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AUGUST 2003
ISSUE #135

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- MAX. CUTTER DIAMETER: 5"
- APPROX. SHIPPING WEIGHT: 220 LBS.

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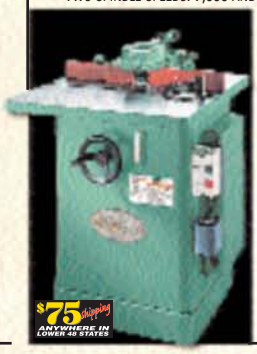
- 3 INTERCHANGEABLE SPINDLES: ½", ¾" AND 1"
- TWO SPINDLE SPEEDS: 7,000 AND 10,000 RPM



- 3" SPINDLE TRAVEL
- SPINDLE OPENINGS: 1⅜", 2¾", 4", AND 5½"
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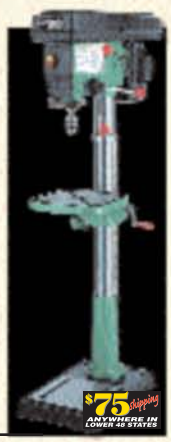

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- 1½ HP, SINGLE-PHASE, 110/220V MOTOR
- PRECISION GROUND CAST IRON TABLE
- TABLE SIZE (W/ WINGS ATTACHED): 27⅛" X 40⅝"
- CUTTING CAPACITY : 3⅛" @ 90°, 2⅛" @ 45°
- ⅝" X 1¼" ARBOR ACCEPTS DADO BLADES
- FRONT & REAR QUICK-LOCK FENCE IS MICRO-ADJUSTABLE
- MAXIMUM RIPPING CAPACITY: 24"
- APPROXIMATE SHIPPING WEIGHT: 220 LBS.

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10" LEFT-TILTING SUPER HEAVY-DUTY TABLE SAW

- MOTOR: 3 HP, SINGLE-PHASE, 220V
- 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"
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- APPROX. SHIPPING WEIGHT: 210 LBS.

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17" HEAVY-DUTY BANDSAW

New!

- MOTOR: 2 HP, SINGLE-PHASE, 110V/220V, TEFC
- PRECISION GROUND CAST IRON TABLE: 17" SQUARE

- CUTTING HEIGHT: 12"
- CUTTING CAPACITY LEFT OF BLADE: 16¼"
- FULLY-BALANCED CAST ALUMINUM WHEELS WITH RUBBER TIRES
- DELUXE EXTRUDED ALUMINUM RIP FENCE
- 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
- HEIGHT FROM FLOOR TO TABLE: 37½"
- APPROX. SHIPPING WEIGHT: 321 LBS.

G0513 **INTRODUCTORY PRICE**

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19" HEAVY-DUTY BANDSAW

New!

- MOTOR: 2 HP, SINGLE-PHASE, 60 Hz, 110V/220V, TEFC

- 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
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- BLADE TENSION INDICATOR
- MICRO ADJUSTING GEAR TABLE
- 4" DUST PORT X 2
- TABLE TILT 10° LEFT, 45° RIGHT
- APPROX. SHIPPING WEIGHT: 383 LBS.

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- MAX. DEPTH OF CUT: ½"
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- 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
- APPROX. SHIPPING WEIGHT: 450 LBS.

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- MAGNETIC SWITCH WITH THERMAL OVERLOAD PROTECTOR
- 4-HSS CUTTERHEAD KNIVES ARE 8" X ⅛" X 1"
- MAX. DEPTH OF CUT: ½"
- CUTTERHEAD SPEED: 5500 RPM
- CUTS PER MINUTE: 22,000
- APPROX. SHIPPING WEIGHT: 461 LBS.

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G0500

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12½" PORTABLE PLANER

- 2 HP, SINGLE-PHASE, 110V MOTOR
- 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 SPEED: 8,540 RPM
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- CUTTERHEAD SPEED: 5000 RPM
- RATE OF FEED: 16 FPM & 20 FPM
- MAX. CUTTING WIDTH: 14⅞"
- MAX. CUTTING HEIGHT: 6⅛"
- MAX. CUTTING DEPTH: ⅛"
- NUMBER OF KNIVES: 3 HSS
- ALL BALL BEARING CONSTRUCTION
- APPROX. SHIPPING WEIGHT: 440 LBS.

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G1021

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20" PLANER

- 3 HP, 220V, SINGLE-PHASE MOTOR
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- CUTTERHEAD SPEED: 4833 RPM
- RATE OF FEED: 16 FPM & 20 FPM
- MAX. CUTTING WIDTH: 20"
- MAX. CUTTING HEIGHT: 8⅝"
- MAX. CUTTING DEPTH: ⅛"
- NUMBER OF KNIVES: 4 HSS
- DUST EXHAUST HOOD HAS 5" DUST PORT
- APPROX. SHIPPING WEIGHT: 785 LBS.

4 BLADE CUTTERHEAD!

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G1033

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- FLOOR-TO-TABLE HEIGHT: 35½"
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- BUILT-IN 4" DUST PORT
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- CONTROL PANEL WITH AMP LOAD METER
- HANDLES STOCK UP TO 23½" WIDE AND 4¼" THICK
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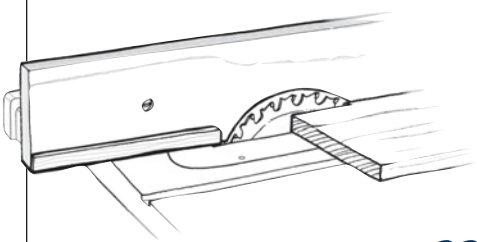

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PROJECTS, TOOLS AND TECHNIQUES

ON THE COVER

Shaker oval boxes intimidate many woodworkers needlessly. We show you everything you need to get started in this fascinating and rewarding project.

Cover photo by Al Parrish

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Hot on the Trail of Hardwoods

There are many aspects of woodworking that cast a spell on people, drawing them into a lifelong affair with the craft. For some it is the pure escapism of leaving everyday stress behind for the precious hours of solitude in the shop. For others it's the joy of engineering a project to find an elegant solution to its construction. For still others it's the pure joy on the face of a child who just received a handmade toy.

For me, there are two allures that inspire every project from the start. Interestingly, both are like dance partners: Each plays a role, and each relies on the other to succeed. What's always been my passion is finding awesome wood and then making the best use of it in a well-designed project.

In my earliest days of woodworking, I had several experiences that lit this fire in my belly. The first was reading James Krenov's "A Cabinetmaker's Notebook" (Linden). In it, he described the importance of finding special material to work with and then studying the grain to put the beauty of the material to best use. From my earliest projects, "showing off the wood" was important, even when my workmanship still needed development.

That meant spending time matching boards to their best advantage when making tabletops or door panels. The slope or curvature of the grain dictated its position in the stiles and rails of a face frame or door.

The next big influence was the opportunity to research the work of and interview woodworker George Nakashima. He and his outstanding book, "The Soul of a Tree" (Kodansha), introduced me to another important concept: Trees, special in their own right as majestic living things, can have a second life after their demise in the form of thoughtful furniture made by sensitive craftsmen. Nakashima extolled this virtue in his work. He made furniture using planks of lumber that came from his private stock – mostly walnut he collected from the United States, southeastern Europe and the Middle East. Nakashima's furniture often included a "free" edge, the natural waney edge of the tree just below the bark. He even used thick slabs of root stock, complete with voids and edges shooting off in many directions. His work always reminded the viewer of the origins of the material. It was a tree!

Then I had the privilege of spending six years in a custom furniture manufacturing company that turned out hundreds of unique furniture projects every year. The work was designed by top interior designers and architects and built to exacting standards with exquisite finishes. Every item used custom-ordered veneers, laid up in beautiful patterns. These veneers were sliced from trees that could be classified as some of the most spectacular in the world, with grain patterns most people see only in books. The veneers were complemented with solid lumber of equally special status.

These experiences whetted my appetite and set me on my quest for finding, then using, special materials when I can find them.

My lumber lust hasn't taken me far from home, and it hasn't cost me a bundle of cash. Sometimes it was in my own backyard or down the street (see photo on page 49). So don't think it's out of your reach. But if your yard or neighborhood is barren of standing timber, be sure to read our road map to finding the objects of your lumber desires. **PW**

Steve Shanesy

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Editor & Publisher

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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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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.

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"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

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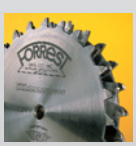
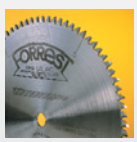
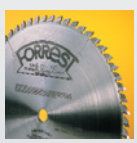


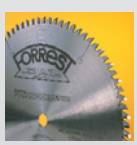
Dado-King – The world's finest multi-tooth dado set. It works effectively in all directions—with the grain or across it.



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.



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What About the European Planes?

Smoothing Plane Article Neglected the Reform-style Handplanes

When I anxiously turned to read your story on smoothing planes (June 2003), I was disappointed for *Popular Woodworking* readers that E.C.E.'s 711 Primus smoothing plane was not mentioned. Except for our advertisement on page 95, your readers would not know a much less expensive option existed. Or, even worse, your omission of E.C.E.'s highly regarded and popular smoother might be seen as a negative comment.

Your readers may have liked to know that the Primus adjustment offers positive action and doesn't require you to "retract the iron. Now advance the iron until it takes the slightest cut." There is no such slop in the Primus 711's depth-adjustment system to contend with.

Unlike metal planes, E.C.E. planes' soles do not have to be waxed with paraffin, as you describe. Lignum vitae wood is self-oiling; the plane's sole becomes slick with use.

Our 649-P Pocket Plane also is considered a miniature smoothing plane because the iron is bedded at 50°.

Dave Warren
David Warren Direct
E.C. Emmerich, U.S. representative

Editor's note: In hindsight we should have mentioned that reform planes such as the Primus are indeed an option for people who want a wooden plane with a mechanical adjuster (and adjustable throat in some cases). To be truthful, I use mostly traditional metal-bodied planes, and those are what I chose to focus on because I know them best. As a result, I also didn't discuss Rali smoothing planes, traditional Japanese pull planes, Terry Gordon's Australian planes or any of the other Eastern-style planes (Taiwanese-style, Hong Kong-style, etc.).

As to the lack of backlash in the Primus's adjusting mechanism, I agree that it is nice. However, avoiding backlash is not why I recommend starting with the iron retracted and then advancing it to the correct depth. Instead, making test cuts with the iron extended too far tends to chew up your work. No matter what sort of plane you use, I recommend you begin with the iron retracted and advance from there.

— Christopher Schwarz, executive editor

Be Sure to Use Photo-safe Pages in the Heirloom Photo Album Project

In the April 2003 issue, Steve Shanesy wrote an interesting article, "Heirloom Photo Album." While the finished product looks nice, it can possibly cause severe damage to the photos stored in it.

For proper storage of photos, it is necessary to use archival materials to prevent image degradation over time. For proper storage of photos, it is necessary to use materials that are acid-free. Wood does not meet this requirement due to its high acidity.

In "Storage and Care of KODAK Photographic Materials: Tech Pub E-30," the Eastman Kodak Co. warns that "Fumes from … mildew inhibitors, wood preservatives, paints, varnishes and wood glues can contaminate drawers and harm photographic materials." This publication also states, "All mounting boards, interleaving paper, album covers and pages, and plastic sleeves and

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WRITE TO US

Popular Woodworking welcomes letters from readers with questions or 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*.
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LETTERS

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sheets must be free of acids, peroxides, plasticizers, metal particles, wood fibers, sulfites, nitrates and chlorides."

Also, rather than advising readers to purchase plastic pages at an "art or office-supply store," Mr. Shanesy should have informed readers to be sure to get plastic pages that are certified as photo-safe by the manufacturer.

For further information, you can view this online at kodak.com/global/en/consumer/products/techInfo/e30/e30Contents.shtml.

Ken Luskay
via the Internet

A Vote for More Hand Tool Articles

I recently subscribed to your magazine, and I wanted to give you a bit of feedback. The primary reason I subscribed is Don McConnell's new column, "From the Bench." I have corresponded with Don for many years and have a great deal of respect for his knowledge of the old tools world. I am looking forward to more articles on hand-tool usage and history in the future.

Ken Greenberg
Los Gatos, California

Try CAD for Free Before You Buy it

I have used computer-aided design (CAD) software on and off throughout the years and remembered that there is an even better deal out there: TurboCad gives its learning edition away for free, allowing you to try it for 15 days with no obligation. Look here: imsisoft.com/free/. **PW**

Mark Parsons
via the Internet

CORRECTIONS

Popular Woodworking corrects all significant errors. For a list of corrections to the magazine (or to report one), visit our web site at: popwood.com/features/mag.html.

In the review of Senco's new compressor and nailing kits (April 2003), we listed incorrect prices. The FinishPro 15 kits retail for $179, and the FinishPro 18 kit retails for $199.

In the Colonial Chimney Cupboard (April 2003), the shelves should be 10½" wide, not 10¼" as listed in the cutting list.

In the Traditional Entertainment Center (March 2003 and June 2001) the door rails should be 2½" wide, not 3½" as listed in the cutting list.

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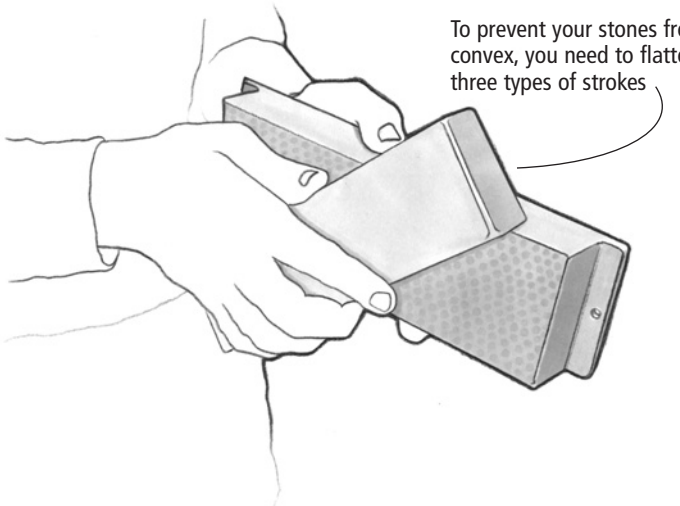
How to Keep Your Stones Flat



To prevent your stones from becoming convex, you need to flatten them using three types of strokes

Illustration by Hayes Shanesy

Sharpening Questions: What's the Best Way to Flatten Stones?

In the "Supplies" box of your recent sharpening article ("Sharpening Plane Irons and Chisels" April 2003), you specify using an 8" DuoSharp Coarse/X-coarse diamond stone. This diamond stone is slightly smaller than the Norton waterstones. But in the illustration on page 49, you show a DuoSharp stone that appears to be larger than the Norton stone – it looks like a 10" DuoSharp.

I'm new to flattening waterstones, but it seems as if the larger DuoSharp stone would make it a lot easier to flatten the Nortons. Also, do you have any suggestions for techniques for flattening the waterstones?

Tom Ryan
via the Internet

You're right about the DuoSharp. I'm using a 10" but specify an 8" to save a few dollars. I've flattened my Norton waterstones with both sizes of DuoSharps without too much difficulty. But you're right, using the 10" is a bit easier.

The trick to flattening the stones is to use three different kinds of strokes. The first stroke is to push forward with both stones parallel. Then skew the Norton about 30° and pull back. Push forward with the stones parallel. Then skew the other way and pull back. This maintains flatness. I grasp a stone in each hand under running water, which keeps the diamond stone from clogging. You might find this process easier with the diamond stone sitting flat in your sink. If you have difficulty with the diamond stone, try using plate glass and wet/dry sandpaper. And others recommend you use another Norton 1,000 stone, which I've never gotten the hang of.

— Christopher Schwarz

More Sharpening: Should I Avoid Wire Edges and 8,000-grit Stones?

Great article on sharpening. A quick question: I've been told to only push the tool forward on the stone, as to avoid a wire edge. Is that necessary, or can you go back and forth, a far faster process?

Also, I just purchased 800- and 4,000-grit waterstones; is the 8,000 required? With cash a little tight to buy a third stone at this time, will I notice a big difference with the 8,000?

Tim Reagan
Chatworth, California

Push back and forth when sharpening because you want that wire edge. The wire edge allows you to gauge your progress – it becomes smaller at each finer grit. Plus, you use the wire edge to gauge if you're sharpening all the way across your edge. If there's someplace along the cutting

continued on page 14

imagine how simple. how precise.

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continued from page 12

edge where you cannot feel the wire edge, you need to go back to a coarser grit and sharpen some more. Basically, wire edges are your friend until you get to the final grit, when you hone them off.

As to your 4,000-grit stone, it will do fine until you can afford an 8,000-grit stone. Do save your pennies, because the 8,000 is worth it. It takes the tool to another level of sharpness that you can feel and see.

If you can't afford the 8,000, you might want to buy a few sheets of the really fine wet/dry sandpaper (1,500 grit) and a flat piece of glass to take your edges up to that level. It's cheaper in the short run and does a good job.

— Christopher Schwarz

What Products Bleach Out the Grain?

Is there a safe wood bleach out there that doesn't require you to wash down your entire project with great amounts of water? If not, what besides what you would call bleach can "lighten" wood grain?

Sam McRae
via the Internet

There are three types of wood bleach. Two-part bleach (made of sodium hydroxide and hydrogen peroxide), oxalic acid and sodium hyperchlorite bleaches (clothes bleach).

Two-part bleach is the only bleach that will lighten wood significantly. Oxalic acid will lighten wood if it has aged and darkened, but it won't lighten the wood beyond what it was originally. Clothing bleaches will remove dye, but they won't lighten the wood.

You want to bleach wood to a lighter color than it is originally, so a two-part bleach is what you should use. It leaves the wood somewhat alkaline, which is why washing is suggested – to neutralize the wood. A much faster way than washing many times is to wash once with an acid such as vinegar. Use a white vinegar so that it doesn't color the wood, and you can reduce it by half with water if you want. Wash liberally and then rinse with water and dry off. You won't reach full neutrality, but the wash will bring it close enough so you won't have any problems.

The reason for the neutralization doesn't have anything to do with the bonding of the finish to the wood (as long as you don't use a catalyzed finish that uses an acid catalyst). It has to do with preventing excessive damage if water gets through your finish and into the wood. If the wood is very alkaline, the water will activate it and cause the finish to blister everywhere the water gets in. The finish will "strip," in other words.

— Bob Flexner, contributing editor

What to do with Walnut Sawdust

I have a request. Could you please do an article on what to do with sawdust? I work mostly with ash and black walnut and have learned the hard way that black walnut sawdust is not a viable substitute for wood chips around trees. If you could make some suggestions as to possible uses or good ways to dispose of the stuff, I would be grateful.

Sue Nelson
Pierce, Colorado

You are correct that black walnut is not good for plant bedding or animal bedding. It contains chemicals that are a natural herbicide (called juglone), and it is toxic to horses. Contact with walnut or butternut shavings causes laminitis (also called founder) within 24 hours of being placed on bedding. Laminitis restricts the flow of blood to horses' feet. And in humans, we're told that a little black walnut can be a mild laxative (that's why you don't often see wooden cooking spoons made using the stuff).

Sawdust from other species can be used in the garden after it has decomposed. Otherwise it will pull out the naturally occurring nitrogen in the soil, which is important for healthy plants.

I wish I had a better solution for you but we throw our black walnut sawdust into the garbage. We do take some small solace from the fact that it will decompose a lot faster than the Styrofoam cups and hot dogs in the landfill. **PW**

HAVE A QUESTION?

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

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Compiled by Paul Anthony

Make Your Table Saw Double as an Edge Jointer

THE WINNER:

If you're a beginning woodworker, there's a good chance you don't have all the tools you want in your shop. One machine that seems to get put off is the jointer. While working with a friend in a similar machine-needy shop, we needed to edge-join some boards to make a panel for a top. Unfortunately, no jointer was available. Then I looked at his table saw. Hmmm … what about using the saw as a jointer?

I started by making an auxiliary rip fence from a straight, flat board that extended beyond my rip fence to provide extra bearing surface. I then measured the distance from the trailing end of the fence to the rear of the blade and ripped a 1/16" x 3/4" shim to that length. I glued the shim to the bottom edge of the auxiliary rip fence at the trailing end, then screwed the auxiliary fence to the rip fence. After raising the blade into the auxiliary fence, I aligned the outer edges of the teeth with the outer face of the shim, which would be serving the same purpose as a jointer outfeed table.

After testing this alignment with a piece of scrap, I ran a board that was "lumberyard-prepped" through the saw. It trimmed the edge beautifully. We even trued-up the end of one of the glued-up panels without any tear-out on the end grain. I have since used the technique for "jointing" unruly woods with curly and bird's eye figure with great success.

Cory Torppa
Ellensburg, Washington

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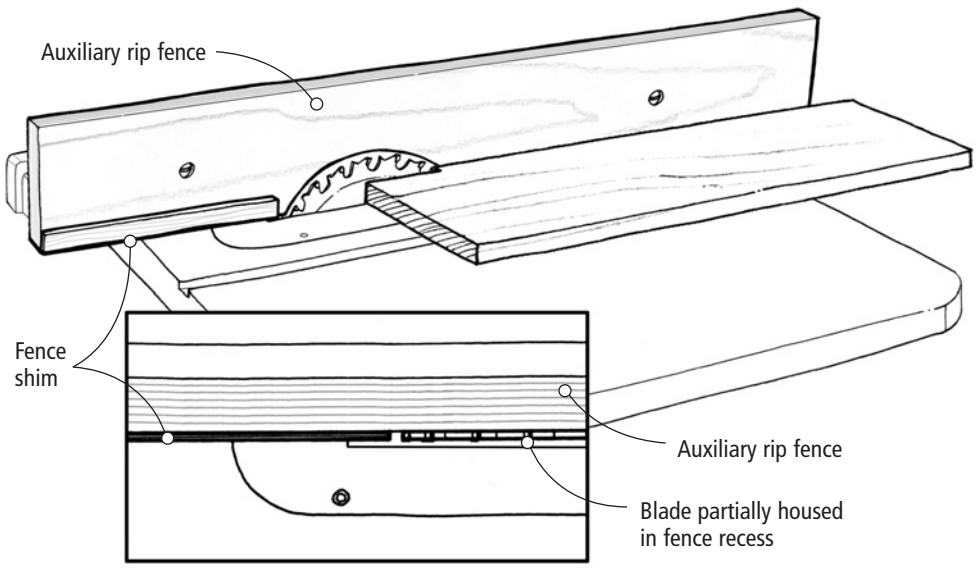

Top view detail

Illustrations by Matt Bantly

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Each issue we publish useful woodworking tips from our readers. This issue's winner receives a **Grizzly** G0555 14" band saw. Next issue's winner will receive a **Grizzly** G1014Z, 6" x 48" belt/ 9"disc sander with quick release for fast belt changes and a convenient, single-knob tracking control system. The G1014Z offers a 3/4 horsepower (10 amp) motor, shielded bearings, a cast-iron table and body, a 2" dust port and an A-frame stand.

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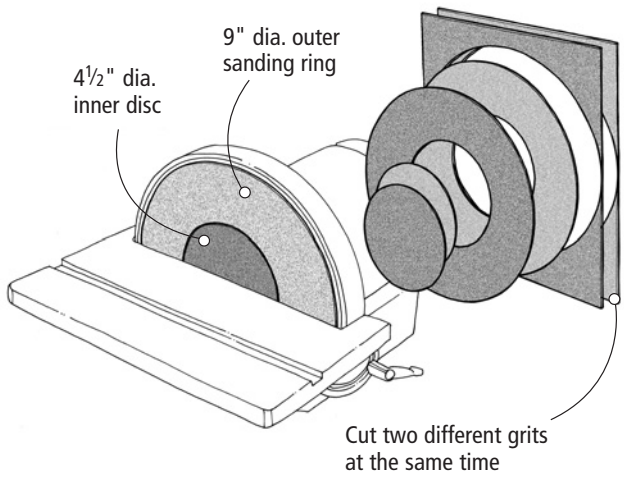
continued from page 16

A Double-duty Disc Sander

I make a lot of wooden toys and find my disc sander indispensible for both shaping and smoothing small parts. Unfortunately, this calls for the use of both coarse and fine discs, and I have only one disc sander. My solution is to mount both 80-grit and 150-grit paper to the disc at the same time. A circle of one grit is attached to the center of the sander's platen, while the other grit surrounds it as a ring.

To make the discs, I stack two sheets of standard 9" x 11" sandpaper upside down on a scrap panel. Using a compass, I mark out a 4½"-diameter circle within a 9" circle, then knife through the lines. I stick one set of these perfectly matched discs to my sander's platen. When the sandpaper wears out, I simply replace it with the complementary set of sandpaper.

Dan Reeve
Swanville, Maine

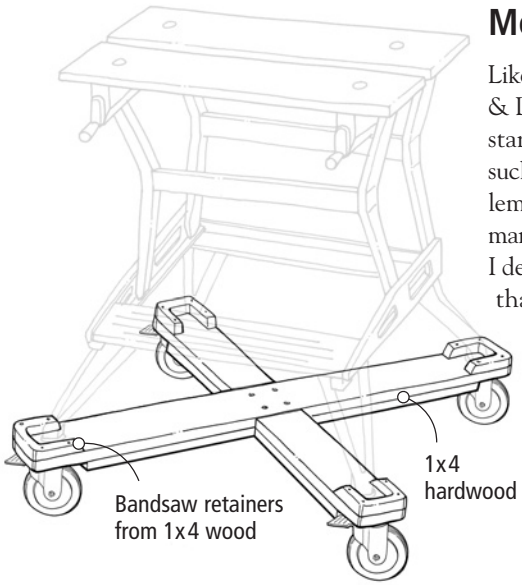


Mobile Workmate Base Helps Your Back

Like many garage woodworkers, I use a Black & Decker Workmate as a convertible tool stand for holding platform-mounted tools such as my grinder and scrollsaw. The problem I encountered with this is that it placed many tools at an uncomfortably low height. I decided to build a base for the Workmate that would raise it and make it mobile at the same time.

This X-shaped base is easy to build and allows toe space all around. It's made from two 1 x 4 oak boards cross-lapped and glued at the center. Wooden U-shaped retainers at the ends capture the Workmate. My casters lock the wheel rotation and swivel at the same time. I doubled up the boards from the casters in to the center, although that's probably overkill because the weight rests directly over the wheels. I used casters with an overall height of 5¼", which locates the top of the Workmate ¼" below my 37¼" table saw height. By covering the Workmate with ¼"-thick plywood, I can use it as an outfeed table. Of course you may need to use different sized wheels and a different thickness of lumber to match your own table saw height.

Douglas Jermyn
Ontario, Canada



Reducing Radial Arm Saw Tear-out with Bondo

The table on a radial arm saw gets worn after time from wide saw kerfs. Unfortunately, these wide grooves leave the workpiece unsupported on the underside, inviting exit tear-out. A simple fix is to fill the grooves with a polyester body filler such as Bondo, available at auto supply stores. Apply this two-part filler with a putty knife, then scrape away the excess before it hardens.

Paul Lopez
Santa Fe, New Mexico

Tuning a Marking Gauge for Sharper Lines

Typical marking gauges come with tapered, cylindrical points that do not make a precise line. They also are usually too long. Filing the point to create a shorter, rounded knife edge as shown will produce a much more accurate layout line.

Ric Hanisch
Quakertown, Pennsylvania

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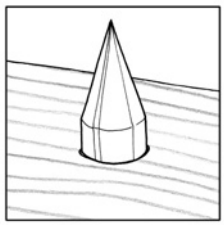
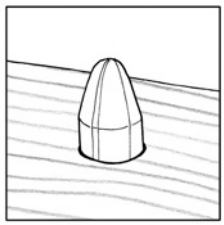
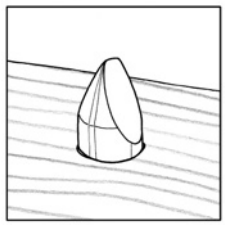


Typical point, conical and too long



1. Shorten and round tip



2. File to knife edge

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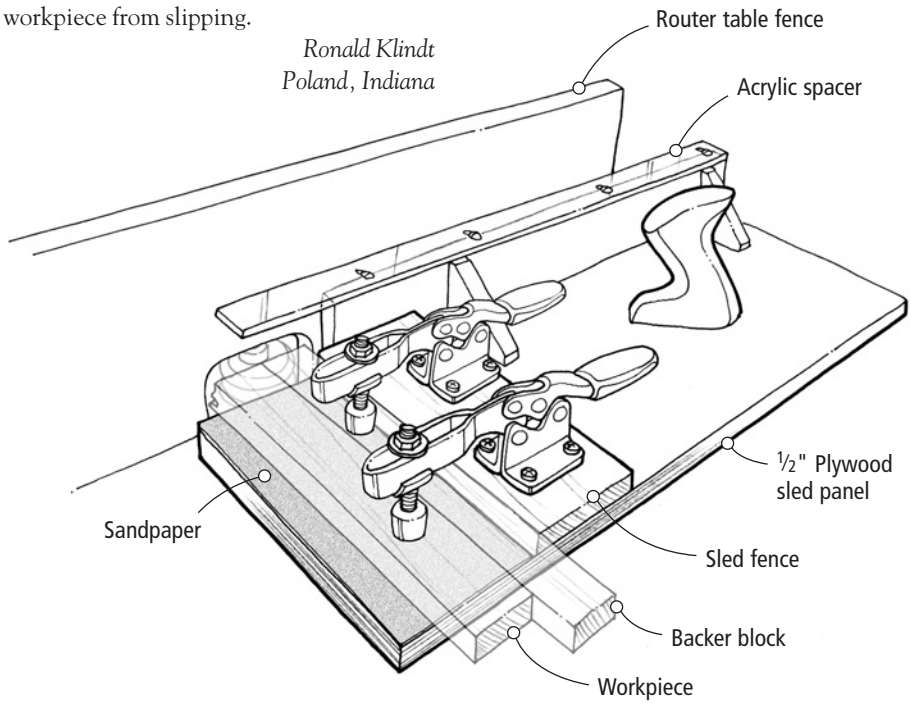
A Better Router Table Sled for Cope Cuts

I've used a router table sled for some time for routing the ends of door frames and drawer parts. A basic shop-made sled is a simple jig that consists of a hardwood plywood panel outfitted with a fence and toggle clamps to hold the workpiece and a backer block in place for the cut. You can use some ¾"-thick plywood for the panel, but ½"-thick plywood allows more bit extension when needed.

Typical router table sleds are designed to ride against the fence. However, in the process, the edge of the panel gets chewed up by the bit after it has passed through the workpiece. To prevent this problem, I designed my sled to include a spacer bar that acts as a "stand-off" to hold the sled panel about ¾" away from the fence. The acrylic spacer rides above the cutter, serving as a transparent bit guard at the same time. When using the sled, it's important to include a sacrificial backer block behind the workpiece to prevent any exit tear-out. I also glue 220-grit sandpaper to the panel in front of the fence to prevent the workpiece from slipping.

Ronald Klindt
Poland, Indiana



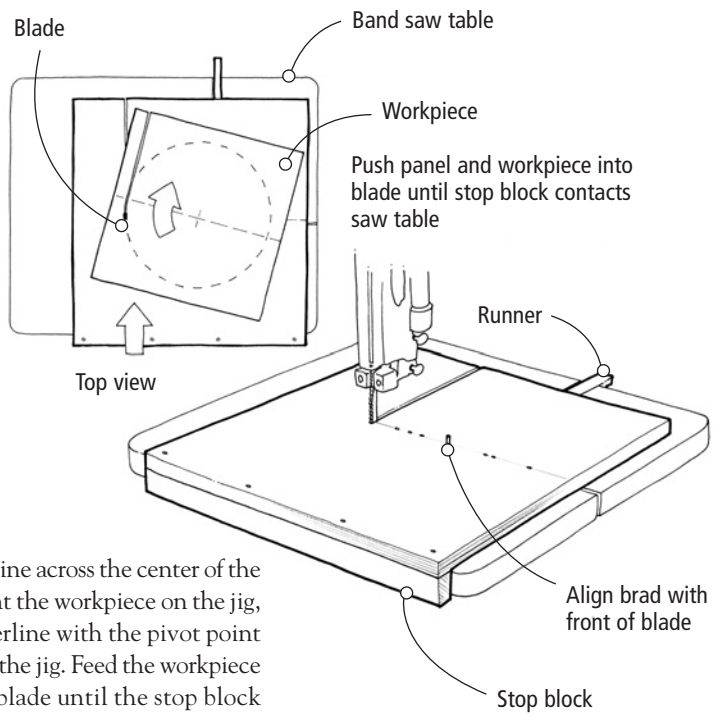
Cutting Circles on the Band Saw

The band saw is a great tool for cutting circles if you have the proper jig. The jig shown here can be used to cut circles of various diameters. It's made of a smooth-faced panel that is guided by a runner that rides in my saw's miter gauge slot. A stop block attached to the panel's front edge registers it in the proper relation to the blade. My jig, with its 18"-wide x 14"-long panel, suits my 12" band saw, but the jig can be sized for any saw.

To make the jig, glue and screw the runner and stop block to the panel, then cut the slot in the jig while pushing it forward in the table slot until the stop block makes contact with the saw table. Scribe a line squarely across the panel in line with the front of the saw blade. This will be your reference line for various circle pivot points. I drill 1/16"-diameter holes along the line at ½" intervals to accommodate a ⅞"-long brad whose head I've snipped off and ground smooth.

To use the jig, first prepare your workpiece by drilling a 1/16"-diameter blind hole at its center to accommodate the brad. Also draw a reference line across the center of the workpiece. Mount the workpiece on the jig, aligning its centerline with the pivot point reference line on the jig. Feed the workpiece and jig into the blade until the stop block contacts the saw table, then slowly rotate the workpiece to cut the circle.

Edward Yeager
Amelia, Ohio

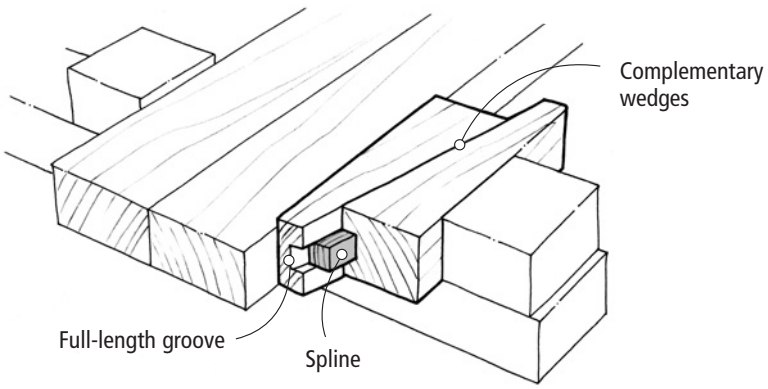


Splined Clamping Wedges

A pair of complementary wedges provides an inexpensive alternative to bar clamps when gluing up panels and other assemblies. The only problem is that wedges have a tendency to slip sideways on each other as you drive them in. To remedy this, I cut a groove in the edges of my wedges, then insert a spline to keep them aligned in use.

You can rout the grooves or saw them using a dado head. However, unless you have a router table, routing a groove in a wedge like this can be difficult because of its shape. Instead, you can rout the groove in a wide board held in a vise, then saw the wedge from the board and repeat the process.

Percy Blandford
Stratford-upon-Avon, England



Remount Turnings the Same Way Every Time

Woodturners often need to temporarily remove turnings from the lathe to mortise a table leg, check a round tenon for fit in a bore or some other operation. When remounting the workpiece afterward for further turning, sanding or finishing, it's always best to replace it in exactly the same orientation on the spur for proper balance. However, because most spurs and drive centers have four prongs, you have only a 1-in-4 chance of returning the spur to the same location.

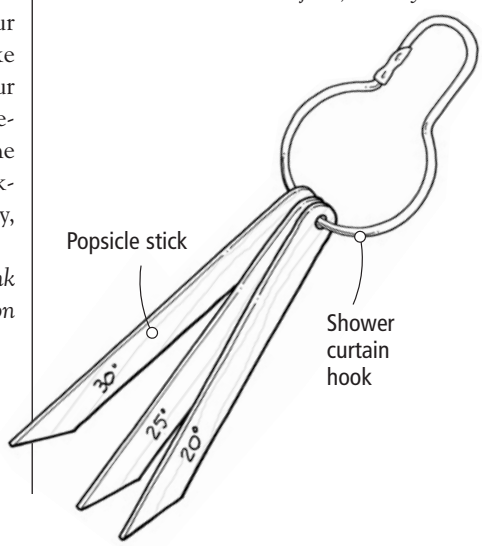
To eliminate the guesswork, take your drive center over to the grinder and make a narrow, deep notch in the face of one spur using a sharp corner of your wheel. This creates a distinct impression on the end of the turning, allowing you to replace the workpiece exactly as it was mounted originally, ensuring that it will run true.

Steve Blenk
Sequim, Washington

Low-tech Grinder Angle Gauges

Setting up the proper angle on a grinder tool rest can be a fussy business. To simplify matters, I make angle gauges from popsicle sticks. I scribe the end of a stick to the desired angle, then sand to the line using a disc sander. I drill a hole in the opposite end and note the angle on the stick with a permanent marker. My gauges all hang on a metal shower curtain ring near my grinder. **PW**

Craig Bentzley
Chalfont, Pennsylvania



WaldMann Workbenches an Excellent Value

Not every woodworker has the time to build a proper workbench, which is a time-consuming project. But commercial workbenches can be as expensive as a premium cabinet saw.

To fill that need, WaldMann Benches has a line of traditional well-appointed beech workbenches at reasonable prices. The Professional 7423 model we tested for several months costs $800.

That's a good deal when you start shopping around. The WaldMann bench is heavy (240 pounds) and includes a face vise with a 10" capacity and a quality shoulder vise that opens 8½" – that's great for dovetailing drawer sides. Standard equipment includes two steel bench dogs, a handy drawer and a board jack on the right leg that lets you clamp large panels in the face vise.

Assembly is a snap. It took just 35 minutes to get the bench out of the box and on its feet. The fit and finish are fine for a workbench, though not for a Duncan Phyfe highboy. There's a little putty here and there, but everything fits and moves smoothly. And remember: This is a workbench.

If you do any handwork, you'll find this bench ideal. If you do a lot of handsawing, I recommend you spend a little extra money ($100) to purchase the 7423C, which has a large cabinet below the top. Despite the weight of the 7423, you can still push it around during aggressive sawing. A till full of tools will fix that in a second.

I've built five workbenches in the last few years. But after trying out this bench, I think my next one might very well be a WaldMann.

— *Christopher Schwarz*

For more information, circle #146 on Free Information Card.

Photo by Tim Grondin

SPECIFICATIONS
WaldMann 7423 Workbench

Street price: $800
Top size: 23⅞" x 74¾" (plus shoulder vise)
Height: 33⅞"
Top: 4¾" thick at skirt, 1½" at center
Weight: 240 lbs.
Performance: ●●●●○
Price range: $ $ $ $ $
WaldMann: 248-684-1377

Ryobi Spindle Sander: Power at a Reasonable Price

The day the Ryobi OSS500 oscillating spindle sander arrived in our shop, we had a half-dozen woodworkers visiting. The machine caught their eye, so I gave them the tour.

We sanded some white oak in an overly aggressive style on the 1½"-diameter spindle. Everyone nodded their heads, liking the action and power of the machine. A quick check with an engineer's square showed negligible spindle deflection during sanding, and the dust collection (through a built-in 2½" port) was effective.

Then I told them the price.

"Less than $100?" they said. "Where? I'll go get one right now!"

Ryobi's got a winner with this machine. While an oscillating spindle sander (OSS) isn't the first thing woodworkers put in the shop, its usefulness quickly becomes evident the first time you need to sand any curve, large or small. When it comes to curves (inside and out) an OSS is the way to go.

The OSS500 has a 19¼" x 15¾" table that is small enough to maneuver around but large enough (thanks to its teardrop shape) to support most work. The OSS500 is heavy enough to stay put, but it can be screwed to a work surface if you prefer.

The sander is sold with five rubber spindle sizes and another ½"-diameter spindle that doesn't require a rubber cylinder. Also included are three grits of sanding sleeves (50, 80 and 150 grit), six throat plates and convenient storage for everything.

The machine's universal motor (using a permanent magnet rather than a wound field, with only the armature energized) provides good performance. It slows some under use, but not enough to affect the sanding performance. The motor is louder (76 decibels) than other OSS machines we've tested, but not enough to send you running for some hearing protection.

Overall we were as impressed as our guests. This is a perfectly functional and well appointed oscillating spindle sander. And by offering it for less than $100, we anticipate a lot of happy spindle sanding taking place in home shops very soon. — *David Thiel*

For more information, circle #147 on Free Information Card.

Photo by Al Parrish

SPECIFICATIONS
Ryobi OSS500 Spindle Sander

Street price: Less than $100
Motor: 3.5-amp permanent magnet motor
6 Spindles: ½", ¾", 1", 1½", 2", 3"
Spindle RPM: 2,000
Oscillations: 58 per minute, ⅝" stroke
Weight: 49 lbs.
Performance: ●●●◐○
Price range: $ $ $ $ $
Ryobi Technologies: 800-525-2579
or www.ryobitools.com

Glü-Bot – They Built a Better Mousetrap!

I've always used mustard containers as glue bottles, but all my bright yellow bottles are going in the trash thanks to Glü-Bot.

Glü-Bot is a spill-proof, drip-proof, vertical application glue bottle with amazing precision. By forcing the glue from the bottom of the storage chamber into the spout, you can control your glue line precisely by applying a little pressure on the bottle's sides. With two tips (a blade tip and fine-line tip) you can lay down an exact amount of glue vertically and horizontally. The vacuum action pulls glue away from the tip after use to keep the spout clear of dried glue. The only thing we're worried about is losing the second tip. Glü-Bot belongs on every workbench. — *DT*

For more information, circle #148 on Free Information Card.

SPECIFICATIONS
Glü-Bot & Bábe-Bot

Street price: $6 for 16 oz.
$4 for 4 oz.
Performance: ●●●●○
Price range: $ $ $ $ $
FastCap: 888-443-3748
or www.fastcap.com

Norton 3X Sandpaper

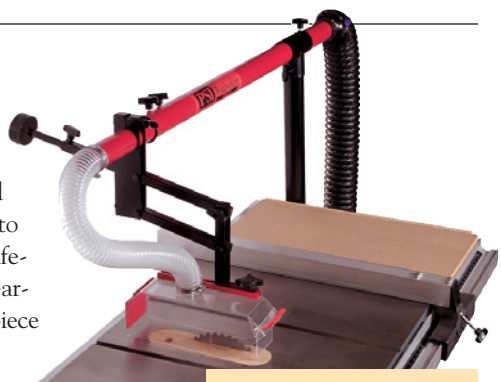
Norton's 3X sandpaper is so-named because Norton says it sands three times faster and lasts three times longer than other sandpapers. We cannot say if it's three times better, but the 3X is definitely an improvement.The fiber-reinforced backing feels more like cloth than paper. It is resistant to cracking and tearing, which makes the paper last longer and allows you to fold it to get into mouldings. Longer life isn't important without longer cutting ability. The P-graded abrasive grain clearly retains its edge significantly longer than conventional abrasives, and the stearate coating keeps the paper from clogging, again improving the use-time per sheet. Sold in packs of 20 sheets at a competitive price, we're switching to 3X in our shop. — *DT*

For more information, circle #149 on Free Information Card.

SPECIFICATIONS
Norton 3X Sandpaper

Street price: $10 - $18 for 20
Grits: Available in nine grits ranging from 60 to 400
Performance: ●●●●○
Price range: $ $ $ $ $
Norton Abrasives: 800-551-4415 or nortonabrasives.com

Penn State Overarm Guard



We've long recommended table saw guards, but have always hated the necessary expense to put a good (non-intrusive and easy-to-use) guard on a saw. We're happy to let you know that Penn State has made safety more affordable – $100 less than the nearest competitor. The TS Guard offers a one-piece shatterproof hood that makes the blade completely visible to the operator. The guard also includes through-the-boom dust collection (with a 4" connector), and it is large enough to handle blades up to 16" in diameter and beveled to 45°. The guard can be attached to any saw's right-side extension table, or it can be ceiling-mounted. The dust collection works well, the operator has a clear view of the cut and the entire boom swings out of the way when necessary for taller cuts. Safety is now more affordable for all woodworkers. **PW** — *DT*

For more information, circle #150 on Free Information Card.

SPECIFICATIONS
Penn State TS Guard

Street price: $200
Boom length: up to 83"
Weight: 48 lbs.
Performance: ●●●●○
Price range: $ $ $ $ $
Penn State: 800-377-7297
or pennstateind.com

JET'S CASTER SETS FOR CABINET-STYLE TOOLS

Jet's caster set for cabinet-style machines is the first mobile base that I've enjoyed installing. Rather than the common base design that is an adjustable frame with wheels, the caster set (designed by former woodworking editor Bill LaHay) quickly mounts to the lip of almost any closed base.

The casters use an adjustable clamping bracket (shaped to fit either a flat or lipped cabinet edge) to tighten against the base side. A magnetic pad on the vertical face of the caster holds the bracket in place while you tighten the two cap screws. Installation requires slightly elevating one side of the machine at a time.

The assembly was quick, simple and the results are excellent at a substantial savings compared to other mobile bases. Offered in both four-locking swivel (JMB-CTR 4, $59) or two locking swivel, two locking fixed caster sets (JMB-CTR2, $49) (both rated at 600 lbs. capacity), you can decide how much mobility your machine needs.

For machines with a small footprint, both sets extend the stance of the machine a bit. When mounting the casters on a floor-model mortising machine, I was concerned about making the machine unstable, but the wider footprint actually improved the stability, adding only 1" in height. The sets are available from Amazon.com and Woodworker's Warehouse (800-877-7899 or www.woodworkerswarehouse.com). — *DT*

Performance: ●●●●○
Price range: $ $ $ $ $

TOOL RATINGS

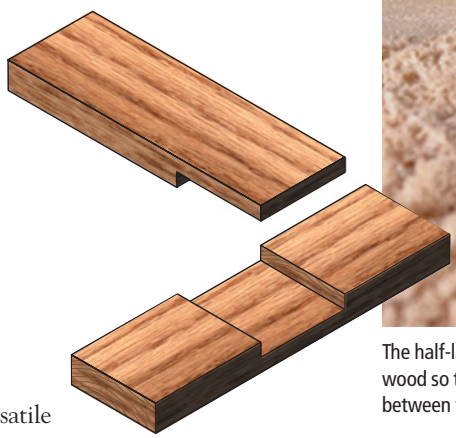
Performance is rated on a one-to-five scale. You won't see a low rating ("one" or "two") because we don't publicize inferior tools. "Five" indicates the leader in the category. Five dollar signs indicates highest price in the category. Three indicates an average price. If you have tool questions, call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

— David Thiel, senior editor

Photos by the author

Make Accurate Half-lap Joints

The versatile half-lap is easy to cut with 2 jigs and a router.



The half-lap is made by cutting dados of equal width and depth on two pieces of wood so that the face surfaces are flush when assembled. Each piece is trapped between the shoulders of the other, so it's a can't-fail joint. The wood will break first.

A half-lap joint is strong, versatile and easy to cut. You simply cut recesses in both mating pieces, then nest them together, forming an X, L or T.

Half-laps can be used for all sorts of flat frames. Doors, for example, but also face frames, web frames and picture frames. An intermediate rail half-lapped to the stiles "looks" right because it visually abuts the stile (the way a mortise-and-tenon joint would) rather than crossing it (the way a bridle joint would). On the other hand, a rectangle of end grain is exposed in assembled end laps and T-laps (see diagrams on page 26), which can be regarded as unsightly.

The half-lap can be used in post-and-rail constructions to join rails or aprons to legs. You usually see this joint in worktables rather than fine furniture. But even in the most traditional table construction, the half-lap is used where stretchers cross (a cross-lap).

From a practical perspective, the half-lap enjoys an advantage over the mortise-and-tenon joint in that one tool setup can suffice for both parts of the joint. (There's more than one way to cut the joint, of course, and some do require two setups, as we'll see.) You can join parts at angles quite easily. The joint accommodates curved parts, too. You can join curved pieces, or you can shape the half-lapped frame after it's assembled.

Despite its simplicity, this joint is strong if properly made. The shoulder(s) resist twisting and there is plenty of gluing surface.

But be wary of using half-laps on wide boards. Wood movement can break the joint, so confine the joinery to members no more than 3" to 3½" wide.

You can cut half-laps using several different power tools. Let the job suggest the tool to use and the way to use it, too.

On the Router Table

Everyone has favorite approaches, and mine involves the router. I cut end-laps on the router table using a lapping sled I originally made for tenoning. This shop-made device looks like a T-square on steroids (see the drawing at right). The stout fence is long enough to extend from the tabletop edge to well beyond the bit. The shoe rides along the edge of the tabletop. An adjustable stop clamps to the fence to control the length of the cut.

Construction is simple, but pay attention to the details. The fence must be square to the shoe. The edge of the fence must be perpendicular to the tabletop. The adjustable stop also needs to be square to the fence. If any of these is off, you won't get consistently sized, square-shouldered laps.

by Bill Hylton

Bill Hylton makes noise, dirt and the occasional piece of furniture in his basement workshop. His book "Chests of Drawers" (The Taunton Press) shows both his shop and his handiwork.

What bit to use? Well, a straight bit is the obvious choice, and it will work fine. I use what's variously called a planer, mortising or bottom-cleaning bit. The several bits I have range in diameter from ¾" to 1½ ", and the vertical-cutting edges range from 7/16" to ⅞". The bit is designed to clear a wide, smooth recess. Perfect for laps!

The first time you use the lapping sled you'll cut into the fence. This cut is what you use to position the stop for the length of lap you want. Measure from the shoulder of the cut (include the cut itself in the measurement, of course). The stop prevents you from making a cut that's too long.

Cutting a half-lap on the router table is fast and accurate using a lapping sled to guide the work and a large-diameter mortising bit to cut it. The guide references the edge of the tabletop and a stop sets the length of the cut.

Be mindful of the size of the cut and of the amount of material you will remove in a pass. You don't necessarily want to hog out a 3/8"-deep cut in a single pass, especially if you are using a 1¼"- to 1½"-diameter bit.

You probably know there are two ways to moderate the bite: Reduce the depth of the cut or the width of the cut. Here, the most expeditious approach is the latter. Form the full cut in small steps. The first pass should be about 1/8" wide, produced by holding the workpiece well clear of the stop, so only 1/8" of the workpiece extends over the bit. Make pass after pass, shifting the workpiece closer and closer to the stop. One last pass with the workpiece dead against the stop and your lap is complete.

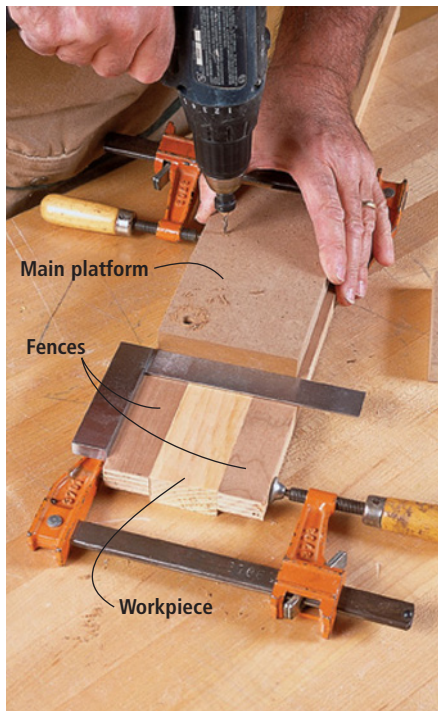
This approach works well for end-laps, but not for laps midway between the ends of the workpiece. For a cross- or a T-lap, the router table accessory to use is the dadoing sled shown in our April 2003 issue (#133). You need to use a stop with this sled to keep the work from moving as the bit cuts it, and that helps you place the cut as well. Set the stop to position the final cut, and use a spacer between the stop and the work to position the first cut.

Personally, I think it's fussy to do Ts and crosses accurately on the router table. Given my druthers, I'd do them with a hand-held router and a job-specific (and thus disposable) jig, such as the lapping platform shown in the drawing below.

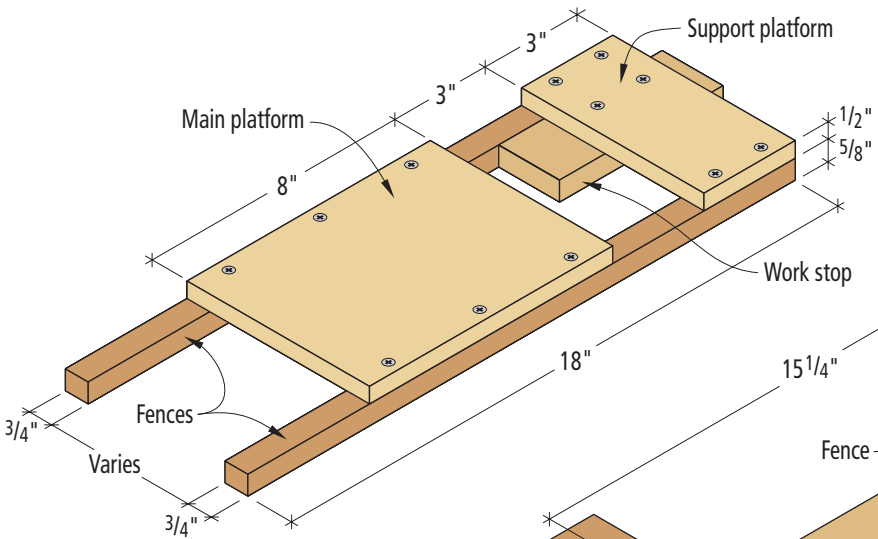
Hand-held Router

When cutting this joint with a hand-held router, I prefer a fixed-base router, rather than a plunge. I use the same planer-mortising bit, but I mount a pilot bearing on the shank of the bit. The lapping platform I make from four scraps and a dozen drywall screws. I use the actual workpieces to scale it.

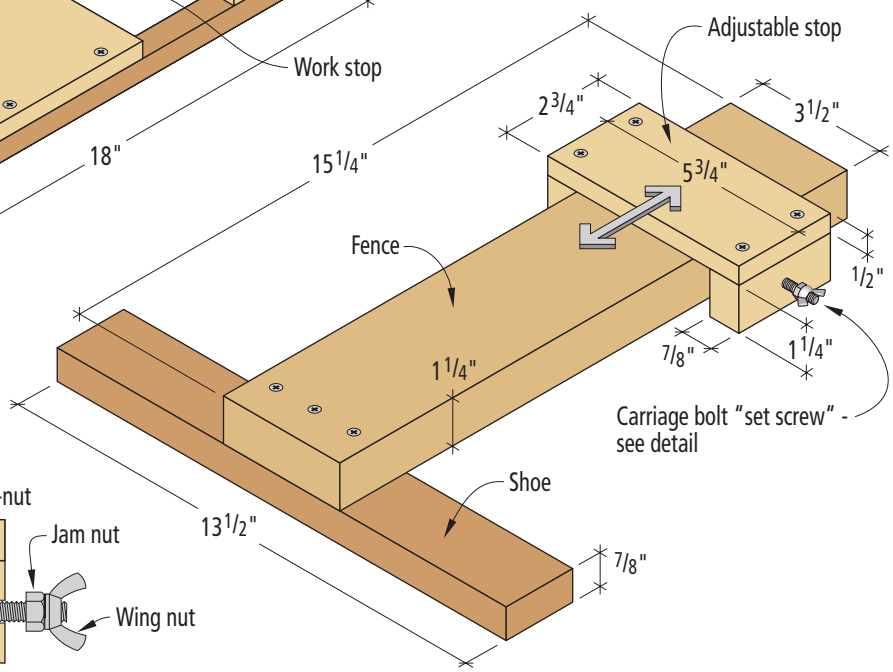
Begin by clamping the jig's two fences to the edges of a workpiece. These fences need



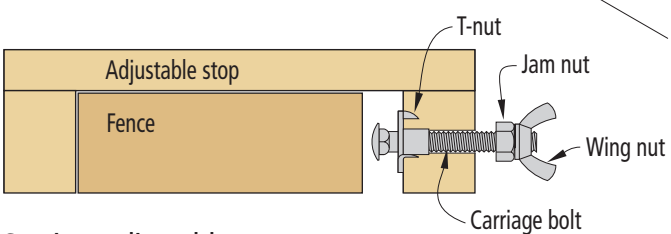
To assemble a lapping platform, capture a workpiece between the fences and align the primary platform on them. The edge of the platform must be square to the work. You can build the simple version of this jig for cross-laps as shown in the photo or add a work stop as shown in the illustration to also cut end-laps.



Lapping platform



Lapping sled



Section, adjustable stop

Use the mating workpiece as a spacer to position and align the support platform. Screw the support platform to the fences and you're ready to get to work.

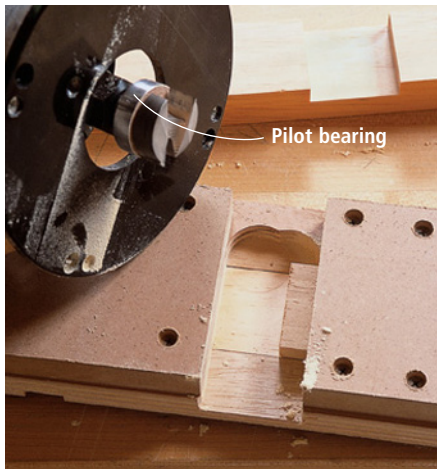
to be a bit less than the thickness of the workpieces and their edges need to be straight and parallel for the jig to work well.

Next, set the main platform on the workpiece and the fences. I usually use some ¾" medium-density fiberboard for this, but plywood is OK for this application. Square it on the jig, then screw it to the fences.

Finally, lay your mating workpiece across the first, tight against the platform's guiding edge. Set the support platform in place and clamp it tight against the second workpiece. Screw it to the fences.

The gap between the platforms is the width of the lap. It is easy to position: You just set the platform edges directly on your layout lines. The bearing rides along the edges of the two platforms while the bit just below it excavates the lap. The bit is trapped, so you won't get a lap that's too wide. The fences tight against the workpiece edges prevent tear-out. The platforms support the router and keep it from tipping. Assuming the workpieces are equal in width, you can use one jig on both.

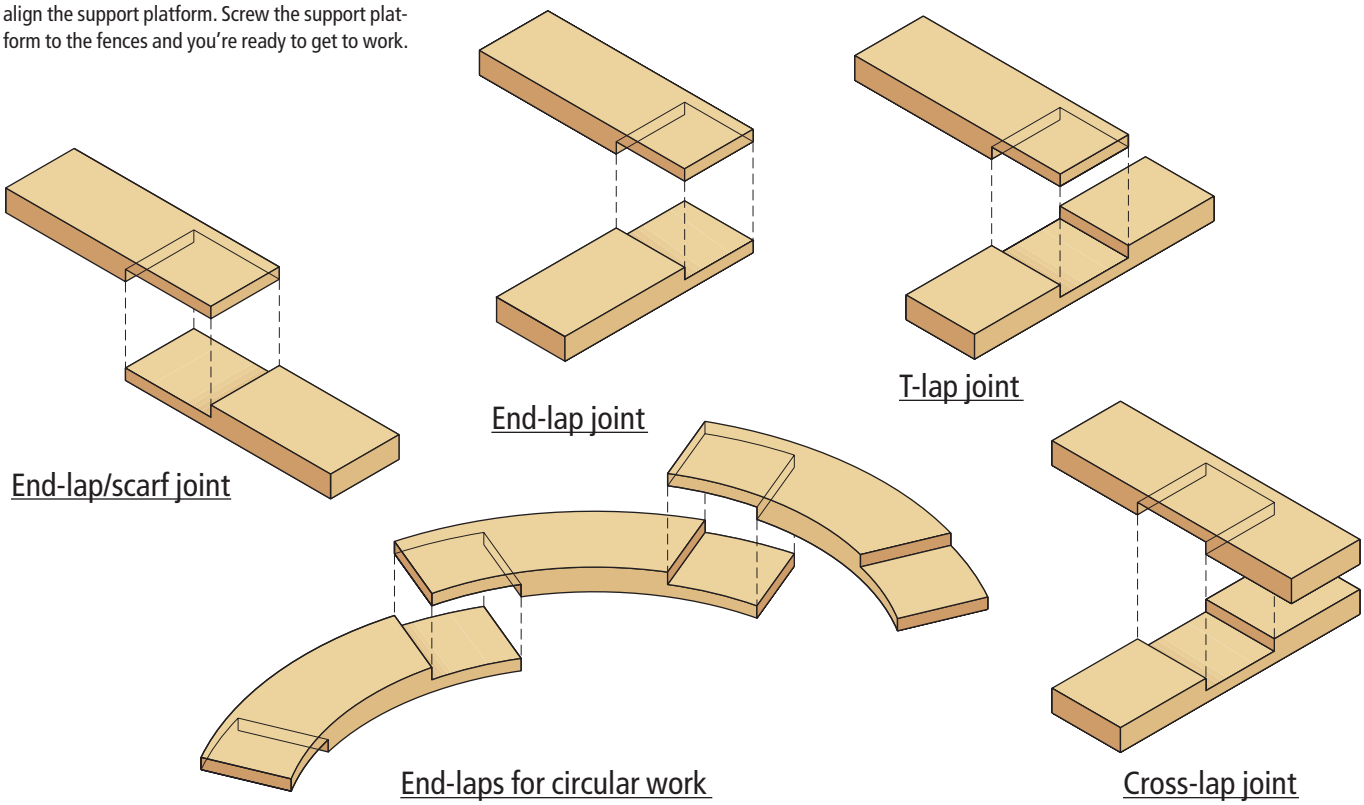
I'm touting this for T-laps and cross-laps, but you can use it as well for end-laps. For this use, add a fifth scrap as a work stop. Attach it to the underside of the support platform so the workpiece end can butt against it.



Make the cut with a mortising bit with a shank-mounted pilot bearing. Trapped between the platforms, the bit produces a smooth, square-shouldered cut that perfectly matches the width of the workpiece.

Sawing Half-laps

Not everyone is as enamored of router woodworking as I am, of course. Saws such as the band saw, the table saw, the radial arm saw, the sliding compound miter saw and, yes,



Set the height of the blade to half the stock thickness and cut the half-lap shoulders.

Cut the cheeks using a tenoning jig – this one is shopmade. For the cut, adjust the blade to match the width of the stock. Position the jig and the work so the waste falls to the outside of the blade.

even the carpenter's workhorse – the circular saw – all can be used.

Doing the job with a circular saw or miter saw is a "wasting" process. You adjust the saw's cut depth to half the stock thickness, carefully kerf the margin(s), then waste the material between the margins with lots and lots of kerfs. Typically, you get a ragged cheek. It has to be smoothed somehow to glue well. But if you're using a circular saw, you are probably doing something rough, where nails or screws work as well as glue.

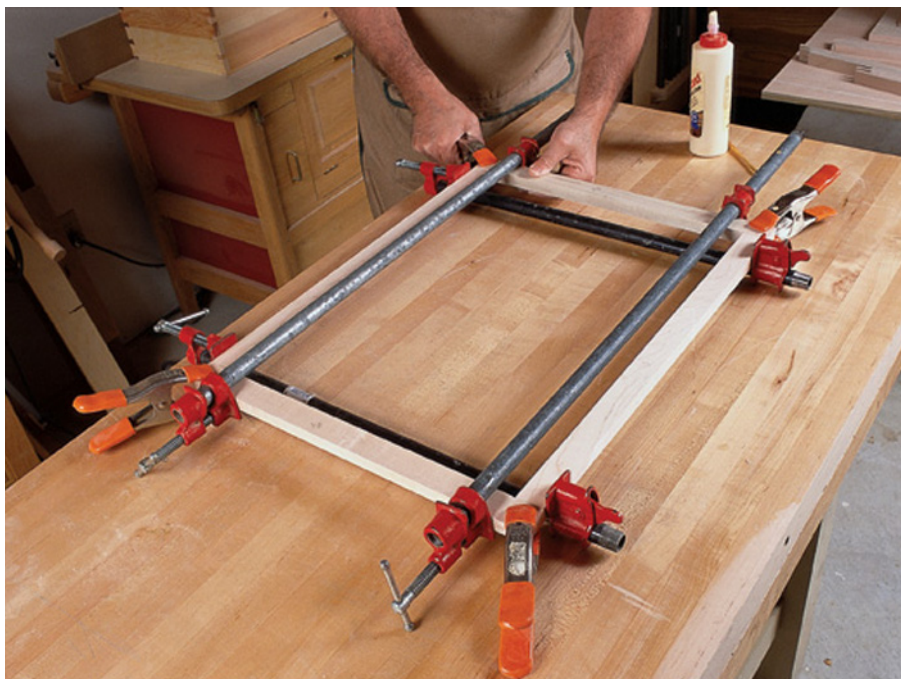
The band saw roughs out end-laps very quickly, but it leaves you with a rough surface that needs to be flattened and smoothed to glue well. Some woodworkers opt to rough out half-laps on the band saw, then finish them with a router. To me, that's extra setups and extra work. Besides, you'll be hard-pressed to effectively band saw a lap that isn't at the end of a workpiece.

The radial-arm saw can be an effective tool for half-laps. Set up with a dado head, a well-tuned radial-arm saw will cut end- and cross-laps quickly and cleanly. You can see your layout lines, so locating the cut precisely is easy. You can do angled laps easily; just swing the arm right or left for the cut. You can set stops to expedite production jobs.

The table saw gives you some options. You can use your everyday saw blade or a dado head. Guide the work with the miter gauge, a cutoff box or a tenoning jig.

I'm sure you can figure out how to use the dado head with either a miter gauge or the cutoff box. This is the fast, single-setup approach on the table saw.

But if you don't have a dado head or you don't want to switch from blade to dado set, you can use the blade with a tenoning jig to cut the laps. The routine is to saw the shoulders using the miter gauge, then saw the cheeks using the tenoning jig.



Gluing up a half-lapped frame requires the usual complement of pipe or bar clamps to pull the shoulders of the joints tight. Each joint also requires a C-clamp or spring clamp to pinch its cheeks tight together.

The cut depth on the shoulder cut is critical, of course. If you cut too deeply, you will have a kerf that shows on the edges of the assembled frame. If you cut too shallow, it isn't ideal but you can correct this with the following cheek cut.

Use whatever tenoning jig you have for the cheek cut. Delta's block-of-iron model is great, but I don't think it works any better than the shopmade fence-rider I use. Mount the jig on the saw and position it for the cut, adjust the blade height and saw those cheeks, one after the other.

Assembly

It's not difficult to assemble a frame joined with half-laps. You must apply clamps to the individual joints, however, in addition to using clamps that draw the assembly together. Use bar or pipe clamps to pull the joints tight at the shoulders. Then squeeze the cheeks of individual joints tight using C-clamps or spring clamps. **PW**

The Genius of Miter Shooting Boards

Cutting miters so they are 'just right' is a problem faced by all woodworkers. Here's how to sneak up on the perfect miter with scrap wood and a plane.

You find yourself in a quandary. To ensure that you don't cut a miter too short, you end up cutting it just a bit too long to fit. You wish you could trim it shorter by just a shaving or two, but the moulding is too small to plane, reliably, freehand.

If you're working with a power miter saw, you might be able to correct this cut if the moulding is held in place perfectly, but it is easy to cut too much off and the blade might deflect during the cut, spoiling the angle. If you're working with a hand miter saw and miter box, it's difficult to get an accurate cut that's thinner than the width of the saw's kerf. This is when you should turn to a shop appliance known as a miter shooting board.

Photo by Al Parrish

A shop appliance, you ask? Like a washing machine? No, I'm using the term "appliance" in the general sense: "A piece of equipment for adapting a tool or machine to a special purpose" (Merriam-Webster). In the world of hand tools, what some people might call "jigs" usually are called appliances.

In this case, the special purpose of the miter shooting board is to enable you to plane a miter in an accurate and controlled manner. Indeed, with this appliance you can quite literally correct the length and/or angle of a miter one shaving at a time.

Shop appliances have great value. If you are already working with hand tools, you may be encountering unnecessary difficulties without the right appliance for the job. If you are not generally interested in hand tools, that may be due, in part, to not realizing their capabilities when used with appropriate and time-tested appliances.

I've chosen to focus on the miter shooting board because it is an appliance that could be useful to almost every woodworker – even those who have no interest in hand tools.

Simple Jig; Easy to Use

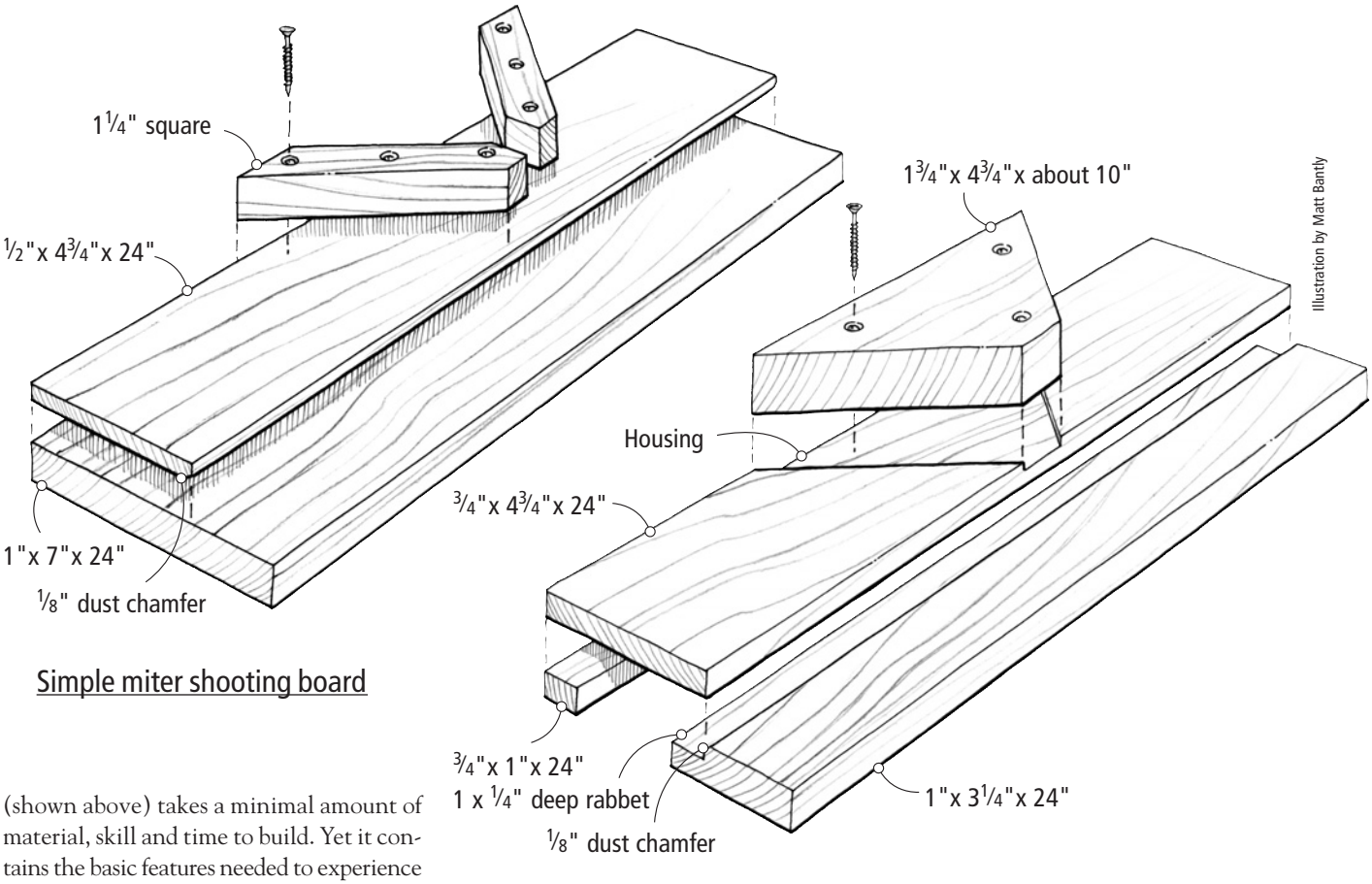
The basic idea of a miter shooting board is simple. At one edge is a wide, shallow rabbet in which a plane (block, miter, etc.) rides. The bed of the rabbet supports the plane's cheek (sometimes called the "side wing"), and the shoulder of the rabbet guides the sole of the plane. A stop, or stops, set at 45° are affixed to the upper surface of the board. The material being planed is held against the stop while the mitered end is planed. The height of the rabbet's shoulder needs to be fairly minimal in order to make use of most of the cutting edge of the plane iron.

Build a Miter Shooting Board

There are a number of ways to construct a miter shooting board. The simple version

by Don McConnell

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



(shown above) takes a minimal amount of material, skill and time to build. Yet it contains the basic features needed to experience its potential usefulness.

The construction is self-evident, though a few aspects deserve comment. It's important that the stop pieces be positioned at a true 45° angle. This needs to be laid out and checked carefully with a miter square or sliding bevel you know is accurate. (In my next column I'll show you how to do this easily with a compass and a scrap of wood.) Using a pair of stops allows planing from both directions (a useful feature), and the placement shown allows the stops to reinforce each other against the planing stresses.

While this version can be satisfactory, there are drawbacks in the long term. First, the manner in which the two base elements are assembled provides for unequal moisture movement from the opposite faces of each piece. This can lead to the appliance going out of true. Careful material selection (quartersawn and straight-grain) can minimize this. And, within reason, it can be disassembled and the pieces re-trued, from time to time. There are other alternative forms of construction that address these issues.

Mark your 45° angles using a knife. Clamp a steel straightedge against the knife line and chisel away your waste. Or pare to the line freehand.

Cut your stop block as close as you dare and then plane it to a perfect fit in the triangular housing you just chopped out.

Test your stop block against your housing; plane until you have a perfect fit.

Second, the means of attaching the stops doesn't anchor them securely. Though this can largely be overcome by installing them in housings such as dados, the problem of cross-grain construction remains.

An Improved Shooting Board

As always, there is a better way. This stop block is more secure and avoids the difficulties of cross-grain construction. It consists of a single piece of wood that's mitered on both ends so that its grain orientation is identical to that of the board it's attached to.

The stop block can be planted on the face of the guide piece, but is better secured by installing it in a housing.

Using hand tools to obtain the accuracy required for this housing and the guide block might seem difficult or mysterious. So I thought it would be worthwhile to touch on the critical aspects of this process.

Start by cutting the housing. It does not need to be deep (¼" at most), but the shoulders need to be accurate. This begins with accurate layout, knifing the shoulders with a reliable miter square. The space between the shoulders at the narrow end isn't critical. Primarily, it needs to be wide enough to allow passage for your tools during construction.

Establishing the shoulders could be done straightaway with a saw. But in such a critical situation and with relatively long shoulders, I prefer to saw, freehand, slightly to the waste side of the knife line. Then, after the balance of the waste is removed, clean up the shoulder through vertical paring with a sharp and wide chisel. You could clamp a straight batten or metal straightedge to the board to guide your chisel, but I can better see my progress relative to the knife line if I do it freehand.

By assuming a relaxed and balanced stance you can usually get a pretty good sense as to when you are holding the chisel vertical for this paring. You can check this with a small square if you are uncertain.

The shoulders need to finish accurately at 45° and with nothing to obstruct the stop block from registering solidly against them when in place. While it's good practice to aim for achieving the required accuracy the first time, in this instance you have the luxury that you can, within limits, simply knife a new line and try again.

Stop Block has Critical Angles

The material for the stop block needs to be somewhat wider than its finished width to allow you to do final trimming after arriving at an accurate fit of the critical miters.

First, mark out one of the mitered ends and saw it as close as you feel comfortable. Then, with a sharp and finely set block or miter plane, clean it up. You want to keep it fairly close to 45° (for the sake of grain orientation), but the critical factors are that it be flat and square to the face that will attach to the shooting board. Then, allowing enough space to have some width for final trimming, lay out the other miter at a right angle to the miter you've just established on the stop block.

Again, saw as close as possible and true the second miter up with your plane. This miter needs to be not only square to the lower face and flat, but at a true right angle to the first one. So, it's a little more critical. But there is some forgiveness in that you can continue to plane to arrive at the necessary accuracy as long as you have sufficient width.

Finally, test the block's fit in the housing (make sure it reads accurately) and trim so its nose is in line with the guide shoulders and perpendicular to the bed. Install the stop block with screws (no glue) and you have a very accurate and serviceable miter shooting board.

Take it for a Test Drive

A miter shooting board is simple to use. You hold the work in place against the stop block with one hand, and push or pull the plane with the other. Always work so that the plane pushes the work against the stop block.

The miter shooting board is most obviously useful when doing inside mitering. In this case, the far edge of the miter is fully supported by the stop block. While it's easy to assume that it wouldn't be as useful for planing outside miters, I believe that to be a mistaken assumption. A sharp iron set to a fine cut will minimize any tear-out when shooting outside miters.

I had been building furniture for a few years before I finally built my first miter shooting board. Though I occasionally considered it before, there was always a question as to whether it would be worth taking the time. After just a few passes with my plane in fitting up the first miter, I was amazed at the control and accuracy provided by this simple appliance. My only regret was that I hadn't made one years earlier. **PW**

In use, the miter shooting board is used with the plane always pointed toward the stop block.

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Building Shaker Oval Boxes

Try this traditional bent-wood craft for a project that is attractive, useful and easier than you might think.

There was a time when households had few belongings, when clutter from too much stuff was not an issue. Basics such as matches, glue powders and paint pigments, and sugar, coffee, tea and spices needed containers. Before the age of canisters and Tupperware, the Shaker craftsmen made and marketed their oval boxes.

The place for boxes in the home has changed throughout time. Modern metal and plastic containers have displaced the traditional preeminence of wooden boxes in the pantry. Today they are more often seen on the coffee table in a more decorative setting. Along with the change in use has come a change in finish so that varnish rather than paint is preferred. Cherry is more common for bands than plain maple. Yet this is still a box for all occasions, utilitarian as well as decorative. Its charm and grace make a difference for whatever role it plays.

These beautiful boxes were first made from hard maple and white pine. In an age before machines, thin wood strips were rived from a straight billet of wood and made ready for bending by handplanes and scrapers. Hot water soaking makes this sturdy wood pliable, and bending gives a complete oval shape in a single motion. Tacked and made secure by oval shapers, this efficient process impresses me every time I do it.

The Search to Find Wood that Bends

Today we are not likely to go to the wood lot for a straight-grained section of log to split stock for the bands. Few of us have a wood lot nearby, and technology has separated us from skilled hand-tool use. But the need for bendable wood to flex around the box core remains the same. This capacity to flex is not always apparent in wood. While straight-grained stock is the place to begin to look for bending material, brittleness can cause the best looking piece to snap. One condition that causes brittleness is drying out. It's a consequence of the fact that we live some distance from the wood lot. Green wood, which bends best, isn't readily available.

In your search for materials for bending wood you will find hard maple a good species. Cherry, while it makes a fine box, is prone to changes in growth direction and unexpected brittleness. I sometimes imagine Shaker craftsmen watching my frustration with ornery cherry boards and sighing, "Ah, the price of vanity. Stick to the utility of maple, and it would go well."

Strange as it seems, the same things that make for suppleness in the human body (age and nutrition) apply to wood. Freshly cut boards do better than old dried ones. Also, the conditions of favorable growth will yield better results. Ample nutrients and sunlight make for faster growth as evidenced in wider annual rings. This is a favorable sign in selecting wood for bending. And, of course, straight growth, and not picturesque gnarled figure, is ideal.

by John Wilson

John Wilson first saw oval boxes 25 years ago as a woodworking instructor at Lansing Community College in Michigan. Besides teaching and selling his boxes, Wilson founded The Home Shop to produce supplies for the oval box trade worldwide.

Photos by Al Parrish

The table saw is my tool of choice for resawing bands up to 3" wide, although things slow down appreciably when nearing the capacity of the 10" blade. A sharp blade is a must. The zero-clearance wood insert shown here will prevent the thin wood from dropping through the table. When your setup is cutting effectively, there is little sanding required.

Resawing on the band saw can handle stock of 6" or more depending on the capacity of your machine. The resaw jig guides the cut. Clean up the board's sawn edge between each cut to give one smooth side. A drum sander gives a finished face to the sawn side. The blade shown is a 1/4" Timber Wolf four-teeth-per-inch band that's used for general work in my shop. Others prefer a silicon-carbide hook-tooth 1/2" or 3/4" blade.

Cutting Band Stock

Where will you find such wood for your box bands? The wood you use may be recently cut for firewood, or you may have luck with an old board of unknown species. The real test is to try it. Dimension a piece and slab off thin bands on your table saw or band saw. Photos 1 and 2 show it being done. The table saw needs a zero-clearance insert to reduce the gap next to the blade to prevent the thin band from disappearing down the slot. Avoid short stock. Small box bands 12" to 20" long are cut more effectively and safely when sawn double length, 24" to 40" long. The blade is the key. I use thin-kerf 10" 40-tooth blades with alternate top-bevel design. Try a new blade to see what factory sharp can do.

When the table saw, blade and wood are in sync, the result is a finished band ready to use with little or no sanding.

The band saw needs a steady rest as a guide for thickness. A sharp blade is important here as well. I use a 1/4" four-tooth-per-inch Timber Wolf. Others prefer a 1/2" or 3/4" carbide-tipped blade for their band saw. A thicknessing drum sander will reliably finish the band to the specifications given in the table on page 40. The planer may not work well for thicknessing because of the thinness of the bands. They can catch in the blades and shatter. When planing just a few bands, try sticking them on a shooting board with double-stick tape to stiffen them.

However you cut your wood, be patient and be prepared to try again. You can get a feel for flexibility in the wood as it comes off the saw. I heat my shop with what doesn't work.

Sliced Veneer Stock

Veneer is another source for bands. This is wood dimensioned by slicing at a veneer mill. It is an efficient use of the best grade of logs as there is no saw kerf waste. Successive sheets of uniform thickness make it attractive. Great quantities are sliced for the furniture trade for high-quality face veneers.

Most of this is cut to 1/42" (.024") thickness making it too thin for our use in boxes. The other common thickness is 1/16", which works for smaller boxes, and you can expect reasonable bending results from hard maple. (One commercial source is Constantines: 954-561-1716 or constantines.com.)

When the log is sliced, the knife leaves one side of the veneer with slight crack lines. This "open side" face needs to be inside the box when bent. Otherwise, the surface will be rough and could splinter. Gently flexing the veneer prior to preparation for soaking may reveal a side with these slight crack lines. Placing it in water will always show this. What happens is the wood takes a slight curl across the grain when wet. The rule is this: The inside of the curl is the outside of the box.

I have built my business during the past 20 years on meeting the needs of the oval box trade (ShakerOvalBox.com). I use veneered band stock selected and dimensioned specifically for bending. While I welcome your business, I know that cutting bands in the manner described above can be both rewarding and of high quality. For instance, there is no bias side in sawn band stock. Many of you have the capacity to do your own cutting. It is worth the effort. Try widths of 2" and narrower that cut easily on the table saw. Wider stock has been known to be more difficult.

Top and Bottom Boards

The other materials needed for box making are the oval boards for the top and bottom. These are 1/4" to 7/32" thick and not bent. Unlike the stock for the bands, these are readily available. The oval shape sets off some interesting figures and features. It is an opportunity to use small sections of boards that accumulate from other work.

The one factor you need to consider in tops and bottoms is wood expansion. If the oval board expands too much in humid weather, the band will crack. Breakage is serious stuff, and is ever present in a box. The larger the box size, the more likely it is to occur. The reverse of this is the board drying out after you make your box. That will result in gaps where it meets the band, spoiling your nice tight fit. Where possible you want quartersawn stock to minimize the future effects of humidity change.

One solution to wood movement in larger box sizes is to use plywood. The cross banding of alternative plys stabilizes the wood. For appearance sake, pick plywood without a joint in the veneer face, and be careful not to sand through the very thin face veneers.

It is also a fact that different tree species expand and contract differently. Softwoods are more stable than hardwoods. The Shakers used quartersawn eastern white pine because it is a very stable cut of wood. You can find

a table listing wood behavior as moisture changes in R. Bruce Hoadley's "Understanding Wood" (Taunton). Based on variation in species movement, I opt for plywood when maple tops and bottoms reach 7" wide, cherry at 8" wide and pine at 12" wide.

Whatever your species and growth orientation, be sure the moisture content of the tops and bottoms are similar to the inside environment of your home. If you are uncertain of that, and do not own a moisture meter, never fear. Boards ¼" thick will adjust to your home's humidity level in a few days. Bring the top and bottom boards inside before you make your box and expose all the surfaces equally for a few days to allow this to happen.

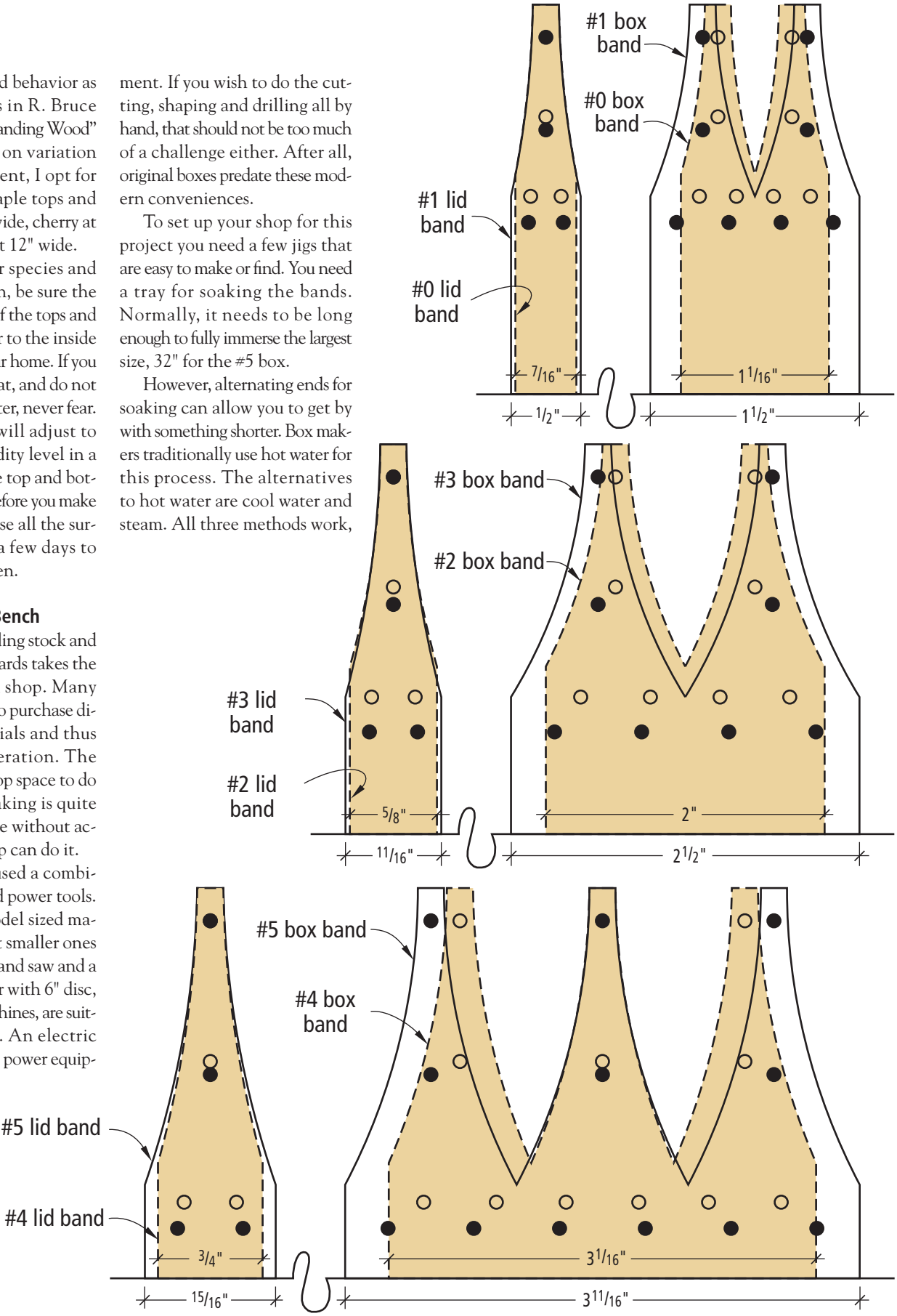
Setting up Your Bench

To dimension bending stock and top and bottom boards takes the resources of a full shop. Many craftsmen choose to purchase dimensioned materials and thus simplify their operation. The equipment and shop space to do the actual box making is quite modest. Even those without access to a wood shop can do it.

I always have used a combination of hand and power tools. Standard floor-model sized machines are fine, but smaller ones work well. A 10" band saw and a 4" x 36" belt sander with 6" disc, both benchtop machines, are suited to box making. An electric drill rounds out the power equipment. If you wish to do the cutting, shaping and drilling all by hand, that should not be too much of a challenge either. After all, original boxes predate these modern conveniences.

To set up your shop for this project you need a few jigs that are easy to make or find. You need a tray for soaking the bands. Normally, it needs to be long enough to fully immerse the largest size, 32" for the #5 box.

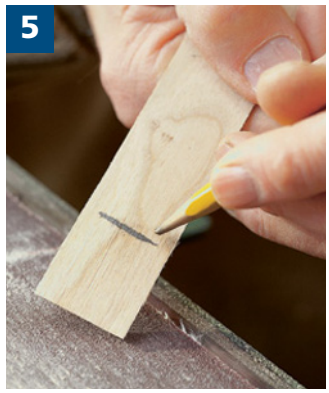
However, alternating ends for soaking can allow you to get by with something shorter. Box makers traditionally use hot water for this process. The alternatives to hot water are cool water and steam. All three methods work,



Full-size patterns of fingers on box and lid bands

Profile the finger design to rough dimension before final trimming with a utility knife. The locations for copper tacks are drilled at this time, too.

My preference for trimming is a utility knife with a fixed, not retractable, blade. This gives the necessary control. Use heavy-duty blades, not the lighter ones that come with a new knife.



The inside end of a band is feathered back 1" to 1½" depending on its thickness. This will provide a fair curve to the inside of the box.

but there are some differences in technique that go with each.

If you are already set up for steam bending, then by all means use it. If you can obtain a metal tray at least 4" x 32", then you are ideally set for hot water soaking. Set the tray on a stove or electric hot plate with stabilizer blocks under each end (photo 7). A length of steel gutter (the modern flat-bottom style) with end caps attached together with a ¾" plywood cover will serve for this.

When hot water is used, soaking takes 15 minutes. The wrap itself goes quickly with a few motions around the core.

Cool water will be the option when neither of the above is available, as you can co-opt the bathtub. Understand that flexibility comes from both soaking and heat, and when only one condition is involved, as in cool water soaking, you must allow 12 to 24 hours of soaking and use more finesse when bending. A forward then back motion to bending in small increments as you go around the tight end of the oval will flex the wood under circumstances such as this.

When tacking the lap, you will need an anvil for clinching the points of the tacks. This can be made from an 8" length of 1" or 1¼" galvanized pipe bolted to a wood cradle and clamped to your bench (photo 9).

The 4" x 36" bench sander sees a lot of use when I make a nesting set of five boxes. Here feathering the end of the band is controlled by a wood block to ensure a gradual taper.

The band has been feathered on one end and the fingers are trimmed and drilled on the other. The hot water tray has an electric hot plate with wood blocks under each end for stability. While a full boil is not necessary, water more than 180° will effect a softening of the lignin.

Cores and Shapers

In addition to a soaking tray you need a set of cores and a set of shapers. The core is a wood plug the size of the inside of a box. The hot, wet band is bent around it (photo 8). Made from soft wood (2" foam board also can be used), they are created using the oval patterns at right.

The shapers are the key to the Shakers' box production (photo 10). You will need a pair for each box made at one soaking. If you wish to make five of one sized box, then 10 shapers are needed. The alternative is to bend on five successive occasions, which is a lot more work than making a few extra shapers. They are made to the same oval pattern as the cores, only they have a 10° beveled edge to act as corks in the oval opening. Cut them slightly oversized by cutting 1/16" outside your pattern line. Drill holes for ventilation and to allow you to grab them for removal after the band is dry. The wood for shapers can be solid

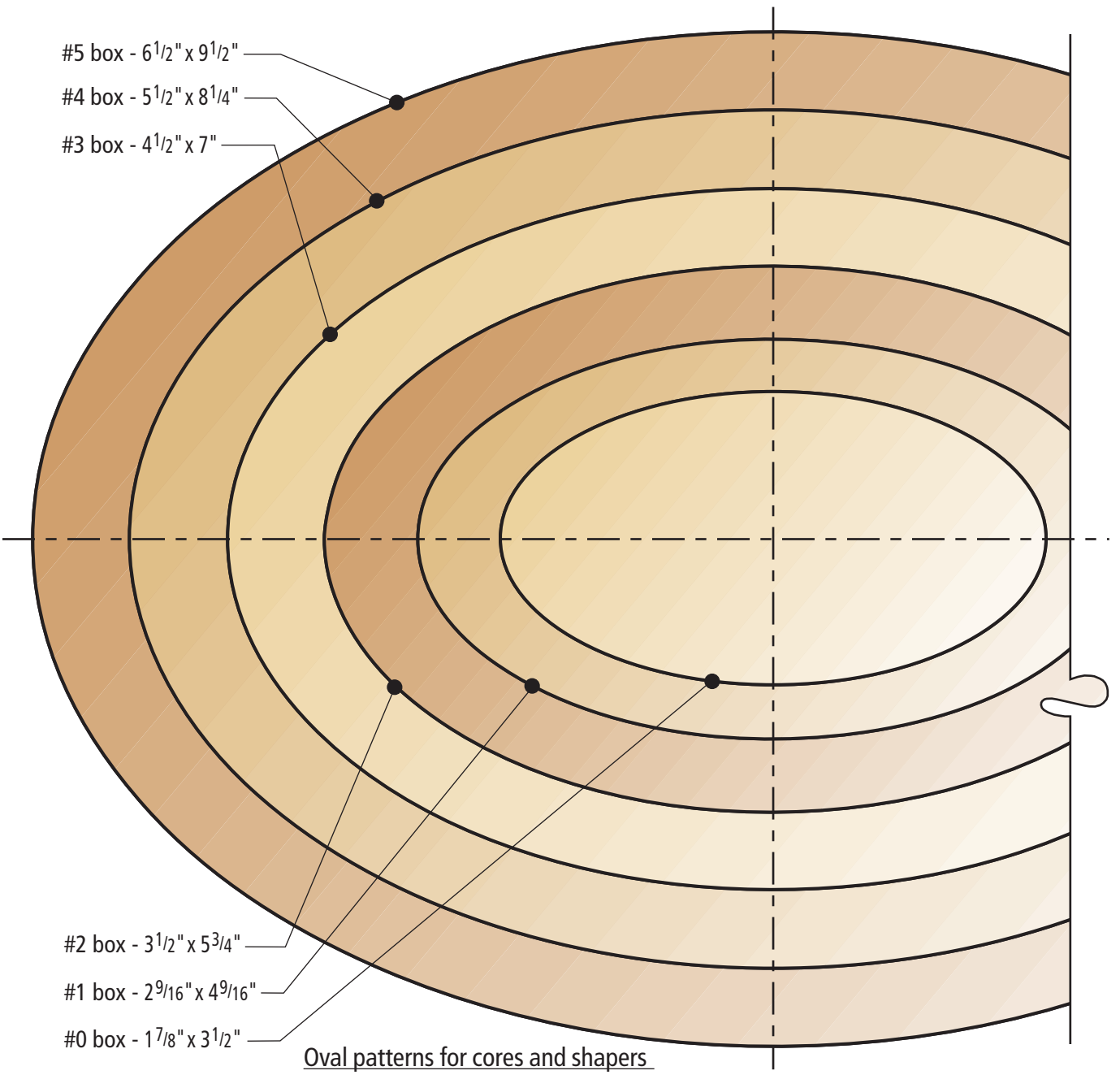
or ply, and the thickness varies. The smallest ellipse is ½" thick, mid-sized is ⅝" thick, and sizes #5 and larger use ¾" stock.

Preparing the Box Band

Now you can begin the box-making process. Cut and drill the bands for the fingers. Photo 3 shows the band marked according to the finger pattern for shape and location of the tack holes. The locations of the copper tacks are drilled with a 3/64" or 1/16" bit. The swallow tails, as the Shakers sometimes referred to the fingers, are cut on a band saw, or this can be accomplished completely with a knife. The rough shape is trimmed (photo 4) to the graceful proportions of the finished box. There are three elements to this shape: narrow width, slight bevel to the edges and a curved, gothic shape. I mention these because almost everyone starts by making the fingertips too blunt and too beveled – losing the graceful curve of the pattern in the process of trimming. The fingertip needs to be only slightly wider than the diameter for the copper tack head. This will make wrapping, tacking and drying go well, and achieve a more Shaker look. The beveled edges are trimmed to a slight 10°, not approaching the 45° commonly cut by novices.

Now you should feather back the inside end of the band 1" to 1½" depending on the thickness of the band stock (photo 5). The sander with a block of wood to hold the veneer evenly is used to taper the end (photo 6).

When the band is trimmed and feathered, place it in hot water to soak (photo 7). Water hotter



Oval patterns for cores and shapers

The wet band is wrapped around a core the size of the inside of the box. Here the wrapped band is being given a pencil mark so that the core can be removed and the band returned to its proper size. Note that both fingers are held to prevent splitting between them. The mismatch at the lapped edges of the band is common at this stage and will be made even when tacking.

Small copper tacks 1/16" longer than the two thicknesses of veneer are used to clinch the lap. No glue is used. The wood cradle secures the pipe anvil to the bench.

Once tacked, wood corks called shapers are put in both sides to hold the box shape for one to two days of drying. The 10° edge bevel and the holes for ventilation are a hallmark of this piece of bench equipment that is key to the Shaker system of production.

than 180° Fahrenheit will soften the lignin in the wood fiber that allows it to be bent. Upon drying it will hold the new shape. Soaking for 15 minutes is sufficient for ordinary bands. However, double that time for very small box sizes with a tight curve, and for troublesome bending stock.

Bending the Oval Band

Your soaked band will cool quickly once it is taken from the tray. When this operation goes in a smooth even motion, band breakage is minimized. Your core will need a pencil mark to show where to start the feathered end of the band in bending. This is how you find that mark: The major tack line is centered in the front of the oval. The start mark is left of center. How far left? It's the same distance as the measurement between the main tack line and the tips of the fingers.

Copper tacks clinch the band. No glue is needed for this efficient fastening. The tacks are 1/16" longer than two layers of veneer. So two or three sizes of tacks are used for a set of boxes, which has thicker veneer for the larger sizes. Have your tacks, anvil, hammer, a pair of shapers and a core ready when the band is taken from the hot water.

The central operation of all box construction takes but a few seconds. In one smooth sweep, hold the feathered end at the start mark and bend halfway around. Change hands, hold and complete the wrap. Pencil a mark across the veneer lap to register the circumference. Photo 8 shows this step completed. Hold both fingers securely at all times to avoid splitting the wood between them. Do not worry about having the edges exactly even or the main tack line centered at this stage. Both of these come next.

Open the band slightly to remove the core. Bring the band together so the pencil marks meet. Here is where you align the edges of the lapping band. Then tack the lap (photo 9).

The last step is to place a shaper in both sides of the oval band. These can be rotated if needed to bring the main tack line into the center of the oval. The band is pliable while wet, so you can rotate the shaper. Match the second shaper with the position of the first to avoid a skewed band. Be gentle inserting the shaper and do not push too hard because this will flare the edges of the bands.

The lid band, which went in to soak along with the bottom band, is next. It is bent on the box itself, which acts as the core (photo 11). Size, alignment and centering are observed for this band as well. When tacked, the lid band goes in place with the fingers pointing the same way as the bottom fingers (photo 12). The first half of box construction will be complete when these two bands have thoroughly dried. Allow for nor-

FIXING MISTAKES

You might find two kinds of repairs helpful in your work, each using their own kind of glue. Wet bands that split can be repaired with cyanoacrylate (like Hot Stuff Original) two-part glue because it works on wet wood. The advantage of this is that any repair will hold the pliable wood before it dries. Minor gaps found around the edges of the oval board can be repaired with carpenter's glue. Wipe glue into the gap and sand immediately. The sander dust loads the wet glue, giving a matching glue line. Unlike cyanoacrylate that remains clear under varnish, carpenter's glue must be removed from the surface before finishing.

mal air flow around the box. Avoid using extra heat, direct sun or fan blowing. Drying too quickly can result in the veneer warping.

Fitting Tops and Bottoms

The oval boards to complete the box are 1/4" thick for mid-sized boxes, and 3/16" and 7/32" for the two smallest boxes.

Draw the oval by using the dry box band as the pattern. Remove the shapers and give the inside a light sanding. Use a mechanical pencil for an accurate line around the inside of the oval band. Now determine the direction of the fingers. It's up to you. Historically most boxes were pointing right, but significant numbers were lefties. In either case, both top and bottom bands should match.

Getting the top band finger direction to match that of the bottom band can be troublesome. The reason is this: When the lid is lying on the bench to be traced out, it is in the opposite position from where it is in place on the box. Check it out in position on the box to make sure that you have the right finger direction to match the bottom.

After band sawing the oval, sand the board up to the line on the disc sander (photo 14). This is not a right angle, but it has a slight bevel to give it a cork effect. To get this, adjust the disc table up 4°. Most sanding machines aren't designed to do this out of the box, but you can easily file the slide that adjusts the table to allow it to tip up the 4°.

Insert the oval board against the front edge first (photo 15), then press in the back. This avoids catching the feathered end of the band, which can be damaged. Press the board into the oval band until it is even or slightly below the band all the way around. Sand this joint line flush. Now repeat these steps for the lid section.

The top band is wrapped on the box itself. It will be tacked and then returned to the box for drying. Note that the direction of the fingers match the bottom band fingers.

The construction of an oval box is half completed when it is set aside to dry for one to two days.

Here I'm tracing the oval on the 1/4" boards used for tops and bottoms. A mechanical pencil will ensure accuracy of this line.

The disc sander finishes the edge up to the pattern line. The sander table is elevated to 4° to provide a slight cork effect to this ellipse for a tight fit. To make this adjustment, you may need to file out the slide slot so it no longer stops at 0°, or you can remove the thumb screw and use a small C-clamp.

The oval board is fitted into the bottom by setting it against the front lap and then working the back into place. This will ensure that the feathered end will not be damaged in the process of pushing the oval.

Wood Pegs Hold the Boards

Once the oval boards are in place and the joints sanded flush, it is time to drill for wood pegs. These holes center on the 1/4" top and bottom boards, and are placed 2" to 3" apart around the edge. They keep the oval boards in place. It takes a 5/64" hole drilled 1/2" deep. Two jigs are shown for ensuring that you do not miss the edge of the boards.

Photo 16 shows a small drill held down with a wood yoke to create a horizontal drilling jig. Photo 17 shows an adaptation for a drill press using a right angle clamped to the work surface. It drills in the vertical mode.

The wood pegs can be split off a thin cutting of wood. However, in my shop, hardwood toothpicks made by the World's Fair Brand Co. serve for pegs. Cut the box in half on the band saw to double your count of pieces at just the right length. Tap the pegs in securely (no glue needed), and snip off with wire cutters (photo 18).

With the pegs in place, sand the surfaces of the box (photo 19). The finger lap is one area I do by hand to ensure that the carved finger design retains its full relief.

After the oval board is in place and sanded flush, drill the perimeter every 2" to 3" for wood pegs. This drill jig locks a spare drill to a board with a front table the right height to center the hole on the 1/4" board inside.

An alternative drilling method makes use of a drill press. The jig, which I call a bookend, creates a vertical drilling station.

Finishing the Oval Box: Paint vs. Varnish

Boxes need a finish coat on the outside for protection, but remain plain wood on the inside. The reason for this is the neutral nature of wood. Just like the insides of bureau drawers, you do not want the odors from oil or paint finishes to affect food or cloth.

Historically, boxes were painted before the mid-1800s and clear finished after that. Paint was made locally from lime, clay, milk and pigments. Recipes for finishes were a shop tradition. Interestingly, craftsmen of old did not remove the lid when painting the box, so original boxes show a narrow band of plain wood around the top edge. This may be due to the possibility of a lid sticking to the homemade paint.

What do I recommend? First, if you do paint, take the lid off and save yourself the trouble of having to explain "incomplete" outside painting. Second, leave the inside plain. Third, use whatever finish you like, have on hand and are familiar with. There is nothing that is all that special about a box finish that should keep you from getting it done.

The little #1 box with red paint (shown on the cover) was finished with one coat of latex flat paint,

SHAKER OVAL BOX SPECIFICATIONS

BOX SIZE	COPPER TACK SIZE *Notes 1 & 2	BAND THICKNESS *Note 3	BOTTOM BAND WIDTH X LENGTH	TOP BAND WIDTH X LENGTH	ELLIPSE WIDTH X LENGTH	TOP & BOTTOM THICKNESS	NO. OF FINGERS & LENGTH TO TACK LINE
0	1	.062"	1 1/16" x 11 7/8"	7/16" x 12 1/4"	1 7/8" x 3 1/2"	.195 - .210"	2 - 1 3/8"
1	1	.065"	1 1/2" x 15"	1/2" x 15 1/2"	2 9/16" x 4 9/16"	.210 - .220"	2 - 1 9/16"
2	1 1/2	.070"	2" x 19"	5/8" x 19 3/4"	3 1/2" x 5 3/4"	.235 - .250"	2 - 1 13/16"
3	1 1/2	.075"	2 1/2" x 23"	11/16" x 24"	4 1/2" x 7"	1/4"	2 or 3 - 2 1/16"
4	2	.080"	3 1/16" x 27"	3/4" x 28"	5 1/2" x 8 1/4"	1/4"	3 - 2 1/4"
5	2	.085"	3 11/16" x 31"	15/16" x 32"	6 1/2" x 9 1/2"	1/4" - 5/16"	3 - 2 7/16"

***NOTES: (1)** Leave 1/16" exposed end of tack inside, tap to clinch. The #1 tack = 3/16" long, #1 1/2 = 7/32" long, #2 = 1/4" long. **(2)** Use 3/64" or 1/16" pilot hole for #1, #1 1/2 and #2 copper tacks. **(3)** Band thickness is in thousandths because these small differences are impossible to read with a tape measure and a difference of as little as .006" will change the wood's bending properties; larger changes (.015") can require you to use longer tacks. Purchase an inexpensive steel dial caliper (Grizzly sells a 4" caliper for $11.95; item# G9808; call 800-523-4777 or visit grizzly.com to order).

Wood pegs are made from cutting in half the box of World's Fair Brand toothpicks. The tapered end to these match the 5/64" hole for a secure fit when tapped in place.

Final sanding is done with a 120-grit belt replacing the 80-grit one used for shaping wood before.

followed by sanding with 220-grit sandpaper. This will accent the edges of the oval and finger area, and reveal the copper tacks. The new paint is finished with Kiwi brown shoe polish! That's right, I call it old-time patina in a can. Rub it on and brush it off. Note of caution: Try a sample of whatever wax finish you use before doing the box to ensure that the solvents in your wax do not "pucker" the surface of the paint.

Clear finishes come in a variety of forms such as shellac, varnish, lacquer, oil and blends of several of these. Some are brushed, some wiped on. Each has fans. All work. Your choice. For myself, I prefer quick-dry polyurethane for durability in areas where water spatter is likely, such as in the kitchen. This can be brushed on from the can, or mixed 50/50 with painter's naptha (a form of paint thinner) to make a wipe-on finish that avoids the nasty habit of varnishes getting runs or drips. Sand between coats.

Conclude with a rub on a brown paper sack. This is an old painter's trick that has been known to really work – simple, available, quick and effective. Open a grocery sack – the kind the bag boy used to put your groceries into, remember? – so the inside is lying flat open. You want to avoid rubbing on the ink printing on the outside lest it transfer to your fine finish. I have a piece of 1/4" foam (used for carpet underlayment) under the paper to avoid encounters with grit on the bench that pokes through the paper. Then rub the top, bottom and sides. It takes less time to do it than reading about it, and it gives your box a smooth, burnished feel.

Sign and Date Your Creation

When the finish is done, you want to sign and date your handiwork. Did the Shakers sign their boxes? Yes and no. There was a feeling at times that the community was paramount and individual expressions of ownership inappropriate.

But there are many examples of boxes that were signed, and many of these were given as gifts, just like yours may be. I think it is a nice touch in this age of mass production to have your individual creation labeled with your own signature and date.

Having finished your first box project, be aware that you will receive both compliments and longing eyes directed to the oval boxes. There is no project in my experience that has such universal appeal as a Shaker oval box. Watch out, you may find yourself joining the ranks of box makers! **PW**

In this industrial age, craft work is highly valued. Sign your box with pride.

SUPPLIES

One of the nice things about making Shaker boxes is that woodworkers of any skill level (even non-woodworkers) can complete a nest of boxes with few tools.

The author of this article, John Wilson, purchased tack-making machines from the W.W. Cross Nail Co. when it ceased production in 1991. Their production in his shop ensures that oval box makers will continue to be supplied with the signature tacks. A "Tac Pac," which includes a variety of common tack sizes, makes 130 boxes and costs $10 ($13 postage paid).

You also can purchase presliced bands in cherry or maple, and tops and bottoms in cherry, pine, lacewood (quarter-sawn sycamore) and bird's eye maple. A set of five box bands (enough to make a #0, #1, #2, #3 and #4) are $14 for cherry or maple. The five tops and bottoms in either species cost $14.

To make your setup even easier, Wilson also sells cores, shapers, patterns for the fingers, copper trays for the hot water and videos.

Wilson also teaches classes on Shaker boxes and other woodworking topics.

To see a full selection along with a class schedule, you can download his catalog at shakerovalbox.com. You also can contact him at:

The Home Shop
406 E. Broadway
Charlotte, MI 48813
517-543-5325
(8:30 a.m. to 5 p.m. Monday through Friday, EST)

Readers wishing to pursue this further will be interested in Wilson's forthcoming book "Shaker Oval Boxes" to be published by Home Shop Books and Videos in 2004.

— Christopher Schwarz

Drawer Slide BASICS

Installing drawer slides can be a scary process, but with a few tips you'll be hanging drawers with the best of 'em.

Every woodworker remembers a moment of paralyzing fear when they had to do some task for the first time. Mine occurred when tasked to make my first drawer while working in a custom cabinet shop. I'd watched the "old guys" make drawers, but now it was my turn. I allowed the proper 1" side-to-side clearance (½" for each side) and the drawers themselves turned out fine. Then it came time to install the drawers. The shop foreman handed me a box of epoxy-coated under-mount slides and walked away. No instructions. Nothing. It was time to learn the hard way.

To help you avoid that paralyzing fear, we decided to share some of our hard-won experience with you on installing drawer slides. Following are instructions on the two most common slides available from home centers, catalogs and retail stores: under-mount slides and full-extension side-mount slides.

by David Thiel

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

Photo by Tim Grondin

About the Slides

Under-mount slides are more common and less expensive – about half the price of side-mount slides. They're easy to position and mount on the drawer box and have enough adjustability to make installation pretty foolproof.

These slides allow you to open the drawer three-quarters of the way out of the cabinet, which means you'll still end up digging around at the back of the drawer. But under-mount slides are attractive, smooth-running, quiet and very affordable.

Many side-mount slides let you pull the drawer box clear of the cabinet (these are called "full-extension slides"), making the entire drawer accessible. The side-mount slides also allow a little better use of the cabinet space because they require less clearance room to install or remove the drawer. They're also available in higher weight-holding capacities, which make them popular for use with larger drawers.

Both can be used in either face-frame cabinetry (cabinets that have a solid-wood picture frame placed over the opening, forming a lip around the front edge of the cabinet) or frameless European cabinets (cabinets with no front lip, allowing maximum use of the interior space).

Installation Tips

While many of the slide manufacturers are more helpful than my former shop foreman by including installation instructions with their slides, the information is superficial and won't provide everything you need to know for easy installation.

The following photos and text provide information for installing both under-mount and side-mount slides in both frameless and face-frame cabinets. These basics will simplify the leap to more advanced hardware (such as pocket doors, for example).

The photos walk you through installing the top drawer in a cabinet. If your cabinet has only a top drawer (with a door below) you're in great shape. If you need a bank of drawers, here are some additional tips you need to know.

How Many and How Big?

Start by determining the amount of interior height available in the cabinet, then determine how many drawers you need. When deciding the number and use of your drawers, remember that drawer interiors usually should be no shallower than 2" and no deeper than 10".

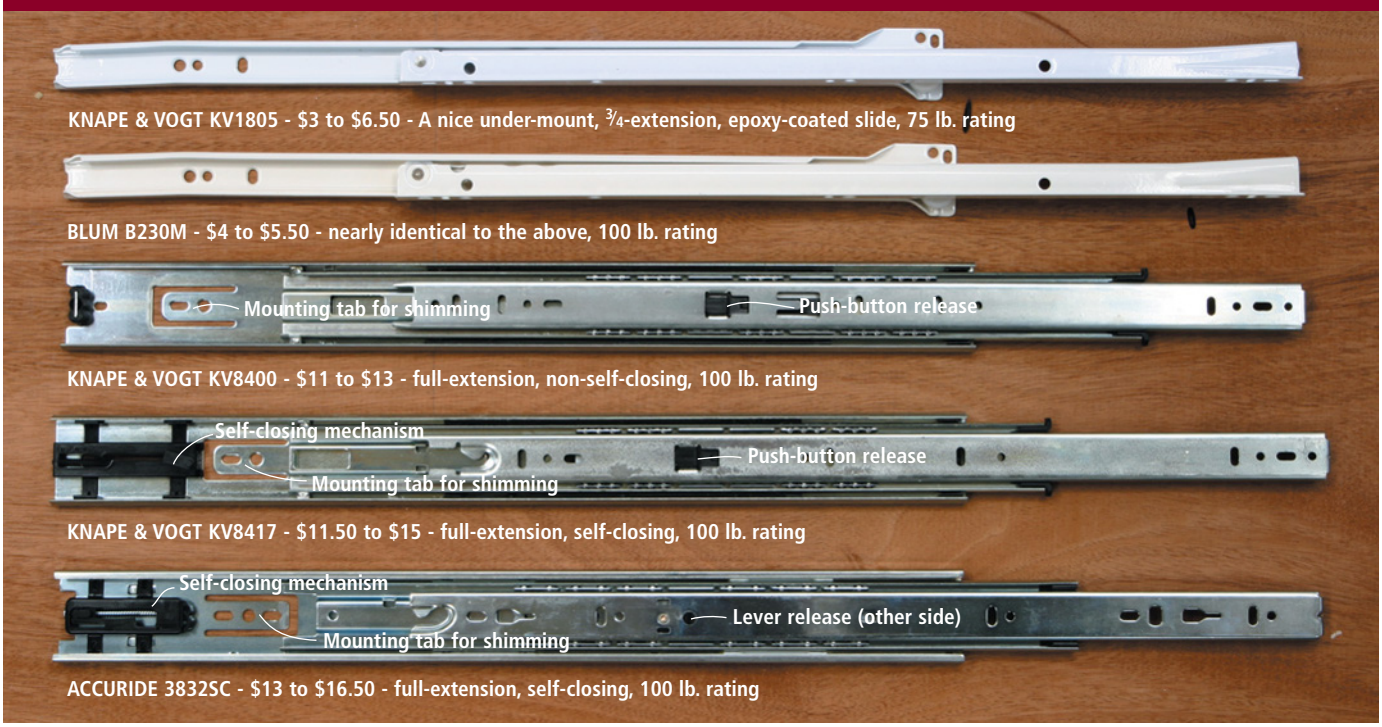
Next, take this interior drawer dimension and add ½", which is typically the part of the drawer that is not usable space: the bottom itself and the space below the bottom. Now add the necessary clearance space above and below the drawer. The amount of space is determined by the type of slide (as discussed with the photos). Generally ½" of space below the drawer is adequate and ½" to 1½" above is typical.

Using the above formula, your 2" lap drawer will require 4" of space when using an under-mount slide. With the drawer heights now in hand, mark them out on your cabinet's interior side, then work backwards to locate the correct slide-mounting locations. Double-checking your math is easy once the slides are on the drawers themselves.

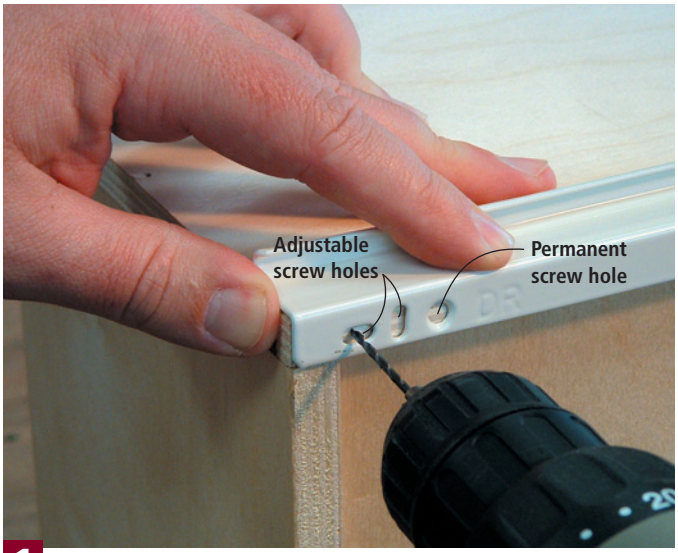
When installing multiple drawers of the same height, a template can save time. Use a piece of ¼"-thick plywood that is cut to the height of the necessary drawer space. Then mark and drill the location holes for the cabinet slides in the template. By placing the template on the floor of the cabinet then moving up the side, you can quickly drill the pilot holes for all your slides.

You're now ready to tackle drawer slides without fear!

SOME BASIC DRAWER SLIDES

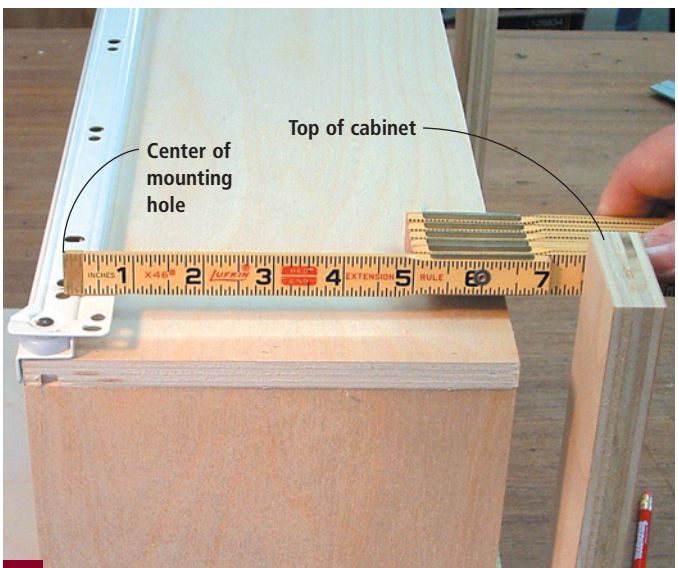


INSTALLING UNDER-MOUNT SLIDES

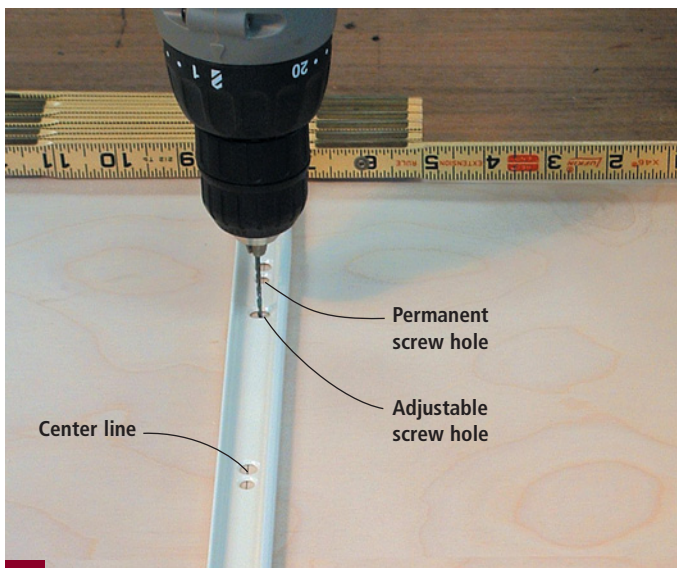


1 With the under-mount slides, it's easy to determine their mounting location on the drawer. Most of the parts are stamped with a DL (drawer left) or DR (drawer right) to make it simple. Slip the drawer slide over the bottom edge of the drawer side and hold the front end (without the roller) flush against the front edge of the drawer box. If you're not using a false-front drawer design, the slide will butt directly against the back of the drawer front. Drill a 5/64" pilot hole in the center of the front-to-back adjustment hole to avoid splitting the drawer side.

2 The slides should come with screws, but some economy slides don't. If not, a #6 x 1/2" screw is your best bet. Depending on the manufacturer, the included screws may be round-head or flat-head. If you have to buy your own screws, opt for the flat-heads. That way you won't run into any situations where the rounded head impedes the slide. Two screws (one at either end) in the adjustable slots will do for now. Once the drawers are adjusted, you'll put the permanent screws in their holes.

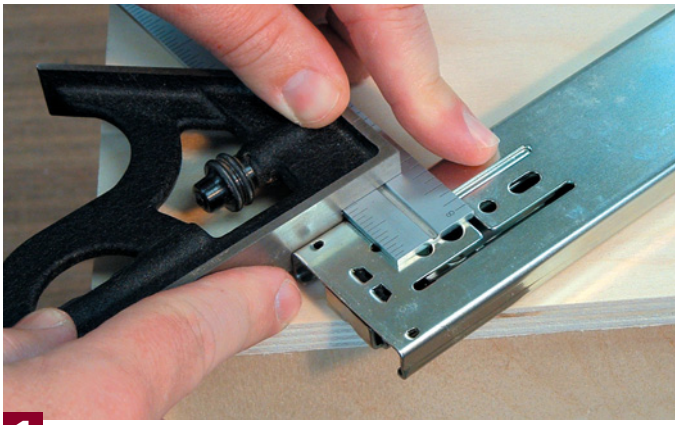


3 When under-mount slides are slid into, or out of, the drawer case, the drawer must be lifted to allow the rollers to clear each other. Because of this, leave space above the drawer. One inch is sufficient to provide clearance. To determine where to mount the cabinet slides, slip the two slide halves together, then position your drawer to determine top clearance. Measure to the center of the mounting holes on the slide and that is your cabinet-mounting dimension. There are three standard types of drawer fronts: Overlay (where the drawer front is completely outside the cabinet box); lipped (where a rabbet cut in the back of the drawer front allows the front to fit partially into the cabinet box); or inset (where the drawer front is fully contained in the cabinet box). Depending on your drawer front, you'll need to flush or recess (usually 3/4") the front end of the slide on the cabinet sides accordingly.

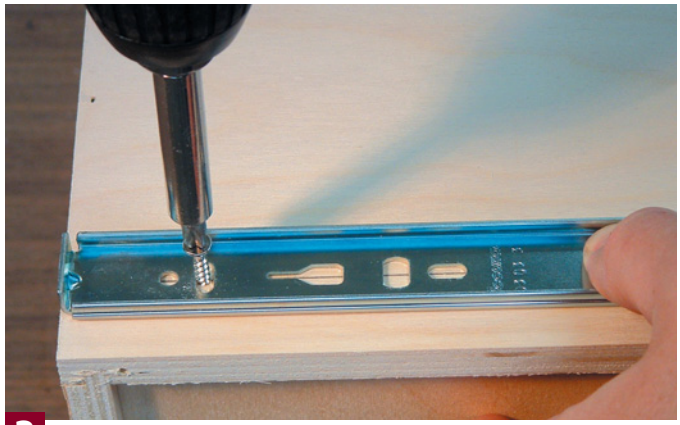


4 Transfer the dimension determined from measuring the slide location on the drawer to the cabinet side. You can make a mark at the front and rear of the cabinet sides, then connect the marks. Or if you have a good square that you trust, you can simply draw the line that way. It's not a bad idea to check the measurement even if you use the square. While there is adjustment in the slides, if the square moves 1/8" while making your line, adjustment will be much more difficult. Make a pilot hole at the front and back of the slide using the vertical adjustment slots, then mount the slides. To install the drawer, rest the wheels of the drawer slides on the top of the wheels on the cabinet slides while lifting the front of the drawer. The drawer will drop into the track, then you can level the drawer and slide it into place. Check your fit and you're done.

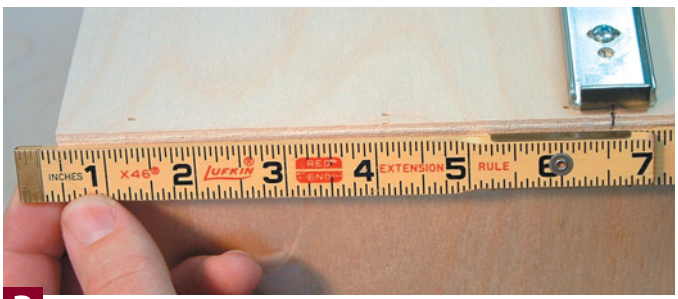
INSTALLING SIDE-MOUNT, FULL-EXTENSION SLIDES



1 Side-mount slides can be attached to the drawers at any location on the side. We'll mount these at the bottom of the drawer. First, determine the center line of the assembled slide. With side-mount slides there is no left or right slide, so we simply use a combination square to take the measurement to the center of the mounting holes. It's then a simple matter to transfer the center location to the drawer sides. Next, disassemble the slide. Check the instructions to see how your slide works. Usually you lift a lever or push a button on both slides simultaneously.

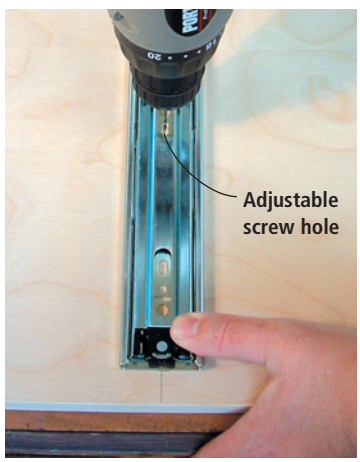


2 While there's no left or right on these slides, there is a front and back. Once the slide is disassembled, orientation can get confusing, so take a close look at the slide before you separate the two parts. Hold the front edge of the drawer slide slightly back from the front edge of the drawer. No more than $\frac{1}{8}$" is necessary, and $\frac{1}{16}$" is preferable. Again, drill a pilot hole in the center of a top-to-bottom adjustable slot, then attach the drawer member.

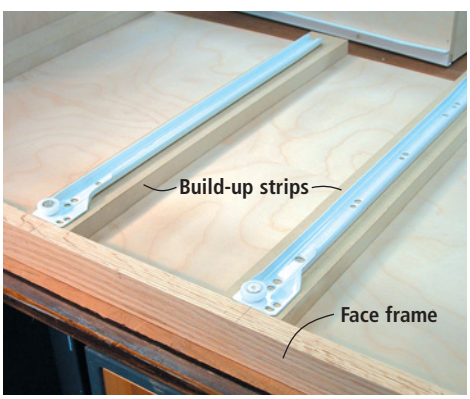


3 To determine the location of the cabinet member of the slide, measure to the center line of the drawer side member. Side-mount slide pieces push directly into one another without the lifting necessary on under-mount slides. Because of this it's not necessary to leave a space above the drawer side, but it's still not a bad idea in case the drawer becomes too full at some time. we allow a $\frac{1}{2}$" space above the drawer box on side-mount slides, just to be safe.

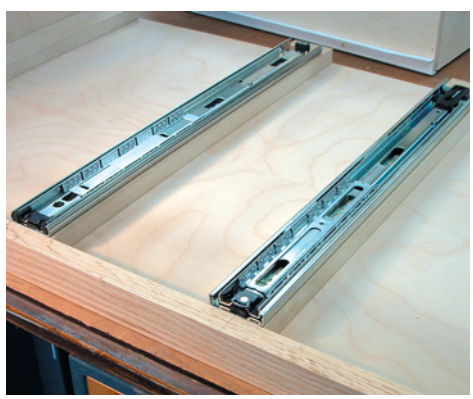
4 Transfer the dimension to the cabinet side and mark a line from the front to the back of the cabinet side. After marking the necessary spacing for the drawer front (in the photo we're allowing a $\frac{3}{4}$" set-back for an inset drawer), hold the cabinet member in place and attach the slide using the adjustable slots. On side-mount cabinet slides, use the front-to-back adjustable slots – that's why we used the top-to-bottom slots on the drawer members. To install the drawer, extend the slides on the cabinet fully, align the slide halves and slide the drawer into place.



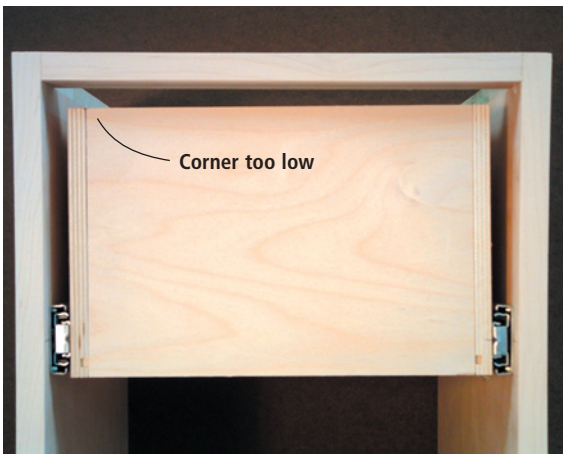
HOW TO INSTALL EITHER TYPE OF SLIDE IN A FACE-FRAME CABINET



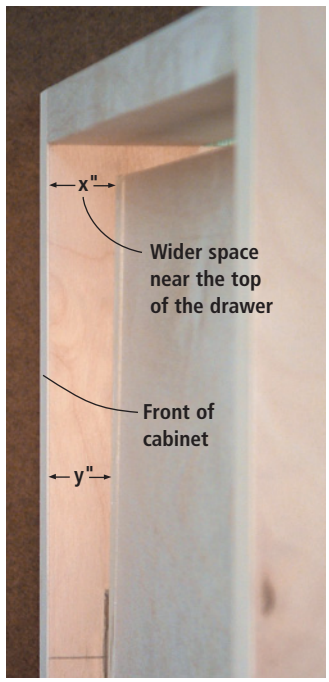
The above photos show a frameless cabinet, but these slides work with face-frame cabinets, too. The only difference is compensating for the lip of the frame. To make the slides work on face-frame cabinets, simply add build-up strips behind the slides. You may be able to use scrap plywood or composite-board to bring the slides flush with the frame edge. However, if the frame-lip dimension isn't a perfect $\frac{3}{4}$", you'll need to run some solid material through the planer to the perfect thickness – which is flush with the inside edge of the face frame.

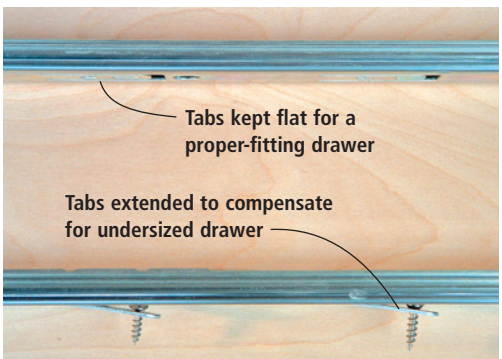


ADJUSTING THE DRAWERS

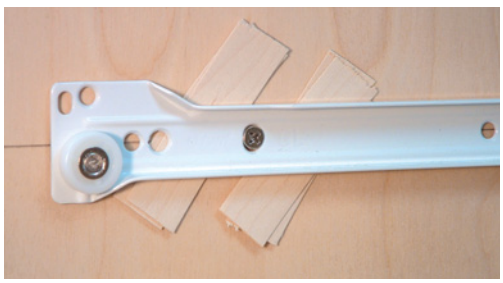


With the drawer slid into place you can see how things are starting to fit. The view of the drawer (left) shows it lower on the left side. The photo at right (getting a look from the side of the cabinet) indicates that the drawer is lower in the back than at the front. Remove the drawer, loosen the screws in the adjustable slots and move the slides to accommodate the changes. The problems shown are all height adjustments and will be adjusted on the drawer slide members. When the drawer is level, attach the false front and check alignment for front-to-back. Any necessary adjustments here will be made on the cabinet-side slides. When everything is in good shape, carefully pilot drill the center of the permanent screw holes on both the drawers and the cabinets slides, and put in the screws. If the screws aren't perfectly centered in the permanent holes, they can pull the slides out of adjustment.





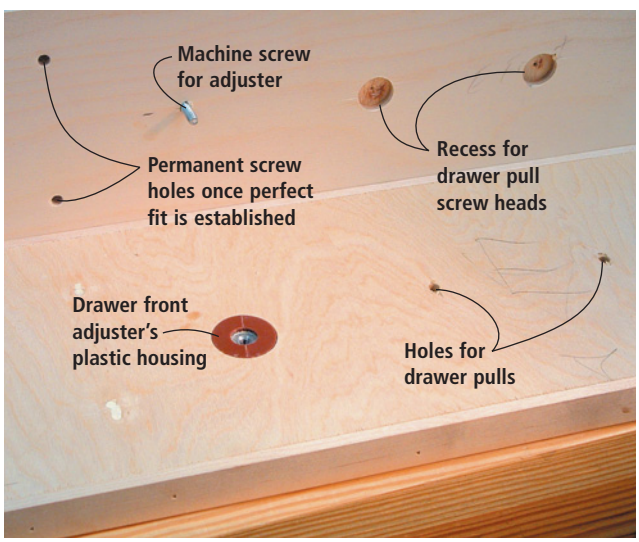
Fitting drawers that are too small is easier than fitting drawers that are too big. If you err on the small side, it's easy to fix on the side-mount slides. Each slide has mounting tabs that can be bent away from the slide body to fit closer to the drawer. When the proper spacing is gained, the permanent screws are installed, locking the tabs in place.



The under-mount slides don't have tabs to help fit undersized drawers. That's when shims come to the rescue. Almost any material can serve as a shim. In the photo above, we're using pieces of self-adhesive edging tape. These pieces can be stacked to reach the appropriate spacing and will stick to one another, as well as to the slide. Make sure you shim on either side of the screw hole. The shims shown are simply slid in place to test the fit. When correct, they will be slid behind the slide so they aren't visible.

A SIMPLE WAY TO ADD A DRAWER FRONT

As you may have noticed, we like using "false-front" drawers. While not appropriate for period furniture, they're easy to adjust. Inset drawers are one of the most difficult type of drawers to build because there is little room for error. By using a false-front design, the drawer box can be installed and fit into the cabinet without worrying about the front. Then the drawer fronts can be made to perfectly fit the opening. While the fronts can be simply screwed in place through the drawer-box front, we've found an even better way. Using drawer-front adjusters mounted in the false front, you gain $^{3}/_{16}$" adjustment vertically or horizontally. Essentially the mounting screw wiggles in the plastic housing. This allows a precise amount of fitting for the drawer front and also makes attaching the fronts easier. **PW**



SOURCES

The following sources carry at least the listed brand-name slides and some also carry other brands or non-branded drawer hardware.

Lee Valley Tools
800-871-8158 or leevalley.com

Lowes
800-44LOWES or lowes.com

McFeely's
800-443-7937 or mcfeelys.com

Rockler*
800-279-4441 or rockler.com

Woodcraft
800-225-1153 or woodcraft.com

Woodworker's Hardware*
800-383-0130 or wwhardware.com

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

* These sources also carry the drawer-front adjusters.

LUSTING FOR LUMBER

Sometimes the hardest part of working with wood is simply finding it. Here are the strategies we use to keep our wood racks full.

Like many legendary lumber tales, our story begins with a farmer and an old barn out in the middle of nowhere.

You see, there was this farmer out in the middle of nowhere, and about 25 years ago a storm blew down the biggest walnut tree on his land. The farmer had a friend at a sawmill cut up the tree, and the old guy put the wood in his barn to use someday.

Someday never came. The farmer died, one of his relatives called us and we went out to this secluded hamlet with visions of 24"-wide clear planks in our heads.

But like many lumber tales, ours ended when we scaled up to the barn's hayloft. Up there we found a mound of moldy, rotting, bug-infested, unstickered wood that wasn't even good enough to burn.

Finding lumber off the beaten path has both risks and rewards. For every time we've bought black cherry for $1 a board foot (kiln-dried but ungraded), we've probably had three or four times when we came up empty-handed. Or worse, we bought wood that looked good to us as we loaded the truck, but it turned out to be junk.

Because we can't always rely on foraging for wood, we're also regular customers at commercial lumberyards. Sure, the price can be a bit higher, but the lumber is graded, so you know what you're going to get. And the supply is more predictable than hunting for the old barn in the woods.

No matter who you are, unless you own a sawmill, finding the best material for your projects is going to be a challenge. Even professional cabinetmakers are constantly foraging for new sources for wood.

But it is possible to find quality lumber – no matter where in the country you

by Christopher Schwarz

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

Photo by Tim Grondin

Editor and Publisher Steve Shanesy pulls out one of his monster walnut boards. The lumber, all 1,100 board feet, came free from a neighborhood tree. A number of boards were up to 30" wide. Steve hired a Wood-Mizer sawmill operator to cut the logs.

live. To verify this, we tracked down several woodworkers from relatively hardwood-deprived states such as Florida, Arizona and Texas (all of whom belonged to a woodworking club by the way). According to these wood scroungers, it is possible to find quality lumber. You just have to know where to look.

And when you do find some wood, you need to figure out if it's worth buying. This means you have to get familiar with the lumberyard lexicon. There are lots of terms you need to know so you can ask for (and get) exactly what you need. To help you on that point, we've included a glossary of the common terms and expressions you'll hear at the lumberyard ("The Language of Lumber" on page 53).

Once you've boned up on the lumberyard-ese, it's time to start your search. Here are the strategies we use to keep the racks in the *Popular Woodworking* shop (and at home) full of good wood.

Commercial Lumberyards

Believe it or not, you might not be aware of all the lumberyards that carry hardwoods in your area. Some are small family operations that rely more on word of mouth than marketing. Your first step should be to check the Yellow Pages (look under "lumber, retail") and visit the WoodFinder web site (woodfinder.com), which can help you find suppliers within a 200-mile radius.

Some lumberyards deliver even small loads, and others are worth

the drive, so don't discount the stores that are out of town. If you're still not having luck finding basic hardwoods such as red oak and poplar, call a local cabinetshop and nicely ask where you can find hardwoods locally.

And don't forget to look for lumber mills if you live near hardwood forests. Some of these mills sell direct to the public, and the prices can be pretty good.

Wood by Mail

It might seem nuts to buy lumber through the mail, especially when you consider that you're buying it sight-unseen and have to pay for shipping. But many of the big mail-order lumber suppliers actually are quite competitive in price, and the wood is of a high quality.

Editor Steve Shanesy recently visited Steve Wall Lumber Co. (walllumber.com or 800-633-4062) in North Carolina and was impressed by what he saw in the racks. Wall offers special 20-board-foot bundles of lumber in 3' to 5' lengths that ship via UPS. Here are some recent prices for 4/4 S2S lumber: mahogany for $5 a board foot, cherry for $5.50, soft maple for $3.95. And those prices include all shipping costs.

Woodcraft (woodcraft.com or 800-225-1153) sells domestic and exotic woods by the board or in bundles. Paxton (paxtonwood.com or 800-325-9800) sells wood by the bundle, and so do many other large lumberyards. Woodfinder (woodfinder.com) lists many other mail-order companies, too.

Join the Club

Of course there are ways to make the search easier. Perhaps the best way is to join your local woodworking club or guild.

Almost every club seems to have a resident wood scrounger who is more than happy to point you to places that are off the beaten path. Some clubs even organize purchases of lumber for their members – buying in volume drives down the price. And if you're looking for a small quantity of a particular species, it's likely that one club member will have a few

How much lumber did you need? Commercial lumberyards and mills are an excellent source of consistent, graded lumber with few surprises.

A LOG IN EVERY PORT

In 1992, Donald Boudreau and his wife, Carol, sold everything they owned, bought a teak 49' sailboat, named it Domicile and began fulfilling their dream of sailing around the world.

While in Rio Dolce, Guatemala, Boudreau wanted to make a cutting board that also would cover the top of his stove. A local gave him some wood to use for the project. Later, Boudreau realized it was goncalo alves (tigerwood). It was Bourdreau's first experience with exotic wood. He soon began collecting exotic wood wherever they docked.

Six years and many islands later, the couple was in New Zealand with an expensive wood collection and grandchildren waiting for their return back home. So they sold the boat and shipped the wood to South Florida where they planned to make their new home near Ft. Lauderdale.

Once in Florida, Boudreau put his exotic wood collection aside and spent three years building every piece of furniture for their new home. With the home furnished, Boudreau began building award-winning boxes using the exotic wood he purchased on his trip and has since been collecting.

Donald Boudreau and his wife sailed this sailboat around the world, collecting tropical hardwoods in Central America, South America and the South Pacific.

At any given time his shop is filled with 50 to 60 different species of wood totaling several hundred board feet. While he has found several Florida dealers who import Latin American wood, Boudreau says he also buys 4/4 hardwood flooring, shops on the Internet and, when necessary, hops on a plane to make a purchase.

— Kara Gebhart

FANCY (AND FREE) FIREWOOD

Three years ago in Moscow, Ohio, Steve Koller and his father, Eugene, were loading a pickup truck with odds and ends from a pallet company – wood they would use to heat their homes. Steve began noticing the dark color of some of the pallet wood. So he took a piece of it to his shop and cut it in half. At that moment Steve realized he and his father had just brought home an entire truckload of walnut. While there were some small pieces, others ranged in size from 18" to 24" long, 6" wide and 3" thick.

The next week, Steve and his father went to the pallet company for some more firewood, only to discover they had brought home a pickup truck full of cherry. But their luck soon ended. According to Steve, since then, the pallets have been the norm: oak and poplar.

— KG

You need a few things to move logs: cant hooks, a strong back and lots of friends (all shown at right). It's grueling work, but it's worth it.

extra board feet of that species to sell. They'll probably offer it to you at a great price, too.

Don't know if there's a club in your area? Go to betterwoodworking.com/woodworking_clubs.htm to find one near you. We highly recommend joining a club.

Mobile Mills

There are, of course, thousands of board feet of lumber outside every window. And whenever Mother Nature is roused, the downed trees in your neighborhood are a potential gold mine of wide, clear stock. It's just a matter of first moving the "bole" – the straight part of the trunk below the branches that yields clear and stable wood. Moving the bole is perhaps the most difficult task.

Then you have to find someone to mill the logs into suitable thicknesses for drying. Luckily, this is pretty easy. Wood-Mizer Products Inc., which manufactures portable band-saw mills, maintains a list of sawyers who perform custom-cutting. Contact Wood-Mizer at woodmizer.com or 800-553-0182. In addition to Wood-Mizer owners, there are probably other sawyers in your area who will do the job. Check with your local woodworking club (another good reason to join).

Finally, you have to learn how to properly sticker your green wood for seasoning. It's not rocket science, but there are some rules to follow. For the basics, check out the "Select Articles" area of our web site.

Farmers with Barns

There are farmers out there with barns full of lumber. And there are garages stacked high with premium wood left behind by de-

STAIRCASE SLIP-UP

Duncan Alldis (now retired) and a friend had a workshop in Croydon, Surrey, England. One day, a friend of his son stopped by and asked if Alldis would be interested in the parts from an old three-flight mahogany staircase. The young man had been hired to remove and dispose of the staircase, and he thought Alldis might like to buy the parts he salvaged from the job.

Alldis often used mahogany in his shop. So he calculated its value and told the (now smiling) young man how much he could offer.

The next day the young man arrived at Alldis's workshop with a pile of stairs. Alldis took one look at the wood and knew it wasn't mahogany. Closer examination verified this fact and the young man, noticing Alldis's frown, asked if he still wanted the wood.

Alldis said he would take the wood but also said that the price would have to be recalculated. The young man told Alldis that any money would be appreciated. You can imagine the young man's surprise when Alldis handed him the original payment and told him he would need a few days to work out an additional payment.

Once cleaned, each of the handmade staircase's treads amounted to a beautiful 2" x 8" x 32"-long piece of 100-year-old Burmese teak. The "mahogany" staircase quickly became the most glorious stack of Burmese teak Alldis had ever seen.

— KG

HARDWOOD LUMBER GRADES: THE BASICS

When you buy wood at a lumberyard, it has been graded – essentially separated into different bins based on how many defects are in each board. The fewer the defects, the more expensive the board. Grading hardwood lumber is a tricky skill with rules set by the National Hardwood Lumber Association. (Grading softwood is different; these rules do not apply.)

Here are some of the basic guidelines graders follow as they classify each board.

FIRSTS: Premium boards that are at least 6" wide, 8' long and 91⅔ percent clear of defects.

SECONDS: Premium boards are at least 6" wide, 8' long and 81⅔ percent clear of defects.

FAS: The two grades above are typically combined into one grade called FAS, or "firsts and seconds," which must be at least 81⅔ percent clear of defects.

FAS 1-FACE: One face must meet the minimum requirements of FAS; the second face cannot be below No. 1 common.

SELECTS: While not an "official" grade, this refers to boards that are at least 4" wide, 6' long and with one face that meets the FAS 1-FACE requirements. Essentially, these are good clear boards that are too narrow or too short to fit in the above grades. This and the FAS grades are good choices for nice furniture.

No. 1 COMMON: Boards that are at least 3" wide, 4' long and 66⅔ percent clear of defects.

No. 2 COMMON: Boards that are at least 3" wide, 4' long and 50 percent clear of defects.

NOTE: There are exceptions to these rules. For example: walnut, butternut and all quartersawn woods can be 5" wide instead of 6" wide and still qualify for FAS.

ceased woodworkers. But how do you get your hands on it?

Basically, it's a matter of putting the word out among your friends, relatives and co-workers that you're a woodworker and on the prowl for wood. Tell enough people, and you'll eventually hear from the friend of a friend who wants to dispose of some boards. Sometimes you get lucky. We once bought a garage full of impressive lumber that one woodworker (who could not take it with him to the afterlife) had amassed over several decades.

Classified Ads, Auctions & Offcuts

There are a few somewhat surprising ways to find wood. Believe it or not, wood shows up pretty regularly in the classified ads of the daily newspaper and local free shopping papers.

And while you're poring over the classifieds, keep an eye out for auctions at farms and cabinet shops. When these places go under, there can be good deals on wood (and machines). Bear in mind that haunting auctions is both time-consuming and addictive.

Some people buy lumber through eBay.com, an online auction web site. Shipping can be a real killer ($1 a pound), so tread cautiously and do the math before you buy from online auctions.

Finally, for the true bottom-feeder, there's always the waste stream. Find out if there's a pallet factory, furniture manufacturer, veneer mill or construction site in your area. Their waste might be perfect for your woodworking.

We've cut up pallets made from mahogany, ash and other desirable species. In fact, most of the projects in "Building the Perfect Tool Chest" (Popular Woodworking Books) were built in our shop using wood discarded from pallets. A cabinet shop that built a lot of face frames once sold us their falloff, which was the perfect size for chair spindles. All you have to do is ask.

And speaking of asking, make sure that when you climb up to that hay loft to check out that wood in the barn that you ask if there are any hornets' nests waiting up there. There's more than one way to get stung when hunting for lumber. **PW**

STICKER SHOCK

Twenty five years ago Gene Nurse, from Darmouth, Nova Scotia, Canada, went to the lumberyard on his lunch break to buy some wood for a mahogany desk he wanted to build. When he arrived, the man who usually worked the desk wasn't there and a young teenager was in his place.

The sticker price on the pile of undressed mahogany indicated that the lumber was a typical $3 (Canadian) a board foot. Nurse said the young man, not knowing the difference between dressed and undressed lumber, said that the sticker "must be a mistake for that crappy stuff. They must have meant 30 cents a board foot."

After trying to dissuade the guy several times, Nurse loaded up his truck with 500 board feet of mahogany. Price: $150.

Feeling guilty, Nurse went back and explained what had happened to the man who usually worked the desk. The man thought the story was funny, said it was their mistake and let Nurse keep the wood. But next time, the man said, Nurse should deal with him personally.

— KG

Straight from the woods, this pile of cherry is being stickered as we go. When complete, we painted the ends with a special paint (which is wax suspended in a water-based emulsion) to retard end checking.

BYOB: Bring your own bole. All over the country, independent sawyers such as Ed Motz can mill the logs you find into rough slabs. Moving it and drying it usually is up to you.

The Language of Lumber

These boles are waiting to be de-barked, milled and dried to become prime hardwood.

A

air-dried lumber: Wood that has been dried from its freshly cut state by stacking it (usually outside) with stickers between. Air-drying reduces the moisture content to about 12-15 percent. Wood for interior use needs to be dried further.

B

board foot: A piece of wood that is 1" thick x 12" wide x 12" long in the rough – or its cubic equivalent.

C

chatter mark: A defect caused when the board was surfaced at the mill and the knives mar the surface.

cupped: A board with edges higher than its middle. The cup is always to the sap side of the board.

D

defect: An imperfection in the board that will change how it is graded (and its price).

dimensional lumber: Lumber that is surfaced on all four sides (S4S) to specific thicknesses and widths: 1 x 4s, 2 x 8s, etc. Note that with this lumber the finished thickness and width are less than the stated size. For example, a 1 x 4 typically will measure $^{3}/_{4}$" X $3^{1}/_{4}$".

E

end check: Separation of the wood fibers at the end of a board, almost always a result of drying.

F

flitch: When a log is sawn into veneer and the sheets are stacked in the same order as they came off the log. Good for bookmatching.

G

green lumber: Wood that has been freshly cut from the tree, typically with a moisture content of 60 percent or higher.

H

heartwood: The part of the tree between the pith (the very center) and the sapwood (the whitish outer layer of wood).

honeycomb: A separation of the wood fibers inside the board during drying – it might not be evident from the face of the board.

K

kiln-drying: An artificial way to reduce the moisture content of wood using heat and forced air.

knot: A circular woody mass in a board that occurs where a branch or twig attached to the tree.

L

lineal feet: A measurement of wood that's 12", regardless of the board's width or thickness – usually used to refer to mouldings.

M

mineral streak: A typically green or brown discoloration, which can be caused by an injury to the tree.

moisture content: The percentage of a board's weight that is water.

P

pitch: A resinous, gummy substance typically found between the growth rings of softwoods.

pith: The small and soft core of a tree that the wood grows around. It's undesirable for woodworking.

plain (flat) sawn: A method of milling a log that results in the growth rings intersecting the face of the board at an angle less than 45°.

Q

quartersawn: A method of cutting a log at the mill that results in the growth rings intersecting the face of the board at more than 45°. Quartersawing wastes more wood and there is more effort. But quartersawn wood is more stable.

R

random widths & lengths: While softwoods and cabinet woods such as red oak and poplar can be found as dimensional lumber, many hardwoods cannot. These hardwoods are cut in different widths and lengths to get the best grade.

rift sawn: A method of cutting a log that results in the growth rings intersecting the face of the board at an angle between 30° and 60°. More stable than plain-sawn wood; less stable than quartersawn.

rough: A board as it comes from the sawmill; not surfaced or planed.

S

SLR1E: The acronym for "straight-line ripped one edge," meaning the board has one true edge.

S2S: Planed on two faces; the edges are rough.

S3S: Planed on two faces and one edge; one edge is rough.

S4S: Planed to a smooth finish on all four long edges of a board.

sapwood: The lighter colored wood between the heartwood and bark – typically weaker than the heartwood.

shake: A split that occurs before the tree is cut – typically from the wind buffeting the tree.

shorts: High-quality lumber that is less than 6' long.

sound knot: A knot that is solid across the face of the board and shows no sign of decay.

straight-line rip: A perfectly straight edge that is suitable for gluing.

surface check: A shallow separation of the wood fibers.

T

twist: Where the board has warped into a spiral.

W

wane: The presence of bark on the edge or corner of a piece of wood.

warp: A general term for a distortion in a board where it twists or curves out of shape.

worm holes: A void in the wood caused by burrowing insects (killed during kiln-drying).

Thanks to Paxton, The Wood Source for assistance with this glossary.

LUMBER IS MEASURED IN QUARTERS

For new woodworkers, one of the most confusing aspects of buying lumber is figuring out the terminology for thicknesses. Rough lumber (which has not been surfaced) is sold in "quarters." Each quarter represents $^{1}/_{4}$" of thickness in its rough state. So four-quarter lumber (written as 4/4) is 1" thick in its rough state; 5/4 is $1^{1}/_{4}$" and so on. When the lumber is surfaced by the mill it loses thickness. That's why 4/4 lumber is $^{3}/_{4}$" thick when it's surfaced. Here's a chart that you can use as a quick reference:

If you ask for	Rough thickness	Finished thickness
4/4	1"	$^{3}/_{4}$"
5/4	$1^{1}/_{4}$"	1"
6/4	$1^{1}/_{2}$"	$1^{1}/_{4}$"
8/4	2"	$1^{3}/_{4}$"
10/4	$2^{1}/_{2}$"	$2^{1}/_{4}$"
12/4	3"	$2^{3}/_{4}$"

Photo by Al Parrish

Arts & Crafts BOOKCASE

A simple, knockdown, turn-of-the-century classic provides lots of storage for your favorite books.

My mom has a bookcase in every room of my parents' house. Most of them are stuffed two-rows deep with paperbacks, hardbacks, picture books and travel books. And still, whenever I visit, I find even more novels piled on top of end tables, underneath coffee tables, near the sides of chairs and on the backs of toilets. But I'm like her – I love collecting books.

Tired of moving my own piles of books every time I needed a place to set a drink down, I decided to build a bookcase of my own. This project serves as a nice challenge for the beginning woodworker and as a great weekend project for those more skilled. Its Arts & Crafts style is emphasized by mortise-and-tenon joinery, wedges and Stickley-style (sans ammonia) finish. While the ends remain forever assembled, a few good whacks to the wedges and the whole project comes apart, stacks together and can be transported easily in the trunk of a car.

Getting Started

In keeping with the Arts & Crafts tradition, I bought rough quartersawn white oak for this project, which I jointed and planed. Don't have a jointer or planer? No problem. Head out to your local home center and purchase dimensional lumber. The shelves can be cut from 1 x 8s, as can the rails and stiles, with some waste.

When purchasing your lumber, be picky. Choose knot-free heartwood (you don't want pieces with a lot of sap) that has lots of figure. Determine which pieces are the most attractive and mark those for the most visible parts of the project. Cut all your pieces to size according to the cut list.

Test Mortise

The first step to building this bookcase is tackling the joinery and assembling the sides. It's important that the project's tenons fit snugly into the mortises, which means first making a test mortise. This will allow you to check the size of your tenons throughout the tenon-cutting process, ensuring accuracy. There are 24 mortises in this project. Do yourself a favor and, if you don't already have one, buy a hollow chisel mortising machine (about $250). A mortising attachment for your drill press or a 3/8" Forstner bit also are acceptable options.

by Kara Gebhart

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

A few quick passes are all it takes to cut one side of the rails' tenons, using a dado stack and a miter gauge.

To make your test mortise, first select a piece of scrap from this project. Some sappy waste will do just fine. As a rule of thumb, mortises should be half the thickness of your tenon's stock. Because this project's tenon stock is 3/4" thick, the mortises need to be 3/8" thick. It's also a good idea to make your mortises about 1/16" deeper than the tenons are long. This will keep the tenons from bottoming out in the mortises. The depth isn't as important as the width in a test mortise, so simply make your test mortise as deep as your longest tenon is long. Because the rails have 3/4"-long tenons and the stiles have 1"-long tenons, your test mortise for this project needs to be 1 1/16" deep.

If you've never used a hollow chisel mortiser before, check out "A New Manual for Mortisers" (August 2001 issue #123). Cut your test mortise.

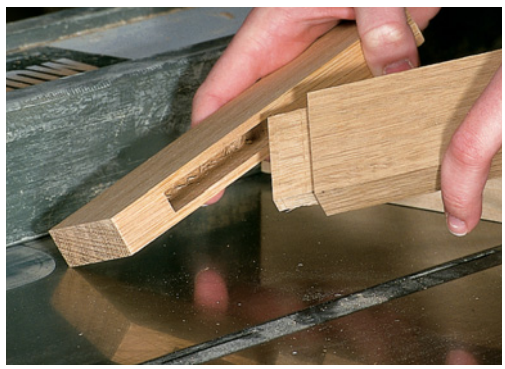
Table-saw Tenons

Now it's time to cut the 24 tenons. Sure this sounds like a lot, but with a dado stack and a miter gauge, you'll breeze through this step in no time.

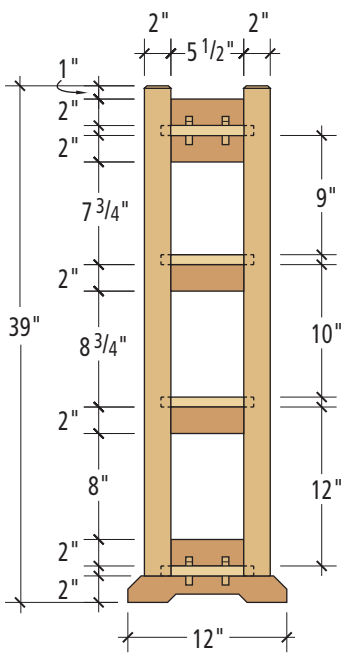
First, install a 5/8" dado stack in your table saw. Set the fence for the finished length of your tenon and set the height of the dado stack to about 3/16", which is the depth of your shoulders on your tenon. I cut the rails' tenons first, so the finished length was 3/4". Hold the piece about 1/16" from the fence and push it through the blade, using your miter gauge. Now hold the piece directly against the fence and, using your miter gauge, push it through the blade again. Repeat this same procedure for the edges of the tenon.

After you've cut your first tenon, make sure that it fits snugly into your test mortise. If satisfied, keep cutting. Remember to set the fence for 1" once you're ready to cut the tenons on the end of the stiles.

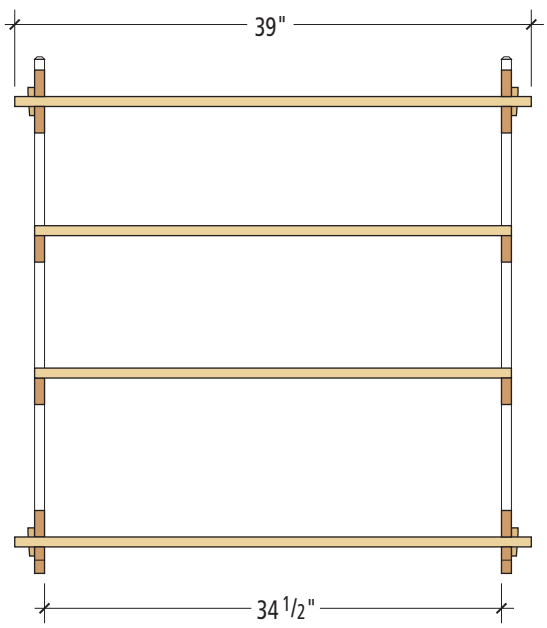
Use a test mortise to check the fit of your tenons throughout the tenon-cutting process. This ensures accuracy.



Plan



Profile



Section

Back to the Mortiser

To cut the mortises, first use the diagrams to measure where the rails start and stop along the stiles. Now use your rails to lay out the locations of your mortises (as shown at right). Cut each mortise a little over each measured line so that you're able to maneuver the rails for perfect positioning during glue-up. Cut all the stiles' mortises. You'll cut the mortises in the feet after the sides of the bookcase are assembled.

Before assembling the sides, use your table saw, plane or chisel to cut a 3/16" x 3/16" chamfer on the stiles' top four edges, which is a traditional Arts & Crafts look.

Assembling the Sides

Now that the rails and stiles are complete, it's time to assemble the sides. First, dry-fit everything together. Choose the face sides of your pieces carefully. Remember: Your most visible pieces should be your most attractive. Clamp the assembly together.

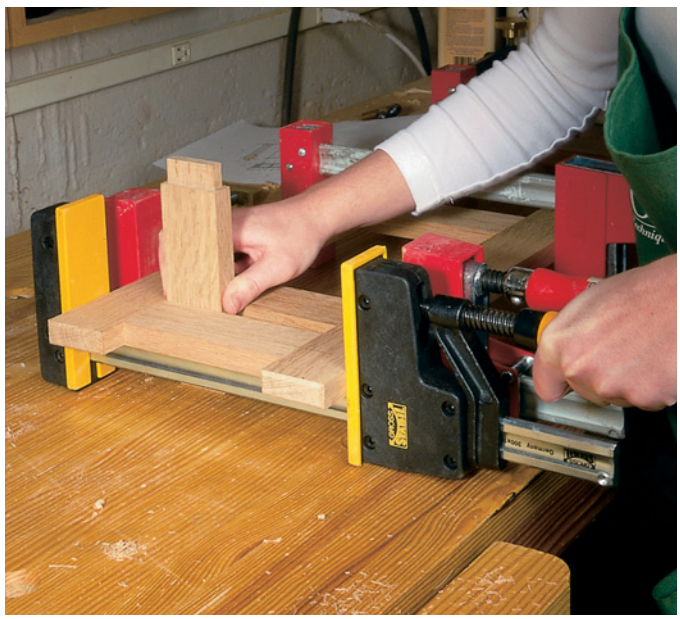
Check for gaps, squareness, mistakes or anything else that might cause panic during gluing. Use the extra space you cut (when you mortised slightly over the measured lines) to maneuver the rails until they're in their appropriate places. If it's tight, try hitting them with a mallet. Once you're positive that everything is perfectly positioned, use a ruler to draw lines across the joints. These lines will be your guides during glue up. Now take everything apart, put glue in the mortises, clamp and let dry.

Band-sawn Feet

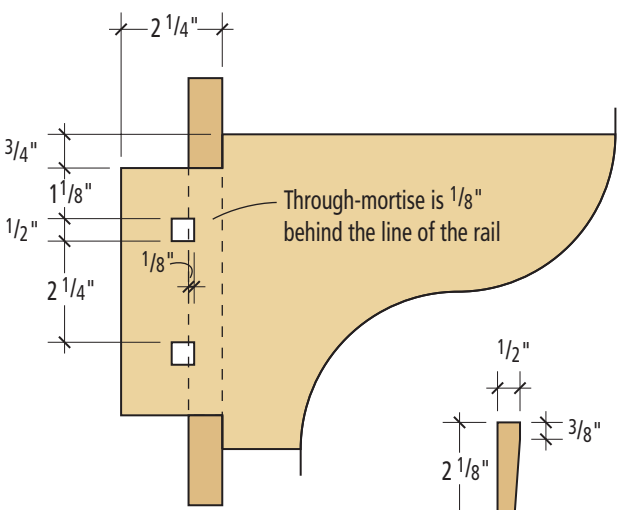
Once the glue has cured, it's time to cut the feet. Each foot has two mortises and a detail cut using the band saw. Use the diagram to lay out the shape of the feet on each piece. Lay out and cut your mortises, again going a little over each line for maneuverability during assembly.

Now head over to your band saw. Cut the feet to shape as close to your lines as you possibly can. The closer you get, the less cleanup you'll have to do. Remove the saw marks with a chisel or a plane. Dry-fit the sides and feet, draw your guide lines, take the sides and feet apart and then glue the assembly together.

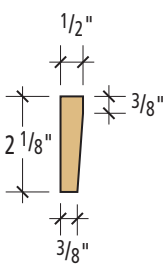
Use the edges of the rails' tenons like rulers to mark the beginning and end of each mortise in the stiles.



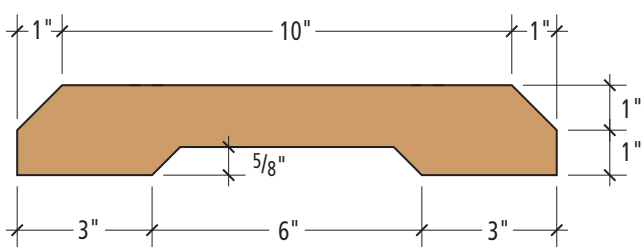
Slide an extra rail (which is 3/4" thick) into the space between the top two rails to ensure a perfect slot for the top shelf.



Detail of top and bottom shelf

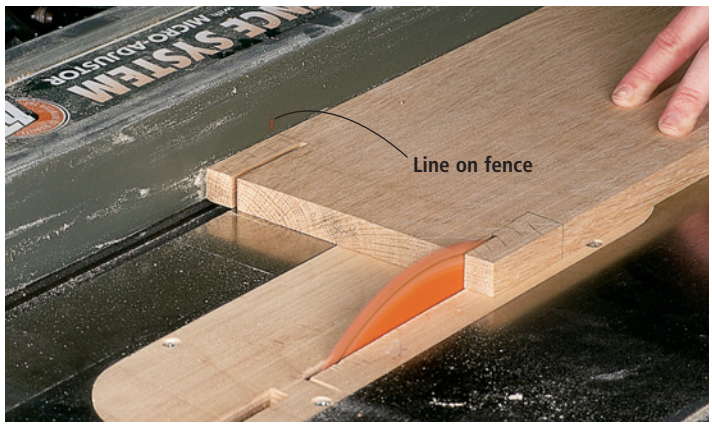


Detail of wedge



Detail of foot

Use the diagrams to measure where the stiles start and stop on the feet. Like the rails, use the edge of the stiles' tenons like rulers to mark the beginning and end of each mortise.



When cutting the shelves' notches, draw a line on your table saw's fence to determine when to stop cutting. Because of the table saw's curved blade, more material will be cut away on the underside of the piece than on the top.

Wedges slide through mortised holes in both the top and bottom shelves. Use the diagrams to lay out the locations of the ½" x ½" mortises. Note on the diagram how the mortises are located ⅛" behind the line of the rails.

Sturdy Shelves

With the sides now assembled, it's time to cut the shelves. First you need to cut notches in the shelves' corners. The top and bottom shelves' notches are 2¼" long by ¾" wide, allowing enough overhang for the wedges. The notches in the two middles shelves are ¾" long by ¾" wide.

Once you've measured and drawn where the notches start and stop, head to the table saw to cut the notches on the top and bottom shelves. Because the table saw's blade is curved and because you won't be running the entire length of the board through the blade, you must be a little creative in your cutting. First, correctly position your fence and raise your blade to its appropriate height. Then, with a grease pencil, draw a line on the fence where the blade enters the table. Now, draw a line on your work where the cut should stop. Run the piece through until the two lines meet, stop and pull the piece back. Carry the line on the piece over to the other side, flip the shelf over and again run it through until the two lines meet, as shown in the top photo.

Head to your band saw and cut the remaining part of the top and bottom shelves' notches away. Now cut the notches on the middle shelves, using the band saw.

The whole bookcase is held together tightly by tapered wedges that snug into through-mortises in the top and bottom shelves. Cut the mortises in the top and bottom shelves, as shown at left.

Tapered Wedges

If you haven't done so already, plane the stock for your wedges down to ½" thick. Measure and make a mark ⅜" from the top of each wedge, and another mark ⅜" wide from the bottom of each wedge. Draw a line, connecting

your marks. Cut the taper, using either your band saw or a sander. Clean up the wedges with your chisel. Test fit the wedges, as shown in the photo at right.

Finishing Touches

After all your hard work, the last thing you want to do is slack off when it comes to sanding. First, clean up all your edges with a sanding block and a chisel. Next, sand everything, starting with 100 grit and moving on to 150. Hold each piece up to a light, making sure you have all the scratch marks removed. Don't forget to break the edges.

Because this is an Arts & Crafts piece, I decided on a Stickley-style finish, without ammonia's danger. First apply J.E. Moser's Golden Amber Maple water-based aniline dye. Let it dry overnight. Next, apply Valspar's Professional warm-brown glaze. Let it, too, dry overnight. Finally, apply your favorite topcoat. Check out the Supplies box at right for ordering information. For complete instructions on how to create this ammonia-fumed-looking hue, check out "Arts & Crafts Finish" (June 2002 issue #127, available for sale online at popwood.com). **PW**

Most of the tapered part of the wedges should slide through each mortise. As the wedge gets wider, you will need a mallet and a block of wood to finish pounding them down to a uniform height.

SUPPLIES

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

J.E. Moser's Golden Amber Maple water-based aniline dye

1 oz. • #844-743, $5.29

4 oz. • #844-750, $12.99

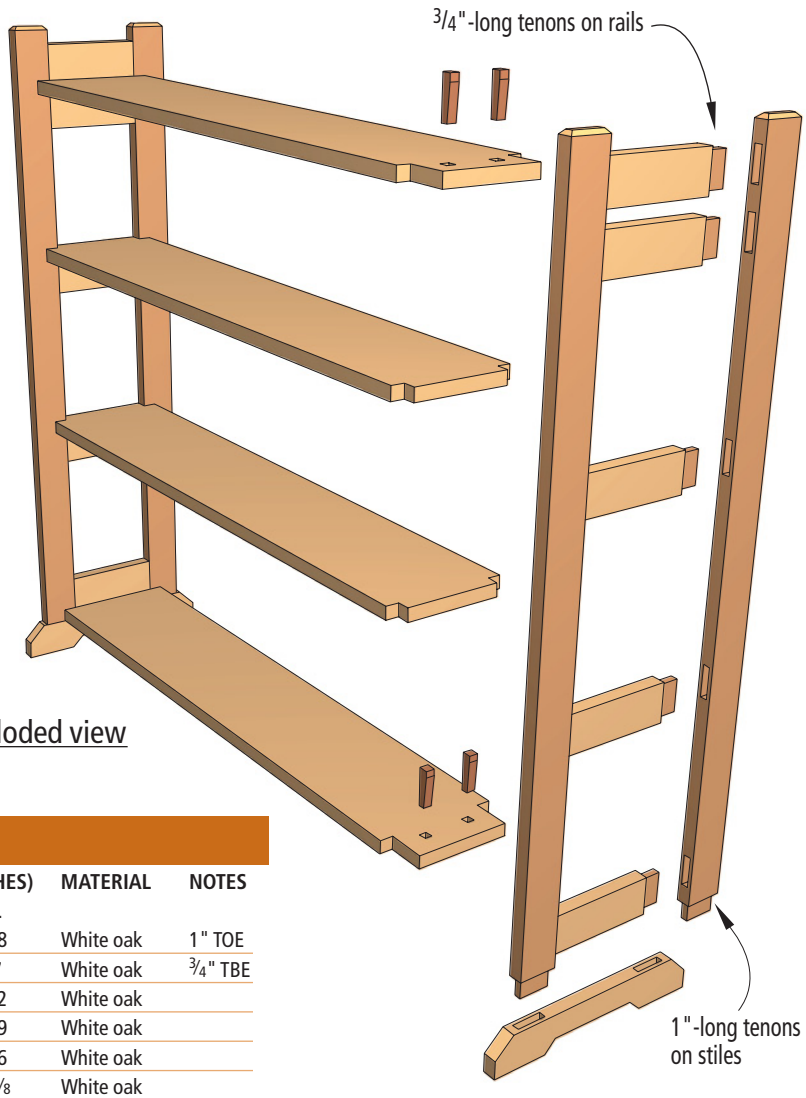
8 oz. • #844-757 • $22.59

Woodfinishingsupplies.com
507-280-6515

Valspar Professional Glaze, choose the color "warm brown/mahogany"

1 quart • #WL6100-25, $10.99

1 gallon • #WL6100-1,$34.99



Exploded view

ARTS & CRAFTS BOOKCASE

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	NOTES
❑	4	Stiles	3/4	2	38	White oak	1" TOE
❑	10	Rails	3/4	2	7	White oak	3/4" TBE
❑	2	Feet	3/4	2	12	White oak	
❑	2	Top & bottom shelves	3/4	7	39	White oak	
❑	2	Middle shelves	3/4	7	36	White oak	
❑	8	Wedges	1/2	1/2	2 1/8	White oak	

TBE = tenon, both ends; TOE = tenon, one end

The 16 DUMBEST Woodworking Mistakes

How to fix the problem at hand and never make the same mistake again.

Photo by Tim Grondin

For the record, I want it known that I had everything clamped down tight when I turned on the drill press to mix a gallon of dark brown glaze. What happened next is somewhat of a legend in our woodworking shop.

The drill press was set to run too fast, and the quill was down too low. Within seconds, the wall of the shop, all the tools within 10 feet and most of my exterior surfaces looked like we had all been dipped in chocolate at the Snickers factory.

That was five years ago. We moved the shop six miles up the highway, replaced almost all the machinery and we still find little bits of the dried glaze clinging to things just about every week. (Want proof? Just see photo 12 on page 73.)

Ask any woodworker about the dumbest mistake he or she has made and a look of pain will pass over his or her face. In our shop you'll hear stories of entertainment centers not deep enough (the wall behind it had to be punched out to make room for the stereo components) or cabinets where the knob on the last drawer was in the worst place possible.

by Christopher Schwarz

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

Some of these mistakes can be fixed after the fact. All of them are avoidable. The following is a list of the 16 dumbest woodworking mistakes common to the craft. If a problem can be fixed, we show you how. But most of all, we tell you how to keep out of trouble in the first place.

1. You Measure Carefully, but Everything is a Bit Off

PROBLEM: As you proceed though the project, small errors creep into the assemblies – errors you cannot explain. Things aren't lining up by 1/32" or so.

NEXT TIME: Stop where you are and gather all the measuring devices you've used on a project. Your tape measure, your combination square, your table saw's fence scale and your steel rules should all measure the same.

Find the problem (it's usually the tape measure or the table saw's scale) and adjust the tab on the end of the tape measure or the scale on the saw until they match your other measuring tools. If a steel ruler and a combination square don't agree, one of them has to go. Before you start a project, calibrate all your measuring tools. Plus, be aware that when ripping on your table saw, regular-kerf blades and thin-kerf blades have a different-sized kerf. Pick one blade for ripping and set your fence's scale to that blade.

2. Remember the Kerf

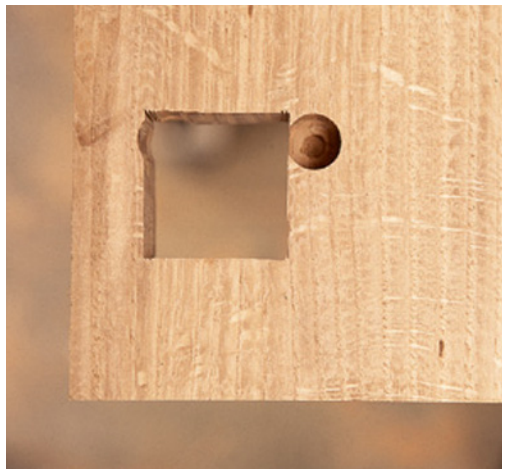
PROBLEM: When cutting a joint or trimming off some extra waste, you forget to include the kerf in your measurement so your final workpiece is off by 1/8" or 3/32".

NEXT TIME: To avoid the problem, just remember what my grandfather always said: Never measure the waste piece; always measure your keeper piece. This keeps you out of trouble when the saw kerf is involved.

For additional insurance, when marking the face of a board for a cut, carry that mark onto the front edge of the board. Put the board in position on the saw and line up the mark with the blade.

3. Ending Up on the Wrong Side of the Line

PROBLEM: You mark your mortise or crosscut, but you bore or cut on the wrong side of the line.



When boring a hole for a through-mortise, we ended up on the wrong side of the line. Time to get the plug cutter.

NEXT TIME: To avoid the problem, get in the habit of marking your waste area with cross-hatches. It takes a few seconds, but it is faster than fixing this mistake.

QUICK FIX: There's little you can do to fix a board that's too short. To repair a round hole in face grain, never use a dowel if the area will show. You need to match the grain and color if you want to hide the repair. Purchase a set of plug cutters that cut a tapered plug. With a plug cutter you can make a bunch of plugs and compare them to the area you need to repair. Some glue and a few taps with a mallet will seat the plug firmly. Trim the excess with a flush-cut saw or sharp chisel.

4. Your Mitered Moulding is Too Short

PROBLEM: You're trying to sneak up on a miter by nibbling at it bit by bit. You cut too far.

NEXT TIME: To avoid the problem, you can make a miter shooting board. This simple hand-tool appliance allows you to sneak up on the right fit in a more controlled manner – about .002" at a time. See the "From the Bench" column on page 28 for details on building this accessory.

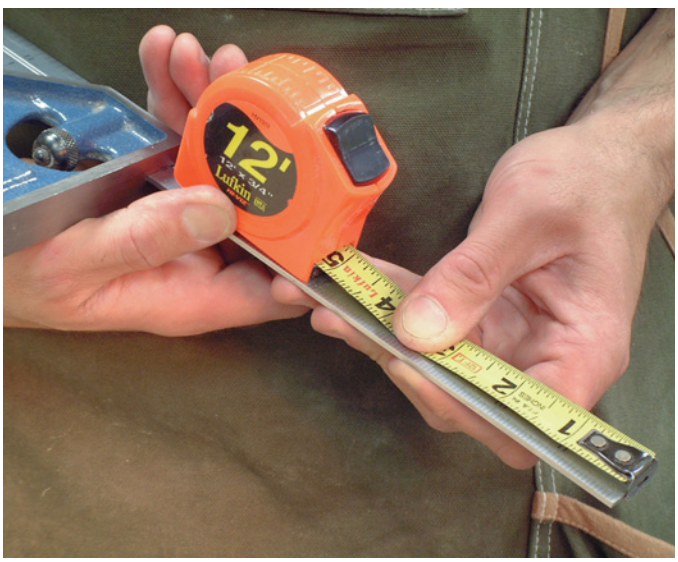
QUICK FIX: Before you throw away that too-short moulding, there is a way to stretch it a tad with a sharp block plane. By planing a slight taper on the backside of the moulding (the part that attaches to the cabinet or wall), you can actually make the piece of moulding a little bit longer. If this is moulding that goes on the side of a cabinet, you want the taper to begin at the back and diminish to nothing at the miter.

There are limits to what you can squeeze out of one of these boards (usually about 1/32" to 1/16" depending on the size and profile of the moulding) before things don't look right.

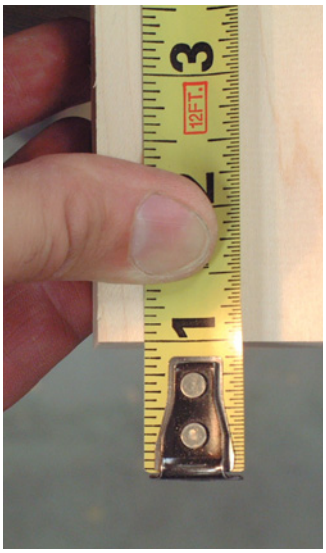
5. Off by an Inch – Might as Well be a Yard

PROBLEM: You're measuring a board with your tape measure to cut it to length. You make the mark and the cut, but your board is exactly 1" too short. The culprit usually is one of two things: You were holding the beginning of the tape at the 1" mark for a more accurate measurement. Or you were looking at the wrong number when you made your pencil mark. This second mistake is common when you have the tape measure in your left hand (reading upside down) and the pencil in your right.

NEXT TIME: There are several ways to avoid the problem in the future. First, measure everything



To prevent errors from creeping into your projects, be sure to calibrate all your measuring tools against one another before you begin.



Starting your tape measure at 1" can make you more accurate. But it also can cause you to burn an inch if you're not careful. Measure things twice.

twice (we had to say it). Second, use your combination square or (even better) a 24"-long metal hook rule to mark out small cuts instead of your tape measure.

6. Gappy Joints

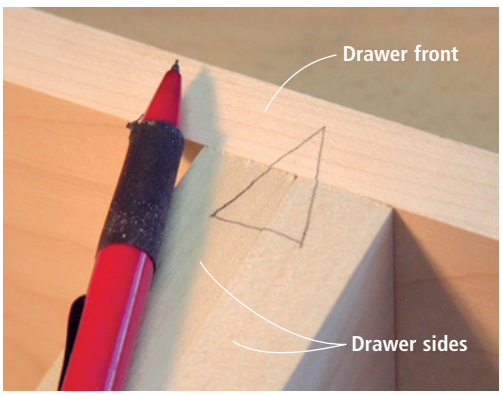
PROBLEM: You glue up your case or assembly and there are ugly gaps between the joints.
NEXT TIME: There are several causes, but usually it's because you didn't clamp up the project without glue first. Joints should close with minimal clamp pressure. If you have to really twist the clamps down hard, you've got some ill-fitting joints to correct first.

Always perform a dry-assembly and closely inspect your joints.
QUICK FIX: This error is why they make wood putty.

7. Things are Not as They are Supposed to be

PROBLEM: You're gluing up a cabinet, a drawer or any assembly and you get one of the parts placed wrong – it could be upside down, on the wrong side or the wrong face of the board is showing.
NEXT TIME: Here's how to avoid it: Use a cabinetmaker's triangle to distinguish left, right, front, back, inside and outside at a glance. Here's how: Say you're building a drawer. Once you get your parts cut out, put the sides together and then place the drawer front on the end so it makes a "T." Draw a triangle that spans the three parts and points to the front of the drawer. Put the back piece against the sides in a "T" formation and draw another triangle that spans the three pieces and points to the front of the drawer. Now you'll always know how the pieces should be oriented without labeling each joint.

The same triangle works with doors, too. Always mark the triangle on the outside face of the board and always have it point up to the top of the case.
QUICK FIX: If you use a slow-setting glue or hide glue (which is reversible with hot water), the obvious solution is to take the thing apart and try again. But these problems usually are discovered when it's too late.



The cabinetmaker's triangle will save your bacon. The point of the triangle always faces front (or to the top). Mark all your assemblies with it before cutting your joints.

8. Two Left Feet

PROBLEM: You're milling the dados and rabbets in a case side, drawer or other box and you forget that you have left- and right-sided pieces. So you make two left-handed or right-handed parts.
NEXT TIME: Again, the cabinetmaker's triangle can help avoid this problem. And you should stack your left and right pieces in different piles as you work.

9. You Drill a Large Hole that is too Small

PROBLEM: You bore a hole with a Forstner or hole saw that is too small, and locating the center for the next size up is difficult because there's a hole there.
NEXT TIME: You're working too fast; slow down.
QUICK FIX: It's easy. Cut a square plug you can pound into the round hole. Mark the center on the plug and cut your new hole.

10. Your Doors Don't Fit

PROBLEM: Your doors are too small or crooked to fit in their opening.
NEXT TIME: To avoid this problem, rip your stiles and rails $\frac{1}{8}$" wider than your cut list calls for. Then you can square and trim the door easily to size.
QUICK FIX: To repair your immediate problem, trim the doors so they are square – even if this results in gaps between your case and doors that are too big. Now you can fix your problem with moulding. Mill some $\frac{5}{16}$"-thick x $\frac{3}{4}$"-wide flat moulding and cut a profile on one edge that matches the style of your project (a bead goes well with traditional furniture; a bevel looks good with more contemporary pieces).

If you're building a face-frame cabinet, miter and nail the moulding to the inside edges of the face frame. Voilá. The hole for your doors just got smaller. If you have a frameless cabinet, miter and nail the moulding to the doors. Voilá again. Your doors are bigger.

A smaller hole is easily made bigger by pounding a temporary plug in place before drilling the new hole.

11. Pencil Line Too Fine to See or Too Dark to Remove

PROBLEM: We all hate erasing and sanding off the pencil marks on a project, and some of us mark really fine lines to make that part of the job easier. Unfortunately, it's easy to overlook a fine pencil line and miscut. So we make the lines darker, which dents the wood and is difficult to remove.
NEXT TIME: Hold your pencil at a low angle and don't keep it too sharp when marking parts (see the photo at right). This makes lines that are easy to read but don't dent the wood.
QUICK FIX: Remove all pencil lines using a rag soaked with denatured alcohol before sanding.

12. You Ruin One of the Critical Parts to Your Project

PROBLEM: This is painful for woodworkers to discuss. After machining a part so it's almost

done, something unspeakably bad happens. The part is ruined.

NEXT TIME: Making replacement parts is easier if you plan for the problem in advance. First, always run out extra stock in all the thicknesses you're using (thickness is the most difficult dimension to reproduce). For the critical parts in a project, always make an extra one. For a table, make an extra leg. For a set of doors, make an extra stile and a couple extra rails.

13. Fasteners Too Long

PROBLEM: One of us (who shall remain nameless) once nailed a project to his father's bench with a pneumatic nailer. The nails were too long. Nails and screws that emerge where they are not supposed to emerge is sadly common. With screws this happens when you countersink too deep or the clutch is set too high on your cordless drill.

NEXT TIME: You can measure your fasteners and keep them organized to avoid this problem, but we have a better solution. Before you fire a nail or drive a screw, hold it up to the work. Fasteners should be twice as long (or a hair less) as the material they're passing through. For example, when joining ¾" material, use 1¼"- to 1½"-long screws.

When driving screws, always measure your countersinks and start with a low clutch setting.

14. The Color of Your Finish Isn't What You Expected

PROBLEM: Surprise surprise, the stain color on your project looks nothing like the stain color on the can (or in your head).

NEXT TIME: Good finishing requires making a sample board beforehand. As you are sanding or planing the parts of your project, take one of your extra boards and sand or plane them the same way. This means sanding them using the same equipment, the same amount of pressure and for the same amount of time. Use this as your sample board.

Stain the board and add your topcoat finish of choice. Then take your sample board into the room where the project will be located. Daylight, florescent and lamp light all make stain colors look different.

QUICK FIX: Get out the can of stripper or the appropriate solvent. You'll never be happy with a bad-looking finish.

When we added the glaze to this cherry table it started to look like red oak. A sample board would have saved us the time spent removing the glaze.

15. When You Glue Up a Panel the Edges Don't Close

PROBLEM: You joint the edges of the boards you are planning to glue into a panel but there are gaps between the boards' edges. You check the jointer's fence and it reads 90° to the bed.

NEXT TIME: Even if your square says the fence is at 90°, it might be a little off at other places on the fence. Or your square is off. Either way, there's an easy way to fix the problem: geometry. Use the power of complementary angles to make perfect tabletops.

For every joint in the tabletop, mark one board to edge-joint with its face against the fence, then joint its mate with the face facing away from the jointer's fence. Even if your jointer is off by some whopping degree, the two angles will cancel each other out and result in a tight fit.

QUICK FIX: If you glued up the panel, rip it apart along the joint lines and start over.

16. More Panel Problems: The Boards Slip at Glue-up

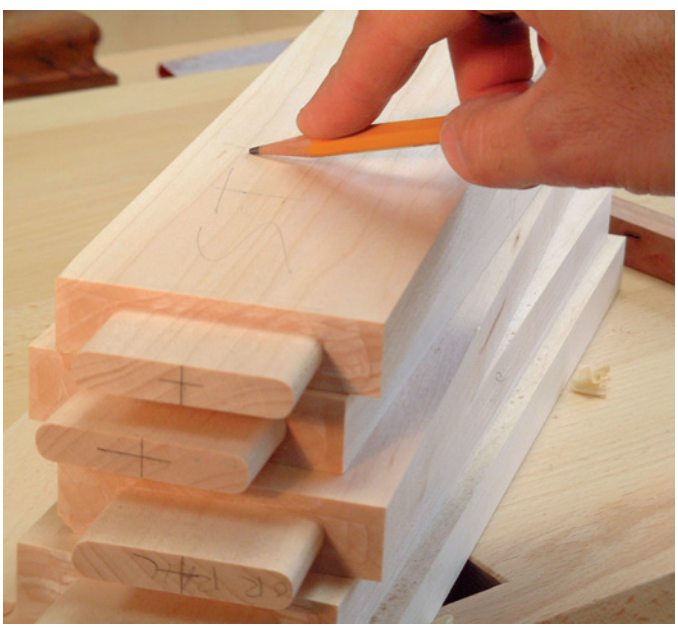
PROBLEM: You're gluing up a tabletop. As you apply clamping pressure, the boards slip up and down and refuse to line up.

NEXT TIME: To avoid the problem in the future, consider using dowels, splines or biscuits to line up the boards during critical glue-ups (though they will not add any strength to the joint).

Clamp only until the joint closes – no further. Most woodworkers use far too much pressure when clamping. And the pipe in pipe clamps tends to bend under pressure, which also can push the boards out of alignment.

QUICK FIX: If you're in the middle of a glue-up, grab handscrew clamps and clamp them across the joints at each end of the panel. Then apply pressure with your bar clamps. **PW**

Have we missed some of the dumbest mistakes? E-mail your mistakes to chris.schwarz@fwpubs.com and it might appear in a future issue.



Hold your pencil at this low angle and use a light touch when marking pieces (not joinery). This will keep you from denting the wood.

Tom Willenborg's assembly room is a study in organization and function. Everything has a place and he makes sure no space is wasted.

Photo by Al Parrish

What Makes an Ultimate Workshop?

Take a peek inside two ultimate shops and get ideas for what might work for your own.

Most woodworkers have seen Norm Abrams' shop on "The New Yankee Workshop" and drooled over both the machinery and the acres of workspace. For many, it's the ultimate shop.

Unfortunately the average woodworker is more likely faced with using the garage or basement. That doesn't mean it can't be an ultimate workshop; it just means you need a different approach to layout and organization while recognizing that compromises are necessary.

Speaking of compromises, DIY, the Do It Yourself Network, recently set out to demonstrate to viewers how to set up a woodworking shop,

by David Thiel

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

an auto mechanic shop and a gardening work area! If you want to see the clever ways DIY solved this space problem, visit diynet.com to check the air times for the five-part mini-series, "The Ultimate Workshop II."

Ultimately, everyone's needs and wallet will determine what their shop is. And for every woodworker, the ultimate workshop is likely to be very different from his or her neighbor's.

A Tale of Two Shops

We had the chance to take a look at two woodworkers who approached their ultimate shops in different ways. We learned from them and we hope you will also.

Tom Willenborg is a children's advocacy attorney in northern Kentucky in his early 50s who has been woodworking for 30 years. While his wife abandoned their basement to his hobby in 1990, it wasn't until two years ago that he decided the space could be used better. So he excavated the floor to gain ceiling height and added a two-story loft for his ultimate shop.

The second shop belongs to George Jaeger, who worked as a human resources manager for 38 years at an international machinery manufacturer. While woodworking was always a hobby, it wasn't as all-consuming until his retirement in 1992. He and his wife moved into a fairly new house that included a 32' x 40' barn that screamed to be turned into a woodshop.

High-tech, High-concept

Willenborg's shop is hidden in the basement of his 1927 farmhouse. Formerly part of a large parcel of land, it now sits on about an acre with urban sprawl and a widening road encroaching.

His basement workshop underwent changes during the 10 years he'd been woodworking there. A non-load bearing wall had been removed to gain some space and a crawl space had become a room for a dust collector and bathroom.

But after 10 years stooping under heating ducts, he decided it was time to do it right. He removed the concrete floor and dug down 12". It was a messy job that he doesn't recommend, but it was the cornerstone of his plan for his 1,250-square-foot shop.

To gain even more head room, he sunk his central dust collection ducting in the new concrete floor, choosing 8" PVC pipe for the main run, and 6" and 4" branches running to the individual machines. Oneida Air helped him plan the system, and he added the new Ecogate automatic blast gate system to the 16 drops in the system.

The main assembly room (opening photo) lets in natural light through rooftop skylights. Double doors serve as the entry to the shop. The cabinetry offers an amazing amount of storage, while still leaving space for assembly and finishing. It also has a cleverly tucked-away router table built into the island top.

The clamp wall allows Willenborg to glue up lots of solid panels efficiently (they can be mounted in the rack in two horizontal tiers) without dragging clamps all over the shop. When glued up, the panels are tucked against the wall and out of the way.

The work flow in Willenborg's shop was a compromise. While each room has a purpose, the flow is backward from tradition, with his lumber storage furthest from his jointer and table saw.

Willenborg decided that with his busy job as an attorney, the time in the shop was too short to be spent setting up tools. So all his machinery is dedicated to one purpose. There's no drill press with a mortising attachment here. In fact, he even bolted a second table saw to his main saw, making it a combo machine with a dado stack always at the ready.

You'll also find another time-saving device on the wall of the lumber prep room. A series of pipe clamps allows for quick and space-saving panel glue-ups.

Speaking of saving time, tucked away near his dust collector room and lumber racks is a bathroom. While it took more work than the average bathroom (with no handy sewage hookup, the waste has to be pumped out), Willenborg didn't want to have to run upstairs to answer nature's call.

Most of the equipment in his shop was upgraded during his recent renovation as well. In keeping with his ultimate plan, all the machinery is top-quality and even color coordinated.

Is this a lot of work just for a basement shop? Well, working within the given constraints, Willenborg built a shop that he's happy to spend as much time in as he can. While it might not be yours, it is *his* ultimate shop.

Woodworkers are nothing if not creative. One fine example in Willenborg's shop is the double table saw (above), combining a standard 10" cabinet saw with a 10" contractor saw mounted in the right-hand wing. Willenborg leaves an 8" dado stack set up in the contractor saw constantly to save time. The well-organized and fully stocked lumber racks (right) show a good sense of organization and recycling. The racks were purchased from a going-out-of-business home center store. A good assortment of clamps are tucked out of the way behind the lumber, but still within easy reach.

Why is George Jaeger smiling? Well it could be the excellent deal he got on the complete Stanley 45 plane lying on his bench. Or it could be the majestic view surrounding his enormous stand-alone shop (right). Either way, when you look at the spacious, well-organized and well-appointed shop interior (one-quarter of which is shown above), it's easy to see Jaeger has created his ultimate workshop.

Gimme that Countryside

While Willenborg chose to make the most of his existing house, Jaeger and his wife chose their "retirement home" with an existing barn in mind for his shop.

As you approach Jaeger's place along the back roads of the northern Kentucky countryside, you can appreciate the beauty and solitude. You might also think of the distance to the nearest lumberyard. For some woodworkers, that distance might be too far.

The Jaegers' home had been built with all the contemporary comforts only a few years before, and the former owner had added an ample barn (32' x 40') with sliding cargo doors at either end and about 12' of headroom.

Inside Jaeger's shop is a great collection of machines and tools he's gathered for decades. Some of the machinery he even made himself, such as his tilting-top router table and shaper. Most of the equipment has an acquisition story behind it that shows as much joy at the getting as in the using.

The 1,280 square feet of storage in his shop is almost an embarrassment of space. In fact, there's so much room in his shop that Jaeger stores his fishing boat below his lumber racks.

The shop has most amenities: heat (no air conditioning ... yet), excellent lighting from both windows and a score of both fluorescent fixtures and incandescent task lights (it seems fluorescents do funny things to spinning forms on the lathe).

There's one thing missing, however. During our visit, Jaeger's wife suggested that we "make use of the facilities" before heading out to the shop.

While Jaeger also recognizes the importance of adequate dust collection in his shop, his solution is a bit lower-tech than Willenborg's. A large filter-bag dust collector is tucked away in a closet, with a special access door to change which blast gates are open. Jaeger did add an extra window to the "closet" to avoid losing any natural light.

A nice collection of hand tools round out the shop's equipment. It's Jaeger's ultimate workshop. You might have different ideas for your own shop, but that's the beauty of woodworking. It's a little different for everyone, and what we bring to it makes it our own, ultimately. **PW**

Willenborg took advantage of being able to create what he needed in his shop space. The Oneida cyclone dust collection system (above right) is built into a separate room, with the ducting running under the poured concrete floor. Where the ducting meets the machines, he incorporated Ecogates (above) that automatically open and activate the cyclone collector when the machine is turned on.

Jaeger wanted efficient dust collection, but also wanted it tucked away. His dust collection room was built out from the existing wall, forming a bump-out with worktop space on either side. To avoid losing any of the natural light pouring in from the windows, he added an interior window to the bump-out. A lift-off door panel (shown removed at left) allows easy access for emptying the bags. A small Plexiglas access door (far left) lets him not only see which blast gate is open, but allows easy access while still keeping the room sealed.

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10-Drawer Tool Chest

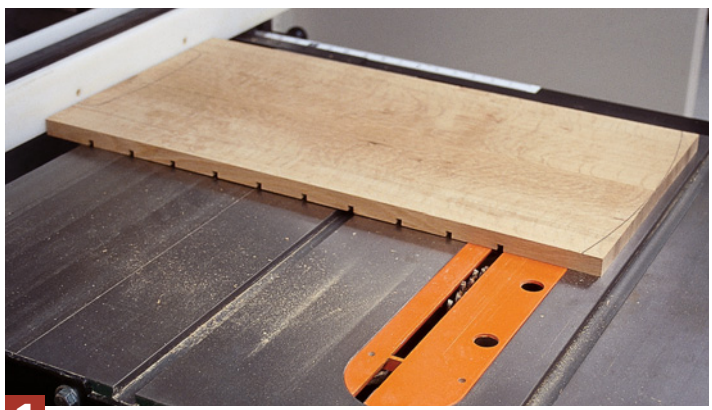
Store your smaller tools in style with a tool chest that's surprisingly simple to build.

Most woodworkers have dozens of tools that are small, such as screwdrivers, files, chisels, pliers, dividers and compasses. All these can be stored in shallow drawers, which is where this chest comes into the picture.

The design for the chest came from two inspirations. One was a Craftsman-style bookcase plan. The sides and top are shaped like the bookcase, and the chest is made of quartersawn white oak. The other inspiration came from multi-drawer chests that were made years ago to store sheet music.

This chest was assembled with butt joints and screws. I countersunk the screws and plugged the holes with 3/8" redheart plugs. The drawer pulls also are redheart, which I cut using a 1/2" plug cutter.

by Jim Stack



Step photos by the author

1 The first step is to cut the sides 3/8" narrower than the finished dimension. Then cut the 1/4" x 1/4" dados for the drawers. Glue a 3/8" x 3/4" strip to the back of each side. This strip covers where the dados exit the sides, creating a stopped dado.

2 Now draw the top arc on each of the sides. Trammel points mounted on a stick are great for drawing arcs. A little trial and error is involved here unless you can figure the radius using math. I try connecting the dots, moving the pencil up or down the stick until I find the radius that works. If you don't have trammel points, drive a nail through a stick at one end. This is your fixed point. Use a small clamp or rubber band to hold a pencil anywhere you need along the length of the stick to draw your arc.

Photo by Al Parrish

3 Now you need to draw the arc at the bottom of each side. When laying out the radii at the bottom of the sides, use a small, round object to draw the small radius that defines each foot.

4 Connect these two small radii with an arc that is 1" high from the bottom of the side.

5 Drill holes with the same radius as the small arcs and connect them by cutting the larger arc with a jigsaw or band saw.

6 Smooth and shape the arcs with a rat-tail file or curved rasp.

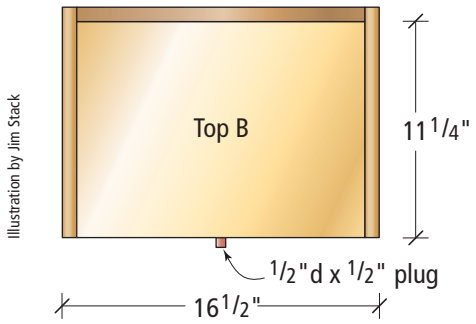
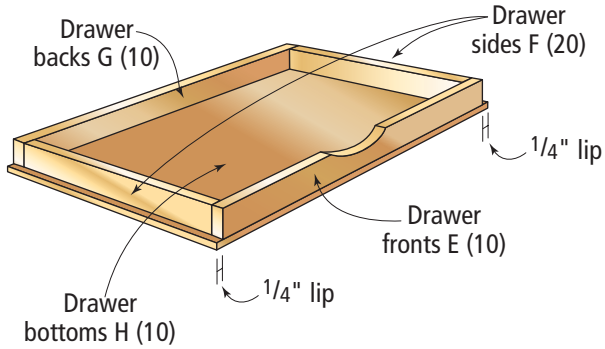
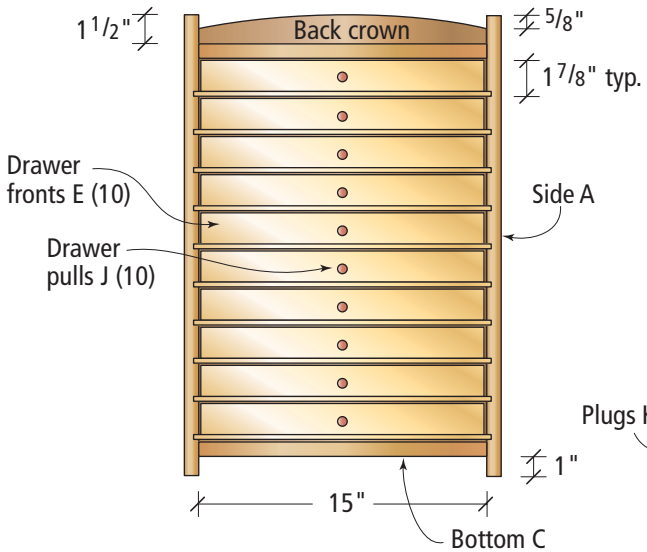


Illustration by Jim Stack

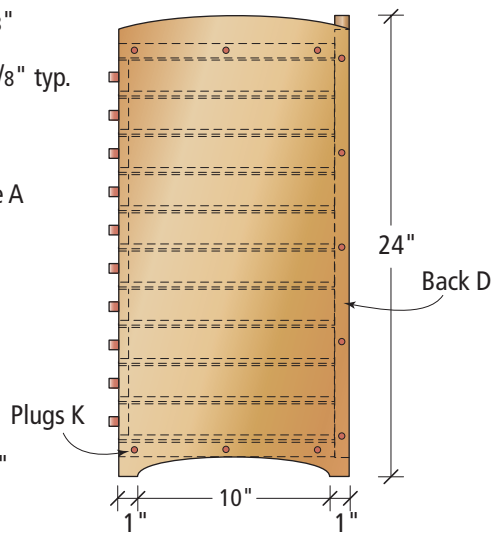
Plan



Drawer assembly



Elevation



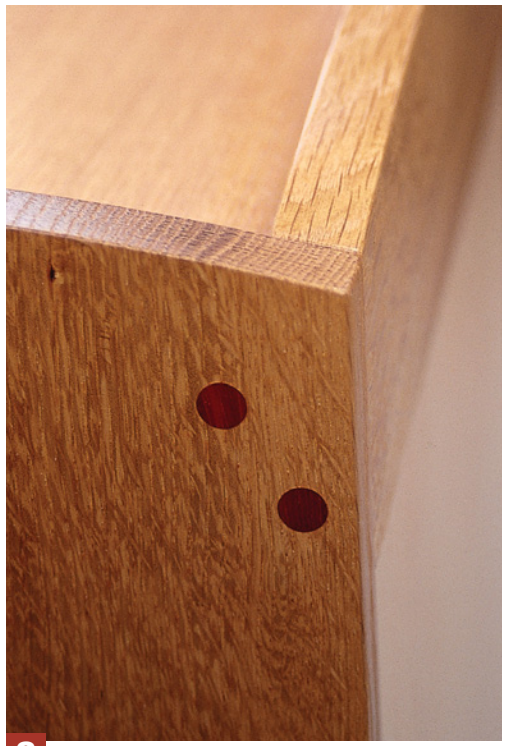
Profile

10-DRAWER TOOL CHEST

	NO.	LET.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑	2	A	Sides	3/4	12*	24	White oak	Width includes 3/8" edging
❑	1	B	Top	3/4	11 1/4	15	White oak	
❑	1	C	Bottom	3/4	11 1/4*	15	Plywood	Width includes 3/8" edging
❑	1	D	Back	3/4	15	23*	Ply/oak	Top crown is 2 1/4" wide, glued to ply
❑	10	E	Drawer fronts	1/2	1 5/8	14 15/16	White oak	
❑	20	F	Drawer sides	1/2	1 5/8	10 1/4	Poplar	
❑	10	G	Drawer backs	1/2	1 5/8	14 15/16	Poplar	
❑	10	H	Drawer bottoms	1/4	11 1/4	15 1/2	Plywood	Trim sides to fit after drawers are assembled
❑	10	J	Drawer pulls	1/2-dia.		1/2	Redheart	Cut with 1/2" plug cutter
❑	22	K	Plugs	3/8-dia.		1/4+/-	Redheart	Cut with 3/8" plug cutter
❑	2		Side strips	3/8	3/4	24	White oak	Glued to back edge of sides
❑	1		Bottom strip	3/8	3/4	15	White oak	Glued to front edge of bottom
❑	1		Back crown	3/4	2 1/4	15	White oak	Glued to top edge of back
❑	10		Dowel rods	1/8-dia.		3/4	Hardwood	

*Measurement is finished dimension and includes solid-wood edging

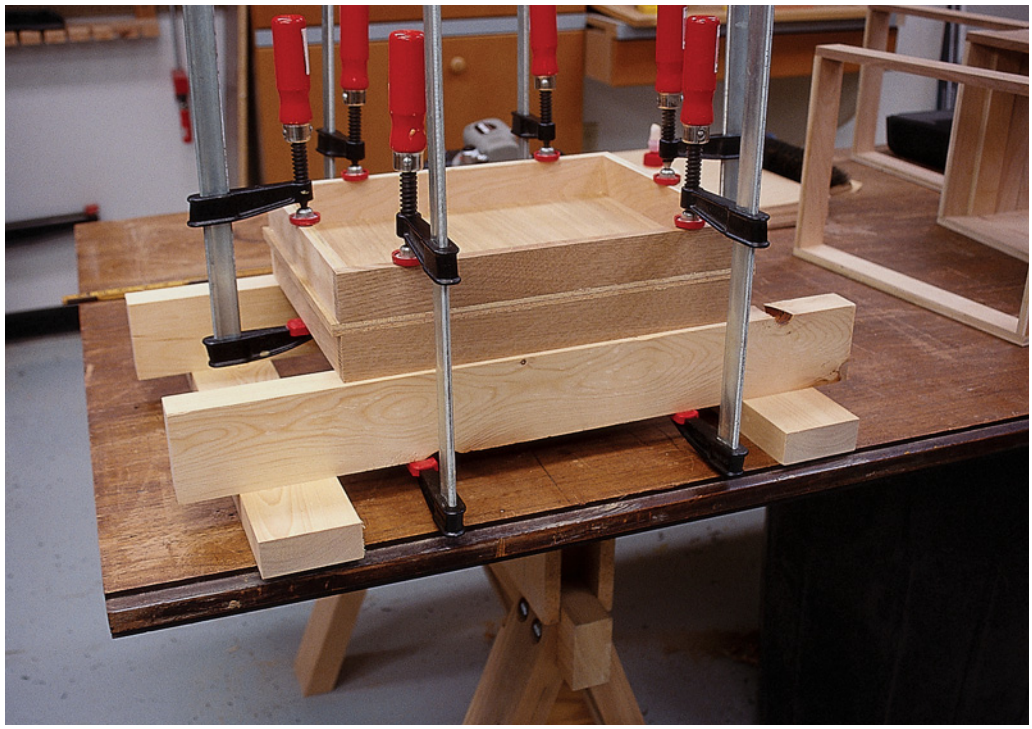
7 Glue the back crown on top of the plywood back panel. Make the arc on the crown as you did for the sides. Cut the top and bottom panels to size, then glue a $\frac{3}{8}$" x $\frac{3}{4}$" strip on the front of the bottom panel. Assemble the chest using 2" screws. Cut the plugs and glue them in place to cover the screw heads.



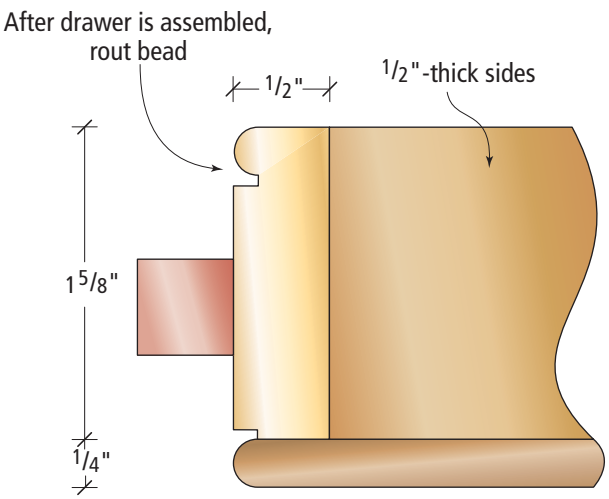
8 Here you can see how the two arcs meet nicely at the back corner of the case. These little details will make the sides and back flow together nicely.

9 Cut all the drawer parts to size. The sides are captured between the front and back parts, so glue-up can be done with two clamps. I just used glue on these butt joints. I know what you're thinking: Why would he use just glue and no fasteners or other joinery to strengthen this joint? Well, after the plywood bottoms are glued in place, the drawers are quite strong. (If you would like to use fasteners, please do so. Screws or dowels would work well.)

10 I use bench horses all the time to hold parts for gluing. Several drawers can be glued at one time. After applying glue to the bottoms, hold them in place with a few small brads or nails. Then stack up a few drawers and clamp them while the glue dries. This also helps keep the drawers flat.

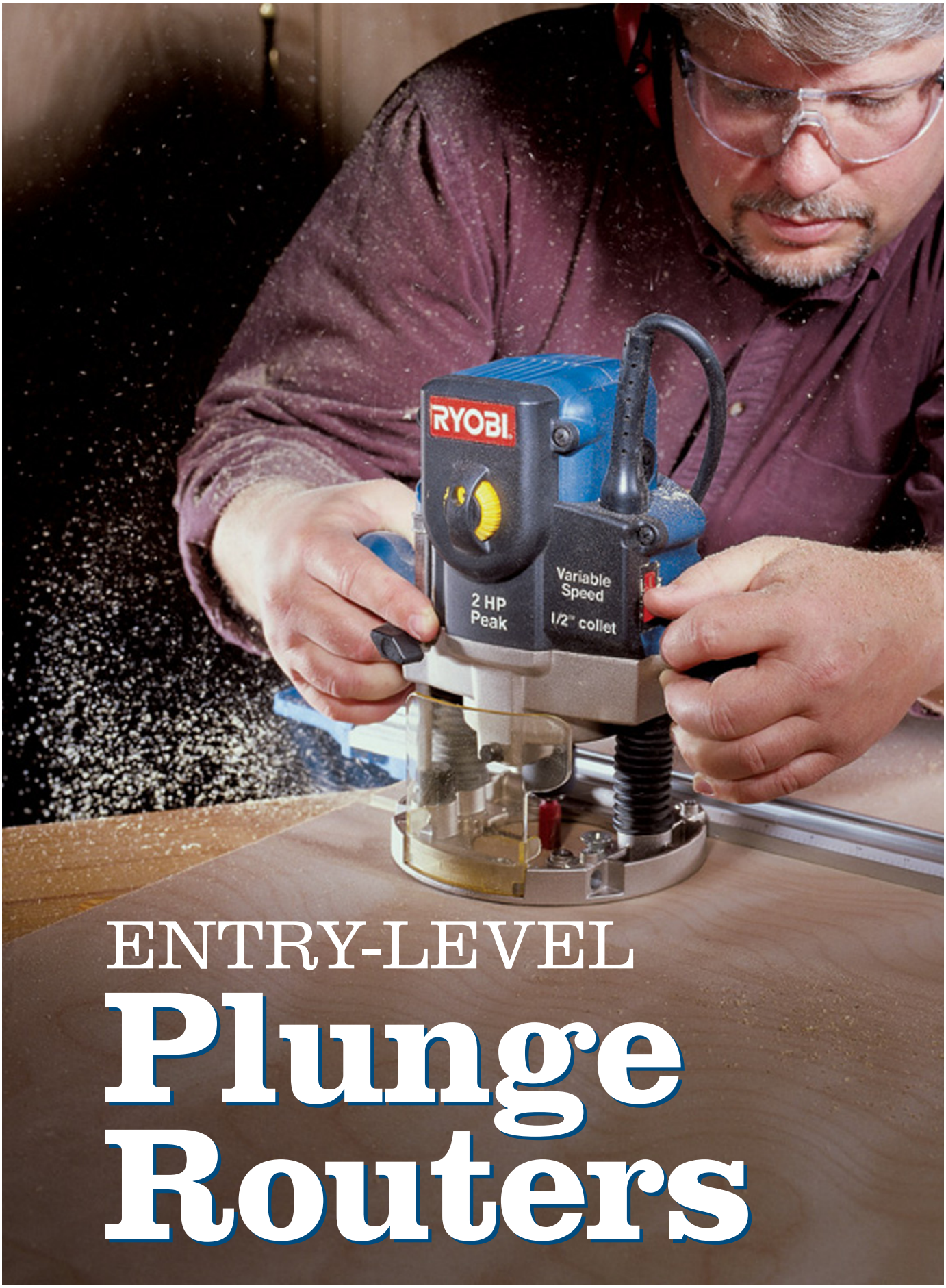


11 When the glue has dried on the drawers, rout the 1/4" bead on the top and bottom of the drawer fronts. The drawer bottoms are the perfect thickness to accept the radius of the bead. (See below.)



Drawer profile detail

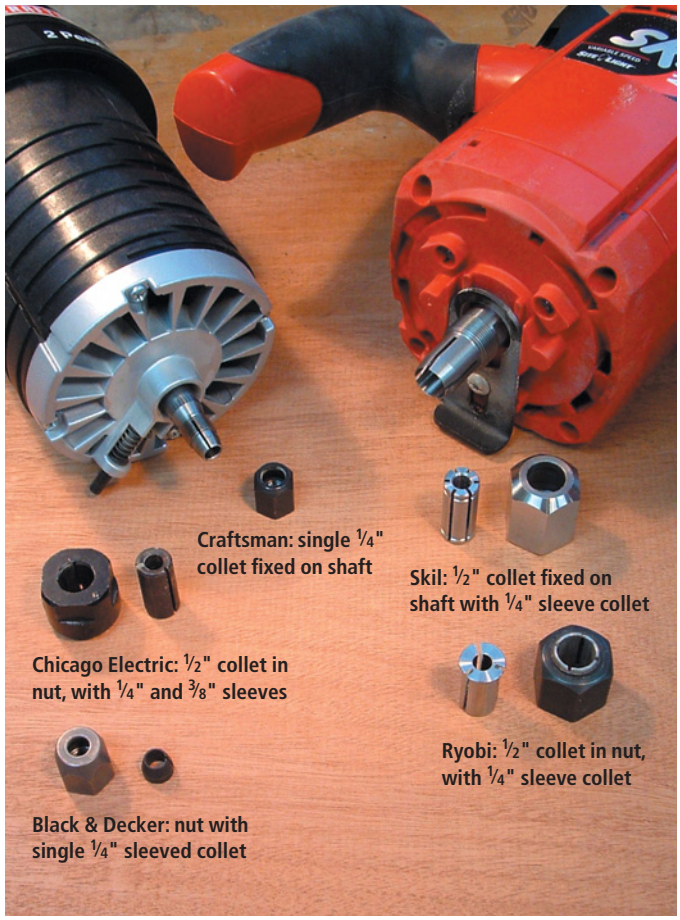
12 If necessary, fit the drawers by planing or sanding the sides of the bottoms that fit into the grooves to ensure the drawers slide smoothly. Then cut the plugs for the drawer pulls. I attached the pulls with an 1/8" dowel rod. Drill a hole in the center of the plug, and a matching hole in the drawer front. Glue the pulls in place, then sand and finish the chest and drawers. **PW**



ENTRY-LEVEL Plunge Routers

Photo by Tim Grondin

Can you buy a good plunge router for less than $125? Yup. And many of these tools are priced even less and still have lots of features.



One significant difference we noticed between "entry-level" routers and higher-priced models was in the collet. None of the routers in the entry-level category offers two independent collets. The ¼" collets all are designed as sleeved inserts into the ½" collet. In addition, there can be a significant difference in the quality of the collets, with some being more substantial in construction, and the collet nut is of a varying quality as well. While most of the collets, regardless of construction, performed well in our tests and would likely be fine for the entry-level woodworker, the failure of the Chicago Electric collet to adequately hold a bit in place speaks to how important this small piece of metal can be to router performance.

For any beginner a plunge router is certainly on the list of necessary equipment. It's a versatile tool that can stand in for the table saw to cut rabbets, dados, grooves, mortise-and-tenon joints, splines and biscuit joints. On top of that, it's great for edge details. Plus, it's not terribly expensive.

The problem most woodworkers face is choosing which router to buy. You can buy a fixed-base router, a plunge router or a kit with both. You can spend $70 or more than $250.

If you've been shopping recently you've probably noticed a new crop of inexpensive routers with big-boy features, such as variable speed and ½" collets. Is an inexpensive router good enough? We decided to find out.

Opening Bid

Even if you're considering one of these bargain routers as a third router in your collection (rather than your first), there are a few things to consider. It's our opinion that a plunge router is more versatile than a fixed-base router, so if you can choose only one tool, we recommend a plunge router.

That said, having both types of routers is great, which is why we also recommend two-base kits. These offer both a fixed-base and plunge-base tool with an interchangeable motor. While the kits offer flexibility, there's also a chance that they may not perform as well as a single-purpose tool, trading off versatility for solid features. Until recently the only router kits available had been for professionals. Happily, two of the new tools in this test are multi-base router kits.

When considering features on a router, there are a few things we consider important, while others are just nice. First is power versus size. While power is nice, if the router is too big to be used hand-held, you've gone too far. Also, lots of power can mean jerky (and scary) starts. For these reasons we recommend a 2-horsepower (or 10-amp) router and whenever possible a soft-starting motor. Soft-start is available only on variable-speed motors. Variable-speed motors also allow you to reduce the router's speed, which is good for large-diameter bits.

Another important feature is the collet. While you might decide to stock your router cabinet with only ¼"- or ½"-shank bits, there's also a good chance you'll end up with a mixture. If your router will accept only one size shank, you've immediately limited your choices. Also, while ¼" bits will likely satisfy most of your cutting needs, ½" bits can offer better stability in a cut, producing less vibration and reducing the possibility of "runout." Runout is basically the shaft wobbling. It can be measured as the difference between the diameter of the cutter and the actual cut it makes.

One feature we like is a dust collection port, whether as an accessory or as an integral part of the machine. Also nice is the ability to use template guides (which are good for cutting patterns), and the inclusion of collet locks to let you change router bits with

by David Thiel

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

BUYING YOUR FIRST ROUTER BITS

In this article we've told you how you can buy an entry-level plunge router to handle a great many routing tasks without spending a lot of money. It would be an oversight not to address the other part of the router ... the bits.

In shopping for router bits, you've probably noticed they fall into two price categories: regular (which seems high) and discount (which seems like a bargain).

After speaking with some router bit experts we determined that there are only a couple of areas where savings can be achieved in making router bits. The materials used can be of lesser quality, or the assembly process (primarily mounting the carbide to the bit bodies) may have lower quality control standards. If either of these areas are the reason for the bargain you may be disappointed in the bit's performance with extended use. That doesn't mean they should be excluded as an option. It depends on your routing needs.

If you're likely to be using your router only occasionally, the bargain Roman ogee bit will likely take care of your needs for the next year or two without any concerns.

Our suggestion for an entry-level router owner is to buy two regular-price router bits. For most router users this would be a ¼"- or ½"-diameter straight bit plus either a roundover bit, or a rabbeting bit with interchangeable bearings to adjust the rabbet size.

With two of these bits in your tool cabinet, much of your routing needs will be taken care of, and you'll get a good feel for the quality of the bits.

Next, to supplement your higher-priced bits, purchase a "starter set" of less-frequently used bits from one of the bargain dealers. They'll be available for those times you need an unusual profile, and also will let you evaluate the bargain bits. You can then decide which price category seems the right choice for your routing requirements.

Photo courtesy of Freud

Quality materials can make all the difference in a router bit. How the carbide is made is one crucial step. Above you see carbide blanks from the Freud factory in Udine, Italy, ready to be brazed to the tooling. These blanks have been through a number of rigorous spot checks to guarantee quality and conformity. Even a few degrees temperature change during the heating process can ruin tens of thousands of dollars of carbide.

just one wrench. All the routers tested here have collet locks.

There are multiple ways to set the plunging depth of a router. The simplest is a rod that slides up and down and can be locked in place. When the rod hits the router's base, the tool stops plunging. One common variation is the "turret depth stop." This is where the depth rod hits screws or steps that are in a rotating turret on the router's base. The turret depth stop allows you to make deep plunge cuts easily in small increments, which is good for the motor and the bit.

"Rack-and-pinion" depth stops allow you to dial-in the depth of the rod, while others merely free-fall. "Fine height adjustment" is a separate knob that lets you fine-tune your plunging depth in small and measurable increments.

The Test

Because the routers included in this test are designed as entry-level routers, we didn't test them to the extremes that we would ask of a professional router. We did, however, think they should be held to certain levels of scrutiny, and here they are:

We tested each router for noise using a decibel meter held 2' from the router (running without cutting wood). Any noise at 85 dB and higher can cause hearing loss with extended exposure.

We also cut ½"-wide x ¼"-deep grooves in plywood using quality double-flute carbide-edged bits from Freud. Costing about $15, this bit might not be the choice for first-time router users, but we think it should be (read "Buying Your First Router Bits" at left). We then measured the width of the groove with a dial caliper and compared its average measurement to the diameter of the bit used to make the cut. This difference gave us a sense of the runout of the tool and an indication of the accuracy of the router.

Also, while cutting similar grooves, we tested the amperage draw of each router both while it was free-spinning and while it was under load, cutting a groove. The smaller the variance between these two readings can be evidence for a more efficient motor.

As criteria for the test we selected the more feature-laden model from each manufacturer, with a maximum price of $125. While the $69 router may look very attractive, spending the extra $20 will add beneficial features that will greatly improve your satisfaction with your new router.

And the Winner is ...

Needless to say we were attracted to the two-base router kits. They offer good versatility for a reasonable price. That said, the Craftsman costs $120 (only $50 away from a professional-grade plunge router) and it is handicapped by its single ¼" collet and single-speed motor. The Skil kit is priced $20 lower, offers two collets, variable speed and even a clever task light. The Skil is our choice for a bargain in the entry-level router category.

Of the dedicated plunge routers, we can't recommend the Chicago Electric router from Harbor Freight. While the Black & Decker router performed OK, the bit runout was the highest tested and it offers only a single ¼" collet. While initially swayed by the allure of dust collection, the payoff wasn't there during testing. The Ryobi performed exceptionally, with perfect runout results, plenty of power, good ergonomics and two collets.

While a tight race, we recommend the Ryobi as a solid choice for a first (or third) plunge router for your workshop. **PW**

BLACK & DECKER RP400K

Black & Decker: 800-544-6986 or blackanddecker.com

The Black & Decker router entered the competition with one particular feature we were pleased to see – an integral dust collection port. In addition, the fit and finish, as well as the smooth plunge action and overall feel of the router, gave a solid, quality presentation.

Featuring a 2-horsepower (hp), 10-amp motor with variable speed control and soft-start, the RP400K lacks a fine-adjustment knob, but the rack-and-pinion depth stop almost functions in that capacity, lending an easier depth setup. The rubber over-molded grips are comfortable and the router feels good in your hands overall. The router has a flat area cast into the base, which helps maintain even spacing against an edge guide. A standard round base may be out-of-round slightly, and if the router is rotated during a pass it can ruin the cut.

One limitation of the router is its single 1/4" collet. When using the router we found that the runout was the worst tested. This was surprising in light of the tight plunge mechanism, indicating the shaft may be the culprit. We also were disappointed to find that the through-the-column dust collection didn't perform as well as expected. In fact, after a couple of passes we decided the hose was more inconvenient than the dust itself – so we disconnected the hose. Also lacking is a way to attach template guides.

Overall the router performed fine, and it was the quietest tool in the test. It was disappointing that the dust collection didn't live up to our expectations, and we'd prefer tighter tolerance in the shaft runout. It's OK, but there are nicer routers available.

CHICAGO ELECTRIC 41348

Harbor Freight: 800-423-2567 or harborfreight.com

On paper this Chicago Electric router looks like a great deal. At $80 it's the least expensive of the bunch and boasts a 2 1/2-hp, 12.7-amp motor with three collets, (1/4", 3/8" and 1/2"), an edge guide, roller guide, 5/8" template guide, 3/8" carbide straight bit and an extra set of brushes for the motor. But once the router arrived, it didn't look as good as it did in the catalog.

On opening the box we were greeted by crude castings with visible surface voids. The overall fit of the plastic to the metal was poor and the router looked cobbled together. It was very heavy. We didn't want to make too much of a deal about how it looked, so we went to work with it. The first thing we noticed was that plunging the motor on the base made a grating noise from the fine-height adjustment mechanism. Beyond the sounds of metal rubbing on the threads of the mechanism, the rubbing affected the smoothness of the plunge action. We noticed significant play in the column during plunging operations and that the base plate was warped by .090".

We decided it was time to stop criticizing and just turn it on. To mount the 1/4"-shank straight bit in the sleeved insert collet, we had to apply much more pressure than expected and the bit still managed to slip out of the collet three times before completing a 4'-long groove. At this point we stopped testing and called Harbor Freight. The company shipped a new collet without too much discussion. When it arrived, the collet was 1/8" longer and significantly better machined and we were able to complete our testing.

Ultimately the router performed OK, but while this is a very affordable router, it's not necessarily a bargain.

CRAFTSMAN 17533

Craftsman: 800-377-7414 or www.craftsman.com

Offered with both fixed and plunge bases, this 2-hp, 9.5-amp router kit has some nice features, but it falls short of grand praise. This is another router that offers only a 1/4" collet – we prefer the versatility of having both a 1/4" and 1/2" collet. It's a single-speed router, so you cannot operate larger bits at slower speeds. We were happy with the performance of the tool, which has a smooth solid plunging action and adequate power. An innocent-looking plastic dust collection attachment is included in the kit, but don't underestimate it. When we routed grooves with the dust collection enabled, we were pleased to see all the dust disappear, even pulling it up from the bottom of the groove – very nice!

Changing from the fixed to plunge base is made less convenient by the use of a threaded-knob release on the plunge base, while the fixed base offers a much easier lever-release latch. Sliding the motor into the separate bases isn't a smooth process and requires some wiggling and adjusting to seat everything properly. Once in place, however, both bases offer nice performance, and they both are outfitted for template guide inserts.

Overall this is a decent but ultimately average router, with its strongest recommendation being its two bases. When considered against the similarly priced Skil two-base kit, it falls a bit short because of its 1/4" collet and single-speed motor.

RYOBI RE180PL

Ryobi: 800-323-4615 or www.ryobitools.com

Editor's Choice

Ryobi's plunge router starts off on our good side by coming in at less than $100. When you look at the features, that's even more surprising.

With a 2-hp, 10-amp motor with electronic variable speed and soft-start, the RE180PL provides good power and performance for entry-level needs and beyond.

The router is equipped with both 1/4" and 1/2" collets and is one of two tools in the test with a flat area cast into the base (for improved accuracy when following an edge guide). It offers a nice compact design with a smooth plunging action and the excellent option of adding a template guide insert plate.

Power is controlled by a rocker switch mounted to the motor body. While we understand the need to have the switch located on the body of the two "kit" routers to make them interchangeable in the bases, we're not sure why Ryobi opted for this location on this model. We prefer a handle-mounted switch on a plunge router, so that both hands can be used to control the router during starts. The Ryobi switch is located close enough to the handle so this shouldn't be a problem, though.

The router also offers a wholly adequate depth-stop mechanism with a nifty precision dial-in depth stop on the base, rather than a turret, though we'd love to see a fine-height adjustment knob on this machine.

When we put the router to use, we were pleased. It's comfortable to use and quiet (within a decibel of the lowest in the test) and had a remarkable runout statistic of zero. Add to that the electronic feedback on the motor to keep the speed up in heavy cuts and this is a very smooth and accurate router.

OK, one gripe: This router threw dust all over the place. If Ryobi can add a dust collection accessory like the one on the Craftsman, we'd be most appreciative. All things considered, this router's our winner.

SKIL 1825

Skil: 877-754-5999 or skiltools.com

Best Value

We tested a pre-production model of this brand-new router, but we didn't have to overlook any flaws to build a solid opinion. Though offered as a dedicated plunge router ($79), that model is a single-speed, 2-hp, 10-amp version and offers only a 1/4" collet. We chose to test the two-base (fixed and plunge) kit.

The 2 1/4-hp, 11-amp router is the most powerful router successfully tested in this review. It is equipped with both 1/4" and 1/2" collets, variable speed (but not soft-start), an on-board task light activated by a photo-electric sensor in the right handle (nice feature) and comfortable over-molded soft grips.

In use, we found the fine-adjustment knob (one of only two in the test) to be very useful during height setups. We noticed some play in the column and a .007" runout during operation. Some of this may be associated with the "hand-built" nature of our test model. One thing we were less happy with was the "constant lock" position of the plunge mechanism. Unlike other routers in the test, the Skil plunge mechanism is locked until released by moving the plunge lever. This adds an extra motion to have to worry about while making a plunge cut, and it is distracting to us.

In general, the router had enough power for any home-shop task. It's lightweight and the three-position depth stop offers easy depth settings. We didn't get to test the through-the-base dust collection on this pre-production model, but it will be offered as an aftermarket accessory.

We enjoyed the fixed-base accessory option, and were happy to see lever releases on both bases. Switching bases takes some practice (a button must be pushed on the plunge base, while a lever is used to release the fixed base). Though there is no option for using template guides, at $99 this feature-laden kit is our choice for the bargain in this category. **PW**

ENTRY-LEVEL PLUNGE ROUTERS

MODEL	PRICE	HP/AMP	COLLET SIZES	RPM	dB @2'	PLUNGE RANGE	WGT (LBS)	RUN-OUT	AMP VAR.	COMMENTS
Black & Decker RP400K	$105	2/10	1/4"	8-25K	96	1 1/2"	9.2	.013"	1.05	Includes case
Chicago Electric 41348	80	2 1/2/12.7	1/4", 3/8", 1/2"	23K	104	2 1/4"	13.9	.007	1.80	Includes edge guide
Craftsman 17533	120	2/9.5	1/4"	25K	98	2"	9.5	.006"	2.76	Sold as 2-base kit, with case
Ryobi RE180PL	99	2/10	1/4", 1/2"	15-23K	97	2"	8.5	.000"	1.25	
Skil 1825	99	2 1/4/11	1/4", 1/2"	8-25K	101	1 7/8"	9.6	.007"	1.44	Sold as 2-base kit, with case

NOTE: Winners listed in red.

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Rob McClanahan from Bethel, Ohio-based Tri-State Hardwood Floors Inc. uses a stand-up sander to begin the refinishing process. This type of sander can be rented at rental stores and some flooring-materials suppliers. Look under "rental" in your phone book.

Photo by David Thiel

Wooden floors used to be finished with shellac, a coating that dries rapidly, brings out a lot of depth in the wood and adds a warm amber coloring.

But shellac doesn't wear well, so it was almost always waxed to reduce scuffing and extend longevity. Keeping waxed floors in good shape was a lot of work, however, so with the introduction in the 1960s of more durable, "no-wax" polyurethane finishes, shellac fell out of favor.

Today, there are a number of durable finishes that can be used successfully on wood floors, including oil-based polyurethane, water-based polyurethane, moisture-cured polyurethane and water-based finish with a catalyst (or "hardener") added. Of these finishes, oil- and water-based polyurethanes are the most popular with do-it-yourselfers because these finishes are considerably less toxic and much easier to use.

Though both of these finishes are based in large part on polyurethane resin, they differ in several significant ways. Oil-based polyurethane is more durable (meaning more wear-resistant), has a slight amber coloring and dries slower than water-based polyurethane, so application is easier.

Water-based polyurethane, on the other hand, has a much less irritating smell, is easier to clean up (with just soap and water), is non-flammable and doesn't add color at all. Because of its lack of color, water-based polyurethane generally looks better on "white" woods such as maple and woods that are whitewashed or "pickled."

Clearly, there are legitimate reasons for choosing each of these finishes. But unless the non-yellowing characteristic of water-based polyurethane is very important to you, oil-based polyurethane is your best bet for a floor because of its better durability.

Once you've chosen the finish to use, you need to prepare the surface and apply the product. Finishing floors is like finishing any wood surface – with two rather significant differences. First, the surfaces to be covered are usually very large, so different tools are commonly used to increase speed. Second, there is a reduced need for perfection because flaws in the wood or in the finish aren't noticed easily.

by Bob Flexner

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

Preparing the Surface

Just as with newly made furniture, newly laid floors are always sanded before finishing. But already finished floors are rarely stripped. Instead, they also are sanded and the procedure is the same as with new floors.

Special, 100- to 200-pound stand-up sanders are used, and sandpaper grits are kept fairly coarse, ranging from 36-grit to 120-grit. (Sanding no finer than 80-grit is a good idea, for example, when whitewashing floors so that more of the white pigment becomes lodged in the deeper sanding scratches.)

Smaller "cut-in" sanders are used to sand right up to baseboards, and inside corners often are scraped and sanded by hand.

All of these tools, including the floor buffers mentioned below, can be rented at rental stores and some flooring-materials suppliers. These stores also stock the needed sandpaper, steel-wool pads and screens, and they can provide more detailed sanding instructions if you need them.

Applying Stains and Finishes

Methods for applying stains and finishes to your floor are similar to those used on furniture or cabinets, with the major difference being the tools used for the job.

You can use a brush, of course, and this is often the best tool for cutting-in near the baseboards. But for covering large expanses, a sponge mop or a similarly shaped tool with a lamb's wool pad attached is much faster. The lamb's wool will produce better results. For water-based polyurethane, a paint pad attached to a pole also is a good application tool. Each of these tools is available at hardware and paint stores.

To stain a floor, follow these steps:

Vacuum the floor to remove dust.

Pour some stain into a paint tray and apply the stain using a large brush, sponge mop, lamb's wool applicator, paint pad, or simply a large cloth or sponge held in your hand.

Apply the stain rapidly, especially if it's a water-based stain, and wipe up the excess with a large, clean cloth, your last strokes going lengthwise with the wood. It will be helpful to have two people performing this task, one applying the stain and the other wiping up. (To avoid smearing baseboards, tape them off before applying the stain, or cut in a few inches first using a brush.)

Photo courtesy of Varathane

Varathane's ezV sander can be rented at many home centers and hardware stores. This consumer-friendly sander has on-board dust collection.

Allow the stain to dry overnight if it is oil-based and for at least a couple of hours if it is a water-based product.

To apply finish to a floor, follow these steps:

Be sure the room you're working in is warm and there is some ventilation – but not so much that it stirs up dust.

Vacuum the floor to remove dust and walk around in just your socks.

Pour some finish into a paint tray and apply the finish using a large brush, sponge mop, lamb's wool applicator or paint pad. There's no reason to thin the first coat, but you can if you want. The coat will dry faster, but you'll get less build.

Begin work at one side of the room and coat a foot-wide strip up to the room's baseboard, working lengthwise with the boards. It's best if you tape off your baseboards or cut in first using a brush.

With one strip coated, begin the next, overlapping a little onto the first strip and working fast enough to keep a "wet edge." That is, the first strip is still wet when you are overlapping with the next so you don't get a double thickness.

Work across the room in this manner, finally exiting through a door.

If you miss any small areas of the floor and the finish is beginning to set, it's best to leave them until the next coat.

Let the finish dry overnight if it's oil-based and a few hours if it's water-based. Be sure that no areas, even in corners, are tacky or soft before going to the next step.

Buff the finish using a floor buffer and a #2 steel-wool pad or a 120-grit screen (a sanding product available from most rental companies) to remove raised grain and dust nibs. (Don't use steel wool, however, with water-based finishes.) You also can sand by hand using 120- or 150-grit sandpaper.

Vacuum the floor and apply a second coat of finish in the same way you did the first.

Buff or sand again, vacuum up the dust and apply a third coat.

Recoating Floors

There's no need to sand a floor to bare wood every time it gets a little worn. As long as you haven't let the finish wear all the way through, you can screen it using a floor buffer and apply one or two coats of finish in the same manner as described above.

You don't need to use the same brand of finish, but it's best to use the same type to avoid color differences in worn areas. Be aware, though, that you may have bonding problems using water-based polyurethane if the floor has been waxed. **PW**

Photo by Al Parrish

You can purchase oil-based polyurethane and a lamb's wool applicator at your local home center. The lamb's wool applicator shown here requires a handle, which you also can purchase at your home center or you can disassemble an old broom.

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Caption the Cartoon

Illustrated by Bob Rech
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#60

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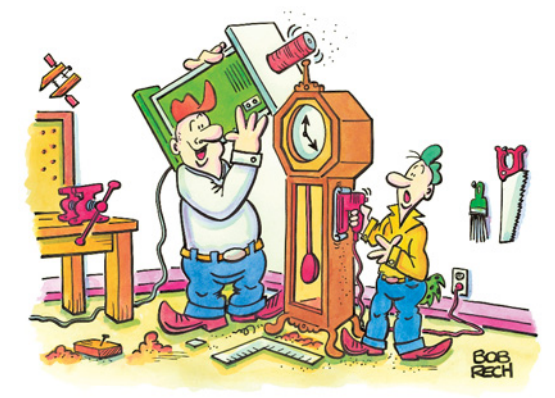
This issue's winner receives 10 12" and 10 24" PSI Clamp-n-Spread clamps. These easy-to-use clamps feature a $3\frac{5}{8}$" throat depth, comfort cushion pistol grip, a heavy-duty steel bar, soft-jaw pads and a convenient clamp-release button. The clamp quickly converts from a clamp to a spreader. The set is a $209 value! The runners-up each win a one-year subscription to *Popular Woodworking*.

#58



"Dremel, schlemel ... it's all in the wrist!"

Tom Maciel, of Monmouth Junction, New Jersey, is the winner of our Cartoon Contest from the April issue and recipient of the Makita drill. The following runners-up each receive a one-year subscription to *Popular Woodworking:*

"Sanding is the easy part – it's the table saw that gets heavy."
John Hogan, Dearborn, Michigan

"Let's speed up the 'sands of time.'"
Duane Enck, Scio, Oregon

"Why didn't the plan say to sand before gluing it up?"
Don Temple, Champaign, Illinois

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When Possums Attack

Three men and a broom are no match for a marsupial and his pile of lumber.

There are several fundamental requirements to be a woodworker. One needs the proper tools, followed by a degree of skill. Most importantly, though, a woodworker needs wood. Consequently, one of the great pleasures I derive from woodworking is that long quest to the lumberyard. Sure, you might be able to find a bland selection of poplar and pine at the home center, but if you want something special you must go the extra mile.

Now, I live in the woods, so I'm surrounded by trees. Yet, for some reason, the only lumberyard within 100 miles is in the industrial district of Newport News, Va. My wife, Helga, also a person of rural descent, is apprehensive about the city. Understandably, she insists I make my journey in periods of extreme daylight. So, one morning last month, I set off on my most recent expedition.

The sheds at Waterfront Lumber are jammed with lumber of every variety, and I'm always surprised at what I find. A regular customer, I parked the station wagon in front of the oak shed and went to the front office. A nod to the manager and an apprentice was sent to help me load and tally the booty.

The young boy slid back the shed door to reveal the much-anticipated stack of rough oak. Of course, neither of us expected to find the enormous, furry, bug-eyed possum that was sitting there like a cherry on top. I turned to the apprentice to comment on our circumstances, but I found nothing but a dropped tape measure and trail of dust.

Now, where I come from possums are an unwelcome occurrence. In fact, the last one that violated Helga's territory was batted over the fence with a broom. Unfortunately, she wasn't with me and most of my dealings with possums had transpired through a windshield. I decided to follow the boy's lead.

Upon arriving back at the office, I caught my breath while the young man painted a disturbingly accurate picture of the beast … describing him as a "greasy, red-eyed fiend." I nodded in concurrence … he was greasssy. The yard foreman, a renowned naturalist, set his jaw and delved into the closet looking for the right tool for the job. He emerged with a broom – the expert's tool of choice.

We promptly departed the office and marched lock-step to the front lines, emptying a 50-gallon drum of rainwater along the way. In a raspy whisper, the foreman revealed his plan. He would throw open the doors, give the animal a good shove and one of us would catch it in the drum where it could be "disposed of" at our leisure. Needless to say, no one was volunteering for the second part.

When we rounded the corner it became clear that the original plan would have to be altered. The possum now was sitting comfortably in the front seat of my wife's station wagon. As I watched the "greasy, red-eyed fiend" glare at me over the steering wheel, I realized that the "great circle of life" was now complete. Helga must never learn of this.

I grabbed the broom and moved forward, intent on putting mankind back in the driver's seat. The foreman rolled the drum to the passenger side door, we counted to three and flung the doors open in unison. With one tremendous thrust, I lunged at the beast. It was at that moment I recognized the flaw in our plan. This was no ordinary animal. He was a city possum, streetwise and crafty. He latched onto the bristles and wrapped his tail around the broomstick. I jumped back with the broom (and possum) in tow.

Now, on the upside, the possum was out of the car … unfortunately, I was now the proud owner of 20 pounds of hissing meat at the end of a 4' stick. The spectators backed away quickly, choosing to watch the negotiations from a distance. They were brief.

After running around the car twice, I stumbled over the water drum, and we tumbled to the ground. While I landed with a thud, his landing was more like a grocery bag full of wet newspaper. The time had come for a deal. As I lay there, face to face with the angry possum, we reached an understanding. He would amble back to his oak pile, and I would buy a load of walnut instead.

Hours later, as I sat at the gas station washing the stains out of my wife's upholstery, I realized that Helga had been right. The inner city really was a dangerous place. I beat a hasty path back to Seaford … home of the laid-back country possum. **PW**

by Walt Akers

Walt Akers now carries a broom and steel drum anytime he leaves his workshop in Seaford, Virginia.

IT WILL DRILL THROUGH WOOD, CONCRETE AND TIME.

Scared to go into the basement? Is it only fit for habitation by cardboard boxes, cobwebs and the outdated washer and dryer? Obviously, you need to do something about it. If only there were time, right? Well, here's a way to find some. First off, you'll need materials: wood, drywall or wood paneling and hardware—screws and bolts. And then, you'll need a drill with the power to turn your dungeon of despair back into a living space. Volt for volt and feature for feature, no line of cordless drills offers more torque than our new Craftsman® EX™ drills. With a bigger motor, these drills will carve right into stone or concrete. (The built-in level will make sure your pilot holes stay on the straight and narrow, too.) But anyone who has worked with concrete or stone foundations will tell you, it doesn't give up easy. No, far from it. But that's okay. The cushioned pistol grip dampens the vibration caused by drilling into harder substances. In other words, the walls will surrender long before your hand will. Speaking of giving up, you'll be a long way into screwing the drywall or wood paneling into the studs before the EX wears out. Every EX drill has the longest battery life of any drill in its class. Longer life means longer time working and less time changing batteries. And when you think that for every sheet of drywall, you'll be driving four rows of five screws, the EX can save you a lot of time. Which brings us to the final point: What are you going to do with all this time you just saved? Perhaps spend it in your now newly renovated basement, excuse us, family room, watching the game? The new line of Craftsman EX drills. Find them at Sears, Sears Hardware Stores, online at craftsman.com or call 800-437-9686. You'll find it well worth your time.

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