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American Woodworker Subscriber Service Dept., P.O. Box 8148, Red Oak, IA 51591-1148, (800) 666-3111, e-mail AWWcustserv@cdsfulfillment.com

Article Index:

A complete index is available online at www.americanwoodworker.com

Copies of Past Articles:

Photocopies are available for \$3 each. Write or call: American Woodworker Reprint Center, P.O. Box 83695, Stillwater, MN 55083-0695, (715) 246-4344, 8 a.m. to 5 p.m. CST, Mon. through Fri. Visa, MasterCard, Discover and American Express accepted.

Back Issues:

Some are available for \$6 each. Order from the Reprint Center at the address above.

Comments & Suggestions:

Write to us at American Woodworker, 2915 Commers Dr., Suite 700, Eagan, MN 55121, (651) 454-9200, fax (651) 994-2250, e-mail aweditor@readersdigest.com

AMERICAN WOODWORKER

Subscription questions? See page 2.

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PUBLISHED BY HOME SERVICE PUBLICATIONS, INC.,
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READER'S DIGEST ASSOCIATION, INC.

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Issue #111. American Woodworker®, ISSN 1074-9152.
 USPS 738-710 Published bimonthly, except monthly October
 and November by Home Service Publications, Inc., 260 Madison
 Avenue, 5th Floor, New York, NY 10016. Periodicals postage paid
 at New York, NY and additional mailing offices. Postmaster: Send
 change of address notice to American Woodworker®, PO Box
 8148, Red Oak, IA 51591-1148. Subscription rates: U.S. one-year,
 \$24.98. Single-copy, \$5.99. Canada one-year, \$29.98 (U.S.
 Funds); GST # R122989633. Foreign one-year, \$29.98.
 (U.S. Funds). U.S. newsstand distribution by Hearst Distribution
 Group, New York, NY 10019. In Canada: Postage paid at
 Gateway, Mississauga, Ontario; CPM# 1447866. Send returns and
 address changes to American Woodworker®, PO Box 8148, Red
 Oak, IA, USA 51591-1148. Printed in USA. © 2004 Home
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QUESTION & ANSWER

by Dave Munkittrick & Bruce Kieffer

ALIGN BANDSAW WHEELS

Q I've tried everything to get good resaw results on my bandsaw, but the blade still wanders. What gives?

A If you use a sharp blade designed for resawing, you compensate for drift angle, you've set the proper tension and you're still getting bad results resawing, there's only one other possibility: Your wheels need alignment. Pop the hood (well, the wheel covers) on your saw and put a straightedge across the rim of both wheels (Photo 1). If there's a gap, your wheels are not operating in the same plane.

Misaligned wheels are a problem for bandsaws with crowned wheels. If your saw is 16 in. or smaller, chances are it has crowned wheels. A crowned wheel has a slight hump where the blade rides. The crown is designed to force the blade toward the center of the wheel and aid in tracking the blade. If the two crowned surfaces are not in the same plane, they pull against each other, robbing the saw of power and accuracy.

Fortunately, the problem is easy to fix on most saws. First, measure the misalignment (Photo 2). Next, remove the blade and the wheel and apply the appropriate shim(s) (Photo 3). Most saws have thin washers behind each wheel. You may find removing the stock washer and replacing it with a thicker one is just the ticket.

Reattach the wheel and give your saw a spin.

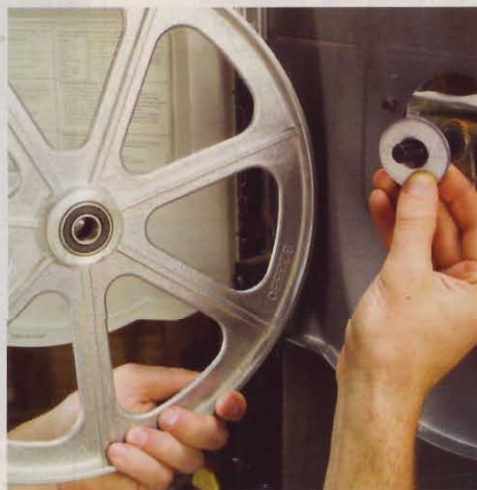
Note: Some saws have an adjustable bottom wheel. Just loosen the setscrew and slide the bottom wheel in or out the appropriate amount.



1 Check the wheel alignment with your resaw blade mounted and tensioned. It may be necessary to adjust the tracking of the upper wheel to make the faces of both rims parallel.



2 Measure the gap with a ruler calibrated to at least 1/32 in. or with a dial caliper.

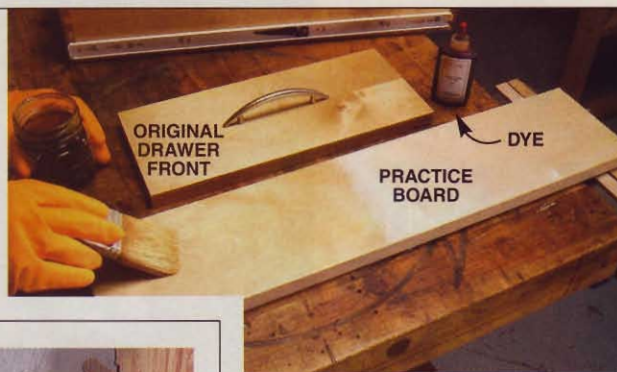


3 Add or replace washers behind the wheel to achieve alignment. For small adjustments, use metal shim stock or metal dado blade shims behind the washer.

EDITOR: DAVE MUNKITTRICK • ART DIRECTOR: DAVID SIMPSON • PHOTOGRAPHY: THIS PAGE, RAMON MORENO

MAKE NEW VARNISH LOOK OLD

Q I built my own kitchen cabinets a few years back. One drawer got damaged, so I stripped the finish from the drawer front, made the repair and applied a fresh coat of polyurethane. The new finish is noticeably lighter than the old one. I sure don't want to refinish the entire kitchen. Is there a way to match the aged finish?



A The solution is to tint the new finish with dye. Varnish yellows with age and that's the reason your newly finished drawer doesn't match the old. I recommend using a dye called Orange Shellac from Wood Finishing Supplies. Don't let the name fool you; it's just a color and has nothing to do with real orange shellac. It's best to keep the tinting very light so two or three coats of the polyurethane give you the color that matches your old finish.

For one drawer, pour a small amount of polyurethane into a container. Add a few drops of the dye concentrate, mixing it in well. It'll look like a dark olive oil, which seems weird, but the color looks a whole lot different on the wood. It will take some experimentation to get the dye-to-polyurethane ratio correct. Brush a couple of coats of the tinted poly on a test board. If the color matches, your formulating is done. If not, adjust the number of coats or the amount of dye until you get a good match.

Source
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PHOTOGRAPHY: STAFF

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Circle No. 9

WHAT'S THE IDEAL WORKBENCH HEIGHT?

Q Is there a standard or recommended height for a workbench?

A For most people, a height that allows you to lay the palm of your hand on the benchtop with a

slightly bent elbow works best. If you have back problems, you may want to raise that height to your belt line.

The ideal workbench height is really the one that works best for you. It's a function of what kind of



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Circle No. 2

woodworking you do and how tall you are. Traditional workbenches were built low to get the user's full body weight and muscle power behind their tools. It's effective for pushing a hand plane but uncomfortable for almost all other work. With handheld power tools, a higher bench height is more desirable and less of a strain on the ol' back.

If possible, try mocking up a bench with plywood and sawhorses. Start with our ballpark height and see what you think. Adjust the height accordingly until you find the height that's best for you and what you do. **AW**

If you have a question you'd like answered, send it to us at Question & Answer, American Woodworker, 2915 Commers Drive, Suite 700, Eagan, MN 55121 or e-mail to qanda@readersdigest.com. Sorry, but the volume of mail prevents us from answering each question individually.

PHOTOGRAPHY: STAFF

CLAMP DOUBLES AS TAIL VISE

After years of wishing my old workbench had a tail vise, I realized I could make one of my new Jorgensen Cabinet Master bar clamps do the job. All I had to do was reverse the sliding lower jaw (it's removable) and mount the bar and fixed jaw under the benchtop.

I drilled and chiseled out an elongated hole in the leg so the sliding jaw would extend only 5/8-in. above the benchtop. Then I lag-screwed a notched block and cap at the opposite end to act as a bearing surface for the fixed jaw. To finish my tail vise, I drilled a row of 1-1/8-in.-dia. holes in line with the sliding jaw and fashioned a bench dog to fit.

When I need to use the clamp elsewhere, I just remove the sliding jaw and pull the fixed jaw and bar out from the other end.

Robert A. Miller



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WORKSHOP TIPS



BANDSAW OFFCUT TRAY

While sweeping up offcuts from around my bandsaw, I realized two things: First, I hate sweeping. Second, a dustpan-shaped tray attached to the bandsaw would catch most of the offcuts I was sweeping.

I made my tray from scraps of 1/2-in. plywood and 1/4-in. hardboard. I fastened two pieces of 1/8-in. x 1-in. steel to the tray and bolted it to my saw through the rip fence mounting holes. In addition to catching offcuts, this tray also offers convenient storage when I'm cutting numerous small pieces.

Kevin Groenke

Circle No. 165

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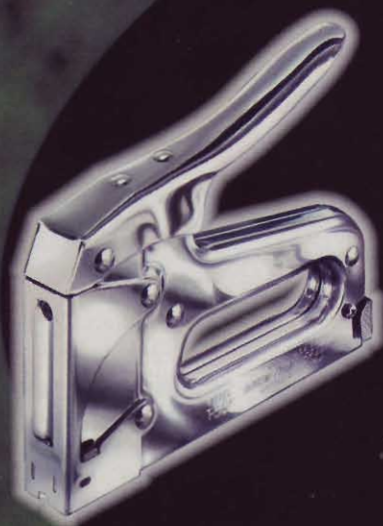
SPEEDY BLADE TENSIONING

Changing bandsaw blades used to be a pain, because my bandsaw doesn't have a quick-release blade-tensioning mechanism. I finally got tired of hand-cranking, so I replaced the tensioning rod with a 3/8-in. threaded rod. I locked two nuts against each other on top of the rod, making sure their faces lined up. Now a 9/16-in. socket operates the tensioning system and only my trigger finger gets tired.

C.J. Wiesenfarth



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I love adjustable clamps, but I used to have trouble gripping and tightening the handles, especially at the end of a long day. Glued-on pieces of drawer liner (\$5 per roll at most home centers) make them much easier to use.

Two or three wraps make a comfortable grip that you can really put the squeeze on. **AW**

Don Peterson



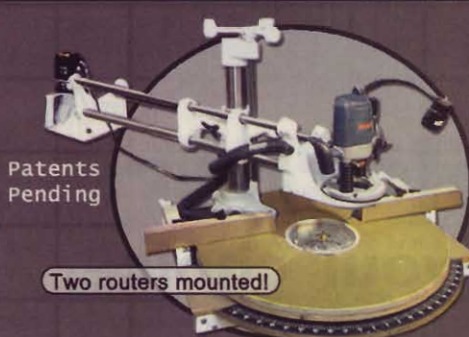
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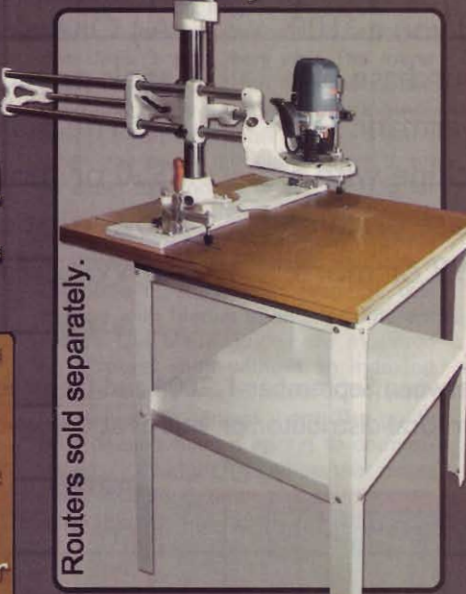
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by Bruce Kieffer



Forstner Bits

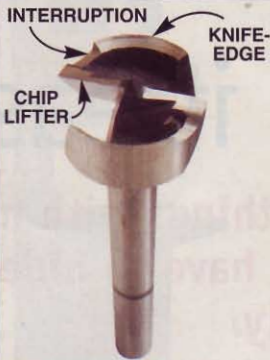
A Forstner Bit Can Drill Holes Other Bits Only Dream About

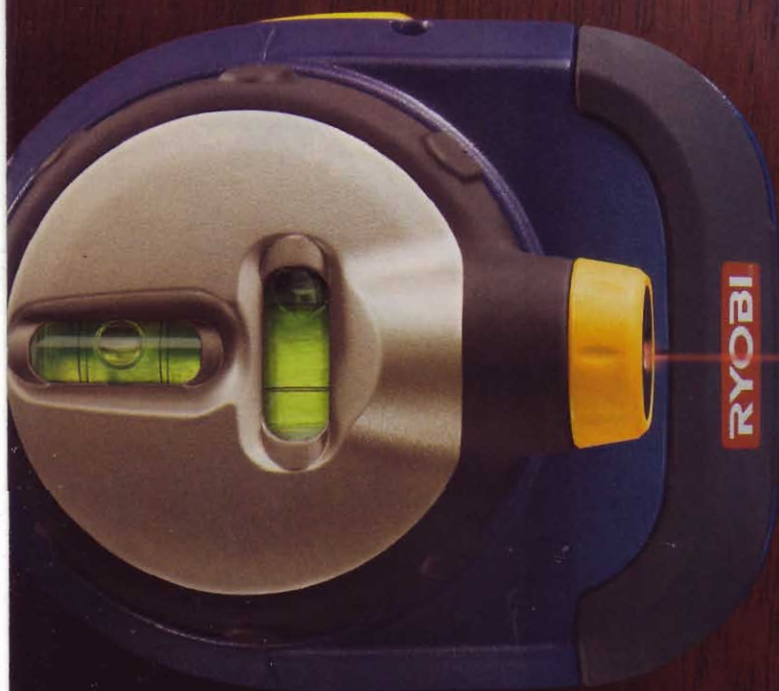
Forstner-style bits can go where no other drill bits dare. The reason is simple: A Forstner bit is rim-guided while other bits are center-point guided. That means you can use all or only part of the bit's diameter to drill overlapped, angled or partial holes. Forstner bits also shine when it comes to drilling clean, precise 90-degree holes and large-diameter

holes. Carbide-tipped Forstner-style bits excel at drilling the precise, flat-bottomed holes required for European-style hinges. Plus, unlike other drill bits, the rim-guided Forstner bit can drill into end grain without deflection.

Forstner bits do have their drawbacks and are not a substitute for your everyday twist- or brad-point bits. For one thing, they are

more expensive: A 1/4-in. Forstner bit costs between \$3 and \$23. They're also designed primarily for use in a drill press, although Forstner bits that are 1 in. or smaller can be used in a hand drill if the bit's center point is firmly engaged. Forstners also require a very slow rpm rate and thus are slow cutting. Finally, they are very difficult to sharpen.

BIT TYPES	DESCRIPTION	SOURCE
KNIFE EDGE 	The knife-edge is the most traditional Forstner design and does a great job of cutting nonstandard holes. That's because it has the fewest rim interruptions. Its rim is ground to create an inside bevel with a sharp knife-edge. The rim scores the wood before the chip lifters remove the wood from the hole, creating a very smooth, flat-bottomed hole with no tear-out. The knife-edge rim's "rubbing" cut generates a lot of heat from friction. Because of this, the style is found primarily in 1-in.-dia. or smaller bits, whose rim speed is relatively slow. To avoid overheating, follow the speed recommendations that come with each bit.	Lee Valley (800) 871-8158 www.leevalley.com 1-in. Forstner bit, #06J71.16, \$7.
WAVY EDGE 	A new Forstner rim design is the wavy edge. Manufacturers claim their wavy-edge bits run cooler than knife-edge Forstners. The idea is that the complex grind of the wavy edge creates ultrasharp points along the rim that help break up the wood chips for easier passage through the bit's throat openings. The wavy-edge rim performs just as well as the knife-edge does on 90-degree holes. However, holes drilled by a wavy-edge bit on a board's edge without the center point engaged have slightly rougher sidewalls than those made by the knife-edge bits. And starting a hole at an angle produces a bit of chatter until the center point engages.	Freud Diablo (800) 334-4107 www.freudtools.com 1-in. Precision-Shear Forstner bit, #FB-007, \$12.



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BIT TYPES	DESCRIPTION	SOURCE
SAWTOOTH/MULTISPUR 	These bits, with sawlike teeth ground into the rim, are great for drilling 90-degree holes. The rim teeth cut, rather than score, the wood, generating less heat and allowing a faster feed rate than knife-edge bits do. Because it can handle a higher rim speed, the sawtooth rim style is most common on bits larger than 1 in. diameter. These bits don't perform well when drilling without the center point engaged. The teeth create too many rim interruptions, so the bit is not truly rim guided. Starting a hole at an angle produces chatter and rough sidewalls with heavy tear-out.	Hickory by Oldham (800) 828-9000 www.oldham-usa.com 1-in. Forstner bit, #HW1013, \$10.
CARBIDE SPUR 	This rim style features two protruding carbide spurs at the outside ends of the carbide lifters. The spurs score the wood fibers in the same way as the rim does on a knife- or wavy-edge bit, for clean, smooth standard 90-degree drilled holes. The carbide stays sharp for a long, long time, even when you're cutting through melamine or MDF. That's why these bits are mainly used to bore holes for mounting European-hinge hardware. Because this style lacks a rim to guide it, the bit is incapable of drilling a hole without the center point engaged.	Woodtek from Woodworker's Supply (800) 645-9292 www.woodworker.com 1-in. Carbide-tipped Forstner bit, #109-061, \$11.

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BUYING ADVICE

For this article, I tried more than 100 different Forstner-style bits from various manufacturers. Four basic styles are available: knife edge, wavy edge, sawtooth and carbide spur (see "Bit Types," pages 26 and 27). All the bits I tested drilled standard 90-degree holes just fine. But only some could drill the angled or partial holes that Forstners are known for. If you want to drill these specialized holes, stick with the knife-edge or wavy-edge design. These bits have an almost continuous rim, with few interruptions. The more interruptions in the rim, as in a sawtooth bit, the poorer the bit's performance

when drilling holes without the center point engaged. These interruptions have an advantage, however: They generate much less heat, so the bits can run faster and drill holes more quickly than bits with a more continuous-rim design can. The sawtooth bit is also easier to sharpen than other Forstner style bits are.

COST AND PERFORMANCE

U.S.- and European-made Forstner bits can cost up to four times as much as bits imported from other countries. But I found that generally the more expensive bits held their sharpness longer and drilled more accurate holes.

One factor in the price is the

steel used to produce the bit. The more expensive Forstner bits are made of durable high-speed steel. Carbon-steel bits cost slightly less, but their steel will not hold an edge as long as high-speed bits will.

A carbide-tipped bit also costs more, but it's the bit to buy if you drill lots of 90-degree holes in abrasive materials, such as MDF, particleboard or melamine. These abrasive materials will quickly dull even high-speed steel bits.

One last bit of buying advice: Most of these bits are available in sets. Buying a set can save you money. Plus, the sets come with a handy storage case to protect the delicate edges of your Forstner bits.

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Max CFM.....	1250
Fan.....	11"
Inlet Dia.....	1-5"/2-4"
Bag Capacity.....	42 gallons
Decibels.....	67-77
Electrical.....	110/220
↳ Switch Prewired for 110V	

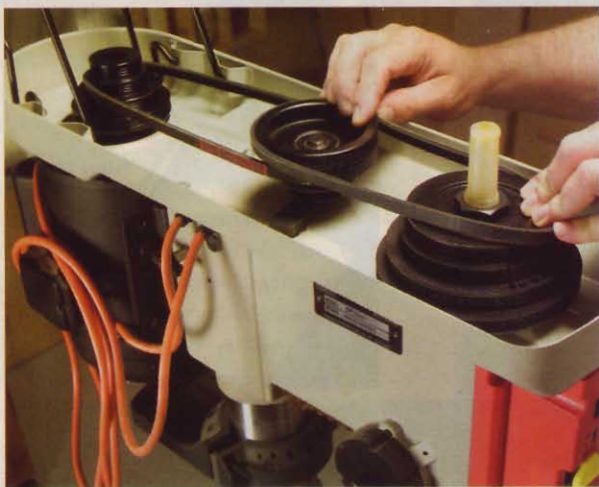
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10 TIPS FOR USING FORSTNER BITS



1

OBEY THE SPEED LIMIT

Adjust the speed of your drill press to match as closely as possible, but not exceed, your Forstner bit's recommended speed. Most Forstners have different speed ratings for hardwoods and softwoods.



2

KEEP 'EM SAFE

A clean, sharp rim is critical to a Forstner bit's performance. Rolling loose in a drawer will damage the bits' delicate rims. A simple wood block with holes drilled for the bit shanks does the trick.

"...dovetail one, or a hundred drawers – perfect every time."

– Norm Abram,
New Yankee Workshop

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Popular Woodworking Magazine



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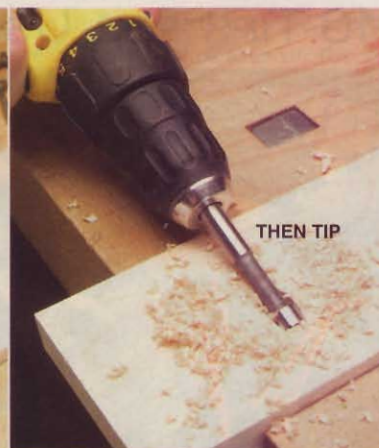
FMT



10 FORSTNER TIPS

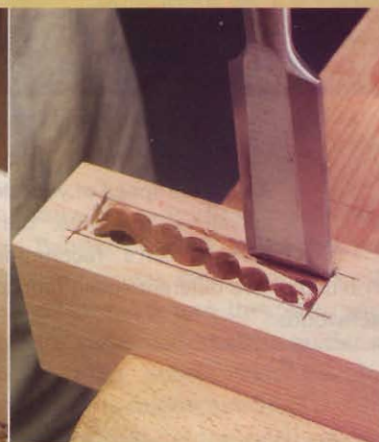
3 DRILL ANGLED HOLES BY HAND

You can make angled holes using a Forstner bit in a hand drill. The trick is to start at 90 degrees until the rim and the center point are engaged, and then tip the bit while keeping it spinning. This works best with knife- or wavy-edge bits that are less than 1-in. diameter.



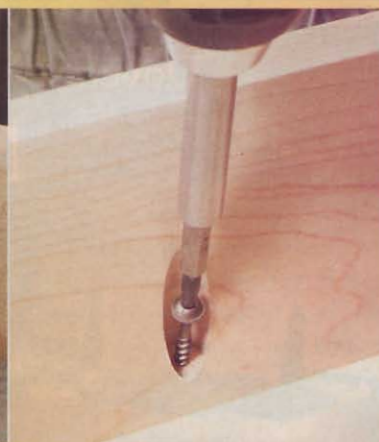
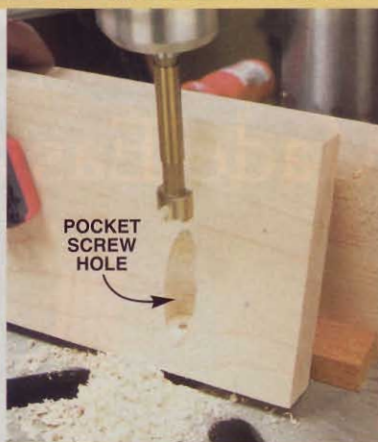
4 HOG OUT A MORTISE

Forstner bits can cut overlapping holes. This is an especially useful technique for hogging out the majority of material in a mortise. It keeps the chisel work and elbow grease to a minimum.



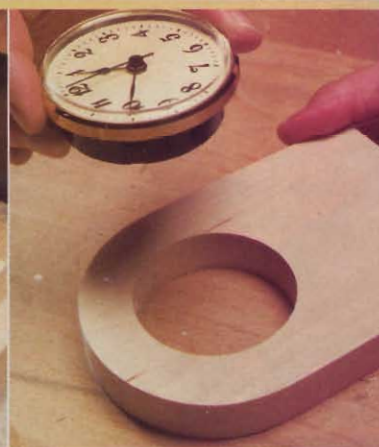
5 POCKET SCREWS WITHOUT A JIG

Drilling angled pocket screw holes is a snap with a Forstner bit and a drill press. Shallow pocket screw holes like this are often used to fasten a table's top to its apron.



6 BIG, CLEAN, PRECISE HOLES

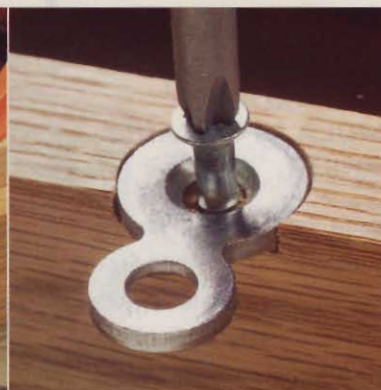
Forstners can't be beat for drilling precise, large-diameter holes up to 4 in. They are a favorite of clock makers. But be warned: These large-diameter bits are expensive—more than \$150 for a 4-in. model. If you're only drilling the occasional large hole, you're probably better off with a fly cutter or a hole saw.



10 FORSTNER TIPS

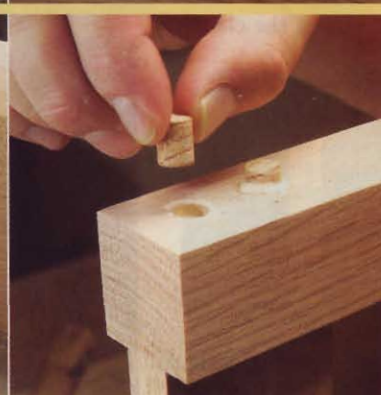
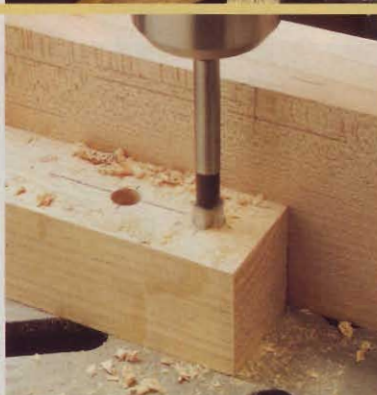
7 DRILLING ON THE EDGE

Partial holes on a board's edge are required for figure-eight-style fasteners used to attach a tabletop to an apron. A Forstner is the only drill bit that can drill this style of hole. It's the perfect choice for this task.



8 NO TEAR-OUT DRILLING

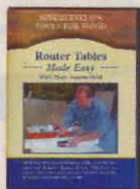
Forstner bits excel at drilling clean, precise holes for wood plugs. Because the rim scores the wood fibers ahead of the cutters, the Forstner bit virtually eliminates tear-out.



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#VID-AW1 #DVD-AW1
(30 min.)



Router Tables
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#VID-AW3 #DVD-AW3
(120 min.)

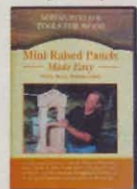
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#VID-AW6 #DVD-AW6
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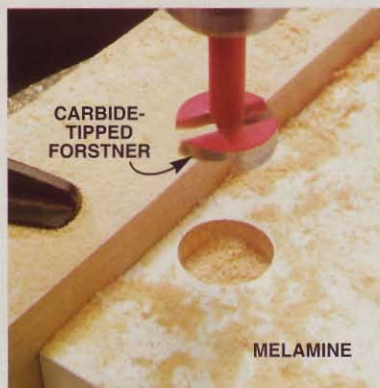
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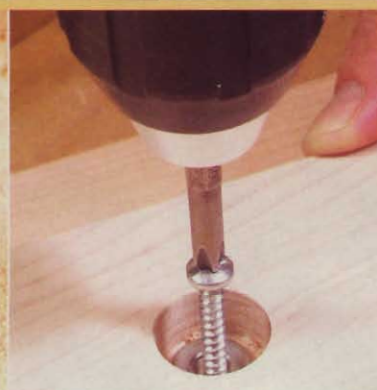
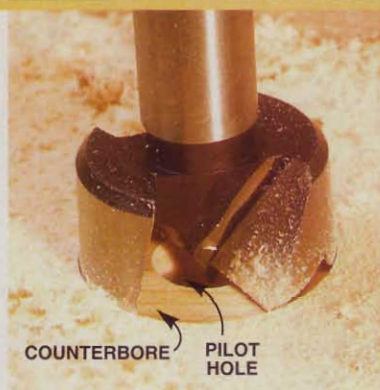
9 BEST BIT FOR A CUP HINGE

Carbide-tipped Forstners are the choice for drilling European-style hinge-mounting holes. They can drill into melamine or MDF all day long and stay sharp.



10 FORSTNER BIT TO THE RESCUE

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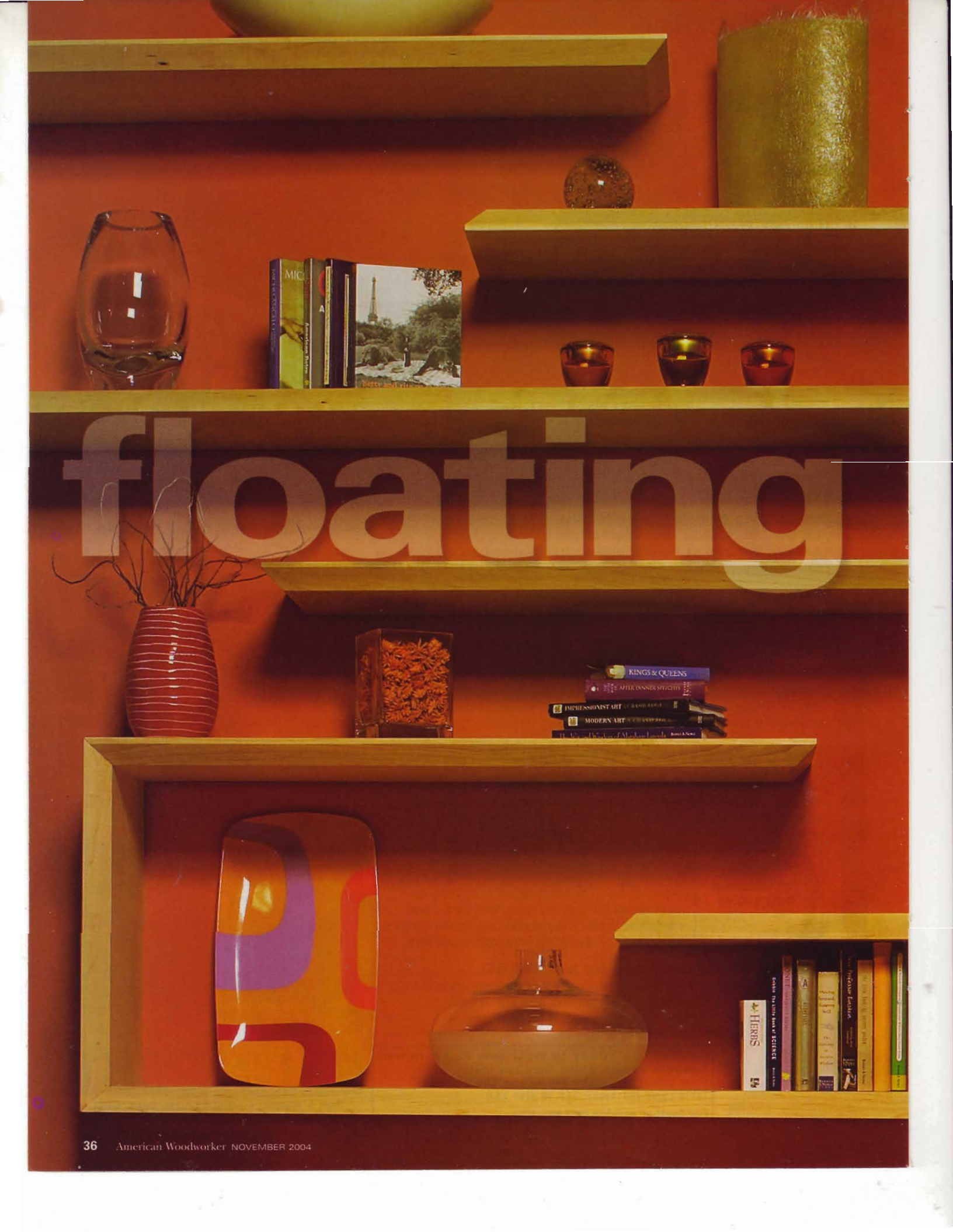
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floating



Torsion-box construction creates sag-proof shelves that “defy” gravity.

Some time ago, an Ace Hardware ad in *American Woodworker* sparked a surprising number of inquiries from readers. They all wanted to know how to build the cool-looking shelves that appeared in the background. We liked the shelves, too. Their contemporary design and invisible mounting created a dramatic effect.

The secret was torsion-box construction. A torsion box is a simple grid of slender

shelves

ribs glued between thin plywood skins. It makes these shelves stiff and flat, yet incredibly light. This rigid architecture means torsion-box shelves won't sag or twist, and they can be mounted without any external support.

We've made these shelves easy to build and install by using simple shop-made jigs and dividing the process into four steps. We'll make the torsion boxes, attach the face moldings, then glue the C-shaped units together and, finally, hang them on the wall. To create the wall of shelves shown here, you make four identical C-units and hang every other one upside down.

We wanted our shelves to be a uniform light color, so we chose hard maple instead of birch. The cost is the same, but maple lumber and plywood colors are easier to match. The Multiply brand of underlayment (available at home centers) makes great rib stock, because it's inexpensive, stable and exactly 1/4 in. thick. We spent \$220 to make our four C-unit shelves.

by Tim Johnson

PROJECT REQUIREMENTS AT A GLANCE

Materials for four C-units:

12 bd. ft. of 6/4 hard maple
15 bd. ft. of 5/4 poplar
Two sheets of 1/4-in. x 4-ft. x 8-ft. hard maple plywood
Two sheets of 1/4-in. x 4-ft. x 4-ft. underlayment
One sheet of 3/4-in. x 4-ft. x 8-ft. MDF
One sheet of 3/4-in. x 2-ft. x 4-ft. fir plywood

Cost: \$220 for four units

Hardware:

One box No. 9 x 1-in. brass screws
A handful of No. 6 x 3-in. drywall screws

Tools:

Tablesaw, 1/4-in. dado set, chop saw, jointer, planer, router, 1/2-in. flush-trim bit, drill, plate jointer, wood glue, roller, clamps, level, compass

FIGURE A EXPLODED VIEW

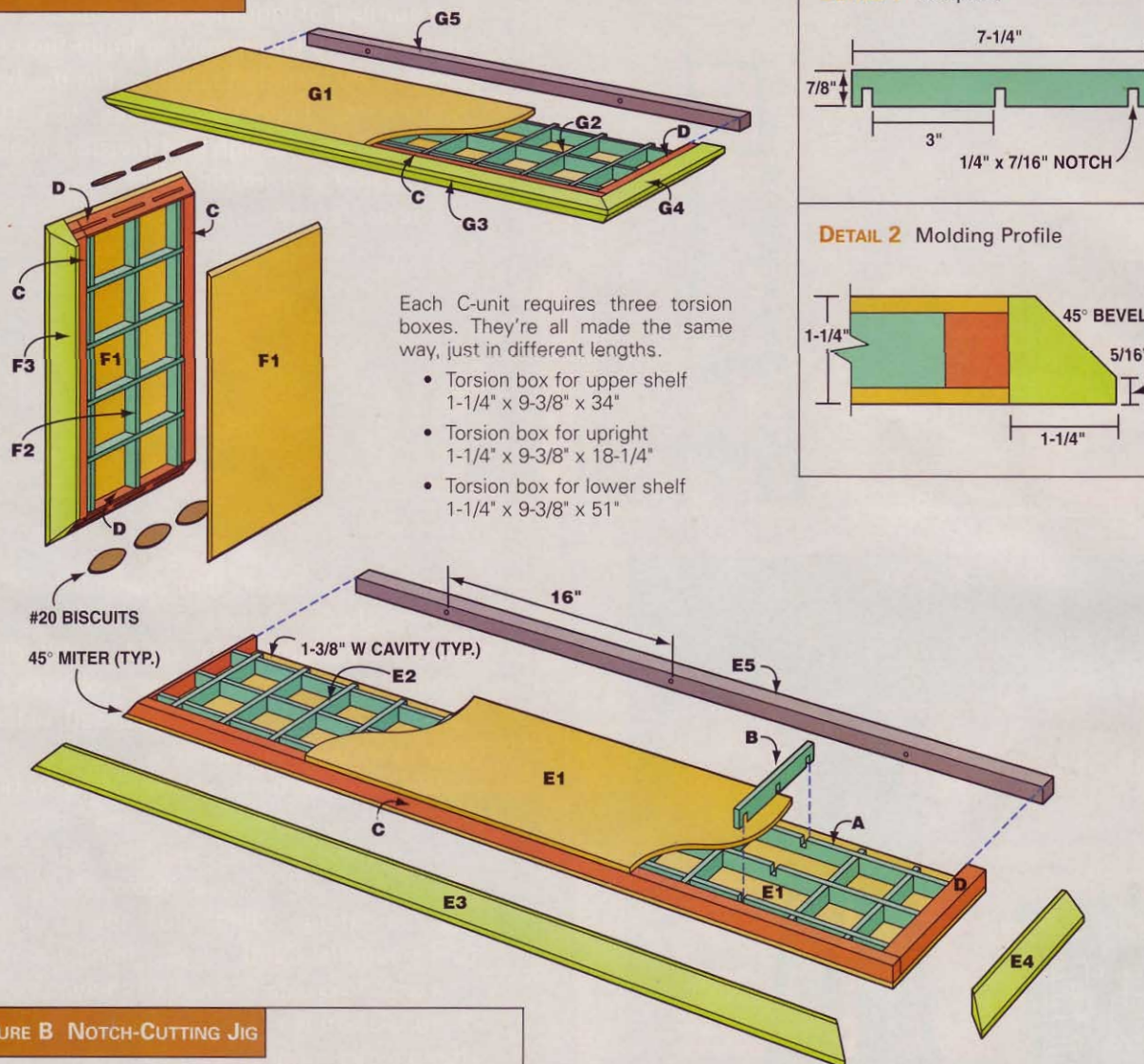


FIGURE B NOTCH-CUTTING JIG

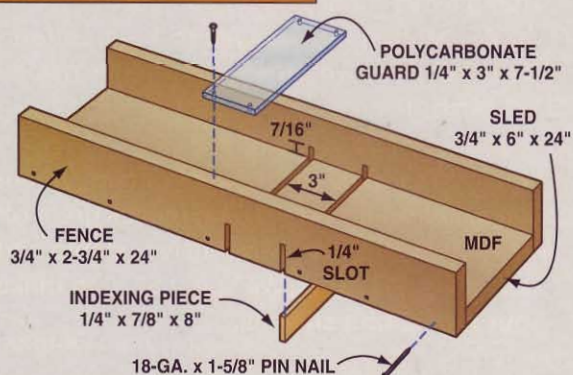
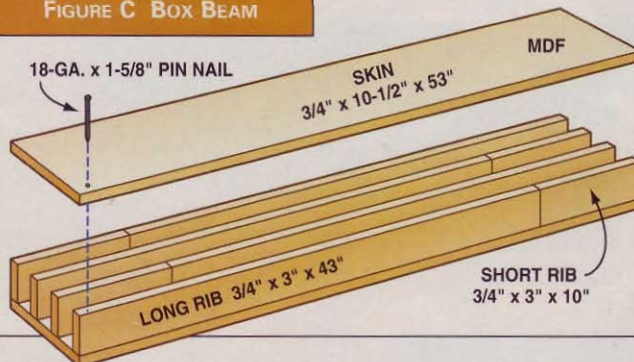


FIGURE C BOX BEAM



BUILD THE TORSION BOXES

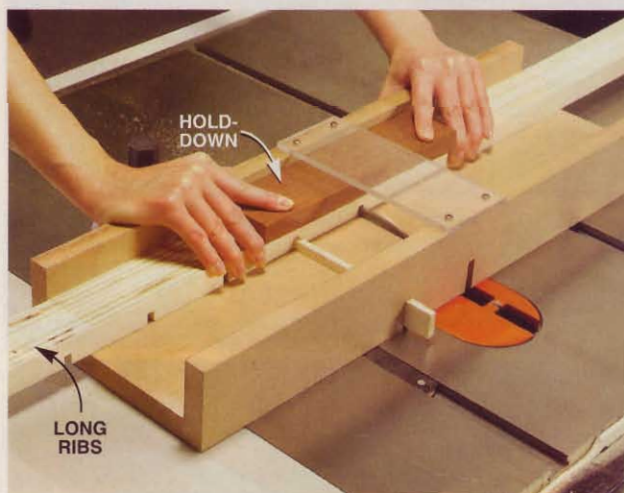
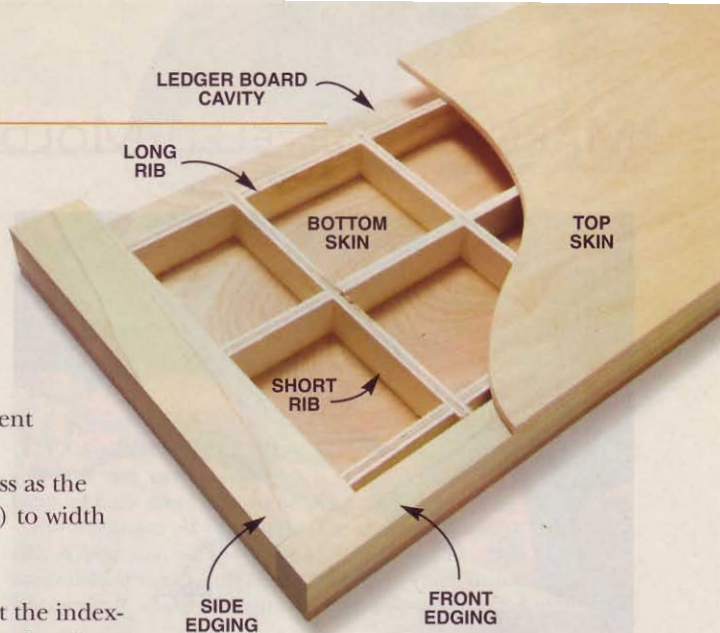
1. Cut the torsion-box skins (Fig. A, E1, F1 and G1, page 38) from 1/4-in. maple plywood (see Cutting List, page 45). To get skins for all four C-units from two sheets of plywood, rip each sheet into five 9-1/2-in. x 8-ft. blanks. Cut eight of these blanks into 51-in. and 34-in. skins for the shelves. Cut the eight 18-1/4-in. skins for the uprights from the remaining two blanks.

2. Cut the sheets of 1/4-in. Muliply plywood underlayment into 7/8-in. x 48-in. ribs (A).

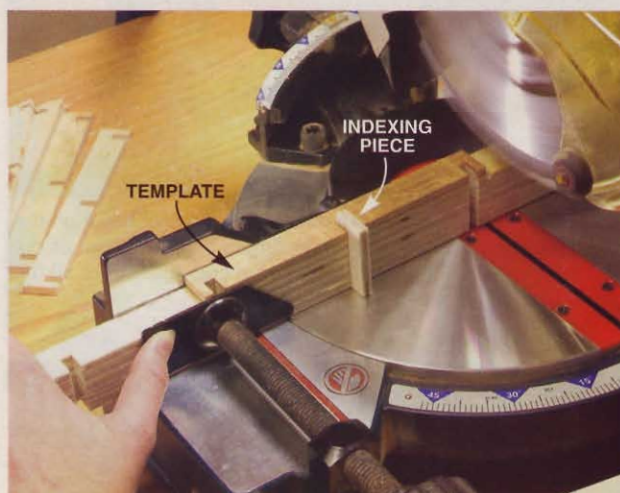
3. Plane poplar edging stock to the same 7/8-in. thickness as the ribs' width. Cut the front and end edging pieces (C and D) to width and length.

4. Build the notch-cutting jig (Fig. B, page 38).

5. Cut notches in the ribs (Photo 1). Butt the ribs against the indexing piece to cut the first notches. Use these notches to index the ribs so



1 Cut notches in the ribs, using a shop-made indexing jig and a 1/4-in. dado set. The notches allow you to assemble the ribs into the grid sections that comprise the core of the torsion boxes.



2 Cut short ribs from some of the long ribs. Use a template (Fig. A, Detail 1) and an indexing piece to make sure you cut them consistently.



3 Glue the torsion boxes together by sandwiching the edging and the grid section between the plywood skins. This is a complex glue-up, so use glue that won't dry too fast and a roller to spread it quickly and evenly.



4 Clamp the torsion boxes between box beams. Box beams distribute clamping pressure evenly and guarantee your glued-up shelves will be flat. They're well worth the effort to make.

MAKE THE BEVELED MOLDING



5 Glue on molding blanks that are slightly thicker than the shelves. Make sure you feel ridges on both sides of the blanks as you tighten each clamp, and again after all the clamps are tight.



6 Rout the edges flush. Use a second shelf to support the router and a piece of scrap plywood as a spacer.



7 Bevel the molding. It's difficult to get good results when you cut thick, hard wood at an angle, so make two passes. First, make a slightly oversize rough cut. Adjust the fence and make a second light pass to clean the edge.



8 Bevel the end molding with your miter gauge and a long support fence. Rough-cut the bevel and then make a light final pass.

Caution: If your shelf and miter gauge are unstable in the starting position because they hang off the front of the saw, use a sled to make this cut (see "The Ultimate Shop-Built Crosscut Sled," AW #75, October 1999, page 38).

you can cut the next notches, and so on. By using a hold-down, you can cut notches in several ribs at once.

6. Cut some of the long ribs into short ribs that are consistent in length (B, Photo 2).

7. Assemble grid sections (E2, F2 and G2) by fitting the long and short ribs together. These sections don't need to be glued; the half-lap joints hold them together. You'll need two 48-in.-long grid sections for each C-unit. Use one full-length section for the lower shelf. Cut the other into a 31-in.-long section for the upper shelf and a 15-1/4-in.-long section for the upright.

8. Build a pair of box beams (Fig. C, page 38).

9. Glue the torsion boxes, using the box beams (Photo 3). We used Titebond Extend wood glue so we didn't have to rush these complex glue-ups. Lay the edging and grid on the bottom skin and check the fit. The edging should be flush at the front and on the ends. Make sure the grid is snug against the back of the front edging. A 1-3/8-in.-wide cavity should extend across the back of the two shelves; the ledger boards (E5 and G5) will occupy this space when the shelves are mounted to the wall. The back of the upright is solid. Roll glue on the edging and grid. It's important to not get any glue in the back cavity. Flip the pieces over, position them and apply glue to the second side. Place the top skin in position. Make sure all the edges are flush.

10. Clamp the torsion boxes between the box beams (Photo 4). Clamp the middle first; then work outward.

11. True up the torsion boxes. After the glue has dried, remove the torsion boxes from the box beams. Joint the front edges, after scraping off any excess glue. Then rip the boxes to the final 9-3/8-in. width.

MAKE THE BEVELED MOLDING

12. Mill your 6/4 maple to 1-1/4-in. x 1-3/8-in. molding blanks (E3, F3, G3, E4 and G4).

13. Orient the shelves and uprights for each C-unit and mark the fronts. Mark the open ends of the two shelves, where the end moldings go, too.

14. True the open ends of the two shelves by cross-cutting. Remove just enough to leave clean edges. Make sure the cut is square to the front edge.

15. Cut and fit the miter joints on the molding blanks. Then glue them on (Photo 5).

16. Trim the molding edges (Photo 6). It's OK if routing leaves the molding a hair proud. You can sand the surfaces flush later.

17. Rip bevels on the front moldings (Fig. A, Detail 2; Photo 7). To avoid kickback, make sure the blade is tilted away from the fence. Your final pass should leave a 5/16-in. square shoulder at the top.

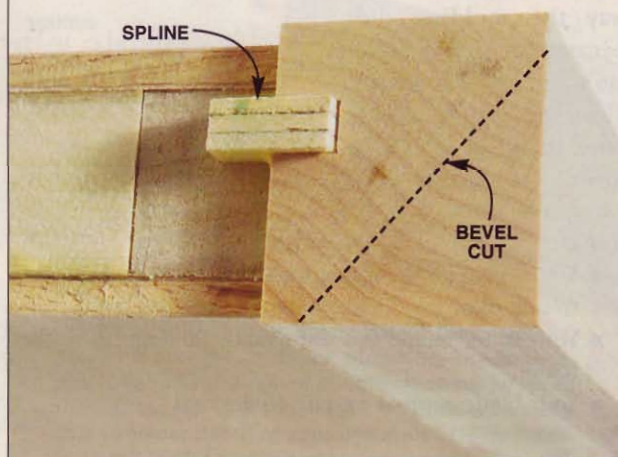
Oops!



My face molding doesn't cover the shelf's plywood edge! The molding was noticeably bowed, and I forgot to check the edges when I was gluing it on. Now I'll have to cut off the molding and start over.

Molding that isn't straight can be a real pain to glue on. The solution is to use a spline. Registering bowed or twisted molding with a spline guarantees it'll glue on perfectly. Cut shallow grooves in both pieces, using your dado set. Be sure to locate the grooves off center, so the spline remains hidden after you cut the bevels.

For both edges of the molding to stand proud, the molding's groove has to be slightly offset from the groove in the shelf. Creating the offset is easy. Make sure the top face of each piece rides against the fence when you cut. First, cut the groove in the molding. Before you cut the groove in the shelf, simply move the fence a bit closer to the blade. If your molding is 1/16-in. thicker than your shelf, a 1/32-in. fence adjustment centers the molding.



BUILD THE MITERED C-UNIT



9 Miter both ends of the upright and the inside ends of the shelves. Unlike the previous beveled cuts, these go all the way to the tip.

18. Crosscut bevels on the end moldings (Photo 8). After your final pass, the square shoulder should match the one on the front.

19. Remove all the saw marks by sanding the bevels. You'll get the best results if you use a sanding block. A power sander is likely to round over the crisp edges. It's safer to smooth the joints between the moldings and the plywood with a block, too.

BUILD THE MITERED C-UNIT

20. Miter the corners (Photo 9). These angled cuts won't tax your saw the way the molding did, because the core material isn't nearly as dense. However, these miters have to be dead on, so make test cuts and be sure of these three things:

- Your miter gauge slides smoothly, without any side-to-side play.
- Your miter gauge is set at exactly 90 degrees to the blade.
- Your blade is tilted exactly 45 degrees.

A couple clamping aids and some angled blocks make it easier to glue the miters.



10 Cut biscuit slots. Biscuits align and strengthen the miter joints.

21. Check your miter cuts with an accurate square and cut again if they aren't right. In the end, it doesn't matter whether your shelves are exactly the same size as the dimensions in the Cutting List. What's important is that the joints fit.

22. Cut slots in the mitered ends for biscuits (Photo 10).

23. Make a pair of fir plywood braces to square and support the C-unit during assembly. Their height must match the upright's inside length (between the miters), and their outside corners must be dead-on at 90 degrees.

24. Assemble the C-unit and check the miter joints (Photo 11). It's easy to make adjustments, because the biscuits and braces keep everything in place when you loosen the clamps.

25. Glue clamping blocks onto the shelves (Photo 12). Grocery-bag paper and triangular offcuts from beveling the molding are perfect. Be sure to glue both sides of the paper. Don't use clamps; just rub the blocks back and forth on the surface until they stick. Wait at least 15 minutes before using them.

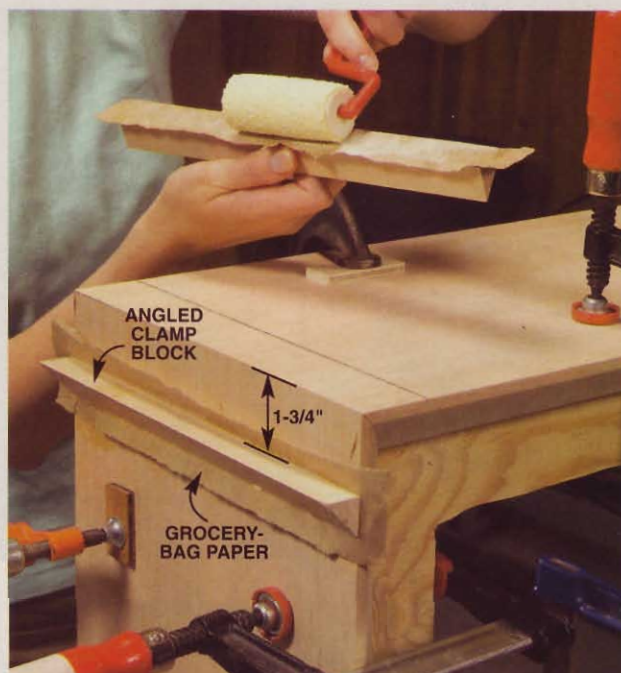


11 Clamp the three shelf components together without glue, so you can check the fit of the miter joints. Use plywood braces to support the upper shelf and hold everything square.



26. Disassemble the C-unit and apply glue to the miter joints. Reassemble the unit and clamp the corners, using the temporary blocks (Photo 13). Be fussy when you fit the joints.

27. Remove the clamping blocks by tapping the end grain with a hammer. The papered joints will break, leaving half the paper on the block and half on the shelf. (You can also split a papered joint with a chisel.) Moisten the paper residue on the shelves to soften the glue. After a few minutes, the paper will rub off and the glue will turn white, so it'll be easy to see. Gently scrub off the glue using a paper towel or a fine nylon abrasive pad. Don't use steel wool; it'll discolor the wood. Remove excess glue from the mitered joints the same way.



12 Glue temporary clamping blocks at the corners. They'll allow you to clamp the miter joints effectively, without using long, heavy clamps. Pieces of heavy paper glued between the block and the shelf make the blocks removable.

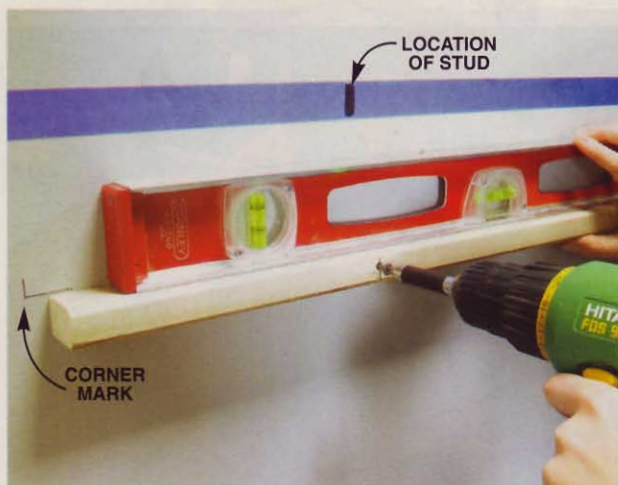


13 Clamp the miter joints to glue the C-unit together. After the glue dries, the clamping blocks knock off easily because of the paper, and the residue cleans off completely with water.

MOUNTING THE C-UNIT



14 Position the C-unit on the wall and mark the inside corner. A piece of tape can be used to mark stud locations. Installation is easiest when both ledger boards anchor in two studs.



15 Install the ledger board for the bottom shelf, using a level and your corner mark for reference.



16 For a perfect fit, use the C-unit to locate the upper ledger board. Attach double-faced tape to the ledger and slide the ledger into its cavity, using spacers so it protrudes. Install the C-unit on the lower ledger and press the upper shelf against the wall.



17 The upper ledger board remains when you remove the C-unit, thanks to the double-faced tape. Anchor this ledger to the studs.

MOUNT THE C-UNIT ON THE WALL

28. Mill ledger boards for both shelves. They should fit the cavities firmly, but without binding.

29. Locate the C-unit on the wall after marking the stud locations (Photo 14).

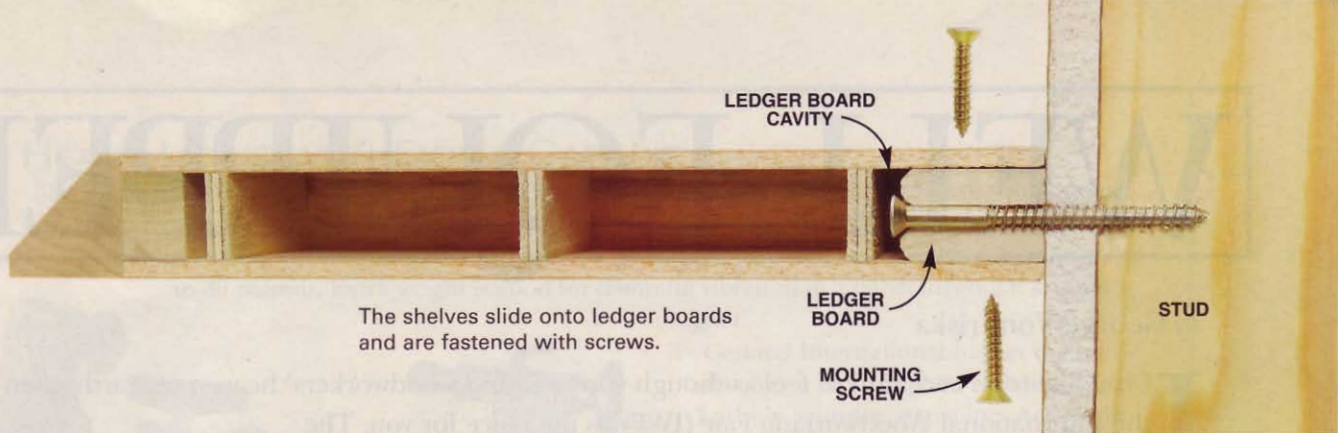
30. Fasten the lower ledger board to the wall (Photo 15). It's shorter than the cavity, for side-to-side adjustment. If you need to be fussy about height, install the ledger a bit below the line, to allow for the shelf's plywood skin.

31. Locate and install the upper ledger board by using the C-unit. It's much easier than measuring on the wall (Photos 16 and 17). It helps to sand this ledger down a bit, so it slides easily in and out of the cavity. Use a brace

to support the C-unit and keep the shelves parallel during this process. If the upper ledger bridges only one stud, use a toggle bolt for the second anchor.

32. Install the C-unit to determine whether it needs to be scribed (Photo 18).

33. With the C-unit firmly pressed against the wall, drill pilot holes for the mounting screws. Keep the counter-sink shallow—the plywood skins are thin and you just want the screws to install flush. Fasten the C-unit to the wall (Photo 19). If you're installing multiple C-units, mount each unit separately to drill the pilot holes. Then go back and install them, using a stubby screwdriver to drive the screws where the shelves overlap. **AW**



18 Scribe the shelves to remove gaps. First, transfer the wall's uneven shape with a compass. Remove the shelf and sand the back edges to the lines. It'll be easy because you're sanding 1/4-in. plywood skins. Reinstall the shelves. Voilà! No gaps!



19 Fasten the shelves to the ledger boards with screws. This is strong enough for most applications and it makes the shelves removable. For maximum strength (to hold your anvil collection, for example) glue and screw the shelves to the ledger boards.

CUTTING LIST for one C-unit			Overall dimensions: 10-5/8" x 18" x 52"	
Part	Name	Material	Qty.	Finished dimension
A	Long rib	Underlayment	6	1/4" x 7/8" x 48"
B	Short rib	Underlayment	28	1/4" x 7/8" x 7-1/4"
C	Front edging	Poplar	4	7/8" x 3/4" x cut to length
D	End edging	Poplar	6	7/8" x 1-1/2" x 8-3/4"
E	Lower shelf			1-1/4" x 10-5/8" x 52" ⁽¹⁾
E1	Lower shelf skin	Maple plywood	2	3/16" ⁽²⁾ x 9-1/2" x 51"
E2	Lower shelf grid	Parts A and B	1	7/8" x 7-1/4" x 48"
E3	Lower shelf front molding	Hard maple	1	1-1/4" x 1-3/8" x 53" ^(1, 4)
E4	Lower shelf end molding	Hard maple	1	1-1/4" x 1-3/8" x 11-1/2" ^(1, 4)
E5	Lower shelf ledger board	Poplar	1	7/8" x 1-1/4" x 47"
F	Upright			1-1/4" x 10-5/8" x 18" ⁽³⁾
F1	Upright skin	Maple plywood	2	3/16" ⁽²⁾ x 9-1/2" x 18-1/4"
F2	Upright grid	Parts A and B	1	7/8" x 7-1/4" x 15-1/4"
F3	Upright molding	Hard maple	1	1-1/4" x 1-3/8" x 18-1/4"
G	Upper shelf			1-1/4" x 10-5/8" x 35" ⁽¹⁾
G1	Upper shelf skin	Maple plywood	2	3/16" ⁽²⁾ x 9-1/2" x 34"
G2	Upper shelf grid	Parts A and B	1	7/8" x 7-1/4" x 31"
G3	Upper shelf molding	Hard maple	1	1-1/4" x 1-3/8" x 36" ^(1, 4)
G4	Upper shelf end molding	Hard maple	1	1-1/4" x 1-3/8" x 11-1/2" ^(1, 4)
G5	Upper shelf ledger board	Poplar	1	7/8" x 1-1/4" x 30"

⁽¹⁾ one end mitered

⁽²⁾ actual thickness of 1/4" plywood

⁽³⁾ both ends mitered

⁽⁴⁾ cut to length after mitering

WELL-EQUIPPED

by George Vondrisk

If you like tools and want to feel as though you've found woodworkers' heaven on earth, then the International Woodworking Fair (IWF), is the place for you. The IWF event, held in Atlanta every two years, is host to manufacturers displaying everything from hand planes to computer-driven routers. Incredibly, even the largest of machines is up and running!

Lots of manufacturers go to IWF to show off their newest tools, and we go to check out what they've got. From our Well-Equipped Shop to your well-equipped shop, here's some cool new stuff we saw this year. Look for more in upcoming AW issues.

A NEW CORDLESS SYSTEM

Replacement batteries for cordless tools are expensive, but Ryobi has slashed the price of its batteries, selling two 18-volt batteries for \$40, as part of its new One+ System.

À LA CARTE TOOL PURCHASES

One problem with owning more than one cordless tool is the variety of batteries and chargers that end up lying around the shop. Even if you buy all your cordless tools from the same manufacturer, you pay for new batteries, a new charger, probably even a new case, with every tool. Ryobi is helping to eliminate clutter and save you money with its new 18-volt One+ system. It gives you the option of buying tools with or without batteries.

One+ is a system of 18-volt tools that can be purchased either individually or in kits that include two batteries and a charger. If you already have a Ryobi 18-volt drill and want a cordless circular saw, you can

buy just the saw for \$60—a big savings over buying the tool with two more

batteries and another charger. Lots of 18-volt tools are available in the system, including a jigsaw, drill, flashlight, reciprocating saw, even a cordless chainsaw!

STRAPPING CORDLESS TOOL STORAGE

Another Ryobi innovation will help with cordless tool storage. Its Plug-In Lanyard, two for \$5, fits into the tool's battery cavity and provides a strap so the tool can be hung on the wall.

Source
Home Depot,
www.homedepot.com
Technical information,
www.ryobitools.com.



SHOP BLOWOUT

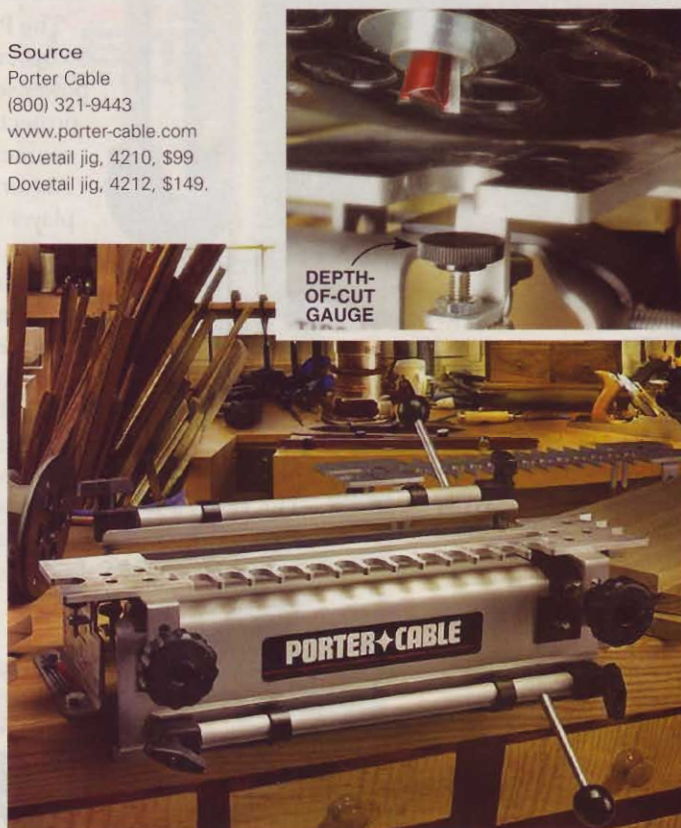
NEW DOVETAIL JIG

I've pulled out a few hairs trying to tweak my dovetail jig so it cuts perfectly. Porter Cable's 4200 series dovetail jigs have some great conveniences that make much of that unnecessary. Unlike most dovetail jigs, these come fully assembled and ready to go, which in itself is a big time-saver. They've also got a built-in gauge for setting the router bit's depth of cut. You'll still need to do test cuts, but this is an effective shortcut to success. The instructions for what to do if the joint is too tight or too loose are right on the side of the jig, so you won't have to search for your owner's manual.

The 4210 jig, \$99, cuts half-blind, rabbeted half-blind and sliding dovetails. The 4212, \$149, cuts through, half-blind, rabbeted half-blind and sliding dovetails and box joints. Few other jigs in this price range produce through dovetails and sliding dovetails.

Both jigs accept material from 1/4 to 1-1/4 in. thick and up to 12 in. wide. Each comes with a dovetail bit and guide bushing. Porter Cable says the jigs should be available in December.

Source
Porter Cable
(800) 321-9443
www.porter-cable.com
Dovetail jig, 4210, \$99
Dovetail jig, 4212, \$149.



Source
Freud TMM
(800) 472-7307
www.FreudTools.com
Combination blade,
LU83R, \$45.

THIN-KERF BLADE, SILKY SMOOTH CUT

Thin-kerf blades aren't news. Fifty-tooth blades aren't news. But when I see a blade that cuts as well as the 50-tooth, thin-kerf Freud LU83R and sells for \$45, that's news. It's a great price for a blade with such a high quality of cut.

The LU83R combination blade uses a mix of alternate top-bevel and flat-top grind teeth and can be used for ripping and crosscutting. Combination blades sometimes mean a quality-of-cut compromise on both cuts. In the case of the LU83R, there is no compromise. Rip cuts, even in thick hardwood, are glassy smooth. Crosscuts are equally good. Even on such easy-to-chip material as melamine, the quality of cut isn't bad, although there are blades better suited for cutting melamine and plywood.

Thin-kerf blades are perfect companions for contractor saws. But even on cabinet saws with plenty of power, a thin-kerf blade makes pushing material through the blade easier.



EDITOR: RANDY JOHNSON • ART DIRECTION: DAVID SIMPSON • PHOTOS SUPPLIED BY MANUFACTURERS



HARMONIOUS WOODWORKING

When my shop was a two-car garage with one outlet, I had to carefully choose what I plugged in. That generally meant no radio, because there weren't any outlets left for it. Enter Bosch's new Power Box, \$169. Yes, it's an expensive radio, but that's because it's much more than a radio.

The Power Box includes a four-way GFCI outlet. So, when you've plugged in the Box, it becomes a power source for other tools. And it's ground-fault protected, which is a must-have in damp environments. Music? No problem. You can listen to AM or FM stations or your favorite CD. The CD player has built-in antiskip technology, so whacking the Box with an offcut doesn't mean missing your favorite verse. Every potential point of entry for dust or moisture, including buttons, speakers and the CD drawer, is sealed. An aluminum roll cage protects the Box, which is suspended from the cage by rubber shock absorbers to further damp accidental whacks.

The Box also features a 12-volt output to recharge cell-phones or two-way radios and a battery charger for Bosch batteries. The radio and CD player will run off those batteries if you haul the radio out to the middle of the yard.

Besides all that, the Power Box is just plain cool-looking and kicks out great sound.

Source
Bosch Power Tools
(877) 267-2499
www.boschusa.com
Power Box, \$169.

PLUNGE DRILL

Drilling a hole with a handheld drill is easy enough to do, but making the hole perfectly perpendicular to the surface can be tough. Triton has married a plunge mechanism to a cordless drill to create its new 18-volt cordless plunge drill for \$289. It's comparably priced to other 18-volt cordless hammer drills, although others lack the plunge features. Yes, \$289 will buy you a drill press or even a plunge router, but if you're a woodworker whose cordless drill is expected to do lots of home-improvement jobs, too, the Triton may be for you.

The plunge mechanism telescopes from the drill body and can do a couple things for you. It helps guide the drill squarely into the material. It has a depth-of-drill stop to control the hole depth. With the fence attached (included with the drill), it centers itself over round stock and on outside corners. The fence can also be registered against an outside edge of a board so an entire series of holes (for instance, adjustable-shelf holes) can be uniformly spaced from the edge. The plunge mechanism self-stores, locking in the body of the drill when not needed.

The plunge drill also has a 24-position clutch, 1/2-in. chuck, hammer function (used for drilling into concrete) and an LED light so you can see where you're boring. The drill comes with two batteries and a charger.



Source
Triton Workshop Systems
(888) 874-8661
www.tritonwoodworking.com
18-volt cordless plunge drill, \$289.

REMOTE-CONTROL DUST COLLECTION

Do you turn on your dust collector every time you should? "I'm only making one cut," you say. But how many times in a day do you make "only one cut"? A lot of devices on the market allow conveniently controlling your dust collector from a distance, but they have to be added to the system after the fact and cost \$50 to \$300.

New dust collectors from Jet come with a remote switch built into the machine. It adds about \$50 to the machine's cost.

For that you get an onboard timer that allows the collector to run from one to 99 minutes. You also get a handheld remote control that is small enough to carry in your pocket. With a push of the button, your dust collector is on or off. Unfortunately the signal won't travel through a wall, so your collector must be in the same room you are. Some add-on systems from other manufacturers do have signals that will penetrate a wall.

The remote control and timer system is available on three dust-collector models, which pull 650, 1,100, and 1,200 cubic feet per minute (cfm). Each model is available with a standard filter bag or canister-style filter and quick-install collector bags.



ONBOARD TIMER

Source

Jet Tools

(800) 274-6848

www.jettools.com

Dust collectors with remote control and timer:

DC-650, standard filter bags, \$280

DC-650, canister filter, \$400

DC-1100, standard filter bags, \$350

DC-1100, canister filter, \$500

DC-1200, standard filter bags, \$450

DC-1200, canister filter, \$550.



CARBIDE INSERT FLUSH-TRIM BIT

I use a flush-trim bit a lot, particularly for trimming face frames to cabinet sides and parts flush with templates. Unfortunately, after a few sharpenings, it's not a flush-trim bit any more. It's an almost-flush-trim bit, because of the cutter's reduced diameter. CMT's new carbide insert bits, \$85, solve this problem, plus a few others.

"Whoa!" you say. "85 bucks for a flush-trim bit?" You're right; it's a lot of dough. A comparable noninsert flush-trim bit with a 1/2-in. shank and 1-in. cut length costs around \$35. But let's do a little math. The carbide inserts are double-edged, so you automatically get two bits for the price of one. That eliminates one \$10 sharpening. After you've worn out the sec-

ond edge, replacement cutters are only \$6 per pair, which is like getting two flush-trim bits, because they're double-edged. So the inexpensive replacement knives save you another \$20 worth of sharpening. Finally, the carbide used on CMT's insert cutters, as on almost all insert cutters, is higher quality than on noninsert cutters, so it lasts longer.

Insert router bits aren't for everyone. They're obviously more expensive than their noninsert counterparts. But if you're a heavy user of router bits, especially if you do lots of work in abrasive material, such as particleboard, MDF or plastic laminate, they pay off in no time.

Source

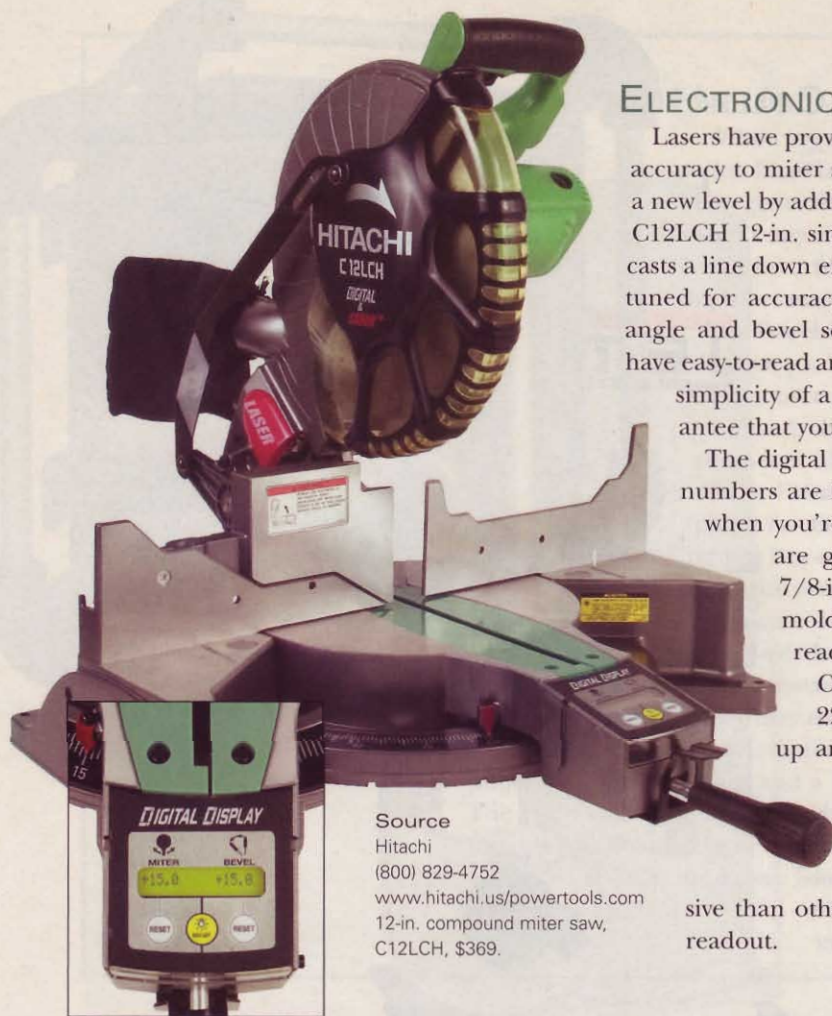
CMT

(888) 268-2487

www.cmtusa.com

Double Flute flush-trim bit, 657.692.11, \$85

Replacement knives, 790.300.300, \$6.



Source
Hitachi
(800) 829-4752
www.hitachi.us/powertools.com
12-in. compound miter saw,
C12LCH, \$369.

ELECTRONIC AGE HITS MITER SAWS

Lasers have proven to be a wonderful way to add safety and accuracy to miter saws. Now Hitachi has taken ease-of-use to a new level by adding both a laser and a digital readout to its C12LCH 12-in. single compound miter saw, \$369. The laser casts a line down either side of the saw blade and can be fine-tuned for accuracy. The digital readout shows the chosen angle and bevel settings. Good quality miter saws typically have easy-to-read angle and bevel scales, but you can't beat the simplicity of a digital readout. What a great way to guarantee that you're hitting the correct angle every time!

The digital readout is in 0.05-degree increments. The numbers are large, are easy to read and can be backlit when you're in a low-light area. This saw's capacities are great enough—3-7/8-in. thickness and 7-7/8-in. width—to allow easy cutting of crown moldings. Hitachi hopes to improve the digital readout to 0.02 degrees in the near future.

Conventional positive stops on the saw at 0, 22.5, 31.6 and 45 degrees (left and right) set up angle cuts. The saw also has positive bevel stops at 0 and 48 degrees and a fine-tune mechanism to simplify tweaking bevel angles.

This machine is slightly more expensive than other saws that include a laser but no digital readout.

MITER SAW DUST SHROUD

Miter saws are a great convenience, but they spread sawdust like a sprinkler spreads water. The new Downdrafter shroud from Rousseau, \$200, combined with a dust collector, acts like a parachute behind the saw and grabs almost every bit of dust.

You may cringe at the price, but some good engineering is at work here. The shroud is mounted on a sliding track and a pivot so, no matter what angle the saw is set at, you can position the shroud in the high sawdust traffic area. The dust collector creates a down draft through the port in the bottom of the shroud and dust disappears. Without the slide and pivot, it would take a shroud the size of a garage to capture dust at every angle a miter saw can cut.

The shroud is deep enough to accommodate sliding saws and large enough to surround even the biggest miter saws. A shop vacuum provides some dust collection, but this unit works best when used with a dust collector.



Source
Rousseau Co.
(800) 635-3416
www.rousseauco.com
Downdrafter dust shroud, \$200.

HEAVY LATHE WITH EXTRA CAPACITY

So here's a dilemma: Mini lathes are designed to be portable, but when you get where you're going, it's nice to have some weight in the machine. At 106 pounds (more than a sheet of MDF weighs), the Maxi Lathe, \$300, from General International outweighs other machines in this category by 20 to 30 pounds. Extra weight is good for damping vibration in a lathe; lugging it around is tougher.



Source

General International
(514) 326-1161
www.general.ca
Maxi Lathe, 25-100 M1, \$300
Bed extension, 25-130, \$95
Bed extension, 25-125, \$160.

General International has set the mini-lathe bar a little higher with the Maxi Lathe's spindle capacity. At 15 in. between centers, it exceeds other mini-lathe capacities by up to 2 in., depending on the model. Its 10-in. bowl capacity is comparable to that of other machines.

The Maxi Lathe, model 25-100 M1, has step pulleys at 480, 1,270, 1,960, 2,730, 3,327 and 4,023 rpm for speed control. It's driven by a 1/2-hp motor. Two bed extensions are available. The 25-130 extension, \$95, increases the spindle capacity to 35 in. between centers.

The 25-125 bed extension, \$160, increases the spindle capacity to 45 in.

TWO-FOR-ONE DRILL OFFER WITH IMPACT

It's hard to imagine a day in the shop without a cordless drill. You can't beat its convenience. But I'm intrigued by impact drivers, which are hitting the cordless market hard. Impact drivers are overkill for the small screws commonly used in the shop, but their rat-a-tat-tat action makes it easy to drive long deck or lag screws. Although impact drivers are great for driving screws, they're not always the best tool for drilling plain old holes, countersinks or delicate work. In a perfect world, you would have both a cordless drill and an impact driver. Makita brings the perfect world a little closer by offering a cordless drill and impact driver package. If you buy the 12-volt impact driver for \$249, you get its 12-volt drill free. Buy the 14.4-volt impact driver for \$269, and get the 14.4-volt drill free.

The impact driver is variable speed and very compact, so it is easy to handle. It has a built-in LED light that illuminates the area in front of the chuck. You get a charger and two batteries with the impact driver, plus a mail-in coupon. Send the coupon to Makita and the company will send you your free drill.

Both drills have two speed ranges, a keyless 3/8-in. chuck and a multi-position clutch.

If you're interested, you'd better hurry. This deal is only available until Dec. 31.

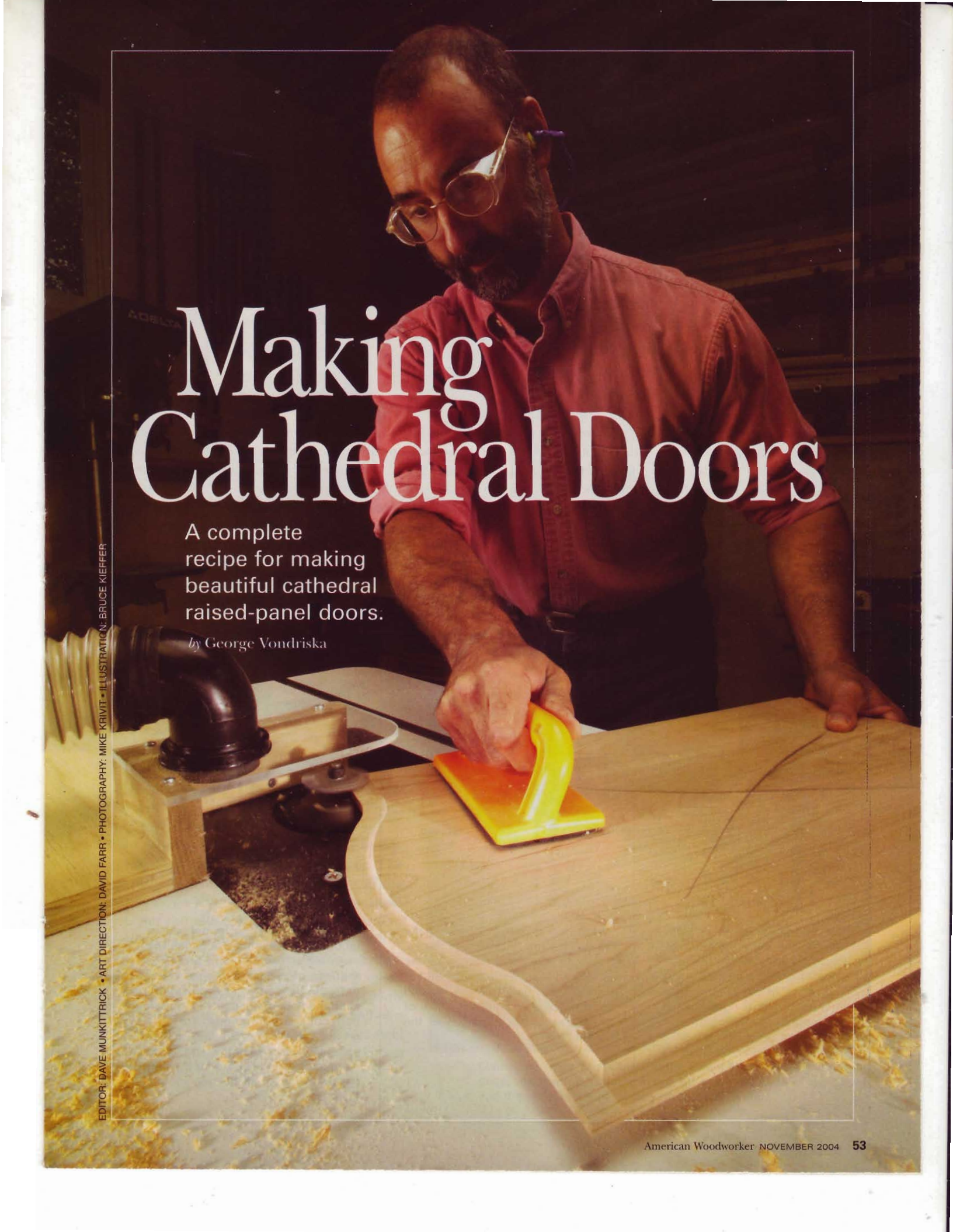
Source

Makita
(800) 462-5482, www.makitatools.com
12-volt impact driver 6980FWDE, 12-volt drill, 6217D, \$249
14.4-volt impact driver 6935FDWDE, 14.4-volt drill, 6237D, \$269.

BUY THIS

GET THIS FREE



A man with a beard and glasses, wearing a red button-down shirt, is focused on his work in a workshop. He is using a yellow-handled router to shape a large, light-colored wooden door panel. The panel is resting on a workbench, and a significant amount of wood shavings is visible around the router's bit. The background is dark and slightly out of focus, showing more of the workshop environment.

Making Cathedral Doors

A complete
recipe for making
beautiful cathedral
raised-panel doors.

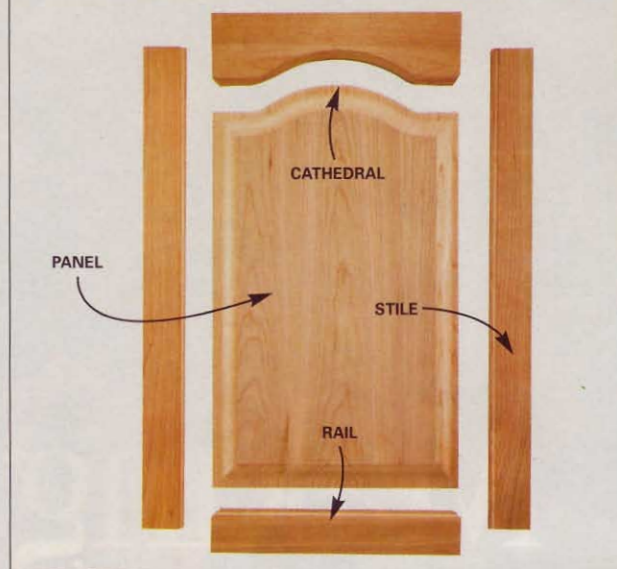
by George Vondriska

EDITOR: DAVE MUNKITTRICK • ART DIRECTION: DAVID FARR • PHOTOGRAPHY: MIKE KRIVIT • ILLUSTRATION: BRUCE KIEFFER

Cathedral raised-panel doors are beautiful, but they can be intimidating to make. After many years of teaching students how to make these doors, I've got a trick or two up my sleeve to simplify the process and remove some of the fear factor. Here's a tried-and-true recipe to help you safely and successfully make beautiful doors.

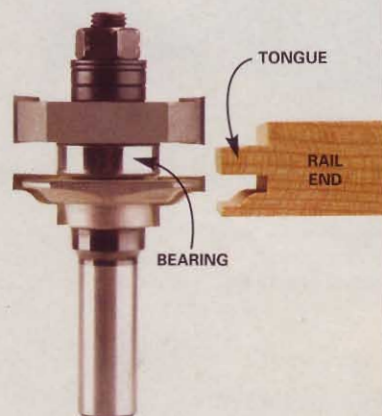
There are a few specialized tools you must have to make cathedral doors. Start with a suitable router table. It should be equipped with a 2-hp or higher variable-speed router that accepts 1/2-in.-shank router bits. You'll also need a bandsaw or jigsaw for cutting the curves and a set of door-making router bits. The bits and a template set will set you back nearly \$400, but they are a big part of what makes this technique airtight. The good news is the router bits are not specific to cathedral-top doors; they can be used to make any frame-and-panel door.

PARTS OF A DOOR

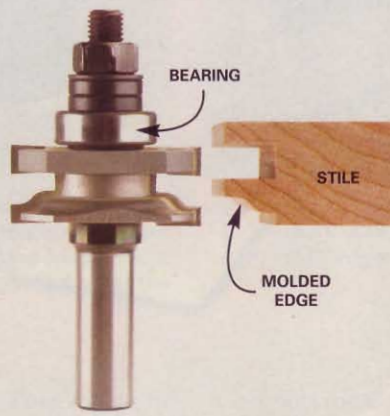


You'll need a two-piece matched rail-and-stile set (about \$135) to make the frame. It's easier to get good results with a two-piece set than with a one-piece reversible bit. With a two-piece set, you feed all the pieces face down. Reversible bits use one arbor with removable cutters. Some parts are machined face up, others face down. This often results in poor alignment between rails and stiles. Plus, it's a hassle to have to change cutters on the arbor. Bits with a 1/2-in. shank will produce less chatter and a smoother cut than those with 1/4-in. shank.

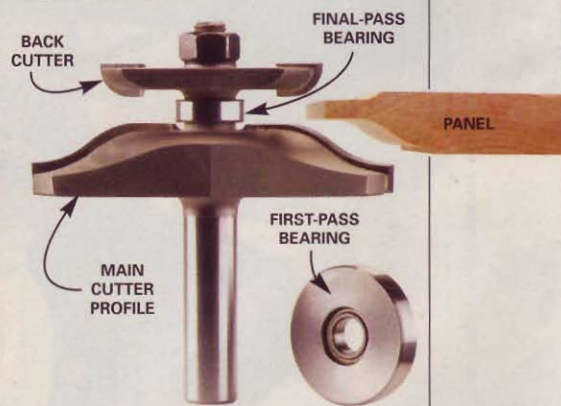
RECOMMENDED CUTTERS



The end-grain cutter is used only on the rail ends and produces the tongue and the mating profile to the molded edge. The depth of cut is controlled by a bearing that rides against the tongue. Mark a number 1 on the end of the shaft with a permanent marker, because it's the first cutter you'll use.



The long-grain cutter is used on the inside edge of *all* the frame pieces. It makes the groove for both the panel and the tongue on the end of the rails. It also forms the molded edge you see around the inside of the frame. Label this bit with the number 2.



Use a back-cutting panel raiser (about \$150) to make the panel. The main cutter cuts a broad profile in the face of the panel. At the same time, the back cutter sweeps material off the back of the panel to leave a perfectly sized tongue for the groove in the frame. Our favorite bits come with two bearings: The large-diameter bearing is used for the first pass and the small bearing for the final pass.

MAKE THE FRAME

First, cut all the frame pieces (see "Sizing a Door," page 61). For a good-looking, stable door, make the frame from straight-grained wood.

Next, on your router table, set up the end-grain cutter for machining the rail ends. Cutting end grain before long grain helps prevent blow-out on the rails. Here's a memory device for you: Machine the Rails before the Stiles, because R comes before S in the alphabet.

Mark the *back* of all the frame pieces. They get machined with their good faces down, so you should be looking at the mark on the back for all the cuts.

Note: Run the end-grain and long-grain cutters at full speed on your router.

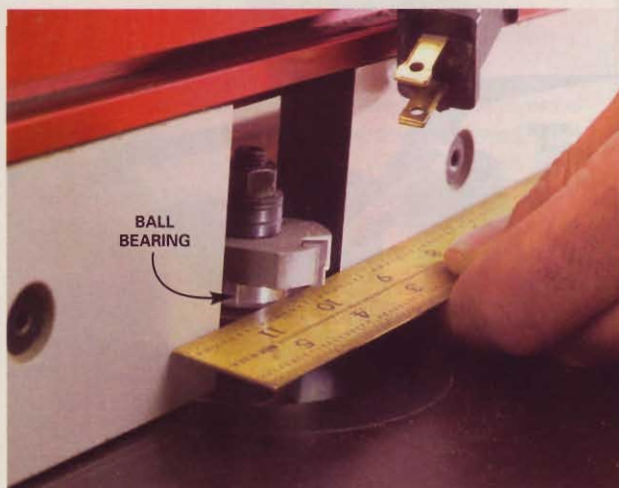
RECOMMENDED TOOL: COPING SLED



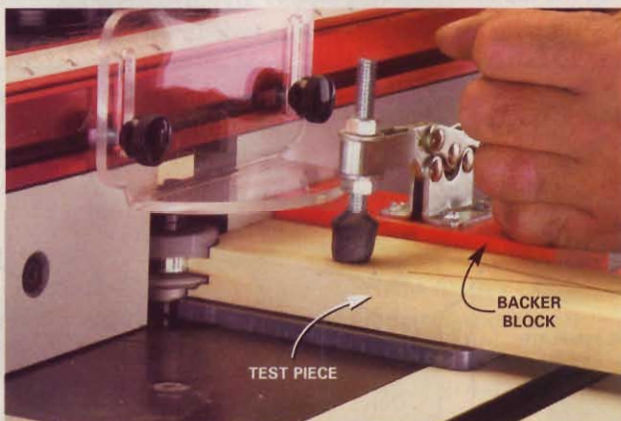
Get a coping sled (\$40) for making the end-grain cuts on the rails. The sled uses a quick-release clamp to hold the rails with a firm grip. A replaceable backer block keeps the rail square to the fence and backs up the edge of the rail to prevent blow-out.



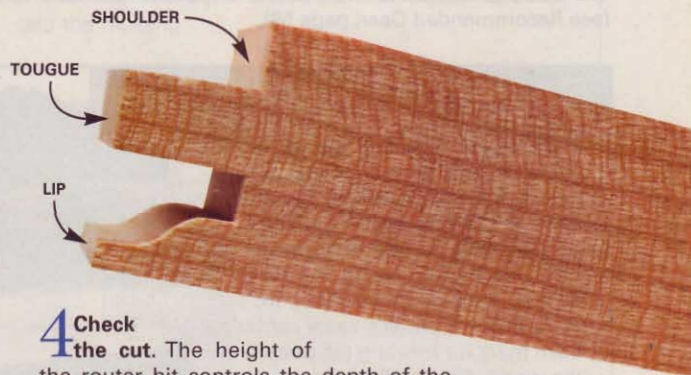
1 Set the height of the end-grain cutter against a test piece in the coping sled. The cut should leave a shoulder on top of the piece that's twice as thick as the lip on the bottom (see Photo 4). You can tweak the height after a test cut.



2 Set the fence even with the face of the ball bearing. A straightedge makes quick work of this job.



3 Make a test cut, but don't cut all the way through the test piece. You don't want to cut into the backer block until the bit height is perfect. That way, the block can be used to quickly set the bit height the next time you make doors.

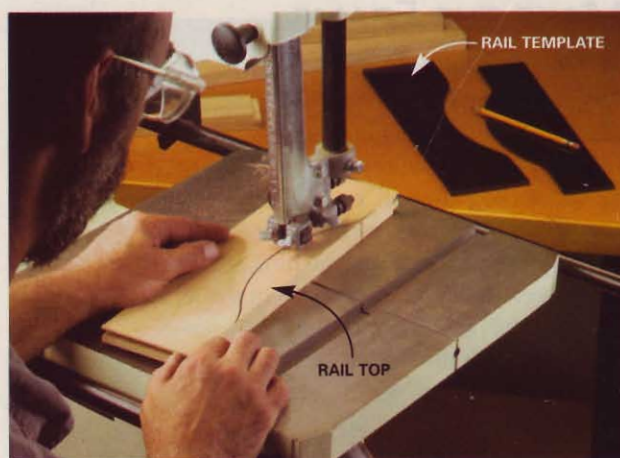


4 Check the cut. The height of the router bit controls the depth of the shoulder and the thickness of the lip. The tongue size is fixed. The shoulder should be about twice as thick as the lip. In 3/4-in.-thick stock, this works out to a shoulder depth of approximately 3/16 in. Raise or lower the bit as needed and make test cuts until it's right.

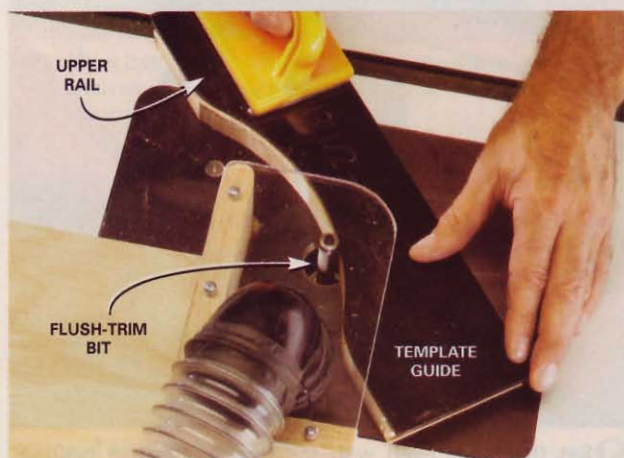
MAKE THE FRAME (CONTINUED)



5 Rout the rail ends. Remember, the back of the board is face up for all cuts. To ensure a uniform cut, keep consistent downward pressure on the sled at all times.



6 Rough-cut the arch in the top rail. Center the rail template on the top rail with the bottom of the pattern even with the rail's bottom edge. Use a template that is the same length or slightly longer than the rail. Trace the template and use a bandsaw or jigsaw to cut the curve. Stay at least 1/16 in. but no more than 1/8 in. outside the line.



7 Flush-trim the rail with a template guide and a flush-trim bit. Use double-faced tape to adhere the pattern to the rail. The fence is replaced with a bit cover and starter pin assembly (see Recommended Gear, page 59).



8 Set the height of the long-grain cutter by aligning the groove cutter with the tongue on the end of a machined rail. The top of the cutter should be even with the top of the tongue.

RECOMMENDED TOOL: TEMPLATE SET

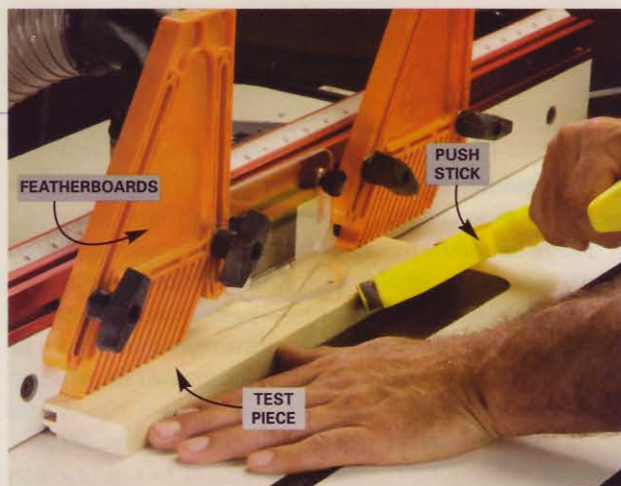
A cathedral template set (\$70) is a matched set of rail-and-panel templates. A template can be fastened directly to the material to act as a guide for the flush-trim bit. A set typically covers a range of panel widths, generally from 9-1/2 in. to 22 in. Each pattern has a centering hash mark for locating the pattern on the wood. Sure, with careful layout, bandsaw and drum-sander work you can make your own patterns, but it's hard to beat the simplicity of commercially made patterns (see Sources, page 62).



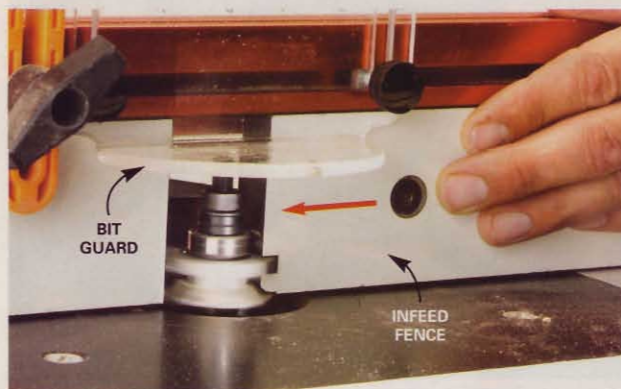
Oops!



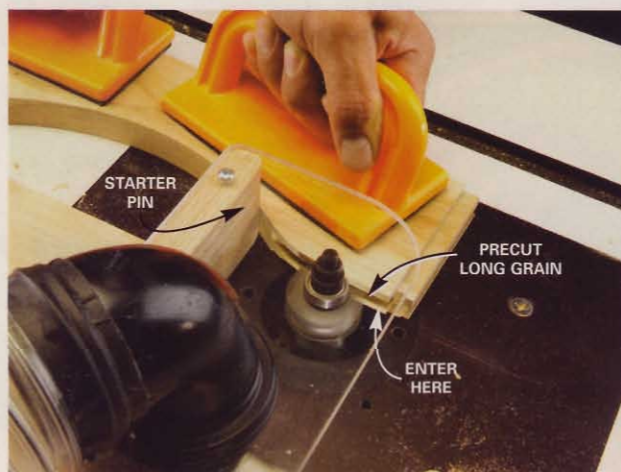
Don't forget to mark the backs of all your parts, and pay attention to the marks! It's very easy to flip a rail and end up with a piece that's no good!



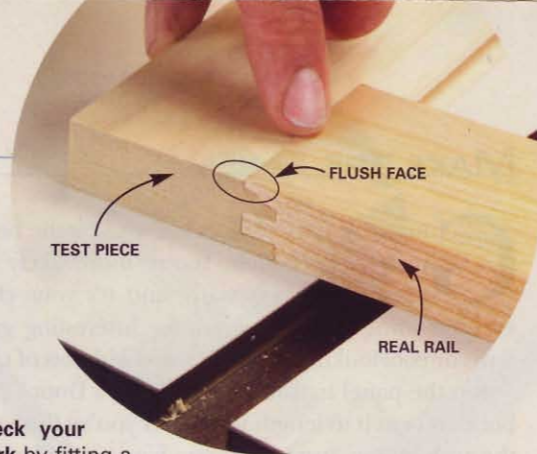
9 Make a long-grain test cut in a scrap piece. Use featherboards to hold the rail down onto the table and a push stick to drive the piece past the cutter.



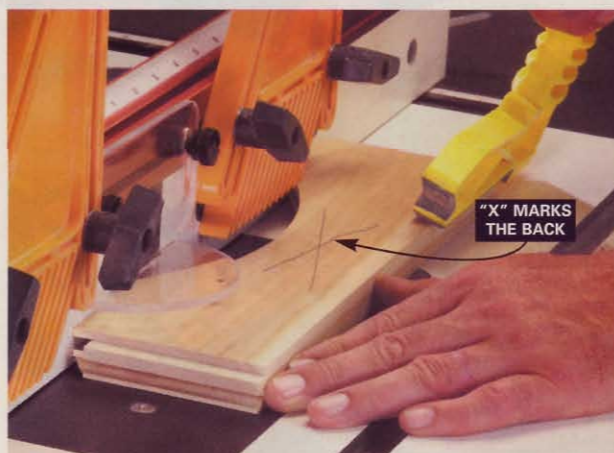
11 Make a zero-clearance fence by slowly sliding the infeed half of the fence into the spinning bit. This eliminates most of the chipping that can happen on these cuts. You only need the zero-clearance fence on the infeed side. **Caution:** Make sure your bit guard is in place and the mounting bolts on the fence are just loose enough to let the fence slide easily.



13 Begin the arched cut at the precut section of the top rail. First position the rail against the starter pin without contacting the bit. Then pivot the rail into the bit so the bit enters the previous long-grain cut. **Caution:** Do not allow the bit to contact the end grain, as this typically causes it to grab the rail and ruin the piece.



10 Check your work by fitting a rail into the test piece. The faces of both parts should be flush. If they're off by just a little—the thickness of this page, for instance—you're probably OK. A tiny discrepancy like that will easily sand out after assembly. If they're off more than that, raise or lower the bit to correct it. Make test cuts until you've got a good match.



12 Machine the long-grain edges of every frame piece, including the straight portions of the arched rail. Make sure the piece is face down. You should be able to see the mark on the back of the piece when you're machining it.

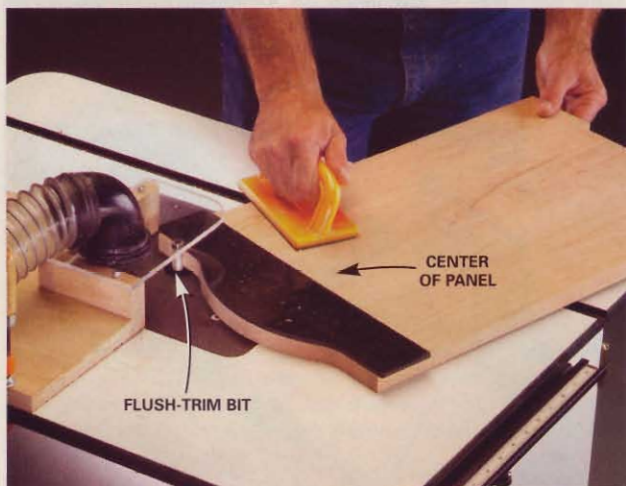


14 Complete the long-grain cut by pivoting off the starter pin and riding the router-bit bearing through the entire length of the arched rail. Use push blocks to keep consistent downward pressure on the rail throughout the cut.

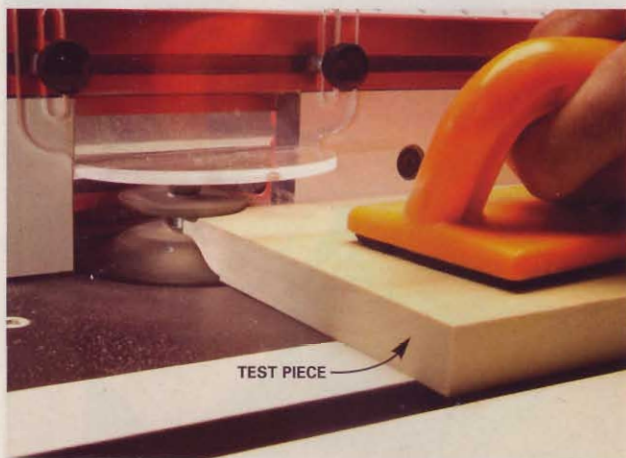
MAKE THE PANEL

Gluing up narrow pieces of wood is the best way to make wide panels. You're more likely to get a panel that won't warp, and it's your chance to exercise some creativity. Look for interesting grain patterns or cool-looking pieces of wood with lots of character.

Rip the panel to width (see "Sizing a Door," page 61), but don't cut it to length until after you've flush-trimmed the arch on top, just in case you have a problem with the



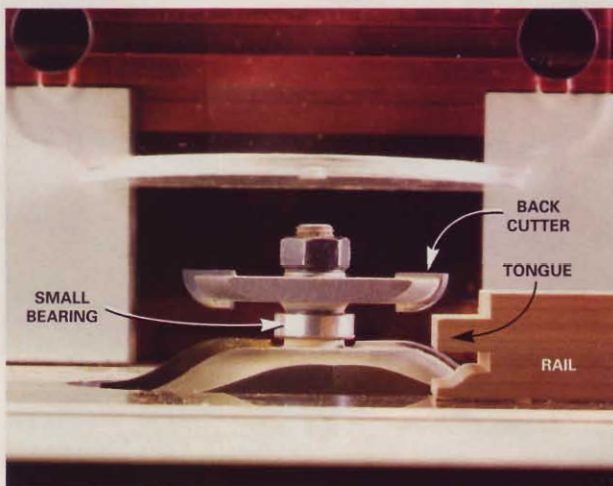
15 Form the arch on the panel the same way you did the rail, but using the matching panel template. Use a square to make sure the pattern is set square on the panel. Center and trace the pattern, cut outside the line, tape the pattern to the panel and flush-trim the shape.



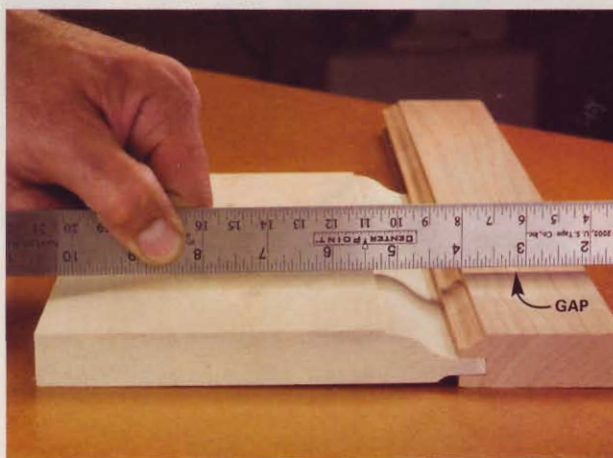
17 Make a test cut on the long-grain edge of a piece of scrap. It's easier to cut long grain than end grain, so make your test cuts on a long-grain edge. Make the first pass with the fence about 1/4 in. ahead of the bearing. Set the fence even with the bearing for the second pass.

flush-trimming step. Mark the back of the panel to remind you to keep it face down on the router table.

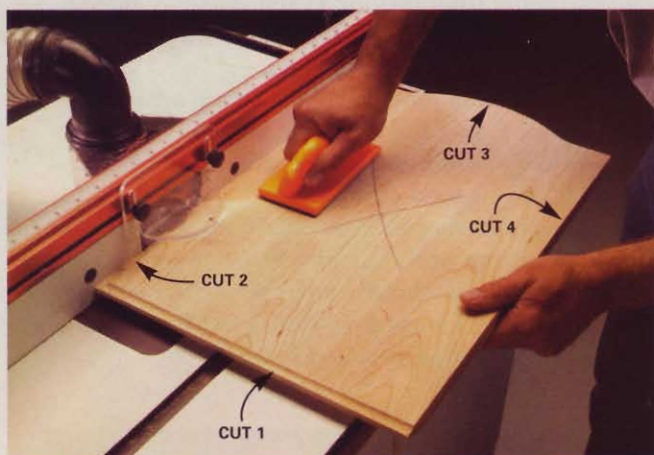
Large-diameter panel-raising bits must be run slowly, at no more than 12,000 rpm. Routers with 3-hp motors can easily raise the panel in two passes using the fence to limit the depth of cut. A router whose motor has less than 3 hp may struggle a bit. Use push pads to grip the panel and guide it past the bit.



16 Set the panel-raising bit's height by aligning it with a rail's tongue. "Eyeball" the bit height so the bottom of the back cutter is even with the top of the tongue. Use the bit's small bearing and set the fence 1/4-in. in front of the ball bearing. At this stage, the fence is back in place of the bit cover.



18 Check your work by slipping the test piece into the groove and laying a straightedge across the face. The panel and the frame face should be flush. In this case, the gap means the bit is set too high. Adjust and test the bit height until it's right. When the correct bit height is established, replace the small bearing with the large one.



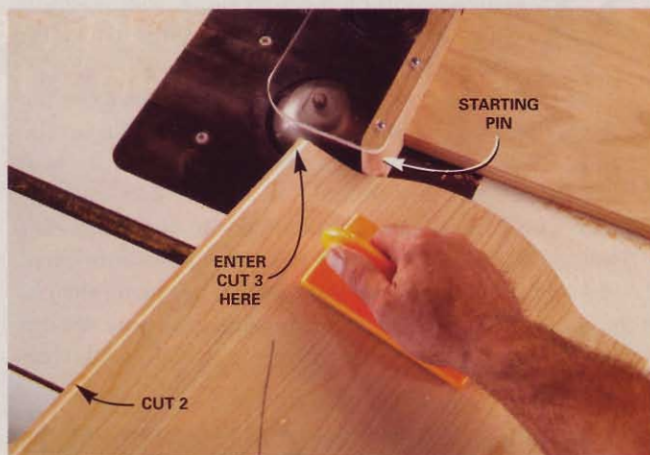
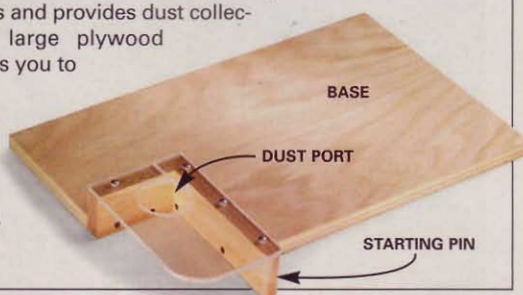
19 Make the first pass on the panel with the face of the fence set even with the large bearing. The first cut is made on the panel's bottom edge. Rotate the panel counterclockwise and make the second cut on the long-grain edge. Keep the panel moving in one continuous motion to prevent burning. Cuts 3 and 4 will require different setups.

TIPS AND REMINDERS

- If you're making a door with rails and stiles less than 2 in. wide, it's easier and safer to work with pieces wide enough to make two back-to-back pieces. After all the machining is done, rip the stock down the middle to create a pair of stiles or rails.
- Practice making a door with an easy-to-machine material, such as poplar or pine. Keep a successfully made door, dry-assembled only, so you can use the parts for future setups.
- Make extra pieces, just in case. Rails are especially easy to goof up. You'll appreciate having a spare ready to go if you need it.
- Use straight-grained material for the frame and more open-grained pieces for the panel.
- Prefinish the panel before you assemble the door.

RECOMMENDED GEAR: BIT COVER

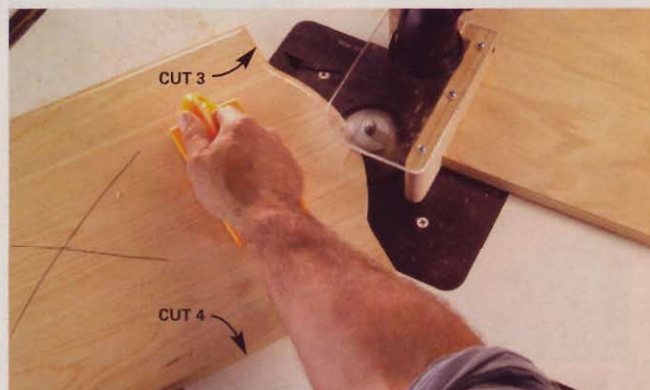
A shop-made bit cover with a starter pin is essential, because the arched shapes can't be cut with a fence. The starter pin acts as a fulcrum for easing the arched rail and panel into the router bit. The cover protects your hands and provides dust collection. The large plywood base allows you to clamp the cover to your router table (see Fig. D, page 62).



20 Set up to cut the panel arch (Cut 3) by removing the fence and clamping the bit cover and starting pin in place. Turn on the router and position the arch against the starting pin without contacting the bit.



21 Start the cut by easing the panel into the bit so the bit enters at the previously cut corner. At this point, the arch is in contact with both the starting pin and the bearing on the router bit.



22 Rout the arch by pivoting off the starting pin so the panel is only contacting the router-bit bearing. Finish the arch, reposition the fence so it's even with the bearing and make Cut 4 on the remaining long-grain edge. Replace the large bearing with the small one and repeat the process (Photos 19 through 22) for the final pass.

ASSEMBLE THE DOOR

With the router table work done, you're almost home free. Still, there are some tricks for making assembly easier.

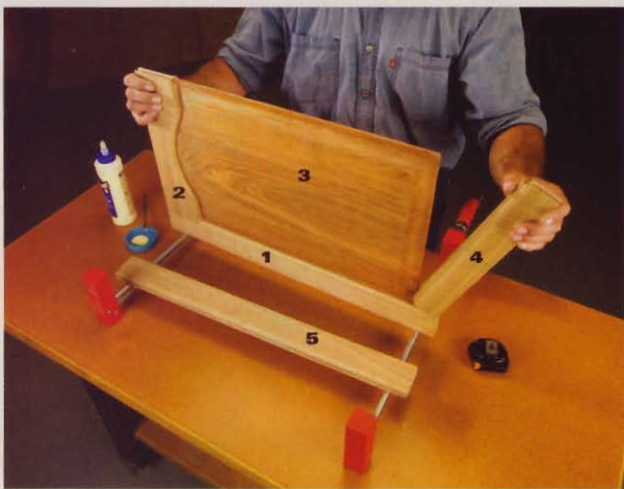
Sand all the pieces before putting the door together. Be careful when sanding the long-grain profile on the stiles. If you sand too much, the stiles won't mate with the rails the way they should.

Prefinish the panel to guarantee the entire panel is coated with finish. That way you won't have unfinished edges peeking out of the frame when the panel shrinks in winter. Prefinishing also prevents glue squeeze-out from gluing the panel to the frame, which would pre-

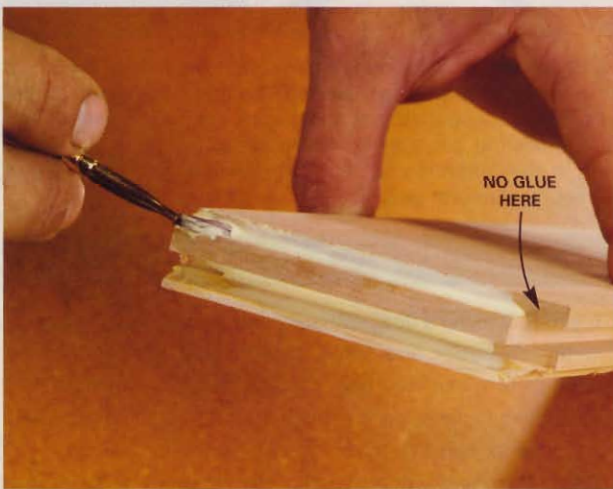
vent the panel from floating in the frame. A glued-in, solid-wood panel is bound to crack as it tries to expand and contract with seasonal changes.

Have everything you need ready before applying the first drop of glue. Glue dries fast, and you don't want the glue to start setting up while you're running around the shop looking for a clamp.

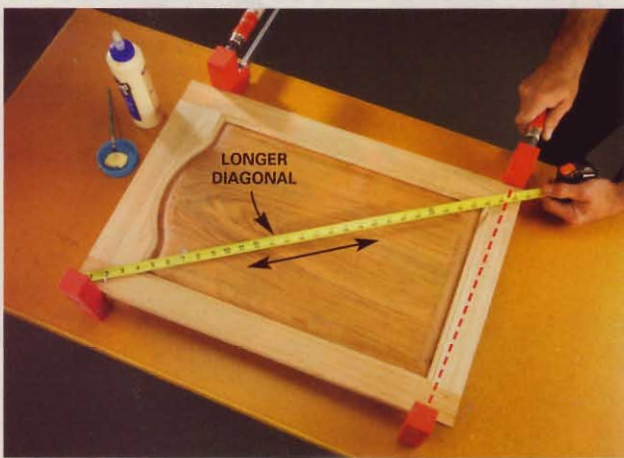
Speaking of clamps, use good ones. Sure, you can make almost any clamp work, but parallel jaw clamps are the best by far. They stay dead flat, even under clamp pressure. If you only spring for one pair—and glue a kitchen full of doors one door at a time—you won't regret it.



23 Glue in sequence from 1 to 5. Start with a stile and the top rail. Add the panel, then the bottom rail, and capture it all with the last stile. Keep the edge of the rail dead even with the end of the stile.



24 When you apply glue to the rail ends, make sure the entire profile is covered except for the areas just above and below the groove. This helps prevent getting glue on the panel.



25 Clamp the door gently. It doesn't take much pressure to pull the rails and stiles together. Excessive clamping can bow the door. Measure the diagonals to make sure the door is square. If it's not, loosen the clamps and rack them in the same direction as the longer of the two diagonals. Tighten the clamps, and recheck the diagonal.

TIP: ANTI-RATTLE SNAKES

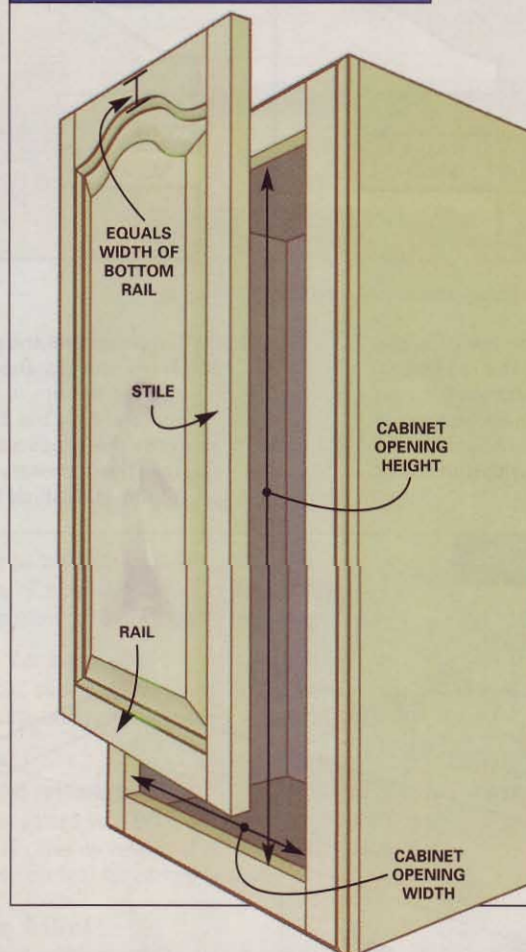
Solid-wood panels expand and contract seasonally. When they're at their smallest, they can rattle within the frame. You can take the rattle out with these silicone strips. Make them by squeezing 1/8-in.-dia. beads of silicone caulk onto a piece of wax paper. After the caulk dries, peel off the strips and cut them into 1-in. lengths. Set these into the grooves before you assemble the door. They'll provide a cushion that allows the panel to expand but not rattle.



Before you can calculate the lengths of the rails and stiles, you have to know how the door will fit over or into the cabinet opening. If the door will lay over the opening, it's called an overlay door. You must know the amount of overlay to make your rail and stile calculations. The size of the overlay—how much bigger the door is than the opening—can be affected by the hardware you use. So, get the hardware before you build your door.

If the door will be set inside the opening, it's called an inset door. To calculate your stile and rail size on an inset door, you need to know the gap size between the door and the cabinet (usually about 1/32 in.). Many cabinetmakers cut the parts to fit the opening exactly and then trim the assembled door to create the gap.

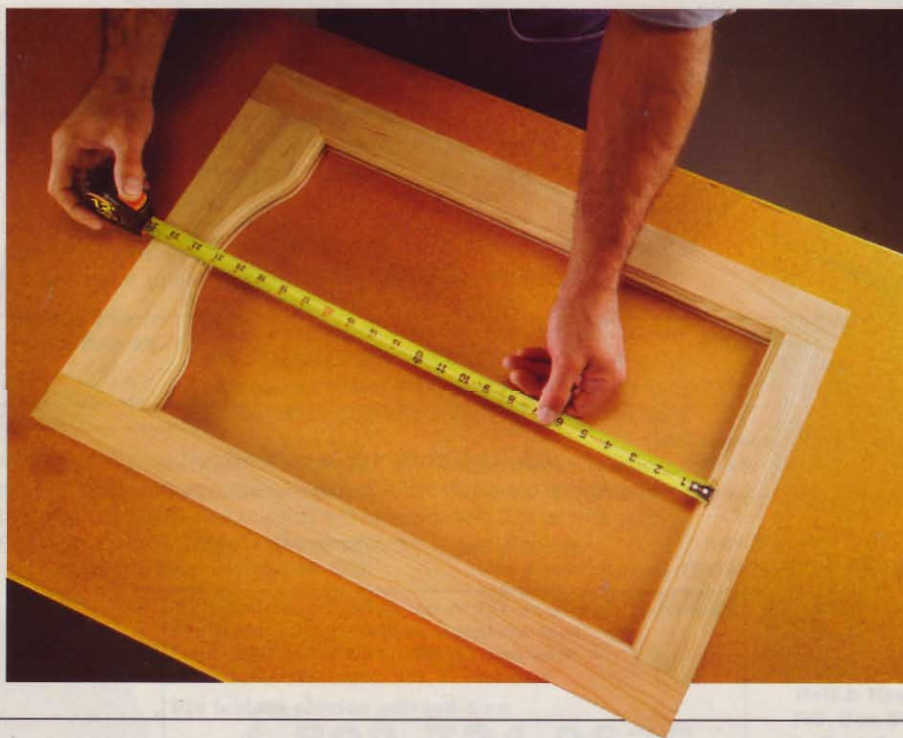
FIGURE A SIZING STILES AND RAILS



Calculate the stile length by measuring the height of the opening and either adding the overlay amount or subtracting the inset gap's width.

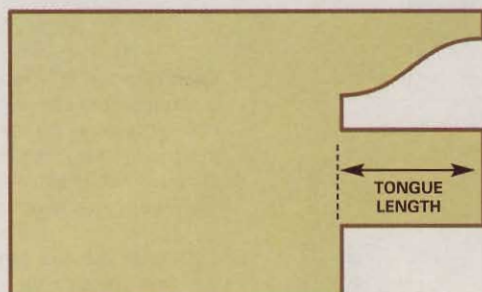
Calculate the rail length by first measuring the width of the opening. Add the overlay or subtract the inset gap amount; this gives you the door's overall width. Now, subtract the width of the two stiles and then add the length of the two tongues on the ends of the rail (Fig. B, page 62).

Determine the width of the arched rail. First, measure the depth of the arch in the rail using the appropriate template guide. Make the top rail wide enough so that after the arch is cut out, the thinnest part of the rail top equals the width of the bottom rail.



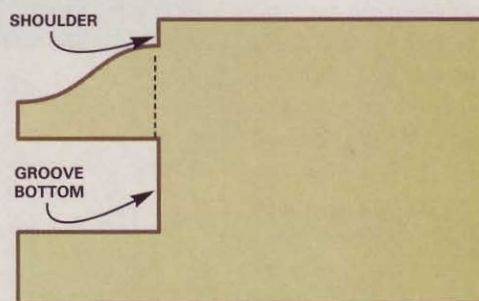
Determine the panel size by dry-assembling the frame and measuring from groove bottom to groove bottom. Make the panel 1/8-in. smaller in both length and width to allow for expansion. On many cutters, the shoulder on the frame's face is aligned with the bottom of the groove (Fig. C). This allows you to simply measure from shoulder to shoulder on the dry-fit frame.

FIGURE B RAIL END



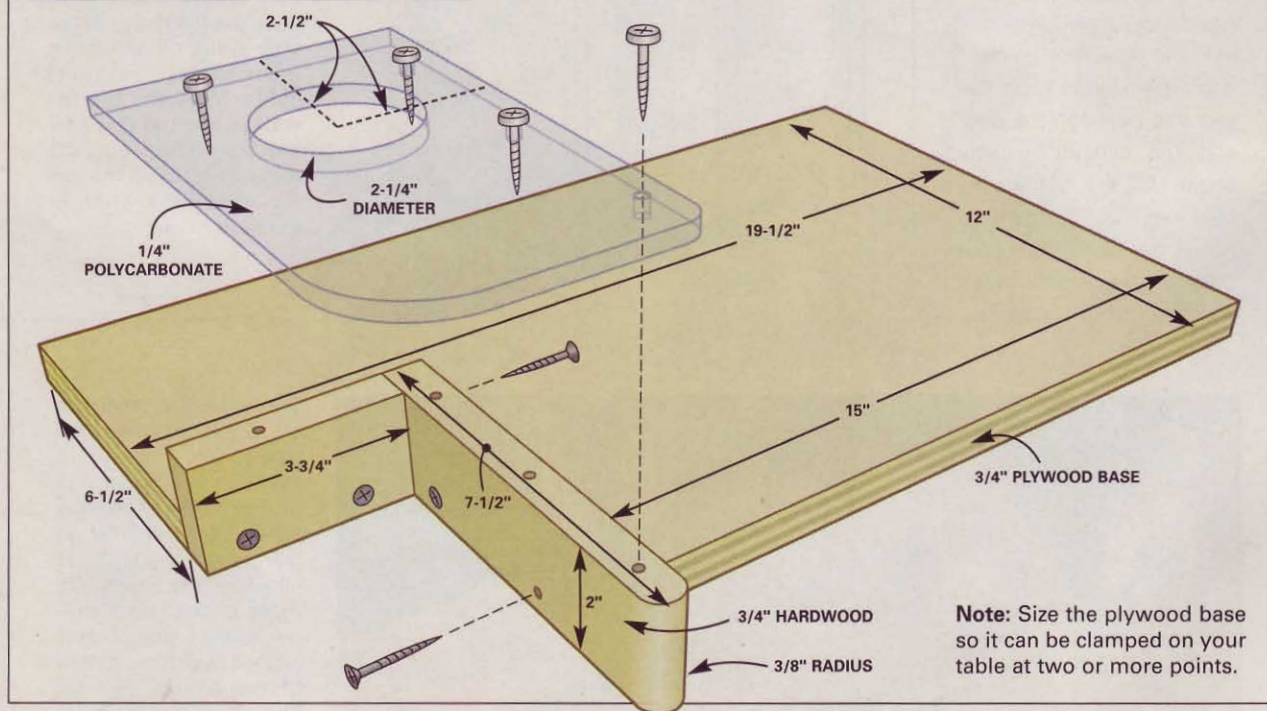
Measure the tongue length on the rails. You need this number to calculate the rail length. When you figure out the dimension for your router bits (it can vary from manufacturer to manufacturer), keep it—you'll use it for every set of doors you make with that cutter.

FIGURE C STILE CROSS SECTION



To determine the panel size, you first need to know the distances from groove bottom to groove bottom in the assembled frame. Most cutters align the shoulder on the frame's face with the groove bottom. This allows you to take the necessary measurements right on top of the assembled frame (see Fig. A photo).

FIGURE D BIT COVER AND STARTING PIN



Note: Size the plywood base so it can be clamped on your table at two or more points.

Sources

Infinity tools
(877) 872-2487, www.infinitytools.com
Classic door templates, PDT-100, \$70

MLCS
(800) 533-9298, www.mlcswoodworking.com
Rounded curve template, 9378, \$70

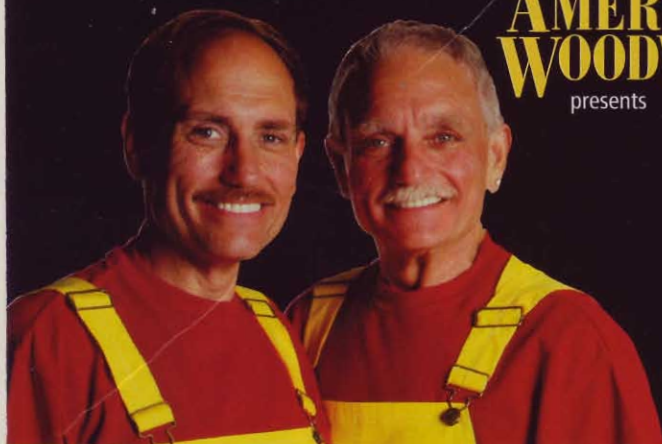
Sommerfeld Tools
(888) 228-9268, www.sommerfeldtools.com
Cathedral door templates, TMP-003, \$80

Woodhaven
(800) 344-6657, www.woodhaven.com
Cathedral door template set, 5455, \$95

Eagle America
(800) 872-2511, www.eagle-america.com
Coping sled, #400-1235, \$40

Woodworker's Supply
(800) 645-9292, www.woodworker.com
Double-faced tape, #127-877, \$11.

**AMERICAN
WOODWORKER.**
presents



On the House

**With the
Carey Brothers**

Tips of the Month

We are proud to be associated with the premier woodworking magazine, and we are pleased to offer the following tips:

An Easy Way To Get A Grip

We recently assembled a piece of office furniture where the only tool required was an Allen wrench. Sufficiently tightening each connector proved to be a struggle at best - we didn't have the strength to properly tighten a couple of the connections. All that was needed was something that would provide just a little more leverage. Rather than reach for the vice grips that would likely damage our Allen wrench with bite marks, we decided to create our own lever by simply drilling a hole near the end of a small scrap of wood. Be sure to drill all the way through, and then simply slide the wood over the end of the wrench and use the leverage for easier turning. We also made one with a hole in the middle, and it made a really neat 'T-handle.' As we continued to think-out the problem we also determined that a short length of quarter-inch iron pipe could be used as well. Simple solutions like this can help you get a grip on your projects too.

3-Piece Carrying Case

Here's how to make an unbreakable container that can be used in your shop and taken anywhere. All you need is a length of plastic water or sewer pipe - you pick the diameter and length - and two end caps (yes, the same size as the pipe would be nice). You'll have the perfect container for assorted jigsaw blades, that special staining cloth, important screws from your favorite project-- you name it. In some instances you may have to slightly sand the outside of the pipe so that the cap(s) can be more easily removed. By the way, you can glue one of the ends, but we have found that being able to remove both ends gives us more accessibility.

Ask the Carey Brothers a woodworking, home improvement or remodeling question on their live radio broadcast every Saturday from 9:00 a.m. to 1:00 p.m. Eastern Time. Call toll-free at 1-800-737-2474 to ask your question. Visit their website at www.onthehouse.com for recaps of the show and other helpful info.



The Woodworker's Corner

A note from the Publisher of American Woodworker, Jim Schiekofer

As you know, every Saturday morning our radio partners—the Carey Brothers—broadcast their radio show, On The House, around the country. Now you can tune in to hear expert woodworking tips from our own Tools & New Products Editor, George Vondriska. George will be calling in to share his extensive woodworking expertise during a special Woodworker's Corner segment of the show. We're proud and excited to be able to reach out to a wide audience of passionate woodworkers across the nation each week, and we hope you'll tune in.

Awesome power
and rock-solid
construction do
deliver better
results

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MIKE KRIVIT

PART 2
saws
from
\$1,000
to
\$1,500

Same song, second verse. In our last issue, we tested 19 bandsaws that each cost less than \$1,000 (AW #110, October 2004, page 71). This time, we're looking at the heavyweights in this class: saws that cost from \$1,000 to \$1,500.

What you get is more power, larger capacity, a super-stiff frame and huge wheels that can easily take wide blades. The difference between this group and the last is comparable to the difference between a contractor's and a cabinet saw. Both will get the job done, but under tough circumstances, the bigger machine gives better results and is a lot more satisfying to operate. It can be a precision tool one day, a small lumber mill the next.

Tool Test Bandsaws

by Tom Caspar

PROS AND CONS OF A BIG BANDSAW

You'll find a lot of good features primarily on large, expensive bandsaws. But there are some drawbacks, too, if you have a small shop.

TENSION WHEEL

This adjustment wheel is often conveniently located under the saw's frame, rather than on top.

STIFF FRAME

A large bandsaw generally has a continuous column from top to bottom that's exceptionally sturdy and can take lots of tension.

LOTS OF POWER

Resawing is much easier and smoother with 2- to 3-hp motors.

WEIGHT

A big bandsaw weighs from 200 to 550 lbs. The biggest saws aren't really suitable for most mobile bases.

LARGE WHEELS

Wide and thick blades for resawing last longer and have more traction on large wheels.

GUIDE-POST CRANK

To raise or lower the heavy guide post, simply turn this wheel or crank handle.

BLADE SELECTION

You can run 1- to 1-1/4-in.-wide blades that are ideal for resawing, but 1/4-in. and smaller blades for detail work are often hard to set up.

STURDY TABLE

The table on a big saw is usually extra-large and very stable. It often comes with a rock-solid fence.

4-IN. DUST PORT

You'll need a dust collector with at least 400 cfm to be effective.

VOLTAGE

You'll need a 240-volt outlet for most big saws.

FEATURES

POWER

You simply can't have too much power in a bandsaw. For cutting wood under 2 in. thick, a 1-hp motor is plenty. But one of the really useful things you can do with a bandsaw is to stand a board on edge and split it into two matched halves for panels or tops. You can also save money by sawing thick wood into thinner pieces for drawer sides and jewelry boxes, for example. Either operation is called resawing, and doing it well requires lots of power.

A smooth, consistent feed rate is the key to resawing success. If you slow the blade, it wanders. If you stop it (which is very easy to do on an underpowered machine), you get a nasty bump. On a 1-hp saw, you must proceed very slowly when resawing and pay a lot of attention to how the motor is performing. Resawing is easier on a 1-1/2-hp saw, for boards up to 6-in. wide. Beyond that, you want 2, 2-1/2 or even 3 hp—the more, the better. The kerf of a wide blade can be up to 50 percent thicker than the kerf of a narrow blade. Removing that extra wood requires plenty of muscle.

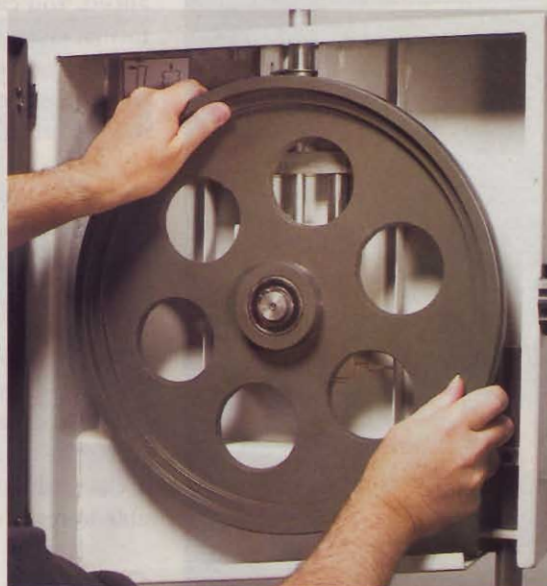
RIGIDITY

A bandsaw is a hands-on machine, like a lathe. You can feel right through your fingertips how the machine is performing. If it shakes and vibrates, you naturally tense up and have a hard time holding to a fine line. If your bandsaw runs smoothly, it's heaven.

In this price range, we expect a saw to be very solidly built. We can overlook some vibration in an inexpensive saw, but who can accept a rough ride in a Mercedes?

We carried out three simple tests that tell a lot about how well a saw is built and performs. We wiggled the upper wheel (Photo 1), pushed on the guide post (Photo 2) and balanced a nickel on the table (Photo 3). We aren't reporting our findings in this nickel test, though. A lot

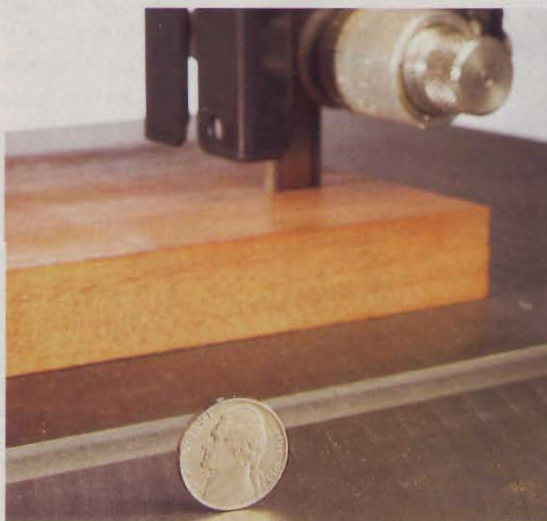
THREE TESTS FOR A WELL-BUILT SAW



1 Rock the upper wheel of a large bandsaw. It should barely budge. That's the first of three easy tests that say a lot about a bandsaw's construction. Play in the upper wheel is caused by the sliding mechanism that tensions and tilts the wheel, not by a poor bearing.



2 Push the guide post. It, too, should barely move. After all, the post holds the guides that steady the blade. Excessive play here is usually caused by the rack-and-pinion mechanism that raises and lowers the guides and by flex in the upper wheel housing.



3 Balance a nickel on the bandsaw's table while it's running. On a solidly built saw with well-balanced wheels, the nickel stays up. This is a classic seat-of-the-pants test for vibration in any machine.

Caution: Don't let that coin come within 6 in. of the blade!



4 An observation window in the upper frame makes setting up a new blade much easier. You can center the blade by adjusting the upper wheel's tilt while the saw runs.



5 Extra tension from a powerful spring below the upper wheel lets you pull some blades tighter, improving their performance. Large-diameter saws generally can develop more tension than small saws, but the range is wide.

depends on how well an individual saw's wheels are balanced. You can't judge a whole line of saws on the performance of one set of wheels. If you buy a saw in this price range and inadequately balanced wheels cause it to fail the nickel test, you've got reason to complain to the manufacturer.

WHEEL DIAMETER

Big wheels have a lot of advantages that add up to a better machine for resawing (see "Big Wheels," page 69).

CAPACITY

You may hardly ever need it, but it's disappointing in this range of saws to get less than 12 in. of resaw capacity. (Some saws can only cut 10 in.) After all, you get 12 in. of capacity with a 14-in. saw and a riser block. If you can fit a 12-in. wide board through your planer, you should be able to resaw it on a premium bandsaw.

GUIDES

We prefer block guides for ease of setup with small blades (see "Types of Bandsaw Guides," AW #110, page 75). Disc and ball-bearing guides are the norm in this class of larger saws, however, because they offer more front-to-back support for wide blades. (Disc guides are also called European roller guides.) Unlike block guides, they require very little maintenance.

Both disc and ball-bearing guides perform well. Neither one is clearly superior to the other; they're just different. Some bearing guides aren't very deep, though. We prefer guides that offer at least 5/8 in. of support, front to back, to get the straightest cut with a wide blade (see Chart, page 78).

You can certainly use small blades with disc and ball-bearing guides, but you must become adept at setting up the guides. Incorrectly set guides can quickly ruin a blade's teeth. Look for a saw whose upper and lower guides we rate as easy to set up (see Chart).

We prefer bandsaws that allow you to set the side guides and thrust bearing independent of each other. On other saws, whenever you move the side guides forward or backward, the thrust bearing moves, too.

OTHER FEATURES

- **Blade observation window.** This is a handy innovation (Photo 4). When you change blades, you often must "track" or adjust the tilt of the upper wheel to center the blade. On most bandsaws, you must slowly spin the upper wheel by hand while tracking. With a window, you can turn on the saw and track the blade much faster and more accurately while it's under power.

- **Powerful spring.** If you think every bandsaw has a similar spring, think again. The spring regulates tension on the blade and acts as a shock absorber if you hit a rough patch. The springs on every bandsaw we tested delivered adequate tension, but some are capable of

MIKE KRIVIT

BIG WHEELS, BIG BENEFITS

SIZE

Most bandsaws have 14-in.-dia. wheels, but machines with 15- to 18-in.-dia. wheels have five advantages.

■ Deeper throat.

Every additional inch in diameter adds an inch in throat capacity left of the blade.

■ Larger blades.

Big wheels can easily handle thick-bodied 3/4- to 1-in. blades for resawing. The bigger the wheel, the better. Most wide blades break prematurely on 14-in. wheels because they're bent over too tight a radius.

■ **More rigidity and momentum.** Large, heavy, stiff wheels deliver better performance than small lightweight wheels. Extra mass helps carry you through the rough spots at a steady pace, and that's critical for a smooth cut.

■ **Longer blade life.** Big bandsaws take very long blades. They last longer than shorter blades simply because they have more teeth. In addition, blades flex less around a large wheel. That puts less strain on the weld, where most blades break.

■ **Better traction.** A blade is less likely to slip when it contacts more tire. Powerful saws running thick-kerf blades

need more traction because they get pushed harder.

CROWN

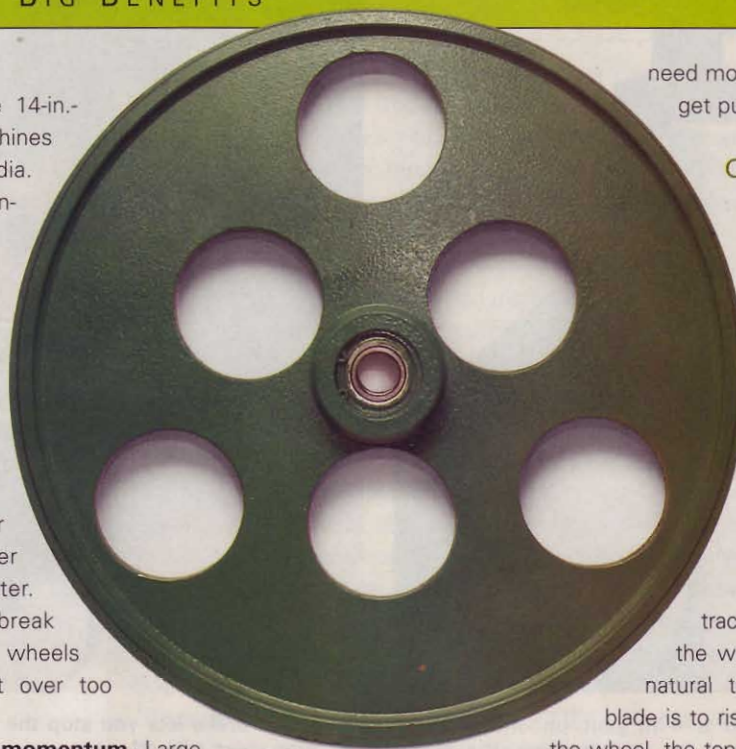
If you look at the edge of a typical bandsaw wheel, you'll notice that it has a curved surface, or crown. Most 14-in. bandsaws have a pronounced crown, but the amount of crown on some 15- to 18-in.-dia. saws is almost negligible. Why is that?

A high crown helps you track a blade in the center of the wheel. That's because the natural tendency of a spinning blade is to rise to the highest spot on the wheel, the top of the crown. Tilting the wheel changes the position of the highest spot.

When you put a wide blade on a high crown, however, some of the blade doesn't touch the tire. The blade doesn't bend enough to fully conform to the crown.

A low crown is better for wide blades and resawing. Most of the blade touches the tire, so it has more traction. In effect, more horsepower is delivered to the blade.

The downside to a low crown is that tracking the blade is a more sensitive adjustment. For an all-purpose premium saw, we prefer a compromise: a wheel with a medium crown.



HIGH CROWN

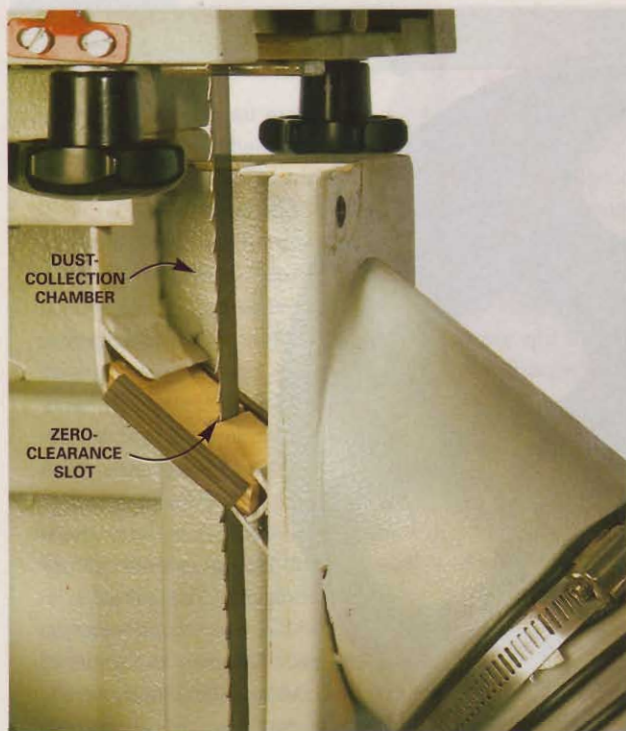
A high crown is well-suited for a narrow blade. The blade is easy to track, because it naturally moves to the wheel's highest spot.



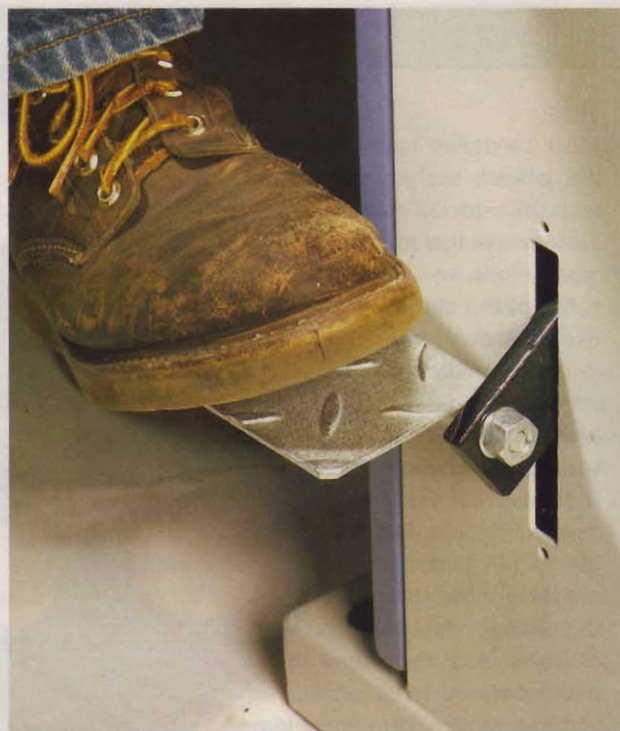
LOW CROWN

A low crown is best-suited for a wide blade. More of the blade lies flat on the tire. You get more traction and better power delivery.





6 A sealed chamber and a 4-in. port under the table improves dust collection. On this machine, the blade passes through a piece of wood with a zero-clearance slot. The lower door seals the front of the chamber. This chamber concentrates the flow of air directly past the blade.



7 A foot brake lets you stop the blade in seconds. Some large saws' wheels are so massive that they spin quite a while after the power is off. By using a brake, you can quickly make sure the blade stops before you walk away from the machine.

pulling a blade much tauter than others (Photo 5). Some brands of 1-in. and wider bandsaw blades are designed to take plenty of tension (as much as 30,000 psi), but the springs on some saws only develop about 8,000 psi. Occasionally, increasing the tension on a blade can improve its performance, especially when resawing. Bandsaws with our two highest spring-tension ratings are capable of pulling a blade as tight as it should go. These saws give you one more option for improving the quality of your cut. Check with the manufacturers of your blade and saw before exceeding your saw's maximum tension settings.

■ **Quick-release lever and tension wheel.** Few of the bandsaws in this price range have a really useful feature recently introduced on less-expensive saws: the quick-release tension lever. When you're done using your saw for the day, you simply swing this lever to relax the tension on the blade. This is good for extending blade and tire life, but it's certainly not an essential feature.

When it's time to change blades and retighten the tension spring, we really like a machine with a conveniently located wheel under the upper frame (see "Tension wheel," page 66). This is much easier on your back and wrist than a knob located atop the saw.

■ **Direct dust-collection chamber.** Truly effective dust collection has a long way to go on most bandsaws. Large 4-in. dust ports are a big help, but the single best

improvement to date has been a sealed chamber under the table (Photo 6). The concentrated flow of air strips a lot of sawdust directly from the blade.

■ **Foot brake.** You might remember this basic power-tool safety rule from shop class: The operator should stay at the machine until the blade stops. Large bandsaws have such momentum that their wheels can spin quite a while after you push the Off switch. A foot brake stops a bandsaw almost instantly, so you can quickly go about your other business (Photo 7).

■ **Guide-post crank.** If you've ever smashed your fingers under a falling guide post, you'll appreciate this feature. A crank or wheel makes it easier to set the height of a heavy guide post, but it's not a make-or-break feature.

■ **Table height.** Table heights vary widely. Most of us are used to the 44-in.-high tables of 14-in. bandsaws, which are perfect for detail work. However, a low (34 in.) table is much better on your back for lifting and pushing big timbers. Many large bandsaws have low tables to meet European ergonomic standards. It feels odd to stand in front of a low table, though, and when you hunch over to see detail work, it's hard on your back in a different way. Some blade guards also obscure the blade when they're set low on a short table. You can raise a low bandsaw on a wide and stout shop-made riser base to a good compromise height.



PATRICK HUNTER

CRAFTSMAN 22450

- Price: \$1,300
- Power: 120 volts, 1 hp
- Maximum resaw capacity: 10-3/4 in.
- Wheel diameter: 18 in.

PROS

Most bandsaws can cut wood, non-ferrous metals (aluminum and brass) and plastic, but this saw can also cut iron and steel. It has a second set of pulleys on the back side that increase torque and slow the blade to three very low speeds (80, 150 and 200 ft. per minute). In case you push too hard, a circuit breaker with a reset button is right on the front of the saw. This saw uses block guides. They're our favorite style of guide for ease of setup, but we'd replace the steel with phenolic blocks for cutting wood. The lower guides are quite close to the table's surface, which minimizes the length of unsupported blade. The blade comes out the saw's front, which decreases the chance of kinking a blade when you change it. We really like saws with this feature.

CONS

Craftsman rates this saw at 2 hp maximum developed. That's a different standard than most other manufacturers use. By the more commonly used continuous-duty standard, this saw has a 1-hp motor. That's pretty good for a 120-volt machine, but not as powerful as most other saws at this price. We'd prefer more brawn for resawing thick wood. The saw has no tension scale because it doesn't have a spring. (The frame itself provides tension and acts as a shock absorber.) You need four different tools to change blade sizes, which is a hassle.



DELTA 28-682

- Price: \$1,250
- Power: 240 volts, 2 hp
- Maximum resaw capacity: 12 in.
- Wheel diameter: 18 in.

PROS

With 18-in. wheels and 12 in. of room between the guides and table, this saw has huge throat and resawing capacities. The table is located at a good working height and is exceptionally sturdy, because it has a third support point. This is the only saw with adjustable stops for tilting the table to 20, 30, 35 and 45 degrees. A sliding bar on the left-hand side of the table supports wide work. This is one of the few large saws that has a quick-release tension lever, but it's not our favorite design. The guides offer plenty of front-to-back support for a wide blade. This saw has a second, slower speed (2,300 fpm) for cutting plastics and nonferrous metals. With its 2-hp motor, you won't need the slower speed for wood.

CONS

The tension lever is on top of the machine, about 7 ft. off the floor. One of the lower guide adjustment screws is really hard to access, requiring you to tilt the table 45 degrees. The lower thrust bearing doesn't always lock in a rigid, upright position. The saw's spring develops adequate tension, but little more. The rigidity of the upper wheel and guide post is about average, as is the wheels' weight.

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PATRICK HUNTER

MINI MAX S16

- Price: \$1,500 (\$1,650 as shown)
- Power: 240 volts, 2-1/2 hp
- Maximum resaw capacity: 12-1/4 in.
- Wheel diameter: 16 in.

PROS

You'd never guess that so much power, rigidity and reliability could come in such a compact package. The excellent results you get when resawing on this machine come from just about everything working right. It's a tried-and-true design, made in Italy for MiniMax by Meber. The upper guides are easy to dial in place and don't require any tools. This is one of the few saws whose fence can actually be adjusted for blade drift. The blade comes out the front of the table, which makes changing blades a snap. An optional foot brake costs \$75 and an optional guide-post rack-and-pinion wheel is \$75. Optional phenolic (Cool Block) guides for 1/16-in. to 1/4-in. blades are \$75.

CONS

Like most other big saws, this machine with stock guides is best suited for 3/8-in. and larger blades. Its flat wheels offer better traction for large blades but make it harder to track small blades. Its disc guides give lots of support for large blades but are awkward to set with small blades. You must reset the fence parallel to the miter slot each time you change blades. You need a 15/16-in. box wrench for tilting the table, which wiggles around when you loosen it, making it difficult to set the table to a precise tilt. The table is only 34-1/4 in. off the floor. That's fine for big timbers but too low for detail work. The blade guard hangs below the lower guides and obscures your line of sight for work under 2 in. thick.



JET JWBS-18

- Price: \$1,200
- Power: 120 volts, 1-1/2 hp
- Maximum resaw capacity: 10 in.
- Wheel diameter: 18 in.

PROS

This saw has many advantages over 120-volt, 14-in. machines. Huge 18-in. wheels underneath the sleek white cabinet create an 18-in. throat capacity left of the blade. (Of course, that's 4 in. more throat capacity than a 14-in. saw offers.) Wheels this size can easily take 1- to 1-1/4-in. blades for resawing. The stacked-bearing blade guides provide plenty of front-to-back support for these wide blades.

CONS

This model has only 10-in. resaw capacity (but see "Jet Upgrade," below). The motor is powerful, but doesn't feel as strong as the 1-3/4-hp motors on some other 120-volt saws. The rigidity of the upper wheel and guide post is less than average for big saws. Setting the front-to-back position of the lower guides is very awkward. The table is not as rigid as those on most big saws.

JET UPGRADE

As we went to press, Jet announced two major improvements to the JWBS-18. New models this fall have a 12-in. resaw capacity and a 1-3/4-hp motor. The new JWBS-18 is priced at \$1,250.



GRIZZLY G0506

- Price: \$1,200
- Power: 240 volts, 2 hp
- Maximum resaw capacity: 9-3/4 in.
- Wheel diameter: 18 in.

PROS

This is one solid, monster saw. The blade on every other saw in our test travels at a stately pace of around 3,000 ft. per minute (fpm), but this saw's blade zips by at about 4,500 fpm, driven by a 2-hp motor. This results in a lightning-fast cut, even in thick wood. The saw has an exceptionally sturdy upper wheel and guide post, develops more tension than you'll ever really need and has extremely heavy wheels. Basically, it's built to gobble up as much big stock as you can feed it.

CONS

With all that oomph, its resaw capacity is limited to just under 10-in. (For a similar saw with a 12-in. resaw capacity, see "Two Others Worth Considering," page 76.) Tipping the scale at 460 lbs., this saw definitely won't fit on the average mobile base. The bandsaw's wheels have a low crown. That's ideal for wide blades but makes it tricky to track narrow blades. This saw has disc guides, too. Again, they're fine for wide blades but hard to set up with narrow blades. If you often switch between large and small blades and don't have a lot of patience for setting guides, this behemoth is not for you.



GENERAL INTERNATIONAL 90-240 M1

- Price: \$1,100
- Power: 120 volts, 2 hp
- Maximum resaw capacity: 11-5/8 in.
- Wheel diameter: 17 in.

PROS

This is one of the most powerful 120-volt saws we've tested. The next closest are two 14-in. saws we reported in the last issue, the Delta 28-475X (\$900) and the Powermatic PWBS-14CS (\$900). You must add a riser block to either of these saws to get 12-in. resaw capacity, however. The General International 90-240 M1 has this built in, plus a larger throat capacity. You also get a blade observation window, a quick-release tension lever, an excellent rack-and-pinion table-tilting mechanism and a lower-mounted tension wheel. This saw is very similar to two other saws we really liked in the last issue: the Grizzly G0513 (\$750) and the Bridgewood BW-17WBS (\$900), which required 240 volts. If your shop has only 120-volt outlets and you primarily use 3/8-in. and larger blades, this saw is a fine choice.

CONS

The saw is rated at 2 hp, but it feels more like a 1-3/4-hp machine. It's not as powerful as the similar 240-volt, 2-hp Grizzly and Bridgewood models. The upper wheel is not as rigid as the best of the big saws. The side guides are ball bearings, which are harder to set up with narrow blades than the more versatile blocks on our favorite 120-volt machine, the Delta 28-475X. In addition, the guides only support 3/8-in. worth of blade, front-to-back—the shallowest in this group of saws.



LAGUNA GROUP

	LAGUNA 14SE	LAGUNA 16
■ Price:	\$1,200 (\$1,295 as shown)	\$1,400
■ Power:	240 volts, 2 hp	240 volts, 3 hp
■ Maximum resaw capacity:	12 in.	12 in.
■ Wheel diameter:	14 in.	16 in.

PROS

Both these compact powerhouses are built on the same well-engineered foundation: tight tolerances, super strength and real reliability. Neither machine is a giant, but both run so solidly that you feel you could cut veneer off any wide board. Both saws have recently been upgraded to Baldor brand motors, which have a well-deserved reputation for long, trouble-free lives. The heavy upper wheel is housed in an extremely robust slide mechanism.

The 14SE is basically the same as a Laguna 14 (\$950), but it has a full 12-in. resaw capacity and a larger motor to cut bigger boards. As shown, it's mounted on an accessory riser stand (\$95) that raises the table to a comfortable 44 in. for detail work. The Laguna 16 has more massive wheels, a motor with as much horsepower as you could ever want on a saw this size and a much lower table.

Both saws are a breeze to move around and store in a small shop when you add a mobility package (\$135). This contains a set of two wheels on one axle that go on the saw itself and a separate jack handle with another set of wheels.

CONS

Be careful which resawing blade you choose for a 14-in. saw. One-inch or wider blades may break prematurely because they're too thick. For resawing, we recommend a 5/8- or 3/4-in. blade that's 0.025 in. thick.

No two ways about it, the ceramic guides on all Laguna saws brings out strong opinions. No one disputes that they offer more support to a blade than any other saw in this class and they're virtually maintenance-free. The question is whether it's worth it. Just mention "ease of adjustment" and "sparks," and watch some verbal sparks fly.

Adjusting these guides is not for the faint of heart. It takes concentration, a number of tools and an orderly mind. A good mechanic would have no trouble but, the counter-argument goes, why should it be so complex? As for the small sparks, they're common to all ceramic-style thrust bearings. They won't make your shop explode, but some people find them disconcerting when concentrating on a cut. On the other hand, when you're not pressing hard on the blade, the guides rarely spark. Even when they do, the sparks are not nearly as numerous as those you'd get sharpening a chisel on a grinder.

Just the fact that these saws have only two "cons" tells you a lot about their good qualities. When you come to terms with the guides, these are terrific machines.



RIKON 10-340

- Price: \$1,000
- Power: 240 volts, 2 hp
- Maximum resaw capacity: 12 in.
- Wheel diameter: 18 in.

PROS

This is a huge machine for the price. It has as much resaw capacity, power and wheel size as other machines in this test costing hundreds more. You also get a very large table with miter slots on either side of the blade, micro-adjust screws for squaring the table to the blade's front, a quick-release tension lever, a blade observation window and a good dust-collection chamber. Plenty of tension is available to pull harder on a blade to improve its performance. This saw has a second, slower speed (1,500 fpm) for maximizing torque and cutting plastics and nonferrous metals.

CONS

The guide bearings tend to creep minutely out of position when you give them a final tightening. The upper wheel and guide post aren't as rigid as we'd like.

CORRECTION



Rikon 10-320

Last issue, in our test of bandsaws for less than \$1,000, we mistakenly ran the photo of the 18-in. Rikon bandsaw (above) in describing the 14-in. model (10-320, \$500). Here's what the 14-in. Rikon bandsaw really looks like.



PATRICK HUNTER

WOODTEK 118-199

- Price: \$1,000
- Power: 240 volts, 2 hp
- Maximum resaw capacity: 10 in.
- Wheel diameter: 18 in.

PROS

It's a massive saw. You get big wheels, a big motor, almost-big resaw capacity and a table strong enough to support a massive framing timber. This is the only saw in this class with a foot brake that also automatically shuts off the motor. The fence is rock-solid and easy to adjust side to side. The spring under the upper wheel is mighty powerful, providing more tension than any blade will ever need.

CONS

With all its good, large qualities, this saw is full of small annoyances. Dust collection doesn't work very well. The lower blade guides are a full 6 in. below the table's top, leaving a lot of extra blade unsupported. The table swims around when you loosen it, making it hard to set an exact tilt, and we're still looking for the right weird-shaped 23-mm wrench to tighten down the table when you heel it to 45 degrees. The tension gauge is a complete mystery, with readings that change with blades of slightly different length. The blade guides are mounted on a round shaft without an indexing slot, so they're free to rotate out of position when you adjust them. The guide post doesn't have a spring to counterbalance its weight. The wheel that raises and lowers the guide post would be easier to use if it had a crank handle.

TWO OTHERS WORTH CONSIDERING

There are plenty of good saws to choose from beyond those under our somewhat arbitrary price cap of \$1,500. Generally, you get larger wheels (20 in. is common), more power (3 to 5 hp) and much faster blade speed. Two saws just beyond our price range are worth noting.

The General International

90-270 M1 (\$1,600) is a real powerhouse. It's very similar to another



saw we like in this test for its strength, rigidity and high blade speed (4,000 to 5,000 fpm): the Grizzly G0506 (\$1,200). The General International version has a full 12 in. of resaw capacity

and a 3-hp motor, compared with the Grizzly's 10 in. capacity and 2-hp motor. The 90-270 M1 is available from General International, (514) 326-1161, www.general.ca.

The Bridgwood PBS-440

(\$2,100) is an awesome produc-



tion saw. It has 18-in. wheels, a 3-hp American-made motor, foot brake and an extra-rigid frame. It's actually the starter saw in Wilke Machinery's Professional

bandsaw series. You can reach Wilke at (717) 764-5000, www.wilkemach.com.

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TYPE OF TOOL	BUYING BASICS	TOOL TEST	SPEC CHART
Bandsaw	Buying Basics	Tool Test	Spec Chart
Cordless Drill	Buying Basics	Tool Test	Spec Chart
Dado Blades	Buying Basics	Tool Test	Spec Chart
Dovetail Jig	Buying Basics	Tool Test	Spec Chart
Drill Press		Tool Test	
Drum Sander	Buying Basics		Spec Chart
Dust Collector	Buying Basics		Spec Chart
HVLP Sprayers	Buying Basics		Spec Chart
Jointer	Buying Basics		Spec Chart
Lathe	Buying Basics		Spec Chart
Mini-Lathes	Buying Basics	Tool Test	Spec Chart
Miter Gauges		Tool Test	
Miter Saw		Tool Test	
Moisture Meters	Buying Basics		Spec Chart
Mortiser	Buying Basics		Spec Chart
Planer	Buying Basics		Spec Chart
Plate Joiner	Buying Basics		Spec Chart
Portable Sander	Buying Basics		Spec Chart
Router	Buying Basics		Spec Chart
Router Tables		Tool Test	Spec Chart
Scrollsaw	Buying Basics		Spec Chart
Sharpening Machines		Tool Test	
Shop Vacuums		Tool Test	
Spindle Sanders		Tool Test	
Tablesaw	Buying Basics		Spec Chart

American Woodworker NOVEMBER 2004 77

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RECOMMENDATIONS

This test looks at bandsaws priced between \$1,000 and \$1,500; we reviewed bandsaws priced under \$1,000 in our October issue. We'll be the first to admit that \$1,000 is a somewhat arbitrary line to draw. The features of saws over this line aren't dramatically different than those below it. Obviously, if your budget extends to \$1,000, you should look at bandsaws in both tests on either side of the line.

We typically give selected machines in a tool test "Best Buy" and "Editors' Choice" awards. This test is different. Premium bandsaw owners have so many different needs that we're making use-based recommendations.

In the last issue's test, we divided the field into four price ranges and picked our favorite saws, in both 120 and 240 volts. In this test, we'll pick saws for four different kinds of woodworkers: our favorite 120-volt saw (the rest require 240 volts), the least-expensive saw with the largest capacity, the out-and-out beefiest saw for heavy work and, finally, the best all-around big saw.

■ **Our favorite 120-volt saw: General International 90-240 M1 (\$1,100).** You get lots of power and capacity, a reasonable amount of rigidity and a bunch of good features. The million-dollar question, though, is whether it's a better pick than our 120-volt favorites in the last test, the Delta 28-475X (\$900 plus \$100 for a riser block) and the Powermatic PWBS-14CS (\$900 plus \$70 for a riser block). We prefer the Delta because it uses block-style guides, the easiest type to set on very small blades. (Both this General International and the Powermatic use bearings, which are a bit trickier to set up with 1/4-in. blades and impossible with smaller ones.) If your interest is to fully explore all the things a good bandsaw can do, from using tiny to large blades, we still prefer the Delta over the General International. If, however, you see yourself doing lots of resawing and little work with small blades, we recommend the General International 90-240 M1.

■ **The least expensive saw (in this price range) with the largest capacity: Rikon 10-340 (\$1,000).** If you want a

Model	Specifications								Guides				
	Price	Voltage	Horse-power	Maximum resaw capacity	Wheel diameter	Blade capacity	Weight (lbs.) ¹	Blade length ¹	Type of side guides	Side guides depth of blade support	Side and thrust independently adjustable	Upper guide ease of adjustment	Lower guide ease of adjustment
Craftsman 22450	\$1,300	120	1	10-3/4"	18"	3/16"-1"	280	133"	Steel rods, blocks	1/2"	N	••	••
Delta 28-682	\$1,250	240	2	12"	18"	1/4"-1-1/4"	400	136"	Stacked bearings	5/8"	Y	•••	•
General Int'l 90-240 M1	\$1,100	120	2	11-5/8"	17"	1/8"-1"	320	132"	Large bearings	3/8"	N	••	•••
Grizzly G0506	\$1,200	240	2	9-3/4"	18"	3/8"-1"	460	148"	Discs	1-3/8"	N	••	••
Jet JWBS-18 ⁴	\$1,200	120	1-1/2	10"	18"	1/8"-1-1/2"	320	133"	Stacked bearings	1-1/8"	Y	••	•
Laguna 14SE	\$1,200	240	2	12"	14"	1/16"-1" ⁵	240	112"	Ceramic blocks	7/8"	N	••	•
Laguna 16	\$1,400	240	3	12"	16"	1/16"-1" ⁵	350	132"	Ceramic blocks	7/8"	N	••	•
MiniMax S16	\$1,500	240	2-1/2	12-1/4"	16"	1/16"-1" ⁵	330	130"	Discs	1-1/8"	N	•••	••
Rikon 10-340	\$1,000	240	2	12"	18"	1/4"-1-1/2"	350	142"	Stacked bearings	3/4"	N	••	••
Woodtek 118-199	\$1,000	240	2	10"	18"	3/8"-1-1/4"	300	144"	Discs	3/8"	N	•••	•••

••• = Excellent •• = Above average • = Average • = Below average

¹ Approximate ² Low = 34-37 in., Medium = 37-40 in., High = +40 in. ³ Low = < 3-in. radius, Medium = 3- to 4-in. radius, High = > 4-in. radius ⁴ Fall 2004 JWBS-18 models will have 1-3/4 hp and a 12-in. resaw capacity. ⁵ Phenolic guides required for 1/16" to 1/4" blades. ⁶ Option, \$100 ⁷ Option, \$75 each

good value in a saw that can handle almost any size board, this is an excellent candidate. However, in our last test, we selected two less-expensive saws that deliver as much power and have the same resaw capacity: the Grizzly G0513 (\$750) and the Bridgewood BW-17WBS (\$900). Among these three saws, the Bridgewood is our favorite. None of these three saws use block-style guides, however. So be aware of the trade-off for a huge capacity and ability to run 1-in. or larger blades: Small blades are fussy to set up.

■ **The beefiest saw for heavy work: Grizzly G0506 (\$1,200).** With little exaggeration, we'd say you could rip railroad ties on this thing all day long. This saw would ideally supplement a smaller, more versatile bandsaw in an extremely well-equipped shop.

■ **The best all-around big saw: Laguna 16 (\$1,400) and MiniMax S16 (\$1,500).** Here, we're looking for a muscular, compact tool, a bandsaw that's good for heavy resawing, as well as fine detail work. With a saw like one

of these, you can learn new techniques, such as sawing veneer or cutting dovetails. Based on their strengths, either of these saws is a fine choice. They're extremely well-built, run very smoothly and should give many years of trouble-free service.

It all comes down to one choice, though, and these saws' minor weaknesses might tip the balance for you. The Laguna's guides are a chore to set up. However, if you want to run narrow blades, Laguna sells an auxiliary set of phenolic guides (\$80) that eliminate the risk of ruining your blade with an improper setup. The MiniMax, on the other hand, uses disc guides that are very easy to adjust, but it has relatively flat wheels. Thus, the MiniMax is ideal for wide blades, but a bit awkward to set up for small blades. Phenolic guides for narrow blades are a \$75 option.

In the end, the best way to choose between the two saws might be to wait for a really good deal to come along and jump on it—they're both a joy to use! **AW**

Tension			Rigidity		Features								Contact
Quick-release tension lever	Lower-mounted tension wheel	Maximum tension	Upper wheel	Guide post	Guide-post crank	Blade observation window	Direct dust collection chamber	Foot brake	Table height ²	Amount of crown on wheels ³	Dust port		
N	N	...	•	...	Y	N	N	N	Low	Low	1 @ 4"	(800) 377-7414 www.sears.com/craftsman	
Y	N	..	...	..	Y	N	N	N	High	Low	2 @ 4"	(800) 438-2486 www.deltawoodworking.com	
Y	Y	...	•	..	Y	Y	Y	N	Medium	High	2 @ 4"	(514) 326-1161 www.general.ca	
N	Y		...		Y	N	Y	Y	Low	Low	1 @ 4"	(800) 523-4777 www.grizzly.com	
N	Y	...	•	•	Y	N	N	N	Medium	Medium	1 @ 4"	(800) 274-6848 www.jettools.com	
N	N	..			N	N	Y	N	High	Medium	1 @ 3"	(800) 234-1976 www.lagunatools.com	
N	N	..			N	N	Y	N ⁶	Low	Medium	2 @ 4"	(866) 975-9663 www.minimax-usa.com	
N	N	...	...	..	N ⁷	N	Y	N ⁷	Low	Low	2 @ 4"	(877) 884-5167 www.rikontools.com	
Y	Y	...	•	•	Y	Y	Y	N	Medium	Low	2 @ 4"	(800) 645-9292 www.woodworker.com	
N	Y		...	•	Y	N	N	Y	Low	High	1 @ 4"		

table hockey

by Randy Johnson

It's fast,
it's wild—
go for the goal!

PHOTOGRAPHY: BAUMON MORENO • ILLUSTRATION: FRANK ROHRBACH

ART DIRECTION: EVANGELINE EKBERG •

Looking for a great holiday gift project? This table hockey game is a blast to play, even for adults, and it's so simple, you can make it even if your gift-building time is running short. It's made from easy-to-get materials, and the finish is all water-based, so it goes on quickly.

It's basically a shallow box, made from 3/4-in. hardwood (we used oak) with a playing surface of 1/2-in. birch plywood. Add some small pieces of mesh fabric (available from a fabric store) for the goals, a couple of strategically placed goalie blocks, a pair of sticks and a puck, and you're ready to play. Have fun!

PROJECT REQUIREMENTS AT A GLANCE

Power tools:

Tablesaw
Dado blade
Jigsaw
Drill
Sander

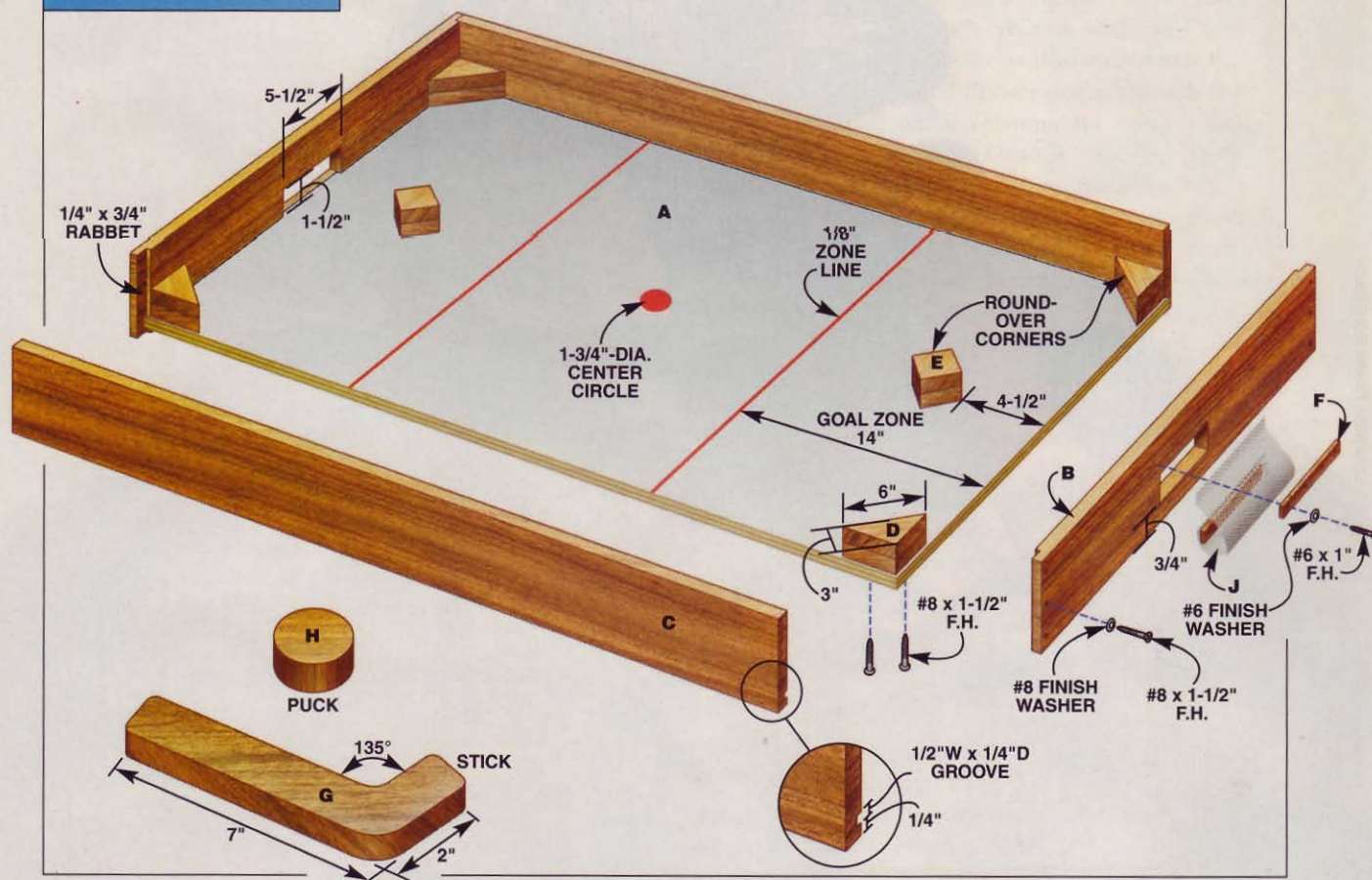
Materials:

1/2-in. birch plywood
3/4-in oak lumber
Stain
Paint
Varnish

Total cost: About \$75

Netting
Screws
Finish washers

FIGURE A EXPLODED VIEW



CUTTING LIST OVERALL DIMENSIONS: 4-1/4" T x 32" W x 48" L

Part	Name	Qty.	Dimensions (T x W x L)	Material	Notes
A	Bottom	1	1/2" x 31" x 47"	Birch plywood	
B	Ends	2	3/4" x 4-1/4" x 32"	Oak	
C	Sides	2	3/4" x 4-1/4" x 47"	Oak	
D	Corner blocks	4	1-1/2" x 3" x 6"	Oak	Cut from two pieces of 3/4" x 3-1/2" x 24" lumber glued together.
E	Goalie blocks	2	1-1/2" x 2" x 2"	Oak	Cut from two pieces of 3/4" x 2-1/2" x 18" lumber glued together.
F	Net boards	4	1/4" x 3/4" x 7-1/2"	Oak	
G	Sticks	2	1/2" x 2" x 7"	Oak or birch plywood	
H	Pucks	2	1/2" T x 1-3/4" dia.	Oak or birch plywood	
J	Nets	2	7-1/2"H x 7-1/2"W	Mesh fabric	

How To BUILD IT

1. Mill the end and side boards (B, C) to final size and cut the grooves for the bottom panel (A, Fig. A, page 88).

2. Cut the rabbets in the end boards (Photo 1). Use an auxiliary wood fence so you can run your dado blade right next to it. This setup also allows the auxiliary fence to serve as a guide when you cut the rabbets.

3. Cut out the opening for the goals using a jigsaw or scrollsaw (Photo 2).

4. Glue and clamp together two layers of 3/4-in. lumber for the corner blocks (D). Wipe off any glue that squeezes out. When the glue is dry, rip the board to 3 in. wide for the corner blocks. Make the goalie blocks (E) the same way.

5. Cut the corner blocks and goalie blocks to final size (Photo 3) using your miter saw or tablesaw. You'll notice that the glued-up lumber stock is much longer than actually needed. This extra length gives you more to hold for safer mitering and crosscutting. Cut the net boards (F).

6. Use your bandsaw or scrollsaw to saw the sticks (G) and pucks (H) from either oak lumber or birch plywood. Make a couple extra pucks, so you won't have to take a time-out if a puck flies off the table and rolls under the couch.

7. Sand and finish all the parts. We used water-based stain, paint and finish (see Sources, page 90). Water-based finishes tend to raise the grain after they are applied, which makes a rough finish. To prevent this, raise the grain first with a moist sponge. After the wood dries, do your final sanding. Then apply the stain to all the parts. When the blue stain on the bottom panel is dry, tape off and paint the zone



1 Cut rabbets in the end boards, so the corners are strong enough to take abuse. Use an auxiliary fence to protect the main fence from damage. A 1/2-in. groove at the bottom edge houses the plywood playing surface.



2 Saw goal openings with a jigsaw. Holes near each corner make starting the cuts and turning the corners easy. Smooth the inside of the goal opening with a file or sanding block.



3 Cut the corner blocks from glued-up 3/4-in. boards. These blocks keep the puck from getting trapped in the corners and allow interesting bank shots.



4 Finish all the parts before you assemble them. After the blue stain on the bottom panel is dry, tape off and paint the zone lines and the center circle.



5 Assemble the parts with flat head screws and finish washers. Finish washers provide extra bearing surface for the screw heads and don't require countersinking.



6 Attach the goal netting with the net boards and screws. Leave the net open on the sides to make it easy to retrieve the puck. You're ready to play!

lines and center circle (Photo 4). Finally, brush on the clear topcoat finish.

8. Assemble the hockey table with screws and finish washers (Photo 5). Drill shank and pilot holes in the sides to prevent splitting the wood or stripping the screw heads.

9. Attach the netting (J) over the goal openings with the net boards

(F). The bottom net board goes inside the net and the top net board goes outside the net (Photo 6). Hold the netting in place with a bit of double-sided tape during assembly. You can substitute almost any kind of fabric for the netting, if you wish.

10. Attach corner and goalie blocks (D, E) with screws from the bottom.

It's game time! Go for the goal! **AW**

TABLE HOCKEY RULES

You can play table hockey two ways. The first is free play. Players start with the puck on the center circle and both hit it around until a goal is scored. The only limit is that a player may not play the puck within the goal zone of the other player (see Fig. A). If the puck flies off the table during play, return it to the center circle and resume playing.

The second way to play is to take turns. Each player takes a predetermined number of shots. Two swings per player is common, but the exact number is up to you. You can handicap a better player by giving him or her fewer swings than a less experienced player. The entire rink area is open for play. If a puck is knocked off the table, it's turned over to the other player, who then gets to take one additional shot during his or her turn. Of course, it's also fun to make up your own rules!

SOURCES

Minwax
(800) 523-9299, www.minwax.com
Available at home centers.
Winter Sky water-based stain, \$7 per quart
Rose Wood water-based stain, \$7 per quart
Polycrylic water-based clear satin finish, \$8 per quart.

Rust-Oleum
(800) 553-8444
www.rustoleum.com
Apple red latex paint, \$4 per half pint.

edited by David Olson

HIDEAWAY TOOL STAND



My bench grinder is out of the way but instantly accessible, thanks to this sturdy flip-up table. It works great and it's simple to make. You'll only need a scrap of 3/4-in. plywood that's 1/2-in. narrower than the overhang, four 3-in. butt hinges, a strap hinge and a length of 1x4.

BUILD IT

1. Mount three butt hinges to the underside of the plywood table, with the barrels centered on the edge.
2. Fasten the table to the benchtop.
3. Install the remaining butt hinge on the far side of the foot. Make sure it's aligned with the outer hinge on the table.
4. Make the hinged brace from two 1x4s of equal length. The brace's overall length is the distance between the barrels of the two centered hinges with the table fully open.
5. Attach one 1x4 to the foot hinge and the other to the top hinge. Rejoin the two halves by attaching the strap hinge.
6. Fasten the 10-in.-long brace lock to the upper 1x4.
7. Install pivoting support blocks to hold the table in the folded-under position.
8. Open the table and install the bench-top tool of your choice.

Kenneth T. May





WIRE HOOK

CONTINUOUS HINGE

DROP-DOWN BIT STORAGE

In my crowded shop, there's no such thing as unusable space. My router bits store under a shop cabinet, out of the way until I need them, thanks to a scrap of wood, a leftover length of continuous hinge and a shop-made wire hook.

I had planned to glue a block on the underside of the shelf near the hinge to act as a support, but my parts bins did the job instead. **AW**

Yaniv Matza



PATRICK HUNTER (2)

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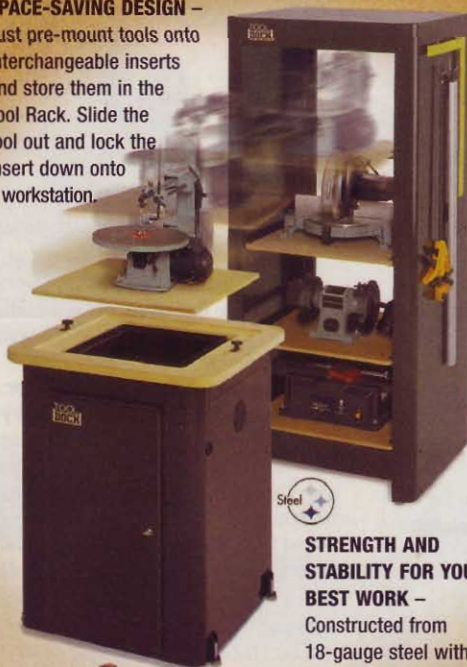
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edited by Tim Johnson

GETTING AN EARFUL

I had to install the crown molding on a customer's built-in cabinet, so I packed my glue, nail gun, nails and hearing protectors in my toolbox and headed for the job site. I arrived and immediately focused on the cutting and fitting I had to do. Without looking, I opened my toolbox and grabbed my hearing protectors. But when I put them on, I got an ear full of wet, sticky glue. Yuck! The cap had fallen off the glue bottle during the trip, and my hearing protectors provided a reservoir for its contents.

Gregg Carlsen



SWELL(ING) TREE HOUSE

My husband built a fabulous multilevel tree house for our kids. It had walls, windows and even a winding stairway to the upper levels. Everything fit beautifully—at first.

Having built almost all the furniture in our house, my husband knows how to allow for seasonal

movement. Unfortunately, when he built the tree house, he didn't consider all of the movement that occurs in a living tree. In only three years, the tree's growth and the swaying of its limbs conspired to blow apart his magnificent creation.

Joy Johnson