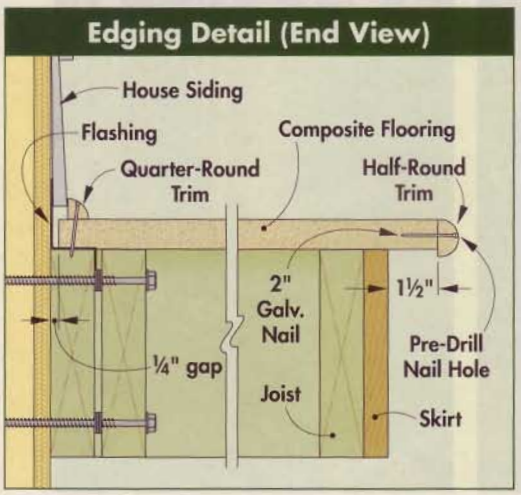
If you're working on an existing porch, you'll have the perfect opportunity to examine these structural elements firsthand — after you tear off the old flooring. To shore up the framework, you may have to replace rotting boards, add bridging to take the "bounce" out of the floor, or perhaps "sister" a new joist to one that's sagging.

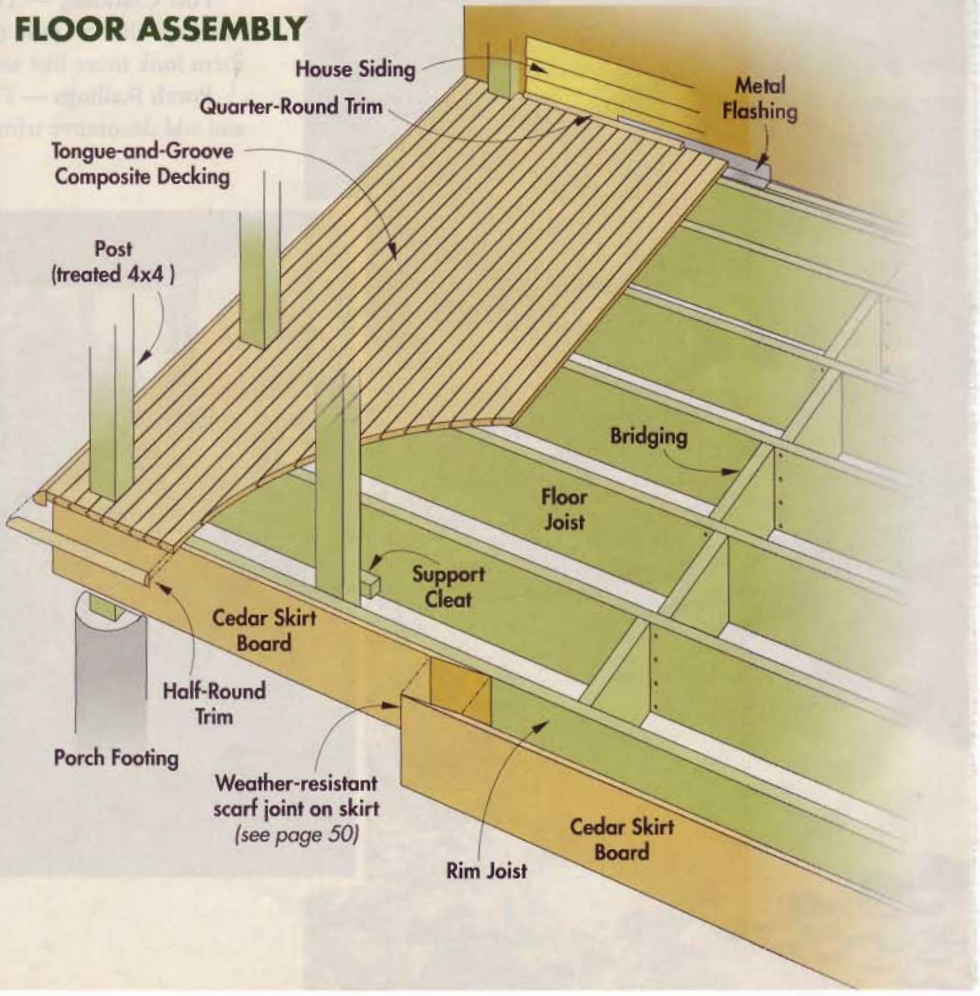
Depending on the condition of the porch, you may want to hire a contractor to do this work. That's also a good idea if you're adding a new porch, as building the structure of a porch can be a fairly complicated process.

Installing the Flooring

That will free you up to concentrate on the most visually appealing elements of the porch — like the flooring. On this porch, the flooring runs perpendicular to the house *(Illustration, below)*. In a nod to the olden days (and to ensure a rock-solid installation), I used tongue-and-groove flooring. But not just any old tongue-and-groove flooring, mind you.







To minimize maintenance and create a durable, weather-resistant surface, I used a composite material called Tendura Classic *(Photo, right)*. It's a mixture of wood fibers and plastic (hence its longevity), which you'd never guess by looking at it. Tendura looks so much like traditional wood flooring that it's actually used for historical restorations. That made it ideal for this project. *(See page 30 for more information about composites.)*

Starting Square — The key to making sure the floor will be square to the front of the house is to carefully lay out the the first strip of flooring. If it isn't square, the rest of the boards will also be "off," compounding the problem as you work your way across the porch. The *Box* below outlines a simple method for starting off square.

Before installing the first board, you'll need to rip the groove from the edge of the piece *(Fastening Detail, Front View)*. This produces a square edge, to which you will later attach a half-round trim piece.

As for the length of the board, there are two things to consider. First, to allow for expansion (yes, even composite material expands), you'll want to leave a 1/4" gap between the end of the board and the house. It's also a good idea to allow for an ample overhang on the front of the porch *(Edging Detail)*. This way, if the porch framing is out of square, the overhang will make any discrepancy less noticeable.

With that in mind, position the board so its cut edge overhangs the side of the porch. This board and the one that's installed next are simply face-fastened with screws, creating a solid backstop for subsequent pieces.

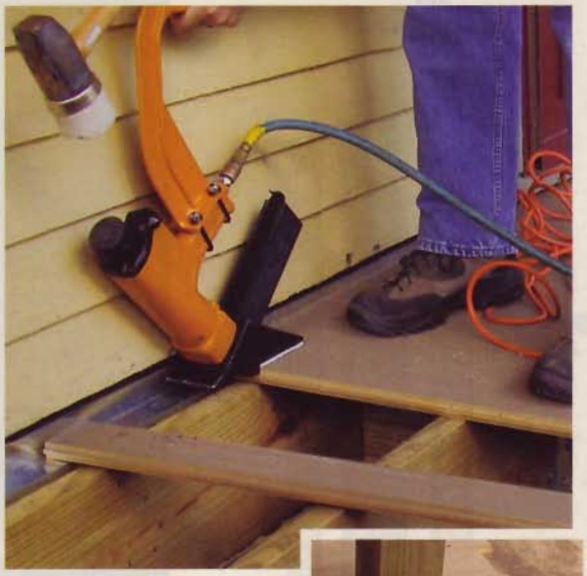
A Tool You'll Need — To install most of the remaining flooring, I rented a pneumatic floor nailer *(Photo, right)*. It drives a fastener at a 45° angle through the tongue and into the joist. To operate it, set the nailer right on the flooring, and then strike the plunger with a mallet.

Using the nailer, installing the boards should go smoothly and quickly. As you work your way across the porch, some boards will have to be notched to fit around the posts. Here, a wood cleat will help support the flooring *(Inset Photo)*.

When you get to the opposite end of the porch, rip the tongue off the last board (again, for the half-round trim). As before, face-fasten the last two boards. Then attach a half-round trim piece on the three sides of the porch perimeter and a strip of quarter-round next to the house.

Just Finishing — To finish off the floor, I painted the Tendura, which came pre-primed. It's important here to use the type of paint recommended by the manufacturer.

▲ For a durable, low-maintenance surface, we used a pre-primed composite called Tendura Classic for the tongue-and-groove flooring and half-round trim.



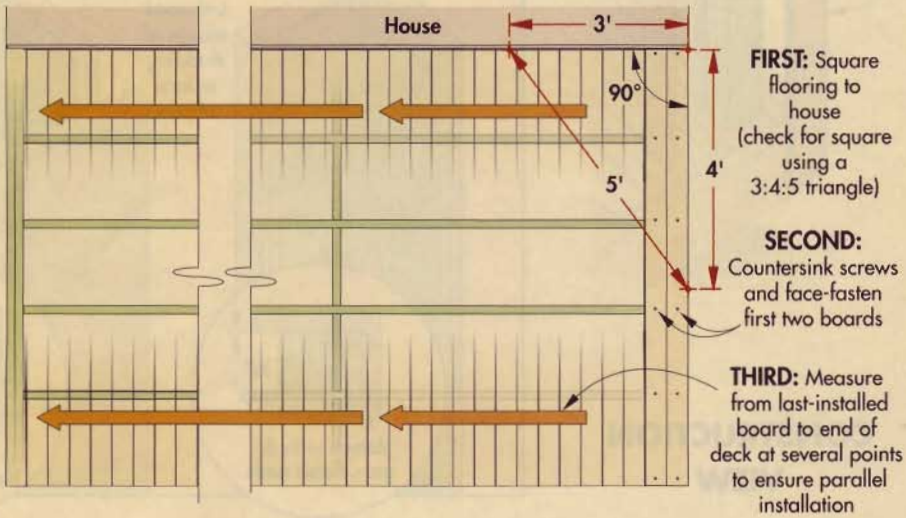
▲ A floor nailer *(above)* drives nails at an angle into the tongues of the flooring. A cleat attached to the post *(right)* supports notched boards.

start square — stay square

To square the first flooring board to the house, I used the concept of a "squaring triangle." It's based on the fact that a triangle with a 3:4:5 ratio will yield a perfectly square 90° angle in one corner.

Start by laying out two "legs" of a triangle (one 4' and one 3' from the corner of the porch). If the distance between these points is 5', the board is square.

After installing about every three or four boards, measure between the last board and the end of the porch at several points along the board. The measurements should be the same. If not, make a *very* small adjustment in the next board.



cedar-clad COLUMNS

Typically, 4x4 pressure-treated posts are used to hold up a porch roof. They're strong enough for the job, but they just look skinny. One way to achieve a more proportional look is to wrap the posts with 3/4"-thick cedar boards. That is, to *clad* the posts.

To clad the posts on this porch, I used a three-step process that involves cladding the lower posts, adding a decorative mid-cap, and installing the upper cladding *(see Illustration at left)*.

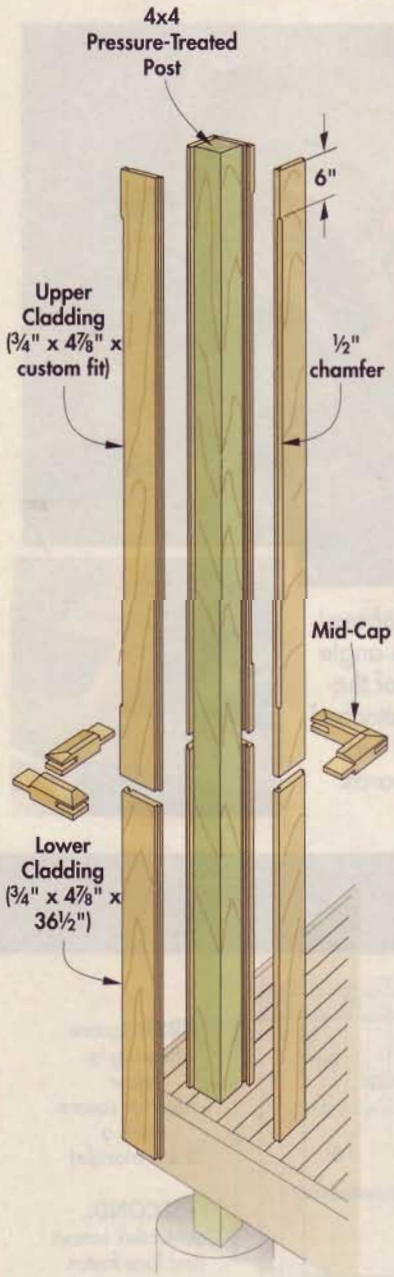
Locking Rabbet Joints — The cladding is assembled with locking rabbet joints. This is a strong, durable joint that, when glued with exterior glue, stands up to the worst weather. (The technique for making locking rabbet joints is explained on page 47.)

Start with Lower Cladding

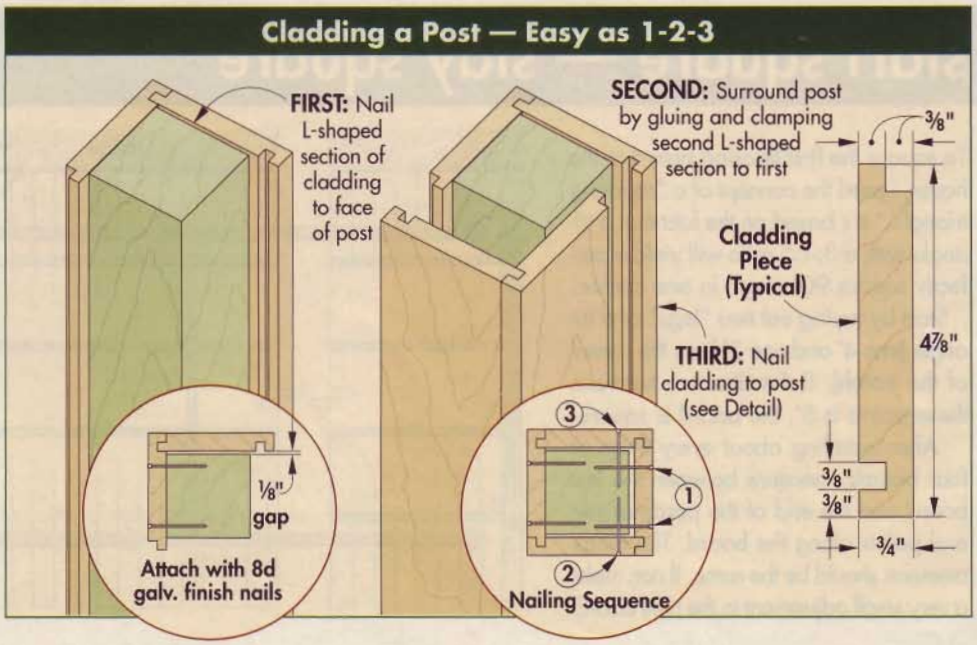
Essentially, the cladding is a "box" that's built around the post. For easy assembly, it's built in two L-shaped sections that fit around the post.

The size of this box is important. You don't want it to fit too tightly around the post. If the post twists, the joints — strong as they are — could "blow" apart. The solution is to build in a "fudge factor" — that is, a gap between the box and the post to accommodate possible post movement.

Most of the cladding work is done in the shop. Using the dimensions shown in the *Illustration* below, go



CONSTRUCTION VIEW



ahead and rip the cladding pieces to width ($4\frac{7}{8}$" in my case) and crosscut them to length ($34\frac{1}{2}$"). Next, cut the locking rabbet joints, as explained on page 47. Then, make each of the two L-shaped halves by gluing two pieces of cladding together.

At this point, you're ready to transport the cladding to the job site and install it. This is a simple, three-step process *(Cladding a Post, page 42)*.

Just a note here. To ensure that the porch railings will align with each other once they're installed, the *face* of the post to which you attach the first L-shaped section of cladding is important. This face is, in a sense, your "true north." The idea is to attach that first L-shaped section to that same relative face on each post.

Add the Mid-Caps

To create a visual "break" between the upper and lower cladding, I added thick mid-caps to the posts. Each mid-cap is a frame made of $1\frac{1}{2}$"-thick cedar *(Mid-Cap Assembly)*. Like the cladding, the idea is to make two L-shaped sections, and then assemble them around the post.

Once again, making mid-caps that would withstand the weather was high on my priority list. So this time, I used open mortise and tenon joints to assemble the mid-caps *(see page 48 and detail at right)*.

To shed water, the mid-caps are beveled on their upper face. Cutting these bevels is easiest to do if the mid-cap is completely assembled. The problem is the two L-shaped sections of the mid-cap have to fit around the post, so you can't actually assemble it until you're at the job site.

The solution is to glue two pieces together to form the L-sections, and then temporarily join the two L-sections with screws. *(Fig. 1, below)*. Be sure to keep the screws out of the path of the saw blade. But just in case, it's best to use brass screws. That way, the blade won't get damaged if it accidentally nicks one of the screws.

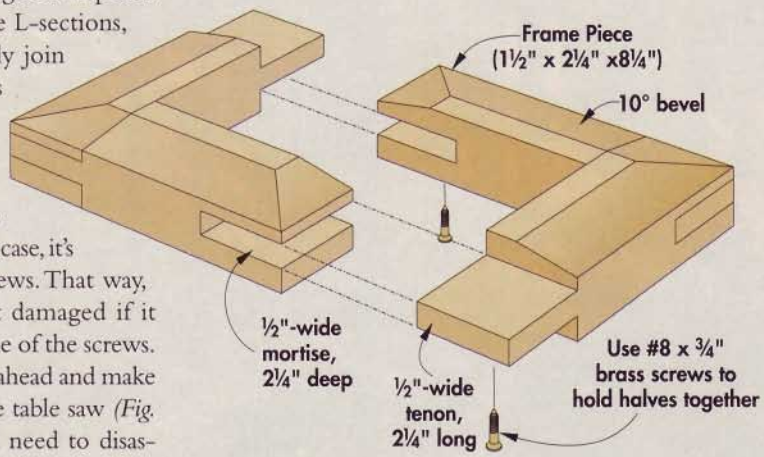
Now you can go ahead and make the bevel cuts on the table saw *(Fig. 2)*. Of course, you'll need to disassemble the mid-caps before installing them on the posts *(Fig. 3)*. After gluing the halves together, simply toenail them to the post *(Photo, page 40)*.

Install Upper Cladding

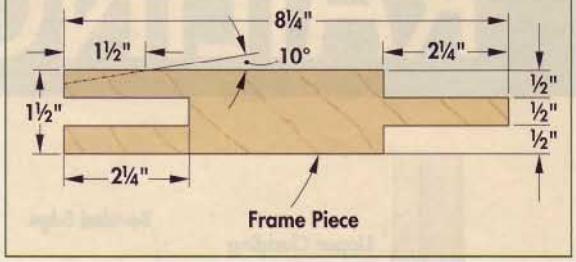
The final stage of converting a porch post to a column is to install the upper cladding above the mid-cap.

It's almost identical to the lower cladding: $\frac{3}{4}$"-thick cedar, locking rabbet joints, and L-shaped sections that wrap the posts. The only difference is that here, I routed a decorative chamfer on all four edges. This detail isn't added to the lower claddings because trim pieces will cover those corners once the railings are installed.

MID-CAP ASSEMBLY



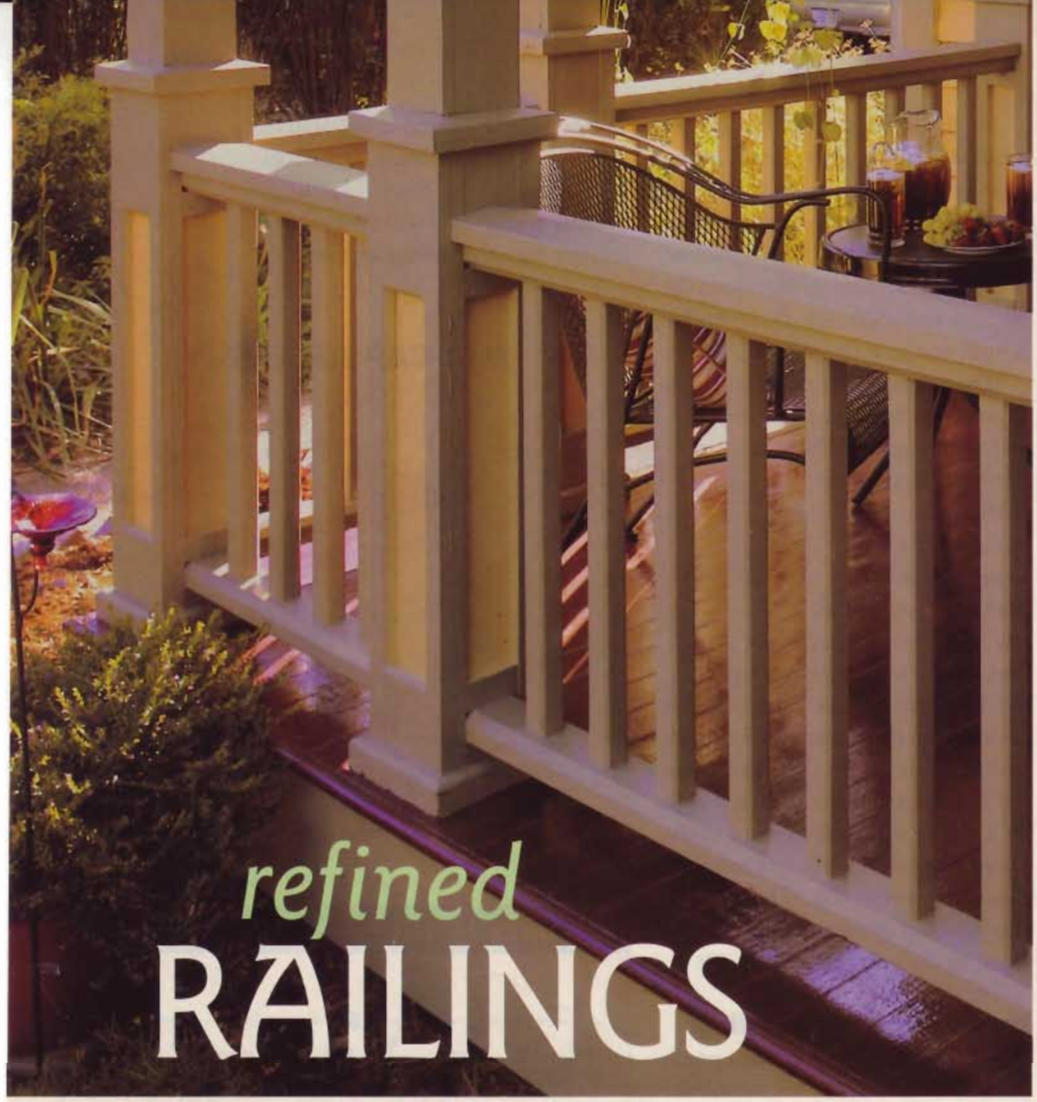
Open Mortise and Tenon Detail



▲ In order to cut the bevels on the top face of each mid-cap, temporarily assemble the two unglued joints with *brass* screws.

▲ Once the mid-cap is assembled, tilt the saw blade 10°. Then, after attaching a tall fence and featherboard, make a beveled cut on all four faces of the mid-cap.

▲ To install the mid-cap, remove the screws to separate it into the two L-shaped sections again. Then apply exterior glue, fit the sections together, and clamp the joints.



refined RAILINGS

A porch railing is required by most building codes. Therein lies a dilemma: How do you construct a protective barrier that looks and feels more like a friendly leaning rail?

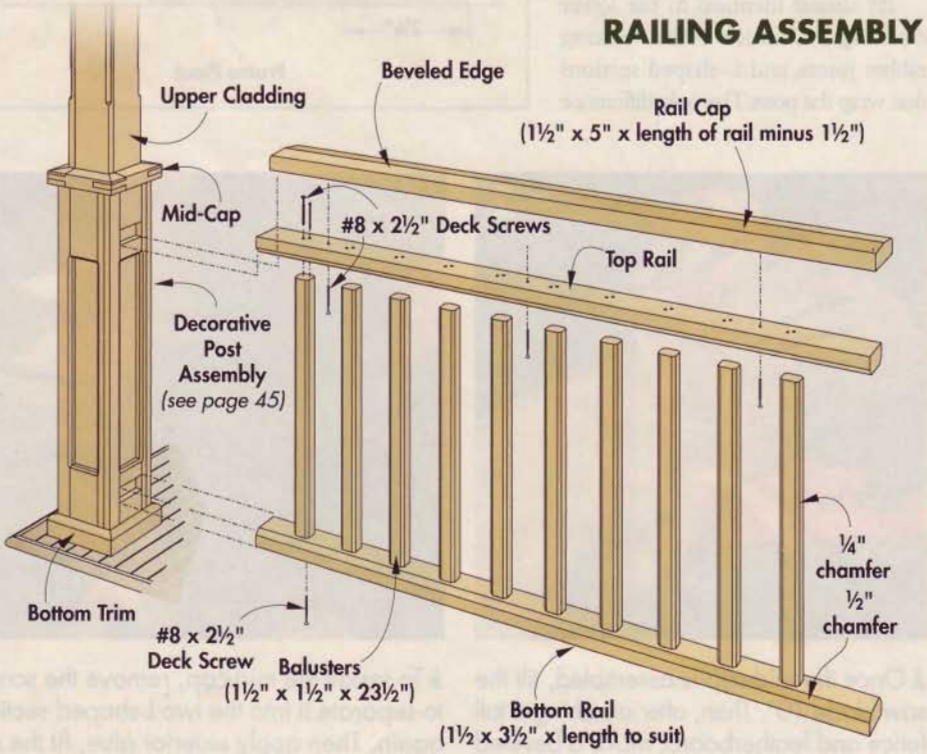
This cedar railing does that well. As you can see in the *Photo* at left, it has a simple, straightforward design. Combined with some simple trim pieces, the railing integrates quite nicely with the porch columns.

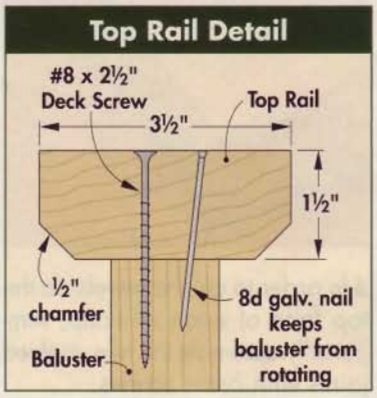
Railing Basics

The *Illustration* below provides a quick overview of the railing. Note how the upper and lower rails (2x4s) are connected by 2x2 balusters. A 2x6 cap provides the crowning touch.

Rails — Cut the rails to length to match the distance between the columns. As a decorative detail, I routed a 1/2" chamfer in the bottom edges of the upper rail and top edges of the lower rail *(Top Rail Detail)*.

Balusters — As for the balusters, it's just a matter of cutting them to length. Here, routing a 1/4" chamfer on all four edges helps to "soften" the look of the balusters. The top and bottom ends of each baluster are fastened to the rails with a screw and





a nail. The screw makes for a solid connection, and the nail prevents the balusters from rotating.

Rail Cap — Although it's installed after the trim blocks, there's no reason the rail cap can't be made in advance. It's $1\frac{1}{2}$" shorter than the rail below it because the cap fits against a $\frac{3}{4}$" trim piece on each end. Wide bevels cut in the top face of the rail cap provide a comfortable hand rest *(Photo, right)*. And grooves routed in the bottom create a drip edge.

Time for Trim

Once the railings are constructed, it's time to install them on the porch. This is where the trim pieces I mentioned earlier come into play.

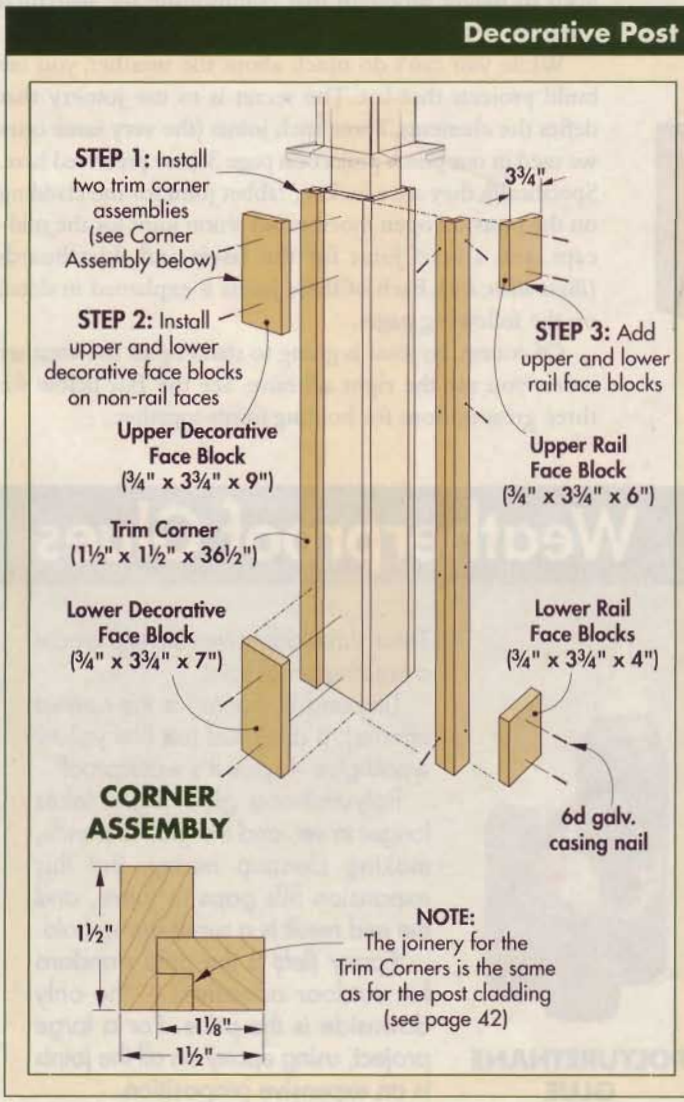
The trim pieces do two things. First, they add depth to the lower part of the column. And second, they capture the ends of the railings, providing a solid connection with the columns *(Railing Assembly, page 44)*.

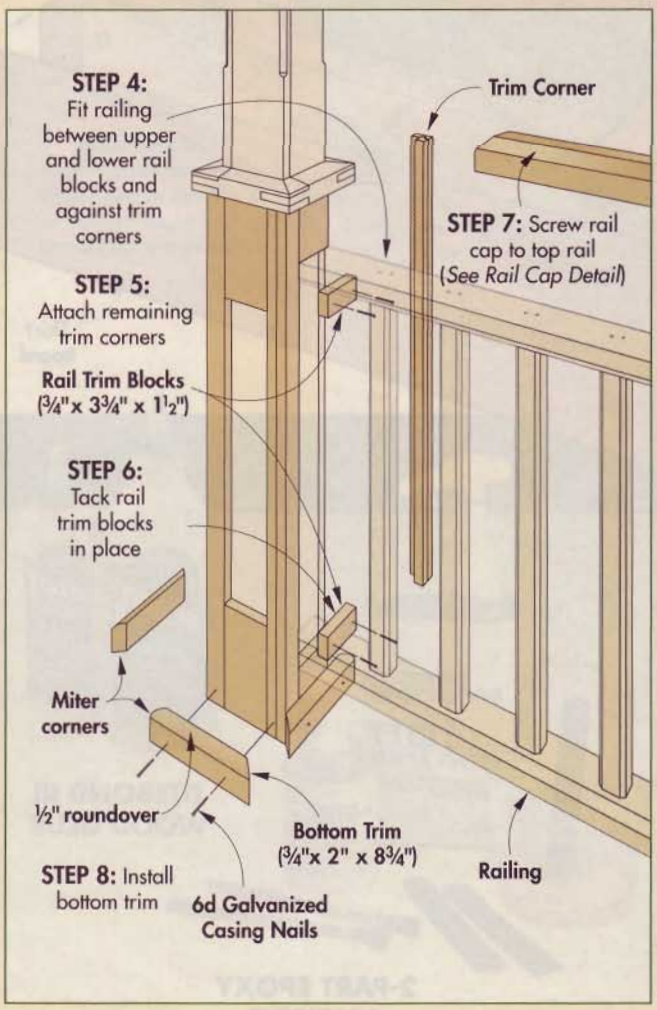
All the trim pieces are made from $\frac{3}{4}$"-thick cedar. Two of these pieces form an L-shaped corner assembly that covers each corner of the column *(Illustration, below left)*. It's assembled exactly the same way as the post cladding — with locking rabbet joints *(see page 47)*. The remaining pieces are just blocks of wood attached to the columns one piece at a time.

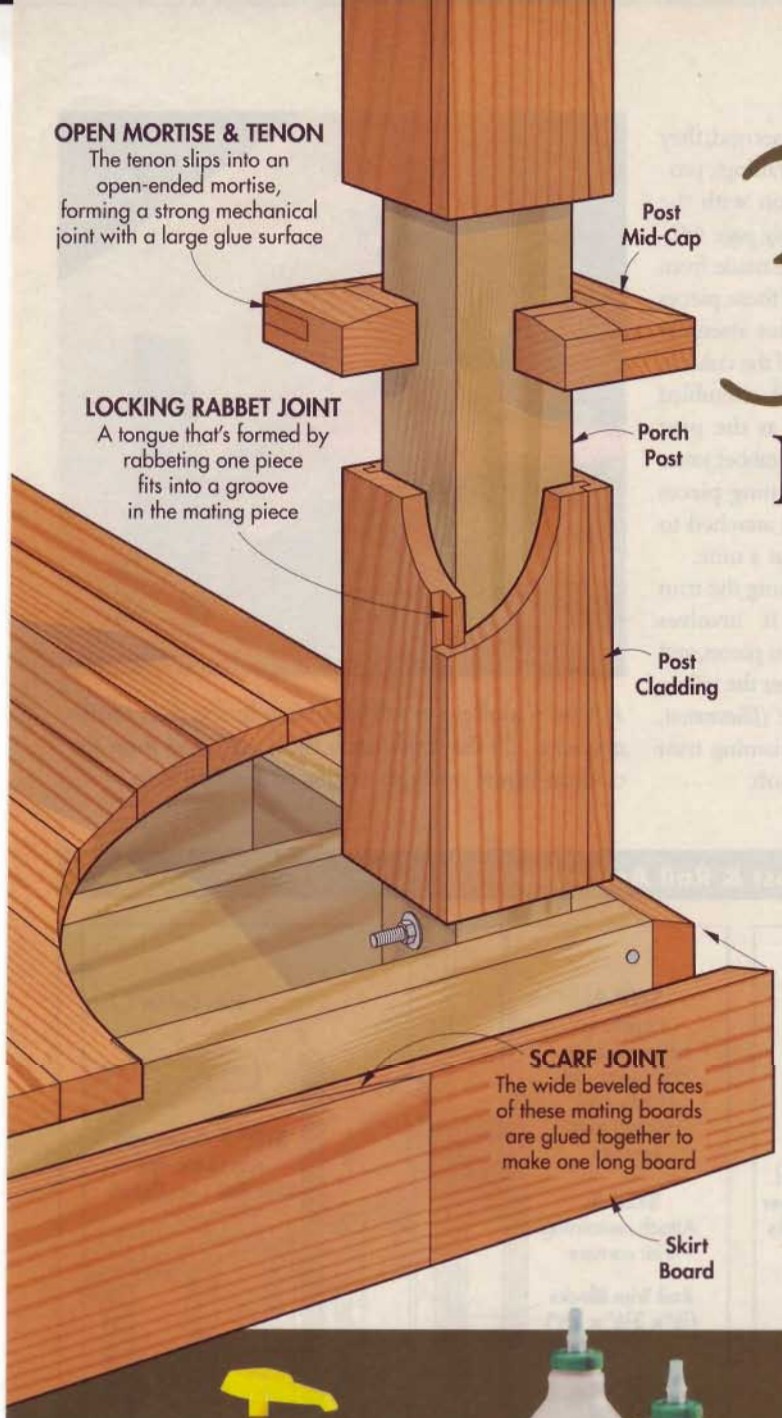
The *sequence* of attaching the trim pieces is important. It involves attaching the first few trim pieces, and then using them to register the railing as you slide it into place *(Illustration, below right)*. Add the remaining trim blocks to complete the job.

▲ After installing a tall auxiliary fence and featherboard, tilt the table saw blade 5° and then rip a wide bevel on both edges of the rail cap.

Decorative Post & Rail Assembly







3 JOINTS THAT BEAT BAD WEATHER

Regardless of where you live, building outdoor projects that withstand the weather can be a challenge. The minute the temperature drops below freezing, that first rain or snow hits, or nature turns up the heat, your woodworking projects are under attack from the elements. As wood expands and contracts with changes in the weather, these joints often open up — or blow apart completely.

At first, the problem is cosmetic. But if left alone, it leads to bigger problems that compromise the structural integrity of the project.

While you can't do much about the weather, you *can* build projects that last. The secret is to use joinery that defies the elements. Three such joints (the very same ones we used in our porch project on page 38) are presented here. Specifically, they are a locking rabbet joint for the cladding on the posts, an open mortise and tenon joint for the mid-caps, and a scarf joint for the fascia and skirt boards *(Illustration, left)*. Each of these joints is explained in detail on the following pages.

Of course, no joint is going to stand up to the weather unless you use the right adhesive. See the *Box* below for three great options for holding joints together.

Weatherproof Glues

2-PART EPOXY ADHESIVE

TITEBOND III WOOD GLUE

POLYURETHANE GLUE

These three adhesives all help create a weatherproof joint.

Titebond III *(center)* is the newest offering. It dries fast just like yellow wood glue — plus it's waterproof.

Polyurethane glue *(right)* takes longer to set, and the glue expands, making cleanup messy. But this expansion fills gaps in joints, and the end result is a super-strong hold.

Epoxy *(left)* is the gold standard for outdoor adhesives — the only downside is the price. For a large project, using epoxy on all the joints is an expensive proposition.

LOCKING RABBET JOINT

Skill Builder

On our front porch, we used locking rabbet joints to join the cladding that surrounds the 4x4 posts. As you can see in the *Photo* below, there's a tongue on one piece that's formed by cutting a rabbet in the edge. This tongue fits into a groove cut in a mating piece. These interlocking parts form a strong mechanical joint. Plus, the large glue surface of the joint provides additional strength.

Locking Rabbet Basics — The main goal when creating this joint is to have the tongue fit into the groove with a friction fit — not too tight, but not so loose that the mating pieces can move around. Also, the pieces that are joined together should fit flush with each other on the outside.

Groove Setup — To accomplish these two things, I start by cutting the groove. (For the porch project on page 38, it's a $^3/_8$"-wide groove, $^3/_8$" deep.) For that size of groove, it's easy enough to mount the proper size of dado blade in the table saw.

The critical thing, however, is positioning the rip fence to cut this groove. That's because the fence determines the location of the *inside* shoulder of the groove. To get a flush-fitting joint, this shoulder has to be set in from the edge of the workpiece a distance that matches the thickness of the stock. The easiest way to do this is to use a scrap piece of the cladding material as a thickness gauge for setting the rip fence *(see Fig. 1 below)*.

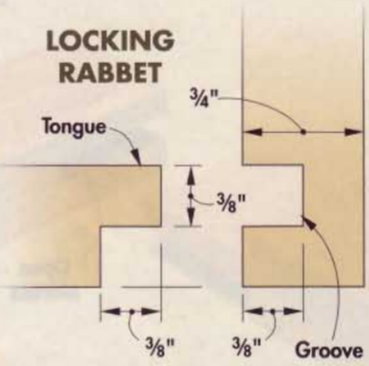
Get in the Groove — With the fence set, cutting the groove is as easy as setting the workpiece face down on the table, butting it against the rip fence, and making a pass over the blade *(Fig. 2)*. To ensure that the groove is a consistent depth, I mounted a featherboard to my rip fence to hold the workpiece down on the table. Cut the groove in all four pieces before turning your attention to the rabbets.

Rabbet Setup— Once the grooves are completed, the next step is to cut a rabbet in the opposite edge of each piece to form the tongue. You can use the same width dado blade as for the groove to make the rabbet. Only this time, attach an auxiliary fence to the table saw's rip fence, and set the dado blade so it just grazes the side of this fence *(Fig. 3)*. Here, the position of the fence in relation to the blade determines the *length* of the tongue, which should match the *depth* of the mating groove (in our case, $^3/_8$").

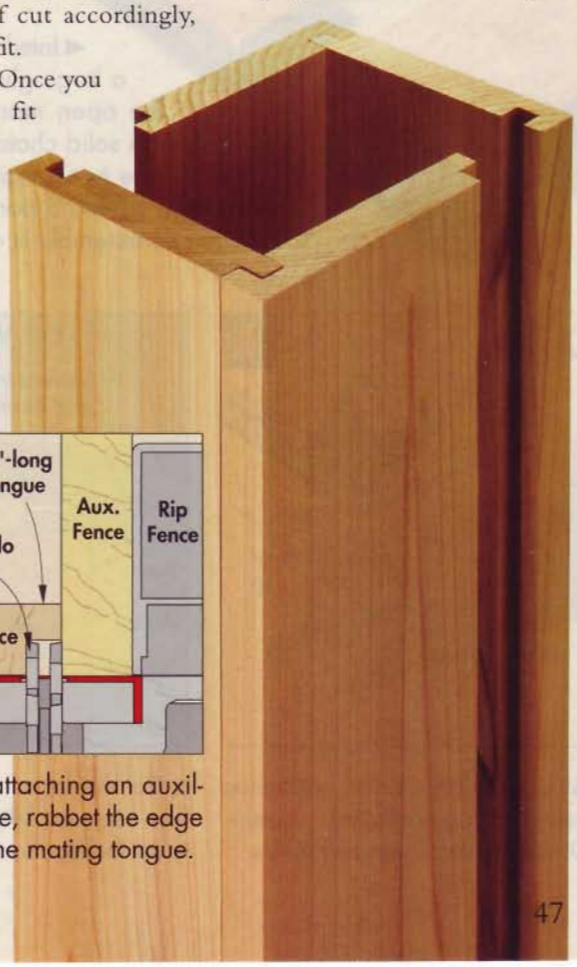
The other critical dimension here is the *depth* of cut, as it determines the *thickness* of the tongue. To get a good fit, run a test piece through the blade. Then test the fit of this tongue in one of the grooves you've already cut. Adjust the depth of cut accordingly, sneaking up on a perfect fit.

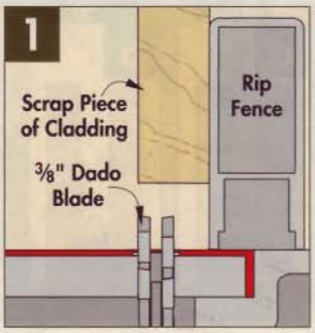
Make the Rabbet — Once you have achieved a nice fit between the tongue and the groove, proceed with cutting the rabbets in all four pieces *(Fig. 3)*. Again, use a featherboard to hold the workpiece down on the table saw during the cut.

ONLINE Extras WorkbenchMagazine.com
Video: 3 Weatherproof Joints

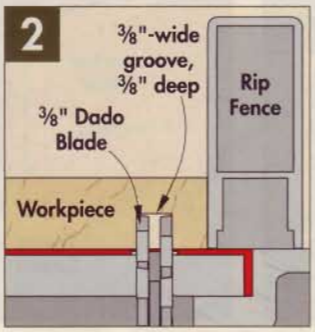


▼ The interlocking parts of the locking rabbet form a sound mechanical joint and have a large glue surface for strength.

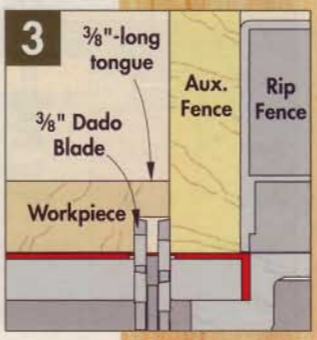




▲ Use a scrap piece of cladding as a thickness gauge to set the rip fence.



▲ Holding the workpiece firmly against the fence, cut the groove in a single pass.



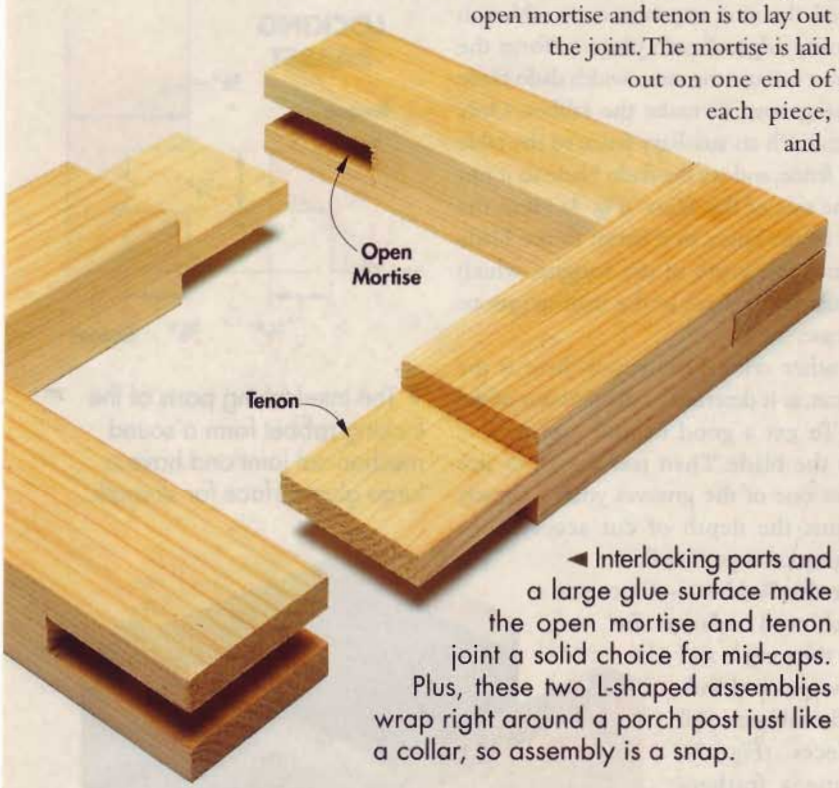
▲ After attaching an auxiliary fence, rabbet the edge to form the mating tongue.

OPEN MORTISE & TENON

Strength, durability, and ease of assembly — three reasons for using an open mortise and tenon joint to assemble the mid-caps of the porch posts.

Open Mortise & Tenon — Also known as a "slip" joint, it has an open-ended mortise on one piece that accepts a tenon on the mating piece *(Photo, below)*. Here again, these interlocking parts and the large glue surface they create form a strong, durable joint.

Layout — The first step in making an open mortise and tenon is to lay out the joint. The mortise is laid out on one end of each piece, and the tenon on the other. This goes quickly because the layout for the mortise is exactly the same as it is for the tenon. I divide the thickness of the workpiece into thirds and use a combination square to lay out the lines *(Fig. 1)*.

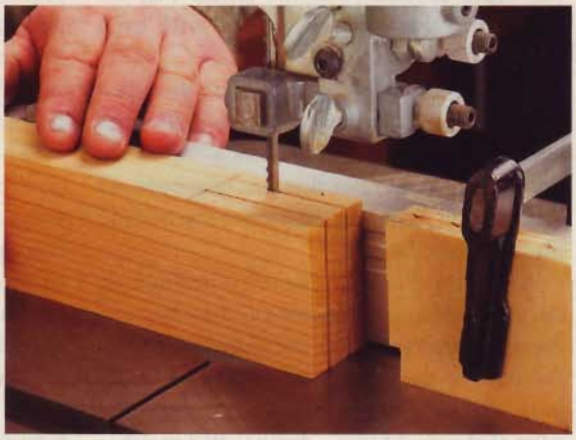


◀ Interlocking parts and a large glue surface make the open mortise and tenon joint a solid choice for mid-caps. Plus, these two L-shaped assemblies wrap right around a porch post just like a collar, so assembly is a snap.

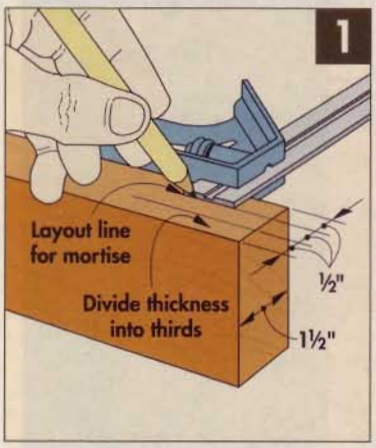
Mastering Mortises

It's best to cut the mortises first. This way, it's easier to make the tenons fit the mortises than vice versa. These mortises are fairly deep ($2^1/_4$"). So in order to make a safe, controlled cut, I use the band saw to cut both parts of the joint.

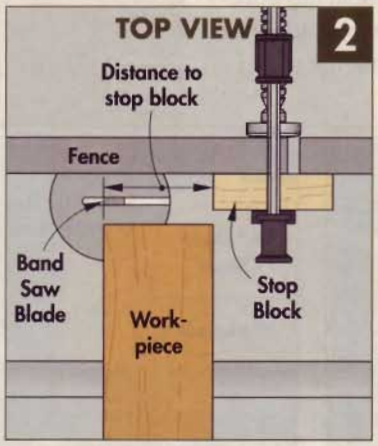
Fence Setup — For accuracy, you'll need to set up a fence. The location of this fence determines the *width* of the mortise. The idea here is to position the fence so the blade will cut to the *inside* of the layout line *(Fig. 3)*.



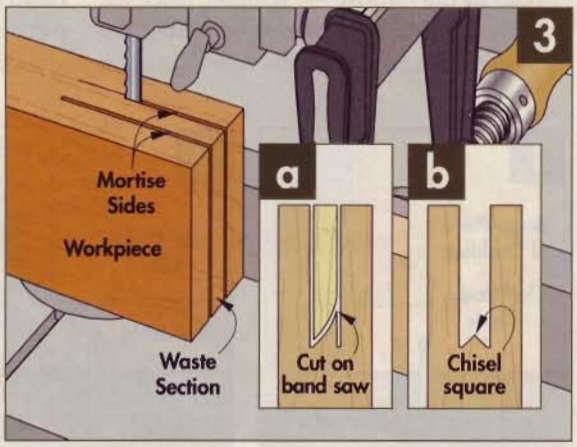
▲ A band saw provides a controlled way to cut the mortise. Here, the fence determines the *width* of the mortise, while a stop block determines its *depth*.



▲ Lay out the mortise and tenon using a combination square. Divide the thickness into thirds.



▲ Set the band saw fence, and then use one of the mid-cap pieces to set the location of a stop block.

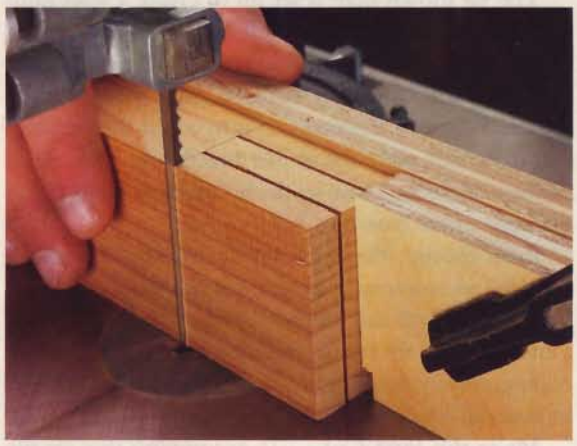


▲ Cut both sides of the mortise, flipping the piece between cuts. Then back off the fence, and remove the middle waste section as shown above.

Then, when it's time to cut the tenons, you'll cut to the *outside* of the line, which should result in a snug fit.

Stop Block — Another important consideration is the *depth* of the mortise. That's determined by a stop block that's clamped to the fence. The depth of the mortise equals the width of the workpiece, so an easy way to set the stop block is to use one of the workpieces as a gauge *(Fig. 2)*.

Make the Mortise — With the fence and stop block in place, cut the mortise by holding the workpiece against the fence and running it through the blade until it contacts the stop block. Then, flip the workpiece over and make a second cut to establish both sides of the mortise *(Fig. 3)*. Flipping the workpiece between cuts this way ensures a perfectly centered mortise.



▲ For square, precise tenon shoulders, use a miter gauge on the band saw. Here the stop block determines the *length* of the tenon.

Mortise Clean-out — The middle waste section of the mortise still needs to be removed. To do that, back off the fence, and cut out the middle of the mortise as shown in *Fig. 3a* on page 48. Then use a chisel to square up the bottom of the mortise *(Fig. 3b)*.

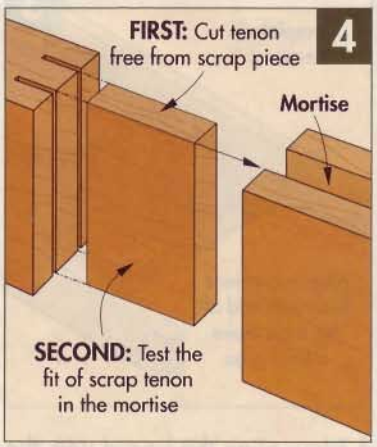
Tenon Tips

Now it's time to cut the mating tenons. You can use the same fence and stop block to establish the tenon cheeks that you used for the mortises. Remember though, this time you'll want to cut on the *outside* of the layout line.

Test Cut — As simple as it sounds, this can be a tricky cut to get just right. So I recommend using a scrap piece the same thickness as the workpiece to test the tenon cuts. After cutting both cheeks of a tenon on this piece, cut the "test" tenon free. This scrap tenon makes a key that you can slide into the mortise to check the fit *(Fig. 4)*. Once you have the setup just right, lock the fence in place and cut the cheeks on the actual workpiece *(Fig. 5)*.

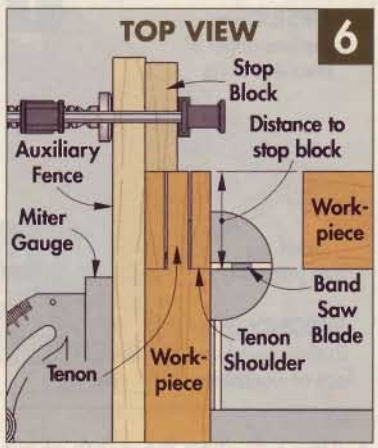
Tenon Shoulders — The next step is to cut the shoulders of the tenon. To ensure a square cut, use a miter gauge on the band saw. The length of the tenons is crucial to a tight-fitting open mortise and tenon joint, so again, use a stop block to establish where the shoulder will be cut. This time, clamp the stop block to an auxiliary fence attached to the miter gauge *(Photo at left)*.

Once again, use one of the workpieces to set the distance from the blade to the stop block *(Fig. 6)*. Then, cut the shoulders by butting the end of the workpiece against the stop block and pushing it into the blade using the miter gauge. Cut into the shoulder until reaching the tenon cheek, removing the waste piece. Then, flip the workpiece over and cut the other shoulder.



▲ Cut a "test" tenon on a scrap piece of stock, and insert it into the mortise to check the fit.

▲ Once the setup is just right, cut tenon cheeks like the mortise sides, flipping the piece between cuts.



▲ Use a miter gauge to cut the tenon shoulders square. A stop block ensures precise cuts.

▲ To cut a scarf joint, the router is mounted to a sled that rides on a shop-built jig with tapered sides. Use a 1/2" straight bit or spiral bit to cut the wide, beveled faces of the joint.

SCARF JOINTS

Occasionally, it would be nice to have a board "stretcher." The fascia and skirt boards on the porch, for example, are over 20 feet long. We couldn't buy boards that long, so we did the next best thing — we used a scarf joint to make one long board from two shorter ones.

Strong & Simple — Compared to many joints, a scarf joint is quite a bit simpler. The basic idea is to take two full-thickness boards and cut a bevel in the face of each one to form a thin "feather" of material on the end. When put together, these beveled faces create such a large glue surface that the result is an extremely strong joint.

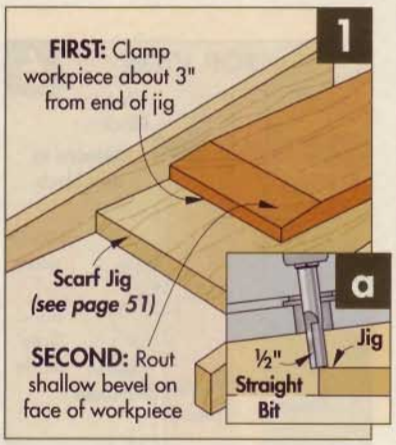
Build, Then Cut — To make a scarf joint, you'll need to build a simple jig *(Box on page 51)*. This jig allows you to cut the beveled faces in the boards with a handheld router and a 1/2" straight bit.

The jig shown here is set up to create a scarf joint with an 8:1 ratio. In other words, the board will have 8" of glue surface for every 1" of board thickness.

Adjust the Cutting Depth — After mounting the router to the sled, the first step is to adjust the depth of cut. To do this, place the router directly over the end of the base of the jig. Then, set the bit depth so it just grazes the edge of the base *(Fig. 1a)*.

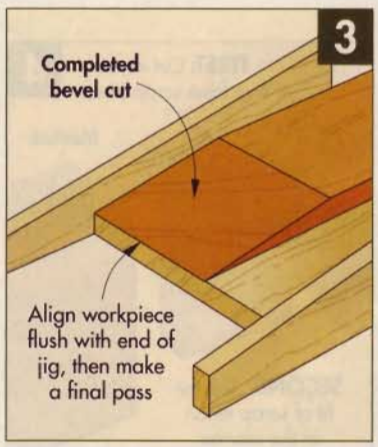
Even though the bit is set at maximum depth, I wouldn't recommend cutting the bevel in one pass. You'd have to "hog" off too much material, which would put a lot of stress on the bit. Instead, the idea is to make a series of progressively deeper passes to produce a thin "feather" of material on the end *(Figs. 1-3 below)*.

Make the First Cut — To accomplish this, set the workpiece a few inches back from the end of the jig, and clamp it firmly in place. Make sure it's butted against



▲ After adjusting the depth of cut *(Fig. 1a)*, clamp the workpiece in the jig. Then make a series of passes to rout a shallow bevel.

▲ To increase the size of the bevel, reposition the workpiece closer to the end of the jig and make a second series of passes.



▲ Now align the board with the end of the jig and make the final passes. This produces a "feather" of material at the beveled end.

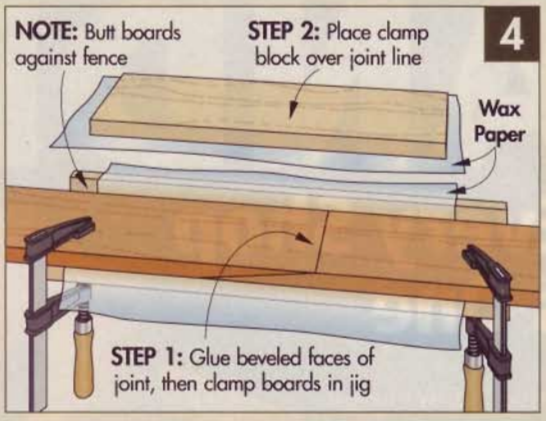
one side of the jig to keep it square. Then set the router sled on top of the jig so the bit is over the exposed edge of the workpiece. Now turn the router on, and slowly slide the sled down the jig, and then back up. Repeat this process across the entire width of the workpiece *(see Fig. 1)*. When you reach the opposite edge of the workpiece, the bit will actually cut into the side of the jig, but that's okay. You need to do this to completely clean up the edge.

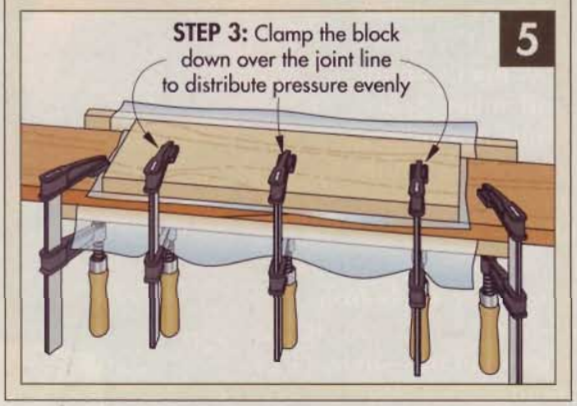
Finish the Cut — When you're finished, unclamp the workpiece, and slide it closer to the end of the jig (about half the distance). Then reclamp it, and repeat the process. The bit will cut deeper this time, creating a larger bevel *(Fig. 2)*. For the final pass, move the workpiece all the way to the end of the jig *(Fig. 3)*.

Scarf Joint Glue-Up — Gluing a scarf joint together presents a couple of challenges. First, the beveled faces of the two pieces tend to slip against each other. Also, it can be difficult to keep the edges aligned. An easy way to solve both problems is to build a simple L-shaped assembly jig. The base of this jig provides a clamping surface for the workpiece. And a fence keeps the pieces aligned. To glue up the joint, simply follow the procedure outlined in *Figures 4 and 5* at right.

Planer Trick — When the glue sets, there's one optional step you can take to produce a super-smooth face where the scarf joint comes together. That's to make a light pass through the thickness planer with the joined boards.

Clamping the Joint





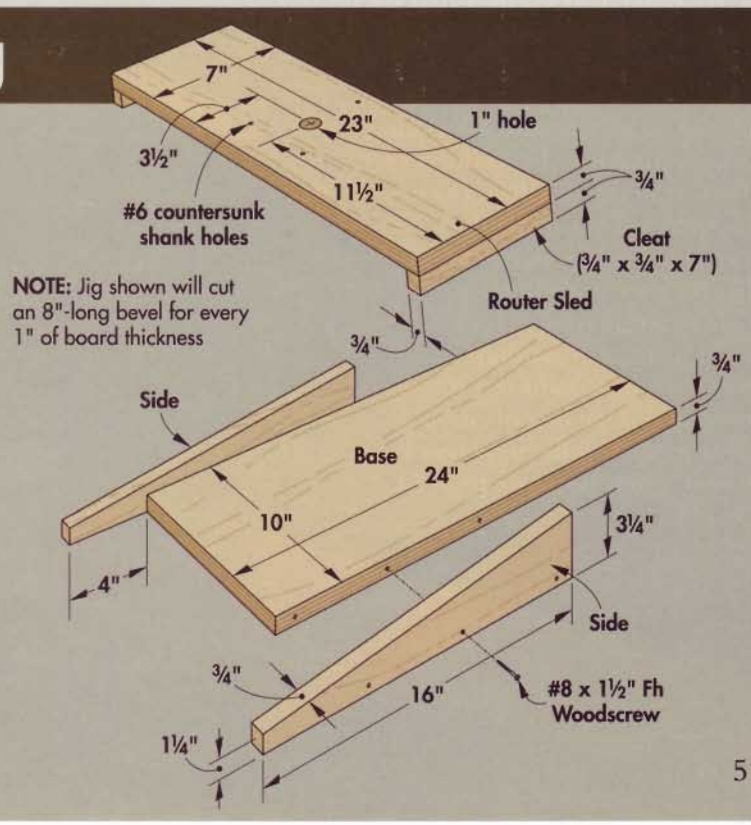
▲ After gluing up the mating faces of the scarf joint, a light pass on a thickness planer makes the joint line almost disappear *(Inset)*.

Building a Scarf Jig

The jig used to make scarf joints consists of three different parts: a long plywood base to hold the workpiece, two tapered sides, and a sled for the router that "rides" on the angled sides *(see the Illustration at right)*.

For a smooth, accurate cut, it's important that the tapered sides are identical. To accomplish that, use double-sided tape to temporarily gang the sides together. Then lay out the taper and rough-cut it on the band saw. Next, joint to the layout line to produce a smooth edge. Pull the pieces apart, and glue and screw them to the base.

The sled that the router is mounted to is equally simple. It's a piece of 3/4" plywood with a couple of cleats attached to the ends *(Illustration)*. Drill a 1" hole for bit clearance, and attach the router to the sled by running machine screws up through the countersunk holes in the sled and into the router base.



6" Random-Orbit SANDERS

Why Every Shop Needs One

I'm guessing that most woodworkers buy power sanders grudgingly. After all, I've never heard anyone wax poetic about the satisfaction and inner peace that comes from hours of sanding. So the experience of spending hard-earned money for a sander is, at best, unfulfilling.

But among the seven sanders we tested, some elevate these tools from a "necessary evil" to one you love to hate. Hardly auspicious, but hey, sanding will always be sanding.

Quite frankly, as we began testing these tools, we had no idea that they might have such attitude-shifting powers. But our tests revealed that many of these sanders have made significant strides toward alleviating the most obnoxious byproducts of sanding — noise and dust. Even more, some of these sanders have taken on dual personalities so that they are equally effective for aggressive stock removal *and* finish sanding.

The tests we conducted to uncover all this are described on the next page. And the sometimes surprising results begin on page 54.

HOW WE TESTED

STOCK REMOVAL ►

Lofty claims about belt-sander like performance prompted this test. Can a random-orbit sander really be expected to flatten an uneven, imperfect panel, as shown at right? Turns out a few of these sanders are up to the challenge.

To put the sanders on an equal footing, we sanded for 10 minutes with a 60-grit disc to remove as much stock as possible. We weighed the panels before and after to measure how much stock was removed *(Photo, left)*. This was the first indication that these sanders have varying capabilities and usages.

▲NOISE LEVEL

Sanding is dirty, hard work. Does it have to be loud, too? We measured and compared the loudness of the sanders.

▲DUST COLLECTION

It can't be long before sanders will come with warnings from the Surgeon General about the health risks of dust. In the meantime, we need to look for sanders that swallow their own dust, so we don't have to. Our measure of this was to sand solid-surface material (which creates very fine dust) and see which sanders cleaned up after themselves.

▲TOOL CONTROL

Your sander wants to go in a circle, but you want it to go in a straight line. The outcome of this contest will have a big impact on the quality of your project. We tested control by sanding narrow boards to see if an errant sander would round the edges.

▼FINISH QUALITY

80-GRIT: At this grit, sanding swirls are obvious, and the finish is muddy. Quite a bit more sanding is necessary.

120-GRIT: Swirls are fewer, and the finish is clearer, but we we wouldn't stop here if this were a project.

180-GRIT: By this point, all the sanders had achieved a satisfactory finish. Most made the grade at 150-grit.

6" Random-Orbit Sanders:
SAME IN NAME ONLY

These are all 6" random-orbit sanders, and they all have electric motors. Those are the only truths that apply to all of these tools without exception. Beyond that, each tool distinguishes itself, for better or worse, in at least one of the following categories.

Sanding Action

Three types of sanding action are represented by these seven sanders. Namely, single action only, dual-random orbit, and eccentric/random orbit.

The single-action sanders (Porter-Cable, DeWalt, Fein) are those we have conventionally thought of as random-orbit sanders (ROS). The discs of these sanders spin while simultaneously moving in an elliptical pattern. There is no means of affecting the size or pattern of orbit on these tools.

One dual random-orbit sander (Ridgid) lets you toggle between different orbit sizes. And while the company claims that this gives the sander more aggressive stock removal characteristics, we feel it's more accurate to consider this a finish sander (like the conventional ROS) with an extra measure of versatility because of the two orbit settings.

For rapid stock removal, three sanders (Bosch, Makita, Festool) offer an eccentric, or direct-drive action, in addition to the conventional ROS pattern *(see page 55 for more on this).*

Dust Collection

Most of these sanders *require* a shop vacuum for dust control. The DeWalt and the Ridgid, however, come equipped with a dust collection bag. Although not as effective as a vacuum connection, they both did a passable job of minimizing dust. And it's nice to have the option of a dust bag when a shop vacuum isn't convenient.

As to what's required to connect a sander to a vacuum, there are some telling differences:

- The Festool sander requires a Festool hose because of its oval port.
- It's hard to get the Makita to work with any hose, as most hoses tend to slip off the small dust port.
- The Fein, Bosch, and Porter-Cable sanders fit best with their own brand of hose, but can be adapted to others without much trouble.
- DeWalt requires you to purchase an accessory to connect its sander to a vacuum.
- Only the Ridgid comes ready to connect to any standard $1\frac{1}{4}$" or 2" vacuum hose.

Dual Random-Orbit Sanders

Bosch

Virtues: Perfectly balanced; Awesome stock removal; Excellent fine sanding; Flawless dust control.

Vices: Not louder than other sanders, but quite shrill by comparison. Put the earplugs in for sure.

Verdict: Only the Festool matches this sander feature-for-feature and on all performance points. And this one costs about $100 less.

www.BoschTools.com
877-267-2499

Festool

Virtues: Smooth, powerful, and perfectly balanced; Outstanding stock removal *and* fine sanding.

Vices: Requires a Festool hose for dust collection.

Verdict: This is as good as the Bosch in every way. Only money separate the two. And you'd never regret the extra expense.

www.Festool-USA.com
888-337-8600

Makita

Virtues: Accepts six-hole and nine-hole sanding discs; Dual modes for aggressive or fine sanding.

Vices: Our test model was poorly balanced and difficult to control. Dust collection was least effective.

Verdict: We were disappointed with our test tool because of average dust control and poor balance.

www.Makita.com
800-462-5482

▲ We prefer the lever-type (Bosch, Makita, Festool) changer to switch sanding modes *(Photo, top)* over Ridgid's button *(Photo, bottom)*.

WORKBENCH AWARD OF QUALITY TOP VALUE

Ridgid

Virtues: Good price; Dual orbits make it a versatile finish sander; Dust control is excellent with the bag and even better with a vacuum.

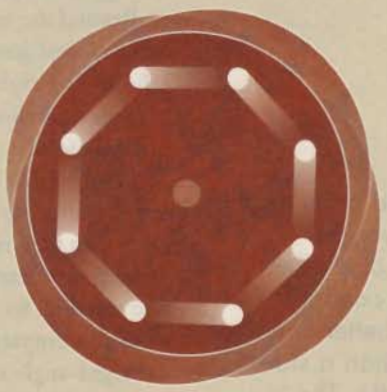
Vices: Slight wobble requires a firm grip at times.

Verdict: This is an affordable, complete package with versatility beyond single-mode finish sanders.

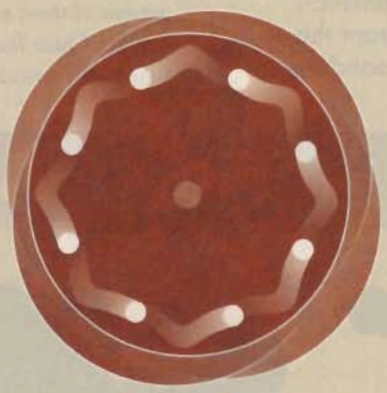
www.Ridgid.com
800-474-3443

Sanding Modes:

RANDOM-ORBIT vs. ECCENTRIC



RANDOM ORBIT



ECCENTRIC

A relatively new wrinkle in random-orbit sanders is dual-mode functionality. The idea is to offer aggressive stock removal *and* fine-sanding abilities in the same sander. The Makita, Bosch, and Festool sanders all have this feature.

These sanders couple conventional orbit action in one mode with an eccentric action in the second mode.

In random-orbit mode, these three tools operate just like all the others in the test. That is, the sanding pad spins while also moving in an elliptical orbit *(above left)*. This is the action that has earned random-orbit sanders a reputation for being excellent finishing sanders.

The eccentric mode is all about stock removal. The pad still spins, but the elliptical pattern is replaced by a lineal back-and-forth movement *(left)*. This is a direct-drive mode, which simply means the pad won't stall under pressure. Thus, stock removal is more like that of a belt-sander.

SIZE OF ORBIT?

This simple experiment clearly shows the size of a sander's orbit. A small dot marked on the sanding disc becomes a circle when the sander is running at its slowest speed. The diameter of the circle equals the orbit size of the sander. Shown here is the 5mm Festool orbit.

▲A molded palm grip directly over the sanding disc offers more comfort and better control than a side handle. The palm grip also dampens vibration from the sander.

Body Type

Most of these sanders evolved from right-angle grinders, and that heritage is clear in their barrel-grip style bodies.

The one exception in this group is the Ridgid, which is an inline-style sander, with the motor mounted directly above the sanding pad.

Beyond the aesthetic differences, inline sanders generally aren't as powerful as the right-angle variety, so they aren't well-suited to aggressive stock removal.

On the other hand, inline sanders usually offer up less vibration and noise than their right-angle brethren, making them excellent for extended fine sanding. Such was our experience in comparing the Ridgid to the right-angle sanders in this test.

Handhold

Another throwback to the right-angle genesis of these sanders are their side handles. Quite frankly, these have little worth in a woodworking shop.

An integral palm grip on top of the sander is a much better place for that "other" hand. Of the right-angle sanders, all but the Fein have this comfort feature.

An even better design is Ridgid's sander, which has a molded palm grip and a *front-mounted* handle. The palm grip, just as with those on the right-angle sanders, offers a comfortable, effective hold directly over the sanding disc. This hand position helps you apply consistent pressure over the full area of the sanding disc.

Where Ridgid went one step further is with their front-mounted handle. This simple variation on the side handle makes a lot of sense.

First, the shape of the handle is much more ergonomic than the cylindrical types on other sanders. Second, its location — directly inline with the main grip — keeps the downward pressure centered on the sanding disc, instead of to one side or the other as with the side handles.

Single-Action Sanders

Porter-Cable

Virtues: Competitive price; Effective dust control; Not much quieter than others, but less "whiny."

Vices: Moderate wobble that's difficult to control at lower speeds; Dust hose interferes with barrel grip.

Verdict: This is a basic sander that's quite capable of a fine finish. Partner this with a good belt sander if you also want fast stock removal.

www.Porter-Cable.com
800-487-8665

DeWalt

Virtues: Low price; Well-balanced (no wobble); Excellent dust control with the bag, flawless dust control with a vacuum connection.

Vices: Hose connector is sold as an accessory.

Verdict: This is the best single-mode finish sander in the group. It's effective, affordable, and a pleasure to use. Don't expect much for stock removal.

www.DeWalt.com
800-433-9258

Fein

Virtues: Well-balanced; Powerful; Dust free.

Vices: Relatively expensive compared to the dual-mode, variable-speed sanders it competes against.

Verdict: Once an industry standard, this sander is now a little behind the curve in terms of performance and features. A lower price or more bells and whistles are in order.

www.FeinUS.com
800-441-9878

This made a noticeable difference in the way this sander performed on narrow stock when the tools were prone to some sideways tipping anyway.

Speed Control

Although there seems to be no agreement about where to locate the variable-speed switch on a sander — some models have it on the side of the barrel, others have it way on the back, while one has it mounted up front — it's clear that most manufacturers consider speed control to be a worthwhile feature. And we agree, particularly during aggressive sanding with coarse grits. Being able to slow the tool down adds a great deal of control and lessens the likelihood of careening off line and damaging a surface. In this group, only the Fein lacks variable-speed control.

▼ It's all about the paperwork. With the Festool sander, only their paper will work. Makita, on the other hand, accepts standard six-hole paper or the proprietary nine-hole variety invented by Festool.

Final Recommendations

Editor's Choice

BOSCH

Bosch takes top honors with a sander that's aggressive enough for flattening uneven panels but still delicate enough for final sanding.

A fairly reasonable price, better vacuum compatibility, and greater availability give the Bosch a slight advantage over its only equal in this test, the Festool.

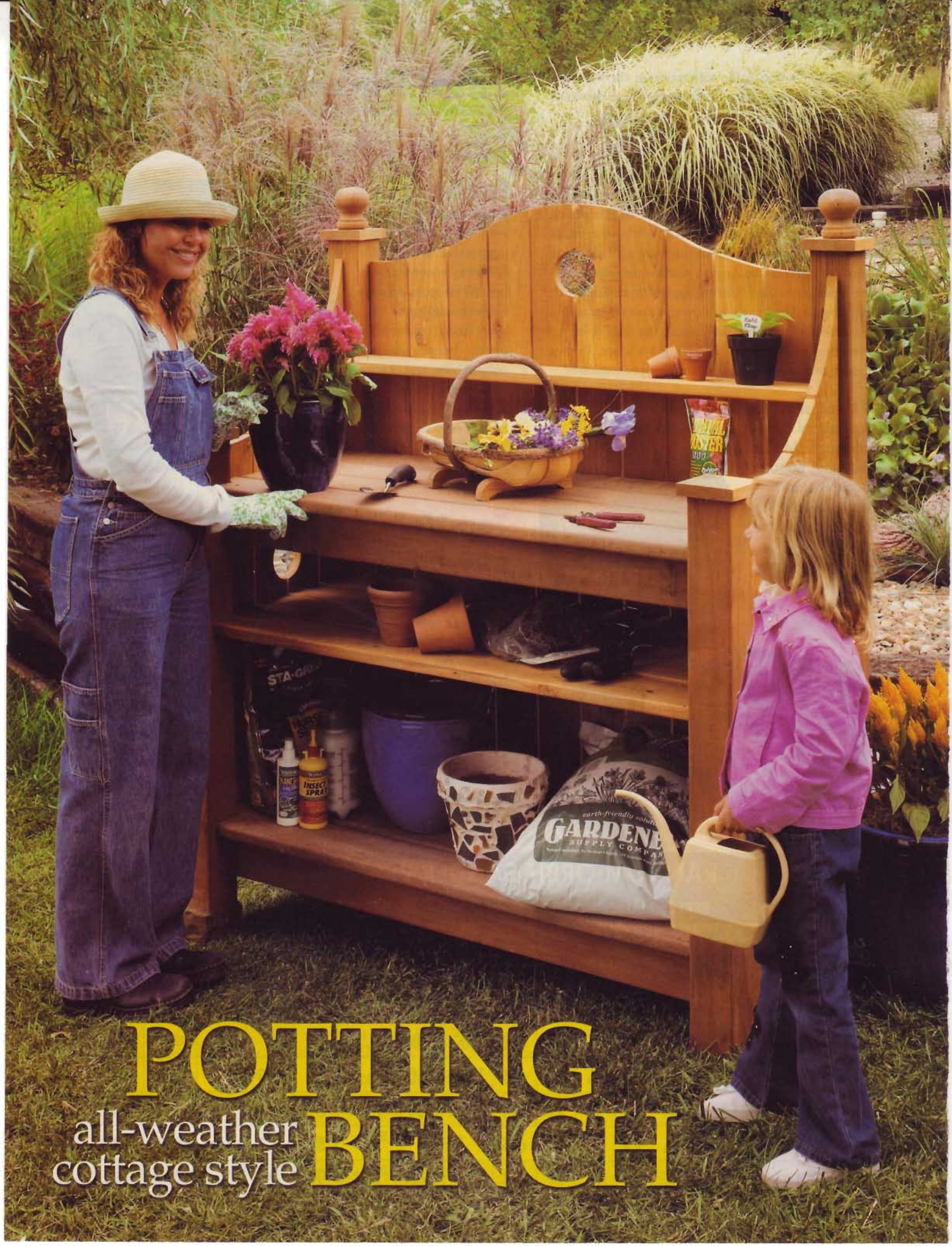
Top Value

RIDGID

We can't agree with Ridgid's claim that aggressive stock removal is a benefit of their dual-orbit sander. But we wholeheartedly endorse this as an affordable, effective, dust-free finish sander with an extra bit of versatility. And the near-perfect ergonomics make it all the more attractive.

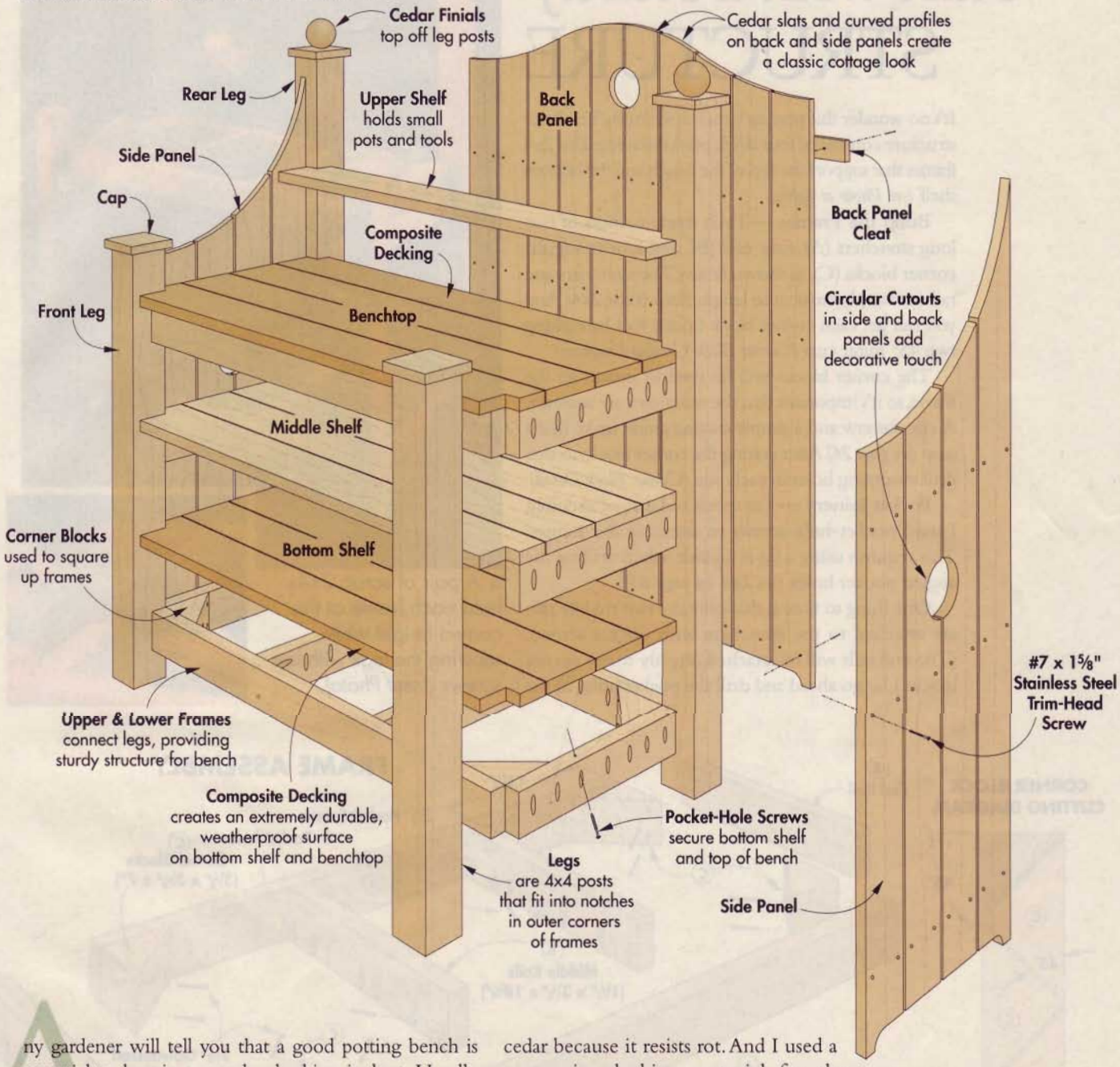
RANDOM-ORBIT SANDER REPORT CARD

	PERFORMANCE						SPECIFICATIONS							
Model	Stock Removal	Finish Grit	Dust Control	Noise (in dbs)	Vibration	Balance	Amperage	Orbits per Minute	Orbit Size	Paper Type	Weight in Lbs.	Warranty	Model	Price
PORTER-CABLE	C	150	B	97	B	B	3.7	2500-6,000	3/16"	6h	5.75	1yr	97366	$180
DEWALT	C	150	A	99	A	A	4.3	4,300-6,800	3/16"	6h	5.75	1yr	DW44	$160
RIDGID	C	150	A	95	A	B	3.8	4,000-10,000	1/4",1/8"	6h	6	3yr	R2610	$170
MAKITA	A	180	C	99	A	C	6.6	1,600-5,000	7/32"	6h	5.9	1yr	BO6040	$260
BOSCH	A	150	A	97	A	A	6.5	3,100-6,650	3/32"	6h	5.3	1yr	1250DEVS	$300
FEIN	B	150	A	99	B	A	6.5	7,500	5/16"	8h	3.7	1yr	MSf-636-1	$379
FESTOOL	A	150	A	99	B	A	3.8	4,000-11,200	5/16"	9h	5	3yr	RO150	$395


POTTING
all-weather
cottage style
BENCH

Construction Details

Overall Dimensions: 52½" W x 25½" D x 61" H



Any gardener will tell you that a good potting bench is essential to keeping a garden looking its best. Usually however, it's a strictly utilitarian item that gets stuck in an old shed somewhere.

That certainly won't happen to this potting bench *(see Photo at left)*. With its gracefully curved side and back panels, it has a rustic charm that's reminiscent of a country cottage, making it an extremely attractive fixture *in* the garden. And the best part is you don't have to worry about rain, snow, and sun damaging the bench. Like a perennial plant, it will withstand the weather *and* continue to look great from year to year.

Built to Last — The key to this longevity is the weather-resistant materials used in constructing the bench. The large panels and thick leg posts are made of cedar because it resists rot. And I used a composite decking material for the benchtop and lower shelf. This type of decking, made up of plastic and wood, is an extremely durable material that will stand up to extremes of weather. Equally important, it cleans up easily, making the benchtop a perfect worksurface for a potting bench.

Fasteners & Finish — Of course, even weather-resistant materials will be spoiled if the fasteners corrode or rust. So I used galvanized and stainless-steel fasteners to assemble the components of the bench.

No-Finish Finish — Just a note about the finish. With these weather-resistant materials, there's no need to apply a finish. Over time, the bench will develop a beautiful silver-gray color that complements the garden.

start with a sturdy STRUCTURE

It's no wonder this potting bench is so sturdy. The basic structure consists of four thick posts connected by 2x4 frames that support the top of the bench and the bottom shelf *(see Photo at right)*.

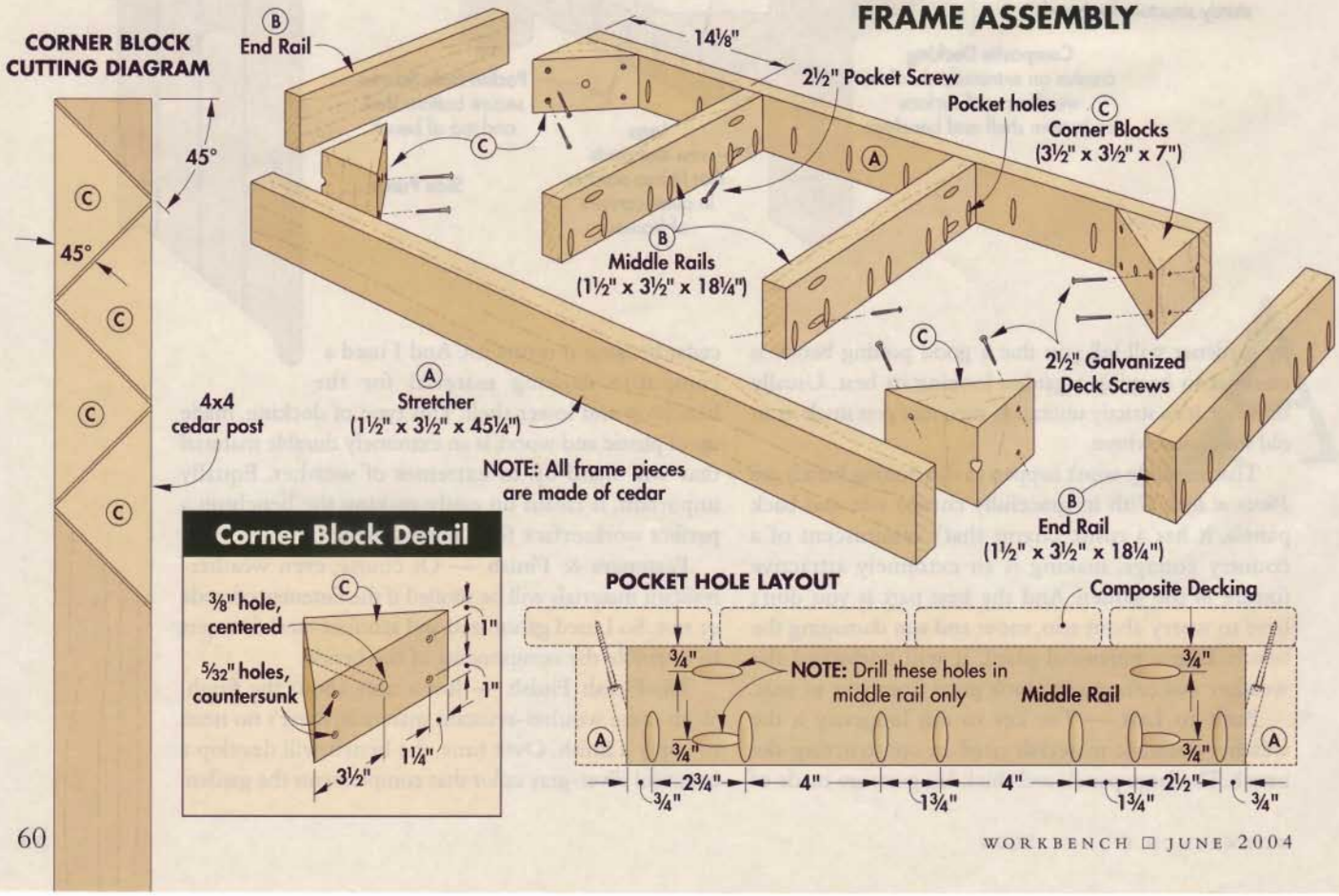
Build the Frames — Each frame consists of two long stretchers (A), four rails (B), and four triangular corner blocks (C), as shown below. The stretchers and rails are simply crosscut to length from cedar 2x4s. And you can get each corner block from a 4x4 by making two 45° miter cuts *(Corner Block Cutting Diagram)*.

The corner blocks will be used to square up the frame, so it's important that the miter cuts are accurate. A circular saw and a simple cutting guide make that a snap *(see page 26)*. After cutting the corner blocks to size, drill mounting holes in each one *(Corner Block Detail)*.

Pocket Joinery — For speed and ease of assembly, I used pocket-hole screws to assemble the frames. This requires using a jig as a guide when drilling the angled pocket holes *(see Box on page 61)*.

One thing to note is that only the two middle rails are attached to the stretchers with pocket screws. (The end rails will be attached directly to the corner blocks.) So go ahead and drill the pocket holes in the

▲ A pair of scrap 2x4s hold each frame at the correct height while securing the legs with lag screws *(Inset Photo)*.



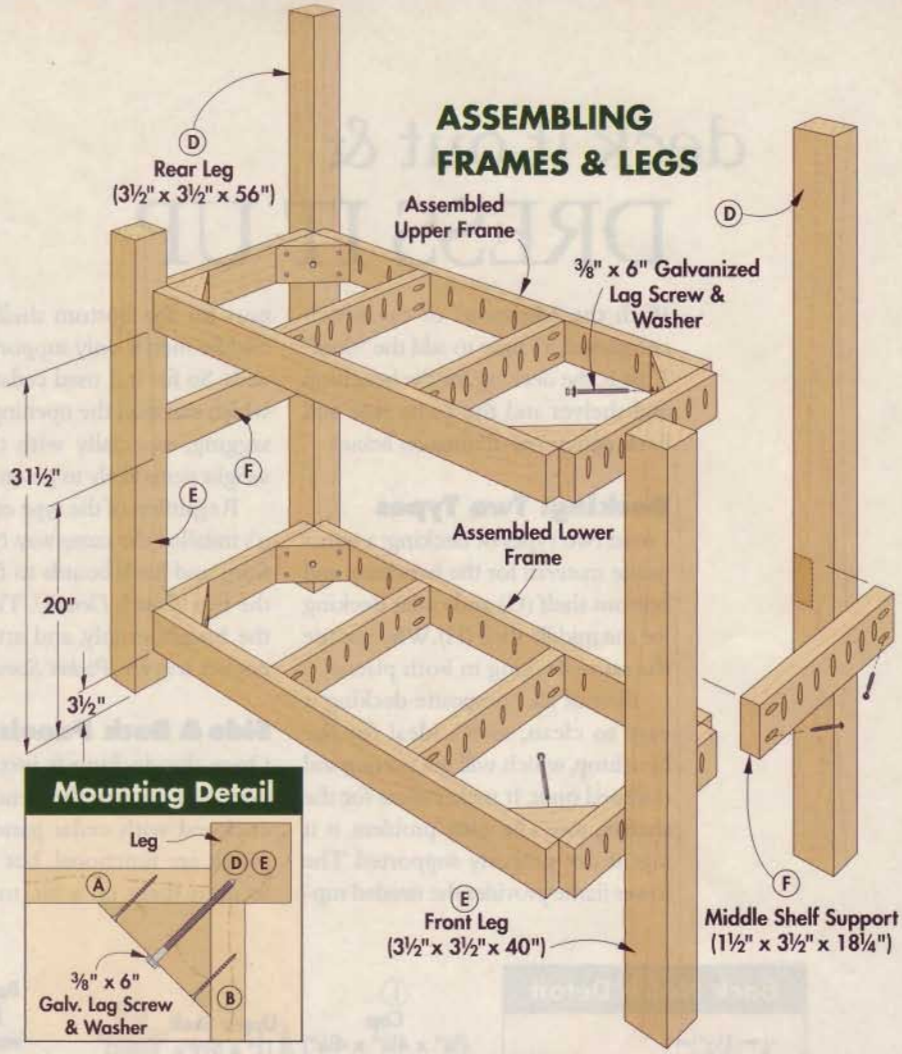
ends of the middle rails. While you're at it, drill pocket holes in *all* the rails and both stretchers for mounting the benchtop and lower shelf. This way, no fasteners will be exposed on these surfaces.

Assemble the Frames — After drilling the pocket holes, the next step is to assemble the frames. Start by gluing and screwing the corner blocks to the stretchers and end rails *(Mounting Detail)*. Note how this creates a notch in the outer corners to hold the legs. Then fit the middle rails into place and fasten them with pocket screws.

Add the Legs — At this point, you can turn your attention to the legs. The tall rear legs (D) and shorter front legs (E) are simply cut to length from cedar 4x4s *(see Illustration at right)*. The circular saw cutting guide *(page 26)* comes in handy here, as well.

The legs fit into the notches in the outer corners of the frame, and they're held in place with lag screws that pass through the holes in the corner blocks. The tricky part is holding the frames at the proper height while you install the lag screws. Using scrap pieces as shown in the *Photo* on page 60 makes this an easy one-person job.

Middle Shelf Supports — Now all that's left is to add a couple of 2x4 supports (F) for a middle shelf. Here again, drill pocket holes for attaching these supports to the legs, and as before, for mounting the benchtop and bottom shelf.



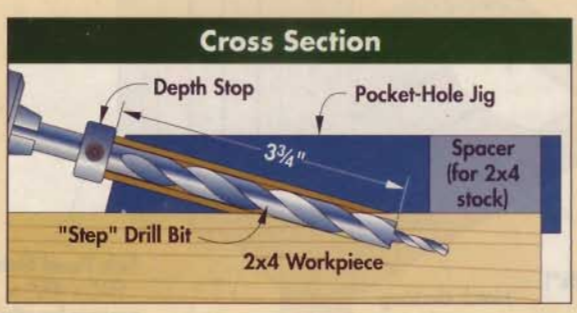
pocket joints pull it together

In a pocket-hole joint, the screws aren't driven "straight" through the workpiece — they're set at a 15° angle. This means the screw enters the *face* of one piece and the *edge* of the mating piece.

To guide the drill bit so it drills a hole at exactly 15°, I use a pocket-hole jig *(Photos, right)*. Like most pocket-hole jigs, it has a special "step" drill bit that makes an oval counterbore (to hold the head of the screw) *and* the shank hole in one operation.

The nice thing about this jig is it has a spacer *(shown below)* that ensures that the exiting screw is roughly centered on the thickness of 2x stock. That makes it ideal for the 2x4 frame pieces of the bench.

► This pocket-hole jig (the Rocket), manufactured by the Kreg Tool Company, includes a face clamp, 3/8" "step" drill bit, depth collar, a 6" square-drive bit, and pocket screws.



deck it out & DRESS IT UP

With the "skeleton" of the bench completed, it's time to add the "skin." That is, the decking for the benchtop and shelves and the cedar side and back panels *(see Illustration below)*.

Decking: Two Types

I used two types of decking: a composite material for the benchtop and bottom shelf (G) and cedar decking for the middle shelf (H). Why not use the same decking in both places?

First of all, composite decking is easy to clean, so it's ideal for the benchtop, which will get potting soil dumped on it. It makes sense for the shelves, too. The only problem is it sags if not properly supported. The lower frame provides the needed support for the bottom shelf, but the middle shelf is only supported at the ends. So for it, I used cedar decking which can span the opening without sagging, especially with the lightweight items likely to go on this shelf.

Regardless of the type of decking, it's installed the same way. Notch the front and back boards to fit around the legs *(Notch Details)*. Then space the boards evenly, and attach with pocket screws *(Pocket Screw Detail)*.

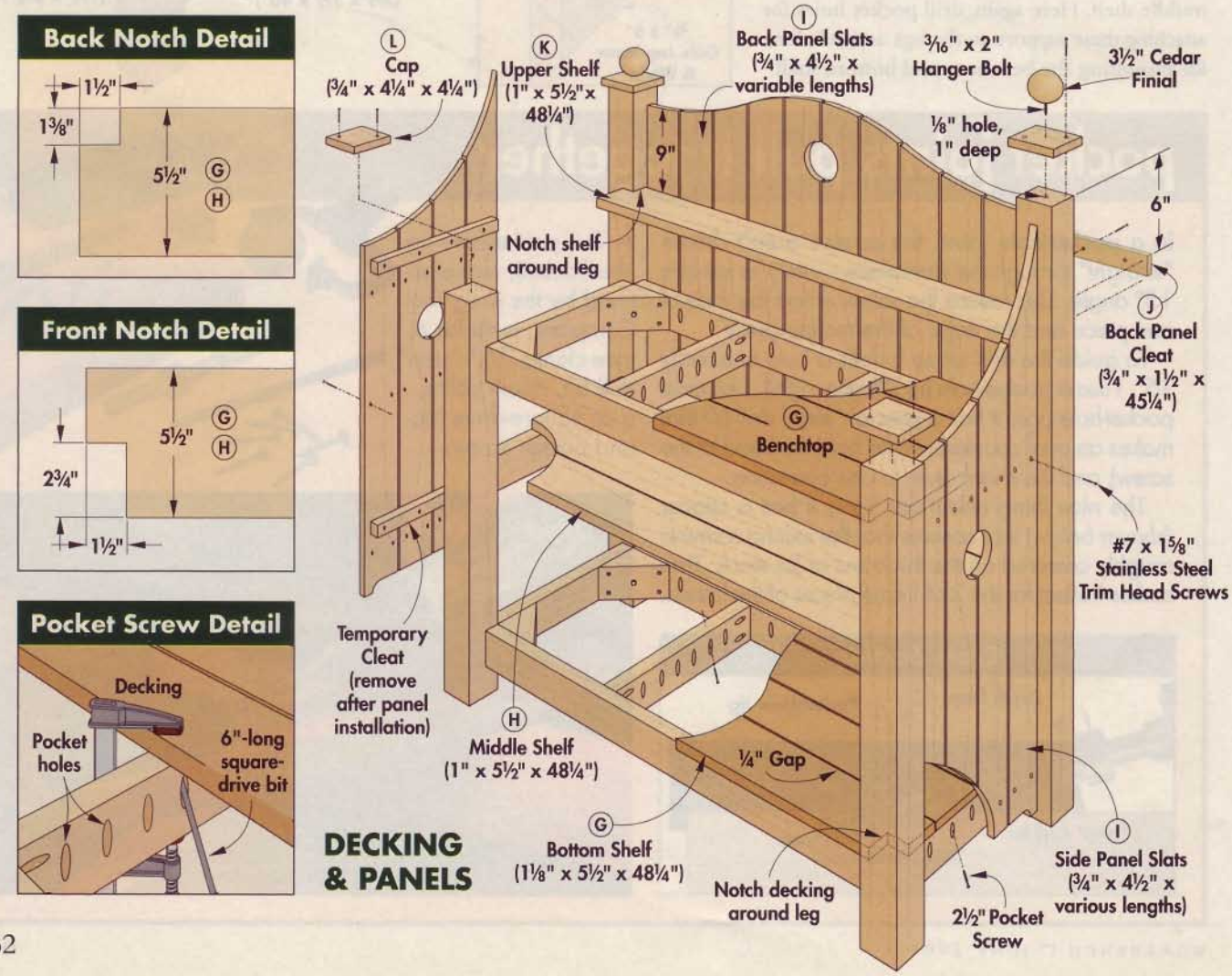
Side & Back Panels

Once the decking is installed, the sides and back of the bench can be enclosed with cedar panels. These panels are functional, but I wanted to dress them up a bit, too. Hence the curved profiles on top of each panel, the decorative circular cutouts, and the wide notch in the bottom edge *(Panel Assembly)*.

Each panel is built like a picket fence. The "pickets" are 3/4"-thick cedar slats (I) ripped 4 1/4" wide. To save material, it's best to use varying lengths of slats. (Note how the top ends of the slats are staggered.)

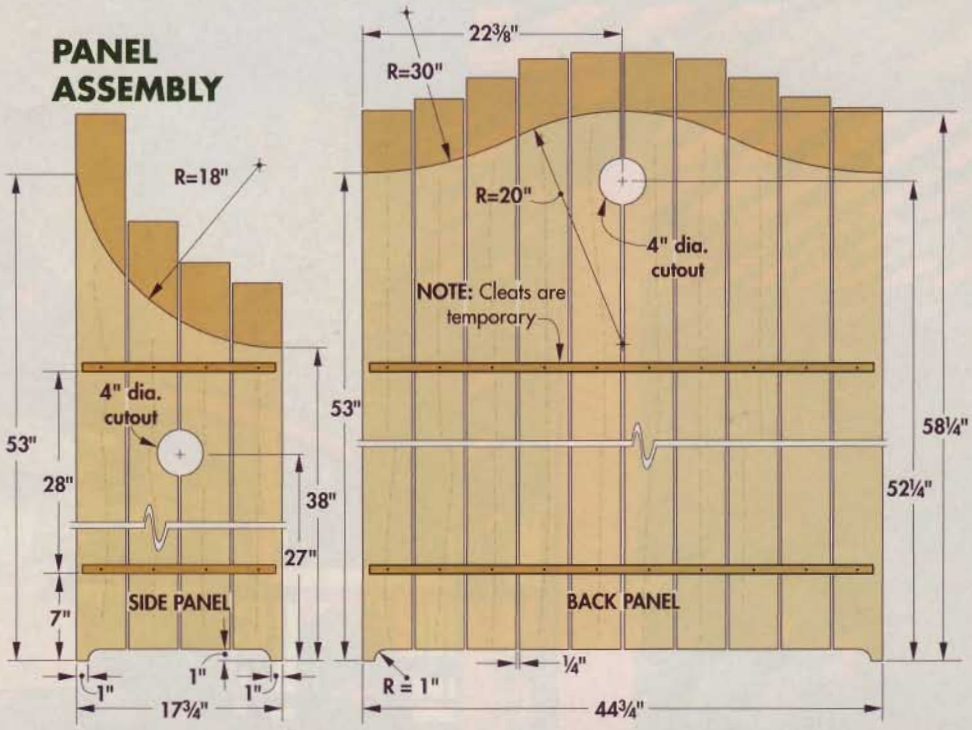
The slats are evenly spaced and assembled into a panel using temporary cleats *(Fig. 1)*. Locate the cleats as shown in the *Panel Assembly*. Later, they'll be used to hold the panels in position when attaching the individual slats to the bench *(see Fig. 3)*.

But first, you'll need to lay out the shape of the panels. A template



provides a quick, accurate way to do this *(see page 24)*. Then cut the panels to shape using a jig saw *(Fig. 2)* and install the panels, as shown in *Fig. 3*. Once the panels are in position, screw the slats to the upper and lower frames and the middle shelf supports.

Final Details — At this point, there are just a few final details to take care of. To keep the slats from twisting, I attached a permanent cleat (J) to the back panel. I also added a small upper shelf (K). It's notched to fit around the legs and screwed to the back slats. Finally, I added square caps (L) and round finials to the legs.



▲ To assemble the panels, use ¼"-thick blocks to space the slats evenly. Then clamp across the panel and attach temporary cleats to keep the slats aligned.

▲ After laying out the arcs on the panels *(see page 24)*, use a jig saw to cut them to shape.

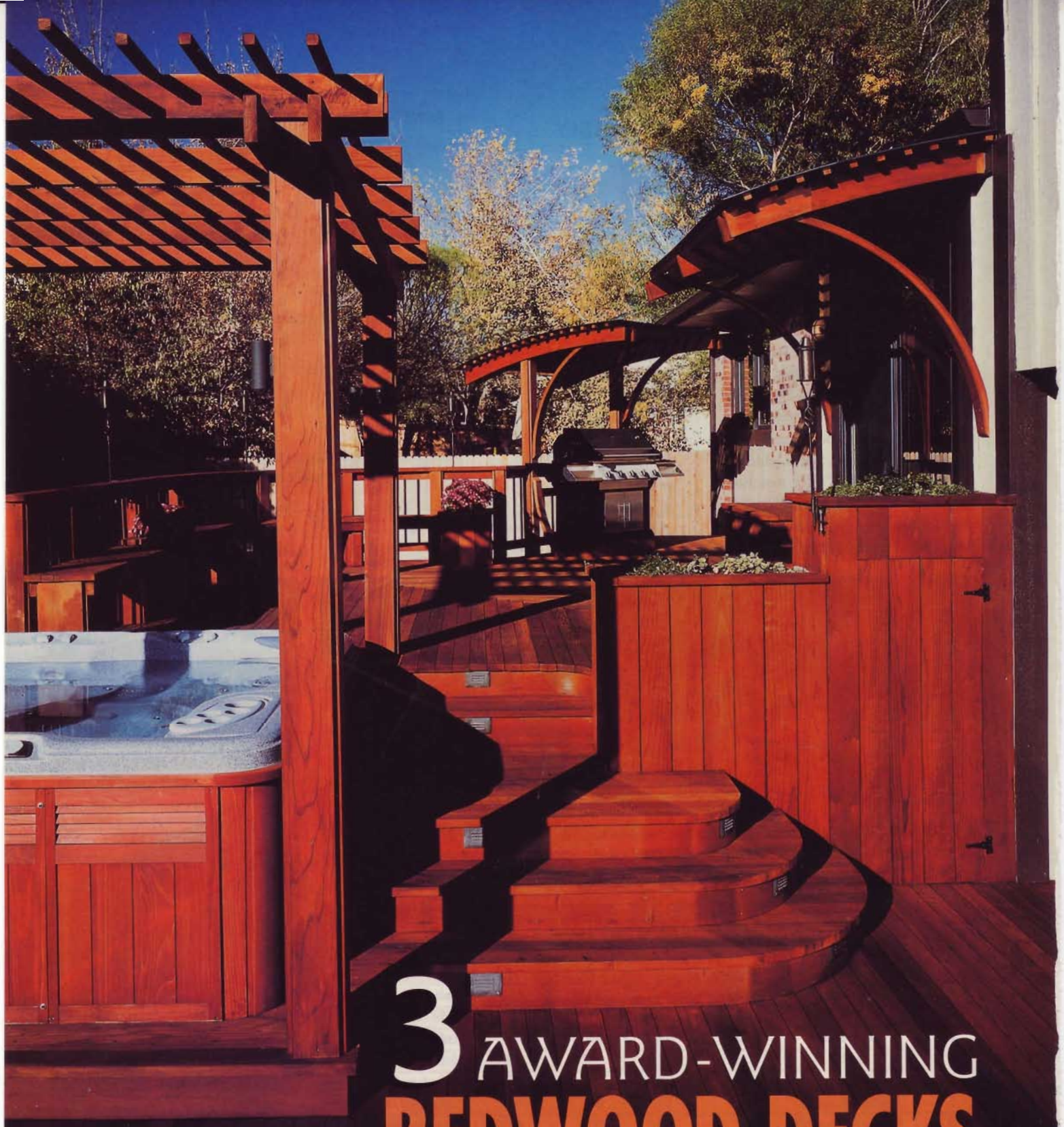
▲ Set the panels in place so the cleats rest on the benchtop and bottom shelf. Then screw the slats to the upper and lower frames and remove the cleats.

MATERIALS & HARDWARE

	Part	Qty.	T	W	L	Material
A	Stretchers	4	1½"	3½"	45¼"	Cedar 2x4s
B	Rails	8	1½"	3½"	18¼"	Cedar 2x4s
C	Corner Blocks	8	3½"	3½"	7"	Cedar 4x4s
D	Rear Legs	2	3½"	3½"	56"	Cedar 4x4s
E	Front Legs	2	3½"	3½"	40"	Cedar 4x4s
F	Middle Shelf Supports	2	1½"	3½"	18¼"	Cedar 2x4s
G	Benchtop & Bottom Shelf	8	1 1/8"	5½"	48¼"	Composite Decking (Trex)
H	Middle Shelf	4	1"	5½"	48¼"	Cedar Decking
I	Side & Back Panel Slats	18	¾"	4¼"	60" (rgh.)	Cedar
J	Back Panel Cleat	1	¾"	1½"	45¼"	Cedar
K	Upper Shelf	1	1"	5½"	48¼"	Cedar Decking
L	Cap	4	¾"	4¼"	4¼"	Cedar

- (8) 3/8" x 6" Lag Screws
- (120) 2 1/2" Pocket-Hole Screws (coarse thread)
- (60) #7 x 1 5/8" Stainless Steel Trimhead Screws
- (16) 2 1/2" Deck Screws (Galvanized)
- (2) 3 1/2"-dia. Cedar Finials

ONLINE Extras — Potting Bench Cutting Diagram
WorkbenchMagazine.com



3 AWARD-WINNING REDWOOD DECKS

Workbench and the California Redwood Association proudly announce the results of our jointly sponsored redwood deck contest. The purpose of this contest is to recognize the most attractive and interesting uses of redwood in a deck project. Our judges chose the winners on the basis of design, quality of construction, innovative details, and overall appearance in relation to the house and yard. The impressive decks of all three of our winners exhibit some incredible woodworking. And we hope they'll provide inspiration for outdoor projects of your own.

1 FIRST PLACE

ARCHITECTURAL ARTISTRY

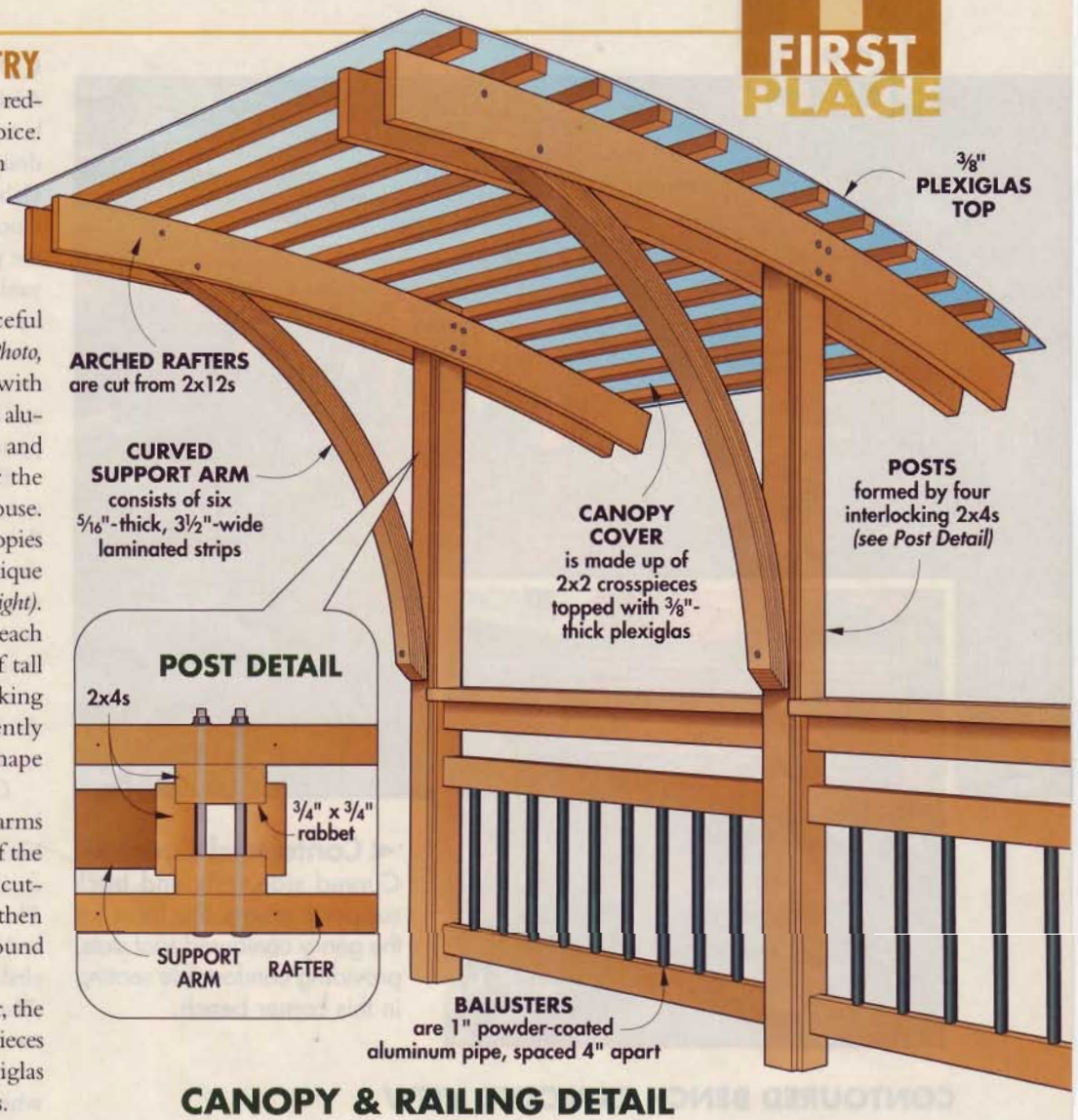
Awarding first place to this elegant redwood deck was an easy choice. Designed by owner Sean Hudelson of Englewood, CO, and built by Rondi Lambeth of Parker, CO, this deck is remarkable for its curved architectural elements.

In particular, note the graceful sweep of the built-in benches *(Photo, below left)*, the curved railings with balusters made of powder-coated aluminum pipe *(Photo, below right)*, and the arched canopies that cover the grilling area and entry to the house.

Canopy Details — The canopies are without a doubt, the most unique feature of this deck *(Illustrations, right)*. The main structural support for each canopy is provided by a pair of tall posts made up of four interlocking 2x4s *(Post Detail)* and four gently curving rafters that are cut to shape from 2x12s.

A couple of curved support arms hold up the cantilevered ends of the rafters. These arms are made by cutting thin strips of redwood and then gluing and clamping them around a bending form.

To provide shade and shelter, the rafters are topped with 2x2 crosspieces and a sheet of 3/8"-thick Plexiglas attached with self-sealing screws.



CANOPY & RAILING DETAIL

▲ Kudos for Curved, Built-In Benches

Built-in benches are tastefully integrated into the curved shape of the deck. Redwood planters with internal drip-irrigation systems define the ends of the benches.

▲ Railings Highlight Redwood & Metal

To accent the redwood railing and to keep finishing and maintenance to a minimum, the balusters are made of 1" powder-coated aluminum pipe.

2 SECOND PLACE

◀ Contoured Comfort
Curved side rails and back supports create the form for the gently contoured seat slats, providing comfortable seating in this corner bench.

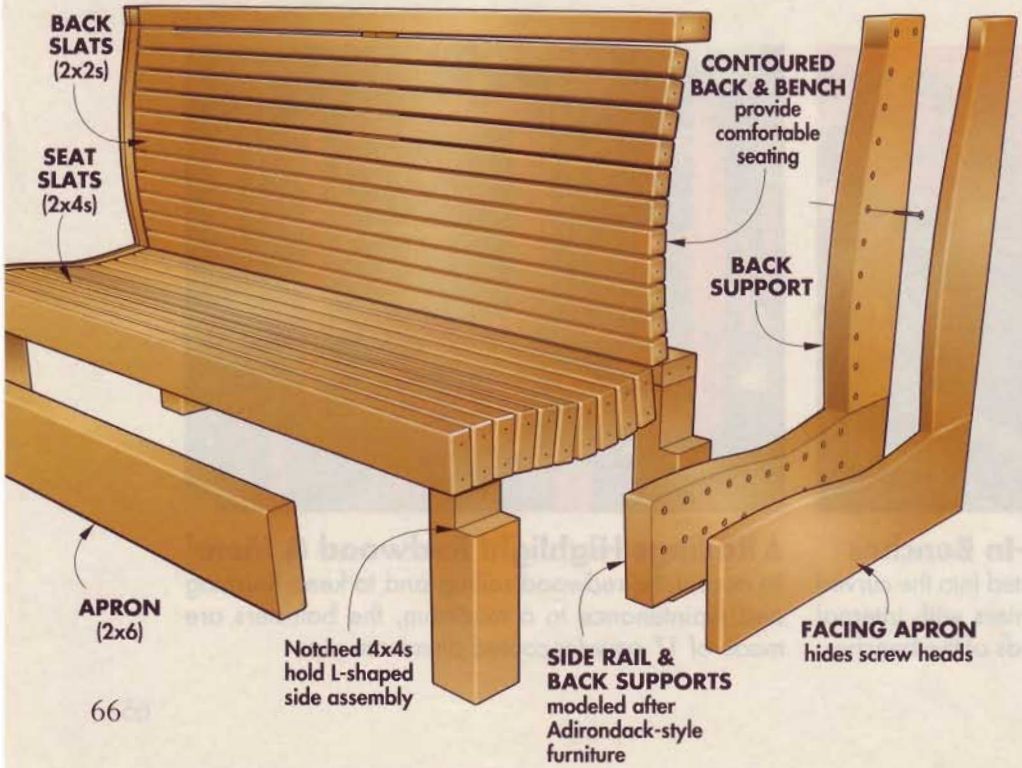
COMPACT CLASSIC

As the saying goes, bigger isn't always better. And this redwood deck, designed and built by Thomas Gabrielli, Ralph Smith, and Bob Coombs of San Diego, CA, proves the point. Tucked into a small backyard, it makes efficient use of every square inch of space. That, plus its attention to detail (no visible fasteners, recessed lighting in railings and steps, and copper post caps), earns this compact deck second-place honors.

But in spite of its relatively small size, this deck "works big." Traffic flows smoothly from the house to the deck, and then down the wide steps to the yard. An octagonal area surrounded by a railing provides an intimate place to visit away from the activity on the main part of the deck. And built-in seats provide yet another conversation spot.

Contoured Seating — These benches aren't your typical flat-bottom, flat-back seats — they're *contoured* for comfortable sitting *(Inset Photo)*. Note the curved side rails and back supports, which are modeled after Adirondack-style furniture *(Illustration, below)*. Compound miters, cut in the ends of the seat slats (2x4s set on edge), produce a perfect fit where they meet in the corner. And each of the 2x2 back slats is individually scribed and cut to fit.

CONTOURED BENCH EXPLODED VIEW



▲ Corner Craftsmanship
Compound miters and scribed joints result in a perfect fit where the seat slats meet in the corner.

3 THIRD PLACE

URBAN GETAWAY

A complete remodel of a Victorian mansion influenced the design of this redwood deck. The house was redone with a Japanese motif, a theme that's echoed by a colorful mural overlooking this urban getaway.

This deck was designed and built by Ryan Farrell, John Romadis, and Audrey Brandt of Mill Valley, CA. It's accessed by stairs leading from the house down to a secluded courtyard *(Photos, below)*. Here, the main deck lies at the base of a wide terrace level, surrounded on two sides by built-in benches.

Privacy Fence & Trellis — A privacy fence topped with a trellis screens the deck from the street. In keeping with the aesthetics of the deck, the privacy fence and trellis are all about function *and* form.

For practical purposes, the fence posts run "long," serving as key structural components of the trellis *(Illustration, right)*. Attached to these posts are 4x4 crossmembers and 2x6 stretchers, which in turn support an open grid made up of 2x4s and 2x2s.

For the privacy fence, overlapping 1x6s create a strong sense of depth. Applying long, vertical strips of wood accentuates the architectural look and feel of the fence.

◄A Study in Stairs
Made of clear heartwood, the redwood stairs feature enclosed risers, molded handrails, and tight-fitting joinery.

chicken alfredo lasagna
MUSTARD
OREGANO
APPLE PIE

drop-down KITCHEN STORAGE

EASY ADD-ON TRAYS FOR KITCHEN CABINETS

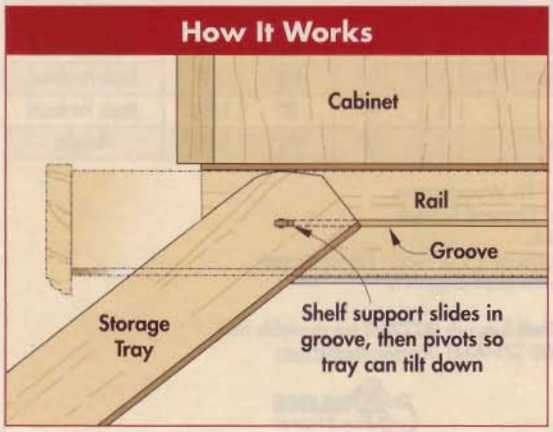
When it comes to the kitchen, you can never have too much storage. But after every available cabinet, drawer, and scrap of countertop space is crammed with pots, pans, dishes, and utensils, one simple question remains: where do you find more space?

This question kicked off a recent *Workbench* project designers' meeting, and the solution our designers came up with was ingenious — create more storage by utilizing the space *underneath* the cabinets.

Drop-Down Trays — In this kitchen, we've mounted four storage trays in that under-cabinet space. These trays pull open like regular drawers, but then they *drop down* at an angle and lock in place, putting spices, knives, or your favorite recipe right at hand.

How It Works — To see how this works, take a look at the *Illustration* below. Notice that there's a plastic shelf support mounted in each side of the tray. These shelf supports slide in grooves cut in the rails that enclose the unit. When you pull the tray all the way out, the shelf supports pivot, allowing the tray to tilt down.

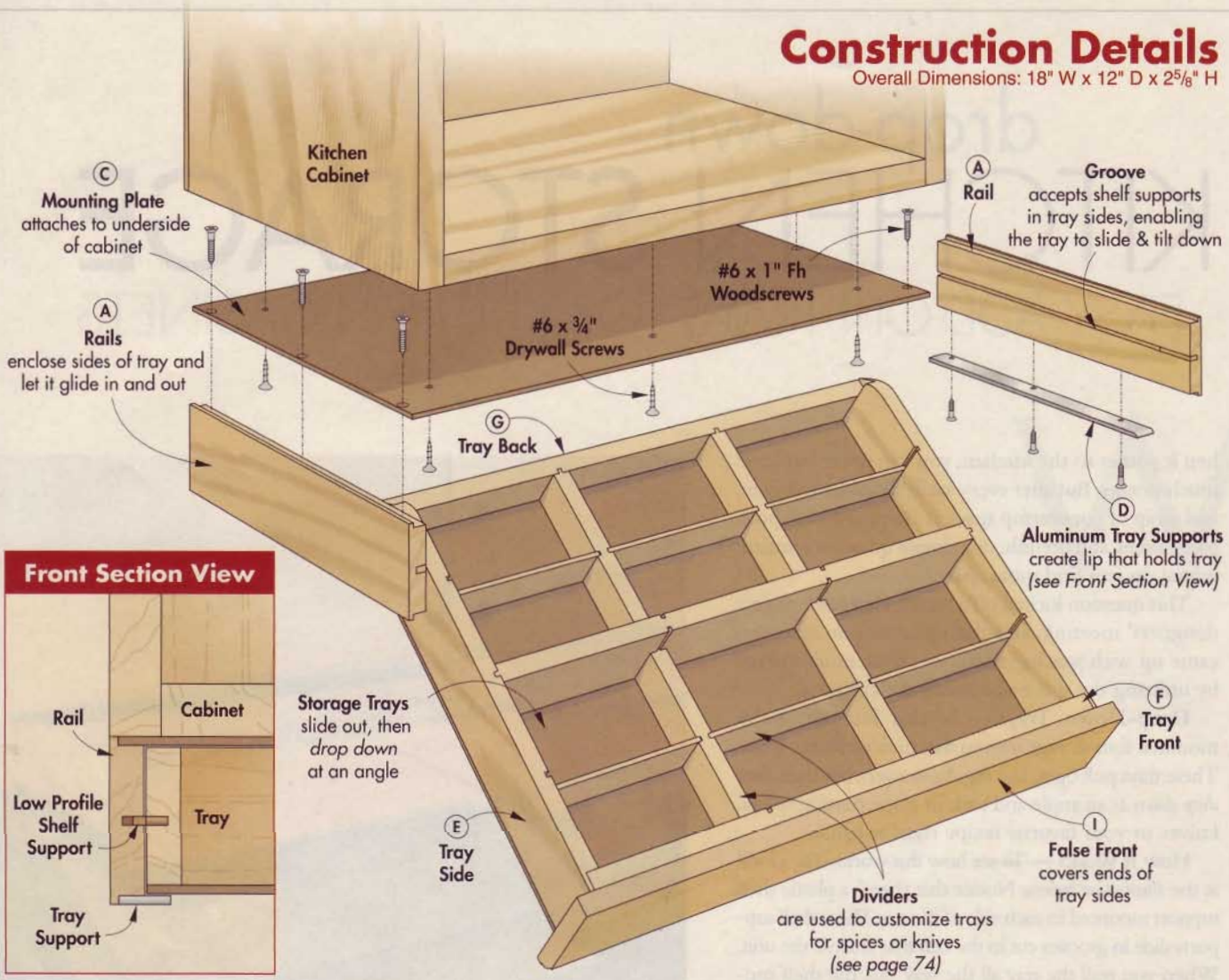
Custom Storage — As an option, you can add dividers that organize the space inside the trays for spices, knives, and other items *(see pages 74-76)*.



If you think there's no more storage space in your kitchen — think again. These unique trays pull out like drawers and then "drop down" at an angle to keep spices, knives, and other items close at hand.

Construction Details

Overall Dimensions: 18" W x 12" D x 2⅝" H



Front Section View

MATERIALS & HARDWARE (for 18"-wide kitchen cabinet)

	Part	Qty	T	W	L	Material
A	Rails	2	½"	2⁷⁄₁₆"	11½"	Maple Hardwood
B	Filler Strips	2	⅛"	⁵⁄₁₆"	1¼"	Maple Hardwood
C	Mounting Plate	1	⅛"	11½"	17¾"	Hardboard
D	Tray Supports	2	⅛"	¾"	9⅝"	Aluminum Bar Stock
E	Tray Sides	2	½"	2"	11½"	Maple Hardwood
F	Tray Front	1	½"	2"	16¹¹⁄₁₆"	Maple Hardwood
G	Tray Back	1	½"	1⅛"	16¹¹⁄₁₆"	Maple Hardwood
H	Tray Bottom	1	¼"	11½"	16¹⁵⁄₁₆"	Hardboard
I	False Front	1	½"	2⅝"	17⅞"	Maple Hardwood
Spice Rack Parts						
J	Tray Divider	1	½"	2"	16³⁄₁₆"	Maple Hardwood
K	Compartment Dividers	4	½"	1⅛"	5¼"	Maple Hardwood
L	Slats	6	⅛"	1⅛"	5³⁄₁₆"	Hardboard
Knife Rack Parts						
M	Tray Divider	1	½"	2"	16³⁄₁₆"	Maple Hardwood
N	Small Knife Holders	2	½"	1⅛"	5¼"	Maple Hardwood
O	Large Knife Holders	2	½"	1⅛"	5¼"	Maple Hardwood
P	Small Knife Block	1	½"	5"	4¹⁵⁄₁₆"	Maple Hardwood
Q	Knife Handle Blocks	4	½"	1¾"	5"	Maple Hardwood
Book Holder Parts						
R	Back Panel	1	½"	9¼"	14½"	Maple Hardwood
S	Panel Support	1	½"	4⅜"	13"	Maple Hardwood
T	Book Rest	1	½"	2"	14½"	Maple Hardwood
U	Book Cover	1	⅛"	8½"	14½"	Plexiglas

- (18) #6 x 1" Fh Woodscrews
- (6) #6 x ¾" Drywall Screws
- (6) ¾" Brads
- (3) 12" lengths of 1 1⁄16"-wide Piano Hinge
- (2) Low-Profile Shelf Supports *

* Low-Profile Shelf Supports (#22286) are available from Rockler at 800-279-4441 or www.Rockler.com

ONLINE Extras

Our Interactive Materials List at WorkbenchMagazine.com makes it easy to size these trays for your cabinets. Just enter the dimensions of your cabinets to create a custom materials list.

building the RAIL ASSEMBLY

What makes the unique "pull out, drop down" feature of these storage trays possible is the rail assembly. It's made up of five parts: two hardwood rails that enclose the sides of the unit, two aluminum tray supports, and a hardboard mounting plate.

Sizing the Rail Assembly — When sizing the assembly, the outside faces of the rails should sit flush with the sides of the cabinet. My cabinets were 18" wide, so the rail assembly matches that width. As for depth, you'll want to make it 1/2" shorter (front to back) than the depth of the cabinet. This will allow for a 1/2"-thick false front that's added later.

Making Rails — The rails (A) are pieces of 1/2"-thick hardwood that are ripped to width and cut to length on the table saw. To accept the shelf supports, you'll need to cut a centered groove in the inside face of each rail. A pass on the table saw is all that's needed to accomplish this.

Of course, the tray would just pull out of these open-ended grooves. So I glued in a hardwood filler strip (B) to create a "stopped" groove.

The next step is to cut a rabbet in the top and bottom edge of each rail. The rabbets in the top edges hold a mounting plate that's added next. The bottom rabbets accept the aluminum tray supports.

Mounting Plate — The mountng plate (C) is a piece of 1/8" hardboard that connects the rails. It will also be used to attach the storage tray unit to the cabinet. For easy assembly later, it's best to drill mounting holes now *(Rail Assembly Detail)*. While you're at it, drill holes for attaching the mounting plate to the rails.

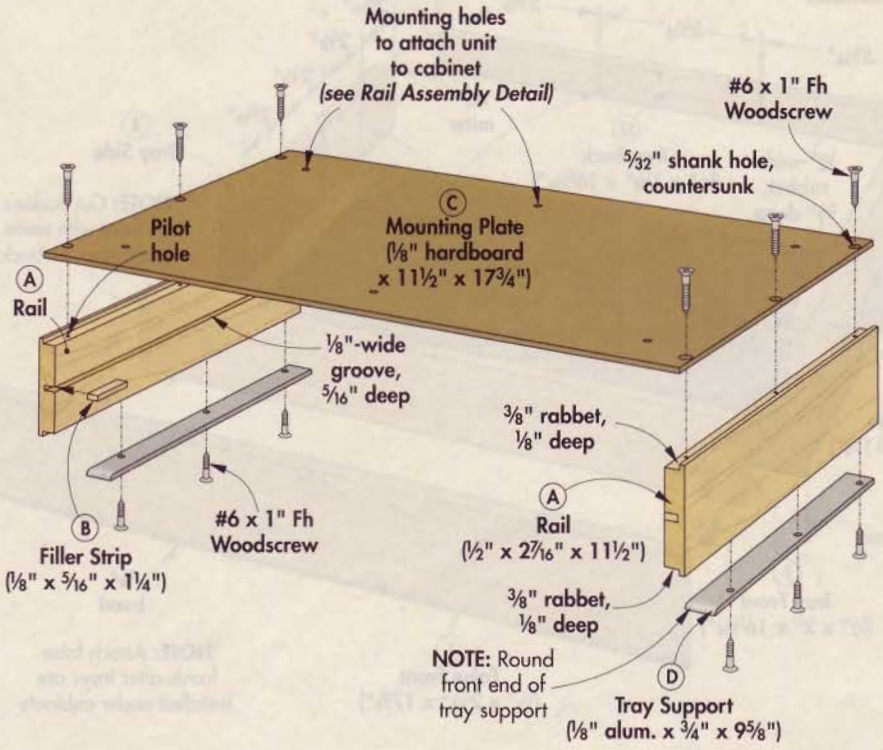
Tray Supports — The next step is to add the two metal tray supports (D). These are pieces of aluminum bar stock that form a lip to hold the tray. (Aluminum bar stock is available at most home centers.) Cut the tray supports to length with a hacksaw, and then drill countersunk shank holes, which will be used to attach them to the rails.

Next, use a sanding block to round the front end of each support. This will prevent the sharp edges of the metal from digging into the tray when it's open.

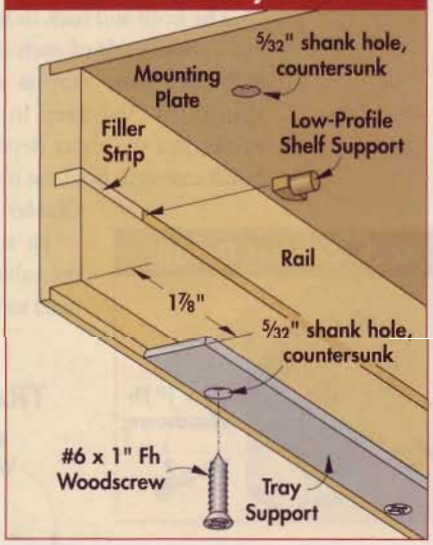
Putting It Together — Now it's time to put the rail assembly together. To do this, clamp the mounting plate between the rails. Using the countersunk holes as guides, drill pilot holes in the rails, and attach the mounting plate with screws.

Before you attach the tray supports, there's one thing to be aware of. To allow the tray to tilt down at the proper angle, the supports must be set back from the front end of each rail *(Rail Assembly Detail)*.

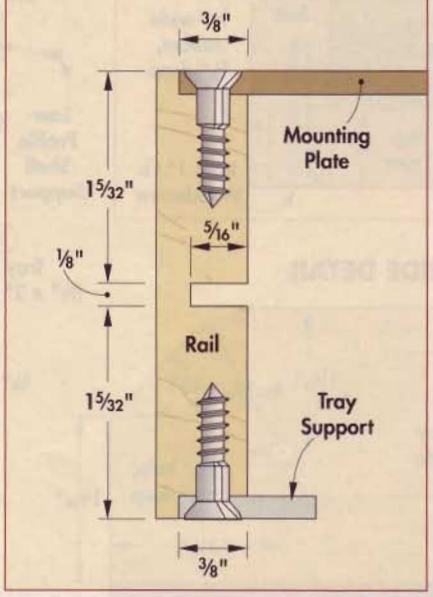
RAIL ASSEMBLY



Rail Assembly Detail



Rail End View



assembling the STORAGE TRAYS

With the rail assemblies complete, you can turn your attention to the trays that fit inside them.

Tray Size — The trays are 1/16" narrower than the distance between the rails. This leaves clearance for the trays to slide smoothly in and out.

Make the Tray — Each tray is a box made of 1/2"-thick hardwood that's assembled with rabbet joints and screws. After planing the stock to thickness, rip and crosscut the tray sides (E), front (F), and back (G) to size on the table saw *(Tray Assembly)*.

The front and back fit into rabbets cut in both ends of each side. It may seem like these rabbets are deeper than usual (3/8" deep in 1/2"-thick stock), but the extra depth lets you install screws to hold the tray together *(Rabbet Details)*.

In addition to the rabbets, you'll need to cut a series of 1/8" dadoes in the inside faces of all four tray pieces. These dadoes will hold the dividers that organize the trays *(page 74)*. Each dado only requires a single pass over the table saw blade.

Once that's done, the top rear corner of each tray side needs some attention. Start by laying out and drilling a hole for a shelf support in each piece *(Side Detail)*.

The next step is to cut a 45° miter in that same corner. This miter allows the trays to tilt down and rest at the proper angle. To end up with identical pieces, it's a good idea to join them together with double-sided tape. Then miter the corners using a table saw or miter saw. To finish up, I sanded a radius to soften the sharp corners.

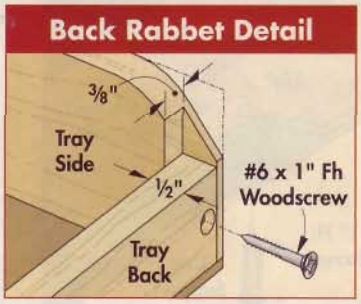
Tray Assembly — The tray is held together with glue and screws. As always, dry assemble the pieces to check the fit and make sure the tray is square when you glue it up.

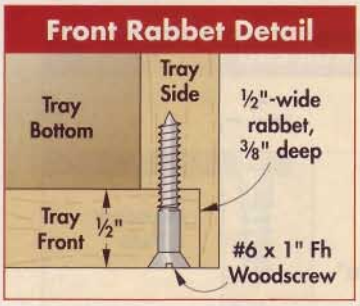
The last step is adding a 1/8" hardboard bottom (H) to the tray. It's just cut to fit and then glued and nailed with small brads.

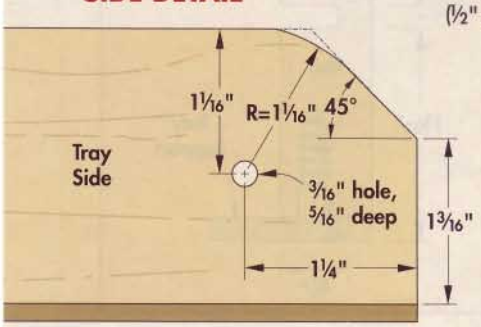
False Fronts — Before installing the trays, there's one last thing to do. That's to make a false front (I) for each tray. The false front is ripped wider than the front of the tray. This way, it forms a lip underneath for pulling the tray out.

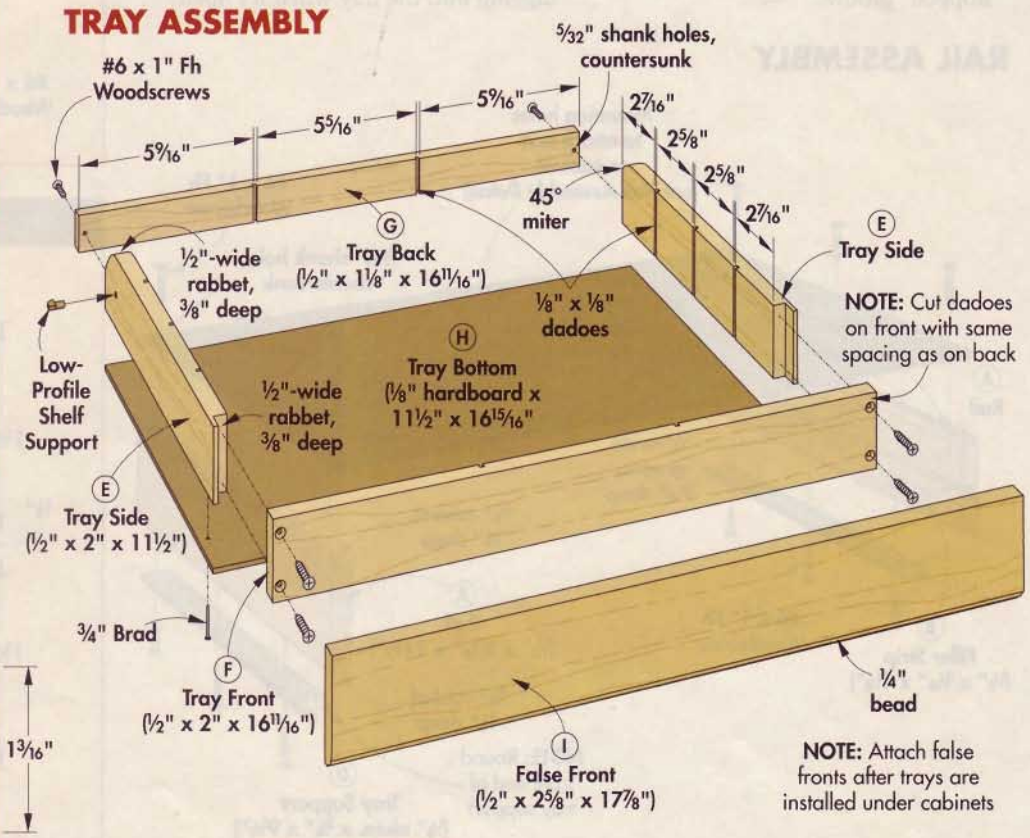
As a decorative touch, you might want to rout a profile along the bottom edge to match your cabinets. (I used a 1/4" beading bit.) Then trim the false fronts to length and install them as shown on page 73.

Matching the Finish — One final note. You'll want to finish the false fronts and exposed tray sides to match the existing cabinets. I just took a cabinet door to a local paint store and had them prepare a finish that matched.









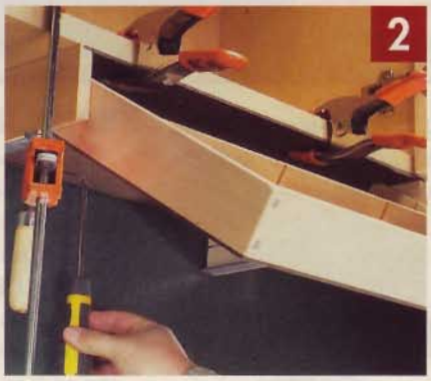
TRAY INSTALLATION

Given the "drop-down" design of the trays, there are two things to keep in mind when mounting them under the cabinets.

First, to allow the trays to tilt all the way down, you'll need to clip one of the "wings" off each shelf support *(Photo, above)*.

Second, the storage tray and rail assembly must be installed as a single unit. If you were to attach the rail assembly first, you wouldn't be able to insert the tray from the front. (The filler strips in the grooves in the rails would prevent it.) So slide the tray into the opening in back of the rail assembly *(Fig. 1)*. Then attach the entire unit, as shown in *Fig. 2* and add the false front *(Figs. 3 and 4)*.

▲ To install the trays, clip one "wing" off each shelf support. Then install the supports and slide the tray into the opening in back of the rail assembly.



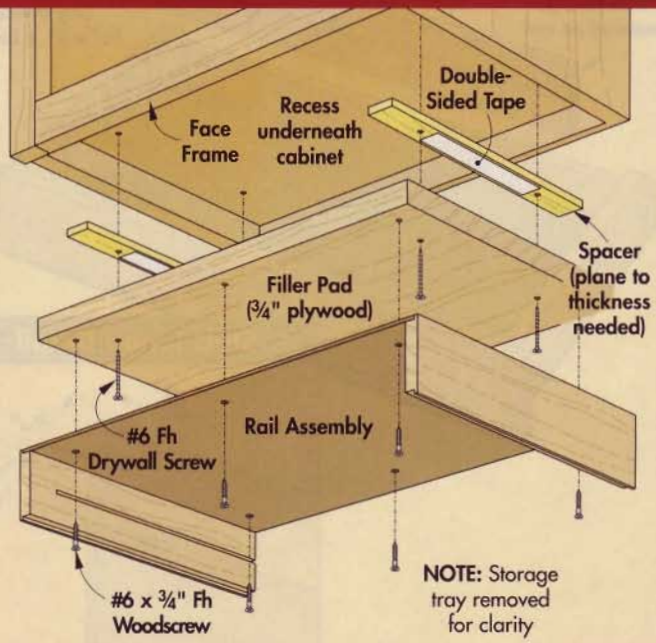
▲ Next, align the unit under the cabinet and clamp it in place. Now pull out the tray to access the mounting plate and screw the unit in place.

▲ Finally, align the false fronts on the trays with double-sided tape *(Fig. 3)*. Attach them by running screws through the tray front and into the false front.

Cabinets with Recessed Bottoms

Our kitchen cabinets had a flat bottom for mounting the trays. A cabinet with a face frame, however, will have anywhere from a 1/2" to 1" recess underneath *(Illustration, right)*. You'll need to fill this recess before mounting the tray. To do this, screw a plywood filler pad into the base of the cabinet. Note: You may need to add spacers to make it fit flush with the bottom of the face frame.

Once the filler and spacers are attached, mount the tray to the cabinet the same way as before — by driving screws up through the mounting plate and into the filler pad *(Mounting Detail)*.



DESIGN OPTIONS

▲ These trays are handy for displaying a touch-screen tablet computer or storing a cutting board *(left tray)*. Other options include a spice rack, knife rack, or book holder.

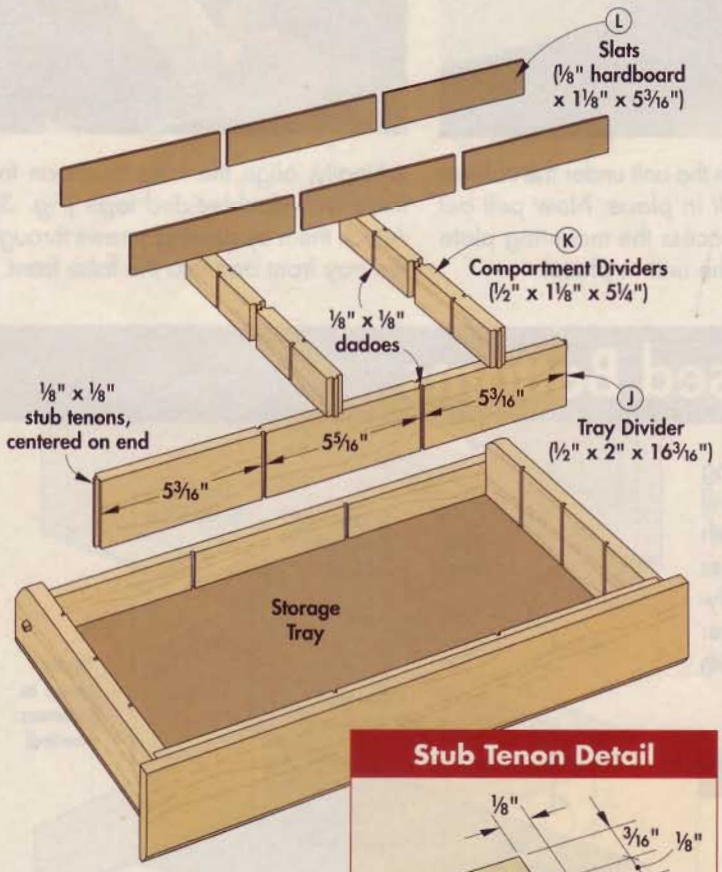
SPICE RACK

Add a few extra parts, and you can convert a tray into a handy spice rack. The rack can be divided into anywhere from two to 12 compartments, depending on the size and number of spice containers you want to store.

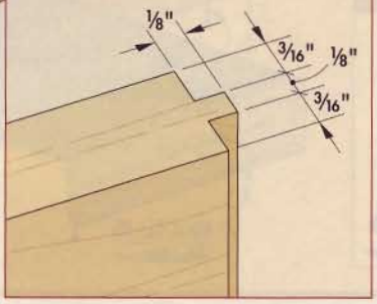
Tray Divider — The key component of the spice rack is a tray divider (J) that separates the tray into two main compartments. This divider has stub tenons cut on the ends to fit the dadoes that were cut in the tray sides earlier *(Tenon Detail)*. It also has two dadoes cut in each face to accept a pair of smaller dividers that further compartmentalize the tray.

Compartment Dividers — These smaller dividers (K) are hardwood blocks that separate the tray into six equal-sized compartments. Here again, they have stub tenons cut on the ends to fit the dadoes in the large divider and the tray front and back.

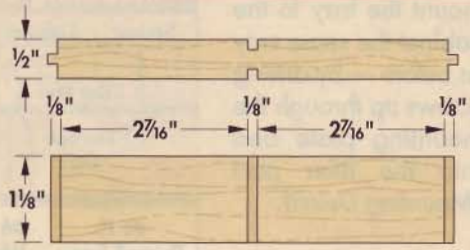
Hardboard Slats — Notice that these compartment dividers also have centered dadoes cut in both faces *(Spice Rack Parts)*. These dadoes accept optional hardboard slats (L) that further divide the compartments. If you want to use your spice rack to hold taller, 4" spice containers, leave the slats out. To store the shorter, 2" ones, add the slats, and each section will accommodate two rows of spice containers.



Stub Tenon Detail



Compartment Divider Detail



KNIFE RACK

Another option is to convert a tray into a knife rack. This rack has two compartments: One for smaller steak knives and the other for larger kitchen knives.

Tray Divider — The construction of this knife rack is similar to that of the spice rack. A tray divider (M) separates the tray into two compartments. Here again, this divider has stub tenons cut on the ends to fit the dadoes in the tray sides. And as before, two dadoes are cut in each face of the divider. Only this time, these dadoes accept knife holders.

Knife Holders — The knife holders (N, O) are 1/2"-thick blocks with slots cut in the top edge.

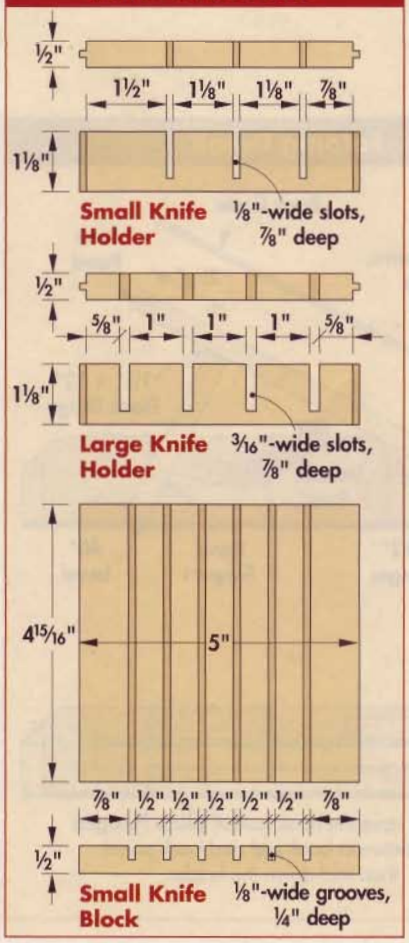
Notice that the size and location of the slots on the knife holders varies depending on the knives they will hold *(see Knife Rack Parts below)*.

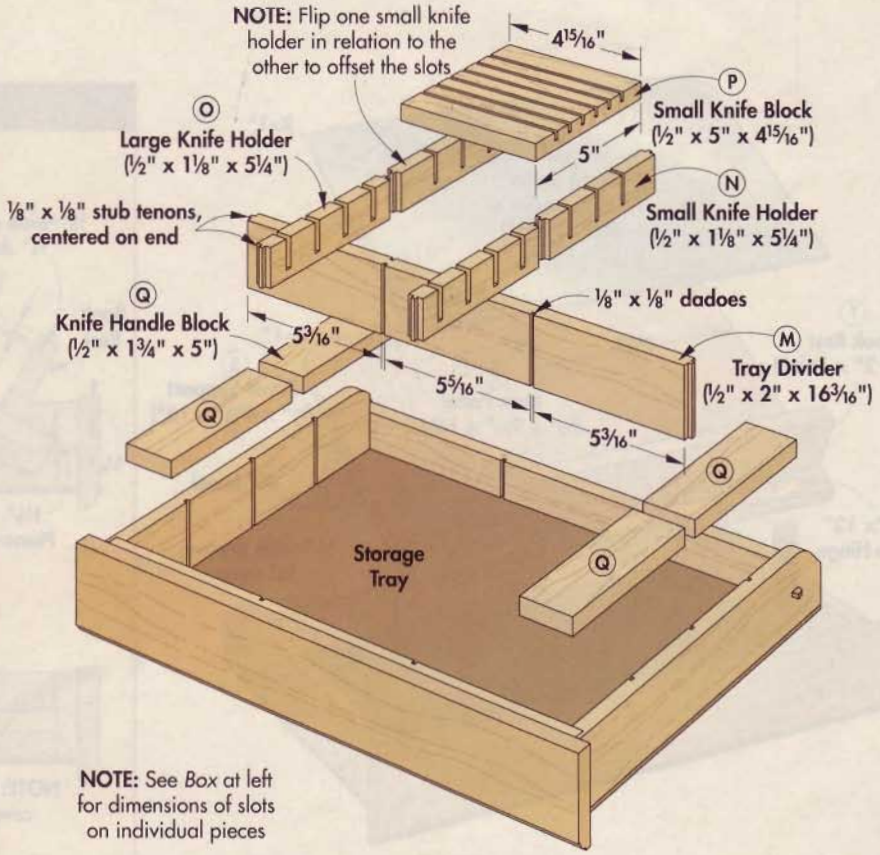
Small Knife Block — In addition to the two small knife holders, a small knife block (P) nestled between them lends extra support to the steak knives. It has six grooves cut in its face to hold the blades.

Knife Handle Blocks — The last parts of the rack are four knife handle blocks (Q). As their name implies, they support the knife handles.

Put It Together — Once all these pieces are cut, just slip them into the tray. (No glue needed.) To make the most efficient use of the space, the handles and blades of the steak knives alternate. To accomplish this, simply *flip* one of the small knife holders in relation to the other one, so the slots in each one are offset.

Knife Rack Parts





DESIGN OPTIONS

COOKBOOK HOLDER

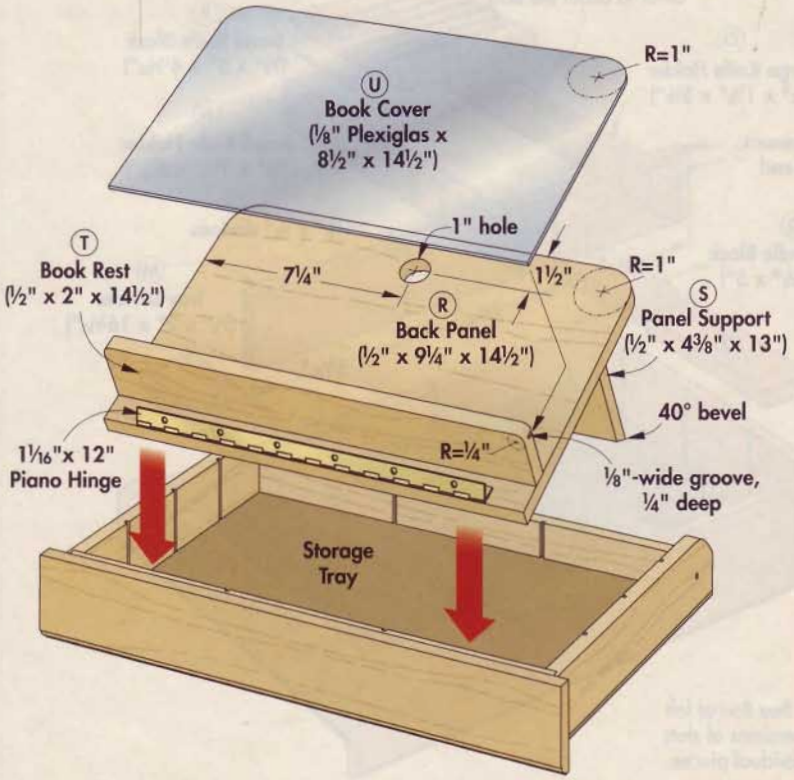
Another nifty way to accessorize one of these storage trays is to add a fold-out cookbook holder. With the tray open, you can tilt the book holder up to hold a cookbook, magazine, or loose-leaf recipe. A Plexiglas cover prevents grease from splattering on your cookbook, and it holds the book open to the correct page.

Back Panel — The cookbook rests against a back panel (R). It's a solid-wood panel that's made by edge-gluing pieces of 1/2"-thick hardwood. To make it easy to lift the cookbook holder out of the tray, cut a 1"-dia. finger hole near the top edge of the back panel. Then round the top corners of the panel.

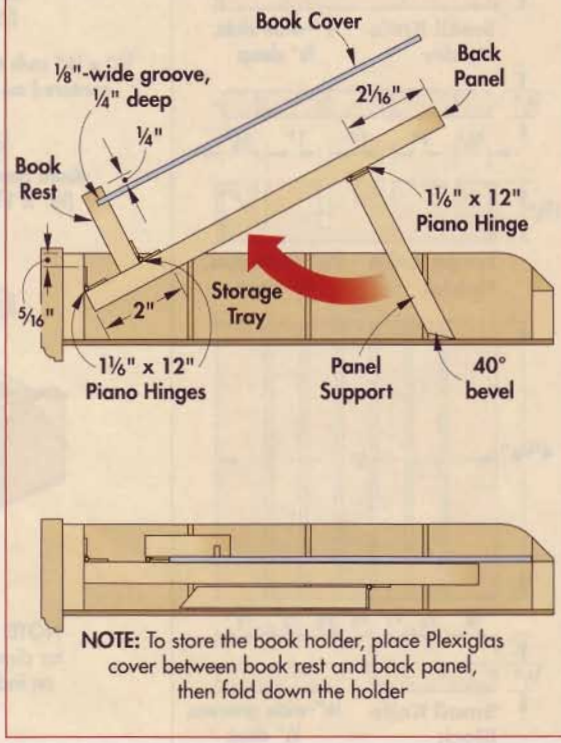
Panel Support — The panel support (S) props the back panel at an angle that makes the cookbook easy to read. All that's needed to accomplish that is to rip a 40° bevel on the bottom edge of the panel support.

Book Rest — The last piece of this accessory is a book rest (T). It's a piece of 1/2" hardwood with a groove cut in it to hold a Plexiglas book cover (U). Here again, round the corners of the book rest.

Assembly — With all these cuts made, you should now be ready to assemble the book holder and attach it to the tray. This is done with three 12"-long piano hinges, which connect the pieces to one another *(see Folding Detail below)*.



Folding Detail

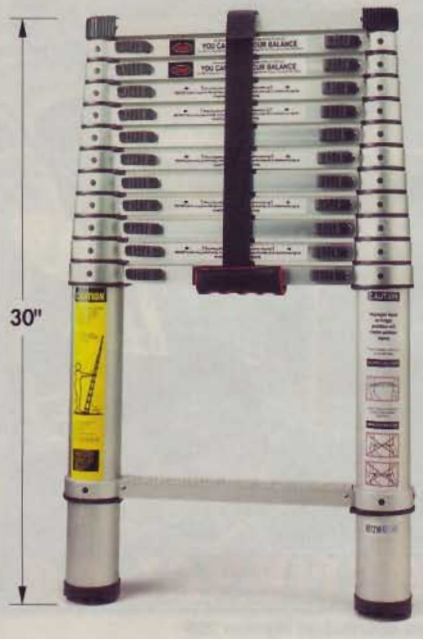


NOTE: To store the book holder, place Plexiglas cover between book rest and back panel, then fold down the holder

Tools & PRODUCTS

WORKBENCH APPROVED

telescoping ladder TRAVELS LIGHT



Even when collapsed to their smallest size, most extension ladders are unwieldy and difficult to store and transport. That's not the case with the Xtend & Climb ladder, however. With its telescoping design, this ladder is a compact 30" tall when closed, yet it extends to 12½ feet — the same as a typical 16-ft. extension ladder.

The Xtend & Climb ($199.95 plus $49.95 for the carrying case) can be extended in one-foot increments, locks securely at each position, and provides surprisingly sturdy support as you climb. It is made of aluminum alloy and weighs 25 lbs.

It is available at Hirschfield's Decorating Centers, and True Value, Ace, and Do-It-Best hardware stores, and can also be purchased at www.TrueValue.com www.Target.com and www.GetLadder.com

▲ The Extend & Climb ladder, which extends to 12½ ft. and closes to 30", is easy to store.

microadjustable MARKING GAUGE

A few years ago, Lee Valley & Veritas unveiled a great new marking gauge that featured a razor-sharp disk for scoring precise, clearly visible lines on a workpiece.

Their latest offering does that and more. With increments etched into the shaft of the marking gauge, setting the distance from the disk to the fence has never been easier. To "tweak" the position of the fence, you simply use the built-in micro-adjuster to "dial in" the correct setting. Tighten the knurled lock knob, and you're ready to go to work.

The marking gauge, which sells for $32.95, is available from Lee Valley & Veritas at 613-596-0350, or visit www.LeeValley.com

◄ Graduated markings on its shaft and the ability to handle microadjustments make this marking gauge a perfect tool for precise layout.

adjustable Profile Sander

Sanding is especially difficult on uneven surfaces like molding. The Vario-Pro profile sander, however, ($49.95) makes quick work of these tasks. Just press the tool against the workpiece, and its "lamellas" (thin sheets of plastic) will conform to the shape. Tighten the wing nut to lock the sander in that shape, then attach sandpaper. Available at www.BridgeCityTools.com or 800-253-3332.

the bygone era of the CABINETMAKER

John Olson

Here at *Workbench*, we consider most anyone who gets to work with tools for a living extremely lucky. So you can imagine how we feel about a guy whose job is to use tools the way they were used 130 years ago.

Life in 1875 — This is the enviable position of John Olson, cabinetmaker at Living History Farms in Urbandale, Iowa. Since 1970, the mission of the Farms has been to portray prairie life from the late 19th and early 20th centuries. They uphold that mission by operating a working farm, schoolhouse, blacksmith shop, and an entire village called Walnut Hill, all as it would have looked in 1875. As the cabinetmaker, John's role in this community is to educate visitors by creating cabinetry and furniture the way it was made back then.

In that era, John likely would have made a decent living at his craft. As pioneers moved westward onto the open prairie after the Civil War, they needed to establish themselves in new homes. John's skills as a carpenter and a cabinetmaker were in high demand. Cabinetmakers earned $3 or more a day — a healthy sum for a tradesman at the time.

Tools of the Time — Perhaps as interesting as the era in which John practices his craft are the tools he uses. This J. Marston & Co. "Hand & Foot Saw" *(Photo, below)* had just arrived in shops by 1875. It is operated by a foot-powered treadle to keep the blade running at 1,200 RPM. For an in-depth look at the tools and techniques John uses in his 1875 cabinetmaking shop, see page 96.

planes & treadles: building in 1875

▲ Planes handled many shop tasks in 1875. Here, John adjusts a jointer plane *(above)* and rounds an edge with a hollow plane *(below)*.

A project in John's shop starts out the same way it does in a modern wood shop — workpieces are cut to size, and then square, smooth edges are produced with a jointer and planer.

Planes for All Purposes — Only John's jointer and planer are not the large, noisy machines we're used to today. Cabinetmakers of the past used a series of four different planes to thickness and smooth a workpiece: a scrub plane, trying plane, jointer plane, and smooth plane. Here, John relies on a jointer plane *(Top Photo)* to smooth the rough edge of a workpiece.

Cutting Material — Most crosscuts and rip cuts were made with hand saws, but if you were fortunate enough to afford a $50 treadle table saw, you would have used that instead *(Photo, page 94)*. These foot-operated tools typically were only affordable for cabinet shops with 12 employees or more. The "jig" saw shown below is another example of such a tool.

Life Without Routers — Treadle shaper tables were just becoming available in 1875, and the first router was still 30 years away. So cabinetmakers relied on other means to produce profiles and joinery. Here, John shows how he makes a roundover and dovetail joints *(Photos, right and lower right)*.

Wood Workout — John jokes that cabinetmakers got their exercise from all these hand- and foot-powered tools. But a well-crafted project was always worth it, just as it is today.

► By pumping his foot up and down on the treadle, John causes the arm of this "jig" saw to produce a cutting motion like a scroll saw. Like its modern equivalent, this saw excels at making fretwork and decorative cutouts.

▲ Routers, dovetail bits, and dovetail jigs didn't exist in 1875, so cabinetmakers relied on more traditional methods for creating dovetail joints. First, John lays out the dovetail pins with a pencil and cuts the sides of them with a hand saw. Then, he removes the waste between them using a chisel *(Photo above)*.