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Fine WoodWorking

February 1996, No. 116
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210-600	*Thin-kerf* Fine	60	$84.40	$71.70
110-800	Ultra-Cut™	80	$100.90	$85.80

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185-600	8-1/2"	60	5/8"	$74.40	$63.20
110-801	10"	80	5/8"	$100.90	$85.80
112-901	12"	90	1"	$135.00	$114.75
114-100	14"	100	1"	$144.00	$122.40
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210-600 Thin Kerf 60T Fine — **$115.40**

110-225 List: $185.40
110-800 60T General Purpose &
110-800 80T Ultra-Cut — **$138.90**

110-228 List: $178.00
110-800 80T Ultra-Cut &
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BSB-108	3/4"	6 TPI	Std.	$17.00
BSB-110	1"	3 TPI	Hook	$18.80
BSB-111	1"	8 TPI	Std.	$18.80
BSB-112	1"	14 TPI	Std.	$18.80

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SPK-035	2	Ryobi AP12 planer	$45.80
SPK-040	2	Ryobi AH-115 & AH-125	$91.30
SPK-045	2	Makita 2030N planer	$63.40
SPK-055*	2	Delta 22-540	$45.40
SPK-060	2	Makita 2040	$77.80

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(Number of knives in parenthesis)

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SJK-012	6" Knives for Grizzley (3)	$24.00
SJK-015	6-1/16" Knives for Delta DJ-15 (3)	$25.10
SJK-020	8" Knives for old Delta & Rockwell (3)	$31.80
SJK-025	8-1/16" Knives for Delta DJ-20 (3)	$32.60
SJK-030	12" Knives for Powermatic (3)	$46.10
SJK-035	12-1/2" Knives for RBI 612 & 812 (2)	$44.90
SJK-040	12-1/2" Knives for Grizzly & other (2)	$45.90
SJK-045	13-1/8" Knives for Delta RC-33 (3)	$52.10
SJK-055	15" Knives for Grizzly, other imports (3)	$58.20
SJK-057	16" Knives for SCMI jointer (4)	$82.60
SJK-065	20" Knives for Parks 20" planer (4)	$101.60
SJK-070	20" Knives for Delta 20" & others (4)	$103.30
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SCK-015	6-1/16" Knives for Delta DJ-15 (3)	$89.10
SCK-020	8" Knives for old Delta & Rockwell (3)	$117.00
SCK-025	8-1/16" Knives for Delta DJ-20 (3)	$118.30
SCK-030	12" Knives for Powermatic (3)	$193.60
SCK-035	12-1/2" Knives for RBI 612 & 812 (2)	$122.10
SCK-040	12-1/2" Knives for Grizzly & other (2)	$122.10
SCK-042*	12-1/2" Knives for Delta 22-540 (2)	$193.50
SCK-045	13-1/8" Knives for Delta RC-33 (3)	$193.10
SCK-055	15" Knives for Grizzly, other imports (3)	$196.90
SCK-057	16" Knives for SCMI jointer (4)	$279.90
SCK-065	20" Knives for Parks 20" planer (4)	$392.70
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Fine WoodWorking®

January/February 1996 No. 116

DEPARTMENTS

ARTICLES

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Shaker sewing stand, p. 87

On the Cover: *Woodworking's classic joint, the dovetail, can be made by cutting either pins or tails first. Which is the right approach? Two craftsmen take opposite sides (p. 81). Photo: Vincent Laurence*

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More on waterborne finishes—After carefully looking at one of the photos appearing with the article on waterborne finishes (see *FWW* #115, pp. 48-53), it is clear that the lot number stamped on the label of Hydrocote Equal lacquer is 1/4/94. That proves the material evaluated for your article was 1½ years old and a second-generation product. There have been two formulation changes since that time with emphasis on increased water resistance.

Your comparison of waterborne finishes mixes products of different classes and chemical compositions. It's like comparing a Lexus to a Ford Escort in luxury and comfort. If you had used our Polyshield Super Poly in your evaluations, you would have found its performance by far superior to all the products listed. However, this product retails for around $60 per gallon.

Equal lacquer models a conventional nitrocellulose lacquer in look, performance, chemistry and cost. It is the only waterborne finish on the market that offers a 100% burn-in just like nitrocellulose lacquer. It develops resistance properties equivalent to nitrocellulose lacquer in five to seven days. Our current product will pass heat and stain-resistance tests similar to a nitrocellulose lacquer.

I'm disappointed that the article misrepresents facts, that the evaluation tests are subjective and statistically not viable, and that the article doesn't go far enough to include the differences and benefits of the specific products.

—Erick Kasner, president and general manager, Hydrocote Finishing Products

CHRIS MINICK REPLIES: The article had two objectives. The first was to provide readers with an objective, scientifically accurate procedure that could be used in the shop to evaluate finishes. The second was to evaluate a cross section of currently available waterborne finishes.

I included Hydrocote Equal as an example of a professional waterborne wood finish and because of advertisements in professional woodworking journals touting its virtues. Finishes selected for the article were purchased at retail outlets or by mail (just as readers would buy them) at roughly the same time. Equal was purchased at a North St. Paul, Minn., distributor on April 11, 1995.

Initial test results for Equal were so poor that I repeated the experiment. I suspected from the claim of "100% burn-in" that the polymers in Equal might be similar to those in no-wax floor finishes.

So I included a test panel coated with Future acrylic floor polish from Johnson Wax in the second set of experiments. Those results confirmed the accuracy of the initial tests. The floor wax scored higher on the stain-resistance test than the Equal. And all the other test scores for the two products were equivalent.

The Hydrocote Finishing selection chart recommends Equal for interior, light-use applications only and recommends against using this product where resistance to detergent, chemicals, alcohol and water are needed. It seems to me that my results merely confirm what is already printed by Hydrocote.

As a manufacturer of wood finishes including but not limited to water-based urethanes, I feel I must comment on Chris Minick's article. He makes the statement that "Waterborne finishes are not toxic to the environment." This statement, in almost all cases, is not true.

Although these products are lower in volatile organic compounds (VOCs) than the products they replace, they still contain some. Although the water-based urethanes do not contain traditional paint thinners, they do contain other types of solvents that are at least as toxic and sometimes more so. To give the impression that water-based urethanes are nontoxic to the point that they can be poured on your cereal sends a potentially dangerous message to your readers.

—J.W. Hawkins, president, Waterlox Coatings Corporation

Two views of pneumatic fasteners—I loved your article on pneumatic fasteners (see *FWW* #114, pp. 42-47). Too many cabinetmakers are afraid to add these versatile tools to their shops, either due to cost or the stigma of air tools. I used to think that nail guns were a sign of down-and-dirty, low-quality production shops. After a few years of using them on high-end cabinets and furniture, I have found that they simply increase the speed of a basic task and often make it simpler.

One safety tip that I would like to add: When changing nail or staple sizes in the gun, make sure that every fastener has been removed. Sometimes one or two fasteners at the end of a strip are tight in the chamber and don't fall out with the others. A co-worker buried a 1¼-in. staple in his finger after changing to ½-in. loads. It's a lesson better learned the easy way. Keep up the good work.

—N.J. Anastas, Toronto, Ont., Canada

How many *Fine Woodworking* readers, the vast majority of whom I suspect are either professional craftsmen or professionally minded, are only capable of driving in a nail as illustrated in Robert Vaughan's article on air nailers? Only minimal skill is needed to leave the head flush, and if there's doubt, a head left proud can be safely driven home with a punch. I find this representation of hammer-driven nails

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absurd and only worthy of the most low-minded, scurrilous air-nailer salesman.

—Richard Fox, Gwynedd, Wales

Kudos to Chris Becksvoort—Hats off to Chris Becksvoort! I would just like to acknowledge the man (a *Fine Woodworking* contributing editor) for his contributions to your great magazine. I enjoy his how-to articles more than all the others and the way that he gives several options to achieve a woodworking goal. I also appreciate his straightforward approach and simplified techniques.

I run a small, one-man shop on the coast of Maine. While working in my shop, I try to simplify every operation as much as possible to keep a reasonable amount of production going out the door. I still consider myself slow, partly due to keeping the quality standards as high as possible. Simplifying processes also keeps my brain from hurting. This is my tip: To avoid black spots on glue-ups from bar clamps, put Scotch tape along the bar.

—Gregory Hatt, Rockport, Maine

Virtues of an oil-varnish finish—Ha! I really thought it would never happen. When I started getting interested in woodworking, I picked up a copy of Ralph Parsons Kinney's book on furniture repair and restoration. He inspired me to try my hand at projects, and he taught me an easy-to-use, practically foolproof, very forgiving finish that I have continued to use ever since. He called it a "varnish and oil" finish, but it was a mix of spar varnish, boiled linseed oil and turpentine.

I could never quite figure out the strange looks I would get from "serious" cabinetmakers when I would mention this finish. I found that it was easy to apply, worked well, did not water-mark, was simplicity itself to mend and left a fine glow on the wood. Well, what to my wondering eyes should appear, but Garrett Hack advocating this very mixture as a tough, easily renewable finish for a tabletop (see *FWW* #114, p. 26).

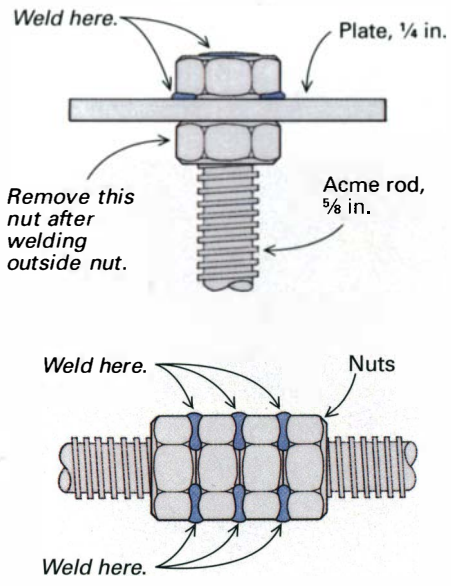
I don't happen to live anywhere near Thetford Center, Vt., or I would've rushed over and claimed him as a long-lost brother. Everything he says is true. I can't understand why everybody wants to spend zillions on high-tech spray booths and a lot of equipment to spray lacquer. Instead, they could pop 'round to the corner hardware store and buy the fixings for Kinney's finish for pocket money.

I've never tried Mr. Hack's beeswax, linseed and turps as a final coat, but I'm going to. My only concern there is that turps is very volatile and not good for you. If this coat is to be applied hot, it better be applied outdoors, I would think. I had a hot turpentine headache once and don't hanker for another one.

—R.L. Whitney, New Brunswick, Canada

A cheaper approach for the Shaker revolver—Mario Rodriguez suggests contacting a local machine shop to facilitate fabrication of the mechanism for a Shaker revolver stool (see *FWW* #114, pp. 48-52). You also can make your own with the help of a nearby welding shop or garage.

Mechanism for a revolving stool



Start by buying ⅝-in. Acme threaded rod and ¼-in. steel plate. Then use a high-speed drill (drill-press speed should be set to 550 rpm) to make a ⅝-in.-dia. hole in the center of the plate. Make sure the plate is clamped to the drill-press table, and mark the location of the hole with a center punch. Now place the rod in the hole, and place a nut on either side of the hole to locate the rod perpendicular to the plate.

Take these to a local garage or machine shop that has welding facilities, and ask them to weld the outside nut to the plate and the rod (see the drawing below). The wood of the seat should be countersunk to accommodate this nut. The other nut is removed after the welding process.

To form the steel block, four nuts can be assembled onto a spare piece of threaded rod, and the corners can be tack-welded at the same time as the other welding is done.

—Eric Worden, Halifax, N.S., Canada

Caution, in its place, is fine—When I decided it was time for a shaper, I remembered Lon Schleining's article (see *FWW* #112, pp. 45-49). I would like to thank him for a good overview of the good and bad points of a shaper, as well as some interesting tips on curved work.

In most respects his article was well-written and informative. I did find one thing quite disturbing, however. His obsession with safety comes across as full-fledged fear of his machine. I have always been considered a safety-conscious guy (some would say a safety nut), but one lesson I did learn a long time ago is that too much of a good thing (even safety) is bad.

Fear is a debilitating emotion that causes people to panic or freeze-up during a crisis and should not be confused with being cautious. If you do not feel a certain level of comfort using your equipment, then you should not use it. Thanks for a good magazine, and keep up the good work.

—Nils Hunter Alving, Chevy Chase, Md.

A scraper mystery unveiled by math—Some years ago in *Fine Woodworking*, I remember reading what amounted to a personal breakthrough on how to prepare a scraper. Tage Frid told how, after meticulous preparation, he would draw the burnisher over the edge of the scraper with

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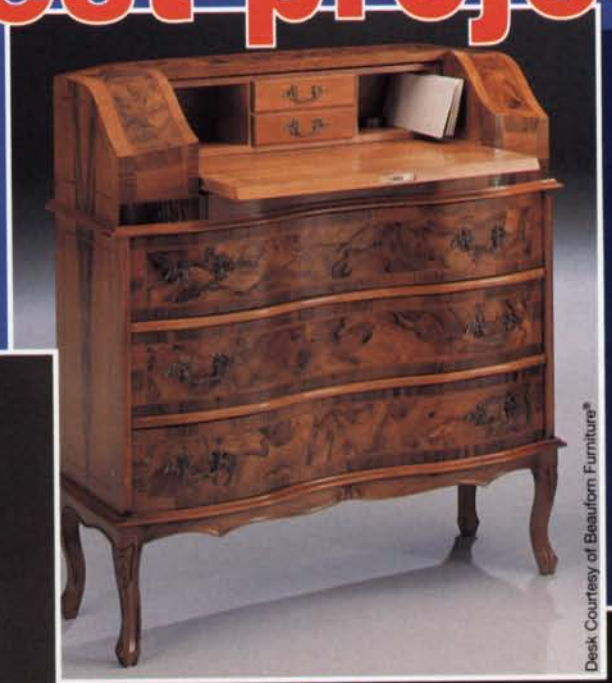

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14"	108	1"
15"	108	1"

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light pressure. The breakthrough was the quantification he gave to the term "light," about ¼ lb.

I began to ponder how such a small force could shape tool steel with a Rockwell hardness around Rc60. It became clear when I considered the small size of the contact patch between the burnisher and the scraper. Because the scraper has a polished 90° edge on it, the contact patch between the scraper and burnisher is very small, perhaps .001 in. by .001 in. sq. or about one-millionth of a square inch.

The force applied to the burnisher divided by the contact patch's area equals the pressure, or stress, at the point of contact, in this case 250,000 pounds per square inch (psi). Tool steel used for a scraper may yield at a tensile stress in the neighborhood of 120,000 psi, only half of what's being delivered. So the material yields, and a burr is formed.

—Paul O. Davis, Dearborn, Mich.

A thought on the value of quality—I have been following the exchange of views between suppliers and buyers of Taiwanese power tools with some amusement (see "Letters," *FWW* #113 and #115). Having had my own mixed experiences with some of these tools, I would like to contribute the following paragraph, attributed to John Ruskin (1819-1900) more than a century ago:

"It's unwise to pay too much, but it's worse to pay too little. When you pay too much, you lose a little money—that is all. When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing it was bought to do. The common law of business balance prohibits paying a little and getting a lot—it can't be done. If you deal with the lowest bidder, it is wise to add something for the risk you run, and if you do that you will have enough to pay for something better."

Some things never change.

—Paul A. Martin, East Aurora, N.Y.

The dangers of abrasive particles—I disagree with Chris Minick in his description of abrasives as being "approximately spherical in shape" (see *FWW* #115, p. 34). They are not. They are highly angular fragments, as a good magnifying glass will show. These miniature shards make good abrasives because they are angular in shape. Stoneworkers (masons and sculptors) through the centuries have died of silicosis from exposure to silica, the principal ingredient of flint and presumably of the abrasive on flint paper. Not much of this is being used as an abrasive for woodworking, but I wouldn't hazard equal exposure to non-siliceous abrasives, either.

The ability of lungs to shed invasive materials depends very much on whether the owner is a smoker. Very, very fine dust, the kind that escapes our vacuum sweepers, is best able to find its way to the smallest cavities of the lungs. Mr. Minick cautions about breathing dust or grit, but I think he doesn't caution enough. The little cautionary label glued on every carton of Norton sanding belts warns that using coated abrasives without proper protection "can result in serious injury to the eyes, face, body or respiratory system."

—Vernon Raaen, Oak Ridge, Tenn.

Watch your posture at the bench—Having retired just a few years ago, I attacked my woodworking projects with the kind of energy stored up in years of never having enough time. When I wasn't engrossed in a bird carving, I was bent for hours over a lathe.

Recently, I was struck with an extremely painful condition involving my neck and one arm. Home treatment made little difference, and the pain worsened. Tests confirmed pinched nerves in the cervical

spine area. Extensive therapy was prescribed, and though complete recovery is expected, it's a long haul.

As I reviewed the situation with therapists, it was clear that a head bent forward puts the full weight of the head on the neck vertebrae. I've not been in my shop for a few months. And when I do return, it will have to be with some new habits, like taking a break every 15 minutes if I'm working over something, doing a few regular exercises to relax and strengthen my neck, and taking the time to raise work closer to eye level when possible.

Most of us are probably "it won't happen to me" folks. But believe me, it can. The good news is, if we're aware of the danger, little changes in the way we work can ensure that the sawdust keeps flying.

—James H. Blough, Cincinnati, Ohio

Corresponding with Woodworkers Alliance—Thank you for printing Scott Landis' article about the Woodworkers Alliance for Rainforest Protection (WARP) Greenwood Furniture Project in Honduras (see *FWW* #114, pp. 118, 120). As one of the two instructors, I have received numerous requests for information about WARP and the project. There is a problem, though: I am not the organization's contact person. Inquiries should go to WARP, 1 Cottage St., Easthampton, MA 01027.

—Curtis Buchanan, Jonesborough, Tenn.

Stickley family reference was wrong—Your reference to the Stickley family in the review of *Quaint Furniture* (see *FWW* #114, p. 108) is just plain wrong. To set the record straight, there were five Stickley brothers, all engaged in an on-again, off-again business relationship with each other. The Stickley Brothers Company had two incarnations. In 1884 Gustav, Albert and Charles formed the Stickley Brothers Company in Binghamton, N.Y. By 1888, all five brothers were working together in this company. Later in that same year, Gustav left, followed by Leopold in the next year.

In 1891, Charles and Schuyler Brandt (the brothers' uncle) took over the business, renaming it Stickley and Brandt Chair Company. At this time, Albert and John George moved to Grand Rapids, taking the Stickley Brothers name. Around 1901, John returned to New York to join Leopold in the L. & J.G. Stickley Company. Stickley Brothers operated in Grand Rapids until about 1940. The L. & J.G. Stickley Company is still in operation, although it is no longer owned by the Stickley family.

I don't expect *Fine Woodworking* to always reflect my opinion, but I do expect articles of a historic nature to be accurate. The reference missed the mark by four states, one brother and nine years.

—Robert W. Lang, Newark, Ohio

Erratum—An item in "Notes and Comment" (*FWW* #115, p. 130) placed furnituremaker David Ramazani in the wrong state. He lives and works in Charlottesville, Va. The McGuffy Ash, from which he built the table in the accompanying photos, was taken down five years ago. The pedestals are copies of balusters found in the rotunda at the University of Virginia.

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.

—Scott Gibson, editor

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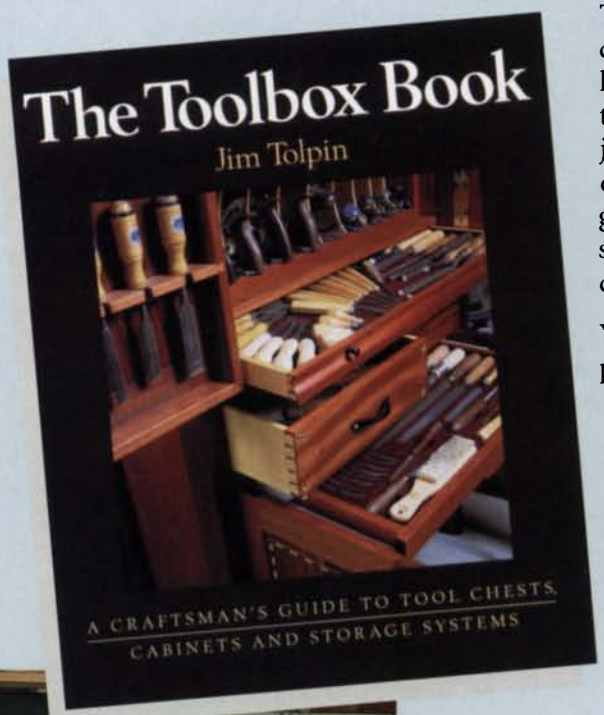

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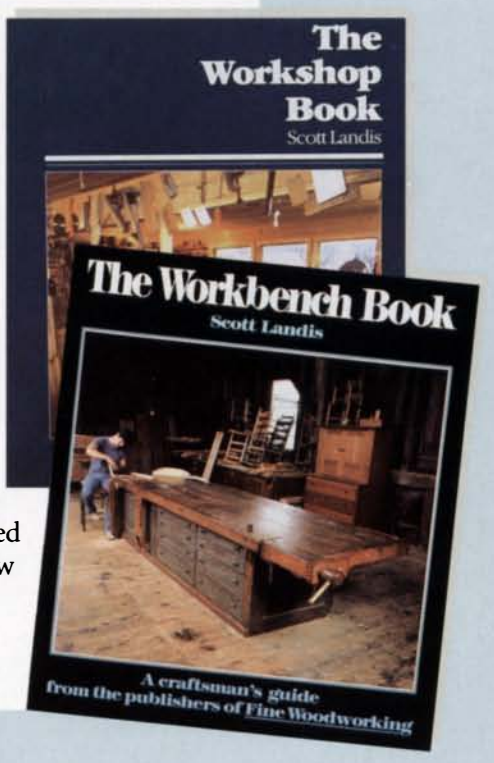

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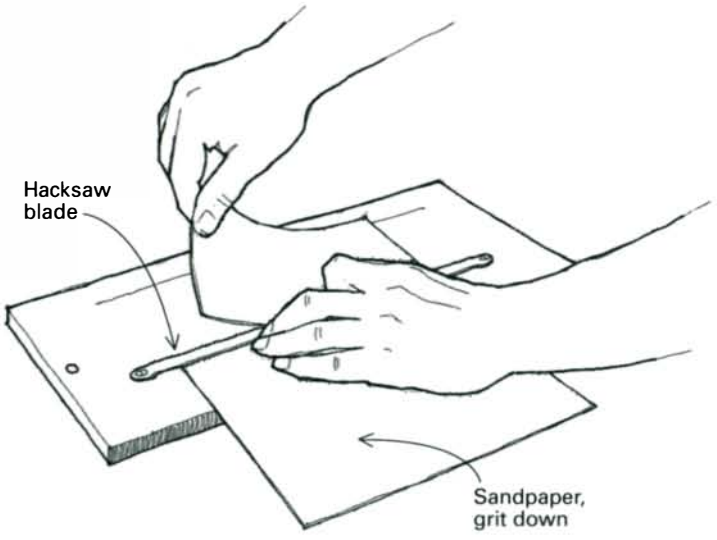
Sandpaper cutter



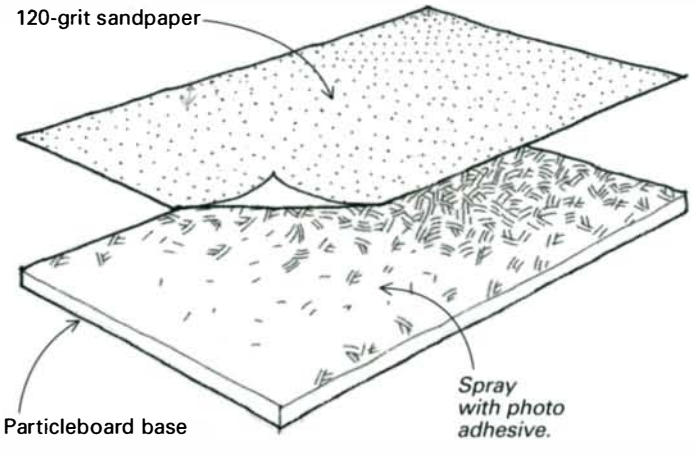
If you're like me, folding and tearing sandpaper along the crease isn't always successful. Try making this simple cutter. Screw an old hacksaw blade to a strip of scrap plywood. Insert a screwdriver under the blade, and twist the screwdriver to provide ample clearance for the sandpaper. To use the cutter, slide the sandpaper, face down, under the blade. When the sandpaper is in position, push the blade down, and pull the sandpaper up. The sandpaper will cut cleanly against the serrated blade.

—Anthony Guidice, St. Louis, Mo.

Quick tip: To organize the various scraps of paper around my shop (plans, receipts, user manuals), I glued spring clothespins to shelves, jigs, overhead beams and workbench legs. For a small investment, you can put a lot of order in your shop.

—Steve Tkaczyk, Gaithersburg, Md.

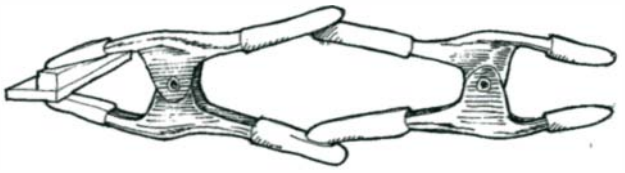
No-slip sanding board



Here is a no-slip sanding board I use for sanding small pieces of wood with an orbital sander. It's always a daunting task when the pieces are too small to be clamped. I use 120-grit sandpaper glued to a piece of ¾-in. particleboard or plywood—anything, as long as it is flat. I cut the plywood to the size of a full sheet of sandpaper and use 3M #77 spray adhesive for a quick mount. Place the sanding board on your benchtop, and lay your small workpiece on top of it. Hold with a finger or two, and sand away. Make a new one when the pieces begin to slip under the sander.

—Spider Johnson, Mason, Texas

Tandem spring clamps apply more pressure



Insert second spring clamp to increase pressure.

Spring clamps can be made to exert more pressure by compressing a second clamp and placing its handles between those of the first clamp. When you release the second clamp, its spring will add to the strength of the first.

—Paul K. Murphy, San Jose, Calif.

Tool for measuring inside frames for panels

Squeeze ends flat.

Telescoping radio antenna takes inside measurements.

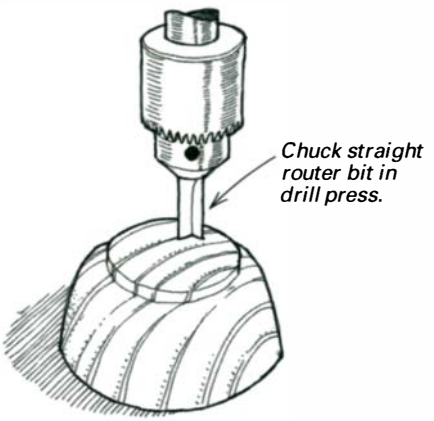
To size panels to fit a frame, it's important to measure the exact length and width of the frame space. But it can be difficult measuring from the bottom of the grooves in which the panel fits. My solution is to use an old car-radio antenna with tips that have been squeezed flat ½ in. or so on each end (clip off the tip at the small end first). I telescope the antenna until it bottoms out, top and bottom, in the panel grooves. Then I remove the antenna and transfer the measurement to a rule. The antenna sections have enough friction to hold a measurement.

—J. Kirkham Jenner, Grants Pass, Ore.

Quick tip: To coat wooden objects smaller than 10 in. across with an oil finish, pour a small amount of oil into a resealable plastic bag. Place the wooden object in the bag, and slosh the whole thing around. After removing the object, pour any remaining finish back into its original container.

—Carl R. Faix, Cherry Hill, N.J.

Flattening the bottom of turned bowls



To trim down and flatten the base of a turned bowl, chuck a straight, dado-cutting router bit in the drill press. With the bowl inverted on the table, position the quill (or table) so that the bit takes a skimming cut off the bottom of the bowl, and then lock the quill. Use light cardboard between the bowl and the table to prevent damage to the bowl's rim. Slide the bowl over the table

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10"X40TX1/8" or 3/32"	$156	$119	$107	$ 95
30T 1/8" or 3/32"	$135	$ 99	$ 89	$ 79
9"X40T	$146	$109	$ 98	$ 87
30T	$125	$ 99	$ 89	$ 79
*8-1/4"X40TX 3/32"	$136	$ 99	$ 89	$ 79
8"X40T 3/32"	$136	$ 99	$ 89	$ 79
30T	$115	$ 89	$ 80	$ 71
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SHOP TEST, Woodworker's Journal Nov./Dec. '95 pg.78

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12"x80Tx1-1/8"K	$212	$181

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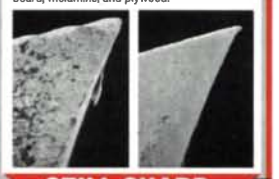

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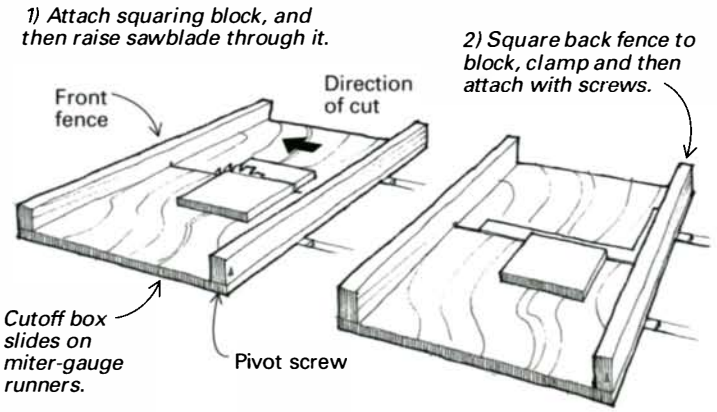
to mill the base. Take light cuts, lowering the quill repeatedly until the base is at the desired height.

—Charlie Morrison, Powell River, B.C., Canada

Squaring the fence on a tablesaw cutoff box

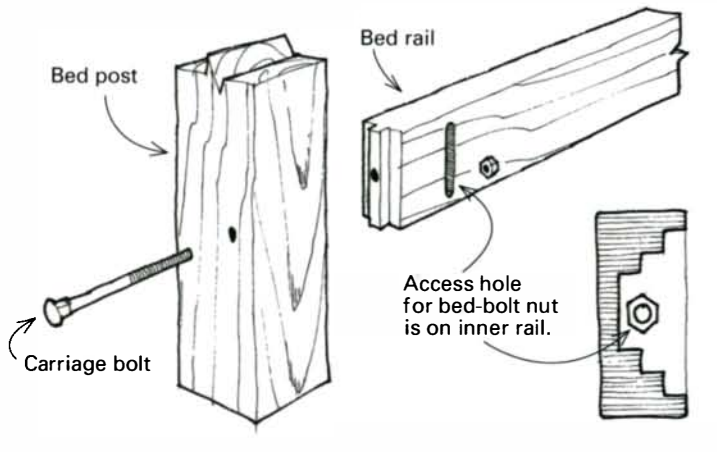


I've found an easy way to set the back fence on a tablesaw cutoff box perfectly square to the cut line: Build the cutoff box to the dimensions you need, attach rails to run in the tablesaw miter-gauge slots and attach the front fence securely to the box. (The front fence is the one farthest away from you when you're using the saw.) Attach the back fence with one wood screw through the bottom in the left corner to allow the fence to pivot.

Now attach a piece of scrapwood near the back fence with double-faced tape. This will be used as a squaring block. Raise the sawblade through the bottom of the cutoff box, and cut through the squaring block but not through the back fence. Remove half of the squaring block, and pivot the back fence until it is square to the remaining squaring block. Use an accurate framing square for this. Clamp the back fence in place, and attach it with screws through the bottom. Remove what's left of the squaring block, and you're set.

—Tony Busch, Port Orchard, Wash.

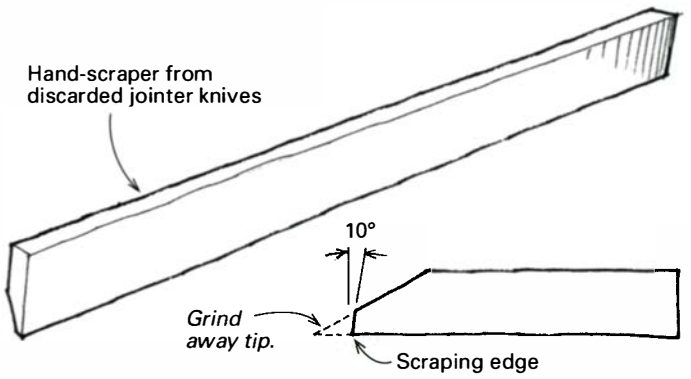
Carriage bolt joins bed rail to bedpost



A carriage bolt can be used to fasten a rail to a post in a bed frame. It's a variation of another better-known approach that uses a captured nut in the rail and a bolt tightened from the post side. In the version shown above, a carriage bolt is captured in the post, and the nut is tightened in the rail with an open-ended wrench. To leave room to swing the wrench, plunge-rout a ½-in.-wide slot in stepped depths into the inner face of the rail. One bolt will suffice for small rails, but wide rails will require two bolts. If you wish, recess the bolt heads so that you can cover them with bed-bolt covers.

—Andy Westerhaus, Burnsville, Minn.

Scrapers from old jointer knives



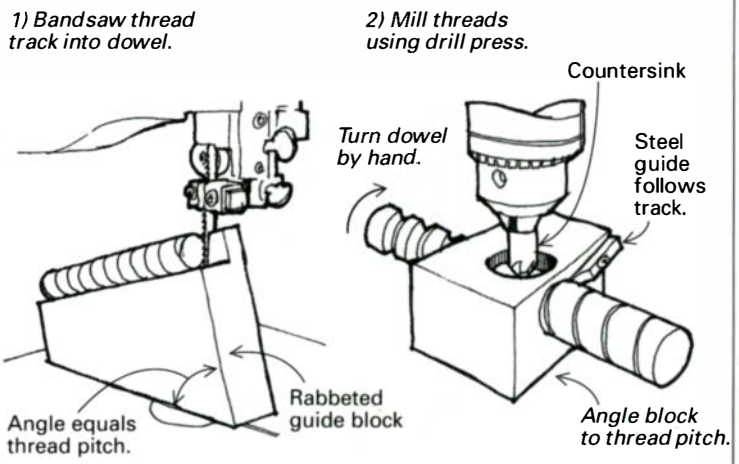
Instead of discarding old planer or jointer knives that are too narrow to use, make scrapers out of them. Grind the front edge to about 10°. Use a fence on the grinder's tool rest to get a straight edge, and use a fine grinding wheel to get a smooth surface with a slight burr. These scrapers won't flex like ordinary scraper blades, and the high-speed steel really holds an edge. There's no need for burnishing—just use the scraper right from the grinder.

—Robert Vaughan, Roanoke, Va.

Quick tip: To cut thin brass with a jigsaw or bandsaw, clamp the metal to a scrap of ¼-in. plywood. This lessens the vibration and minimizes tooth clogging.

—Jim Good, Fox, Ark.

Shopmade bench screws from dowel rod



To make bench screws of any size and pitch using ordinary hardwood dowel, start by determining the dowel size and pitch for the threads. Make a rabbeted fixture to bandsaw a spiral kerf (the thread track) into the dowel. The angle of the fixture's base will determine the pitch of the thread, between 7° and 15°. For a right-hand thread, the right-hand side of the fixture must be higher. As you turn the dowel by hand, it will track up the incline.

Next drill a hole slightly larger than the dowel through a block of wood. The dowel should slide easily through the hole with no slop. Drill a larger hole on the flat top of the block. Angle one end of the block to match the pitch of the threads, and attach a steel guide to ride in the bandsawn track. To cut the threads, clamp the

block to your drill-press table, install a regular countersink (or grind one from an old spade bit) in the chuck, and align the block so the bandsaw kerf is directly under the countersink point.

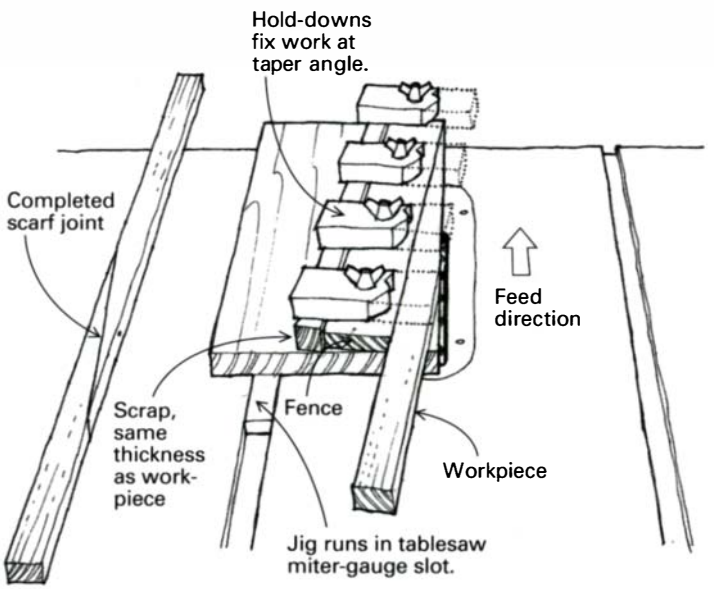
With the drill press running, begin threading the dowel into the block. The spiral cut in the dowel is self-jigging. The countersink rides in the bandsaw kerf—about ¼ in. deep—with no side-to-side movement. The countersink acts as a short tap. The depth at which you lock the quill sets the thread depth. You can make minor adjustments in the first ½ in. or so of length. But take care to get the right depth on the first pass because there is no second chance once a V-groove is formed.

—Dennis R. Brock, Rawson, Ohio

Quick tip: When learning to fold a bandsaw blade, use an old V-belt to practice with first. It's easier on the hands and face.

—Robert M. Vaughan, Roanoke, Va.

Tablesaw jig for making scarf joints



The scarf joint, which joins stock lengthwise without loss of strength, deserves more recognition outside its traditional domain of wooden boatbuilding. Here's how I make the joint for other woodworking projects.

Make a tablesaw jig from a scrap of ½-in. plywood, about 8 in. wide by 32 in. long. Attach a runner to the bottom of the jig to ride in the miter-gauge slot. Trim the edge of the jig with a pass through the sawblade. Now attach a ⅝-in.-high fence angled to the blade at 5° (a slope of 12:1). Install four or five hold-downs with machine bolts and wing nuts, as shown.

To use the jig, locate the piece to be scarfed tightly against the fence, and clamp with the hold-downs. Support the left side of the hold-downs with a piece of material the same thickness as the workpiece. With the sawblade set slightly deeper than the material to be cut, make a pass through the saw.

To keep the joint parts in registration during glue-up, drill a small hole through the splice, and drive in a small round dowel or bamboo skewer. *—William R. Fuller, Dewitt, N.Y.*

Sharpen your hammer?

Many years ago when I was helping an old man install trim on kitchen cabinets, he stopped me and said, "Sharpen yer hammer first." I looked at him suspecting some ruse like a snipe hunt or left-handed monkey wrench. Instead, he showed me how to rub the face of the hammer on abrasive paper to make a non-skid surface. Then he did the same with the nail set. Subsequently, there was a wondrous feeling of certainty and coupling in each blow. The non-skid finish doesn't last long on the hammer, but it doesn't take long to renew. Since that lesson, I almost never make a mule track or send a nail set spinning across the shop.

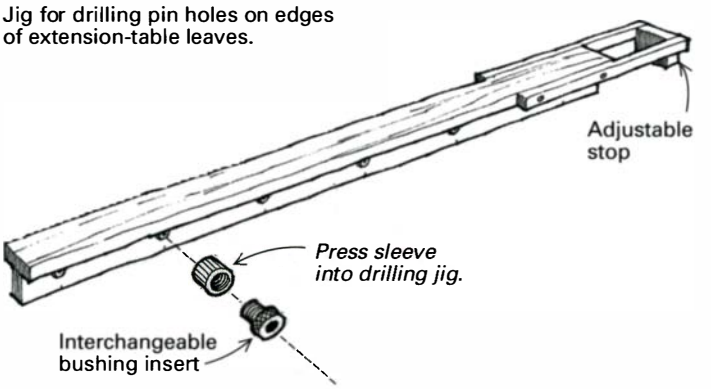
—Joseph Whitehill, Chestertown, Md.

Quick tip: To make a disposable felt buffing wheel, cut a 6-in.-dia. disc from ¾-in. plywood, and enlarge the center hole to ½ in. Now attach felt weather stripping to the circumference of the disc with yellow carpenter's glue. Hold the felt in place with thumbtacks every few inches while the glue dries. Charge the wheel with buffing compound as you would a regular wheel. When the wheel glazes over, throw it away, and make another.

—R.B. Himes, Vienna, Ohio

Drilling table pins

Jig for drilling pin holes on edges of extension-table leaves.



For years I used a doweling jig to drill holes for pins in extension tables and leaves. This approach, unfortunately, requires dozens of separate operations, each subject to the error of misalignment. So I came up with a jig that allows me to drill all the holes on each side of a table part in perfect alignment.

The jig is simply a wooden T-beam containing precisely spaced drill bushings. My jig is 48 in. long with bushings set 9 in. apart. I use two-part drill bushings that consist of a sleeve and a bushing insert (available in various sizes), which threads into the sleeve. Sleeves and bushings are available from the Woodworkers' Store (4365 Willow Drive, Medina, MN 55340; 800-279-4441). The jig, fitted with an adjustable stop on one end, can be centered on different-sized tabletops.

To use the jig, I lay out the tabletop halves and any leaves in their correct positions. Then I mark one end of all parts with an X. This is the reference end that I hook the jig's stop against. I clamp the jig into place, screw appropriately sized drill bushings into the sleeves on the exposed side of the jig and drill the holes. I move the jig to each leaf and drill all the edges in the same way. These are the holes for the pins. To drill matching pin holes in the corresponding leaves, I remove the drill bushings and screw them into the sleeves from the opposite side of the jig.

To make the traditional wooden pins, I use ⅜-in. dowel stock cut to 1-in. lengths. To keep them from binding in the pin holes, I mount the pins in a three-jaw chuck on the lathe and sand down half the length and round the ends. You can also use brass pins (⅛-in.-dia. brass pins that fit the sleeves require 5/16-in.-dia. holes). The pins are also available from the Woodworkers' Store.

—Chris Becksvoort, New Gloucester, Maine

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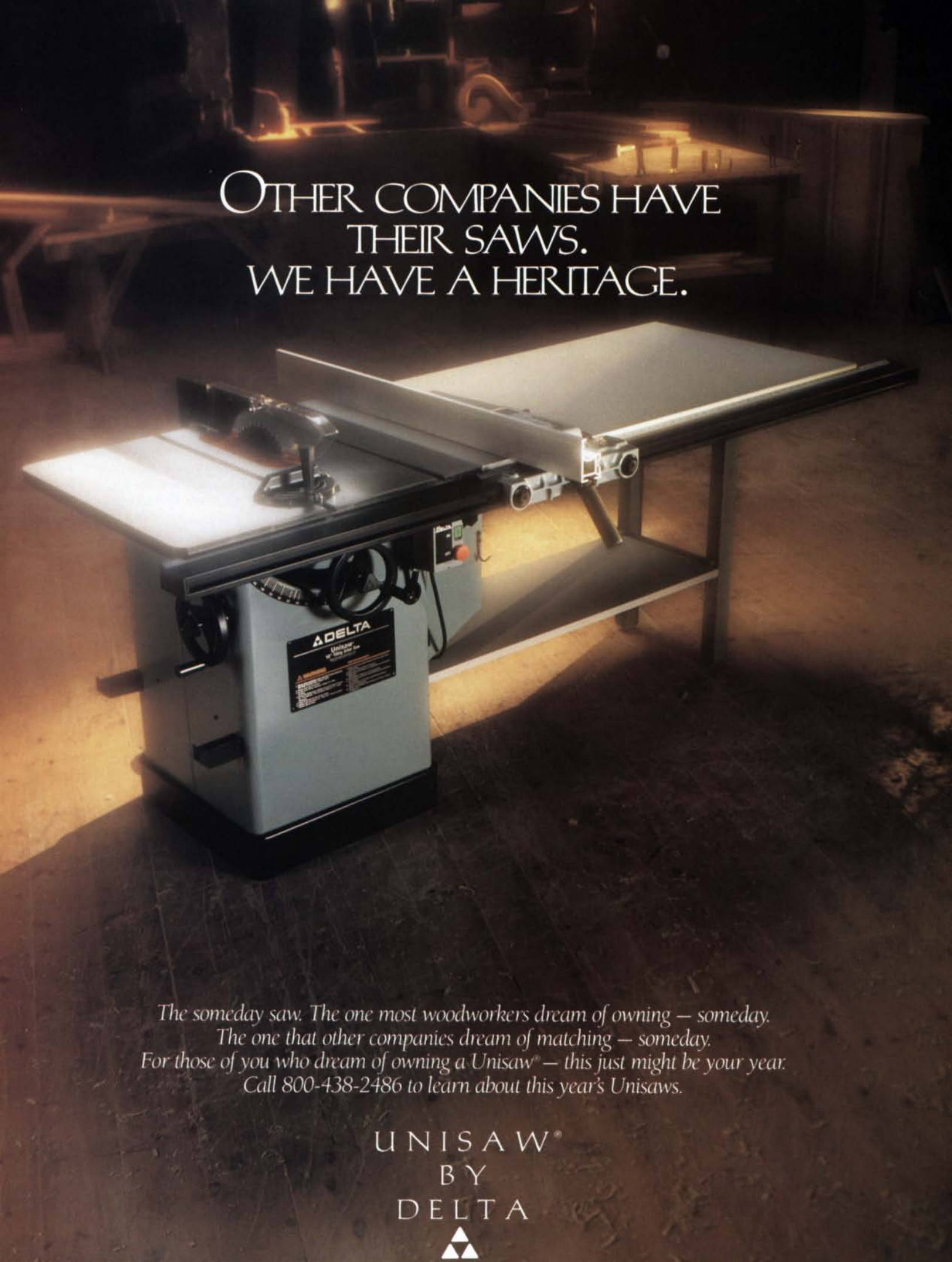

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Putting a hole in a lamp stand

Years ago, I turned some 26-in.-long lamp stands on my old Delta Homecraft lathe, which has a capacity of 36 in. between centers. I also drilled holes through these stands. But now, 20 to 30 years later, I can't remember how I did it. I'd like to make more lamps. I hope you can help.

—C.E. Newman, Baton Rouge, La.

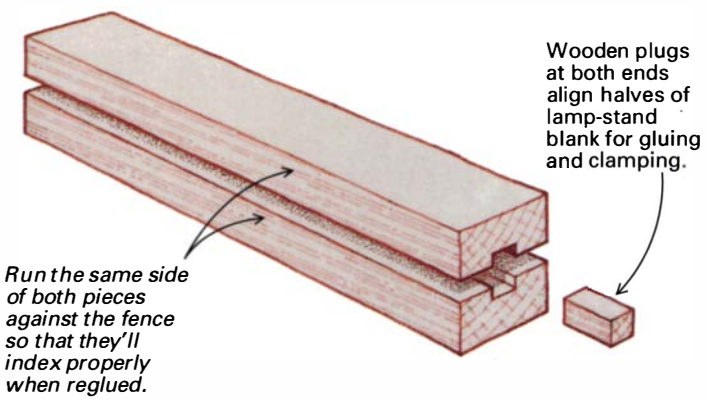
Chris Becksvoort replies: There are at least two possible methods of drilling a long hole through a lamp base. No matter which you choose, drill the hole in the blank first, and then turn the base to its finished shape. It's a good idea to experiment on scrap first.

The first method requires the removal and replacement of the center in the tailstock with a chuck that has the same Morse taper. Then insert a drill bit into the chuck, and crank the bit into the center of the lamp base, as the lathe turns at a slow speed. Because your lathe has 36 in. between centers and a 26-in. turning, allowing for the length of the chuck and bit, this method won't get you very far. Once you have the hole 5 in. or 6 in. deep, you could remove the blank from the lathe and use the hole as a guide to bore the rest of the hole with a portable drill.

A second option is to knock out the drive center at the headstock, press the blank into position, and use a portable drill and long bit to bore directly through the lathe shaft. This method is done with the lathe turned off, using the hole in the headstock as a guide. Bits up to 18 in. are available from W.L. Fuller (P.O. Box 8767, Warwick, RI 02888; 401-467-2900), and I've seen antique bits up to 36 in. long. With a shorter bit, you can reverse the blank and bore from the other end, hoping the holes will align.

Grooving a lamp stand for a cord

It's easier to rip, groove and glue a lamp stand together than to drill a long hole.



My preference, however, is not to drill at all. Rip the stock in half lengthwise, and dado a ¼-in. to ⅜-in. groove on the sawn faces. Glue and clamp the two halves, using wooden plugs at both ends for alignment. If the grain is straight, the gluelines should be barely noticeable. Length is no longer an issue. When the glue is dry, remount the blank (with the plugs in the holes), and turn to shape. The plugs can be removed by driving a screw into them and then pulling.

[Chris Becksvoort builds custom furniture in New Gloucester, Maine, and is a contributing editor to *FWW*.]

Eliminating planer end snipe

How do I eliminate end snipe when thickness planing?

—George McClellan, Savannah, Ga.

Robert Vaughan replies: The solution to end snipe depends on the type of planer you have, but here are the basics:

1. Face joint each piece of lumber on the jointer until one face is perfectly flat. This is the most crucial step because all a planer does is make two surfaces of a board parallel.

2. Adjust your planer's bed rollers, feed rollers and pressure bar correctly (for more, see my article in *FWW* #107, pp. 72-77). Planers without these features encourage snipe. If your machine does not have an adjustable pressure bar and adjustable feed and bed rollers, consider replacing it with a planer that does.

3. Support the stock as it's entering and exiting the planer. The weight of long, free-hanging boards tends to rock the ends into the cutterhead.

4. If your planer has a bed or cutterhead carriage lock, make sure that it's securely locked in position after you adjust for depth of cut. If the bed or cutterhead carriage is left unlocked, it can rock when wood enters and exits the feed system.

[Robert Vaughan rehabilitates woodworking machinery in Roanoke, Va., and is a contributing editor to *FWW*.]

How to avoid stains where steel meets oak

I recently built a pencil-post bed of red oak and used steel bed bolts to hold it together. Will the tannin in the oak cause stains on the oak? If so, what can I do to prevent it?

—Charles Griffin, Laughlin AFB, Texas

Garrett Hack replies: In my experience, oak, iron or steel and moisture react quickly to stain oak black, even through a good oil or varnish finish. Red oak is particularly susceptible. The moisture can come from within the wood if it is not fully dried, or it can condense out of the atmosphere onto the bed bolts if exposed to wide temperature swings. The slightest amount of moisture will set up the reaction.

The most important thing to do is to make sure the wood you're using is thoroughly seasoned. In addition, you can set the bed bolts below the post faces, as was done traditionally on more formal beds, and cover them with brass covers. Any stains will be hidden. This will work as long as the post is thick enough not to be weakened by the holes for the bed-bolt heads.

If your posts are fairly thin or if you prefer having bed bolts that tighten on the face of the post, as was often the case on country beds, you can make some washers from medium-weight cardboard or a plastic milk jug. You could also file brass washers so they're hidden behind the bolts. All you have to do is isolate the bed bolts from the oak. If you work carefully, the washers will be all but invisible.

[Garrett Hack designs and builds custom furniture in Thetford Center, Vt.]

Steel-corner reinforcers to attach tabletops?

Is it possible to fasten a solid-wood utility tabletop to a frame with steel-corner reinforcers? I have used this method with a plywood top, but I didn't have to worry about seasonal wood movement. Would undersized pan-head screws and washers (rather than the standard screws provided with the hardware), allow enough movement for a solid top?

—Bill Pierce, Trenton, N.J.

Garrett Hack replies: Even pan-head or round-head screws with washers probably won't allow enough movement for a table any wider than about 24 in. Seasonal stresses could distort the base or cause a wider top to crack.

If you're determined to use corner reinforcers, I'd do two things when attaching wide tabletops. First, attach the top positively at the center so that it moves equally in both directions, front and back. This can be done with a corner reinforcer installed with its countersunk screws, but a better way would be a pocket hole and screw. (See the article in *FWW* #112, pp. 54-57, for more information on attaching tabletops.)

The second thing I'd recommend is that you elongate the holes (side to side) and use pan-head screws on the leg of the reinforcer that attaches to the top. This might weaken the rein-

forcers a bit. But only those installed at the outer edges of the table's width need to be modified because that's where the potential wood movement is greatest. Also, be sure to use countersunk screws on the aprons, because you want this connection as positive as possible.

Another potential problem with these reinforcers is that they may not be strong enough for large tables. Tables are bound to be picked up by their tops, distorting the connectors and creating a gap between the top and the frame.

Your best bet is to use wooden buttons or metal Z-clips, both of which are discussed in the article mentioned previously. Either can be installed quickly and easily, will hold any size tabletop securely and will allow wood movement.

Parts for a Boice-Crane tablesaw

I need a part for a Boice-Crane tablesaw, model #2550, and I hope you can help. The last known company address was in Schiller Park, Ill., but Boice-Crane is no longer there. Do you have any leads? —*Billy Lewis, Columbia, Ill.*

Robert Vaughan replies: What used to be Boice-Crane is now called Gothenburg Manufacturing Co. (P.O. Box 308, Gothenburg, NE 69138; 308-537-3628).

However, a better bet for finding parts for old Boice-Crane machines is from a company that specializes in parts for those machines. For information, write or call Myron Buehrer, Boice-Crane Parts, 2442 Densmore Drive, OH 43606; (419) 531-1113.

Preventing stored tung oil from skinning over

There was an excellent suggestion in FWW *#113 for preventing tung oil from skinning over. The writer puts leftover tung oil in a beer bottle, which reduces the surface area in contact with the air, and then removes a lot of the air. I remove the air from the screw-top cans by inserting the tip of an unlit propane torch and gently displacing the air with propane. Refrigerant or acetylene probably could be used as well, as long as you displace the air. Is there any reason not to do this?*

—*Ellis E. Wind, San Antonio, Texas*

Chris Minick replies: Using propane to displace the oxygen in a can of varnish or tung oil seems to be a fairly common practice—I've heard of it several times. It will definitely prevent the tung oil from skinning in the can and should not cause any subsequent harm to the oil itself.

Even though I don't know of any chemical reason for not doing it, my gut says this is a dangerous solution to a simple problem. Especially if, as you suggest, acetylene is used in place of propane. Acetylene has a nasty tendency to explode when it comes in contact with certain metals or metal salts. I don't know if these particular metals are present in tung oil, but I'd hate to find out the hard way.

I've solved the skinning problem in my shop by storing my tung oil in plastic dish-detergent bottles. I squeeze the bottle to expel the air and push the cap down to seal the bottle. These containers work great for storage and make nice oil dispensers, too. [Chris Minick is a contributing editor to *FWW* and a finishing chemist and woodworker in Stillwater, Minn.]

Looking for a miracle adhesive

I'm building a red oak rocker with mortise-and-tenon joinery throughout. The construction is tricky in that the majority of the joints must be assembled simultaneously.

I need a glue with a long open time (about 30 minutes or so) and good gap-filling qualities for my less-than-perfect joints. I considered epoxy, but literature from Gougeon Bros. on the company's West System's epoxy discouraged its use with oak. The viscosity of epoxy limits grain penetration into the high-density latewood portions of the oak, and epoxy isn't elastic. What do you recommend? —*Daryl Jones, Margate, Fla.*

Chris Minick replies: Chair joints, especially rocking-chair joints, take a terrible beating. Even the best-made chairs eventually loosen at the joints and must be reglued. Therefore, an adhesive that would be ideal for chair joints needs to have good shear strength and should be easy to repair.

Hide glue is an adhesive with both of those characteristics. It is stronger than many common woodworking adhesives and is moderately gap-filling. The premixed liquid variety (Franklin hide glue, for instance) has an open time of 15 to 20 minutes. Best of all, joints initially assembled with hide glue are easily repaired. Unlike other adhesives, fresh hide glue will reactivate old hide glue. To repair the joint, simply scrape the dried hide glue from the mating surfaces, put on some fresh hide glue and reassemble the joint.

Relying on the gap-filling ability of an adhesive to compensate for ill-fitting joints is always a bad idea, though. Thick gluelines are inherently weak and prone to premature failure. A better approach is to glue a strip of veneer (or two, if necessary) to your tenons, and pare or sand the tenons until they fit snugly in the mortises. Then assemble the rocker with hide glue.

Is spalted wood safe for use around food?

I read the letter in FWW *#112 about spalting your own wood. I was wondering about the safety of using spalted woods for kitchenware. Once a spalted bowl is turned, dried and sanded, is there any health risk from the fungi or pigments?*

—*Tom Albrecht, Wilmette, Ill.*

Karen Nakasone replies: Spalted wood results from the activity of fungi and other microorganisms present in wood. Microfungi and bacteria often produce pigments that stain but do not decay wood appreciably. White-rot fungi produce dark zone lines in wood and can cause significant decay. Once the water content in the wood falls below 20 to 25%, though, the fungi and microorganisms become inactive and eventually die. Although it is possible for the pigments to leach out of spalted wood, there is no evidence that this happens. Spalted wood has no known health risks and should be safe to use for food containers and serving utensils.

[Karen Nakasone is a mycologist at the Forest Products Laboratory in Madison, Wis.]

A best time to harvest wood?

I build piers primarily with cedar logs. Recently, I heard that cedar cut in the summer lasts only half as long as cedar cut in the winter because of the sap in the log. Is there any truth to this? Is there an optimum time to harvest wood for greatest durability, strength, workability or any other characteristic?

—*Randy Tryczak, Three Lakes, Wis.*

Jon Arno replies: The saying "a time to sow, a time to reap" is true of all crops and probably of all living things. In any event, it certainly applies to forestry. In temperate regions, for many practical reasons, logging has traditionally been a winter activity. Cheap labor was more readily available after the summer food crops had been harvested. And in winter, logging trails could be iced to make moving the logs by sleigh easier. Also, cool weather and the absence of mosquitoes made strenuous work in the bush a little more bearable.

The goal was to get the logs cut and to the mill, sawn into lumber and stacked in stickered piles in time to take full advantage of the warm-weather drying season. Modern, mechanized transportation and the extensive use of kilns make winter logging less mandatory, but it's still preferable.

Most hardwood (deciduous) species have a high moisture content when harvested in the summer, and this slows the drying process. Also, some species with poor natural durability (such as maple, ash and basswood) quickly blue stain if harvested in warm weather. Many softwoods, such as spruce, hem-

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lock, true firs and, to some extent, the pines, tend to be more prone to blue stain when harvested in warm weather.

Harvest time is least significant with softwood species that have high natural durability, such as redwood and cedar. Sap contains nutrients that make the wood tastier to decay organisms, so there is at least some minor benefit in harvesting the logs when sap flow is at its lowest, regardless of the species.

The advice you've been given has a factual basis, but I suspect the two-to-one improvement in durability is grossly overstated. [Jon Arno is a wood technologist and consultant in Troy, Mich.]

Cleaning up cocobolo stains from maple

I recently made a bed of cocobolo and curly maple. To preserve the light color of the maple and achieve a rich, luxurious surface, I finished it with a brushing lacquer. As you might imagine, I ended up with a mess. The red pigment in the cocobolo not only spread onto the maple but also muddied its own appearance. What can I do? I'm afraid that stripping the wood will remove the lacquer, but not the pigment, and a solvent will only drag more pigment out of the cocobolo.

—Dick Horn, Philadelphia, Pa.

Jeff Jewitt replies: Cocobolo is a member of the rosewood family, and the problem you describe is typical of all rosewood species. The pigment that is responsible for the characteristic color of these species will be pulled out by most organic solvents, causing the bleeding problem you describe. The pigment bled into the adjacent maple and into the finish, causing the muddy appearance.

To fix things, start by removing the lacquer with lacquer thinner and then letting the surface dry thoroughly. The red pigment left on the adjacent maple can be sanded off with 150-grit paper followed by the rest of your normal sanding routine. Or you can use a sharp scraper. Trying to remove the pigment with various solvents (including water) will only exacerbate the situation. Once you're back to where you were before you finished the piece, you'll need to take a different approach to finishing. Here are three options:

1. The best remedy, and the one I'd use in my shop, would be to spray a vinyl lacquer sealer before the lacquer topcoats. The sealer I use is available from M.L. Campbell (P.O. Box 22, Buffalo, NY 14240; 716-873-6000).

2. If you don't have spray equipment, purchase several aerosol cans of lacquer, and mist on several light coats before brushing on the heavier topcoats.

3. Mask off the maple areas, and brush the cocobolo with several coats of shellac. Let it dry, remove the tape and seal the maple in the same way. Then continue with your normal lacquer-brushing routine.

[Jeff Jewitt restores and conserves antique furniture in North Royalton, Ohio.]

Value of a Sargent No. 407 smooth plane

I inherited a Sargent No. 407 smooth plane with a patent date of February 3, 1891. According to the instruction manual, the retail price was $4.30. The plane and manual are in fairly good condition. The original box is in poor condition. Should I use the plane, or does it have some value as a collectible?

—David D. Edmonson, Dallas, Ore.

Mario Rodriguez replies: Sargent's No. 407 is a small, all-metal bench plane, comparable to the Stanley No. 2. This size was never made in great numbers by Stanley, and the Sargent version is rarer still. Experts tell me that, alone, a No. 407 in good

condition is worth approximately $200. Because you have both the original box and the instruction manual, it could be worth as much as $350. Its exact value would depend on an inspection of the tool.

If you're planning to maintain the plane as a collector's item, don't alter its finish or physical condition. By opening up the mouth, sharpening the blade or disturbing its patina in any way, you'll severely reduce its potential value to collectors.

[Mario Rodriguez teaches woodworking at the Fashion Institute of Technology in New York City, and he is a contributing editor to *FWW*.]

Problem with drying cherry crotch

I have been harvesting, drying and working with wood all my life, but I'm having a real problem drying cherry crotch. It wants to pull and check all over the place. Is there a trick to it? I've heard of a product called PEG for bowl turners—would that help? I have a 1,000-bd.-ft. kiln with an electric dehumidifier. I'm planning to use the cherry for gunstocks.

—Henry Kolesin, Baden, Pa.

Redmond Manierre replies: You're not alone in feeling frustrated when the cherry crotch pieces that you've sawn crack open upon drying. The heart of the problem is the heart of the tree! Unlike a walnut tree (in which the center is a chambered pith—a hollow column thinner than a drinking straw), cherry has what's called shaky heart. Instead of being a discrete nonentity, its core is a loose, apparently random network of radial checks, or shake, that penetrate and degrade the surrounding wood for up to 3 in. So I doubt that polyethylene glycol (PEG) would help you. Your difficulty is not a matter of supplanting the water in the wood with a more stable material (which is what PEG does) but rather of dealing with an inherent flaw.

The difference between cherry and walnut is most apparent when I cut them through and through, which is also called flitch cutting. The boards sawn through the heart of the walnut log hold together and are usable their full width, even though one can see the chambered pith meandering in and out of the surface of the board.

But the cherry yields two to five boards through the heart of the log that have bands, several inches wide, running the length of the boards that are completely unusable. It's for this reason that a sawing technique called "boxing the heart" was developed. Here, the sawyer continuously takes boards off the perimeter of the log until all that's left at the heart is a low-grade piece of wood about 3 in. sq.

By the way, in addition to walnut, I've had good luck sawing crotch slabs of white ash. It has the same type and degree of figure as walnut, but it's white and beautiful.

[Redmond Manierre is the proprietor of Landmark Logworks, a sawmill catering to custom woodworkers, in The Plains, Va. He is a former professional woodworker.]

Reader exchange

I have a Sears model 101.02143 tablesaw I bought at a garage sale. I believe it's an 8- or 9-in. model, and it looks as if it dates back to the 1940s. I'd be grateful if there is any way someone could help locate a manual for this piece of equipment.

—Ward Haidle, 1550 Robincrest, Lindenhurst, IL 60046

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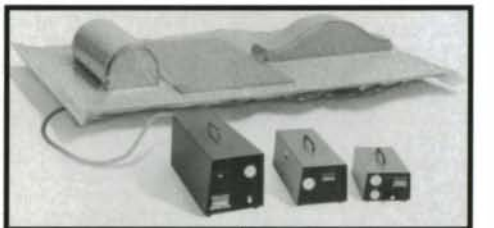

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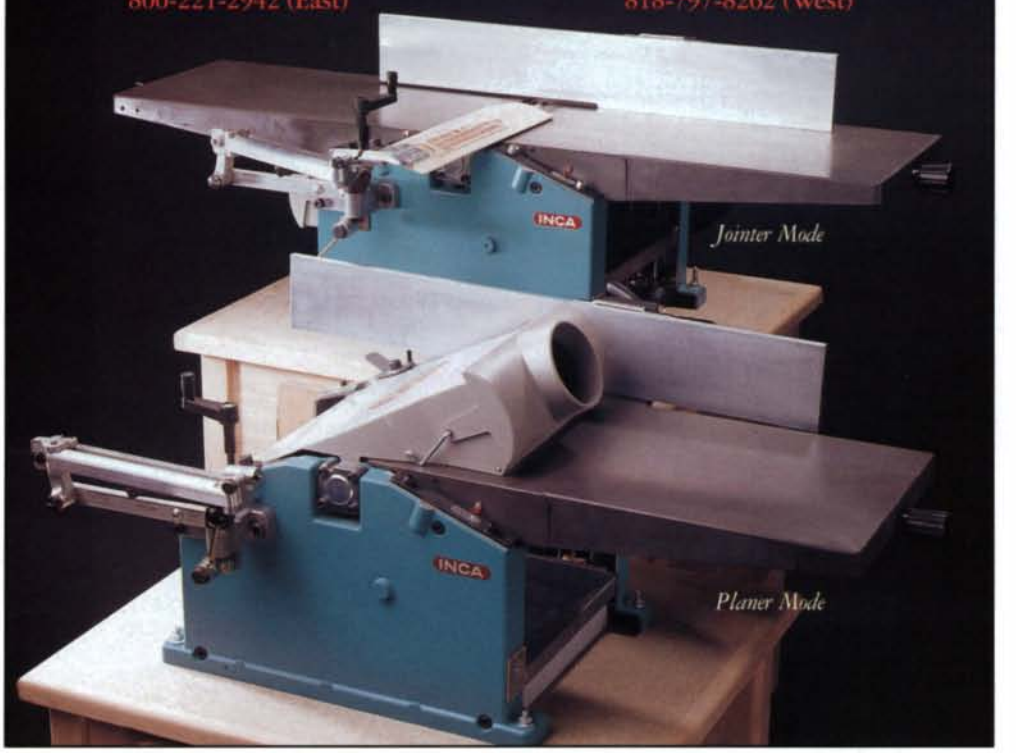

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5080 Pro Framer Tool Belt $134
8080 oxy light pro framer 124

SENCO
SFN40K 1-1/2 to 2-1/2 Finish Nailer w/Case $389
SN325+ 6d - 12d nailer. 419
SFN-1 Plus 1"-2" finish nailer 349
SN60 New full hd stick nailer 449
SN70 6d-16d frame nailer 479
SLP-20 5/8"-1-5/8" brad nail kit 279
SLS20 New finish stapler w/cs 279
SKS 1/4" crown finish stapler 279
M-II 1-3/8" to 2" HD stapler 369

KRAUSE
121482 12' Multimatic Alum. Ladder $129
121499 16 foot ladder 149

shop-vac
890-11 10 Gallon, 2 Stage, 2 HP By-Pass S. Steel Vac $289
610-50 10 gal. S.S. cont. vac 174

DEWALT
DW935K 14.4 Volt Cdls Saw Kit w/2 Batteries $239 (With 2 Batteries!)
DW935 14.4 volt cdls saw only 159
DW930K 12 volt cdls saw kit 199
DW930 12 volt cdls saw only 129
DW670 laminate trimmer 99
DW673K laminate trimmer kit 209
DW614 1-1/4 HP Plunge Router w/Height Adjuster $99
DW615 1-1/4hp vs plng router 164
DW625 3hp vs plunge router 279
DW610 1-1/2 hp, 1/2" router 154
DW306K 8 amp, vs, recip saw 164
DW304K 6 amp, vs recip saw 144
DW705K 12" Compound Miter Saw $359 (Includes Dust Bag)
DW364 7-1/4 brake &cs 159
DW361 7-1/4" saw & case 149
DW318K top hdl vs jig saw kit 159
DW675K 3-1/8" planer w/case 164
DW402 4-1/2" angle grinder 89
DW682K Plate Jointer Kit $219
DW106 3/8" 4 amp keyless dr 74
DW160 3/8" RA shorty drill 139
DW250 0-4000 drywall driver 89
DW254 0-2500 deck driver 89
DW280K all purp scrwdrvr kit 119
DW290 1/2" impact wrench 174
DW510K 1/2" VSR hmer dr kit 179
DW421 5" Hook & Loop Dustless Random Sander $74
DW423 5" vs random sander 94
DW420 5" PSA random sander 69
DW443 6" RA H&L rdm sndr 139
DW444 6" RA PSA rdm sndr 149
DW411 1/4 sheet sander w/bag 59
DW431 3"x21" vs belt sander 184
DW991K 14.4 Volt, 3/8" Drill Driver Kit $199 (KIT BOX INCLUDED)
DW991KS-214.4v saw/drill pkg 349
DW994KQ 14.4v 1/2" 15m d kit 239
DW972K-2 12v 3/8"dr kit/2b 189
DW952K-2 9.6v 3/8"dr kit/2b 149

PERFORMAX PRODUCTS, INC.
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Powerfeed attachment 349
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NR83A Full Head Stick Nailer $399
NR83AA clipped head stick nlr 429
NV83A full head coil nailer 429
NV45AB coil roofing nailer 429
N5008AA 5/8" to 2" HD stapler 339
NT65A 1" to 2-1/2" brad nailer 339

BOSCH
B7000 NEW! Center Detail Sander $69
B7001 vs corner detail sander 94
1370DEVS 6" hd random sander229
3296 3-1/4" power planer 154
1609KX laminate trimmer kit 219
1195VSR 3/8" 6 amp hmr drill 139
1194VSR 1/2 vsr 6 amp hmr drl 159
11222EVS 1-1/8"sds rotary hmr 399
1613EVS 2 HP, VS, Microfine Plunge Router $209 (Includes Deluxe Edge Guide)
1655 New 7-1/4" circle saw 129
1289D New1/4 sheet palm sndr 69
B1650K New plate joiner kit 179
B4050 New in-line jigsaw 129
B2300K New 12v crdls drill kit 179
3296K New 3-1/4" planer kit 169

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1587VS Top Handle Jig Saw w/Case $169
1584VS barrel jigsaw w/case 169
1587VS New top handle jigsaw 149
1584VS barrel grip Clic jigsaw 149
1587DVS top hdl dstlss jigsaw 179
1584DVS barrel dustless jigsaw 179
1632VSK vs recip saw kit 159
3051VSRK kyls3/8vsr kt w/2 bt 154
3283DVS Dustless Random Orbital Sander $95
3283DVSK 5" rndm sander kit 119
1348AE 5" elec. mini grinder 139
1608 laminate trimmer 98
1609 offset base laminate trmr 149
1942 heavy duty heat gun 79
3310K New 12 Volt T-Handle w/2 Batteries $199
3054VSRK 12v,3/8" vsr kt,2bat 189
1273DVS 4x24 vs belt sander 229
1273D 4x24 sander with bag 219
1272D 3x24 sander with bag 209
3270DVS 3x21 vs sndr w/bag 169
1615EVS 3-1/4 HP, VS Plunge Router $299
1608DW drywall cutout tool 94
1604 1-3/4 hp router 144
1606 1.75 D-handle router 189
1609K 3 in one trimmer kit 179
1003VSR 3/8" keyless 0-1100 drl 94
1404VSR 0-4000 drywall driver 94
11224VSR 7/8" Bulldog SDS Rotary Hammer $219
11304 Brute breaker hammer1249
11305 demolition hmr 10 amp 749
11220EVS 1-1/2" spline hmr 499
11219EVS 1-1/2" spline w/stop 569
1194VSRK 1/2" hmr drill w/cs 159

Porta-Nailer
401P Hardwood Floor Nailer $209
501 floor face nailer 209
120 universal router table 329

AEG
TXE-150 6" EVS Random Sander $144
HBSE-75S 3x21 vs belt sander 184
FSPE-100X brl grip jigsaw w/cs 164
BSPE-100X top hndl jigsaw w/cs164

David White
LP6-20 20X Sight Level Package $209
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ML200 New visible beam laser 899
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LTP6-900 level transit pkg. 379
ALTP6-900 18 auto lvl trnst pkg 479
LT6-900 20 x level transit 249
LT8-300 26 x transit 449
LT8300P 26 x opt. transit 529
ALT6-900 18x auto level transit 399
ALP6-18HD 18x auto package 389

Elu
3339 3 HP VS Plunge Router $279
2721 1.5 hp fixed base router 149
3379K plate joiner w/case 239
3375 3-1/8" universal planer 169
4024 3x21 vs sander 184

VEGA
U26 Utility 26" Fence $179
U50 utility 50" fence 199
PRO40 professional 40" fence 249
PRO50 professional 50" fence 259
DU-36 utility 36" duplicator 399
D-36 prof. 36" duplicator 569

Wap
766RDF Turbo Vacuum $449
776RDF-D turbo drywaller vac 549
SQ14ASTurbo Vac w/auto start 569

Makita
6095DWE 9.6 V 3/8" VRS Keyless Drill w/2 Batteries $134
5007NBK 7-1/4" saw w/case 124
5007NBA 7-1/4" saw w/elec brk 139
2711 10" table saw w/brake 609
2708W 8-1/4" tbl saw w/brake 309
LS1030 10" mitre saw 239
2012 12" port. plnr w/dust cht 499
3612C New 3hp plunge router 269
LS1011 10" Compound Mitre Saw $479 (Includes Carbide Blade)
LS1211 12" cmpnd miter saw 789
6201DWHE 9.6v hi cap kyls2 bt 179
6211DWHE 12v hi cap kt w/2 bt 184
9820-2 blade sharpener 214
HP2010N 3/4", vsr hammer kit 189
JR3000V vs recip. saw kit 139
N1900B 3-1/4" planer w/case 134
3901 New plate joiner 209

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DELTA BENCH TOP TOOLS

Model	Description	List	Sale
23-700	Wet/Dry Grinder	234	155
23-680	6" Bench Grinder 1/4 HP	86	69
23-880	8" Bench Grinder 1/2 HP	151	115
11-950	8" Drill Press	199	128
28-160	10" Hobby Band Saw	210	135
31-050	1" Belt Sander 2.0 amp	104	75
31-460	4" Belt/6" Disc Sander	198	129
31-340	1" Belt/8" Disc Sander	268	204
31-080	1" Belt/5" Disc Sander	134	89
40-560	16" 2 speed Scroll Saw	266	169
40-530	NEW 16" Scroll Saw	153	115
11-990	12" Bench Drill Press	276	184
11-090	32" Radial Bench Drill Press	399	305
43-505	1/2" Bench Router/Shaper	399	295
22-540	12" Bench Top Planer	595	385
	FREE Set of extra knives Included !		
36-220	10" Compound Mitre Saw	350	215
14-650	Hollow Chisel Mortiser	668	285

NEW TOOLS BY DELTA

23-710	NEW Sharpening Center	210	165
11-980	NEW 10" Bench Drill Press	186	149
33-060	NEW "Sidekick" Miter saw	510	389
14-070	NEW 14" Floor Drill Press	450	349
28-180	NEW Bench Band Saw	232	158
40-640	NEW 20" Bench Scroll Saw	466	295
28-190	NEW 12" Band Saw w/ stand	465	395
20-150	NEW 14" Cut-off Saw	375	219
36-090	NEW 10" Sidekick Miter Saw	293	225
37-070	NEW 6" var. speed Bench Jointer	337	258
37-190	NEW 6" Deluxe jointer	554	479
36-275	NEW 8-1/4" Builders Saw	444	265
36-210	NEW 10" Compound Mitre Saw	438	255
36-070	NEW 10" Mitre Saw	284	165
36-630	NEW 10" Contractors Saw II	700	579
34-555	NEW Sliding Table	459	289
36-250	NEW 10" Slide Compound Saw	Sale	489
36-230	NEW 12" Compound Mitre Saw	480	359

DELTA STATIONARY

17-900	16-1/2" Floor Drill Press	462	415
40-601	18" Scroll Saw w/stand and blades.	1003	819
34-080	10" Mitre Box	Xtra Special	194
33-990	10" Radial Arm Saw	818	695
37-280	6" Motorized Jointer	488	389
50-179	3/4 HP 2 stage Dust Collector	483	358
43-355	3/4" Shaper 1-1/2 HP	964	795
46-700	12" Wood Lathe	548	449
33-055	8-1/4" Sawbuck comp with legs	865	629
36-540	10" Table saw	210	169
34-670	10" Motorized Table Saw	511	395
32-100	Stationary Plate Jointer	645	255
36-040	8-1/4" Compound Mitre Saw	224	149
36-905	30" Unifence	385	249
36-906	50" Delta Unifence	525	305
36-755	10" Tilt Arbor Saw	1264	1039
33-890	12" Radial Arm Saw	1829	1495
14-040	14" Bench Drill Press	382	345
28-560	16" Three Wheel Band Saw	487	445
28-245	14" Band Saw w/open stand 1/2 HP.	719	598
34-444	Table Saw w/1-1/2HP motor & stand	812	659
34-445	34-444 Saw with 30" unifence	1200	829
	above saw comes with mobile base		
28-283	14" Band Saw with enc stand 3/4 HP	910	779
	above saw comes with mobile base & fence		
22-661	13" Planer with stand 2 HP	1513	1239
22-675	NEW DC380 15" Planer	1439	1275
37-154	DJ15 6"Jointer w/ mobile base	1451	1239

DEWALT TOOLS

DW945K	3/8" 12V cdlss drill kit w/cs & 2 batt.	309	185
DW364	7-1/4" Circ. Saw w/brake, 13 amp	285	158
DW306K	8.0 amp Recip Saw w/case var. spd	291	164
DW610	1-1/2 HP 2 handle Router	274	149
DW411	1/4 sheet Palm Sander, 1.7 amp	97	58
DW705	12" Compound Mitre Saw	706	359
DW704	12" Mitre Saw	570	325
DW100	3/8" Drill, 4 amp, 0-2500 rpm, rev	118	68
DW250	4.5A Drywall Gun, 0-4000 rpm, rev.	169	94
DW254	4.5A Drywall Gun, 0-2500 rpm, rev.	169	94
DW280K	NEW Screwdriver kit complete	207	124
DW402	4-1/2" Grinder 6 amp	158	92
DW682K	Biscuit Joiner with case	429	219
DW615	1-1/4 HP Elec. Plge Router	290	164
DW625	3 HP Electronic Plge Router	511	275
	Above router comes with Free DW6966 Fine depth adjustment !		
DW675K	3-1/8" Planer with case	289	164
DW431	3 x 21 var. speed Belt Sander	331	184
DW420	NEW Palmgrip Random Orb Sander 120		69
DW421	above Sander with dust collector	138	74
DW930K	NEW 12 volt 5-3/8" Trim Saw kit	370	199
DW444	6" Random Orbit Sander - PSA pad	266	139
DW443	DW444 with hook & loop pad	266	139
DW935K	NEW 14.4 volt 5-3/8" Trim Saw kit	444	237
	DW935K Saw comes with 2 batteries!		

NEW DEWALT CORDLESS DRILLS

DW952K	3/8" v/spd incl. two 9.6V batteries.	280	145
DW962K-2	3/8" v/spd incl. two 9.6V XR batt.	324	179
DW972K-2	3/8" v/spd incl. two 12V XR batt.	352	189
DW904	12 volt flashlight	29.95	

DW972K-2 drill & **DW904** flashlight **Sale 205**

DW944KQ	1/2" v/spd incl. one 14.4V XR batt	450	235
DW991K	3/8" v/spd inc. one 14.4V XR batt.	370	199
DW991K-2	above drill with 2 batteries		225

Above drill kits come w/charger & steel case !

DW991KS-2 DW991K drill, DW935 saw, &case.... 339

DREMEL TOOLS

3955	Moto Tool Kit with bits & case	134	79
3956	NEW Super Moto Tool Kit w/ acc.	152	95
1672	16" Scroll Saw - 2 speed "Best buy"	302	174
1695	NEW 16" var. speed Scroll Saw	408	229
290	Electric Engraver with point	25	16
1731	5" Disc 1" x 30" Belt Sander	189	114

JORGENSEN ADJUSTABLE HANDSCREWS

Item#	Jaw Length	Opening Capacity	List	Sale	Box of 6
#3/0	6"	3"	16.53	9.59	55.75
#2/0	7"	3-1/2"	17.75	10.35	58.95
#0	8"	4-1/2"	19.76	11.75	58.00
#1	10"	6"	22.63	12.50	68.00
#2	12"	8-1/2"	25.95	14.50	78.00
#3	14"	10"	32.88	18.00	99.00
#4	16"	12"	42.76	23.95	139.00

STYLE 3400 NEW E-Z HOLD II

Model	Opening	List	Sale	Lots of 6
3410	10"	15.95	11.95	59.95
3416	16"	17.20	12.75	65.95
3422	22"	18.40	13.25	71.00
3428	28"	20.00	14.50	76.95

JORGENSEN STYLE 37 2-1/2" Throat 1/4"x3/4"

Item#	Jaw Length	List	Sale	Box of 6
3706	6"	10.65	6.05	32.50
3712	12"	11.80	6.65	37.25
3718	18"	13.00	7.45	40.50
3724	24"	14.25	7.99	42.50
3730	30"	15.88	8.85	47.75
3736	36"	17.36	9.99	53.95

JORGENSEN STYLE 45 5" Throat 1-3/8" x 5/16"

Item	Jaw Length	List	Sale	Lots of 6
4512	12"	33.17	19.95	109.99
4518	18"	34.97	21.45	116.99
4524	24"	37.02	22.75	123.99

JORGENSEN STEEL "I" BAR CLAMPS

Model	Size	List	Sale	Lots of 6
7224	24"	34.36	19.50	109.00
7236	36"	36.88	21.50	119.00
7248	48"	40.54	23.50	129.00
7272	72"	46.64	28.50	162.50

PONY CLAMP FIXTURES

Model	Description	List	Sale	Lots of 12
50	3/4" Black Pipe Clamps	14.87	7.80	88.95
52	1/2" Black Pipe Clamps	12.40	6.70	71.50

QUIK DRIVE KITS

Model	Description	List	Sale
SG-2000	Subfloor/drywall, drives screws 1" - 2", complete kit including extension	765	485
SG-3000	Deck/subfloor, drives screws 2" - 3", complete kit including extension	936	595

Msx636	FEIN Triangle Sander Kit	Sale	199
Msx625	FEIN NEW Air Triangle Sander	Sale	189
LPN672	PONY Air Palm Nailer with glove	Sale	94.99
RTM01	ROTOZIP Drywall cutout unit	Sale	68.95

BLACK & DECKER

1166	3/8" Drill 0-2500 rpm 4 amp	118	68
2600	3/8" Drill 0-1200 rpm 4.5 amp	167	98
79-034	Workmate 400	184	109
1350K	1/2" Timberwolf Drill 2 speed	551	319
1180	3/8" Drill rev. 0-1200 rpm 5 amp	207	119
2037	Drywall Gun 0-4000 5.0 amp	184	95
2038	Drywall Gun 0-2500 rpm 5 amp	184	95
2054	Tek Gun 0-2500 5.0 amp	287	159
2750	4-1/2" Grinder 10,000 rpm 6 amp	156	89
2694	7-1/4" Super Sawcat Circ Saw w/cse	285	158
2695	8-1/4" Super Sawcat Circ Saw w/cse	328	179
3339	Elu 3 HP v/spd Plunge Router	511	269

Black & Decker Continuous Rim Dry Cut Diamond Blades

Model	Size	Thickness	Arbor	List	Sale
40280	4"	.080	7/8"	79	44
40281	4-1/2"	.080	5/8", 7/8"	90	49
40282	7"	.090	5/8"	154	79
40283	8"	.090	5/8"	199	98
40285	12"	.118	1"	419	195

Piranha Carbide Tooth Saw Blades by B & D

Model #	Diameter	# Teeth	List	Sale
73-715	5-1/2	16	14.39	8.25
73-716	6-1/2	18	14.39	8.25
73-717	7-1/4	18	14.60	7.99
73-737	7-1/4	24	18.06	9.45
73-757	7-1/4	40	32.87	17.49
73-718	8	22	20.95	11.25
73-759	8-1/4	40	46.88	25.95
73-719	8-1/4	22	20.63	12.45
73-740	10	32	34.63	18.85
73-770	10	60	70.37	35.50
73-711	10	50	68.33	35.50

DURA III - ADJUSTABLE STILTS

Model	Description	List	Sale
D1422	14"-22" extension	258	199
D1830	18"-30" extension	274	215
D2440	24"-40" extension	289	229
	Above models include strap adapter kits		

SIOUX TOOLS

8030	3/8" variable speed Drill	250	145
8000	3/8" v/sp close quarter Drill 0-1300rpm	201	125
8005	Same as 8000 but is 0-2500 rpm	200	139
690	5" Air Random Orbit Sander	139	132
658	5" Air Random Sander - dual action	261	155

ALUMINUM LADDER JACKS

Must be installed on Type 1 or Type 1A ladders only

Model	Accepts Stage Width	Spans	Attaches to Rung	Sale
10-14-02	14"	2 rung	2 rungs	76.95
10-20-02	20"	3 rung	2 rungs	83.95
10-20-03	20"	3 rung	3 rungs	93.95

ALUMINUM ARTICULATED LADDERS TYPE IA - 300 # RATING

M7-14	7'	43	145.00
M8-16	8'	46	159.00

FIBERGLASS STEP - TYPE 1- 250# RATING

6004	4'	13#	55.95
6005	5'	16#	66.95
6006	6'	16#	69.95

FIBERGLASS STEP - TYPE 1- 250# RATING

6004-S w/pail shelf	4'	15#	61.95
6005-S w/pail shelf	5'	18#	71.95
6006-S w/pail shelf	6'	20#	76.95

FIBERGLASS STEP - TYPE 1A- 300# RATING

6204	4'	14#	63.95
6205	5'	18#	75.00
6206	6'	20#	86.95

ALUMINUM FLAT STEP TYPE 11- 225# RATED EXTENSION

Model	Size	Working Length	Weight(lbs)	Sale
D1216-2	16'	13'	22#	117.95
D1220-2	20'	17'	27#	135.95
D1224-2	24'	21'	33#	159.95
D1228-2	28'	25'	42#	185.95
D1232-2	32'	29'	53#	209.95
D1236-2	36'	32'	62#	239.95

ALUMINUM FLAT STEP TYPE 1- 250# RATED EXTENSION

D1316-2	16'	13'	26#	134.95
D1320-2	20'	17'	32#	159.95
D1324-2	24'	21'	39#	183.95
D1328-2	28'	25'	50#	204.95
D1332-2	32'	29'	62#	244.95
D1336-2	36'	32'	77#	295.95
D1340-2	40'	35'	85#	324.95

ALUMINUM FLAT STEP TYPE 1A- 300# RATED EXTENSION

D1516-2	16'	13'	31#	159.95
D1520-2	20'	17'	37#	179.95
D1524-2	24'	21'	45#	209.95
D1528-2	28'	25'	56#	234.95
D1532-2	32'	29'	66#	274.95
D1536-2	36'	32'(250# rating)	79#	305.95
D1540-2	40'	35'(250# rating)	89#	354.95

FIBERGLASS FLAT STEP TYPE 1A- 300# RATING EXTENSION

D6116-2	16'	13'	34#	189.95
D6120-2	20'	17'	40#	209.95
D6124-2	24'	21'	53#	239.95
D6128-2	28'	25'	60#	284.95
D6132-2	32'	29'	74#	364.95

FIBERGLASS FLAT STEP TYPE 1A- 300# XTRA HEAVY DUTY EXTENSION

D7116-2	16'	13'	37#	219.95
D7120-2	20'	17'	43#	259.95
D7124-2	24'	21'	58#	290.95
D7128-2	28'	25'	66#	324.95
D7132-2	32'	29'	79#	389.95

STABILA LEVELS

Model	Description	List	Sale
24640	24" Level w/ hand holes	62.20	43
24670	48" Level w/Free case	79.70	55
24680	72" Level w/hand holes	145.45	100
28340	24" Magnetic level	66.64	46
28390	48" Magnetic level w/ Free case	88	59
28410	72" Magnetic level	135	94

RECORD WOODWORKING VISES

Model	Jaw Width	Opening	List	Sale
53E	10-1/2"	15"	Quick release	199	109
52D	7"	8"	Quick release w/dog	137	85
52-1/2D	9"	13"	Quick release w/dog	186	99

KRAUSE MULTIMATIC LADDERS

Model	Description	List	Sale
121482	12' Aluminum Multi Purpose	228	128
121499	16' Aluminum Multi Purpose	272	148

AEG POWER TOOLS

Model	Description	List	Sale
HBSE75S	3 x 21 variable speed Belt Sander	309	182
FSPE100X	NEW Barrel Grip v/spd Jig Saw	274	164
BSPE100X	NEW Top Hdle v/sp Jig Saw w/cs	286	164
TXE150	NEW 6" var/spd Rand Orb Sander	304	142
WS1200	5" Grinder 11 amp	249	135

HITACHI TOOLS

C8FB	8-1/2" Slide Compound Saw	1400	575
998862	8-1/2" Carbide blade - 60 tooth	Sale	39.95
C10FS	NEW 10" Slide Compound Saw	1595	745
C7BD	7-1/4" Circular Saw with brake	258	139
M12V	3 HP variable speed Router	476	249
TR12	Plunge Router 3 HP	389	192
SB-75	3 x 21 Belt Sander w/ bag 2 speed	278	155
P12R	12-9/32" Planer	1470	795
P12RA	Planer/Joiner	1940	995
C10FC	NEW 10" Mitre Saw	432	259
C15FB	15" Mitre Saw	1320	675
DN10DYK	9.6V Right Angle Drill Kit	350	189
G12SA	4-1/2" Grinder 6.9 amp	160	89
DS10DVAK	12V Cordless Drill Kit w/2 batt	393	199
DV14V	1/2" Hammer Drill with case	225	109
NR83A	Framing Nailer 2 - 3-1/2 Full Head.	700	409
NR83AA	Framing Nailer 2 - 3-1/2 Clip Head.	750	425
NT65A	16 ga. Brad Nailer 1 - 2-1/2	610	345
NT45A	18 ga. Brad Nailer 13/16 - 1-3/4	490	275
NV45AB	Coil Roofing Nailer 7/8 - 1-3/4	750	435
N5008AB	7/16" Stapler - 16 ga. 1 - 2 lgth	580	325

WAGNER PAINT & SPRAYER PRODUCTS

959	Power Roller	140	109
255	Airless Kit	180	135
375E	Airless System	195	164
404	Airless Painter & Roller	320	265
505	High performance Airless Painter	440	369
550	Professional Airless Painting System	769	709
HVLP	Fine coat finishing HVLP System	195	159
CS2000	Professional fine finish HVLP System	339	278

DAVID WHITE INSTRUMENTS

LP6-20	Sight Level package - 20x	310	205
LP6-20XL	LP6-20 w/9056 tripod & 7620 rod	375	265
L6-20	Meridian Level - 20x	290	188
LT8-300	Level Transit - 26x	695	449
LT8-300P	above Level with optical plum	821	529
LT6-900	Level Transit - 20x	389	254
LTP6-900	Above Level with tripod & rod	601	379
ALT6-900	Automatic Level - Transit - 18x	638	399
ALTP6-900	above Level with tripod & rod	708	479
ALP6-18HD	Auto. Level-18x w/tripod & rod	570	385
AL8-22	Automatic Level - 22x	599	399
AL8-26	Automatic Level - 26x	854	529
ALP8-26	above Level with 9075 tripod and 7620 rod	977	609
ML100I	NEW Laser Level	1099	945
ML100	NEW Laser Level w/detector	1249	1075
LL100	NEW Finish Line Laser Level	210	135

QUAL-CRAFT JACKS

2200	Pump Jack	79	58
2201	Pump Jack Brace	30	20
2203	Pump Jack guard rail holder	31	21
2204	Work Bench & rail holder combo	53	39
	Buy any 6 (can be assorted) deduct additional 10%		
2601	Wall Jack	167	108
	Lots of 4 deduct additional 10%		

PASLODE IMPULSE GUNS

Model	Description	List	Sale
IM250	Trimpulse Finish Nailer Kit complete drives 3/4" - 2-1/2" brads	849	548
IM325	Impulse Framing Nailer Kit complete drives 2" - 3-1/4" nails	849	548

SENCO AIR NAILERS

SFN1+	Finishing Nailer 1" - 2" w/ case	448	335
SFN40	NEW Finish Nailer w/cse 1-1/4" - 2-1/2"	571	389
SN325	Nailer 1-7/8" - 3-1/4"	665	419
SLP20	NEW Pinner w/case 5/8" - 1-5/8"	399	278
SKS	Stapler 5/8" - 1-1/2"	390	275
M2	Stapler 1/16" wide - 1-3/8"- 2" length	535	365
SN70	Framing Nailer Clip Hd 2" - 3-1/2"	690	479
SN60	Framing Nailer-Full Hd 2" - 3-1/2"	638	449
SN65	15% more power than SN60	709	479

AIRY AIR NAILERS

0241SK	Brad Nailer 3/8" - 1-9/16" Same as Senco SLP-20	180	98
0250SK	Brad Nailer 3/4" - 2"	296	164
0626SK	1/4" Crown Stapler 3/8" - 1"	194	104
0635SK	1/4" Crown Stapler 1/2" - 1-3/8" Same as Senco SKS	310	175
EZ-1	New Multi-purpose nailer & stapler	180	98
	Above nailers come w/case, fasteners, oil & wrenches		
0565T	Angle Finish Nailer 1" - 2-1/2"	386	205
8290	Framing Nailer 2" - 3-1/2"	475	319
	Airy nailers use Senco brand fasteners		

DUO-FAST AIR NAILERS

BB-4440	Brad Nailer 1/2" - 1-1/4"	336	199
LFN-764	Finish Nailer 1" - 2"	564	339
HFN-880C	Finish Nailer 1-1/2" - 2-1/2"	720	425
RCN-60\225	Coil Roofing Nailer	740	459
CN-350	Framing Nailer - Full Head	704	455
CN-325	Framing Nailer - Clip Head	670	429

EXCALIBUR Fences & Tables

Model	Description	List	Sale
TT45R24L9	24" Fence	369	309
TT45R50L12	50" Fence	399	325
EXSLT40	Sliding Table	599	485
EXSLT60	Sliding Table	745	595

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READER SERVICE NO. 56

No shortage of choices. *Router bits come in a variety of profiles, materials and sizes. Storing them in a fitted box helps protect edges and makes bits easy to find.*

All About Router Bits

How to choose the ones you really need

by Jeff Greef

For many woodworkers, a good-quality router may seem like an expensive tool. But few of us realize as we start to acquire tools that the cost of a router, or even several routers, pales in comparison to what we'll spend over time for bits. The growing selection of bits is what makes the router so versatile. They're capable of everything from molding edges to cutting raised panels. But with so much to choose from, it's harder than ever to buy wisely.

It's surprising that a tool with roots in metalworking should become such an indispensable tool for woodworking. The router has no hand-tool counterpart—it's a milling machine.

Router and bit technology was transplanted first to industrial woodworking operations and then to the small shop. And industry is still the source of advances we see in bit design. At one time, for instance, carbide was an exotic material for industrial use only. Now it's more common than steel.

Similarly, new materials, coatings and bit styles are slowly working their way into the mainstream. It's easy to amass a wallet-flattening, little-used collection. You have to weigh the bit's intended use as well as its cost and overall quality. The story on pp. 46-47

Photo this page: Scott Phillips

***Both bits make a cut 1/2 in. wide,** but the 1/2-in. shank (left) reduces chatter and allows a more aggressive cut than the 1/4-in. shank bit.*

***Spiral flute cutters slice wood fibers.** The down-shear bit (left) leaves a crisp edge at the top surface. The up-shear bit efficiently ejects chips.*

***Machinist's end mills look just like router bits for wood.** End mills make good, inexpensive alternatives to spiral bits.*

gives suggestions on bits for specific cutting operations.

Carbide stays sharp longer than steel

High-speed steel and tungsten carbide are the two most widely used materials in router bits. Steel is inexpensive, and because of its uniform crystalline structure, steel can take a keen edge and can produce a very smooth finish.

Steel bits may be the right choice for short runs or one-time operations. You easily can sharpen flat-fluted steel bits and, with a grinder, modify the profile. But steel wears quickly, especially in highly abrasive materials like plywood, medium density fiberboard (MDF) and particleboard.

Tungsten carbide is an alloy of carbide granules and powdered cobalt fused under high pressure and temperature. The hardness of carbide is directly related to the amount of cobalt used—the smaller the percentage of cobalt binder, the harder the alloy.

But an extremely hard metal is brittle, too fragile for a cutting edge. So manufacturers strive for the best compromise between hardness and shock resistance. Because of extreme hardness, carbide holds an edge 25 times longer than steel. And although more expensive than steel, carbide is generally a better value.

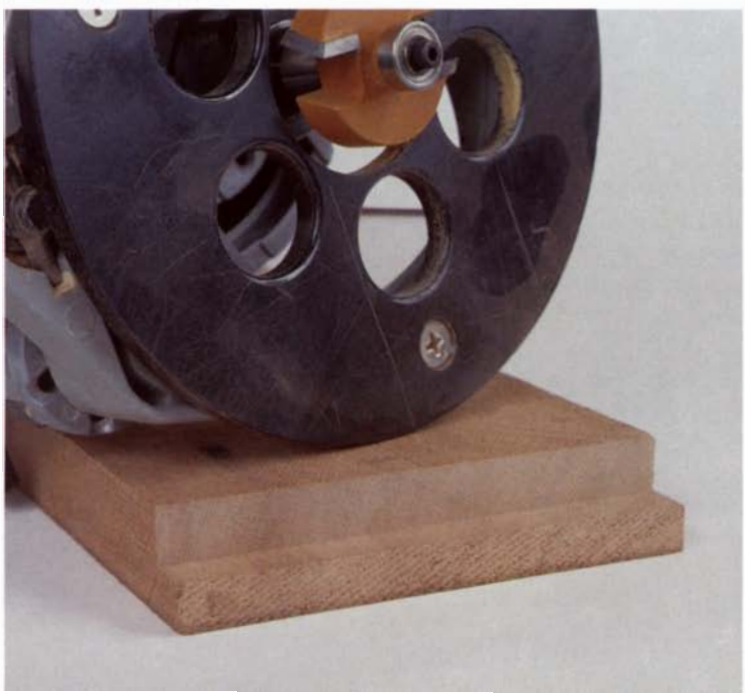
Most carbide bits have carbide-cutting tips brazed to a steel body, combining the hardness of carbide and the economy and shock resistance of steel. Manufacturers also offer solid carbide bits. These bits are much more expensive. But a solid carbide bit has two advantages: It will withstand high temperatures generated by high feed rates and continuous use, and it's more than three times stiffer than steel so that chatter and tip deflection are minimal. Sharpening carbide bits is more difficult than steel, but for minor edge touch-ups, a diamond honing stick can be used.

Polycrystalline diamond bits are now being advertised as the ultimate bit for highly abrasive man-made materials. A typical bit costs approximately $500 (which is 40 times more expensive than carbide but lasts 150 times longer). Users are large commercial manufacturers, but if history serves, we may someday see these bits in small shops.

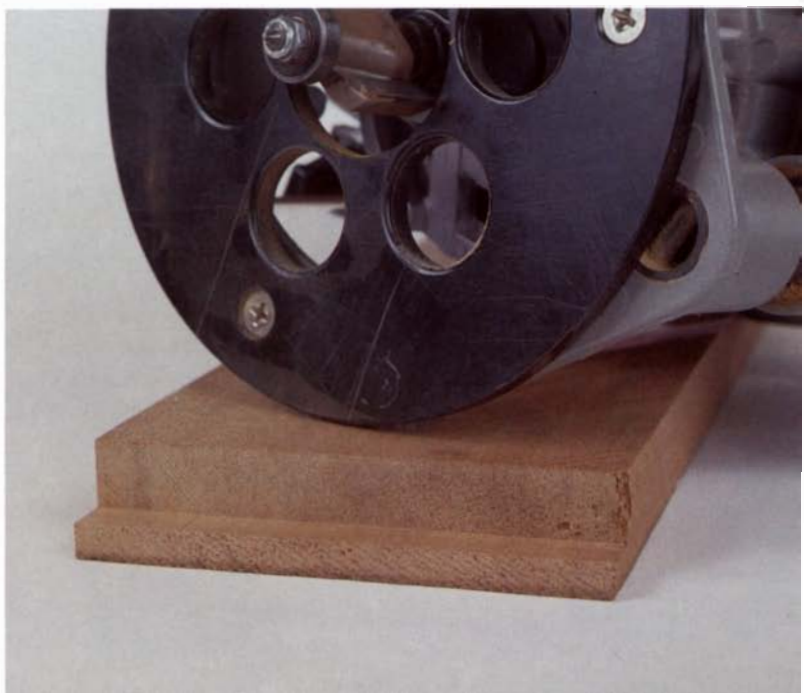
Matching the bit to the job

How well a bit performs depends on factors like shank

***Shear angle reduces tearout on end grain.** The angled cutter on this rabbeting bit cuts cleanly in redwood.*



***Straight bits chop the wood.** Bits without a shear angle cut cleanly with the grain but not as smoothly on end grain.*



diameter, number of flutes (or cutting edges), shear angle of the cutter and type of pilot

Use largest shank diameter—Shank diameter should correspond to cutter size (see the top left photo on p. 45). Large bits need the stiffness of ½-in. shanks to minimize vibration and deflection. Many bits with small cutting profiles are only available with ¼-in. shanks. If you have a choice between a ¼-in. or a ½-in. shank, pick the larger one. The router's collet will grip better, and the extra mass minimizes chatter (the result of vibration and deflection) to produce a better cut. And select the shortest cutting edge that meets your needs because excessive length increases vibration.

More flutes for a smoother cut—The gap, or flute, in front of the cutting edge provides clearance for chip removal. Most bits have two flutes, but some have one, three or four. More flutes (and, therefore, more cutting tips) produce a smoother cut, but they reduce the feed rate the bit will allow. Conversely, a single-flute, straight bit works great for making rough cutouts in stock quickly.

Choose a shear angle that's right for the job—Bits cut better when the cutting edge is angled slightly in relation to the centerline of the bit. This is called the shear angle. The effect is similar to skew-cutting with a plane or a chisel. Bits with no shear angle chop their way through the stock. The shear angle causes more of a slice than a chop, producing a smoother cut. Most manufacturers I spoke with believe the difference is only pronounced on end-grain cuts (see the bottom photos on p. 45).

The shear direction can be either up or down. Up-shear bits (the most common) quickly clear chips from the cut and tend to pull the router base down on the work. Down-shear bits are used where an upward cut would leave a ragged edge at the top surface. Down-shear bits make exceptionally clean cuts in veneered and laminate-covered surfaces. However, they do not clear chips well when mortising and tend to push the router base off the work.

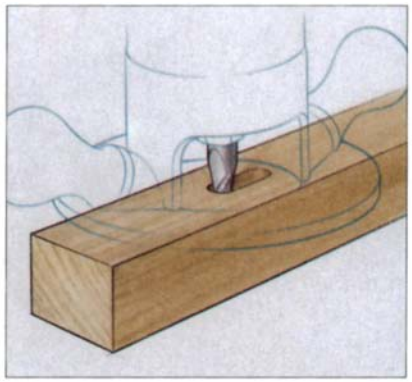
Spiral bits take shear angle to the extreme. The helical flutes (see the top center photo on p. 45) provide a continuous slicing action and are excellent at ejecting chips from the cut. They are especially well-suited to mortising. For a more economical alternative, you can use two-flute, machinist's end mills. These are cutting bits designed for machining metal, but they also cut wood. Like spiral bits, end mills have helical flutes (see the top right photo on p. 45) and cut wood very well. The range of sizes is more limited than router bits, but they are inexpensive and are easily available at industrial tool-supply stores.

A note of caution when using up-shear spiral bits and end mills: the force developed by the high shear angle tries to pull the bit out of the collet. Be sure the collet and bit are in good condition, free of rust and burrs. The bit should be

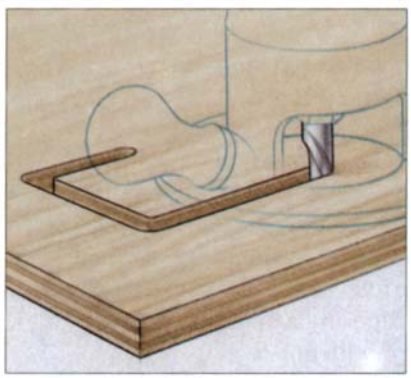
Bits for specific cuts

You'll get the best results by choosing a router bit specifically designed for the job. If the bit is to be used regularly, a bit with a ½-in. shank and high-quality carbide is a good choice. ***—Dennis Preston, assistant editor***

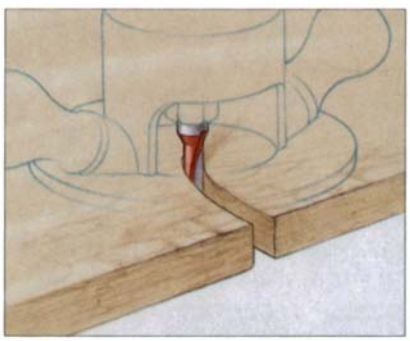
Plunge mortising and dadoes: A spiral up-shear bit (far left) is unmatched in its chip-clearing ability. These bits cut fast and clean with minimum chatter. When cutting into laminate or splintery wood, use a down-cut spiral to eliminate chipping at the top edge of the cut. It will be slow going, though, because you will have to stop frequently and blow the chips out of the cut.



Cutting through stock with two good sides: A compression bit (half of which is an up-shear and the other half a down-shear) is a specialty bit used when the edge of both upper and lower surfaces must be crisp. This bit design sacrifices feed rate and chip-clearing ability for unblemished edges.

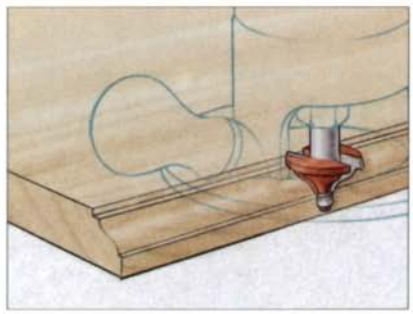


Making rough cutouts through stock: A single-flute, stagger-tooth bit cuts aggressively and roughly. The tooth orientation minimizes chatter.

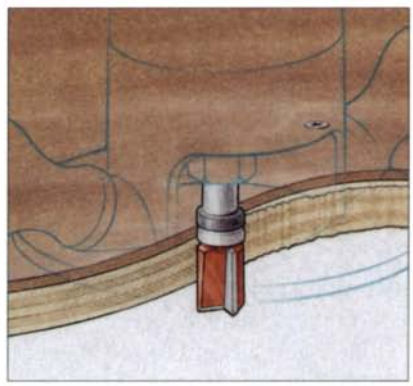


Drawings: Bob La Pointe; photos except where noted: author

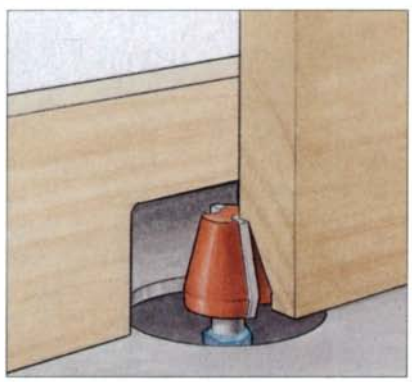
Edge molding and rabbeting: A bit that has a slight shear angle cuts more smoothly. For freehand routing and following curves, a ball-bearing pilot is the easiest to use. An edge-guide attachment or a fence lets you use a bit that doesn't have a pilot.



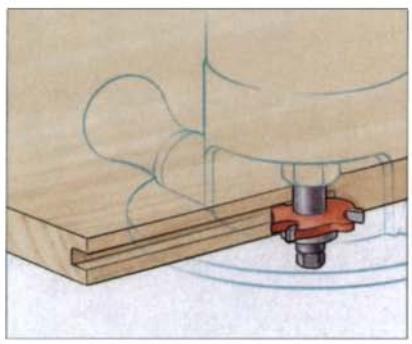
Template and pattern routing: Flush-trimming or pattern-routing bits have a pilot bearing mounted on the shank, either above or below the cutting tips, and are used with a template to guide the bit. The top-pilot location has one big advantage over a bottom-mounted bearing. The template can be mounted above the work and the bit plunged into the work.



Panel raisers: Large-diameter bits let you lay the stock flat on a router table. These bits generally produce a smooth finish. With them, you can easily follow curves. But these bits should be run at about 12,000 rpm, which is slower than most fixed-speed routers. Face molding, or safety raisers (shown at left), can run at higher speeds but the stock must be held on edge against a fence. Molding a curved piece of stock is not easy.



Grooving for splines and biscuits: A slot cutter is really a small saw with a precise kerf width. You can mount cutters from 1/16 in. to 1/4 in. on a standard arbor. Some new sets allow stacking cutters like a dado set to get widths up to 11/16 in. Changing the diameter of the pilot bearing controls the depth of cut.



well-seated, not bottomed out, in the collet, and the collet nut must be securely tightened.

Ball-bearing pilots work best for edge profiling—A pilot bearing, found on edge-trimming and edge-molding bits, guides the bit and limits the depth of cut (see the top right photo on p. 48). One-piece steel bits generally have a solid pilot, which is simply a small knob at the end of the shank that rubs against the edge of the work. Solid pilots work, but two problems can arise. If you don't keep the bit moving, the spinning pilot generates enough heat to burn black marks in the edge of the stock. And because of their small diameter, solid pilots can dig into the surface on which they ride, particularly on softer woods. That causes the cut to go slightly deeper than intended. Ball-bearing pilots take care of these problems. The large-diameter pilot bearing is unlikely to dig into the wood, and burning is eliminated because the bearing doesn't spin against the wood.

Arbors with removable cutters are versatile

Bits come in two basic designs: those with cutters permanently attached to the shank body and those with separate cutters that attach to a threaded shank, or arbor, with a nut. When you want a different profile with an arbor and cutter set, all you do is change the cutter itself.

Bits with separate cutters are versatile and cost far less than buying a number of separate bits. I have one arbor on which I can fit one of two rabbeting cutters with any of three different diameter pilot bearings (see the top left photo on p. 48). This gives me six different rabbet depths. Pilot bearings of different diameters often can be switched even on bits that do not have interchangeable cutters. The bearings change the depth of cut and expand the bit's usefulness. In fact, a slightly smaller diameter pilot bearing is the only difference between a beading and a roundover bit.

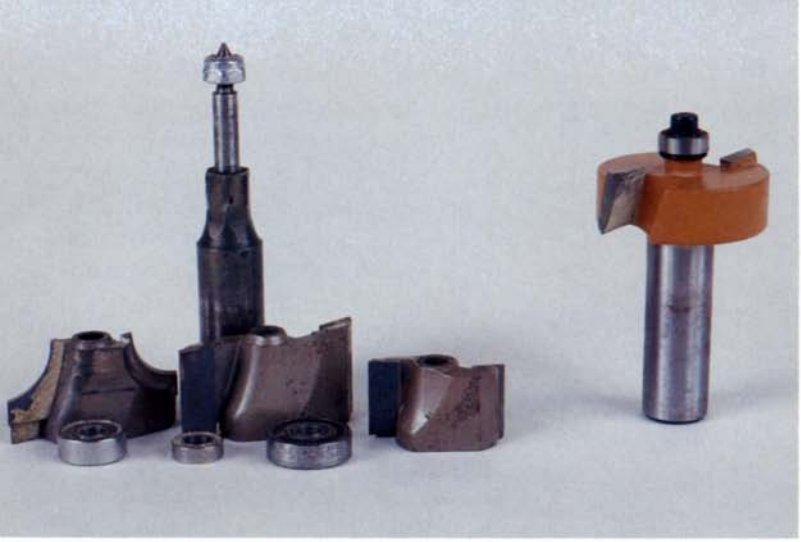
Replaceable cutters and special coatings

Carbide insert tooling, long available in industry, lets you replace just the cutters when they get dull. A disposable cutting bit is fastened to the body with screws. Initially more expensive than fixed-cutter bits, insert tooling may be cheaper in the long run for heavy-use applications because the cutters are cheap to replace. Insert tooling offers a consistent cutting diameter or profile. The same can't be said for standard bits whose dimensions are altered by sharpening.

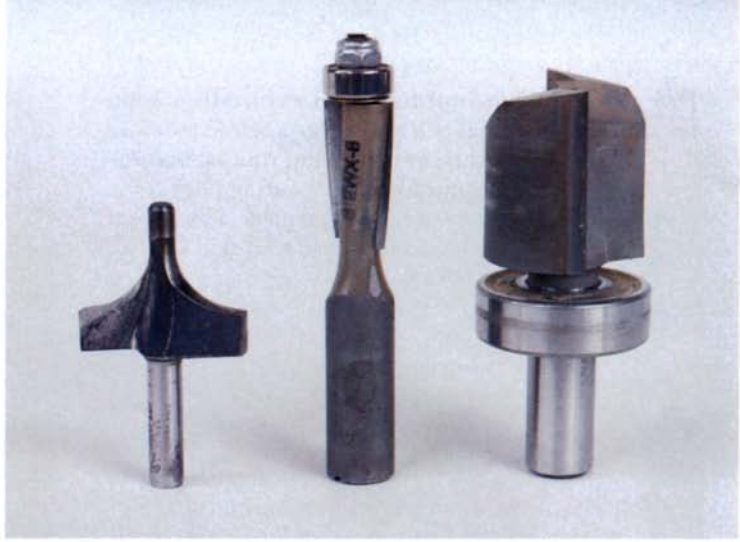
Brightly colored, Teflon coatings are now widespread on several brands of bits. These coatings reduce pitch buildup and promote chip clearing. In my work, I have not found this to be a big advantage, but colored bits do enhance safety. A spinning red or yellow bit is easier to see than a dull gray one.

The coating used on industrial metalworking bits, such as titanium nitride and zirconium nitride, are beginning to push into woodworking. Because these coatings are slippery,

Photos these two pages: Scott Phillips



Interchangeable parts are versatile. *A variety of cutters and pilot bearings can be mounted on one arbor, saving the cost of buying a number of single-purpose bits.*



Pilots guide bits for uniform cut. *The solid pilot on the end of the bit at left spins against the stock and leaves burn marks. The ball-bearing pilots on the center and right bits eliminate burning.*

they withstand tremendous heat and promote faster chip clearing on very abrasive materials. The result is cooler cutting and longer tool life.

Anti-kickback designs are widely available

Most manufacturers now offer an anti-kickback design on their bits, which limits the amount of wood the bit can bite on each revolution (see the bottom left photo). This prevents overfeeding, which can cause kickback. Many manufacturers I spoke with believe this design is most useful on shaper cutters and on large router bits like panel raisers where kickback is a serious threat. The smaller bits, they said, don't present enough danger to warrant the design. I agree with them.

How to spot a quality bit

Finish grinding is the most expensive process in bit manufacture and the most critical. A smooth cut requires a sharp edge, and a sharp edge requires a smooth face and edge. Technically, grinding faces smooth is easy; grinding edges is not, particularly on curved, pattern-shaping bits. I have seen wide variation in the smoothness of edge grinding on bits, and now it's the first thing I look for.

Take a pencil with you when buying a bit. Run the tip along the edge of the bit. If the tip scrapes along rather than slides smoothly, chances are the bit has been ground to a rough finish and will leave small nicks in the work (see the bottom right photo). A rough grind also causes the bit to dull faster because the minutely serrated cutting edge loses relatively big chunks of carbide granules.

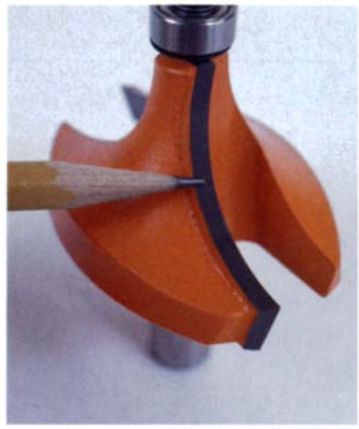
Carbide tips must be brazed securely to the steel body or the brittle carbide can break loose and fly like shrapnel. Always inspect bits for brazing voids. Don't use any that appear unsafe. In industry, a general rule is to reject any bit with a void larger than a pinhole.

Many manufacturers I spoke with said that a visual inspection of a bit says a lot about its quality. If the brazing is splattered or a grinding wheel has touched a spot it shouldn't have, attention to detail was lacking. The presence or absence of any kind of warranty with a bit is probably a good measure of the manufacturer's confidence in its work.

Why are there such wide price differences in bits that look similar? Generally, it's because there are many manufacturing practices affecting quality that you can't see. There is no universal quality standard for rating carbide, and it all looks the same.

The care taken by the manufacturer when brazing the carbide to the body and grinding the edge may not be obvious. Yet these factors can affect the longevity of the material because overheating reduces carbide's ability to hold an edge. Some bit shanks are hardened, others are not. The quality of grinding on the shank itself determines how accurately the bit spins and cuts. All of these factors are reflected in the cost.

Chip-limiting anti-kickback design reduces the bite *that the bit can take and prevents overfeeding.*



A pencil slides easily *along a smoothly ground edge. The lead is scraped away on a coarsely ground edge.*

Choosing bits and building your collection

The most important factor to consider when deciding how much to spend on a bit is cost per cut. Many expensive bits are made to be used in commercial situations where the bits will be used to destruction. In the long run, it is more cost effective for commercial shops to buy the most expensive bits.

But if you won't be using a bit very much, it doesn't make sense to buy the most expensive one. A less-expensive bit might not hold up as long, but you may not use it enough to have it re-sharpened even once.

Many bit manufacturers and retailers offer boxed bit sets at lower prices. Before you buy one of these sets, though, seriously consider whether you will use more than half of them. The price break you get on the set may be substantial, but if you use less than half the bits, you will have spent more money than if you had bought only the bits you'll need.

Choose bits as you go according to the design and profile you need and the quality you want for that bit. □

Jeff Greef is a woodworker and writer in Santa Cruz, Calif.

Glass adds a whole new dimension to a cabinet. *The inside is as important as the outside. The thin beveled strips holding the glass to the back of these doors looks good from either side.*

Glazing Cabinet Doors

Beveled strips hold glass firmly in place

by Tony Konovaloff

I've opened a lot of glass doors on finely crafted cabinets and cringed. The joints are tight, the finish is fine, but the glass is held in place by methods that look, at least to my eye, crude. I've seen big, clunky strips held in place by #8 screws, badly done putty and perhaps worst of all, vinyl strips screwed or even stapled to the door frame.

What looks much better is glass set in a relatively deep rabbet in the frame and held in place with beveled strips of wood on the back side of the door. The strips function like quarter-round molding, but the profile is more refined. The strips, which are easy to make, are fastened to the shoulder of the rabbet with brass escutcheon pins. Should the glass need to be replaced, the strips easily pop off and can be reused.

Holding glass in a door this way is nothing new. It's an old technique that works because it's simple and practical, and it looks good whether the door is open or closed.

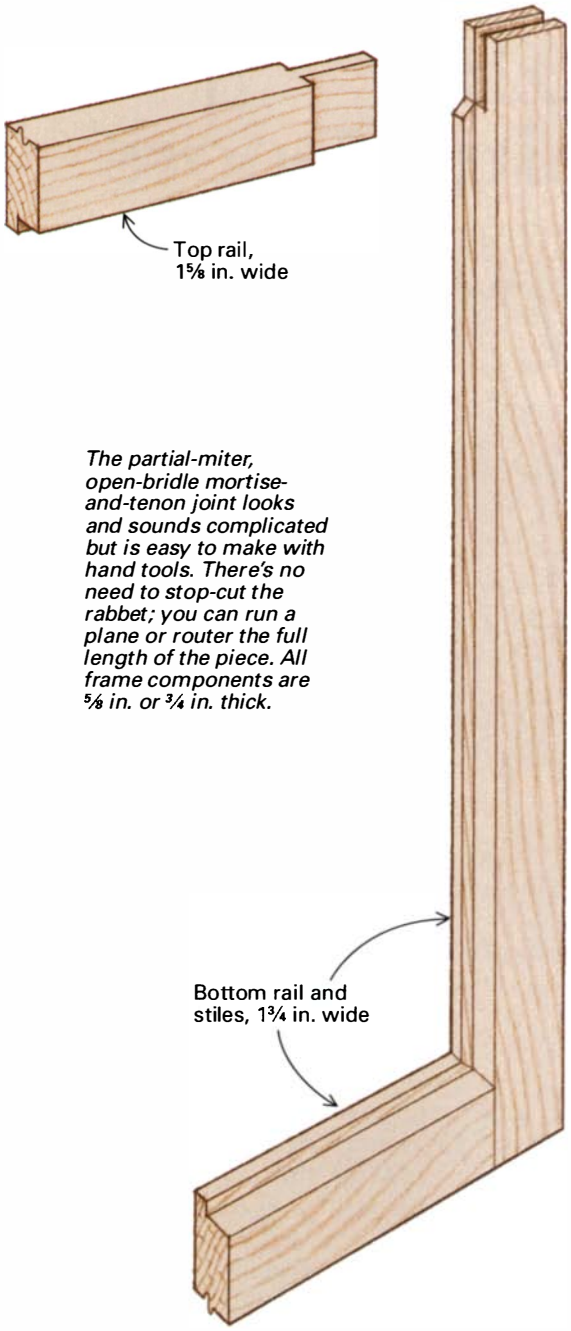
Designing for glass

With glass-front cabinets, the focus is not on the furniture but on what's inside it. Before you begin making the cabinet, think about how a glass front will affect the design and construction. For instance, everything is now visible, so the layout and fit of the joints on the inside of the cabinet are as important as those on the outside.

Glass thickness and temper—Standard window glass is only 3/32 in. thick, and I use it almost exclusively. It's called single-thickness float glass, and I buy it cut to order at a local glass shop. When safety is a factor (when the glass will be near the floor in a household with children, for example), I use tempered glass. The thinnest readily available size of tempered glass is 1/8 in., and it has to be special-ordered (see the story on p. 53).

I wouldn't use beveled strips where the glass is thicker than 1/8 in. because the rails and the stiles must be beefed up to accommodate the glass and the larger strips. Unless the cabinet

BUILDING THE FRAME



The partial-miter, open-bridle mortise-and-tenon joint looks and sounds complicated but is easy to make with hand tools. There's no need to stop-cut the rabbet; you can run a plane or router the full length of the piece. All frame components are ⅝ in. or ¾ in. thick.

is really large, the whole thing probably will look clumsy.

Glass weighs about three times as much as wood. But the weight of a simple door glazed with 3⁄32-in. or ⅛-in. glass is roughly the same as that of a similar wooden panel door because the glass is so much thinner. There's no need to consider special hinges or hardware.

Glass color and wood choice—Standard float glass, sometimes called soda-lime float glass, has a slight green tinge (see the photo on p. 53). The effect is more noticeable as the thickness of the glass increases, and it can alter the color of the wood behind it. Sometimes the effect can be pleasing, and sometimes it's not. Test it by looking at wood samples through the glass you intend to use.

Dimensions and construction of frames—When sizing the cabinet-door frames, keep in mind that the clear front affects the apparent widths of the frame pieces. The same size frame you'd use for a wooden panel front looks too heavy with glass.

When I make a medium-sized cabinet door (something like 15 in. wide by 24 in. tall), the frame pieces are ⅝ in. or ¾ in. thick, depending on the thickness of the glass. I make the bottom rail and the stiles 1¾ in. wide, with the top rail ⅛ in. narrower. The rabbet depth is two-thirds the thickness of the frame.

I join my frames with a partial-miter, open-bridle mortise and tenon. It's a long-winded name for something quite simple (see the drawing at left). It's an old molding joint that saves the trouble of stop-cutting the rabbets. The joint is quick and easy to do with hand tools (which are all I use), because you can cut the joint first and then run the rabbet the full length of the piece. It's also an attractive joint.

Another way to join the frames is to glue up a doweled (or biscuited) frame and run a rabbet around the inside with a router, squaring up the corners with a chisel. It really doesn't matter how the frames are made as long as you plan for the rabbet.

Installing the glass

When the doors are made but not finished, I take them to the local glass shop to have the glass fitted. A good slip fit is desirable for the glass—if it's loose in the frame, it may rattle when a truck drives by. There's no need to allow for movement in either the wood or the glass in a medium-sized door.

If the glass is too snug in the frame, adjust the fit with a rabbet plane and a bullnose rabbet plane. If the glass is a little small, you can shim out the rabbets with thin slivers of wood. Nothing will show once the beveled strips are in place

Once the glass fits correctly, I turn my attention back to the door. I fit it to the carcase and install the hinges and catches. Then I finish the door (inside and out) and set it aside.

Fitting the beveled strips—The beveled strips are sized so that when they're installed, they will stand slightly proud of the frame and be a little narrower than the rabbet (see the drawing on p. 52). The strips are not rectangular in section—they bevel about 5° to 8° (see the bottom right photo on the facing page). This makes them less visible from the outside.

I rip the strips from long scraps of the same wood as the frame. I plane all four sides (including the bevel) on a small vise-mounted bench I built for handling small pieces (see the photo at right and the drawing on the facing page). It has an adjustable stop made from a brass screw and a light fence tacked on to hold the strips for planing. Then I lightly chamfer all the edges with a small spokeshave (see the top right photo on the facing page).

When the finish on the door is dry, I lay it on the bench, set the glass in the rabbet, and fit the strips: first the top and bottom strips and then the sides. I cut them a little long with a backsaw and then pare them to fit with a chisel (see the top left photo on p. 52). Because of the bevel, the side pieces aren't cut at a right angle. The best way to fit them is by paring away a little at a time. Once the strips are fitted, I lightly file the corners to match the chamfer on the other pieces.

Fastening the strips

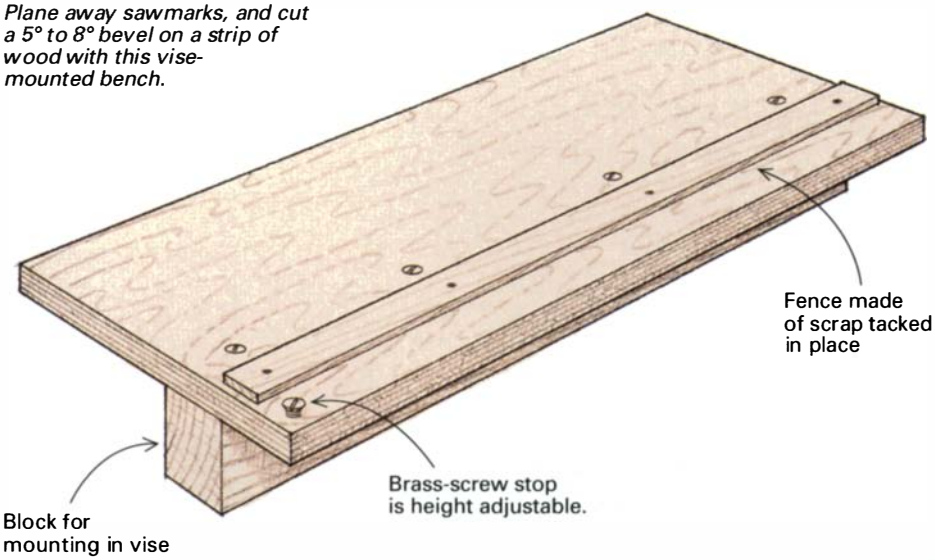
I prefer escutcheon pins over brads for holding the strips in place. I like the look of the brass head, and the pins make a more secure fastening. I use #18 escutcheon pins, ⅝ in. long.

With the strips fitted in place, I mark the locations of the escutcheon pins every 4 in. to 5 in. I remove the strips and drill the shank holes for a push fit. I use a #53 (.059 in.) or #54 drill (.055 in.), depending on the wood. Check the fit in a piece of scrap to be sure. I drill the holes at right angles to the bevel and

Photos except where noted: Aimé Fraser; drawings: Vince Babak

SHAPING BEVELED STRIPS TO KEEP GLASS IN PLACE

Plane away sawmarks, and cut a 5° to 8° bevel on a strip of wood with this vise-mounted bench.



***Using the mini-bench**—A screw keeps the strip in place while the author planes a 5° to 8° bevel.*

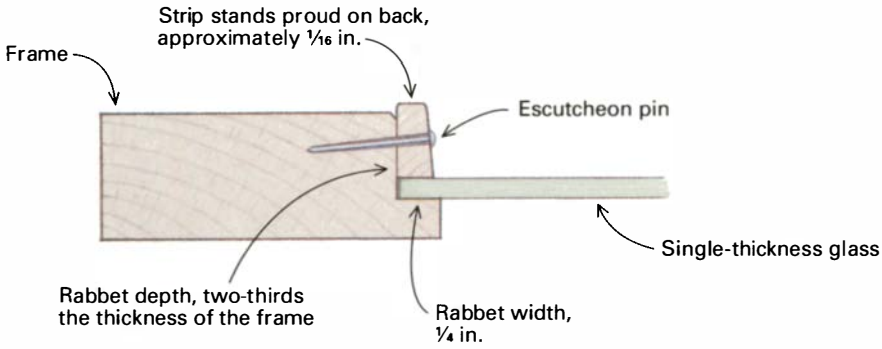
***Chamfering the beveled strips** relieves any sharp edges.*

***The strip on the left is ready to install.** The bevel and chamfers, though small, are obvious when compared to the rectangular strip on the right.*

Use a chisel to pare the ends of the strips to fit after cutting them a little long with a backsaw.

***Clean up both sides** of the escutcheon-pin shank holes by hand-turning a small countersink.*

ATTACHING THE BEVELED STRIPS



***Protect the glass with cardboard**, and carefully use a light hammer when setting the escutcheon pins.*

clean up both sides of the hole by turning a small countersink a few times by hand (see the bottom left photo).

I put the escutcheon pins partway in the shank holes in the strips and put the strips back in place on the glass. Holding the strip firmly in place, I lightly tap each pin to mark the frame for the pilot holes. After removing the strips and the glass, I use the marks in the frame as centers for drilling the pilot holes. I use a #55 drill (.052) for a hammer fit, and I drill at about 5° off the perpendicular—the amount of the bevel.

Everything is ready for final assembly, but first I finish both the strips and the inside of the cabinet with paste wax.

Final assembly

Before installing the glass, I clean it one last time. I put it back in the frame, put the strips in place and protect the glass with a piece of cardboard cut from a cereal box. I set the escutcheon pins with a 3-oz. Warrington hammer; it's light and narrow, perfect for such delicate work (see the photo above right). Don't try to drive the pins in one blow—take it slowly. Be careful not to hit the strips, or they'll be marred by the hammer.

If an escutcheon pin goes into the frame too easily because the diameter of the pilot hole is a little too big or the hole too deep, you can tighten it up by bending the pin. Just hit it with the other end of a Warrington hammer to put in a slight curve. When you put the pin back in the pilot hole, it'll snug up nicely.

Because I've already fit and finished the door, all that's left is to mount it in the cabinet. After this is done, I install a small riser in each door opening to support the doors when closed. Risers are pieces of wood, ¼ in. by ¼ in. by ⅜ in. long, mortised into the cabinet bottom on the catch side. The block goes in end grain up and is filed down until its height equals the gap between the carcase and the door (about the thickness of a business card). The door rests lightly on the riser and opens and closes freely. □

Tony Konovaloff is a professional furnituremaker in Oak Harbor, Wash.

Getting clear on glass

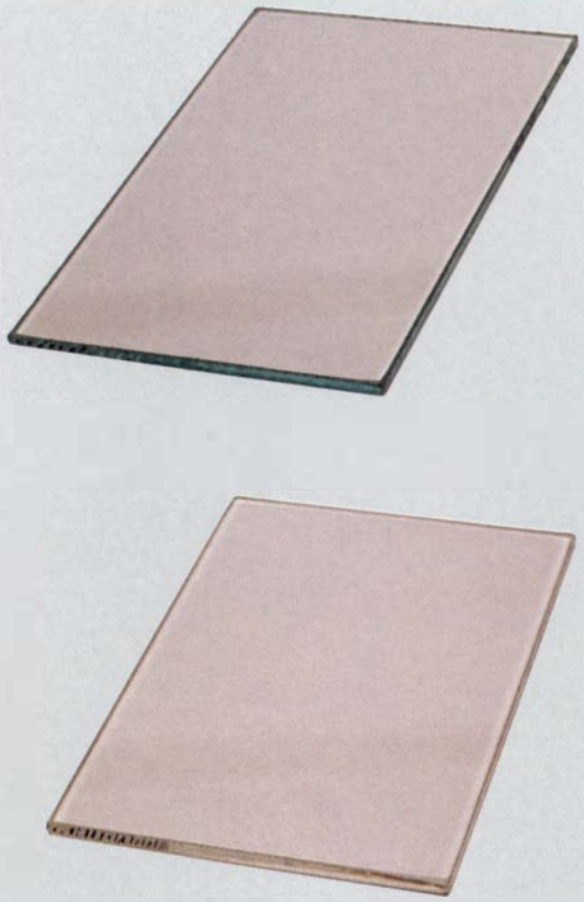
by Aimé Fraser

People who work with glass have their own language, and the terms don't necessarily coincide with common usage. As glass formulations and manufacturing change, so do the words. Here's a partial list to make it easier to talk with your glazier.

Plate glass: These days, plate glass is a generic term for sheet glass, but it has a more specific meaning to glaziers. To them, it refers to sheet goods produced by running molten glass through rollers and then lapping and polishing it on both sides. This is the way most glass was made prior to the 1960s, but it is a labor-intensive process. Plate glass is used now only for high-quality optical glass.

Float glass: About 30 years ago, a new manufacturing process was perfected that fully automated the production of flat and virtually distortion-free glass. A plant easily can manufacture a nearly perfect sheet of glass 4 ft. wide and a quarter of a mile long. Today, the bulk of commonly available glass is produced this way.

The whole process takes place in a giant oven. Molten glass is poured onto a pool of molten tin, where it levels itself out. It cools slightly and is slid off the tin and into an annealing oven. From there, it is reheated to just below the melting point and then cooled slowly to relieve internal stresses. When annealed glass breaks, it breaks into large, irregular sharp shards.



***Double-thickness soda-lime float glass** (top) has a slightly green tinge. Water-white glass of the same thickness (bottom) has almost no color.*

Tempered glass: It is possible to temper glass and alter its breaking characteristics so that it breaks into small, relatively harmless pieces. In the bargain, the glass is strengthened. The downside is that once tempered, the glass cannot be drilled, cut or even nicked without shattering into tiny pieces.

Tempered glass starts as annealed glass that is cut and machined to its finished dimensions. It's put into the oven and heated once more, almost to the melting point. Then it's quickly cooled on one side by jets of chilled air, which causes rapid hardening of the glass on that side; the other side is still red hot. This builds a great deal of stress into the glass, so when it breaks, it shatters into thousands of pieces. Each one is the size of the area cooled by one jet.

On thick glass, this process causes no distortion. But it can cause thinner or smaller pieces of glass to curl like a potato chip. For this reason, glass less than ⅛ in. thick is usually tempered chemically. It's not as strong as heat-tempered glass, and it breaks into larger pieces.

Leaded glass: The color of the glass is determined by the mineral content of the sand it's made from. Each sand quarry produces glass of a slightly different color, which can be altered by the addition or extraction of various mineral oxides. The green color of common glass is from iron oxide. When this mineral is removed, the glass has almost no color (see the photo at left). The addition of lead will further enhance clarity, but leaded glass cannot be produced by the float method. It must be lapped and polished; however, the process does produce optical-quality glass for lenses and prisms.

Single-thickness glass: Glass is manufactured in a variety of thicknesses from .0394 in. (1mm) up to several inches. Most glass is 3/32 in. thick. The industry has designated this single thickness, whether or not it has been tempered.

Double-thickness glass: For some reason, ⅛-in.-thick glass is commonly known as double thickness, even though this glass is only 1/32 in. thicker than single-thickness glass. □

Aimé Fraser is an assistant editor to Fine Woodworking *magazine.*

Photo: Scott Phillips

Finishing Brushes

A top-quality finish starts with the right brush

by Jeff Jewitt

The difference is inside

These two rectangular, chisel-edge brushes are made from similar parts, but the one on the right is of better quality. A thick wooden divider at the center of the brush on the left gives it an appearance of fullness, but a heavier divider means fewer bristles. The brush on the right has a smaller divider and more bristles, so it will hold and release finish more evenly.

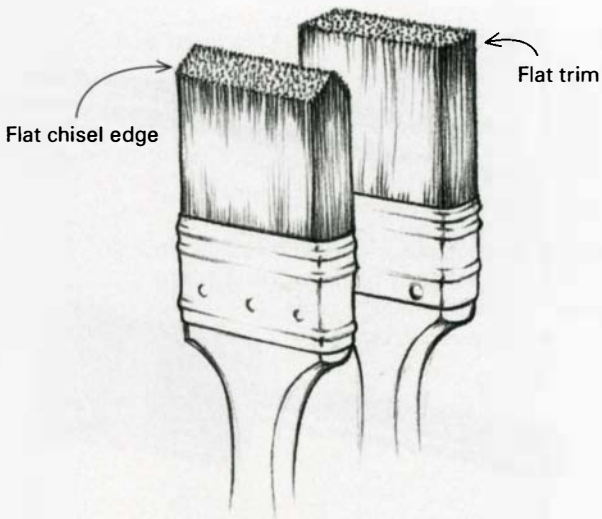
Applying finish with a brush seems easy enough. Dip the brush into the finish, spread the finish on the wood and then wait for it to dry. That's the theory, anyway, but many woodworkers are disappointed with the brush marks, streaks and bubbles that can mar a finish. Maybe, they may wonder, there's some secret technique. Or maybe the finish itself is to blame. Quite often, though, the problem is neither the technique nor the finish. It starts with the selection and use of the brush. Using the wrong brush or a second-rate brush makes it difficult to get first-rate results.

A brush is more than some bristles attached to a handle. Brush-making is an art. Manufacturers mix bristles of different lengths and stiffnesses for different types of brushes. In a top-quality brush, the bristles are selected and arranged by hand (for a list of my favorite types of brushes, see the story on p. 56). For a closer look at the parts of a brush, see the photos and drawings on these two pages.

Manufacturers of cheap brushes economize on the content and configuration of the bristles. They may use an oversized divider to give the brush an illusion of fullness (see the photo at right). Bristle tips on a good-quality brush have natural splits, or flags, that help hold and spread the finish. Brushes that are cut to shape after they are formed are cheaper to make, but they will be missing flags at the bristle tips. That's a good indication the brush won't perform very well.

The most important, and the most expensive, brush component is the bristle. The type of bristle determines the suitability of a brush for a particular finish as well as how it works in general. Bristles can be divided into two broad categories: natural animal-hair and synthetic-filament bristles.

Bristles are the most important part. *Look for flagged tips, which help hold and spread the finish.*



Animal hair is best for solvent-based finishes

Natural-hair brushes are expensive and don't perform well with water-based finishes. But for top-quality results using oil-based varnish or paint, natural hair is unsurpassed.

Natural hair is divided into two categories: stiff bristle and soft fur. Hog bristle is used in most painting and finishing brushes. Soft fur, such as sable, camel, ox, skunk or badger, is used for varnish and artist's brushes. Two or more types of hair are often combined for specific performance characteristics.

Hog bristle is for paint and varnish. Chinese hog bristle (also called China bristle) is the best. The natural split ends on these stiff bristles allow the brush to carry a good deal more finish than bristles with smooth tips. The natural taper toward the tip gives hog bristle its strength and resiliency, or spring, which is especially important when applying paints and varnishes. The paint or varnish can be worked into the pores of the wood with the tip of the brush.

Sable is for detail work. Sable is the best natural hair for artist's brushes. Sable forms a fine, strong point when wet, making it ideal for touch-ups. Kolinsky sable is the best and most expensive; hairs from other red weasels are cheaper. All are known as red sable.

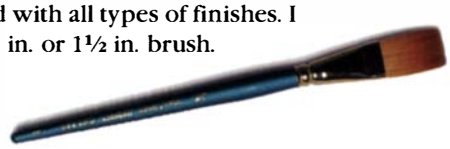
Camel is soft. A camel brush is good for lettering. The fur is not really from camels but usually from the tails of Russian and Siberian squirrels. Other kinds of squirrel hair are too coarse. Cheaper grades of camel brushes are made with ox, goat or pony hair.

Badger is best for oil-based finishes. This very soft and resilient hair is regarded as the best for flowing on oil-based finish-

The author's choice

Here's a selection of brushes that I've found to be most useful in my finishing business.

Taklon synthetic bristle brush has a tapered filament without natural splits at the ends of the bristles. This brush is made without a divider, so it has a very narrow chisel edge. I use it on small projects where exceptional control is needed. It can be used with all types of finishes. I recommend a ¾ in., 1 in. or 1½ in. brush.



Red sable is great for touch-up work. I recommend at least two sizes, a #1 and a #4.

Combination badger/skunk brush is first rate for all flowing finishes, particularly oil-based varnish and polyurethane. A 2-in. brush will cover most tasks. An expensive brush, but it's well worth it.

Chinex synthetic bristle is a good all-purpose brush. It's my favorite for water-based finishes. A 2-in. brush will cover most applications. It's an excellent tool for applying water-based dyes and stains and also can be used for solvent lacquer and oil-based varnishes.

China bristle brush is less expensive than fitch and excellent for all oil-based finishes. I use 1 in. and 1½ in. for detail work and 2½ in. and 3 in. for large surfaces. I particularly like oval-shaped brushes because they hold a lot of finish. Large oval brushes are called varnish brushes; smaller ones, 1 in. or less, are called oval sash. They also work well for effects like glazing, dry brushing and highlighting.

es. It does not have the body of hog bristle, so it's usually combined with a coarse hair, like skunk or black bristle. Pure badger-hair brushes are used for blending and highlighting in glazing and wood graining.

Ox is for lettering. Ox hair is taken from behind the ears of oxen and is silky and durable. It resembles sable but cannot form as fine a tip. It's used in lettering and sign painting.

Fitch is a combination of hair and bristle. Fitch is a confusing term because it applies to both a hair and a type of brush. American fitch is skunk hair. European fitch comes from a gray or black weasel. Fitch brushes usually are a combination of hairs—skunk on the outside for softness and bristle on the inside for stiffness. Fitch brushes are excellent for flowing finishes, such as oil-based varnish.

Synthetic bristles best for water-based finish

Synthetic bristle is a good choice for all types of finishes. It hasn't eclipsed natural bristle for the ultimate varnish brush, but synthetic bristle is constantly improving. The search for synthetic filaments to replace natural hair has been ongoing since the beginning of this century.

The first synthetic filaments were blunt tipped, similar to toothbrushes. Nowadays, manufacturers use several filaments that are tapered like natural bristle. Du Pont's Tynex and Chinex are manufactured specifically for brush-making. Taklon (a generic name) is a dyed white nylon filament with a tapered shaft and a smooth, unflagged tip. It is used extensively in artist's brushes.

Chinex is the most recent synthetic filament and is good for oil-based finishes and excellent for water-based finishes (see the photo at right). Taklon artist's brushes are exceptional for applying all finishes and usually are available in sizes up to 1½ in.

The chief advantage of synthetic filament over natural hair is that synthetic filaments absorb only 7% of their weight in water. Hog bristle and natural hair may absorb as much as 100% of their weight in water, causing the brush to become soft and floppy in water-based finishes.

Modern manufacturing can now duplicate the natural flags of bristle. These flags are made by wire wheels that create a microscopic score along the entire length of the filament so that the tip will continue to split as it wears. Synthetic filaments also are less expensive and much easier to clean because they don't have microscopic pores of natural hair that trap finish.

Brush and bristle variations

Brushes for painting and varnishing are available in flat trim, rectangular chisel, oval chisel and touch-up. Flat-trim brushes (see the drawing on p. 55) are used for exterior painting; the blunt edge works the paint into the pores and crevices of the wood. I use these brushes for applying paste wood filler. The chisel edge on rectangular and oval brushes is used where precise control is needed, such as on moldings and edges. An oval profile has more bristles so it carries more finish (see the top photo on the facing page). This is desirable for oil varnishes because the finish should flow on to minimize bubbles.

Touch-up brushes are assembled so that the tip ends in a round, fine point. These are the best brushes for detail work and painting fine grain lines in restoration work.

Buying a brush

Staining and general painting don't demand a great brush. But for applying finishes like varnish, which must be flowed on smooth-

Photos: Boyd Hagen; drawings: Michael Gellatly

Same width, more bristles. *The oval chisel-edge brush (right) will hold more finish than the flat chisel-edge brush. This allows varnish to be applied in long, smooth strokes.*

Synthetic bristles rival nature. *Chinex bristle brushes (front) look, feel and work like the natural hog-bristle brush.*

ly, a poorly made brush just can't do a good job. Be prepared to spend around $25 to $35 for a 1½-in. to 2½-in. China bristle brush of good quality.

When shopping for a brush, unwrap it. The bristles should feel soft at the tips and have spring in the overall length of the bundle. Examine the tips to make sure they have natural flags. Then pinch the whole thickness of bristles a little below the ferrule to see whether the fullness is the result of a lot of bristles (good) or a large divider (bad). Finally, fan back the brush with your hand. If the bristles come loose, don't buy the brush. And the color? The color of the bristles has no effect on performance. □

Jeff Jewitt repairs and restores furniture in North Royalton, Ohio.

Cleaning a brush

Start by wiping off the excess finish on newspaper. Then dip the brush into the appropriate cleanup solvent, and squeeze out the excess. Pour a liberal amount of dish-washing detergent on the brush (I like Dawn), and follow the steps below.

Cup your hand, and lather up the bristles with water. Swirl the bristles around vigorously.

Rinse out the soap under warm water. Bend the bristles back to force out the finish at the base of the brush, near the ferrule. Repeat this until the bristles no longer feel slimy.

Run the bristles under cold water. Spin out excess water by holding the handle between your palms and twirling it briskly.

Straighten the bristles with a brush comb.

Wrap the bristles with paper (do not use newsprint; the ink will stain the bristles), and fold as shown. Lay the brush on a flat surface to dry. Don't store brushes in solvent for extended periods (more than four hours). The bristles will soften and lose resiliency.

Hardened finish

Soak the brush for four to six hours in a NMP (N-Methyl-Pyrrolidine) stripper such as Citristrip. Clean it as described above. Then, using a stiff wire brush, scrub the base of the bristles near the ferrule to remove the softened finish.

String Inlay

Fine lines of contrasting woods add an elegant touch to furniture

by Garrett Hack

A look borrowed from an earlier era—Inlay only 1/16 in. wide on the author's table is reminiscent of Federal pieces.

Early American furnituremakers used string inlay for much the same reason they used moldings—to outline and highlight parts of their furniture. In rooms where dim light was often the norm, the narrow bands of inlay emphasized the vertical lines of a table leg (see the photo at left) or carried the eye around a curved apron. String inlay is most common on pieces from the Federal, or Hepplewhite, era (late 18th century through the first quarter of the 19th century). Designs from that period are among my favorites because the lines of the furniture are simple, yet the stringing adds high-style sophistication. That combination still works well today.

At one time, applying string inlay looked intimidating to me. Surprisingly, it's one of those techniques that looks more difficult than it really is. There are three main steps: cutting the groove, making the inlay and fitting the string to the groove.

Cutting the groove

I've always liked fine inlay, single-color strings no wider than 1/16 in. and about 3/32 in. deep. String this thin is very delicate in appearance and adds subtle detail, yet it's strong enough visually that it won't be missed. To inlay thin string, you must cut a very narrow groove in the workpiece. Most of the time, the best way to do this is with simple shop-made hand tools. I've come to distrust the power of a router, which can ruin work in an instant. Just the same, a template-guided router may be the best way of cutting grooves with complex curves. It's certainly the most efficient method, but you have to be prepared for the consequences of a momentary slip, because things happen quickly at 20,000 rpm. Each situation has its own best solution.

Cutting straight or gently curved grooves—Most grooves I cut can be made with a modified marking gauge. I removed the pin, used a bandsaw to cut a slot lengthwise on the beam of the marking gauge and inserted a cutter made from an old heavy-duty (about 1/16 in. thick) hacksaw blade (see the top photo on p. 60). The cutter, held in place with a pair of small nuts and bolts, is ground so that a tooth protrudes about 3/32 in., with sides beveled at approximately 5° (see the top drawing on p. 60). The bevel helps the inlay go into the groove more easily. When grinding the tooth, I cool it often to avoid removing the temper, which would be easy with such a small profile. After grinding, I hone the four sides and bottom so that all of the edges are very sharp.

If you don't want to modify a marking gauge, you could pick up an old Stanley No. 66 beader or the reproduction of it now being made by Lie-Nielsen Toolworks (Route 1, Warren, Maine 04864; 800-

Photos these two pages: Scott Phillips

327-2520). Either of these tools will hold a cutter similar to the one I made, and Lie-Nielsen also sells cutter blanks.

It's easiest scraping with the grain, so I do these grooves first. I hold the fence of the tool tightly to the edge of the workpiece while rolling the tooth slightly back and scraping forward with smooth, light passes. The beauty of this scraping tool is that it cuts forward and backward. Once the groove is started, I deepen it, moving in both directions until the beam of the tool is rubbing against the work surface. The slight taper of the tooth helps keep the tool tracking down the groove. I keep the passes light, with the fence firmly pressed to the workpiece, and stop often to clear the tooth of accumulated scrapings. A light waxing of the fence and arm helps keep things running smoothly. It is not a rapid process, but part of what I enjoy most about woodworking is the quiet coordination of hand and eye.

My marking gauge also works well cross-grain as long as the tooth is sharp and the initial cuts are light with the tooth slanted well backward. Still, there is a tendency for the grain to rip a little in all but the hardest woods. It helps to use a sharp marking knife to score along the grain. I use a square or steel ruler as a guide and cut just inside of the lightly started groove. I repeat this when the groove is about half-cut. This decreases the resistance on the tooth, allowing it to cut more smoothly. The slight bevel of the tooth helps make the groove less fuzzy as it's deepened.

It's hard to scrape into the corners, so I use a sharp chisel, a marking knife and a second chisel I ground to fit easily within the groove (see the bottom photos and the drawing at right). Working with these three tools, I can make sharp corners.

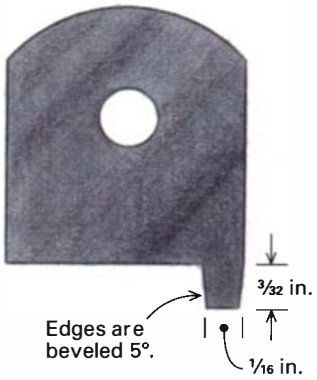
For gentle curves, I use the same modified marking gauge, as long as the fence has enough surface bearing on the workpiece to remain stable. Sometimes, I make bolder curves by attaching a specially curved fence to my marking gauge. Or sometimes, I mount the cutter from my marking gauge in a specially made scratch stock with a fence whose curve matches the workpiece. With a curved fence, however, the tooth can't be tilted backward. This means that the tooth contacts the wood squarely, which calls for even lighter passes initially.

Cutting grooves for complex curves— There are situations where the curves are just too much for the modified marking gauge. To inlay a string line with complex curves, I generally resort to using a pattern

TOOLS FOR CUTTING STRAIGHT GROOVES

Scratch tool cutter

Cutter is ground to a slight bevel (about 5° on each side) to make it easier to fit the inlay to the groove.

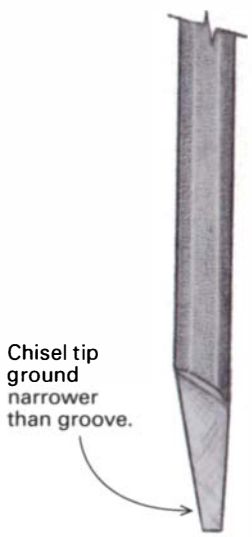


A scratch tool for cutting grooves parallel to an edge. *The author made his from an old marking gauge and a piece of hacksaw blade.*

Make grooves with light cuts. *To use the tool, the author cants the tooth backward so that it scrapes lightly over the surface. With each pass, the tooth can be tilted more toward the perpendicular.*

Squaring up the ends of a groove

Custom chisel—*Any good piece of tool steel can be made into a chisel for cleaning up the end of a groove.*



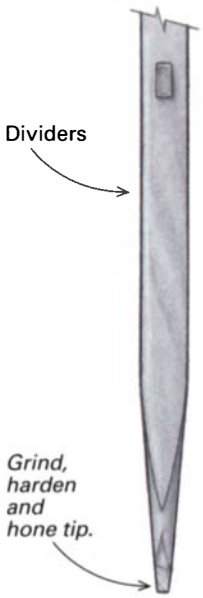
Square end of groove *with the custom chisel. A marking knife and standard bench chisel are also used.*

Photos except where noted: Vincent Laurence

TOOLS FOR CUTTING CURVED GROOVES

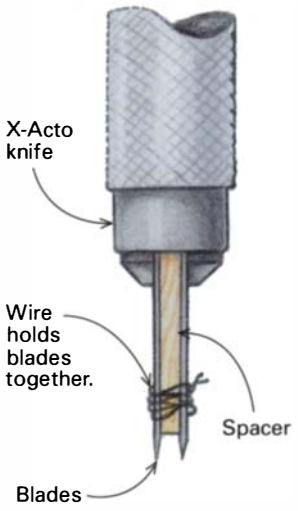
Cutting gentle curves

To cut an arc, use a set of dividers. *File one tip of the dividers to a slightly beveled square profile, and then harden and hone it.*



Cutting tight curves

Cutting a groove that doesn't follow an edge— *An X-Acto hobby knife with two blades separated by a spacer outlines the groove around a plywood template. The author cleans out the waste with his custom chisel.*



Drawings: Heather Lambert

and a specially made two-blade knife. This method also is useful anytime my design calls for a string line of some shape not parallel to an outside edge, such as outlining an oval reserve on a table apron (see the bottom photo and drawing).

I make a pattern of thin hardwood or plywood to follow either the inside or outside edge of the intended string, whichever is easier. The knife is simply a pair of honed X-Acto blades, a thin spacer between them, mounted in a handle.

Lightly, at first, I score all around the pattern and then lift out the chips with my fine chisel. This process usually needs to be repeated a few times to get a sufficiently deep groove. For the final few passes, I hold the cutter from my marking gauge with my fingers and scrape carefully to get a groove of consistent depth and width.

Grooving with a router—Though I have done so a number of times, I don't like using a router to cut inlay grooves. Other woodworkers may not share my aversion. Outfitted with a template guide, the router's strength is its ability to follow a template of whatever shape. I've found it easier to follow an inside curve than an outside curve, so when I do use a router, I usually make a template with a cutout, remembering to account for the diameter of the template guide when sizing it. Router bits generally aren't available any smaller than ⅛ in.

In these wider grooves, I usually inlay multicolored lines glued up from veneer. I have ground a high-speed-steel router bit down to a little less than 1/16 in., for a single band of string. I rough out the groove with this bit and then clean it up with the cutter from my modified marking gauge.

Grooving an arc of a circle—To cut a groove that's an arc of a circle, I modified a pair of dividers, shaping the end of one leg to the same profile as the cutter from my modified marking gauge. The tooth scrapes a groove as the dividers are swung through an arc (see the top photo and drawing on this page).

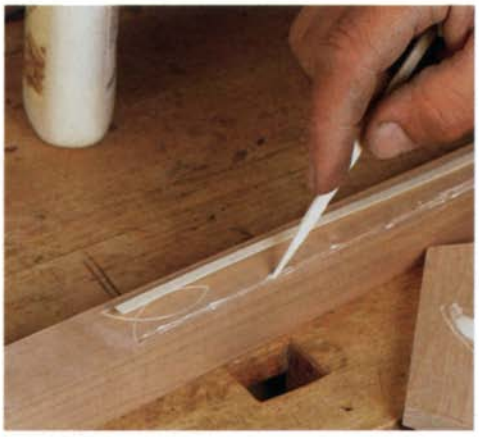
Because the steel used for the dividers was soft, I hardened the tooth so it would stay sharp. I heated the tip to red hot with a propane torch and quenched it in water. I cleaned the tip with some fine sandpaper so the steel was shiny again; then I tempered the tip by reheating it until it was a light-straw yellow. I let it cool slowly and honed all edges of the tip.

I use the tool as I do the modified marking gauge, taking light passes at first to define the curve and reduce tearout in the

CUTTING AND GLUING IN THE STRING

Rip strips of inlay on the tablesaw. *Because the inlay stock is so thin, take it off on the waste side of the blade (above). Slice strips to ¼ in. or so with a knife and straightedge. Plane to width with a block plane (right), beveling slightly to match the groove. Check the fit frequently.*

Don't be fussy with the glue. *Once the glue starts flowing, you have to move quickly because the moisture in the glue will swell the walls of the groove.*



A burnisher seats the strip of inlay securely. *Tap the strip of inlay into the groove with a hammer and a block of wood. After removing most of the excess with a plane, make several passes with a burnisher. Apply more pressure with each pass until the inlay is seated.*

Plane inlay flush and leg smooth *after the glue has set up. Don't sand it, though, because that can muddy the crisp colors of the inlay. The leg is now ready for assembly.*

cross-grain areas. Slanting the tooth back from the cut also helps, as does outlining the cut with a knife. The pivot point needs to be well-anchored. I sometimes can place the pointed leg in an area that will be inlaid later. If not, I glue down a small scrap of hardwood and chisel it off later or clamp a block to the piece I'm grooving.

Inlay materials

I use string inlay to outline or highlight, so I prefer to use a wood that contrasts with the primary wood. Black or white lines or some combination of the two work well because these colors hold better. Traditionally, holly has been used for white string because it stays the whitest and has almost no figure. I suspect white birch also has been used, but I prefer aspen, which stays nearly as white as holly and is so plentiful here in Vermont.

Ebony is another favorite of mine. I use it alone for black lines and in combination with aspen to make thicker stringing of alternating colors. Almost any wood that can be worked in thin dimensions can be inlaid, as can metals like brass and pewter.

When making string from solid stock, I rip it from a dressed board on the tablesaw to a dimension slightly wider than the groove it will fit. I find it safer and more accurate to pass the board against the fence, using the strips from the offcut side for the inlay (see the top left photo above). This means the fence needs to be reset every pass. Rather than turning off the saw, waiting for the blade to coast to a stop and then measuring to get an offcut of precise thickness, I gauge it by eye. Small varia-

tions in thickness are unimportant because each piece is planed to fit its groove.

Fitting string to groove

I start with a piece of inlay that will protrude from the groove by as much as ⅛ in. A piece this wide is easier to hold while it's being planed to thickness and beveled. I mark one edge and designate it the top, so I can keep track as I'm planing and, later, when I'm gluing. The bevel, which should roughly match the groove, helps the inlay get started. And if I plane the inlay too thin, I can plane the bottom edge a bit so that the inlay will set deeper in the groove and snug up at the top. This is another good reason for leaving it wide when you start planing it.

Getting a good fit is simply a matter of trial and error. The inlay should fit snugly into the groove over its whole length. I miter the corners where inlays meet at an angle, using a chisel and splitting the angle by eye. When the strips have been beveled and planed to thickness, I rip them to about 3⁄16 in. with a knife and straightedge. That leaves no more than 3⁄32 in. of inlay above the surface of the workpiece. I also undercut the ends slightly and leave the inlay just a whisper long, so the ends will compress together when the inlay is tapped home.

As thin and flexible as inlay is, it sometimes won't make the bend when set into tightly radiused grooves without being soaked in water for a few minutes and bent around a form. I try to plan ahead when I have tight radii to inlay, so I can let the pieces dry overnight on the form before working with them.

Gluing in the string requires quick and careful work because the moisture in the glue swells the parts. I try to put a fine bead of glue in the groove using a whittled piece of scrap thinner than the groove (see the top right photo on the facing page). It's not always a neat process, though. I quickly position the string and, working from one end to the other, lightly tap it in using a hammer and a block of scrap to protect the inlay strip.

With my block plane set for a moderate cut, I plane off most of the excess and then set the inlay with an oval burnisher (see the center right photo on the facing page). This snugs the inlay in place and works out any extra glue at the corners. When the glue has set, I level the whole surface with a sharp plane (see the bottom right photo on the facing page). □

Garrett Hack is a furnituremaker and designer in Thetford Center, Vt.

String inlay deserves a good ending

***Cuff inlay,** which is a band encircling a leg near the floor, is the traditional termination for string inlay.*

A good way (and the traditional way) to terminate string inlay is to run it into a cuff inlay, which is a narrow band running around a leg just a few inches off the floor (see the photo at right). A cuff inlay defines the transition point between the primary taper of a leg and a secondary taper for the foot.

I vary the cuff's width, depending on the piece I'm making, but I always make the groove for it between 3⁄32 in. and ⅛ in. deep. This makes the cuff less vulnerable if it's kicked or bumped. I use a router and an adjustable fixture to create the groove (see the photo below).

The fixture compensates for taper: Because the leg is tapered, the trick in making the fixture is figuring out the angle that will create a continuous groove, with edges that line up perfectly all the way around. I do this by trial and error with a bevel gauge and pencil. Once I'm able to make a continuous pencil line around the leg, I use that bevel-gauge setting to position the front fence of the fixture and the plywood that will guide the router. I glue and tack these together.

After the glue has set up, I position the half-completed fixture so that the bottom edge of the plywood is properly situated to guide the router for the cuff groove (don't forget about the template guide). Then I clamp the fixture and another piece of scrap (the back fence) around the leg. I center a single screw through the plywood into the back fence and countersink the head. The fixture is ready to go.

Start the groove at the inside corner: I position the inside corner of the leg against the top edge of the front fence so that if the groove doesn't meet itself perfectly, the flaw will be less noticeable. Whenever possible, I use a template guide and bit that will cut the desired groove width in one pass. Occasionally, though, I have cut wider grooves in two passes by tacking a shim between the edge of the plywood and the template bushing for the first pass. Then I remove the shim and make a second pass, with the template guide directly against the plywood.

I adjust the depth of cut in the front fence so the first complete pass is perfect. This groove helps me align the leg for subsequent passes. After each pass, I unclamp the leg and turn it toward me, lining up the routed groove in the leg with the one in the fixture. I'm careful to keep the orientation of the router the same on each pass, because router bases aren't always perfectly round.

Making, cutting and inlaying the cuff: I make my own inlay bands, laminating them from veneers or solid stock depending on the design. I start by gluing up a blank that will be ripped into strips of banding a little wider and thicker than the groove is wide and deep. (For more on inlay bandings, see *FWW* #103, pp. 67-69.)

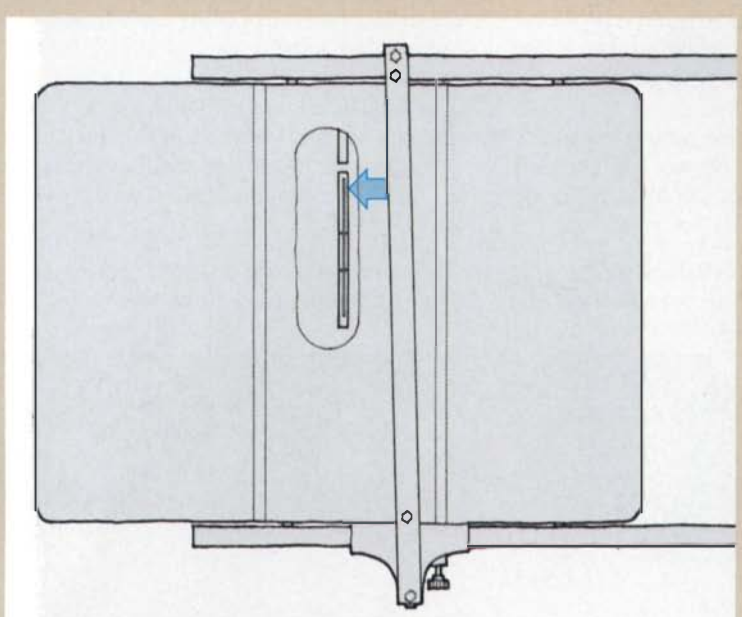
I cut the strips to length with a dovetail saw and miter them using a 45° shooting board and a wide chisel. Then I adjust the width of the banding with a block plane, creating a slight bevel on the edges. This helps when setting the banding into the groove. I clamp each face, one at a time, using a small hardwood block as a caul. When the glue has set, I level all of the inlay with a sharp plane. If there's a secondary taper for the foot, I cut and plane it now. —*G.H.*

***A jig for cuff inlay**—A scrap of plywood glued and nailed to a fence guides the router when cutting the wide groove for cuff inlay. Extra pieces on either side of the leg help locate the cuts and steady the router.*

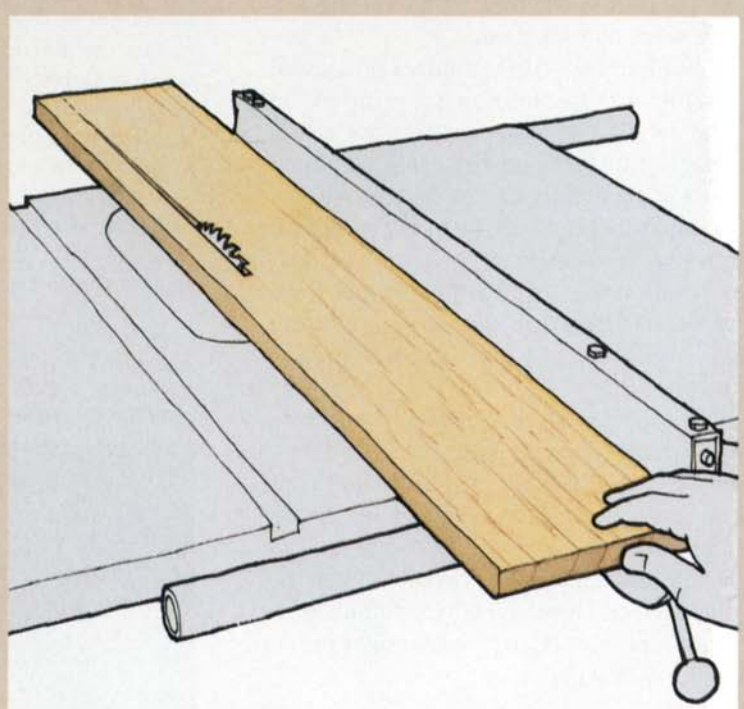
Kickback zone

Teeth at the front of a tablesaw blade push stock down as they cut. But when the back of the blade comes into contact with the stock, it can be lifted off the table and thrown back violently at the operator.

CAUSES OF TABLESAW KICKBACK



Misaligned fence forces stock into back of blade.



Stock with internal stress can pinch into kickback zone.

Photo this page: Boyd Hagen; photos except where noted: Dennis Preston

Tablesaw Kickback

Causes and prevention of this common shop hazard

by Kelly Mehler

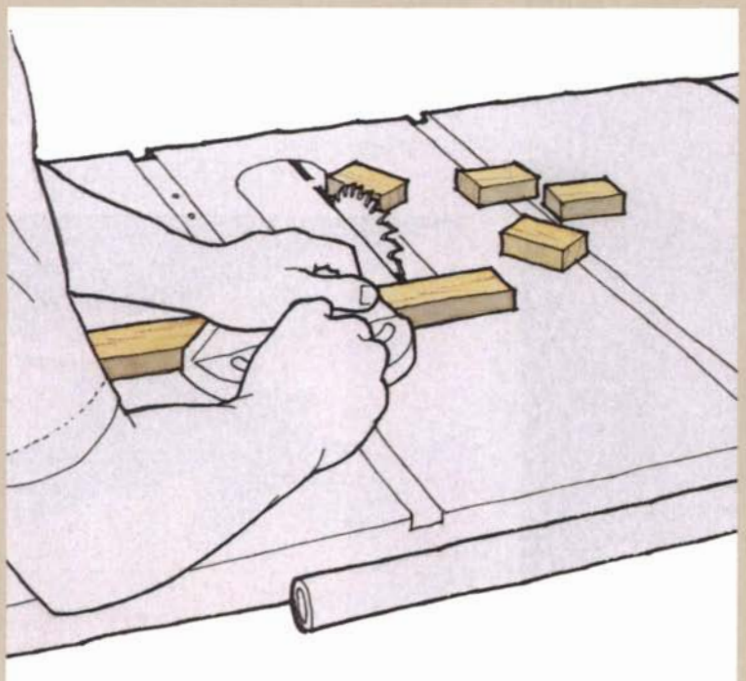
One afternoon, I was cutting a stack of walnut panels, about a foot square, on my tablesaw. I was being careful, but the repetitive work was mind-numbing. My body was on autopilot, and my brain was taking a snooze. Then, wham! I was slammed in the gut, doubled over in front of the saw. There was no warning; I never saw it coming. It took a few seconds for me to realize that I had been hit by a piece of wood thrown off the tablesaw.

Later, in reconstructing what had happened, I guessed that a short piece of stock had pivoted into the back of the blade. The result was kickback.

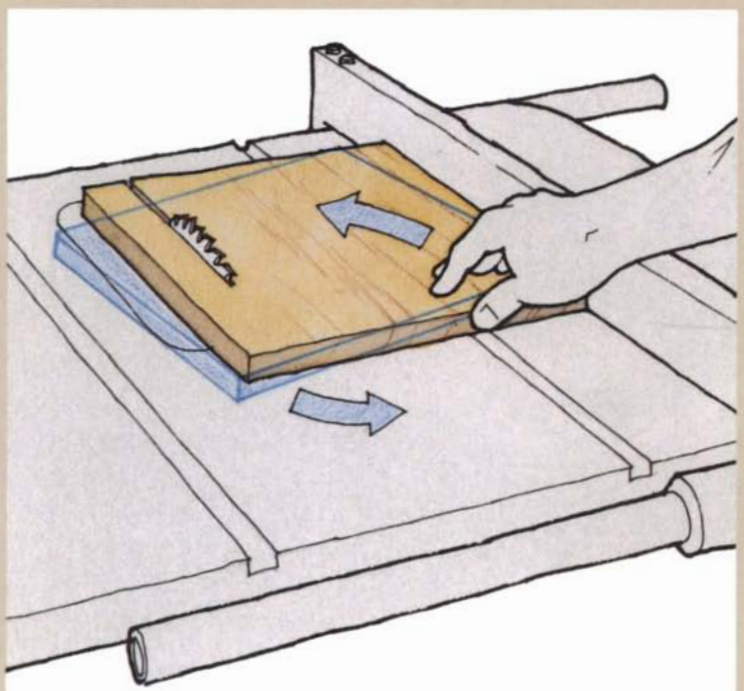
Stock that's hurled by the tablesaw is pretty scary. I escaped serious injury, but I know others have not been so lucky. Recognizing the causes of kickback and its prevention is an important survival skill for any woodworker.

The potential for kickback is inherent with any circular saw, and on a tablesaw, kickback can occur when either ripping or crosscutting. Unlike a bandsaw, where the cutting force drives the stock into the table, a tablesaw can lift the work off the table and throw it with tremendous force. Under normal conditions, teeth on the back of the blade, which are rising out of the table, don't encounter any resistance because they are in the kerf. Kickback results when stock comes into contact with the teeth at the back of the blade. With the outer edge of a typical 10-in. blade moving at about 100 mph, any workpiece can become a missile.

Even though tablesaw kickback is most commonly associated with ripping, it also can occur when you are crosscutting. Cutoff pieces that vibrate or are pushed into the back of



Small offcuts vibrate into back of blade.



Short stock rotates into kickback zone if not held tightly against fence.

Drawings: Jim Richey

the blade can be launched toward the operator.

A good splitter

Preventing the workpiece from contacting the back of the blade is the only foolproof solution to kickback. This is the job of the splitter. A blade guard alone does not work.

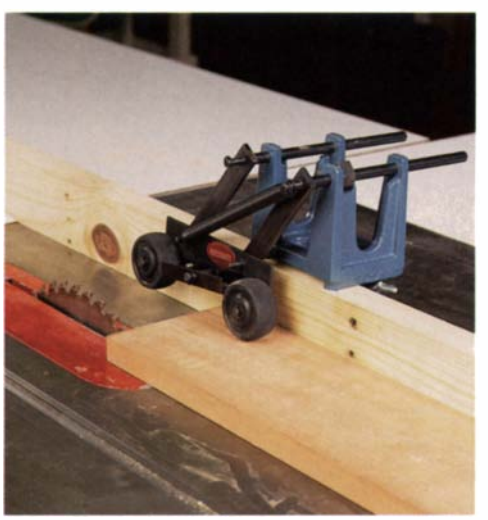
Most stock tablesaw splitters are part of a 3-in-1 unit (see the photo below left) that includes a blade guard, anti-kickback pawls and a splitter. When installed and aligned, this kind of splitter works well for ripping stock. But it must be removed from the saw when cutting grooves, tenon shoulders and when the stock is not cut completely through. The splitter tilts with the trunnion, but it doesn't rise and fall as blade height is adjusted, so the lower the blade is set, the greater the gap from the back of the blade to the splitter. Consequently, with typical ¾-in.-thick stock, there is a gap of about 2 in. between the back of the blade and the splitter. Kickback can occur before the work reaches the splitter.

Another splitter, like the one in the top right photo below, has anti-kickback pawls and is used with a separate blade guard. It mounts to the saw's trunnion and shares the same

A splitter helps prevent kickback, but this one, with anti-kickback pawls and a guard, must be removed when not cutting completely through the stock.

***This splitter is more likely to be used** because it dismounts and remounts easily.*

***The best splitter** closely hugs the back of the blade and can be left in place for all cutting operations.*



***Anti-kickback wheels** drive the stock against the fence.*

shortcomings as the 3-in-1 unit. The real advantage of this design is that it dismounts and remounts quickly, eliminating one of the chief complaints with the 3-in-1 design.

The best design, one that comes closest to totally eliminating kickback, is the splitter that rises and falls with the blade (see the center right photo on the facing page). As far as I know, this splitter is available only on some European tablesaws. Because it attaches to the arbor assembly, it can be set close to the blade teeth and below the top of the blade. This is handy because the splitter does not have to be removed when stock isn't cut all the way through.

A throat-plate-mounted splitter is another option. It's a thin, hardwood fin glued into a shopmade, wooden throat plate just behind the blade. Because this splitter does not rise or tilt, you may have to make several of them, so you have one suited to the stock thickness you're working with. (For more on this, see *FWW* #115, pp. 70-75.)

A typical 10-in. blade moving at about 100 mph can turn any workpiece into a missile.

Other precautions

Besides a good splitter, other commercial and shop-built fixtures can help prevent kickback. Your strongest ally may be care and common sense. The tablesaw is an easy tool to take for granted, especially when you're tired or in a hurry.

Equipment you can buy or make—A fence that angles toward the blade encourages kickback, so make sure the fence is parallel to the blade or angled away from it slightly. For crosscutting, a crosscut box or a fence attached to the miter gauge keeps cutoffs away from the blade (see the bottom photo at right).

A well-designed push stick is a must for keeping your hand out of danger. A good push stick holds down the work on the saw's table and allows you to steer the work against the fence (see the photo at right). The type that I prefer is shaped like a shoe and is much better than a stick with a bird's mouth in the end.

There are several types of fence-mounted, anti-kickback wheels (see the bottom right photo on the facing page), but they all operate on the same principle. The wheels only allow rotation in the feed direction, and they lock when the stock is pushed toward the operator. The wheels are angled so that they force stock against the rip fence.

A featherboard clamped to a table is a low-tech but effective way of preventing kickback (see the photo at right). The featherboard has a series of closely spaced kerfs cut into one end. The spring-like fingers hold the work tightly against the fence, and they act like a pawl to prevent the stock from being pushed backward.

Shop practices help, too. A sharp blade cuts with less resistance, reducing the chances of kickback, so it's a good idea to check your blade regularly. Don't stand directly in line with the blade. By standing off to the side, you'll be out of the way if the blade catches a piece of stock and throws it. And it pays to know when to quit. When you're tired or when someone breaks your concentration, it's time to turn off the machine. Kickback happens instantly and seldom when you're expecting it. □

Kelly Mehler is a furnituremaker in Berea, Ky.

Large push stick keeps stock against fence *and holds it on the table. Note that the author is not standing in line with the blade.*

A featherboard holds the stock against the fence, *reducing the chance of kickback. Mount featherboard in front of the blade.*

Miter-gauge fence prevents kickback *by pushing offcuts away from the blade and providing more support to the stock.*

Top and center photos: Kara Brunner

***A lightly bowed caul,** faced with felt, needs only a few clamps to apply even pressure on plywood edging.*

Solid-Wood Edging for Plywood

With bowed cauls, you only need a few clamps

by Steven Cook

Plywood cabinets are great: strong, quickly assembled and relatively light. But what do you do with all those raw edges? Veneer tape is certainly the easiest way to cover an edge, but I've found that sooner or later the tape chips and frays. An edge made of ¾-in.-sq. stock stays put, but it looks clunky, especially around a cabinet door. I experimented with a number of ways of concealing plywood edges before finding one I liked.

I now use 3/16-in.-thick edging and glue it to the plywood before the cabinets are assembled. The look is clean and sophisticated, and the quality of the finished product is obvious. It's sold many jobs for me.

***Finish the edges of a door with a 3/16-in. roundover bit.** Run the sides by the top and bottom to cover the end grain.*

The secret to using such thin edging successfully is in the clamping. The glueline must be even and free of gaps. Rather than using heavy cauls held flat with many clamps, I use light bowed cauls faced with dense felt. A clamp on each end of the panel is all I need, because flattening the bow presses the felt face against the edging from end to end of the panel. I get a clean, even glueline with a minimum of trouble (see the photo above).

In my shop, I have four cauls 3 ft. long,

Photos: Graham Ashford

four 1½ ft. long and two 8 ft. long. This is ample for gluing up the edging on an average kitchen-cabinet job. The cauls are handy for all kinds of clamping operations; I find myself reaching for them often.

Make cauls from bowed stock or laminations

All I need to make a bowed caul is stock that's about 1 in. sq. and lightly bowed. A curve of about ½ in. over 3 ft. works fine. A little more than that is fine, but if the curve is much less, the caul will not exert enough pressure for an even glueline.

I use stock that's too warped for anything else—like offcuts I get from straightening bowed edges or pieces that take up a curve after being sawn. If I have no warped lumber, then I laminate four ¼-in. layers of scrap to make cauls. I glue up the strips over a form with yellow glue to create a curve.

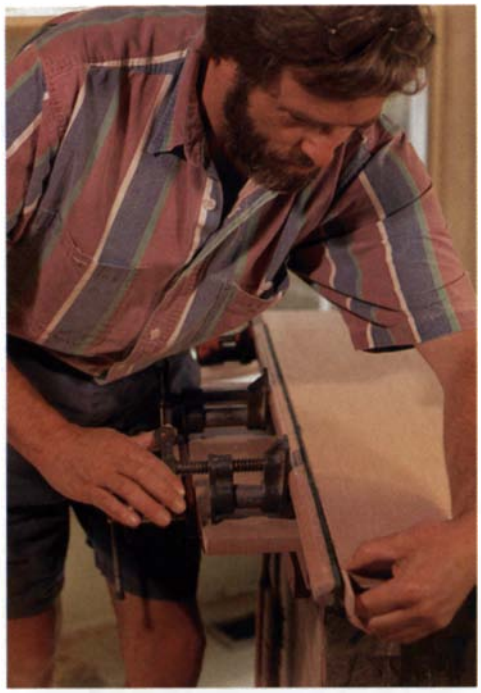
I can't find any functional difference between these two kinds of cauls, but trying to cut the cauls out of straight stock on a bandsaw isn't a good idea. It's difficult to saw a curve without creating bumps and hollows. Uneven spots in the face of the caul will prevent it from being held tightly against the edging all along its length. So a sawn caul requires a lot of extra planing and sanding. By using planed laminates bent around a simple form, I can get a perfectly fair curve that requires no additional smoothing.

The dense felt I glue to the cauls is something I use in piano repair. It's called backrail cloth, and it pads the rails that piano keys sit on while at rest. The felt is about ¼ in. thick and is sold in rolls 1½ in. wide by 52 in. long. I buy it from Pacific Piano Supply, 16153 Leadwell, Van Nuys, CA 91406; (818) 779-1586. A roll costs $7, and Pacific Piano has a $25 minimum. (Also, a piano tuner probably has some felt and may be willing to sell a few feet.) I glue the felt to the convex side of the caul with yellow glue. When the caul is dry, I clamp it, felt side down, on a scrap of plywood and trim the excess felt with a razor blade or X-Acto knife.

Apply and trim the edging

I apply edging to plywood before the cabinet boxes are assembled. For an average-sized kitchen, I figure on 20 bd. ft. of wood for 3/16-in.-thick strips. I usually make the edging from the same species of wood as the cabinets, but I have used contrasting colors on occasion. Maple and walnut, for instance, look great together.

I dimension my edging stock so that it overhangs the plywood by 1/16 in. on each edge. Having the edging wider makes it easy to cover the plywood edge without having to worry about careful alignment during clamping (see the photo at left).



***If the edging is 1/8 in. wider than the plywood**, then the alignment is not crucial. You can trim the overhang later.*

***Run the router in a climb cut** (from right to left) to prevent tearout. It leaves a rough edge, so follow with a block plane.*

***Finger pulls are deeper than standard edging.** So make the bottom edging thick enough to accommodate them.*

I run the stock through the tablesaw, cutting the strips thicker than I need. Then I take them down to 3/16 in. with a planer, cutting both sides to get clean, parallel-sided strips.

I always use yellow glue for edging simply because it's easy to use and holds up well. If the caul is long, I put a clamp in the middle to hold it and then one on each end. Twenty minutes is all the job needs—just long enough for the glue to tack. I get into a nice rhythm—gluing, clamping, unclamping and on to the next. It's a good time to listen to music.

The glue can continue to cure unclamped; just be sure to wait several hours before trimming the edges flush. For that, I use a router with a flush-trimming bit (see the center photo at left). If you run the router in the usual way—from left to right as you face the panel—the edge might tearout, possibly to a point below the edge of the plywood. To prevent this, I run the router the "wrong way" in what's known as a climb cut.

Climb cutting can be risky, but by using a bit with a bearing and by keeping the overhang to less than 1/8 in., it's easy to keep the router under control. A climb cut tends to be a little rougher than a push cut, but a light pass with a handplane will leave the joint absolutely flush (you can do all the trimming with a plane, if you like). Then I trim the ends to length with a fine-toothed Japanese saw and a file.

Try a roundover bit for doors

I like the look of thin edging on a door when it has been finished with a 3/16-in.-radius roundover bit (see the bottom photo on the facing page). Doing this hides the glueline and makes it easier to hang the door because the rounded line is visually more forgiving. If a hinge has to be pulled out to true up a warped door, your eye isn't drawn to the slight unevenness. You can chamfer the edge right up to the glueline, but that creates a hard shadow that tends to draw the eye to any place slightly out of parallel.

Finger pulls can be routed into the door edge very easily. Simply plan ahead by making the edging deep enough to accommodate the cove bit you'll use for the detail (see the photo at left). □

Steven Cook is an instrument- and cabinetmaker who has been making his living at woodworking for more than 25 years.

Using a Hollow-Chisel Mortiser

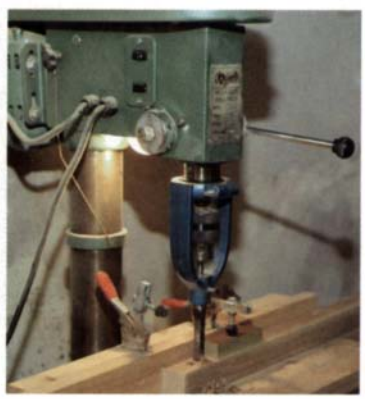
One man's techniques for a machine vital to his craft

by John W. West

Some time ago, fresh out of school, I practiced architecture for several years. I discovered early on that I had to make too many compromises to practice my trade. Now I own and run a small custom woodworking business, and I'm often awarded jobs that demand we make things in limited production quantities. It's not unusual to get an order for two or three dozen large doors or to do a kitchen requiring 50 to 60 cabinet doors. For these jobs, I'd be lost without my mortiser.

I use a manual, foot-operated hollow-chisel mortise machine. There have been times when I would have appreciated the brute strength and speed of a pneumatic-operated chain or oscillating mortiser. But the one I use will produce a square-bottomed, square-ended mortise. It's easy to set up for angled or canted mortises, and it's the only type that will make a single square hole, like those in window-sash bars and louvered doors.

With a little ingenuity and some jig making, the hollow-chisel mortise machine will handle any angle or curve. I've used mine for cabinet face frames, chairs and benches, curved windows, lock sets, miniature fretwork and 10-ft.-high by 2½-in.-thick doors. I could cut mortises by hand or use either a drill-press attachment or one of the benchtop mortisers that have come onto the market in the past few years (see the photos at right). Neither of those would do the job as quickly or as accurately, but they are options.



Three ways to cut mortises. *The author uses a large foot-operated mortiser (left), a capable but expensive tool. Alternatives for smaller shops include dedicated benchtop mortisers like this Multico (below) and an attachment for a drill press (bottom).*

How the tool works

The cutting tool consists of a square hollow tube with a relief, or emptying slot, cut out of one face (sometimes two slots on opposing faces). The tool is internally flared and sharpened at one end and turned down at the other end to fit into a collet (see the drawing at left on the facing page). Within the tube is a double-spur machine bit (with no point) that telescopes through the chisel and fits into a drill chuck. The way it works is simple: As the tool plunges into wood, the bit drills a hole and the chisel cleans out the corners by scraping the side walls, producing a square hole. Multiple plunges in line produce a rectangular mortise slot. Chisel sets come in square sizes from ¼ in. to 1 in. and in various lengths.

Setting up and troubleshooting

There are two ways to set up the tool in the machine. Most manufacturers recommend this procedure: Slide the bit into the chisel,

Photos at right: Boyd Hagen

install both through the collet and place a 1/32-in. spacer (1/16 in. for sizes 3/4 in. and larger) between the chisel shoulder and the collet. Push the bit tight to the bottom of the chisel tube, and tighten the bit in the drill chuck. Then remove the spacer, push the chisel shoulder tight to the collet and tighten the collet clamp. This method provides the recommended clearance between the bit tip and the chisel tip, which prevents heat buildup from too much friction.

I prefer another method: Install the bit and the chisel assembly through the collet, push the chisel shoulder tight to the collet and tighten the collet clamp. Push the bit into the drill chuck, and sight the bit tip and chisel tip, adjusting the bit up or down until the straight cutting edge—not the spurs—of the bit is in line with the pointed corners of the chisel (see the top right drawing on this page). Tighten the bit in the drill chuck. I like this method because it's easier for me to get the cutting edge in line with the chisel points. And even though I risk more heat buildup, I'm convinced I get less wear on the tool.

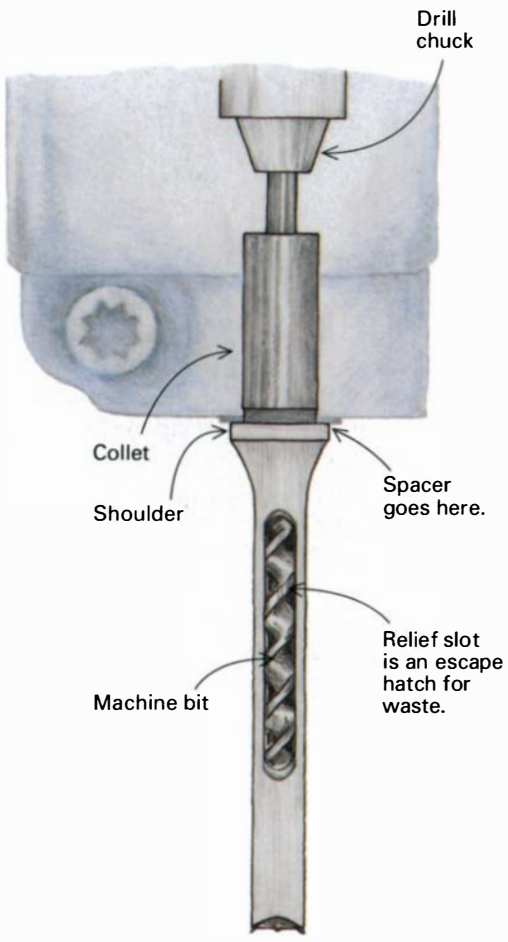
When I have to cut mortises 1/2 in. or larger into hardwoods like ash or white oak, I set up the tool a little differently. I keep the bit's cutting edge as much as 1/16 in. below the corners of the chisel. This produces a little less resistance in the plunge. Under too much stress, tips will snap off. However, I have found that the incidence of tip breakage is the same for either method and is very rare. Allowing the bit to stick out much more than 3/32 in. from the chisel tip may cause it to begin oscillating within the hollow shaft, causing scoring and damage to the interior of the chisel.

Bits do rub against the inner wall of the chisel during normal operation. Older, much-used bits occasionally will begin oscillating, but they will stop when the plunge is started. This doesn't seem to affect performance, until the oscillating becomes so severe the bit tip wanders when the plunge is started. The only cure for that is to buy a new chisel.

Another serious problem can occur when the chisel overheats (see the photo above). This happens most frequently with smaller tools (1/4 in. to 3/8 in.) when mortising deeply into resinous wood like cherry or sugar pine. Hot debris collects in the flutes of the machine bit between the chisel tip and relief slot. If the material is not forced out the emptying slot with the next plunge, enough heat and pressure can build up to split the chisel. This usually happens on the weaker relief slot face at the thinner tip area (see the bottom right drawing). Plunging quickly helps prevent the problem.

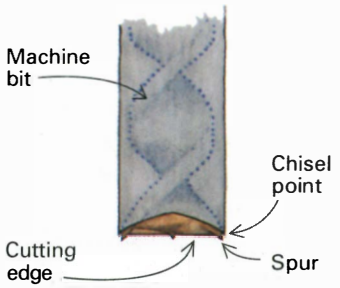
***Overheating can be a problem**, especially with smaller bits and resinous woods, when chips get clogged inside the chisel. The faster you plunge, the less likely this is to happen.*

A mortise chisel and bit



The cutting edges

When setting up his machine, the author takes pains to align the cutting edge of the bit with points of the chisel. Notice that the spurs of the bit make the first contact with the wood.



A chisel gone bad

The heat and pressure of clogged debris may cause the steel to crack, usually on the weaker relief side of the chisel.

When installing the tool into the machine, place the relief slot (as you face the machine) 90° to the right. The waste empties away from the direction of the plunging and away from the operator (hot debris can hurt). The weakest axis of the chisel is captured between the side walls of the mortise, decreasing chisel flex. Plastic drafting triangles work well for squaring up chisel to fence, as shown in the photo on p. 72, or setting the chisel on an angle.

Plan your joints first

You must allow for the seasonal movement of a rail when laying out mortise-and-tenon joints. A wide rail locked tightly between

Drawings: Christopher Clapp; photos except where noted: William Duckworth

both ends of a mortise will be forced to cup when expanding in high humidity. This may create a bulge or even a split in the stile around the mortise area. I've seen stiles split out at the ends because the rails were locked in too tightly. It is best to accommodate movement so that as the rails expand, they'll move toward the inner part of the frame, as shown in the center drawing below. This is especially important for inset cabinet doors, so they won't bind.

I've always been dead set against gluing opposing grains. The joints break down after many years of service. I've never glued a mortise-and-tenon joint in a large interior or exterior door because I know it will last a lifetime. But narrow rails, depending on the species, won't move too much, so I glue these joints. (I prefer white glue; it has some elasticity when dry.) I usually pin the joint in some fashion.

***Set the chisel square to the fence** or at whatever angle the job demands. The author likes small plastic drafting triangles for this task because they're light and true.*

Mark the joints precisely

After I've processed and sized the materials, I pair up the stiles, mark their faces and mark the faces of the rail stock. Machining of all the parts should be done with the faces against a fence, table or other fixed platform so that all parts are indexed from the face surface. This ensures that the relationship between the mortise and tenon will be the same on all pieces.

Establish and mark where mortise slots and haunch cuts begin and end. Using a sample piece, make a mortise to the desired depth (about ⅛ in. deeper than the tenon length) in its approximate location front to back. Use scrap from the materials being used.

Next make a tenon (with or without a cope) to the desired length, position it front to back on the rail (tenons are rarely centered on the stock) and thickness to fit the mortise. Then fine-tune the front-to-back position on the mortise machine so that the fit is flush on the face, or whatever position is desired. Remember that when you assemble frames with a coped and molded stile and rail, most copes will have a tendency to pull the tenon toward the face as the frame is clamped up, as shown in the bottom right drawing.

Making the plunge

Plunging methods vary depending on the size and type of mortise and the material used. Facing the machine, I make the first plunge at the left end of the mortise. If I need to make a really deep mortise—too much work for the first plunge—I'll go as deep as possible, move to the right one-half the chisel width and plunge just short of the first hole's depth.

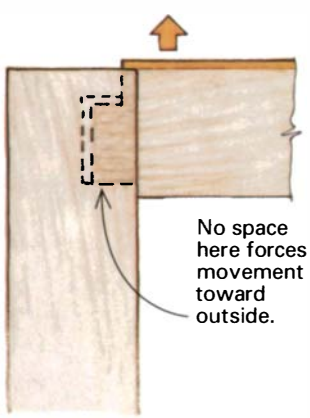
I return to the first hole and plunge deeper, repeating this process until the first hole is to the desired depth. I move to the right end of the mortise and make a full-depth plunge (or repeat the above process in reverse). Then, starting from the right and working to the left, I plunge one-half to three-quarters the width of the chisel with each overlapping plunge, until I reach the first hole on the left. I re-plunge in line from left to right. This cleans off the side walls and the bottom of the mortise. It's a little dangerous to drag the chisel across the bottom of the mortise to clean it; snagging may snap the bit tip, bend the chisel or both. But I do use this process for cleaning a tenon haunch, which isn't as deep.

When the mortise slot is six or more times (my own rule of thumb) longer than the chisel size, I will make one or more midway holes between the left and right ends. This keeps the tool cutting straight on long mortises, especially when the edge of the mortise is close to the face of the stock. On very long mortises (for large door bottom rails, for example), I will split the tenon and make two mortise slots.

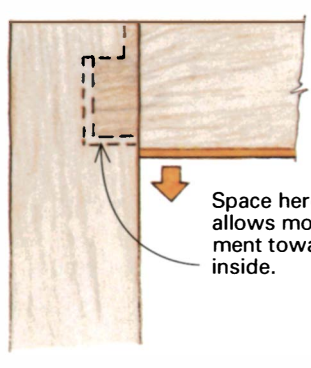
Cut haunches cleaner—On most frame-and-panel doors, a groove is cut in the rails and stiles to hold the panel. If this groove is the same width as the tenon, it can serve as the cut for the haunch. If not, a haunch cut must be made with the mortise ma-

Plan the joint for movement

Seasonal expansion of rail will cause this door to bind.

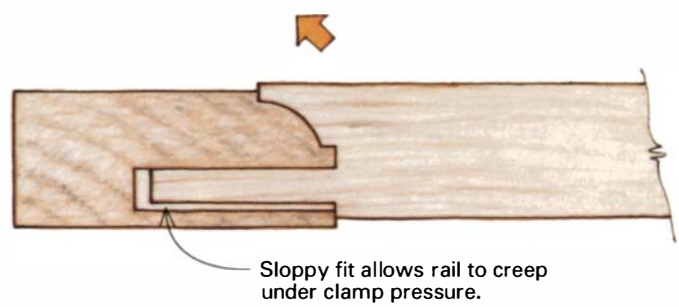


Seasonal movement won't affect fit of this door.



Shape affects the fit

Coped rails tend to move toward the front face under clamp pressure. To avoid this problem, snugly fit the tenon to the mortise.



To limit depth, use a block. *Instead of resetting the machine for the shallow haunch, the author inserts a block of wood as a spacer (upper right).*

chine. When the machine is set up for the regular mortise, a stop controls the depth of the mortise. A second stop will serve to cut the desired haunch depth. Rather than reset the machine stop, I use a block of wood (see the photo at left) as a spacer to save time and trouble.

After the mortise is made, I plunge the haunch, working toward the end of the stile. Re-plunge the haunch from the outside back toward the mortise. Then, with the chisel pressed to the bottom of the slot, I slowly scrape the bottom of the slot clean with a side-to-side motion of the chisel. This produces a clean haunch cut, which may be visible at the end of a frame or top of a cabinet door.

Frames with no panels have joints that show—When making frames that have no panels, such as a cabinet face frame, a tight joint is required at the intersection of the mortise and tenon because the joint is not hidden inside a panel groove. Before cutting the mortise, I score the ends of the slot with a hand chisel the same width as the mortise. That helps prevent chipping.

I've noticed that the bit has a tendency to leave a slightly ragged edge as it plunges. I also use the chisel to shave back the tenon slightly, so it will go into the mortise easily but draw up tightly at assembly. Also, when the bit is exiting from the end plunge, it will sometimes snag on the edge and lift up some material with it. To keep that from happening, I exert slight pressure on the stock, with the wheel that controls the left-to-right movement of the table, keeping the chisel away from the edge of the mortise.

Large mortises need more passes—If you have to make a wide mortise and don't have a big enough chisel, make two separate mortise slots, leaving ⅛ in. or so of material in between. Go back and plunge out the middle. This is time-consuming. But if you overlap the first slot, the chisel will flex into it and produce a tapered mortise, and you'll have to taper all your tenons. In some cases, this routine may be your only choice because you'd have to be Godzilla to push a 1-in. chisel into a piece of hard maple.

Cut sash bars on both sides—If I have to make a through mortise for sash bars, I'll plunge from both sides to keep the mortise tracking straighter vertically and to eliminate tearout, which seems to occur even when I use a back-up piece.

Cut for lock sets before assembly—If I'm making a batch of passage doors or a lot of cabinet doors that require full-mortise

locks, I'll mortise all the stiles for the hardware before the doors go together. It's easier and more accurate than using a hand drill and chisels later on.

The benchtop versions

I don't use a drill-press mortiser, but I did try a few of the benchtop mortisers to see how the smaller machines compared to industrial-grade mortisers. Without going into a full-fledged tool review, I should say that I was skeptical of these machines before I got my hands on them. But I was surprised to learn how well a little ½-hp motor with a hand-lever driven, pinion-geared plunger could cut a fine mortise. The design is similar to the industrial-grade versions, but the devil is in the details. Driving the plunge by hand is more cumbersome and tiring, and the benchtop versions don't offer the same conveniences of table movement. The hold-down mechanisms are not nearly as strong and somewhat difficult and time-consuming to adjust.

If you're not in the market for a large mortise machine, I think you may be better off using a router. Unless, of course, you just want a new toy to play with. □

John West owns Cope and Mould Millwork Co. in Danbury, Conn.

Sharpening hollow chisels

by John Lively

You probably can get by with a slightly dull blade on your tablesaw or a less-than-exquisitely sharp slotting bit in your router. But if you're punching out mortises in oak or cherry with a hollow chisel, *very sharp* is a required condition. A dull hollow chisel just won't work. It takes lots of muscle to force a dull bit into the cut, and once buried in the stock, the bit sticks there. This is why you'll find more hollow-chisel mortising rigs in storage than in actual use.

But if you keep your hollow chisels really sharp all the time, they'll cut crisply with minimal effort and back out of the hole with ease. With the right tools, sharpening hollow chisels can be an uncomplicated, uncluttered, quick affair.

Hone the outsides first: All four outside faces of the hollow chisel should be honed before you tackle the cutting edges of the tool. There are two reasons: First, you get sharper cutting edges, and second, you reduce binding in the cut. Honing polishes all those grinding scars, which act like treads on a tire, and reduces friction during cutting and withdrawal.

For honing the sides, I clamp the hollow chisel in my vise and use a medium-india slip stone (see the top photo at right). You could hone them on a benchstone just as you would the back of an ordinary chisel. Make sure you get a nicely polished surface on all four faces of the chisel—smooth and slick.

First, hone the chisel. *Use a small slip stone to hone all four outside faces of the hollow chisel until smooth and polished.*

Then ream the inside bevel. *Interchangeable pilots fit different chisels. After selecting the correct pilot and mounting the reamer in a brace, gently grind the inside bevel. Any burrs may be removed with a slip stone.*

Then go after the bevel: Now that you've honed the four faces of the chisel, how do you get into the hollow of the tool to sharpen those bevels? Without the correct tool, that can be a big problem. A look through the stack of woodworking catalogs teetering on the back of your commode will reveal that almost every mail-order supplier offers hollow chisels. But few offer the simple little device you need to sharpen them.

This thing is a reamer, basically. Its body is a fluted conical cutter (sort of like a countersink). The reamer has a tapered square shaft on one end for chucking into a bit brace and a hole in the pointy end for accepting interchangeable pilots (see the photo at left). You insert the correct pilot into the reamer, insert the pilot into the hollow chisel and crank away gingerly (see the bottom photo) to remove enough tool steel to establish clean, sharp interior bevels. Return briefly to your stone to hone off any burrs, and you're finished.

I use a Clico reamer, which is available through Garrett Wade Co. (161 Avenue of the Americas, New York, NY, 10013; 800-221-2942). Wherever you buy one, make sure you ask whether the pilots fit into the bits you own. The Clico reamer that Garrett Wade sells, for instance, fits Clico's English chisels but may need a masking tape bushing to fit Taiwanese chisels. □

John Lively is the editor-in-chief of The Taunton Press.

Photos this page: Boyd Hagen

Glazes and Toners Add Color and Depth

Layered finishes allow correction, enhancement

by David E. Colglazier

Many woodworkers assume they're committed to store-bought stain colors. For some finishing jobs, though, a one-time application of stain just won't do. But by adding colored finish layers at the right time, you can alter or compensate for an existing color as you go, getting exactly the right result. Two finishing products, glazes and toners, will let you do this.

Glazing and toning can add depth and color to a finish or adjust the hue to get the look you're after. I rely on both methods in my antique-restoration work because there's no other finishing process I'm aware of that can bring such subtle refinement or dimension to a finish. Despite their similarities, glazes and toners are used differently.

Glazes rely on an applicator to add texture or simulate grain detail. It helps to think of glazing as painting (see the photo below) because you're covering, or at least partially obscuring, a base color of some kind. Glazes usually go on just before the topcoats so that you won't disturb or cover up the brushstrokes.

Toners are generally not manipulated with a brush or rag after

Glazing transforms color and adds detail. *Glazes are colored finish layers applied over a sealed base, like this painted cabriole leg. Glazes stay workable long enough for blending and texturing.*

I rely on both glazing and toning in my antique-restoration work because there's no other finishing process I'm aware of that can bring such subtle refinement or dimension to a finish.

Photos: Alec Waters

they are applied. Think of toning as applying thin layers to alter the overall color of a piece. Spraying is best.

Glazes and toners are great for refinishing, restoration and color matching, but they aren't for every job. They require more artistic skill than other finishing methods. With glazing and toning, you need to know how to spray a finish. You often have to lock in a layer of glaze or toner by spraying a coat of nitrocellulose lacquer or shellac. If your shop isn't equipped to do this, you can use aerosol cans of lacquer (made by Deft) and shellac (Wm. Zinsser & Co.), which are readily available.

Layering is the key

The human eye is a very perceptive tool. With training, it can observe at least five variables of a finish: surface defects, wood-pore and flat-grain color, finish depth, topcoat sheen and texture. Glazes and toners rely on the eye's ability to perceive depth. By visualizing what the final result will look like two or three steps ahead, I can plan glaze and toner layers that will compensate for or correct a hue that isn't quite right. (The story on p. 79 gives a brief explanation of color matching.) Each layer, whether opaque, transparent or somewhere in between, affects the final color, texture and readability of the underlying wood.

Layering a finish is like building a house from the foundation up. Layers can be applied in many orders, but some are more practical than others. From the wood up, this might be a finish-layering sequence: tint and apply pore filler, dye or stain to get the right flat-grain color, correct the hue with a toner or semitransparent glaze, lock that in with a clear layer, add a thicker glaze for texture, tone where needed to add color or shade, and put on the topcoats. Toners can be added just about anytime in the layering process to change the overall color because, usually, they are nothing more than tinted finish. However, if you want to apply a heavy, textured glaze, you typically would apply it at the end of the layering. Unlike toners that can serve as their own barrier layer, glazes always need to be topcoated.

Glazes make a leg look old. *The author used glazes on three legs of a table (above) to match a leg that had darkened from iron reacting with tannin. He applied a tan base color and then defined the pores and grain patterns with darker glazes.*

Wiping off a glaze changes the look. *To show how color and texture can dramatically change, the author brushes and then wipes off a burnt umber glaze on one of the oak legs (right). Mineral spirits or naphtha can be used to soften or remove an oil-based glaze layer. A sampling of brushes used for texturing is in the background.*

What are glazes and toners?

Glazes and toners are special stains meant to be applied over a sealed surface, rather than applied to bare wood. Glazing stains come as liquids in cans and are most often brushed or wiped on with a cloth. Toning stains come in aerosol cans (see the sources of supply box on p. 79). The pigments used as colorants in glazes make them opaque. Toners usually are a lacquer-based solution of dye and/or pigments. They're almost always thinner and more transparent than glazes, but here's where the terminology can get confusing. What some finishers call toner, others refer to as shading stain. Likewise, glazing is sometimes called antiquing. To distinguish some of the terms, I put together a glossary of common colorants (see the box below).

Great for restoration jobs and color matching

Old finishes are not uniform. They become worn in places, faded in others. They accumulate dings, dirt and wax from being used and polished over the years. To match the finish of an old piece of furniture, you have to fake the patina it has acquired, which can

Glossary of common colorants

The two most common colorants are pigments and dyes (not including substances that chemically alter wood color, such as bleaches). Pigment and dye stains can be applied to wood or as colored layers of finish.

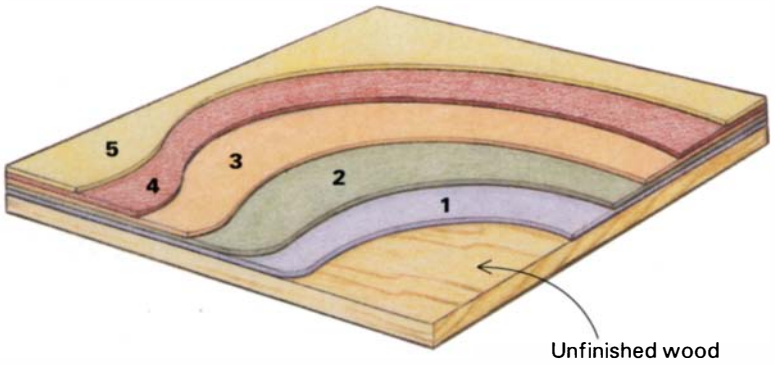
The definitions (to simplify things, I omitted paints) at right are partially adapted from several manufacturers' literature and from Bob Flexner's book *Understanding Wood Finishing: How to Select and Apply the Right Finish*, Rodale Press, 33 E. Minor St., Emmaus, PA 18098; 1994. *—D.C.*

Pigments: Ground opaque particles that, when added to a binder, color wood at the surface, lodging in pores, scratches and defects. Pigment stains vary from semiopaque to semitransparent and fade slowly. Pigments are a key ingredient in glazes (see *FWW on Finishes and Finishing Techniques*, pp. 78-79).

Dyes: Tiny particles that color wood or dissolve in finish to add a transparent color layer. Dyes penetrate deeply but are known to fade. Because of their clarity, dyes offer good depth and grain readability. Dyes are often used for toning (see *FWW* #114, pp. 72-76).

Anatomy of a layered finish

A layered finish can add depth to a piece, adjust color, obscure or pronounce detail, add an aged look and permit easier repair to the finish. The order of the layers can vary. The illustration shows just one example.



1) Tint, fill pores and dye or stain flat grain.

2) Apply sealer (may be colored).

3) Add toning layers and barrier layers (if needed).

4) Use glazing layer for final color adjustment and surface texture.

5) Apply topcoat(s) to seal, give protection and add sheen.

be complex. Mixing up trial stains (see *FWW* #110, pp. 49-51) could get you the right color, but stains ordinarily are used directly on the wood. Once applied, they are difficult to remove. By contrast, glazes and toners are layered over a sealed base (see the drawing above). Glazes can add an unusual color or mimic a grain pattern. Toners can blend in a repair, hide a wood defect or create a special effect, such as shading. I use toners more than glazes, though I often use a combination of both in the same project.

Glazes and toners could be useful if you want to make new work look old or add a special look to a new piece, like a sunburst. Glazes and toners conceivably could give more mileage to an undesirable piece of wood. For example, a glaze could be applied to a board to simulate figure. Or, to get wider stock for a panel, you could tone the sapwood so it matches the heartwood.

To lock in a layer, use a barrier

Glazes and toners can be layered one over the other or separated by a clear film (barrier) of finish. When you don't want to disturb what's underneath, you should spray on a barrier layer. I use nitrocellulose lacquer mostly and sometimes shellac. I avoid water-

Stains: A broad label applied to any mixture of pigments, dyes, resins and solvents that alters wood color. The percentage of pigment affects the clarity: Glazing and pickling stains are semiopaque, pigmented stains are semitransparent and penetrating stains are quite transparent (see *FWW* #101, pp. 66-69).

Glazes: A fairly thick oil-, varnish- or water-based stain that contains pigments. Glazes are usually brushed or wiped over a sealed surface and spread or partially removed as (or just after) the thinner evaporates. Glazes are used for antiquing, coloring pores, accenting grain patterns and adding depth to carvings and turnings.

Toners: Fast-drying solution (usually lacquer) containing dyes and/or pigments applied to a sealed surface to alter the color. Toners are sprayed on the entire surface and left to dry. Pigmented toners tend to obscure the under-color and detail; dye toners are more transparent.

Shading stains: Designed for highlighting, shading stains are specialized toners that are applied to specific areas. They can give a shaded appearance to a surface or blend regions of color. Tinting lacquers are similar products that build quickly and are used to unify tones.

Drawing: Heather Lambert

***A glaze patina**—The author applies dark glaze to a corner block for an old door frame to emphasize its age. After a light wash coat, he can dab on heavier coats in the recesses of the rosette and nail holes to simulate an accumulation of dirt.*

***Toning unifies an antique sofa table.** The author often tones and glazes furniture parts separately. Here, he sprays the legs and stripped table edge with a red mahogany toner. He used pigment from a can of dark stain to glaze the edges of the stretcher. The legs were wiped with this glaze, left to dry and then shellacked.*

***Toner used as a shading stain**—To simulate a table with a faded center, the author shades the edge of this mahogany top with a dark toner. After he rings the top with light, even coats, he can refine the look and color by spraying other toner bands.*

borne lacquers because they can cause compatibility problems.

A barrier can lock in a layer of color and let you, with care, alter a subsequent layer without damaging what's under it. Lacquer barriers or lacquer-based toners can help melt one layer into the next. If a glaze layer doesn't look right, it can be removed with a rag dampened with the appropriate solvent (mineral spirits or naphtha for an oil-based glaze). Each glaze, toner and barrier layer should be thoroughly dry before you do the next. Be especially careful when spraying lacquer over oil-based glazes because wrinkling can occur if each isn't allowed to dry thoroughly. I use several thin coats of lacquer or shellac, so any solvent will evaporate completely. Certain shellacs can introduce yellowing; however, that might be what I need to give the piece a golden, aged look.

Glazes are applied and then manipulated

Glazes develop a bite on an undercoat as the solvent evaporates, but they still offer plenty of working time (5 to 10 minutes). I apply the glaze over the surface and work it until the brush starts dragging (see the photo at left on p. 76). This happens as the glaze turns flat. I can use a brush or rag to remove glaze from the high spots, leaving it in the recesses (see the photo on p. 77).

Sometimes I use a dry-brushing technique, which is glazing with an almost empty brush. The bristles stay soft, not tacky or stiff as they would if the glaze were drying. Dry brushing offers the most control for putting down a minimal amount of glaze. To soften an oil-based glaze, I apply mineral spirits or naphtha after the bite occurs. This gives me a bit more time to experiment and is especially useful when I'm matching wood patterns or texture.

Viscous glazes applied over a nonporous surface can be manipulated with rags or brushes to produce special effects. Marbleizing, graining, faux-finishing and antiquing are all forms of glazing. Glazing brushes come in an assortment of sizes and bristle types. Many finish-supply stores carry a good selection of them.

I prefer oil-based glazes because of better compatibility between brands and because the solvents don't rapidly affect the previous layers I've applied. To get started, it's a good idea to practice with just a couple of glazes from one product line. Then you can expand your range with confidence. As you get better, you can use glazes in more creative ways (see the top photo at left).

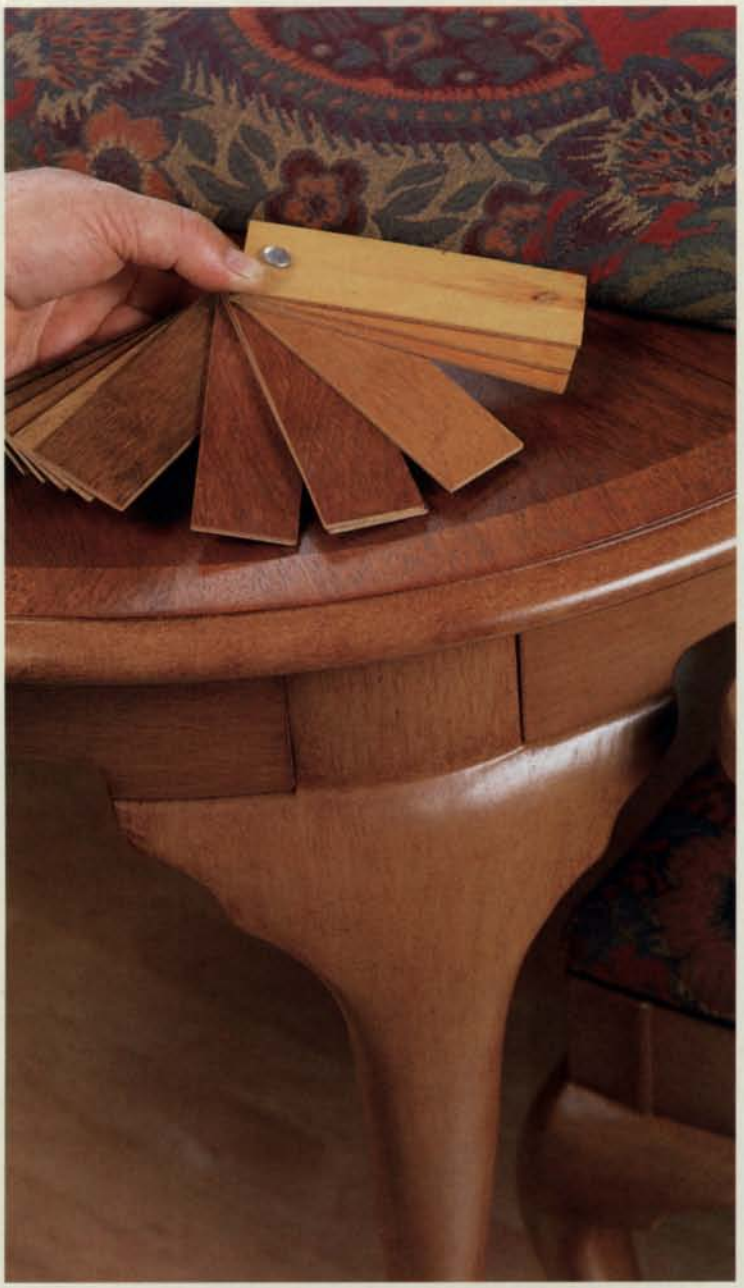
Toners are sprayed on and left to dry

Toners come in many pigment and dye combinations ranging from opaque to transparent. Transparent toners can be layered to adjust color without losing the distinction between the pores and the flat grain. I probably use transparent toners the most. They're ideal for shading (see the bottom photo at left) and for blending colors on components of an original piece (see the center photo). Using opaque toners can be like glazing. The color becomes muddier and the wood lacks grain definition, but this can be an advantage when, for example, I need to disguise a blemish. The thickness of the layer can be varied to get more opaqueness, too.

You can make your own toners by mixing dry pigments and/or alcohol-soluble aniline dyes in shellac or lacquer. For toning (shading) specific areas of furniture, I mix up a shading stain using lacquer and a low concentration of dye. I apply the shading stain in three or four thin layers so that I can sneak up on the color and not overdo it. I can always add another light layer, but if the color is too dark, it's nearly impossible to lighten uniformly. Every job hones your application skills and perception of color. □

David Colglazier and his wife, Laurie, own and operate Original Woodworks, an antique furniture and trunk-restoration company in Stillwater, Minn.

Color matching made easier



***Stain sticks aid color choices**—Guided by a fan of stain sticks, the author chose a glazing stain for this tabletop. The samples also helped the customer come up with a color that makes the veneer band look natural and blend with the chair fabric.*

I often have to match colors that a client or a decorator has selected. It can be tricky finishing a piece so it goes well with a rug, the wallpaper, the couch fabric, the curtains and the other wood in the room. There are three things that make my job easier: a color wheel, stain-sample sticks and the proper lighting.

Color correction is the art of knowing which color additives are needed to make a certain hue. For instance, red can warm up brown, and green can cool it. As simple as this sounds, the permutations of hue become far more numerous by adding black and white to darken or lighten the color.

Interestingly, men have more difficulty at color matching than women because more men have color blindness in the red and green regions of the spectrum. I don't have this problem, but even so, I still need help with color decisions. I use a primary color wheel. Grumbacher wheels (called Color Computers) are available from Star Finishing Products (see the sources box at right). The wheels come with directions and a summary of color theory.

Stain sticks, a collection of stir sticks that are already stained, are also helpful. The sticks (I use Old Masters brand, but you can make your own) are pinned at one end like a set of feeler gauges. I can fan them out (see the photo above) and ask the customer to determine the color direction. I don't have to make up a wall full of sample boards.

Back at the shop, I try to match colors under the same light that will be used to view the piece. True colors can change as a result of the light source. For example, incandescent light is rich in red; fluorescent light is predominantly blue. A balance of cool-white and full-spectrum fluorescent bulbs is pretty close to sunlight.

Recently, I replaced the fixtures in my shop with T8 lamps made by Philips, which use triple-phosphorous tubes. The tubes are very efficient. The light has a warm color temperature and a more natural look in the shop. They've made color matching much easier. —*D.C.*

Sources of supply for toners and glazes

Constantine, 2050 Eastchester Road, Bronx, NY 10461; (800) 223-8087

Liberon/Star Supply, P.O. Box 86, Mendocino, CA 95460; (707) 937-0375

Mohawk Finishing Products, Inc. (H. Behlen & Bros.), Route 30 N., Amsterdam, NY 12010; (800) 545-0047

Olde Mill Cabinet Shoppe, 1660 Camp Betty Washington Road, York, PA 17402; (717) 755-8884

Star Finishing Products, Inc., 360 Shore Drive, Hinsdale, IL 60521; (708) 654-8650

The Woodworkers' Store, 4365 Willow Drive, Medina, MN 55340; (800) 279-4441

Woodworker's Supply, Inc., 1108 N. Glenn Road, Casper, WY 82601; (800) 645-9292

Gluing with Paste

Simple to make, nontoxic and reversible

by Keith Davis

Adhesives lining woodshop shelves range from traditional animal-hide glue to modern epoxies. But there's one adhesive that gets scant attention: flour-based paste, a material that has bound books for centuries and will adhere leather and felt to fine furniture.

Paste can be just a blend of white flour and water. But if you combine flour, alum and water (see the photo above) and cook it, you'll get a paste that has several unique characteristics:

- It is reversible and removable.
- It sets up and dries slowly, so you have plenty of working time.
- It soaks into many materials, softening and filling pores.
- It contains no hazardous solvents and is nontoxic.

Paste won't edge-glue boards, but it has no equal for sticking labels on wooden storage boxes, lining drawers with paper, covering the interior of a jewelry chest with felt or adding a leather surface to a writing desk.

Basic cooked paste

Ask 10 paste users how to make paste, and you'll likely get as many answers. Some add sugar to the mixture, so it will keep for several weeks in the refrigerator. Wallpaper can be hung with a simple wheat paste that's made cold. Other recipes call for rice flour, which makes a light-colored paste. And laundry starch can make an especially tough paste. I usually use the basic cooked-paste recipe shown in the box at right.

Tips for smooth paste

Materials stretch with paste, which can be a curse and a blessing. Papers stretched when still wet with paste often will shrink and buckle when they dry. But stretching can be helpful when you want paper to conform to contours and leather to be formed into irregular shapes.

To apply paste, I use an inexpensive bristle brush with the bristles cut off about half length. Use single, one-way strokes of the brush to minimize stretching. If you're gluing porous materials like leather, coat both surfaces, and leave them wet-side up for several minutes. Wipe off any excess globs, and apply a thin second coat of paste. Again, wait a few minutes. Paste the two materials together, pressing down evenly. Extremely thin leathers or pigskin may weep paste when pressed down. Wipe off any squeeze-out with a dampened cloth or paper towel.

Labels and thin covers glued with paste must be rubbed down well. I cover the label with plain paper and use a stick of hardwood or a bone folder (a small book-making tool made for folding and pressing paper) to rub out the label. Then I lift off the paper and throw it away. If you have lots of pasting to do, such as drawer labels, you can brush the paste onto a piece of glass, place labels on the paste and lift them from the glass with a knife point.

If you're lining drawers with felt or velveteen, use a stiff batch of paste so it doesn't bleed through. Mix the paste with a few less tablespoons of water, and apply the paste to the wood only. Press the precut material in place, and smooth it using a print roller, a dull straightedge or an old credit card. □

RECIPE FOR PASTE

This recipe yields about 1 cup of paste.

¼ cup white flour

1/16 tsp. kitchen-grade alum (to prevent spoilage)

1 cup cold water

Combine the flour and the alum. Add ¼-cup water, and stir well to eliminate lumps. Add about ¾-cup water, and stir well with a wire whisk. Bring the mixture to a boil over medium-high heat. Boil for one minute, constantly stirring the paste. The mixture may thicken when cooled, but you easily can thin it as needed with tap water.

Keith Davis repairs musical instruments in Iron River, Mich.

Photo: Scott Phillips

Cutting Through Dovetails

Pins or tails first: a case for each

by Vincent Laurence

I was trying to explain to someone years ago why I'd just taken a job as an apprentice woodworker after spending four years and $70,000 on an English degree. Suddenly, in the midst of my explanation, his eyes lit up. "You mean," he asked, "you're going to learn how to make dovetails?" He understood.

There's good reason for the lofty esteem accorded the dovetail joint. Even without glue, dovetails are very strong. And they've proven their reliability for well over three millennia. Much of their contemporary allure, though, has nothing to do with strength or reliability. Finely executed, hand-cut dovetails are a testament to the skill of the craftsman who made them.

It takes practice to cut a dovetail joint well, but the joinery is relatively simple. Two pieces of wood are connected with interlocking pins and tails. There are only two methods of cutting dovetails by hand: cutting the pins first and cutting the tails, or pin sockets, first (see the stories on p. 82). Both methods work. But advocates of each method tend to be passionate about the advantages of their approach and the obvious flaws in the other. With this in mind, we asked two of our contributing editors, a pair of woodworkers with 99 years of cutting dovetails between them, to tell us how and why they cut dovetails the way they do. Their methods and tools may differ, but both cut flawless dovetails that will last generations. Here's what they had to say.

Vincent Laurence is an associate editor of Fine Woodworking *magazine.*

Pins first

***TAGE FRID** immigrated to the United States from Denmark in 1948. A furnituremaker for 67 years, he also taught woodworking for nearly four decades.*

Continued next page

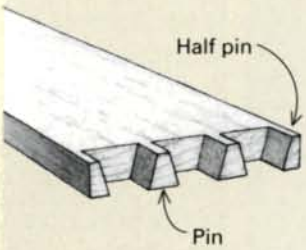
Tails first

***CHRIS BECKSVOORT** builds custom furniture in New Gloucester, Maine, and does restoration work for the Shaker community at Sabbathday Lake, Maine.*

Tage Frid: I cut pins first

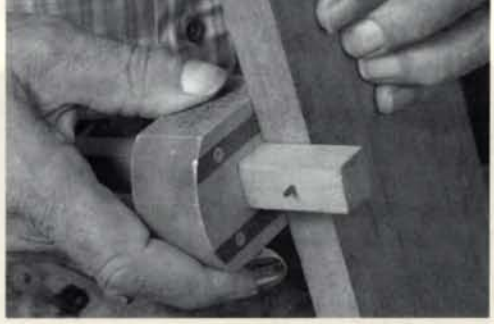
I started my apprenticeship in 1928, at the age of 13. At first, I drove a push cart, delivering furniture around the city of Copenhagen. After a year, I told the master to whom I was apprenticed, "All right, I know how to drive the push cart. I'd like a bench now, so I can learn some woodworking." Within a month, I was cutting dovetails. I've cut quite a few since then and have taught hundreds of students.

Pin board

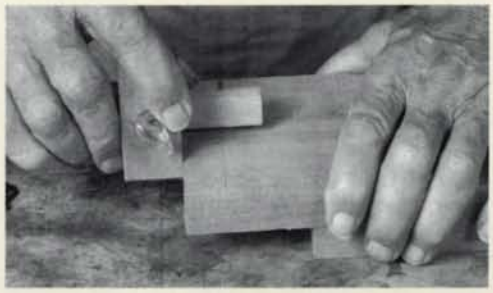


Cutting the dovetail pins first makes sense. It's easier to hold the pin board in place to mark the tails than it is to hold the tail board against the end of what will be the pin board. Also, the walls of the pins provide a good surface for the awl as you mark the tails. And by marking from the inside of the joint, the angle of the pins will cause the awl to cut cleanly across the face grain of the tail board rather than follow the grain.

Another reason to cut the pins first is that when accuracy counts—when cutting the second half of the joint to fit the first—you're cutting to a line on the face grain, not on the end grain. It's easy to split this line right down the middle (but be sure the sawkerf is on the waste side of the line). Doing that in the end grain is almost impossible. It's easy to lose the line in the end grain with the first sawcut. By cutting the pins first, I don't have to worry if the saw bounces around a little on the end grain—I just cut the tails to fit. *—T.F.*



Set the marking gauge 1/64 in. wider than the stock, *so the pins and tails will protrude slightly.*



Gauge the baseline *on both sides of both boards being dovetailed together.*

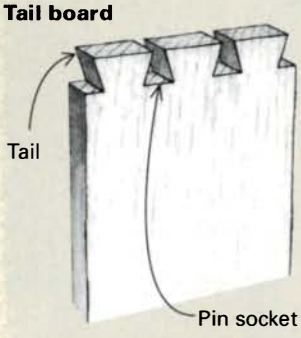
Mark pins and half pins *on the end of the board. You can space them by eye, or use a ruler for more consistent spacing. A pencil mark is plenty accurate at this stage, because the pins are the first parts of the joint to be cut.*

Chris Becksvoort: I cut tails first

The first time that I made dovetails, I consulted a woodworking book. It stated, in no uncertain terms, that the pins had to be cut first. Also, my father, a European-trained cabinetmaker, insisted that dovetails must be cut pins first.

But because I was a teenager with an attitude, I took these stern pronouncements as a challenge. I made the tails first, and I have been doing it that way ever since.

Tail board

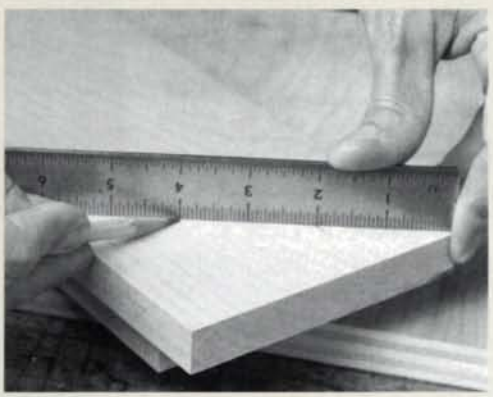


I find that this approach is more efficient because I can cut the tails for a pair of boards at the same time by taping them together. And because I'm not trying to match tails to pins, the cut isn't critical. When it comes time to mark the pins from the tail boards, accuracy *is* critical. And that's another reason I prefer cutting the tails first.

I think a knife is the most accurate tool for transferring position, more accurate than an awl and far more accurate than a pencil. But a knife will tend to follow the grain on the face of a board, which is the surface that you're marking if you use the pins to lay out the position of the tails.

When cutting the tails first, I end up marking out the pins on end grain. The knife doesn't drift or wander with the grain; it marks out the pin locations with great precision. Then I saw just outside the line and pare to the line. The result is a tight, strong, attractive joint every time. *—C.B.*

Scribe a baseline on both sides of all the boards you're dovetailing. *For boards that are the same thickness, you need only one setting—the thickness of either board. When the pin board and tail board are different thicknesses, the thickness of each determines the baseline for the other.*



Lay out center lines for the pin sockets on the tail board. *For a board with two pins, I divide the board into thirds, as shown. There's also a half pin at each end.*

Drawings: Christopher Clapp; photos: Vincent Laurence

Use a bevel gauge to extend pin and half-pin marks *across the end of the board. A 1:6 ratio is about the right angle for most hardwoods.*

Extend the pin marks down to the baseline *using a combination or try square.*

Cut to the gauged baseline. *Split the line with the sawblade on the waste side.*

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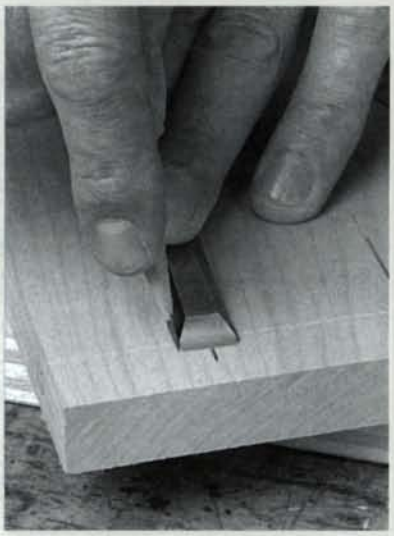
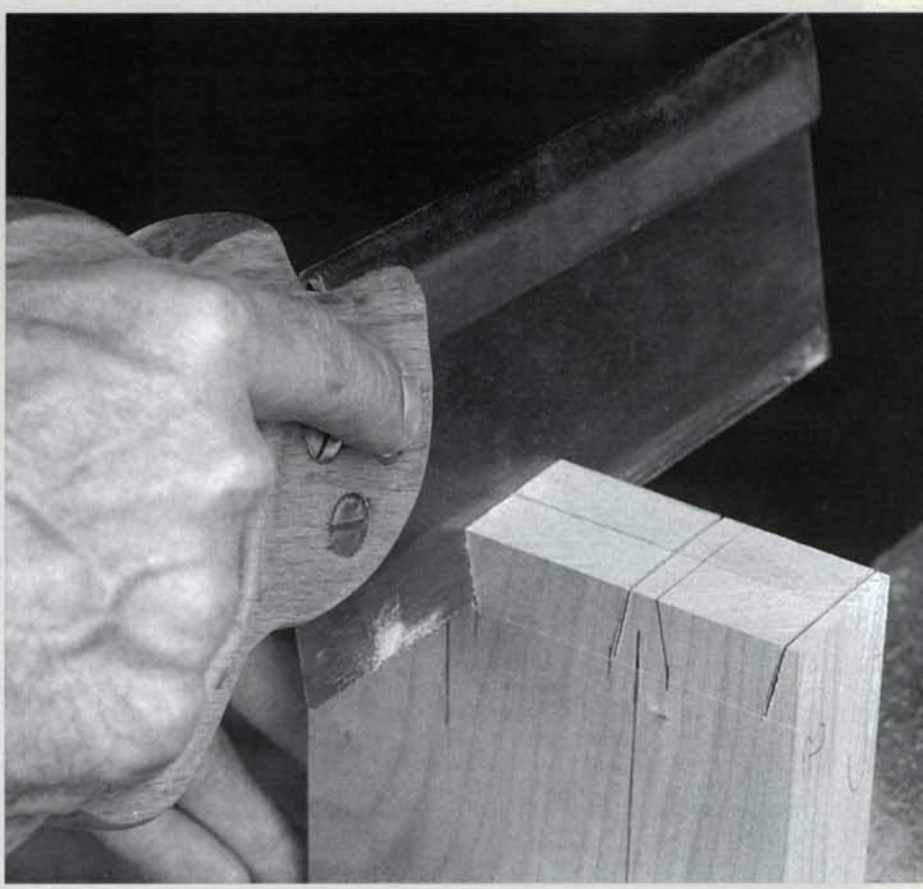


Use a chisel to determine the width of the pin sockets. *This makes chopping the sockets much more efficient. Place the chisel over the center-line, and use a pencil to mark each side. Then mark out the half-pin sockets on the ends.*

Mark the angles of the pin sockets *with a dovetail gauge or a bevel square. Transfer these lines across the end grain. Now tape the two tail boards together, so you can cut pin sockets on both at the same time.*



Cut the tails. *You can use a handsaw, a scroll saw or a bandsaw with a fine blade to make cuts to the baseline. Remember to cut on the waste side of the line. Also, cut the two half-pin sockets now.*

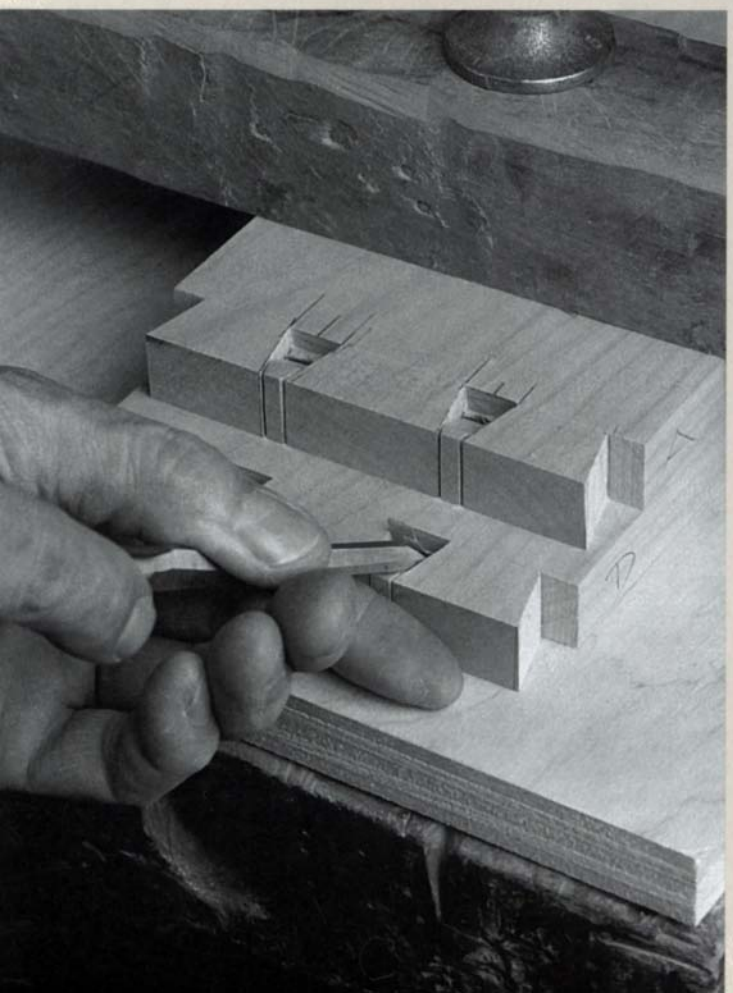
Frid: Pins first *(continued)*

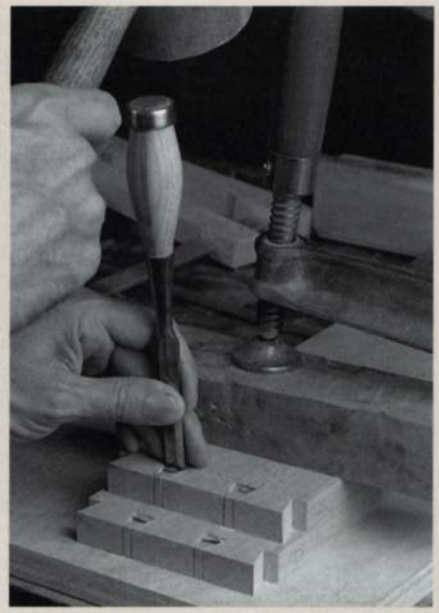
***Deepen the baseline** with the corner of a chisel **(near right)**, and then chop a slight bevel to the baseline from the waste side **(far right)**. This will prevent fibers from tearing out beyond the baseline when removing the waste between pins.*

***Alternate chopping from the face of the board and the end (photos right).** When chopping on the face, hold the chisel in at a slight angle so that the tail slot is undercut. Chop just about halfway through the board. Flip the board over and repeat.*

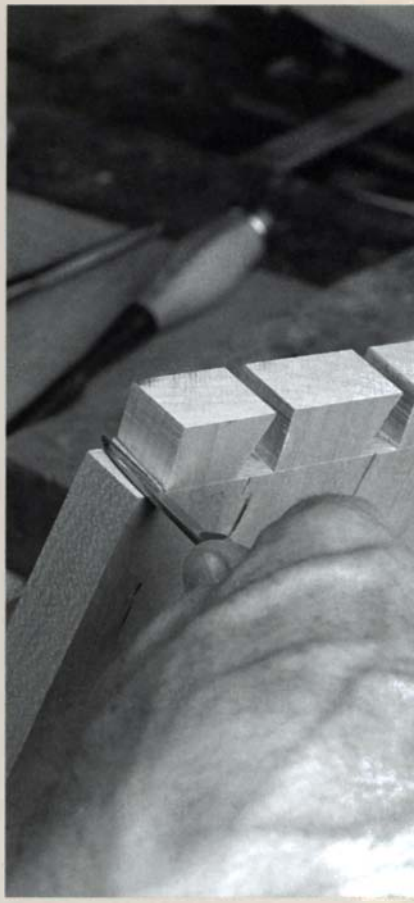
***Continue chopping the board** until the remaining waste drops out.*

Becksvoort: Tails first *(continued)*

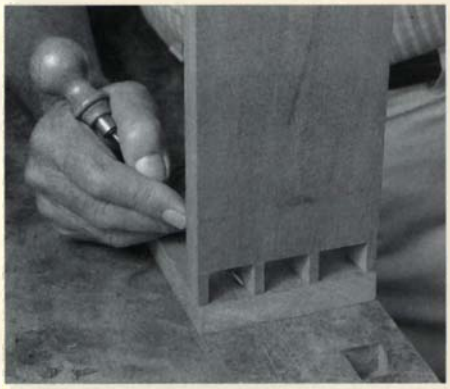


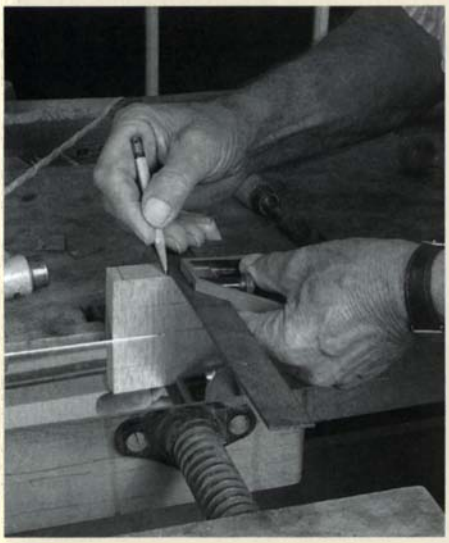


***Chop out the waste.** Start by creating a small groove on the waste side of the baseline. Then chop alternately in at a sharp angle **(left)** and downward at a slight angle **(above)**. Don't chop in from the end of the board yet. Keeping the corner intact prevents tearout when the waste is removed from the center of the socket. Once you've chopped about halfway through the joint, flip the boards over and repeat. This time, though, chop from the end.*

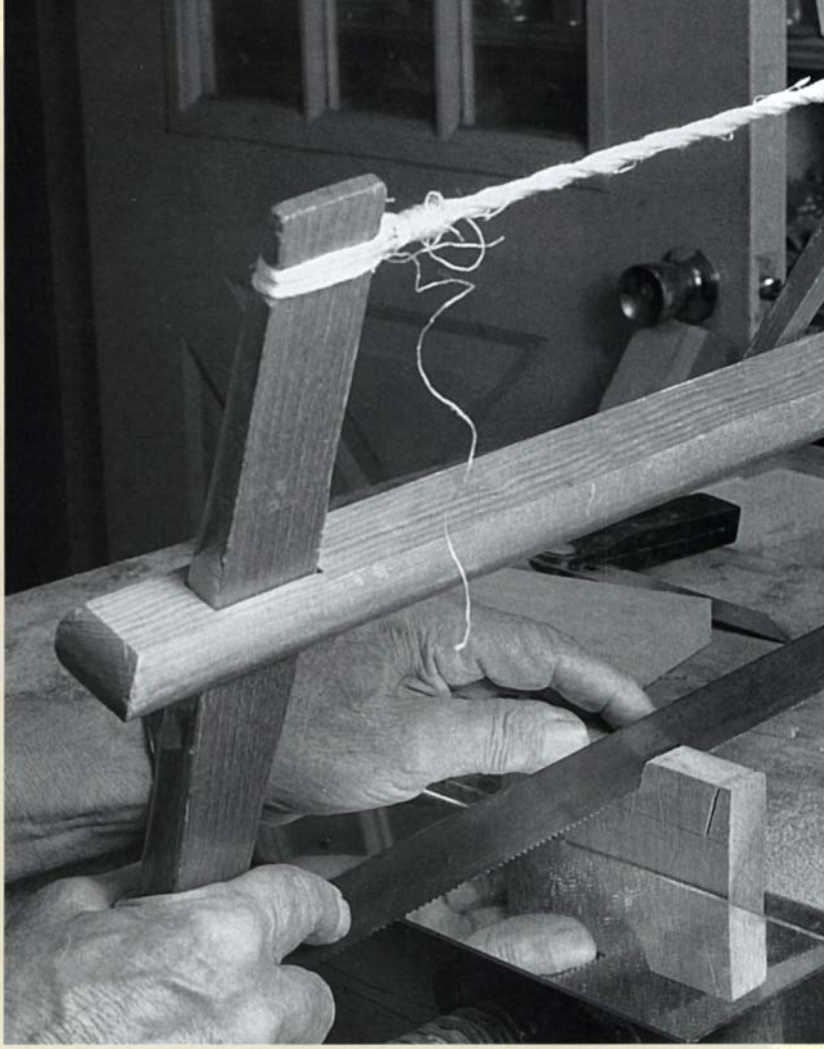


***Use a chip-carving knife** to clean the corners.*





Mark the tails from the pins (top left). *Hold the pin board securely in place on the tail board. The edges of both boards should be flush with each other and the inside face of the pin board should rest on the baseline of the tail board. Scribe the tail layout from the inside of the joint so that the awl follows the pins, not the grain. Extend the marks across the end of the tail board* ***(bottom left)****. Then cut the tails down to the baseline* ***(right)****. A mirror makes the layout lines easier to see. Split the line on the waste side.*



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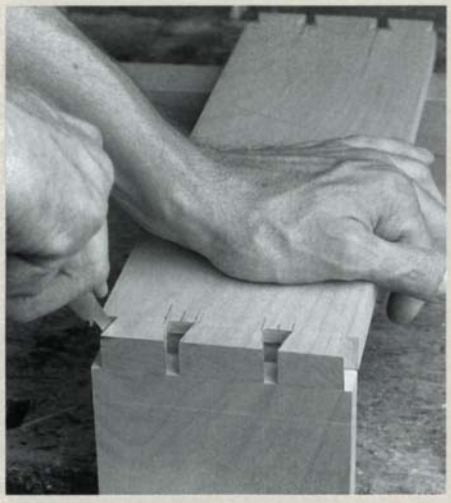
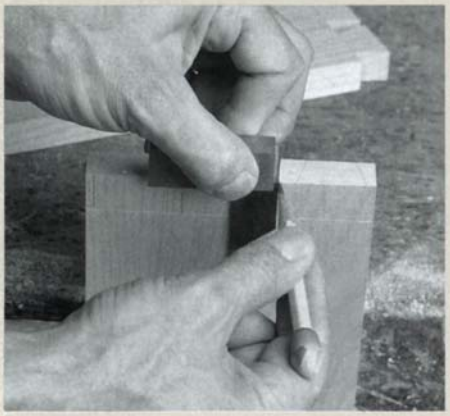
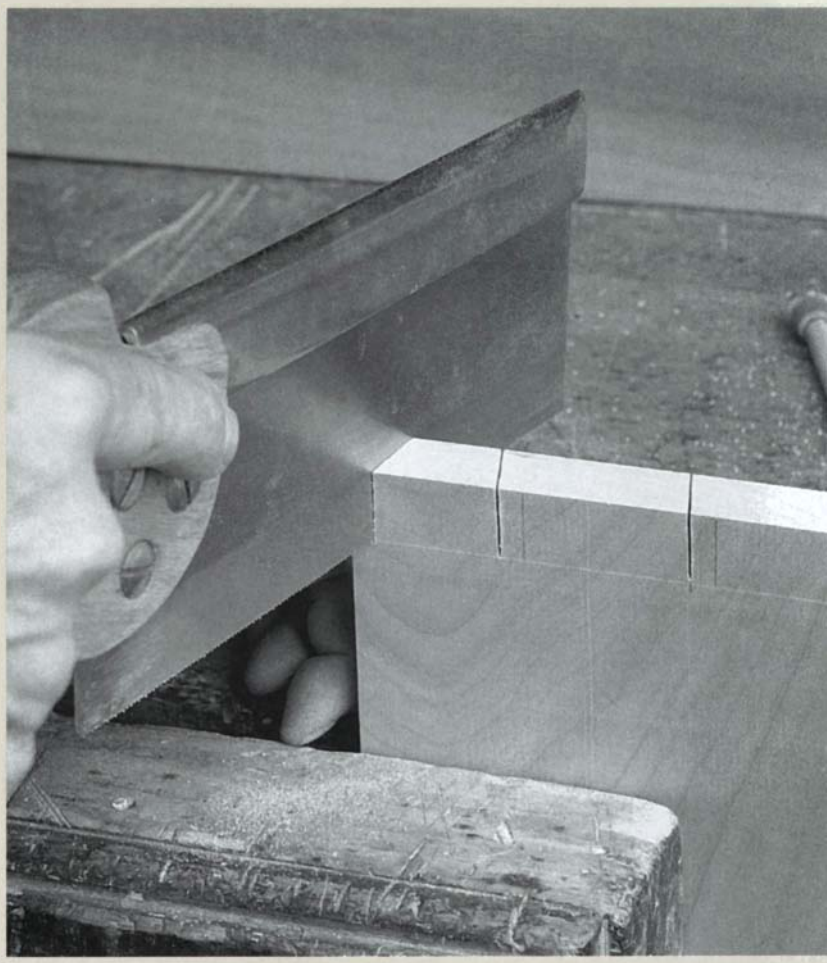


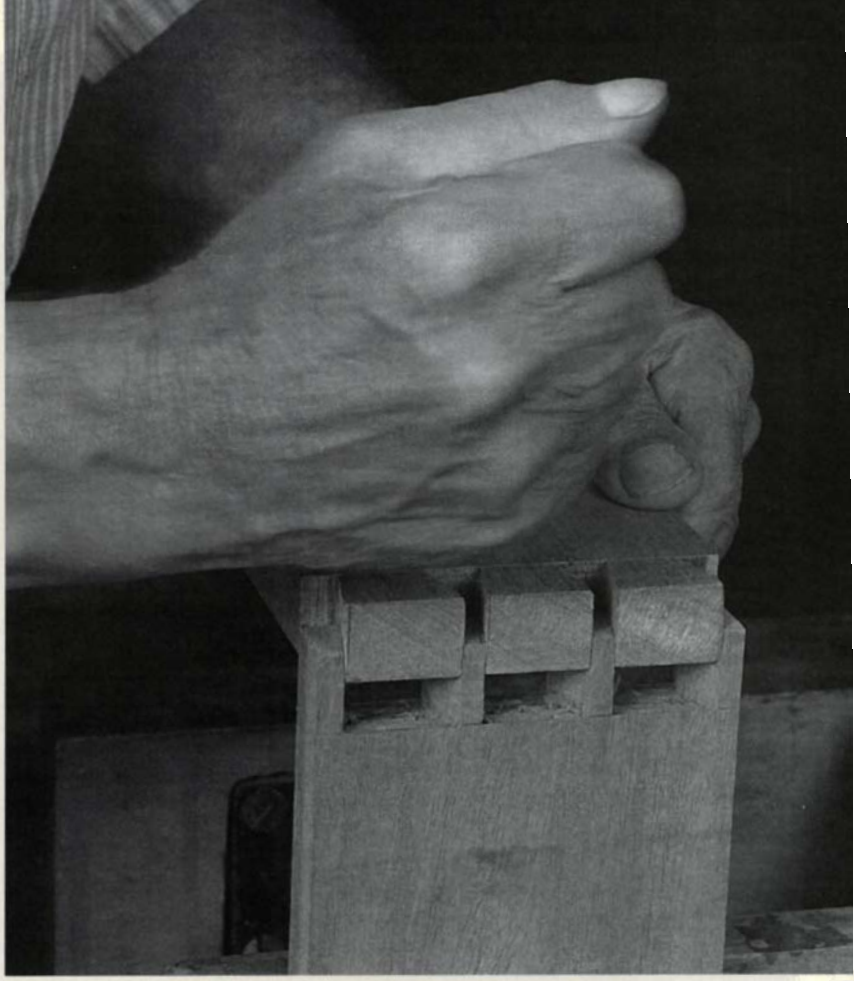


Mark out the pins from the tail board. *Clamp the pin board into a vise, and set the tail board perpendicular to it. Make sure the edges of both boards are flush, and be sure the inside edges of all the sockets align perfectly with the inside corner of the upright board. Apply pressure to the top board, and mark the dovetails with a sharp knife* ***(top left)****. Extend the pin marks down the side of the pin board using a small square* ***(bottom left)****. Cut down to the baseline on the waste side of the line* ***(right)****.*



Frid: Pins first *(continued)*

With an awl, connect the baselines *from both sides of the board* ***(top left)****. Chop away the waste between the tails, first creating a little bevel to prevent tearout at the baseline. Alternate chopping from the end and face until you're halfway through the board* ***(bottom left)****. Then flip it over and repeat. Clean out the corners* ***(below)****. The little bit of wood remaining at the base of the tails often prevents dovetails from closing.*



Check the fit, make any necessary corrections and tap the joint closed. *It should go together with a light tap of your hand. Don't forget that the joint will swell when you apply the glue.*

Becksvoort: Tails first *(continued)*

Chop out waste between pins. *Clamp the boards so their inside faces are up* ***(top left)****. This prevents the chips from becoming wedged between the pins when you finish chopping out the waste from the other side. When you're about halfway through, turn the boards over and re-clamp* ***(bottom left)****. As with the tail boards, once you've flipped the boards over, you can chop in from the end. Pare to the line with a chisel* ***(below)****.*

Test-fit the joint. *If you've cut and pared right up to the lines, the parts should fit like they were made for each other, a snug friction fit that comes together with a light tapping of your fist.*

Shaker Sewing Stand Remains Stylish, Practical

A two-way drawer hangs beneath a rectangular top

by Robert Treanor

Shaker sewing stands have a simplicity and a charm that few other pieces of furniture can match. Although I don't sew, and have buttonless shirts to prove it, I am drawn to these small stands. And that's not just because I like Shaker furniture. The stand's convenient size and two-way drawer (see the top drawing on p. 88) make it useful for any household—as an end table, a night stand or especially as a hall table. Because the table is small, it will fit in almost any entryway, providing a place to drop the mail and your keys.

Most of us are familiar with the Shaker candle stands that have round tops. In Shaker communities, round stands were great for candles, but their tops didn't hold much else. Shaker craftsmen sometimes substituted rectangular tops for the round ones and suspended a drawer or two under the top to provide additional storage. These tripod stands usually are called sewing stands, although their main purpose is debatable.

Several versions of sewing stands with under-slung drawers evolved (see the story on p. 91). The style I like best has a single drawer and cabriole-style (snake) legs, as shown in the photo above. I built this stand mostly from cherry, with a few pine

Photo this page: Kaz Tsurta

parts. Similar stands are attributed to the Hancock Shaker community in western Massachusetts and are, arguably, the most elegant. The height usually is about 26 in.

The legs on the original stand, on which my piece is based, are tenoned into the turned pedestal (a common feature of Hancock stands). The legs on my stand are joined to the pedestal by sliding dovetails. This joinery adds strength to the piece. Some original stands were built this way, and to further strengthen the connection, a metal plate (known as a spider) was secured to the bottom of the pedestal. I omitted the spider on my stand. The bottom drawing at right shows the patterns for the legs and the pedestal. I cut the leg dovetails on a router table. For the pedestal grooves, I use a jig and a hand-held router with the pedestal still mounted on the lathe, as shown in the bottom photo on the facing page. (For more on this, see *FWW* #110, pp. 72-73.)

The yoke unites the top, the drawer and the pedestal

The tabletop on my stand is 21 in. wide by 17⅝ in., front to back. I edge-joined the top from two 4/4 boards. After glue-up, I planed the top to 11/16 in. thick, and I shaped the edges all around using a ¾-in. roundover bit in my router. The radius is clipped because of the table thickness, but this slightly flattened round is intentional.

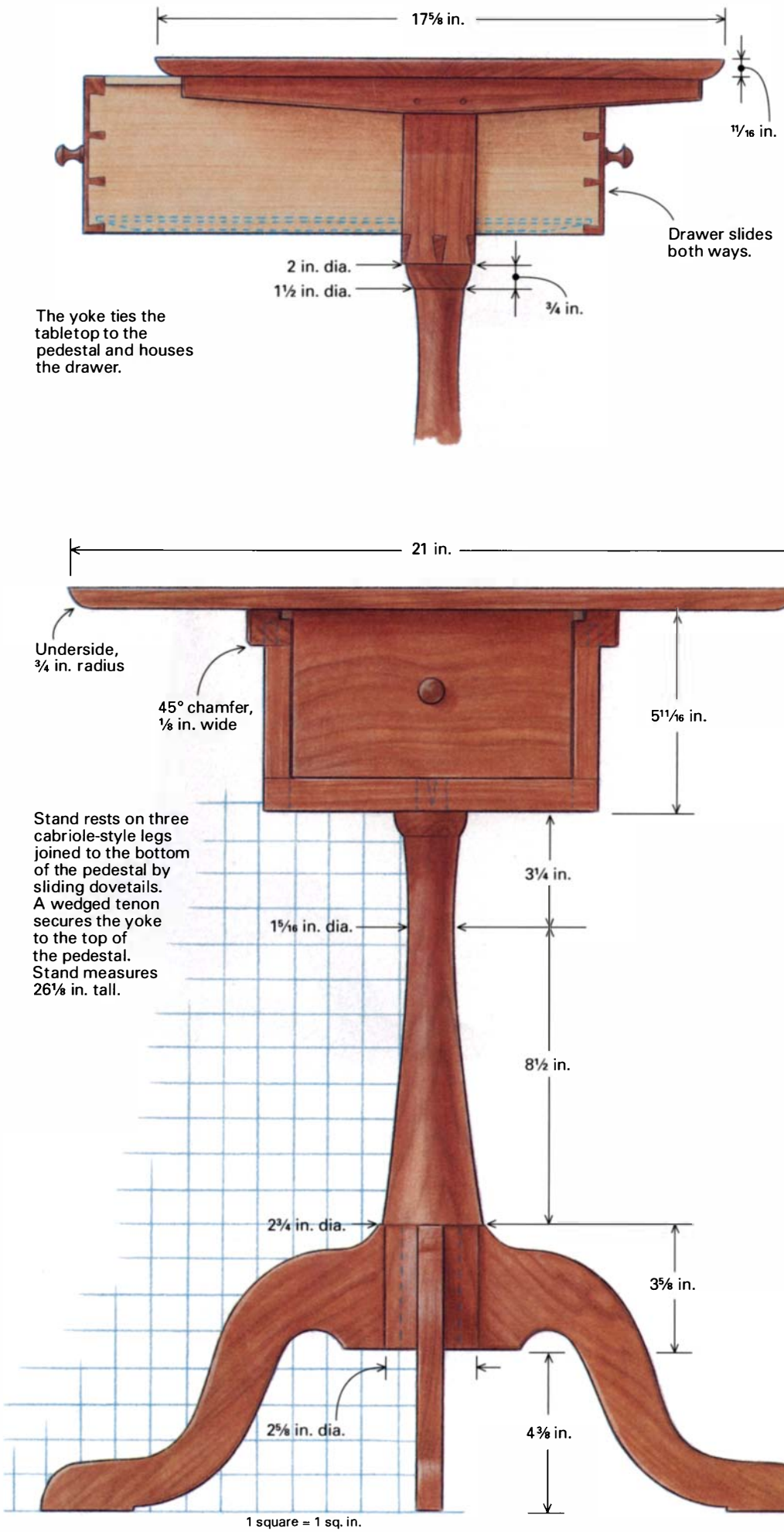
The U-shaped yoke that houses the drawer and attaches the top to the base distinguishes this stand from those with two drawers. The two vertical members of the yoke are joined to the crosspiece with through dovetails. The yoke could be joined with a single dovetail, but the original stand had twin dovetails. I used one in the middle and a half pin at each end.

Dovetailing the crosspiece to the uprights—I laid out the dovetail pins on the horizontal crosspiece. For accuracy, I cut the pins with a dozuki (a Japanese crosscut saw) and a chisel. When I chopped out the waste at the deep part of the pins, I guided the chisel against a square block clamped to the top of the work (see the top photo on the facing page).

I lay out the tails on the uprights of the yoke using the pins as a pattern. Just as with the pins, I carefully saw the tails and chop out the waste. Ideally, the joint will fit right from the saw. But a little paring with a chisel is often needed.

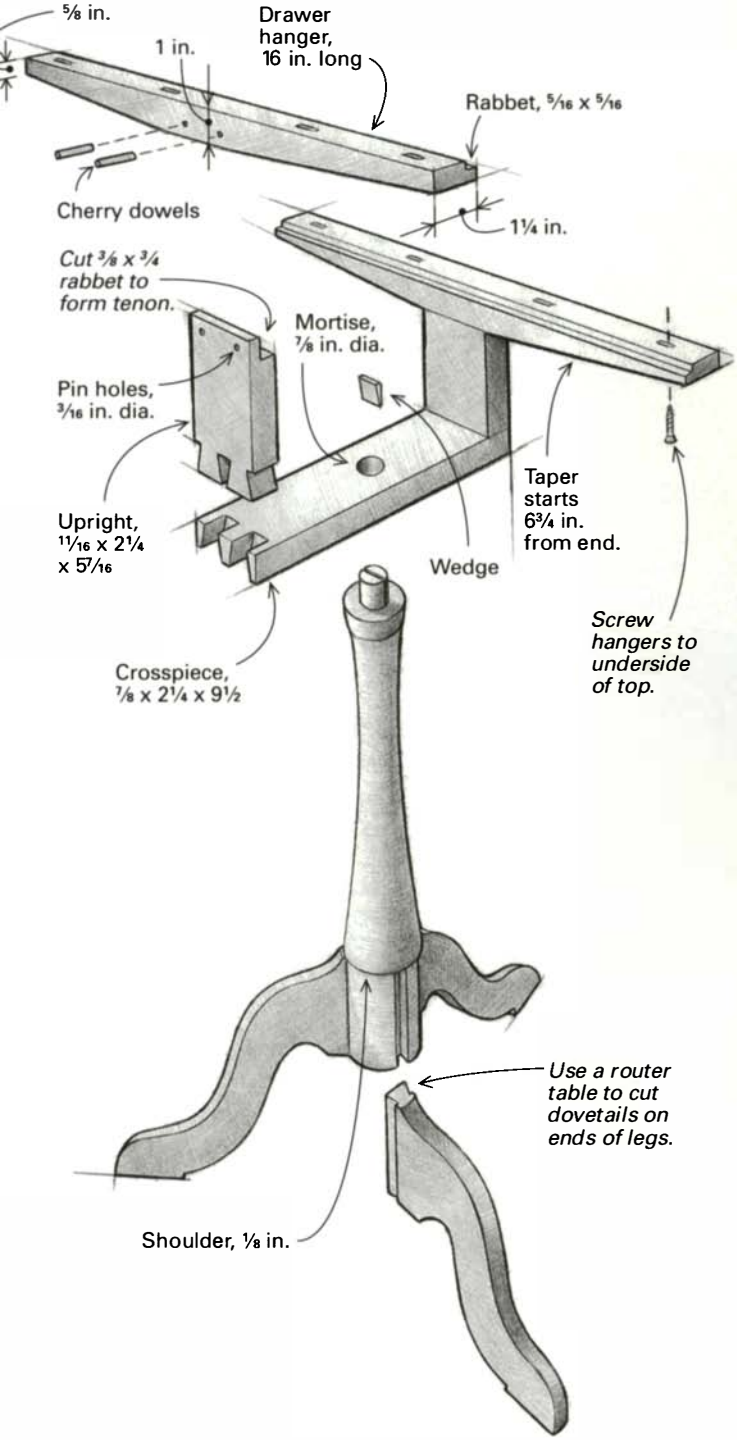
Tenoning the yoke to the pedestal—The yoke crosspiece is attached to the stand's base by a turned tenon on top of

Shaker-stand anatomy

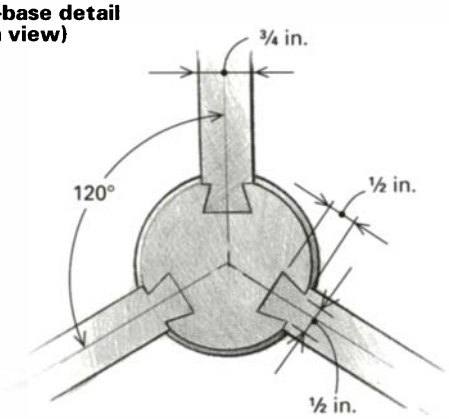


Drawings: Bob La Pointe

Yoke and drawer supports

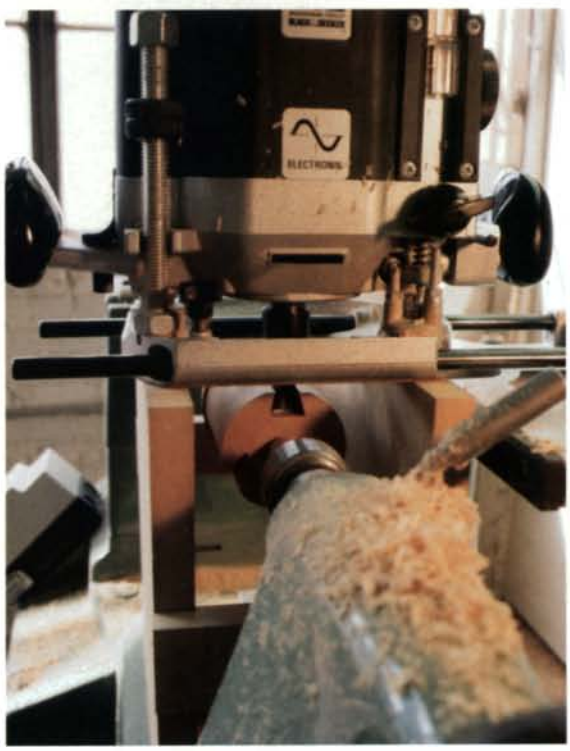


Legs-to-base detail (bottom view)



A guide block improves accuracy—*When chopping the through dovetails in the crosspiece, the author uses a block of wood to guide his chisel. The crosspiece forms the bottom of the U-shaped yoke.*

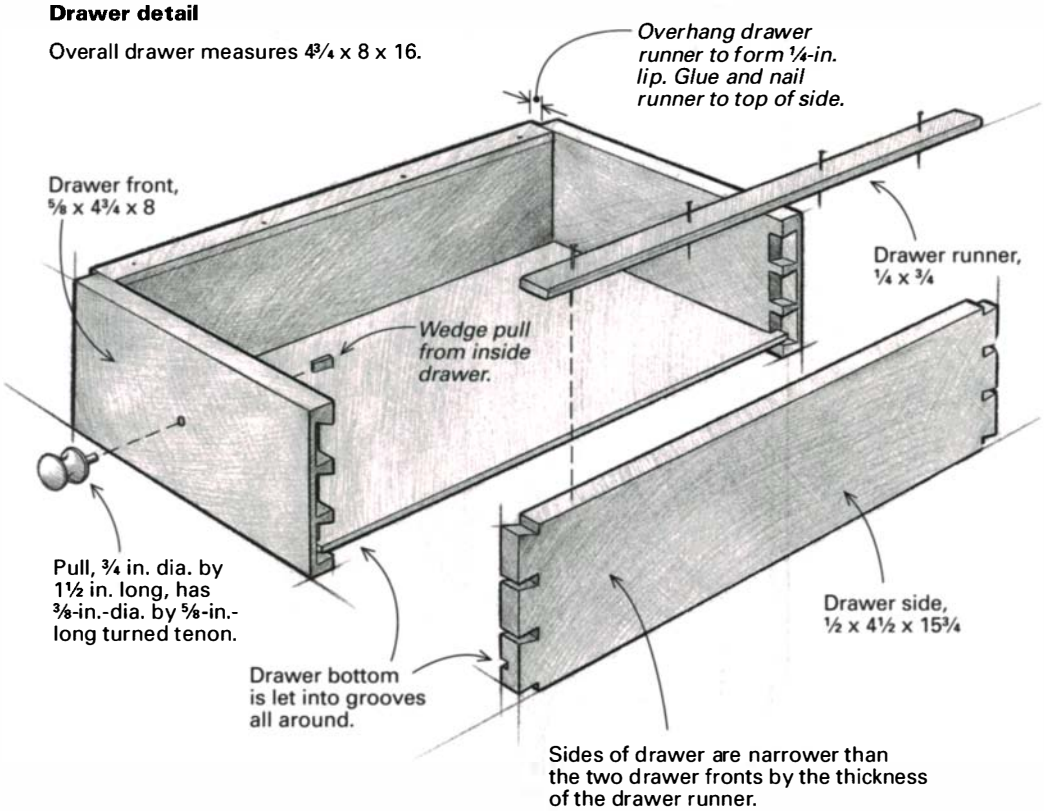
Glue and insert a wedge in the slotted tenon *to secure the yoke to the pedestal. Orient the wedge perpendicular to the crosspiece's grain to prevent splitting.*



Router jig cuts sliding dovetail sockets—*With the pedestal still mounted on the lathe, use a router to cut sockets for the leg dovetails.*

Bottom photo: author; photos except where noted: Alec Waters

Assemble the drawer with the bevel down. *The pine bottom floats in grooves in the pine sides and in the cherry drawer fronts.*



the pedestal. I sized the tenon while the pedestal was still on the lathe. I like to rough out the tenon diameter so it's slightly greater than the finished one. Then, using a gouge (you could also use a skew), I slowly trimmed the tenon down to size, stopping the lathe frequently and checking the tenon diameter with a dial caliper.

I bored the hole in the crosspiece and sawed a slot in the tenon before the yoke was assembled. Then I assembled the yoke, placed it on the pedestal and drove a wedge, wet with glue, into the tenon to lock the yoke in place (see the center photo on p. 89). To avoid splitting the crosspiece, I oriented the wedge perpendicular to the grain.

The drawer is suspended and guided by two hangers

A ¼-in. by ¾-in. runner was glued and nailed to the top of each drawer side. The runners guide the drawer in two L-shaped hangers that connect the yoke and tabletop. The hangers, tapered gently at each end, have rabbets cut in the upper inside edges to support the drawer. Each hanger is attached to the underside of the top with four screws. I counterbored the slotted holes in the hangers to recess the round screw heads. To break the hard edges of the hangers, I used a spokeshave to make a ⅛-in., 45° chamfer around the outside.

The uprights are joined to the center of the hangers with pinned tenons (see the top drawing on p. 89). It's best to cut the tenons before you dovetail the other ends of the uprights. The stand that inspired mine has two pins at each juncture, which suggests that double tenons were used. I used single tenons, but I matched the look by pinning each tenon with two 3/16-in. cherry dowels.

I joined the drawer sides and fronts using half-blind dovetails. The original stand's drawer had through-dovetailed corners, but I opted for half-blind dovetails because I think their functional, understated look goes better with the nature of this stand. The drawer bottom is let into a groove all around the inside, frame-and-panel fashion (see the photo above). The pulls, turned with integral tenons, are affixed to the two fronts with wedges from the inside. The drawer can be opened from either end. This push-me/pull-you orientation may be unique to Shaker furniture. Regardless, it makes the stand more interesting and useful. □

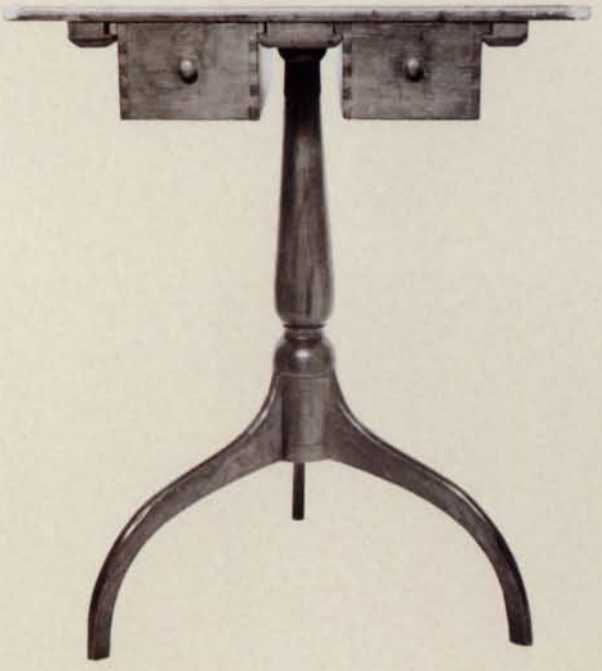
Robert Treanor is a woodworker and writer in San Francisco who specializes in Shaker and Queen Anne style furniture.

Stands change along with Shakers

by John Kassay

The sewing stand gracefully expresses the Shaker principles of economy, utility and order. Economy is reflected in the small amount of wood needed to make one. Utility and order are evident if you consider that the stands were used for sewing and other occupations of Shaker community sisters. The stands can be moved easily, and those with two drawers can accommodate two sewers.

There were several versions of the Shaker sewing stand (see the bottom photo). The differences are mostly due to regional and cultural influences. Knowing a bit of Shaker furniture history helps explain how the differences came to be.



***America's Shaker era**—Robert Treanor reproduced the tables below (from left): an early peg-leg stand, a Classic-period stand and a two-drawer stand (original shown above), the most modern of the three.*

Furniture styles driven by religion and work ethics: Shaker furniture passed through three somewhat distinct stylistic periods. The first is the Primitive period (about 1790-1820). It is marked by furniture that usually is heavy and plain in form, crudely made, but strong and functional.

In the Classic period (about 1820 to 1860), the pieces show greater utility, simplicity and perfection—all attributable to spiritual inspiration, dedication to the Shaker community and skill. This was the golden age of Shaker furnituremaking.

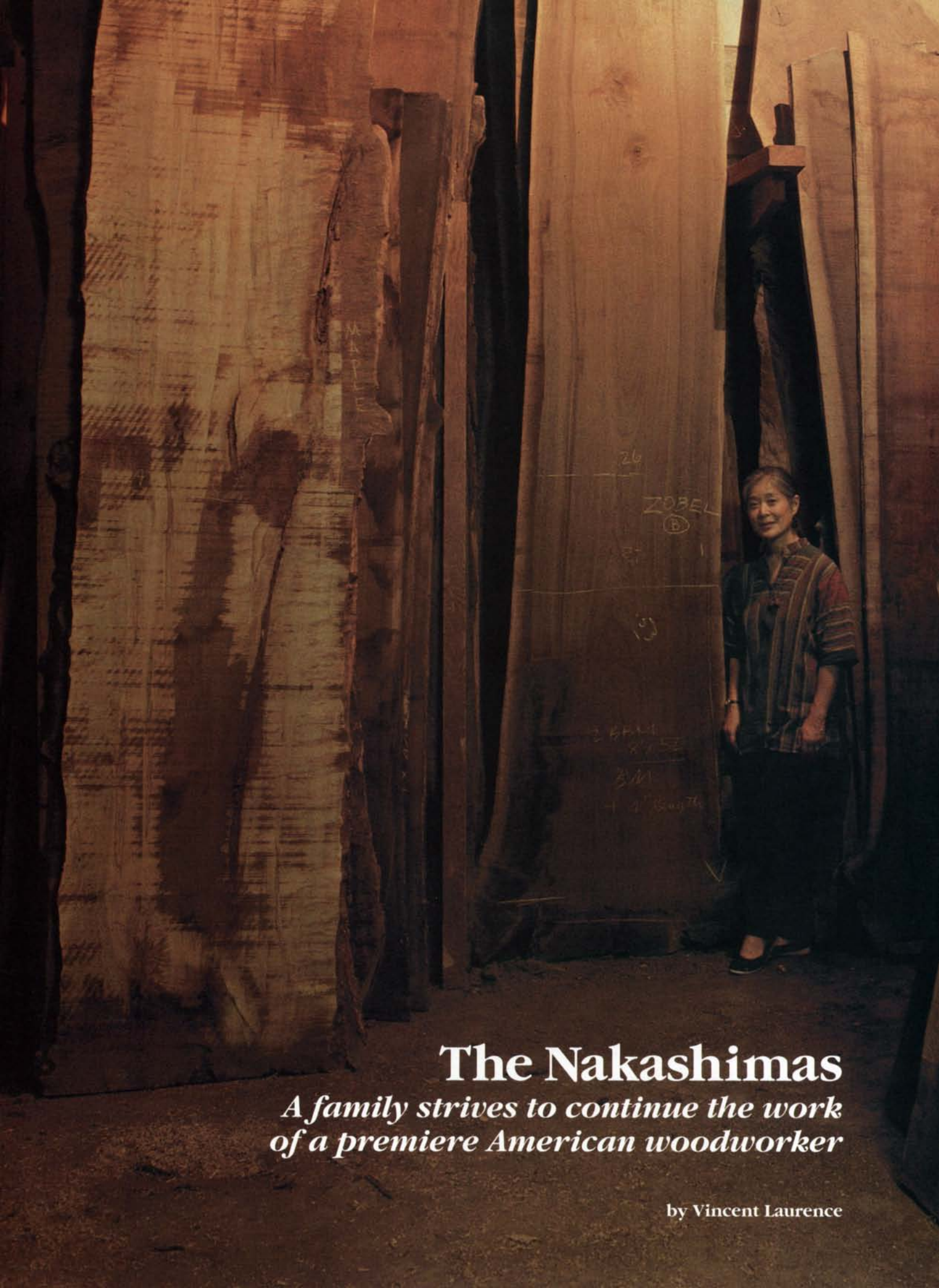
Victorian Shaker pieces, the most recent, have more decoration, such as moldings, ornate turnings, contrasting woods and fancy, commercially made pulls. These ornate elements were used to lure new members after the Civil War.

Variations on a stand: The earliest sewing stands probably had one drawer. One of the oldest stands I measured had a pedestal with three peg legs at the bottom and a turned transitional element on top, just below the drawer case. Stands with a single drawer surrounded by a yoke likely came shortly thereafter. They may or may not have Queen Anne (serpentine-style) legs, like the one shown in preceding pages.

The most recent sewing stands often have two drawers suspended from the tabletop. Cleats on the upper sides of the drawers slide in hangers. The hangers, attached to the table's underside, help retain flatness in the top. Many of these later stands had three Sheraton-style legs that give an umbrella shape to the base (see the top photo). These two-drawer sewing stands are especially popular in America and are eagerly sought by antique-furniture collectors. Like most single-drawer stands, the two-drawer variety can be opened from the back. □

John Kassay is a retired industrial arts teacher living in San Bruno, Calif. He's the author of The Book of Shaker Furniture *(The University of Massachusetts Press, 1980) and a soon-to-be-published book (by the same press) titled* American Windsor Furniture: Styles and Techniques.

Top photo: John Kassay



The Nakashimas

A family strives to continue the work of a premiere American woodworker

by Vincent Laurence

Trees were George Nakashima's life. He hiked through them, climbed them, sojourned among them. He also made his livelihood from them while he rose to prominence as a craft woodworker after World War II.

Nakashima planted trees, lots of non-native species chosen for beauty and companionship rather than utility. On the right as you pull into the driveway of his New Hope, Penn., estate is a Japanese cedar, or cryptomeria, a tree often used for columns in Buddhist temples and shrines. A little farther along is a Chinese chestnut. Down the hill by the pool are several dawn redwoods, leafy conifers native to China. Apple and cherry trees dot the property. And between the design studio and the office are two of the most beautiful Japanese maples I've ever seen. George Nakashima clearly loved trees.

Nakashima died in 1990 at the age of 85 (see the box on p. 95 for a brief biographical portrait), but his legacy and his business live on. His widow, Marion, and son, Kevin, take care of the finances. Daughter Mira runs the business on a day-to-day basis and, perhaps most important, is responsible for the firm's design work. Business, though, has slowed considerably. Although the Nakashima workshops still design and build furniture, craftsmen and family alike are finding commissions harder to come by than they did when George was alive.

A daughter apprenticed to her father

Mira is well-trained for her role as the studio's new creative chief. After obtaining architecture degrees from Harvard and Waseda University in Tokyo, she returned in 1969 to New Hope to become her father's assistant. For the next 21 years, she worked alongside George, often taking his concept sketches and turning them into working drawings.

For most of that time, their relationship was much like a traditional Japanese apprenticeship—the master never reveals anything explicitly, trusting instead in the apprentice to learn by observation. After a stroke in October 1989, however, George became much more open and communicative, explaining his designs to Mira and passing on what he'd learned in nearly 50 years of designing and building furniture.

Mira is not the only link to her father. Many of the craftsmen working under her direction, including her husband, Jonathan Yarnall, have been with the Nakashimas 20 years or more. Jerry Everett, the current foreman, started in 1970. He's responsible for most of the lumber selection these days. Two

Mira Nakashima-Yarnall is walking in her father's footsteps. *Mira is now responsible for design work at the Nakashima workshop. At right is a Conoid chair, one of her father's signature pieces.*

Photo at right: George Erml

Peace Altar II *under construction.* *It took a crew to move this altar, which weighs nearly a quarter-ton. Mira Nakashima (far left) looks on as foreman Jerry Everett measures to determine the location of the base. Mira's husband, Jonathan Yarnall, is at Everett's left.*

other employees, Mario Gioia and Adam Martini, have been working for the Nakashimas since the 1950s. Such loyalty is rare in this era, but there are rewards. As Jerry said while I was admiring some 2½-in.-thick walnut boards, 60 in. across and 14 ft. long, "You get spoiled working with this wood."

Demand for furniture output declines

Mira buys considerably less wood these days than her father once did—maybe 50 logs last year compared to the well over 100 that George bought in his last year. Even so, the Nakashimas are in no danger of running out any time soon. There are numerous woodsheds on the property, including a huge pole barn stuffed to the rafters with incredible planks from around the world. As if that weren't enough, there's another warehouse down the road in Philadelphia with more than 100,000 bd. ft. of dry lumber ready for use.

A classic endures. *Jonathan Yarnall works on one of George's most popular designs, the Conoid chair.*

One reason for buying less wood is that business, and therefore wood consumption, has been much slower lately. It's way down from the flurry of activity that followed the big American Craft Council show in 1989, "George Nakashima: Full Circle." The sales generated by that show and by a fire that same year, which destroyed nearly 150 pieces in the home of one of George's major patrons, kept the shop hopping for three years. But since 1993, business has slowed to the point where shop craftsmen now work only four days a week. One even expressed doubt about whether any of them would be around in a year. Times are hard.

Times have been hard before, though. Mira tells a story of George walking through the chair shop, muttering in a de-

Photos except where noted: Vincent Laurence

pressed tone, "Anyone want to buy a woodworking business?" Hours later, after some therapeutic rambling through the woodsheds, he returned smiling, saying, "We can't quit—we've got to use all this wood."

Still using George's designs

Much of the studio work these days is furniture designed by George, including the Conoid chair, as shown in the bottom right photo on p. 93. Many of George's designs are called Conoid pieces, named after the studio in which they were designed (see the top photo at right). It's not just production line work, though. Because the Nakashimas work exclusively with flitchsawn lumber, there are a lot of decisions to make about where to cut and join these boards, especially for the live-edged tables and desks that were among George's most popular pieces.

And a major project that George began in the mid 1980s continues today. As much a spiritual man as a woodworker, George had a dream of building an altar for each continent on the globe. The first, completed in 1986 and placed in the Cathedral of St. John the Divine in New York City, was dedicated to the peoples of North America. The second altar was being built when I visited last August (see the photo at left). It is to be placed in the Academy of the Sciences' Exhibition Hall in Moscow and will be dedicated to the people of Russia and the continent of Europe.

Carrying on a tradition

I asked Mira, who is more a designer than a woodworker, why she has stayed with it. What is it about her job that keeps her going? She laughed and said: "It's fun. I've always enjoyed making things, ever since I was a little girl. And although I just physically can't handle most of these boards—they're so big—I can be part of the creation of these beautiful objects."

And now a third generation wants to get involved. Mira's eldest son, Satoru, recently expressed an interest in the family business. Ru, as he's known by his family, was particularly close to George and has done a fair amount of woodworking on his own. Unfortunately, the business just won't support another employee right now—not even a Nakashima. □

Vincent Laurence is an associate editor of Fine Woodworking.

George Nakashima, woodworker

Born in Spokane, Wash., in 1905, George Nakashima spent his youth roaming the mountains and forests of his home state. He went on to study architecture and earned his bachelor's degree from the University of Washington and a master's degree from the Massachusetts Institute of Technology.

After a two-year stint as an architectural designer for the Long Island (N.Y.) State Park Commission, he spent four years traveling in Europe and Asia, eventually taking a job in an architectural firm in Tokyo. He was transferred to India to supervise the construction of a dormitory for a spiritual community and became a disciple of that community's leader.

A wellspring of design inspiration. *The Conoid studio is but one of the structures George built on his Pennsylvania property. The studio is named for its roof, which is a section through a cone.*

Photo: Alec Waters

Butterfly keys save boards, *preventing checks from spreading and providing a decorative element as well.*

Live edges are part of the design. *George's intent in working wood was to give trees a second life.*

In 1939, he left India for China, but the war between Japan and China forced his return to Japan. There he met and became engaged to his future wife, Marion, another Japanese American. They returned to the United States in 1940, settling in Seattle, and were married the following year.

He set up his first furniture shop in Seattle in 1941, but he was interned in Idaho along with thousands of other Japanese Americans in 1942. It was there that he met an old Japanese carpenter who taught him a great deal about wood and tools. Life in the camp was hard, though, and in 1943, George asked his old boss from Tokyo, Antonin Raymond, to sponsor the Nakashima family's release. They moved to the Raymond farm in New Hope, Penn., and worked as general laborers. A year later, they rented a small house in which they lived until 1946. That year, they moved to their own piece of property and started building, a process that would continue for more than three decades.

From the 1940s until his death in 1990, George Nakashima built nearly a dozen structures on his property in New Hope. He also put in ponds, built a small foot bridge, planted trees and built stone walls. All the while, he was designing and building furniture with an emphasis on craft and on preserving the spirit of the tree. George had all his wood flitchsawn (cut through and through, as he called it), often using it just as nature provided it. He didn't eliminate sapwood and used butterfly keys to prevent checks from spreading. He finished his work with a tung oil varnish rather than lacquer or polyurethane. All of this may seem tame today, but in the design-for-industry and make-it-uniform-and-modern climate of the 1940s, it was revolutionary. —*V.L.*

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Index to issues 110 through 115

This alphabetical index covers all the issues of *Fine Woodworking* magazine published during 1995 (*FWW* #110 through #115). Starting in 1988, *Fine Woodworking* has published annual indexes, which can be found in *FWW* #74, # 80, #86, #92, #98 and # 104. The Taunton Press also sells a cumulative index covering issues #1 through #100 (Fall 1975 through May/June 1993) for $12.95. The format of each index reference is issue number:page numbers. A hyphen between page numbers means the discussion is continuous; commas between page numbers indicate an intermittent discussion. This index, like all previous indexes to *Fine Woodworking*, was prepared by Harriet Hodges, chairmaker, of New Castle, Va.

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READER SERVICE NO. 98

Jet tablesaw

Taiwanese toolmakers are in the same bind that frustrated their Japanese counterparts a generation ago. For many consumers, "made in Taiwan" might as well say "not of the best quality."

Jet is one company hard at work trying to overcome that suspicion among woodworkers. Its JTAS 10 tablesaw (see the photo at right) is a serious attempt to compete directly with the Powermatic model 66 and the Delta Unisaw.

With its list price of $1,399, the Jet JTAS 10 tablesaw is hundreds of dollars less than its American-made competitors. And for that price, the saw comes with your choice of a 50-in. Biesemeyer, Excalibur or Vega rip fence.

I set up the tablesaw at Cerritos College where I teach woodworking so that the students and instructors could all help to evaluate its performance. As expected, the saw received considerable scrutiny, especially from those who already had a preference for an American-made product. The saw we tested was 3 hp, weighed 438 lbs. and, like the Powermatic, came with extension wings on both sides, making the table 27 in. by 40 in.

The first thing we noticed was that the fit and finish were exceptional. The extension wings, for example, aligned nearly perfectly with the table. (There can be a problem with sliding the Biesemeyer fence across the table if there is a ridge where the table and extension wings meet.) Small things like the knurled-metal locking knobs on the hand wheels are a nice touch and a good indicator of an overall attention to detail.

In class one night, we spent a few hours checking the miter-gauge slot alignment, the blade angle stops and other features. The blade guard was difficult to use. Most of the students said they probably would take it off.

Overall, however, the saw came from the factory in good shape, except for some runout on the arbor. At first we thought that we had a bent blade. But, with a dial indicator, we discovered runout on the arbor flange of .003 in.—about four times the factory tolerance.

The manufacturer promptly changed the arbor after it was notified of the problem, but this problem served to reinforce the skeptics' beliefs about Taiwanese products. On the plus side, we learned that Jet will stand behind the saw: For two years, Jet will send someone to fix or replace any factory defects with no questions asked.

Will the Jet perform day in and day out like its American-made counterparts? Only time will tell, of course. But now that the tablesaw is set up and running properly, it has quickly become a fixture in our shop. In fact, one of our students ordered one last week.

For more information about the Jet tablesaw, contact Jet Equipment & Tools, Inc., P.O. Box 1349, Auburn, WA 98071-1349; (206) 351-6000. —*Lon Schleining*

***The Jet tablesaw** has a large cast-iron top, magnetic switch and a choice of rip fences.*

Carbide insert woodturning tools

The manufacturers of Enduro woodturning tools have answered requests for a scraper with an adjustable, replaceable carbide tip. The set comes with square-, circular-, rhomboid- and triangular-tipped scrapers (see the photo at right).

These tools are massive. The steel shafts aren't tapered; they're rectangular or square in cross section. At their largest, the shafts are a full ½ in. by ⅝ in., with slightly rounded edges. The carbide tips are mounted on a milled platform on the ends of the bars and are secured with hardened-steel, hex-recess screws (see the photo at left on p. 110). The tips appear to be standard industrial-carbide inserts. When worn, the inserts are simply replaced. The tips can be rotated to expose a fresh car-

***Enduro's scrapers have replaceable carbide tips.** Hefty shanks allow heavy cuts on the lathe.*

Top photo: Joe Romero; bottom photo: David Goldenberg

bide edge. The tips didn't shift in use.

The handles are plain but nicely turned. The tool shaft is secured into the handle with epoxy and has either a brass or bronze ferrule. Without drilling test holes, I couldn't determine how deep the shaft was sunk into the handle. The handles are 11 in., and the exposed shaft plus carbide tip is about 6 in. long.

The four-page instruction manual that's included with the set is clear and concise. It is written for those who have a good understanding of woodturning.

***Scraper tips are held with a screw.** They can be turned to expose a new cutting edge.*

The scrapers removed fairly heavy amounts of wood. The finish wasn't as clean as it would have been with a well-sharpened gouge, but for roughing, who cares? On dry wood, the tools performed about as well as any scraper, and the edge wasn't dull even after considerable use. On more exotic materials, such as alabaster (especially those with abrasive qualities), the tool edge did not stand up as well. But no cutting edge lasts long. Though the heavy shank dampens vibration and allows more of the tool to overhang the tool rest, I would have appreciated longer handles to give better leverage when taking heavier cuts.

I would recommend these tools for the woodturner who makes small- to medium-sized bowls or for the spindle turner who does not have the time to learn the use of gouges and skews. Large or deep bowls would be difficult without longer handles, despite the heft of the shanks.

The set of four tools sells for $265. Replacement tips are $18 to $47, depending on size. Enduro tools are available from Farris Machinery Inc., 1206 Pavilion Drive, Green Valley, MO 64029; (800) 872-5489.

—David Goldenberg

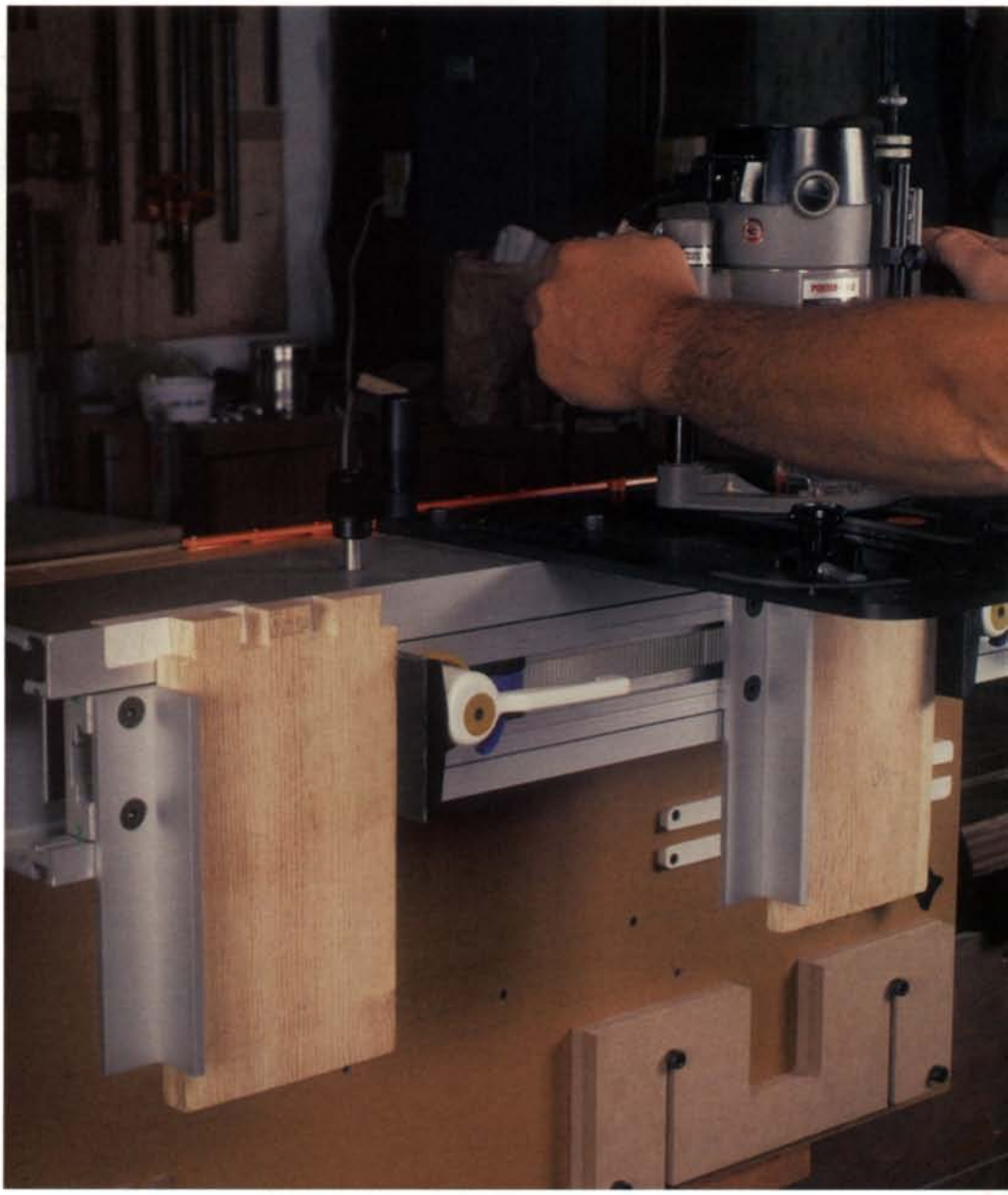
WoodRat cuts a wide variety of joints

If you're into routers and machine-cut joints, you'll enjoy the WoodRat (see the photo below), a machine that cuts almost any joint. A wide variety of through-, blind- and tapered-dovetail joints are possible, from small to large, all with the variable spacing and precision that are typical of hand-cut joints. The WoodRat cuts tongue-and-groove, dado, lap, bridle and box joints. Virtually every permutation of mortise-and-tenon joint is possible. You can raise panels with straight bits or with vertical, panel-raising bits. By stacking parts together, you can mass-produce through dovetails and box joints.

All this versatility comes at a high price ($499) and a greater degree of complexity than is normally associated with a router jig. When I opened the box, I discovered a bundle of parts that required about 2½ hours of assembly before I was ready to cut my first joint.

The 38-page manual covers installation, operating principles, machine setups, jigs and joint making. The manual is thick for two reasons: The WoodRat cuts many joints (22 separate cutting operations are described), and the machine's use is not always intuitive. With the help of the manual and a stack of scrapwood, I played with the WoodRat for a few days before I began to feel comfortable with the machine.

Most joint-cutting operations on the WoodRat require clamping the workpiece vertically beneath the router and then pulling the router through the piece or us-



***Accurate, well-made and capable—**Although versatile, the WoodRat is more expensive and more complicated than similar router devices.*

Photo at left: David Goldenberg; photo at right: Charley Robinson

ing a hand crank to move the workpiece past the cutter. With a little practice, you can bang out tight-fitting joints in just a few minutes. But it is still possible to make mistakes, such as the classic dovetailing error of cutting away the pins and leaving the waste.

I was impressed with the accuracy, smooth operation, quality construction and versatility of the WoodRat. It did indeed cut a wide variety of joints, but some operations, such as grooving or edge-shaping long rails, are easier on a conventional router table. And, although it can mass-produce joints, the WoodRat's real strength is in quickly and easily laying out and cutting a variety of custom-sized dovetail joints, box joints or mortise-and-tenon joints. It is ideally suited for stock up to 1 in. thick and 12 in. wide, but it can handle pieces up to 2 in. thick and 30 in. wide.

In all, the WoodRat is far more versatile than the standard dovetail jig. The WoodRat is available from CMT Tools, 310 Mears Blvd., Oldsmar, FL 34677; (800) 531-5559.

—Charley Robinson

Bosch 12v cordless drill

Testing this new ⅜-in. variable speed, reversing drill/driver from Bosch was a struggle; I had to wrest it away from several *Fine Woodworking* staff members who wanted it for various works-in-progress.

This drill has a T-handle design. The grip is below the motor housing, and the block-shaped battery pack, attached to the end of the grip, counterbalances the motor assembly (see the photo below). Clearly, ergonomics was one of the design objectives. I particularly like the feel, balance and location of all the controls, which provide both comfort and power.

The 12v nickel-cadmium batteries are not memory sensitive, so the batteries don't have to be fully discharged before recharging. The recharge time is one hour.

With two speed ranges and 16 torque settings, there's ample power for driving screws and nuts. The high torque and the long run-time between battery charging makes this drill/driver a real workhorse.

The keyless chuck was a big hit among the staff. When alternately changing from drilling bits to screw-driving bits, locking a bit in place without having to reach for a chuck-key is a real blessing.

The drill/driver comes with two battery packs, charger and carrying case. It sells for about $200. Depending on whether it's sold through discount home centers or industrial-supply houses, the identical drill has one of two model numbers: 3310K or B2310. The Bosch drill is available from S-B Power Tool Co., 4300 West Peterson Ave., Chicago, IL 60646; (312) 286-7330.

—Dennis Preston

***Excellent balance and ample torque** make this Bosch 12v drill/driver a joy to use.*

Briefly noted

Taploc knockdown fastener

Not every rail-to-post joint needs to be a mortise and tenon. The interlocking steel wedges of the Taploc bed-rail fastener (see the photo above) may have other uses, such as for a knockdown table or stand. The fastener appears to be sturdy and installation simply requires a ½-in.-wide by 1-in.-deep groove in the rail. The hardware is mounted with screws. The fasteners ($14.90 for a set of four) are available from Taploc Inc., 8618 N. Ferris, Unit C, Morton Grove, IL 60053; (708) 966-5752.

Cabinetworks Ltd. folding bed mechanism

Photo: courtesy of Cabinetworks

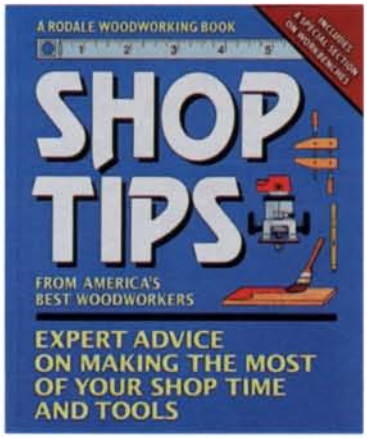
Thinking about building a hide-a-bed? Cabinetworks Ltd. has the folding bed hardware. The mechanism (see the photo above) sells for $299.

The mattress recommended for use with the mechanism sells for $119. Prices do not include shipping. Both are available from Cabinetworks Ltd., 75 Akerley Blvd., Dartmouth, N.S., Canada B3B 1R7; (902) 468-8118 or Louis Pokorny Co. Inc., 950 Johnson Ave., Ronkonkoma, NY 11779; (516) 588-8181. *—D.P.*

***Lon Schleining** is a stairbuilder and woodworking instructor in Long Beach, Calif. David Goldenberg is a woodturner in Danbury, Conn. Charley Robinson is a woodworker and writer in Sandy Hook, Conn. Dennis Preston is an assistant editor of* Fine Woodworking.

Photos except where noted: Dennis Preston

Shop Tips. *Rodale Press, 33 East Minor St., Emmaus, PA 18098; 1994. $27.95, hardback; 320 pp.*



To build this book, the editors at Rodale Press put out the word to every woodworker they could find, amateur and professional, that they were buying tips. About 1,000 techniques, hints and shortcuts were selected from the resulting avalanche, all edited down to the nub.

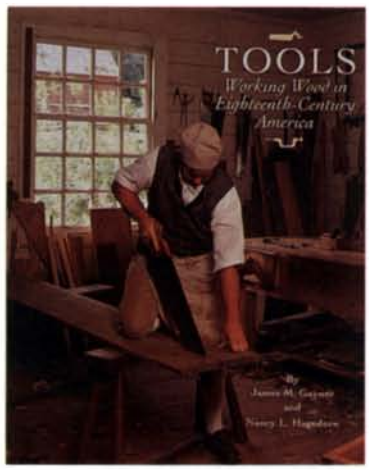
There's no rambling here. It's just pure, tamped-down woodworking wisdom in one-paragraph chunks, four or five to the page. All the old standards are here (as they should be), as well as a number of new ideas. Most of the tips are accompanied by informative illustrations, often more eloquent than the words.

Many of the helpful hints come from well-known woodworking writers like Jim Tolpin, Ernie Conover, Mario Rodriguez, Simon Watts, Bob Flexner and Percy Blandford. Jeff Greef, from Soquel, Calif., holds the record with 97 published tips.

Sprinkled among the smaller entries are several extended discussions (two or three pages, typically), which cover some of the basics of woodworking in a little more depth: sharpening a hand scraper, cutting tenons on the tablesaw and cutting dovetails by hand. Building a workbench, a topic that would be difficult to cover adequately in this format, gets special treatment in a whole chapter. These longer discussions, taken together, comprise a fairly good beginner's guide to woodworking and make this book more than just a compendium of tips.

True, the cover is tacky and a couple of the illustrations are misdrawn. But these are insignificant flaws. This book has a batting average in the high .900s. *—Jim Richey*

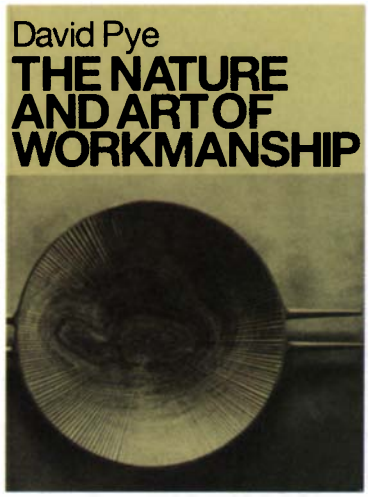
Tools: Working Wood in Eighteenth-Century America by James M. Gaynor and Nancy L. Hagedorn. *The Colonial Williamsburg Foundation, P.O. Box 1776, Williamsburg, VA 23187; 1993. $19.95, paperback; 140 pp.*



Many books on antique tools are written by experts and collectors and tend to be too specific. This book is written for the novice. It begins with chapters on toolmaking, how tools were sold and a pictorial essay on tools and tool chests. The remainder of the book is divided into sections on tools based on their function. *Tools* is well-bound and has thick, glossy pages with abundant illustrations.

It is a book written not by tool experts but by skilled researchers and writers. They sifted through mountains of information and examined thousands of artifacts to craft a book that carefully explains how tools were made and who used them. The text is written in plain English and provides a basic but thorough understanding of 18th-century tools and woodworking. The authors avoid using terms that would be familiar only to seasoned woodworkers and tool collectors. The book will neither confuse nor intimidate the beginner and will introduce aspiring woodworkers to a fascinating subculture of woodworking. *—Mario Rodriguez*

The Nature and Aesthetics of Design and **The Nature and Art of Workmanship** by David Pye. *Cambium Press. Distributed by Lyons & Burford, 31 West 21st St., New York, NY 10010; 1995. $19.95 (each), paperback; 160 pp. and 144 pp.*



Anyone who either designs or works with wood should find these two books worthwhile reading. Although written nearly 30 years ago, these books remain surprisingly undated. The author, David Pye, was a respected English architect, industrial designer, accomplished woodworker and longtime professor of furniture design at the Royal College of Art in London. He died in 1993.

These two books certainly aren't how-to books. They are written more in the form of well-illustrated essays. What makes these books both readable and informative is Pye's ability to illustrate his concepts with a variety of subjects to get the point across. In both books, he uses aptly chosen examples of machinery design, structural engineering, ship construction, architecture, printing and graphic arts—even poetry and music—to enhance his theories on design.

The Nature and Aesthetics of Design could be described as a philosophy textbook for product designers. But I found a great deal in this book that should be of interest to woodworkers. Pye begins by clearly defining *design* as distinct from *art* and *invention*. He further categorizes six requirements of good design, covering everything from function to cost. Pye builds on the subject from there, with a discussion of compromise in designing, a designer's responsibilities and public perception of design as defined by taste and style.

Throughout the book, Pye reveals himself not only as a designer but also as a strong supporter of those people who make the designer's ideas come to life: "Probably few people realise how nastily things can be made and still work well enough. There is still so much good workmanship about that we take it for granted and turn up our noses at the people who take the trouble to produce it."

The Nature and Art of Workmanship is devoted to the relationship between the workman and the designer. Pye breaks processes into categories such as "operations of certainty" (jig, fence, template-guided work) and "operations of risk" (hand-guided tool work). He explores whether good workmanship always means precise and bad workmanship means rough. Crediting the role of the Arts-and-Crafts movement on modern attitudes toward workmanship, Pye uses the final portion of the book to critique John Ruskin's writings from the late 1800s and to make a passionate plea for the continuance of good workmanship in modern society.

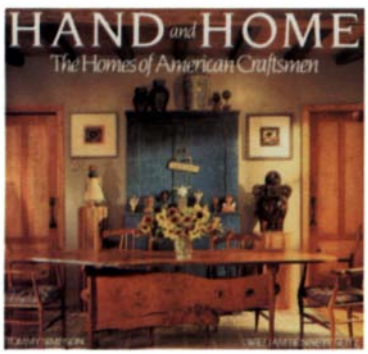
To me, one of the fascinations about designing and woodworking is that you can never master them; there is always something more you can learn. Because most books about design or woodworking focus on how to do things, these two books are refreshing in their unique approach. More than any-

thing else, they force us as designers and woodworkers to sit back and reconsider what we do and why we do it.

—Cameron Russell

EDITOR'S NOTE: These books were first reviewed in *FWW* #13. That issue was published in November 1978, which is the same year these titles last appeared in print. They've been reissued under a new imprint, and we think they are worth a second look.

Hand and Home: The Homes of American Craftsmen by Tommy Simpson, with Lisa Hammel; photos by William Bennett Seitz. *Bulfinch Press/Little, Brown and Co., 1271 Avenue of the Americas, New York, NY 10020; 1994. $40, hardback; 152 pp.*



What's most surprising about this book is that no one has written it until now.

Devoting one's life to a craft is seldom an economically motivated decision. Craftspeople are drawn to pursue their craft, almost inexorably, by their appreciation of materials, form and design. So it stands to reason that the homes of accomplished artisans should be well-designed, built of fine materials and filled with pleasing forms. This book supports that notion. Filled with excellent photos of the houses (interiors and exteriors) and yards of famous (and not-so-famous) woodworkers, metalworkers, ceramists and other craftspeople, *Hand and Home* is a voyeuristic tour of some great spaces.

If you're a traditionalist, this book probably won't be your cup of tea because much of the wooden furniture is what would be called whimsical. And there's as much emphasis on metal and ceramics as there is on wood. Still, on almost every page, I found a piece of furniture, detail, idea or some other non-wood craft item that I really liked.

The woodworkers whose homes are featured in *Hand and Home* are Tommy Simpson, James Schriber, Roy Superior, Wendell Castle and Sam Maloof. Maloof's home is particularly amazing. Just as interesting to me were the homes of Bennett Bean, a ceramist, Albert Paley and Tom Joyce, both blacksmiths.

At $40, this is not a book most woodworkers will run right out and buy. But if you have more than a passing interest in other media (metal, clay and so forth), you might be hooked when you see *Hand and Home* in your local bookstore. It's a tour de force of contemporary craft that you'll find yourself going back to again and again.

—Vincent Laurence

EDITOR'S NOTE: *Welsh Stick Chairs* by John Brown (reviewed in *FWW* #93) was originally published in Wales by Abercastle Publications. It is now available on this side of the Atlantic from Linden Publishing, 3845 N. Blackstone, Fresno, CA 93726. This 96 page paperback book sells for $14.95.

Jim Richey is the "Methods of Work" editor for Fine Woodworking. *Mario Rodriguez conducts workshops in techniques of traditional woodworking and is a contributing editor to* Fine Woodworking. *Cameron Russell teaches furnituremaking at Camosun College in Victoria, B.C., Canada. Vincent Laurence is an associate editor for* Fine Woodworking.

Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We list events (including entry deadlines for future juried shows) that are current with the time period indicated on the cover of the magazine, with overlap when space permits. We go to press three months before the issue date of the magazine and must be notified well in advance. For example, the deadline for events to be held in March or April is January 1; for July and August, it's May 1, and so on.

ALASKA: **Meetings**-Alaska Creative Woodworkers Association meets at 7 p.m. on the fourth Monday of each month at the Anchorage Museum. For more information, call (907) 345-3077.

ARIZONA: **Workshop**-Arizona Designer Craftsmen presents Paul Sasso, Wood, March 22-25. Arizona State University, Tempe. For more information, call Joan (602) 963-2965.

ARKANSAS: **Meetings**-Woodworker's Association of Arkansas meets the first Monday of each month at 7:00 p.m. at Woodworker's Supply Center, 6110 Carnegie, Sherwood, 72117. For more information, call (501) 835-7339.
Meetings-Ozark Woodturners meets the third Saturday of each month, Mountain Home. For more information, call Michael Kornblum at (501) 424-5893.
Workshops-Woodcarving, bamboo fly rod, wood-strip canoe, fly fishing accessories and more. For more info, contact White River Artisans School, P.O. Box 308, 202 South Ave., Cotter, 72626. (501) 435-2600.

CALIFORNIA: **Workshops**-Woodworking for women. Furnituremaking with hand tools using traditional joinery, weekends. San Francisco. For more info, contact Debey Zito (415) 648-6861.
Classes-Classes on wood finishing and decorative painting for furniture and cabinets. For schedule, write Studio 1829, 1829 Stanford St., Santa Monica, 90404. (310) 453-0230.
Workshops-Shaker bench, sofa table, Mission lamp table, Adirondack chair, more. Saturdays and Sundays. No experience necessary. Private instruction available. For more information, contact the Woodworkers Place at (818) 952-3177.
Workshops-Various workshops including Japanese woodworking, joinery and sharpening. For more info, contact Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (510) 524-3700.
Exhibition-Masterpieces from the Museum of Classical Chinese Furniture thru March. Pacific Heritage Museum, 608 Commercial St., San Francisco, 94111. (415) 399-1124.
Show-California Open Wildlife Art Show & Carvers Competition, Feb. 17-18. Holiday Inn On-The-Bay at the Embarcadero, San Diego. For more information, call Thelma Jennings at (619) 748-6643.
Show- Artistry in Wood '96, March 8-April 21. Sonoma County Woodworkers Association Museum, 425 7th St., Santa Rosa. For more information, contact Thomas Stockton at (707) 756-9885.

COLORADO: **Classes**-Woodworking and related classes, year-round. For more info, write Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401. (303) 988-6160.
Classes-Traditional hand woodworking, year-round. Contact Tom Larkin, Shadow Mountain School of Woodcarving, 32037 Stenzel Drive, Conifer, 80433. (303) 674-8560.
Exhibition-1996 American Craftsmen 11th annual custom woodworking exhibition, Jan. 14-28. Vail Public Library, Vail. For more information, call Tim O'Brien at (970) 328-7253.
Classes-Hand-cut dovetails, finishing, tablesaw, cabinetmaking. The Woodworkers' Store, 1550 South Colorado Blvd., Denver. (303) 782-0588.

CONNECTICUT: **Classes**-Hands-on woodworking, finishing and lathe classes. For complete schedule, call Harris Enterprise Corp., 80 Colonial Road, Manchester, 06040. (203) 649-4663.
Exhibition-Featured artist: Dennis Elliott, Jan. 22-March 15. University of Connecticut, Storrs. For further information, call (203) 354-9678.

FLORIDA: **Meetings**-South Florida Woodworking Guild meets every second Monday at 7 p.m. Constantine, 1040 East Oakland Park Blvd., Ft. Lauderdale. For further information, contact Woody McLane at (305) 565-2729.
Juried show-The Woodcrafters Club of Tampa's 11th annual fine furniture show, Feb. 2-18. Florida Expo Park, Tampa. For more information, call John Fischer at (813) 645-8933.
Meetings-Central Florida Woodworkers Guild meets the second Thursday of each month at 7:30 p.m. Woodcraft Supply Corp., 246 E. Semoran Blvd., Casselberry. For more information, contact Bob Elliott (407) 695-8960.
Meetings-Tallahassee Woodcrafters Society meets at 7:00 p.m. the second Tuesday of each month. For more information, contact Walt Behrle at (904) 668-6653 or Austin Tatum (904) 386-6876.
Meetings-St. Petersburg Woodcrafters Guild meets the fourth Thursday of every month at 7 p.m. Montgomery Electric and A/C, 1200 19th St. N., St. Petersburg, 33713. For more info, contact Don Montgomery at (813) 898-0569.

GEORGIA: **Meetings**-Woodworkers Guild of Georgia meets the second Monday of every month. Southern College of Technology, 1100 S. Marietta Parkway, Marietta. For more information, call (404) 299-3972.
Workshops-Japanese woodworking by Toshihiro Sahara. One Saturday each month. For further information, contact Sahara Japanese Architectural Woodworks at (404) 355-1976.

ILLINOIS: **Classes**-Finishing, routers, veneering, caning biscuit joinery, turning and more. The Woodworkers' Store, 286 West Rand Road., Arlington Heights. (708) 253-8875.

INDIANA: **Classes**-Hands-on woodworking classes with Michael Van Pelt. Superior Woodworking Supply, Inc., 922 Ft. Wayne Ave., Indianapolis, 46202. (317) 635-5747.
Classes-Instructors include Brian Boggs, Kelly Mehler, Marc Adams and Marc Berner. For more information, contact the Marc A. Adams School of Woodworking, Route #2, Box 121A, Franklin, 46131. (317) 535-4013.

KENTUCKY: **Workshops**-Woodturning and joinery instruction. For further information, contact Jim Hall, Adventures in Wood, 415 Center St., Berea, 40403. (606) 986-8083.
Meetings-Kyana Woodcrafters Inc. meets the first Thursday of each month. Bethel United Church of Christ, 4004 Shelbyville Road, Louisville, 40207. For more information, call (502) 426-2991.
Workshops-Traditional Windsor chairmaking. One-week courses. For further information, contact David Wright at (606) 986-7962.

MAINE: **Workshops**-Two-week basic and intermediate furnituremaking courses. Faculty includes Peter Korn, Silas Kopf, Bob Flexner, Nora Hall, Michael Emmons. For more information, contact the Center for Furniture Craftsmanship, 125 W. Meadow Road, Rockland, 04841. (207) 594-5611.
Meetings-Guild of Maine Woodworkers meets the first Wednesday of every month. For time and location, call the Guild at (800) 805-5100.

MASSACHUSETTS: **Classes**-Woodworking classes, most of the year. For further information, contact Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.
Instruction-Full-time program in fine furniture construction. Complete facilities. For more info, contact Wm. B. Sayre, Inc., One Cottage St., Easthampton, 01027. (413) 527-0202.
Classes-Woodworking, turning, carving, finishing, veneering, beginner and intermediate classes, woodworking for women. For more information, contact One Cottage Street School of Fine Woodworking, One Cottage St., Easthampton, 01027. (413) 527-8480.
Workshops-Toolmaking for woodworkers. First three weekends of each month. Registration limited to two students per weekend. Contact Ray Larsen, Genuine Forgery, 1126 Broadway, Hanover, 02339. (617) 826-8931.
Workshops-One-week woodworking and related workshops, year-round. Contact The Heartwood School, Johnson Hill Road, Washington, 01235. (413) 623-6677.
Classes-Ongoing woodworking classes and one day seminars. Beginner thru intermediate. For information or brochure, call Michael Coffey at (413) 527-8480.
Workshops-Three day intensives. Sharpening, layouts, carving techniques, tool forging, design study. Taught by professional carver with 16 years experience. Calvo Studio, 17 Mill Lane, Arlington, 02174. (617) 648-5589.
Workshops-17th Annual Wood Identification Workshop, taught by Dr. R. Bruce Hoadley, Jan. 16-19, University of Massachusetts, Amherst. For more information, contact Alice Szlosek or Trudie Goodchild at (413) 545-2484.
Workshop-Lumber Dyeing workshop offered by the New England Kiln Drying Assoc. and the University of Massachusetts Dept. of Forestry and Wildlife Management, Jan. 8-12. Holdsworth Hall, University of Massachusetts, Amherst. For more information, call Bill Rice at (413) 549-0795.
Workshops-Carving, dovetail jig, finishing, furniture repair and restoration, more. Woodcraft Supply Corp., 313 Montvale Ave., Woburn, 01801. (617) 935-6414.

MICHIGAN: **Workshops**-Woodwrighting. Tillers International, 5239 S. 24th St., Kalamazoo, 49002. For more information, call (616) 344-3233.
Workshops-Woodworking basics, furnituremaking basics with Joseph Hoover, January, February, March. For more information, contact Woodcraft Supply, 42102 Ford Road, Canton, 48187. (313) 981-6808.

MINNESOTA: **Classes**-Woodcarving classes, year-round. For information, contact the Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.
Meetings-Minnesota Woodworkers Guild meets the third Tuesday of each month at 7:15 p.m. Demonstrations presented each month. Contact Richard Gotz at (612) 544-7278.
Classes-Ongoing classes. Wild Earth Woodworking at a Minneapolis/St. Paul facility. Contact Wild Earth Woodworking, 401 Hunter Hill Road, #3, Hudson, WI 54016. (715) 386-3186.
Show-Turned wood show by the Minnesota Woodturners Association, Feb. 12-March 31. The Duluth Art Institute, 506 West Michigan St., Duluth, 55802. (218) 727-8013.
Classes-Shaker boxes, router, finishing tablesaw, sharpening, build a workbench and more. The Woodworkers' Store, 3025 Lyndale Ave., South, Minneapolis. (612) 822-3338.

MISSISSIPPI: **Classes**-Various woodworking classes. For more information, contact Allison Wells School of Arts & Crafts, Inc., Canton. (800) 489-2787.

MISSOURI: **Classes**-Wood furniture design with Ron Diefenbacher. Fifteen week course beginning Jan. 16. For more information, contact Washington University Fine Arts Institute, St. Louis. (314) 935-4643.

NEBRASKA: **Meetings**-Omaha Woodworkers Guild meets at 7 p.m. the third Tuesday of every month. Westside Community Center, Omaha. For more info, contact John Cahill at (402) 334-5550.

NEW HAMPSHIRE: **Classes**-Fine arts and studio arts. For info, contact Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104. (603) 669-2731.
Classes-Various woodworking classes. For more info, contact The Hand & I, PO Box 264, Route 25, Moultonboro, 03254. (603) 476-5121.
Auctions-Antique and craftsman's tool auctions, year-round. Contact Richard A. Crane, Your Country Auctioneer, 63 Poor Farm Road, Hillsboro, 03244. (603) 478-5723.
Workshops-Week-long Shaker-style furniture and chairmaking workshops, year-round. For more info, contact Mary Sweet, Dana Robes, Wood Craftsman, Lower Shaker Village, Enfield, 03748. (603) 632-5385.
Classes-Make a Windsor chair with Michael Dunbar. Also, sack back, continuous arm, fan back, writing arm. Classes start in January. For information, contact Michael Dunbar, PO Box 805, Portsmouth, 03802. (603) 431-4676.

NEW MEXICO: **Classes**-Woodworking classes. For more information, contact North New Mexico Community College, El Rito, 87520. (505) 581-4501.
Classes-Woodworking classes. For info, contact Santa Fe Community College, Santa Fe, 87502. (505) 438-1361.

NEW YORK: **Classes**-Traditional 18th-century woodworking techniques with Mario Rodriguez. For more info, contact Warwick Country Workshops, PO Box 665, Warwick, 10990. (914) 986-6636.
Meetings and classes-New York Woodturners Association meets bi-monthly. YWCA, 610 Lexington Ave. (53rd St.), New York City. Contact Howard Alalouf (914) 337-0226.
Classes-Woodworking, traditional and contemporary; turning and finishing with Maurice Fraser and Bill Gundling. All levels. The Craft Students League at the YWCA, 610 Lexington Ave., New York City. For information, call (212) 735-9731.
Classes-Wood inlay, routing, woodcarving, veneering, finishing, tablesaw techniques, more. Saturdays, January thru April. For more info, contact Albert Constantine & Son, Inc., Woodworking Classes, 2050 Eastchester Road, Bronx, 10461. (718) 792-1600.
Meetings-The Long Island Woodworker's Club meets the first Wednesday of every month, September thru June at 7:30 p.m. Brush Barn, 211 Jericho Turnpike, Smithtown. For more information, call (516) 360-1216.
Classes-Intermediate Woodworking & Furniture Design, Jan. 3-May 14, Purchase College, Purchase. For more information, contact Olene Duncan at (914) 251-6503.
Show-Wendell Castle, March 7-April 20. For more information, contact Peter Joseph Gallery, 745 Fifth Ave., Fourth Floor, New York, 10151. (212) 751-5500.
Show-Woodworkers Expo 1996, March 23-24. Saratoga Springs City Center, Saratoga Springs. For more information, call Fran Finkbeiner at (518) 371-9145.

NORTH CAROLINA: **Meetings**-North Carolina Woodturners meets the second Saturday of each month. For more information, contact North Carolina Woodturners, PO Box 1833, Hickory, 28603. (704) 324-5960.
Workshops-Winter schedule includes Windsor chairmaking, Welsh stick chairs, Swiss cooperage, carving Swedish woodenware. For more information, contact Country Workshops, 90 Mill Creed Road, Marshall, 28753. (704) 656-2280.
Classes-Pencil-post bed, bedside table, hanging corner cupboard. January thru April. Benjamin C. Hobbs, Route 1, Box 517, Hertford, 27944. (919) 426-7815.

OHIO: **Workshops**-Windsor chairs, taught by Joe Graham. For more information, contact Lenox Workshops, 1192 Webster Road, Jefferson, 44047. (216) 576-0311.
Workshops-Various workshops, year-round. Conover Workshops, 18125 Madison Road, PO Box 679, Parkman, 44080. (216) 548-3491.
Classes-Router basics, making cabinet doors, wood sculpting, turning, marquetry, chip carving, more. The Woodworkers' Store, 2500 East Main St., Columbus. (614) 231-0061.
Meetings-Cincinnati Woodworking Club meets from 9:00

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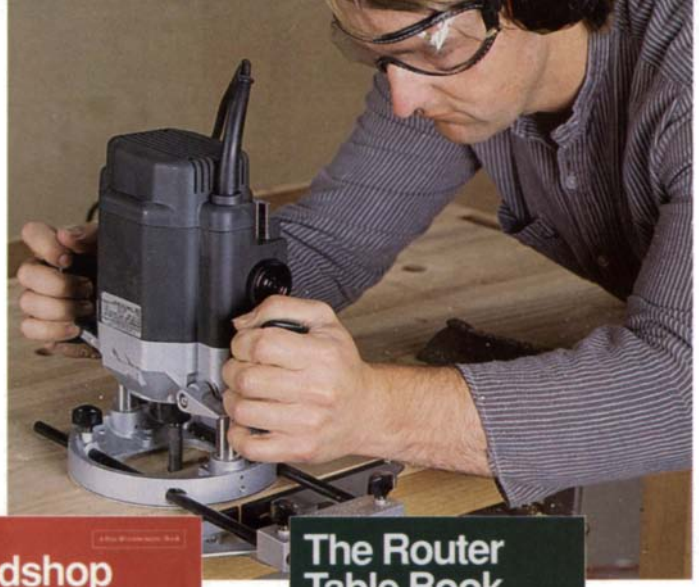

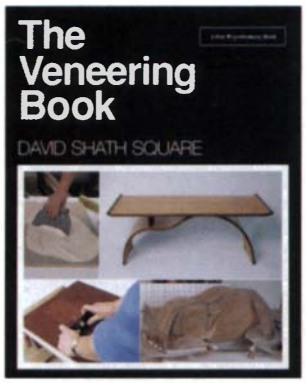

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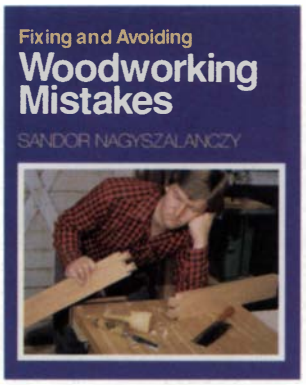

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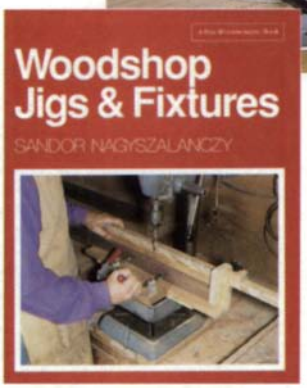

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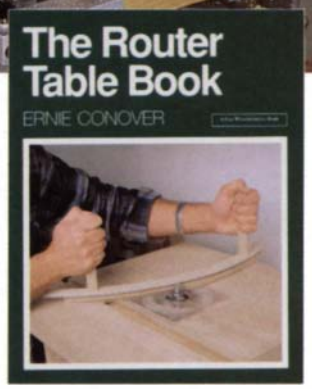

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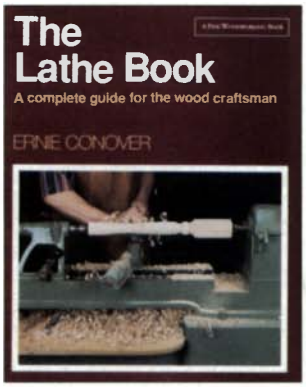

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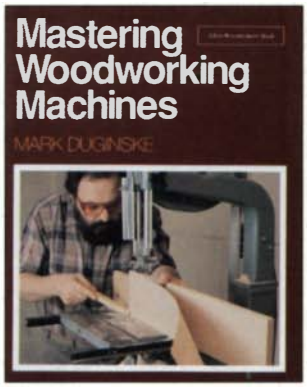

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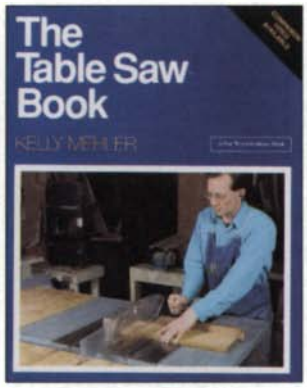

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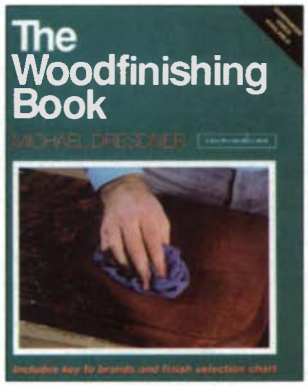

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to noon on the second Saturday of January, March, May, September and November. Reading High School,801 E. Columbia Ave., Reading. For more information, contact Cincinnati Woodworking Club, 5974 Gaines Road, Cincinnati, 45247.
Meetings-Woodworkers of Central Ohio meets on the second Saturday of November, February, April and June. For more information, call Chuck at (614) 457-3704.
Classes-Bowl turning, chip carving, router techniques, finishing, thru March. The Hardwood Store, 1695 Dalton Drive, New Carlisle, 45344. (513) 849-9174.

OREGON: **Meetings**-Cascade Woodturner's Association meets every third Thursday. For more info, contact Cascade Woodturners, 11575 S.W. Pacific Highway, #104, Tigard, 97223. (360) 887-3903.
Classes-Oregon School of Arts and Crafts, 8245 S.W. Barnes Road, Portland, 97225. (503) 297-5544.

PENNSYLVANIA: **Show**-20th annual Mid-Atlantic woodcarving show and competition sponsored by the Pennsylvania Delaware Valley Wood Carvers Association, April 13-14. Pennsylvania State Abington campus gymnasium, Abington. For more information, call (215) 757-2152.
Classes-Windsor chairmaking, weekly and weekends. For more information, contact Jim Rendi, Philadelphia Windsor Chair Shop, PO Box 67, Earlville, 19519. (610) 689-4717.
Meetings-Black Hills area woodworkers interested in organizing for purposes of sharing information and working toward a show. For more information and to be on mailing list, call (605) 343-1878.
Classes-Bowl turning with David Ellsworth. Three-day weekend classes in private studio, beginner to intermediate. For further information and schedule, contact David Ellsworth, Fox Creek, 1378 Cobbler Road, Quakertown, 18951. (215) 536-5298.
Show-Furniture and accessory market, Feb. 17-19 and June 8-10. Fort Washington Expo Center, Fort Washington. For more information, call (717) 245-9051.
Show-Lancaster County woodcarving and wildlife art festival and competition, March 16-17. Millersville University Student Union Building, Millersville. For more information, call (610) 926-3692.

RHODE ISLAND: **Exhibition**-Marriage in Form: Kay Sekimachi & Bob Stocksdale, thru Feb. 4. Museum of Art, Rhode Island School of Design, Providence. For info, contact Palo Alto Cultural Center, Palo Alto, CA. (415) 329-2605.

TENNESSEE: **Workshops**-Turning, carving and more, year-round. Arrowmont School of Arts and Crafts, PO Box 567, 556 Parkway, Gatlinburg, 37738-0567. (615) 436-4101.
Classes-Lumber selection, grading, stacking, drying, kiln operation, sawmilling, more. Tennessee Valley Authority, 17 Ridgeway Road, Box 920, Norris 37828-0920. (615) 632-1656.
Workshops-Spring workshops include turning, carving, Windsor chairmaking, fretted dulcimer making. Tennessee Technological University, Appalachian Center for Crafts, 1560 Craft Center Drive, Smithville, 37166. (615) 372-3051.

TEXAS: **Meetings**-North Texas Woodworker's Association meets the third Tuesday of each month. For more information, contact Bruce May, PO Box 831567, Richardson, 75083. (214) 271-0125.
Classes-Woodworking classes, year-round. Bowl turning basics to advanced furniture and cabinetry. For info, contact Woodshop, Inc. Woodworking School, 1225 West College, Suite 612, Carrollton, 75006. (214) 466-3689.
Meetings-Woodturners of North Texas meets the last Thursday of every month, 7:30-10:00 p.m. For more information, contact the Paxton Beautiful Woods Store, 1601 W. Berry St., Fort Worth, 76110. (817) 927-0611.
Classes-Carving classes with Don Schol, every Thursday, 6:00-9:00 p.m. For more information, contact the Paxton Beautiful Woods Store, 1105 Sixth St., Carrollton, 75006. (214) 245-1192.
Show-10th annual Rio Grande Valley Woodcarvers show and sale, Jan. 19-20. McAllen Civic Center, McAllen. For information, contact Dorothy Chapapas, Route 2, Box 150, McAllen, 78504. (210) 581-2448.
Call for entries-Furniture of the 90's-1996, a juried show that will tour Houston, Atlanta, and New York. Deadline: Jan. 25. For more information, contact the American Society of Furniture Artists, (ASOFA)/Furniture of the 90's, PO Box 35339, Houston, 77235. (713) 556-5444.

VERMONT: **Courses**-Yestermorrow Design and Building School, Route 1, Box 97-5, Warren, 05674. (802) 496-5545.

VIRGINIA: **Classes**-Fundamentals of woodworking, router techniques, bowl turning, more. Classes offered year-round. For class schedule, contact The Woodworkers Club, 216 Dominion Road, N.E., Vienna, 22180. (703) 255-1044.

WASHINGTON: **Workshops**-Build a sea chest, small boat construction, handplane repair and construction, paddle carving, woodturning. Northwest School of Wooden Boat Building, 251 Otto St., Port Townsend, 98368.
Classes-Woodcarving, lathe, router, tablesaw, furniture and cabinetmaking. Individual and small group. Common Sense Woodwork, 8231 S.E. 67th St., Mercer Island. For schedule, call (206) 232-1714.

WISCONSIN: **Seminar**-Kiln drying for smaller operations, taught by Gene Wengert and Don Lewis, Jan. 5. Eau Claire. For more information, call (800) 777-6953.

CANADA: **Workshops**-Traditional Windsor chairmaking. Weekly courses. For more info, contact David Goodwin, Village Chairmaker, Sparta, Ont., N0L 2H0. (519) 775-2751.
Association-Canadian Woodturners Association. Markham, Ont. For info, and quarterly newsletter, call (905) 479-0755.
Meetings-West Island Woodturners Club (Montreal) meets every Tuesday, thru May. Contact Dennis Brown, 8817 Cure Legault, Lasalle, Que., H8R 2V9. (514) 366-6071.
Association-Superior Woodworking Association meets 7:00 p.m. the last Monday of each month. Confederation College, Ont. For more information, contact Vic Germaniuk at (807) 767-5964.
Show-Eighth annual wood and wood products expo and sale, March 1-3. Lansdowne Park Civic Complex, Bank St. at Holmwood. For more information, contact John Cryderman 136 Thames St., Chatham, Ont., N7L 2Y8. (519) 351-8344.
Show-Calgary Woodworking Expo, Jan 12-14. Roundup Centre, Stampede Park, Calgary. For more information, call (403) 236-5834.

ENGLAND: **Workshops**-Restoration, hand finishing, cabinetmaking for beginners, marquetry, furniture design, year-round. Bruce Luckhurst, Little Surrenden Workshops, Bethersden, Kent TN26 3BG. 0233-820-589.

SCOTLAND: **Workshops**-Ongoing workshops. For more information, contact the Myreside International School of Antique Furniture Restoration, Myreside Grange, Gifford, East Lothian, EH41 4JA. (062 081) 0680.

Walk softly

Some learn woodworking for fun, others as a trade and some out of sheer necessity. Take Bill Owston, who in his younger years plied the fishing trade in the Caribbean. The condition of his wooden boats required that he quickly become an expert woodworker, and he's never stopped.

Now living near the coastal town of Pescadero in northern California, Owston builds furniture and other things from found lumber he and his friends gather in the surrounding woods. His pieces fre-

***Carved from fallen eucalyptus** found in the woods, these walking sticks sell for about $500. The shaft and details, like these creeping lizards, are carved from a single piece of stock 4 in. to 6 in. dia.*

Photos this page: Jeff Greef

quently incorporate the rough textures and natural shapes of raw wood, including the inevitable splits and checks in the eucalyptus that he uses to make his rustic walking sticks.

Owston carves the sticks from sections 4 in. to 6 in. dia. After removing most of the waste with a bandsaw, he carefully shapes the shaft of the stick so it looks like a 2-in.-dia. branch. Then he carves the details. Selling for about $500 each, the sticks go to a wide variety of people, from New Age enthusiasts who need a powerful scepter to somewhat less flamboyant types who just want a nice stick to take for a jaunt in the woods. *—Jeff Greef, Soquel, Calif.*

Key grips from scrap

I was tired of looking at the cracked, worn and incredibly ugly plastic grip on my car key. So I tore it off and set to work with a piece of tambootie, an African wood that's dark brown, dense and as hard as a tax-collector's heart. The result was a wooden key grip that was wonderful to touch and hold, no matter what the temperature. And it looked very expensive and exclusive.

Photo: Scott Phillips

***Dressing up a plain key.** Even though the Ford went to the junkyard long ago, its key, fitted with a Massur-birch grip plate, is still treasured.*

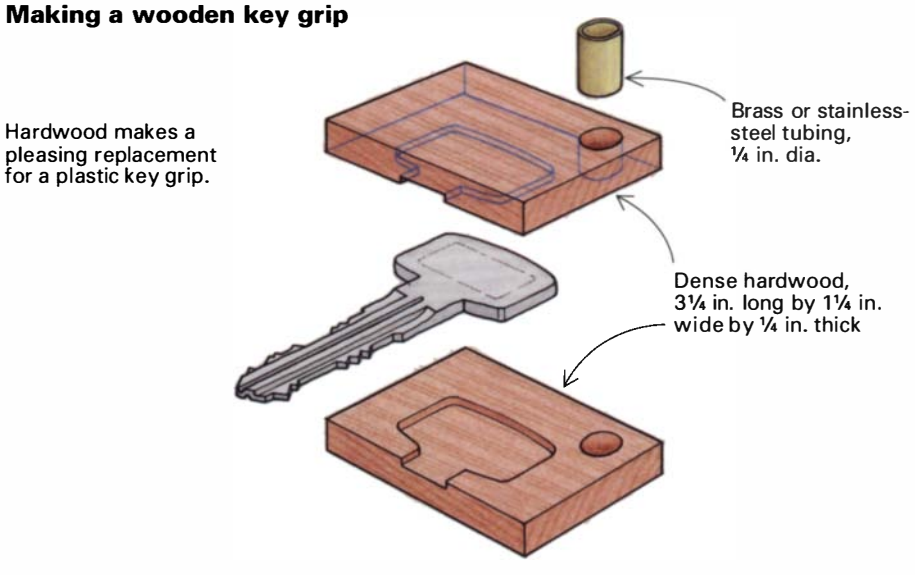
To make such a grip, start with a piece of hard, dense, good-looking wood, about 3¼ in. long by 1¼ in. wide by ¼ in. thick. I sand both sides smooth and flat and cut it in half to get two pieces, each about 1⅝ in. by 1¼ in. by ¼ in. Then I remove the hideous plastic grip plate by holding the key with pliers and setting fire to the plastic with a torch. The plastic turns soft and gooey, and I simply scrape it off.

Mark the contour of the key's shaft on the two wooden pieces, and let the key in, as shown in the drawing below. You can use a knife, small carving gouges or a Foredom or Dremel Moto-Tool with a small burr. Take care to get a close fit; it's crucial for a really good-looking result. Glue the whole assembly together with epoxy or polyurethane glue. When the glue is dry, drill a hole for the key ring. I bush the key-ring hole with a short piece of ¼-in. brass or stainless-steel tubing.

File the wooden grip to a smooth, rounded, pleasing shape. Sand it silky smooth, and rub the grip well with oil. Take your time because you'll be handling this key for a long time.

—Lasse Carenvall, Stenungsund, Sweden

Making a wooden key grip



Drawing: Vince Babak

Lomkhuleko and her painted coffee table

I was in the way outback bushveld of Swaziland, Africa, courtesy of the Peace Corps. And for two years, I had argued with parents and officials of the village high school about whether it was useful for girls to take my woodworking class. They finally relented. In the sea of freshmen boys who were my students, there were six girls.

For the first project, I designed a simple small table. The base was two 2x2s joined with a cross-halving joint (half lap), and the top was the same, covered with a 12-in.-sq. piece of Masonite. The base and top were connected by two 1x1s, and the height was only 14 in.

The boys attacked their projects with their usual cockiness, but the girls had a little more trouble. Their prior education had not included the kinds of skills that are the foundation for building things. One girl, Lomkhuleko, had no skills for such work, but she did have a dogged desire to try. The five boys who shared her workbench were helpful, and she struggled to incorporate their various suggestions into her technique. Each step took her several tries, but finally she got the table assembled into a freestanding form.

One day during lunch period, I was standing in the front of the room among the class's finished tables. Although all the tables came from the same set of plans, no two tops were in the same plane, and each table was a slightly different height. Lomkhuleko approached me and shyly asked if she could start painting her table. Because she had rendered a fairly nice table, in spite of everything, and had shown the initiative to work on her project during lunch, I got out our many partial liters of different-colored paints.

Just then, word came that the headmaster was asking for me. I gave Lomkhuleko a brush, told her to pick a color and then hurried to the office. The meeting lasted much longer than I hoped, and I had a moment of panic when I returned to the room to see that Lomkhuleko was still working. She had opened every one of the cans of paint.

She was bent over her table, painting a detailed picture of her family homestead using small pieces of notebook paper twisted into points for brushes. She'd used a different paper twist for each color and had mixed small amounts of various colors to get the shades that she wanted. It was a charming picture.

"Have you ever painted a picture before, Lomkhuleko?" I asked.

"No sir," she replied, looking at the floor, "I have never seen so many colors."

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"How did you know to mix the colors so well?" I asked, noting the subtle browns and greens.

"I just tried my best, sir. I wanted to make a very beautiful table for my grandmother, who told my father to let me come to your class. He does not think that woodworking is a proper thing for girls to learn."

Two weeks later, I was sitting in a homestead with a number of the community fathers. They were talking about how pleased they were to have a woodworking program at the high school. Lomkhuleko's father was there, and I heard him say, "My daughter produced a beautiful coffee table in the class. I am sure that she will soon develop into a fine woodworker."

—Sam Birchall, Dale, Texas

Minibike on a bet

I was trying to decide what to build next when my wife bet me I couldn't build a working model of a bicycle. I took the bet. It seemed the size of the chain would dictate the overall size of the model, so I started there. I discovered that maple links with rollers made of ⅛-in. dowels fitted with 1/64-in. bamboo pins was as small as I could go. That made the bike about 10 in. high.

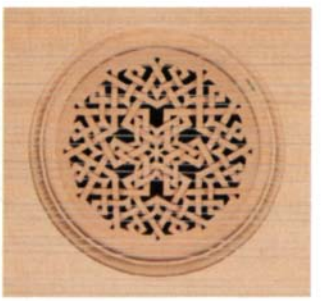
The spokes are bamboo skewers that were forced through four consecutively smaller holes to trim them to 1/16 in. The sprockets are scrap mahogany. The frame and hubs are made from birch dowels of various diameters, reinforced with maple blocks. Clamping the frame and handlebar angles correctly required a series of fairly complex jigs.

I built the bike in a few months of spare time using only a bandsaw, router and drill press. *—Maynard Faul, Scottsdale, Ariz.*

Photo: J.C. Seeman

Bike scaled to the smallest workable chain—The chain links are made of ⅛-in. dowel. Overall height is about 10 in.

Hammer dulcimer



Though it looks simple, this dulcimer took about 270 hours to build. The time went into details such as a carved rosette, butterfly joints on the lid miters, moldings and handmade brass hardware. The hardware was sawn from flat stock, brazed, filed, sanded and polished in the shop.

The first time I saw a hammer dulcimer, I was struck by its simplicity and clean sound. As a builder of harpsichords and clavichords, I recognized a natural relationship between the construction of those instruments and the dulcimer. I built one as soon as I had the time.

This commissioned dulcimer is my third. It's larger and more complex than the first two, partly because it is triple-strung (three strings for each note). I added a drawer for necessary items, like the hammers and a tuning wrench, and designed and built all the brass hardware. Despite those additions, this dulcimer is more understated than the others; I strove for subtlety in the details.

I wanted a drawer for the accessories, but it took some time to figure out just how to build it. The problem was the bracing on the underside of the soundboard, which restricted the size and location of the drawer. I ended up with a trapezoidal drawer with one slide along the right side. A quarter-turn of the tagua pull raises a brass blade hidden in the drawer front to keep the drawer closed. I made brass hooks to hold the lid in place, and to keep the lid from shifting, I supplemented the hooks with matching bevels on the lid and on the case.

The hammer dulcimer is a minstrel's instrument; therefore, it needs to be transportable. With the drawer closed and the lid in place, this dulcimer is protected from any bumps and dings by a light case made of cherry plywood.

—Abijah Reed, Putney, Vt.

Notes and Comment

We welcome news stories, anecdotes about the triumphs and pitfalls of woodworking, tales of government regulators, photos of unusual work—anything that you think other woodworkers would like to know about. We pay for material we use. Send submissions to Notes and Comment, Fine Woodworking, *P.O. Box 5506, Newtown, CT 06740-5506.*

Photos except where noted: Scott Phillips

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Oops

It's not that Jake Cress can't make furniture. Quite the opposite. It's just that the Fincastle, Va., furnituremaker needs to cut loose once in a while. The self-described "dusty old guy who works by himself in an ancient log cabin" turns out high-style reproductions of American furniture. Well, most of the time.

Then there are pieces like *Oops*, a Chippendale chair that would be perfectly executed were it not for a wandering ball foot. For Cress, the chair and similar pieces are a way of rebelling against the pretensions of furnituremakers who take themselves too seriously. Cress has been invited to exhibit what he calls his "funny furniture" at the Smithsonian Institution's Renwick Gallery in Washington, D.C., this December.

Photo: Martin Church