

TAUNTON'S

Fine WoodWorking

Build a coffee table

August 2005

No. 178

**Wipe-on
finishes:
Which one
works best?**

**New choices
in sandpaper**

**TOOL TEST:
8 benchtop
mortisers**

**Smart tips
on using
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**Conquering
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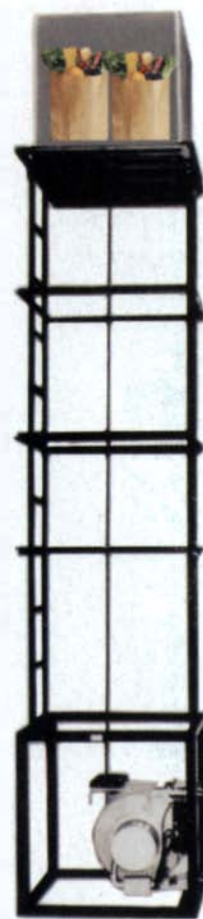
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RANDALL O'DONNELL ("A Little Masterpiece") lives in the scenic hills of Brown County, Ind., with his wife, Susy, and their little dog, Margaret. After a year's break to build a home and studio, O'Donnell is once again making period furniture full-time. Influenced by his grandfather, a builder and cabinetmaker, O'Donnell found furniture making a natural destination from home building via architectural millwork and cabinets. In the early 1980s, his interests turned to the hand skills of the 18th-century American cabinetmakers. Since then, his body of work has grown to include some of the finest examples of Queen Anne and Chippendale reproduction furniture.



KEVIN RODEL ["Coffee Table Puts Joinery on Display"] has been building furniture in his shop in Pownal, Maine, since 1986. He looks largely to the Arts and Crafts movement for his design inspiration, and recently co-authored a comprehensive book on the subject, *Arts & Crafts Furniture: From Classic to Contemporary* (The Taunton Press, 2003). Rodel teaches part-time at the Center for Furniture Craftsmanship in Rockport, Maine. More of his work can be seen at www.kevinrodel.com.

GEORGE HURON (*Master Class*) set aside a career as a mechanical engineer several years ago to build furniture and teach. When he's not working wood, he and his wife, Pat, like to travel and dote on their pug pups, Maggie and Mollie. A San Antonio native, Huron has a shop and classroom within walking distance of the Alamodome.



RICHARD BEEBE ["A Better Tapering Jig"] first appeared on the pages of *Fine Woodworking* when he submitted a winning tip to the Methods of Work department for issue #153. One of the editors saw his tapering jig and encouraged him to write an article. Beebe, a computer-system manager for a medical school, builds furniture for friends and family in his basement shop.



CHRIS MINICK ("Wipe-On Finish Test") has felt a big increase in demand for his furniture-making skills now that his children are setting up their own households. Unfortunately, his offspring settled in California and North Carolina, so to get the furniture to them from his home in Minnesota, Chris has had to enter the transportation business. Minick Van Lines consists of a 4-ft. by 8-ft. enclosed trailer that can hold a dining-room table and eight chairs. There is no end to the furniture wish list, but at least Chris now has a good idea which oil finishes to use and which to avoid.

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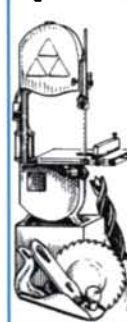
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From the Editor

IN NEED OF HAND-TOOL SKILLS

Most woodworkers I know personally are quite proficient with hand tools and enjoy using them. But that's not true of the greater population of woodworkers. I'm frequently reminded by woodworking teachers such as Michael Dunbar and Gary Rogowski that many of their adult students are lacking in basic hand-tool skills.

There are a number of reasons for this. My generation was exposed to woodshop in high school, where we got a taste of working with hand tools. But in the last 20 years, many high schools swapped their woodshops for computer labs. Community-college-level vocational schools today tend to focus on machine work, as their mission is to train students for the cabinet industry.

There are a few exceptions, such as the North Bennet Street School in Boston, the College of the Redwoods in northern California and others, which have in-depth woodworking programs. But for the hobbyist who has time only for a weekend or weeklong seminar, a great place to learn how to use hand tools is at private schools, such as those run by Dunbar, Rogowski, Marc Adams, Peter Korn, and others. (For a more complete list, visit www.finewoodworking.com.)

In this magazine, we regularly feature articles on hand tools and will continue to do so. For this issue, we've put together a primer on skill-building exercises using common hand tools (see pp. 78-85). These are excellent exercises for beginners as well as intermediate-level woodworkers who may need to fine-tune their techniques.

Once you become proficient with these tools, you'll wonder how you ever got along without them.

—Anatole Burkin
aburkin@taunton.com

Nontoxic glue alternative

I read with interest your article on glues in the April issue (*FWW* #176). I have some difficulty with the yellow glues, which cause the skin on my hands to peel and turn red. I have found a nontoxic yellow woodworking glue which does not cause me any problems. It's made in Canada by Frank T. Ross and Sons, and it's called Weldbond Professional Wood Glue (not to be confused with Weldwood). The same company makes a nontoxic white "Universal Glue" which will glue almost anything together. It's a little hard to find, but you can find a supplier via the Internet.

—ED WILLER, Raleigh, N.C.

Make sure your oily rags are really dry

I'd like to add a caveat to Chris A. Minick's method of safely disposing of oily rags ("Pros and cons of oil finishes," *FWW* #177, pp. 22-26). He writes, "Spread them on your shop floor to dry, or hang them over a rack outside. Once dry, the rags can be tossed into the trash safely."

When our house was under construction, I faced the disposal of a large quantity of oil-soaked rags. My brother set his garage on fire when he left a wadded-up oil-soaked rag on a bench, so I was cautious.

As a test, I hung the rags outside to dry, and days later stuffed a pile of the then-board-stiff rags into an 8-in.-high cardboard box and set the box on a rock



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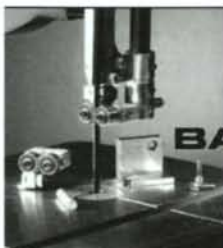
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ledge away from the house. A short time later the box was smoking!

A dried rag, or several, dispersed in the trash may be safe, as Minick says, but my experiment suggests that a wad of seemingly dry rags can still present a fire hazard if compressed in a closed, combustible container.

—IAN R. WALKER, Stonington, Maine

Comments about glue

In your article on glues ("Six Essential Glues," *FWW* #176, pp. 42-49), you did not mention that Titebond III Ultimate Wood Glue solves the shortcoming of yellow glue: poor water resistance. Titebond III provides a higher level of water resistance than any product in its category.

—MARK SCHROEDER, Titebond Glues & Adhesives, Columbus, Ohio

Improving airflow

I found the "Fold-Down Sanding Table" (*FWW* #174) very well designed but would

like to offer a tip to improve the airflow at the table-to-hose connection. If you build up the inside area of the box around the dust port using scrapwood, then round over those pieces, creating a cone or trumpet shape where the air enters the hose, you'll increase airflow by 20% or more.

—JIM WAYMIRE, Portland, Ore.

Where can I complain?

I have been a loyal reader of *Fine Woodworking* since your first issue. I have often thought that it would be useful if you had a section devoted to complaints or suggestions about materials and tools. That way, suppliers or manufacturers might get an idea of what people in the field think of their materials. I think it would be popular.

—CORI HIGGINS, via email

Editor replies: We have just the place. Visit www.finewoodworking.com, go to the Knots Discussion, and the "Tools for Woodworking" forum. It's quite popular.

Clarification

A Tools & Materials item (*FWW* #176, p. 30) about horsepower ratings for small and midsize air compressors neglected to mention that the power-tool manufacturers who are changing their ratings system are doing so in part to settle a lawsuit contesting the old system.

About your safety

Working wood is inherently dangerous. Using hand or power tools improperly or ignoring standard safety practices can lead to permanent injury or even death. Don't try to perform operations you learn about here (or elsewhere) until you're certain they are safe for you. If something about an operation doesn't feel right, don't do it. Look for another way. We want you to enjoy the craft, so please keep safety foremost in your mind whenever you're in the shop.

—Anatole Burkin, editor

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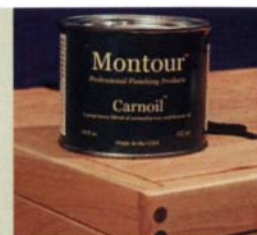
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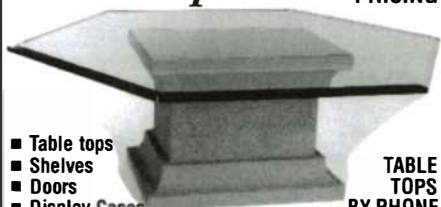
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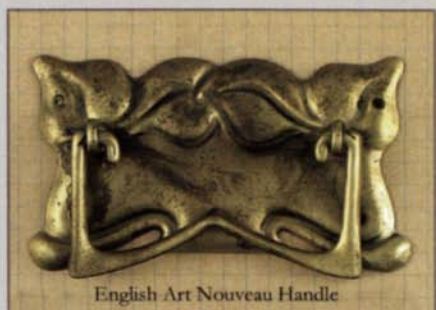
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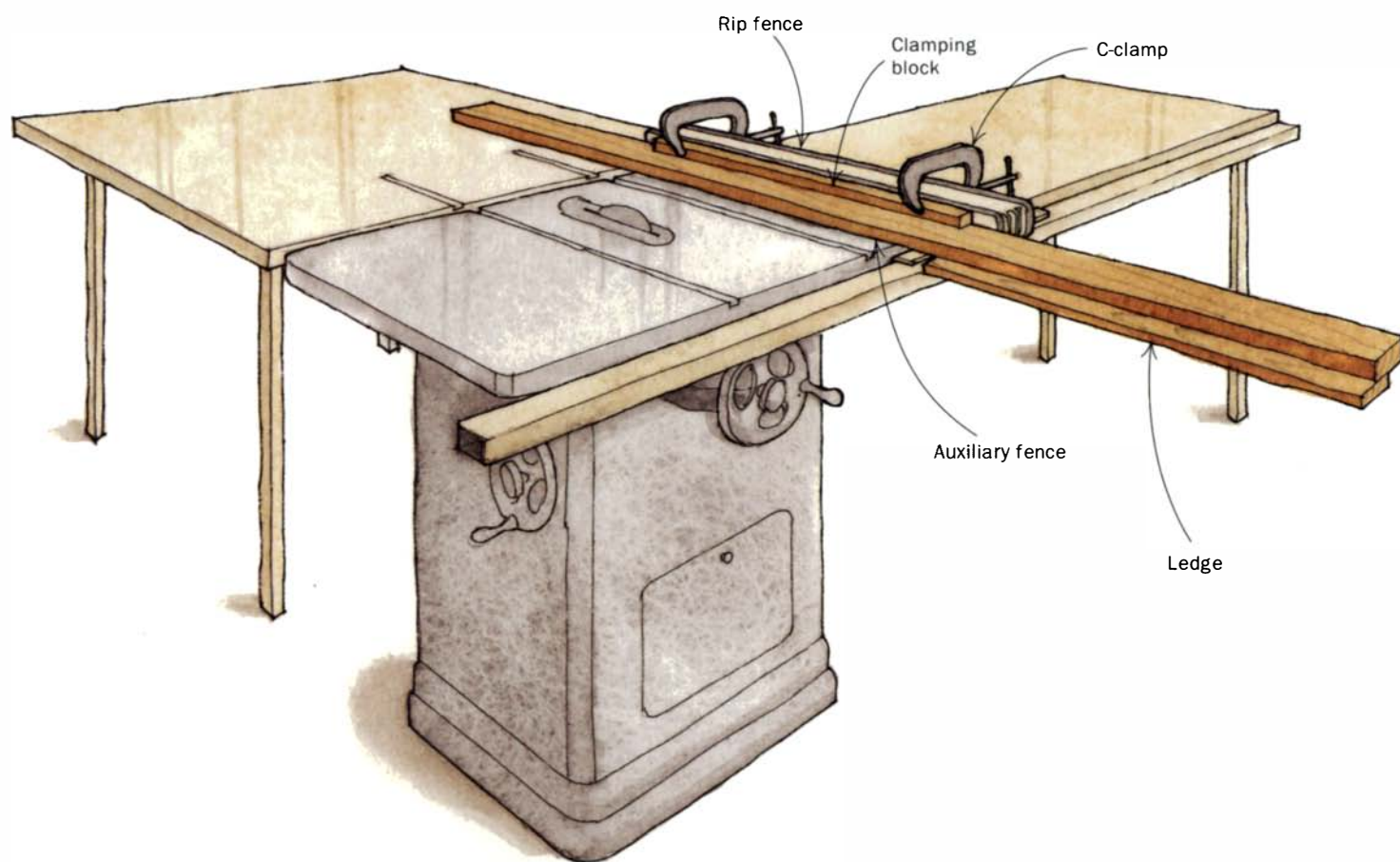
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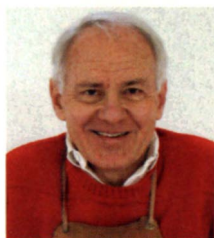
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The woodworking bug gave Philip Houck a good bite at a young age—he completed his first piece of furniture at age 10. Then, some 42 years ago, he began making reproductions of antiques. Currently, he is a semiretired life-insurance agent.

ON MOST TABLESAWS, CUTTING A 4X8 SHEET of plywood is, at best, a dicey proposition. The sheet is heavy, the rip fence is too short, and, at the beginning of the cut, most of the sheet hangs unsupported in front of the saw.

As a solution, I added a rip-fence extension to my tablesaw. It helps support the right side of the plywood when it's overhanging the front of the saw table.

The extension has just three parts: an auxiliary fence, a ledge, and a clamping block. The auxiliary fence serves as a substitute for the rip fence, extending forward to provide a longer, more positive reference for the right edge of the plywood. The ledge provides vertical support for the overhanging plywood. And the clamping block provides a means to clamp the extension securely to the rip fence.

When cutting the auxiliary fence, make sure its two edges are straight and parallel. The clamping

block and ledge attach to the auxiliary fence with glue and a few screws. To use it, clamp the auxiliary fence tightly to the rip fence. Establish the cut width by measuring the distance from the blade to the edge of the auxiliary fence, and lock the rip fence in place. Place the front of the plywood on the saw table, and keep the right-hand edge of the plywood against the auxiliary fence during the cut.

—PHILIP A. HOUCK, Boston, Mass.

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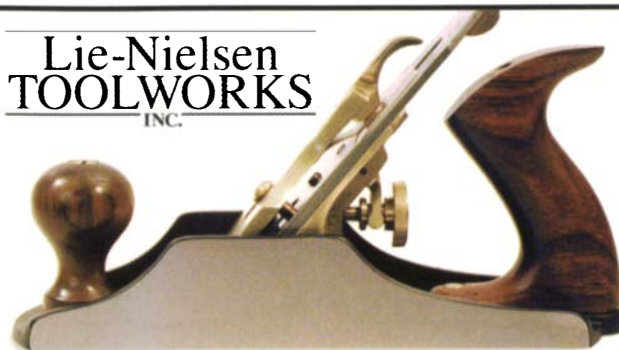
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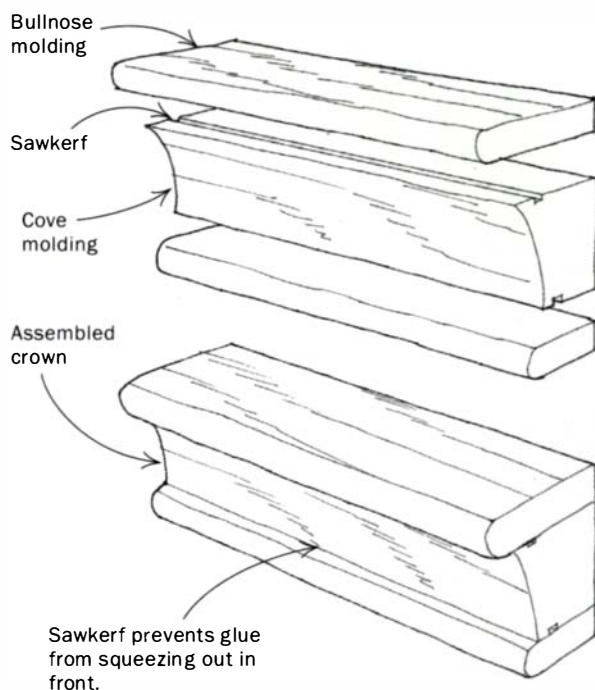
READER SERVICE NO. 37

Sawkerf prevents glue squeeze-out

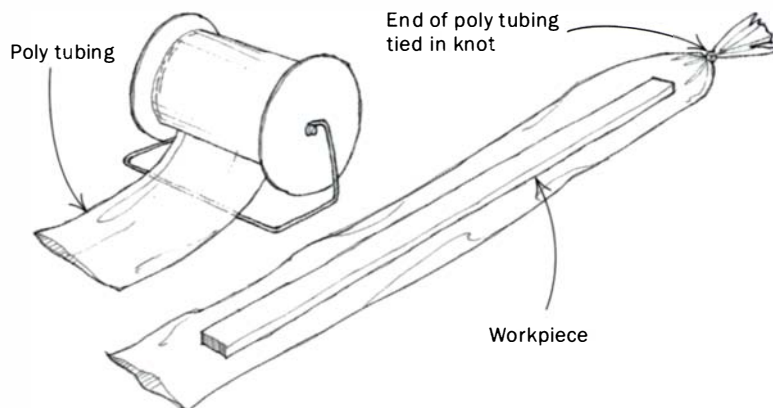
This sketch (below) shows a three-piece crown molding I like to use for small display cabinets. I cut the two bullnose moldings on a router table using roundover bits. The cove is made by passing the stock at an angle over a tablesaw blade.

When I'm gluing up the pieces, the last thing I want is glue squeeze-out in front of the molding. So, I lower my tablesaw blade until about $\frac{1}{16}$ in. is exposed and cut two shallow slots in the cove molding about $\frac{1}{8}$ in. from the front edge. I apply glue behind the slots. On clamping, excess glue is forced into the slots and nothing squeezes out.

—DENIS LOCK, Bedfordview, South Africa



Steam-bending with poly tubing



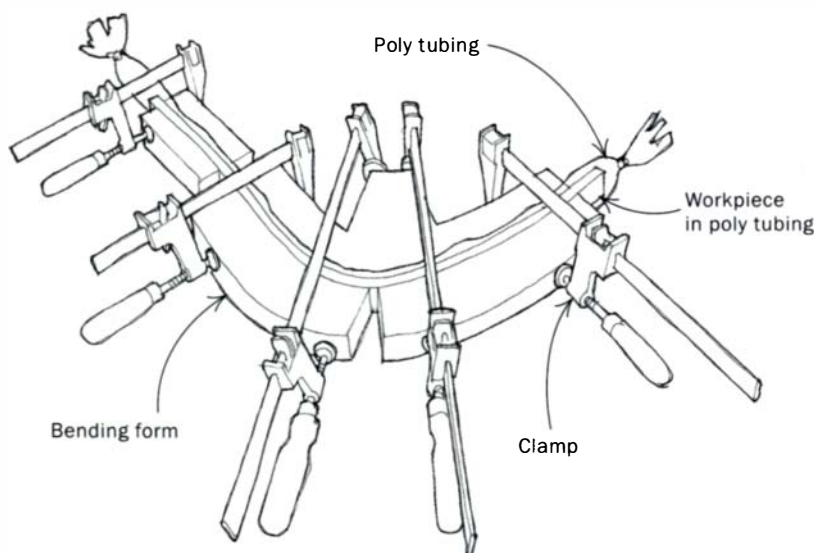
This unlikely method of steaming wood eliminates the need for a steambox. It slows the cooling process, so you have a little extra time to make a bend. The method works best on stock less than $\frac{5}{8}$ in. thick.

The setup uses readily available 6-mil polyethylene packaging material, or poly tubing, which comes on a roll. Available in widths from $1\frac{1}{2}$ in. to 48 in., poly tubing can be purchased from packaging suppliers such as www.packagingsupplies.com.

To begin, first cut a strip of the tubing about 3 in. longer than the workpiece and tie off one end (see drawing, above). Place the workpiece in the tube and pump in steam from the open end. I use a steam cleaner for this job, which works great and is easy to set up. I wrap a rag around the steam nozzle and then secure the nozzle in the tube with another rag. The poly tube has held up fine for steaming sessions as long as one hour.

After steaming, remove the nozzle and rags, and then tie off the open end of the tube. Clamp the workpiece and tube in the bending form (see drawing, below). The tube helps retain the heat and moisture, so you have extra time to get everything in place. After tightening the clamps, cut away the exposed portions of the tube to allow for normal drying, typically about 24 hours.

—SAM CARPENTER, Farmington, N.M.



Quick Tip

My wife, a quilter, came to my aid recently when I had to transfer some complicated patterns to a piece of wood. She said to cut the pattern shapes from freezer paper. Freezer paper has a plastic coating on one side. If a paper pattern is placed coated side down on the wood, you can attach the paper simply by heating it with a warm iron (no steam). I gave it a try, and it worked like a charm.

—FREDERICK HOSTETTER,
Ottawa, Ont., Canada

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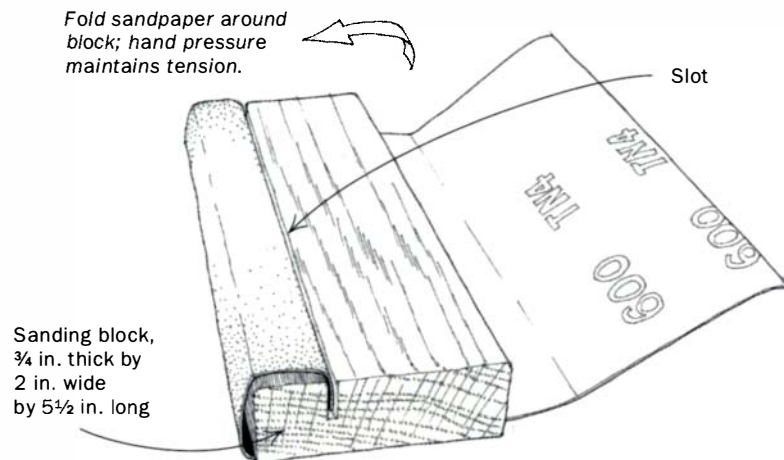
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Simple sanding block holds paper tightly

A sanding block is invaluable in the shop. But for me, the classic rectangular-shaped block has always lacked one refinement—a means to keep the sandpaper secure and taut while sanding. To solve this problem, I took a standard-sized block ($\frac{3}{4}$ in. thick by 2 in. wide by $5\frac{1}{2}$ in. long) and, using my tablesaw, made a single pass to cut a $\frac{3}{8}$ -in.-deep by $\frac{1}{8}$ -in.-wide slot about $\frac{1}{2}$ in. from one edge.

To use the block, cut a sheet of sandpaper to $5\frac{1}{2}$ in. wide and slip one edge into the slot (see drawing, right). Then, wrap the paper around the other side and cut it to a length that overlaps the slot. Once mounted, it takes only a little hand pressure to keep the paper securely in place.

—RICHARD MICHAEL, Lexington, Va.

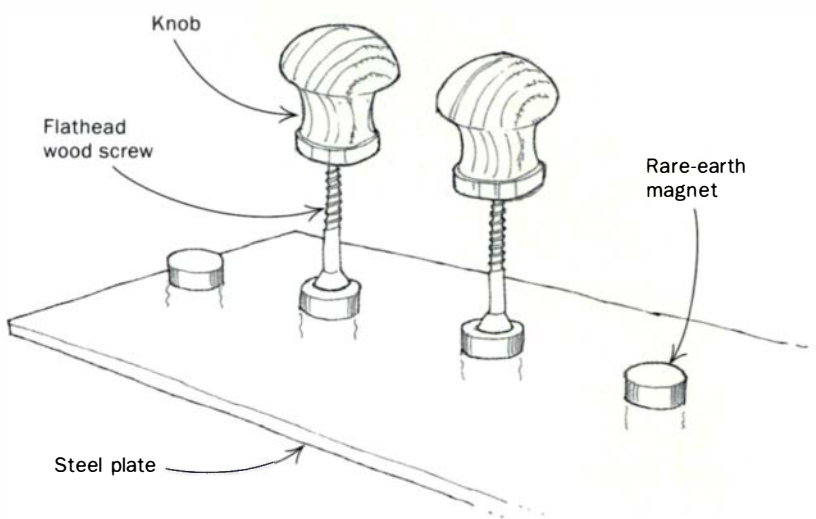


Magnets and screws make small parts easy to handle when finishing

Before applying finish to small wooden parts, like knobs or handles, I drill a small hole in the base of the part and insert a flathead wood screw a few turns. The screw need only be long enough to allow me to grasp it without touching the part.

Once I've applied the finish, I place a rare-earth magnet on the end of the screwhead, then place the magnet, screw, and finished part on a flat metal surface (see drawing, left). The magnet sticks firmly to both the metal surface and the screw, so I don't need to worry about the wood part tipping over before the finish dries.

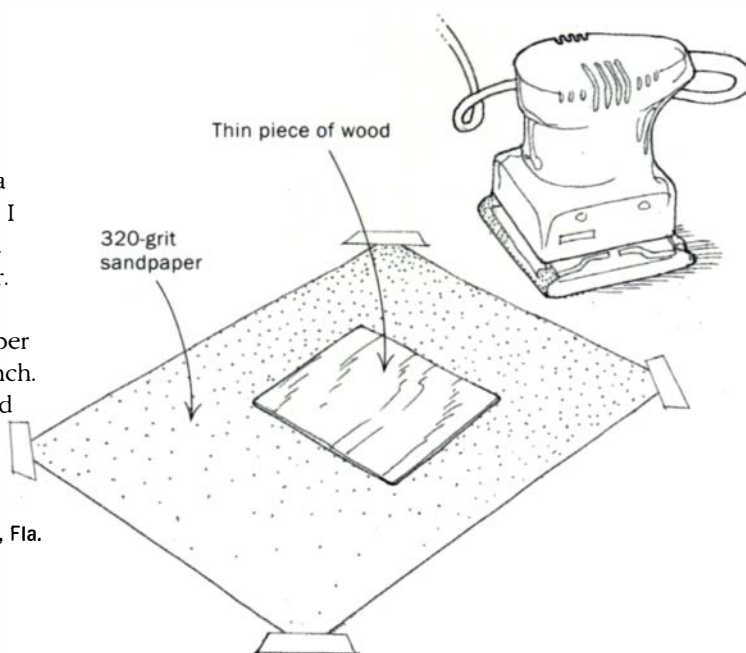
—MIKE WATSON, Sherwood Park, Ala.



Sandpaper makes handy sanding pad

When faced with sanding a small, thin, piece of wood, I find it helpful to lay it on a sheet of 320-grit sandpaper. A piece of masking tape at each corner of the sandpaper holds it securely to my bench. The grit bites into the wood just enough to keep the piece from shifting as you sand.

—RICH DILLON, Rockledge, Fla.



Quick Tip

If you can't justify buying a portable air compressor to run a pneumatic brad or finish nailer outside the shop, consider a portable air tank, the kind used to inflate flat tires. They aren't expensive, and once you attach a coil-type air hose and pressurize the tank, you can take it to your work site without much fuss. Granted, it's not going to provide air all day, but it will drive quite a few brads or small finish nails.

—MIKE BAKER, Hamilton, Mo.

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methods of work continued

Jig simplifies glue-up of large mitered frames

I bid on, and won, a job that included a dozen 4-ft.-high cabinet doors. The frames of the doors had mitered corners. It wasn't until somewhat later, when I had to build the doors, that it occurred to me I didn't know how to clamp miters on such a big door. Thankfully, this fixture I made solved the problem.

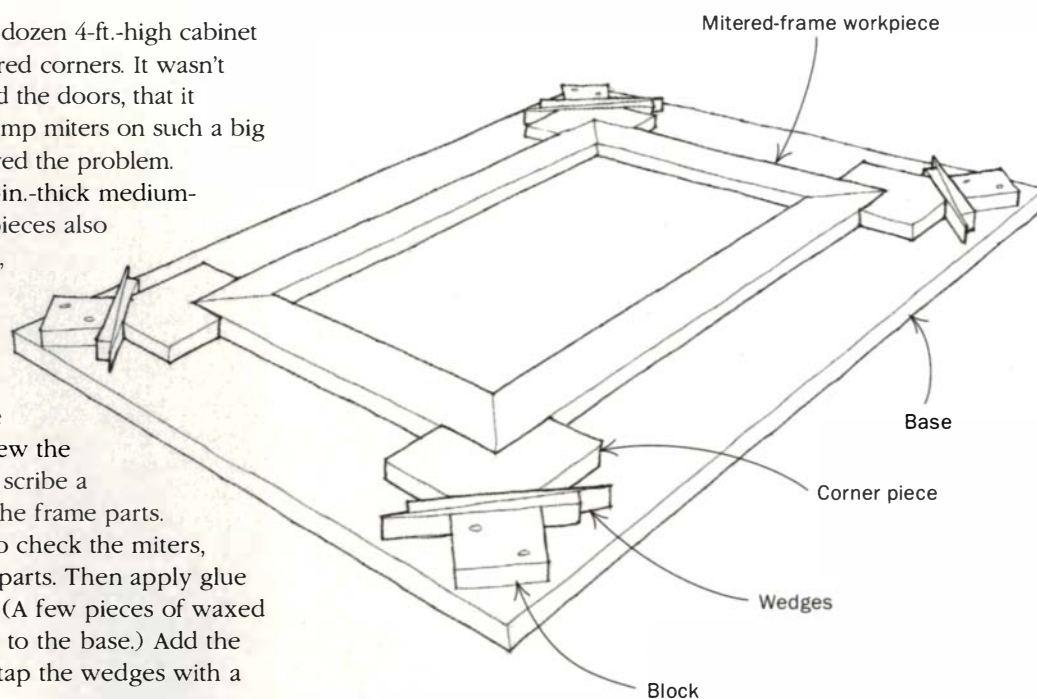
It uses a large, flat base made from $\frac{3}{4}$ -in.-thick medium-density fiberboard (MDF), four corner pieces also made from MDF, four hardwood blocks, and eight hardwood wedges to create the necessary clamping force.

Dry-fit the frame parts inside the layout lines, then lay in the corners.

Next, slip the wedges in place (with the thin ends opposing each other) and screw the four blocks to the base. Use a pencil to scribe a reference line around the perimeter of the frame parts.

To assemble the frame, dry-fit it first to check the miters, using the reference line to position the parts. Then apply glue and position the workpieces on the jig. (A few pieces of waxed paper will keep the frame from sticking to the base.) Add the corner pieces and wedges, then lightly tap the wedges with a hammer to provide the clamping force.

—DICK JOHNSON, Grand Junction, Colo.



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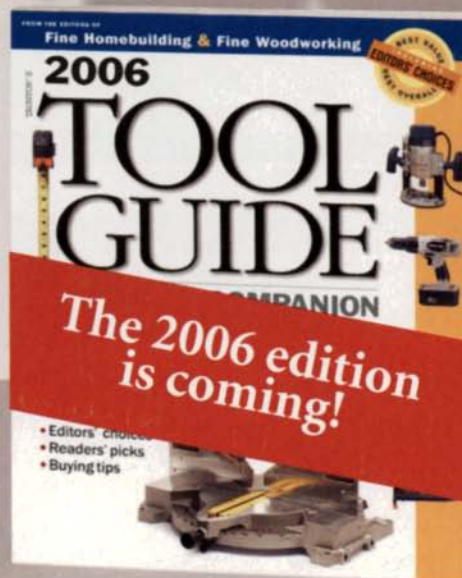
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Fine Woodworking honors clockmaker



Fluid form, movement. Borden's walnut table clock (above) has a rotating pendulum action. His cherry wall clock (right) is 7 ft. high, 5 ft. wide, and 18 in. deep, and has a rocking pendulum motion.

JAMES BORDEN WAS AWARDED the Best New Artist in Wood prize at the 2005 Philadelphia Furniture and Furnishings show held this past April. *Fine Woodworking*, the award's sponsor, honored Borden for his well-crafted sculptural wooden clocks.



"His work shows impeccable craftsmanship and original design," said Anatole Burkin, editor of *FWW*, who singled out Borden. The award includes a \$1,000 cash prize.

Borden came to woodworking via an indirect path. While studying humanities, he took a college trip to Europe and became fascinated with the renowned Glockenspiel, a tower clock

in Munich with 43 bells and mechanical figures driven by the clock's movement. After graduating, he began to study clock movements in earnest and experimented with his own designs. But he had doubts about clocks as a career choice, so he went back to school, this time to study theology. His interest in timepieces proved a stronger calling, and eventually he created his own niche of sculptural wooden clocks.

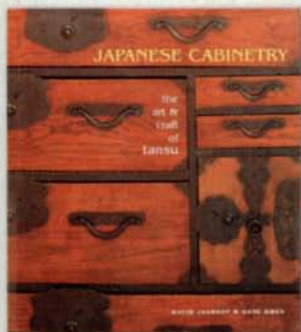
Borden's clocks, run by springs or weights, are made almost entirely from native midwestern hardwoods. Some will fit on a table, but the most dramatic are wall-

mounted or floor-standing models, some more than 20 ft. tall.

Borden works out of a restored 1880s barn in Zumbrota, Minn. Each timepiece takes several months to create. For more information, visit his Web site at www.timeshapes.com.



Book Review



Japanese Cabinetry: The Art & Craft of Tansu by David Jackson and Dane Owen. Gibbs Smith, www.gibbs-smith.com 2002. \$75 hardcover; 237 pp.

WHILE LIVING IN CALIFORNIA, I BECAME interested in a style of Japanese woodworking known as tansu. Examples range from steamer-trunk-sized cases containing drawers and sliding doors reinforced with decorative metalwork, to assemblies of cases, often arranged in stairstep formation, that can cover an entire wall.

Until now, reference material for woodworkers interested in tansu has been hard to find, but *Japanese Cabinetry* solves that

problem. This book ably covers the history, style, and construction of tansu furniture. It offers no how-to plans, but provides numerous joinery illustrations and well-photographed examples of tansu cabinetry. The breadth of design variations provides as much inspiration as information. Some pieces have an ornate, antiquated look, while others feel contemporary in their modular construction, asymmetry and clean lines.

—MICHAEL PEKOVICH, art director

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Modern art that floats

CONNECTICUT KAYAK

maker Nick Schade has seen one of his boats enter rare waters—the collection of the Museum of Modern Art in New York.

Officials accepted Schade's Night Heron kayak into the museum's design and architecture collection after it was donated by its owner late last year. Objects in the collection are examples of modern design chosen for their beauty and their creators' mastery of technical skill.

The craft took 300 to 350 hours to build. The primary wood came from two 20-ft. planks of fitchsawn western

red cedar, milled into 60 individual strips $\frac{3}{16}$ in. thick by $\frac{1}{16}$ in. wide. Secondary woods are maple and Alaskan yellow cedar. Schade molded



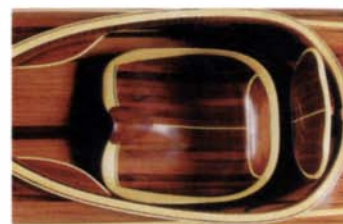
the strips into shape by hot-gluing them onto a row of forms. During that process, he edge-glued the

strips together with yellow glue, hand-beveling the joints as he went to achieve the curves of the hull and deck.

After planing and sanding, he strengthened and protected the surface with a layer of fiberglass cloth and epoxy resin, followed by varnish, which provides UV protection. The finished craft is 18 ft. long by 20 in. wide by 13 in. tall. It weighs 35 lb.

Schade's company, Guillemot Kayaks, sells plans for the Night Heron and several other kayaks. For information, see his Web site, www.guillemot-kayaks.com.

—Steve Scott, associate editor



Seaworthy sculpture. Nick Schade's kayak was inspired by traditional Inuit designs and classic mahogany runabout boats of the 1920s.



Guild starts its own shop to further charity work



A hive of activity. Use of the Greenville Woodworkers Guild's shop does not cost extra for members, who pay \$40 in annual dues.

FOR THE LAST YEAR AND A HALF, MEMBERS OF THE GREENVILLE Woodworkers Guild in Greenville, S.C., have been enjoying what some woodworking clubs would call a luxury—their own shop.

The facility is more than just a place to learn new skills or work on a personal project. Members say their private shop also helps them carry out a very public mission. The guild, which recently incorporated as a nonprofit organization, has worked for 25 years to help a local center for disabled children and other charities. Using the shop, outfitted with \$45,000 worth of tools, members have turned out chairs, bookcases, and computer tables for the center.

The shop occupies donated warehouse space refurbished by members. Membership fees, and individual and corporate contributions, helped defray costs. Guild officials say they hope the idea catches on. "We're just trying to further all the members' knowledge and help the community at the same time," said Darryl Roberson, the guild's communications director. "If we can do it, why can't other guilds around the United States do the same thing?"

—S.S.

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CLAMPING

Veritas panel clamps keep glue-ups flat

IT'S NOT ALWAYS EASY TO GET A FLAT PANEL. YOU have to alternate pipe clamps on either side of the panel and apply equal pressure to prevent bowing and twisting. These problems are exaggerated with large panels, which is why I decided to try the Veritas panel clamps to glue up the top for a 7-ft.-dia. dining table. The Veritas clamp consists of two clamping blocks: a fixed tailpiece and an adjustable head on a threaded screw. Both blocks are attached to serrated posts that fit into $\frac{3}{4}$ -in.-dia. holes. To use these clamps, you have to make wood battens that go above and below the panel. As the clamps are tightened, they produce inward tension in the battens, which keeps the panel flat and the boards aligned and minimizes the planing, scraping, and sanding needed to flatten the glued-up panels. I made 3-ft., 5-ft., and 8-ft. battens of $\frac{8}{4}$ maple. After milling the lumber to size, I drilled holes along the center of the battens. You can use tape, or several coats of polyurethane, to protect the battens from glue squeeze-out.

It's easy to center the clamping blocks on the edge of the workpiece, and I was able to apply sufficient pressure by hand-tightening the adjustable blocks. The battens are far more stable than my pipe clamps, which tend to tip over.

These clamps can be used to glue up panels from $\frac{5}{8}$ in. to 2 in. thick. They are available from Lee Valley Tools (800-871-8158; www.leevalley.com) for \$29.50 each, or \$27 each in a quantity of three or more.

—David Bedrosian is an electrical engineer who enjoys doing woodworking projects for friends and family in Waterloo, Ont., Canada.

Make your own battens. The Veritas panel clamp consists of two parts: a movable head on a threaded screw and a fixed tailpiece. Both fit into holes drilled in wood battens, which you make and cut to length depending upon your clamping needs.



SHOP SAFETY

A WASHABLE DUST MASK



The Dust Bee Gone nuisance dust mask attempts to dethrone those disposable masks that so many of us reach for when the air gets unhealthy. It looks and fits just like a surgeon's mask, with straps that adjust easily and are fastened behind the head and neck. A thin wire closes the nose area

tightly to prevent eyeglasses from fogging up. The layered fabric is soft and comfortable, rated to particles as small as 3 microns.

To clean the mask, simply wash it in warm, soapy water, rinse, and dry it by twirling it around your head like a lasso. The \$34.95 price tag might seem steep, but with proper care it will work much better and last longer than several boxes of disposable masks. It's available online at www.dustbeegone.com, or call 239-694-3627.

—MARK EDMUNDSON builds custom furniture at his shop in Sandpoint, Idaho.



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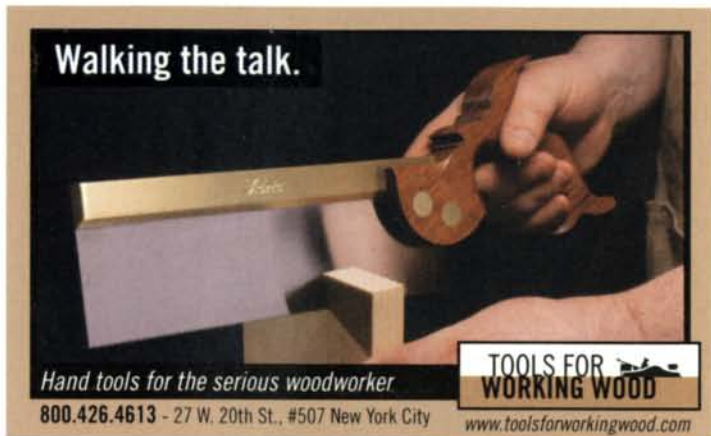
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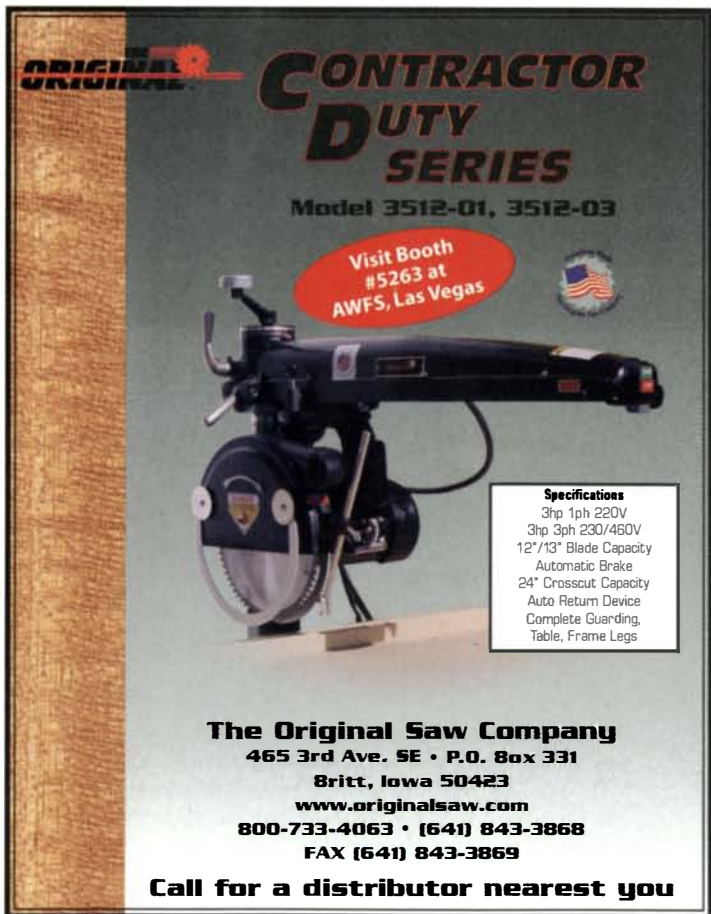
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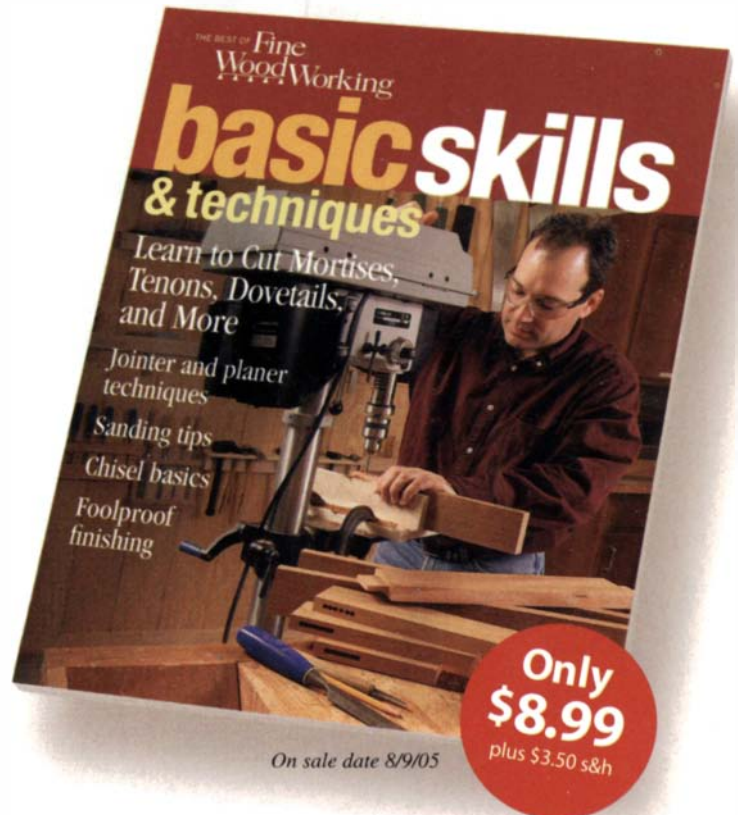
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■ POWER TOOLS

Festool router is a joy to use

ON ITS WEB SITE, FESTOOL PROMISES “NEAR-TOTAL dust extraction” from the new OF 1400 EQ router. They’re not exaggerating. Unlike other manufacturers who merely add some sort of suction port to their routers, Festool surrounds the bit on all sides. The primary dust-collection device is a removable, clear plastic extractor hood that encircles the bit from above; but for edge-routing applications, the manufacturer also provides a rotating chip catcher that clips into the bottom of the baseplate. All Festool tools are designed to use with an integrated vacuum system, but you can hook this router up to a standard shop vac.

The extractor hood works for cutters up to 1½ in. dia. I found both the extractor hood and the chip catcher remarkably effective at capturing fine dust.

Even if the Festool OF 1400 didn’t suck up dust so well, it still would be impressive because it offers many of the benefits of a medium-duty plunge router (running at just under 12 amps on a 120v circuit), without the clunkiness. It’s well-balanced, with an ergonomic trigger handle and an ingenious ratcheting spindle lock that makes for the easiest bit change of any router I’ve used. The depth-adjustment gauge reads in millimeters, rather than inches.

The Festool OF 1400 EQ router sells for \$395. To find a dealer near you, visit www.festoolusa.com.

—Tom O’Brien is a carpenter in New Milford, Conn., and a former associate editor at *Fine Homebuilding*.

■ SOFTWARE

CALCULATE WOOD MOVEMENT WITH YOUR PC

Wood Movement Master is a new software program for Windows-based PCs (it doesn’t work with Macintosh computers) that will predict wood movement from seasonal humidity changes. The calculations are based upon equilibrium moisture content (EMC) and regional climate information that the author obtained from the U.S. Forest Products Laboratories. With this software, you can accurately predict the range of movement in panels, doors, drawer fronts, and tabletops made from any of more than 500 species of wood in 91 climatic regions of the United States. The program is simple to use and is expandable.

Commercial shops shipping furniture to distant places can use the program to determine eventual wood sizes based upon conditions in that location. Novices can size panels and drawer fronts, as well as breadboard ends on tables, with confidence. The program works with either Imperial or metric measuring systems, and you can read the results in either decimal or fractional formats. It’s available for \$20, and can be downloaded directly from the source at www.woodmovementmaster.com.

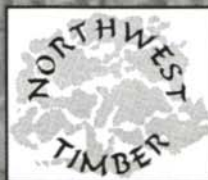
—LEE GRINDINGER is a carver and furniture maker (www.furniturecarver.com) in Livingston, Mont.

Calculate wood movement reliably. For this software program to work, you need only enter the pertinent data: type of wood, location, and current moisture content. It works better with readings taken by a moisture meter, but you also can use the program without one.

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■ VENEERING

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THE THIN AIR PRESS OPENS THE DOOR TO VACUUM VENEERING for the woodworker who can't afford the relatively high cost of a conventional compressor-driven vacuum press. This simple system, made by the Roarokit Skateboard Co., uses a vinyl bag with a one-way valve and a hand pump to draw a vacuum.

I used the press to veneer both flat and curved parts and was impressed with its simplicity and performance. I tried both the 13½-in. by 47-in. and the optional 26-in. by 28-in. bags.

The company claims that the pump will pull about 15 psi. I found that the vacuum held overnight, more than enough time for most glues to set.

The Thin Air Press is available from Woodcraft (www.woodcraft.com, or 800-225-1153) for \$55. Extra bags cost \$40. For more information, visit the manufacturer's Web site: www.roarokit.com.

—Anatole Burkin is the editor.



■ UPDATE

MILLER DOWELS AVAILABLE FOR EXTERIOR FURNITURE

John White, the *Fine Woodworking* shop manager, reviewed the Miller Dowel Company's new joinery system in *FWW* #173, p. 34. The system works with engineered, stepped dowels that fit into matching holes bored into both mating parts at once by specially made drill bits.

The company recently introduced six new species of dowels that are especially suited for outdoor projects: black locust, ipé, mahogany, purpleheart, teak, and white oak. Each is available in small and large sizes. For more information, call 866-966-3734 (toll-free in U.S.), or visit www.millerdowel.com.

—WILLIAM DUCKWORTH is a contributing editor.

■ SHOP SAFETY

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I've seen lots of gizmos come and go, so I was a bit dubious when I took home the Saw-Jaw, a device that wraps around a tablesaw blade and stabilizes it while you loosen or tighten the arbor nut. To my pleasant surprise, this product is a true innovation.

It's easy to clamp the Saw-Jaw around the blade (disconnect the power first). When you begin to loosen or tighten the nut, the handle lodges against the table. The handle adjusts to allow the Saw-Jaw to lock onto blades that have been resharpened, and the hole in the middle is large enough to allow you to remove or slip on a blade stabilizer. If you buy two or more, it also can serve as safe storage for your favorite blades. The Saw-Jaw costs \$16 (800-345-2396 or www.hartvilletool.com).

—ASA CHRISTIANA is managing editor.

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Wipe-On Finish Test

Many perform well,
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BY CHRIS A. MINICK

Like many amateur woodworkers, I rely on wipe-on finishes to bring out the best in my projects. These varnish/oil blends, known collectively as Danish oils, are a mixture of varnish resins, solvents, chemical driers, and linseed or tung oils. They give woodworkers the best of all worlds: easy application, quick drying time, and good protection.

However, while doing research for a recent article on oil finishes (see *FWW* #177, pp. 22-26), I became intrigued by the differences between pure-oil finishes and oil/varnish mixtures. The scientist in me took over, and I ended up doing a full-blown study of 17 wipe-on finishes. A few were outstanding and have found a permanent place in my finishing arsenal. Others will never see the inside of my shop again.

Selecting products, preparing samples

There are dozens of wipe-on finishes and I couldn't test them all, so I tried to get a representative sample. I included a water-based finish and both tung-oil and linseed-oil-based finishes in a price range of less than \$6 a quart to more than \$40 a quart. Wipe-on finishes typically fall somewhere between pure-oil finishes and brushed-on finishes in terms of build and protection. To represent these boundaries, I included Minwax Fast-Drying Polyurethane,



a widely available brushing varnish, and pure boiled linseed oil.

All the finishes were tested on 12-in. by 16-in. pieces of red-oak plywood cut from the same sheet. Each piece was sanded using a quarter-sheet pad sander equipped with P120-grit paper followed by hand-sanding with P180-grit paper. The sanding dust was vacuumed off, and three coats of each finish were applied to separate panels. I applied the first coat with a lint-free cloth, adding more finish as dry spots appeared. After 15 minutes, I wiped off the excess and allowed the panel to dry for 24 hours.

To see how each additional coat built the finish, I taped off a quarter of the panel and applied the second coat in the same way as the first, except this time it was wet-sanded with a gray Scotch-Brite pad that equates to about P220-grit sandpaper. Coat three was applied to half the panel and sanded in with a gold Scotch-Brite pad similar to P1000-grit sandpaper. I let the panels dry for two weeks before beginning the tests because by that time most oil-based finishes are 95% cured.

The first tests are ease of use and drying time

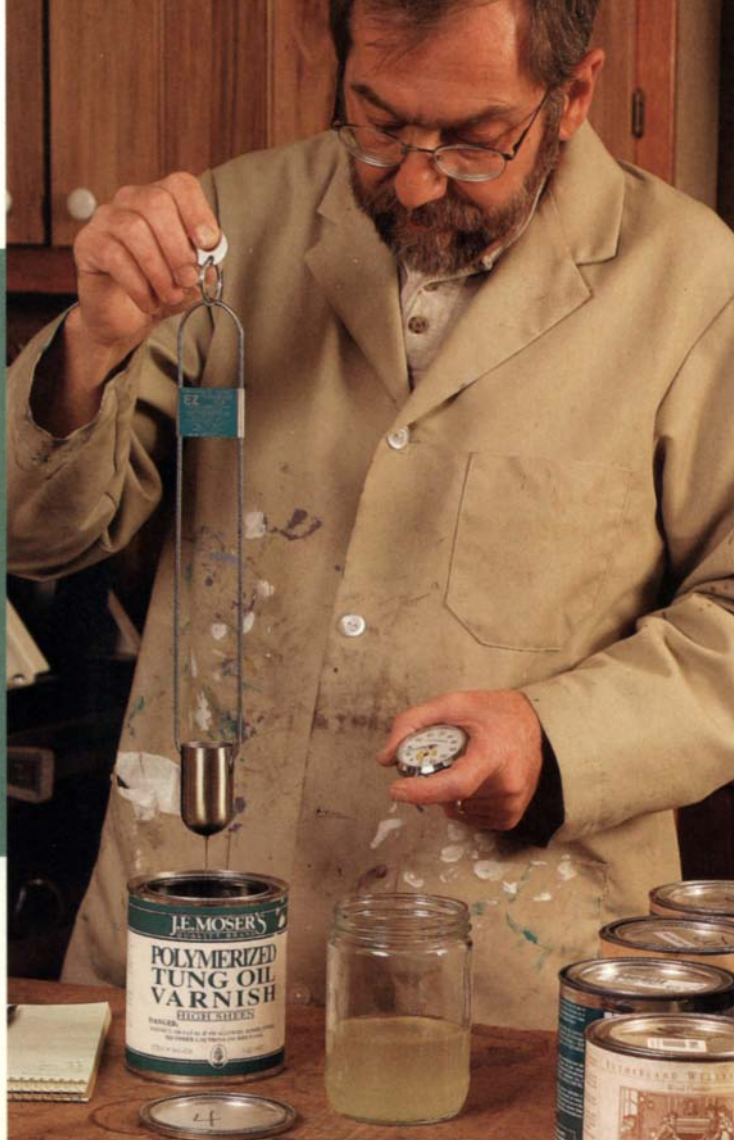
I wanted the tests to be as objective as possible. For ease of application, I tested the viscosity and the drying time of each finish. To determine beauty, I ranked the finishes by color from lightest to darkest, measured their sheen, and tested their ability to penetrate the wood. Finally, I tested each finish for solids content and the ability to protect the wood from water damage.

Most of the finishes were ideal for wiping. Exceptions included Sam Maloof's Poly/Oil Finish and Tried & True Varnish Oil, which were difficult to wipe on and off. I really had to work at it to apply an even coat of either. The water-based Hydrocote Danish Oil Finish applied easily enough, although I did feel a little weird smearing this white stuff over a nice piece of wood. However, wiping off the excess finish after a 15-minute soak was a real chore. It was downright glue-like. In fact, small pieces of my wiping cloth stuck to the finish and had to be removed with tweezers.

I was surprised by the drying speed of these finishes: Most dried in less than eight hours, meaning that a couple of coats could be applied in a day. Three others needed a full 24 hours to dry,

Is it easy to apply?

The viscosity, or thickness, of each finish was tested by measuring how fast it flowed out the hole in the bottom of a drip cup. A lower viscosity rating indicates the finish is easier to wipe on and off.

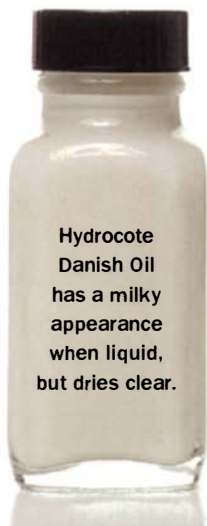


How fast will it dry?

Minick coated small glass plates with wet finish, then tested the samples every hour for 12 hours to measure the drying time. Short dry times are better. After that, the plates were checked every four hours. The finish was wet if it felt tacky or a finger dragged across the glass left a visible smudge.

Will it color the wood?

Color is a consideration when selecting a wipe-on finish. Medium or dark woods, like cherry or walnut, are very forgiving because the base color of the wood dominates. Not so for pale woods like maple, which takes on a pronounced amber tone when finished with one of the darker finishes.



Hydrocote Danish Oil has a milky appearance when liquid, but dries clear.

Hydrocote Danish Oil Finish



Watco Wipe-On Poly Finish



Minwax Fast-Drying Polyurethane Varnish



Minwax Wipe-On Poly



Watco Natural Danish Oil



Sam Maloof's Poly/Oil Finish



Sutherland Welles Tung Oil High Luster



Boiled Linseed Oil



Minwax Antique Oil Finish



Sutherland Welles Wiping Varnish High Luster



Tried & True Varnish Oil



J.E. Moser's Natural Danish Oil



Woodcraft Clear Urethane Oil Finish



General Finishes Seal-A-Cell/Arm-R-Seal



Waterlox Original High Gloss Finish



Waterlox Original Sealer/Finish



J.E. Moser's Polymerized Tung Oil

while even after 30 days, the Tried & True Varnish Oil was still wet.

Measuring color, gloss, and penetration

Because color is either a good or a bad thing depending on your point of view, I simply poured each finish into a glass jar and lined them up from lightest to darkest.

I measured the gloss of each finish in five different places on the panels, averaged the results, and recorded the gloss number. Then I used the standard industry table to convert that number to a sheen description. The results varied, from a dead-flat 3 for Hydrocote Danish Oil Finish to a semigloss 40 for Waterlox Original High Gloss Finish. For comparison purposes, the number for an unfinished red-oak panel was 3.

Directly measuring wood-penetration depth requires a laboratory full of sophisticated equipment, but a reasonable estimate can be made with a simple glass capillary tube. The higher a finish rises in the tube, the deeper it will penetrate wood, and the more it will highlight the grain.

Waterlox Original High Gloss Finish (0.745 in.) is a better choice than Sam Maloof's Poly/Oil Finish (0.430 in.) for popping subtle figure from a piece of wood. Conversely, J.E. Moser's Polymerized Tung Oil Varnish (0.439 in.) is a better choice than Minwax Antique Oil Finish (0.746 in.) for finishing blotch-prone woods like cherry (less penetration means less blotching).

More solids, fewer coats

In the finishing world, solids content refers to the amount of dry resin left on the wood after the solvent has evaporated. To measure the solids in each finish, a small amount was weighed, then dried in a laboratory convection oven. The weight of the dried sample was compared to the weight before drying and converted to a percentage.

With higher solids, you need fewer coats to get the desired look. But more is not always better. High solids often means higher viscosity (more difficult to apply) and lower penetration (less protection), so the solids content should be the deciding factor only when all other parameters are equal. I would select Watco Wipe-On Poly Finish at 29% solids over Sam Maloof's Poly/Oil Finish at 85% solids for a tabletop, because the Watco product penetrates more deeply and dries flat in four hours. In this case, while it will take more coats to get the desired sheen, the greater protection

Does it look good?

Appearance is a function of both sheen and penetration. A gloss meter was used to check the sheen produced by three coats of finish (right). The meter shines a light at a 60° angle to the surface and converts the volume of reflected light to a number. Next, a capillary tube was held in the finish for 15 seconds, and the distance the finish was drawn up the tube was measured with dial calipers (lower right). This is an indicator of how well the finish will penetrate wood.



Will it protect the wood?

To see how well each finish protected the wood, water was sprayed on each panel, and a steel bolt with its face freshly sanded was placed on the board. After drying overnight, the board was examined to see whether the wet steel had reacted with the tannic acid in the oak to form a blue-black stain.





Which wipe-on finish is the best?

All but two of these finishes fared well, yet the performance of Minwax's Wipe-On Poly was particularly impressive. The adage "You get what you pay for" doesn't apply here: At \$5.95 a quart, the best-overall choice is also the least expensive finish tested, which makes it the best value as well. The Waterlox Original High Gloss Finish was a close second. Two popular products, pure boiled linseed oil and Minwax Fast-Drying Polyurethane, a brushing finish, were included for comparison.

and a fast dry time are more important. To evaluate each finish's water resistance, I sprayed each finished piece with water and placed a large steel bolt on the wet panel. In the presence of water, iron reacts with the tannic acid in oak to form a blue/black stain. The next day, I removed the bolt and inspected the panels. Panels with no visible staining received an excellent rating; those with a slight mark were rated good; panels with a light blue discoloration rated fair, while those with a deep blue/black stain rated poor.

Finishes with a high oil content like Watco Natural Danish Oil or Tried & True Varnish Oil fared badly in this test, while finishes rich in resin, Minwax Wipe-On Poly or Waterlox Original High Gloss Finish, performed well.

The good, the bad, and the ugly

It was difficult to select a single winner from this field. All but two performed well,

Product	Contact
BOILED LINSEED OIL	Widely available
MINWAX FAST-DRYING POLYURETHANE VARNISH	Widely available
GENERAL FINISHES SEAL-A-CELL/ARM-R-SEAL*	www.woodcraft.com
HYDROCOTE DANISH OIL FINISH	www.highlandhardware.com
J.E. MOSER'S NATURAL DANISH OIL	www.woodworker.com
J.E. MOSER'S POLYMERIZED TUNG OIL VARNISH	www.woodworker.com
MINWAX ANTIQUE OIL FINISH	Widely available
  MINWAX WIPE-ON POLY	Widely available
SAM MALOOF'S POLY/OIL FINISH	www.rockler.com
SUTHERLAND WELLES TUNG OIL HIGH LUSTER	www.garrettwade.com
SUTHERLAND WELLES WIPING VARNISH HIGH LUSTER	www.garrettwade.com
TRIED & TRUE VARNISH OIL	www.woodcraft.com
WATCO NATURAL DANISH OIL	www.woodcraft.com
WATCO WIPE-ON POLY FINISH	www.woodcraft.com
WATERLOX ORIGINAL HIGH GLOSS FINISH	www.woodcraft.com
WATERLOX ORIGINAL SEALER/FINISH	www.woodcraft.com
WOODCRAFT CLEAR URETHANE OIL FINISH	www.woodcraft.com

*Seal-A-Cell used for first coat, Arm-R-Seal for second and third coats according to manufacturer's instructions.

but I was particularly impressed with the performance of Minwax Wipe-On Poly. After the test, I used it to finish a walnut and figured maple dining-room set I had just completed. Apparently the adage "You get what you pay for" doesn't apply to wipe-on finishes: At \$41.95 a quart, Sutherland Welles Wiping Varnish is seven times more expensive than the \$5.95 Minwax Wipe-On Poly, but the Minwax product performs better.

Choosing the worst performer was much easier: Tried & True Varnish Oil is hard

to apply, hardly penetrates the wood, has no sheen, is expensive, and—worst of all—doesn't dry.

Hydrocote Danish Oil walks away with the ugly award. The oak panel finished with this product had a bleached-out appearance. In fact, the unfinished oak panels that I used for the tests looked better than the ones finished with Hydrocote Danish Oil. □

Chris A. Minick is a consulting editor on finishing for Fine Woodworking.



Viscosity (seconds)	Dry time (hours)	Color (1 = lightest)	Sheen	Penetration (capillary tube)	Measured solids	Water resistance	Cost per quart
30	24	8	Flat	0.695 in.	100%	Poor	\$7.95
35	2	3	Semigloss	0.734 in.	39%	Excellent	\$6.27
20	2	14	Low-gloss	0.624 in.	39%	Fair	\$15.50
40	24	1	Flat	0.509 in.	66%	Poor	\$12.99
18	9	12	Satin	0.583 in.	56%	Excellent	\$11.49
87	3	17	Low-gloss	0.439 in.	42%	Fair	\$14.99
18	5	9	Low-gloss	0.746 in.	37%	Poor	\$8.49
18	3	4	Satin	0.632 in.	32%	Excellent	\$5.95
45	24	6	Flat	0.430 in.	85%	Good	\$15.99
22	3	7	Low-gloss	0.759 in.	51%	Good	\$41.20
28	3	10	Satin	0.592 in.	52%	Good	\$41.95
264	> 30 days	11	Flat	0.348 in.	100%	Poor	\$24.99
16	12	5	Flat	0.548 in.	42%	Poor	\$12.50
17	4	2	Satin	0.663 in.	29%	Good	\$13.99
21	3	15	Semigloss	0.745 in.	43%	Excellent	\$22.99
18	3	16	Low-gloss	0.684 in.	29%	Good	\$17.99
18	4	13	Satin	0.678 in.	38%	Good	\$15.99



Coffee Table

Puts Joinery on Display



BEVELED
THROUGH-TENONS

GRIDWORK
STRETCHER

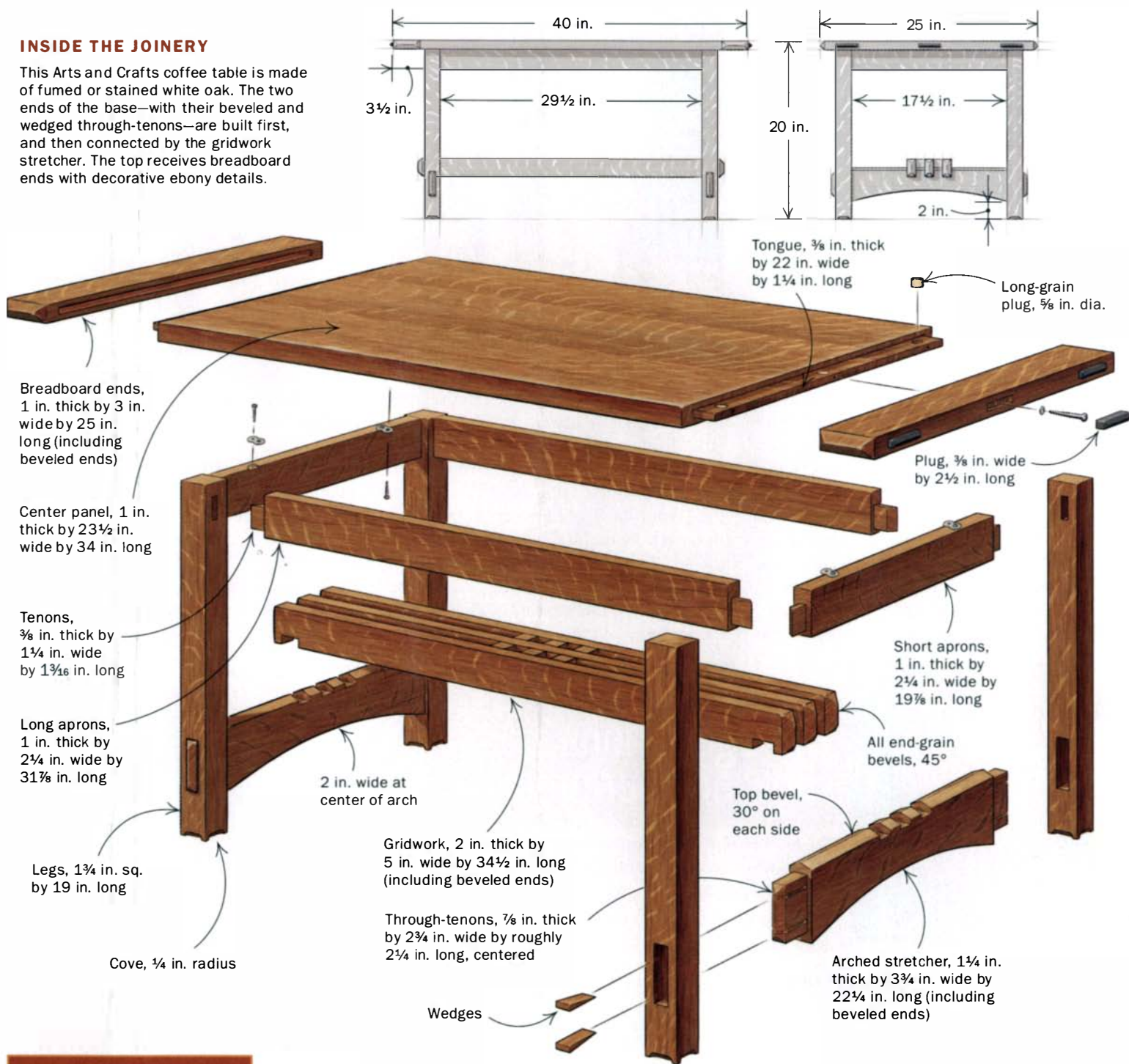
Harmonious
details will
work in tables
of many sizes

BY KEVIN RODEL

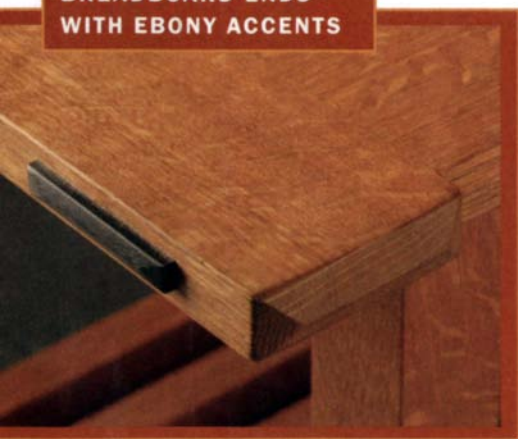


INSIDE THE JOINERY

This Arts and Crafts coffee table is made of fumed or stained white oak. The two ends of the base—with their beveled and wedged through-tenons—are built first, and then connected by the gridwork stretcher. The top receives breadboard ends with decorative ebony details.



BREADBOARD ENDS WITH EBONY ACCENTS



Arts and Crafts style is noteworthy for taking joinery—the product of the craftsman's hand—and elevating it to the level of artistic decoration. The basis of this table design is four decorative joints: through-tenons, gridwork, half-lap joints, and breadboard ends. These design elements will work beautifully together in tables of almost any size.

Although the project detailed here is a coffee table, the techniques are the same for all of the tables illustrated on p. 45. I usually build the base first. Start by milling

the leg stock to the required square dimensions, and then cut it to length.

Cut mortises before tenons

A rule of thumb is to cut mortises before cutting and fitting tenons. Lay out the mortises in the legs. The aprons are joined to the upper portion of each leg with stopped mortises, which intersect inside the leg. Keep in mind that the leg and apron junction is not flush; the apron is set back from the outside face of the leg, so lay out the mortises accordingly. I recommend a ¾-in.

shoulder at the top of each mortise to keep the end grain from splitting, but only a ¼-in. shoulder is necessary at the bottom. Make the tenon ⅜ in. thick. All of these apron mortises can be done with the same machine setup, whether you are using a mortising machine or a plunge router.

The through-tenons at the lower end of each leg are thicker because they also function as a decorative detail. Note that the ends of the tenons are both beveled and wedged, in that order. Make each through-tenon about half the thickness of the leg stock and, of course, centered. That means a ⅞-in.-thick tenon for the 1¾-in.-thick leg on the coffee table. There is no need for a variety of cutting bits to make large mortises for these through-tenons. I make two cuts with a ½-in.-dia. bit, referencing off opposite sides of the leg, which guarantees the mortise is centered. When cutting a through-mortise, set the stops to cut a little more than halfway through the leg, and then turn the workpiece around and finish cutting from the opposite face.

Because the tenon will receive two



wedges when assembled, the mortise must be flared slightly toward its outer, visible face. To flare the mortise, simply add an extra ⅛ in. when laying out the upper and lower ends of the outer face. Then follow the layout lines when mortising halfway through from each side. Don't worry about the small step created inside each end of the mortise. The tenon will be made to fit snugly into the shorter inside length of the mortise, and the wedges will flare the

TIP Detailing the bottom of each leg is easier if done before assembling the legs and stretchers.

tenon at the top and bottom to close the gap and leave a neat-looking joint.

A final, optional design detail is the small coves I add to the bottom of each leg. They can be cut most easily on a router table, with a bearing-guided ¼-in.-radius cove bit, but you also can use a laminate trimmer and a steady hand.

With the legs complete, make up the apron parts and tenon the ends. The tenons will intersect within the mortises, so cut the ends at a 45° angle.

On the arched stretchers, complete the joinery first

The most labor-intensive pieces in this design are the arched stretchers in the table base. The key is to complete the joinery before doing anything else.

When cutting the stock to length, remember that the through-tenons will protrude

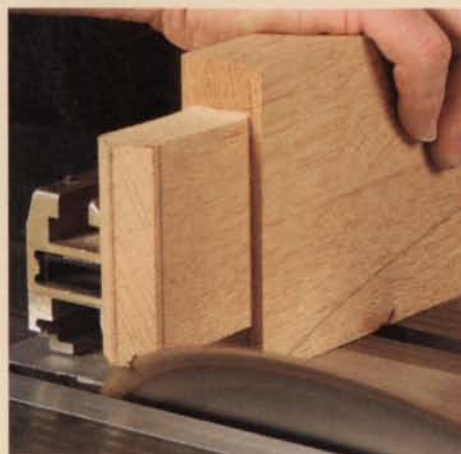


Through-tenons show off your precision

The beveled ends of the tenons mirror the bevels on the gridwork stretcher and breadboard ends. The outer portion of the mortise is the most critical: Be sure that its thickness fits the through-tenon exactly and that there is extra width to allow for the wedging action.



Dry-fit the joint and mark for the bevel cuts. Use a sharp pencil. Note that the mortise is slightly wider on the outside of the leg to accommodate the wedging action.



Bevel the tenons on the tablesaw. Undercut the bevels by about ⅛ in. Trim them to fit with a file and a sanding block.



Prepare the tenons for the wedges. Use the bandsaw to cut a kerf at each end, and drill holes at the bottom of the kerfs to keep the workpiece from splitting.

$\frac{3}{8}$ in. beyond the legs. It is critical that a through-tenon fits snug in the mortise—not so tight that you need to force it in with a mallet, nor so loose that the joint will fall apart from its own weight. When satisfied with the fit, dry-assemble the joint and use a sharp pencil to mark around the tenon where it protrudes through the leg. This line will help you set up the tablesaw for cutting the bevels on the tenon ends. Use a good crosscut blade and don't cut right up to this line; leave $\frac{1}{16}$ in. or so between the cut and the pencil line. Now scrape, file, or sand the exposed end of the tenon. When the base is assembled, the beveled end should appear to grow right from the surface of the leg.

Before assembling the table base,

bandsaw two kerfs in each tenon—almost down to the shoulder—to receive the wedges. Locate these kerfs about $\frac{3}{8}$ in. from the ends, and drill holes at the bottoms to keep the piece from splitting.

Notch the arched stretchers for the gridwork—With the through-tenons complete, notch the arched stretchers for the half-lap joints to hold the gridwork. The half laps are not going to be flush; half of the thickness of the gridwork sits atop the arched stretchers. Therefore, the depth of the notches in the arched stretchers as well as those in the underside of the gridwork should be a quarter of the thickness of the gridwork. Each member of the gridwork is 1 in. wide and spaced 1 in. apart, di-

mensions which determine the width and spacing of the notches.

I cut the notches in a series of passes with a fine crosscut blade on the tablesaw, using a crosscut sled and working to the layout lines. In keeping with the beveled look used throughout the piece, I also bevel the top edge of the arched stretchers 30° on each side, so it comes to a point.

To make the arch, use a shopmade template of $\frac{1}{4}$ -in.-thick material several inches longer than the stretcher. Lay out, cut, and smooth a curve that is pleasing to your eye. Use the template to lay out the stretchers, and bandsaw them close to the line. Then attach the template to each stretcher with double-sided tape and use a bearing-guided, flush-cutting router bit to smooth the arch.



Before assembly, notch the stretchers. Use the tablesaw to notch the arched stretchers for the gridwork. For uniform results use the same fence and stop setup for the two outside notches.

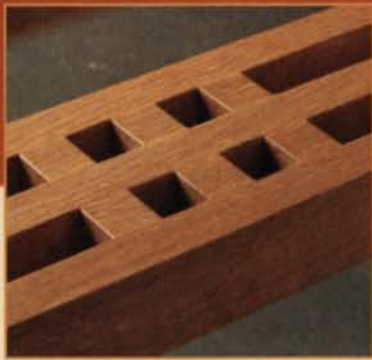
Assemble the ends of the base

At this point, finish sanding all of the parts made so far and assemble the ends of the table base. Before glue-up, make



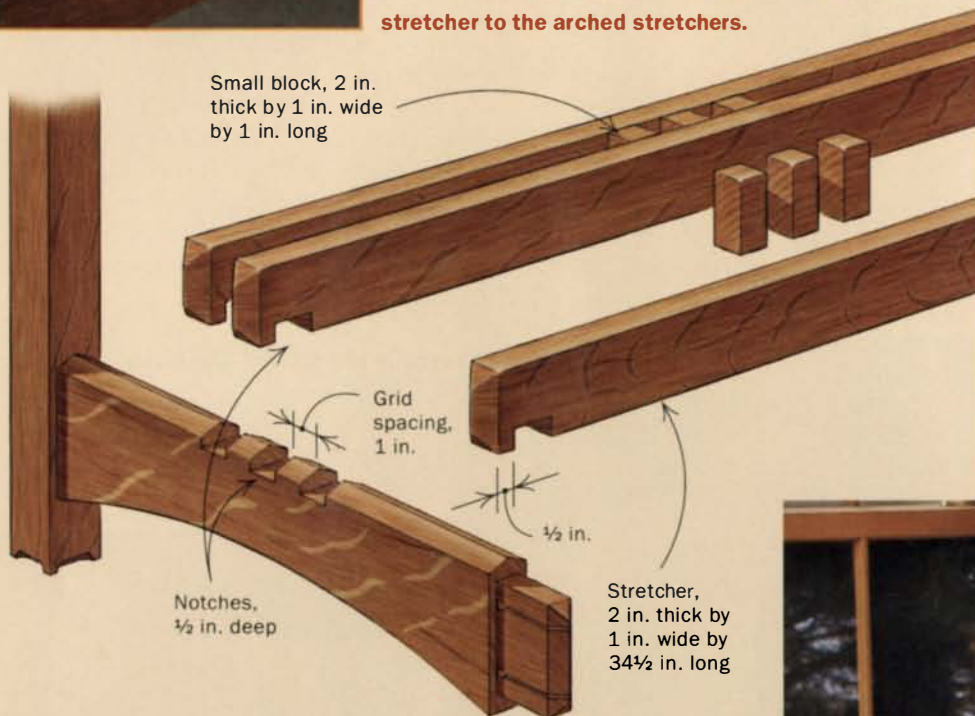
Drive and trim the wedges. During glue-up, drive in the two wedges evenly (top) to ensure proper assembly. After the glue has set, use a chisel to trim the wedges flush with the beveled ends (bottom). Use sandpaper to clean up the surface, including any glue residue.





Gridwork looks harder than it is

The gridwork introduces another geometric element to the angular feel of this design. Like the other end-grain areas of the table, the ends of the gridwork are beveled. Half-lap joints connect the gridwork stretcher to the arched stretchers.



two wedges for each through-tenon. The wedges should be thick enough to fill the ¼-in. gap at each end of the mortise before they bottom out in the sawkerf.

When gluing the through-mortises and -tenons, I have found it best to apply glue on the tenon only. Spread the glue so that it does not get onto the exposed end and also leaves bare the inner third of the cheek, next to the shoulder. As you seat the tenon in the mortise, the glue will spread backward and cover the entire tenon surface, ideally without oozing out at the shoulder. Never apply glue in a through-mortise; it only will push out onto the tenon end and the leg, leaving a mess that is hard to clean up and that might interfere with the finish.

Glue-up of this subassembly should be organized and quick. As soon as the two legs, apron, and arched stretcher are in clamps and checked for square—but before the glue has set—apply a small



Fit the pieces to the notches. When milling the pieces for the gridwork, test-fit them in the half-lap notches in the arched stretchers.

The gridwork is simply blocks and butt joints. To make the glue-up manageable, start by joining just two of the long grid parts with three small blocks. Place waxed paper under the assembly and press it down as you clamp it. After the glue has begun to set, add the last stick and blocks to the assembly.



amount of glue to the ends of the wedges and drive them into the sawkerfs with a small hammer. Do one tenon and then the other, but alternate hammer blows to the wedges of any one tenon so that both wedges go in equally. Saw off most of the excess with a dovetail saw and then pare the surface clean with a chisel.

Build and attach the gridwork

With each end of the table base complete, dry-fit the entire base using the long apron members. Be sure that the tenons in the apron don't hit each other inside the legs.

Now it's time to decide exactly how long to make the gridwork. It should protrude at least 1 in. beyond the arched stretchers; otherwise, the half-lap joints may be weak. Once you have settled on the length, mill three pieces of stock to the required width—1 in.—but leave them about $\frac{1}{4}$ in. thicker than the final dimension and

at least 3 in. longer. Test-fit these pieces in the half-lap notches you cut earlier in the arched stretchers.

From the excess length, cut off enough 1-in.-long blocks to form the grid, leaving a few extra as temporary spacers. Now cut the three long pieces to their exact length and bevel the ends on the tablesaw just as you did the ends of the through-tenons. Be sure to keep these three pieces the same length. Then, on a flat surface, clamp them together, ends square. Find the centerline and use a sharp pencil to lay out the grid.

The gridwork appears complicated but is actually built with simple butt joints between the long and short pieces.

Dry-fit the gridwork to lay out its notches—When the gridwork is assembled and glue is set, send the assembly through the planer on each side, taking light cuts to bring it down to final thickness and to level out any inconsistencies in the grid. Now place the assembly on the base and fit it into the half-lap notches. With a knife, scribe the location of the half laps to be cut into the underside of the gridwork. At this point, the extra 1-in. spacer blocks

come into play. Tape or hold them in place several inches away from each end to keep the parts from flexing while you cut the half-lap notches on the tablesaw.

To finish assembling the table base, first glue and clamp the end assemblies to the remaining apron members, and then attach the gridwork. Rather than trusting glue alone to secure the half-lap joints, I like the additional security of screwing these members together from below.

Make the breadboard ends

With the top panel glued up and surfaced, you are ready to make the breadboard joints. Consider the anatomy of the breadboard ends (see illustration, p. 44) when cutting the top to length, remembering to allow for the two tongues. I make the breadboard tongues $1\frac{1}{4}$ in. long.

Now, scribe the shoulder line for the tongue around all sides. I attach the finished breadboard with screws driven through its edges into the end grain of the tabletop. However, a screw in end grain does not provide the strongest joint without some modification, so before cutting the tongue, I glue wood plugs into the end grain to give the screws some long

TIP A combination square will ensure that the gridwork remains square during glue-up.



Mark the gridwork for its lap joints. After lightly planing the whole assembly, set it in the stretcher notches and scribe its mating half-lap joints.



Notch the gridwork on the tablesaw. Insert filler blocks between the long parts of the grid to keep them from flexing during the process.

Cap off the top with breadboard ends

The beveled end grain echoes the overall theme, as do the beveled ebony plugs that hide the screws.

Ebony plug,
2¼ in. wide

Elongated
screw hole

Long-grain
plug

Standard
screw hole

Mortise for
tongue

TIP Plugs driven into the ends of the tabletop provide a better grip for the screws than end grain.

Fit the ends over the tabletop tongue. Mortise the breadboards first, then cut and fit the tongues.

Cap the screw holes with ebony plugs. Elongate the two screw holes at the ends of the breadboard to allow the tabletop to shrink and expand.

grain to bite into. While the plugs are drying, make up the breadboards. In keeping with the overall aesthetics of the piece, I purposely make the breadboards longer than the table width and bevel their end grain to match the ends of the through-tenons in the base. Be sure that the length of the breadboards is sufficient to withstand seasonal wood movement; they should remain a little longer than the width of the tabletop, even when it expands due to humidity.

Center the long mortise in the breadboard and cut it a little deeper than the 1¼-in.-long tongue will be. Stop this slot about 1 in. from each end. The center of each breadboard is attached with a screw and glue, while the end screws pass through slotted holes and are used without glue.

On the opposite edge of each breadboard, where the ebony plugs will be located, make ¼-in.-deep slots, ⅜ in. wide, squaring the ends with a chisel. Use a drill press to drill clearance holes through the center of these shallow slots. Elongate the outside holes to allow for wood movement.

Now, back to the tongue. Using a plunge router and a breadboard-end jig, cut the tongue to its ⅜ in. thickness (this jig is described in Scott Gibson's article on sofa tables in *FWW* #162, p. 78). Trim the ends of each tongue to allow for seasonal expansion, and dry-fit the breadboard to be sure of a snug fit.

Next, insert an awl through the screw holes to mark on the tongue's end grain where the screws will enter. If you did everything right, these points will line up

with the hardwood plugs in the tongue. Remove the breadboard, drill pilot holes for the screws, add glue to the center few inches of the joint only, reattach the breadboard, and drive all of the screws.

Finally, make up some ebony (or any other dark wood) plugs to cover the slots and screw heads. After finish-sanding or scraping the top, attach it to the base. If you use white oak for this project, as I have, and you wish to darken it with ammonia fumes, see my article on the process in *FWW* #126, pp. 46-49. I finish all of my work with Tried & True linseed-oil finishes, which have a tone that warms up the cool color of fumed white oak. □

Kevin Rodel builds Arts and Crafts furniture in Pownal, Maine.

One design, many tables

My goal as a furniture maker always has been to develop a design vocabulary, which in turn would allow me to create a line of furniture incorporating pieces that work well together

END TABLE/ NIGHTSTAND

20 in. sq.
by 27 in. tall

Apron,
2½ in. wide

Gridwork,
1¼ in. thick

Corner,
¼ in. sq.

Strip,
⅝ in.
wide

Leg, 1½ in. sq.

Arched stretcher,
3½ in. wide

Base,
17½ in. sq.

**THE END TABLE
GETS A SIMPLE INLAY**
Breadboards would be overkill for this small tabletop. The ebony inlay echoes the ebony plugs in the other table.

SOFA/HALL TABLE

20 in. deep by 60 in.
long by 30 in. tall

Breadboard end,
3½ in. wide

Apron,
3 in. wide

Arched stretcher,
4½ in. wide

Gridwork,
1½ in. thick

Leg, 1½ in. sq.

48 in.

17½ in.

DINING TABLE

42 in. deep by 72 in.
long by 30 in. tall

Apron,
3 in. wide

Breadboard
end, 4 in. wide

Arched stretcher,
5 in. wide

Gridwork,
1½ in. thick

Leg, 2¾ in. sq.

30½ in.

44½ in.

The coffee table and end table work well together.
Both share the same design details.

and seem to come from a single maker. This table design is no exception. By changing the dimensions of the stock, you can build similar tables: coffee table, end table/nightstand, sofa/hall table, or dining table. Combining these pieces in a home will unify the decor. The pieces are similar enough to create a nice theme, but they're different enough to avoid the feeling of boring repetition.

One key difference is the tabletops: A simple inlay is enough for the top of the end table, while the dining table has a tile inlay. Of course, for these designs to work visually, the thicknesses of some elements must be adjusted appropriately.

— K. R.



A Better Tapering Jig

Adjustability, safety, and ease of use are key elements of this shopmade sled



BY RICHARD W. BEEBE II

I build a lot of Shaker-style furniture, and many of the pieces have tapered legs. There are numerous ways to taper a leg, and I tried them all before concluding that my preferred method is to use a tablesaw to cut off most of the waste, and a jointer to make a light pass to clean up the surface of the sawcut. I tried one commercially available jig made of aluminum, but it felt terribly unsafe because it did not hold the workpiece firmly in place while I made the cut. So I set about making my own tapering jig.

The design shown here is the third generation of my attempts to make a jig that's easy and safe to use. I made the base of

Cut this end at approximately 75° for clearance.

Handle, 3/4 in. thick by 3 3/4 in. wide by 12 1/4 in. long, glued and screwed to the plywood base from underneath

Half-round scrap of MDF glued to the handle helps keep fingers away from the blade.

1/4-in.-thick plywood, reasoning that a thinner base would allow the sawblade to cut through thicker stock. For all but the thickest legs, however, a 1/2-in.-thick base would make a sturdier jig. I screwed a strip of UHMW (ultra-high molecular weight) plastic to the underside of the base so that the jig can ride in the miter-gauge slot with as little friction as possible.

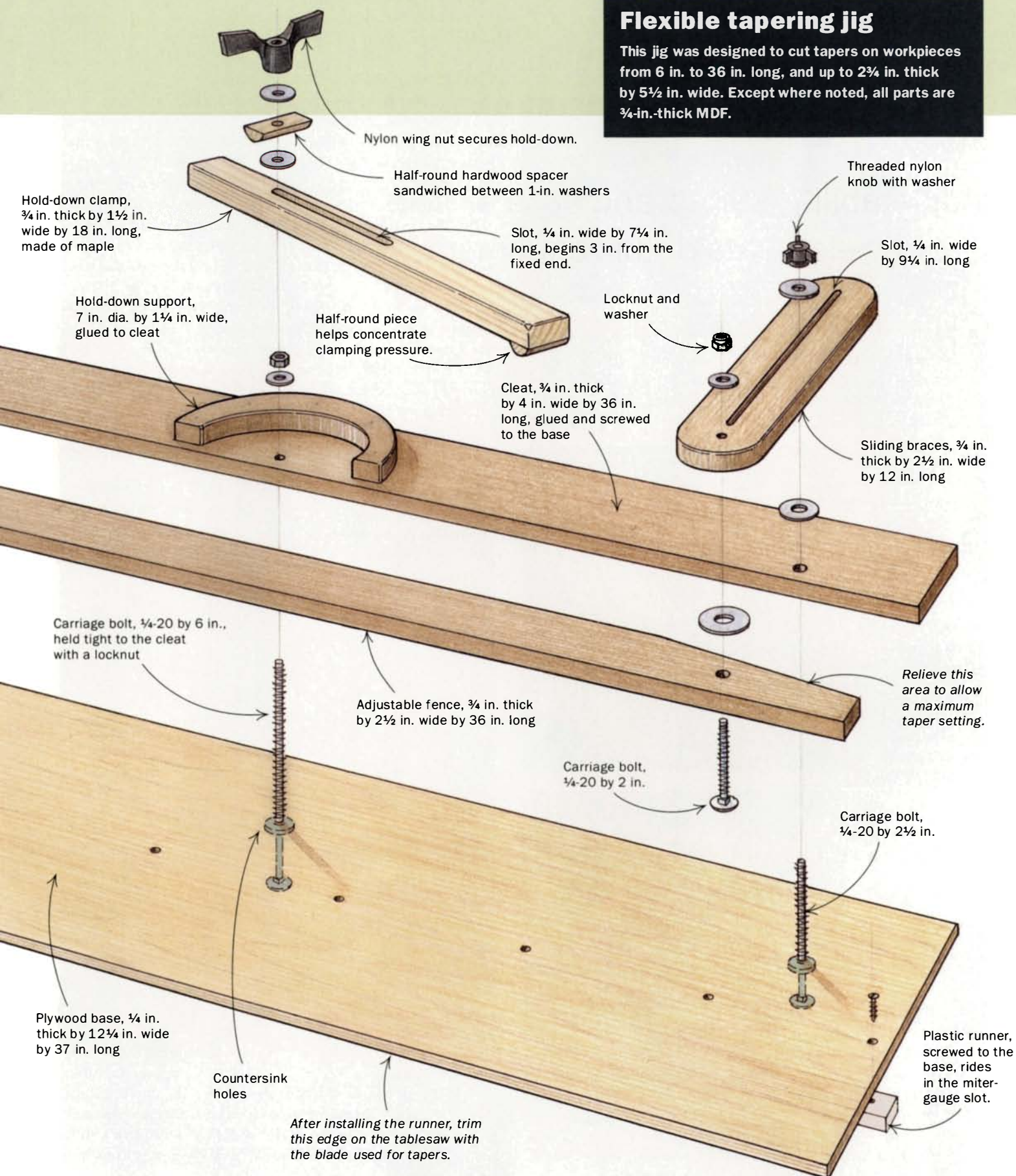
I used 3/4-in.-thick medium-density fiberboard (MDF) for the fence, the cleat, the handle, the hold-down support, and the sliding braces because it's flat and stable, and it machines well. I used a scrap of maple for the hold-down clamp because it's stiff and strong. The clamp applies pressure wherever

finewoodworking.com

Visit our Web site to see the author demonstrate his tapering jig.

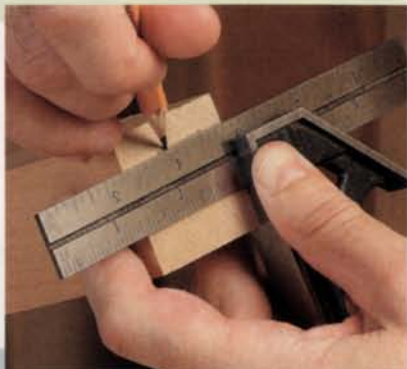
Flexible tapering jig

This jig was designed to cut tapers on workpieces from 6 in. to 36 in. long, and up to 2½ in. thick by 5½ in. wide. Except where noted, all parts are ¾-in.-thick MDF.



Cutting two-sided tapers

Many furniture designs feature legs that are tapered on the two interior faces. When using the tapering jig, it's important to cut these tapers in the proper order (see drawing, below right).



1

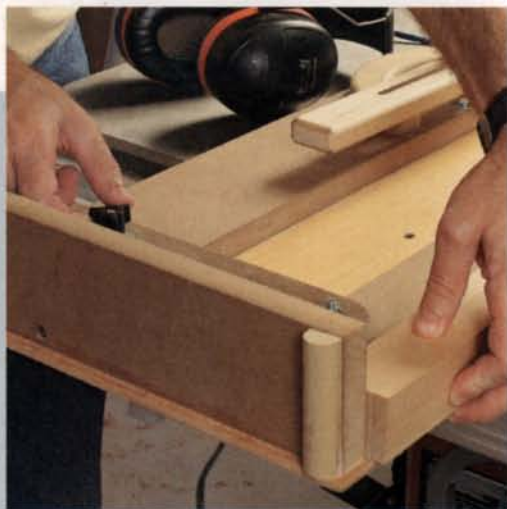
MARK THE TAPERS

Scribe where the tapers begin and end, first on the faces of the leg (left), then on the bottom of the leg (right).

2

POSITION THE WORKPIECE IN THE JIG

Line up the layout mark on the bottom of the leg with the edge of the jig's base (top), then lock down the sliding brace. Next, adjust the top end of the fence until the layout mark on the leg face aligns with the blade (bottom). Now lock down the top sliding brace.



needed, on any size workpiece that will fit on the jig. The sliding braces and the hold-down clamp are held in place with threaded knobs and carriage bolts. The adjustable fence is secured to the braces with carriage bolts and nylon locknuts.

Mark pencil lines to define the tapers

Before tapering the legs for a project, I always cut all of the mortises first because it's easier to do on square stock. For two-sided tapers, the mortises help me keep track of which sides of the legs will be tapered.

Using a pencil, mark the apron line, indicating where the taper starts on the leg, and then mark a line on the bottom of that same leg to define where the taper ends and how much material must be removed. Use those two lines to set up the jig, lining them up with the edge of the jig that will ride against the sawblade. Set the fence in place and clamp the leg firmly onto the jig.

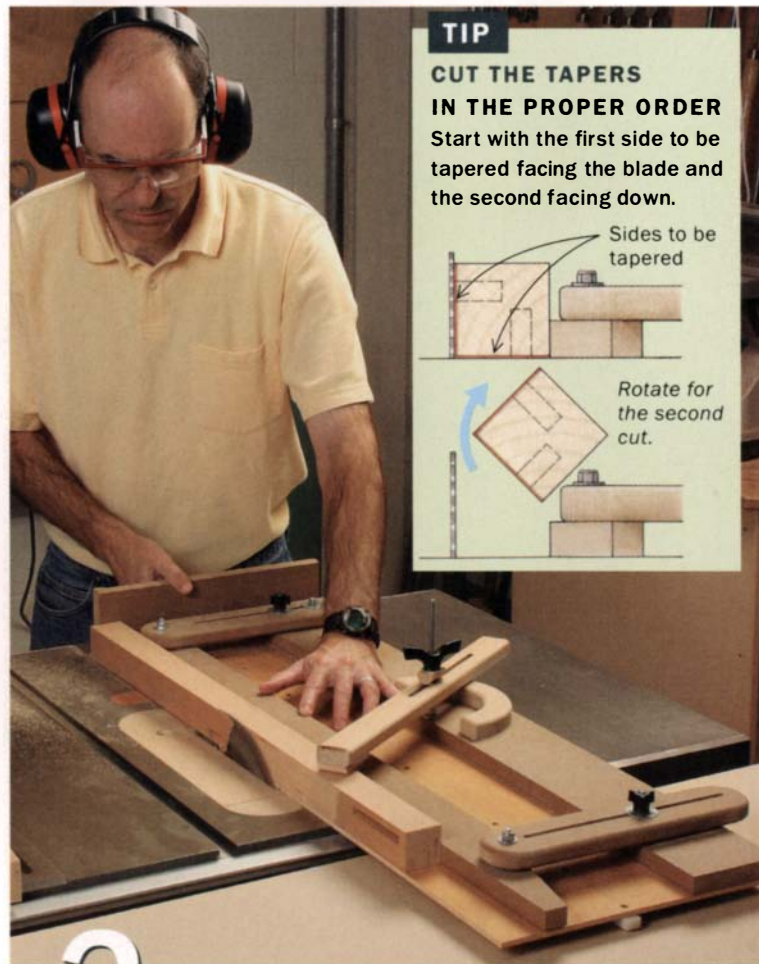
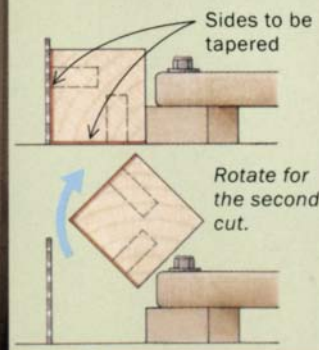
Two-sided tapers are cut on the inside faces of each leg, which already have been mortised for the aprons. To prepare for the first cut, set up the leg in the jig with one of the mortises facing down. Make the first cut, unclamp and rotate the leg, clamp it back in place for the second cut, and then taper the second side.

To cut tapers on all four sides of a leg, I use a center-point attach-

TIP

CUT THE TAPERS IN THE PROPER ORDER

Start with the first side to be tapered facing the blade and the second facing down.



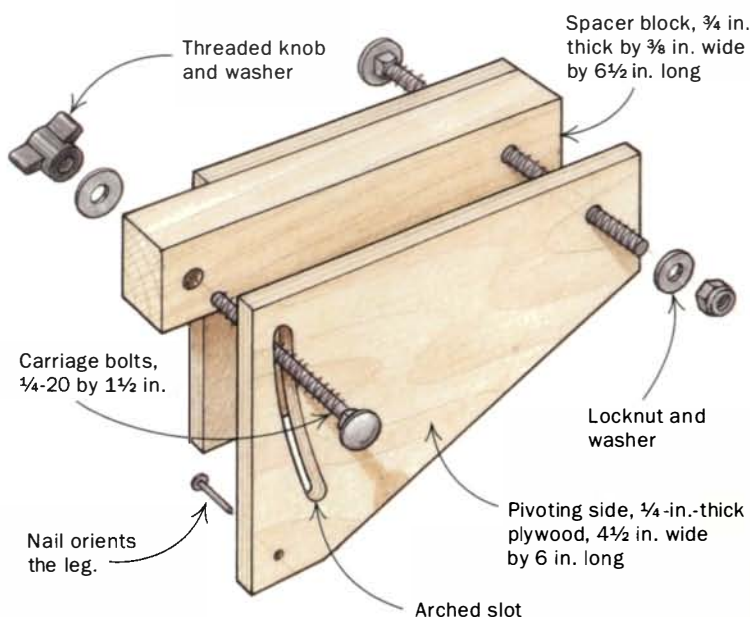
3

CUT THE TAPERS

Secure the leg in the jig with the hold-down clamp. Make the first cut, turn off the saw, then rotate the leg (see drawing) to make the second cut.

Cutting four-sided tapers

A center-point attachment allows you to cut a four-sided taper without readjusting the jig. The attachment has one pivoting side with a nail that engages the center of the leg. After cutting each taper, the leg is rotated and reengaged on the nail.



ment that slips over the jig's handle. The pivoting side of the attachment has a nail that engages and supports the leg as it's being tapered. Mark a center point on the bottom of the leg. Use an awl to punch the center point. When rotating the leg for all four tapers, it will revolve around this point.

When you're setting up a four-sided taper, you still have to follow the routine used on the two-sided tapers, marking pencil lines where the taper begins at the top apron line and where it ends on the bottom of the leg.

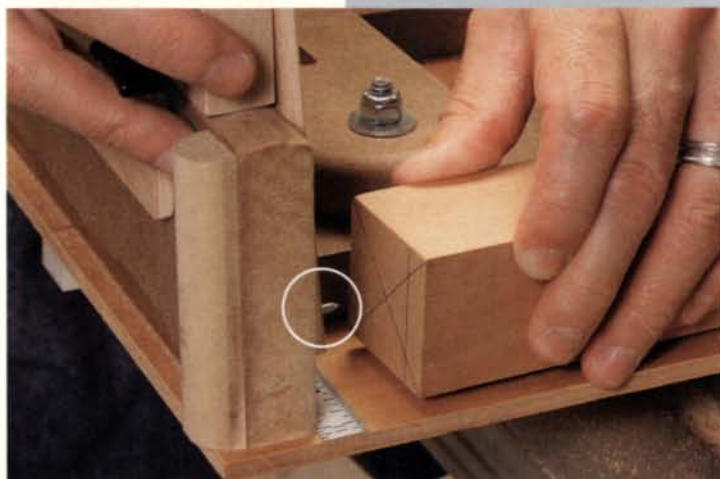
Now set up the center-point attachment so that the nail engages the center of the leg. From there, it's a matter of repetitious cutting: Clamp the leg in place, make the cut, unclamp, rotate and clamp it back in place, and so forth, until you've finished cutting tapers on all four sides. It's best to rotate the leg (see drawing, facing page) so that there's an untapered side against the base of the jig for all but the final cut.

Keep in mind that you don't need the center-point attachment to cut four-sided tapers. Instead, follow the steps for cutting two-sided tapers, then readjust the fence to cut the last two. When cutting the last two tapers, the flat of the apron surface is all that is riding against the fence, so be sure to place the hold-down clamp over that part of the leg (see photo, right). □

Richard W. Beebe II manages the data network for the Yale School of Medicine. Away from work, he makes furnishings and cabinetry for his home in a small basement shop in Hamden, Conn.

1 INSTALL AND ALIGN THE CENTER-POINT ATTACHMENT

Slide the attachment over the handle (left). Adjust the pivoting side until the nail engages the center point marked on the bottom of the leg (below). Lock that setting in place with a clamp.



2 CUT EACH TAPER, THEN ROTATE

Clamp the center-point attachment to the handle and secure the leg with the hold-down clamp. Make the cut, then rotate the leg (see facing page) until all four sides have been tapered.



The virtues of Black

Long favored by furniture makers, it's

Fresh out of high school and working to earn college tuition, I spent several summer days helping to tear down an old timber-frame barn in northern Ohio.

As my employer and I began crosscutting a timber to remove it, we noticed that the sawdust was a beautiful purple-brown. The timbers framing his barn were, each and every one, black walnut.

After nearly 50 years, I still find the memory painful. This was long before the heyday of salvaged barn lumber, and the owner was interested only in getting the old structure out of the way. We carried all of those beautiful walnut beams to the burn pile.

Modern, with a traditional background

Happily, plenty of black walnut has found better use as one of America's most versatile and popular cabinetwoods. Reviewing the work of contemporary furniture-making icons such as George Nakashima, Tage Frid, and Sam Maloof, one sees a lot of this hardwood. But black walnut's popularity goes back much further.

Native Americans ate the nuts, dyed animal skins with the hulls, and fashioned pipestems from walnut twigs. Colonists and pioneers found the easy-splitting, decay-resistant wood ideal for log- and timber-frame structures and for split-rail fences. From its earliest days, the U.S. military insisted on black-walnut gunstocks for their shock absorption, stability, and grip.

American furniture makers have always used black walnut, even if some overlooked its beauty—early homemade pieces often were finished with paint. The wood was popular for fine furniture in Colonial times but became even more so in the 19th century. In the Ohio farm country where I grew up, it seemed every family had a piece or two of heirloom solid-walnut furniture.

More recently, black walnut has seen periods of popularity as a cabinetwood, and times of weaker demand. Today, black-walnut lumber is relatively expensive; current prices for 4/4 stock are around \$5.20 or more per board foot for select and better. But the wood is

Popular figure. Contemporary master George Nakashima often worked in black walnut. His spare designs, like this bench, showcase the natural beauty of the wood's grain and color.

Walnut

BY BOYD A. HUTCHISON

beautiful, plentiful, and easy to work

widely available. For years, the best logs often wound up as veneer or were exported. But today, the export market has weakened, and more logs are sawn into lumber. Dave Bramlage, sales director at Cole Hardwoods in Logansport, Ind., estimates that his firm has sold more walnut in the past 18 months than in the previous five or six years.

Easy to work with machine and hand tools

What makes black walnut such a favorite? It machines beautifully, taking a clear, crisp, sculpted edge. Handplaned walnut, even unfinished, can have a silky-smooth and deeply lustrous surface. Its dark color accentuates subtle contours, and it accepts oil finishes without peer. Walnut is beautiful with a film finish, too.

The wood is moderately hard and heavy, with a specific gravity of 0.55 (compared to white oak at 0.68, cherry at 0.50, and butternut at 0.38). Walnut is strong and stiff and has high shock resistance. Shrinkage during seasoning is moderate (flatsawn, 7.8%; quartersawn, 5.5%), but once dried, the wood is very stable. It also steam-bends well.

Black walnut is a semi-ring-porous hardwood. The pores (vessels) of



Photo of chest: Lance Patterson, courtesy of the North Bennet Street School; chest-on-stand: Michael Seward

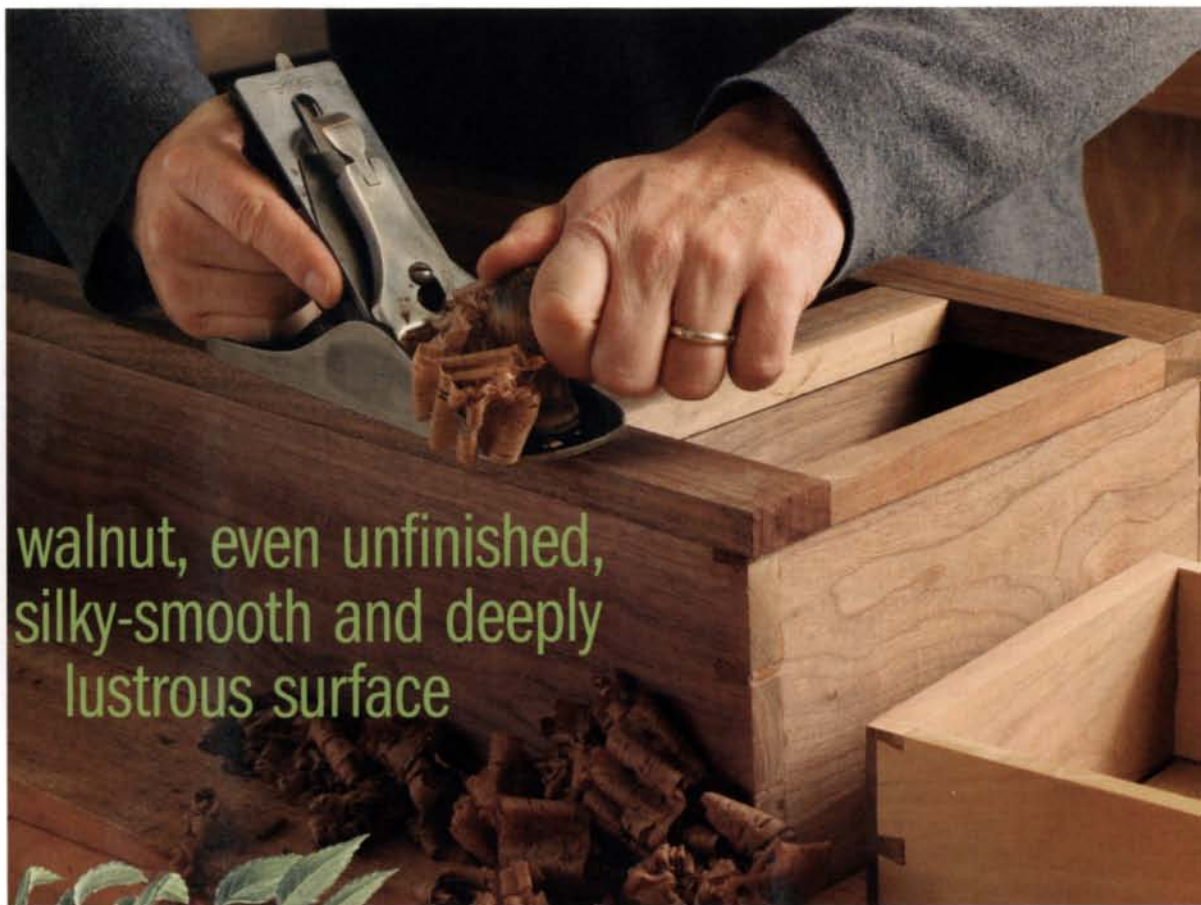


Still in demand. Pennsylvania furniture maker Michael Seward used black walnut for this Krenov-style chest-on-stand.

A long history. Black walnut has always been used by American furniture makers and often is chosen for period reproductions like this 18th-century chest by Nick Colt, a student at the North Bennet Street School in Boston.

Works smoothly. Black walnut's medium texture and its combination of large and small pores make the wood easy to plane and finish.

Handplaned walnut, even unfinished, has a silky-smooth and deeply lustrous surface



LEAF PATTERN

Large compound leaves have up to 23 finely serrated leaflets along a central stem. The tree flowers in mid- to late spring, with short, spiky female flowers and clusters of male catkins. The nuts have a thick green husk that turns brown at maturity.

GROWTH RANGE

Black walnut is found almost exclusively in the eastern half of the United States, thriving in well-drained bottomlands and flood plains. Shade-intolerant, the tree grows singly or in small groves, most often among shrubs and seedlings in relatively young forests.



the early wood are distinct to the unaided eye, but they gradually diminish in diameter until, in the late-wood portion of a growth ring, you need a hand lens to see them. To the woodworker, this structure means that black walnut can be handplaned with relative ease and minimal tearout. The wood can be finished without using grain fillers for all but the most formal of furniture styles. It also takes a stain well, although why anyone would want to alter the beautiful color is beyond me.

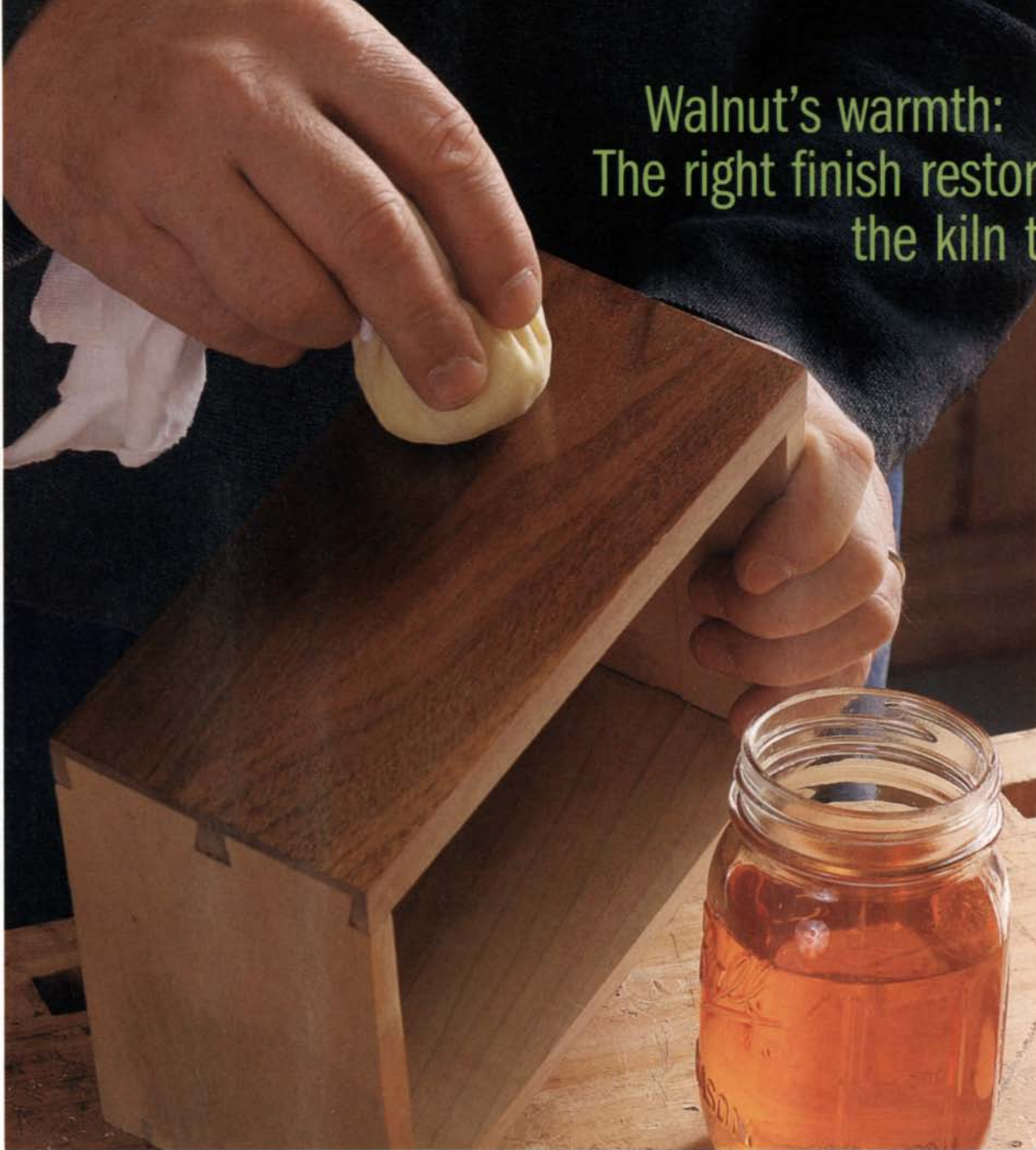
Beyond black walnut: an impressive family tree

For Americans, black walnut (*Juglans nigra*), which grows mainly in the eastern half of the United States, is the most visible member of a large and popular family of woods. The genus *Juglans* comprises at least 18 species worldwide. The United States is home to five other walnut species, two of which are commercially important sources of lumber.

Butternut, or white walnut (*J. cinerea*), as its name implies, has a lighter color than black walnut and is a popular cabinetwood. California's claro walnut (*J. hindsii*), very similar to black walnut, has a more pronounced color and figure. The three other species grow over limited ranges in the southwestern United States and Mexico. California walnut (*J. californica*), Arizona walnut (*J. major*), and Texas walnut or Nogal (*J. microcarpa*) all yield beautiful wood from smallish trees.

Walnut's warmth: The right finish restores what the kiln takes away

Often, black walnut is steamed during drying to darken the cream-colored sapwood. Finishing with orange shellac (left) or aniline dye can help restore the warmth and luster lost from the darker heartwood.



The only native walnut in Europe and the Middle East, *Juglans regia* is known by many names—Persian, Italian, Circassian, French, or English walnut. Like black walnut, each wood reflects the climate and soil where it grows. Argentine walnut (*Juglans australis*) has color, grain, and figure similar to black walnut.

A couple of caveats

For all its assets, walnut has a few problems. The light-colored sapwood surrounding the brown heartwood is thick, representing 10 to 20 years of growth. It takes a very large-diameter log to yield walnut boards of decent size that are free of sapwood.

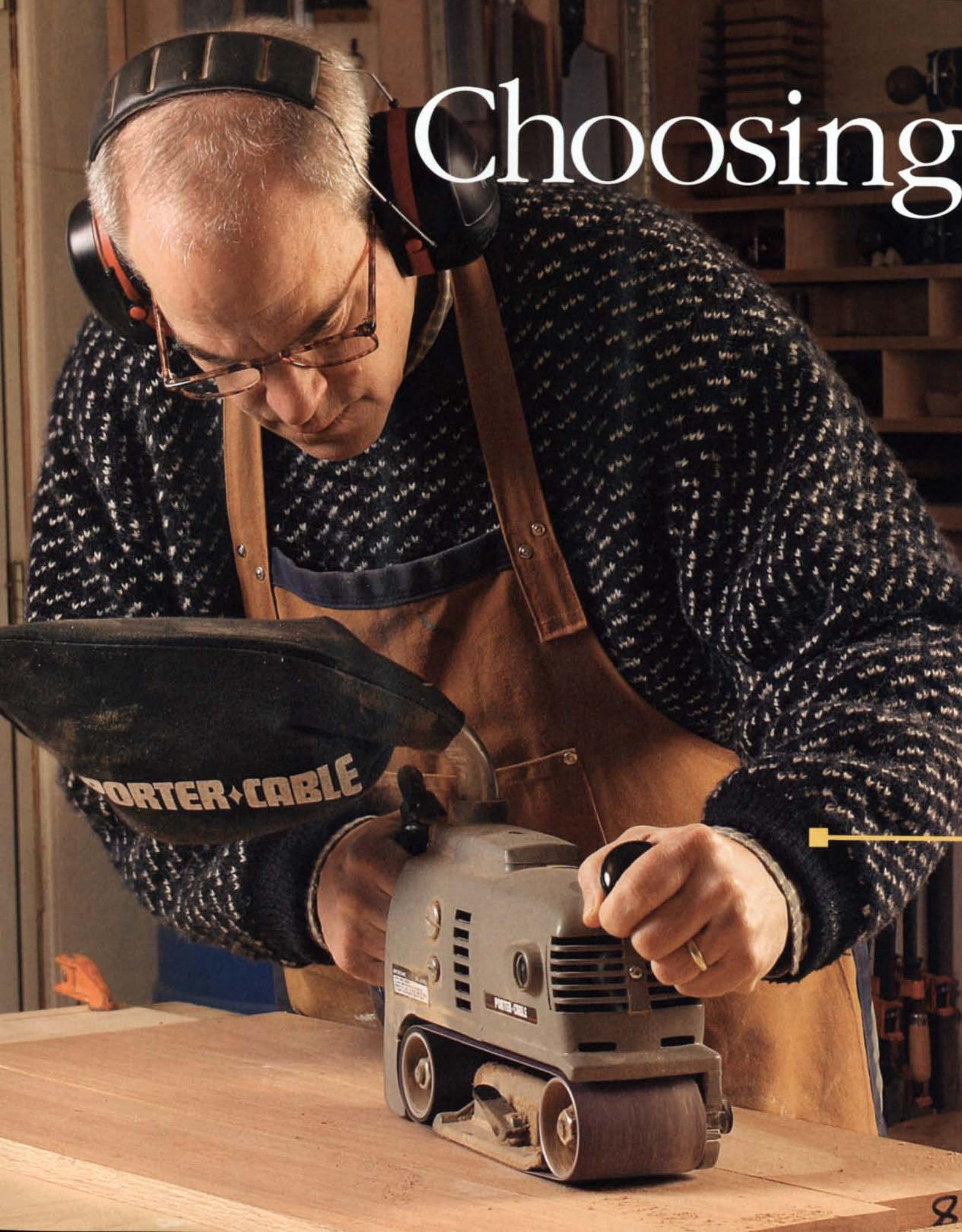
One way around the problem is to inject live steam briefly into the kiln in the late stages of drying. This causes chemical compounds from the heartwood to migrate into and darken the sapwood for a better match. The downside is that steamed walnut is dull. Finishing with a coat or two of orange shellac or orange aniline dye (see “Finishing Walnut” by Jeff Jewitt, *FWW* #176) can help.

Bear in mind that walnut, like some other dark woods, lightens with age. I have seen many antiques built of walnut and cherry, but the attractive combination tends to lose its beautiful contrast over time as the cherry darkens and the walnut lightens.

Although walnut is a joy to work, its toxicity can do damage. The tissues in mature walnut trees contain the chemical compound juglone as well as other extracts that can irritate the eyes and skin. Precautions are reasonably simple: Wear goggles and a dust mask or respirator when machining black walnut, and wash exposed skin with soap and water afterward. Those with greater sensitivity might want to wear a head covering, face mask, long sleeves, and gloves. Juglone also can wilt or kill plants, and harm horses and dogs, something to consider when disposing of sawdust or if your dog likes to chew on table legs. □

Boyd A. Hutchison, a retired forestry researcher, specializes in reproductions and adaptations of period furniture. He lives in Sheffield, Mass.

Choosing



Sandpaper

BY SCOTT GIBSON

For power-sanding, new abrasives are worth the extra cost

Few woodworking shops would get far without sandpaper. It's used for everything from flattening rough panels to polishing delicate finishes. Its versatility comes from the variety of available grits, coatings, and backings. Following is a primer on the combinations that work best for the types of sanding you are likely to do.

Manufacturers offer a variety of sophisticated abrasives, backing materials, and adhesives. Sandpaper is engineered for specific uses, depending on the material to be abraded and whether the paper is designed for hand- or machine-sanding.

Some of these new high-performance abrasives have migrated into woodworking from other industries. While they make

sanding faster, they also cost more than the old standbys.

For woodworkers, striking a balance between cost and performance amounts to knowing what you are buying and understanding what the abrasive is designed to do. Manufacturers put a variety of abrasives into belts, disks, sheets, rolls, and sanding sponges, and these products come in several price ranges. There is a sandpaper for just about any purpose.

Printed on the back of most sandpaper is information about abrasive type and grit size (see "Pay attention to your grades" on p. 60). You also might find the weight of the backing and the type of glue. The information, however, isn't likely to be all that helpful.

For example, unless you know there are three conventions for grit size (in addition to the generic coarse, medium, and fine found on some inexpensive papers), you might not really know how coarse or fine the sandpaper is. Do you need an A-weight or a C-weight paper for sanding varnish between coats? Knowing the basics of abrasives, backings, and coatings can help you sort through the jumble of trade names and murky product codes.

Abrasives: the sand in sandpaper

Although manufacturers still use a few natural minerals, synthetic abrasives coat most of the sandpaper we buy. The most common abrasives—aluminum oxide, silicon carbide, and ceramics—are synthetic,

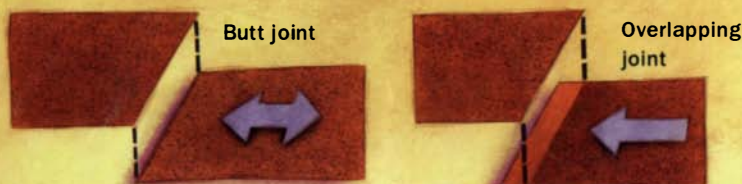
Beltsanding abrasives must withstand heat



Because they're heavy and capable of running at high speeds, belt sanders excel at rough sanding. The resulting heat and high pressure requires that sanding belts be made from tough material, such as cloth backing, and tough grits like aluminum oxide or the newer synthetic abrasives.

Some belts should run only one way

Tape-reinforced butt joints (left) allow belts to run either way, slightly extending their life. Older-style, lap-joined belts (right) run in only one direction.



The minerals make the difference

Abrasive performance is a balance of hardness, sharpness, durability, and friability. Friability is the highly desirable tendency to fracture with wear and expose new, sharp cutting edges. For general use, aluminum oxide seems to present the best compromise, although several other abrasives have specific uses that make them worth keeping in the shop.



ALUMINUM OXIDE: THE SHOP WORKHORSE

Aluminum oxide is the most common abrasive in woodworking sandpaper. It works well on a number of materials, including bare wood, painted surfaces, and metal. In its most basic form, this furnace-produced mineral does not fracture easily. It tends to wear down until it becomes too dull to cut efficiently. More expensive forms are friable or semifriable. A number of companies offer more than one grade of aluminum oxide in sandpaper. More expensive, heat-treated versions of the mineral tend to go into higher-priced product lines, such as Norton's 3X or 3M's Sandblaster. Generic aluminum oxide, with its familiar brown and black flecks, is used in tandem with hide-glue adhesives on less expensive sandpaper.

while garnet and emery (used mostly in metal-working) are the only common abrasives that occur naturally.

Manufacturers have concentrated their research on aluminum oxide and newer ceramic abrasives, designing abrasive grains that are friable or semifriable, meaning they break down to expose fresh cutting edges as the sandpaper wears.

"Friability is an excellent thing," says Chris Minick, an advanced product development specialist at 3M and a consulting editor to *Fine Woodworking*. "What it does is rejuvenate the points, so it extends the life of the sandpaper. Second, it gives you a much, much more consistent scratch pattern than you'd get with a nonfriable material."

Most sandpaper for woodworking has an open coat, meaning that abrasive grains cover between 40% and 70% of the backing. The space between grains gives saw-

dust a place to go, so the paper doesn't clog as readily. On the other hand, closed-coat sandpaper produces a more uniform scratch pattern, making it a good choice for sanding finishes.

Coatings keep abrasives on and sawdust out—Stearates are no-load coatings that help to prevent clogging when sanding painted surfaces between finish coats or resinous wood like pine. Stearated paper costs more, and it's not really necessary when sanding dry hardwood.

Unlike some of their predecessors, modern stearates are engineered not to interfere with water-based finishes. However, there are anecdotal reports to the contrary. Jeff Jewitt, a frequent contributor of finishing articles to *Fine Woodworking*, claims good success using 3M's 216U Frecut Gold and Mirka's Royal papers, as long as he

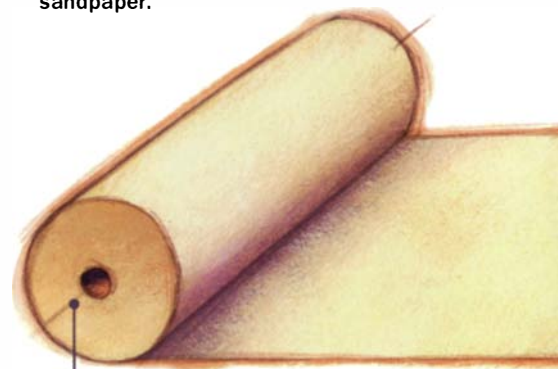


SILICON CARBIDE: FOR LEVELING FINISHES

Also a synthetic, silicon carbide is sharper and harder than standard forms of aluminum oxide. It has needle-like grains that resemble shards of broken glass. These hard, sharp grains cut glass, plastic, and metal very well under light pressure, but silicon carbide is not a very tough mineral. Its elongated shape shears off easily, making it too friable for bare-wood sanding because the abrasive wears down too quickly, according to manufacturers. It's an excellent choice for smoothing finish between coats, and for rubbing out film finishes like lacquer and shellac, because it cuts quickly and produces a very uniform scratch pattern. Waterproof versions won't degrade when used with water or oil.

Turning abrasive grit into sandpaper

Paper or cloth, glue, and abrasive particles are combined to make durable and reliable sandpaper.



1 Sandpaper starts as a huge roll of cloth or paper backing. The thicker and stiffer the backing, the more aggressive the sandpaper.



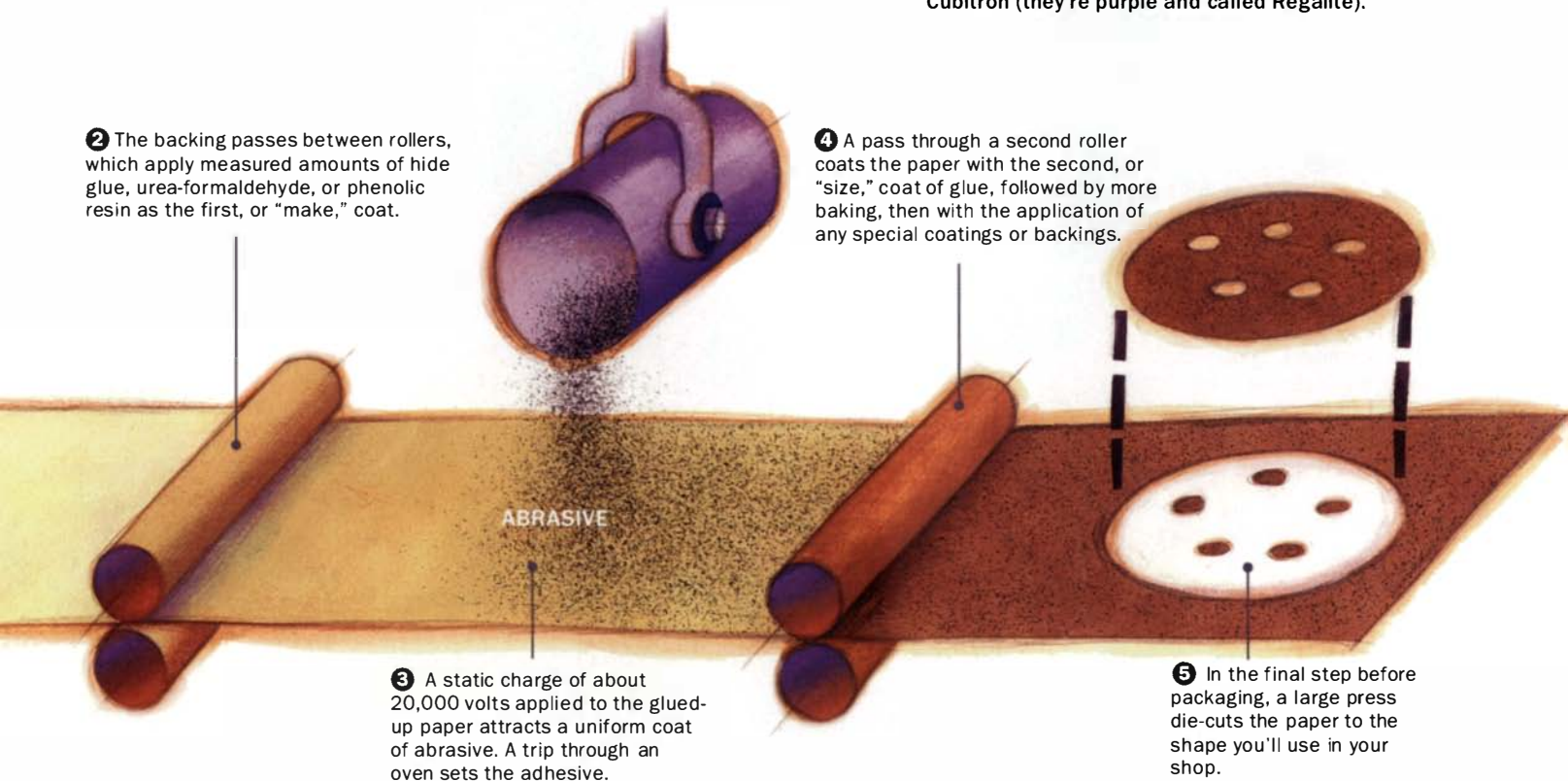
GARNET: THE NATURAL

One of the natural minerals still on the shelves is garnet, a relatively soft substance with a characteristic orange color and without fancy trade names. Garnet is garnet. Although it won't last as long or cut as quickly as aluminum oxide or the ceramics, traditionalists think garnet produces a finer and softer scratch pattern for final sanding. You'll find it in sheets for hand-sanding or for use on an orbital block sander for fine finish work. Garnet is steadily being replaced by newer aluminum oxides—Norton sells less garnet every year, and Mirka lists no garnet products.

ALUMINA ZIRCONIA AND CERAMICS: THE TOUGH ONES

A tough alloy of aluminum oxide and zirconium oxide, alumina zirconia outlasts aluminum oxide but costs about 20% more. Because its greater durability is most evident under heavy loads, alumina zirconia is used mainly in products for power sanding.

Other high-performance abrasives include ceramic aluminum oxide from 3M (Cubitron) and a similar mineral from Norton (SG). Ceramics are extremely tough, sharp, and long-wearing—and at least several times as expensive as anything else. They often are blended with other abrasives on premium belts and disks. Norton's 3X random-orbit disks, for example, combine its SG mineral and aluminum oxide. 3M makes disks and belts with both aluminum oxide and Cubitron (they're purple and called Regalite).



Sanding disks come in many flavors

Random-orbit sanders can be fine finishing machines, or nearly as aggressive as belt sanders. Consequently, disks for these sanders are available in almost the entire range of backing-paper weights, abrasive types, and coatings. Most are perforated for dust collection.

FIVE- AND EIGHT-HOLE DISKS

UNIVERSAL DISKS

MESH DISKS

Holes allow dust collection. Five- and eight-hole disks are intended for specific sanders, while the universal type fits any machine of a matching diameter. A mesh alternative, Mirka's Abranet, comes in grits from P120 to P600 and is intended for virtually dust-free sanding. It's said to work on hook-and-loop bases, but an adapter is also available.

wipes down the stearate-sanded wood with alcohol. Jewitt says this technique works best on closed-grain woods.

On open-grain woods such as oak, stray accumulations of stearate can remain in the pores.

Backings also affect performance. Backing paper comes in five common weights—A, C, D, E, and F. A-weight paper is the lightest, used for finer grits. E and F weights are found on disks for heavy grinding. Cloth backings are more durable but not quite as smooth as paper. Cloth comes in J-weight, the most flexible, and X, Y, and Z.

Beltsanding: Look for cloth backing and tough abrasives

Belts for stationary sanding machines come with either a cloth or paper backing. Belts for portable sanders are always cloth, typically X-weight. Because of their short length, belts for portable sanders run hot; paper-backed belts wouldn't last long.

The standard abrasive for portable-sander belts is aluminum oxide. Manufacturers also offer belts coated with alumina zirconia or ceramic aluminum oxide, which stand up to heat and pressure better than ordinary aluminum oxide.

Open-coat belts don't clog as readily, and belts with P-graded abrasives (see the sidebar on p. 60) produce a more consistent finish. Butt-joined belts can run in either direction, so they are easier to put on the machine and last slightly longer.

Bargain hunters should think twice about stocking up on belts for their portable sanders. According to Lisa Beard, manager of technical services at Klingspor, the adhesives used



Are high-performance abrasives worth the cost?

At the time of this printing, a major woodworking outlet sold a 3-in. by 24-in. aluminum-oxide belt on X-weight cloth for about \$1.40. An alumina-zirconia belt cost about \$3.10, and a ceramic-grain belt was about \$3.80. Premium belts wear slowly and can be cleaned repeatedly to nearly new condition with a rubber cleaning stick. Likewise, the alumina-zirconia and ceramic random-orbit disks I've used seem to cut faster and wear more slowly than conventional aluminum oxide.

However, meaningful tests for abrasive life and efficiency require expensive testing equipment that I don't have. In writing this article, I spent a lot of time sanding wood, and while I may lack the scientific data, my subjective take is that high-performance belts and disks are worth the extra money.

High-performance abrasives really shine when used under high heat and pressure, like machine sanding. I'm less convinced that high-tech abrasives are worth the money for hand sanding, considering that most of the hand-sanding I do is limited to light finish work. I will pay extra, however, for a waxy coating called stearate. Stearated papers don't clog as quickly, and often are used for sanding out finishes.

—S.G.

to join belts last for only about a year. Belts that have been sitting around too long can pop apart when they're put on the sander. Beard suggests buying no more than will be used in a year.

Random-orbit sanding: A variety of disks for the finishing touch

Most random-orbit disks have either five or eight holes that feed dust into the sander's collection system. Some disks come with slots instead of holes and so can fit any base with a matching diameter.

Disks can be had with paper, film, or cloth backings, although C-weight paper seems to be the most common. Cloth backings are more durable but not quite as smooth as paper. The edges of a cloth random-orbit disk don't crease or tear as readily when sanding into a corner, but for most applications, paper works fine. Flatter and more expensive than paper, film backing often is used in automotive finishing. It may be overkill for sanding wood.

Because random-orbit machines don't generate a lot of heat and pressure, they don't take advantage of the properties of premium alumina zirconia or ceramic abrasives to the same degree as do belt sanders. Manufacturers offer these abrasives on



High-tech abrasives pay for themselves in time saved. Not only do they cut faster, but premium sanding belts and disks last longer under the heat and pressure of power sanding than do traditional abrasives.



No-load coatings work great for sanding finishes. Uncoated garnet sandpaper (left) clogs quickly, while stearated paper (right) remains clean and effective longer.

Pay attention to your grades

Manufacturers grade the size of abrasive particles using the CAMI standard, the FEPA standard, and micron grading (identified by the Greek letter μ). The first two are the most common. CAMI is the old American standard. FEPA is the European standard, but appears more and more often on products in the United States. It is sometimes identified with a "P" placed in front of the numbers that designate grit size. In both CAMI and FEPA scales, the higher the number, the finer the grit.

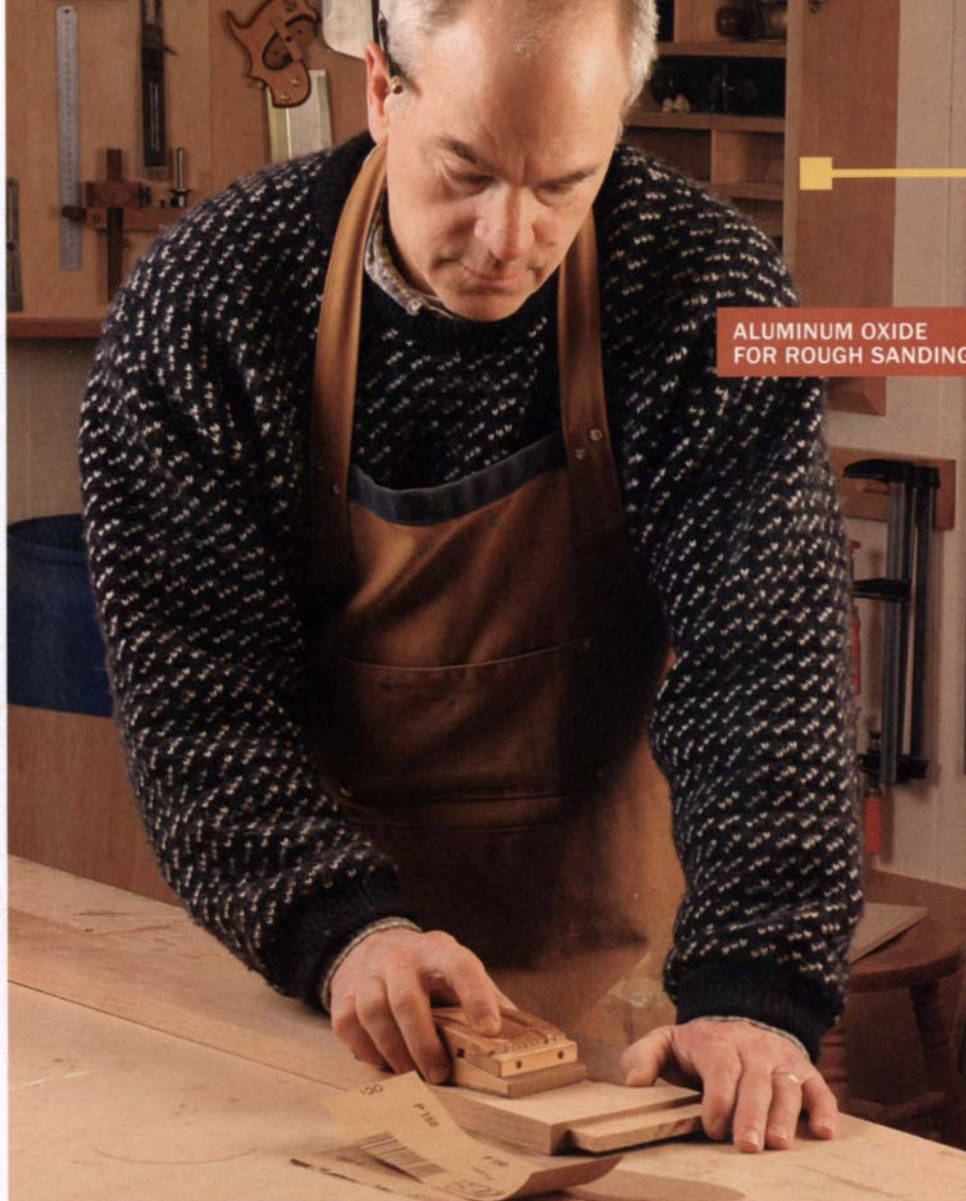
FEPA-graded abrasives are more uniform in size than CAMI abrasives, and thus leave a more uniform scratch pattern, which is better for fine finishing. CAMI and FEPA grits are roughly the same until they get above 220. Above this grade, FEPA papers are significantly more abrasive than identically numbered CAMI papers.

The most accurate scale, micron grading, sometimes is found on finishing films, more common in auto-body work than in woodworking. Micron-graded papers in very fine grits aren't necessary for most woodworking.

For more on sandpaper grades, see **FWW #176, pp. 117-118.**

As of this printing, the four major manufacturers whose products are available in the United States use the CAMI and FEPA scales as follows:

- **3M:** Both CAMI and FEPA; FEPA papers all carry the P designation. CAMI abrasives are silicon carbide and garnet.
- **Klingspor:** All FEPA; some marked, some not.
- **Mirka:** All FEPA and marked.
- **Norton:** Most FEPA, but unmarked; silicon carbide is CAMI grade.



ALUMINUM OXIDE
FOR ROUGH SANDING

random-orbit disks nonetheless, promising longer disk life over standard aluminum-oxide products.

For sanding finishes, random-orbit disks are available with stearate coatings. Some even come in extremely fine grits: Mirka's Abralon pads, useful for polishing high-gloss surfaces such as a rubbed-out finish, are available in grits up to P4000.

Disks are available with either pressure-sensitive-adhesive (PSA) or hook-and-loop backs. Hook-and-loop systems are worth the extra cost because they can be reused. PSA disks stick only once, so if you need to switch between different grits frequently, count on wasting a lot of paper.

Hand-sanding: Rolls and sponges add versatility to the old standby, sheets

Power sanders help take the tedium out of sanding, but it's still sometimes less trouble

to pick up a sanding block or a scrap of sandpaper and do the job by hand. A bit of sandpaper wrapped around the pad of your thumb quickly takes off milling marks from the inside curve of cove molding, and several suppliers sell detail-sanding blocks that match a range of profiles.

Hand-sanding offers outstanding control when sanding between coats, and a final hand-sanding with the grain can eliminate even a random-orbit sander's minor cross-grain scratches.

You can buy abrasives intended for handwork in just about any form—sheets, rolls, sponges, and even thin cord on 50-ft. spools. Rolls come in a variety of widths, typically from 1 in. to 6 in., in lengths of 10 ft. and 25 ft., and they can be had with either hook-and-loop or PSA backing. A new class of abrasives, nonwovens, isn't sandpaper in the traditional sense at all.

Hand-sanding requires a variety of abrasives ...

For hand-sanding as well as machine, aluminum oxide is the first choice for rough work. Garnet is still loved by many for the last sanding of bare wood because of its soft scratch pattern. Silicon carbide cuts quickly with light pressure and so is great for wet-sanding finishes.



Nonwovens resemble nylon scrubbing pads used in the kitchen and are intended for contoured areas and for rubbing out finishes.

A standard sheet of sandpaper, which measures 9 in. by 11 in., can be cut into four equal pieces to fit a sanding block. Sheet sandpaper also can be had with a lightweight cloth backing that's more flexible and more durable than paper. Look for a no-load coating when sanding resinous softwoods or finishes.

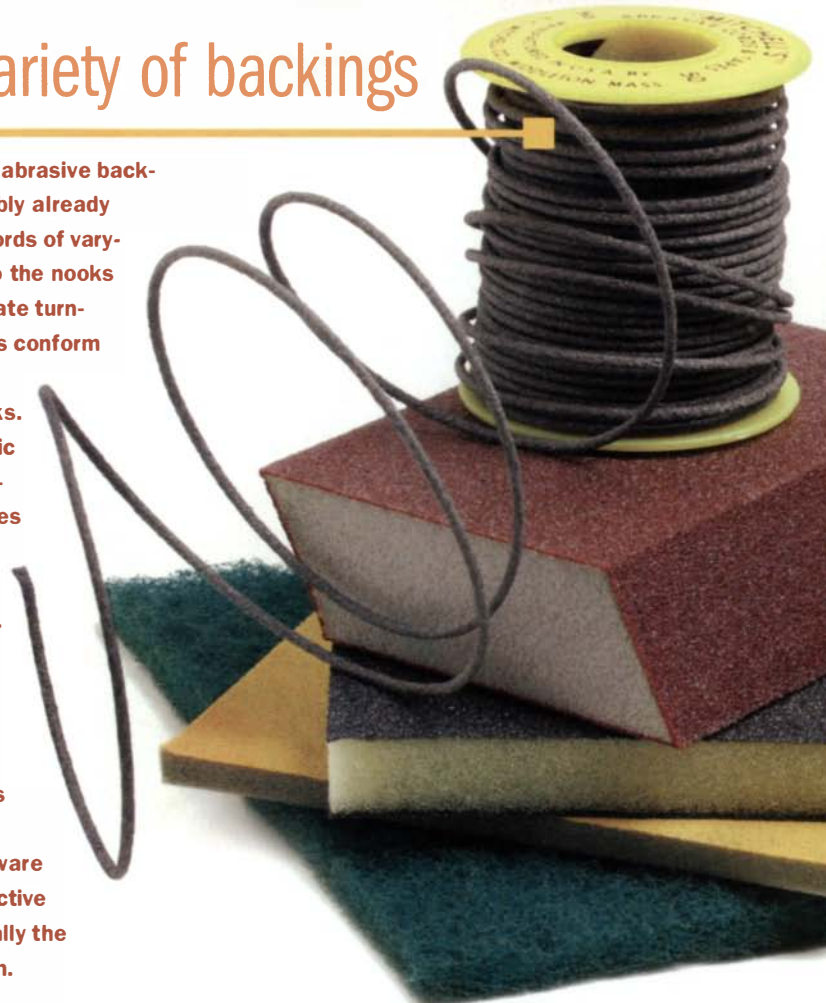
Sanding sponges, which combine flexible foam blocks and sandpaper in one, are available in different foam densities and thicknesses, so they can be matched to the application. Firm rectangular blocks get into corners more easily than a folded piece of sandpaper or a conventional sanding block.

Will you find the huge range of modern abrasives in your local hardware store? No, but you are likely to find most of what you use from day to day. And every product mentioned in this article is easily found in catalogs or online. □

Scott Gibson is a woodworker and writer in Steep Falls, Maine.

... on a variety of backings

If you can imagine an abrasive backing, someone's probably already making it. Abrasive cords of varying diameters get into the nooks and crannies of intricate turnings. Sanding sponges conform to molded surfaces to remove machine marks. Abrasive-loaded plastic wool knocks down finishes. Flat paper comes in adhesive-backed rolls for quick sticking to sanding blocks. Despite the variety of specialty backings on today's market, the old standby, 9-in. by 11-in. sheets, remains viable. Found on the shelves of every hardware store, sheets are effective abrasives, and generally the least expensive option.





A Little Masterpiece

Block-front document cabinet
will challenge your skills

BY RANDALL O'DONNELL

As much as any known specimen, this 1750s document cabinet displays the creativity of the Rhode Island block-front style. Exquisitely crafted, this small piece possesses the features of the very best furniture made by the very best craftsmen. Most of the techniques are similar to those required to build any Newport block-front case piece. However, while you will save on materials, don't expect to save on time: The details and construction on such a small scale are very challenging (besides carving three fans, there are 271 hand-cut dovetails). This project will push your woodworking skills to a new level, but you will be rewarded with an exquisite piece of furniture.

Start with the carcass and its dividers

The 15 half-blind dovetails that join each corner of the carcass typify the no-expense-spared tone of the design. The half-pins at the front allow for the mitered corners, and those at the back accommodate the rabbet. The miter is not at 45°, because it starts ¼ in. from the outside edge of the sides.

Once the carcass has been dry-fitted, rout the grooves for the main vertical dividers and the drawer dividers, stopping short of the front edge. The V-shaped terminus for the drawer divider grooves is made with a chisel and a mitered scrap block. Work a fillet and quarter-round on the inside edges of the carcass and on both sides of the vertical dividers.

The base is pine with a front section of mahogany. Unlike the original, I joined these two pieces with the giant dovetail more commonly seen in Boston case work because I think this is a superior construction method. You can cut the front molding on the mahogany either before it is joined to the pine or after the whole base has been dovetailed. I used a router to establish the fillets and flats and then hand-carved the remainder. Once all of the dadoes and carving are done—but before gluing the carcass together—run a rabbet inside the back edges to accept the back boards.

With the carcass glued, make the partitions. The drawer dividers on both sides of the center compartment are identical. Unlike the original antique, where the dividers are about 7 in. wide, on this piece they run to the back of the case. The front edges of the



vertical dividers in the center compartment have a birdlike profile. The dividers fit in $\frac{1}{8}$ -in.-deep by $\frac{1}{4}$ -in.-wide dadoes.

After cutting, profiling, and dadoing the valances and the horizontal and vertical partitions, slide them in from the back of the case. First, dry-fit the two main vertical dividers, marking and trimming them to width. After gluing them in, dry-fit the drawer dividers and the interior partitions and glue them in place.

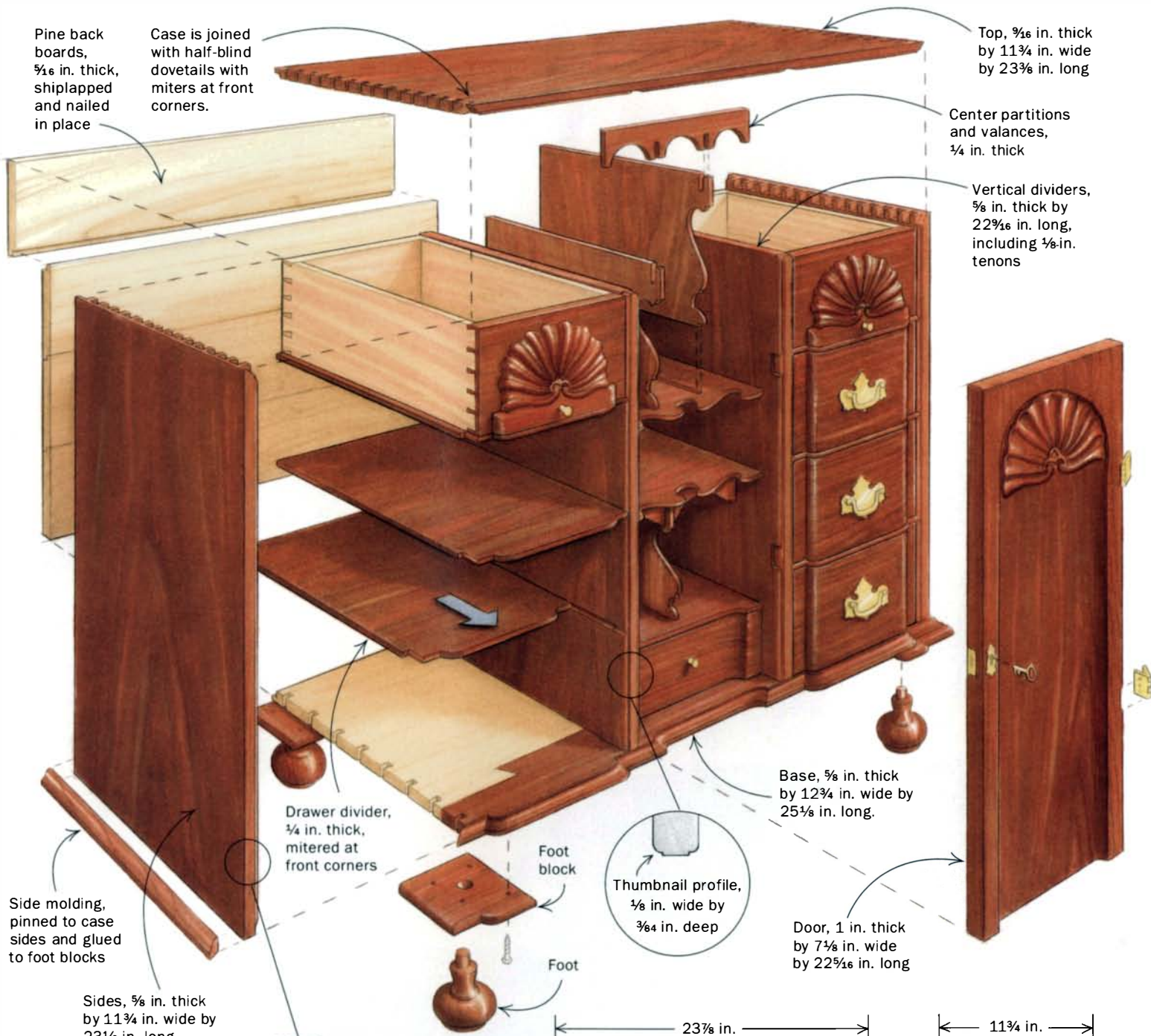
Drawers require hand-cut dovetails

The sides, backs, and bottoms of the drawers are all $\frac{3}{16}$ in. thick. I resawed $4\frac{1}{4}$ mahogany stock to economize on lumber and to end up with book-matched drawer sides. The drawer fronts are $\frac{3}{4}$ in. thick. Carve the quarter-rounds that form the block fronts with a gouge and then file and sand them smooth. The top drawers have an applied convex shell, so resaw the drawer front to $\frac{3}{8}$ in. thick, saving the other half of the stock for the carved shells, to be reapplied later.

No router will be able to cut the narrow dovetails found on the drawers of the original cabinet. Instead, I used a thin-kerf Japanese saw to cut the joints. Run the rabbet for the drawer

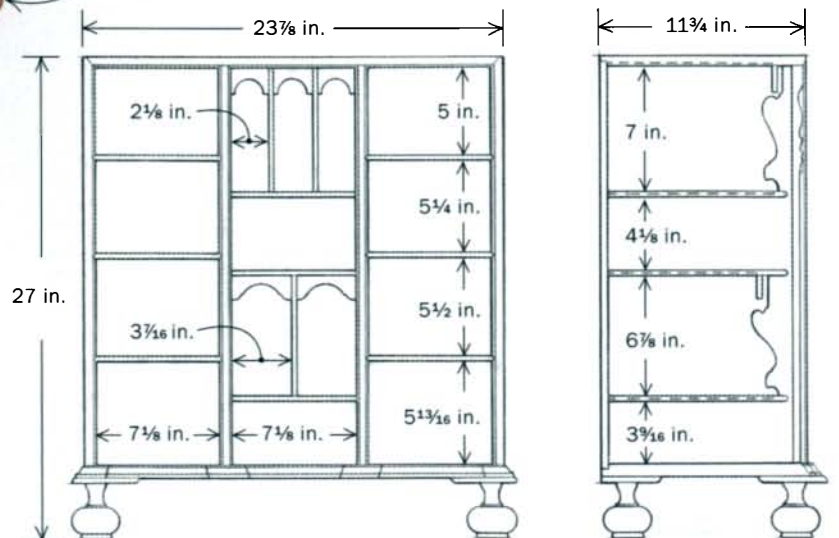


Inside and outside come together. After the carcass has been assembled, the dividers and valances are slid in from the back (above). The profiles of the drawer fronts match those of the drawer dividers and the base.

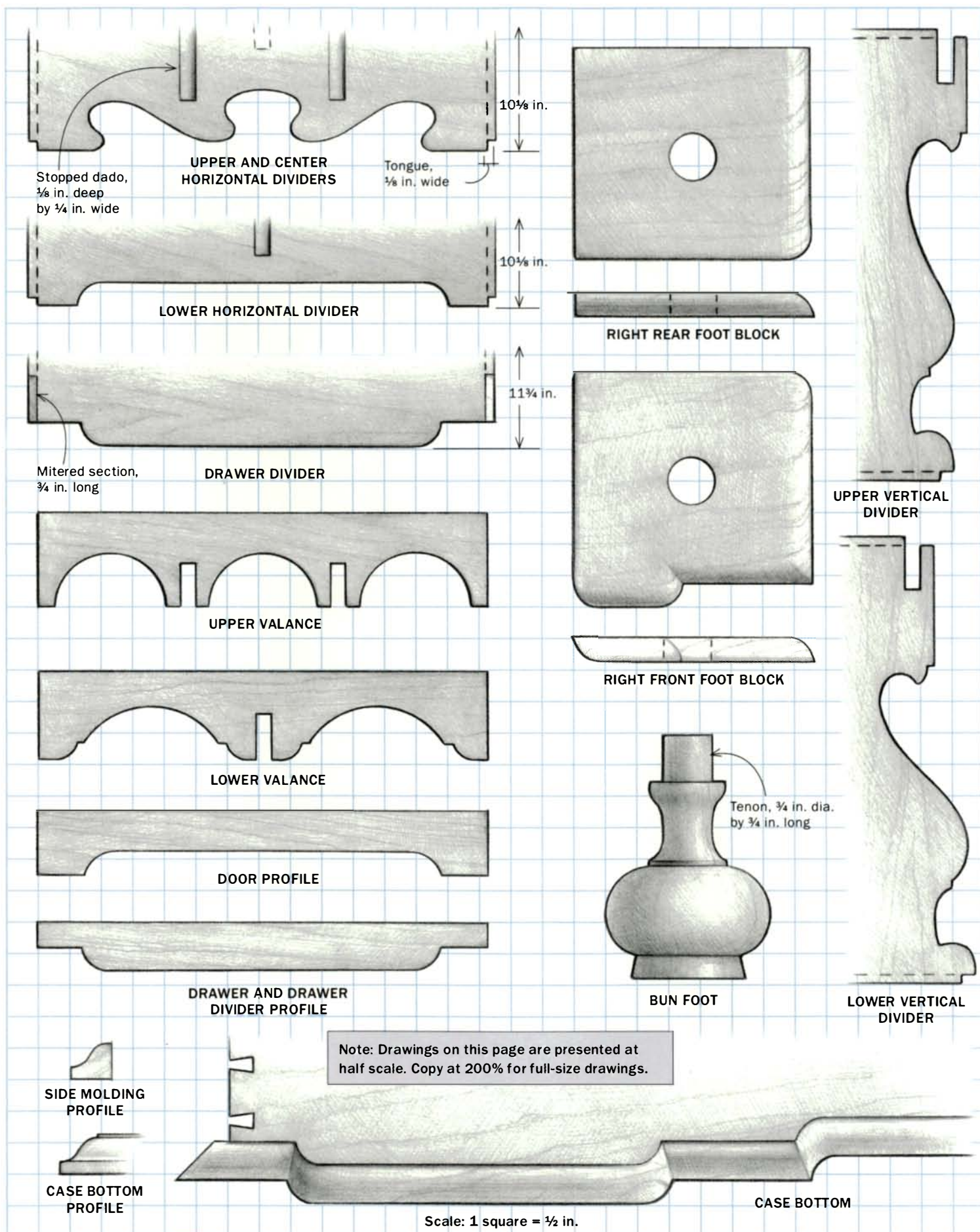


MAHOGANY DOCUMENT CABINET

The small size of this project allows you to spend money on some really good lumber. The author made the drawer sides from book-matched mahogany, but you can use a secondary wood (as shown here) and be faithful to the original.



Side view of center section



bottoms in the drawer front and the sides. Now assemble the drawers.

Carve the shells

I like to attach the drawing of the shell to the resawn blank using dry-mount adhesive. After establishing the outer profile on the bandsaw and with files, mark out the *fleur-de-lis* with various gouges. Use a ballpoint pen to draw over the rays of the shell on the drawing. Peel away the paper, and then darken the impressions with a pencil. To achieve a perfect match, place the shells back to back toward the end of the process, which will allow you to easily detect any differences.

Carve the door from a 1-in.-thick board, removing the bulk of the concavity with a router. The large shell is carved in the same manner as its smaller cousins. Carve the perimeter of the shell first; work the rays, saving the interior *fleur-de-lis* for last. This *fleur-de-lis* is a carbon copy of those on the convex shells.

The feet and the finish come last

The small blocks under the base, whose sides are visible as quarter-rounds, can be drilled on the drill press to accept the turned tenon of the bun feet. Once glued on, they serve as a guide to drill the hole deeper into the case bottom. Stop the hole just shy of breaking through. Turn the feet, fit them, and then tape the turned tenon, so you can apply a finish to the feet while they are on the lathe prior to gluing in place.

Finishing begins with a mahogany aniline dye sealed with a thinned coat of shellac. Fill the grain with paste filler, and then apply several coats of shellac until a flat surface is obtained. Rub out the finish with steel wool and wax. □

Randall O'Donnell is a period furniture maker in Brown County, Ind.

Carving the shells

The cabinet is graced by two convex shells, which are carved from wood resawn from the top drawer fronts and then reapplied. A third, concave shell is carved into the central door. While the concave and convex shells are similar, only the central *fleurs-de-lis* are identical.

CONVEX SHELLS ARE APPLIED TO THE DRAWER FRONTS



Note: Drawings on this page are presented at half scale. Copy at 200% for full-size templates.

THE CONCAVE SHELL IS CARVED INTO THE DOOR



HARDWARE SOURCES

BALL & BALL

www.ballandball-us.com; 610-363-7330

Part	Catalog No.
2¼-in. boring Chippendale pull	6x C29-081
¾-in.-dia. solid plain knob	2x G17-136
¾-in.-dia. solid plain knob	1x G19-144
1¼-in. x 1½-in. left-hand door lock	1x TCB-010
Escutcheon, 1½ in. high	1x L95-046

LONDONDERRY BRASSES

www.londonderry-brasses.com; 610-593-6239

Part	Catalog No.
1-in. hinge	2x H26



1
Carve with a template. Spray-mount the convex shell design to the carving blank. Bandsaw and carve the edge profile and then define the fleur-de-lis with carving tools.



2
Trace the shell. With a ballpoint pen, draw over the lines defining the rays of the shell. The pressure will create faint lines in the wood, visible when the template is peeled away.



3
Form the convex profile. First establish the basic convex shape of the shell, redraw the lines of the rays, and then relieve the base of the shell.



4
Define the rays of the shell. Use a V-parting tool to create the veins that divide the convex and concave rays of the shell.



5
Form the concave rays. Use both V-parting tools and sweep gouges to carve the concave rays first.



6
Round over the convex rays. An inverted fishtail gouge works well to establish the convex rays.



1
Shape the cabinet door. Use a router to remove the bulk of the wood from the recessed center of the door and gouges to create the curves. Use a V-parting tool to define the edge of the shell.



2
Carve the concave shell. As with the convex shell, first establish the perimeter profile, then the fleur-de-lis. Establish the main profile, and finally create the rays. Spoon gouges work well in the concave sections.

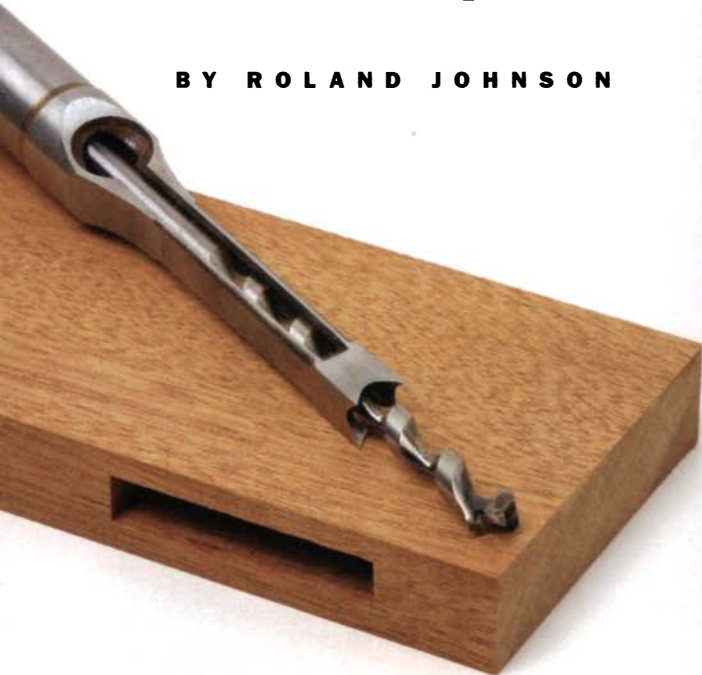


3
Alternative shaping tools are useful. In difficult grain or confined locations, files, rasps, and rifflers come in handy.

Benchtop Mortisers

Make mortises quickly and easily with these compact, square-hole-drilling machines

BY ROLAND JOHNSON



When it comes to cutting mortises, there is no shortage of ways to get the job done. One of the most efficient is to use a mortising machine, also called a hollow-chisel mortiser. Properly set up and operated, it cuts straight, square-sided mortises in relatively short order.

To compare the current benchtop models, I had them shipped to my shop for a close examination. Once all the unpacking was done, eight machines were sitting on my workbench: Bridgewood HM-11, Delta MM300, Delta 14-651, Fisch BTM99-44252, General International 75-050T, Jet JBM-5, Shop Fox W1671, and Woodtek 138-224.

A good fence and hold-down are important

The fence helps support the workpiece during a cut. It adjusts front to back so that you can align the chisel with the mortise location. It also keeps the workpiece square to the machine, so successive

cuts will line up with each other. On several of the mortisers, the fence also provides a mounting point for the hold-down.

The fences on the General and Woodtek mortisers were my favorites. I liked the miter-gauge-like bar and slot assembly and the sturdy fence-locking system. If I had to pick between the two fences, I'd go with the General, simply because it's bigger.

Each machine includes a hold-down. As the name suggests, the hold-down prevents the workpiece from lifting off the table as the chisel and bit withdraw from the hole. The Bridgewood, Fisch, Jet, Shop Fox, and both Delta mortisers have a horseshoe-shaped, cast hold-down that slides on a rod mounted to the fence (see top photo, facing page). Once secured, each hold-down did an admirable job holding the workpiece against the table.

The standout hold-downs are the General and the Woodtek. Both machines have a sliding hold-down that was especially easy to adjust. Two cutouts in the middle of the fence allowed the

hold-down to be lowered below the top of the fence, a feature shared by the Delta 14-651. The cutouts made it easier to secure stock narrower than the fence. Of course, the other machines were able to secure narrow stock, too, but they needed a spacer block made from scrap. In addition, the General and Woodtek are the only benchtop mortisers in this review with a front vise (see bottom photo, below). A vise is a big plus because it keeps the workpiece anchored securely against the fence during a cut.

Only the Delta 14-651, General, Jet, and Woodtek have toolless methods for securing the hold-down to the shaft. The rest of the machines make you hunt down an Allen wrench. I much prefer the toolless approach. The General and Woodtek mortisers are almost entirely toolless, except for a chuck-key needed to install the drill bit. Nearly as user-friendly is the Delta 14-651; it needs only an Allen wrench that's integrated into the chuck-key to secure the chisel. The other machines require at least two tools to make machine adjustments.

Longer lever arms are less tiring to use

When cutting mortises, some machines needed a lot more downward force on the lever-arm handle, even though I used the same chisel and bit to make the cuts. All things being equal, I'd much prefer using a mortiser that cuts with less effort. That distinction was shared by three machines: the General, Shop Fox, and Woodtek. As you might expect, they also have the longest lever arms.

I especially liked how easy it was to adjust the lever arm on the Shop Fox. A spring-loaded cogged collar allowed me to simply push the lever to the side, move the handle to a new position, and let the lever return to its original position, locking the cogs. The two Deltas, the Fisch, and the Jet have spring-loaded cogged levers, which were okay, but it took two hands to operate them.

Cutting depth is affected by machine design and bit choice

More is better when it comes to the maximum depth of cut a mortiser can produce. However, before you can nail down that number, you must consider a couple of measurements: the plunge depth of the machine and the cutting depth of the chisel. The smaller of the two determines the cutting depth.

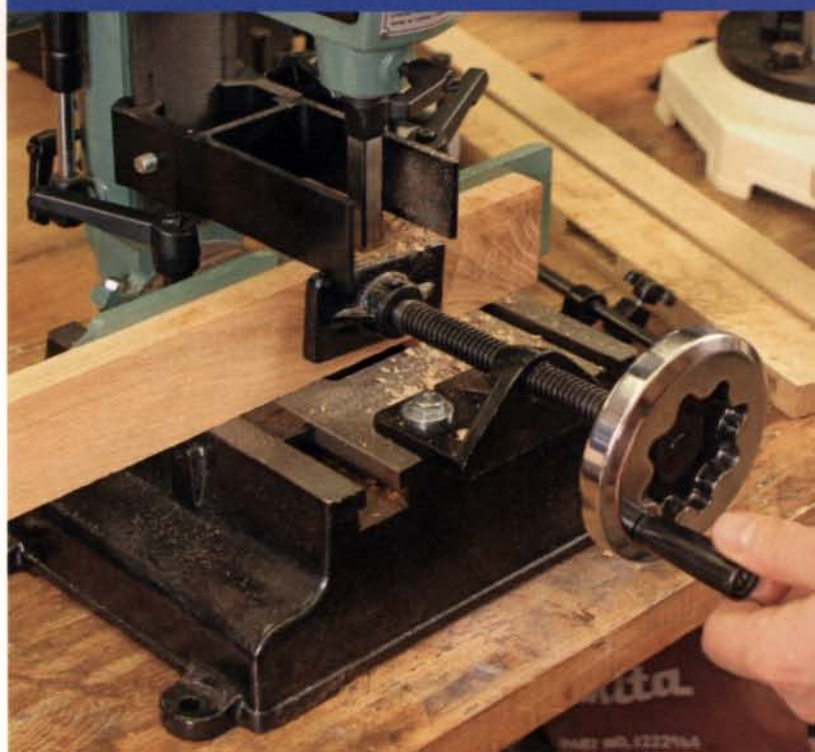
The plunge depth is the distance between the tip of the installed chisel (when the motor is raised to its highest point) and the surface of the table. (See the chart on p. 70 for a listing of the plunge depths.) The chisel's cutting depth is the maximum depth you can lower the chisel into the workpiece. If a mortiser has a plunge depth of, say, 4½ in., but the chisel has only a 2-in. cutting depth, the deepest mortise you can cut is 2 in. On the other hand, if the plunge depth is 3½ in., and the chisel can make a 4-in. cut, the maximum mortise depth is 3½ in.

While on the subject of workpiece capacity, one of the mortisers,



Fence options

On most mortising machines, a sliding rod permits in-and-out adjustment of the fence (top). Thanks to a rack-and-pinion gear, the fence on the Delta 14-651 lets you make relatively fine adjustments simply by turning a knob (left). General and Woodtek mortisers have a fence that slides in grooves in the base and a front vise to hold the stock against the fence (bottom).



BENCHTOP MORTISERS

The standouts here are the General and the Woodtek. Both machines have a hold-down that is especially easy to adjust.



MORTISER	BRIDGEWOOD HM-11	DELTA MM300	DELTA 14-651	FISCH BTM99-44252
CONTACT	800-235-2100 www.wilkemachinery.com	800-438-2486 www.deltawoodworking.com	800-438-2486 www.deltawoodworking.com	724-663-9072 www.fisch-woodworking.com
PRICE	\$189	\$199	\$240	\$240
MOTOR	7.4 amps, ½ hp 1,750 rpm	5 amps, ½ hp 1,725 rpm	6 amps, ½ hp 1,750 rpm	7 amps, ¾ hp 1,720 rpm
BITS INCLUDED	None	¼ in., ⅝ in., ⅜ in., ½ in.	¼ in., ⅝ in., ⅜ in., ½ in.	¼ in., ½ in., ⅜ in.
PLUNGE DEPTH	4 in.	4½ in.	4¼ in. (6 in. with riser block)	3½ in.
WEIGHT	53 lb.	52 lb.	68 lb.	64 lb.
BIT CHANGES	Fair	Fair	Very good	Fair
COMMENTS	Capable of cutting long or wide workpieces; second-lowest runout; lowest price; chisels and bits not included.	Capable of cutting long or wide workpieces; second-lowest price.	Tallest fence; toolless hold-down; riser block included; gap at fence bottom allows chips and sawdust to escape; greatest runout.	Microadjustable fence; upper-limit stop on support column.

the Delta 14-651, includes a riser-block kit. When installed, it adds about 1¾ in. to the plunge depth of the mortiser.

The BridgeWood, Delta MM300, Jet, and Shop Fox can mortise a workpiece that's wider or taller than the norm simply by unbolting the vertical-support assembly, turning the top of the machine 180°, and then reattaching it to the base. After that, the base must be unbolted from its stand or platform, then rotated and reattached so the fence extends over the workbench. This takes the table out of play, leaving an unobstructed space under the chisel. Granted, the setup process is a chore, but it's a feature some woodworkers occasionally might put to good use.

All of these machines have depth stops. When properly adjusted, they will stop the chisel when it reaches the desired mortise depth. Considering that the downward pressure applied by the

mortiser's lever arm can be substantial, a sturdy stop system is ideal. If the stop slips, you'll end up with a mortise that's deeper than you anticipated. The stops on each mortiser I tested provided adequate holding force.

The ability to secure the bit and chisel easily is important. The drill chuck secures the bit, with a chuck-key providing the tightening force; a setscrew secures the chisel. Any machine that simplifies the procedure of changing the bit and chisel gets bonus points in my book.

When it comes to mounting only the bit, the Delta 14-651 offers the best access to the drill chuck. A clever wraparound door swings to the side, out of the way of the chisel. I much preferred it to the more common drop-down doors that always seemed to be in the way. On the Delta 14-651, the Allen wrench for securing



GENERAL INTERNATIONAL 75-050T	JET JBM-5	SHOP FOX W1671	WOODTEK 138-224
514-326-1161 www.general/ca	800-274-6848 www.jettools.com	800-840-8420 www.ballewtools.com	800-645-9292 www.woodworker.com
\$440	\$250	\$230	\$320
3.8 amps, ½ hp 1,720 rpm	6 amps, ½ hp 1,720 rpm	8 amps, ¾ hp 3,450 rpm	12 amps, 1 hp 1,720 rpm
¼ in., ⅝ in., ¾ in., ½ in.	¼ in., ⅝ in., ½ in.	½ in.	None
6 in.	4 in.	9 in.	6 in.
95 lb.	50 lb.	92 lb.	84 lb.
Good	Good	Fair	Good
Includes vise; post tilts to make angled cuts; when moved, fence remains square to chisel; includes end stops; best hold-down (tie with Woodtek); minimal chip jamming during cuts.	Toolless hold-down; capable of cutting long or wide workpieces; lowest runout; lightest mortiser.	Easy-to-adjust lever arm; long lever arm makes for easier cuts; capable of cutting long or wide workpieces; microadjustable fence; greatest plunge depth.	Includes vise; when moved, fence remains square to chisel; includes end stops; best hold-down (tie with General); long lever arm makes for easier cuts; minimal chip jamming during cuts.

the chisel is stored on the chuck-key; that's helpful, but a lever handle would be a lot more convenient. The Jet mortiser, by the way, has a great chuck-key, thanks to a long shank that makes it easy to reach the chuck.

When securing only the chisel, the General and Woodtek mortisers were my hands-down favorites, thanks to nothing more than a generously sized lock handle. But when considering the overall ease of changing both the bit and chisel, I favored the Delta 14-651 because of its chuck-cover design.

Stated horsepower vs. perceived power

A mortiser that constantly bogs down during a cut is frustrating to use. Generally, the problem occurs when chips jam the chisel. The simple solution is to slow down the feed rate. But if you

have a mile of mortises to cut, a slow feed rate can make you feel like you're doing 40 mph on a highway when the speed limit is 70.

To compare the power of these mortisers, I made test cuts in red oak and maple using the same ½-in. bit and chisel. All of the machines cut shallow mortises well. But as the cuts got deeper, I began to notice differences. Deeper cuts meant the motor had to push the chips up through more of the chisel and out a relief slot that gradually got smaller. All of the machines accomplished the task, but some needed a slow feed rate to do so.

The performance of the General (½ hp) and Woodtek (1 hp) stood out during this test. Compared to the other machines, aggressive cuts jammed these two mortisers less often.

Most of the mortisers ran at approximately 1,720 rpm, with the

Installing a bit and chisel

The bit must extend past the end of the chisel to allow wood chips to pass between the auger and the mortising chisel. Typically, I offset the parts by $\frac{1}{16}$ in. to $\frac{1}{8}$ in.

1. INSERT THE BIT AND CHISEL, AND TIGHTEN THE CHISEL

Place a piece of scrapwood on the table of the mortiser, then slip the bit into the chisel. With the tip of the bit supported by the scrap, slip the shank of the chisel into the mounting bushing, then tighten the shank to allow about $\frac{1}{16}$ -in. space between the shank and the bushing (top photo). To help wood chips eject as easily as possible when you're cutting a mortise, position the slot of the chisel so that it faces either left or right.



2. TIGHTEN THE BIT AND REPOSITION THE CHISEL

Use the lever arm to lower the chisel until it just touches the scrap. Tighten the bit in place (center photo). Loosen the chisel and push it up until the shank butts against the bushing. This positions the end of the bit $\frac{1}{8}$ in. below the chisel's end. Place the scrap against the fence and slide the fence until the scrap butts against the chisel (right photo). Hold the chisel, loosen the setscrew and rotate the chisel until one face is parallel to the scrap.



exception of the Shop Fox, which ran at 3,450 rpm. I couldn't discern any advantage or disadvantage to the higher speed.

Runout: Less is more

A mortiser with too much runout creates a lot of friction between the outside of the bit and the inside of the chisel. Add that to the heat produced as the bit and chisel work their way through a chunk of hardwood, and you can end up with the steel in both parts turning blue. Blue steel has lost its hardness, which means it won't cut as well.

Typically, runout on a mortiser can be traced to the bit, the chuck, or both. A bit that's not especially straight will create extra heat. So will a perfectly straight bit in a chuck that's less so.

To measure chuck runout on each machine, I first installed a dead-flat drill rod to the chuck. Then, using a dial indicator, I measured the drill rod at a point 5 in. from the chuck. Showing the least amount of runout, by far, was the Jet mortiser, with a measurement of only 0.0008 in. (0.0004 in. each side of the centerline). On the other end of the scale were the Fisch, with 0.0140 in. of runout (0.0070 in. each side), and the Delta 14-651, with 0.0190 in. (0.0095 in. each side). That said, I couldn't conclude that the runout on any of these machines affected their cutting capability in any way.

Choosing a favorite

After spending several weeks with these machines, I generally was impressed with all of them. All of the hold-downs worked pretty effectively. And while none of these mortisers could be considered industrial-strength machines, they performed quite well, as long as the chisels and bits were kept sharp and I watched the feed rate.

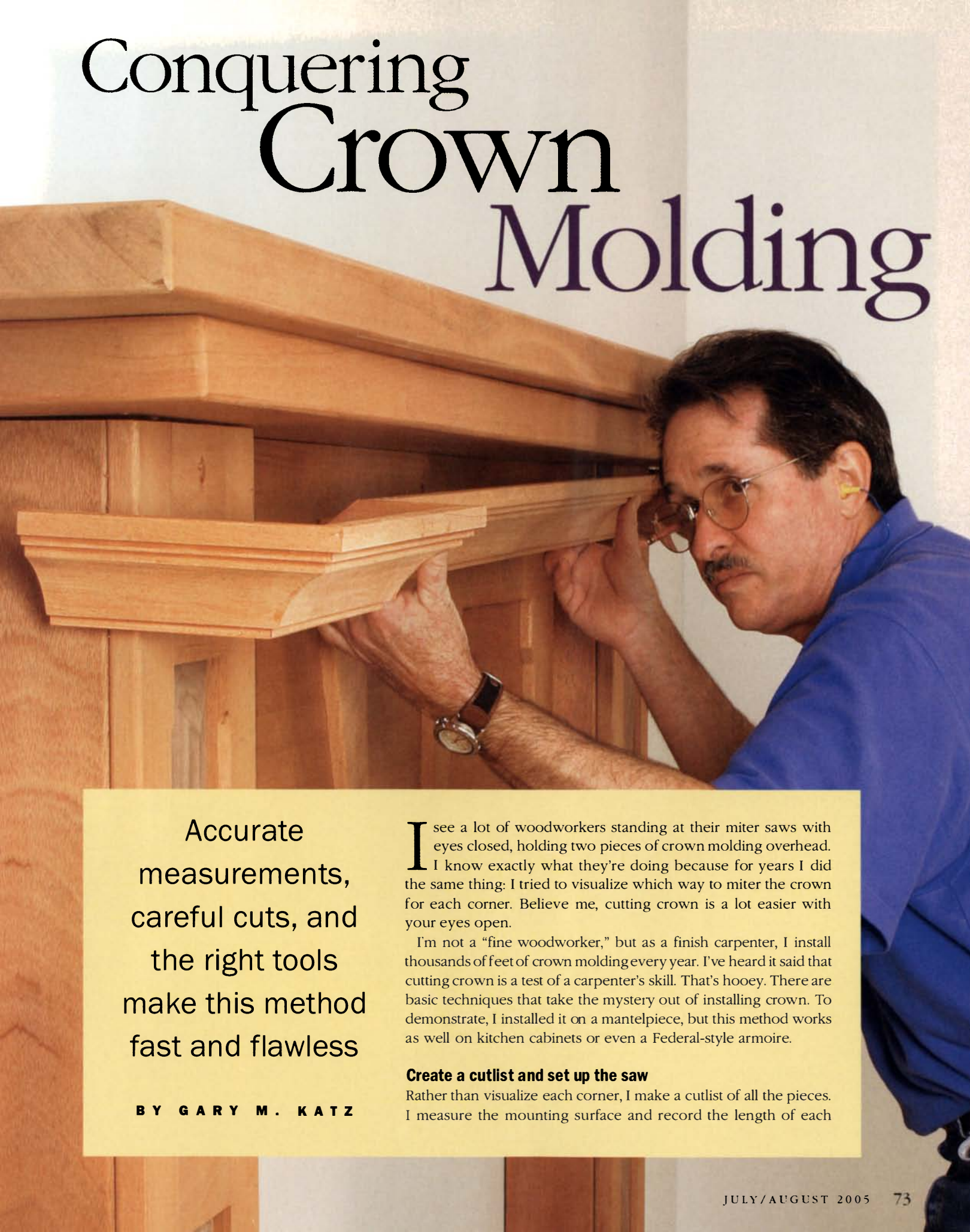
I consider the General the best all-around benchtop mortiser. It features a great fence and hold-down; it has a vise and end stops; and it's the only mortiser with a tilting head. On the downside, though, these features come at a price: The General sells for about \$440, making it the most expensive pickle in the barrel by nearly 35%.

If you want something a bit more affordable but with a list of solid features, consider the Woodtek mortiser. It has a fence much like the General's, a vise, end stops, toolless adjustment, plus good mechanical advantage and motor power. Although the Woodtek's \$320 price tag makes it the second-highest priced in the group, the boatload of features it provides for that price qualified it as the best value.

If your wallet is really squeezed, consider the Delta 14-651. It had a better than average fence and the best bit-changing system of the mortisers tested. □

Roland Johnson is a professional woodworker and a contributing editor to Fine Woodworking. He lives in Sauk Rapids, Minn.

Conquering Crown Molding



Accurate
measurements,
careful cuts, and
the right tools
make this method
fast and flawless

BY GARY M. KATZ

I see a lot of woodworkers standing at their miter saws with eyes closed, holding two pieces of crown molding overhead. I know exactly what they're doing because for years I did the same thing: I tried to visualize which way to miter the crown for each corner. Believe me, cutting crown is a lot easier with your eyes open.

I'm not a "fine woodworker," but as a finish carpenter, I install thousands of feet of crown molding every year. I've heard it said that cutting crown is a test of a carpenter's skill. That's hooey. There are basic techniques that take the mystery out of installing crown. To demonstrate, I installed it on a mantelpiece, but this method works as well on kitchen cabinets or even a Federal-style armoire.

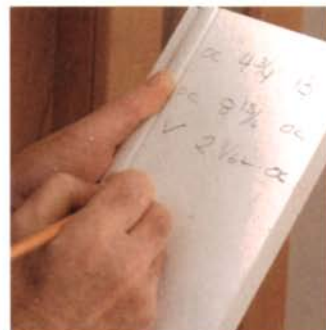
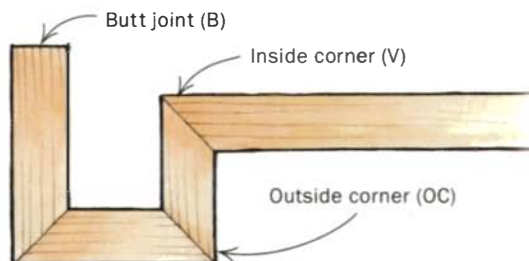
Create a cutlist and set up the saw

Rather than visualize each corner, I make a cutlist of all the pieces. I measure the mounting surface and record the length of each

Measure first, then cut precisely

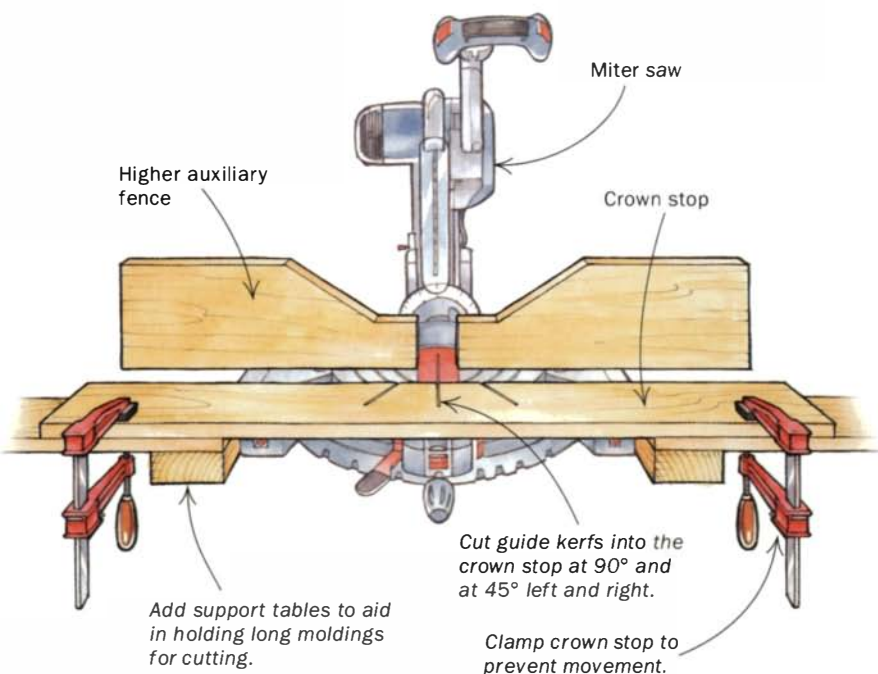
1 MAKE A CUT LIST

Before you cut any crown molding, measure the mounting surface at the base of each piece (left). Indicate inside corners with a "V"; outside corners with "OC"; and for 90° cuts, write a "B" (butt joint). Record the type of corner at each end of the piece (right).



2 SET UP THE MITER SAW

Crown molding is best cut "in position," leaning against the miter saw's fence, because it is faster, easier, and more accurate. A higher auxiliary fence supports the back of the molding, while a crown stop clamped to the saw table prevents the molding from moving when it is cut.



piece of molding at its base. On either side of the number I write the type of cut required. I indicate inside corners with a "V," for outside corners I write "OC," and for 90° cuts I write a "B" (butt joint).

I know the corners on this mantelpiece are perfectly square because I built it myself, but I often check the corners, especially on walls and commercial cabinets, with a protractor. If the corner is more than 2° out of square, I make a note on

my cutlist and compensate while cutting each miter. For a corner that reads 88°, for example, I cut each miter at 44°.

Cut upside down and backward—Crown molding can be cut "in position," leaning against the miter saw's fence, or "on-the-flat," lying on the saw's table. I prefer the former, because you only need a saw that makes side-to-side miter cuts, not one that can flop over to cut bevel angles. Besides,

many miter saws have an upright cutting capacity of 4 in., which accommodates most crown moldings, and cutting in position is faster, easier, and more accurate.

Cutting crown in position doesn't mean you place it on the saw exactly the way it's positioned when installed, leaning away from the saw's fence. If you tried that, the material would move all over the place as soon as the blade touched it. Instead, turn the molding upside down so that the top

of the crown is supported by the miter-saw table, and the bottom is leaned against the fence (that's why carpenters call it "upside down and backward"). This position has two advantages: The bevel angle is always 90°; and because crown molding is almost always measured at the bottom, you can see your measurement marks.

Make two modifications to your saw—I always attach an auxiliary fence to my miter saw, for two reasons: The fence must

be taller than the crown molding when it's standing up; I also need a fence with square ends on which to hook a tape measure (see photo, bottom). Most factory fences are rounded.

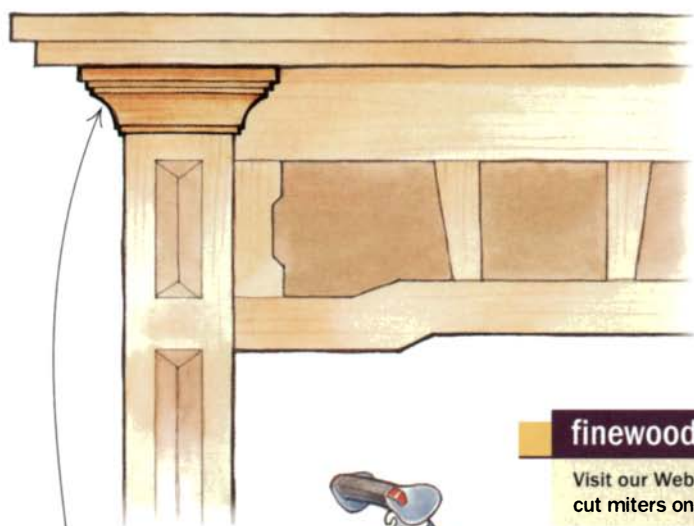
I place the molding upside down against the auxiliary fence and wiggle it until it is resting against both the fence and the saw table. I then place a crown stop, a sacrificial board, on the table to secure the molding. Before clamping the stop to the saw, I measure the distance at both ends

between the front edge of the stop and the auxiliary fence to make sure the board is perfectly parallel. With the crown stop attached, even long pieces of molding are held securely in position, and similar cuts are made at precisely the same angle.

Before I start cutting molding, there are two more tasks. I put an "L" on the right-hand end of the stop and an "R" on the left-hand end to remind me that because the molding is upside down, the miters will be cut on the opposite sides of the

3 CUT CROWN MOLDING "UPSIDE DOWN AND BACKWARD"

When crown molding is cut vertically, as opposed to lying flat on the saw table, it leans against the fence in the direction opposite to how it will be installed. To compensate for this and to cut the miters at the correct angle, the piece must be placed upside down against the fence. Cuts made to the left-hand end of the molding are made on the right-hand side of the saw, and vice versa.



Molding is cut upside down on the saw.

Mark "R" on the left and "L" on the right of the crown stop as a reminder of which side of the molding you are cutting.

finewoodworking.com

Visit our Web site to see the author cut miters on crown molding.



Follow the cutlist. Work your way down the cutlist, cutting each section of molding to the prescribed length and with the correct miter at each end.

MEASURING TIP

Use the fence to measure outside corners. On a piece with two outside corners, it is impossible to hook the tape measure over the end. Instead, align the molding with the square end of the auxiliary fence and hook the tape measure to the fence.

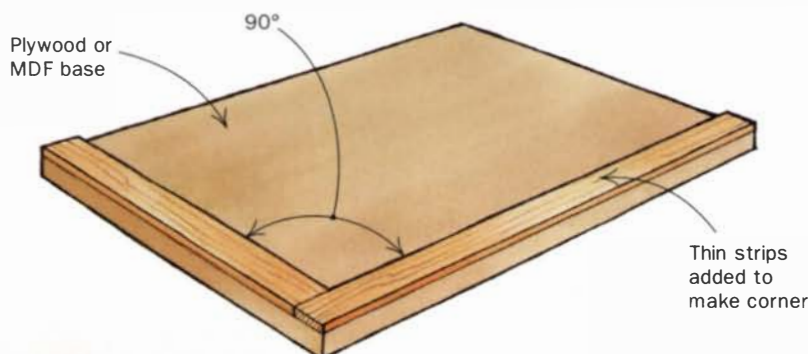




Gluing mitered moldings

1 MAKE PERFECT 90° CORNERS WITH A SET-UP TABLE

To assemble the molding, Katz uses a set-up table made from a piece of plywood or medium-density fiberboard (MDF). Cut one corner perfectly square and add thin strips of wood to the edges that form the corner. Then place the two pieces of molding into the corner and check their fit.



saw. Last, I cut three kerfs into the crown stop at 90° and 45° left and right. It is hard to see the saw's angle marker with the stop in place, and if I make a cut at the wrong angle, the kerfs will signal my error.

Cut the molding accurately and safely

For most cabinet work, I get better results by pre-assembling crown molding. I measure all pieces carefully, but I also judge how much to add or subtract from each measurement. For pieces with two outside corners, I add a bare $\frac{1}{32}$ in., to be sure the finished assembly will fit around both corners; for pieces with two inside corners, I subtract the same amount. The finished assembly must fit tightly but not too tightly.

Mitering molding is all about short points and long points. When you cut crown, the long point of the miter/bevel always will be against the fence for an inside corner; the short point of the miter/bevel always will be against the fence for an outside corner. That rule never changes.

If there is an inside corner, I cut that end first, then hook my tape on the long point and reach across the crown to measure the opposite end. For pieces with two outside corners, I cut one end and align the short point of the miter with the square end of the auxiliary fence. I hook my tape on the end of the fence to measure the molding.

Always keep your free hand behind and tight against the auxiliary fence to protect your fingers and ensure precise cuts. Make a very shallow cut slightly wide of the pencil mark, and then with your thumb wrapped over the top of the molding,



Use specialized clamps. Apply a spring clamp to the outer joint of the molding, massage the joint to find the best fit, and then apply a second clamp (above). To make the joint stronger, use 23-ga., headless pin nails to reinforce both sides of the joint (left). The holes are easily filled with dust when the molding is lightly sanded.



2 ASSEMBLE IN SECTIONS

After you have assembled the molding for each column of the mantelpiece, test the fit. It should be slightly loose.



Clamp inside corners. To give the spring clamps a better grip on the smooth back of an inside corner, drill small holes $\frac{1}{8}$ in. deep.

gradually ease the molding along the fence until the saw cuts precisely on the mark. If the molding is too short to reach the end of the auxiliary fence, it is too short to cut safely, so grab another piece.

The one thing you can't do is allow the crown to move once you start cutting. Any movement, even a slight deflection as the blade enters the molding, will alter the miter/bevel angles. Deflection usually will result in a mismatch, with one miter coming out longer or shorter than the other.

A pair of tools aids accurate assembly

I use a set-up table to make sure that each corner of the molding is perfectly square. The table is made of a scrap of plywood or medium-density fiberboard (MDF) with one corner cut perfectly square and thin strips of wood glued to the two edges that form the corner. I place the two pieces of molding into the corner and check their fit. I make sure that they meet at 90°, that one piece doesn't go inside the marked corner of the other, and that the profiles on the outside match. You rarely will achieve perfection in all three areas, so compromise for a good all-around fit. But don't crowd your measurement marks or the assembled sections may not fit together.

When you are satisfied, spread a generous bead of glue over each face. Place the pieces back on the set-up table and clamp the joint. Using spring clamps is the only



Attach the finished molding. When the molding is assembled, slide it onto the mantelpiece and secure it to the shelf with 16- or 18-ga. finish nails.

way to be sure the miter joints stay tight, especially when you fire a nail through the molding. I use spring clamps and a pair of dedicated pliers made by Collins Tool Co. (www.collinstool.com) because they're strong but needle sharp, so they don't leave large marks in the molding. While the glue is still wet, reinforce the joint with 1-in.-long, 23-ga. headless pin nails. Conceal the tiny holes with a light sanding.

For the mantelpiece, I assembled the three pieces of molding that crown each column and checked their fit. I then cut the long center piece of molding and checked its fit. Finally, I assembled all three sections, sanded the high spots, and attached the molding to the mantel shelf. □

Gary M. Katz is contributing editor to *Fine Homebuilding*. For more tips on trim carpentry, visit his Web site at www.GaryMKatz.com.

Hone Your Hand-Tool Skills

A handful of exercises develops competence and confidence with chisels, planes, and saws

BY MICHAEL PEKOVICH

Hand tools intimidated me for a long time. I knew I could trust machinery to mill flat surfaces and make perfectly straight cuts, but hand tools didn't afford the same mindless accuracy.

I've since learned that for certain tasks, a properly wielded hand tool lends speed, precision, and a sense of joy to woodworking that no machine can match. A router and dovetail jig can turn out precise dovetails all day long, but the elegant, narrow pins that are the hallmark of craftsmanship come only from a backsaw and chisels. An edge rounded over with sandpaper is lifeless compared to the crisp chamfer cut by a sharp block plane. And while a power sander can remove planer snipe and machine marks on a board, only a handplane's long, flat sole can remove imperfections while leaving a truly flat surface.

Fortunately, acquiring competence and comfort with hand tools is not a long or grueling process. There are simple skill-building exercises for the tools I use most frequently: backsaws, chisels, block planes, and bench planes. To my mind, mastery of these four tools is the foundation for doing good work.



Cutting on a line

MASTER THE BACKSAW TO CUT PRECISE TENONS AND DOVETAILS

With its top-mounted stiffener, a backsaw is designed to do one thing: cut straight lines for tenons and dovetails. The two types of backsaws are the Western saw, which cuts on the push stroke, and the Japanese saw, which cuts on the pull stroke. Because even an inexpensive Japanese saw comes razor sharp right out of the box, and beginners usually find it easier to start a cut on the pull stroke, I recommend it to those choosing a first backsaw.

To cut accurate joinery, you must be able to saw to a line scribed or drawn on a board. The easiest way to become proficient at this is to learn to cut straight down. Then it is just a matter of orienting the workpiece so that the intended line of cut is perpendicular to the benchtop. Even dovetails can be cut in this fashion simply by angling the board in the vise.

This exercise will help you determine the proper grip and stance for straight cuts. Use a softwood board, roughly 6 in. wide by 18 in. long, with a square cut on both ends. Draw a series of lines about 2 in. long, spaced about 1/4 in. apart, along the top edge of the board (see photo, left). Begin cutting, but don't worry where the saw is heading.

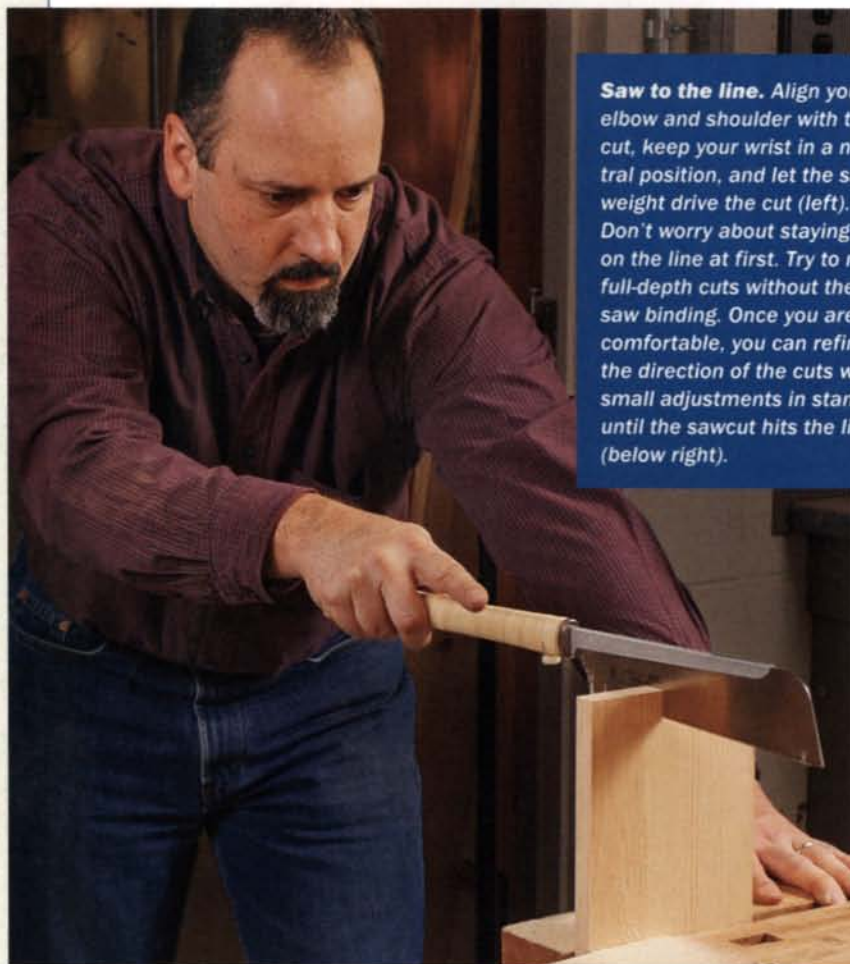
Sawing a straight line depends on setting up properly before you start the cut, then relaxing and letting the saw do the work. Once you start to cut, the saw will end up where you first aimed. Minor course corrections can be made, but blatant attempts at changing direction will wedge the blade in the kerf. Stop after a few cuts and check your progress. The kerfs probably will be off angle a

bit. This drift may be due to your stance or to the way the saw was sharpened. Adjusting your stance is the best way to alter the line of cut. If the saw is cutting to the right, move slightly to the right; if it cuts to the left, move to the left. The point is to team up your body with the saw. Neither one of you is perfect, but together you can make perfect cuts.



For square cuts, start with a square setup. Clamp a board in the vise using a square for alignment. Then use the square to draw lines on the board's face. With plumb lines as a guide, you're ready to start sawing.

Saw to the line. Align your elbow and shoulder with the cut, keep your wrist in a neutral position, and let the saw's weight drive the cut (left). Don't worry about staying on the line at first. Try to make full-depth cuts without the saw binding. Once you are comfortable, you can refine the direction of the cuts with small adjustments in stance until the sawcut hits the line (below right).





Chisel

Paring clean, precise joints

**CHISEL AWAY WASTE
WITH FINESSE,
NOT FORCE**

Chisels are straightforward tools, but there are techniques that can help you use them more precisely. I use chisels primarily to pare end grain and to clean out between dovetails or around tenons. For years, I chopped more than pared, pounding away on the chisels with a mallet to remove the waste. Then I discovered that by getting the chisels very sharp, I could pare paper-thin shavings, allowing me to sneak up on a scribed line with more precision and without the dulling force of a mallet.

On the end of a square-cut board, scribe a shoulder line and some 1-in.-wide tenons. Cut to the shoulder line with a backsaw. With a coping saw, remove the waste between every other kerf, leaving a rough triangle. With the board flat on the bench, start the chisel as close to the point of this triangle as possible. Holding the chisel perpendicular to the bench, push straight down.

Pare away the waste until you reach the shoulder line, then flip over the board and check your progress on the other side. Ideally, you'll have pared right to the scribe line but not past it. It's better to leave a bit of waste than to overcut. You'll find it easy to pare to the line from the back. Be careful not to leave a hump in the middle that would prevent a joint from closing fully.



A coping saw removes waste quickly. After backsawing a few tenons, cut the wood in between, leaving just a small triangle to be trimmed with a chisel.



Paring beats pounding. The lower hand guides the chisel, and the upper transfers power from the shoulder. Keep the chisel perpendicular to the work, and take small cuts.

Downward force should be centered over the chisel.



At first, the going is easy. If the chisel skips out of the cut, it is angled away from the shoulder line. If it wedges in, it is angled too far into the workpiece.



Take thinner parings as you approach the shoulder. When you reach it, flip the board. If you're not to the opposite shoulder line, pare from that side. Be careful not to undercut either side, or leave a hump in the center of the cut.





Block plane

Planing perfect corners

USE GUIDELINES FOR CRISP, ACCURATE CHAMFERS



Guidelines on each face make a target. Many woodworkers wouldn't draw lines for a chamfer. But these lines, $\frac{1}{8}$ in. from the edge of the board, provide a valuable reference for this exercise.

My 4-year-old daughter sometimes likes to work alongside me in the shop. Her activities usually are limited to nailing and gluing scraps together, but when she sees me pick up a block plane to knock an edge off a board, she runs over to tackle the task herself. Clearly, the block plane is not difficult to use, but you can get better performance from it by practicing a few maneuvers.

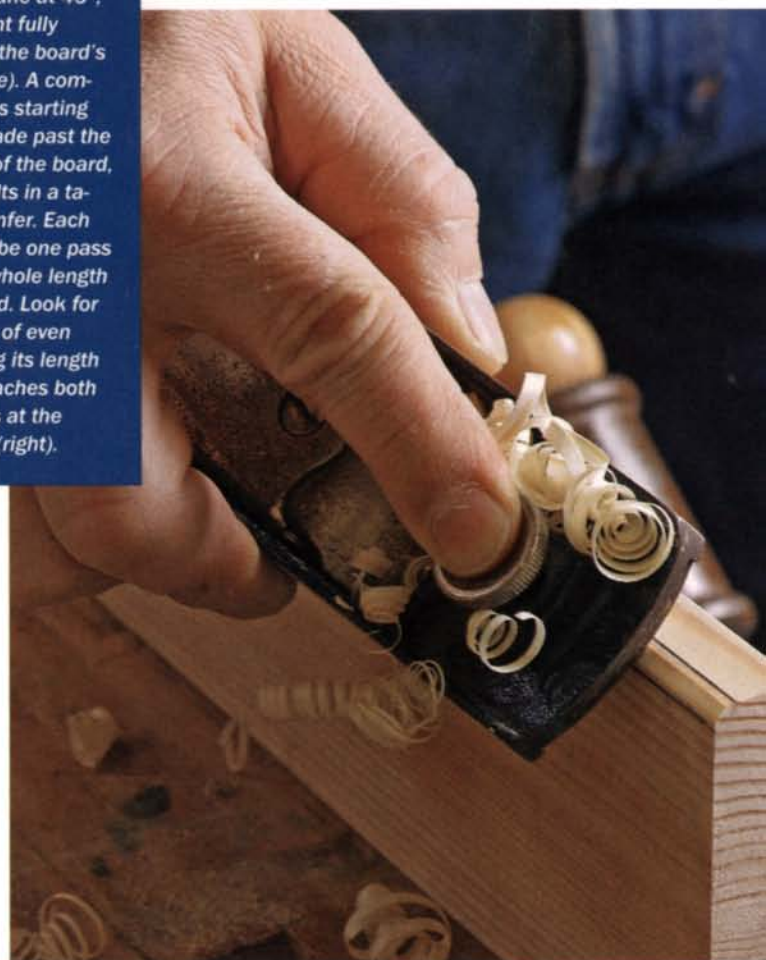
I use a block plane chiefly for chamfering the edges of boards. My aim is to cut a 45° chamfer of a consistent depth along the length of the board. To get the hang of this, scribe pencil lines $\frac{1}{8}$ in. from both sides of a board's corner (see photo, above). Practice chamfering until you hit the lines. For wide chamfers, I still make it a habit to use layout lines, but for anything less than $\frac{1}{4}$ in. wide, I rely on technique and let my eye be the judge.

Set the blade, or iron, to take a fairly aggressive cut, and secure the board in a vise. Hold the plane at 45° to the board, and plane the entire length. If you get tearout, adjust the blade for a lighter cut or plane in the opposite direction. After a few strokes, check your progress. Ideally, the chamfer will be of consistent width, which means you're approaching both scribe lines at the same rate.



Start with the blade beyond the board.

Hold the plane at 45° , with its front fully contacting the board's edge (above). A common error is starting with the blade past the beginning of the board, which results in a tapered chamfer. Each cut should be one pass down the whole length of the board. Look for a chamfer of even depth along its length that approaches both scribe lines at the same rate (right).



Chamfering end grain

ACHIEVE CHIP-FREE CHAMFERS ON END GRAIN

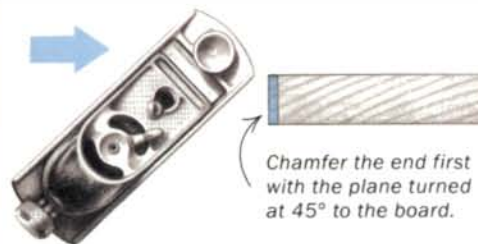
Use a marking gauge to scribe a $\frac{1}{8}$ -in. shoulder around one end of a board and along each edge of the end grain. I wouldn't bother with this step on a piece of furniture because the cuts from the marking gauge will remain after the chamfer is complete. In this case, they're there to provide a target as you practice chamfering all four edges of the end of a board.

Clamp the board securely in a vise and chamfer the first end. Skew the block plane and cut from the base toward the top. The finished chamfer should be a single facet that hits each scribe line. Turn the board, and chamfer the other end. By chamfering the ends first, you'll avoid tearout as you plane the sides. When the ends are done, start chamfering the long edges, trying to hit the scribe lines evenly on the final pass. To prevent tearout, skew the plane as you move it parallel to the edge. As you finish the chamfer, don't let the side bevel become deeper than the end bevel, or you can end up with tearout. All the chamfers should meet exactly at the corners (see photo, right).

Now, flip the board and repeat the exercise on the other end, this time without the scribe lines. The result may not be perfect, but if you concentrate on clean bevels that align at the corners, it should look pretty nice without a lot of time spent scribing lines.



Start planing at an end. Set the plane to take a light cut. Hold the plane at 45° to the direction of cut to create a shearing action, and make continuous passes.



Plane toward a chamfered end. By planing in this direction, the wood fibers at the end are supported, and won't tear out.



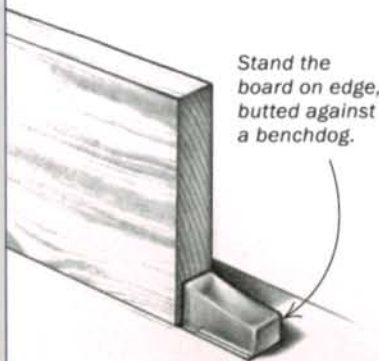
A perfect chamfer. The width and angle are consistent, and the facets meet exactly at the corner.

Jointing edges

WEIGHT SHIFT IS THE KEY TO CONSISTENT EDGE-PLANING



Recess the blade, then run it back out. Use two fingers to gauge the depth of cut and whether the blade is parallel to the sole while making adjustments with the other hand.



Most woodworkers I know have had a bad experience with a hand-plane, and I'm no exception. In the middle of one of my first projects, I grabbed a dull, rusty plane from my dad's toolbox and promptly ruined a nice walnut board. The plane went back in the toolbox and never came out again. It wasn't until years later when I was handed a sharp, well-tuned plane that I finally discovered the joy of taking a paper-thin shaving off the edge of a board. A bench plane isn't absolutely necessary for woodworking. But nothing beats one for quickly removing machine marks, leaving a surface ready for finishing (or just a few swipes of fine sandpaper away from it).

Of all the tools mentioned so far, sharpness is most critical to the performance of a hand-plane. The sharper the blade, the thinner the shaving you can take, and the better the resulting surface. For more on tuning and sharpening a handplane, see *FWW* #172, pp. 36-41.

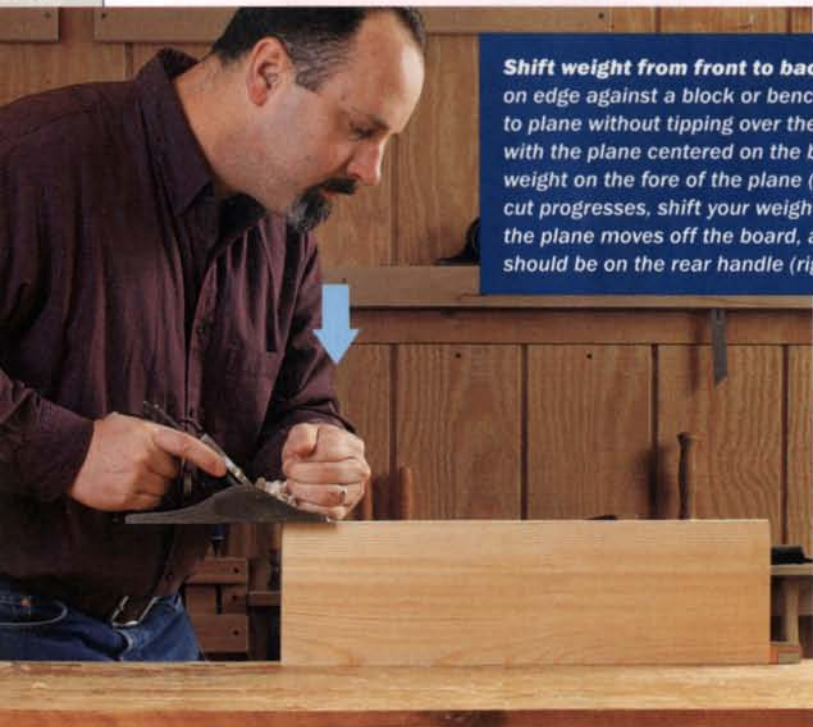
The two basic jobs of a bench plane are jointing (making the edge of a board straight and square to its sides) and smoothing the face of a board. In both cases, start by setting the

plane's blade, or iron, for a fairly light cut. The best way to gauge how far the blade protrudes from the plane's sole is by feel (see photo, top left). Square the iron to the sole using the lateral adjusting lever, found below the iron.

Effective edge-jointing involves a gradual weight shift from front to back during a pass while keeping the plane's sole flat on the board (see photos, below). There is a quick exercise that lets you get a feel for this concept. Take a 6-in.-wide by 18-in.-long board whose edges are ripped square, and stand it on edge. Place the front end of the board against a benchdog or stop. Take some full-length passes on the top edge of the board. Taking these passes without the board tipping over or lifting off the bench requires that you shift your weight as described. After a while this weight shift will become second nature.



Shift weight from front to back. With a board on edge against a block or benchdog, learn to plane without tipping over the board. Start with the plane centered on the board, and your weight on the fore of the plane (left). As your cut progresses, shift your weight backward. As the plane moves off the board, all of your weight should be on the rear handle (right).



Smoothing face grain

A SHARP BLADE AND LIGHT CUTS LEAVE A BOARD READY TO FINISH

Planing the face of a board requires the same weight shift as planing the edge of a board, but because the entire width of the blade makes contact with the surface, more force and a lighter cut are necessary. Sometimes, especially at the beginning of a cut, the plane will leave a scalloped surface as it cuts. This is known as chattering. To avoid it, get the blade sharp and set it for the lightest cut possible. Begin the cut with your weight at the front of the plane, and move slowly across the board. Skewing the plane as you move forward also can minimize chattering.

To practice smoothing, secure the board on the benchtop. Pencil some lines across the face along the length of the board. Set the blade for a very light cut. I like to back the blade into the sole, then slowly lower it.

Start at the left edge and take a full-length pass with the plane. If the board's surface is uneven, the plane may take a sporadic shaving. This is fine. If the plane doesn't cut at all, set the blade for a deeper cut. By making a habit of gradually increasing the depth of cut, you should avoid gouging your work. Continue planing, moving from left to right with slightly overlapping strokes. Resist the urge to take multiple passes when you come to an area where the plane doesn't shave. The way to remove a low area is to plane the entire board to that level. Finally, if the plane leaves ridges across the face of the board, its blade is not parallel with the sole. Adjust the blade, and plane on to a perfect finish.



Pencil marks gauge your progress. To minimize tearout, set the blade for a light cut. Shift your weight from front to back, and skew the plane to make a shearing cut (above). Make a series of passes, moving from one side to the other. Pencil marks will show the low spots (right). Keep planing the entire board until it's flat and the pencil marks are gone. The sharper the blade, the thinner the cut you can take, and the less tearout you'll have (below).



readers gallery

BOBBY HARTNESS

Greer, S.C.

Hartness made these reproductions of an 18th-century Pennsylvania secretary—one mahogany (front), one walnut—as Christmas gifts for his two daughters. For guidance, he used plans published in the January/February 2002 issue of *Fine Woodworking* (#154). Each secretary (21 in. deep by 38 in. wide by 84 in. tall) required about 320 hours in the workshop. The finish is lacquer.



MATTHEW SCHER

Troy, Mich.

Commissioned by a local gallery to build a viewing bench, Scher used walnut, maple, mahogany, and bubinga to create this piece, which measures 21 in. deep by 72 in. wide by 18 in. tall. To create a pair of seats, he carved a textured surface onto each end of the bench. The legs, made from mahogany, are painted. A mixture of oil and varnish serves as the finish.

JIM KILTON

Mauldin, S.C.

A donated log provided the raw material for the 6½-in.-dia. by 3-in.-tall spalted-maple bowl (top). The shouldered vessel (right), made from Norfolk Island pine, has a diameter of 7 in. and measures 7 in. tall. After turning the 9-in.-dia. by 2-in.-tall flower vessel from maple (left), Kilton painted the outside surface to look like marble. All the bowls were finished with lacquer and then waxed.



BRENT WRIGHT

Ketchum, Idaho

Blending the design influences of the East, West, and James Krenov, Wright used reclaimed Douglas fir to make this 21½-in.-deep by 42-in.-wide by 36-in.-tall cabinet. The panels are medium-density fiberboard (MDF), painted with acrylics to mimic the silhouettes of willow and sagebrush. He needed about 65 hours to complete the piece, finishing it with a washcoat of red acrylic, followed by a satin lacquer topcoat.

LEE F. JOHNSON

Portland, Ore.

This display case, known as a vitrine, was made for a client to hold a book of original art. The design of the case (17½ in. deep by 24½ in. wide by 9 in. tall) has roots in 18th-century tray-top tea tables. Western black walnut serves as the primary wood; hard maple is the secondary wood. The pinecone-like carved legs and feet evolved from Johnson's habit of asking clients if they'd like the piece to incorporate a touch of nature. The finish is an oil/varnish mix.



Submissions

Readers Gallery provides design inspiration by showcasing the work of our readers. For an entry form, visit www.finewoodworking.com. Send photos and entry forms to Readers Gallery, *Fine Woodworking*, 63 S. Main St., Newtown, CT 06470.



TIM O'BRIEN

Eagle, Colo.

The wife of one of O'Brien's best friends commissioned this drop-front secretary as a surprise 60th-birthday present for her husband. On more than one occasion, the friend got a look at the piece under construction, but a ruse ("it's for a wealthy client") kept him in the dark until O'Brien presented him with the finished piece at the birthday party. Made from figured cherry with rosewood accent pieces, it measures 19 in. deep by 43½ in. wide by 44 in. tall.

DONALD ROGERS

Lindenhurst, N.Y.

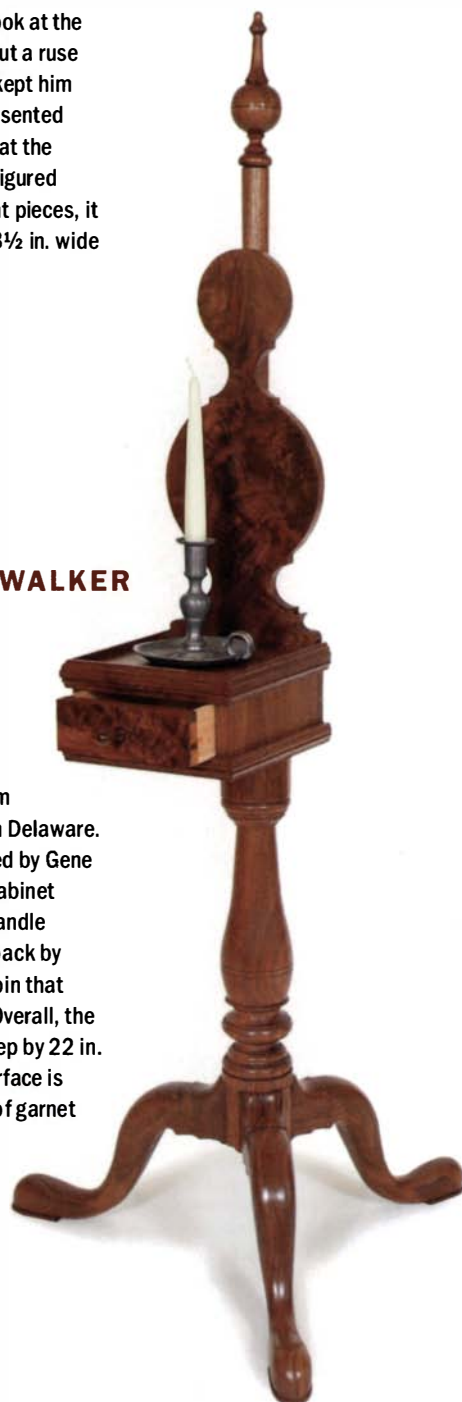
Rogers made this banister-back chair from a photograph in the book *Furniture of the Pilgrim Century* by Wallace Nutting. Made entirely from maple, the chair measures 20 in. deep by 21 in. wide by 46 in. tall. The molded, arched top was created as a turning and then sawn in half. The finish is milk paint followed by linseed oil. Rogers estimates the chair took about 40 hours to build.

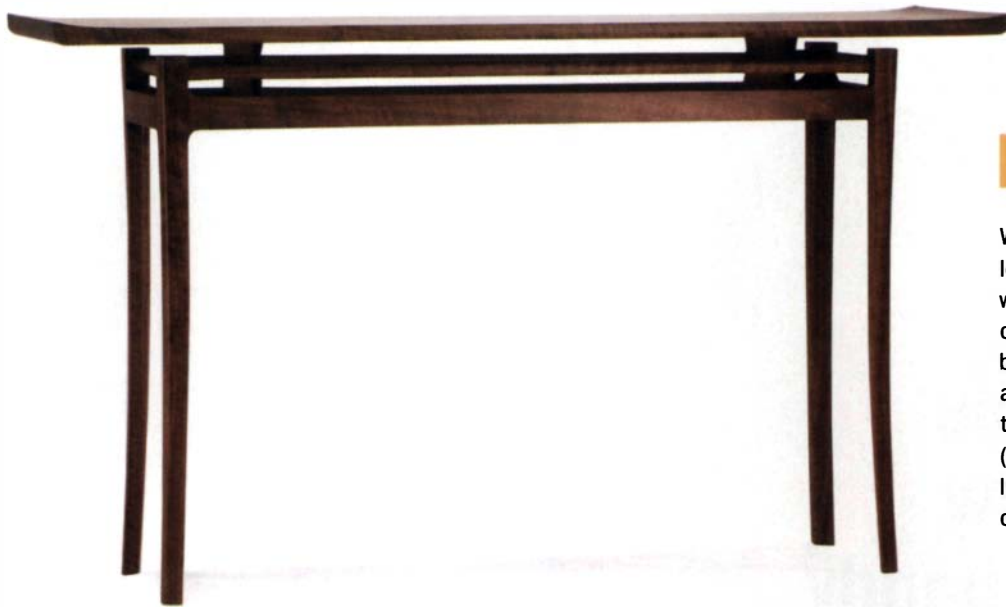


FREDERICK WALKER

Woodbine, Md.

Using American black walnut and handwrought iron, Walker created this Queen Anne candlestand by modifying a design from the Winterthur Museum in Delaware. He built it in a class offered by Gene Landon at the Olde Mill Cabinet Shoppe in York, Pa. The candle height is adjusted at the back by means of a wrought-iron pin that fits into the turned post. Overall, the piece measures 22 in. deep by 22 in. wide by 56 in. tall. The surface is finished with eight coats of garnet shellac followed by two coats of dark brown wax.





BENJAMIN A. WOOD

Seattle, Wash.

Wood made this table (14½ in. deep by 54 in. long by 31½ in. high) out of American black walnut. The design combines the subtle curves of Asian furniture, sculptural elements used by Sam Maloof, and the delicate look of twin aprons that Wood saw on a Ross Day piece. The table is finished with five coats of an oil mixture (consisting of equal parts polyurethane, boiled linseed oil, and raw tung oil) followed by a coat of paste wax.

RICHARD C. CHEEK

Memphis, Tenn.

Several years ago, while perusing a catalog, Cheek spotted a chest he knew he'd want to build someday. The catalog stayed in a safe place until last year, when he came across some quilted mahogany that would work perfectly. The finished chest, which took about 600 hours to complete, measures 10 in. deep at the top, 17 in. deep at the bottom, 21½ in. wide, and 58½ in. tall. Cheek used alder as a secondary wood. He curved the inside faces of the drawer fronts to match their outside faces. As a result, the drawers incorporate curved dovetails. For the finish, Cheek used a sealcoat of shellac, followed by a gel stain, a wiped-on gel varnish, and five coats of wax.



NATHAN KUSHNER

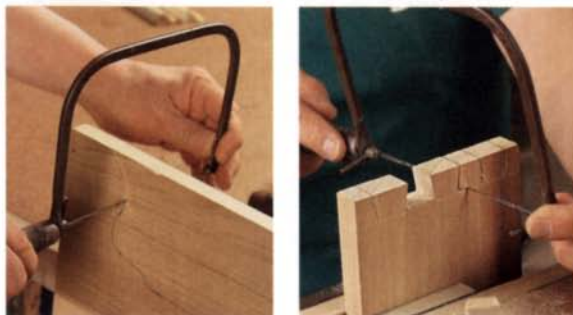
Thunder Bay, Ont., Canada

Using solid cherry and European walnut burl veneer, Kushnertook around 200 hours to build this table, which is 36 in. deep by 36 in. wide by 30 in. tall. For the finish, he applied flat lacquer followed by an oil/varnish mix.

The humble coping saw comes in handy for many tasks

BY MIKE DUNBAR

A shop workhorse



Modest but versatile. The coping saw excels at cutting all kinds of curves, including those for bracket feet. The slim blade turns nimbly in narrow spaces, handling tight corners to saw out dovetail waste. Its flexibility and inexpensive blades also make it a better choice than a backsaw for many general trimming operations.

When I was in junior high school in the early 1960s, I had to take what was then called “Manual Training.” Each student had to build a wooden tie rack for his dad. Because we were 14-year-old boys, the instructor would let us use only two tools—a rasp and a coping saw. I grew up thinking that coping saws existed only so that kids and klutzes wouldn’t hurt themselves.

Not so. I use a coping saw in a professional woodworking shop every day. The saw can simply and quickly cut coped joints for molding or curved parts for furniture and other work. Its blade can be threaded through stock to cut interior shapes or worked into tight places to trim waste from joinery. All this from a tool that’s inexpensive and simple to maintain. Whenever I gather my tools, the coping saw is among the first I reach for.

Choose a model with a sturdy frame

A coping saw has a C-shaped steel frame whose two arms are slightly farther apart than the blade is long. These arms pull the thin, flexible blade taut. In the end of the wooden handle and the front arm, two slotted yokes hold the blade.

The handle also holds a captive nut that loosens when the handle is turned. This allows the blade to pivot relative to the frame so that you can adjust the saw to the cutting situation. Be sure to turn the two



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Installing a coping-saw blade

Release pressure.

Loosen the handle and slightly compress the saw's arms against a benchtop to install the blade.



Seat the blade.

Make sure the blade pins sit securely in their notches before tightening the handle. The author mounts the blade to cut on the pull stroke.



yoke pins equally to avoid twisting the blade, and re-tighten the handle afterward.

Not all coping saws are created equal. I prefer an all-steel saw with some heft. For example, Woodcraft sells a sturdy model for \$13.99 (product #141403). Cheaper, lightweight models tend to have weaker frames and poorly attached handles.

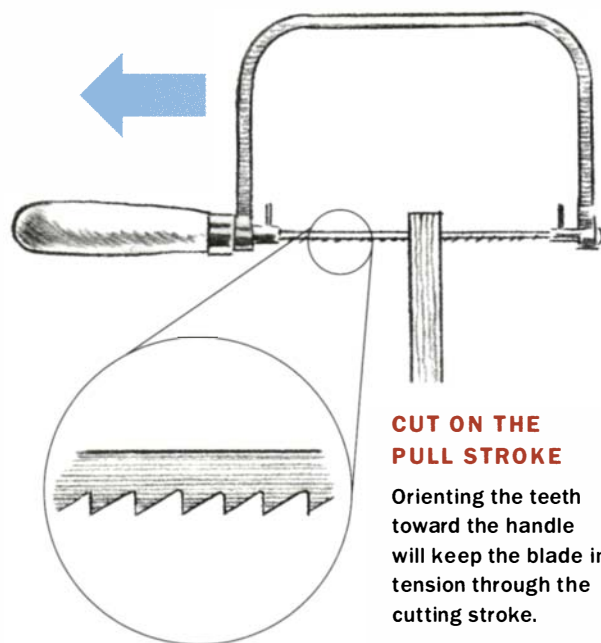
Low-quality blades also can be a problem. Some brands are not as sharp as others; some break easily. I only use Stanley blades, which are available at Ace Hardware. Coping-saw blades are made for different purposes and materials. The fewer the teeth per inch, the coarser the cut. Available sizes include 10, 15, 20, and 24 tpi. For most work, I use a 15-tpi blade.

Guide the saw with both hands for straight cuts, smooth curves

To install a blade, compress the saw's arms to close the distance between them and slide the ends of the blade into the yokes. Be sure to seat the small pins securely on the ends of the blade, or the tension in the frame can launch the blade like a slingshot.

I was taught to install the blade so that it would cut on the push stroke, and I still use it this way for making coped cuts. But I've found I have more control making other cuts on the pull stroke, as with a Japanese saw. In this orientation, the blade is less apt to bind, which can cause it to break or allow the blade to spring out of the saw.

Most woodworkers use a coping saw for cutting curves on a board's edge. These cuts can be for



CUT ON THE PULL STROKE

Orienting the teeth toward the handle will keep the blade in tension through the cutting stroke.



Use two hands. Grasp the saw by the handle and front arm, and cut with the blade's full length. Keep your strokes parallel to the benchtop.

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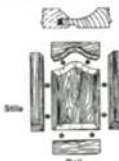
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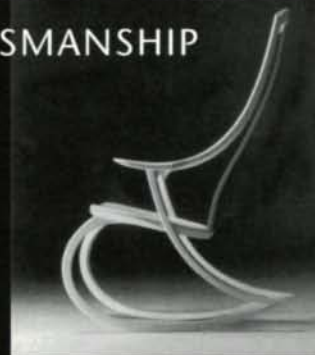
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Coped cuts for seamless corners

Coping is the process of fitting one three-dimensional surface to another. Often, those surfaces are moldings. When moldings are mitered, seasonal movement can cause the joints to open. If moldings are coped, the two surfaces slide imperceptibly across each other when they move, and a gap never develops.



Coping a corner joint. To cut a coped joint, miter the workpiece and highlight the edge to mark a clear path for your coping saw (1). Cut along the pencil mark, back-beveling the rear surface to allow the joint to close completely (2). To avoid chipping the surface, mount your blade to cut on the push stroke. The finished cut will mate closely with its neighbor to form a tight corner (3).

making furniture or architectural parts, or for shaping the mating edge of a scribed joint. Many users imagine the coping saw as a hand version of a scroll saw. They clamp the wood flat to the bench and try to use the saw vertically. This method does not permit good control. I secure the wood vertically in a vise and use the saw horizontally.

I keep the saw's frame upright and turn the blade so that the direction of cut is horizontal. Being right-handed, I grip the handle in my right hand and the front yoke in my left. I keep my stroke smooth and regular, using as much of the blade as I can without running the yokes into the workpiece.

I am careful to keep my hands parallel to the benchtop for a square edge. If you want a beveled edge, you can create it by purposefully raising one hand as you use the saw.

A coping saw also will cut interior shapes. First drill a small hole in the waste. Remove the blade and pass it through the hole. Remount the blade and use the saw in the same way as for an exterior cut. You will have to reposition the wood in the vise to allow the saw to cut the entire perimeter.

Trimming joinery and hard-to-reach corners

The coping saw is also handy for removing the waste between dovetails. After cutting the tails, run

a coping-saw blade down the kerf. At the bottom, begin sawing as you turn the blade horizontally. This turn will leave a small, round corner. Cut across the waste just proud of the scribe line and into the opposite corner. Pare the round corner and down to the scribe line with a chisel.

I often keep a coping saw nearby when I'm using the bandsaw. I find the hand tool makes quick work of trimming tight corners and other spots that are time-consuming and awkward to reach on the machine.

Being a frugal Yankee, I also use my coping saw for a lot of trimming that many woodworkers would do with a backsaw. Here's why: When my backsaw gets dull, I have to send it out to be sharpened. It is gone for a week, and it costs me \$10. When a coping-saw blade gets dull, it usually breaks. I pop in a 65¢ replacement, and I am back to work.

Because an improperly mounted blade can be launched by the frame, it is always a good idea to wear safety glasses when changing blades. And while you're unlikely to cut off a finger with a coping saw, it can give you a nasty, ragged cut that will hurt a lot more than a nice, clean slice. Such cuts usually occur during trimming. Be sure not to place a free hand where the blade will exit the workpiece. □

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READER SERVICE NO. 34

Improve ray-fleck pattern in oak

Q: My quartersawn oak stock doesn't always have interesting figure. Is there a way to improve the appearance?

TIM LEE, Milton, Ont., Canada

A: RAYS IN A TREE CONTRIBUTE TO THE FIGURE of a piece of wood. They radiate out from the center of the tree, perpendicular to the growth rings. Ideally, when lumber is quartersawn, the growth rings are perpendicular to the surface of the board and the rays end up parallel to the surface. The split and exposed rays create what is known as ray fleck. Not every piece of quartersawn lumber has rays parallel to the board surface, but by resawing the board's surface relative to the rays and growth rings, you can make the ray fleck in your oak look spectacular.

To accomplish this, I use a 14-in. bandsaw, which lets me cut at the proper angle on boards as wide as 6 in. (or even 12 in. with a riser kit installed on the saw). First, tilt the table to an angle so that when the board is placed on its edge, the rays are parallel to the blade. Then set up the fence so that the blade cuts to the corner of the board, maximizing the final thickness.

Now the face of the board is parallel to the rays. Use that new face as your reference to mill the remaining sides of the board.

Although this process generates a large amount of waste, it gives me the option to build furniture that has a stunning ray-fleck pattern.

—Hendrik Varju builds furniture in Acton, Ont., Canada. For more on his work, go to www.passionforwood.com.

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Quartersawn stock doesn't always have growth rings that are perfectly perpendicular or rays that are perfectly parallel to the face of a board (top). But slicing through the rays closest to the face of the board will reveal classic ray-fleck figure (bottom).

READ THE END GRAIN

The end grain reveals the direction of the rays.

Growth rings

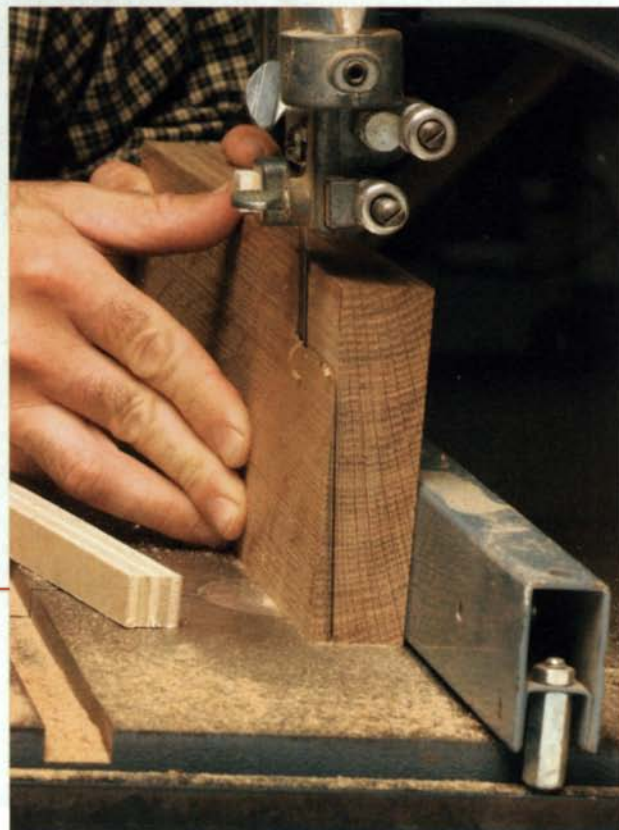
Rays

Plan your cut so that rays are parallel to the face.



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Place the stock against the fence and tilt the table to align the rays parallel to the blade. Position the rip fence so that the blade just clears the top corner of the board.



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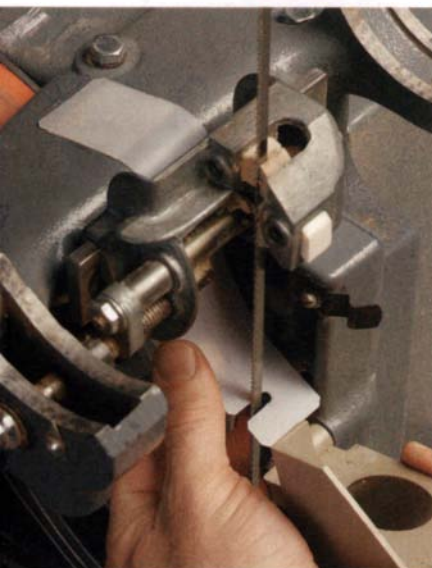
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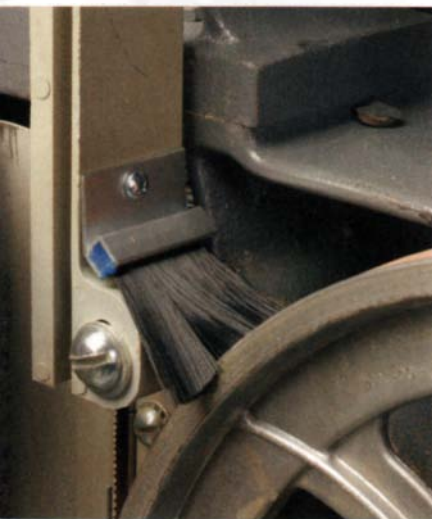
Keep bandsaw tires clean

Q: How do you clean embedded sawdust off bandsaw tires and minimize the dust from building up on the tires?

MEL HALPERN,
Richboro, Pa.



Install a dust deflector below the table. Use a piece of flexible cutting board, found at hardware stores, and align it with the existing dust-collection port.



Install a brush in the lower housing, against the wheel. Iturra Design carries a brush that fits the Delta 14-in. bandsaw.

A: WITH THE SAW TURNED OFF AND UNPLUGGED, scrub off embedded sawdust with a brass brush. Spin the wheel by hand and hold the brush in place against the wheel. Avoid using oil-based solvents such as paint thinner because they may damage the rubber of the tire.

To avoid the buildup in the first place, you can make three simple modifications.

First, install a deflector that will channel the dust toward the pickup chute. A piece of stiff rubber or flexible plastic can be attached with self-tapping screws or double-sided adhesive tape.

Second, install an additional dust pickup in the bottom left-hand corner of the lower housing, where a pile of dust tends to collect. You can use a metal-cutting hole saw to drill the hole. A sawdust pickup chute available from tool suppliers can be attached with screws over the hole.

Finally and most important, any remaining dust can be kept off the wheels by installing in the lower housing a stiff brush that cleans the lower wheel as it rotates. I use a wooden scrub brush with stiff natural bristles that I cut to size and attach with wood screws, inserted through holes in the metal casting.

With these modifications, I haven't had to replace the tires that came with my bandsaw 30 years ago. For more on dust collection, see "Five Tips for Better Bandsawing," *FWW* #173, pp. 66-71.

—Michael Fortune, furniture maker in Lakefield, Ont., Canada

Grounded wire on PVC pipes reduces electrical shock

Q: When I installed a dust-collection system, I ran a wire inside the PVC pipe to pick up the static charge and reduce the threat of fire. But the system clogs where the wire exits the pipe. Is wrapping the wire on the outside as efficient as having it inside?

STEVE PRESTON,
Salina, Kan.

A: ANECDOTAL AND SCIENTIFIC EVIDENCE says that static is not a fire hazard in the kind of dust-collection system you describe. However, a user might receive a nasty jolt from such a system, which could be a different sort of hazard.

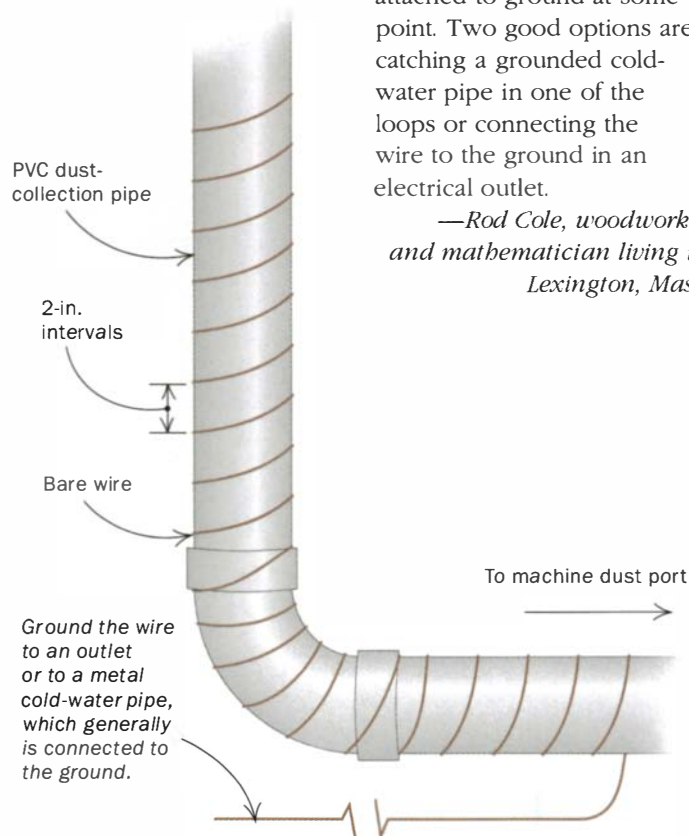
Because a plastic system cannot really be grounded, you cannot eliminate the chance of the user getting a shock. But you can reduce it. A grounded wire either inside or wrapped around the outside of the pipe is reasonably effective at reducing the chance of shock.

To install an outside ground wire, use any old or new bare wire and wrap it around the pipe so that the loops are snug. Make sure the wire is attached to ground at some point. Two good options are catching a grounded cold-water pipe in one of the loops or connecting the wire to the ground in an electrical outlet.

—Rod Cole, woodworker and mathematician living in Lexington, Mass.

GROUNDING DUST-COLLECTION PIPES

A grounded wire will minimize electrical shocks. Wrap a bare wire around PVC pipes so that the loops are 2 in. apart.



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Thin, wide stickers lead to mold problems

Q: Two years ago, I ordered several thousand board feet of ash, which I stickered with pieces of lath intended for plaster walls. Months later, where the lath contacted the ash, I noticed a reddish discoloration $\frac{3}{16}$ in. deep with a musty sort of mold growing. The red stripes would not go away with bleach. What caused the discoloration?

CHRIS HARVAN,
Cleveland, Ohio

A: STRIPS OF LATH ARE TOO THIN TO USE AS STICKERS. Under warm conditions, ash has enough moisture to create the perfect environment to support discoloring molds. Such stains often are quite deep; nothing I know will remove them other than planing them away.

Using stickers that are narrower but thicker than lath (hardwood is best), at least 1 in. thick, allows better air circulation through the pile and quicker drying. Avoid using white pine, basswood, and poplar as these softer woods seem to soak up moisture more than harder woods.

Build the stack in an airy

place, well off the ground, and no more than 42 in. wide. I sometimes make a “chimney” inside the pile, leaving plenty of space between the center boards to encourage better airflow. Cover the pile with an overhanging roof that sheds water, such as an old roofing tin. Don’t leave the stickers jutting out from the sides, or they will catch

Maximum air circulation, minimal contact. By using narrower and thicker stickers, you increase air circulation and minimize contact between the stickers and the lumber.



rain and wick moisture into the pile. And always try to cut and start drying lumber well before the warm months.

—Garrett Hack, contributing editor

How to slow the drying time of shellac

Q: I’m a violin maker, and I use a seedlac and alcohol finish colored with transparent aniline dyes. Can lacquer retarder be added to the mixture to improve brushability and flow characteristics without adverse effects?

BRIAN T. DERBER,
Presque Isle, Wis.

A: LACQUER RETARDER CAN BE ADDED TO SHELLAC to slow the drying time and improve flow-out. However, residual lacquer retarder trapped in the shellac film will soften the finish significantly and may take months to evaporate. During that time, the shellac film will appear hard and dry but will be prone to scratches and marking.

A safer way to slow down the evaporation rate of shellac is to add isopropyl alcohol to the mixture. Isopropyl alcohol evaporates about 25% slower than denatured ethyl alcohol.

Equal parts isopropyl alcohol and denatured alcohol works well. The drying time is slow enough to level out brush marks but still fast enough to dry hard in a few hours.

An alternative is H. Behlen

& Bro. Behkol solvent. It evaporates slower than traditional denatured alcohol, improving both flow-out and leveling of the shellac finish.

—Chris A. Minick, consulting editor



Two solutions to improve shellac flow-out. Isopropyl alcohol can be purchased from Circuit Specialists (www.web-tronics.com), and Behkol is available from www.garrettwade.com and www.woodcraft.com.

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THE DIFFERENCES BETWEEN NATURAL
AND MAN-MADE PRODUCTS

BY GARRETT HACK



Walk into Norton's manufacturing plant in Littleton, N.H., and the smell is reminiscent of a bakery. Arranged like so many pastries on cooling racks are row after row of fresh Crystolons, Indias, and waterstones—just some of the dozens of different sharpening stones they bake daily.

Just down the road, the Pike Manufacturing Company has quarried its world-famous stones for well over a century: "1,100 different abrasive products, a whetstone for every purpose." Holding a hunk of this mica schist in one hand and a fresh man-made India stone in the other prompted me to learn more about sharpening stones. Where do they come from? How are they made? What are the differences between natural stones and man-made stones, and what series of grits do you need to keep your tools sharp?

The properties of sharpening stones

All stones, man-made or natural, share distinct features that give them the ability

to cut tool steel. Steel isn't easy to cut: It can be hard and tough, especially the new alloys such as A2 that are finding their way into plane irons and chisels.

To bite into the steel and scrape some away, a good sharpening stone has to have plenty of tough, hard grit particles. While the maximum size of the particles should be uniform, free of the odd large pieces that would cut extra-deep scratches, smaller particles are fine; in fact, they fill voids around the larger particles and cut and polish, too. The particles can't be bonded too tightly together, though, or no fresh ones will be exposed with use and the stone will glaze and clog.

It isn't easy to see what's inside a sharpening stone, even with a microscope. You can't just take one apart to see the grit, although manufacturers try to understand a competitor's product by doing just that. There is much subtlety in producing man-made stones, and lots of proprietary knowledge. It's possible to know the relative grit size of a stone, but little of

how much grit there is or its sharpness and durability.

With both natural and man-made stones, the best you can do is get a feel for how the stone cuts, and perhaps look at the honed surface with a magnifying lens. Some stones feel smooth and slippery, while others give the friction of a steady cut. Every stone is different.

Natural stones go back a long time

Until about 1870, all sharpening stones were natural. Today, most natural stone comes from quarries in Japan or Hot Springs, Ark. The Arkansas stones are quarried from novaculite, a sedimentary rock composed mostly of microcrystalline quartz. The rock is classified by the abrasives industry into two categories: Arkansas stone and



Quarried or baked?

Until relatively recently, all sharpening stones came from natural sources. A novaculite quarry near Hot Springs, Ark., still produces hard black Arkansas stones (left). Synthetic stones are created by baking a mixture of materials. Looking remarkably like wheels of mature cheddar, Norton's 8,000-grit waterstones (right) start life as disks before being cut into individual stones.



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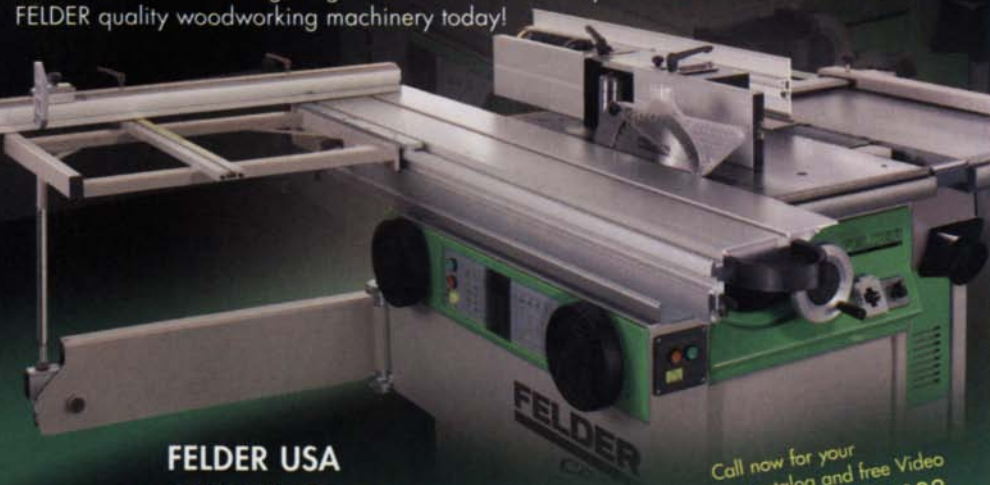
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Creating a combination stone. A mixture of 100-grit abrasive and ceramic material is used to fill the hollow area in the molding table (top). After the layer of coarse grit has been compressed at nearly 2,500 psi, a layer of 320-grit mixture is spread over the top (center). After a second compressing, the combination stone joins others ready to be baked for about 48 hours in a kiln at 2,000°F (right).



Washita stone. The former is very fine and uniformly grained, light gray or white, with a waxy luster. The latter is less dense, more porous, and has a dull luster.

Novaculite was deposited underwater and over eons was pressed into its present dense and hard form. The water part of its history accounts for the consistency of the grit: The larger particles were deposited first and formed the coarser stones, while the finest translucent and black Arkansas stones were made from the smallest sediment that remained suspended the longest.

Typically, the veins are narrow and 50 ft. to 100 ft. long, but they're often so fractured that the yield of the best stone is only 5% to 10% of what is quarried. Because of the brittle nature of the stone, the quarries use little or no blasting. Instead, circular diamond saws lubricated and cooled with water are used to remove blocks of novaculite. These blocks are either cut to size and lapped on horizontal grinding machines, or they are ground into dozens of shaped slips.

Novaculite is dense with grit that cuts slowly, leaving an excellent finish on

tool steel. Novaculite wears slowly, too, so the stone stays flat with only minor maintenance. Lubricated with oil or water to float away abraded bits of steel and grit, the hardest Arkansas stone feels very smooth, almost polished.

Man-made stones have a wider range of grits

Man-made stones, both oil and water, first evolved as a means of making sharpening stones less expensive and more consistent.

At first they were made from natural grit, ground, sized, and rebonded into a stone. Today, they are made from various grades of aluminum oxide or another man-made grit, silicon carbide, used by Norton in Crystolon and Carborundum oilstones. (For more on these minerals, see "Choosing Sandpaper," pp. 54-61). Silicon carbide is made by burning silica with carbon material such as sawdust. The result is a coarse grit that cuts fast but also dulls quickly and is better suited to cutting cast iron and nonferrous metals rather than tool steel.

Particles are bound together under pressure

Two other important factors in determining the quality of a sharpening stone are the density of the stone and the type of bond holding the grit particles together.

Key to producing the right density is the pressure, up to 2,500 psi, used to mold the stone. Higher pressure makes for a harder stone that will cut and wear more slowly. Stones formed with less pressure feel soft.

Pressure alone would not keep the particles together, so a binder is added—some clay, glass, and organics such as horse glue or flour, which explains where that fresh-baked smell comes from. A little water helps hold everything together.

Most very fine waterstones (8,000 grit and higher) contain a hard resin binder. Resin is used for ease of manufacturing and to yield a dense stone with a good feel and finish.

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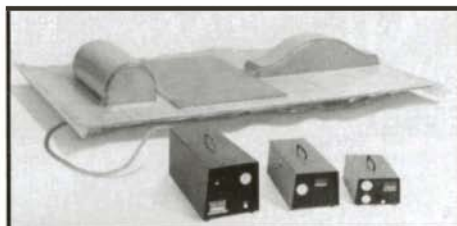
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Different measures of abrasion

One difficulty with many man-made stones and all natural ones is that they don't specify numerical grit size. To add to the confusion, most waterstones are measured using the Japanese JIS scale, which is different from both the European FEPA and the American CAMI standards for measuring sandpaper. By comparing common stones and sandpaper grits, the chart will help you compare apples to oranges and select the right range of stones for your shop.

mixed and pressed, the stones are baked to vitrify the clay and glass and to drive out the moisture and organics. The stones bake at 2,000°F for one to two days and then cool. The spaces left in the matrix from the burned-off organics create a certain porosity of the stone. Coarse stones are more porous, fine ones less so. This is why coarse waterstones need soaking and constant splashing with water, while the water puddles atop fine waterstones. Oil works well as a lubricant, and being more viscous, sinks into a coarse stone more slowly and requires less frequent replenishing than the water on a waterstone. To slow the oil even more, Norton soaks its India and Crystolon stones in a hot waxlike material, which fills their interior pores.

What stones should you buy?

You can see that what makes a stone ideal for sharpening tool steel is a balance of some not-so-obvious factors: the type and grade of grit, the range of particle sizes, the type of bond, and the density of the stone. With Shapton's new 30,000-grit stone, some woodworkers might feel that man-made stones have far surpassed those found naturally. But the natural stones still have their own magic in the way they polish and finish an edge, which ultimately is

SYNTHETIC OILSTONES	NATURAL OILSTONES	DIAMOND PLATES	SYNTHETIC AND NATURAL WATERSTONES JIS (Japan)	SANDPAPER	
				CAMI (USA)	FEPA (Europe)
Coarse Crystolon			150	100	
Coarse India				120	
Medium Crystolon				150	
				180	P180
		Extra-coarse (220)	220	220	P220
Medium India				240	
Fine Crystolon					P320
Fine India		Coarse (325)		280	
			360	320	
	Washita			360	
				400	
		Fine (600)	600		P800
	Soft Arkansas		800	600	P1200
			1,000		
				800	P1500
		Extra-fine (1200)	1,200		
	Hard White Arkansas		1,500	1,000	
				1,500	P2500
			2,000		
	Hard Translucent Arkansas		4,000	2,000	
	Hard Black Arkansas				
			8,000		

what sharpening is all about.

Should you buy either oilstones or waterstones, or some combination of the two? Neither is superior, although high-quality waterstones are easier to find. I always have favored oilstones for their easy maintenance and their simplicity of benchtop use. Compared to waterstones that create large amounts of slurry and need frequent flattening and washing, oilstones create little mess, and the oil protects hand tools against rust.

Most important is having a progression of grits and learning to use the stones effectively and maintain them well. To this end, you need a coarse stone (220 to 320 grit) for honing out nicks

and renewing a very dull edge; a medium stone (1,000 to 2,000 grit) for refining the edge further; a fine stone (4,000 to 6,000 grit) for polishing the edge; and a superfine stone (8,000 to 12,000 grit) for when you need to get that perfect edge on a plane iron used for a final surfacing. Lubricate your coarse and medium stones well for rapid cutting, and use your finer stones a bit drier to get some polishing action from the broken-down grits that form a paste on the stone.

Flatten sharpening stones regularly on a large diamond plate or silicon-carbide paper on plate glass, and you will get many years of use from them. □

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Tapered sliding dovetails

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BY GEORGE HURON

Building a set of wall shelves recently, I wanted them to be strong enough to hold some real weight and yet appear delicate.

A face frame or back would add strength but spoil the look. Simple glued dado joints weren't certain to hold the carcass together. Instead I chose tapered sliding dovetails.

This project requires well-developed hand-tool skills, but part of the tapered joint's beauty lies in its forgiving nature. You don't have to be a surgeon with the backsaw and chisel to get a tight fit.

The standard sliding dovetail—like all dovetails—is sturdy because its structure locks the pieces together. Cutting and fitting a straight sliding dovetail, though, can lead to repeatedly paring wood from a too-snug joint only to find that you've made the fit too loose. And a very tight fit tends to bind during glue-up.

This tapered joint is easier to fit and assemble. The socket and tail have one straight and one tapered dovetail cheek each. The dovetails on the end of each shelf are driven into the sockets like wedges, and the surfaces mate despite small errors in cutting the joinery. The

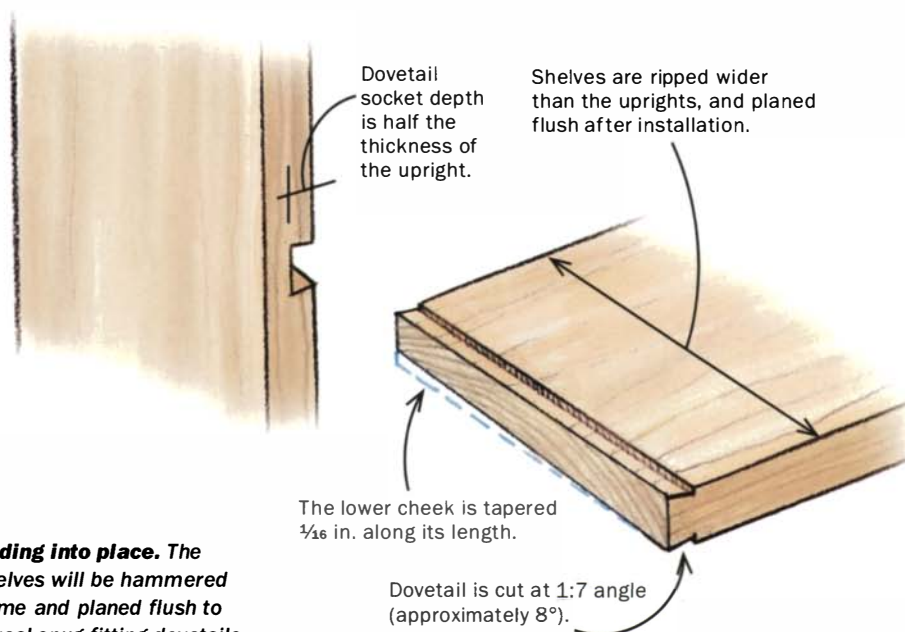


Lightweight and strong. Tapered sliding dovetails help create a backless case that's rigid and sturdy.



Anatomy of a locking joint

This sliding dovetail is tapered on one side, so the joint can be driven until it fits like a wedge. In this case, the bottom cheek of the tail is tapered, along with the bottom shoulder of the socket. The top facets are cut straight.



Sliding into place. The shelves will be hammered home and planed flush to reveal snug-fitting dovetails.

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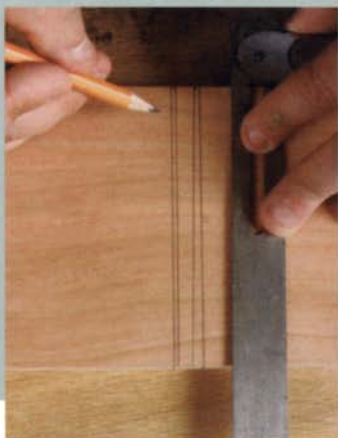
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Start by cutting the socket

LAY OUT AND DEFINE THE SHOULDERS

After locating the shelves on the uprights, use a square to mark the straight shoulder and a bevel gauge for the tapered shoulder (left). Scribe both lines with a marking knife (center). Chisel a narrow channel along the knife lines to create a starting place for the backsaw (right).



shelves, ripped slightly wider than the uprights, stand proud in front or back. Plane them flush and you're left with clean looks and very sound joints. Structurally, it makes no difference which shoulder is tapered, but be consistent. I taper the shoulder on the underside of the shelves.

Lay out and cut the sockets

These shelves are made of 1/2-in.-thick cherry, with the uprights ripped to 4 5/8 in. wide and the shelves 5 3/8 in. wide.

Use a sharp pencil to lay out the shelf locations on the front, rear, and inside face of each upright. Then set a cutting gauge to half the thickness of the uprights and cut vertical lines on the front and back edges to mark the socket's depth.

The tapered side doesn't need to taper much to work. You'll want the wide end of the socket a little narrower than the shelf stock itself, to make a snug fit for the tail. The narrow end should be wide enough to allow you to pare out the waste. For these shelves, I made the socket 1/16 in. narrower at the back.

To lay out the tapered shoulder, start on the inside face at the front of the upright, making a mark 3/32 in. from the bottom shelf line. Then mark the face at the back 5/32 in. from the bottom shelf line and use a bevel gauge to draw a line connecting the two marks. I keep this setting on my



SAW AND REMOVE THE WASTE

Use a guide block to set the saw angle. After sawing the sides, pare away the waste, working from both ends, with a narrow chisel that has a dead-flat back. A router plane also can be used to remove the waste and cut a flat bottom, or simply to clean up your chisel work.

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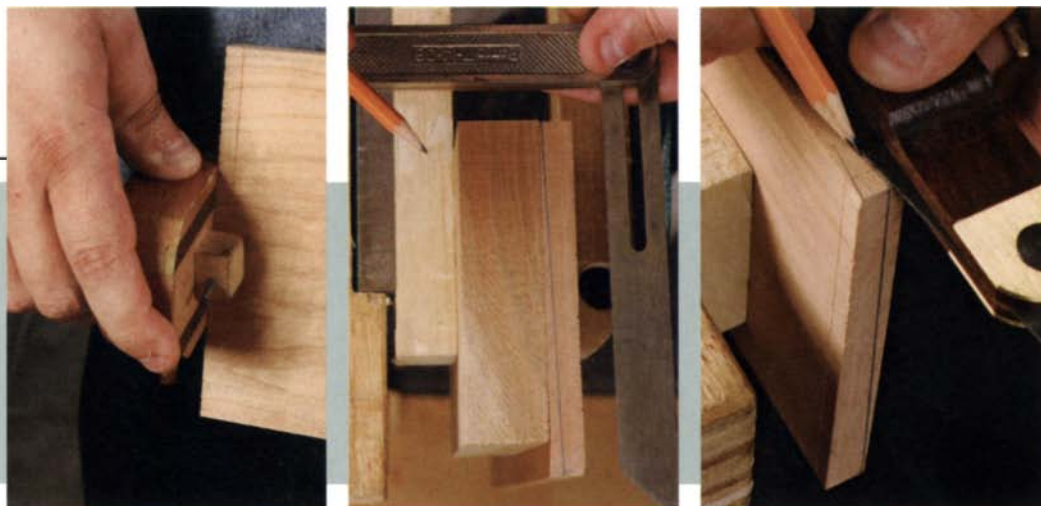
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Cut the tapered tail

LAY OUT THE SHELF DOVETAIL

Scribe the shoulders (left) and transfer the taper angle of the socket to the shelf end (center). A piece of thicker stock clamped beside the shelf helps support the bevel gauge for marking the tapered cheek. Use a bevel gauge set to the 1:7 angle to mark the front and back of the shelf (right).



gauge so that I can reproduce the angle when I lay out the tail. For the straight shoulder, I simply mark the face $\frac{3}{32}$ in. from the top shelf line and use a square to draw my saw line.

Begin cutting the sockets with a wide chisel, creating a groove to guide the backsaw. I support my saw with a 1:7 angled guide block (approximately 8°), and cut to the depth line on the board's edge. Start chopping out the waste by driving a chisel from the center toward the sawkerfs. Then pare from the ends for a flat bottom, making sure to remove all fuzz from the corners.

Use a marking gauge to match the socket depth around the ends of each shelf. Next, use the angle set previously on the bevel gauge to mark the end grain for the tapered cheeks of the tail. You won't need a line for the straight cheek.

Pencil mark the front and back edges of the shelf, using a dovetail gauge or a bevel gauge set to a 1:7 angle. Carry these marks beyond the gauge line to use as a reference when paring.

To cut the shoulders, first chisel a groove for your backsaw and saw down to the marks on the front and back of the shelf. Use a $\frac{1}{2}$ -in. chisel with a dead-

flat back to pare the cheeks. Take care to keep the chisel at the proper angle.

Test-fit and assemble

Use only light hand pressure to test the fit. The joint should close to within an inch of the back of the uprights. If the fit is too snug, scribe a new line just inside the original knife line for the tapered cheek, and trim the tail. If you take one or two shavings too many, simply drive the shelf a little farther into the uprights.

The only glue you'll need is a dab covering about $\frac{3}{4}$ in. near the back of each socket. Use a hammer and a wooden block to bring the joints together, starting with the top and bottom shelves. Set the uprights on wooden risers so that you can drive the shelves past the back of the case if needed. When the glue dries, trim each shelf with a jack plane until flush with the uprights. □



SAW AND PARE THE CHEEKS

After chiseling a channel along the marking-gauge lines (above), saw down to the marks for the cheeks (right). When taking waste from the tail, light pressure on the front of the chisel helps register its back against the flat surface created by the initial cut (far right).



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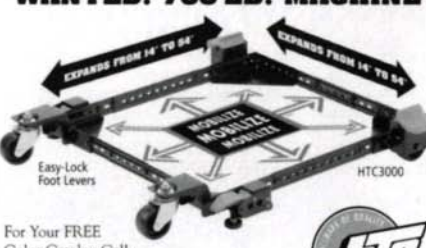
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Protect inlay with selective staining

BY JEFF JEWITT

Sometimes you want to preserve the natural color of inlay, stringing, and banding when staining a piece of furniture. On other pieces, you may want to selectively darken an area without affecting the majority of the piece. While it would seem logical simply to tape off certain parts, that method is not foolproof when staining a porous material. Unless there is a physical barrier other than tape, the stain will penetrate the masked-off areas of bare wood.

Fortunately, there are several ways to get around this, involving both hand and spray applications. However, before you practice any of these techniques on your hard-earned inlay work, you should make a small piece exactly like the real thing and experiment on it.

Selective sealing isolates inlays

The secret to leaving inlaid areas unstained is to apply a clear finish beforehand. It's best to use a fast-drying finish such as lacquer or a 2-lb. cut of shellac. To avoid redissolving the finish, you must follow it with water-based dyes or oil-based stains. Do not use alcohol-based stains, fast-drying lacquer-based stains, or most premixed water-based stains. They contain solvents that may affect shellac or lacquer.

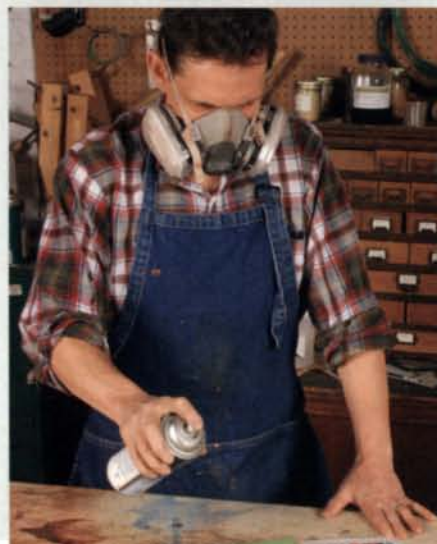
A steady brush seals stringing—Hand-painting a clear finish on light stringing can be tricky. The stringing is delicate and hard to see, so it helps to work with good backlighting and to use a brand-new #1 artist's brush with a sharp tip.

Apply at least three coats of shellac, with an hour's drying time between each coat. You don't have to sand between coats. Let the last coat dry for at least four hours before applying the stain.

Because liquid stains are more likely to find any breach in the clear sealer and wick up into the inlay, I recommend using thicker gel stains. An alternative to buying a premade gel stain is to use



Brush on the sealer. With a new #1 artist's brush, apply several coats of either shellac or lacquer to the stringing.



Seal before staining

BRUSH SMALL DETAILS



Wipe on a gel stain. Thick gel stains are less likely to seep into the protected inlay areas than liquid dyes and stains.

SPRAY LARGE AREAS

Leave the banding exposed. Mask off areas that will be stained using a tape designed for your choice of sealer (see "New tapes," p. 122). Use a sharp knife and a ruler to achieve a clean break. Masking paper protects large areas away from the banding.

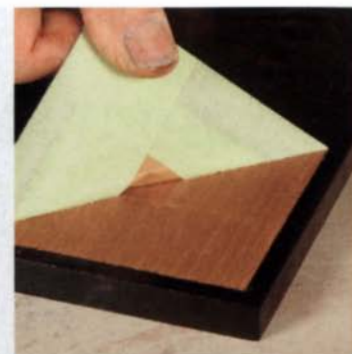
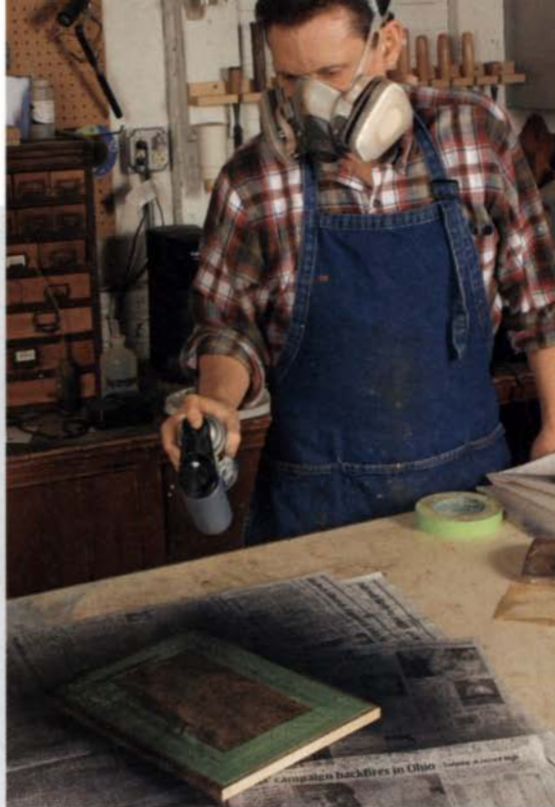


Seal the inlay. Apply several light coats of lacquer to the unmasked banding (left). Then wipe or brush on a dye or stain that won't dissolve the sealer (above).

Tone selected areas



Seal the whole surface. Brush or spray on a coat of lacquer or shellac over the whole project (above). Use tape to protect areas to remain undyed, and then spray over the sealer with toner.



Peel and reveal. After the toner has dried, peel away the tape and masking paper. If toner has seeped under the masking tape, gently scrape it away with a scraper or the tip of a sharp knife. Then topcoat the whole piece.

dye concentrates to tint a clear-gel satin finish. If a spot of inlay gets hit with color, you usually can use the sharp tip of an X-Acto knife to clean it off. Once you are happy with the appearance of the piece, protect it with a clear finish.

Larger inlays can be sprayed—It's time-consuming to seal larger areas of inlay by hand, so instead I tape off the wood around the inlay and then seal the inlay with a spray gun or aerosol. Do not wipe or brush on the clear sealer because it may creep under the tape. Use the correct tape (see sidebar, below) and burnish the edge of the tape with your

fingernail. Protect other exposed surfaces with tape and masking paper, available at auto-parts stores.

The sealer should be compatible with the topcoat and should resist any solvent in the stain. In the case illustrated, I'm using an aerosol version of the lacquer I'll apply later as the topcoat. Spray three or four light coats, wait 10 minutes, and then remove the tape. Let the lacquer dry overnight before applying the stain, in this case a water-soluble dye.

For cleaner edges, try toning

You'll get the sharpest and cleanest edges between stained and unstained areas if you apply the stain to a sealed surface, a process known as toning. Seal the whole project with either lacquer or dewaxed shellac, and let it dry overnight. Then mask off the area not to be toned, using an X-Acto knife and a ruler to trim the tape and get crisp edges.

You can use a premixed toner, but I make my own from dye and lacquer. Spraying several light coats works better than laying on a thick layer of toner. Avoid getting the area you're coloring too wet, or the toner will creep under the tape.

After the stain has dried, remove the tape. The border should be clean and crisp. If necessary, you can scrape off color that crept under the tape, or retape and apply toner to touch up any bad areas.

If you're not able to spray, sand the sealer with P320-grit paper or with a maroon abrasive pad. The rougher surface will allow the wiped-on stain to adhere better. Tape off the areas you don't want to color, and make sure to burnish the tape where it meets the stain. As with selective sealing, a gel stain works best and shouldn't creep under the tape. □

New tapes outperform the old

To get the best results, don't use plain old masking tape. 3M makes a masking tape for every situation, but the three I use are fine line tape (3M part #218, left), which works with any finish; painter's blue tape (#2090, center) when working with water-based finishes; and green lacquer tape (#2060, right) for solvent lacquer finishes. Fine line tape is used

for pin-striping in the automobile industry and conforms to curved shapes and surfaces. Furthermore, it's extremely thin, so it leaves a thinner ridge between the taped and untaped areas after a finish or stain has been applied.

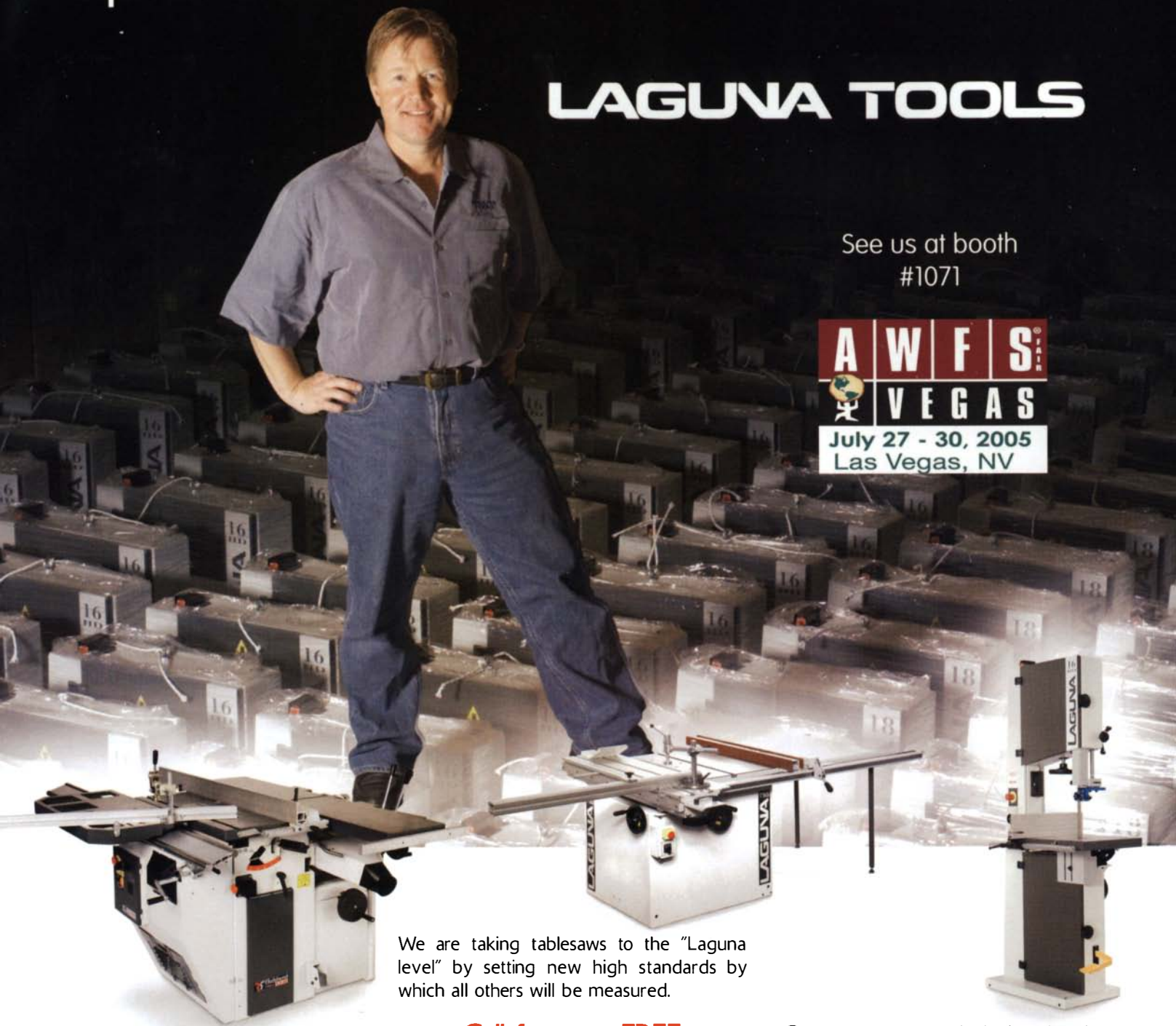
Fine line tape is sold at auto-parts stores; blue tape is available at most hardware stores; and green tape can be purchased at professional paint stores. All three also can be found online at www.jamestowndistributors.com.



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Scallops and Scales



With skills developed as a self-taught carver from age 14, as a furniture student under James Krenov, and as a pattern maker for toy companies in Chicago, Brian Newell produces furniture that traverses untracked territory. This scallop-sided cabinet in Macassar ebony and rosewood is both deeply personal and perfectly functional,



deliciously elegant yet off-putting in places. The pearwood pierced carving between the cabinet doors might resemble a traditional Chinese “cracked ice” pattern from across the room, but turns out, at arm’s length, to be a criss-crossing cluster of scaly chickens’ feet convincingly carved. In Newell’s work, the classical crosses paths with the heretical.

—Jonathan Binzen