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NOVEMBER 2003
ISSUE #137

Popular Woodworking

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- 1½ HP, single-phase, 110/220V motor
- Precision ground cast iron table
- Table size (w/ wings attached): 27⅛" x 40⅝"
- Cutting capacity at 90°: 3⅛" and at 45°: 2⅛"
- ⅝" x 1¼" Arbor accepts dado blades
- Maximum ripping capacity: 24"

- Approximate shipping weight: 220 lbs.

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10" LEFT-TILTING SUPER HEAVY-DUTY TABLE SAW

- 3 HP, Single-phase, 220V motor
- Precision ground cast iron table
- Table size (w/ wings attached): 40⅛" x 27"
- Extra-large handwheels
- Cutting capacity: 8" L & 26" R of blade
- Maximum depth of cut @ 90°: 3"
- Maximum depth of cut @ 45°: 2⅛"
- ⅝" Diameter arbor accepts dado blades up to 13/16"
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- Approximate shipping weight: 495 lbs.

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- Motor: 1 HP, TEFC, 110V / 220V single-phase
- Precision ground cast iron table: 14" x 14"
- 2 speeds: 1500 & 3200 FPM

New!

- Cutting capacity/throat: 13½"
- Maximum cutting height: 6"
- Quick change blade release/tensioning
- Table tilt: 45° right, 10° left
- Fence: Deluxe extruded aluminum
- Wheels: Fully balanced cast aluminum with rubber tires
- Blade size: 92½" - 93½" (¼" to ¾" wide)
- Ball bearing blade guides
- 4" dust port
- Includes one ⅜" blade
- Approximate shipping weight: 210 lbs.

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17" HEAVY-DUTY BANDSAW

- Motor: TEFC capacitor start induction, 2 HP, single-phase, 60 Hz, 110V/220V

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- Precision ground cast iron table: 17" x 17" x 1½" thick
- Cutting capacity height: 12"
- Cutting capacity left of blade: 16¼"
- Wheels are fully-balanced cast aluminum with rubber tires
- Deluxe extruded aluminum rip fence
- Blade guides: Euro-style roller disc
- Blade size: 132" x ⅛" - 1" (standard ½")
- 2 speeds: 1600, 3300 FPM
- 4" dust port x 2
- Table tilt 10° left, 45° right
- Quick change blade release/tensioning with blade tensioner indicator
- Height from floor to table: 37½"
- Approximate shipping weight: 321 lbs.

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19" HEAVY-DUTY BANDSAW

- Motor: 2 HP, single-phase, 60 Hz, 110V/220V TEFC capacitor start induction,

New!

- Precision ground cast iron table: 19" x 19" x 1½" thick
- Cutting capacity left of blade: 18¼"
- Cutting capacity height: 12"
- 2 speeds: 1700, 3600 FPM
- Blade size: 143" x ⅛" - 1¼"
- Quick change blade release/tensioning
- Wheels are fully-balanced cast aluminum with polyurethane tires
- Deluxe extruded aluminum rip fence
- Blade guides: Roller disc
- Blade tension indicator
- Micro adjusting gear table
- 4" dust port x 2
- Table tilt 10° left, 45° right
- Approximate shipping weight: 383 lbs.

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- 2 HP, SINGLE-PHASE, 110V MOTOR, 15 AMPS
- MAX. CUTTING WIDTH: 12½"
- MAX. CUTTING DEPTH: 1/16"
- 2 HSS KNIVES
- FEED RATE: 25 FPM
- ON/OFF TOGGLE SWITCH
- MAX. CUTTING HEIGHT: 6"
- MIN. BOARD THICKNESS: 3/16"
- CUTTERHEAD RPM: 8,540
- 57 CUTS PER INCH
- APPROX. SHIPPING WEIGHT: 85 LBS.

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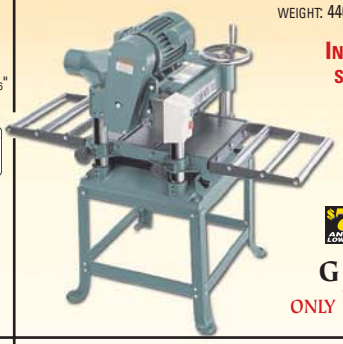
15" PLANER

- 2 HP, 220V, SINGLE-PHASE MOTOR
- PRECISION GROUND CAST IRON BED
- CUTTERHEAD SPEED: 5000 RPM
- RATE OF FEED: 16 FPM & 20 FPM
- MAX. CUTTING WIDTH: 14⅛"
- MAX. CUTTING HEIGHT: 6⅛"
- MAX. CUTTING DEPTH: ⅛"
- NUMBER OF KNIVES: 3 HSS
- ALL BALL BEARING CONSTRUCTION
- APPROX. SHIPPING WEIGHT: 440 LBS.

INCLUDES STAND!



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20" PLANER

- 3 HP, 220V, SINGLE-PHASE MOTOR
- 25¾" X 20" PRECISION GROUND CAST IRON TABLE
- CUTTERHEAD SPEED: 4833 RPM
- RATE OF FEED: 16 FPM & 20 FPM
- MAX. CUTTING WIDTH: 20"
- MAX. CUTTING HEIGHT: 8⅝"
- MAX. CUTTING DEPTH: ⅛"

4 BLADE CUTTERHEAD!

- NUMBER OF KNIVES: 4 HSS
- DUST EXHAUST HOOD HAS 5" DUST PORT
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15" WIDE-BELT SANDER (OPEN END)

- SANDING BELT MOTOR: 5 HP
- BELT FEED MOTOR: ¼ HP
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- MOTOR: HEAVY-DUTY 1½ HP, 110/220V
- 2 INTERCHANGEABLE SPINDLES: ½" AND ¾"
- TWO SPINDLE SPEEDS: 7,000 AND 10,000 RPM
- TABLE SIZE: 20¼" X 18"
- SPINDLE TRAVEL: 3"
- SPINDLE OPENINGS: 1¼", 3½", AND 5"
- FLOOR-TO-TABLE HEIGHT: 33½"
- MAXIMUM CUTTER DIAMETER: 5"
- APPROX. SHIPPING WEIGHT: 220 LBS.

(SHOWN WITH OPTIONAL WING)

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G1035
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3HP SHAPER

- HEAVY-DUTY 3 HP, SINGLE-PHASE, 220V MOTOR W/REVERSING SWITCH
- 3 INTERCHANGEABLE SPINDLES: ½", ¾" AND 1"
- TWO SPINDLE SPEEDS: 7,000 AND 10,000 RPM
- 3" SPINDLE TRAVEL
- SPINDLE OPENINGS: 1⅜", 2¾", 4", AND 5½"
- PRECISION GROUND CAST IRON TABLE
- TABLE SIZE WITH STANDARD WING ATTACHED: 30½" X 28¼"
- FLOOR-TO-TABLE HEIGHT: 34"
- APPROX. SHIPPING WEIGHT: 353 LBS.

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G1026
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6" X 47" JOINTER WITH HANDWHEELS

- 1 HP, 110/220V, SINGLE-PHASE MOTOR
- 6" X 47" PRECISION GROUND CAST IRON TABLE
- RABBETING CAPACITY: ½"
- MAX. DEPTH OF CUT: ½"
- 3-KNIFE BALL BEARING CUTTERHEAD
- SUPER HEAVY-DUTY, CENTER MOUNTED FENCE IS 4" X 29¼"
- INFEED & OUTFEED TABLES HAVE HANDWHEELS FOR CONVENIENT TABLE HEIGHT ADJUSTMENT
- POWDER COATED PAINT
- STEEL STAND HAS BUILT-IN CHIP CHUTE
- APPROX. SHIPPING WEIGHT: 215 LBS.

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8" X 65" SUPER HEAVY-DUTY JOINTER WITH HANDWHEELS

- 1½ HP, 220V, SINGLE-PHASE MOTOR
- SUPER HEAVY-DUTY PRECISION GROUND CAST IRON BED
- 3-KNIFE CUTTERHEAD IS 3" IN DIA. AND RUNS IN SHIELDED, PRE-LUBRICATED BALL BEARINGS
- MAX. DEPTH OF CUT: ½"
- INFEED TABLE HAS RABBETING LEDGE
- HEAVY-DUTY CENTER-MOUNTED FENCE
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8" X 75" JOINTER WITH 4 BLADE CUTTERHEAD

New!

- 2 HP, 110V/220V, SINGLE-PHASE MOTOR
- 8" X 75" PRECISION GROUND CAST IRON TABLE
- MAXIMUM DEPTH OF CUT: ½"
- 3" DIAMETER CUTTERHEAD RUNS IN SHIELDED, PRE-LUBRICATED BALL BEARINGS
- 4-HSS CUTTERHEAD KNIVES ARE 8" X ⅛" X 1"
- CUTTERHEAD RPM: 5,500
- CUTS PER MINUTE: 22,000
- MAGNETIC SWITCH WITH THERMAL OVERLOAD PROTECTOR
- APPROXIMATE SHIPPING WEIGHT: 461 LBS.

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G0500
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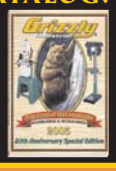

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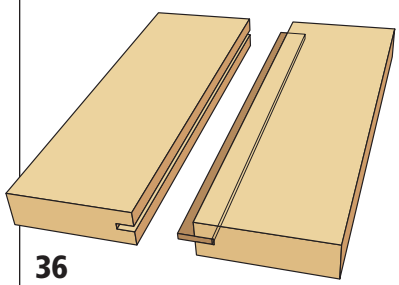

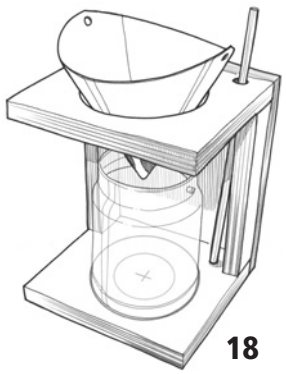

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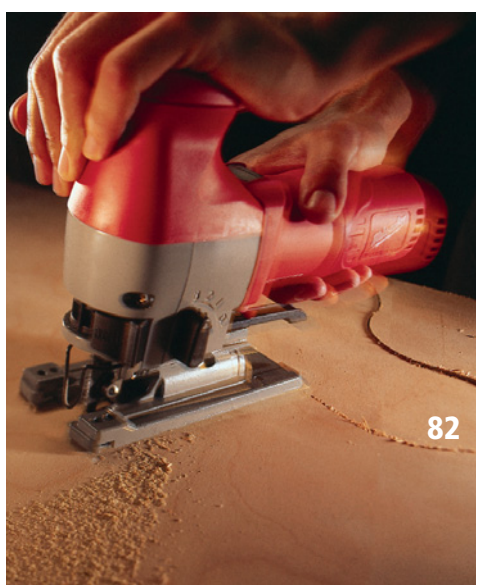
ON THE COVER

The curves and cutouts of the Limbert #238 occasional table suggest it's a project best left to the masters. But don't believe it. A dose of cleverness and a nail gun can take you a long way with this fun project.

Cover photo by Al Parrish

DEPARTMENTS

PROJECTS, TOOLS AND TECHNIQUES



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SAFETY NOTE:
Safety is your responsibility. Manufacturers place safety devices on their equipment for a reason. In many photos you see in *Popular Woodworking*, these have been removed to provide clarity. In some cases we'll use an awkward body position so you can better see what's being demonstrated. Don't copy us. Think about each procedure you're going to perform beforehand. Safety First!

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Congratulations! You're an Artist

In case you don't follow the New York museum world, the American Craft Museum recently changed its name to the Museum of Arts and Design (MAD). And that's how I felt (MAD) when I read about it.

I always thought art was art and craft was craft and there was a real distinction. I was perfectly willing to accept my work as craft, even defend it, leaving art to reach for, if not always attain, a higher plane.

But the people who now run MAD have concluded that art has evolved and the distinction between art and craft has blurred. They may be right, and I'll leave the academic and semantic debate to those who know more about the subject than me.

But I think there may be other things at work in the name change. I wonder if in today's world "craft" has come to mean something a little too shabby, a little too "crafty" for the people operating the museum. Do they believe a museum dedicated to art and design (even though the museum collections and exhibits won't change) will sell more tickets? Unfortunately, they probably will. Not that it's all their fault, but as an institution supporting craft, they failed to defend "craft" as something worthwhile.

Some in our woodworking community have contributed to the demise of the term craft, feeling the need to label their work as "art" or "studio" furniture. At the very least, the new label has probably helped some command a higher price for their work.

Interestingly, Sam Maloof, an American icon of finely crafted furniture, has openly rejected the title "artist" or "art furniture" to describe his work. When referred to as an "artist," Maloof respectfully expresses his preference for the moniker "woodworker," a modest title he wears with pride. (Maloof was a long-time associate of the museum and expressed dismay at the name change.)

Reading about the name change made me sad and mad because it's another nail in the coffin of the respectability of craft.

Instead of getting angry, perhaps we woodworkers also should "evolve" and adopt the title of artist. Some real good could come of it. Strangers who learn that we are artists might wander up to us at parties or backyard barbecues and ask our thoughts on important, esoteric subjects. Members of the opposite sex might look at us in a whole new way. It could be great. But what I haven't figured out yet is how wearing black clothes all the time will ever work in a dusty shop. **PW**

Steve Shanesy

Steve Shanesy
Editor & Publisher

Come Visit our Booth at the WoodWorks 2003 Shows this Fall and Winter

We're packing our tools and heading to the WoodWorks shows. The first event starts Oct. 10 in Indianapolis. Come by our booth, check out some great deals on woodworking books and then sign up to win a great prize!

What makes WoodWorks events special (in addition to the great deals on tools) are the free demonstrations by the country's top woodworkers (such as Frank Klausz, left). Also, many exhibitors actively demonstrate the newest products right in their booth. You can't help but learn a lot and have a good time. Be sure and bring a buddy. Visit woodworks2003.com for a complete rundown on the shows, dates and free demonstrations. See you there!

CONTRIBUTORS

PAUL ANTHONY

A woodworker for almost 30 years, Paul Anthony got his start making router-carved wall mirrors and planter boxes on a show circuit in San Diego. The Pennsylvanian is now working on a "hybrid traditional bench" for his 700-square-foot shop because he not only works there, but he teaches classes as well. He is putting an end vise with the wooden jaw extending completely across one end of the "heavy mother" of a bench, and converting a face vise for the other end. For his students, though, he has another project lined up. "One of the first things that I always have my students make is a crosscut sled, because the stock miter gauge that comes with most table saws just doesn't do it." Check out Anthony's advice about what every table-saw owner must do to keep the machine in tip-top shape in "Table Saw Tune-up" on page 57.

LONNIE BIRD

Lonnie Bird, who specializes in period furniture, has been woodworking for about 30 years. His first piece of furniture (a junior high school shop project) was a little stool built out of solid white pine with splayed legs. Today, he's building a reproduction 1810 turned-post bunk bed (yes, bunk beds existed back then) for his daughters. He's also building each of them a chest of drawers. When asked how large his shop is, he says "To be quite honest, I just don't know." *[Editor's note: It's huge.]* When building projects, his favorite tool to work with is his Lie-Nielsen No. 4½ bench plane with a York pitch (50°). "The Essential Shoulder Plane" begins on page 70.

A Stacked Dado Set With No Shims Needed?

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Haven't We Seen That Trick Before?

Sure It's a Nice Trick, But Didn't Someone Else Write About it Once?

Your winning Trick of the Trade "Make Your Table Saw Double as an Edge Jointer" (August 2003), submitted by Cory Torppa, was actually first published in the January/February 1992 issue of *ShopNotes* magazine. Assuming this is merely a coincidence, I don't think he should profit by winning a piece of expensive equipment. If I, as a casual reader of woodworking magazines, could spot this duplication, then shouldn't your editorial staff be able to pick it out as well?

Keith Ferguson
Vancouver, British Columbia

Editor's note: You obviously have a sharp eye and memory. If you've been reading woodworking magazines that long, you've probably seen how few new "tricks" there are in the world. There is some duplication and repetition, but I doubt there is outright plagiarization.

Mr. Torppa's trick is one I've seen suggested before. And as it is akin to offsetting the outfeed fence on your shaper or router table, it would be no surprise if several people came up with the same idea for their table saw independently. It was the best trick among the entries submitted for that issue and we have no reason to think Mr. Torppa lifted the idea from another magazine, so his winning entry stands as-is.

— Christopher Schwarz, executive editor

Yet Another Dumb Mistake – Make Sure You Know Top from Bottom

I have a 17th item to add to your article, "The 16 Dumbest Woodworking Mistakes" (August 2003).

A co-worker of mine (an engineer) was telling me about his weekend project recently. He had new carpeting installed in his living room, but the front door dragged on the carpet and, if left that way, it would eventually wear on the carpet.

The carpet installer said he knew someone who could modify the door at a reasonable cost, but the engineer said he could do it himself. So he measured the depth of the carpet to see how much he would need to trim off the door, took the door down, measured the amount and drew a line.

He remembered that if you took a sharp instrument and scored the line, the veneer wouldn't splinter. He made his cut – no splintering this time. Good!

He re-hung the door and swung it open, but it still dragged on the carpet. He took the door down again and went through the same procedure again and removed another strip of wood.

He re-hung the door again and guess what? It still dragged the same amount.

He stepped back and asked himself, "What did I do wrong?" Then he noticed the gap at the top of the door. He's never lived this down.

Edward H. Daniel Jr.
Davenport, Iowa

Drilling Correct Size in a Scrap Piece Can Help Enlarge that Hole

I enjoyed your article "The 16 Dumbest Woodworking Mistakes," though I haven't ever made any of them. Here's another way to correct #9 ("You Drill a Large Hole that is Too Small"): Drill a piece of scrap with the

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WRITE TO US

Popular Woodworking welcomes letters from readers with comments about the magazine or woodworking in general. We try to respond to all correspondence. Published letters may be edited for length or style. All letters become the property of *Popular Woodworking*. How to send your letter:

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LETTERS

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larger size bit. Eyeball the new hole exactly concentric to the smaller hole and clamp it to your workpiece. Then use the scrap as a "drill bushing" to drill your new bigger hole. This method avoids messing around with fitting a plug and marking the center.

Paul M. Burri
Goleta, California

Editor's note: This tip lets you fix the mistake rather quickly. We've even done it this way before. But if you need your hole to be precisely located, we still prefer our method of cutting the square plug (which you can easily mark the center of) and pounding it into the hole.

My Jointer is Missing the Safety Guard; Is it Possible to Get a Replacement?

Someone recently gave me an Atlas 6" jointer built by Atlas Press Co. in Kalamazoo, Mich. I'm not sure when it was made, but it is old. The model number is 6001 and the serial number is O13640. To get it running required only a new switch.

But it is missing the safety guard. Can I find an original safety guard or would one from another brand work? Also, are the knives standard or will I have trouble finding them?

Levon Doggett
Tifton, Georgia

Editor's note: With the large number of older machines (and bargains) available, it's nearly impossible to have information on all the brands. When a question such as yours comes up we rely on a large pool of your fellow woodworkers who frequent a web site and discussion group called Old Woodworking Machines. We've had great success finding information on obscure machines and parts, and we're sure they'll be able to help you online at oldwwmachines.com. **PW**

CLARIFICATION

Popular Woodworking corrects all significant errors. For a list of corrections to the magazine, or to report one, please visit our web site at popwood.com and click on "Magazine Extras."

• In the "Lusting for Lumber" article (August 2003) we mentioned a special paint that reduces checking in wood as it air-dries. This sealer is item #125305, available from Woodcraft, 800-225-1153 or woodcraft.com.

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Left-tilt Table Saws: Are They Just Hype?

Is There Any Reason to Buy a Left-tilt Table Saw Instead of a Right-tilt One?

I'm finally taking the plunge and getting a table saw and have noticed many of the higher-end saws offer a left-tilt version.

What are the major advantages/disadvantages of a blade that tilts left instead of right? I assume there is a big safety advantage because the blade will tilt away from the fence, right?

Jay Oppenheim
Columbia, South Carolina

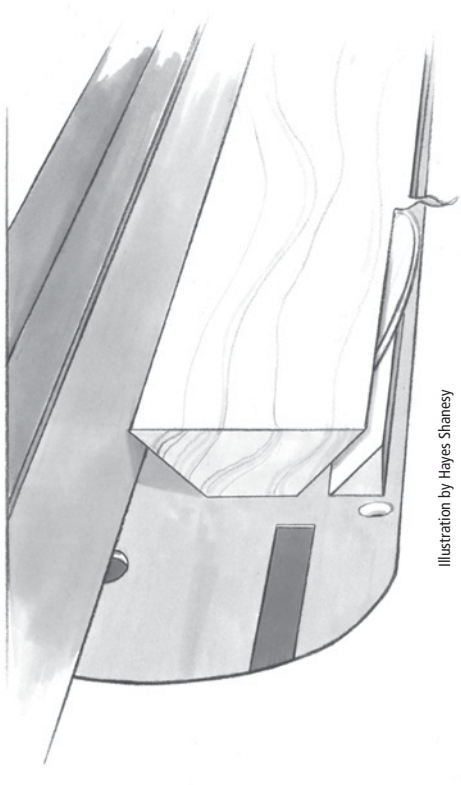

Illustration by Hayes Shanesy

Tilting the blade away from the fence is one advantage, but it actually presents itself as a safer way to work because of where your waste piece falls when making a cut with the blade at an angle. When using the rip fence (and working on the left of the fence) to make a bevel cut, a left-tilt saw will allow the waste to fall below the blade, while a right-tilt saw will leave the waste resting on top of the blade, where it could get thrown back at you.

Another advantage of left-tilt saws comes when ripping bevels on two edges of your material. With a left-tilt saw, the rip will be more accurate because the point of your bevel won't slip under your rip fence.

That said, when you use your miter gauge on the left side with the blade beveled, the situations are reversed, with the right-tilt saw being safer.

In all honesty, with the newest rip fences (the Biesemeyer-style, as well as the Unifence) available on almost every table saw, you can work from either side of the rip fence, though the rip capacity with your fence on the left side is usually limited to about 12".

What it all really comes down to for me is that I'm right-handed, which means that it's easier for me to change the arbor nut on a left-tilt saw than on a right-tilt.

— David Thiel, senior editor

WRITE TO US

Every day we get questions from readers on all subjects about their woodworking. Some are letters; many are e-mail messages. We are more than happy to share our woodworking experience with you by answering your questions or adding some clarity to whatever aspect of the craft you are unsure about. In addition to the hundreds we answer privately every month, we want to share the best questions here with readers.

Send your questions via e-mail to popwood@fwpubs.com, or by mail to:
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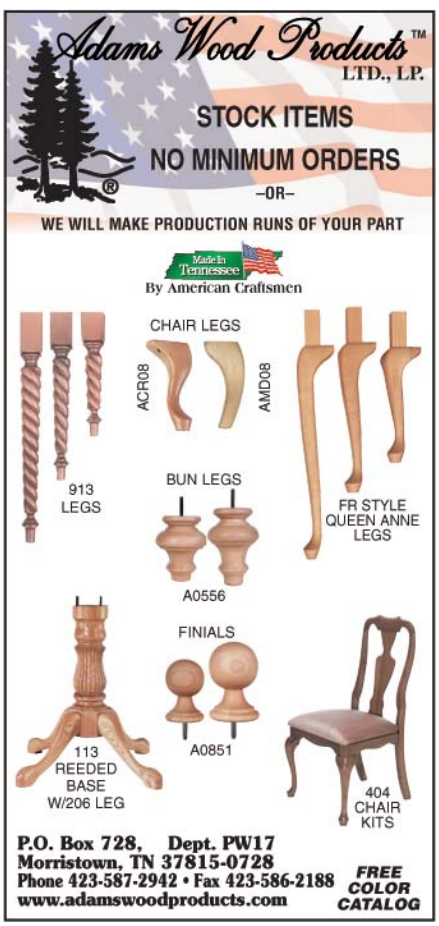

Q & A

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Questions About QuickCAD

I really enjoyed your article about AutoCad's QuickCAD (June 2003) and I have purchased the software. I'm very computer literate and also did some detailed drafting a couple of years ago, but I have no CAD experience. I intend to learn to use QuickCAD and create detailed plans of projects that will be somewhat complex, such as an executive desk and credenza. I intend to market the plans, so they must be very professional and a cut above the average in clarity and ease of comprehension.

My questions are:

1. Is QuickCAD everything I need for plans of this type?

2. Is QuickCAD easier to learn than AutoCAD's higher-end software?

3. Does QuickCAD print to large-format printers as well as the small-format ones that you applauded in your article?

Ed Hobbs
Houston, Texas

QuickCAD is no more or less difficult to master in the realm of two-dimensional drawings than AutoCAD. You'll have to remember, however, that QuickCAD is only a 2-D program. You can create isometric drawings that appear three-dimensional, but they're still just static 2-D illustrations. The isometric drawings I did for the article were done independently of the 2-D straight plan drawings. I've been bombarded with e-mail messages asking where the magic button is that will snap everything into a 3-D drawing. Unfortunately, there isn't one. To get that option, you need to move up to something such as TurboCAD.

QuickCAD will print to any plotting device. The in-depth instruction manual should be able to give you guidance there.

I can't really answer your question about QuickCAD being "good enough" for what you want to do because the phrase "good enough" is so subjective. I use AutoCAD 2000 for all of my magazine illustrations. The ability to run 2-D and 3-D simultaneously is a delight. It does, however, come with a price. The cost of the current edition of AutoCAD is $3,595. Yikes! I use it only because I'm an architect (illustrating is my second job and passion) and AutoCAD is the universal language of architecture.

I'll summarize by saying that the QuickCAD program will always be my software-of-choice in its price range.

— John Hutchinson, project illustrator

Why are Some Planes So Expensive?

I'd like the straight poop on handplanes. I remember getting instruction on the use of them during woodshop class in junior high school back in the early 1970s. I can guarantee you the school system did not shell out big bucks for those planes. When I go to Lowe's, I see Stanley planes for anywhere from $20 to $50. In woodworking magazines I see all these fancy planes selling for anywhere from $60 to hundreds of dollars. What's the deal with these expensive planes? I think having a block plane for my projects would be a good idea, but I sure can't see spending hundreds on one.

Why are the expensive ones so much better than a low-cost Stanley plane? I can't imagine it being worth the extra money for occasional use on small projects. What is your opinion?

Lane Wallace
Knoxville, Tennessee

A sharp well-tuned block plane is an asset in any shop. But if you're not building a lot of furniture, your best bet is to find an older block plane at a flea market. Inexpensive new planes are poorly made and require more tuning than vintage ones. Look for an old Stanley, such as a 60½, with no chips, cracks or major rust. These are pretty common and inexpensive ($5 to $15). You can read about every plane Stanley made at Patrick Leach's excellent web site, www.supertool.com.

For woodworkers who expect to use their planes a lot, a vintage plane is still a good option, though you have to learn to restore it before you can use it – which is an obsession unto itself. I've brought a lot of old planes back to life in my time, but some years ago I decided I liked woodworking more than fixing old tools. I switched to the more expensive new tools and have never regretted it.

Tools made by Lie-Nielsen, Veritas, Clifton and others are better-made, better-machined and work extremely well. After a couple of years, you'll forget what you paid for it and just be glad you own it. **PW**

— Christopher Schwarz, executive editor

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Compiled by Paul Anthony

Filter Finishes Without Fumbling

THE WINNER:

I filter quite a lot of finishes to prepare them for spraying, as well as to clean the shellac I make from flakes. I found it awkward holding paper filter funnels over spray cups and containers, trying to direct the flow while peering into the cup to avoid overfilling it and making a mess.

While loading my coffee maker one morning, the solution hit me. I grabbed some ¾"-thick plywood and cobbled together this finish filter holder. The top and bottom are 7" square and the back is 9" high. (You may want to modify the sizes to suit your particular needs.) I centered and then cut a 4½"-diameter hole in the top and chamfered the top edges to accommodate a funnel filter. To easily position my containers, I marked concentric rings on the bottom piece to match the diameters of my spray cups and commonly used jars. I also drilled a couple of small holes through the top to hold the dowels I use for stirring finishes.

Keith Mealy
Cincinnati, Ohio

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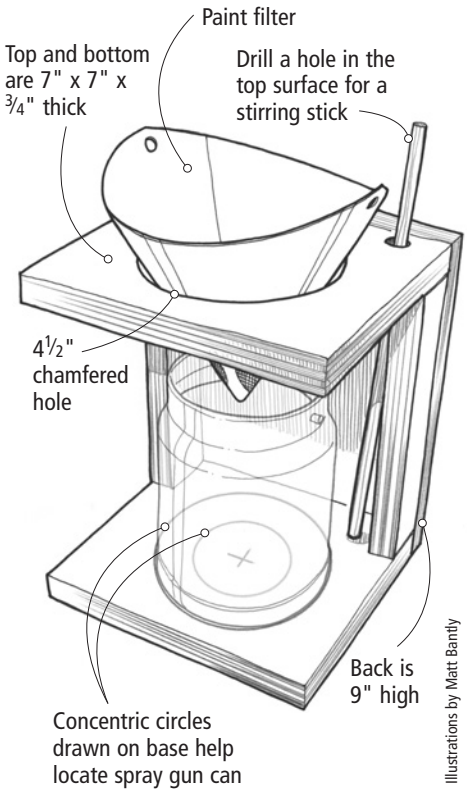

Illustrations by Matt Bantly

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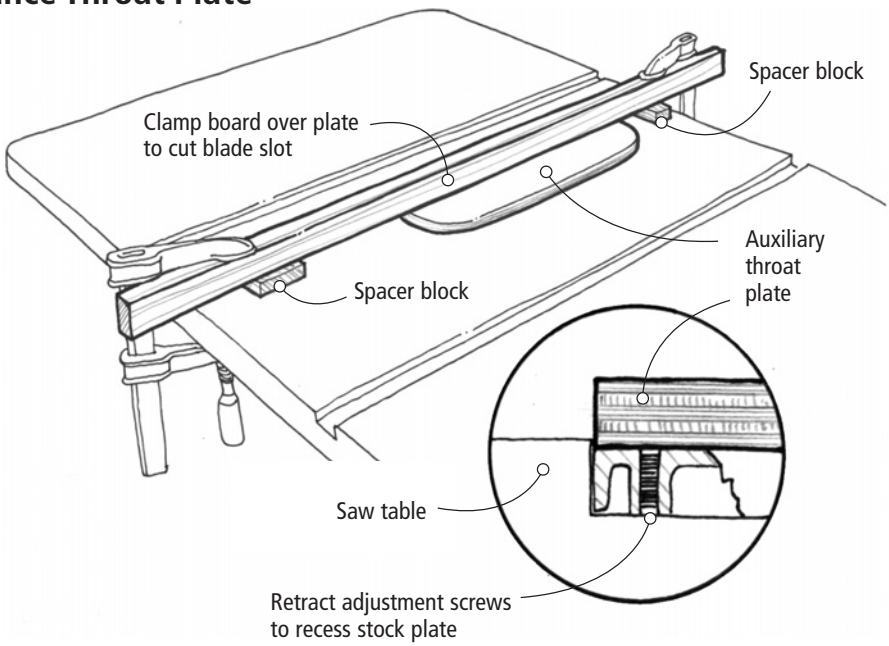
Tricks to Making a Zero-clearance Throat Plate



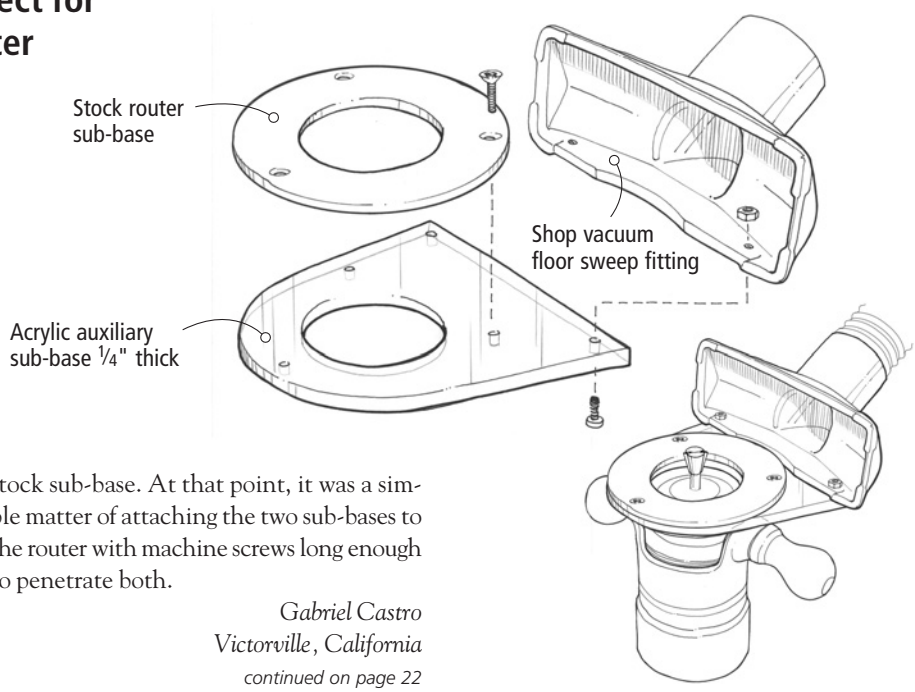
The metal throat plate that comes stock on most table saws has a wide blade opening to allow the blade to tilt. Unfortunately, this allows narrow workpieces to fall through the opening and doesn't provide any back-up support for the workpiece, leading to unnecessary exit tear-out.

It's easy to make your own auxiliary zero-clearance throat plate from any straight-grained hardwood. Begin by ripping a length of wood to a width that exactly matches the width of your throat plate opening. Then plane it to a thickness that matches the depth of the opening. (If you overcut, you can simply shim the underside of the plate with masking tape later.) Using your stock throat plate as a pattern, trace the rounded ends onto your auxiliary throat plate blank; then cut just a small amount outside the line with a band saw or jigsaw. Power-sand the edges to a snug final fit in the opening.

The tricky part is cutting the initial blade slot. Because a fully lowered blade typically reaches almost to the level of the tabletop, you can't just seat the new throat plate and raise the blade through it. One approach is to cut a preliminary slot using a smaller-diameter blade, then finish the cut with a full-sized blade. But there's a better way. I fully retract the height-adjustment screws in my stock throat plate, then place it in its opening. With the screws retracted, the stock plate sits about 1/16" below the saw table, which is enough of a recess to hold the wooden plate in place. I clamp the plate down with a long piece of thick stock, then raise the blade partially through the plate. I finish the cut after placing the wooden plate fully in its recess, again with it clamped down.

Paul Anthony
Popular Woodworking contributor

Shop Vacuum Accessory is Perfect for Collecting Dust from Your Router



I was looking for a way to outfit my router with dust collection for edge routing and cutting dovetails. It occurred to me that the floor-sweep fitting on my shop vacuum would make a nice dust pickup for those jobs, and I could attach the fitting to an auxiliary sub-base for my router. I decided to install the auxiliary base under my stock router sub-base so I could still easily attach a template guide to the latter for routing dovetails.

To connect the fitting, I first made a U-shaped auxiliary router sub-base from a piece of 1/4"-thick scrap acrylic, tracing its rounded half and its screw pattern from my router's stock sub-base and cutting a generous sized opening for collet nut access. I then bolted this auxiliary sub-base to the edge of the shop vacuum fitting, cutting a small arc in the fitting to accommodate the router's stock sub-base. At that point, it was a simple matter of attaching the two sub-bases to the router with machine screws long enough to penetrate both.

Gabriel Castro
Victorville, California

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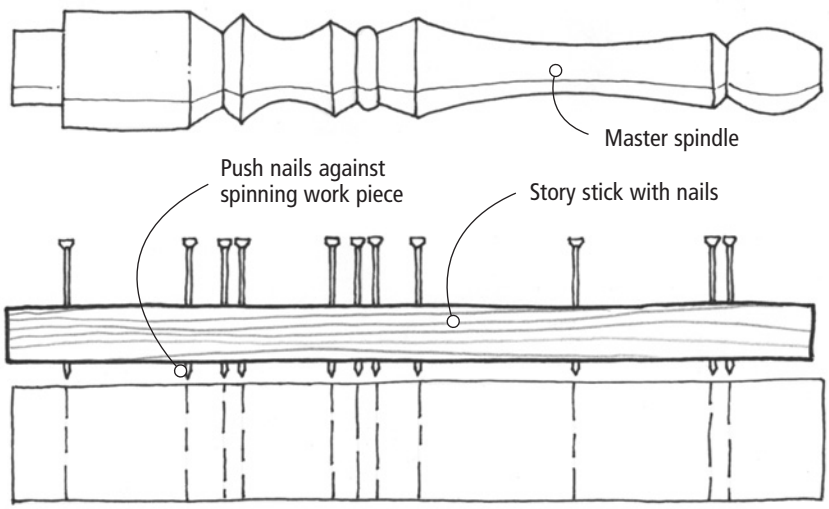
A Story Stick for Turning

I recently had a commission to turn a fair number of identical spindles. To do the job more efficiently, I made a story stick with all the key measurements laid out along its length. At each feature or change in diameter, I drove a nail through the stick so the point stuck out the other side. After rounding the spindle blanks, I marked them by steadying the story stick against the tool rest while gently pushing the nail tips against the spinning workpiece.

Ken Burton
New Tripoli, Pennsylvania



Shedding Light on the Subject

Proper lighting can make all the difference when it comes to clean, careful results with some woodworking operations. For example, when hand-planing or sanding workpieces, a strong, glancing sidelight placed almost parallel to the work surface will dramatically highlight any machine marks, tear-out, glue spots or other defects. When hand-cutting dovetails, a light playing sideways across your scored layout lines will create clear shadow lines to guide your cut.

Of course, the light will be most effective in an otherwise dimmed shop. To appropriately direct the light, I use a clamp-on light fixture judiciously located on a portable post.

Ric Hanisch
Quakertown, Pennsylvania

Hand-drilling with Forstner Bits

Forstner bits and multi-spur bits typically have to be used in a drill press because these large-diameter bits will wander all over the place if you try to guide them with a portable drill. However, I've found that there are times when I need to drill a large diameter hole in the middle of a workpiece panel or some other location that can't be reached using a drill press.

In those cases, I first use the drill press and my chosen bit to bore a guide hole in a ¾"-thick scrap panel. I then secure that panel to my workpiece with clamps, screws or double-sided tape, locating the guide hole over my drilling location. After switching the bit over to a portable drill, I can now bore the workpiece hole much more safely and accurately.

Susan Slutske
Tucson, Arizona

Quick-connect Dust Collection Fittings

Because I'm constantly hooking up my portable dust collector to different machines, I need a quick, easy way to remove and attach the flexible hose to the 4"-diameter dust port on each machine.

To do this, I first used tin snips to cut a piece of 4"-diameter metal duct 8" long, keeping the crimped end. I secured the crimped end to my dust collector's flexible hose using a hose clamp. Now, to make the connection to any machine, I simply slip the metal duct onto the tool's dust collection port.

Paul Anthony
Popular Woodworking contributor

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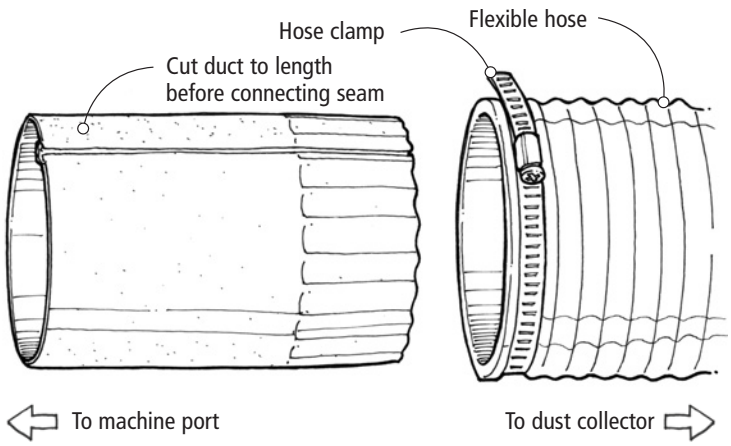

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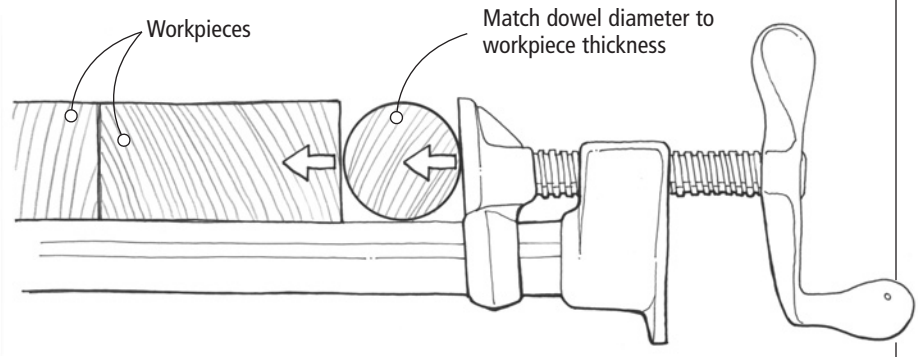
Dowels Focus Your Clamping Pressure

Pipe clamps are great for panel-and-frame clamp-ups because they're strong and relatively inexpensive. The problem is that unless the clamp screw is aligned with the center line of the workpiece edge, the clamp head can cock the outer workpieces out of line, causing the assembly to buckle under pressure. This buckling can be minimized by alternating clamps over and under the assembly, but that isn't always practical, especially when gluing up face frames and similar constructions.

A good solution is to place dowels between the clamp heads and the edge of the assembly. Using a dowel whose diameter matches the thickness of the workpiece centers the clamping pressure on the edge of the workpiece, keeping everything better aligned. It's easiest to lay long dowels across the clamps rather than trying to balance one short piece per clamp.

Odie Bloss
Medford, Oregon



Tape Makes the Tightest Plane Mouth

Setting your plane for fine smoothing cuts sometimes requires a really tight throat (the opening between the body of the plane and the cutting edge of the iron). With most bench planes you adjust this by moving the frog of the tool forward. But how do you get really close (within a few thousandths of an inch) without choking the throat with shavings? Trial and error can be tiresome

I picked up this tip on the Internet last year and it works great. First wrap a piece of masking tape around the cutting edge of the iron. Then install the iron in the plane and adjust the frog until the masking tape just kisses the body of the plane. Screw the frog down tight at that location. Remove the iron, take off the tape and reinstall the iron. Set the plane to take the finest cut possible. I think you'll be amazed.

Christopher Schwarz
Popular Woodworking executive editor

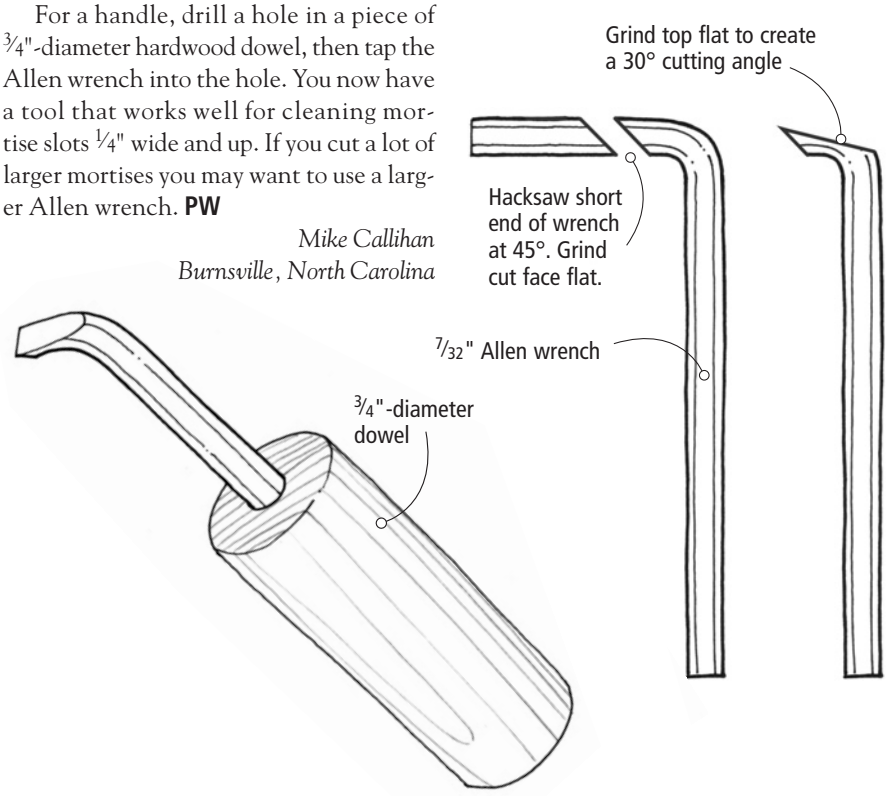
A Mortise Cleaning Tool

When making mortises I found it difficult to remove wood shards left at the bottom of the mortise by my hollow-chisel mortising bit. Prying them out with a bench chisel often damaged the shoulder of the mortise and was not particularly kind to the cutting edge of the chisel. I needed a tool with a right-angle cutting edge that would allow me to scrape the bottom of the mortise right up to the corners, then pull the shavings out. I figured out how to make one from a 7/32" Allen wrench. Here's how:

With a hacksaw, cut the short leg off at a 45° angle, leaving about 3/4" of length on that leg, then grind the face of the cut flat. Next, grind the top of the short leg flat to create a 30° cutting edge at the intersection with the first cut. The exact angle isn't critical. You just want it sharp enough to cut well, but sturdy enough to withstand the prying action. Go easy with the grinding, cooling the metal frequently in water. If you overheat it while grinding, it will lose its temper and dull quickly in use.

For a handle, drill a hole in a piece of 3/4"-diameter hardwood dowel, then tap the Allen wrench into the hole. You now have a tool that works well for cleaning mortise slots 1/4" wide and up. If you cut a lot of larger mortises you may want to use a larger Allen wrench. **PW**

Mike Callihan
Burnsville, North Carolina



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- Oversized welded steel stand
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- Silky-smooth handwheel table adjustment
- Powder coated paint
- Approx. shipping weight: 495 lbs.

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ENDURANCE TEST

Lie-Nielsen Low-angle Jack Plane

Quite possibly the perfect plane.

Photo by Al Parrish

I've used many different planes, but none is as versatile, easy-to-use and robust as the Lie-Nielsen low-angle jack plane.

This 14"-long plane is based on the collectible Stanley #62 plane, which has not been manufactured since the 1940s. Unless you're a collector, there is little reason to seek out the old Stanley version because it's more expensive and less durable than the Lie-Nielsen, which sells for $225.

Essentially the low-angle jack plane is what would happen if you wedded a block plane with a bench plane. You have the mass and length of a jack plane, but you also have the simpler mechanism, adjustable throat and bevel-up blade design of a block plane.

For beginners especially, the combination is hard to beat. Here's why:

The standard Bailey-style bench plane has more adjustments than the low-angle jack. While these adjustments allow for more finesse among advanced users, they also make the tools more difficult for beginners to use.

For example, if you're working with figured wood and want to close up the mouth of a bench plane to reduce tear-out, you have to adjust the plane's "frog" forward. (The frog is the chunk of machined metal that supports the tool's blade.) This operation involves a screwdriver and sometimes requires disassembling the tool. With the low-angle jack plane, there is no frog to adjust. All you do is unscrew the front knob a bit and adjust a lever to open or close the mouth.

Another advantage of the low-angle jack's design is that the cutting bevel of the blade faces up, unlike a bench plane where the bevel faces down and has a chipbreaker.

If you purchase a couple of replacement blades for this plane, you can grind different cutting angles on the blades to make your plane do some amazing tricks. The stock blade has a 25° bevel and sits in the plane at 12°. Add those two numbers together and you have a 37° cutting angle (also called the "pitch"). This pitch is great for end grain and decent for most long-grain planing.

Grind a 33° bevel on the blade and the plane will have a standard 45° pitch (33° plus 12° equals 45°). Grind a 38° bevel and you have a high-angle pitch of 50°, which is great for planing difficult woods. Grind off the bevel entirely at 90° and you have a scraper plane. There's no way you could do that with a Bailey-style bench plane without some major modifications.

So what can you use this plane for? In the modern power-tool workshop, this plane can handle a lot of chores. It's great for planing down doors and drawers to fit (the low pitch of the blade is great for the end grain of door stiles and drawer fronts). You can remove saw marks from the edges of boards.

You can even use it as a smoothing plane to remove the machining marks from the faces of your boards. Hand-tool purists might turn up their noses at this notion and say you need a shorter smoothing plane for this operation because it gets into the hollows of the board. But I've found that if you surface your lumber with a power jointer as well as a planer, it's flat enough for this plane to work rather well as a smoother.

No matter how you use this plane, you'll find that it exceeds your expectations. The machining is impeccable. The cherry knob and tote are perfectly formed and comfortable to use. And the exceptional way the blade has been heat-treated allows it to take and keep a superior edge. The body is made of unbreakable ductile iron (standard gray iron planes can shatter if you drop them) and the blade cap is bronze.

With almost every tool I own there is always something small I wish was improved or a bit different. But that's not so with the low-angle jack, which I've been using for more than three years. As the handles of this tool patinate with age and the blade gets progressively shorter, I find it more and more useful. And I occasionally wonder how I ever did without it. **PW**

— Christopher Schwarz

SPECIFICATIONS

Lie-Nielsen Low-angle Jack Plane

Street price: $225

Nice features: Easily adjustable mouth; exceptionally durable ductile-iron body; and the tool can be modified easily to do many different workshop operations.

Recommended modifications: Buy a couple of extra blades to see what this tool is capable of with different cutting angles.

Lie-Nielsen Toolworks: 800-327-2520 or lie-nielsen.com

ABOUT OUR ENDURANCE TESTS Every tool featured in our Endurance Test column has survived at least two years of heavy use in the *Popular Woodworking* shop.

CIRCLE NO. 134 ON FREE INFORMATION CARD.

CIRCLE NO. 133 ON FREE INFORMATION CARD.

Fisch Oscillating Belt/Disc Sander – No Burns, No Dust

Most woodworkers are familiar with the value of a belt/disc sander. They're also familiar with the problems of belt/disc sanders that are designed for metalworking and run at speeds that are too high, burning the wood they're shaping. Fisch Precision Tools has an answer that goes a step further.

The new BDS-612001 Multi Sander offers the traditional 6" x 48" belt sander and 12" disc sander. But the designers also slowed the motor down to woodworking speeds, making burning wood nearly impossible. They've also added a very nice innovation to the belt sander by including an oscillation mechanism to move the belt ¾" back and forth, further reducing the chance of burning and extending the life of the belt.

There's one other thing woodworkers expect from a belt/disc sander – a lot of dust. While many manufacturers have added dust collection ports, they don't really seem to do the job. Fisch has added two ports, positioned correctly to do the most good. While you do have to move the hose connection from port-to-port or use two separate hoses, working dust-free is worth the effort.

Of course, this is a quality sander in its own right, with a 1½-hp motor that doesn't bog down under tough sanding. The beefy cast-iron tilting tables are ample to support the work, with the belt table measuring 6" x 10" and the disc table is 7" x 16".

The belt sander transitions smoothly between either a horizontal or vertical stance. A wrench is required to make the transition, and while we would have liked to have seen this a toolless operation, the positive lock-down of the wrench will keep the arm from moving out of position.

The base is an enclosed cabinet with the motor mounted inside (but still easily accessible). At 189 pounds, you won't have to worry about pushing the machine around your shop while you are sanding.

The Fisch Multi Sander is priced to compete with other belt/disc sanders. But when you take into consideration the woodworking-friendly speed, oscillating mechanism on the belt sander and the efficient dust collection, we see the Fisch as an obvious choice.

— David Thiel

For more information, circle #175 on Free Information Card.

SPECIFICATIONS

Fisch BDS-612001 Multi Sander

Street price: $700
Surfaces: Belt - 6" x 48"; Disc - 12"
Motor: 1½ hp, 3,400 rpm
Oscillation travel: ¾"
Speeds: Belt - 1,570 square feet per minute; Disc - 2,000 rpm
Performance: ●●●●●
Price range: $$$
Fisch Precision Tools: 724-663-9072 or fisch-woodworking.com

Ashley Iles American-pattern Bevel-edge Chisels

When we tested 20 brands of bench chisels in 2001, the staff favorites – far and away – were the British-made Ashley Iles chisels. The steel took a keen edge and kept it through many abusive rounds of chopping out dovetail pins in white oak.

The only complaint among some testers was that the handle was a bit beefy and bulbous. After two years of daily use in my shop at home, I sometimes wish the tools were a bit shorter when doing fine work.

I got my wish. The new bench chisels from Ashley Iles are made using the same tough steel, but these are a bit shorter and have smaller-size bubinga handles. As a result, these chisels feel better in medium- and small-sized hands and are well-balanced for precision work, especially when removing waste between dovetail pins and tails.

Like their bigger brothers, these American-pattern chisels are well-manufactured. The face of the blade (sometimes called the back) required very little work to get it flat and mirror-polished. The chisels have obviously been carefully heat-treated because they were both hard (we measured 59 on the Rockwell "C" scale) and tough – they hold an edge like a Japanese chisel.

The handles are nicely turned and the bubinga is tough enough for the mild sort of mallet work that bench chisels are designed for. But perhaps most amazing is the price of these beauties. A set of six chisels (¼" wide to 1") is just $100.82. A complete set of 11 chisels (⅛" wide to a whopping 2") is only $211.55.

You could pay more money and not get chisels of this quality. We're impressed.

— Christopher Schwarz

For more information, circle #176 on Free Information Card.

SPECIFICATIONS

Ashley Iles American-pattern Bevel-edge Chisels

Street price: Set of six costs $100.82
Sizes available: ⅛" to 2"
Hardness: 59 Rc
Handles: Bubinga
Performance: ●●●●◐
Price range: $$
Tools for Working Wood: 800-426-4613 or toolsforworkingwood.com

Amana E-Z Dial Slot Cutter

If you use splines, you're going to love this tool.

Traditionally you would use your standard spline cutter to make the necessary slots, then you spend a lot of time fitting the spline thickness to a snug fit. With Amana Tool's new E-Z Dial slot cutter, it doesn't matter what thickness your spline is, you just adjust the slot to fit. And the adjustment is as simple as loosening a nut and dialing in the proper size.

The E-Z Dial is available in two models offering ¼" or ½" thickness. Each full revolution of the adjusting dial changes the thickness of the cut by 1/32", making precision set-ups easy.

The E-Z Dial isn't the least expensive piece of router tooling you'll buy for your shop, but the time and frustration you'll save is worth a lot more. — *DT*

For more information, circle #177 on Free Information Card.

SPECIFICATIONS

Amana E-Z Dial Slot Cutter
Street price: $150
Size: Model 55500: ⅛"-¼"
Model 55510: ¼"-½"
Adjustment: One full turn = 1/32"
Performance: ●●●●●
Price range: $$$$$
Amana Tool: 800-445-0077
or amanatool.com

Festool CT Mini Vacuum

While some woodworkers simply need a vacuum to pick up dust, for those who need all the bells and whistles, the Festool CT Mini is the one to choose.

The Mini features a tool-triggered or manual on/off switch with a time-delay feature to clear the hose when you turn off your sander or router. The vacuum power (rated at 99 cfm) can be regulated by a variable switch for finesse work. The 10-amp motor, in conjunction with the 1"-diameter, 10' hose, does an admirable (and quiet, 72dB) job of removing dust beyond what you would expect from its size (weighing only 21 lbs.).

The CT Mini sports a replaceable two-gallon bag filter (rated at 3 microns) as well as an integrated filter cleaner. So if you need the coolest vacuum on the block, we suggest you get the CT Mini. — *DT*

For more information, circle #178 on Free Information Card.

SPECIFICATIONS

Festool CT Mini
Street price: $250
CFM: 99, 80" of water lift
Motor: 10 amp
Performance: ●●●●❍
Price range: $$$$$
Festool: 888-337-8600
or festool-usa.com

FastCap's AccuScribe

Last February I told readers about the many wonders of the McGrath Scribe and Profile Gauge for installing built-in cabinets. Then the product disappeared after the death of its inventor.

Good thing there's the AccuScribe. This scribing tool does everything the McGrath did – plus it's virtually indestructible. The tool excels at fitting built-ins, backsplashes, mouldings and countertops. The manufacturer plans to soon offer the tool with a small rabbet on the end of the "feelers" to allow you to mark offsets on curved work. There are more expensive scribes out there, but most of us need only this tool. — *CS*

For more information, circle #179 on Free Information Card.

SPECIFICATIONS

AccuScribe
Street price: $16
Performance: ●●●●❍
Price range: $$$
Fastcap: 888-443-3748 or
www.fastcap.com

NEW FROM RIDGID

Ridgid stationary and benchtop machines have been available at The Home Depot for a few years now, but the company has just announced an entire line of new portable power tools designed to compete with the best-known power tools on the market.

The new product line includes two levels – professional and consumer – of cordless tools (drills, circular saws and reciprocating saws) in 12, 14.4 and 18 volts, with 20- or 30-minute recharge times. The corded line includes ⅜" and ½" drills, hammer drills, circular saws, sanders, reciprocating saws and jigsaws (see our review of the new Ridgid jigsaw in "Orbital Jigsaws" on page 82).

All the tools in the line are the result of two years of exhaustive research of marketplace trends and extensive design and testing. These tools are designed to compete both in performance and price. From our initial brief look at the tools, the time and effort spent have produced some rugged, well-designed tools.

Each tool will carry a 90-day satisfaction guarantee and a three-year warranty against defects. As an introductory offer, through December 2003 each new tool sold will carry a lifetime warranty against defects.

The entire line will be available in The Home Depot (along with its existing line of stationary tools, including miter saws, jointers, planers, table saws and more, all with planned upgrades within the year) and also at a number of national smaller retail outlets.

For more information on the complete line, visit Ridgid's web site at ridgid.com – *DT*

TOOL RATINGS

Performance is rated on a 1-5 scale. You won't see a low rating ("1" or "2") because we don't publicize inferior tools. A rating of "5" indicates the leader in the category. Five dollar signs indicates highest price in the category. Three indicates an average price. If you have tool questions, call me at 513-531-2690 ext. 1255, or e-mail me at david.thiel@fwpubs.com. Or visit our web site at popwood.com to sign up for our free, e-mail newsletter.

— David Thiel, senior editor

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Heading for the Hills

After years of teaching woodworking in Ohio, Lonnie Bird has moved to the Smokies to teach, write and build.

Photos by Al Parrish

For 13 years Lonnie Bird was the head instructor for southeastern Ohio's University of Rio Grande woodworking program. He taught, built furniture and wrote books (all for Taunton Press) including "The Shaper Book," "The Bandsaw Book" and "Taunton's Complete Guide to Shaping Wood." He was recognized several times as one of the best craftsmen in the country by *Early American Life Magazine*. He led a good life.

Lonnie Bird's woodshop (front) is at the base of the Great Smokey Mountains in Dandridge, Tenn., and is connected to his home via a screened-in breezeway.

But about two years ago he and his family decided to chuck it all and build their dream home at the base of the Great Smokey Mountains in Dandridge, Tenn., which would include a woodshop where Bird could start a woodworking school. A risky venture, yes. But today, Bird thrives.

Nestled on 12 acres of rolling farmland, the Birds' home and woodshop seem far away from the neon-infused roadside warehouses selling fireworks and billboards advertising outlet malls one sees while driving there. Directions to his house include lines such as "turn left after Grace Baptist Church" and "cross the creek at the bottom of the hill."

Bird and his wife, Linda, chose Dandridge, which is about 20 miles east of Knoxville, for a couple of reasons. One, they love the mountains. Two, Knoxville is within a day's drive for 70 percent of the U.S. population. The home and woodshop are remote, yet accessible – an ideal location for a school.

Historical Context

Bird, a furniture maker for almost 30 years, remembers clearly his first visit to Colonial Williamsburg. He was 8 years old. The trip sparked an interest in period furniture and from that point on, he started building things. He took a junior high shop class, which he says he enjoyed tremendously. His parents weren't woodworkers, but they supported his interest, allowing him to transform their basement into what he calls a "dusty, dirty shop." In high school, Bird made money by repairing antique furniture that was, literally, in pieces. Neighbors would buy old chairs and tables for little money, knowing he would be able to fix them.

Although his gig at University of Rio Grande has ended, Bird's prominence has only grown. He continues to write. His latest, "Taunton's Complete Illustrated Guide to Period Furniture Details," hits bookstores this fall. A book about tool techniques is scheduled to be released next year. He continues to build furniture for clients and his classes book months in advance. Bird calls his shop a flexible shop. Always a woodshop, it also serves as a school and photo studio.

by Kara Gebhart

Comments or questions? Contact Kara at 513-531-2690 ext. 1348 or kara.gebhart@fwpubs.com.

Bird stores his collection of hand tools in a traditional 18th-century wall cabinet (that he built), complete with tombstone doors.

Home and Shop Together

The woodshop is connected to the Colonial-style home via a screened-in breezeway. In the office Bird shares with Linda is a stunning 18th-century reproduction slant-front desk, which Bird built. Next to this is an 18th-century reproduction Pennsylvania armchair, which Bird also built. They're timeless pieces so beautiful you wonder why access to them is not limited by a velvet rope.

The furniture contrasts greatly to the gray Office Depot-esque computer desk that holds two computer monitors and a split, ergonomic keyboard – perhaps the only mass-produced piece in the Bird family's home. Currently Bird is building an 1810 reproduction turned-post bunk bed. This replica of a museum-quality piece is where his daughters, Rebecca, 11, and Sarah, 7, will sleep.

The outside of Bird's three-story woodshop is similar to his Colonial-style home. Inside, the first story is a shrine to modern machinery and power while the second story is a hand-tool woodworker's dream. (The third story is used for storage.) Bird's skillful use of powerful machines and quality hand tools, along with his careful eye for line and proportion, allow him to create fine pieces of reproduction period furniture.

Bird purposefully designed his woodshop with three floors, keeping the machine room in a walk-out basement (the first floor). This way the bench room, which is on the second floor, stays quiet and clean – ideal when trying to carry on a conversation or teach a class. The third floor is used for storing jigs and fixtures. There's also a bathroom up there, which keeps Bird and his students out of the house. Thousands of board feet of lumber stay dry in a large barn at the edge of the property, which is also where Linda keeps her horses.

The Bench Room

You can climb a few stairs and enter the woodshop's bench room via the shop's front door. Or you can enter via the breezeway, which is part of the house's wrap-around porch. There's also a door at the back of the shop. There are seven windows in all, including a window in each door, three windows that line the southwest wall and a large bay window at the front of the shop. On a sunny day, the room fills with natural light.

Eight workbenches, each with its own vise and anti-fatigue mat, face Bird's bench, which is silhouetted by the bay window. Bird allows up to nine students in each class, often giving up his own bench for a student to use. Hand-screw clamps, calipers and spokeshaves frame the bay window, and chisels and carving tools kept in a block of wood line the window's seat. Examples of his work hang on the wall (as you can see below left).

Bird's tool cabinet is a traditional 18th-century wall cabinet with tombstone doors. Inside is his collection of hand tools: bench planes, shoulder planes, a set of hollows and rounds, and dovetail saws.

There is a chop saw, mortiser and drill press in the bench room – three exceptions to the "no machines allowed." Because the machine room is downstairs, these three machines in the bench room help limit up-and-down trips. At the back of the room is a complete sharpening station. Next to it is a small refrigerator, which Bird keeps stocked with bottled water. Overhead fans, along with air conditioning, keep the room cool in the summer. A heater keeps the room warm in the winter.

Bird's bench room features lots of windows, nine sturdy workbenches, a sharpening station and a few machines.

Most of Bird's machines come in sets of two (which means less waiting around for his students) and he keeps them in angled rows for easy access.

The Machine Room

The machine room is downstairs. A garage door and a set of French doors provide easy access for lumber and new machines – Bird says he's constantly upgrading his machinery. The machines are arranged almost two-by-two in angled rows. There are two 10" table saws, a Delta Unisaw and a Powermatic 66. There are two Laguna band saws, one 18" and the other 24". There are two jointers, a Delta 12" and a World War II-era Yates American 16". There are two shapers, a Delta and a Jet. And there are two router tables, a Bench Dog and one he built himself. In each router table is a Porter-Cable router.

He has a Jet planer and a Performax drum sander. A Delta central dust-collection unit, along with Delta ambient cleaners hung on the ceiling, keep Bird's shop almost dust-free. Outside the machine room are several large plastic trash cans – perfect for throwing away unusable offcuts. He is a stickler for cleanliness, and it shows. Like the bench room, the machine room is temperature-controlled allowing Bird to work year round.

Chairs, Baseball and Family

An intimate setting for a woodworking school, the woodshop is quite spacious for Bird's personal projects. Although he says he enjoys building period casework, it's basically dovetailing and constructing boxes within boxes. Building chairs (like the ones below) is Bird's true passion.

When discussing chairs, or any piece of period furniture, Bird talks a lot about line and proportion. He talks about sensuous curves that flow the way they should, making two individual pieces of wood look like one with no dead spots. He talks about technically challenging pieces that require not only a strong knowledge of joinery but also carving, inlay and creating curved shapes.

Bird's understanding of line and proportion comes from studying period furniture in places such as Colonial Williamsburg, museums and books. His favorite book, published in the 1950s, is Albert Sack's "Fine Points of Furniture." Although it's out of print, Bird says you can find some copies.

Of course, with a little pulling, Bird will admit that natural ability does play a part in building a quality piece of furniture. But more importantly than having natural ability is being able to develop that ability, he says. Using baseball as an analogy, Bird says studying and building period furniture is a lot like hitting a baseball. You might have a natural swing and a natural follow-through, but you still need a batting coach or whatever it takes to practice and develop your ability.

Bird likes baseball. He's been known to to attend Smokies baseball games (a class AA minor league affiliate of the St. Louis Cardinals) three times a week with his family. Bird values time with his family more than anything else. They're constantly together. Bird and his wife home-school their daughters who also help out with lunches for students in Bird's classes. The Birds spent their summer rafting in the rivers that flow through the mountains, traveling to Charleston, S.C., and, of course, hitting the books. "We work together, play together and learn together," Bird says. "I feel like we're really close-knit."

Driving out his gravel driveway, over the creek and keeping an eye out for Grace Baptist Church, you begin to realize why Bird and his family chose such an open, idyllic setting for their home, woodshop and new school. It's inspirational, a word Bird uses often when describing the area. A quick look at the spice cabinet Bird fetches from his home for our opening shot, and you can see that the setting has inspired him, too. **PW**

Photo by Lonnie Bird

Bird's classes (offered from early spring to late fall) are limited to nine students. Check out lonniebird.com.

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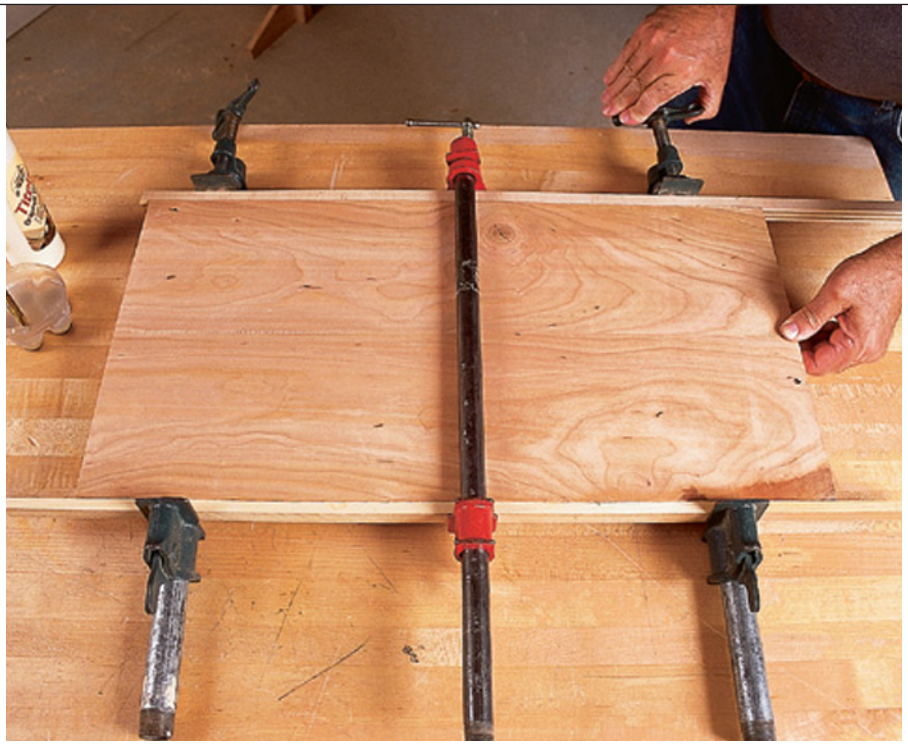
Living on the Edge

The simple edge joint is one of the easiest to learn and one of the most essential for almost any project.



Photos by the author

Glue up a panel with clamps across the top and bottom to keep the assembly flat. Make sure you use plenty of clamps on your workpiece to spread enough pressure across the entire joint.

The edge joint may be the most fundamental joint in woodworking. Any time you need a solid-wood panel more than 6" wide, you likely create it by gluing boards edge-to-edge. Casework, tabletops, door panels, drawer fronts, shelves, headboards and footboards all require boards or panels of a width that outstrips available stock and the capacity of home-shop machinery.

The most widely used type of edge joint couldn't be simpler – just two boards with straight, square edges and some glue. A properly fitted glue joint is stronger than the wood, so if you assemble this joint correctly the boards will split before the joint ever will.

So why are there so many variations – splines, biscuits, interlocking profiles – that add complexity and additional parts? Well, sometimes woodworkers can't accept that a simple joint is better than one with a bit more mechanics to it. Often, splines and biscuits can be assembly aids.

Getting the stock flat, square and true is the biggest task to making a good edge joint. Master that and you'll have no trouble constructing strong, simple edge joints.

But to do a proper job dressing stock, you need three machines: a jointer, a thickness planer and a table saw. Together, they can represent a significant cash outlay.

The upshot is that you may be able to work around the lack of a jointer, a planer or both. You may not have the flattest stock to work with, and a spline or some biscuits can help you line up a slightly bowed board with its mates during glue-up.

Butted Edge Joint

Whether it's for a dining table's top or a small door's panel, jointing the boards and gluing up a panel follow the same routine.

First lay out the dressed stock and find the arrangement that pleases you. Mark the stock so you can remember the arrangement, then gather up the boards and joint the edges, making them straight, smooth, true and, of course, square to the faces. Then put together your panel on a flat surface. If your assembly table is bowed or twisted, you'll have difficulty creating a flat glue-up.

Do a dry-fit first. Set out the clamps, position the boards and cauls, and run through the clamping. The joints must close with moderate pressure. If you need to really crank to close the joints then you know you need to rejoint the edges first.

I use an odd number of clamps and begin tightening the center one before I work out to the ends, alternating from one side to the other. To keep the panel flat, I set alternating clamps across the top surface of the panel.

Spread your glue, set the boards on the bottom-side clamps and move the top-side clamps into place. As you tighten each clamp, make sure the faces are flush by rubbing your thumb over the seam.

If you're uncomfortable trying to monitor two or three seams at once, which you must do if you're gluing up three or four boards, you will need to do more than one glue-up. First do two glue-ups of two boards each, wait about half an hour for the glue to set, then do a third glue-up joining them together.

Using a Router Table

If you don't have a jointer, you can substitute a router: Either set up a router table for jointing or you can produce an excellent butted edge joint using a hand-held router. But keep in mind that router setups are not ideal for handling rough lumber.

On the table, you need a fence with a slight offset between the infeed and outfeed halves – just like the tables on a jointer – so that the work will be supported before and after the bit trims away stock. If you use a fence with split faces, you can shim the outfeed half with cards or plastic laminate. This would apply to most commercial fences.

I've made a simple fence that I can use

by Bill Hylton

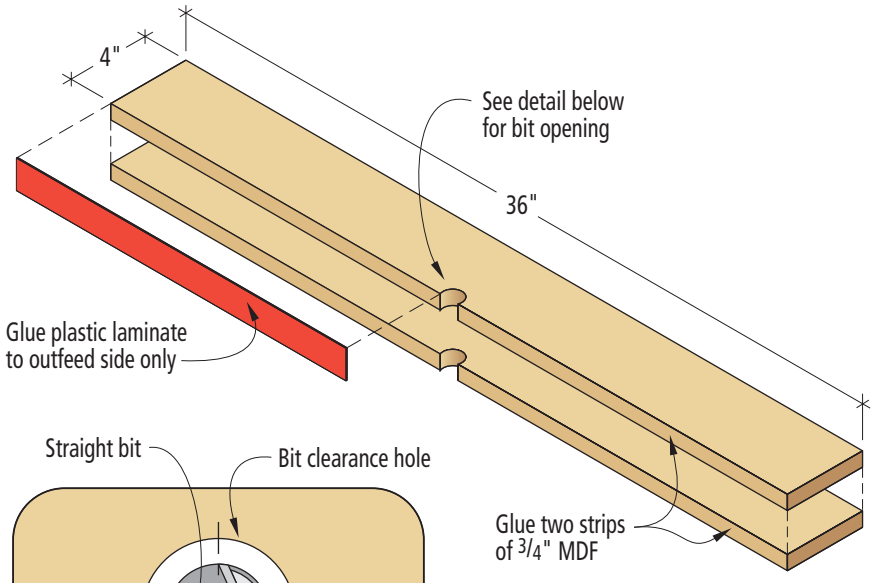
Bill Hylton is the author of several books on router woodworking and furniture making. He will be giving seminars at select WoodWorks 2003 shows. See woodworks2003.com for more information.

on any of my router tables. It's just two strips of ¾" medium-density fiberboard glued together with a piece of laminate attached to the outfeed side. The bit cutout is large enough to accommodate my glue joint bit, so I can use it with that bit or a straight bit. Just secure it to the table with clamps.

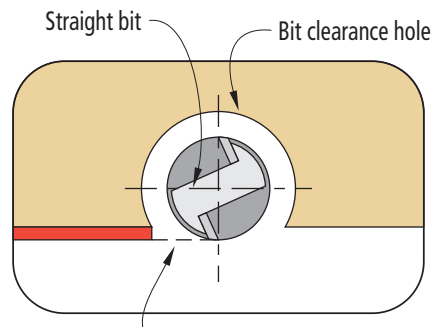
Lock down one end of the fence, leaving the other end free to allow for slight movement. Hold a straightedge against the outfeed side of the fence, extending it across the bit. Adjust the fence so the bit's cutting edges are even with the straightedge.

Then make a test cut by jointing the first 5" of a 12" scrap. If the cut stalls when the scrap hits the edge of the outfeed section, increase the bite. If the jointed stock isn't supported – if you can slip a piece of paper or a feeler gauge between the stock and the outfeed facing – you need to reduce the bite.

The ideal bit in these cases is a fairly heavy but well-balanced ½"-shank straight bit.



Jointing fence



Bit opening detail

Using a Hand-held Router

In this case, clamp a straightedge atop the first workpiece and, guiding the router base against the fence, trim about 1/16" from the workpiece. Then secure the second workpiece directly opposite the first. Adjust the gap between it about 1/16" less than the diameter of the bit. By guiding the router along the same fence – you haven't moved it – trim the second workpiece and produce an edge on it that's a negative image of the edge milled on the first workpiece. The two boards should fit together perfectly.

Because you're cutting positive and negative contours of the fence, it doesn't need to be perfectly straight. In fact, you can produce slightly curved edge joints this way.

To do this, you will need to elevate both boards slightly so the router bit doesn't groove your workbench. Both boards should be in the same plane so the router can remain square to the edges throughout both cuts.

Make sure you work out a placement that allows you to secure both workpieces, such as orienting them across the benchtop.

Feed direction is important, and the direction that's correct is different for each board. You'll be cutting one board on the first pass, the other on the second. Don't cut both at the same time. If you stand where the fence is between you and your router, the feed on the first board is right-to-left, while it is left-to-right on the second.

Biscuited Edge Joint

Despite the strength of the glued edge joint, many woodworkers opt to embellish it with biscuits, splines or dowels. Machining the boards for these elements can be extra work, but when the assembly is complex or the wood is mildly bowed, biscuits and splines can help create a flat glue-up.

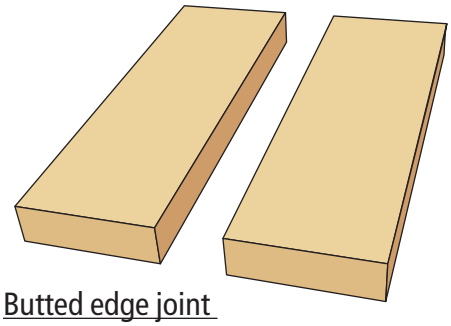
Dowels, on the other hand, are not a good option. It's difficult to drill matching holes in the mating boards. Unlike biscuits, dowels offer no margin for error. On top of that, dowels introduce a cross-grain element to a long-grain joint – if the wood shrinks, the dowels can push the joint apart.

Splining an edge joint was covered in the October 2003 issue (available online at popwood.com), so I won't repeat that.

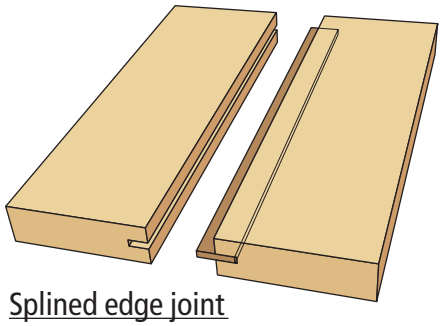
Biscuits are an excellent alternative, and

Rout the first half of an edge joint by guiding the router along a fence clamped atop the workpiece. The feed direction here is right-to-left (moving away from the camera).

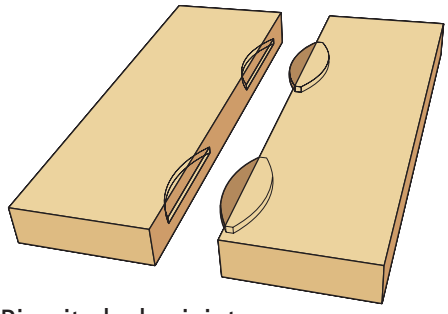
Position the mating board opposite the first, with a gap just smaller than the diameter of the bit between the two workpieces. The feed direction when routing the second edge is left-to-right.



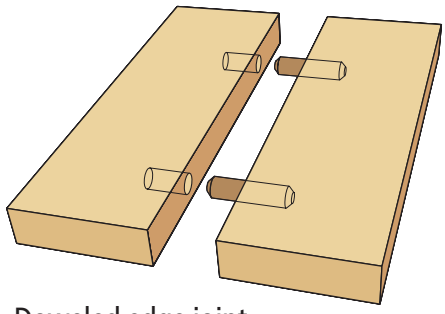
Butted edge joint



Splined edge joint



Biscuited edge joint



Doweled edge joint

pretty easy to accomplish. Cut a series of slots in the mating edges with a biscuit joiner. As you glue up the joint, insert a football-shaped biscuit into each pair of slots. The biscuits register the surfaces, but allow a degree of end-to-end adjustment. Accurate alignment during glue-up is virtually foolproof.

Biscuit slot layout is simple. Line up the boards as you want to assemble them and then mark a line across each joint every 6" to 8" where your slots will go.

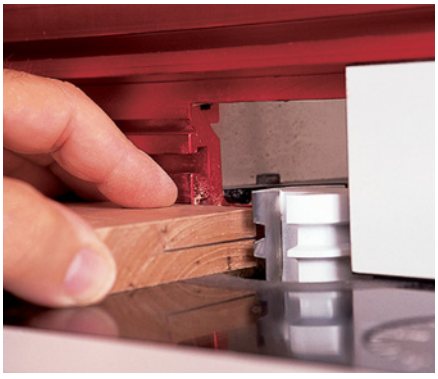
Routed Glue Joint

This industrial joint was developed for high-volume production glue-ups. In that setting, the stock is propelled across a shaper with a power feeder and the cutter simultaneously joints and profiles the edge in a single pass. One edge is milled with the face up, the other edge with the face down.

Long ago, the cutter was scaled down for use in a router table. Because it's typically less than 2" in diameter, it can be run at full tilt (22,000 rpm). But because it's a substantial bit and removes a major amount of stock, lots of horsepower is a prerequisite.

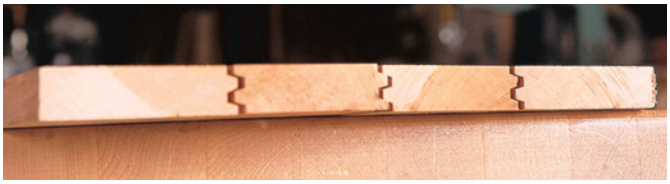
The concept, of course, is that you have a single setup of bit height and fence position. One board is routed face up, the other face down. If the setup is correct, the two boards will come together with their faces flush. Because of the interlock, the fit is a cinch; the boards can't shift up or down. The gluing surface is expanded, too.

But the setup is easier explained than dialed in. (Once you've done it, it's easier to repeat.) The center of the profile must fall on the center line of the stock or the faces won't assemble flush. Also, milling the stock's full edge with the bit requires the infeed and outfeed halves of the fence to be offset from one another (just as you set the tables on your jointer).



For the routed glue joint, mark the center of the work and align the sweet spot on the glue-joint bit with your mark. It probably won't be perfect, but it'll get the setup process started.

Align the outfeed side of the fence even with the cutting edges of the bit's smallest diameter. Use a straightedge and turn the bit by hand to find the correct alignment.



Check the fit of the joint. You want the faces to be flush. If you are milling both edges of a workpiece, alternate the profile from edge to edge, as shown.

Setup Sequence

• Eyeball a bit-height setting. I do this by marking the stock center line on a setup sample and setting it beside the bit. Then I raise and lower the bit to visually align its center point as best I can with the mark. I use this setting to set the fence, then come back to the bit and fine-tune its elevation.

• Next, shim the outfeed half of the fence. I usually use two or three thicknesses of index-card stock. The shims go between the fence and its facings. If you use the jointing fence, shimming isn't necessary, as the infeed-outfeed offset is established.

• Align the outfeed half of the fence with the small-diameter cutting edge. Lock down one end of the fence and adjust it by swinging the free end back and forth. Align the fence visually, then check it with a straightedge held against the outfeed side and across the cutting edge. Clamp the free end. Confirm the setting with a partial test cut. Begin the cut and feed several inches beyond the bit. Switch off the router and check if the edge contacts the outfeed side of the fence.

• Finally make a test cut on a short piece of the working stock. Cut the piece in half and fit the parts together to assess the fit. If the faces are not flush, you need to change the bit height by half the offset. **PW**

Wooden Spokeshaves

Pick up an antique version (or make your own). These tools are unbeatable for curved work.

Photos by Al Parrish

Spokeshaves excel at shaping curved surfaces and can be either pushed or pulled over the work. Wooden tools, such as the one shown here, can be constructed easily yourself, or you can purchase a vintage one.

Many woodworkers might find the traditional wooden spokeshave invaluable for working curved and shaped surfaces. But many others often overlook this useful tool, despite its having undergone something of a revival among Windsor chairmakers during the past several years.

The wooden spokeshave's association with a fairly specific type of work (spindles, spokes, etc.) may help explain this oversight, but I suspect it's mostly because of some uncertainty about how the tool is supposed to function and wondering how to sharpen and tune it. I hope to dispel some of the mystery surrounding wooden spokeshaves and encourage you to discover that they can be ideal for shaping and cleaning up a wide range of circular and curved work.

Chairmakers can use them to shape their spindles and chair seats. Cabinetmakers can use them to fair curves or shape complex work, such as cabriole legs. In short, any woodworker who does any curvilinear work will find them useful.

How a Spokeshave Works

Though it has some unique features, the spokeshave has a key characteristic that identifies it as a type of plane, albeit a very short one. Namely, it has a blade secured in a wooden stock (the body of the tool) and the stock regulates the cutting action.

Many of the tool's more unique features are fairly obvious and require no additional comment. But the significance of some aspects of the blade and its relationship to the stock may not be quite so apparent.

At first glance the lower face of the blade appears parallel, front to back, with the mouth plate, or sole of the shave. In fact, it could be mistakenly assumed that the lower face of the blade is intended to function as the rear sole of the tool. However, my examination of little-used older spokeshaves reveals that the lower face of the blade is slightly canted (I've observed 5° to 9°) from the sole of the shave (see the drawing on the next page).

This slight cant provides a clearance angle for the blade, which is required of every plane. There is a slight compression of the material being worked under the focused pressure of the cutting edge. The spring-back just behind the cutting edge would tend to push the blade up off the material if there was no relief angle. While learning to use a spokeshave, it is helpful to be conscious of registering the sole, rather than the blade, on the material to maintain this relief angle.

This orientation of the blade also means it has a low cutting angle – roughly equal to the amount of cant, or clearance angle, plus the angle of the cutting bevel on the blade. This unique feature results in a very sweet cutting action when working with the grain, especially on end grain. Predictably, this is less than ideal for working against the grain or if there are unpredictable grain reversals.

Luckily, in doing curved work, grain direction is generally more pronounced and the direction you are working in can be adjusted. Because the spokeshave can be used by either pushing or pulling you can accommodate these changes in grain direction without having to change position or turn the work around.

by Don McConnell

Don McConnell builds furniture and does ornamental carving in Mount Vernon, Ohio. Formerly at the cabinetmaker's shop at The Ohio Village, he remains an avid student of the history of the trade, tools and shop practices.

Buying a Vintage Spokeshave

If you decide to look for an older spokeshave to use, you will discover a number of variations. The majority of older spokeshaves were made from beech, though boxwood also is common. Spokeshaves also come in a variety of sizes for different types of work.

The earliest form (which endured throughout the period when wood spokeshaves were commercially produced) has simple tapered tangs that wedge into holes bored into the stock. These require some finesse because adjustment is achieved by hammer taps. If overdone, the stock can split or the fit can become too loose to secure the blade in the needed position. The latter can be remedied with slivers of veneer or blunted set screws inserted from the front of the stock (see the illustration below). When looking for an older shave, it's probably best to avoid examples that are already loose or showing signs of splits in the tang holes.

Other spokeshaves have threaded tangs that are held and adjusted with captured thumbscrews at the top of the stock. These seem more user-friendly, though you have to watch for thumbscrews with noticeable wear where they are captured in the brass plate. Wear allows the blade to shift during use, resulting in erratic cutting action.

Some older spokeshaves have straight blades while many, if not most, have a slight bow, or curvature, along the blade. The purpose of this bow isn't immediately obvious, but it may be to ensure that extraneous areas of the sole don't interfere with the function of the shave on irregular surfaces.

Another feature of older blades is the hollow forged into the upper bevel, reminiscent of old straight razors. This provides guidance for honing the bevel while minimizing the amount of steel needing to be moved.

Finally, older spokeshaves may have a brass mouthplate. It is assumed this was intended to reduce wear, though brass doesn't seem to be a great choice for this purpose. Indeed, wear can be an issue for wooden spokeshaves because they are often used on narrow surfaces, which tends to localize and accelerate wear. People making their own wooden spokeshaves today often prefer to use a small piece of hard, dense wood instead.

One unfortunate result of this unique blade arrangement is that the working portion of the blade is shortened with repeated sharpenings. This inevitably leads to the opening of the mouth, which can't simply be corrected, though one occasionally runs across an older spokeshave that has had a new mouthplate installed to address this condition (and possibly to fix a shave where the stock has worn away from use).

Often, older shaves have seen hard use, with the sole or mouthplate showing significant wear and the blade all but used up. While this is ample evidence of past utility, it's better to find a little-used one. There are still enough of these around that a little patience is usually rewarded.

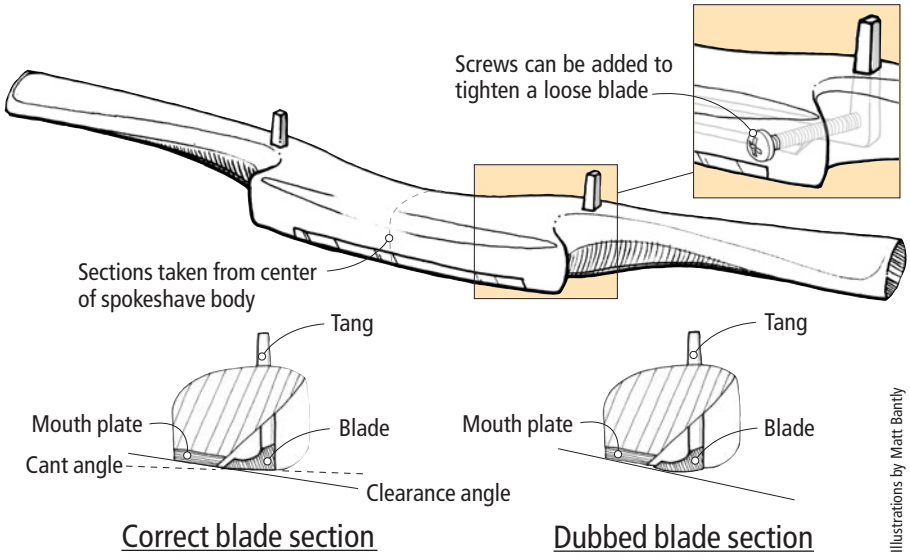
Wooden spokeshaves come in a variety of sizes and configurations. From the top are: a traditional shave with square tangs set into a wooden stock; a shave with a blade that is adjustable by the thumbscrews on the top; a shave with a traditional wooden stock; a new user-made shave with a piece of persimmon inlaid in front of the blade; a vintage shave with a brass-wear plate.

Many people today are making their own spokeshaves. Though not identical to the older ones, there are new blades suitable for wooden spokeshaves that are available; and the process of making one is an enjoyable and instructive experience.

The Trick to Sharpening the Blade

If you've acquired a wooden spokeshave to use the next task is to sharpen it. Obviously, the two tangs limit your options and you'll need to work around them.

If the blade is straight, it's possible to lay your sharpening stone on edge, providing clearance for the handles while you hone on



Illustrations by Matt Bantly

Wooden-bodied spokeshaves have a very low cutting angle, which excels at slicing end grain. Shown here is a ribbon of unbroken walnut end grain taken with this shave.

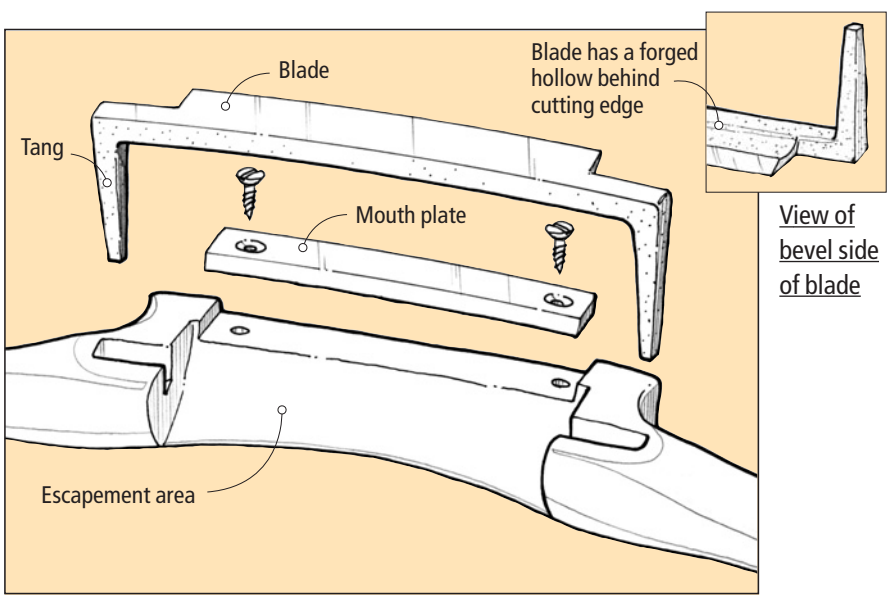
Sharpening the blade is much simpler with it secured in a handscrew clamp. The metal rib behind the hollow that's forged into the blade helps guide your slipstone as you hone the bevel.

the stone's edge. Or you can elevate the stone on another stone or block of wood so you can hone on its face. At this point, you'll appreciate the advantages provided by the forged hollow because it guides your honing.

If your blade is bowed, however, the bevel face will be slightly concave. That means you can't hone on the flat edge or face of a bench stone. The best method I've found for this is to trap the blade, bevel up, between the jaws of a handscrew – which, in turn, is being held in my bench vise. This brings it up to a comfortable working height and provides good visibility while I hone with a slip stone.

Honing and polishing the lower surface of the blade is mostly straightforward. But it's important not to "dub over" or round over the blade front to back in an effort to speed the process. This would quickly compromise the slight relief angle provided by the relationship of the blade to the sole.

Unfortunately, this is an ongoing issue. The bottom surface, just behind the edge, comes in for a fair amount of wear. So while you will probably do your primary honing on the bevel, some secondary honing of the lower face usually needs to be done. It will be tempting to concentrate your honing efforts toward the edge, which, if you're not careful, could easily result in dubbing it over.



As to setting the blade for use, people doing spindle/spoke work seem to prefer cocking their blades so that one side takes a heavier cut than the other. For general curved work, I find a uniform set to be more useful.

Whether you decide to buy or make a new spokeshave or refurbish an older one, I believe you'll find it a satisfying and versatile addition to your woodworking. **PW**

SOURCES

Older wooden spokeshaves:
Auctions, flea markets, antique dealers, yard sales, etc. Also, don't overlook national and regional tool collectors' association meetings where members often have tools for sale.

Make your own wooden spokeshaves:
New blades:
Hock Tools
16650 Mitchell Creek Drive
Fort Bragg, CA 95437
888-282-5233 or hocktools.com

Instructions:
John Gunterman's online tutorial:
www.shavings.net/teachshave.htm

New wooden spokeshaves, kits and blades:
Dave Wachnicki
Dave's Shaves
P.O. Box 980
North Conway, NH 03860
603-356-8712 or
ncworkshops.com/index.html

Limbert Tabourette

Photos by Al Parrish

This historical reproduction is easier than it looks, thanks to a tricky rabbet.

The curves, cutouts and captured shelf of this small table make it look like a daunting project for the beginning woodworker. But thanks to some sharp design work from our project illustrator, this tabourette actually is duck soup.

Or, should I say, "rabbet" soup.

At the core of this table is an unusual rabbet joint that joins the four legs of the table. The rabbets nest inside one another and, when assembled, look like a pinwheel when viewed from above. As a bonus, this joint allows you to make all four legs from one simple template.

But how do you clamp such a curvy form with this unusual joint? If you own a nail gun, then you already have the answer.

This noteworthy joint might be the only thing that separates my reproduction from a museum original. Using historical photographs, we went to great pains to ensure this tabourette looks exactly like the table that appeared in Charles P. Limbert Co.'s 1905 furniture catalog. If you are unfamiliar with Limbert furniture, you should know that this Grand Rapids, Mich., company produced Arts & Crafts furniture with a European flair. Instead of straight lines and massive proportions, Limbert preferred curves. The furniture re-

by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com.

mains popular to this day. The #238 sold for $7 in 1905; a recent example fetched $1,600 at auction. Constructing this replica, as you'll see, is easier than affording an original.

Start With the Legs

You can build this project with just two 8'-long 1x8s, making it affordable and easy to build – even if you don't have a jointer or a planer in your shop. Limbert's company built this table in quartersawn white oak, though we've also built it in walnut and cherry for a more contemporary look.

The first order of business is, as always, to get your stock flat and true. Cut all your pieces to length and true one long edge of each board. Set aside the four boards for the legs and glue the remaining boards edge-to-edge to create the panels you will need for the top and shelf.

You're going to make the legs using a plywood template, a router and a pattern-cutting bit. But before you start cutting curves, you should first cut the 3/8" x 3/8" rabbet on your four legs that will join the four pieces together.

This rabbet is the most critical part of the project. It needs to be precise to ensure the legs nest together seamlessly, so check your work carefully as you go. An inexpensive dial caliper will make the work easier.

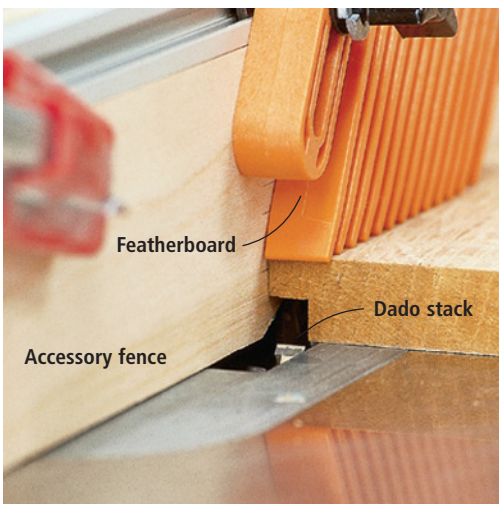
I like to cut my rabbets on the table saw using a dado stack that's buried in an accessory fence. This allows me to cut my rabbets in one pass and has given me consistent results – especially when I add a featherboard to the setup, as shown in the photograph.

With your rabbets cut, fit the four pieces together to check your work. Tweak your saw's settings until everything fits. You'll be able to tune up your joints by hand later if you know how to use a shoulder plane (see "The Essential Shoulder Plane" on page 70).

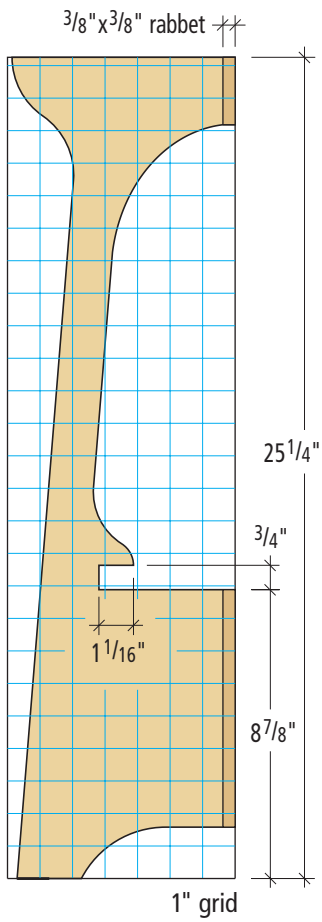
One Template, Four Legs

With the rabbets cut, it's time to make the plywood template that will shape the legs. You can use the scaled diagrams we've provided, or you can download a full-size drawing of one from our web site at popwood.com. Click on "Magazine Extras" for details. The file will allow you to print out the legs on three sheets of letter-sized paper and stick them directly to your plywood with a spray adhesive. (There also is a full-size pattern of this table's shelf on our web site.) To make the template, you can use thin 1/4" plywood if you like, though thicker plywood, such as 1/2" or 3/4", will make your routing easier, as you'll see later on.

Using your band saw or jigsaw, cut slightly wide of the line.



An accessory fence allows you to cut rabbets on your table saw with just one pass. And a featherboard makes this joint accurate and safe.



Leg pattern

With the patterns taped together, attach it to a piece of plywood using a spray adhesive. This 3M product is available in the glue section of most home-center stores.

When trimming your pattern to rough size, cut as close to the line as you dare. The closer you are now, the less you'll labor your router later. But if you go over the line, you'll be in trouble.

Leave a small nib of waste at the foot and the top of the leg that will allow you to screw this template directly to your lumber.

Clean up the curves on your template using sandpaper or files. Make the curves as smooth as possible. To ensure your curves are fair, I recommend you shape a piece of scrap with your template before you move on to the real thing. A trial run will point out rough spots or bumps that need more attention with the file.

To rout the shape of the legs, first lay the pattern on your work and line up the long, straight edge of the pattern with the rabbeted edge of the piece. Trace this shape onto your wood.

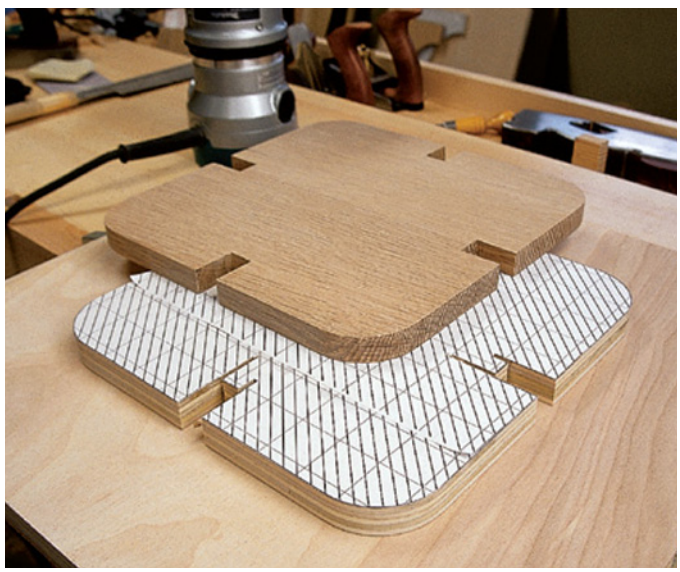
Remove the pattern and trim your leg close to this line using a jigsaw or band saw – get within 1/16" to make it easier on your router and pattern-cutting bit. Save your fall-off pieces because they can help you clamp the legs together later in the game.

There are a couple of ways to rout the legs. You can do the operation on a router table, if your table is big enough. Or you can clamp the work to your bench and use a hand-held router.

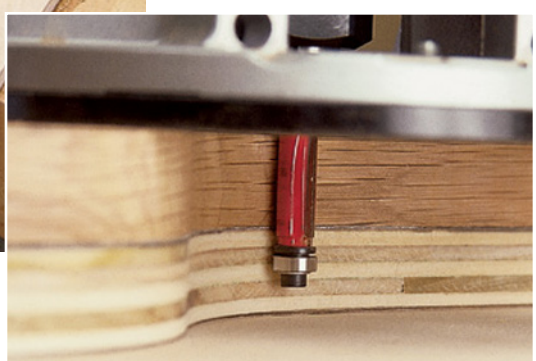
The real trick is the router bit itself. There are two kinds of pattern-cutting bits: One has the bearing at the end of the bit; the other has the bearing above the cutting flutes. I generally prefer bits with the bearing on the end, especially when working with a hand-held router. That's because you can work with the pattern clamped to your workbench (if your pattern is thick enough). If this is the route you choose, clamp the pattern to your bench using a vise and bench dogs – make sure your bench dogs don't interfere with the bearing on the end of the bit. Affix the work to the pattern with screws and double-sided tape and rout it to shape.

With the shape routed, you'll immediately see that the notch that holds the shelf will need some additional work. The round router bit won't cut that area square, so square out this section with a jig saw, band saw or even a handsaw and chisels – whatever works for you. This also is the time to remove the small pieces of waste that you used to screw the work to your template.

I nailed my pattern to a piece of scrap plywood and clamped that to my bench. This made routing the leg a simple operation that could be done in one pass.



A template for the shelf can simplify things if you're making several tables. I cut the notches on each edge of the pattern with a table saw and cleaned out the interior waste with a chisel. Double-sided tape held the shelf on the pattern during routing.



Move the router around the piece in a counterclockwise pattern. As the grain changes direction in the piece, you might want to climb-cut a bit in places (cutting clockwise) for a cleaner cut. Just keep a firm grip on the router when you do this.

Shape the other three legs in the same manner. Remove all the machining marks with sandpaper or hand tools (a spokeshave and smoothing plane would be appropriate). Then move on to the shelf, top and assembly.

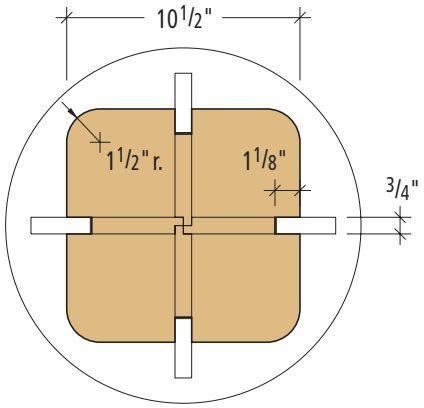
The Other Curves

After shaping the legs, the top and shelf are pretty simple. The lower shelf requires notches on the four sides and round corners, as shown below. You can make a template for this operation, too. Cut the notches with the same tools you used to clean up the notches in the legs.

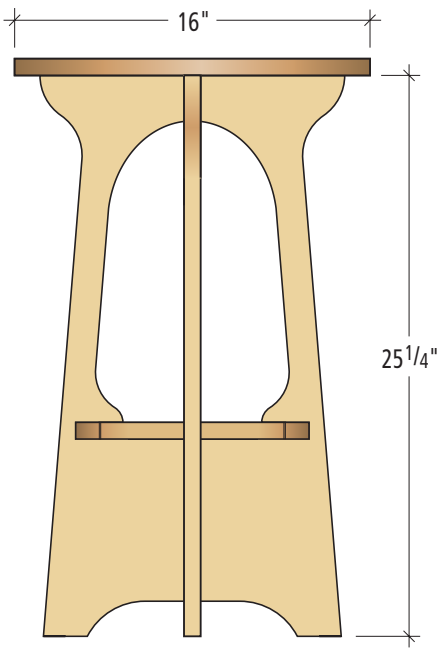
You can round the top in a variety of ways depending on what sort of tools you have. A circle-routing jig like the one featured in our October 2003 issue ("The Magic Trammel Jig") is ideal. You also could cut it close on a band saw or jigsaw and sand it round on a disc sander.

This is the best time to finish the table's parts. Begin by sanding all the surfaces. Start with #100 grit, then move up to #180 or #220. I'm a hard-core hand-

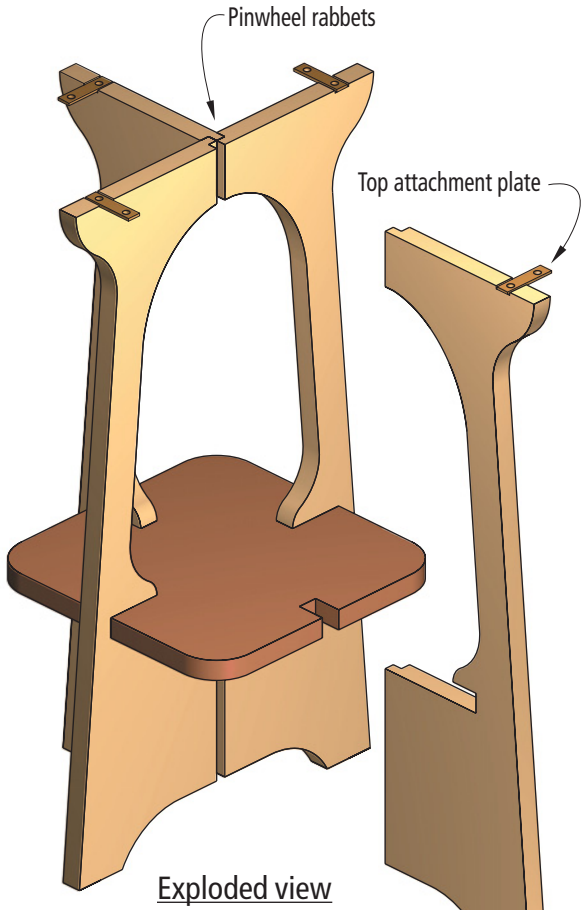
Nail one leg to the other so that the nail holes will not show when the piece is together. It's easy to do, but it's also easy to make a mistake. Use the diagram as a guide and an extra set of hands helps immensely.



Plan, top removed



Elevation



Exploded view

LIMBERT TABOURETTE

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	4	Legs	3/4	8	26*	White oak
❑	1	Top	3/4	16	16	White oak
❑	1	Shelf	3/4	10 1/2	10 1/2	White oak

* Item is slightly oversized for pattern-routing

I made clamping cauls using the patterns for the legs. Sand the edges of the cauls to avoid marring your finished edges. I also taped the cauls to my clamps, which made them easy to get in position without help.

The shallow notch at the top of each leg holds the mending plates ($1.50 for a set of four from my local home-center store). Make the notch a bit wider than the plate to allow it to pivot. This allows the top to expand and contract with the seasons.

tool enthusiast so I skip the sandpaper and use a smoothing plane and a card scraper to prepare my wood for finishing. Either way is fine. Once your wood is perfect, tape off all your glue joints with blue painter's tape.

I use a tried-and-true finishing process we've developed in our shop that emulates the deep reds and browns of a fumed ammonia finish without the downsides of that dangerous chemical. We explained the entire process in detail in our June 2002 issue ("Arts & Crafts Finish," available for sale at our web site).

Essentially, you dye the project with a reddish half-strength water-base aniline dye. After that's dry, wipe on a coat of Valspar warm brown glaze. Then add a topcoat finish – we spray lacquer. The finish takes some time, but it's worth the effort. See the "Supplies" box for ordering what you'll need for this finish.

Assembly

Putting the base together is easier than it looks; the trick is to do it in stages. First study the pinwheel rabbet in the diagram. Then take two of the legs and join them at a 90° angle as shown in the illustration. Here's how: Put glue in the rabbet, put the lower shelf in place and nail the two pieces together. You read that right, nail it. I've used a 23-gauge pinner and an 18-gauge nailer for this operation. Both fasteners work, but the smaller pins are less likely to split the wood.

Place the fasteners so that when you assemble the entire table the nail holes will be covered by the other rabbets.

Now add a third leg to your first assembly in the same way.

What you have left is what you see in the construction drawing: A three-legged table with a groove running down the assembly. And you have a fourth leg with its mating rabbet. Attaching this leg is a bit of a trick. I recommend either band clamps or making clamping cauls.

If you want to make clamping cauls (as shown above) you can use the fall-off pieces from bandsawing the legs to shape. These work, but they won't mate perfectly. The better way is to print out another copy of the leg pattern and use that to saw and sand a set of cauls. To make the cauls easier to clamp to your project, tape the cauls to your clamps' heads. This allows you to assemble the project by yourself.

Using your cauls, clamp the fourth leg in place until the glue is dry, then attach the top. I used brass mending plates that have two screw holes bored in them. These simple bits of hardware allow the top to move with the seasons. To install them on the table's base, use a chisel to make a notch that's just a little bigger than the mending plate. The plate needs to pivot a bit when the top expands and contracts. (If you don't want to use mending plates, the "Supplies" box tells you where to get desktop fasteners, which function similarly.)

The notches shown in the photo are $\frac{3}{32}$" deep x $\frac{5}{8}$" wide and are $1\frac{1}{8}$" in from the outside edge of each leg. Screw each plate to the base. Once you install all four, screw the base to the top.

Now that you're done, be sure to save your templates and clamping cauls. Because you're ready to go into production. **PW**

SUPPLIES

Woodworker's Supply
800-645-9292 or
woodworker.com

1 oz. • J.E. Moser's golden amber maple water-based aniline dye #W14901, $6.29

Woodfinishingsupplies.com
866-548-1677

1 qt. • Valspar warm brown glaze, $10.99

Rockler
800-279-4441 or rockler.com

1 pkg. • 8 desktop fasteners # 21650, $3.99

WOODWORKING ESSENTIALS

BY NICK ENGLER

CHAPTER 2

Plunge Router

While a fixed-base router is a very versatile tool, there are still some operations that require different abilities. This is where a plunge router proves valuable.

For example, some operations require you to rout the interior of a board without cutting in from the edge. When you rout a mortise, it's best to first make a small hole in the interior of the workpiece, then enlarge it. To make this starter hole, you must lower – or "plunge" – the bit into the wood. While you don't need a plunge router to do this (woodworkers have been plunging with standard routers for years), it does make the operation safer and can be accomplished with greater precision.

The main difference between plunge and fixed-base routers (*which were discussed in Chapter One of this series*) is that plunge routers can make interior and stopped cuts much more easily. The plunge-base motor is mounted on two spring-loaded posts above the base, which let you position the motor above the work, then lower the bit straight down into the wood and begin cutting.

Similar to fixed-base routers, plunge-base routers are available in multiple sizes and power. Most will accept both ½" and ¼" collets.

Choosing the Right Size For Your First Router

Plunge routers are available in two main sizes: either a 2-horsepower (or slightly less) or a 3-hp (or slightly more) model.

Most larger plunge routers have found happy homes in router tables *(we will discuss router tables in Chapter Three)*, and that's where they belong. They're honestly too large for convenient hand-held routing operations. They can be used this way, but the smaller plunge router is more likely the better choice for hand-held routing.

The smaller plunge routers are easier

PRO TIP:

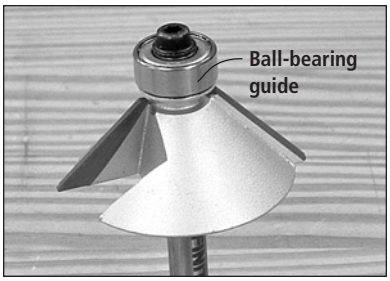
How Much is Enough?

To make sure the collet is safely gripping a router bit, insert ¾" of the length of a ¼" shank bit into the collet and insert a full 1" of every ½" shank bit.

TIPS & TRICKS

PRO TIP:

Use Ball-bearing Guided Bits Instead of Template Guides to Protect the Wood



Metal template guides can burnish the wood, crushing the fibers. This prevents stains and finishes from penetrating the wood evenly. To prevent this, purchase a set of ball-bearing guides, available from any router-bit distributor.

GREAT TIP:

Make Sure You Use Plenty of Protection

Always wear eye and ear protectors when routing. The need for eye protection should be obvious – the router throws wood chips everywhere. But the need for ear protection is just as necessary. A high-speed router motor generates high frequency noise, which can damage your hearing a tiny amount with each exposure. You won't notice any loss after just one routing session, but over time your hearing will grow worse.

GREAT TIP:

Make Sure You Get Good Up-and-down Movement

When plunging, some routers will jam if you grasp only one handle, which is OK because you should always use two hands. But if pushing both handles does not result in a smooth glide to full extremes, you should pass on that router.

There is quite an array of router choices. At left, originally designed as a laminate trimmer, this smaller router is used very effectively for a variety of applications. Offering good power and using standard ¼"-diameter bits, it offers many of the benefits of a larger router with easier maneuverability and convenient size. Kits for the trimmers offer fixed- and beveling-base options. The standard fixed-base router in the 1½-horsepower range (middle) will accept ¼" and ½" bits and do almost everything you could need out of a router. The plunge router in the 2½-hp range (right) is able to do everything a fixed-base router can do and more, with extra torque for larger profile work such as frame-and-panel doors.

to use hand-held and will provide an astonishing amount of power for almost all operations. Today's plunge routers often come equipped with variable speed. This is good because the larger-diameter bits cut better when run at slower speeds. Also, many variable-speed routers now offer a type of turbo-boost called electronic feedback control. This feature allows the motor to maintain the revolutions per minute when the router is in use, meaning there's no slowing or stalling during a cut.

So smaller is best when the tool is used outside of a table and larger is likely better for router-table use.

Choosing the Right Size For Routing Specific Projects

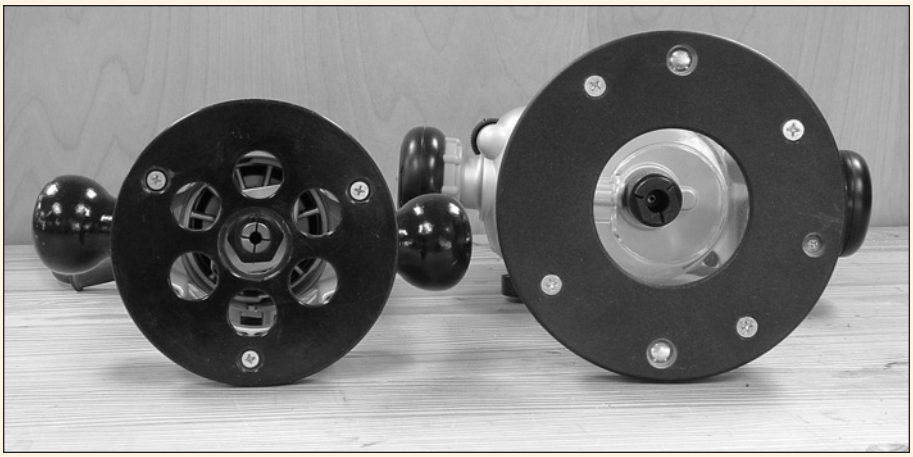
As mentioned above, certain diameter bits perform better at certain speeds. While variable speed can give you a certain amount of leeway in your routing abilities, there are places where the size of your router makes a difference.

In particular, when performing any process that removes a large amount of material in a single pass, a larger plunge router will better meet your needs. This also will indicate that the operation is best performed in a router table. These operations include rail-and-stile applications for doors, panel-raising for doors and frame-and-panel cabinetry, and large profile work, such as in crown moulding, base moulding or banisters.

In fact, the design of the tool will help you make that decision, too. Most smaller plunge routers will not have an opening in the base that is large enough to accommodate a large-profile bit. If the bit won't fit, you've probably grabbed the wrong router for the application.

Height-adjustment Features

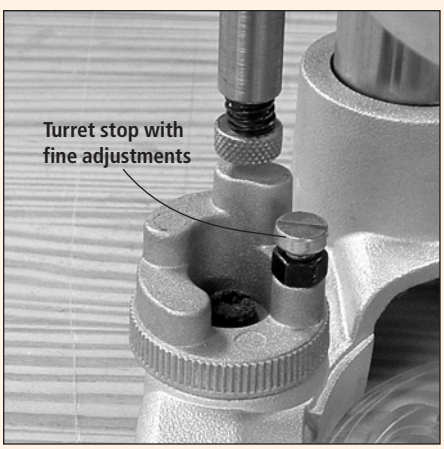
With fixed-base routers, the depth of cut usually is set and adjusted manually by sliding the motor up and down in the base. Some motors will rotate to adjust the height, while others slide straight up and down. When the height is set, the motor is locked in the base and the work proceeds. With plunge routers, the depth of cut also is set by sliding the motor in the base, but there are a variety of ways to set, adjust and fine-tune that height.



The 1½-hp router, left, has a base opening that is sized for bits appropriate to that size motor. The larger plunge router, right, has a 3-hp motor, appropriately sized for larger bits for panel raising or large profiles. This base has a larger opening to accommodate those bits.

Because the plunge router is designed to slide out of the cutting position and then return to the proper depth with a plunge, a repeatable and reliable depth stop is required. The most common and simplest repeatable depth stop on plunge routers is called a "turret stop."

A height-adjustable rod is mounted to the motor housing and aligned parallel to the direction of the plunge. Mounted to the base is a rotating dial with usually three (but this can vary) stepped-height stops. The depth rod is plunged against the lowest position for the proper height, then locked in place. The other two stops come into play when you are making deep cuts in multiple passes to reduce the strain on the bit and the motor by taking no more than a ¼"-deep cut at one time.



The turret stop is the most common depth stop in plunge routers.

There are a variety of designs for the plunge-rod/depth-stop arrangement, but turret depth stops are the most common height-adjustment system. Many newer plunge routers also offer fine adjustment to the depth setting.

This is accomplished either by adding a fine-thread screw mechanism to the depth rod or by adding a fine-thread screw adjustment to the top of one of the depth rests on the stop itself. Fine adjustment can be very helpful during the initial depth setup, as you frequently can find yourself fighting a balancing act between gravity and the tension of the plunge springs to get the setting right.

The fine-adjustment feature also makes plunge routers a good choice for edge routing and profile work, applications typical for a fixed-base router. In fact, many woodworkers when faced with using only one router (thankfully that's not too often) will choose a plunge router, since it is more versatile.

But can't a fixed-base router be used to make plunge cuts? Sure, but it's not recommended. It's a hazardous operation because the base is supported on only one tiny edge while you tip the tool to plunge. If all you have is a fixed-base router, there are ways to get the job done, but for most people who will be making more inside cuts, it's well worth it to get that plunge router.

Should You Buy Two Routers?

Considering the versatility of a plunge router, why should anyone buy a fixed-base router? Simply put, with fewer moving parts and a less-complicated depth adjustment, it's a simpler tool. A fixed-base router is best used for making edge cuttings of a single depth, while the plunge router is built for depth changes and is best for multi-depth interior cuts, such as mortises.

Certainly, a plunge router can be modified or placed in a jig for nearly any cut that you'd want a fixed-base router to do, but that doesn't always make sense. When in doubt, just keep it simple and, in the best of all worlds, both a fixed-base and a plunge router should find a home in your shop.

The fine-adjustment knobs make the depth as accurate as possible.

TIPS & TRICKS

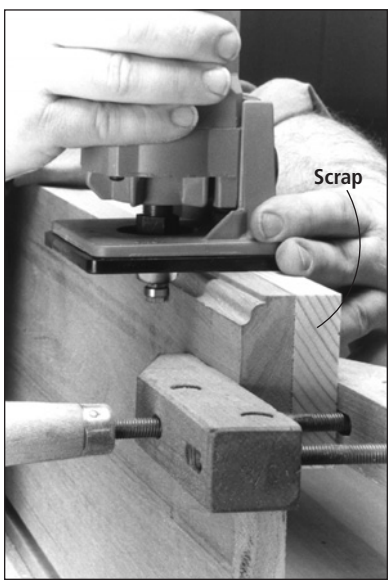
PRO TIP:

Precise Setups with Feeler Gauges

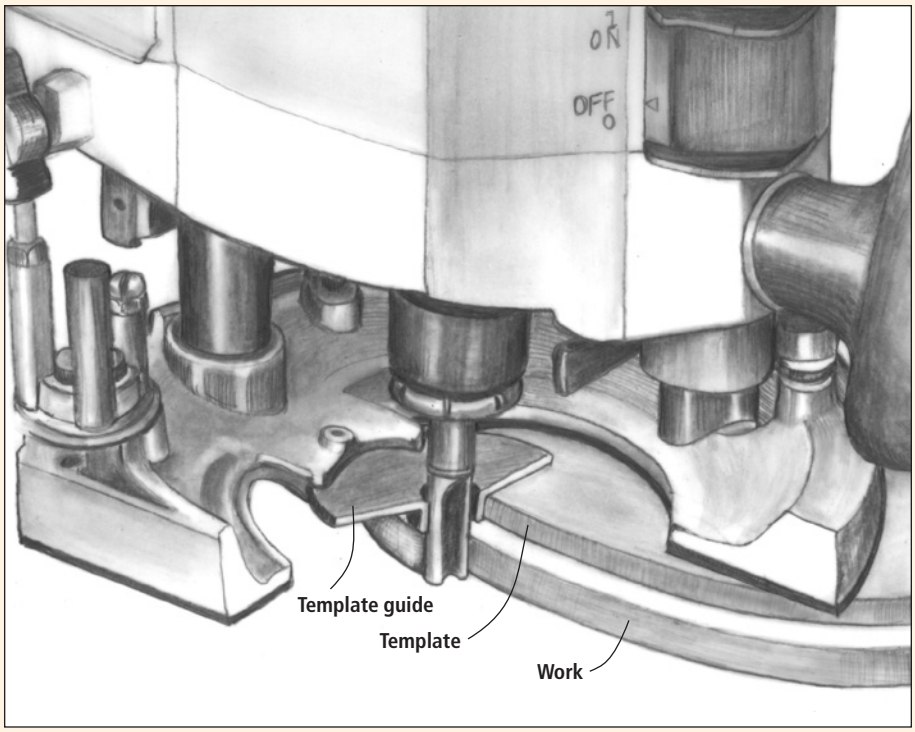
One of the difficulties when setting up your plunge router for a cut is fine-tuning the setting in small increments. The most precise way to change your setting is to use a set of automotive feeler gauges. These thin strips of metal are marked with their precise thicknesses. When you want to adjust your bit up .005", simply place the appropriate feeler gauge between your turret depth stop and the tool's adjustment rod. Plunge the tool and lock it in place. Remove the feeler gauge and move the adjustment rod down until it contacts the turret depth stop again. Bingo. Now your cut is .005" shallower.

GREAT TRICK:

Use a Thick Scrap to Keep Your Router in Balance



If you're routing the thin edge of a workpiece, or if the workpiece is too narrow to balance the router easily, clamp a thick scrap to the work to provide more support.



Illustrations by Mary Jane Favorite

Template guides are designed to follow templates. As the guide traces the shape of the template, the bit cuts a similar shape in the workpiece. The routed shape may be a little larger or smaller than the template, depending on the relative diameters of the bit and the guide.

Base-mounted Guides and Template Guides

Base-mounted guides are available as accessories for most fixed-base and plunge routers. The guide follows the edge of the wood and you can use it rather easily. Instead of holding both router handles, grasp one handle and hold the end of the guide with your other hand. As you cut, keep the guide pressed firmly against the edge of the workpiece. Then just feed the router slowly and easily for a smooth cut.

Template guides attach to the base or sole of the router and follow a straight or contoured edge. These round guides surround the bit and the bit protrudes out through the hole. While template guides can be used to follow along the edges of a workpiece, they were designed to follow templates.

When using template guides, make sure the bit does not rub the inside of the collar. That wear could ruin both the bit and the collar. Also, keep the guide pressed firmly against the edges of the template as you cut.

Don't forget the most simple of router guides – a straightedge clamped to the material you're cutting. This can be a simple piece of scrap found in your shop or one of a number of commercially available guides that have built-in clamping, making their use a lot easier.

Most base-mounted guides will follow either straight or contoured edges, depending on the shape of the guide. Here, a straight guide – which looks like a small fence – rides along the edge of a board.

How to Rout a Mortise

Routing a mortise with a plunge router is an easy operation. First mark the location of the mortise and set up whatever guide system you choose. Your guide system can be as simple as an edge guide, as shown at right, or a jig, as shown in the photo below.

Begin the mortise by making a starting hole. Just position the bit over the work, then push down. Next, enlarge (or elongate) the hole to complete the mortise by moving the router.

Cutting a mortise with the standard fixed-base router is more difficult because you must "rock" the bit into the workpiece before you can cut. You also can cut a mortise with a table-mounted fixed-base router, but the procedure requires careful layout work. You have to mark both the router table and the workpiece to know when to start and stop cutting. That's why the plunge router is perfect for this job.

To rout a mortise with a plunge router, clamp a straightedge or guide to the workpiece and adjust the depth stop. (You also may use a base-mounted guide attached to the router.) Position the router over the work, holding the base against the straightedge (or the guide against the work). Release the height clamp and push the bit into the wood.

Other Applications

Along with mortising, there are some other operations that plunge routers are ideally suited for:

■ Circles and Ellipses

Because cutting these pieces is usually a multi-stage task, the plunge router works best because it can be lowered gradually to make the cuts. You could use a fixed-base router, but it usually takes up more time, or even a band saw, which can be more efficient but won't give you the precision or finished quality of a plunge router.

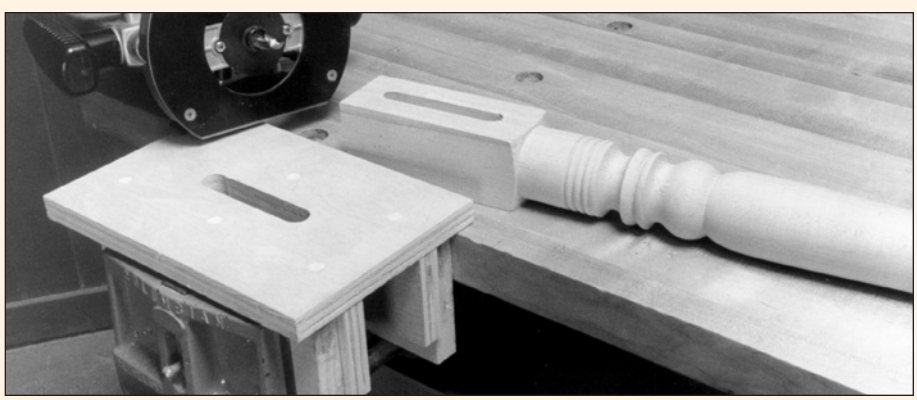
■ Deep or Large Cuts

If you have a deep cut that is going to be more than one pass or is larger than your bit, break out the plunge router. Even if it means building up support on the outboard side of the router's base to prevent tipping, it's almost always better to use the plunge router.

■ With a Router Table

Plunge routers are the most popular choice with a table because there are more options in the 3-hp range than fixed-base routers. They're also relatively inexpensive, but there are some problems to be aware of. Because the router's motor is inseparable from the rest of the tool, you can't change the bit easily if the tool is fixed to the tabletop.

The depth stop will halt the bit at the proper depth. Secure the height clamp and rout the mortise, keeping the router against the guide.

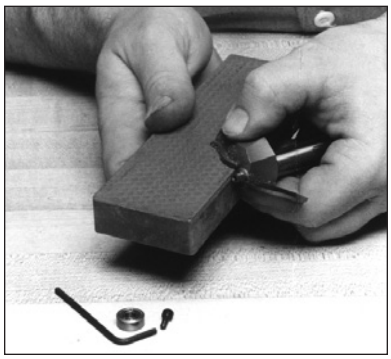


A mortising template can be nothing more than a hole cut in a piece of plywood or particleboard. The size and shape of the hole depends on the size and shape of the mortise you wish to cut, the diameter of the template guide in your router and the diameter of the bit you are using. When you make the template, cut it large enough to support the router base. You also may want to fasten it to one or more mounting boards to help position the template and provide an easy way to clamp it to the workpiece.

TIPS & TRICKS

PRO TIP:

Sharpen Cutting Flutes by Using a Diamond Stone



If your cutting edges seem dull, touch up the carbide flutes on a diamond stone. Sharpen only the inside (flat) surfaces of the flutes, leaving the outside (curved) edges alone. If you try to sharpen those, you might change the diameter of the bit.

GREAT TIP:

Wax That Tool; Don't Worry About Wax on Wood

There is a common misconception that if you wax a woodworking tool the wax will rub off onto the wood and interfere with a finish. This is not true, as long as you buff the wax after it dries. Once buffed, the layer of wax remaining on the tool is only a few molecules thick – enough to protect and lubricate the metal but not enough to ruin the finish.

GREAT TIP:

Remove Your Plunge Springs When Routing in a Table

One of the most frustrating things about using a plunge router in a router table is that the plunge springs work against you as you try to increase the height of the bit. Many plunge routers allow you to easily remove the springs. Give it a try.

Router Maintenance

Like many modern portable power tools, the router is a mostly maintenance-free tool. There are, however, a few things you must do to keep it in good working order. In particular:

• Keep the motor free of dust. Use compressed air or a vacuum to clean out the housing. Otherwise, the dust will get into the bearings – even permanently sealed bearings – and cause them wear prematurely. The dust also can damage the commutator (a part of the router's universal motor that conducts current) and field of the motor.

• Keep the collet dust-free. Dust in a collet is the most common cause of bits slipping. If you don't keep it clean, the collet also can show wear prematurely.

• Replace the collet immediately if it shows signs of wear. A worn collet changes the shanks of router bits. This may ruin the motor shaft, requiring you to replace the entire armature.

• Wax and buff the base plate and the surfaces of the tool that slide together (such as the plunge bars). This simple act will help these parts move freely and keep the router gliding smoothly across the work.

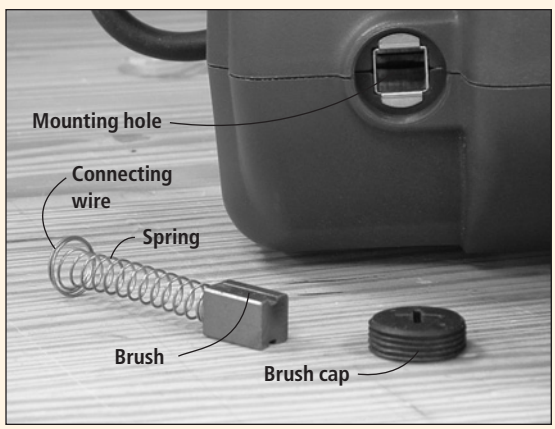
• Specifically with the plunge router, you need to make sure that the plunge bars and sleeves are correctly aligned. If the router is dropped, these parts might need to be inspected. In some routers, the return springs are inside the plunge bars; in others, the spring is fitted externally. Either way, the springs need to be seated properly and cleaned regularly.

• Brushes are blocks of carbon that ride and wear against the commutator in all router motors as part of the motor function. Over enough time, the brushes can wear down enough to require complete replacement. Some, but not all routers, make this a simple task by making the brushes accessible from the outside of the router housing.

Sparking from the motor that is only getting worse is a good indicator that it may be time to replace the brushes. This usually is a simple task that requires removing the brush cover, removing the brush, spring and wire and inserting a new brush. Properly aligning the brushes and leaving proper "play" in the spring will ensure a good fit.

There likely will be a short period where sparking will continue as the new square brush shapes itself to the surface of the round commutator, but after that there should be no problem.

• Many switches included on routers today are sealed against dust. This makes maintenance on them unnecessary. If you happen to have an older or less-expensive router, you may want to take a look at the switch occasionally as well. After unplugging the router it's simple enough to remove the switch from the housing and use a soft toothbrush to clean any accumulated dust from the switch and the switch terminals. Compressed air is another option for cleaning out the switch. Put things back together and you're ready to go.

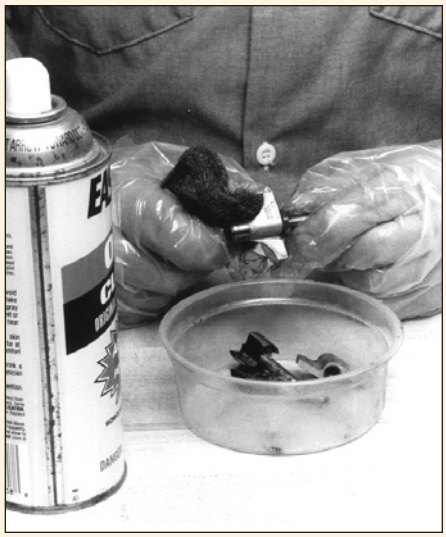


At right is the motor's brush with spring and connecting wire, the cap and the hole in the housing where the brush goes. You can see that the surface of the brush is slightly concave to form to the cylinder of the commutator. When replacing a brush that is already broken in, the shape should be properly oriented to match the motor's round commutator.

Bit Maintenance

Clean and maintain the router bits, not just the machine itself. After all, a bit is the most important part of your routing system. Here are some tips:

- After each use, remove dust and built-up pitch. Then polish the shaft with a piece of steel wool or 3M Scotch-Brite. This will not affect the diameter of the shaft – the tool materials are a lot harder than steel wool and Scotch-Brite.
- If there are any burrs or galling (rough spots) on the shaft of the bit, sand the entire shaft smooth with emery cloth. Carefully check the collet for dust or any signs of wear. Burrs and galling are sure signs that the bit has slipped while you were cutting.
- Lubricate pilot bushings and bearings after every one to two hours of use. Wax and buff the bushings. Apply a dry lubricant, such as powdered graphite, to the bearings – do not use oil or sprays. These mix with sawdust, forming a gummy paste that can ruin the bearing.



To remove the pitch from a router bit, soak it in lacquer thinner or spray it with oven cleaner. Give the solvent a moment or two to work, then wipe off the bit with fine steel wool.

Using Piloted Bits

A piloted bit has either a ball bearing or a bushing to guide the cut. These pilots follow the surface of the work (or the template) and keep the width of the cut consistent, just like you do when using a base-mounted guide.

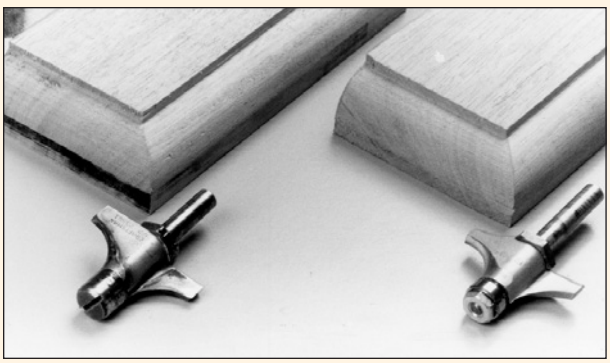
Usually they're mounted to the ends of the flutes, but some are positioned between the shank and the flutes (called "over-bearings").

When using piloted bits:

- Remember that the pilot is meant to follow the contour of the board.

When you set the depth of cut, the pilot must solidly contact the wood surface.

- Anticipate the curves and corners of your work to keep the pilot pressed firmly against the board's edge.
- Treat the pilot as if it was a small straightedge or fence when trying to decide which way to move the router or feed the work. With a hand-held router right-side up, cut counterclockwise around the outside of your workpiece. (With the router mounted upside down in a table, feed the work clockwise around the bit.)
- The diameter of the pilot controls the width of the cut. Some piloted bits have interchangeable pilots for you to change the diameter, but not all do, so make sure you're prepared for this.



For best results, use pilot bearings, rather than bushings or pins, which turn at the same speed as the bit and rub the edge of the workpiece. The friction causes them to heat up and burn the wood. Bearings turn independently of the bit and won't rub or burn the wood.

A BIT OF ADVICE

A router bit consists of a cylindrical shank (usually ¼" or ½" in diameter) and one or more flutes or cutting wings, usually comprised of a piece of carbide brazed to the metal body of the bit. Throughout this series, we will be providing a closer look at a many of the most common (and some specialized) bits that you can use with your router. These four bits are great for making interior patterns.

Round Nose Bit

Provides a perfect radius groove and is most commonly associated with producing fluted millwork, signs and decorative designs in cabinet doors.

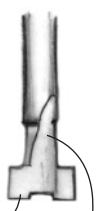
Beading Bit

A bead is different than a roundover in that it has a shoulder that transitions into the round. Used for decorative edges, it can be used on one side (often with a bearing guide) or two sides to make a double bead.

V-groove Bit

This decorative bit allows you to cut deep or shallow grooves by adjusting the cutting depth. Ideal for making signs and adding decorative accents to furniture and plaques.

Keyhole Bit

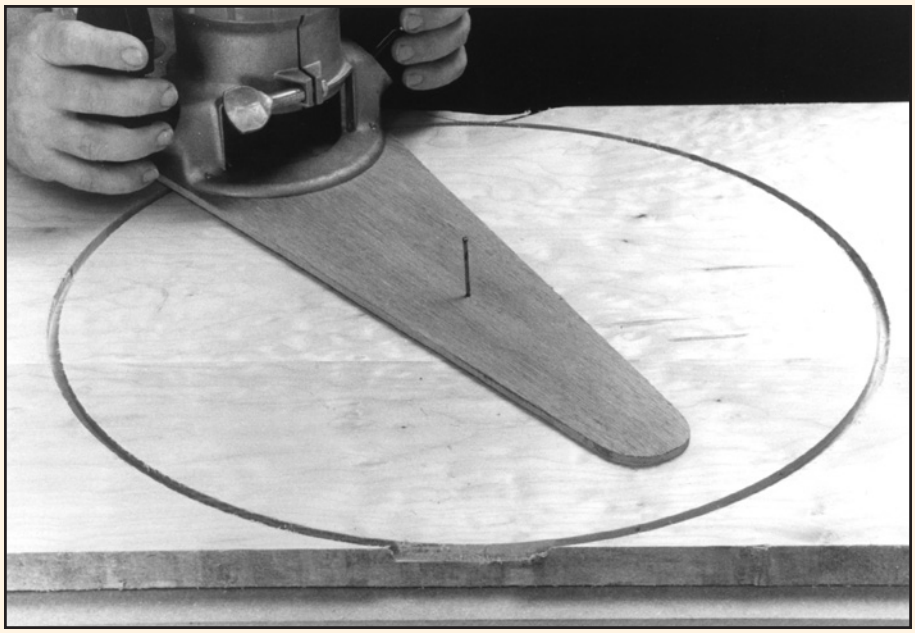


This is a very specialized bit that allows you to cut keyhole openings for hanging pictures and plaques. Perfect for use in plunge routers.

Cuts access hole and space for the nail or screw head

Cuts space for the shank

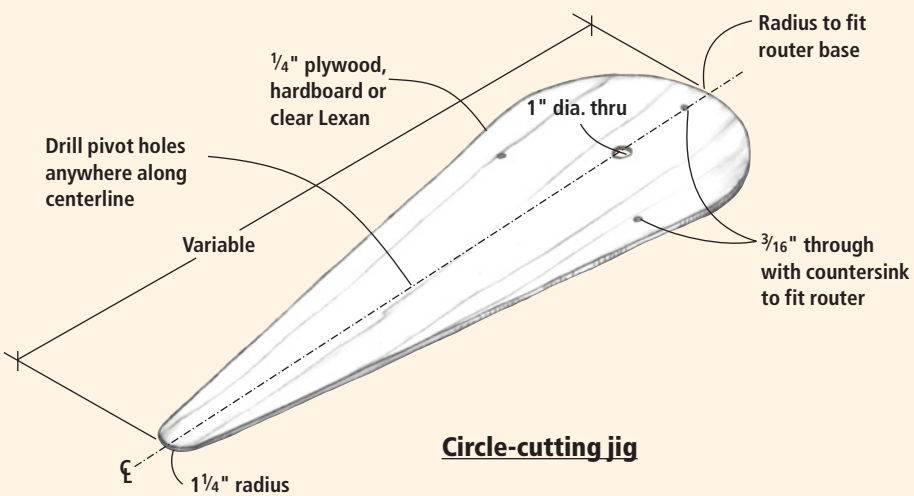
Circle-cutting Jig



The distance from the pivot hole to the nearest edge of the router bit determines the diameter of the circle. Put a scrap of plywood under the workpiece so you don't cut into your workbench.

Many woodworkers use a router, a straight bit and a circle-cutting jig to make circles. And, naturally, there is an easy-to-build and easy-to-use jig that will help you make these perfect pieces. This jig is just an elongated router sole that you can attach to your hand-held router's base. Make the jig from plywood, hardboard or clear Lexan.

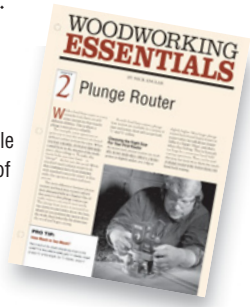
To cut a circle, drive a nail or screw into the workpiece to make a pivot – make sure you drive the pivot nail into the bottom or inside surface of the workpiece, because you don't want the hole to show on the assembled project. Then just drill a hole in the small end of the jig, place the hole over the pivot and swing the router around the pivot.



Circle-cutting jig

Everything you need to know about the router in our special series!

For many woodworkers, one of their first tools is the router, but there often isn't enough instruction about how to use it. This series aims to fix that by giving you everything you ever wanted to know.



Chapter 2
Plunge Router

An in-depth look at versatile plunge routers and loads of information about router maintenance and more.

COMING IN FUTURE ISSUES

Chapter 3
The Router Table

Which routers work best in a table? Plus lots of table tricks.

Chapter 4
Router Joinery

A great tool for joinery, we tell you how to rout all kinds of tight joints.

Chapter 5
Use Your Router to Build Drawers

An excellent application for a table or hand-held router.

Chapter 6
Edge & Surface Treatments

Spice up your projects with these special edge shapes.

Chapter 7
Advanced Techniques

We comb our resources to give you some special tips and projects to work on.

IN PAST ISSUES

Chapter 1
Fixed-base Router

The basics of router set-up and rules every woodworker should know.

Photo by Al Parrish

Table Saw TUNE-UP

For little money down and a few easy installments of elbow grease, you can turn your table saw into a powerful and precise cutting machine.

Do you suspect that your table saw isn't producing the kind of quality of work that it should? Are you getting rough, burned cuts that aren't perfectly straight or square? Does your saw vibrate or bog down? Do you suffer from "kickback anxiety?"

If so, you're not alone. The truth is that most table saws are not operating as well as they should. In fact, many miscuts and accidents are caused not by operator error, but by poorly set-up, ill-equipped machines. We're not talking just about old ones – you can't trust a brand-new saw to be tuned up and aligned properly.

But not to worry: Tuning up your table saw isn't difficult, and it can make a world of difference in the quality and enjoyment of your woodworking. In just a few simple steps, you'll learn how to fine-tune your

by Paul Anthony

Paul Anthony is a 10-fingered woodworking author and teacher living in Riegelsville, Pennsylvania. Anthony will give seminars on table saw tune-up and techniques at the WoodWorks 2003 shows in Indianapolis; St. Paul, Minn.; Fort Washington, Penn.; Columbus, Ohio; and Springfield, Mass.

Photos by the author

None of the tools needed to tune up your table saw are expensive. Here I'm checking the parallelism of the fence to the miter gauge slots using a $14 dial indicator.

saw to bring out its maximum potential. All the adjustments described here apply to portable "benchtop" saws, contractor saws and cabinet saws.

You might not need to perform all the adjustments we talk about here because you may find that in some cases, no fix is necessary. But to be on the safe side, you should perform all the checks to determine where you may have problems. And please be sure to unplug your saw before you start.

Arbor, Bearings and Flange

The first thing to check is the integrity of the blade arbor and bearings. Firmly pull up and down on the arbor shaft, then try to push it in and out. There should be no play in the shaft and no clunking sounds. Also, turn the arbor slowly by hand while listening for any grating sounds that may indicate worn bearings.

A loose arbor or worn bearings are unlikely except on old saws. But mistakes can happen. If your saw has this problem, you'll have to replace the bearings to correct it – a fairly major repair. There's little sense going ahead with the tune-up until that is fixed because you'll get rough cuts from the resulting slop in the blade.

Once the arbor is OK, check the arbor flange for runout (wobble caused by a flange that isn't flat). Whatever runout exists in the flange translates to increased runout at the blade's perimeter. For example, .001" (one-thousandth of an inch) of runout at the edge of the flange can result in several thousandths of an inch of runout at the rim of the blade.

No flange is perfectly flat, but you'll want to make sure yours is within acceptable limits. The best manufacturers aim for less than .001" of runout. To check the runout, you'll need a dial indicator and some way to secure it in place near the flange (See "Dial Indicators" on page 60). The easiest way to do this is to use a magnetic base, but you also could screw the indicator to a length of wood clamped to your table.

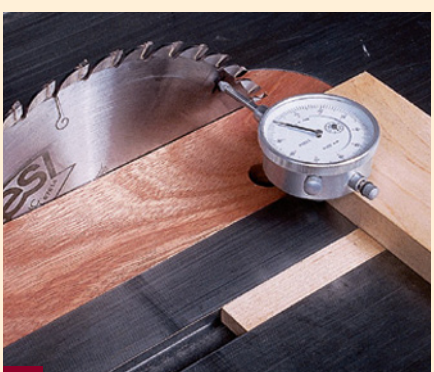
Remove the saw blade, then crank the blade carriage to 45°. Use steel wool to clean any crud from the flange, then position the dial indicator near the perimeter. "Pre-load" the plunger by applying enough pressure against the flange to ensure it will maintain contact throughout rotation, as shown on the previous page.

To measure the runout, turn the arbor slowly by hand while watching the movement of the dial needle. If the runout is excessive, sorry about your luck; it's not a simple repair. You'll have to either live with it or replace the arbor, which is a lot of work.

Align the Blade & Table Slots

For clean, accurate crosscuts, your workpiece must travel exactly perpendicular to the blade. Otherwise the front and rear teeth attack the piece at an angle – a condition called "heeling," which results in rough cuts that may be out-of-square. To correct this, the miter gauge slots must be aligned exactly parallel to the blade.

CHECKING PARALLELISM OF BLADE TO TABLE SLOTS



1 Mark the blade and rotate it fully forward to pre-load the dial indicator plunger against it. Then zero out the dial indicator.

2 Rotate the blade mark to the rear, then slide the dial indicator back until the plunger rests against the mark.

3 As a low-tech alternative to a dial indicator, you can use an automotive feeler gauge to check the gap between the blade and a screw driven into the jig.

The easiest and most accurate way to check this is to use a dial indicator screwed to a simple shop-made, cross-shaped jig that rides in the miter-gauge slots (see "Checking Parallelism of Blade to Table Slots" on the previous page). The jig consists of a ¾"-thick crossbar glued to a hardwood runner that fits snugly in the slot with no side-to-side play.

Wax the runner, as it needs to slide to take the measurement. If you're one of the lucky few whose stock miter-gauge bar fits snugly in its slot, screw the dial indicator to a stick clamped to the miter-gauge head. Then position the dial indicator on the crossbar so the plunger is slightly preloaded against the blade.

Raise the blade all the way. Make a mark on the blade body behind a tooth. Rotate the blade so the mark is 1" above the table. Place the plunger against the mark and zero out the dial indicator by rotating the dial face to align the "0" increment with the needle.

Rotate the saw blade so your mark is 1" above the table at the opposite end of the blade. Position the dial indicator against the mark there and note the difference in measurement from the first location. The reason for rotating the blade like this is to eliminate any blade warp from the equation.

A low-tech alternative to using a dial indicator is to use a roundhead screw and an automotive feeler gauge. Drive a 1½" x #8 roundhead screw into the end of the crossbar, which should extend to within about ¾" of the blade. Adjust the screw in or out so it's about .005" from the blade. Using the feeler gauge, measure the gap, positioning the screw at two points as before. If the difference exceeds .003", you should adjust for parallelism.

To make the adjustments on a contractor saw or a portable saw, you'll need to change the position of the trunnions, which are bolted to the underside of the table. Loosen all four trunnion bolts, leaving one of the bolts in the front trunnion snug but not tight. This is your pivot point.

Next, use a plastic or rubber mallet to tap the rear trunnion bracket right or left as necessary to bring the blade in alignment with the miter gauge slots.

Making the adjustment on a cabinet saw is easier because the trunnions are attached to the cabinet itself. Therefore, all you have to do is loosen the four bolts that attach the saw table to the corners of the cabinet, then shift the table by tapping it with a mallet.

When retightening the bolts, snug them up gradually in turn. If you fully tighten one bolt at a time, you risk shifting the trunnions or tabletop. Be sure to recheck the parallelism after tightening all the bolts.

This can be a fussy procedure and it may take you a while to make the measurements match at the front and rear of the blade. But be patient – it's worth it. Your cuts will improve and you should only have to do this once. (If you intend to clean the internal mechanisms of a cabinet saw, you may want to adjust for parallelism after cleaning the interior, as removing the top allows for the best access to the internal mechanisms.)

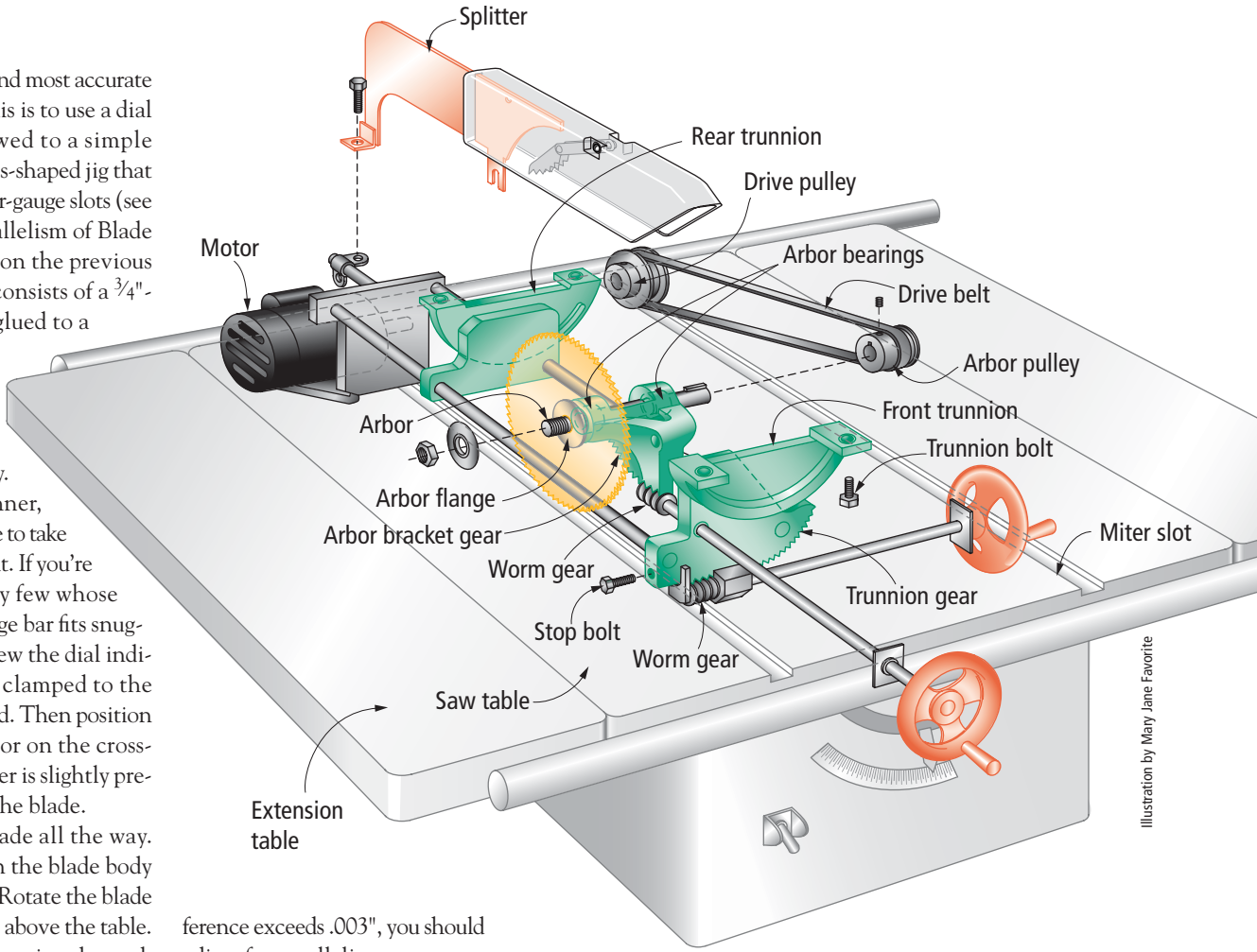


Illustration by Mary Jane Favorite

INTERNAL MECHANISMS OF A CONTRACTOR'S SAW

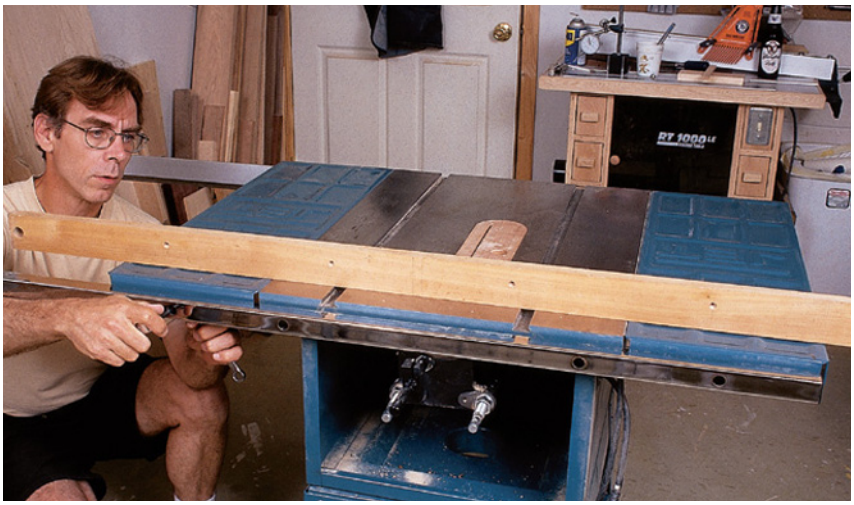
Regardless of the type of table saw, the internal mechanisms are basically the same. The blade carriage consists of a pair of tilting trunnions and an arbor bracket that raises and lowers the blade. On contractor saws and portable saws, the trunnions attach to the saw table. On cabinet saws, they attach to the cabinet.

Cleaning Out the Internal Mechanisms

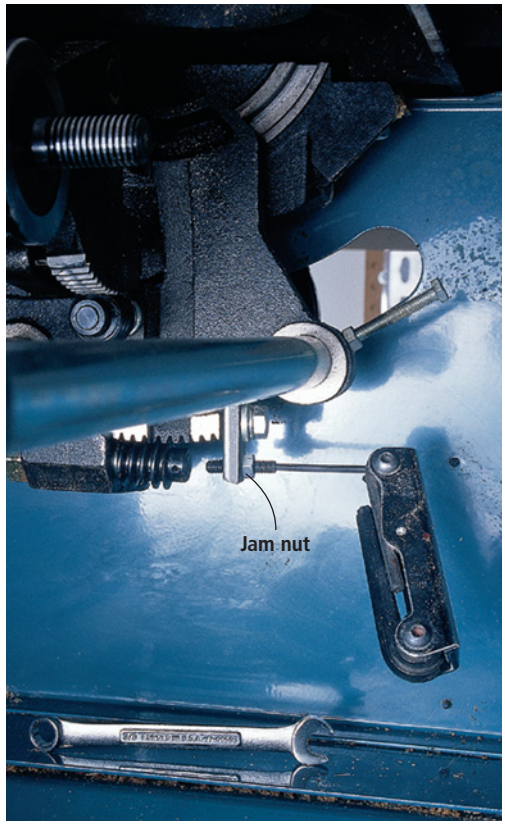
For the easiest and most accurate operation of your saw, the pivot points, trunnions and gears need to be cleaned, lubricated and kept free of oily sawdust that can gum up the works.

Begin by blowing out the interior of the saw using compressed air if you have it. If not, brush away the sawdust as much as possible. To access the internal parts on a contractor's saw, remove the motor and lay the saw on its side or upside-down on a low bench.

The easiest way to get to the guts of a cabinet saw is to remove



A long jointed board serves as a great straightedge to help you level the extension tables.



Adjust the blade angle stop by loosening its jam nut, then turning the screw in or out as necessary. After retightening the jam nut, make a test cut.

the saw table. But if yours is aligned to the blade, you may not want to do this. Instead, work through the access door below. You can temporarily remove the motor to get it out of the way.

Use mineral spirits to clean away dirt and grease. To clean the gear teeth, I use a stiff-bristle toothbrush, continuously dipping it in mineral spirits. To expose the trunnion brackets for cleaning, crank the blade carriage all the way one direction, then the other.

Use a thin penetrating oil, such as WD-40, to lubricate the arbor shaft, the arbor bracket pivot and the points where the handwheel shafts enter the cabinet walls. Don't use oil on the gears or trunnions, as it can collect sawdust. Instead, use a silicone-based lubricating spray or similar product. Graphite also works well. Avoid getting lubricant on the belts or pulleys.

Improve Extension Tables and the Throat Plate

Level the extension tables using a straightedge. First flush up the joints where the side extensions attach to the table. Then make sure the far ends of the extensions are level with the main table.

On a typical contractor saw, the extensions usually are bolted to the saw table and the fence rails. If necessary, just loosen the bolts, level the extension and retighten the bolts.

The solid cast-iron extensions on cabinet saws typically are bolted only to the main table. If an extension droops at its outer edge, raise it the necessary amount by inserting a couple of shims at the underside of the joint. You can make your own shims from paper, plastic or even from aluminum cut from soda cans. If the outer edge of the table is too high, just insert the shims inside the joint near the top edge.

If you use an outfeed table behind your saw, make sure it's set about ⅛" below the surface of the main table to prevent a workpiece from catching on it. Use your long straightedge to ensure that the entire surface of the outfeed table is parallel to, but below, the main table. I drove ½"-diameter lag screws into the bottoms of my outfeed table legs to allow perfect leveling all around.

Adjust the height of your throat plate using its leveling screws. Lay a small ruler or other short

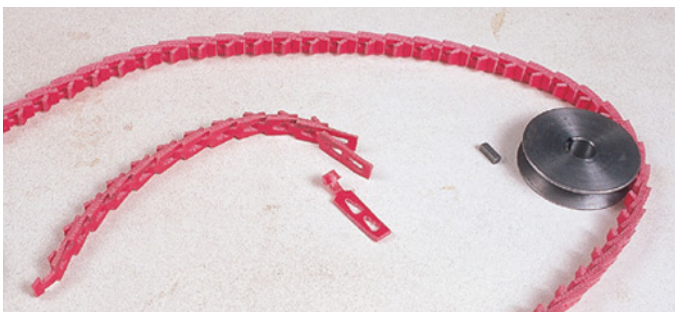
DIAL INDICATORS

When it comes to checking the accuracy of your table saw, drill press, jointer or other machines, it's hard to beat a dial indicator. This simple tool consists of a spring-loaded plunger whose in-and-out movement is indicated by thousandths of an inch on the face of the dial. It can be used to determine the concentricity of shafts, flanges, blades and drill press chucks, as well as the height of jointer and planer knives.

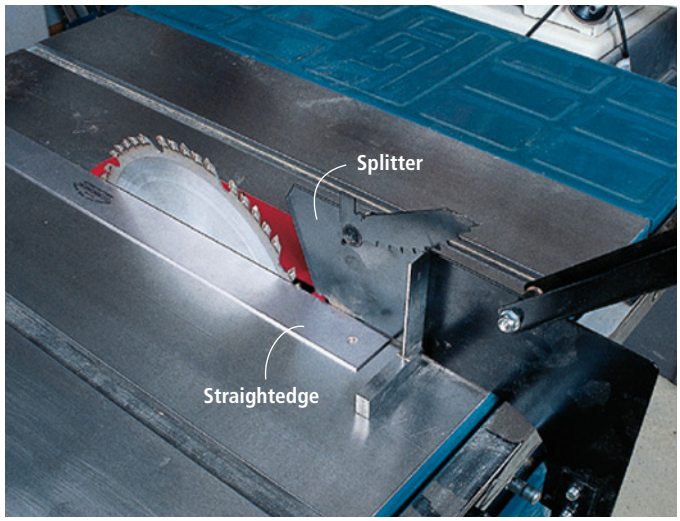
To use the tool, fix it in place next to the part you're measuring. A lug on the back allows for attachment to an adjustable boom arm on a magnetic base for convenient use on metal surfaces. Alternatively, you can screw through the lug hole into an appropriately sized piece of scrap wood that you have clamped in place.

You don't need an expensive dial indicator to measure most equipment. You can get a 2¼"-diameter dial indicator with 1" of travel for $12.95 from Grizzly Industrial (800-523-4777 or grizzly.com – item #G1479). You should get a magnetic base, too, because of its convenience. Grizzly sells a good-quality combination kit that has both a dial indicator and nice magnetic base for just $19.95 (item #G9849). It's a small price to pay for accuracy.

A 45° drafting triangle, which you can find easily and is affordable, is a great tool for adjusting blade tilt stops.



Replacing the stock rubber belts on a contractor's saw or cabinet saw with a link belt (available from Woodworker's Supply, 800-645-9292 or woodworker.com) can reduce vibration, as can replacing die-cast pulleys with machined ones.



To align a splitter, place a straightedge against the teeth on the right side of the blade, then adjust the splitter side-to-side to bring it against the straightedge. Use a small square for vertical alignment.

straightedge over the plate opening as you make the adjustments. Better yet, make yourself a zero-clearance throat plate. *[Editor's note: For details, check out "Tricks of the Trade" on page 18.]* This will minimize exit tearout and prevent narrow strips of wood from falling into the saw.

Adjust the Blade Angle Stops

Most saws include adjustable stops for setting the blade at 90° and 45°. These stops typically consist of a bolt or screw that is locked in position with a jam nut. Refer to your manual for the location of the stops on your saw. If you don't have a manual, don't worry – the stops should be evident when you crank the blade over.

Begin by measuring cuts made on a piece of thick scrap about 18" long that you've dressed straight and square. This is a better initial test than measuring the angle of the blade to the table.

To check the 90° position, make sure the blade is vertical and fully cranked against its stop without using excessive pressure. Using your miter gauge, crosscut about ¼" from each end of the test piece. Don't simply shave a slight bit from the end, as this can cause the blade to deflect slightly, yielding an inaccurate cut.

Next, check the cuts using an accurate square. Don't trust your store-bought combination square; it's likely not very accurate. You can buy a good 4" machinist's square for about $10 from many woodworking supply catalogs.

If neither of your test cuts are square, you need to adjust the blade stop. Loosen the jam nut on the stop and place an accurate square on the saw table against the blade. Drive the stop screw in or out as necessary to correct the blade angle, then crank the carriage against the stop again and recheck the blade angle with the square. When the stop is set correctly, tighten the jam nut. Then make another test cut.

To check the 45° stop, crank the blade carriage against its 45° stop and cut a bevel on each end of your test piece, feeding the workpiece with your miter gauge. If you don't have an accurate miter square to check the cuts, you can place two bevel cuts together and check the resulting 90° angle with a regular square. If the bevels aren't accurate, adjust the 45° stop in or out in the same manner as before. To set the angle of the blade, I use a 45° drafting triangle.

Reduce Vibration

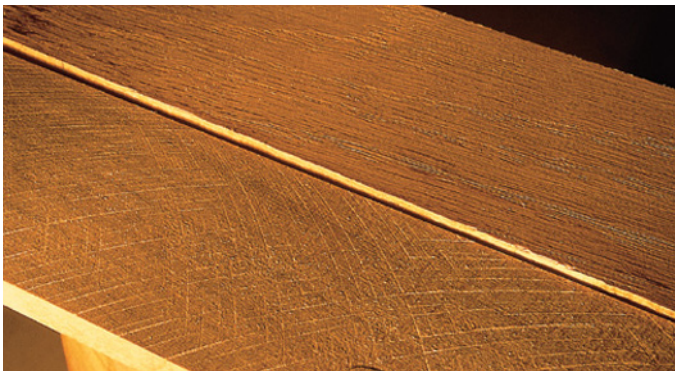
Misalignment of the arbor and motor pulleys on a contractor's saw can cause vibration and power transmission loss. To check the pulley alignment, hold a straightedge against the outer faces of the pulleys to make sure they're in the same plane. If necessary, adjust the motor position to bring them in line with each other. Don't try to correct the problem by simply moving the motor pulley to the end of its shaft, as this can strain the shaft.

Excessive saw vibration often is the result of "belt slap" caused by the rubber drive belt's "memory" of its oblong packaged shape. Replacing the rubber belts with "link" belts greatly reduces vibration on contractor's saws and cabinet saws. The die-cast pulleys that are included with contractor saws can cause vibration because of non-concentricity. They can be replaced by machined steel pulleys available from most supply catalogs.

Also, if your saw isn't standing solidly on the floor, shim it as necessary to prevent rocking.

Align the Splitter

A properly aligned splitter is an absolute necessity to prevent kickback, which is the primary cause of table-saw accidents. Kickback is the result of the workpiece wandering away from the fence and into the rising rear teeth of the blade, then being thrown upward,



A properly adjusted fence will result in a cut with cross-hatched tooth marks. The board in front was cut with a 24-tooth rip blade. The board in back was cut with a premium-quality 40-tooth blade.

After adjusting the miter gauge square to the blade, set the stop on the gauge for accurate repeatability. A sandpaper-faced auxiliary fence allows for greater control when crosscutting.

over the blade. A properly aligned splitter denies the workpiece access to the rising rear teeth, effectively preventing kickback.

It's no secret that stock splitters are a pain. They don't remove and attach easily. A variety of easily removable aftermarket splitters are available for many saws and are a great improvement.

Regardless of the type of splitter that you use, it needs to be properly aligned. Place a good straightedge against the right-hand face of the teeth, then align the splitter against the straightedge. Use a small square to ensure that the splitter is square to the tabletop, too.

Align the Rip Fence and Miter-gauge Stops

For clean rip cuts, the rip fence must be adjusted parallel to the blade. Measure this parallelism using your dial indicator jig.

Place the jig in the left-hand miter gauge slot, with the fence to the right of the jig. Bump the fence against the plunger slightly to pre-load it. Now slide the dial indicator jig to the front of the saw table and zero out the mechanism. Then slide the jig to the rear of the table to compare the measurements.

Align the fence to the table slots using whatever adjustment mechanism your particular fence incorporates. As a test, rip a length of wood, then inspect the cut edge under a strong sidelight.

The cut should show intersecting arcs from the saw blade's teeth. If the arcs run in only one direction, that means that your fence is not in proper alignment.

With the fence adjusted, turn your attention to the miter gauge. For accurate crosscutting with a miter gauge, its bar must fit snugly in the table slots with no side-to-side play. The miter gauge head also must be aligned perfectly square to the blade.

The time-honored trick that I use most often to correct the fit of a loose bar is to dimple its edges with a metal punch to expand the metal a bit. If you pound too aggressively, causing the bar to stick in its slot, you can simply file back the edges to fit.

Once the bar fits well, just use a drafting triangle to set the head so that it is perpendicular to the blade. Then adjust the 90° stop on the miter gauge head. You also can use the triangle to set the 45° angle stops.

Work Surface Maintenance

Clean the saw table and fence rails with mineral spirits. Scrub away any light rust using fine steel wool lubricated with mineral spirits. For heavier rust, use the finest grit of silicon carbide wet/dry paper possible, again lubricated with mineral spirits.

After wiping away the mineral spirits, apply a coat of paste wax to the tabletop, the rails and any areas where the fence contacts the rails. Also wax the faces of the saw's fence.

After the wax hazes, buff it well with a soft, clean cloth. I've tried various sprays marketed as a protectant for machine surfaces and they seem to work fine. However, I've not found them to be any better than paste wax. **PW**

THE IMPORTANCE OF GOOD BLADES

Just as you wouldn't mount cheap tires on a Ferrari, you don't want to use a second-rate saw blade if you're looking for ultimate performance from your saw. Even a perfectly tuned saw will not yield excellent cuts when outfitted with a poorly manufactured blade.

Without getting into the intricacies of design, a premium blade is made from a flat plate with very little warp, or "runout." The best manufacturers maintain a maximum .002" runout tolerance on a 10"-diameter blade. Slowly rotate the blade against a dial indicator to check runout.

The teeth are precisely ground from fine-grain carbide and the arbor hole is machined to an accurate diameter, preventing galloping on the arbor. Expect to spend about $60 to $100 for a good-quality 40-tooth all-purpose blade that will do a fine job when ripping or crosscutting most woods you'll use.

To produce the best cuts, clean your blades regularly to keep them free of pitch, which can overheat and burn your wood. I use a citrus-based cleaner/degreaser available at most home supply stores. Just spray or brush the cleaner on the blade, let it sit for a few minutes, then lightly scrub away the softened pitch with a brass-bristled brush.

Forrest Blades

Quality Blades for America's Craftsmen

Serious woodworkers demand perfection. That's why so many of them choose Forrest saw blades.

Forrest quality is legendary. Our proprietary manufacturing process, hand straightening, and unique grade of C-4 micrograin carbide give you smooth, quiet cuts without splintering, scratching, or tearouts. In fact, independent tests rate our blades as #1 for rip cuts and crosscuts.

Forrest saw blades are simply the best that money can buy. They're made in the USA by the same family-owned business that's been producing and sharpening them for over 55 years. And they're backed by a 30-day money back guarantee. It's no wonder that serious woodworkers give them such high praise!

"Your blades are without question the best by miles, and I have tried them all."
Bob Jensen–Fridley, MN

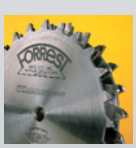
"These are the finest blades I have ever owned and you should be proud of your quality product."
Patrick T. Hankard–South Windsor, CT

"[Forrest blades] cut true, with no vibration. I was a carpenter by trade for over 60 years and continue to be an active woodworker. So, I can say with confidence that Forrest blades are the best."
Carl Stude–Burbank, CA

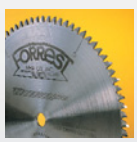
The message is clear. If you're looking for quality, performance, and value, it pays to choose Forrest blades every time.

Our Most Popular Blades:

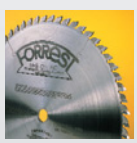
Woodworker II – This award-winning, all purpose blade is the finest of its type. It turns big jobs into easy-to-handle ones.



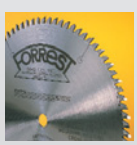
Dado-King – The world's finest multi-tooth dado set. It works effectively in all directions—with the grain or across it.



Chop Master – Produces perfect miters every time—with no bottom splinters. You get smooth edges on all types of wood.



Woodworker I – Great for table and radial saws. It trims and crosscuts all woods up to 2" and is ideal for plywood.



Duraline Hi A/T – Our best blade for birch and oak ply veneers. It also delivers a clean cut on melamine and vinyl over particle board.

Forrest blades come in a wide variety of sizes and are available for practically every application. Call or send for our complete list of products.

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We back our blades with a 30-day money back guarantee. So, choose the method most convenient for you and order today:

- **Visit one of our fine-quality dealers or retailers.**
- **Call us toll free at 1-800-733-7111.** (In NJ, 973-473-5236) Ask about special discounts, free shipping on orders over $275, and discounts for blade sharpening.
- **Contact our internet store:** www.stores.yahoo.com/forrestman

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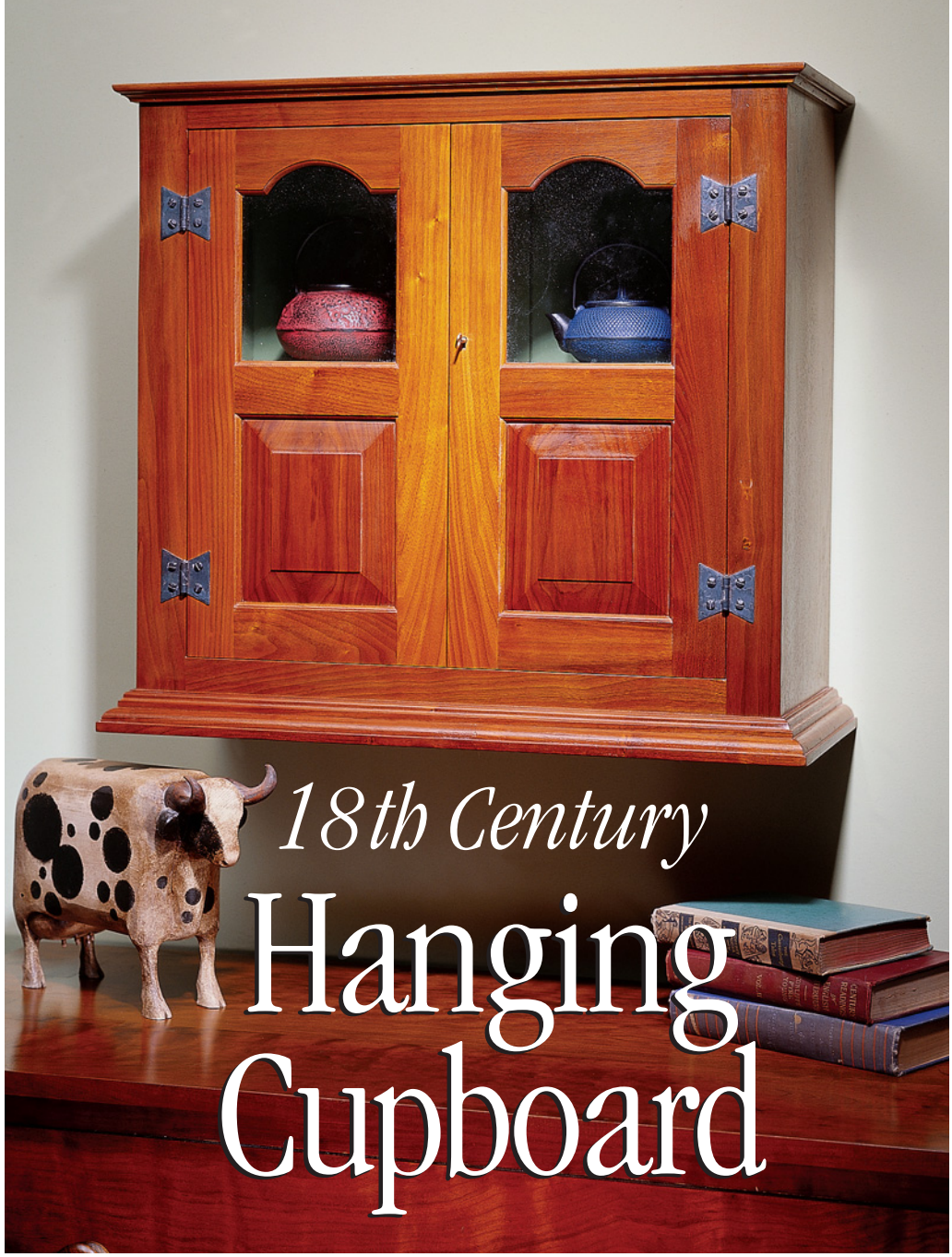


Photo by Al Parrish

18th Century Hanging Cupboard

Mix a basic design with some ambitious details and you have a great project for any skill level woodworker.

This piece first caught my eye a few years back. I was particularly captivated by the tombstone style of the doors (the arched glass panels) that draw you to the display area behind – perfect for showing off one or two prized antiques.

Believed to be from the first half of the 18th century (circa 1730), this wall cupboard has a revered history. Although this is a rather beautiful piece, it appears to be one of a kind.

The simplistic design and some challenging construction details make this a piece that you will want to create, but this project requires a certain amount of skill. The joinery is traditional, using through-dovetails, mortise-and-tenon joints, some haunched tenons, a couple of raised panels and a few rabbets tossed in for good measure.

If you're well-versed in these techniques, you'll have no problem. If you've been looking for an opportunity to try some new techniques, this can be a valuable learning project.

Dovetailing the Carcase

Start the cabinet by selecting your wood. The cabinet shown here is solid walnut, with the exception of the backboards, nailing strips and shelf. The widest lumber needed is 9¼", so if you're a careful shopper you may be able to make the piece without having to glue up any boards. If not, choose your wood carefully, matching grain and color to make your cabinet as dramatic as possible.

The case is assembled with through-dovetails at the corners. It's up to you to decide which method you use to complete the dovetails, but I opted to go the hand-cut route.

If you look closely at Photo 1, you'll see that I've actually thinned down the pins on the top and bottom pieces to ⅝" and made a rabbet on the inside surface of both the top and bottom that is the length of the pins. I do this for two reasons: When I apply the mouldings to the case, they traditionally cover the dovetail. With a smaller piece such as this

by Glen Huey

cupboard, a full ¾" revealed dovetail forces the moulding to overlap the sides by almost an inch. I can make the moulding more delicate-looking by reducing the thickness of the pins. In addition, adding the rabbet makes this strong joint even stronger.

Cut all your dovetails and test-fit the pieces, but don't assemble the case. You still need to cut rabbets in both sides of the case to accept the 7/16"-thick backboards. You could cut rabbets in the top and bottom to house the back, but I opted to add backboard nailers. They give you more room to attach the backboards and double as hanging strips when mounting the cupboard to your wall.

Before assembly, use the illustration to locate the dado position for the shelf. The rabbets and dados can be made on the table saw or with a router and guide, as I've done in Photo 2.

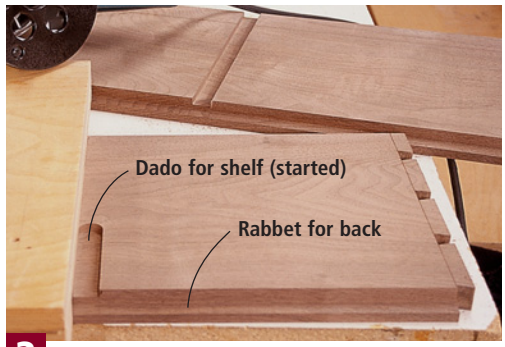
Traditional Face Frame

While the dovetailed box is likely stout enough, the design of this cabinet calls for a face frame applied to the carcase. The face frame serves two functions: it keeps the box square and it adds extra strength and rigidity. After all, it holds heavy dishes, right?

The best way to make the frame strong and square is by using mortise-and-tenon joints at the corners. I cut ⅜"-thick x 1"-long tenons on the face frame rails (1⅛"-wide for the top rail and 2¼"-wide for the bottom rail). Mill the mortises in the stiles and assemble the face frame.

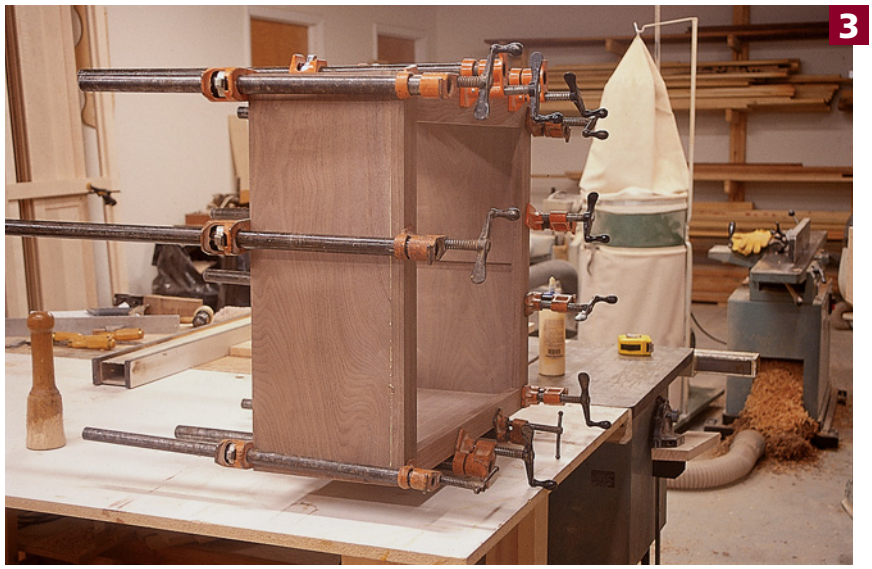
With the face frame assembled and sanded, simply apply some glue to the front edge of the carcase and clamp the frame in place, as shown in Photo 3. The frame should be flush to the cabinet on all four edges. Check to make sure the cabinet is square while clamping up the front.

1 Using the pins, lay out and then cut the corresponding tails into the side pieces.



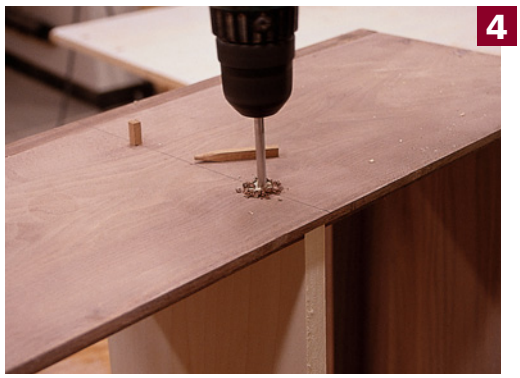
2 With your dovetail joints complete, cut the ½" x ½" rabbet for the backboards, then locate and create the ¼"-deep x ¾"-wide dado for the shelf. Once you have these complete, you should be able to assemble the dovetailed box.

Step photos by the author



3 Using glue and plenty of clamps, attach the face-frame assembly to the dovetailed box.

When the clamps come off the case, slide the shelf in from the back of the cabinet and lock it in position by drilling ¼" holes through the sides into the shelf, then pegging the shelf with ¼" square pegs, seen in Photo 4. Add a little glue for good measure.



4 Slide the shelf into place and, using ¼" square pegs, affix the shelf. I prefer to use red oak for the pegs.

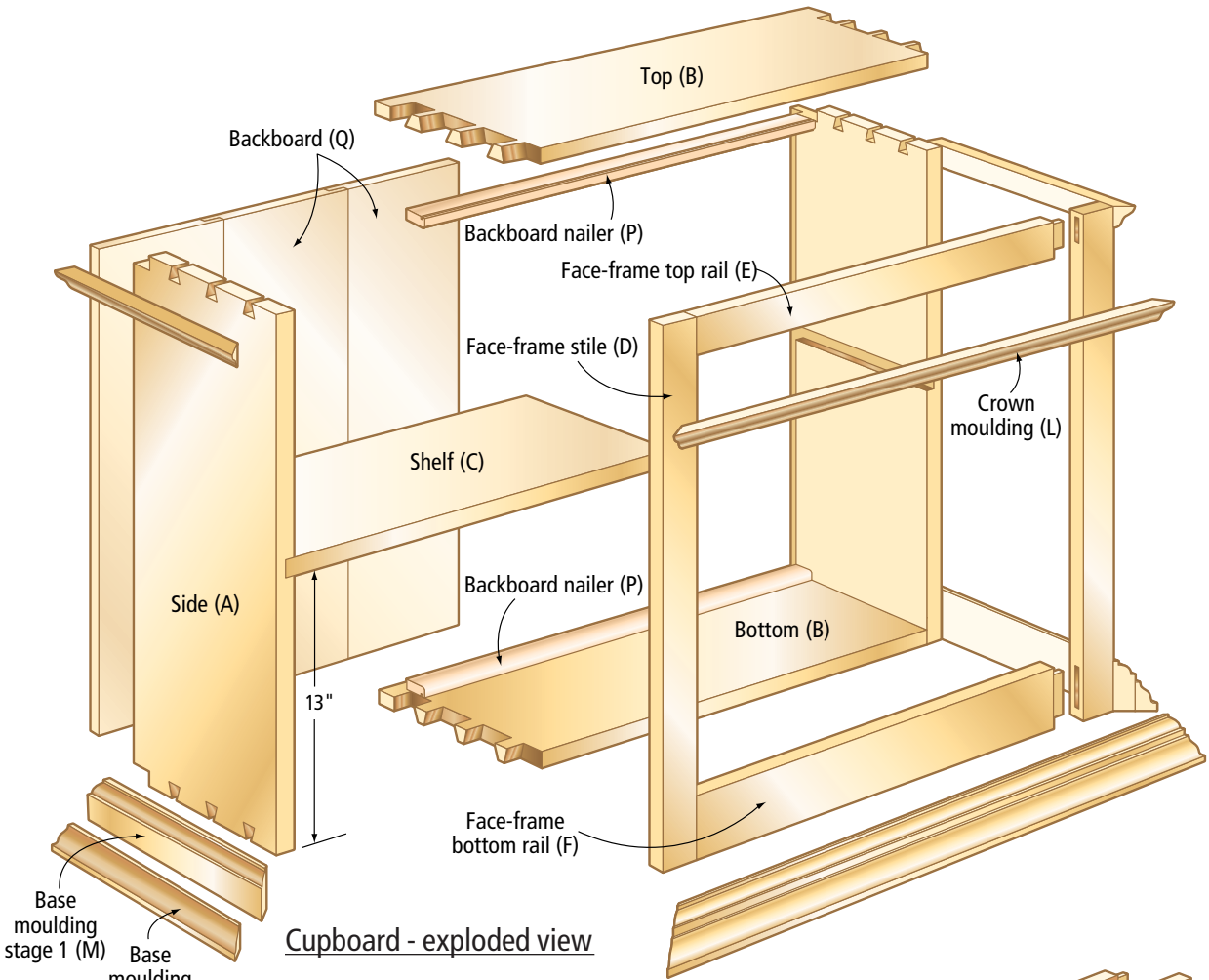
Making Fancy Doors

The doors on this cupboard really make the piece, so it's not too surprising that there's a lot of work involved to get them just right. Start by milling all the pieces to size as given in the cutting list.

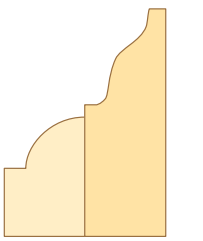
Essentially, the door is a mortise-and-tenon frame similar to the face frame on the carcase, but because of the middle rail and the coped moulding on the inside edge of all the door pieces, some extra steps are required.

After milling the pieces, set aside the top rail for each door. These two pieces need to be cut for the cathedral opening before you go any further. Use the illustration to lay out the radius, then cut and sand the shape.

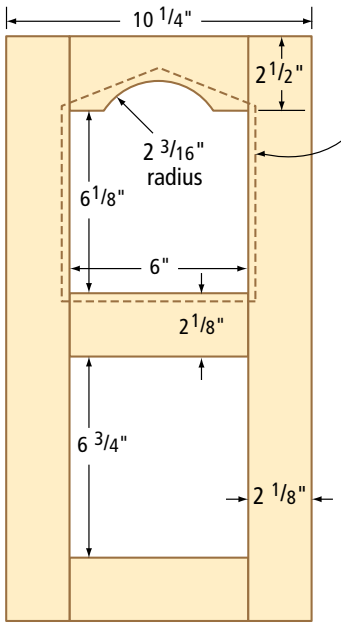
Now it's mortise-and-tenon time. Refer to the illustration to mark, then cut the mortises for the three rails in each stile. With



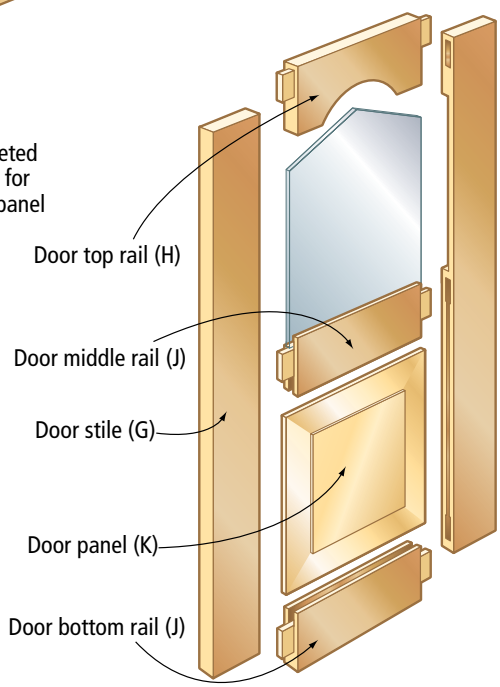
Cupboard - exploded view



Moulding profiles



Door elevation



Door - exploded view

Illustration by Len Churchill

the mortises cut, use a 3/16" roundover bit to shape the front inside edge of the door pieces, then head back to the saw.

Because of the roundover detail, the stiles need to be trimmed flat at the roundover to make the appropriate mating point with the rails. Follow Photos 6, 7 and 8 to first notch the stiles at a 45° angle, then trim the roundover from the stiles.

The tenons on the rails are next. Use the mortises in the stiles and the illustration at left to lay out the tenons, then follow Photos 9 and 10 to create them. Don't forget that the top and bottom rails will require haunched tenons to hide the groove for the panel you'll cut next.

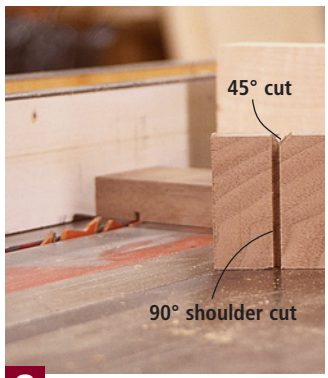
The grooves for the glass in the upper section and for the panels in the lower sections are 1/4" wide x 3/8" deep. They run on the inside edge of all rails and stiles and on both edges of the center rails.

The door panel is best cut to fit the actual doors, so go ahead and dry-fit the doors, fine tuning

5 Cut the door pieces to size, lay out the radius on the top rail and create the tombstone effect. To do this, you will want to use a 3/16" roundover bit on the inside edges of your pieces, making sure to run both edges on the middle rail of each door.

6 Set the saw blade to 45° and cut to the shoulder of the roundover location. There is one cut each for the top and bottom rail and two cuts for the middle rail. The area for the middle rail is nibbled away and cleaned up with a chisel.

7 Use a tenoning jig to remove the waste material where the top and bottom rails meet the stiles.



8 Create the same 45° cut in each rail at the required location, then reset the blade to 90° and complete the cut that defines the shoulders.

18TH CENTURY HANGING CUPBOARD

	NO.	LETTER	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
Case								
❑	2	A	Sides	3/4	9 1/4	24	Walnut	1/4"-deep shelf dado
❑	2	B	Top and bottom	3/4	9 1/4	24 1/2	Walnut	
❑	1	C	Shelf	3/4	8 3/4	23 1/2	Poplar	
❑	2	D	Face-frame stiles	3/4	2	24	Walnut	
❑	1	E	Face-frame top rail	3/4	1 5/8	22 1/2	Walnut	1" TBE
❑	1	F	Face-frame bottom rail	3/4	2 3/4	22 1/2	Walnut	1" TBE
Doors								
❑	4	G	Stiles	3/4	2 1/8	19 5/8	Walnut	
❑	2	H	Top rails	3/4	2 1/2	8 1/2	Walnut	1 1/4" TBE
❑	4	J	Middle and bottom rails	3/4	2 1/8	8 1/2	Walnut	1 1/4" TBE
❑	2	K	Panels	5/8	6 5/8	7 3/8	Walnut	5/16" TAS
Mouldings								
❑		L	Crown moulding	3/4	3/4	5 lf	Walnut	
❑		M	Base moulding, Stage 1	5/8	1 3/4	5 lf	Walnut	
❑		N	Base moulding, Stage 2	5/8	1	5 lf	Walnut	
❑	2	P	Backboard nailers	5/8	1 3/4	22 7/8	Poplar	
❑	1	Q	Backboard	7/16	24	22 1/2	Poplar	Multiple pieces
❑	1	R	Door catch	1/2	3/4	3		
❑	1	S	Lock catch	1/4	3/4	2		

Note: TBE = tenon both ends; TAS = tenon all sides; lf = lineal feet.

SOURCES

Horton Brasses
800-754-9127 or
horton-brasses.com
2 • pairs of 2" x 2" wrought-iron butterfly hinges #HF-12, $29/pair
1 • Brass half-mortise cabinet lock #LK-9, $9
1/4 lb. • 1 1/2" clout nails #N-7, $2

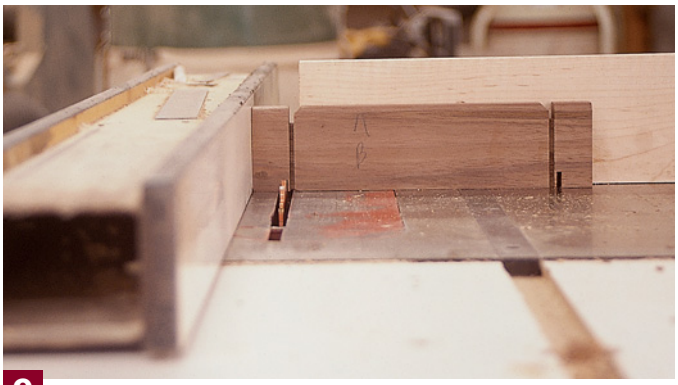
Bendheim Restoration Glass
bendheimrestorationglass.com
800-221-7379 (East)
800-900-3499 (West)
2 • pieces of full-restoration glass, cut to fit

Olde Century Colors
800-222-3092 or
oldecenturycolors.com
1 qt. • Brierwood Green acrylic latex, $13.60

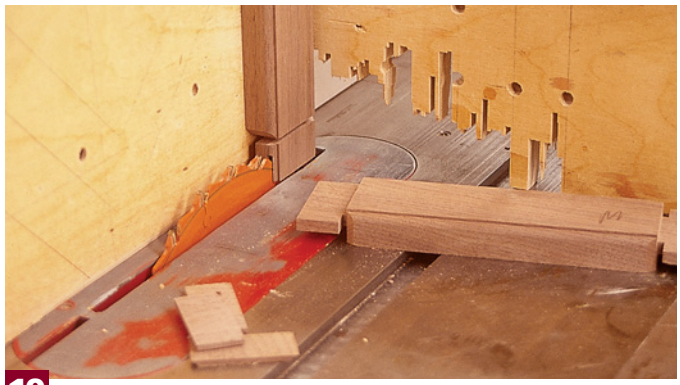
Woodworker's Supply
800-645-9292 or
woodworker.com
1 • Button lac shellac #848-824, $18.99

Woodcraft
800-535-4482 or
woodcraft.com
1 • Behlen Wool-lube #18y61, $6.99

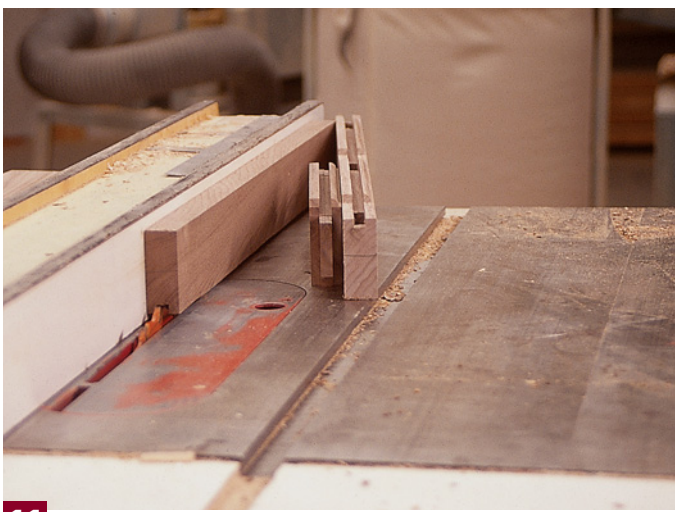
Prices as of publication deadline.



9 Next, adjust the blade height to 3/8" and make the cut that defines the shoulders, remembering that this is a haunched tenon (offset the tenon by 3/8").



10 Return to the tenoning jig to complete the cuts for the tenon.



11 With all the mortises and tenons finished, set the blade to cut a 1/4"-wide x 3/8"-deep groove on the inside of all pieces and on both sides of the middle rail.

12 Dry-fit the door pieces and make any necessary adjustments. Take the measurement for the panels and cut them to size, adding 5/16" on all sides. Moving the fence to the left side of the blade, set the blade angle to 12° and make the cut that creates the raised-panel effect. You can see that I raised the blade through a scrap of plywood for safety. The lower edge has to be able to fit into the 1/4" groove created in the stiles and rails, and not fall into the saw's throat plate.

the joints as you go. Then take the measurement for the panel sections and add 5/8" to both dimensions to accommodate for the panel's "tongues." Cut the panels to size, then set your table saw blade to a 12° angle. Run all four edges of the panel to form the "raised" effect.

Glue up the doors (without putting glue on the panels; they need to float in the grooves to allow for wood movement from humidity). Once the glue is cured, use the illustration and Photo 13 to help you rout the back of the doors for the glass. Essentially you're making a rabbet to fit the glass into, but rather than go to the trouble of shaping the glass to fit the cathedral opening, straight lines are used.

With the glass space routed in the doors, you can now move on to the rest of the project. The glass can be installed after the finish is applied. Use either a water putty to glaze the panes of glass in place or strips of wood nailed in behind the glass.

Trimming Out the Cabinet

With the doors complete, turn your attention back to the cabinet to add the trim. The lower trim is a two-piece moulding, held flush to the bottom of the cabinet, while the upper moulding is a single detail piece.

Take a look at the illustration to match the mouldings, or use whatever router bits or shaper profiles you have on hand to customize your cabinet.

The mouldings are mitered at a 45° angle at the front corners and are cut flush to the back edge. Use nails to attach the mouldings. This is done to help you avoid any wood movement problems that may arise.

Hardware and Hanging the Doors

I used traditional hinges and a lock set for this cupboard. If you're using the same hardware I did, follow Photo 15 and the instructions provided with the hardware to notch the stiles for the lock set. The door latch and handle are explained with more detail in Photo 17. The hinges are

13 This is how the glass area should look after routing.

14 Using a ½" beading bit to form the edge of the Stage 2 base moulding, create the piece and nail it to the Stage 1 moulding.

15 Install the lock into your door, then fit both doors into place and install the hinges, making sure to allow equal spacing around the doors.

16 The backboard nailers are glued and nailed to the top and bottom of the case. Here you can see a groove cut into the bottom of the nailers, which will make sure to eliminate any glue squeeze-out.

17 Using a biscuit joiner, make a groove in the bottom edge of the shelf, just behind the stile and ¼" from the shelf front, to accept the door catch. Next, mark the location of the lock strike and create a catch. It is also possible to purchase an angled strike plate from the lock supplier to eliminate this procedure.

wrought-iron butterfly hinges and though the doors should be carefully spaced while hanging, they're not too complicated.

Adding a Back and a Finish

The back is made up of three shiplapped boards. These are nailed into the rabbets on the side pieces and into the added nailer boards at the top and bottom of the cabinet. The back should not be glued in place; rather, a single nail in each board (top and bottom) should be used to hold the boards in place.

If you're painting your interior, or if you're applying a clear-coat finish, you should leave the back pieces out until after finishing. It makes things a lot easier in the long run.

I used a clear-coat finish for the exterior of this piece. The walnut was just too pretty to even bother adding a stain. The interior is finished with two coats of a green latex paint.

And there you have it – a nice-looking cabinet that not only looks good, but also can teach you a thing or two. **PW**

18 Install the glass. Reattach the hinges, reinstall the lock and apply a coat of paste wax. And with that, your cupboard is done.

THE ESSENTIAL Shoulder Plane

Learn to set up and use this great joint-fitting tool.

For fine-tuning joints, the versatile shoulder plane is a must-have tool in your shop.

It's hard to imagine woodworking without planes; I use a variety of planes on almost every job for smoothing, shaping and fitting. A sharp, finely tuned bench plane will smooth away the mill marks left behind by machines and create a distinctive surface that says "handmade." A set of hollow and round planes will shape a large crown moulding that would otherwise require a heavy-duty industrial shaper and a power feeder. And when carefully fitting tenons to their respective mortises, I reach for a shoulder plane.

The shoulder plane is the only tool that will take thin, delicate shavings from the tough end-grain shoulders of tenons. But it's not limited to trimming shoulders. The shoulder plane's open sides, fine mouth and low bed angle make it useful for a variety of tasks – essentially anytime you might want to take fine, controlled cuts into a corner. Whether it's shaving the cheek of a tenon for a snug fit within a mortise or fine-tuning a drawer runner deep inside a case, a shoulder plane is up to the task and will give you good results every time.

by Lonnie Bird

Lonnie Bird is the author of "The Complete Illustrated Guide to Shaping Wood" (The Taunton Press) and teaches woodworking. You can learn more about his woodworking classes at lonniebird.com.

Photos by Al Parrish

Because the sides of a shoulder plane are open, it's easy to trim into corners of rabbets.

Some shoulder planes, such as the Stanley #92 shown here, feature a removable front piece, which transforms the tool into a chisel plane.

It's Not a Rabbet Plane

I'm not one to get stuck on terminology, but it's pretty easy to get confused when shopping for a shoulder plane because many woodworking catalogs label these tools as rabbet planes. While rabbet and shoulder planes both have open sides for cutting into corners, there are some distinct differences between the two that affect how they are used.

Basically, rabbet planes are designed for cutting rabbets while shoulder planes are designed for trimming. Rabbet planes usually come equipped with a fence and a depth stop to guide the plane and control the dimensions of the rabbet. Embedded in the sides of most rabbet planes is a "nicker" or spur that severs the fibers ahead of the iron when cutting across the grain. Shoulder planes lack these accessories. Because they are used for trimming, shoulder planes are guided by surfaces previously created by other tools.

However, the shoulder plane is a much more refined tool than its coarser cutting cousin. Don't forget: These finely tuned planes excel at trimming and refining surfaces. To perform these functions well, a quality shoulder plane has features that most other types of planes lack. First, the sole of shoulder planes are ground exactly 90° to the sides. This helps ensure square, accurate cuts. The iron is usually bedded at about 20° and ground between 20° and 25°. This yields a cutting angle of 40° to 45°, effective for thin cuts on end grain.

Of course, like a rabbet plane, the sides of a shoulder plane are open. This unique feature allows the plane to trim into corners of rabbets, tenon faces, shoulders and practically anywhere else a fine, controlled cut is required. Some shoulder planes, such as the Stanley #92, also feature a removable front piece that quickly transforms the tool into a chisel plane, another useful tool.

To eliminate chatter, the bed of a shoulder plane supports the iron almost to the cutting edge. This feature, combined with the extremely narrow mouth, allows the plane to remove thin, delicate shavings – just what is needed when fine-tuning joinery.

Tuning a Shoulder Plane

For any plane to perform as expected it must be tuned properly and the shoulder plane is no exception. However, because a shoulder plane doesn't have nearly as many working parts as a bench plane, it's not quite as time-consuming to tune. Also, most shoulder planes are manufactured to more precise tolerances than

Your iron should be .006" to .010" wider than the sole. To get your iron to this width, carefully work the sides of the iron with a coarse bench stone. Check your progress with a dial caliper.

bench planes, so they don't require the extensive reworking that many new bench planes do.

To begin tuning a new shoulder plane, first check the body of the plane to see that the sides are 90° to the sole. Fortunately most are, but if yours isn't, return it and request a new one. As you might imagine, reworking the sides to correct any deviancy from 90° is extremely difficult and labor intensive. Let the plane manufacturer correct this problem.

Next, check the sole for flatness. If the plane has an adjustable nose piece (which allows for adjustments to the mouth of the plane) make certain that the screw that fastens this piece is secure before checking the sole. If the sole is slightly out of true, you can correct the problem by lapping it on a diamond plate.

The next step is to sharpen the iron. It may be necessary to grind the iron; check to see that the edge is 90° to the sides. Unlike bench planes, shoulder planes don't come equipped with a lateral adjustment lever so there is little you can do to compensate for an edge that is out of square.

Although you can loosen the lever cap and pivot the iron slightly, this technique will allow for only a small adjustment. You're better off grinding the iron square to begin with. Grind the edge to 25° and, as always, make sure you don't let the steel overheat.

Before honing the edge, compare the width of the iron to the body of the plane. The iron should be slightly wider than the sole, at the most .006" to .010" wider (.003" to .005" on each side). If the iron is too wide (as it sometimes is) it will gouge the face adjacent to the one you're planing. If necessary, slowly and carefully work the sides of the iron with a coarse bench stone. Be careful and don't overdo it. Otherwise the iron will not cut into the corners. A dial caliper works well to check your progress.

After honing, install the iron and adjust it for a very light cut. Next, sight down the sole of the plane and slowly advance the iron until you can see only the edge. Finally, adjust the mouth of the plane so that only the thinnest of shavings can pass through. Your shoulder plane is tuned.

Once your iron is ready for cutting, install it in the plane and adjust it for a very light cut. Simply sight down the plane and slowly advance the iron until you can see just the edge.

When planing end grain, as I'm doing here, be careful of splintering the grain at the trailing corner of the stock. To avoid this, simply plane from both directions and allow the cuts to meet near the middle.

Using Your Shoulder Plane

Most shoulder planes, small or large, can be used one-handed. I use my other hand to grip the workpiece and position it against a bench stop. When planing long grain, such as when fitting the face of a tenon to a mortise, you can effectively plane all the way across the stock. However, when planing end grain, such as the shoulder of a tenon, planing all the way across risks splintering the grain at the trailing corner of the stock. Instead, plane from both directions and allow the cuts to meet near the middle.

When planing a wide shoulder, such as the end of a tabletop to receive a breadboard end, I reach for a large shoulder plane. Clamp the work to the benchtop and grasp the plane with both hands for the best control.

After a short time, you'll find the controlled, precise cuts you get with your shoulder plane to be addictive – and you'll find yourself using it often. **PW**

SOURCES

Lie-Nielsen Toolworks
800-327-2520 or
lie-nielsen.com
- Large shoulder plane #073, $225

Highland Hardware
800-241-6748 or
tools-for-woodworking.com
- Stanley #92 shoulder plane #031804, $84.99

Prices as of publication deadline.

A Case for Wine

Photo by Al Parrish

Most boxes of wine aren't a good thing, but we're sure this project is of good vintage.

Once upon a time, I was a beer guy. Most woodworkers are, I suppose, and I still enjoy a good brew. But recently I've also learned to appreciate a glass of good wine. Usually a bottle or two of red wine in the house is adequate, but as my interest in wine has grown, so has my interest in having a selection of wines available. So I decided I needed a wine rack.

I don't have a lot of room in my house, so I turned to my computer-aided design program. After carefully measuring a variety of bottles (between sips) I calculated the best way to maximize my bottle storage in the smallest amount of space. The rack shown here is my best effort, with storage for 24 bottles (two cases) in a 20" x 20" x 14"-deep space.

By David Thiel

Comments or questions? Contact David at 513-531-2690 ext. 1255 or david.thiel@fwpubs.com

This design allows for an efficient cutting list and an efficient use of space. I was able to design the rack using 11 pieces of wood in only four sizes. Maybe that's why I decided to complicate it by adding dovetails to the solid mahogany box. That, and the need for reliable strength – 24 bottles of wine are heavy.

The interior dividers are eggcrate-joined Baltic birch with veneer tape applied to the front edges. Designed to hang on a wall with a hidden French cleat, the box could be easily adapted for floor use with a simple base and maybe a drawer added above the box itself. It's a reasonable weekend project with some time left over to have a glass of wine and appreciate your work.

Building the Cabinet

Start construction with the outside of the case. The four pieces are exactly the same, 14" x 20", but because this is a simple piece, an attractive grain pattern can go a long way to make it more dramatic. I was lucky to have a slab of mahogany tucked away in the shop that was actually 14½" wide, which allowed me to avoid any glued-up panels.

After choosing the most attractive faces of the boards for the exterior, start laying out the dovetails. Everyone has their own method of making dovetails, and you may choose to cut yours by hand to get a more unique spacing pattern. I chose the easy plugged-in route and used a model 2200 Keller Jig (kellerdovetail.com, $219) to cut through-dovetails.

Keep On Groovin'

With the dovetails cut and fit, you will need to cut grooves for the back in all four pieces. Because I was hanging my rack on the wall, I allowed a ¾" setback from the rear of each piece and used a ½" router bit in my router table to make the ⅜"-deep grooves.

With the spacing I used on my dovetails, the grooves in the top and bottom pieces are able to run the entire length of the piece without interfering with the dovetail pattern. However, on the side pieces I had to use a stopped groove to avoid seeing the groove in the assembled box.

After running the stopped grooves, use a chisel to square out the ends. Next dry-assemble the box with the back in place to make sure everything fits well.

An Interlocking Complexity

The divided interior of the box is formed from just six pieces of ½" plywood, notched to interlock with one another.

Start by measuring from one inside corner of the box to the opposite corner. While a measurement for the length of these pieces is provided here, it's a good idea to double-check the dimensions against your project.

Your dimensions for the two long dividers should be the same, but if they're not, cut the pieces to the required lengths, then use your table saw to bevel both sides of each end at 45° to form a point on each. Cut them a little long at first, then fit the pieces so they slide snugly into the case.

When the pieces fit, slide one all the way in, then slide the other in against the first. Mark both to indicate the intersecting spot, as shown in the photo at right.

Take the pieces out and use a try square and the intersection marks to lay out the 5" x ½" notches on each piece. Then head to the band saw and cut out the notches. Don't worry about being too neat, but cutting close to the inside of the lines allows for fine-tuning the fit. Test the two pieces in the case and move on to the last four dividers.

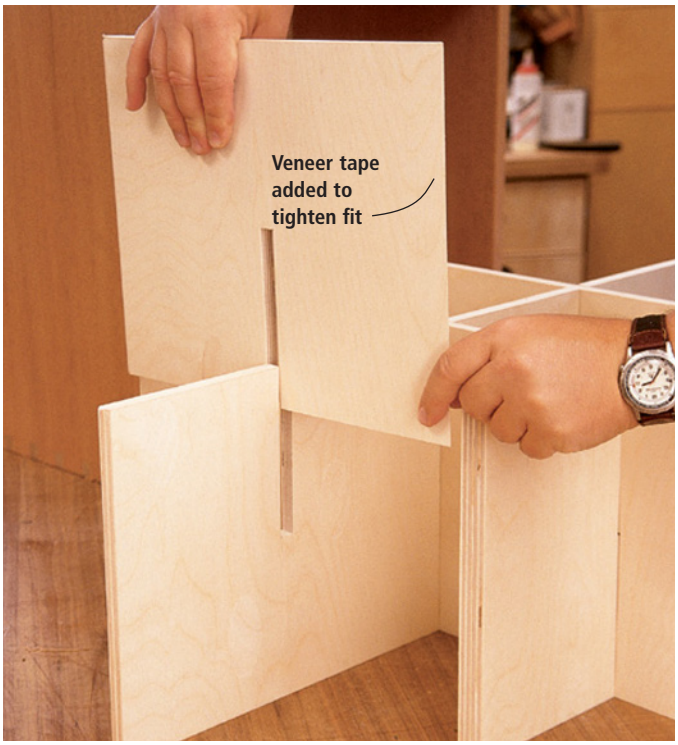
To locate the four smaller divider locations, start by marking the center line on each of the four sides. This mark is where the pieces will meet at 45° angles. Measure the necessary lengths of the four pieces (hopefully these lengths are the same) and then cut the four pieces to length, adding 45° bevels at all the ends.

Next, remove the front diagonal divider and fit two of the short dividers in place at the top left and bottom right corners of the rack, parallel with the remaining long divider. Place the front long divider back in its place, and again mark the notch locations on all the dividers.

The notches should be centered on the short dividers, but it's best to check the location against the actual pieces. Make your notches, then repeat the

The box itself is dovetailed together. When laying out your dovetails, make sure the back groove falls between the tails and the pins on the sides so the groove won't show at the top. I had to run stopped-grooves on the sides to avoid the groove showing from the outside. All you have to do is stop the cut, then use a chisel to square out the end of the groove.

To fit the interlocking dividers to one another, start with the two long dividers. First fit them between the corners of the box, then mark the overlapping locations of the two pieces. The eggcrate notches are cut at the mark. Follow this same process to fit and notch the four smaller dividers.



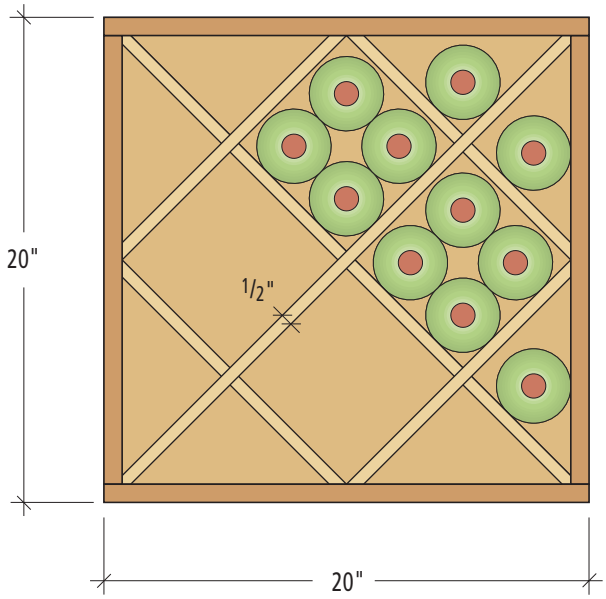
process with the short dividers for the bottom left and the top right corners. With everything fitting snugly in place, I added some birch veneer tape to the front edges of the dividers to hide the layered plywood.

This photo (with the dividers removed from the box) gives a better example of how the dividers all fit together. If you look closely at the right edge of the piece being dropped into place, you'll see a trick I had to use to fix a "too-loose" divider. By adding veneer tape to the beveled end I was able to fix the fit. Veneer tape added to the front of the divider after the fix made the fix virtually invisible.

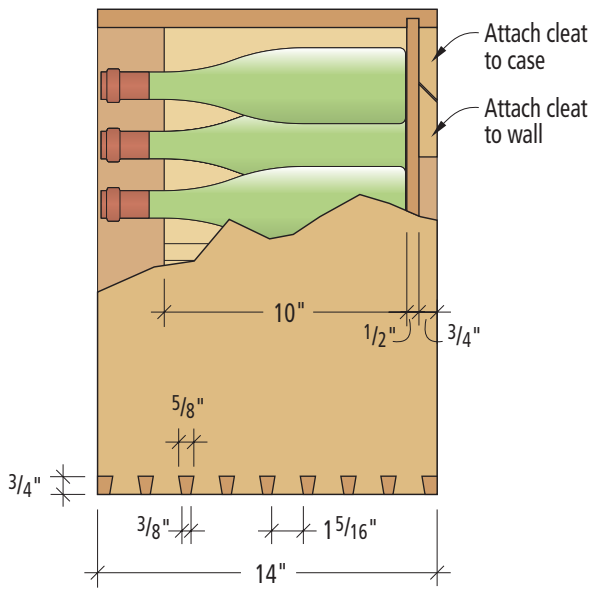
Color and Character

Before gluing up the case, decide how you're going to finish it. I opted to leave the birch plywood pieces natural, but I used Moser's water-soluble Light Sheraton Mahogany aniline dye (Woodworker's Supply, 800-645-9292 or woodworker.com, item #W13301, $6.99 for 1 oz.) on the mahogany box. Because the back is birch plywood, I'd have trouble dying the box after assembly without coloring the back, too.

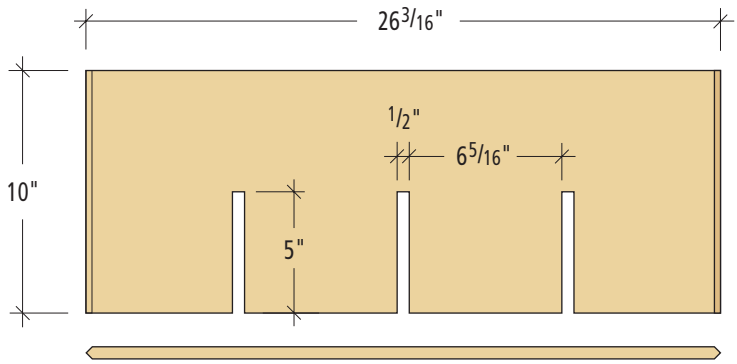
My solution was to give the back a few coats of a clear lacquer finish prior to assembly. Then, when the dye is applied to the mahogany, any errant dye that



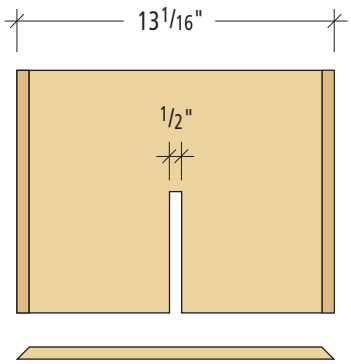
Elevation



Profile/section



Long divider plan & section



Short divider plan & section

gets on the back simply can be wiped off the lacquer finish.

After sanding the interior of the project, it's time to move on to the glue-up stage. Make sure the dovetails are pulled up tight and the case is square.

Measure from corner to corner in both directions and make any necessary adjustments.

After the glue is dry, take the case out of the clamps and flush up the pins and tails. This may require sanding or you may choose to use a sharp low-angle block plane to flush the sides.

Marrying the Rack to a Wall

To hang the rack, I used a French cleat. This is so simple I'm surprised it doesn't get used more often. The cleat is made by cutting a 5"-wide piece of ¾" plywood to fit between the two box sides. Then simply set your tablesaw blade to a 45° angle and rip the piece in half lengthwise.

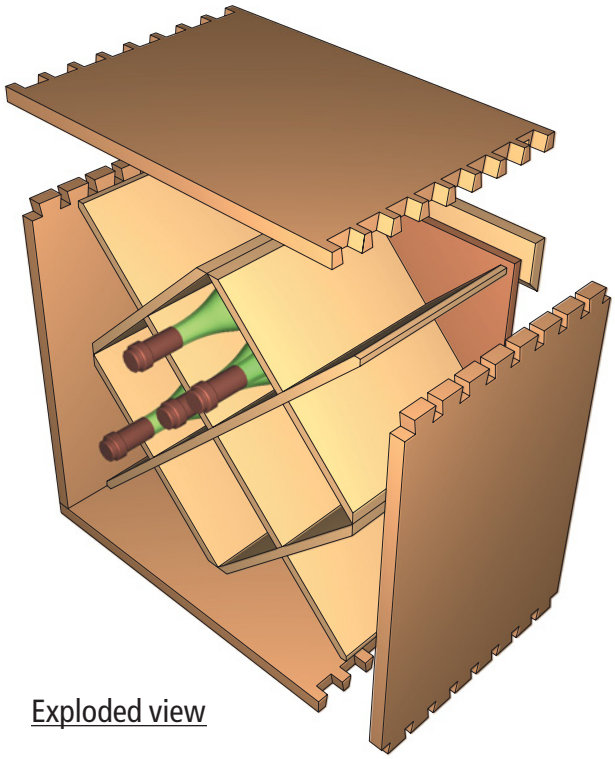
By attaching the top half of the cleat (widest-width facing out) to the case and the lower half to your wall (use drywall anchors if that's not possible) you simply can slide the case down onto the wall cleat using the 45° angle and lock it tightly in place.

A Strong, Woody Finish

Remove the dividers one last time and finish the box as you see fit. A coat of clear lacquer on the dividers will protect against time (and unsightly red wine spills) and make it easier to slide the bottles in and out of the rack.

When the dividers are again reassembled in place, a couple of accurately placed nails through the back into the dividers will hold them firmly in place.

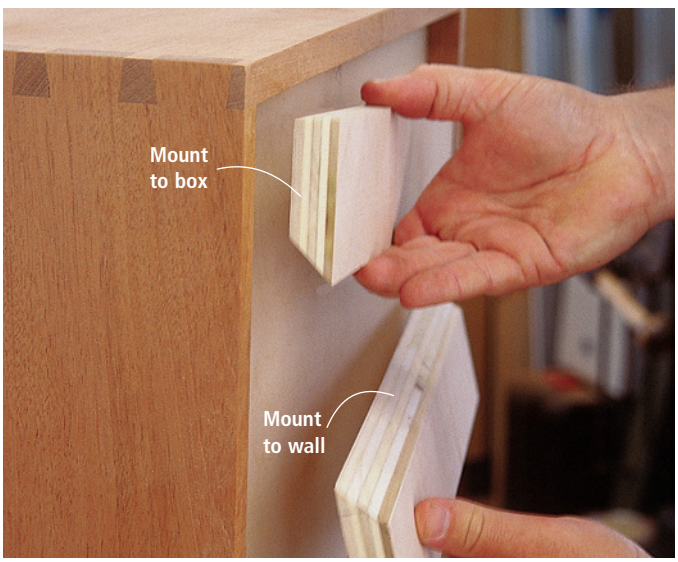
Seeing so many interesting opportunities for taste-bud titillation tastefully displayed in my house is almost as gratifying as the project itself. **PW**



Exploded view

WINE RACK

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑ 4	Sides	¾	14	20	Mahogany
❑ 1	Back	½	19¼	19¼	Birch plywood
❑ 2	Dividers	½	10	26 3/16	Birch plywood
❑ 4	Dividers	½	10	13 1/16	Birch plywood
❑ 2	Cleats	¾	2½	18½	Plywood



To hang the box on a wall I used a French cleat. The photo shows the two parts of the cleat pulled away from the recessed back of the box. Trés simple!

STORING WINE

So now you have this great wine storage box, but what do you need to know to properly store all of your wine? Well, wine is perishable, so you must keep it at a stable temperature and serve it at a temperature that best shows off its specific characteristics.

As you can tell, temperature is the most important factor when storing wine. The "golden temperature" for storing wine is 55° Fahrenheit, although a range of 45°-65°F is fine. But what hurts wine the most is fluctuation. If the temperature wavers, the cork gets pulled in and out, giving air a good chance of getting into the wine and ruining it.

A colder storage temperature will cause the aging process to slow down, preventing proper aging, while a warmer temperature can cause premature aging.

Also, don't just store a bottle of champagne in your refrigerator, waiting for the perfect day to drink it. When that day comes, the wine will be too cold to enjoy. You can temporarily store wine in the fridge to cool it off, but if you need it stored longer, keep it out of there.

Humidity fluctuations aren't nearly as bad, but they should be watched. A high humidity hurts the labels, while a low humidity dries out the cork, letting oxygen in, even if the bottle is properly stored on its side to keep the cork moist.

So throw out the old "refrigerate all whites, drink all reds at current room temperature" adage. According to wine.about.com, generally accepted wine-serving temperature guidelines are: vintage port (66°F), bordeaux and shiraz (64°F), burgundy and cabernet (63°F), pinot noir (61°F), chianti and zinfandel (59°F), beaujolais and rose (54°F), chardonnay (48°F), riesling (47°F), champagne (45°F).

Remember, though, the room temperature is usually higher than these "ideal" temperatures. A refrigerator can cool the wine, but to warm it, just hold it in your hands.

— Michael A. Rabkin

The TRUTH about 240V

Frankly, we're tired of the debate. So, we're ending it here.

Cabinet vs. contractor, metric vs. English, hand tool vs. power tool (yawn). When you're in the mood for a real debate, just bring up 120 volts vs. 240 volts among a group of woodworkers. Tempers will flare, arguments will ensue, indignation will linger.

We're passionate about our voltage and rightly so – it's the lifeblood of our motors. Its importance necessitates you know the facts. So here you go: You won't save a dime and your motors won't be more powerful if you switch to 240V. But, if you're running multiple motors at the same time or you're using the pre-existing wiring in your house, switching to 240V will eliminate voltage drops and stalling, as well as lengthen the life of many of your motors. In almost all cases, 240V is the better deal.

Before you pick up the phone, ready to give us an earful, read what we have to say. We've done our homework – the information here is backed up by facts, experts and experience.

Electricity 101

Before we dig into the debate, you must first learn how electricity reaches your home. Check out the glossary at right to make sure you understand these terms before we move on.

Now then, your utility company distributes electrical energy in your neighborhood through high-voltage conductors (what many people call wires) that terminate on step-down transformers. These transformers change the voltage to single-phase, three-wire, 120V/240V electricity, which is what you need in your home. From the transformer, three conductors (two hots and one neutral) supply your home with electrical energy.

In a residential electrical service, the two hot conductors are designated L1 and L2 and can be any color except white, gray or green. L1 and L2 each have 120V potential. The neutral conductor is intentionally connected to the ground and also can be referred to as the grounded conductor. Neutral

by Kara Gebhart & Greg Hyland

Greg Hyland is president of Cincinnati-based Cooper Electric. He has been in the electrical trade for 33 years and holds Electrical Contractor licenses in Ohio and Kentucky, as well as Master Electrician licenses in five local jurisdictions. Comments or questions? Contact Kara at 513-531-2690, ext. 1348 or kara.gebhart@fwpubs.com.

Photos by Al Parrish

conductors can be white or gray and in some limited uses can even be bare. It has zero V of potential.

The neutral shouldn't be confused with the equipment ground conductor, which primarily is used for safety. The equipment ground conductor connects the metal parts in the electrical system that don't carry current to the neutral conductor. The equipment ground conductor can be bare or green.

The voltage, or electrical potential, measured between L1 and L2 is 240V. The voltage measured between L1 or L2 and neutral is 120V. The voltage measured between L1 or L2 and the equipment ground conductor is 120V. No voltage should be able to be measured between the neutral and the equipment ground conductor because they are grounded to the earth, which is considered to be at zero V.

Note: Even though L1 and L2 have the same 120V potential to the neutral conductor, they are still different. To avoid going into lots of detail here, think of L1 and L2 as siblings: A brother and sister have the same parents but yet they're different.

Now take a look at the picture below. Three conductors (L1, L2 and neutral) enter the circuit breaker panel via the service entrance cable. L1 and L2 connect to the main circuit breaker inside the service equipment load center. The neutral conductor connects to the solid neutral bar.

A Switch of a Wire

The difference between 120V and 240V in your circuit breaker panel is, literally, a switch of a wire. In this panel, there are single-pole and double-pole breakers. Single-pole breakers serve 120V loads, while double-pole breakers serve 240V loads. The breakers in the panel are arranged like this:

L1	L1
L2	L2
L1	L1
L2	L2

A single-pole breaker is plugged into either L1 or L2. A double-pole breaker plugs into both L1 and L2. The 120V circuits have one conductor connected to a single-pole breaker and another conductor connected to the neutral bar. The 240V circuits have two conductors connected to a double-pole breaker and no neutral conductor.

You don't need the neutral wire for a 240V circuit because there's already a difference in potential. (Remember the sibling analogy?) But, you must have the neutral wire in a 120V circuit to create a difference in potential.

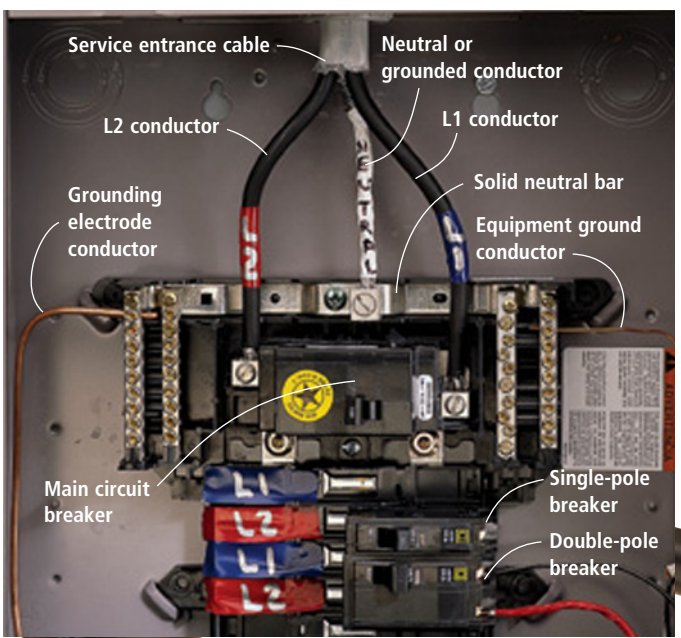
Let's Talk Amps

The difference between 120V and 240V has almost everything to do with amps. Amperage is the measurement of the amount of current flowing through a conductor. The National Electric Code (NEC) requires all homes built today to be equipped with a minimum 100-amp main electric service. Some new homes have services that are 200 amps or more, while older ones can have as little as 60 amps. In your home, a general-purpose branch circuit provides 120V and 15 amps.

The size of a conductor determines the number of amps it can safely carry. A #14 American Wire Gauge (AWG) copper conductor will carry 15 amps. A #12AWG copper conductor will carry 20 amps. A #10AWG copper conductor will carry 30 amps. Unless you or someone else has rewired your shop, we're betting your cables aren't #10AWG copper or larger.

Common 240V Myths

This, you should know: You won't save a watt of energy or a single



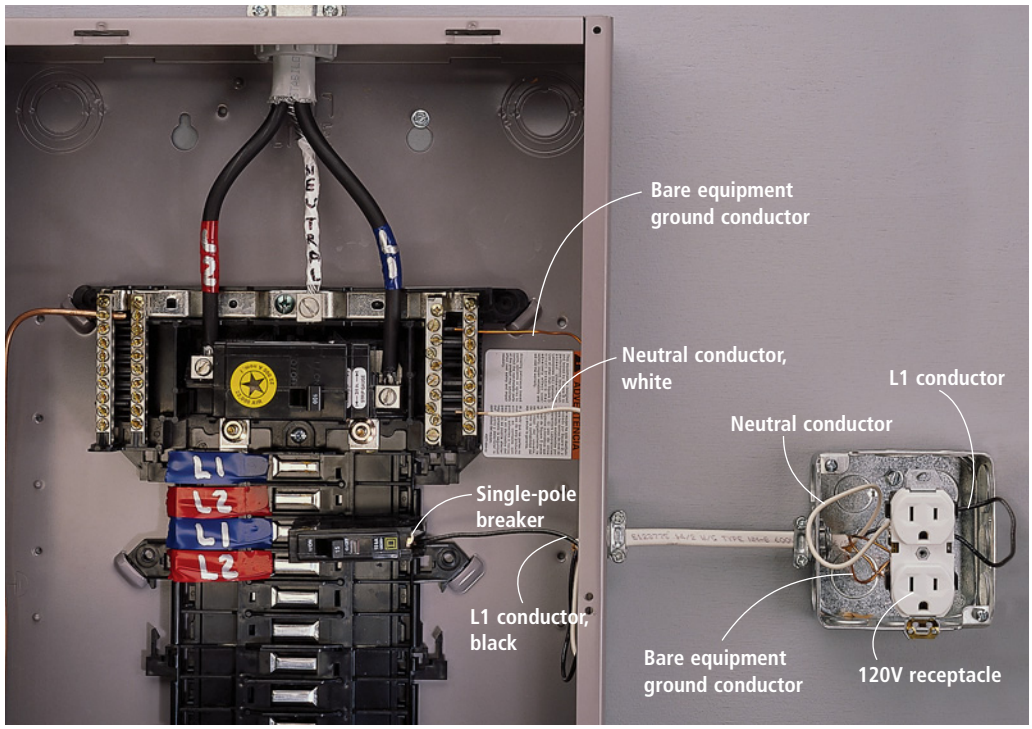
Pictured here is a typical residential circuit breaker panel – what many people call their breaker box. We've labeled several of the conductors so that they're easier to distinguish.

GLOSSARY

- **amps:** Measurement of the amount of electrical current flowing through the circuit or conductor. (Comparable to gallons per minute in a water-system analogy.) Amps = watts/volts.
- **cable:** Conductor covered by an outer metallic or non-metallic jacket.
- **circuit breaker panel:** Breaker box or load center.
- **conductor:** Material that carries electricity; often called wire.
- **current:** Flow of electricity measured in amps.
- **equipment ground conductor:** Safety wire that keeps non-current-carrying metal parts of an electrical system from being accidentally energized. Bare with no insulation or colored green. Doesn't carry current under normal operation.
- **general-purpose branch circuit:** Supplies two or more receptacles or outlets for lighting and appliances.
- **hot:** Supply conductor that carries electricity. In residential electrical system, designated L1 or L2. Can be any color except white, gray or green.
- **load:** Anything that utilizes electricity.
- **neutral:** Conductor that is intentionally grounded or connected to the earth. Carries zero V of potential. Never connected to a circuit breaker or switch. Colored white, gray or bare. Combines with one hot conductor (L1 or L2) to create 120V potential.
- **ohm's law:** States that it takes 1V of pressure to push one amp of current through one ohm of resistance. Volts = amps x ohms.
- **potential:** Electrical pressure, which determines the flow of current through a given load.
- **power equation:** Watts = volts x amps.
- **resistance:** Opposition to flow of electrical current; measured in ohms. Current flows through path of least resistance. Ohms = volts/amps.
- **voltage:** Force that pushes electrons through a conductor. Referred to as electrical pressure. (Comparable to pressure in pounds per square inch in water-system analogy.) Volts = watts/amps
- **watts:** Measurement of the amount of power used in a circuit. At 100 percent efficiency, there are 746 watts in one horsepower. 1 kilowatt (kw) = 1,000 watts.

dime by switching to 240V, period. Whether you're running a motor using 120V or 240V, the horsepower of the motor stays the same. Remember: One horsepower equals 746 watts and watts = volts x amps. If your volts go up, your amps go down. If your volts go down, your amps go up. (Watts always stays the same.) The utility company charges you for the number of kilowatt hours you use – not amps or volts.

Whether you're running a motor using 120V or 240V, the motor's revolutions per minute will stay the same. The only way you can change the speed of an alternating-current (AC) motor is by adjusting the frequency of the sine wave of the electrical energy supplying the motor.



This is a circuit breaker panel set up for a 120V circuit.

Why 240V is Better

If you're not going to save energy or make the motor more powerful, why switch to 240V? Here are five good reasons:

• By connecting a motor at 240V you'll evenly distribute the load across both L1 and L2. For example, let's say your electric service provides you with 100 amps. If you connect a 10-amp load at 120V, you've taken up 10 percent of either L1 or L2. (Remember, 120V requires L1 and a neutral or L2 and a neutral while 240V requires L1 and L2, and no neutral.)

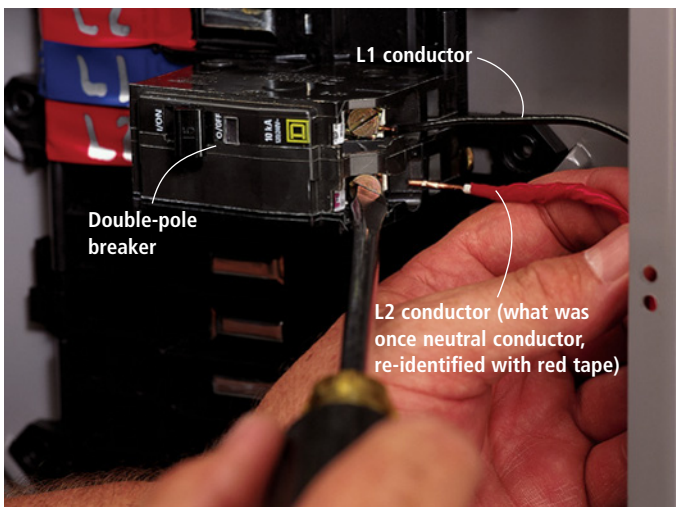
Now, if you connect the same 10-amp load at 240V, five amps would flow through L1 and five amps would flow through L2 – you've only taken up five percent of the capacity of your electrical system. Distributing the current like this keeps the load on the electrical service balanced, which is good engineering practice.

• Switching to 240V reduces your current flow (remember, if volts go up, amps must go down). If you're running a 20-amp machine at 120V, you're using 2,400 watts of power. If you run that same machine on 240V, it will only draw 10 amps, which is also 2,400 watts of power.

Reduced current flow creates less heat, which permits the motor to run cooler. Heat is a motor's deadliest enemy. A common rule of thumb in the motor industry is that a sustained temperature rise of 18° Fahrenheit in the windings of a motor will cut the rated motor life in half (no joke).

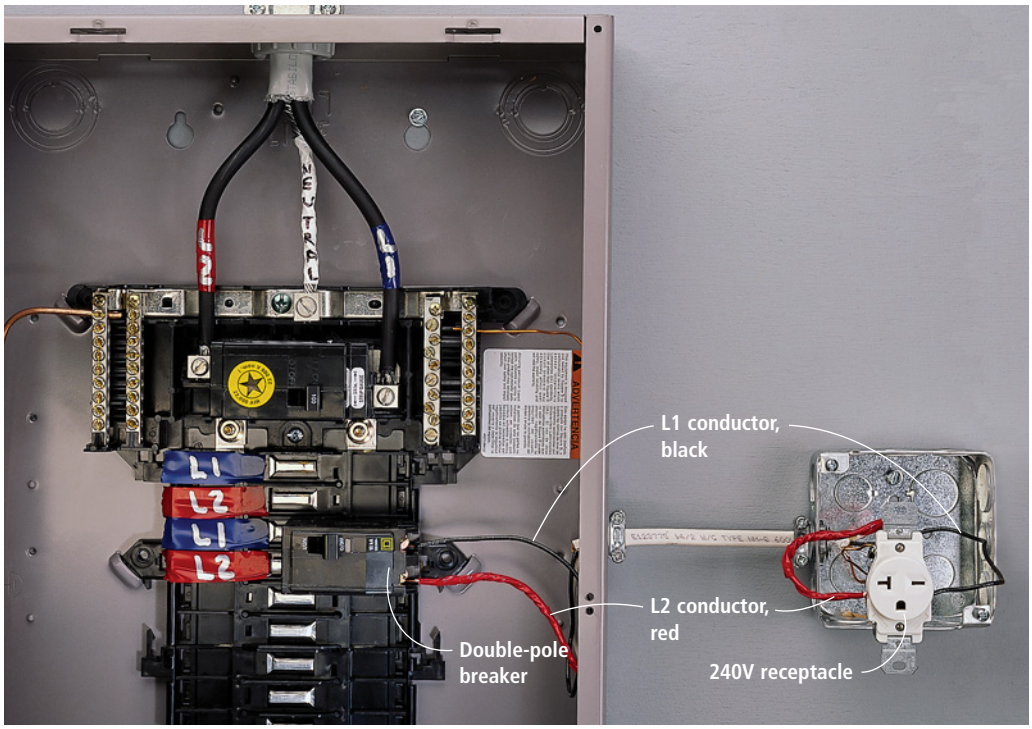
• Reduced current flow lessens the effect of electrical sags in your system. (If your lights have ever dimmed after starting up a machine, you know what we're talking about.) An electric motor started from rest creates a demand on your electrical system of 6-7 times the magnitude of the full-load running amp capacity.

For example, let's say your band saw's 1½-hp motor has a nameplate rating of 11.5 amps at 115V. When started, the motor can put a draw on your system of a whopping 80.5 amps. When you do this, a sag is created in the rest of the system because the system is being deprived of power. Your lights blink, your computer locks up and your family begins hollering. Now, if you connected this same motor at 230V it will draw 5.8 amps at full running load and only about 40.6 amps when it

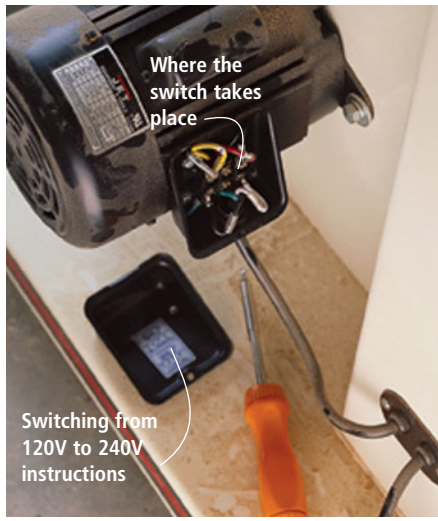


Electrician Greg Hyland is changing the above 120V circuit to a 240V circuit. He has replaced the single-pole breaker with a double-pole breaker, which L1 is now connected to. He removed the neutral conductor from the neutral bar and re-identified it with red electrical tape. Here he's ready to connect what is now the L2 conductor to the double-pole breaker.

This nameplate is on our band saw's motor. Note that at 115V, this motor draws 11.5 amps. At 230V, it draws half the amps: 5.8.



This is a circuit breaker panel set up for a 240V circuit. Receptacles use different colored screws to help with proper identification. Hot conductors always connect to dark or brass screws. The equipment ground conductor always connects to a green screw. The neutral conductor always connects to a silver or light-colored screw.



Most motors have a label that shows you how to switch it from 120V to 240V, as shown here.

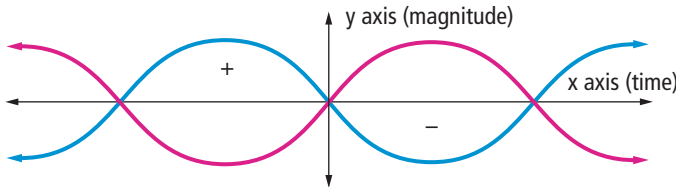


Illustration by Mary Jane Favorite

Sine waves are a mathematical representation of electrons' movement. The blue sine wave represents an L1 conductor and the red sine wave represents an L2 conductor. Even though both carry 120V, they are always out of phase with each other, meaning there's a difference in potential.

starts – that's a big difference.

One thing to keep in mind: Manufacturers use nominal voltage ratings on their nameplates. If you consult the equipment specifications you will probably find an operating voltage range of 115V plus or minus 10 percent, which would mean the equipment will operate on any voltage from 103.5V to 126.5V. Some manufacturers do this because the voltage in the system constantly changes based on the load in the electrical system. Also keep in mind that just as the voltage changes constantly, so will the current flow.

• Using 240V helps eliminate voltage drops. The NEC recommends that a branch circuit should have no more than a 3 percent voltage drop at the farthest outlet of power from the source.

Voltage drop is a combination of four factors: the load in amps, the voltage, the length of the circuit and the size of the conductor supplying the load. Remember the 1½-hp band saw motor with a nameplate rating of 11.5 amps at 115V and 5.8 amps at 230V? Let's say the saw is 100' away from the circuit breaker panel and is supplied from a #12 AWG copper conductor good for 20 amps.

Using the formula from the American Electricians Handbook (we won't bore you with the details) you would calculate that the motor at 115V would have a voltage drop of 4.54V, or 3.95 percent. If the same motor is connected at 230V the voltage drop is 2.29V, or just less than 1 percent. The band saw will perform better and last longer connected at 230V with less than 1 percent voltage drop. Period.

• 240V's lower current flow will frequently permit you to save money because you're able to install a smaller, less expensive conductor to feed the load. In the previous example the motor was fed with a #12 AWG copper conductor good for 20 amps. The NEC would permit the use of a smaller #14 AWG copper conductor good for 15 amps to feed the band saw.

Using the smaller conductor the voltage drop at 115V really starts to get ugly at 7.22V, or 6.3 percent. However, the voltage drop at 230V is 3.64V, or 1.58 percent, which is still within the recommended NEC limit of 3 percent. The money you saved on cable could buy an extra saw blade or two.

The Switch is Easy

Switching from 120V to 240V is surprisingly easy, but if you've never dealt with electricity (rewiring a lamp doesn't count), you need to contact a local electrician who knows what he or she is doing. An electrician will be able to make the switch safely at both the circuit breaker panel and at the equipment. He or she must properly re-identify every exposed conductor along the branch circuit. (Proper identification allows future homeowners to know what voltage to expect from their receptacles.)

The truth: Switching to 240V will increase your electrical system capacity, reduce heat, lengthen the life of your motors and in general make your shop more efficient. Make the switch. You'll be glad you did. **PW**

Special thanks to Franklin M. Barker for his assistance with this article. Barker, a curriculum and instructional specialist at Cincinnati-based Great Oaks Institute of Technology and Career Development, previously served as an electrician for 30 years. He taught electricity at Great Oaks for 22 of those years.

Orbital JIGSAWS

There are a bunch of quality saws out there, but not all can pass our test.

The circular saw is the power tool that belongs in every contractor's toolbox. In a woodshop it's the jigsaw. For straight, curved, fine or rough cuts, the jigsaw makes every task manageable. And you can use it for a variety of projects, from crosscutting a 4' x 8' sheet of plywood to shaping a scrolled arch on a Chippendale highboy.

For this test, we selected 12 jigsaws that have orbital cutting action, which means the blade moves forward during the upward cut, then returns to a straight up-and-down motion on the return cut. The aggressiveness of the orbit can be adjusted as the needed.

There are many jigsaws that don't offer orbital action, but this flick of a switch allows you to choose either a quick-cutting tool or a fine-cutting tool, so we think it's an important attribute.

Different Features

Prices and features vary across the 12 saws, but there are many similarities, including the fact that they all have a 1" stroke (the distance the blade moves up and down). The one feature that helped separate the crowd is the blade-changing mechanism.

Interestingly, many of the saws owe their blade-changing designs to Bosch, the inventor of the jigsaw. The Grizzly saw uses an old Bosch system that requires a screwdriver through the saw body. DeWalt and Craftsman have a top-knob system that clicks when the blade is locked – a system Bosch still uses.

Other manufacturers have moved beyond to what we refer to as a lever release. Depending on which design it is, this system can be good, somewhat confounding or, in a few cases, perfect, thanks to the assistance of an extra lever. (See "Toolless Blade Releases" at right.)

Also, many manufacturers offer saws with both a top-handle and a barrel-grip design. We frequently find the barrel-grip saws easier to control because of the lower center of gravity, but

by David Thiel

Comments or questions? Contact David at 513-531-2690 ext. 1255 or david.thiel@fwpubs.com.

this is a personal preference. While we tested barrel-grip models when we could, we didn't skew our results by body design. We included pricing on the alternative body styles in the individual listings where applicable.

You also should note a couple of dopplegängers in the crowd. The new Ridgid saw is built in conjunction with its European partner, Metabo, making the tools very similar. And the Craftsman saw owes a significant amount of its parentage to Bosch.

The Testing

Three things are important in determining a jigsaw's performance: its power during a cut, the amount of vibration and the blade deflection during curved cuts.

While all of the jigsaws come complete with their own blades, we decided that to be fair we'd use one brand of blade, selecting Bosch Progressor T234X blades.

We tested for power by timing repeated 4" straight cuts in ¾" plywood made by multiple editors, both at the most-aggressive and least-aggressive orbital settings. We then averaged the results and included them in the attached chart on page 86.

For vibration we went a bit more unscientific, relying on the feedback provided by the testers and a black felt-tip pen. We mounted the pen on the nose of each jigsaw, then let it run (at the least-aggressive orbital setting, without a blade and at the highest speed) on a sheet of 11" x 17" paper. We tied the cords directly above the saws to remove influence from them and stopped the test after 30 seconds. We then recorded the linear distance traveled by each saw. In more than half the cases, the saw made its way off the paper before time ran out, so we noted the "time in the ring" in the chart as well.

For blade deflection, we pushed the tools to their limits by cutting 3"-radius S-curves in 1⅝"-thick white oak. This is a tough test for a jigsaw, and we'd usually turn to a band saw to cut thick white oak. We ran the saw at its top speed with a first-position orbital setting and measured the deflection from perpendicular on the furthest points of the interior and exterior turns.

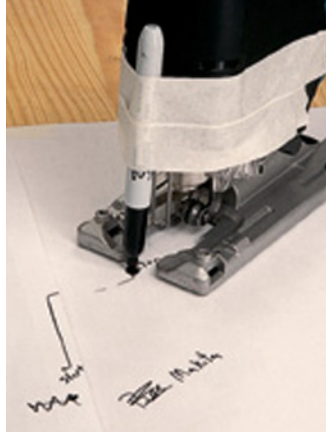
Some Favorite Features

We prefer a toolless shoe-bevel adjustment because we just hate looking for a wrench. The best shoes in the test were those that offer positive stops at the varied angles and a design that allowed you to slide the shoe back for close-to-the-wall work.

When considering a barrel-grip or top-handle design, one feature to consider is the location of the speed control. On barrel-grip saws it is typically on the rear of the motor housing; with top-handle models, the speed control is frequently located on or near the trigger. While this places the speed control within easy reach, it also leaves open the possibility that you could change the speed accidentally during a cut.

Most of the saws tested use a split-bearing guide to support the rear of the blade and help maintain a perpendicular position. Two of them use what we refer to as side guides, in addition to a rear-bearing guide, offering superior blade control.

We found it difficult to determine if dust blowers are really vital to any jigsaw. In some of the designs they can be annoying, and some saws without blowers perform just as admirably. You'll have to make that decision for yourself, but one thing we can recommend using is a vacuum connection to keep your workpiece clean as you cut. **PW**

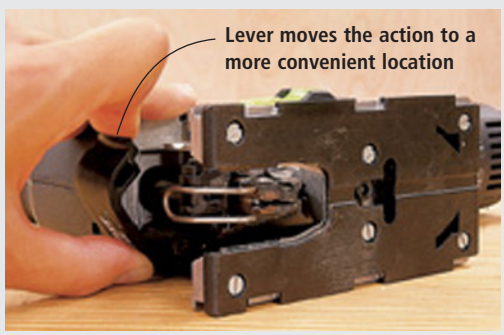


While not totally scientific, we got an interesting indication of the vibration exhibited in each jigsaw by attaching a marker and letting them run.

Photo by Al Parrish

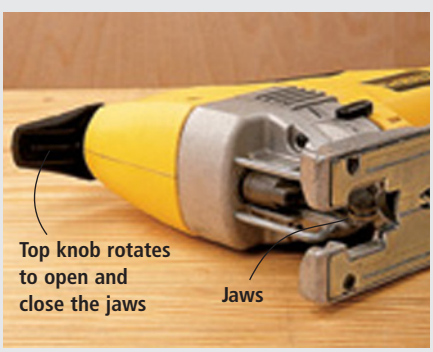
TOOLLESS BLADE RELEASES

The one area that quickly defines how much we like a jigsaw is how easily we can change the blade. Jigsaws have made great strides in the past few years, but there are still a variety of styles to consider. Seen here are the three most-common – the top-knob, the lever-style and the dual-action lever-style. (With one model that we tested – the Grizzly – you need to use a screwdriver included in the package through the body of the jigsaw to change the blade.)



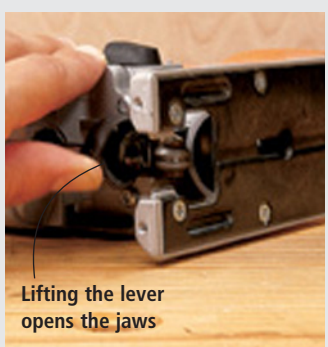
DUAL-ACTION LEVER-STYLE

The Festool (left), Makita, Milwaukee and Hitachi jigsaws all use a lever release with a twist – literally. They all have a plastic arm mounted to the front of the saw to add a lever-assist to the mechanism. When you pull the lever the blade moves forward, making it easier to grasp. In some cases, a collar twists over the blade's tangs to lock it in place in the saw, too. We liked this design the best.



TOP-KNOB

The DeWalt (shown), Craftsman and Bosch models all employ a blade change that works by turning a knob at the top of the housing until you hear a click to open and close the jaws on the blade. While not a bad system, it is slower than others tested.



LEVER-STYLE

The Ridgid (left), Freud, Porter-Cable and Metabo models use a simple lever-style release. A spring-loaded lever near the jaws is pulled away from the blade to release the jaw mechanism. That mechanism differs from model to model, but all are essentially the same. This is a much-faster design than the top-knob system, but you might need to practice a few times to get comfortable with it.

Bosch 1584AVS

This saw made nice cuts in the speed tests, but required more effort than expected and we noticed surprising vibration in the rough cut. It handled the curve cuts well enough with acceptable blade deflection. It's a shame that Bosch's latest design wasn't ready for testing (see "Looking Ahead" on page 86), because the 1584AVS suffered from its outdated blade-changing system. We also ran into some problems with the knob on the blade-changing system popping off the saw – it's designed that way, but it comes off a little too easy for our taste. The saw is sold in a top-handle (1587AVS, $127) or barrel-grip design, so there's something for everyone. The shoe is marked for bevels at 15°, 30° and 45°, but includes a positive lock only at 0° and requires a wrench to make the change. The Bosch is a workhorse and the progenitor of many of the tools tested here, but we'd suggest waiting for the next generation. (boschtools.com)

Craftsman 27719

Made for Craftsman by Bosch, the 27719 essentially is the top-handle version of the above saw. There were no problems with the blade-change system, but it's still awkward compared to the newest lever designs. Performance was good with worse deflection scores than the Bosch. The Craftsman performed comparably with the Bosch through the curves and registered one of the quietest noise levels in the test. It uses the same shoe and beveling design as the Bosch and shares the single positive-stop location and necessary wrench. The variable-speed control is mounted on the trigger. It's a good tool but if you check prices, the top-handle Bosch (1587AVS) costs about $20 less than the Craftsman for essentially the same tool. (craftsman.com)

DeWalt DW321

Similar in design to the Craftsman, the DeWalt adds a toolless shoe-bevel adjustment and a three-position blower. The blade-change system is similar to the Craftsman, but the locking mechanism is a retracting clamp system rather than the turn-and-lock system, keeping the blade oriented straight ahead. The DeWalt did well in the speed cutting tests, but showed some difficulties in cornering and worse deflection scores. We noticed some problems with the blower sending dust toward the operator, which is a pet peeve with us. Variable-speed controls are on the trigger. The shoe is marked (but there are no positive stops) for 15°, 30° and 45° bevels and employs a toolless adjustment lever. One nice thing is the ability to lock the shoe in a set-back position for close-to-the-wall cuts. In the end, the DeWalt is an acceptable tool that is comparable with the Bosch in price, offering better performance and a couple of extra features. (dewalt.com)

Festool PS300EQ TRION

The Festool is a nice saw, and it's priced accordingly. Available in a barrel-grip or top-handle (PSB300EQ, $250) design, the saw proved smooth and strong in the speed tests, but fought with us a little in the corner test. The forked-guide system with its adjustable carbide pads and rear-bearing support gives superior blade support. The lever-assisted toolless blade-change system is our favorite, requiring little effort and no learning curve. The detachable 13' rubber cord is high quality, extra long and is a nice upgrade for replacement concerns and even for storage and blade changes. The shoe, which was difficult to adjust, is marked (but has no positive stops) for 15°, 30° and 45° and requires a wrench to make the chnage. The Festool is the lightest saw in the test and was one of our favorite tools to use. That's why it gets an Editor's Choice award. (festool-usa.com)

Freud FJ85

The Freud is a strange mix of good and not-so-good at a nice price. It performed well in the corner tests and had decent cutting speed. It did vibrate a bit much, had a drift problem during the cut and was fairly loud. It features a lever-style toolless blade change, but again there's a good/bad mix: The blade must be pushed against a spring in the holder to engage the lock, allowing it to be ejected when changing, but the necessary "push" isn't mentioned in the manual, making it frustrating until you figure it out. The shoe adjustment is accomplished with a wrench and offers a single positive stop at 0°. The air exhaust seems excessive and poorly directed at times, but a dust wand attachment is included for use with a vacuum. There are some slight fit and finish concerns (the guide was off-center to the blade in the tool we tested), but the saw provided a good cut with a nice blade change at a reasonable cost. (freudtools.com)

Grizzly G8994Z

Best Value

Even though the Grizzly didn't perform remarkably well in any category, it's very affordable and does an adequate job for the occasional user. Built on a 10-year-old Bosch design, the blade change requires a special screwdriver inserted through the top of the saw and is awkward. The shoe is a reinforced stamped-steel plate, unlike the majority of cast aluminum/steel shoes on the others. It performed slowly in the speed test and had tear-out problems. It also proved to be seriously underpowered in the curve test. The variable-speed motor (trigger-mounted switch) had trouble maintaining torque and fought the curves. The shoe requires an Allen wrench to adjust and can interfere with the blade when set to 45°. So it's not great, but if you need a jigsaw only occasionally, it's a bargain. (grizzly.com)

Hitachi CJ120V

The Hitachi proved to be a better-than-average performer with low vibration, very good performance in the curve test and an amazingly good time in the speed test, but at the cost of some terrible tear-out. It has a nice dual-action lever-style blade release. The one-piece cast shoe has a positive lock at 0° with a set-back stance for tight cuts. The variable-speed control is on the trigger in the top-handle model and at the rear of the pommel on the barrel-grip model. The saw doesn't have a blower, but includes a vacuum wand attachment. The saw is pleasant to use, performs well and has no serious flaws. Unfortunately, it has some tougher competition in the Makita and Milwaukee that shine slightly brighter, keeping this one from our top accolades. (hitachi.com)

Makita 4341FCT

Editor's Choice

The Makita has a great dual-action lever-style blade-change system, a soft-start motor to avoid accidents and electronic feedback to maintain torque in the cut. It's also available in a top-handle design (4340FCT, $160). In our tests the Makita offered a smooth cut and handled the curves with little effort. Also included is a task light, mounted to shine on the cut. This might sound like a throwaway feature, but it actually proves very beneficial. The shoe is marked for bevels at 15°, 30° and 45° but includes a positive lock only at 0° and requires a wrench to make the change. It does offer a set-back stance for tight cuts. The variable-speed control is mounted at the rear of the motor housing and the tool offers no blower, though a dust wand is an optional accessory. It's priced a little higher than most of the rest of the pack, but the features and performance made it our favorite in the affordable price range. (makita.com)

Metabo STE105 Plus

The Metabo also sports the nice lever-style blade-change system, but it hasn't been updated with the dual-action system to make it even nicer. Available in a barrel-grip and top-handle (STEB105, $174) design, it has a soft-start motor that incorporates the electronic feedback, assisting with torque maintenance during heavy cuts (though it didn't test that way). Performance in the speed test was good with little vibration. We had some trouble handling the saw through the curves. The shoe (adjusted using an Allen wrench) is the most unique that we saw, offering positive stop locations for 0°, 15°, 30° and 45° bevel settings – very nice. No blower is included, but a dust collection wand is. The Metabo also offers a five-position orbital setting, as with Ridgid, giving us more choices for aggressive cuts. This is a good saw, but not good enough to pull top honors. (metabousa.com)

Milwaukee 6267-21

Milwaukee has put together a nice jigsaw. We tested the barrel-grip design, but it's also available in a top-handle (6266-22, $140) design. The performance of this saw was OK in the speed test (with some vibration) but did better in the cornering test, with a nice cut and not much hesitation. It offers a toolless shoe adjustment that we like, with positive stops at 0° and 45°. The tool includes a 10-position blower (nice!) and a wand for vacuum connection. Variable-speed adjustment is in the motor housing. It offers a very easy dual-action lever-style blade change. It had one of the best quality cord sets, but also tested out as the loudest one. Priced competitively with the Metabo and Makita, we think the features and performance make this a saw worth serious consideration (even more so in the more affordable top-handle version). But taking everything into consideration, it finishes a whisker away from our top honors. (milwaukeetools.com)

Porter-Cable 9543

The Porter-Cable model 9543 jigsaw is a victim of progress, just like the Bosch. Introduced as an innovative design a few years ago, the toolless blade system is now cumbersome and not all that user-friendly compared to its rivals. The toolless shoe adjustment is still the best, with preset detents at 0°, 15°, 30° and 45° and a lever that locks down very positively. The saw performed average in the speed test, but better in the curve test, with little deflection concerns. It incorporates a split-rod blade guide with rear-bearing support, similar to the Festool, for very nice blade guidance. One annoying problem is the dust. Even with the three-position blower (with a knob so small it's difficult to adjust) the dust managed to always be blowing right in our face. Moderately priced, the Porter-Cable cuts well, but needs an upgrade to improve the blade change system and the blower problems need attention. Though a good saw, it falls short. (porter-cable.com)

Ridgid R3120

Ridgid is a new name in portable power tools, but there's good pedigree behind this saw. Made in conjunction with Metabo, there are a number of similarities between the saws. The performance in testing was OK in speed, but it had some difficulty in the curve test, wandering more than expected. The lever-style blade change is fairly easy, but it could benefit from a dual-action release. As with the Metabo, the shoe (Allen wrench required) has a nice positive stop design at the 0°, 15°, 30° and 45° bevel settings. The cord is good-quality rubber and includes a nice hook-and-loop cord wrap and an illuminated plug to indicate when the power is on. No dust blower is included, but a wand for vacuum hookup is. The Ridgid is only available as a top-handle design and is a nice jigsaw that offers a tad more features than the Metabo for $15 less. There's nothing bad about this saw, but it's edged out by a few competitors. (ridgid.com)

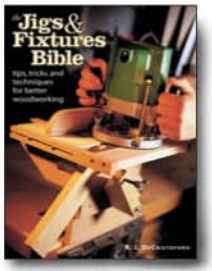
ORBITAL JIGSAWS

Manufacturer Model	Bosch 1584AVS	Craftsman 27719	DeWalt DW321	Festool PS300EQ	Freud FJ85	Grizzly G8994Z	Hitachi CJ120V	Makita 4341FCT	Metabo STE105 Plus	Milwaukee 6276-21	Porter-Cable 9543	Ridgid R3120
Price	$148	149	139	250	108	60	138	169	174	174	148	159
Weight	5.5 lbs.	7.0	6.4	5.1	5.4	5.5	5.5	5.3	6.2	5.7	6.5	5.7
Speed*	500-3,100	500-3,100	500-3,100	1,000-2,900	500-3,000	0-3,100	850-3,000	800-2,800	1,000-3,000	500-3,000	500-3,100	1,000-3,000
Cord length**	14'-R	8'-R	8'-R	13'-R	7'-P	7'-P	8'-P	9'-R	14'-R	13'-R	10'-R	11'-R
Dust blower	3 positions	3 pos.	3 pos.	No	No	3 pos.	No	No	No	10 pos.	1 pos.	No
Decibels***	95	91	96	95	95	94	94	93	96	97	95	91
Stated amps	5.0	5.0	5.8	6.0	6.0	5.0	5.8	6.3	6.0	6.2	6.0	6.0
Amps no load	3.07	2.86	3.05	3.29	3.60	2.40	3.27	3.70	2.90	3.18	3.10	2.90
Amps load	3.86	3.77	3.68	4.24	4.57	3.00	3.96	4.86	3.58	3.65	3.78	3.83
Speed (0)†	5.69	4.88	3.40	3.12	4.21	5.04	3.66	4.50	4.26	5.11	5.59	4.95
Speed (3)†	3.38	2.59	2.14	2.78	2.78	3.38	1.79	2.78	2.11	2.61	2.67	2.84
Deflection††	5/32, 3/32	3/16, 5/32	3/16, 1/8	3/16, 1/16	7/32, 5/32	1/8, 1/32	5/32, 0	1/8, 1/16	1/8, 1/8	1/8, 1/32	5/32, 1/8	3/16, 1/16
Vibration†††	10"	19"	8"/:13	13"/:12	11"/:10	12"/:20	14"/:14	4"	13½"	10"/:05	24"/:28	14"

KEY
* Speed in strokes per minute (spm)
** R = rubber; P = plastic
*** Decibels recorded from 2' away
† Cutting speed settings – (0) = no orbit, (3) = maximum orbit; speed is in seconds
†† Blade deflection in inches from S-curve test; exterior is listed first
††† If the jigsaw vibrated off the piece of paper before the 30 seconds was up, we note how long it took

LOOKING AHEAD ...

Set for a February 2004 introduction, the Bosch 1590EVSK jigsaw will be the next generation. It will feature a 6.4-amp variable-speed motor (500-2,800 spm) with soft-start and constant-response circuitry to resist stalling. Bosch representatives tell us that it has a precision-control blade-guide system to virtually eliminate any blade wander. The One-Touch Blade Change system is expected to provide simple one-handed blade insertion and lever-blade ejection. The saw also will feature a toolless shoe bevel. Expected to weigh 6 lbs., the 1590EVSK will retail for about $170. We can't wait to see it.



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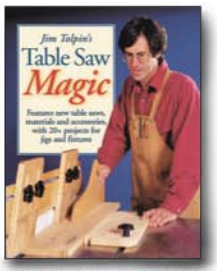

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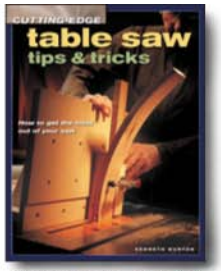

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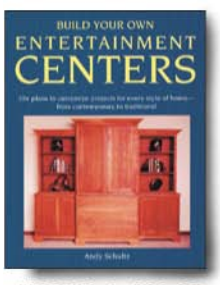

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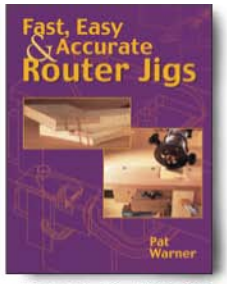

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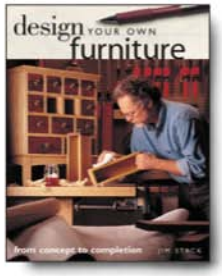

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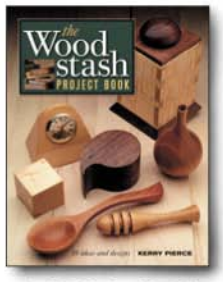

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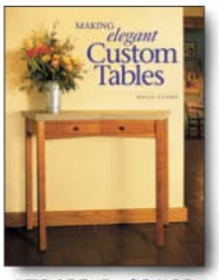

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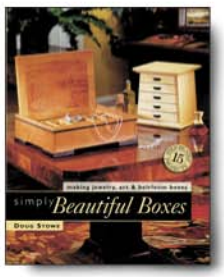

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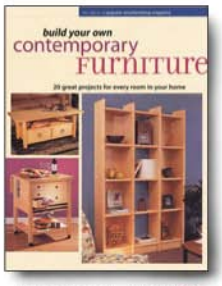

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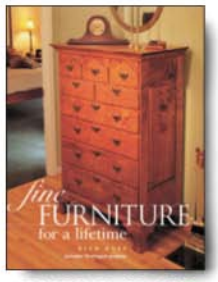

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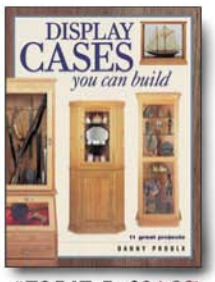

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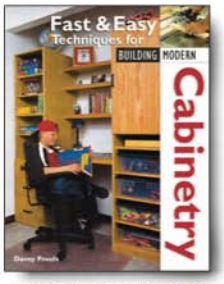

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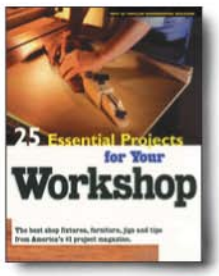

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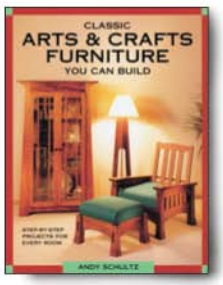

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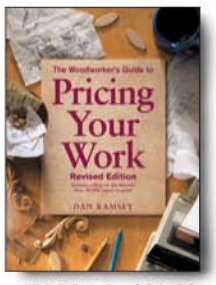

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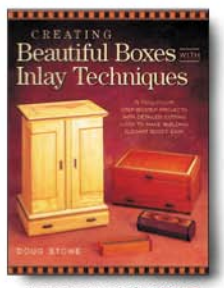

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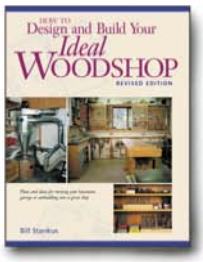

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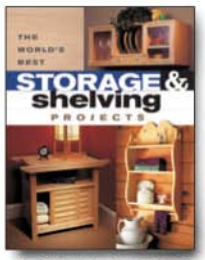

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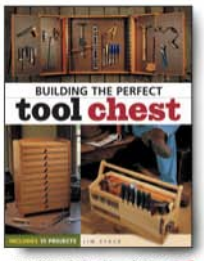

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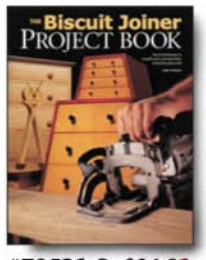

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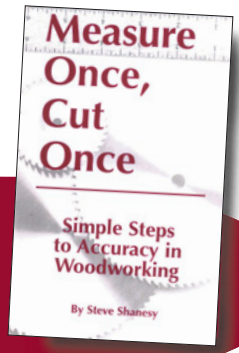

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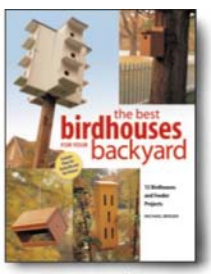

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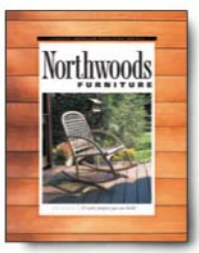

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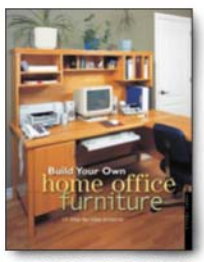

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Photo by Tim Grondin; step photos by Al Parrish

Fruit Bowl

An egg slicer and a little work in CAD results in an interesting and easy-to-build bowl (without a lathe).

Because my duties at *Popular Woodworking* include ensuring the construction drawings match the photos and text, I usually know what to expect from John Hutchinson, the magazine's project illustrator. But occasionally he slips in one of his computer-generated brainstorms along with the projects scheduled for publication. His latest "slip" was the fruit bowl shown here.

by Kara Gebhart & John Hutchinson

Comments or questions? Contact Kara at 513-531-2690 ext. 1348 or kara.gebhart@fwpubs.com. Contact John at jhutchi2@columbus.rr.com.

John was in a kitchen supply store, spotted an egg slicer and thought it could be transformed easily into an interesting bowl with a little help from his computer-aided design software (see "Creating the Fruit Bowl with CAD" online at popwood.com by clicking on "Magazine Extras"). Although he quickly rejected the notion of building a soup tureen this way, the ventilation provided by the open slats made this bowl a natural for storing fruit.

After crafting it electronically, John asked me if I'd be interested in translating it into reality in the *Popular Woodworking* shop. I liked the contrast of the straight lines and curves, so I agreed to the joint venture.

As I worked my way through the project, I found that it has many things going for it:

- It's functional art.
- Building the project requires little material: one 2' x 4' sheet of Baltic birch plywood, two scraps of plywood or hardwood for the base and some clear finish. (One bowl will set you back about $12.)
- You can build the bowl, start to finish, in one day with little woodworking experience.
- It's ideal for production runs, so it's a great gift for loved ones.

This project requires only one type of joint, coincidentally called the eggcrate joint (think modified lap joint). A band saw and a spindle sander are all you really need, but a table saw makes cutting the notches in the slats and bottom rails a little easier. Cut the curves with your band saw, nibble away the notches with your table saw, dry-fit the project and finish. It's that simple.

Curves Over Easy

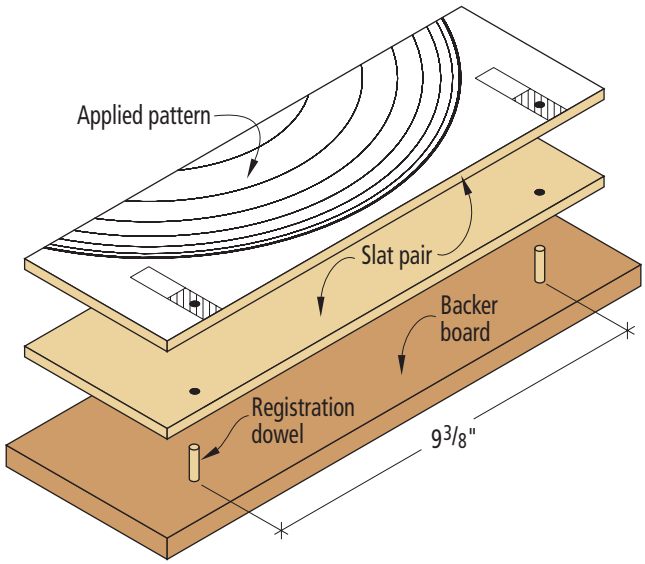
First cut the parts to size. This includes 17 slats (cut a few extra, just in case) and two bottom rails. Cut the rails 1" longer than stated in the cutting list to allow for registration holes in the corners. Organize the slats into eight pairs and let the ninth, or center slat, sit by itself. Because the #1 slats for the ends of the bowl are uncut, set that pair aside. After making nine photocopies of the slat pattern using the drawing on page 93, glue them with spray adhesive to the top member of pairs #2 through #8 and the solitary #9. Clamp the stacked pairs together on the drill press and bore the registration holes in the notch waste area where indicated on the patterns. I used 3/16" dowels for registration pins – use whatever you have.

To keep the slat pairs aligned during the cutting and sanding operations, and to provide a backer board to prevent tear-out, John came up with a simple jig, seen in the photo at right. Build the jig by applying a slat pattern to a scrap of flat stock. I used 1/2" medium-density fiberboard. Now drill the registration holes and glue in the dowels, letting them stand about 3/4" proud.

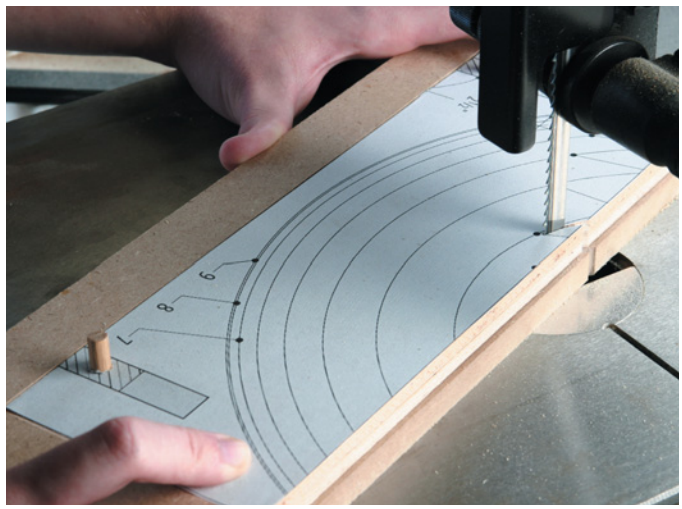
Stack the #2 pair of slats on the jig and head to the band saw. Follow the #2 path, cutting slightly short of the line. You'll be removing a chunk of your jig as you cut but it will continue to serve you well through successive cuts because the registration pins remain intact and you'll always have backer material below. After you've made the cut, take the whole assembly to the spindle sander and sand to the line. When you're satisfied with the smoothness of the arc, remove the pair from the jig, number it and repeat the process on each successive pair. Although slat #9 is a loner, it also should be cut on the jig to avoid tear-out.

Eggcrate Joint

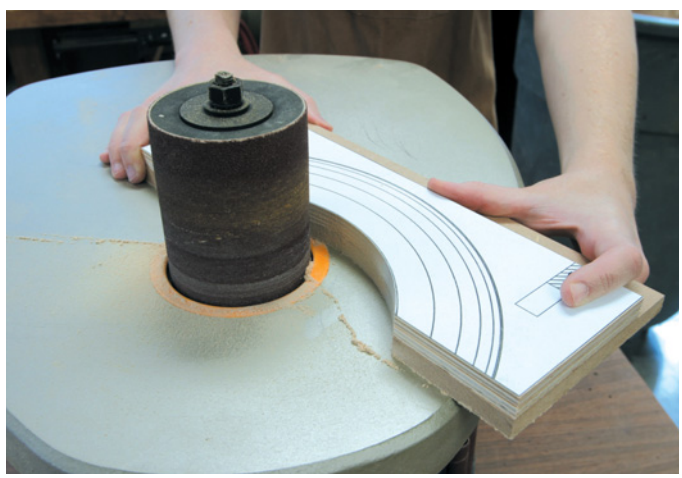
Once all the slats are machined, it's time to cut the eggcrate joint.

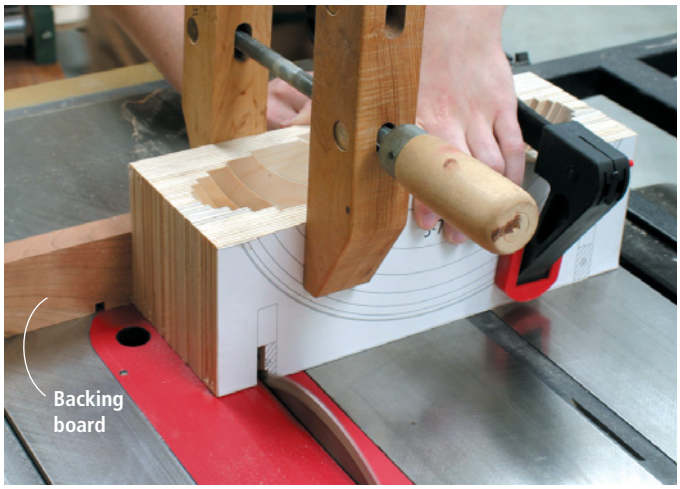


Slat alignment, cutting and sanding jig



A pattern and jig allow you to cut smooth arcs on your slats. Cut slightly wide of the line – a spindle sander will clean things up, as shown below.





You can cut these notches on your band saw but it's much easier to gang all the slats together and nibble away at the notches using your table saw.

Grab one of the #1 slats and adhere a pattern. The hatched areas on the pattern indicate the size of notch you need to cut. Now gang all your slats together and clamp them tight. Make sure all your parts are square and flush.

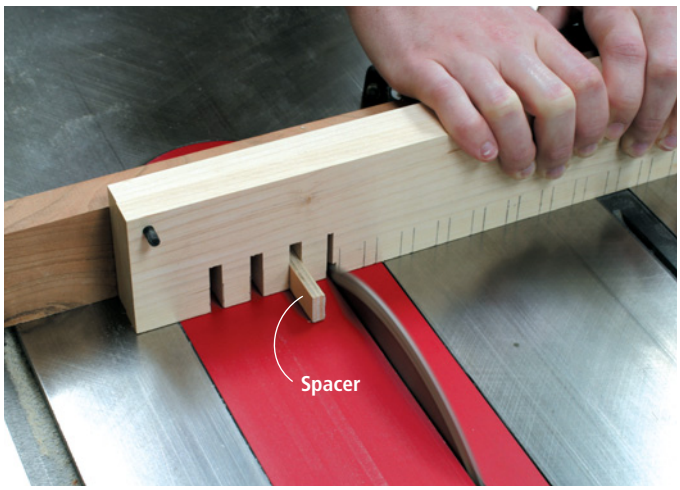
Attach a backing board to your miter gauge to minimize blowout. Carefully nibble away at the slats until the appropriate amount of material is removed.

Now you need to cut the notches in the bottom rails. I used maple, but Baltic birch plywood might be a better choice. If your joints are tight, the maple rail's horizontal grain direction can cause the joint pieces to snap off during assembly. With plywood, grain direction isn't an issue.

First, hold the oversized strips together, drill 3/16" registration holes in the top corners and thread in two dowels. The dowels will hold the strips together and ensure alignment of the notch pairs.

Enlarge the half-size rail elevation drawing and use it to lay out the notches. With the backing board still attached to your miter gauge, begin cutting away the notches on your strips.

Be careful: Cut too big of a notch and you'll end up with some conversation-piece kindling. Cut too small of a notch and your bowl won't go together – especially after you add a finish. Don't rely solely on your pencil marks. Cut a ½"-wide x 2½"-long spacer from some of your leftover Baltic birch plywood and use that to continuously check the fit of your joint. Once all your notches are complete, cut the bottom rails to their final size.

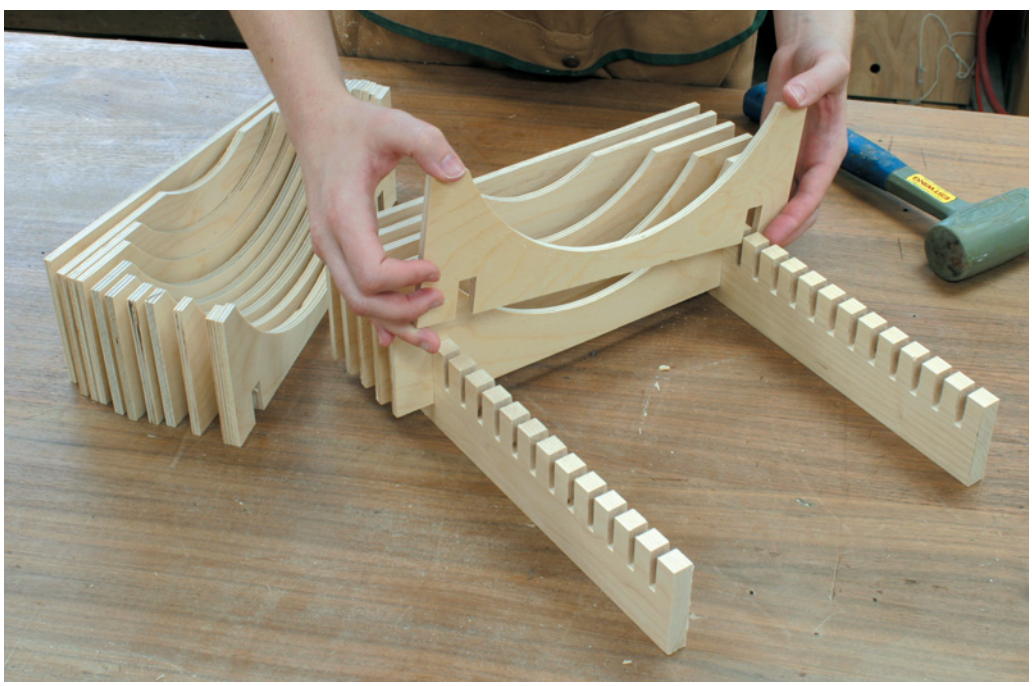


The spacer shown at right allows you to continuously check the back rails' fit. It also keeps the back rails aligned while cutting future notches.

No Scrambling Required

Once your bottom rails are complete, dry fit everything together. If you're happy with the fit, take the bowl apart, sand all your parts and break the edges.

I like the natural look of wood (even Baltic birch plywood) so I sprayed my bowl's parts with three coats of lacquer. A paint job also would look nice. Do yourself a favor and cut two strips of ⅛" scrap wood that fit in the notches on the slats to hold the slats upright while finishing – this cuts your



Assembly simply requires a rubber mallet (be gentle). A little filing inside the notches helps tight joints, and a little glue helps loose ones.

finishing time in half because you can coat both sides at once.

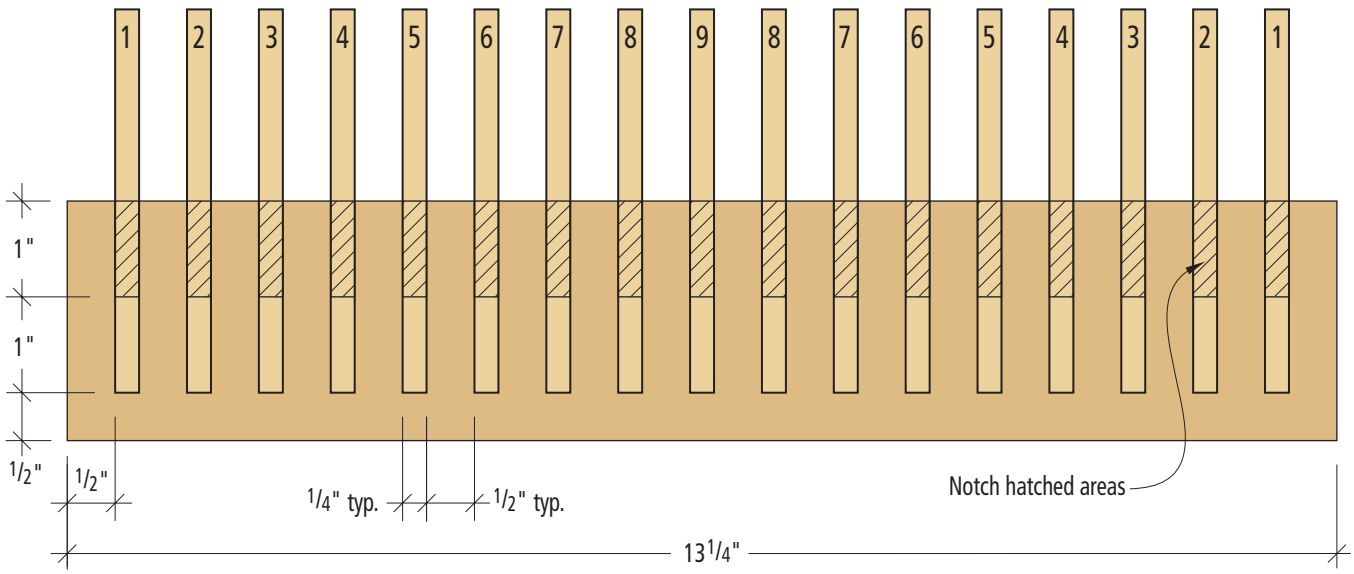
Once the finish dries, it's time for final assembly. The bowl should go together without glue, so there's no need to rush. However, if some of your joints are loose, a little glue will tighten them up. And if your joints are too tight, file the notches in the slats. Take your time and use a rubber mallet if some joints are being ornery.

And now your bowl has reached fruition. I keep mine filled with fruit on my kitchen table. And every time I grab an apple, I wonder what John's next shopping trip will inspire. **PW**

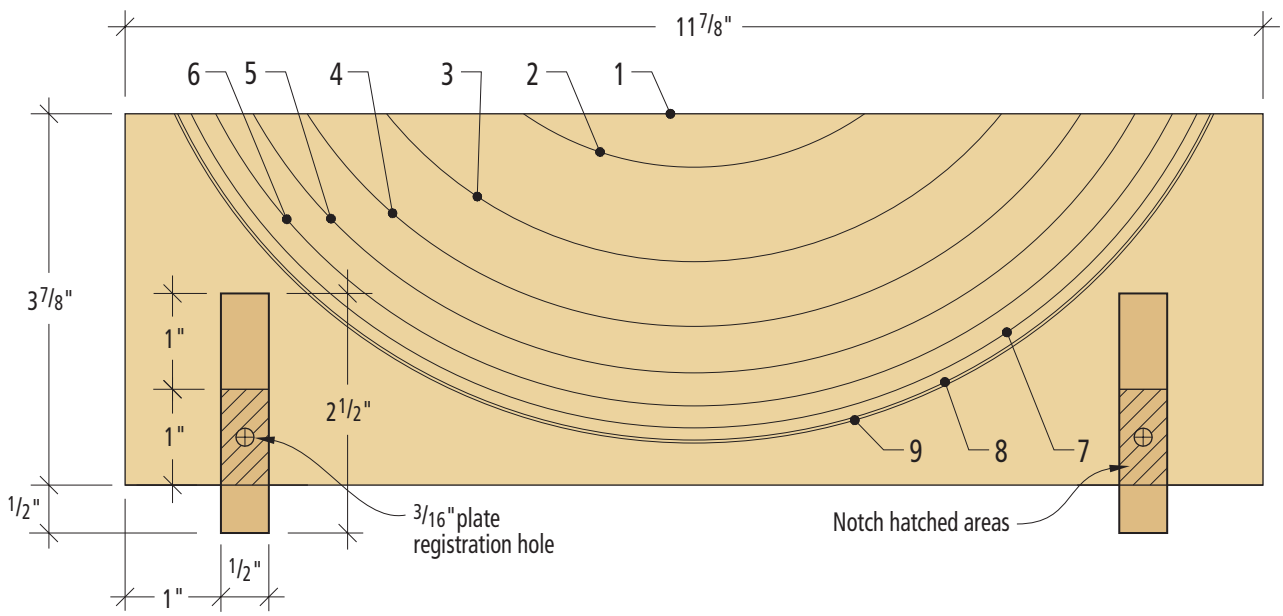
FRUIT BOWL

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑ 17	Slats	1/4	3 7/8	11 7/8	Baltic birch
❑ 2	Bottom rails*	1/2	2 1/2	13 1/4	Maple

*Cut 1" long to allow for registration holes.



Half-size rail elevation



Half-size slat elevation

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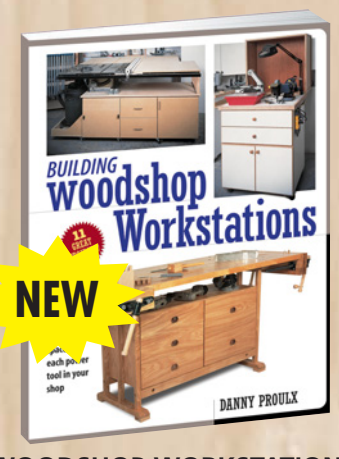

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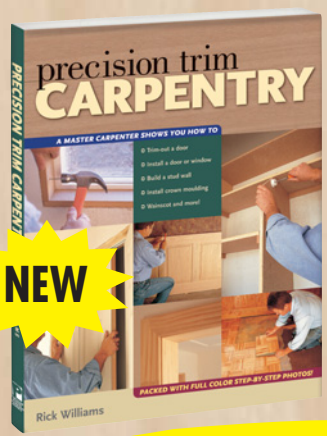

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The Pine Problem

Strategies to make this blotchy wood behave.

Pine is notorious for the uneven way it takes stain. Here we hand-planed a board of Southern yellow pine to perfect shimmering flatness and applied a walnut stain. This board experienced both grain reversal and significant blotching. In other words, the problems occur with even the most careful preparation.

Pine is the first wood used by most beginning woodworkers. It is widely available, relatively inexpensive and one of the easiest woods to cut and shape using common woodworking tools.

But pine may be the most difficult wood to finish. So what begins as an enjoyable craft experience, making some type of decorative or useful object, all too often ends up as a nightmare. It doesn't have to be this way, of course, but it does require some knowledge of the peculiar characteristics of pine and how to handle them to avoid it.

Pine is difficult to finish nicely for the following five reasons:

• The near-white, spring-growth wood is much softer than the orange, summer-growth wood. So hand-sanding without backing the sandpaper with a flat block "grooves out" the springwood and creates ridges that aren't easily visible until after the finish is applied.

• Because of its lower density, the springwood absorbs much more finish than the summerwood, so an extra coat or two of finish often has to be applied to get the sheen even – especially when you are using non-film-building finishes such as oil.

• As it ages, pine darkens to a warm orange color, so colored wood-putty and wax fillings that originally matched perfectly stand out noticeably after a year or two.

• The different densities of the springwood and summerwood impact the coloring of a stain. The soft springwood absorbs stain easily and can become quite dark, while the dense summerwood absorbs almost nothing and stays about the same color. The result is "grain reversal" that can be quite unattractive, depending on the specific boards or veneers being used.

• Uneven coloring shows up much worse in the form of "blotching," which is uneven stain coloring spread randomly over the wood. Blotching is easily the most serious problem in wood finishing because it's the only problem that can't be fixed – even by stripping and starting over. And pine is one of the worst woods for blotching.

The Solutions

The solutions to the first three problems listed above are pretty obvious.

• To avoid grooving, use a flat cork, rubber or wood block to back your sandpaper, or use a pad or random-orbit sander. On non-flat surfaces that have to be sanded by hand, use the thickness of folded sandpaper to help avoid grooving out the springwood.

• To get the sheen even between springwood and summerwood, you may need to apply more coats of finish than you do to other woods. If you sand the early coats smooth using fine-grit sandpaper, you'll achieve an even sheen quicker.

by Bob Flexner

Bob Flexner is the author of "Understanding Wood Finishing" and a contributing editor to Popular Woodworking.

• Unfortunately, there's no good solution for avoiding the development of color differences between pine and a filling, other than to not fill at all. Even stained pine will darken some. You can always color your filling a little darker so it won't stand out as much after a few years, but then it will stand out at the beginning.

The last two problems, grain reversal and blotching have similar causes – the stain penetrating more in some areas of the wood than others – so they have similar solutions. The three best solutions are to use a gel stain, wash-coat the wood before staining or spray a toner after sealing the wood.

Use a Gel Stain

For all non-production situations, using a gel stain is, by far, the easiest and most predictable method for avoiding blotching and most grain reversal.

Gel stains are regular stains that have been thickened so they don't flow readily. As a result, all of the stain stays near the surface of the wood so the coloring comes out fairly even. You still need to wipe off the excess, of course, just as you do with liquid stains, or you'll get an uneven coloring caused by the stain itself rather than the wood.

Gel stains have an interesting and amazing history. They've been around for half a century, but the few manufacturers that made them didn't realize their benefit. Despite these stains being relatively messy to use (compared to liquid stains), they were marketed as "easy to use" and that was it – never a mention about avoiding blotching.

About a decade ago, some woodworking magazines began publishing articles promoting gel varnishes and gel stains as being easy to use, creating a large market for these products. Many more manufacturers then began making gel stains, and they're now widely available. But, incredibly, there's still not one manufacturer that states on their containers that this stain solves the blotching problem!

To add confusion to the issue, a number of magazine articles have suggested several additional steps be taken before applying the gel stain. These steps don't hurt anything, but they aren't needed. Unless you have a reason to use one of the methods described below, you'll find that a gel stain used by itself is your best bet for staining pine.

Liquid stains penetrate unevenly into pine and produce a blotchy appearance (left). Gel stains don't flow or penetrate readily, so they stay near the surface and produce a more even coloring (right).

With some experimentation using a wood conditioner, I was able to prevent most of the blotching (right), but I also lost most of my coloring. I applied the same stain over the wood conditioner and directly to the wood (left).

Blotching can be avoided entirely by toning the wood, but toning (right) produces a very different appearance than staining (left) because toning places the coloring above the wood, not in it. I used the same colorant on both sides.

Use a Washcoat

A washcoat is any finish that is thinned fairly significantly and applied as a first coat to partially seal the wood and retard stain penetration. Commercial products called "wood conditioners" are washcoats.

In the furniture industry, washcoats are usually thinned lacquer or sanding sealer. Experimentation is done to determine how much to thin and how much to apply so the stain produces the desired appearance. If you don't also experiment yourself, you won't be successful at preventing blotching using a washcoat. If you've ever used a wood conditioner, especially if you've followed the directions, you know what I mean.

Wood conditioners aren't necessary because they're designed for non-production situations, and gel stains work much better. Many finish manufacturers now make both products. I believe they should remove wood conditioners from the market and promote gel stains instead.

Spray a Toner

A toner is a finish with a little pigment or dye added. Toning is always done over a sealed surface – that is, over at least one full coat of finish. (If you were to apply a toner directly to the wood, it would be staining.) Toners cause no blotching or grain reversal because all of the color is blocked from the wood, but toning looks different than staining because the figure of the wood is hidden to some degree, rather than highlighted.

You can make your own toner by adding pigment and/or dye to any finish and thinning it enough (usually about four-to-six parts thinner) so you have control and can build the color slowly. Otherwise, you might cover so quickly that you are, in effect, painting.

Toners usually have to be sprayed because it's very difficult to avoid noticeable brush marking. If you don't have a spray gun, you can use an aerosol toner (see "Aerosol Finishing" in the October 2003 issue of *Popular Woodworking*). **PW**

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Caption the Cartoon

Illustrated by Bob Rech
bobrech@juno.com

#62

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This issue's winner receives Amana Tool's new Patented E-Z Dial Slot Cutter. This carbide-tipped slot cutter has no shims and no spacers. Simply dial it, lock it and cut it. One full turn of the dial changes the slot width by 1/32". The slot cutter is valued at $150! Runners-up each win a one-year subscription to *Popular Woodworking*.

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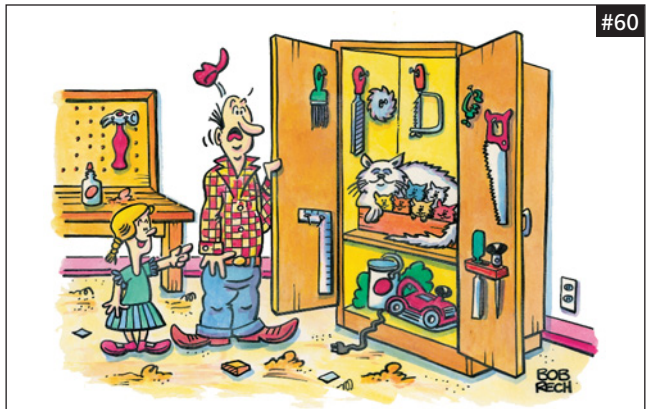

"Wow, Mom was right! Things do magically appear in your tool cabinet!"

Drew Bolton, of Hersey, Michigan, is the winner of our Cartoon Contest from the August issue and recipient of 20 PSI Clamp-n-Spread clamps. The following runners-up each receive a one-year subscription to *Popular Woodworking:*

"You lied, you said you had bench dogs in there."

Andy Nielson, Bellevue, Washington

"Wow, Dad. That duplicating jig you made really works!"

Matthew Brock, Tucson, Arizona

"Mommy said it looks like someone finally decided to do some 'labor' out here."

Bill Kurtz, West Chester, Ohio

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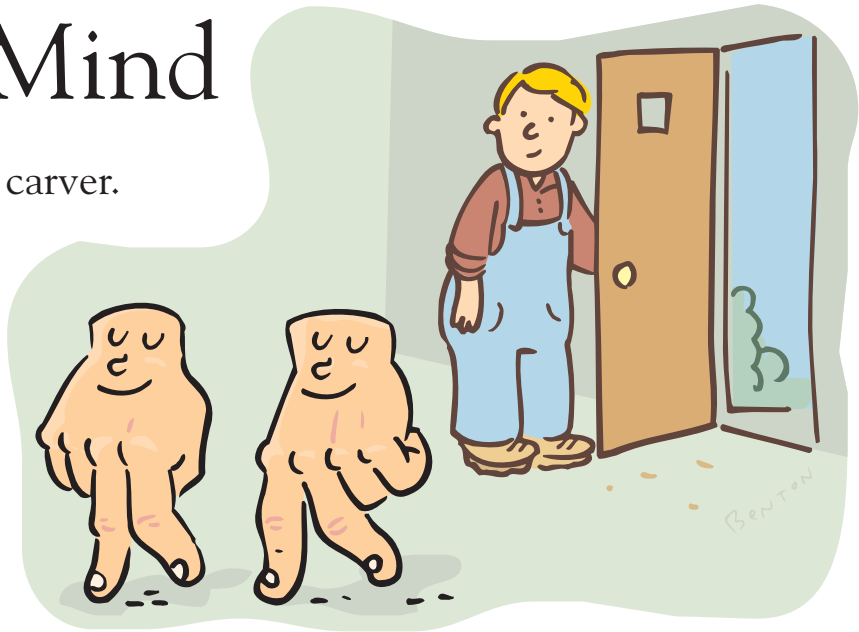

"Don't be afraid to toss it around," Gino said. "That's the best way to shape hair. Create flowing curves that chase each other and graceful lines that dance."

Gino Masero, a member of the English Association of Master Carvers, was my teacher, mentor and friend. In addition to teaching me the ordinary, everyday skills such as carving hair and sharpening tools, he bestowed a much more important gift – he generously opened a window into his soul. And what I saw there, combined with what I learned at his workbench, made it possible for me to become a professional woodcarver.

The first thing you noticed about Gino was his hands. They were massive, strong and competent with fingers so thick that his son can recall a time when he was unable to encompass any one of them with his fist. They were hands that knew what they were about and they showed not the slightest hesitation while doing their work. His hands were so proficient and confident that I sometimes imagined them coming to the shop by themselves, fully capable of meeting the day's challenges without Gino being there.

At my first lesson, Gino had me place my short, stubby hands on the workbench. He studied them for a moment and then solemnly told me that I had "carver's hands." He pronounced them large enough to comfortably grasp a carving gouge and strong enough to control it. That was one of the reasons he took me on as a student, he said.

"But you won't become a woodcarver," he continued in his serious tone, "until the gouges become extensions of your hands. When that moment comes – and you'll probably not even be aware that it has come – when the carving tool becomes a part of your hand and you forget that you are holding a tool – then you'll be a woodcarver."

Gino was right; that moment did eventually come – and yet I don't remember it. There was certainly no drum roll or flashing lightbulb. It just seemed part of a natural progression. One day I was guiding the gouge through the wood and the next day the tool seemed to know the way by itself. I belonged to the gouge as much as it belonged to me. In a near-mystical transference, which perhaps only a fellow craftsman can understand, the tool had become me.

After I had crossed that extraordinary threshold and Gino was satisfied with my hands, he then concentrated on a far more difficult task – he went to work on my head.

He set standards, confident now that I had the physical skills to meet them. "And it has to look right no matter where you stand. Don't be careless with one spot just because it's on the bottom or in the back. It doesn't matter if other people won't notice it; you'll know it's not right, and so will your God."

He wanted me to see what he saw when he looked at a piece of wood. He wanted me to see what Michelangelo, Tilman Riemenschneider and Grinling Gibbons had seen. Books, museums and cathedrals became as important a part of my life as the gouges and sharpening stones.

One afternoon, as we were finishing up, he gently chided me. "You're soon going to become a link in an ancient continuity so you have a responsibility to learn from those chaps who were here before us. I think it's time you got to know some of them."

The next morning, we caught a train to London and spent the day at the Victoria and Albert Museum. He stood me in front of Gibbons' relief masterpiece, The Stoning of St. Stephen. "See how subtly Gibbons guides the viewer's eye by carving those diagonal lines. And see how he adds interest to the lines by gently beveling them. He commands us to look at St. Stephen. Gibbons is dead some 300 years but he's still communicating. Never forget that, Gerry – communicating, that's what we're about."

Gino died in 1995 at the age of 81. His work, including a seven-foot tall Christ in London's St. Paul's Cathedral, can be found throughout England. He loved to carve and he communicated that love to all those who worked with him and even to some who simply watched him. I still remember the day he explained how he felt about his profession. He graciously used that explanation to welcome me into the carving brotherhood.

"It's a grand job, isn't it? You get to do something you love to do and …" He paused with a look that somehow combined bemusement and bewilderment, "… and, they pay you lots of brass to do it." Then, with a characteristic twinkle in his eye, he looked me full in the face and said, "Gerry, we're lucky fellows, us carvers, aren't we?" **PW**

by Gerry Holzman

Gerry Holzman, a specialist in the creation and restoration of carousel art, has just finished a 20-year project – the carving of a full-size, operating carousel based entirely on the theme of New York state history and culture. Check out empirestatecarousel.org.

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