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February 1997, No. 122

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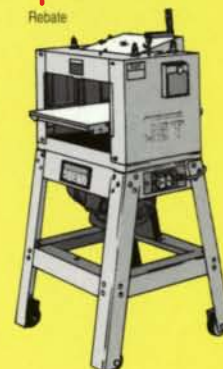


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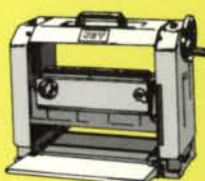
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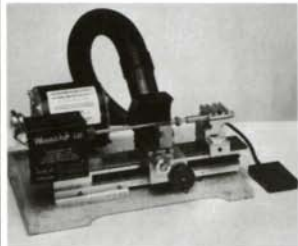
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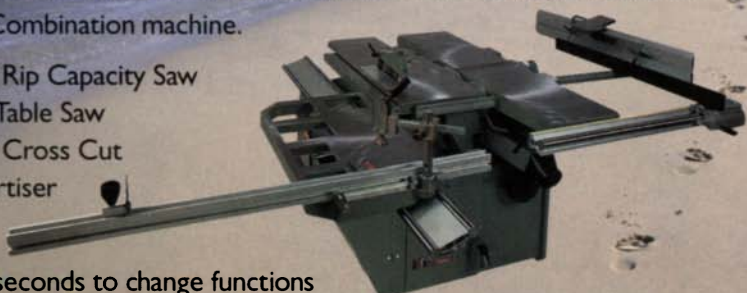
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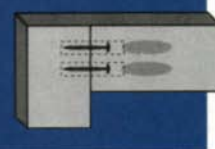
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On the Cover:

The design for this chair is based on the work of Gustav Stickley, the Greene brothers and other Arts-and-Crafts giants. Construction is straightforward, p. 42.

Photo: William Duckworth



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Spokeshaves, p. 69



Shaker tall clock, p. 84

Some trees are not easily renewable—

It was with great concern that I read that both the African species kiasat and umbaua were thought to be environmentally acceptable (*FWW* #118, p. 68). Steve Kearns, the furnituremaker who has used kiasat, said customers are impressed that it can be "sustainably grown." Niall Johnson, an umbaua user, says "customers are really into the wood's ecologically responsible aspect." Nothing could be further from the truth, especially in a country such as Mozambique where both of these woods originate.

Umbaua (*Khaya nyassica*) is a forest tree. Kiasat (*Pterocarpus angolensis*) is not. Both, however, are not easily accessible. When a timber feller comes upon suitable trees, all that can be taken are removed, with absolutely no thought for the medium- to long-term viability of that grove of trees.

Sustainability and *ecologically responsible* would imply a certain degree of disciplined selection of trees to be felled and a replanting program. At present, neither is being carried out.

I suppose it is difficult for those of you who are in the First World to realize just how things work or don't work in Africa. The attitude being that "If I don't take the trees, the next man will." Your writers have, I imagine, the best of intentions and merely may be quoting what they have been told by timber dealers and

importers—and this is where the curse of the whole dilemma lies.

I can buy umbaua in log form for the equivalent of about 37 cents (U.S.) a board foot. Given your price of \$5.80 a board foot for umbaua, it is quite obvious that vast profits are being made from these lovely trees, even after making allowances for waste and shipping.

As a full-time cabinetmaker actively involved in conservation here in my province, I feel very strongly about the misrepresentation of the facts.

—Robert Scott, Kwazulu Natal,
Republic of South Africa

Woodworking needs beginners—The letter from Ed Hilton (*FWW* #120, p. 6) is a perfect example of one of the main problems of learning a new hobby or craft—the small number of mean-spirited, elitist twits who feel the need to lord over the novice and beginner with their supposed superior skill or experience.

Only a fool would belittle a beginner. Every hobby needs new blood, or it cannot thrive and grow. One Ed Hilton could chase away many an ardent beginner. I will continue to press on in learning woodworking and asking silly questions and, someday, maybe I can lead a beginner into woodworking with a gentle hand and not a barbed tongue.

—Peter Harris, Brookfield, Ill.

EDITOR'S NOTE: Our reader surveys indicate that *Fine Woodworking* has roughly equal numbers of beginning woodworkers and full-time professionals.

Well, maybe it's not "never"—In his response to a letter about using U.S. electrical equipment in Europe, Ronald Rockovich is quite categorical in saying that 60-Hz motors cannot be run on 50-Hz power (*FWW* #120, p. 28).

I bought a Rockwell radial-arm saw in California in 1975, which I used until moving to Europe seven years later. I've

Writing an article

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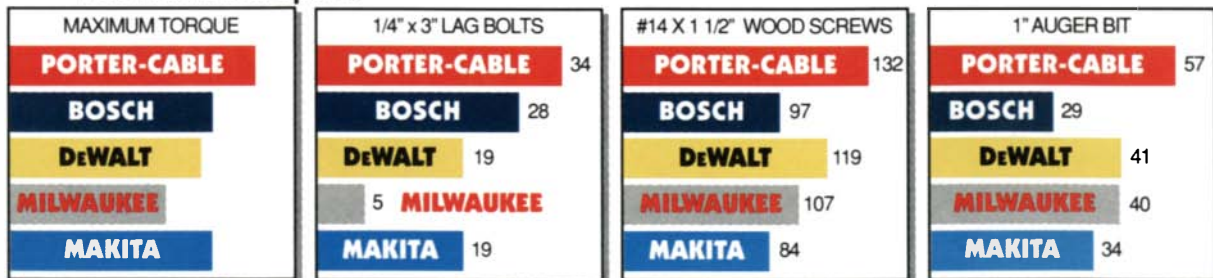
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used the saw constantly since then. The motor was rebuilt last year following an exceptionally long job, which caused considerable overheating. Although this was probably partially a consequence of the 50- to 60-Hz discrepancy, to say that such a motor cannot be used in Europe gives the wrong impression.

—Steve Goulden, Hereford, England

Beyond sharpening stones—Years ago, I noted that the pathologist at my hospital (I'm a physician) sharpened the microtome blade over etched glass. (The microtome is used to cut tissue samples to see them under a microscope.) The cuts are very thin, so the blade edge is sharp and uniform. I decided to use the discarded etched glass from pathology in place of fine-grit sharpening stones.

My son took up glass sandblasting at home, and as soon as I noticed the uniformity of the etched glass surface he created on his work, I realized it was possible for me to manufacture as much etched glass as I wanted. Glass of 1/4 in. or thicker is perfect.

Glass etched with fine sand can be substituted for the 600-grit sandpaper Mario Rodriguez uses to true up a plane sole (see *FWW* #119, p. 39). I can sandblast each side of a piece of glass many times and keep using it. I use oil as the lubricant.

—José L. Martinez,
McGuire Air Force Base, N.J.

Tablesaw switch located for safety—

In light of *Fine Woodworking's* statement about shop safety, the suggestion about moving a tablesaw switch offered by Ron Kent may be worth reconsideration (*FWW* #121, p. 22).

Equipment manufacturers are beset not

only with regulations to build safety into their goods but also with the necessity of "idiot-proofing" (no pejorative intended) their designs against all possibilities of liability litigation.

The recessed location of the Delta Unisaw switch provides a degree of protection against accidentally turning on the saw. Although moving the switch forward enhances access, it also heightens the possibility of starting the saw when the operator, or casual visitor, is unprepared.

Further, relocation of the switch will likely void the manufacturer's warranty and will certainly reduce its liability in case of an injury.

—Edward Underriner, Sparks, Md.

Weaker ammonia works just fine—

Gary Rogowski's article answered a pressing need: how to darken brass hinges to make them match antique pulls and knobs from another source (see *FWW* #121, p. 59-60). I got good results using an inexpensive store brand of ammonia and leaving the hinges suspended above it for 12 hours. Industrial-strength ammonia (28%) is nasty stuff, and dangerous. Be safe. The household variety may take longer, but it worked well for me.

—Charles Watson, Oxford, Ohio

So which blade really cuts best?—I'm just about to purchase a new sawblade, so I read with much interest Michael Standish's article on all-purpose sawblades (*FWW* #120, pp. 38-43). I presently have the old faithful three: a 60-tooth crosscut, a rip and a combination. I keep them sharp and clean, and they work very well.

The problem is that I'm tired of

changing blades so many times during the course of a project, and my combination blade doesn't perform to my standards for all situations.

I had all but decided to bite the \$107 bullet and purchase the Forrest Woodworker II thin-kerf, 40-tooth blade. Then along came your article. If I understand the chart, you are saying the 30-tooth is better than the 40-tooth Woodworker II.

To help solve the mystery, I called Forrest for an opinion of your test (Forrest says its best-selling all-purpose blade is the 40-tooth Woodworker II). The company says you are not correct in your findings, and that the 40-tooth blade is superior, especially after the blade starts to become anything other than extremely sharp.

—Dan Brock, Sharpsville, Ind.

MICHAEL STANDISH REPLIES: That the blades in our survey did so well is a tribute to the diligence and manufacturing sophistication of their makers, whose knowledge and skill make it an excellent rule of thumb to defer to their recommendations about specific applications. I should confess that after a dumpster-full of preliminary cut samples, I felt like Hunter S. Thompson at a presidential convention. The information overload led me to ship a bundle of samples to my editor with the warning that the blades were so universally good that the cut pieces could be as much a report on the quality of the stock as the capabilities of the blades.

What not to do with winding sticks—

The front cover of *FWW* #120 shows winding sticks being used to check whether a door is twisted. For the most

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part, however, it's totally unnecessary to use winding sticks to check for twist. By simply standing the door upright, any twist will be made obvious by sighting one stile against the other. This works for any size door and has been the standard practice in checking for twist for centuries.

It's virtually impossible to assess the amount of twist in a door accurately with the door lying flat. Whether the saw horses or table are level or not, the door will settle on the four supporting points of contact on the stiles.

The advent of machine jointers have rendered winding sticks obsolete except where hand tools are used to prepare stock for joinery. Nowadays, it's common to use a machine to true up the faces of boards in advance of using a thickness planer. Jointing in this way removes the twist, bow and cup from raw lumber and automatically flattens the boards perfectly. Combining this with equally accurate joinery ensures a twist-free door. When the mortise and tenon run exactly parallel with the truly flat outside face of the stiles and rails of a door or frame, the door cannot have twist.

When you have loose play in the joints or you have inaccurately cut the shoulder of the tenon, the pressure of the clamps exposes the shortfalls in accuracy, and the door becomes twisted. When you shave tenon faces or pare the inside of the mortises, the fit of the tenon is compromised, and the door now relies on epoxy to fill the void created by inaccuracy. —Paul Sellers, Waco, Texas

Safety should get a higher priority—It is quite evident that the people who select photos for your editions do not know shop safety. This is evidenced in six photos that appeared in *FWW* #120.

Long sleeves next to moving, cutting parts of machines are dangerous. That's the first rule of any shop where there are these types of dangers. If any of your editors or photo selectors have been in the shop when an accident occurs due to some slipup and carelessness, like long sleeves next to a moving blade, they would not forget it.

This issue will not get to our high school shop library. That is for sure. —Hugh Vickers, Marion, Ind.

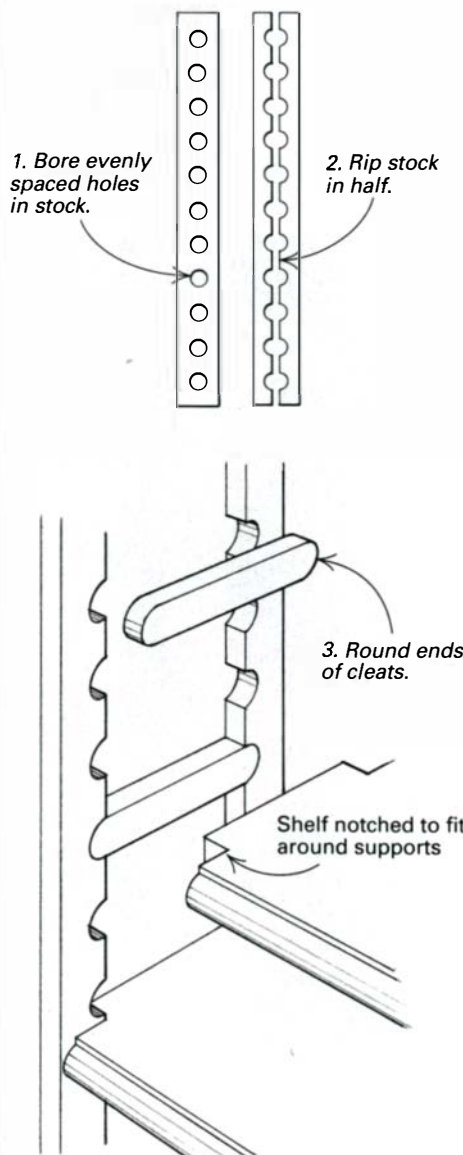
More on supporting cabinet shelves—

There is a slightly faster adaptation of Stephen Winchester's sawtooth shelf supports (*FWW* #120, pp. 74-78). Both Winchester's method and this one are styles used by old German cabinetmakers. I'm surprised he failed to mention it.

Drill a series of holes the same size as the cleat you plan to use down the center of a 1x4 (see the drawing below). I prefer 1½-in. holes on 2½- to 3-in. centers, but size and spacing should be according to taste. Make one piece for each side of the

No-fuss shelf supports

Shelf supports guaranteed to align can be made quickly by boring evenly spaced holes in stock that matches the cabinet and then ripping the stock in half. Cleats supporting the shelves are rounded at each end.



cabinet; then rip each board in half on a tablesaw. Use the same bit, or a compass, to mark the ends of the cleat. Cut and sand, and you're done. Rounded cleats may not be as pretty as the sawtooth design, but they're just as effective when time is money.

—Paul Wilson, Dripping Springs, Texas

Stephen Winchester did not mention the metal shelf support with a nickel or brass sleeve that lines the hole. These inserts give a more finished appearance, and I never use the supports without them. The inserts fit best if the hole rim is countersunk slightly. I had a regular twist drill ground to the shape of the insert and tipped with a brad point. The bit drills and countersinks in one operation.

—Barrie Graham, Arundel, Que., Canada

It's mountain, not bay, laurel—

California bay laurel is the wood that John McAbery uses for his wood carvings (see *FWW* #120, p. 114), not mountain laurel as the article reads. Other names for the bay tree include California bay, California laurel, Oregon myrtle and pepperwood. Its botanical name is *Umbellularia californica*. It is a fast-growing native hardwood. Anyone interested in learning more about John's carvings can write to us at P.O. Box 163, Petrolia, CA 95558.

—Gretchen Bunker and John McAbery

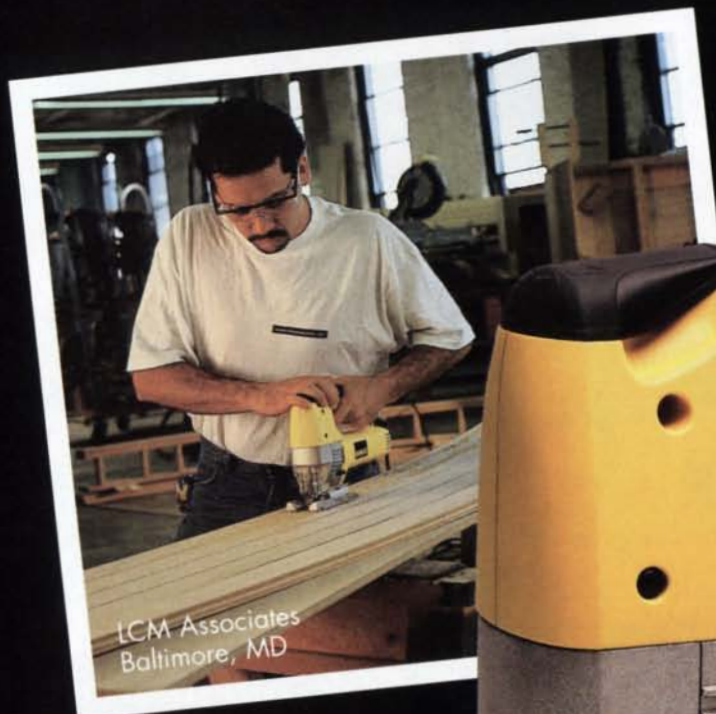
Erratum—An item in "Tool Forum" (*FWW* #121, pp. 108, 110) incorrectly listed the price of Oxford spar finish. The suggested retail price for a quart of the finish is \$29.90.

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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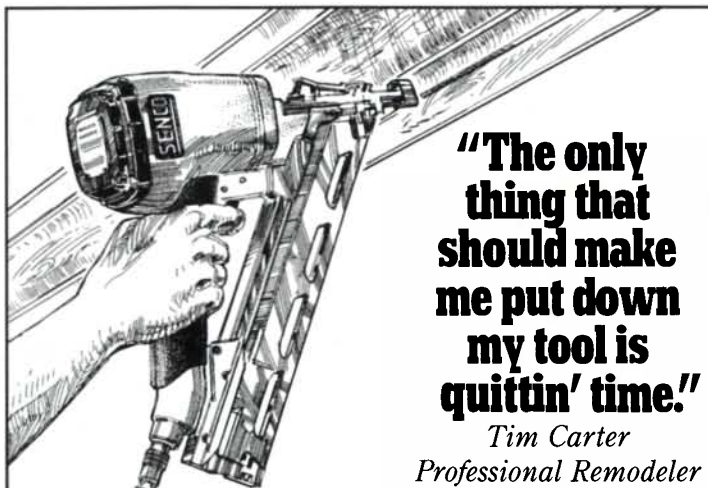
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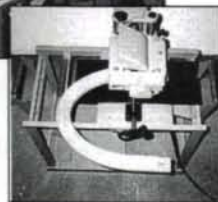
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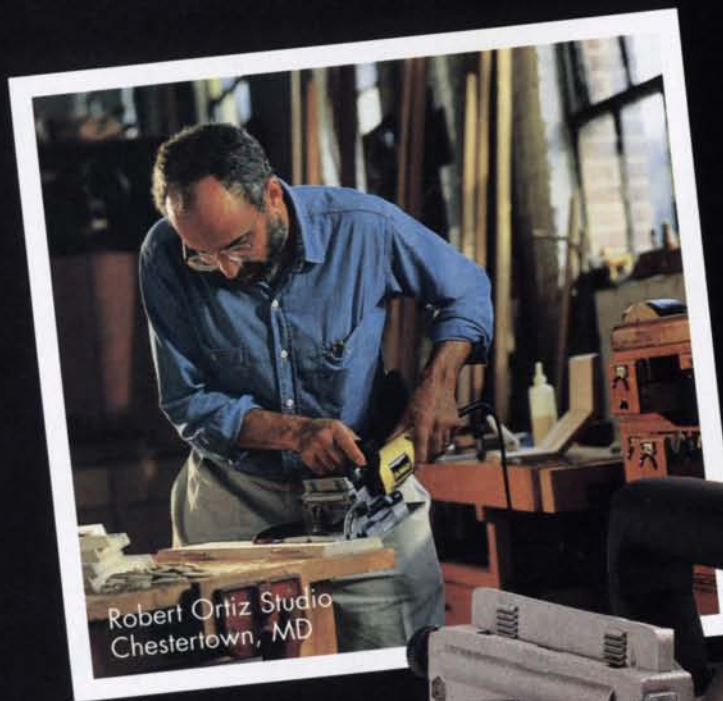


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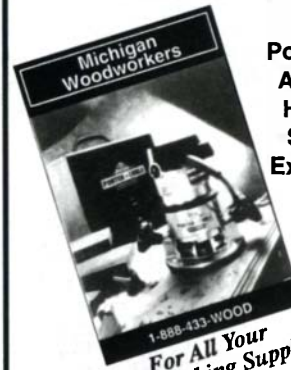
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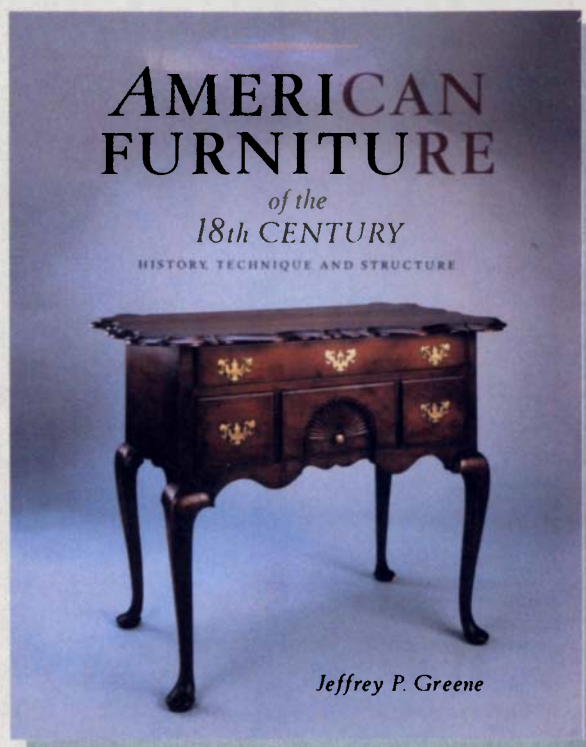
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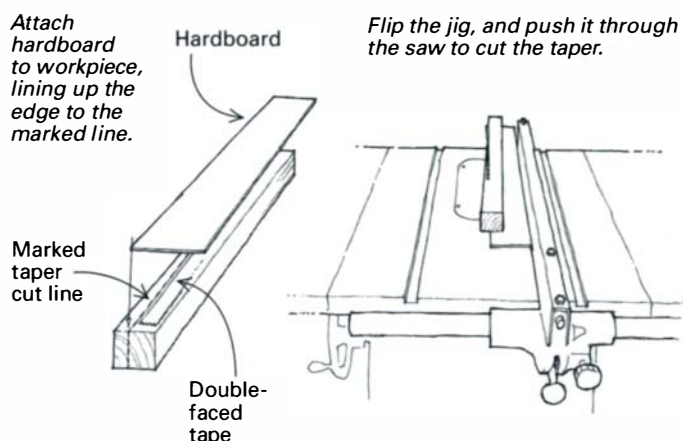
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Quick tapers on the tablesaw



Here's a quick and foolproof way to cut tapers. First draw the desired cut line on the workpiece in pencil. Set the saw fence to a width slightly greater than the workpiece, and cut a scrap of hardboard to this width. Using either double-faced tape or tacks, affix the hardboard to the workpiece, carefully aligning the edge of the hardboard to the pencil line. Run this assembly through the saw without resetting the fence.

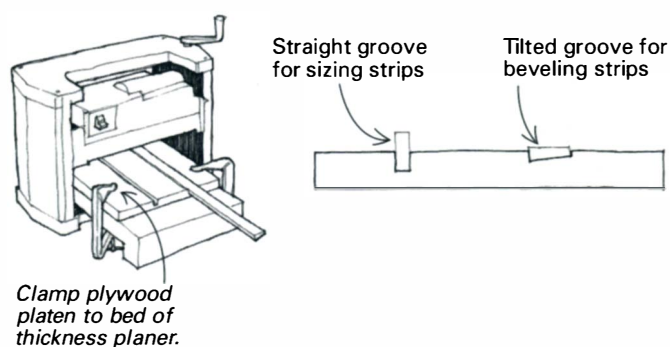
The saw will cut a precise taper, right to the line.

—Leigh Jerrard, Los Angeles, Calif.

Quick tip: If you store your waterstones in water, add a few drops of household bleach to it. The bleach will prevent algae from growing in the water and will not damage the stones.

—Robert Thayer, Brewster, Mass.

A beveling fixture for the planer



I wanted to use Tony Konovaloff's technique of using beveled hardwood strips for glazing cabinet doors (*FWW* #116, p. 49), but I didn't want to handplane all the strips. So I designed a technique to do the work using my thickness planer and a plywood platen. I'm sure that this method could be easily adapted to many other small-stock-milling needs, making them simpler and safer.

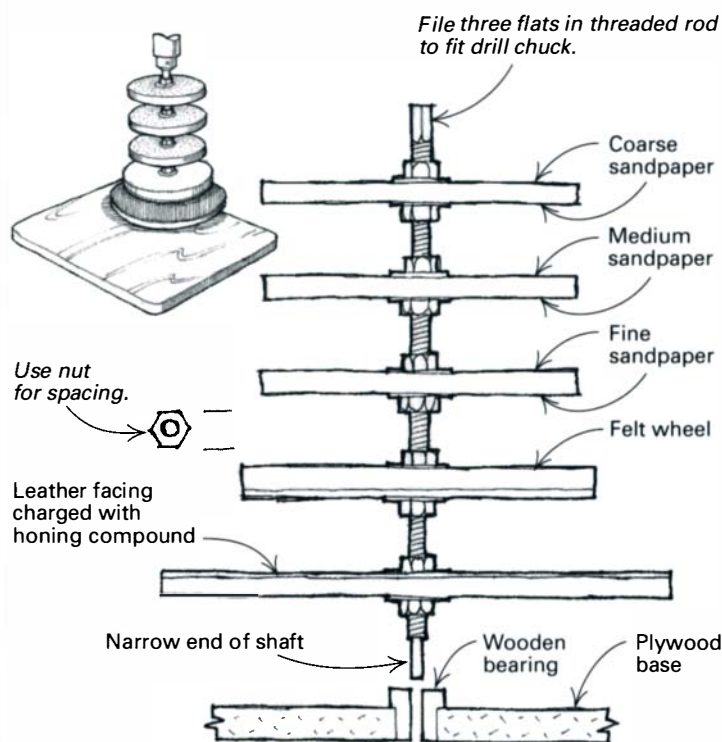
Start by milling the rough blanks and surfacing them to thickness. Then make a platen to fit the bed of your thickness planer by cutting grooves in a piece of plywood. In the drawing, there are two grooves—one to hold the stock on edge and a second groove

to bevel the strips. I cut this second groove by tilting the tablesaw blade 5°. The platen grooves support the blanks on two or three sides and guide them through the planer.

To use the fixture, clamp the platen to the planer bed, and pass the blanks through, taking light cuts.

—Bruce Gillies, Aurora, Ont., Canada

Drill-press sharpening tree



Sharp tools are fundamental to woodworking, but it should not take a lifetime of practice or involve a large cash outlay to sharpen them. This drill-press powered sharpening tree not only satisfies these requirements but also eliminates any worry about ruining the temper in tools by overheating them.

The device consists of a series of medium-density fiberboard (MDF) discs mounted on a shaft. Each disc is covered with a progressively finer abrasive. The whole gadget is mounted on and driven by a drill press. To make it, cut three 5-in. discs and one 8-in. disc from 1/2-in. MDF. Buy a 6-in.-dia. hard felt disc, and cut a 1/2-in. plywood disc to support it. Glue coarse, medium and fine sandpaper to the three 5-in. discs, and attach a disc of thin tooling leather to the 8-in. disc for stropping.

Start with a 12-in. length of 1/2-in. threaded rod. Remove the threads from the bottom 1 in. of the rod with a belt sander or a grinder, and file three flats on the top to fit the jaws of the drill-press chuck. Cut out a plywood base to bolt to the drill-press table. Bore a hole in the base, and insert a hardwood dowel to serve as a bearing—it will last longer. Drill a hole in the dowel to accept the bottom of the threaded rod.

Now you are ready to assemble the tree. Slide the discs onto the

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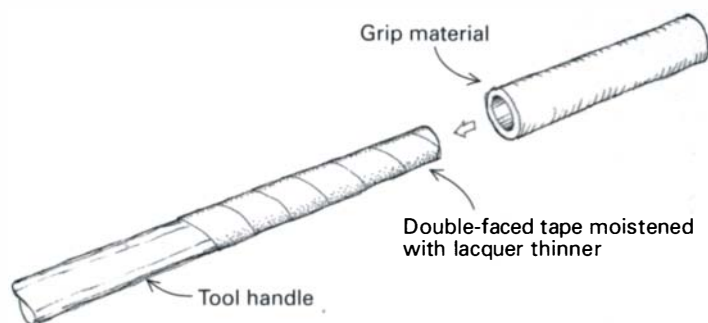
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rod, and hold them in position with nuts and flat washers on both sides. Slide the bottom of the rod into the hardwood bearing, adding a little grease for lubrication. If you prefer, add a tool rest ladder (not shown) to complete the device.

To use, set your drill press at a low speed. Start sharpening at the top of the tree, and work down through the progressively finer abrasives. Finish up on the felt or strop, which has been charged with honing compound. —Herbert Stait, Dundas, Ont., Canada

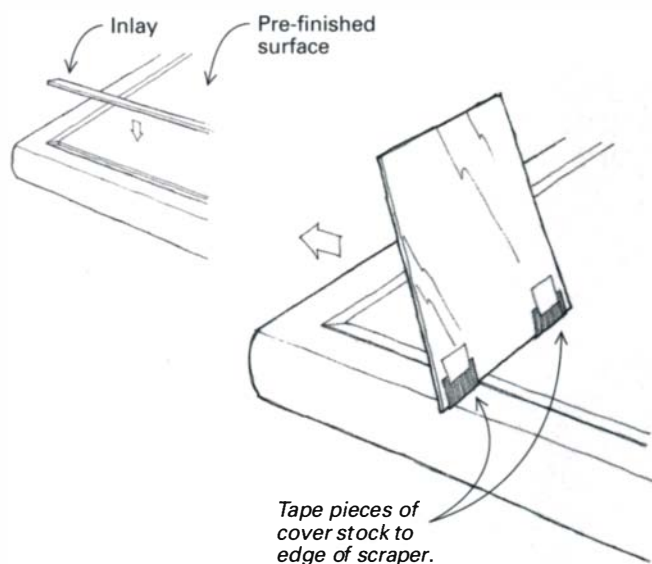
Adding cushioned handles



To attach a rubber or plastic handle over a wood or metal shaft, you can borrow a trick from golf club shops. Wrap the shaft with double-faced tape, and then moisten it with lacquer thinner to make it slippery. Slip the handle over the shaft. When the solvent dries, the handle will be locked in place.

—Henry Fisher, Columbus, Ohio

Inlaying strips in pre-finished wood



When inlaying a decorative strip or a medallion in a tabletop, I've found that it's helpful to stain and apply one coat of varnish on the top prior to cutting the grooves for the inlay. This preserves the contrast between the strip and the background, and it keeps glue smears from ruining the finish by blocking the stain. But in

leveling the strip, it's possible, inadvertently, to tip the scraper slightly and remove the layer of finish.

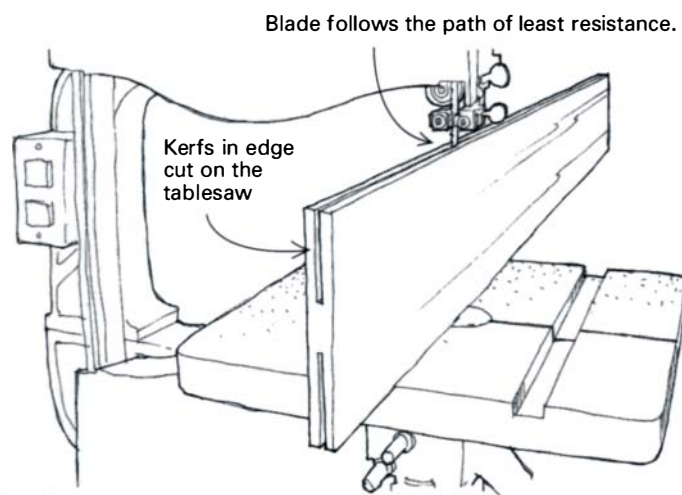
To avoid this problem, I tape two pieces of paper around the cutting edge of the scraper, leaving space between them for the inlay strip to be leveled. I can scrape the inlay nearly to the level of the substrate without ruining the finish. Good-quality coated paper, such as the cover of *National Geographic* magazine (.0045 in. thick), is ideal for this purpose.

—John M. Van Buren, Herndon, Va.

Quick tip: Some woods like poplar and cherry are difficult to carve, even when your tools are sharp. The wood seems to stick to the tool. Next time you are finishing up a carving in one of these woods, paint the surface with a good coat of mineral spirits. The solvent will soak in and lubricate the wood to make all those final smoothing cuts much easier to make. After evaporation, the mineral spirits won't affect the finish.

—Michael Burton, Glorieta, N.M.

Two resawing techniques



As a student at the School for American Craftsmen at the Rochester Institute of Technology, I learned a useful procedure to keep a bandsaw blade from wandering when resawing large planks. Start by kerfing both edges of a board on the tablesaw, centering the cuts on the resaw line. Be sure to register the same side of the board against the fence when making these cuts into the edges. The deeper the kerf the better. But if the wood pinches the blade, it's safer to make several passes.

Pass the board through the bandsaw, cutting the waste between the two kerfs. The interior edges of the kerfs act like blade guides to keep the blade from cutting into the surface of the two new boards. Finally, plane the waste from your two new planks.

—William Crocca, Rochester, N.Y.

To resaw, I make rip cuts in both edges of the timber, taking care to flip the timber end over end, so the cuts line up exactly. Although I have a 12-in. tablesaw that gives me a depth of cut of just over 4 in., I leave a narrow, unsawn strip separating the two cuts. Then I run

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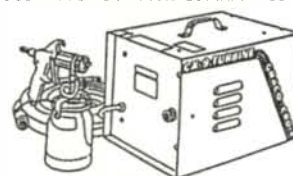
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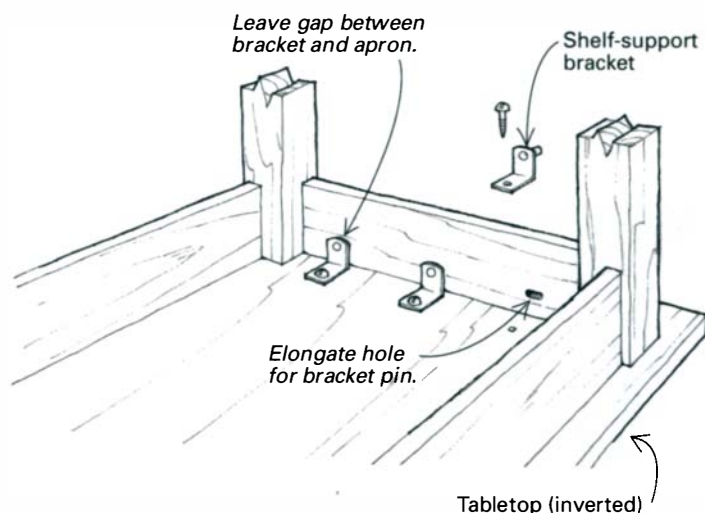
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my reciprocating saw through this narrow strip. The blade takes the line of least resistance and never cuts into the surfaces sawn on the tablesaw.

—Roger Kirby, *Emu Park, Queensland, Australia*

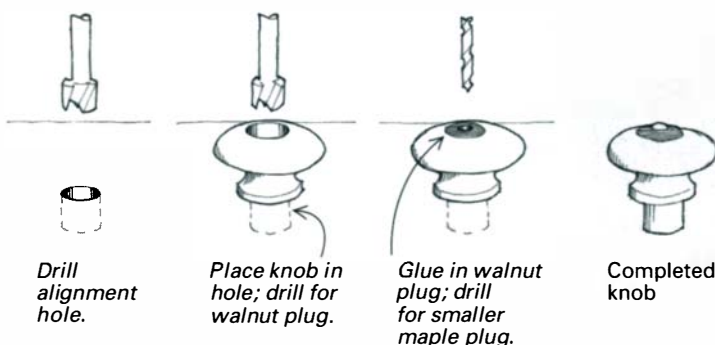
Fastening a tabletop with brackets



While building a small table with my daughter, I came up with a new way of attaching the top to the aprons using shelf brackets left over from previous projects. I drilled a hole in the tongue of each bracket for a screw. The bracket's pin fits in a hole drilled in the apron. To accommodate wood movement, I left a bit of space between the bracket and the apron, and I elongated the hole in the apron to allow the bracket to pivot. When the pin was inserted in the apron slot, I screwed the bracket to the underside of the table. The brackets are designed to support shelves loaded with books, so they should be sturdy enough to hold down a tabletop.

—Andrew J. Lenhart, *Royal Oak, Mich.*

Making bulls-eye knobs



Here's how to make knobs with concentric rings of alternating woods. First turn or buy some maple knobs with round tenons on the back. Clamp a flat piece of stock to the drill-press table, and bore an alignment hole using a bit that matches the diameter of the tenon. Place the knob in the alignment hole. Now chuck a 1/2-in. Forstner bit in the drill press, and bore into the top of the knob

about 3/8 in. deep. Be careful not to weaken the knob by drilling too closely to the narrow waist. Glue a walnut plug in the hole, keeping the grain consistent with that of the knob. Trim and sand the plug so that it's a little proud of the knob and curved to match the contour.

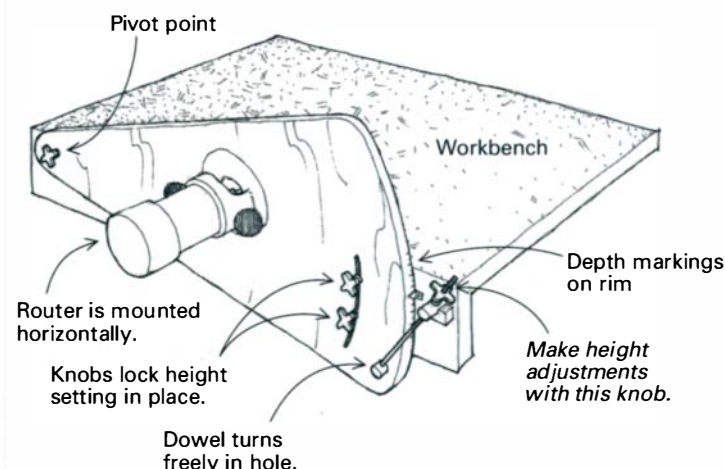
With the knob back in the drill press, bore a 3/16-in. hole in the walnut plug, and glue in a maple plug. Trim and sand the maple plug to a rounded button about 1/16 in. proud of the walnut surface. Chuck the knob in the drill press, adjust the speed to about 800 rpm and use a piece of 000 steel wool to smooth the concentric plugs. The heat caused by the friction will darken the maple and give the entire top of the knob a beautiful patina.

—William Shepard, *Cambridge, Ohio*

Quick tip: Foam water-pipe insulation makes a great pipe clamp cover. It is inexpensive, comes pre-split and can be cut to length with scissors.

—Bill Kershaw, *East Haven, Conn.*

Router-height adjustment fixture



To make panels using vertical panel-raising bits on a traditional router table, you have to slide the panels on edge along a fence. This approach can be awkward, and the fence settings are hard to replicate accurately.

I found that I could get better results by mounting the router horizontally, as shown. This fixture allows you to make extremely fine height adjustments and accurate repeat settings. I made the wedge-shaped section that holds the router from 3/4-in. birch plywood. It pivots on the edge of a bench. To use, loosen the three locking knobs, adjust the router up or down with the adjustment knob and then clamp the router in place with the three locking knobs. The weight of the router keeps tension on the threaded adjustment rod.

Markings on the rim of the router piece allow adjustments (1/64 in. or less) and accurate repeat settings. Because travel at the rim is greater than travel at the bit, you must widen the spacing between the adjustment marks.

—Sid Ladenson, *Tustin, Calif.*

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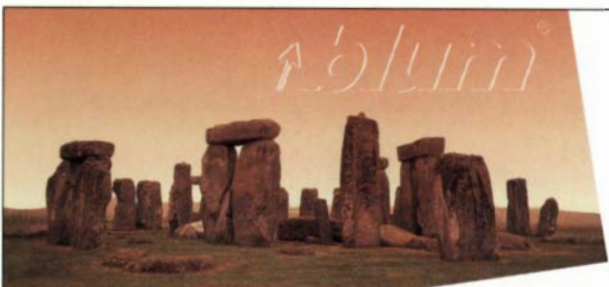


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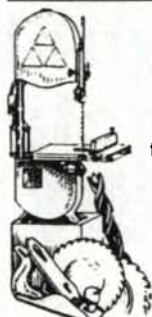
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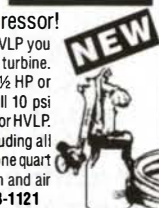


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Child-safe finishes for jigsaw puzzles

I enjoyed "Jigsaw Puzzles" by Anne Williams (FWW #88, pp. 52-55), but the finish that Williams recommends is either a floor wax or a spray fixative.

I went to a local art-supply store to get a spray fixative but found that it contained acetone and toluene. In fact, the label warned that the state of California deemed these materials to be cancer-causing. I realize that both of these chemicals are solvents and will evaporate quickly, but I'm wondering if the residual finish is safe for a child.

—Del Fussell, Englewood, Colo.

Chris Minick replies: The hazard warnings printed on the label pertain to the material in the can, not necessarily to the toxicity of the dried finish. Adequate ventilation, proper protective equipment and some common sense will protect you from the adverse effects of most finishes during application.

Most finishes are totally safe once the solvents have evaporated. However, when making projects for small children, it's still wise to select a finish known to be safe. Two child-safe finishes immediately come to mind: shellac and walnut oil.

Shellac, the processed excretion of a tiny insect, has been used for hundreds of years as a lacquer-like furniture finish and is the main ingredient of a traditional French polish.

The nontoxic nature of dried shellac is well-documented. In fact, shellac is approved by the U.S. Food and Drug Administration as an additive for foods and pharmaceuticals. Shellac is used to make glazes found on some cookies and candy, as well as the timed-release coating found on some pills.

I prefer to mix my own shellac (dry shellac flakes dissolved in denatured alcohol), but the premixed, hardware-store variety also will work. Shellac has a short shelf life once mixed; old shellac doesn't dry well. If you use the premixed variety, test to see how long it takes to dry on scrap. After half an hour, it should no longer feel tacky.

Pure walnut oil, a semidrying oil pressed from walnut meats, is my finish of choice for wooden cooking utensils and cutting boards. Walnut oil dries slowly (usually

about five days) and forms a soft, easily damaged film. It's probably not ideal for your jigsaw puzzles, but it does make a good finish for toys.

Walnut oil can be applied just like any other finishing oil. Apply a heavy coat, let it soak for 30 minutes and then wipe off the excess. When the toys begin to look a little battered from use, just apply another coat to rejuvenate the finish.

I would avoid water-based finishes or floor waxes on your wooden puzzles. The water in either of these will raise the grain, and sanding all those puzzle pieces would be a lot of work.

[Chris Minick is a finish chemist and woodworker in Stillwater, Minn. He is a contributing editor to *Fine Woodworking*.]

Preventing tearout when routing drawer fronts



When I am routing drawer fronts, I often encounter unwanted chipping of the wood at the corners (see the drawing above). Typically, I rout the 3/8-in. rabbet on the inside of the drawer front and then a 3/8-in. thumbnail profile on the face of the drawer front. I usually rout with the grain first and then across the grain. Is there any way to avoid unsightly chipping at the corners?

—Edward J. Hessler, Kalamazoo, Mich.

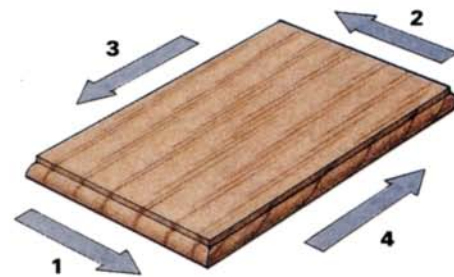
Lynette Breton replies: There are several things you can do to reduce or prevent your drawer fronts from chipping. When removing a lot of material, it is better for the wood, the bit and the router to take a number of small passes, rather than one pass at full-depth. I probably would rout the 3/8-in. rabbet in three passes and the thumbnail in two, routing the thumbnail first. Use sharp bits, and always test sample boards before routing an actual workpiece.

I also suggest routing your drawer fronts on a router table instead of using a hand-held router. Pushing a workpiece across a table and against a long fence is a

much more stable situation than trying to keep a hand-held router balanced on a small drawer front and a short fence tight up to the edge of a drawer front.

Perhaps the most important thing you can do is to rout the ends before the long sides. Wood tends to tear out at the end of a cross-grain pass, so by routing across the grain first, then with it, you can usually rout away any chipping that occurs at the corners (see the drawing below).

To eliminate the possibility of tearout at the corners, you can support the back edge of the workpiece. I like to use a miter gauge with an auxiliary wooden fence to keep the work at right angles to the fence. Then I attach a backup stick to the auxiliary fence, using double-faced tape, and butt the workpiece against this backup stick. The backup stick should be the same thickness as the drawer front, at least 3/4 in. wide and long enough to support the work firmly.



Avoiding tearout: Tearout generally occurs at the end of a cross-grain cut because the fibers at the end of the cut are not supported. If you rout across the grain first, tearout can be routed away with the long-grain cuts.

If you don't have a miter-gauge slot on your router table, you can keep the drawer front at right angles to the fence by pushing it along with a wide, squared-up piece of wood or plywood that rides against the fence.

[Lynette Breton teaches at the Center for Furniture Craftsmanship in Rockport, Maine.]

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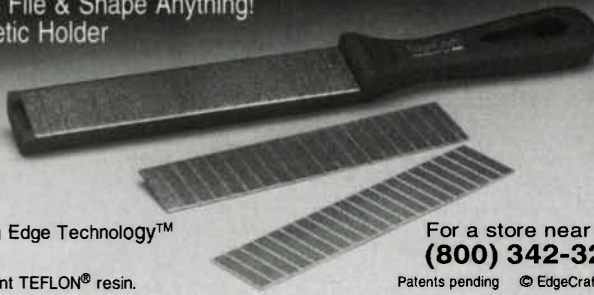
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Harold Steiner, Phoenix, AZ

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hybrid of a machine. It has the weight of a Unisaw with the configuration of a contractor's saw. The table is a very solid casting, the innards are all massive like you'd expect to find on a much larger machine, but the motor is outboard. Can you tell me what this saw is called and when it was made?

—Keith Landin, Vernon, Conn.

Robert Vaughan replies: Your Delta machine is called a Tilting Arbor Bench Saw and was made around 1955. It is a very high-quality, contractor-style saw, but it was priced so close to the Unisaw that sales suffered. It eventually was replaced by the current contractor's saw. [Robert Vaughan tunes, repairs and rebuilds woodworking machinery in Roanoke, Va.]

Staining birch without blotchiness

I read recently that most production cabinet manufacturers are now using water-based stains to abide with government regulations. And the cabinets I've seen in the showrooms have all looked great.

So when it came time to finish the birch kitchen cabinets I'd been building, I tried one of these stains. The results were horrendous—extreme blotchiness, even when I dampened the wood and used wood conditioner. How do the large manufacturers avoid blotchiness?

—Hector Destefanis, Marianna, Fla.

Chris Minick replies: Chances are good that those beautifully stained, blotch-free cabinets were not stained at all, at least not in the conventional sense. The color you see on most high-end production furniture and cabinets is layered on the wood by a process known as toning and glazing. Toners can be thought of as colored finishes and are best applied with spray equipment. Glazes are generally pigmented, heavy-bodied colorants and are designed to be applied by hand.

The main difference between a toning or glazing operation and conventional staining is when the color is applied to the wood. Traditionally, staining is done on the raw wood, often with disastrous results. As you have found, applying a liquid stain directly to a blotch-prone wood like birch (cherry, pine and soft

maple are in the same category) can cause severe blotchiness.

Toning and glazing techniques avoid the problem because the color is layered onto the project after the wood has been sealed with a thin layer of protective finish. Because the color never touches the wood, blotchiness is virtually eliminated. Another benefit of coloring wood by toning or glazing is that you can precisely control the final color of the project, a particularly important feature when color-matching something new to existing furniture. A good primer on toning and glazing techniques can be found in *FWW* #116, pp. 75-79.

A typical toning and glazing finishing schedule is as follows:

1. Apply a coat of sealer to the raw wood. Sand to remove nibs.
2. If necessary, apply a ground stain (a base color) to even up color variations in the wood.
3. Apply a thin coat of sealer to lock in the ground stain.
4. Apply multiple coats of colored toners until the desired color is achieved.
5. Apply a wipe-on, wipe-off glaze to highlight the carvings, turnings or pore structure.
6. Apply a thin sealer coat followed by at least two topcoats.

Although this schedule may sound complicated, it is fairly easy to do with spray equipment. With a little practice, you can do it by hand as well.

Repairing a delaminated tabletop

I recently acquired a round maple tabletop. It measures 4 ft. in diameter and is glued up from 1 3/4-in.-sq. pieces running the full width of the table. The table had been in a damp basement for several years, and the moisture content now varies from 14% to 16%. Some of the glue joints are failing near the edge, forming cracks from 4 to 8 in. long. Can I fill the piece with a polyurethane glue or wood filler, or do I have to cut it apart, plane the edges and reglue it?

—Michael Miciukiewicz, Trumbull, Conn.

Garrett Hack replies: With a moisture content of between 14% and 16%, there's no doubt that your tabletop was stored in a high moisture area. The end grain absorbed moisture, swelled and

compressed the fibers. As the end grain dries out, it shrinks enough to open the weakest joints, causing the glue to fail. As the table dries to a more stable moisture level of 8% to 10%, the joints will likely open up even more, and the top may warp. The table is not likely to fall apart, but there is little you can do to prevent the cracks from growing.

Using wood filler is one option, but it would look crude. Over time, it would work loose from the joints. And because the joints are now somewhat weathered, probably dirty and contaminated with old glue, the introduction of new glue isn't going to help matters much. It would only bond to the old glue or to foreign matter down in the cracks.

A better, but far more tedious, solution is to rip apart each failing joint, shoot it with a plane and reglue it. This is even more challenging than it might seem. It's a real pain to clamp a round form and exert even pressure along the joints. Even after successfully gluing up all those newly jointed edges, each reglued joint will need to be planed or sanded level, and the table's circumference will need to be smoothed.

Here's my advice: Before you try anything, wait at least six months (a year would be better) for the wood to stabilize. By then, you may decide either that you can live with the cracks or that the best solution is a tablecloth.

[Garrett Hack is a furniture maker, farmer and author in Thetford Center, Vt.]

Dyes vs. stains

I have read that dyeing wood is preferable to staining because dyes color the wood fibers without obscuring the grain, and stains fill the pores with color, essentially hiding the wood grain. I would prefer to dye my projects, but I am not sure where to find wood dyes. It seems that finishing products are all identified as stains. How do I know what I'm getting, and where can I purchase wood dyes?

—Tom Naughton, Williamsville, N.Y.

Jeff Jewitt replies: First, let's clear up some of the confusion on various methods of coloring wood. In this country, the generally accepted definition of a stain is any material that imparts color to wood without completely obscuring

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the wood underneath. This distinguishes stains from paints, whose function is to cover up the wood. There are three types of stains used to color wood: pigment-based, dye-based and chemical stains.

Pigment-based stains suspend pigment, a coloring agent, in a carrier/binder solution. The binder adheres the pigment particles to the wood, and the carrier thins the mixture to allow even distribution of the pigment particles over the wood's surface. Because of their size, the pigment particles remain on the surface of the wood, lodging in pores and sanding scratches. Another result of the relatively large size of the pigment particles is that they reflect a good deal of visible light, somewhat obscuring the grain beneath them.

Dye-based stains are organic compounds that dissolve in a carrier: water, alcohol or another organic solvent (such as mineral spirits, naphtha or turpentine). The coloring particles are dissolved, so they're very small—about 1,000 times smaller than pigment particles. This allows them to penetrate deeply into the cellular structure of the wood, coloring it from within. Because they're smaller than the shortest wavelength of visible light, they transmit light, unlike pigment particles. This is why dye-based stains are characterized as transparent.

Chemical stains color wood by reacting with chemicals naturally present in the wood. They act more like dyes. Chemicals used to color wood include sodium hydroxide (lye), potassium dichromate and ammonium hydroxide (ammonia). Strong acids like nitric and sulfuric also produce color changes.

Pigment-based stains are always sold premixed and are identified by the directions on the can. Because the pigments always settle to the bottom, the instructions generally tell you to stir thoroughly. Pigment-based stains are the most commonly available form of wood stain and are found in just about any hardware or paint store.

Dye-based stains are usually sold in dry powder form and are identified by the solvent in which they dissolve best. Most woodworking-supply, mail-order companies sell both water-soluble and alcohol-soluble dye stains. Alcohol-soluble stains are best applied with spray

equipment because they dry so quickly. Water-soluble dye stains dry more slowly, making them easier to work with. They can be applied with a brush, a rag or with spray equipment.

A premixed stain, known as a non-grain-raising (NGR) stain, is also available. NGR stains are either alcohol- or water-soluble dyes dissolved in a blend of organic solvents designed to minimize grain raising. These dyes are very lightfast and are what the large furniture factories use. Like alcohol-soluble dye stains, however, they dry very quickly, so they are best applied with spray equipment.

Dye-stain powders and NGR stains are manufactured by H. Behlen and Bro., a division of Mohawk Finishing Products Inc. (4715 State Highway 30, Amsterdam, NY 12010-9204; 800-545-0047).

Water-, alcohol- and oil-soluble dye-stain powders are available from W.D. Lockwood and Co. (81-83 Franklin St., New York, NY 10013; 212-966-4046). Lockwood also sells to many mail-order catalog companies that repackage the dyes under their own labels.

If you have trouble finding dye-stain powders, call one of these companies to find a local retailer. [Jeff Jewitt restores antique furniture in North Royalton, Ohio.]

What's the proper tablesaw blade speed?

I recently put a new motor on my tablesaw. The motor has a larger diameter shaft than the original and has a larger pulley. I couldn't swap motor pulleys because of the difference in shaft sizes, so I bought a new arbor pulley to keep the blade speed roughly the same. If I had used the larger pulley, it would have increased the arbor speed to approximately 6,450 rpm. (In fact, I did a test run with this pulley and was scared by the high-pitched whirr.) At how high a speed can I safely operate a tablesaw? What's the recommended speed for a tablesaw blade?

—Bob Ricker, Chicago, Ill.

Robert Vaughan replies: There's no consensus on the optimum blade speed for a 10-in. tablesaw. Most run at about 4,000 rpm. Delta's contractor's saws ran at that speed for years. Things change. They now run at 3,450 rpm. Delta says that this

does not adversely affect cutting performance but increases the torque.

The only potential problem I see is that a smaller motor pulley means a sharper bend for a V-belt. With a standard V-belt, this could introduce vibration or lead to premature failure. A cogged V-belt should be able to handle the tighter radius without any problems.

The higher the speed, the greater the strain on the bearings and the sooner they'll need to be replaced. Blades running at high speeds tend to throw sawdust all over the place, including your face, as you're cutting. And high blade speed will lead to heat build-up at the blade tips.

The bottom line? Keep your blade speed under 4,000 rpm, and use a good blade with the correct tooth configuration.

Customizing stock hardware

I'm in the process of building a water bed for my son-in-law. The surface of the drawers follows a convex-concave-convex curve with a radius of 2 1/2 in. for each curve.

My son-in-law wants to use Queen Anne drawer pulls, which are quite large (2 to 2 1/2 in.), along the curved surfaces. Can drawer pulls be purchased that are already bent into this shape, or must I bend them? If I have to bend them, should heat be applied in the process?

—Paul Robson, Las Cruces, N.M.

Bob Dunstan replies: Cabinetmakers have been bending plate handles to suit curved drawer fronts for well over 200 years. Even though your radius is extreme, I see no technical problems. The metal in good-quality brass handles will be around 16 gauge and should bend easily enough without resorting to heat. To ensure a smooth curve, I would place the brass plate between a drawer-front molding offcut and a piece of wood shaped to the opposing profile. Then I would squeeze the whole works in a vise. [Bob Dunstan is a former furniture maker who now owns Whitechapel, Ltd., a manufacturer and distributor of furniture hardware in Wilson, Wyo.]

Do you have a question you'd like us to consider for the column? Send it to Questions & Answers, Fine Woodworking, P.O. Box 5506, Newtown, CT 06470-5506.

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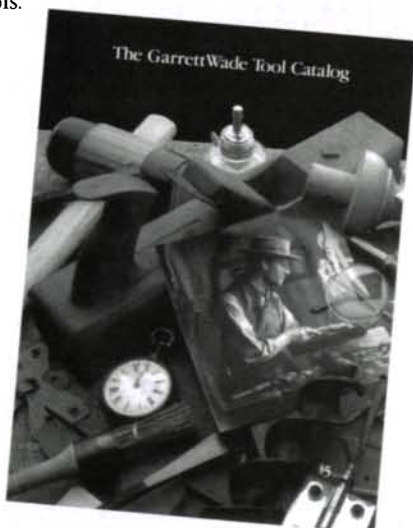
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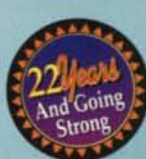
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6078	7/16" 13 amp grinder.....	295 595
0230-1	3/8" Drill 3.5 amp.....	231 132
5936	Belt Sander 4 x 24 w/blade 10 amp.....	495 279
6747-1	Drywall Gun 0-2500 rpm 5 amp.....	205 109
6016	1/4 sheet Palm Grip Sander.....	99 56
6017	6016 Sander with dustbag.....	101 58
6008	1/3 sheet 12,000 orb/min 5 amp.....	230 126
8975	Heat Gun 570° & 1000°.....	102 59
8977	Variable Temp. Heat Gun.....	137 82
8980	8975 Heat Gun w/ case, & acc.....	155 94
3102-1	Plumbers rt angle Drill Kit.....	401 229
5660	Router 1-1/2 HP 10 amp.....	357 209
6256	Variable speed Jig Saw 3.8 amp.....	278 149
6266-6	NEW Top Handle Jig Saw.....	315 165
6527	Super Sawzall with case.....	343 169
6537-22	6527 w/quick lok blade change.....	224 175
6528	above Sawzall with wired cord.....	339 185
6516-21	NEW cordless Sawzall.....	550 299
6125	5" Random Orbit Sander.....	219 129
0406-1	9.6v Drill Kit with 2 batteries.....	315 159
0408-6	12V Drill w/keylock chuck & 2 batt.....	380 172
0502-21	NEW 12V Drill Kit w/ 2 batteries.....	434 225
0231-1	3/8" Drill 0-1700 rpm.....	170 89
0224-1	3/8" Drill 4.5 amp magnum.....	236 132
0225-1	Same as 0224-1 w/keylock.....	236 132
0234-1	1/2" Drill 5.4 amp mag 0-850 rpm.....	255 129
0236-1	0234-1 drill with steel case.....	268 149
0236-1	Same as 0234-1 w/keylock.....	255 129
0244-1	1/2" Drill 5.4 amp mag 0-600 rpm.....	255 129
0222-1	3/8" Drill 3.5 amp 0-1000 rpm.....	213 119
0228-1	3/8" Drill 3.5 amp 0-1000 rpm.....	207 118
0375-1	cordless close quarter Drill.....	255 148
0379-1	1/2" close quarter Drill.....	288 165
6539-1	Cordless Screwdriver 190 rpm.....	139 78
6540-1	6539-1 with bits & case.....	175 99
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6547-1	6546-1 w/bits 1/4" chuck, & case.....	185 108
5399	1/2" D-handle Hammer Drill Kit.....	356 194
1676-1	Home Hawg with case.....	541 309
6507	Original SawZall with case.....	278 149
6508	above Saw with wired cord.....	264 152
6517	6.5 amp Sawzall with case.....	296 159
6175	1/4" Chop Saw 15 amp.....	415 279
6010	Orbital Sander 12 sheet.....	235 129
5397-1	3/8" var. speed Hammer Drill Kit.....	275 145
5371-1	3/8" var. speed Hammer Drill Kit.....	260 194
5377-1	5371-1 with keylock chuck.....	360 194
3107-1	1/2" var. speed right angle Drill.....	411 234
3300-1	1/2" var. speed right angle Drill.....	378 199
5680	Router 2 HP w/ 1/4" & 1/2" collets.....	367 165
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6142	6145 with case & accessories.....	224 125
6749-1	Drywall Gun 0-2500 rpm 5.4 amp.....	235 135
6755-1	Drywall Gun 0-4000 rpm 5 amp.....	183 99
6767-1	Screw Shooter Kit.....	252 142
5353	Eagle 1-1/2" Rot. Hammer w/cs.....	1046 575
6365	7-1/4" Circular Saw 13 amp.....	229 125
6367	above Saw - double insulated.....	224 128
6366	6365 with fence & carbide blade.....	237 129
6368	6365 w/fence, carbide blade, & cs.....	259 142
6377	7-1/4" Worm Drive Saw.....	345 194
6369	7-1/4" Circular Saw with brake.....	280 152
6490	10" Miter Saw.....	496 265
6491	6490 w/carbide blade & bag.....	594 328
6494	10" Compound Miter Saw.....	585 315
0422-1	12V Hammer Drill w/ 2 batt.....	441 239
0431-1	12V Drill w/ 2 batteries.....	441 239
6496	10" Slide Compound Saw.....	1050 569

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EY6100SEOK	Same as above but has 1 ironman battery and 1 diagnostic battery.....	204 249
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EY3502EQKW	NEW 4-3/8" 12V Metal Cutting Saw Kit.....	500 289

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L84M011	Combo 10"	50	78 42
L85M010	Super Cut-off 10"	80	115 59
L87M010	Ripping 10"	24	69 38
L87M010	Cut-off 10"	60	84 45
L87M010	Thin Kerf 10"	24	72 44
L88M010	Thin Kerf 10"	60	88 49
L88M015	Miter Saw blade 15"	108	175 99
L91M010	Compound Miter Blade 60"	88	54
L98M010	Ultimate 10"	80	128 68
L98M010	Quarrel metal 10"	72	104 58
F410	Fierro Blade - 10"	40	95 49
F810	Quiet Blade - 10"	80	135 74
TK303	7-1/4" Finishing - 40 tooth.....	38	25
TK906	10" Combo - 50 tooth.....	53	32
SD306	6" Dado - Carbide.....	215	115
SD308	8" Dado - Carbide.....	230	119
SD506	Super Dado-carb. w/cs&shims.....	292	145
SD508	8" Super Dado-carb. w/cs&shims.....	344	168
FB107	7 piece Forstner bit set 1/4" - 1".....	92	59
94-1005	pc Router bit/d system w/cs.....	320	169
BF3	NEW Router bit w/fence & legs.....	495	289

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5090DWD	3-3/8" Saw Kit 9.6 volt.....	280 148
DA391D	3/8" angle Drill 9.6 volt.....	166 109
DA391DW	3/8" angle Drill Kit 9.6 volt.....	341 179
ML900	9.6 volt flashlight.....	145 95
6095DWE	9.6 volt Drill Kit w/2 batteries.....	125 65
6095DWE2	6095DWE w/ flashlight.....	135 65
6095D	6095DW Drill only & case Special.....	135 65
6011DWE	12 volt Drill Kit w/2 batteries.....	365 168
632007-4	9.6 volt Battery.....	47 30
632002-4	9.6 volt Battery.....	39 28
6201DWEH	9.6V 3/8" Drill Kit w/ 2 batt.....	351 159
6211DWEH	12V 3/8" Drill Kit w/ 2 batt.....	368 169
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9924DB	3" x 24" Belt Sander with bag.....	360 185
JR3000V	Var. speed Recip Saw w/ case.....	264 135
9820-2	Blade Sharpener.....	433 215
1909B	3-1/4" Planer with case.....	263 129
1912B	4-3/8" Planer.....	352 189
B04552	1/4 sheet Pad Sander w/ bag.....	101 55
DA3000R	3/8" Angle Drill var. speed.....	355 175
2708W	8-1/4" Table Saw.....	637 309
5005BA	5-1/2" Circular Saw.....	347 205
6405	3/8" Drill 0-2100 rpm 2 amp.....	115 65
6820V	0-4000 rpm Drywall Gun.....	185 99
6821	NEW Drywall Gun 0 - 4000.....	191 95
6013BR	1/2" Drill Rev. 6 amp.....	270 145
5402A	16" Circular Saw 12 amp.....	1073 609
9401	4" x 24" Belt Sander with bag.....	458 219
LS1030	10" Miter Saw.....	428 205
5007NBK	7-1/4" Circular Saw w/ case.....	250 125
5037NB	NEW 7-1/4" Circular Saw.....	288 148
LS1011	10" Slide Compound Saw.....	995 429
GV5000	5" Disc Sander.....	148 85
N9514B	4" Grinder 4.6 amp.....	118 65
N9501B	4" Grinder 4.6 amp with case.....	174 99
9217SPC	7" Sander/polisher var. speed.....	378 175
2414B	1/4" Cut-off Saw AC/DC.....	419 225
4320	V/spd Jig Saw 2.9 amp.....	182 98
6302	1/2" Drill 0-550 rpm 5.2 amp.....	250 115
SO5001	5" Random Orbit Sander.....	125 69
LS1211	12" Slide Compound Saw.....	1620 779
3901	Table Joiner Kit.....	376 199
3612C	NEW 3 HP Plunge Router.....	492 259
9031	1-3/16" x 21" v/spd miter Sander.....	346 199
LS1040	NEW 10" Compound Belt Saw.....	640 259
HP1500	NEW 1/2" Hammer Drill 5 amp.....	145 95

BOSTITCH AIR NAILERS

Model	Description	List Sale
N805-1	Stick Nailer.....	Super Sale 339

Model	Description	List Sale
N80C-1	Coil Nailer.....	339
RN45	Coil Roof Nailer 3/4" - 1-3/4".....	845 369
N60FN-2K	Finishing Nailer 1-1/4" - 2-1/2" w/ case, oil, & nails.....	618 299
T5054-1	Decking Sheathing Stapler.....	618 365
MIFS	Flooring Stapler 15 gauge.....	902 529
S325X-1	Finish Stapler - 1/2" - 1-3/8".....	245 155
S325X-1K	S325X-2 with case & oil.....	269 165
BT35-2	Brad Tacker 5/8" - 1-3/8".....	254 155
BT35-2K	BT35-2 with case, oil, & brads.....	279 165
BT50-2	Brad Tacker 3/4" - 1-3/16" - 2".....	297 189
BT50-2K	BT50-2 w/ case, oil, and brads.....	335 209
PC5000-1	Power Crown Stapler.....	242 159
CWC100	1 HP Pancake Compressor.....	440 289

FREUD

Model	Description	Teeth	List Sale
L98R010	Ultimate 10"	80	128 75
LM72R010	Ripping 10"	24	78 44
LU84R011	Combo 10"	50	89 52
LU85R010	Super cut-off 10"	80	114 65
LU85R015	Miter saw blade 15"	108	179 105
LU87R010	Thin Kerf 10"	24	72 48
LU88R010	Thin Kerf 10"	60	88 52
LU91R008	Compound miter 8-1/2" 48	88	79 49

FREUD POWER TOOLS

EB100	Edge Banding Machine.....	409 215
FJ85	NEW Top Handle Jig Saw.....	229 125

The following tools have a \$30.00 rebate.

Price shown is before rebate.

JS102	Biscuit jointer w/adj. fence & cse.....	355 179
FT2000E	3-1/4 HP Plunge Router v/spd 410	205

The following tool has a \$50.00 rebate.

Price shown is before rebate.

TR215	8-1/2" Slide Compound Miter Saw.....	349
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NEW Freud Carbide Dado Blades

SD068	8" dial-a-width dado.....	389 199
SD068	6" dial-a-width dado.....	369 189
SD208	8" economy dado.....	155 85

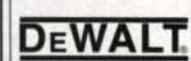
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Cordless Drills

DW995K
1/2" Drill Kit
Sale 229

DW997K
1/2" Drill/Hammer
Drill Kit
Sale 249

DW936K
Saw Kit
Sale 249



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PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ACCU-MITER

18-34	Professional Mitre Gauge.....	149 145
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JDS AIRTECH AIR CLEANERS

Model	Description	List Sale
350	12"x24"x28" 1/5 HP - 350 CFM.....	245
8-12	20"x24"x44" 1/3 HP - 800,1200 CFM.....	469
10-16	20"x24"x44" 1/3 HP - 1000,1600 CFM.....	659

PORTA NAILER

Model	Description	List Sale
401	Porta Nailer complete.....	295 209
501	Face Nailer complete.....	295 209
1,000	Genuine Porta Nails - 1000 qty.....	16.50
5,000	Genuine Porta Nails - 5000 qty.....	74.95
10,000	Genuine Porta Nails - 10000 qty.....	129.95

BIESEMEYER FENCES

Model	Description	List Sale
B-50	50' Corner. Saw Fence.....	443 325
T-SQUARE 62	52' Homeshop Fence.....	360 269
T-SQUARE 40	40' Homeshop Fence.....	335 249
T-SQUARE 28	28' Homeshop Fence.....	325 239

BOSCH

Model	Description	List Sale
1587VS	Top Handle "CLIC" Jig Saw.....	292 139
1587VSC	1587VS Saw with case.....	345 149
1587DVS	above saw w/ dust collection.....	317 178
1584VS	"CLIC" Barrel Grip Jig Saw.....	288 139
1584DVS	above saw w/ dust collection.....	306 178
Bosch Metal Case	for above Jig Saws.....	34 24
Bosch 30 blade assortment	for Jig Saws.....	28.99

Super Special
1584VS or 1587VS with steel case and 30 Bosch blades..... Sale 175

1942	Heat Gun 600°-900° temp.....	132	70
1289D	1/4 sheet Sander.....	113	68
1003VSR	3/8" Drill 0-1100 rpm.....	187	78
1194VSR	1/2" var. speed Hammer Drill.....	272	155
1194VSRK	above Hammer Drill w/ case.....	303	169
1195VSR	3/8" var. speed Hammer Drill.....	247	139
1608LX	5.6 amp Laminate Trimmer w/ guide.....	189	110
1608T	5.6 amp tilt base Trimmer.....	189	110
1608U	Underscribe Laminate Trimmer	239	139
1609K	Laminate Installers Kit w/ 1609 Trimmer.....	355	199
1609KX	Deluxe Installers kit.....	425	229
1604A	1-3/4 HP 2 Handle Router.....	269	142
1604AK	Same as above w/ case & acc.....	337	185
1606A	1-3/4 HP D-handle Router.....	300	179
3270DVS	3"x21" v/spd Belt Sander w/bag.....	301	165
1613EVS	2 HP v/spd Plunge Router.....	369	199
1615EVS	3 HP v/spd Plunge Router.....	536	289
1614EVS	1-1/4 HP v/spd Plunge Router.....	295	165
3054VSRK12	volt cordless drill kit.....	323	185
3270DEV6	6" Random Orbit Sander.....	446	249
B1650K	Biscuit joint.....	Sal	165
B7000	Corner Detail Sander.....	126	69
B7001	Corner Detail Sander v/spd.....	Sal	69
B4050	In Line Jig Saw.....	206	111
3272K	3-1/4" Planer with case 4.2 amp.....	205	111
13474K	4-1/2" Grinder w/ case & acc.....	172	101
1348AE	5" Grinder 8.5 amp.....	237	131
11304	"The brute" Breaker Hammer.....	124	69
11305	Demolition Hammer 10 amp.....	1328	73
11314EVS	Demolition Hammer.....	921	53
11232EVS	1-1/2" Spine Hammer Drill.....	890	52
11224VSR	7-8" SDS Rotary Hammer Drill.....	404	22

DELTA BENCH TOP TOOLS

Model	Description	List Sale
23-700	Wet/Dry Grinder.....	206 149
23-680	6" Bench Grinder 1/4 HP.....	80 69
23-880	8" Bench Grinder 1/2 HP.....	134 108
11-950	8" Drill Press.....	176 128
31-460	4" Belt/6" Disc Sander.....	198 135
31-340	1" Belt/8" Disc Sander.....	270 189
31-080	1" Belt/5" Disc Sander.....	113 85
40-560	16" 2 speed Scroll Saw.....	230 165
11-990	12" Bench Drill Press.....	255 184
11-090	32" Radial Bench Drill Press.....	405 305
43-050	1/2" Bench Router/Shaper.....	398 299
22-540	12" Bench Top Planer with extra knives.....	557 369
36-220	10" Compound Miter Saw.....	294 199
14-650	Hollow Chisel Mortiser.....	380 239
33-060	"Side kick" Miter saw.....	541 429
14-070	14" Floor Drill Press.....	405 299
20-140	14" Cut-off saw.....	299 199
37-070	6" var. speed Bench Jointer.....	351 259
36-275	8-1/4" Builders Saw.....	358 268
36-210	10" Compound Miter Saw.....	344 225
36-040	8-1/4" Compound Miter Saw.....	190 135
36-070	10" Miter Saw.....	217 165
34-182	Tenoning Jig.....	113 79
34-555	Sliding Table.....	487 329
31-780	Oscillating Spindle Sander.....	253 159
23-710	Sharpening Center.....	217 169
28-185	Bench Band Saw.....	213 168
37-190	6" Deluxe jointer.....	603 489
36-250	10" Slide Compound Saw.....	344 225
31-695	6" Belt/9" Disc Sander.....	441 349
40-650	Q3 18" Scroll Saw.....	600 479
40-540	16" var/spd Scroll Saw.....	249 189

DELTA STATIONARY

31-280	Sanding Center w/ stand.....	1250 789
17-900	16-1/2" Floor Drill Press.....	490 399
34-080	10" Miter Box.....	218 168
33-990	10" Radial Arm Saw.....	981 779
33-055	8-1/4" Sawbuck comp with legs.....	846 639
36-540	10" Table saw.....	229 169
34-670	10" Motorized Table Saw.....	492 389
32-100	Stationary Plate Jointer.....	351 269
36-905	30" Unifence.....	346 245
36-906	30" Table Unifence.....	444 319
36-755	10" Tilt Arbor Saw.....	510 199
33-990	12" Radial Arm Saw.....	1579 1199
34-444	10" Contractor's Table Saw.....	559 429

DELTA REBATES !

Prices shown are before rebate !
Rebates are valid thru 3/31/97
\$25.00 rebate

46-700	12" Wood Lathe.....	575 465
28-275	14" Band Saw 3/4 HP.....	635 485
28-280V	14" Band Saw w/enc stand 1 HP.....	798 648
34-445	10" Table Saw with 30" unifence.....	519 419
22-675	NEW DC380 15" Planer.....	835 685
43-355	3/4" Shaper 1-1/2 HP.....	799 649
37-154	DJ15 6" Jointer.....	1289 1039

DEWALT TOOLS

DW321K	NEW Jigsaw Kit.....	300 164
DW364 7-1/4"	Circ. Saw w/brake, 13 amp.....	294 158
DW306K	8.0 amp Recip Saw w/cs v/spd.....	291 164
DW610	1-1/2 HP 2 handle Router.....	266 152
DW411	1/4 sheet Palm Sander, 1.7 amp.....	88 58
DW705	12" Compound Miter Saw.....	734 359
DW704	12" Miter Saw.....	570 325
DW100	3/8" Drill, 4 amp, 0-2500 rpm/rev.....	118 68
DW280K	NEW Screwdriver kit complete.....	222 124
DW673K	Laminate Trimmer kit.....	364 199
DW402	4-1/2" Grinder 6 amp.....	166 89
DW682K	Biscuit Joiner with case.....	448 199
DW625	3HP Electronic Pipe Router.....	520 275
DW625	Router comes with DW666 fine depth adjuster and 8-piece template guide set.....	140 218
DW621	NEW 2 HP Plunge Router.....	400 218
DW675K	3-1/8" Planer with case.....	292 164
DW431	3 x 21 var. speed Belt Sander.....	338 184
DW420	Palmgrip Random Orb Sander.....	124 69
DW421	above Sander with dust collector.....	144 74
DW423	NEW Palm Random Orbit Sander variable speed.....	170 94
DW444	6" Random Orbit Sander.....	266 139
DW443	DW444 with hook & loop pad.....	266 139
DW935K	14.4V 5-3/8" Trim Saw kit.....	444 237
DW935K	Saw comes with 2 batteries!	

DEWALT CORDLESS DRILLS

DW952K3/8"	v/spd w/two 9.6V batteries.....	284 139
DW972K2 3/8"	v/spd w/two 12V XR batt.....	362 189
DW904	12 volt flashlight.....	29.95
DW972K2-2 drill	& DW904 flashlight.....	205 120
DW991K-2 3/8"	v/spd w/two 14.4V XR batteries.....	415 225
DW994KQ	1/2" variable speed w/ one 14.4V XR battery.....	458 235
DW994KQ-2	DW994KQ drill kit w/ 2 batt. Sale.....	259
DW996K	1/2" v/spd Hammer drill w/ one 14.4V XR battery.....	396 245
Above drill kits come w/charger & steel case !		

DW991K5-DW991K drill, DW935 saw, & case 349

NEW DeWalt 18 volt Cordless Tools

DW995K	1/2" Drill Kit.....	428 229
DW997K	1/2" Drill / Hammer Drill Kit.....	454 249
DW936K	Saw Kit.....	458 249

WAP VACUUMS

Model	Description	List Sale
766RDF	10 gallon turbo vacuum.....	845 465
766RDF-D	"Drywall" 10 gal turbo vac.....	915 549
766RDF-DAS	Same as above w/ auto start.....	589 519

CLAYTON OSCILLATING SPINDLE SANDERS

140	Portable sander w/ 4-1/2" spindle.....	625 559
146	Portable sander w/ 9" spindle.....	685 609
100	Floor mount sander w/4-1/2" spnd.....	785 709
106	Floor mount sander w/ 9" spindle.....	845 759

DREMEL TOOLS

3955	Moto Tool Kit with bits & case.....	134 75
3956	Super Moto Tool Kit w/ acc.....	152 85
1672	16" Scroll Saw - 2 spd "Best buy".....	302 174
1695	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
#30	6"	3"	17.05	9.90 56.50
#20	7"	3-1/2"	18.30	10.70 60.95
#0	8"	4-1/2"	20.35	12.10 66.95
#1	10"	6"	23.30	12.90 71.95
#2	12"	8-1/2"	26.75	14.90 83.95
#3	14"	10"	33.85	18.55 105.75
#4	16"	12"	44.05	24.65 140.95

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

Model	Jaw Length	List Sale	Box of 6
3706	6"	10.85	6.20 33.50
3712	12"	12.05	6.80 37.25
3718	18"	13.25	7.60 41.05
3724	24"	14.55	8.15 43.95
3730	30"	16.20	9.05 48.85
3736	36"	17.70	10.20 54.95

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

Item	Jaw Length	List Sale	Lots of 6
4512	12"	34.50	20.75 114.95
4518	18"	36.35	22.30 122.95
4524	24"	38.50	23.65 129.95

JORGENSEN STEEL "I" BAR CLAMPS

Model	Size	List Sale	Lots of 6
7224	24"	35.75	20.30 112.95
7236	36"	38.35	22.35 124.75
7248	48"	42.15	24.45 134.95
7272	72"	48.50	29.60 168.75

PONY CLAMP FIXTURES

Model	Description	List Sale	Lots of 12
50	3/4" Black Pipe Clamps.....	15.45	8.10 92.50
52	1/2" Black Pipe Clamps.....	12.65	6.95 74.95

MK TITEL SAWS

Model	Description	List Sale
MK770	1/2 HP - 7" blade.....	785 579
MK660	3/4 HP - 7" blade.....	795 589
MK880	1 HP - 8" blade.....	986 859

We stock all replacement blades for above saws.

Maxe6362	FEIN Triangle Sander v/spd.....	199
Max625	FEIN NEW Air Triangle Sander.....	195
LPN672	PONY Air Palm Nailer w/glove.....	89
LPN672K	LPN672 w/ case & 3 special tips.....	168.95
RTM01	ROTOZIP Drywall cutout unit.....	50
SCS02	ROTOZIP NEW cordless unit.....	252 169

BLACK & DECKER

1166	3/8" Drill 0-2500 rpm.....	118 68
2600	3/8" Drill 0-1200 rpm.....	173 98
79-034	Workmate 400.....	191 109
1350K	1/2" Timberwolf Drill 2 speed.....	573 325
1180	3/8" Drill rev. 0-1200 rpm.....	215 119
2037	Drywall Gun 0-4000 5.0 amp.....	178 95
2038	Drywall Gun 0-2500 rpm.....	178 95
2054	Tek Gun 0-2500 5.0 amp.....	295 159
2750	4-1/2" Grinder 10,000 rpm.....	159 89
2694	7-1/4" Super Sawal Circ Saw.....	294 149
2695	8-1/4" Super Sawal Circ Saw.....	328 169
3339	Elu 3 HP v/spd Plunge Router.....	520 269

Piranha Carbide Tooth Saw Blades by B & D

Model #	Diameter	# Teeth	List	Sale
73-715	5-1/2"	16	14.39	8.30
73-716	6-1/2"	18	14.39	8.30
73-717	7-1/4"	18	14.60	7.99
73-737	7-1/4"	24	18.06	9.50
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	26.95
73-719	8-1/4"	22	20.63	12.45
73-740	10"	32	34.63	18.85
73-770	10"	60	70.37	36.95
73-711	10"	50	68.33	36.95

DURA III- ADJUSTABLE STILTS

Model	Description	List Sale
D1422	14"-22" extension.....	270 205
D1830	18"-30" extension.....	288 222
D2440	24"-40" extension.....	304 239

Above models include strap adapter kits

SIOUX TOOLS

8030	3/8" variable speed Drill.....	263 145
8000	3/8" variable speed close quarter drill 0-1300rpm.....	211 125
8005	Same as 8000 but is 0-2500 rpm.....	121 139
690	5" Air Random Orbit Sander.....	228 132
790	NEW lightweight 5" Sander.....	235 135

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

Model	Accepts Stage	Attaches To Rung	Sale
10-14-02	14"	2 rung	83.95
10-20-02	20"	3 rung	92.95
10-20-03	20"	3 rung	101.95

ALUMINUM ARTICULATED LADDERS

Model	Length	Weight(lbs.)	Sale
M7-14	7'	43#	159.95
M8-16	8'	46#	189.95

FIBERGLASS STEP - TYPE 1- 250# RATING

Model	Length	Weight(lbs.)	Sale
6004	4'	13#	57.95
6005	5'	16#	68.95
6006	6'	18#	72.95

FIBERGLASS STEP - TYPE 1- 250# RATING

Model	Length	Weight(lbs.)	Sale
6004-S w/pail shelf	4'	15#	63.95
6005-S w/pail shelf	5'	18#	73.95
6006-S w/pail shelf	6'	20#	80.95

FIBERGLASS STEP - TYPE 1A- 300# RATING

Model	Length	Weight(lbs.)	Sale
6204	4'	14#	65.95
6205	5'	18#	76.95
6206	6'	20#	89.95

ALUMINUM FLAT STEP TYPE 11- 225# RATED EXTENSION

Model	Size	Length	Weight(lbs.)	Sale
D1224-2	24"	21'	33#	179.95
D1228-2	28"	25'	42#	208.95
D1232-2	32"	29'	53#	239.95
D1236-2	36"	32'	62#	266.95

ALUMINUM FLAT STEP TYPE 1- 250# RATED EXTENSION

Model	Size	Length	Weight(lbs.)	Sale
D1520-2	20"	17'	37#	189.95
D1524-2	24"	21'	45#	220.95
D1528-2	28"	25'	56#	246.95
D1532-2	32"	29'	66#	269.95
D1536-2	36"	32'(250# rating)	79#	339.95
D1540-2	40"	35'(250# rating)	89#	369.95

ALUMINUM FLAT STEP TYPE 1A- 300# RATED EXTENSION

Model	Size	Length	Weight(lbs.)	Sale
D1612-2	16"	13'	34#	199.95
D1620-2	20"	17'	40#	219.95
D1624-2	24"	21'	53#	254.95
D1628-2	28"	25'	60#	298.95
D1632-2	32"	29'	74#	379.95

FIBERGLASS FLAT STEP TYPE 1A- 300# RATED EXTENSION

D6116-2	16'	13'	34#	199.9
D6120-2	20'	17'	40#	219.9
D6124-2	24'	21'	53#	254.9
D6128-2	28'	25'	60#	298.9
D6132-2	32'	29'	74#	379.9

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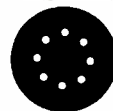
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4 1/2"	8 Hole	\$10.00/50
5"	5 or 8 Hole	\$12.50/50
6"	6 Hole	\$17.50/50
5"	Solid "E"	\$15.00/50
6"	Solid "E"	\$18.00/50
12"	Solid "E"	\$12.00/6

BELTS—A.O. RESIN

1 x 30	\$.75	4 x 24	\$1.10
1 x 42	\$.75	4 x 36	\$1.40
3 x 21	\$.85	6 x 48	\$3.50
3 x 24	\$.90	6 x 89	\$6.20

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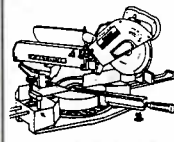
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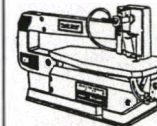
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Building a Chair, Arts-and-Crafts Style

Joinery details make this chair strong and handsome

by Rex Alexander



When the curator of Dennon Museum in Traverse City, Mich., asked me to design and build some Arts-and-Crafts style furniture for an upcoming exhibit, I jumped at the chance. We agreed that I'd look for a customer who would buy the furniture after the exhibit. I approached Jay and Sue Wisniewski, who have been steady clients on a number of projects. They were excited by the idea.

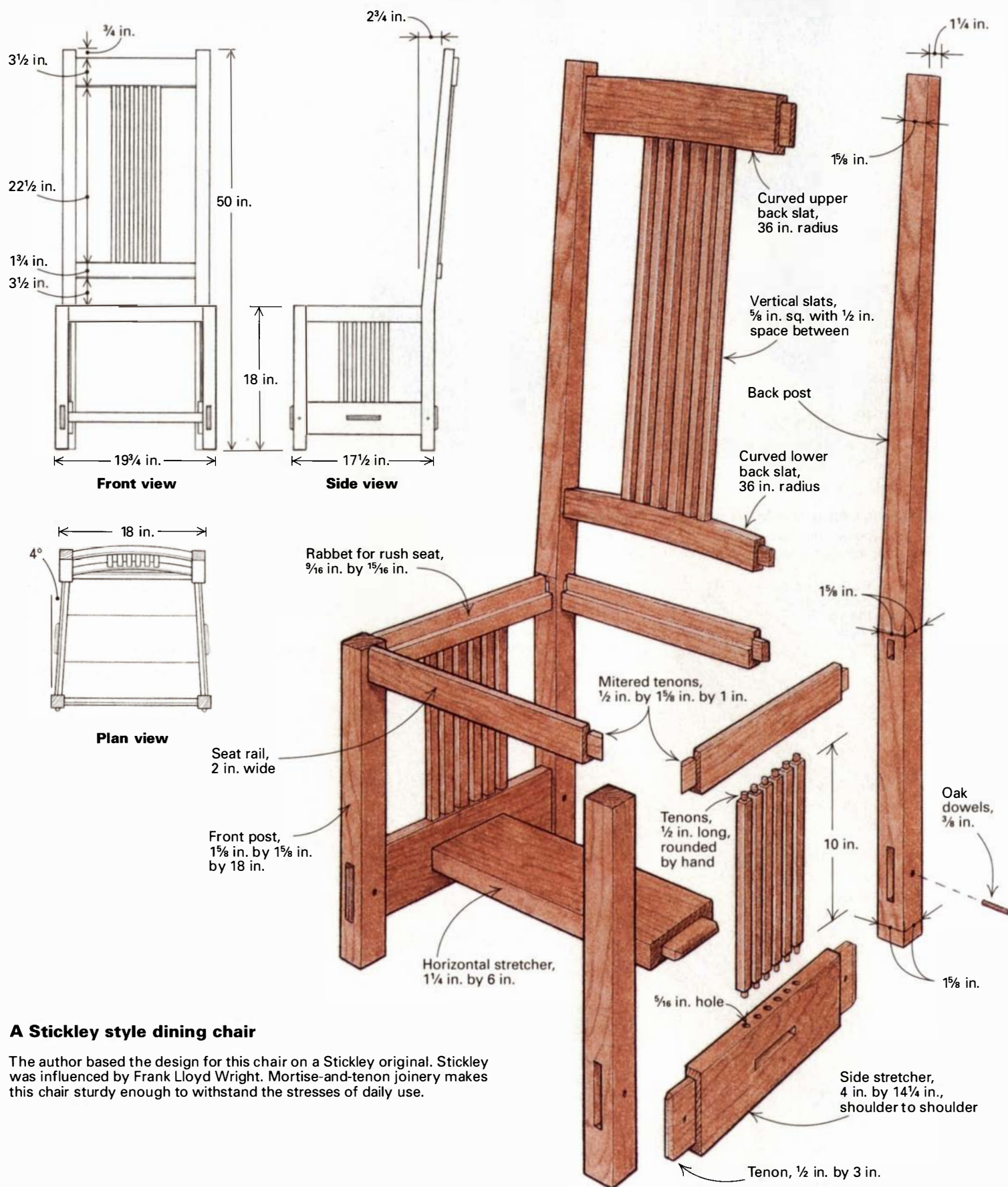
I immediately ordered more than \$100

worth of books by or about Stickley (see the further reading box on p. 47), Greene and Greene, Roycroft and others. These books gave me a feel for designs of this period. And they told me what type of wood to use and how it should be cut and finished. I studied detailed drawings and proportions to help with the design.

The deal with the museum didn't work out, but my clients gave me the go ahead for a dining table and some chairs. We still

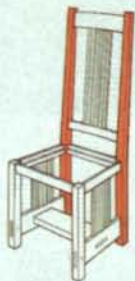
had to agree on a final design, and it had to be compatible with a reproduction Frank Lloyd Wright chandelier they had already bought for the dining room.

I learned that Gustav Stickley, in designing his No. 384 chair, was influenced by Wright's work. I knew I had found the inspiration to my design problems. It was this chair (first built in 1905), with its rush seat and vertical slats on both the sides and the back, that I drew upon to arrive at the



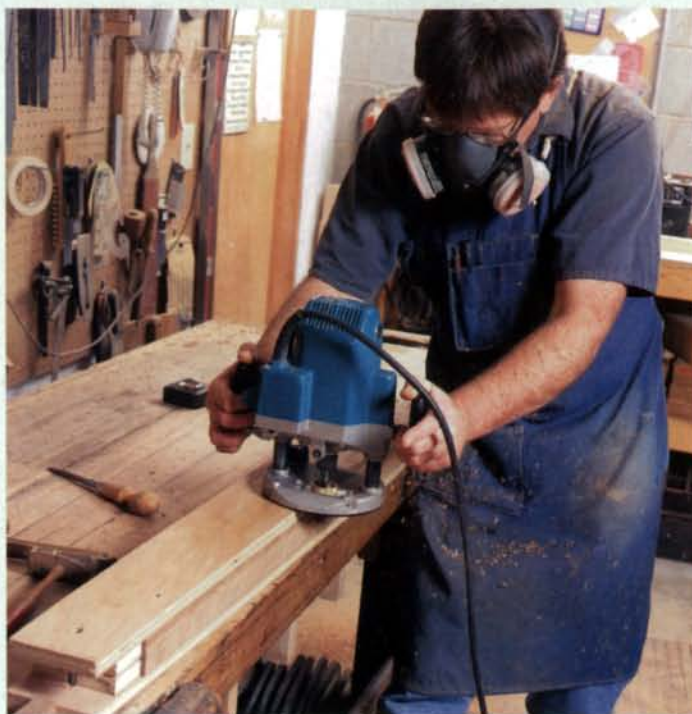
A Stickley style dining chair

The author based the design for this chair on a Stickley original. Stickley was influenced by Frank Lloyd Wright. Mortise-and-tenon joinery makes this chair sturdy enough to withstand the stresses of daily use.



Routing back posts

A plywood jig for shaping the back posts. A little time invested in this jig guaranteed that all back posts would be the same size and shape. A shaper with a rub collar works as well as a router.



final design for these chairs. The chairs are shown in the photo on p. 42.

Solve problems by building a prototype

I developed a scale drawing of the chair to help determine a materials list (see the drawing on p. 43). For several reasons, I also decided to build a prototype: the joinery is complicated, I had to buy tooling and make jigs, and I wanted to be sure my clients were satisfied with the comfort of this chair. Also, I could use the prototype to verify the proportions and to resolve some of the details of the frame and the fit of the inset rush seat.

Building six chairs is a small production run. A prototype helped me to organize each step and avoid many construction problems. I made the prototype with poplar scraps accumulated from other jobs and assembled it without glue so it could be taken apart. A mistake with poplar at this stage would not be too costly.

Once I was happy with the prototype, I took it apart and measured each piece for a final materials list. Each chair was made from front and back posts, seat rails, side stretchers, a horizontal stretcher, curved upper and lower back slats and vertical slats. There were 35 parts in all, including four oak dowels to pin the stretchers to the front and back posts.

Machining the parts

All the parts started out as 8/4 quartersawn white oak. I could resaw the 2-in.-thick material into 7/8-in. seat rails, stretchers, and slats and still have plenty of material for the 1 5/8-in.-sq. front and back posts. For a table, six side chairs and two arm chairs, I ordered 400 bd. ft. I wanted heavily rayed pieces for the sides of the front and back posts, the bottom side stretchers and the curved upper and lower back slats. I chose lightly figured white oak for the seat rails.

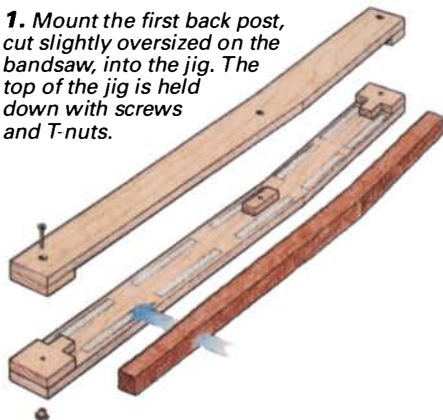
Except for the back posts, I rough-cut all the chair parts on a tablesaw and then cleaned them up with a jointer and a planer. Later, after making tenons, I cut out the curved upper and lower back slats on the bandsaw (see the top photo on the facing page), marked with a 1/4-in. plywood template made to a 36 in. radius. I cleaned up the bandsaw marks with a spokeshave and a compass plane.

I made a special jig to clean up the back posts after they had been rough-cut to size on the bandsaw (see the photo and drawing at left). The jig is based on one in *Tage*

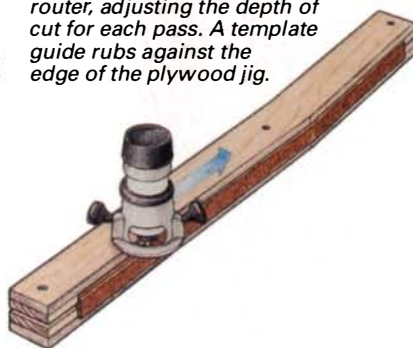
A jig for trimming the back posts to size and shape

This jig is sized to handle two legs at a time. After cutting the profile for the front of the leg, the author moves the leg to the back of the jig and finishes the profile.

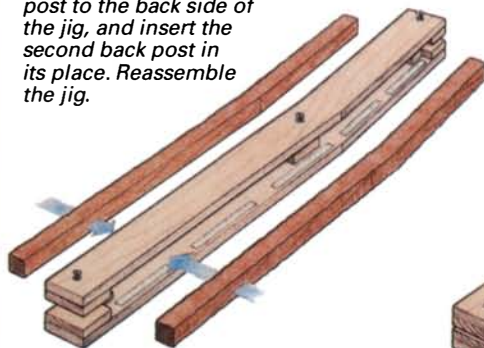
1. Mount the first back post, cut slightly oversized on the bandsaw, into the jig. The top of the jig is held down with screws and T-nuts.



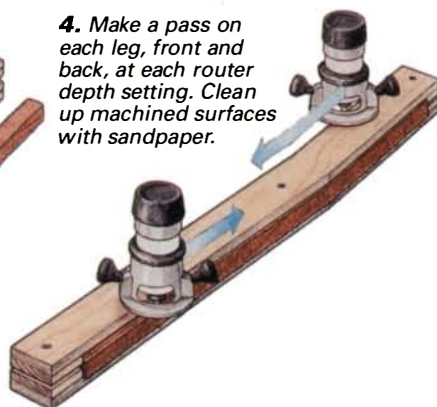
2. Trim the front edge by making several passes with the router, adjusting the depth of cut for each pass. A template guide rubs against the edge of the plywood jig.



3. Move the first back post to the back side of the jig, and insert the second back post in its place. Reassemble the jig.



4. Make a pass on each leg, front and back, at each router depth setting. Clean up machined surfaces with sandpaper.



Frid Teaches Woodworking: Furnituremaking (The Taunton Press, 1985).

Two legs are sandwiched between two pieces of birch plywood. One side of the jig is shaped for the outside cut and the other for the inside cut. Support blocks on each end and one in the middle of the jig register the pieces to be cut. Machine screws through one side thread into T-nuts in the other side and hold the legs firmly in place. I applied strips of self-adhesive sandpaper to the inside of each piece of the plywood jig to keep the legs from slipping.

I trimmed the legs to size with a 3-hp router equipped with a $\frac{5}{8}$ -in. template guide and a 4-in. solid carbide up-cut spiral bit. I cut the front of each leg first and then moved it to the other side of the jig against the registration blocks. You can avoid too much stress on the bit and prevent tearout by making several passes with the router, adjusting the depth of cut a little at a time.

Cutting the mortises

All the chair parts except for the vertical slats are connected with $\frac{1}{2}$ -in. mortise-and-tenon joints. Years ago, I developed a simple jig to cut the mortises for a batch of screen doors, and I was able to use it again for this project (see photos 1-4 on pp. 46-47). This jig is made of $\frac{3}{4}$ -in. plywood with sides that act as a carriage for the router. A $\frac{5}{8}$ -in. slot runs down the middle of the jig, stopping 2 in. from each end. Two adjustable stop blocks sit square in the carriage and control the length of the mortise.

I held the piece to be mortised in the jig by clamping it to the underside, below the $\frac{5}{8}$ -in. slot. I used my 3-hp router with a $\frac{1}{2}$ -in. by 4-in. solid carbide up-cut spiral bit, adjusting the depth of cut with stops on the router. Even with the jig, this was a time-consuming process.

Router bits don't cut square-cornered mortises. Rather than cleaning out all the corners by hand, I devised a method that works really well. I chucked a Lie-Nielsen corner chisel into my drill press (make sure it's unplugged). I clamped an adjustable fence to the drill-press table to rest the stock against and squared the chisel to the fence. The rack-and-pinion force of the drill press pared a clean, sharp corner in the mortise.

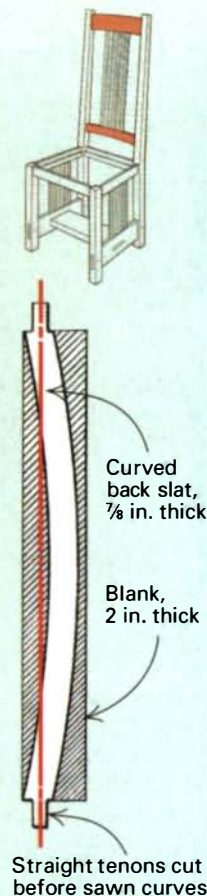
Cut the tenons on the tablesaw

All the Stickley chairs that I've seen are wider in front than in back. The side chair in Gustav Stickley's *Making Authentic*

Cutting curved back slats



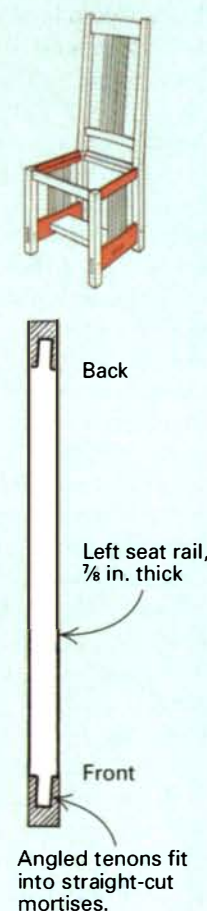
Cutting the curved back slats—Convex and concave cuts from 8/4 lumber yielded $\frac{7}{8}$ -in.-thick slats, after the surfaces were scraped clean. These slats are the only curved pieces of the chair.



Cutting angled tenons



Double-blade tenoning on the tablesaw—With a custom-made jig, the author cut angled tenons for the side stretchers and side seat rails. Sawblades were set at a 4° pitch to the surface of the saw table and separated by a $\frac{1}{2}$ -in. spacer.



A jig for routing mortises



1. Movable base supports make adjustments easy. Built for mortising a set of doors, this jig can be adjusted to cut mortises in stock of different widths.



2. Use chair part to set jig. After securing one base piece, the author snugs the other one against a side stretcher and screws it in place.



3. Stop blocks for the router determine the length of the mortise cuts and keep them all consistent. Pencil lines help to align the stock.

Craftsman Furniture narrows toward the back by $1\frac{3}{4}$ in. I built these chairs to that dimension— $19\frac{3}{4}$ in. wide at the front and 18 in. wide at the back, with a seat depth of $17\frac{1}{2}$ in. Because of this design detail, either the mortises or the tenons have to be angled on the seat rails and the stretchers. I decided it was easier to angle the tenons. I used the tenoning jig shown in the bottom photo on p. 45.

By drawing the seat-plan view to full size on a scrap of plywood, I determined that the front and back of the chair related to the sides by 4° off square, or 86° , so I set the sawblade to that angle. To cut the cheeks of the tenons on the seat rails and bottom stretchers, I used two blades of a dado set with a $\frac{1}{2}$ -in. spacer between them. You can adjust the height of the blades off the table to account for tenons of different length.

After cutting all the angled tenons, I straightened the blade mechanism back to 90° to cut all the cheeks for the horizontal stretcher, front and back seat rails, and the upper and lower back slats. The tenons for all these pieces are straight—parallel to the pieces themselves.

Next I removed one of the dado blades from the table and set the remaining blade at 4° to cut half the shoulders of the angled tenons. I used a miter gauge with a positive stop. I lowered the blade, still set at 4° , and moved the miter gauge to the other slot to

make the shoulder cuts on the other side.

Then I straightened the blade and adjusted the height for cutting the shoulders of the rest of the tenons, except the horizontal stretcher. That piece has straight tenons, but the ends of the piece are cut to 86° to follow the shape of the chair seat. So the shoulder cuts for the horizontal stretcher are cut at 86° with the miter gauge.

The tenons for all the $\frac{5}{8}$ -in.-sq. vertical slats were simple to make. To get $\frac{5}{16}$ -in.-sq. tenons, I cut all four sides at each end with a dado blade. A wooden backer board mounted with double-faced tape held each piece firmly against the miter gauge. I cut each piece slowly to avoid tearout on the corners of the slats. I used a sharp knife to carve the tenons down to a dowel shape to fit $\frac{5}{16}$ -in. holes drilled in the back slats, the side stretchers and the seat rails.

Fine-tune and dry-fit the parts

Before final assembly with glue, I always like to check the joinery by dry-fitting the parts (see the photo at right on the facing page). It helps me avoid surprises when I can least afford them. I check the fit of every piece and make adjustments as necessary with a chisel or a shoulder plane.

I marked the through-dowel pins for the lower stretchers ($\frac{3}{8}$ in. dia.) with a home-made gauge at 4 in. up from the bottom of each post. I drilled halfway in from either

side with a Forstner bit in the drill press. Scraping and sanding removed all the milling marks and provided a smooth surface for finishing. After a satisfactory dry-fit, I completely disassembled the chair and stained all the parts.

You have to think through the order in which the pieces of a chair go together, but it's really pretty simple. Vertical slats went in first, glued into both the back slats and the side-stretcher and seat-rail assemblies. I assembled whole sides by adding the front and back posts and clamped them to dry overnight. The next day, I put two sides together with the horizontal stretcher, the front and back seat rails, and the back-slat assembly to make a complete chair frame. I let any glue squeeze-out around the joints cure partially before removing the glue with a sharp chisel.

After the glue had cured, I removed the clamps and glued and screwed $\frac{7}{8}$ -in.-thick corner blocks to the inside bottom of the chair. These add stability to the frame and support the inset rush seat. I go over the chair completely with 400-grit wet-or-dry sandpaper and follow that with a good rubdown using #0000 steel wool.

A finish from Sam Maloof

Oil on wood is really a beautiful finish, bringing out a depth that looks superior to any film finish. But on furniture and cabi-



4. The depth of the mortise is controlled by the plunge mechanism on the router. The author secures stock to the jig with C-clamps.

nets that come into contact with water, I had been hesitant to use such a finish until I read about Sam Maloof's three-part formula. He mixes equal parts of raw tung oil, boiled linseed oil and polyurethane. The polyurethane prevents this finish from showing water spots.

With the temperature about 50° to 60°F, I sprayed this concoction on the chairs and let it soak in for 10 to 20 minutes. After that, I wiped it off with a rag, using a circular motion. I repeated this procedure two times, letting each coat dry a few days. Then I gave all the surfaces a final buff with #0000 steel wool.

The Maloof technique also calls for another mixture: equal parts tung oil, boiled linseed oil and beeswax. To make this, I melted some beeswax in a double boiler on the stove. While that was still in liquid form, I added the tung and linseed oils, mixing them together. When this mixture cools to a paste, it's easy to apply with a cotton cloth, rubbing in a circular motion. I applied three coats to the chairs. The beeswax gave this finish a nice, satiny glow.

The frame and fiber rush seat

Unlike most chairs made with a rush seat, this one has a separate frame screwed into place after it was woven. Fiber rush exerts a tremendous amount of pressure on a frame, so I decided to use plywood, figur-



Dry-assemble all the pieces. This dress rehearsal for the final assembly helps the author avoid the costly mistake of glued joints that don't fit.

ing the multiple alternating layers would hold up better over time. A ¾-in. piece of plywood, cut out in the middle to make a 1½-in.-wide frame, worked best.

To learn how to weave a rush fiber seat, I consulted an article in *FWW* #85 (p. 51). As a source book for materials, *The Caner's Handbook* by Bruce W. Miller and Jim Widess came in handy. It is published by Lark Books, 50 College St., Asheville, NC 28801, and it's available from Woodcraft Supply (800) 542-9115 or The Woodworkers' Store (800) 279-4441. The weaving process was time-consuming. Each seat took about a day to complete. □

Rex Alexander builds furniture, cabinetry and millwork in Brethren, Mich.

Further reading

Gustav Stickley built many fine examples of Arts-and-Crafts furniture in his factory. He also left a wealth of information in his monthly magazine *The Craftsman* (1901-1916). Much of this information has been republished in two books: *Craftsman Homes, Architecture and Furnishings of the American Arts and Crafts Movement* and *Making Authentic Craftsman Furniture*, both published by Dover Publications, 31 E. 2nd St., Mineola, NY 11501. These books are available through Manny's Woodworkers Place (800) 243-0713.

Oil-Varnish Mixture is Durable, Easy to Apply

Finish makes the most of both ingredients

by Garrett Hack



Finishing just isn't my cup of tea. Planning the design and construction details, picking the wood and carefully laying out the parts to match the wood's color and grain are all exciting. Cutting joints and planing by hand are pure pleasure. But putting on a finish is my least favorite part of building furniture. That may be one reason I've settled on a finish that gives me consistently satisfying results with a minimum of effort.

I first learned about this hybrid finish—a mixture of oil,

varnish and turpentine—at the woodworking school I went to in Boston in the late 1970s. Since then, I've experimented with the ingredients, the proportions and the method of application. These days, I use this finish on everything from fine furniture and kitchen cabinets to the handles on the tools I use around my farm.

The finish is mixed from either tung oil or boiled linseed oil and varnish, thinned with turpentine. It's easy to apply, doesn't require a special dust-free finish room and, like any

oil finish, it won't obscure the texture and character of the wood. Yet because of the varnish, it offers more protection than oil alone.

The varnish also helps the finish build faster than a straight oil finish, eliminating much of the drudgery of application. Because the proportion of varnish is relatively low, this finish is as easy to repair or renew as an oil finish. And it can be tinted with artist's pigments or oil-based stains to match any wood. There's no need to fill pores on open-grained woods: Sanding

the finish creates a slurry of wood dust, oil and varnish that fills the pores beautifully.

Don't sweat the finish proportions

When mixing this finish, I don't get overly scientific about measurements. The finish is very forgiving, and many proportions will work. Generally, I mix them in approximately equal measures. If I want more protection, I'll add up to 50% more varnish. If it's too thick (and always for the first coat), I'll add more turpentine to get better



Crowning touch—Author Garrett Hack tops his varnish-oil finish with wax.

surface penetration. If I'm going to color the mixture, I add an oil stain or artist's colors, keeping it light initially and darkening it more if need be.

Spar varnish is a favorite

Varnishes have been around for a long time. Really old-fashioned varnishes are a mixture of plant resins (such as amber), oils and a solvent, which is heated and combined in formulations often kept secret by their makers. Even the techniques for applying these varnishes are carefully guarded by

the few who still use them. Some of these varnishes take weeks to cure fully.

Modern varnishes are a combination of synthetic resins in an oil vehicle. Among the oils used by finishing manufacturers are soya, safflower, tung and linseed. The proportion of oil to resin in these varnishes ranges widely, and this affects how long they take to cure, as well as how tough and how elastic the cured finish film will be.

A spar varnish has a comparably high oil content, which takes longer to cure and leaves a fairly elastic surface that accommodates wood movement. Polyurethane varnishes dry quickly and form a tough, durable, but less elastic, coating. Also, after the finish has cured, repairs or additional coats don't bond well.

In terms of drying time, toughness and elasticity, alkyd-resin varnishes fall somewhere between spar varnish and polyurethane. They're not as tough as polyurethane, but they're more elastic, and any coats applied after the varnish has cured still bond well.

I have used all three of these varnishes in my finish with good results, but my favorite is color. Spar is the darkest. In combination with linseed oil, which also tends to darken wood, spar varnish significantly affects the color of some woods, like cherry. I happen to like the effect this mixture has.

Right away, cherry and bird's-eye and curly maple look older. But on darker woods like walnut, the color change is barely perceptible. If you want to preserve the light color of a wood like maple or ash, use a polyurethane varnish because it imparts the least color.

Most varnishes also have ultraviolet light (UV) inhibitors added to their formulations to keep the finish in the can from turning an unattractive yellow and to slow the natural aging ef-



Ingredients are simple; proportions are forgiving. Linseed or tung oil, varnish and turpentine make up the author's favorite finish. A pigmented oil stain can be added to give the mixture a little color.



Flood the surface. The first coat will soak into the bare wood, so check the piece carefully for dry spots after it's been covered entirely. Re-coat areas that dry in the first 10 minutes or so.



Rub off the excess. Pay close attention to the inside corners and the areas around details like cock beading, where the finish can collect. It's more difficult to remove excess finish after it has hardened.

Brush on subsequent coats, one area at a time. Keep checking areas you've already coated to see whether they've started to become tacky. After the first coat, the finish becomes sticky quickly.

fect of sunlight on wood.

All varnishes are naturally glossy. The softer luster of a satin or semigloss varnish results from the addition of a flattening agent, such as aluminum stearate or silica, which breaks up the reflection of light off the wood's surface. Stick with a gloss for the toughest finish, and use steel wool to get a satin finish, if that's what you're after.

Boiled linseed or tung oil and turpentine

For the oil component of my finish, I use either boiled linseed oil or tung oil (also known as China wood oil). Boiled linseed oil is made by steam-heating processed oil from raw flax and adding metallic drier compounds. The nondrying portion of the oil is removed, making what's left suitable as a finish.

Tung oil also is heat-treated, which speeds its curing time when exposed to oxygen. Tung oil is more expensive than linseed oil. However, it cures to a tougher, more water-resistant film, and it doesn't darken the wood as much. If you want maximum protection and a light color, use tung oil. Don't use raw linseed oil because it won't dry.

I thin my varnish and oil finish with turpentine. This increases surface penetration and speeds drying time. High-quality turpentine is getting harder and harder to find. It largely has been replaced by mineral spirits, which should work. I stick with turpentine because it's always worked well for me.



Two rags are better than one. To remove excess finish after each coat, the author uses two rags. The first one picks up the majority of the residual finish; the second ensures the wood is really dry.

Brush it on; rub it off

The key to a really good finish with this mixture, or any finish for that matter, is to prepare the surface well. For me, this usually means a planed or scraped surface. I find this to be faster and more enjoyable than sanding. If you do sand, start with a fairly coarse grit, and work up to at least 220-grit. But it's less important which grit you end up with than how thoroughly you work through each grit to eliminate scratches from the previous grit.

For the first coat of finish, I brush on the mixture, flooding the surface and re-coating any dry areas that appear (see the



center photo on p. 49). After half an hour or less, any finish still on the surface will start to feel tacky. As soon as it does, I start rubbing with clean cotton rags to absorb it (see the bottom photo on p. 49).

This initial coat is the easiest to apply because most of it soaks right in. Nevertheless, it's important to wipe off every bit of excess so that the surface doesn't turn into a sticky mess. When the surface is thoroughly rubbed dry, I'll set it aside for at least 24 hours before re-coating. Make sure you dispose of the rags properly. Either spread them flat outside until they've dried or put them in a metal bucket with a lid. Oily rags can combust spontaneously.

Subsequent coats of finish go on in the same way, except that they tack up more quickly and require more rubbing to remove the excess. How fast these coats tack up depends on the temperature and humidity and on the type and amount of varnish in the mixture. Polyurethane varnishes cure within a few hours and can tack up very quickly; spar varnish can take twice as long.

When finishing a large piece of furniture, I work on one section at a time. I keep checking the areas I've already coated so that when the finish begins to tack up, I can start rubbing immediately (see the top photo on the facing page). If I happen to get behind, brushing on a fresh coat of finish softens the tacky layer enough so that I can rub it down.

I like to use two rags, one for most of the excess finish and one for a final once-over polish (see the photo at left). Any places that aren't wiped clean will feel crusty. I don't worry about these too much because I can either rub them down with steel wool or rub especially vigorously when wiping off the next coat of finish.

How many coats to apply is a matter of choice and good judg-

ment. Each layer adds a little more depth to the finish, some gloss and some additional protection. For a chest of drawers, three coats is fine. For a table that's going to see hard use, I would go with a minimum of four coats—five would be better. When I'm satisfied with the finish, I wait at least 24 hours, and then I top it off with a paste wax made from beeswax, boiled linseed oil and turpentine (see the box at right).

Using the finish to fill the grain

Another one of the beauties of this finish is that open-grained woods such as red oak or ash don't need to be filled before finishing. Lightly sanding the wet finish with 220-grit (or finer) sandpaper smooths the surface and creates a pore-filling slurry. I usually apply the first coat in the usual manner and sand the mixture after applying it for the second and third coats.

This method is easier than using a filler, and there are no problems with compatibility or bonding between the layers of finish. I avoid wet-or-dry, silicon-carbide sandpaper because the dark abrasive can color the pores. Instead, I use garnet or aluminum-oxide abrasives.

Rejuvenating the finish is easy

If the finish needs repair or if it just starts to look tired, it's easy to fix. First clean the surface well with 0000 steel wool, turpentine and a little boiled linseed oil, and then wipe the surface until the rags come clean. A light sanding with 320-grit sandpaper will take care of any stubborn areas the steel wool can't handle. Apply a fresh coat of finish, and rub it out with clean rags. After the finish has fully cured, reapply a wax topcoat. □

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

Beeswax topcoat



My favorite topcoat is made of a combination of beeswax, boiled linseed oil and turpentine. This mixture is not as hard as a paste wax made with carnauba, but it's durable enough and it smells great.

In a double boiler on very low heat, I melt together a hunk of light-yellow beeswax (saved from comb honey I bought from a local beekeeper) and slightly less than equal amounts of oil and turpentine. I aim for a consistency similar to butter warmed to room temperature. It should be soft while maintaining its shape (see the inset photo above). If the wax mixture cools to something harder or softer than this, I add more oil or wax, whichever is appropriate, and rewarm. This recipe is very forgiving.

I apply the wax with 0000 steel wool, rubbing out the cured final coat of my oil-varnish mixture at the same time (see the photo above). If the wax is the right consistency, it smooths out easily without feeling gummy. After a few minutes of drying, I buff it with a clean rag to a satin sheen (see the photo on p. 48). To maintain the finish, just re-wax. —G.H.

Molding that Stays Put

Dovetailed keys solve a vexing case-work dilemma

by Christian Becksvoort



This molding will last as long as the chest. Applied over dovetailed keys, the molding will allow the case sides to move seasonally.

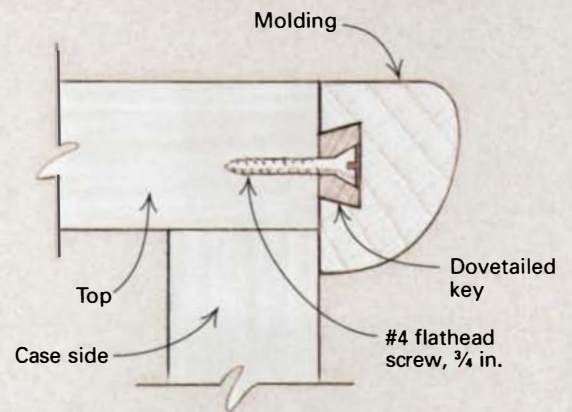
Ask any antique collector or dealer about the most common problem with old case pieces and you're sure to hear a familiar refrain: The molding's always the first thing to go. Attaching molding to a solid carcass side is a problem. A wide case piece, such as a chest of drawers, can move $\frac{3}{8}$ in. to $\frac{1}{2}$ in. through the seasons as the ambient humidity rises and falls. Molding glued or nailed to the case sides, its grain perpendicular to the grain of the sides, isn't moving at all. There are two possible outcomes. Either the case sides will crack because the molding has prevented them from moving, or the molding will fall off because the side *has* moved and broken the glue bond between case side and molding.

I get around these problems by attaching side molding with a series of dovetailed keys (see the photos and drawing at right). A dovetailed slot cut in the back of the side molding allows it to slide onto the short dovetailed keys attached to the case. The connection keeps the molding snugged up tight to the carcass. But because the molding is not glued to the carcass or to the keys, the case sides are free to move. This technique has been used for centuries and is still found on the highest caliber work. It takes a little extra effort to attach molding this way, but the molding will last as long as the case piece, and the case sides will not crack.





Attaching moldings with dovetailed keys



Dovetailed keys, spot glued and screwed to the carcass, secure the molding snugly without restraining movement.



Route the dovetailed slot in two passes. Start the slot in the molding with a straight bit; then make a second pass with a dovetail bit set to full-depth.



Route the dovetailed keys. Use a piece of scrap to set the fence on the router table, making adjustments until the key fits snugly into the molding slot.



Plane the keys to thickness. Check with a dial caliper after each pass. Keys should be .003 in. to .005 in. thinner than the slot is deep.

Preparing the carcase and the molding

The case sides must be perfectly flat all the way across if the molding is to fit correctly. To check for flatness, I set the case on one side and hold a straightedge across the top edge of the exposed side. I pencil mark any high spots and belt-sand the side flat. Then I flip the case over and repeat the process on the other side.

Once the case sides are flat, the front molding can be attached to the case. I miter one end of the front molding, position it in place and mark the other end. After cutting the second miter, I glue the molding to the front of the case. The grain direction of the molding is the same as the case, so wood movement isn't a problem.

Routing the dovetailed slot in two passes—I rout the dovetailed slot in the two pieces of side molding in two passes on my router table. I remove the bulk of the slot with a straight bit. For the second pass, I use a 1/2-in.-wide dovetail bit set to full-depth, about 1/4 in. for the 1 1/8-in.-high molding I used on this chest (see the top photo at left). On smaller case pieces, I use a molding that's 7/8 in. high and rout a 3/8-in.-wide slot, also 1/4 in. deep. For either size molding, I position the dovetailed slot just a little bit higher than the center of the molding, so it's not weakened excessively.

When I have finished routing slots in both side pieces (and in some extra stock, just in case), I check the depth with a dial caliper. This depth reading gives me the precise thickness for the dovetailed keys. Be sure to check it in several places along each piece of molding. The depth can vary slightly if pressure on the moldings isn't absolutely consistent when routing the slots. I generally don't find variations of more than .005 in., which is not a problem. I just thickness the keys to the shallowest reading taken with the dial caliper (see the bottom photo at left). If there's more variation than .005 in. overall, I'll re-route new molding.



Tack keys in place. A dab of glue and a brad at the center of each key hold the strip in place.

Making the dovetailed keys

I make the keys from a blank that's a little thicker than 1/2 in., about 3 in. wide and a few inches longer than the case sides. Before cutting the keys for the case, I use a piece of scrap of the same thickness to make a test piece, adjusting the fence on the router table until the fit is snug but non-binding. I rout a dovetailed profile onto both sides of the blank, top and bottom (see the center left photo on the facing page). Then I saw off the keys with a little to spare.

Keys are taken to final thickness in a planer. Because the keys are so thin, I use an auxiliary bed to prevent snipe. I take material off the narrower side of the keys, checking the thickness with a dial caliper after each pass (see the bottom left photo on the facing page). The keys should be between .003 in. and .005 in. thinner than the slot depth, so the molding will be pulled tightly to the case.

Attaching the keys as continuous strips

A series of keys, not one long piece, holds each side molding to the case sides. But if installed as separate keys, alignment could be a real headache. Instead, I attach the keys as one continuous strip on each side of the case and then chop out the waste between individual keys, which are glued and screwed to the case. This allows the case sides to move and ensures that all the keys are in line, making it much easier to slide the molding home.

The first step in attaching the keys is positioning them. I hold a strip of molding against the side of the case, with the top edge of the molding flush with or just slightly proud of the top of the case (it's easier to remove a little bit of molding than it is to level the whole top down to the molding). With a knife, I mark both the top and bottom of the dovetailed slot, at the front and rear of the case. Then I connect these marks using a straightedge. I now have the position of my key strip.



Countersink holes, and then screw the keys down.
A little beeswax applied to the screw threads will make the job easier and reduce the chance of a screw breaking.

The next step is to lay out where the keys will be and where waste will be removed between them after the key strip has been attached. Because I've built quite a few of these five-drawer chests, I have a pattern. I made the pattern by marking out the center of the key strip, and then dividing each half into three keys separated by 1/2-in. spaces. I marked for screws about 1/2 in. to either side of the centers of the individual keys.

I put a dab of glue at the center of each of the marked keys and then tack the strip with some 3/4-in., #20 brads (see the bottom right photo on the facing page). I countersink holes for the screws that ultimately hold the keys in place and drive home the 3/4-in., #4 screws by hand (see the photo at left below). The waste between the keys is chopped out with a chisel and a mallet (see the photo at right below).

Easing assembly

I take just a sliver off the leading edge of each key and the dovetailed slot in the molding, so the molding will slide home more easily. Then I lubricate the inside of the dovetailed slot with a bit of graphite by rubbing the sides and bottom of the slot with a No. 2 pencil. Keep it back at least 2 in. from the miter, where the molding will be glued.

I test the fit of the molding, sanding the tops of the keys slightly if they seem too tight. The molding should slide right onto the keys without binding. After testing the fit, I put a dab of glue on the miter and on the first 2 in. of the case and then tap the molding home. I clamp the molding across the case at the miter. After the glue has dried, I saw off the excess at the back of the case. □

Christian Becksvoort is a professional furnituremaker in New Gloucester, Maine, and a contributing editor to Fine Woodworking.



Chop out the waste. *The author uses a mallet and a sharp chisel to remove waste between keys. Any chisel marks between keys will be hidden by the molding.*

Making Big Cabinets Manageable

Small parts and knockdown hardware simplify finishing and moving

by Niall Barrett

Working in New York City, where most of my clients live, is trying even at the best of times. There's rarely ever a place to park, so I end up double-parking to unload a delivery, always keeping a sharp eye out for the police. After that, I'm forced to pay exorbitant fees to park my van in a lot. Freight elevators tend to be small and poorly located,

and stairways have sharp corners to negotiate. I once delivered a cabinet that would not fit in the elevator, so I had to walk it up two flights of stairs. I was lucky the client didn't live on the 35th floor. Doors and hallways can be quite narrow when you're trying to deliver a large cabinet.

These anxiety-provoking restrictions and horror stories from fellow cabinetmakers

are what started me thinking about cabinets in a new way. It became clear to me that smaller parts were the answer. They would be easier to handle and transport. The challenge would be to assemble them quickly and not have the end result look like a jigsaw puzzle of small pieces. These days, I routinely build large pieces, like the stand-alone television cabinet shown



Television cabinet, one piece at a time

For author Niall Barrett, getting a new custom cabinet from his shop in upstate New York to a client's house many miles away is all in a day's work. Many of the cabinets he makes, like the television cabinet in the photos at left, go in pieces and are assembled on the spot with knockdown hardware. Parts for the cabinet easily fit inside a standard minivan (facing page).

At the site, the author sets the base (1), adds two lower carcasses (2), attaches finished side pieces (3) and, finally, adds the top, door and hardware (4). Elapsed time is approximately four hours.

above, in easily handled components. When I get to a job site, whether it's in New York City or elsewhere, I assemble the pieces with knockdown hardware.

This approach is not just for woodworkers who make deliveries to a large city. It also works for the guy building a large pantry cabinet in his garage who will have to move it through the house into the kitchen.

Make cabinets easy to finish and move

Small components are light and easy to move around the workroom and take up less space at every step of the way. For me, that's important because I work in a fairly small shop in the basement of my house. The ceilings are less than 8 ft. off the floor. I often build units that are too large to put

together in my shop; they aren't fully assembled until they are delivered to the site.

Whether you use stain, oil, varnish or a sprayed lacquer topcoat, finishes are easy to apply when you work with small components and flat panels. There are no corners to collect excess stain, primer or topcoat, so the finish looks more even. Also, by working with flat panels, you can get

a lot more finishing done by spraying pieces vertically. They take up less floor space than finished cabinets, so I can spray more at one time. And by spraying flat panels vertically, they collect less dust as they dry. This can be significant because I usually use a water-based finish, which takes longer to dry than nitrocellulose lacquer.

You can fit an incredibly large volume of material into a small truck or van if the project is broken down into flat or small pieces (see the photo on p. 56). This alone can save a few hundred dollars for the rental of a large truck and the time it takes to pick it up and return it. Oh yes, the other benefit I enjoy is the amazed look on the client's face after the collection of parts I delivered is almost magically transformed into a beautiful piece of furniture.

Plan ahead for components and fasteners

When I'm in the design phase, I start by thinking about how a piece can be broken down into smaller, more manageable parts and how I'll put it together again. I determine, for example, whether a cabinet with a center divider and two doors can be made as two cabinets. Or I'll weigh the advantages of making the crown and the base as separate components rather than permanently fastening them to the case in the shop. I make a quick sketch, an exploded view of the individual parts, to see whether it makes sense to build something that way. Detailed drawings can follow later.

Once I've determined which route to take, I think about design elements that make the job go more smoothly and the piece look better when it's done. Knockdown hardware makes strong connections between cabinet parts, but it can be difficult to make two surfaces align perfectly along the length of a joint. To solve this problem, I sometimes add a spacer between cabinets and set it back slightly from the edge. This creates a shadow line at the joint and makes the seam less obvious. For the same reason, it's usually better to offset one hard surface from another, like the seam where a bed rail joins the corner post.

No matter how you decide to break a job into smaller pieces, the trick is putting it all together so it looks like a unified whole. And that's where the hardware shown on this and the facing page comes in. □

Niall Barrett owns and operates Avalon Studios, a custom cabinetmaking shop in Narrowsburg, N.Y.

Knockdown fasteners for small components

Knockdown hardware offers the strength and durability of more permanent fasteners but allows a cabinet to be taken apart and moved as easily as it was assembled. There are many types of knockdown, or ready-to-assemble, hardware. Here are the author's favorites.



Hex-drive connector bolts and threaded inserts fasten cabinet parts together where connector heads can be exposed. The connector at right secures a cabinet carcass to its base.



Hex-drive connector bolts and threaded sleeves—This hardware is ideal for linking adjoining carcasses.



Hex-drive connector bolts: These are bolts with a machine thread, usually 1/4-20, and large, flat heads that you tighten with an Allen wrench (see the top photos above). I team them up with threaded inserts for right-angle joints, shelves and dividers (for more on threaded inserts, see *FWW* #120, pp. 79-81). I also use the inserts to attach crown and base assemblies to cabinet cases.

These bolts also come with matching threaded sleeves. I use them for fastening the sides of two cabinet carcasses to one another (see the bottom photos above). The standard finish is an antique bronze color. But you can also buy these bolts in black, or you can spray paint them any color that you like. A number of suppliers sell these bolts and sleeves. I usually buy mine at either Woodcraft (800-225-1153) or Liberty Hardware (800-542-3789).



Lamello Simplex fasteners are one option when hardware must be hidden. These are ideal for attaching a finished face piece to a cabinet side (right).



Lamello Simplex KD fasteners: These fasteners come as interlocking aluminum parts to be glued into regular biscuit slots. They are used in pairs. I often use this hardware to join flat pieces edge to edge and at 90° angles to one another. The hardware is invisible once installed. I used them to join the finished side panels over the cabinet carcasses in the installation shown in the photo at right.

Epoxy glue works best for installation, although I have had some success using polyurethane glue for light applications where the joint is not under much stress from weight or tension. Lamello makes a tool intended to simplify installation. I buy the fasteners and the insertion tool from Select Machinery (800-789-2323).



Confirmat screws can be inserted and removed many times without sacrificing holding power. They require a special bit and driver.

Confirmat connecting screws: These connecting screws (see the photos above) have a deep thread with no taper. To use them, you must also buy a special step drill bit for piloting the workpieces, as shown in the photo at right. You can use these screws to put a cabinet together and to take it apart again a number of times with no loss of holding power. You can buy these screws with small heads, designed to be countersunk, or with large, flat heads like those of hex-drive connector bolts. I only use the ones with small heads.

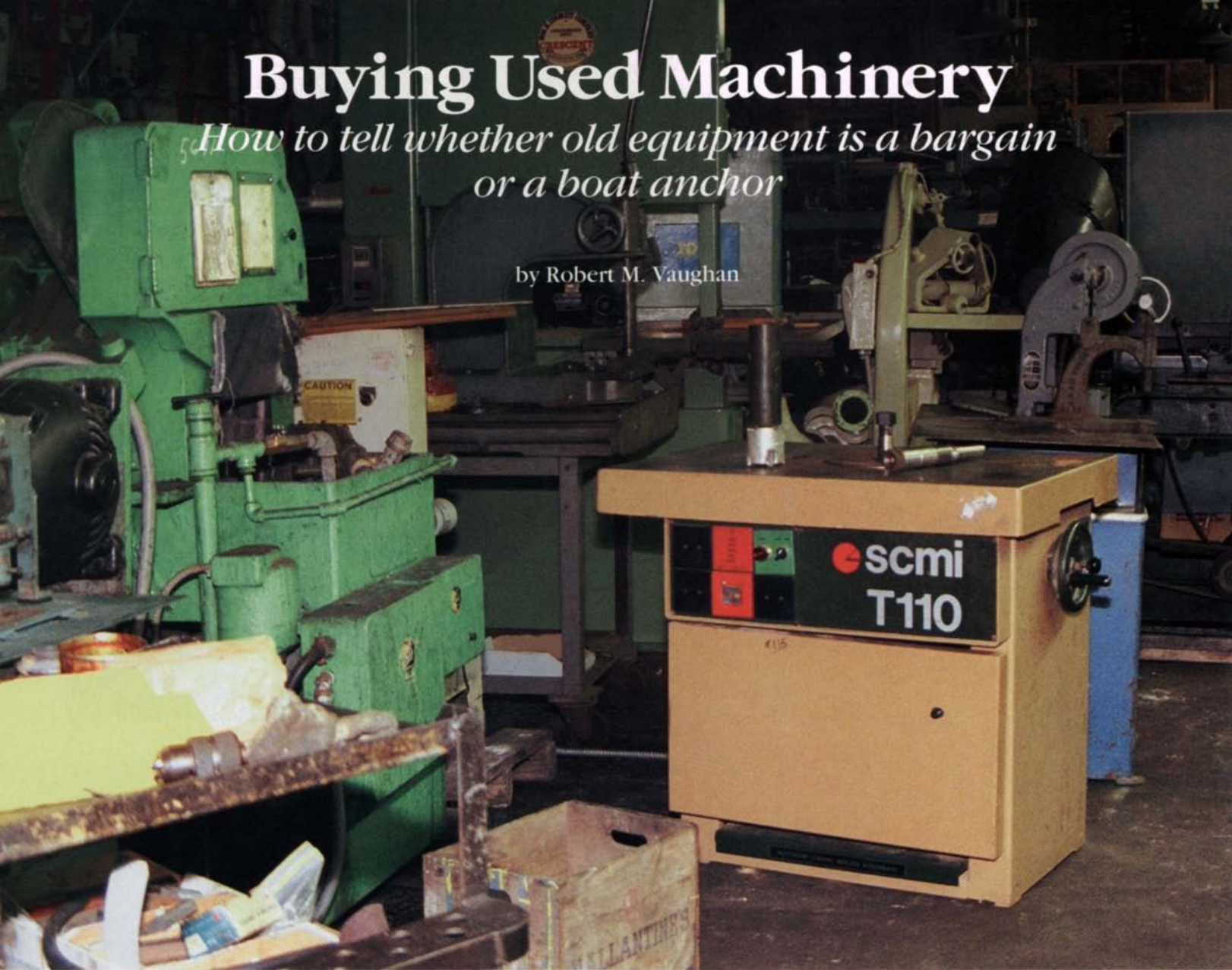
Also, you need a special driver bit called a Pozidrive. It looks a lot like a standard Phillips head, but it fits and grabs better in the head of the screw. A Phillips bit will strip the head of the screw if you drive it home with a lot of torque. Outwater Hardware (800-631-0342) sells the screws and bits. —N.B.



Buying Used Machinery

How to tell whether old equipment is a bargain or a boat anchor

by Robert M. Vaughan



I've been buying and repairing used woodworking machinery for more than 20 years. Demand for good used equipment is stronger than ever, and woodworkers often ask for advice on what to buy. I always tell them the same thing: The condition the machine is in matters more than the price. You can save money buying a used machine just as you can buying a handyman special when shopping for a house, provided you're handy and you go into it with your eyes open (see the photos on the facing page).

Every woodworker has his own repair tolerance. Some are intimidated by changing a belt, and others have no qualms about making new parts or welding frames. You'll do yourself a favor by being honest about



A good inspection requires some disassembly. Be sure to take along the tools to do it right.

your limits before buying a used machine.

The price of used equipment depends on its condition and desirability. An essential machine, like a table saw, in good condition often sells for close to the brand-new price. A less-desirable machine from a little-known manufacturer may sell for a third of its original price.

Just because a machine is old doesn't necessarily mean it's better than a new one. Some new models have compelling advantages, such as better safety features, easier cutter adjustments or a greater assortment of accessories. But a used professional-grade machine will probably perform better than a new entry-level model. Will a used machine need work? Count on it.

A thorough knowledge of new machine

prices and potential repair costs will help you decide when a used machine is worth the effort to repair it. A big bandsaw with a three-phase motor may need \$1,000 in electrical parts alone. If you had planned to buy a \$15,000 bandsaw, the investment would be worth every penny. But if a modest 14-in. bandsaw selling for \$200 will need \$500 in parts, it's clearly no bargain.

Finding good used machines

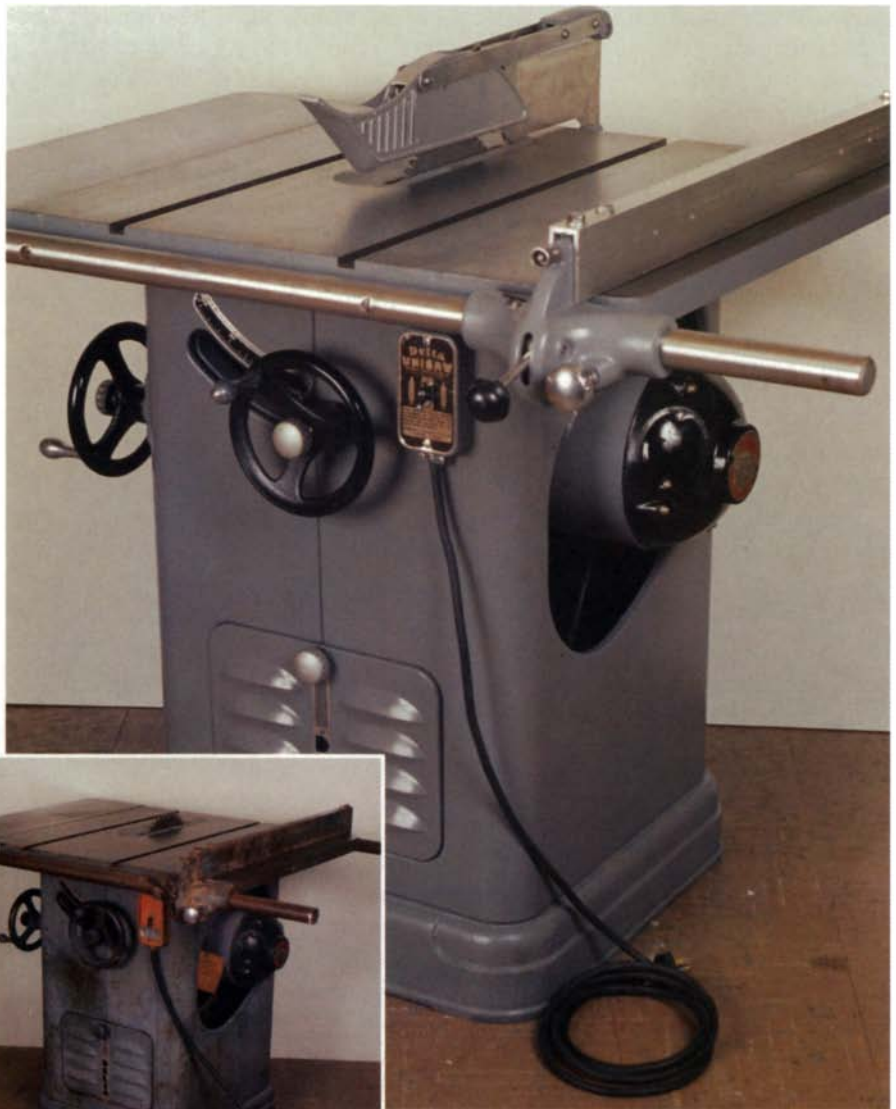
Finding good used equipment is often a matter of waiting. For me, the best deals seem to come from letting plenty of people know what I'm looking for. I sometimes end up with dead-end leads. But I also learn about some great buys before they get into the classifieds.

Auctions are the next best source for machinery, but the bidding can be fiercely competitive if a lot of dealers are present. Bankruptcy auctions are best—the machinery was probably being used until the time of the sale. Government or school auctions are sources of good equipment, but you may have to replace expensive, broken parts. Surplus auctions have the highest risk of bad machinery. Much of what's offered is being unloaded by large companies that have found the machines too expensive to repair.

Reputable machinery dealers are always a good source. They know tools and won't handle worthless junk. The tools are sold as is, which usually means they need some work. But the dealer may be a good source for parts and will have the means for moving or shipping the machine. Most dealers are accustomed to working with buyers from production shops who know exactly what they want. Dealers can be less tolerant with picky small-shop owners. You'll endear yourself to a dealer by doing your homework and acting decisively.

Take along a buyer's tool kit

I carry a small tool kit when checking out a machine (see the bottom photo on the facing page). I take a flashlight and a mirror to get a good view of obscure areas, and I take a combination square to check surfaces to see if they're square, flat and straight. For removing guards and covers, I carry slotted and Phillips screwdrivers and an adjustable wrench. An old toothbrush, a rag and a can of WD-40 are useful for cleaning away rust and grime. And, of course, using a tape measure is better than guessing whether the machine will fit through the shop door.



Know your limits for repairs. This 1948 Delta Unisaw cost \$450. It took \$150 worth of parts and 40 hours to restore this machine to like-new condition.

It's impossible to memorize parts and price lists for every machine that you intend to check, so take several manufacturers' catalogs with you for reference. These catalogs are available (sometimes at a cost) from hardware stores, machinery dealers or the manufacturer. Good catalogs picture the complete machine and often give the prices of major accessories such as starters, motors and other parts that may need replacement.

A well-known brand is usually a good buy

An inexpensive, entry-level machine should be carefully scrutinized because it may have been misused. Chances are the owner was a beginner who may have used the machine

improperly. However, long defunct brands of small woodworking machines can be good buys. Many machines by Darra James, Duro, J-line, King Seeley (Sears), Red Fox, Shopmaster, Shopmate, Walker-Turner and Wallace are still in service. I would buy a machine made by one of these manufacturers as long as there were no missing parts that couldn't be easily replaced (see the top left photo on p. 63). Off-the-shelf, aftermarket parts like belts, pulleys, motors, fences, miter gauges and blade guides are easy to replace. A missing jointer fence or a lathe tailstock is another matter. These are expensive parts, available only from the manufacturer. Replacing one can cost more than an entire yard-sale machine.

Companies like Oliver, Northfield, New-

man-Whitney and Tannewitz make large industrial machines that aren't as commonly known as Delta or Powermatic. These heavyweights handle big stock easily, but replacement parts are not cheap. Just a service manual, for example, can cost more than \$50.

Check the adjustments first

Once I've determined the machine has all its parts, I have a close look at all the adjusting mechanisms. I raise and lower the blades and tables, tilt the fences and blades, and run the guides up and down, checking for stiffness or sloppiness that will take time and effort to repair. I make sure tables and fences are square or can be made so (see the bottom left photo on the facing page). I look for damaged screw or bolt heads that may indicate the owner tried to fix the machine and decided to dump it when the repair didn't work.

With this inspection, I get a feel for how the tool was used and maintained. A machine with signs of neglect is probably no bargain (see the top center photo on the facing page). It will probably have many parts that will need to be replaced.

When I see extensive rust, I walk away. It usually means the machine has been in a fire or a flood, and those things mean big problems. The heat of a fire can distort and soften critical parts. The silt in flood waters penetrates every part of a machine, so it will have to be totally disassembled and cleaned. It's likely that every bearing will have to be replaced. Rust can also make disassembly very difficult.

Check the frame and table for distortion

With a flashlight and a mirror, I carefully inspect the frame and the table for damage. Ideally, they should be in sound condition, but I don't automatically dismiss a machine with a cracked iron casting. Castings can be brazed or welded (see the bottom center photo on the facing page). In my area, a welded repair to an iron casting costs about \$30. If I see evidence of a repair, I make sure that it didn't warp or distort the metal and that the parts are in alignment.

I look closely at the trunnions, if the machine has any. Zinc die-cast parts (the very smooth ones with fine seam lines), like those used in some lightweight bandsaw and tablesaw trunnions, are not easily repaired. If these kinds of castings are broken, they should be replaced. If the machine is still in production, that's no

problem. But if the manufacturer is out of business, you're stuck—unless you are willing to accept the expense of a custom-made part.

Make sure the motor suits the shop wiring

Clean off the motor's data plate to see the kind of electrical power the machine requires. Three-phase motors rated at less than 5 hp usually can be swapped for ones that use standard single-phase current. The cost of replacing a motor is about \$175 for the first horsepower and \$50 for each additional horsepower. That doesn't include the price of a starter, cords and plugs. Single-phase motors larger than 3 hp may require rewiring the shop to handle the heavy amperage load.

Some older machines use direct-drive, three-phase motors that can't be easily replaced (see the bottom right photo on the facing page). In that case, the shop must be outfitted with a phase converter. The cost can run from \$100 to \$1,000, depending on the size of the motor and the type of phase converter—static or rotary.

I check the end of the motor shaft for mushrooming or peening damage from a hammer or gear puller that would make it difficult to install or remove a pulley. Then I grab the shaft to see if there is any up-and-down play. If so, the shaft, bearings or bearing housing may be worn. If the motor is functional, I remove the drive belt and run it at idle. I listen for the hiss of the internal fan. If there's a high-pitched, gravelly whine when the motor coasts to a stop, the bearings need replacement.

The power train must run freely

After checking the motor, I look at the power transmission components of the machine. I don't worry about the belts; I just assume they will need to be replaced. I look for pulley wobble, which means either the pulley bore or the shaft is worn. A new pulley isn't a major investment, but a worn shaft can be expensive to replace. Then I work my way through the power train, checking each part for wear.

Heavy-duty antique machines with babbitt bearings are often sold at bargain prices. Babbitt bearings work fine, but they can be difficult to replace and must be oiled before every use. The inevitable oil drips and spills can foul the surface of a board and may be a fire hazard. I tend to stay away from machines with babbitt bearings because newer machines with ball bear-

Will a used machine need work?

Count on it. The trick is knowing when potential repairs will cost more than the machine is worth.



ings are generally better made. However, with a little care, these machines are a good buy for an amateur millwright with the time and inclination to pour new bearings. Sometimes a machine with babbitt bearings can be modified for modern, standardized ball bearings, but it's no easy job.

I check all the ball bearings in the power train. I'm not concerned if some need replacement. Ball-bearing sizes are standardized, so it's easy to find replacements. However, pressing the bearings on and off the shafts requires some specialized tools. To do the job right, you'll need an arbor press and bearing pullers.

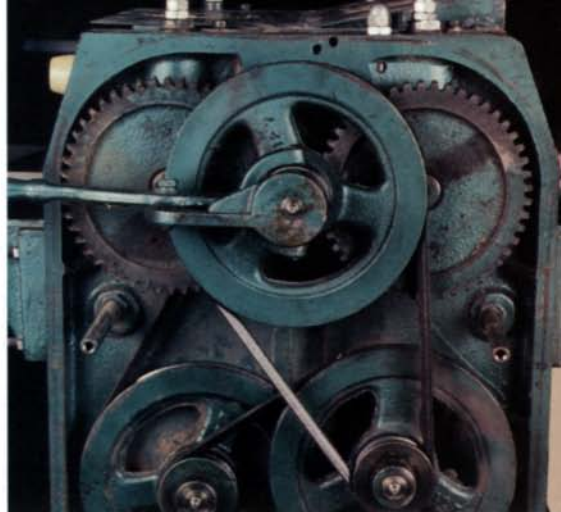


Photo: Dennis Preston

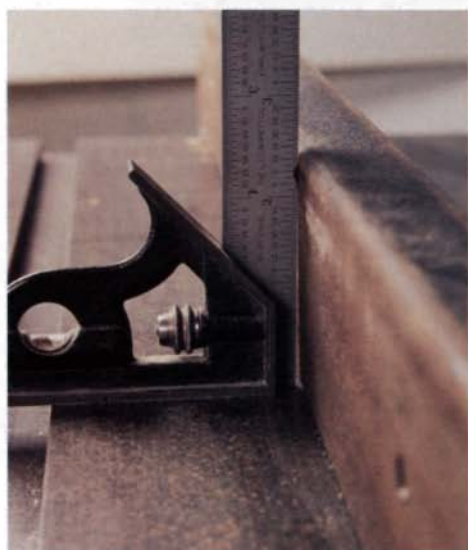
Make sure all the parts are in the box before continuing your inspection. Finding missing parts for this out-of-production combination machine may be nearly impossible.



Badly worn parts may mean poor maintenance. Bandsaw blades are easy to replace, but a thrust bearing like this one indicates the machine was not carefully maintained.



Remove covers, and inspect power trains. The gears of this planer pass with flying colors—no cracks or broken teeth. If possible, try running the machine under a load to check the power train.

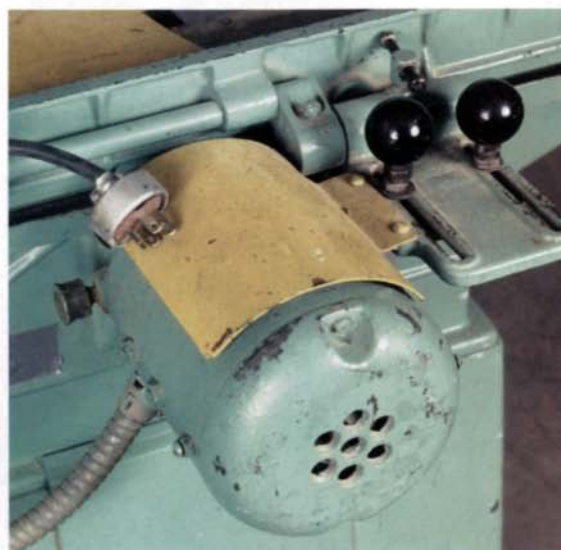


Essential adjustments should work properly. Check the fence for squareness, run all the handwheels and raise and lower the tables or blades. The fence shown here is out of square to the table.



Photo: Dennis Preston

Cracked or repaired parts aren't necessarily a serious problem. Welding a frame is not difficult or costly. But care must be taken not to distort or misalign the parts.



Some motors can't be changed. The three-phase, direct-drive motor on this jointer can't be swapped for a 110v single-phase motor. It will require 220v circuits and a phase converter.

You can inspect gear-drive systems by simply removing the cover (see the top right photo above). One or two broken teeth can be repaired, but more than that will probably require a new gear. Some gear systems operate in an oil bath in an enclosed housing. In that case, I turn the machine over by hand to look for jerky motion in the visible moving parts and listen for grinding noises.

If possible, I run the machine under load and use it to cut some stock. Doing so can reveal problems, such as planers that don't feed, blades or belts that won't track, or excessive vibration due to damage or wear.

Moving the machine is not always easy

It can take a significant amount of time and money to move a machine, and I keep that in mind while I'm inspecting it. A small machine like a Delta 14-in. bandsaw that weighs about 150 lbs. can be carried by two people to a van or pickup truck, but an old 36-in. Crescent bandsaw is another matter. Sometimes I've moved large machines by disassembling them. I've also rented panel trucks with lift gates to carry heavy tools (but be warned that most lifts have a 1,000-lb. limit). I don't use lift gates when loading machines like drill presses,

bandsaws and mortising machines because these tall machines are dangerously unstable as the gate rises.

I've found the easiest way to move heavy machines is to hire a roll-back wrecker. It has unlimited headroom for tall machines and comes with an experienced operator/driver who can make moving a big machine much safer. The cost of moving a machine is about the same as moving a car over the same distance. □

Robert Vaughan is a contributing editor to Fine Woodworking. He repairs woodworking machines in Roanoke, Va.

Curved Table Aprons

Layers of bending plywood faced in veneer are light and strong

by Bruce Peterson



Curved apron is veneered plywood. The author laminated layers of bending plywood capped by veneer around a circular form (right) to make the apron for this table.

As a furniture builder, I'm always looking for production methods that save time but don't sacrifice quality. A good example is a series of veneered tables with circular aprons that I build to sell through galleries. The joinery is simple, so I can concentrate on the details: veneer-matching, shaping, inlaying and finishing. I have a vacuum bag, which speeds up the veneer work considerably, and I use jigs to taper the legs and to cut the joinery that connects the legs to the apron. The challenge was figuring out how to make strong and stable round aprons quickly.

Initially, I considered the more traditional methods of forming a curve out of solid wood. But those methods are neither easy nor economical. Steam-bending requires equipment and set-up time. Laminating and bricklaying solid wood involve lots of cutting, fitting and clamping.

What I needed was a faster, less-expensive way to form a curved apron. I experimented with laminating strips of $\frac{3}{8}$ -in. bending plywood around a circular mold, or form. With some refinement, I could make a small table apron, ready for veneer, in just a few hours. And this construction is more stable and quite a bit lighter than a solid-wood apron.

The trick to this process is the bending plywood I use to make the circular form and the table apron (see the photo at right on the facing page). The plywood can be bent into fairly tight curves, but it will only bend along one axis. The two most com-



mon types are Wiggle Wood (also called Wacky Wood or Bendy Board) and Italian bending poplar. Wiggle Wood is available in $\frac{1}{4}$ in. and $\frac{3}{8}$ in. thicknesses. Italian bending plywood is 3mm thick (just under $\frac{1}{8}$ in.). Both come in 4x8 sheets. Large lumberyards carry one or both varieties. I used $\frac{3}{8}$ -in. Wiggle Wood for my table aprons.

Designing the table and the building forms

I use two wooden forms (see the photo on p. 67) to make my plywood aprons: one is



Bendable plywood—The author uses Wiggle Wood to make circular table aprons. The wood comes in 4x8 sheets, either $\frac{1}{4}$ in. or $\frac{3}{8}$ in. thick.

bending plywood reinforced with $\frac{3}{4}$ -in. plywood (see the photo at left). The form's diameter is just under eight thicknesses of bending plywood less than the outside-to-outside dimension of the table apron. To be exact, figure in the two thicknesses of veneer (usually $\frac{1}{8}$ in. each), as well.

To make the top and bottom of the form, cut two circles of $\frac{3}{4}$ -in. plywood. They should be two thicknesses of bending ply less in diameter than the inside of the finished apron (see the bottom drawing on p. 66). Cut out the centers of the top and bottom so they're hollow, like tires.

With the top aligned over the bottom, insert, glue and nail six or eight plywood pieces between them. The pieces, which are higher than the apron width, resemble the spokes in a water wheel. Glue and tack (I used staples) a layer of bending plywood around the wheel.

A form for the outer, veneered skin—

The form for the outer, veneered layer of the apron is an arc that's slightly longer than a quarter of the table-apron core. The radius of the form is the outside radius of the apron less one layer of bending plywood and the thickness of the veneer.

This form must be strong to withstand the pressure of the vacuum press. It should be about 18 in. from end to end so you will have enough room to glue four to six quarter sections at a time. Having one or two extra quarters is a good idea in case you ruin one of them during glue-up. And the

for a three-layer core and the other for a veneered outer layer that's glued to the core. The outer "skin" is made in quadrants that fit the spaces between the four legs. I veneer these arc sections in my vacuum press. The two forms shown in the drawings on p. 66 are the keys to getting tightly glued layers in the apron.

To size the forms, make a full-scale, top-view drawing of your table. From this drawing, you can get the diameters and the arc lengths you'll need. I take scraps of the plywood, bend them in a curve and set

them on edge right over the drawing so that I can gauge and mark the thicknesses of the apron layers.

The end table I made is 20½ in. dia. (see the photo at left on the facing page). Its four legs are made from 1⅞-in. cherry. The table's plywood apron is 2¼ in. wide, and the top, made from 1⅞-in. medium-density fiberboard (MDF), is veneered with book-matched Carpathian elm burl.

A form for the inner core—The form for the apron's three-layer core is a wheel of

Bending forms

To determine the exact shape of the two forms used to make circular aprons, the author starts with a line representing the diameter of the finished apron (right). The outside edge of the circular form for the apron's core is found by subtracting four layers of plywood plus the veneer.

Outer edge of circular form

Finished apron is a three-layer plywood core, plus a veneered outer layer.

The radius of the form used to make the apron's outer skin is one layer of plywood and one thickness of veneer less than the apron's finished diameter.

First form makes three-layer core of apron.

Second form makes veneered outer layer of apron.

Finished apron diameter

Trammel points lay out plywood form pieces.

Leg locations in blue

extras can speed things up if you are doing a production run. To make the form, wrap and fasten a layer of bending ply over ribs of $\frac{3}{4}$ -in. plywood that are attached to a plywood baseplate, as shown in the photo on the facing page.

If you plan to use hide glue and a veneer hammer or yellow glue and an iron to attach the veneer to the apron, you do not need to build this second form. You would laminate four layers of plywood (instead of three) over the first form. I like using a second form; in the vacuum press, it produces

veneered quadrants that are bent in rigid arcs, ready to be attached to the core. I use epoxy for veneering because it makes a good bond and gives good working time. Also, epoxy reduces the cracking, lifting and chipping that can occur on the edges of delicate veneers.

Cutting and gluing up the apron

Cut the plywood for the apron layers in strips that are $\frac{1}{8}$ in. over-width to allow for trimming. You'll need three strips for the inner core and a fourth for the veneered, out-



Three layers of plywood are painted with thinned glue and then wrapped and clamped on the form at left.

er layer. Wrap the innermost strip around the core form, and mark the strip where the two ends butt. Cut the strip $\frac{1}{4}$ in. short of this length so that it can be drawn together tightly on the form. Tape the strip temporarily in place on the form.

In a similar manner, wrap the second layer around the first strip, and then tape it. Do the same thing with the third and fourth layers. If you measure these lengths now, you can cut strips for subsequent tables. Dry-assemble to make sure that all the layers compress nicely. Remove the layers from the form, and then cut the fourth strip in quarters.

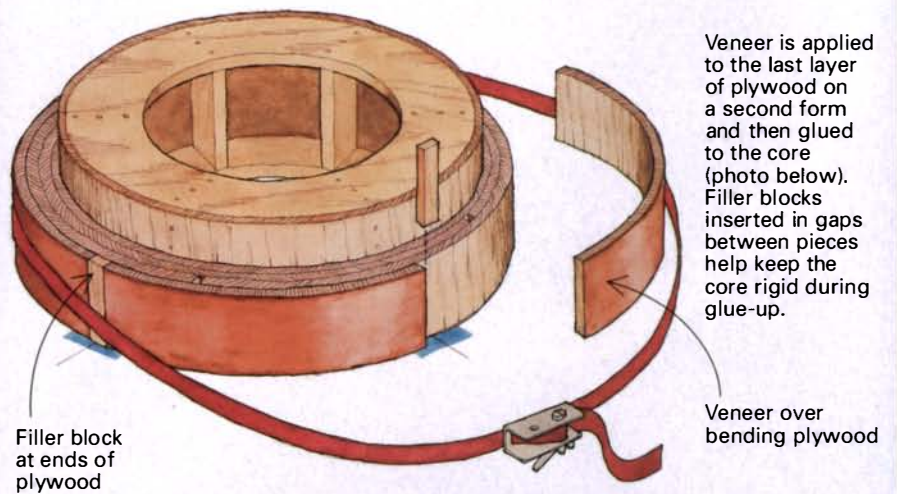
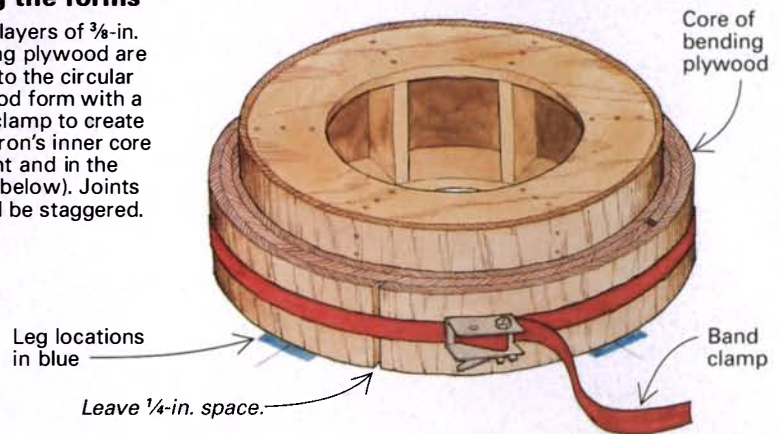
I use yellow glue that's been thinned with water to about the consistency of light cream. Thinning the glue will allow the layers to slide past one another as they are clamped. I use an old paint brush to apply the glue to one side of the three core strips (see the photo above).

I clamp the layers together with two band clamps, making sure that the joints of the strips are staggered. After a few hours, I remove the clamps and trim and clean up the apron's edges. A jointer or stationary belt sander works well for this.

While the aprons are drying, I veneer the

Using the forms

Three layers of $\frac{3}{4}$ -in. bending plywood are glued to the circular plywood form with a band clamp to create the apron's inner core (at right and in the photo below). Joints should be staggered.





Forming the leg sockets—The author starts on a tablesaw, using a miter-gauge jig to cut the ends of a half-lap joint for each leg (above). A bandsaw removes the rest of the waste (right).



quarter-section pieces that make up the fourth layer of the apron in a vacuum press. (For more about this process, see *FWW* #110, pp. 82-85.) Once the veneered sections are removed from the press, I glue and clamp them to the core with band clamps. I like to fill in the voids between sections by gluing in apron and veneer scraps. The fillers don't have to look pretty because they'll be cut out for the leg sockets. But having a rigid, continuous circumference helps ensure accurate cuts.

I also plug any voids in the three inner layers. This gives the apron a cleaner look when viewed from below.

Joining the legs and the top to the apron

To join the legs to the apron, I use simple, but strong, half-lap joints reinforced with screws. This joinery allows the attachment of many different leg styles, and it is easy to do. Shape the legs after the joinery is cut, so you're working with stock that has straight sides and square corners. To determine where to lay out the leg sockets on the apron, return to your drawing. I like to place the apron directly on the diagram and transfer the leg locations to both the top and bottom of the apron.

Use a tablesaw to cut the limits of the dados for the half-lap joints in the apron. The depth of the dados is one-half the thickness of the apron. A scrap of MDF cut in the arc of the apron and clamped to the miter gauge makes a handy jig that helps steady the cut (see the top left photo).

Take a practice cut somewhere inside your marks to make sure that the blade cuts square to the apron surface. Then carefully line up the apron marks, and make your cuts. Although the cut is not too deep, it's a good idea to clamp the work securely to the jig in case the piece should kick back.

Next use a bandsaw to remove the waste between the sawcuts (see the bottom left photo). Test-fit the legs into each dado. Now rabbet the upper backs of the legs so that they will slip into the apron.

The depth of these recesses determines how much the leg protrudes from the outside of the apron. I like the leg to be about 1/4 in. proud. Shape the legs to their final form, and then glue them into place. Drive two screws in from the back of the apron to reinforce the joint. □

Bruce Peterson works in a one-man shop in Pilar, N.M.



The Spokeshave

Choosing, tuning and using this neglected but essential tool

by Mario Rodriguez

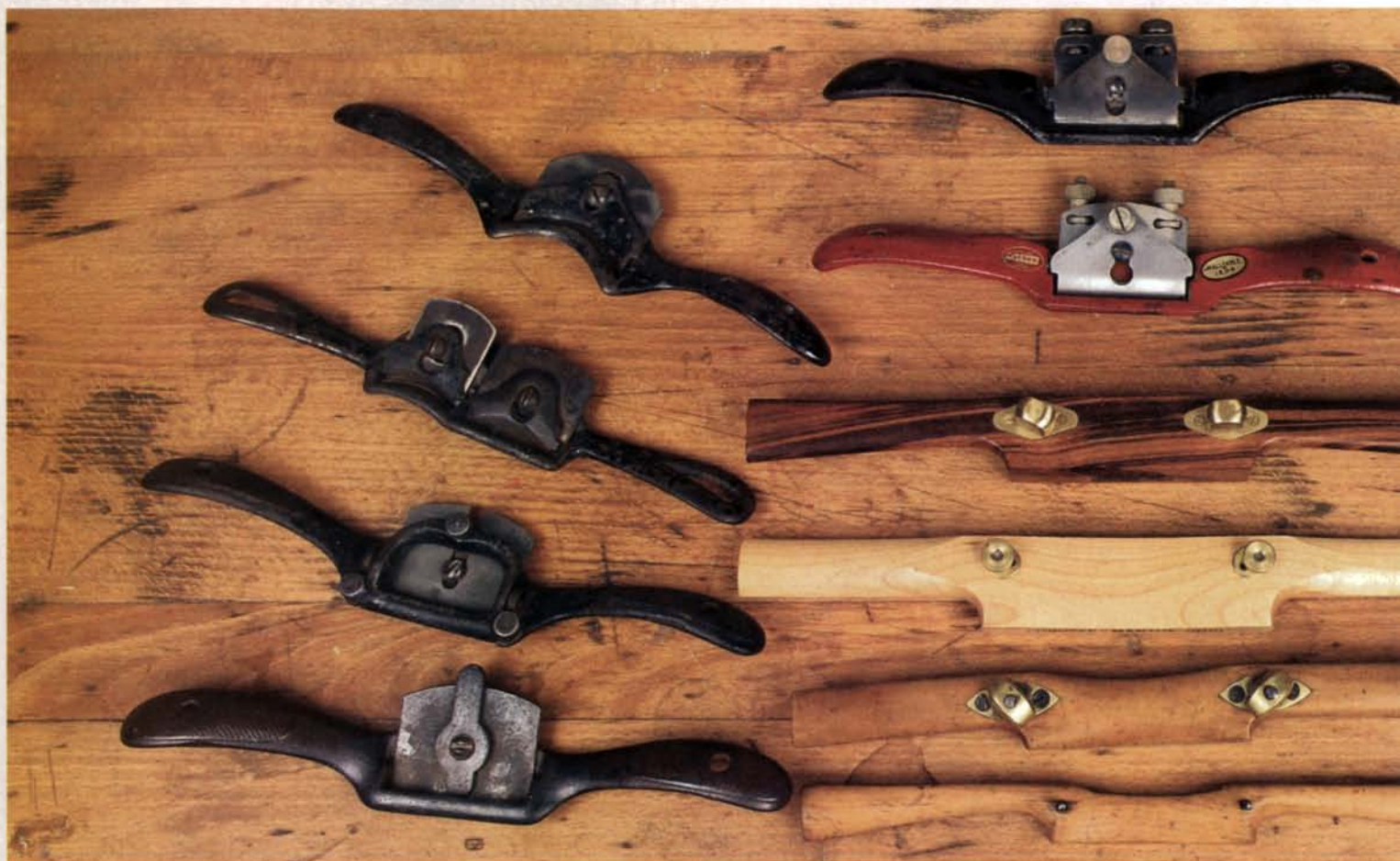
One of my students brought a flea market spokeshave to school last fall, complaining he couldn't get it to work. A group of students gathered as I disassembled, cleaned and tuned up the tool. As I reassembled the spokeshave, I looked around the shop for just the right piece of wood to help me demonstrate how well the tool now worked. Across the shop, I spied a student tediously sanding an inside curve on the first of what looked to be a dozen thick, pine brackets. She'd already spent more than 15 minutes at the oscillating spindle sander, working on a single bracket. Choking on the dust and going deaf from

the noise, she didn't look like she was enjoying herself. I took one of her unsanded brackets to my workbench, and just three minutes later, I handed her a silky smooth, perfectly shaped bracket. She nearly passed out.

That's what a spokeshave can do. As a reproduction furniture-maker, I use spokeshaves most often to clean up cabriole legs, shape Windsor chair seats and fine-tune spindles. Whenever I have to shape a curve, regardless of the style of furniture, a spokeshave is the first tool I reach for (see the photo above).

Some woodworkers who have used spokeshaves complain that

CHOOSING A SPOKESHAVE



A parade of spokeshaves. Everything about a spokeshave has been experimented with over the years, from the material the tool is made of to the sole shape to the adjustment mechanism. Stanley even made a double spokeshave (second from top left).



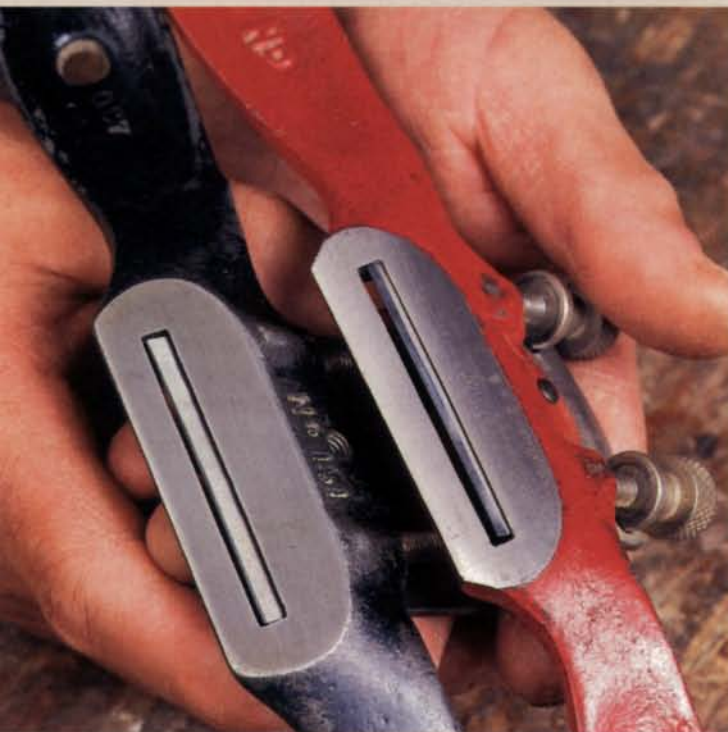
Preventing wear—Spokeshaves used to wear quickly in front of the blade. To prevent this, manufacturers turned to wooden wear plates, usually boxwood. Brass wear plates were an improvement, and metal spokeshaves eliminated the problem.



Going by feel. The author adjusts an old wooden spokeshave by tapping the tangs of the blade with a hammer. Then he checks the setting by feel.



Knurled nuts allow precise adjustment. Because there are two posts, the blade can be skewed so that one side takes a fine cut and the other a heavy cut.



There are a lot of choices, but you only need two. Most furnituremakers can get by with just two metal spokeshaves—one with a flat-sole and one with a rounded sole for tight inside curves.

they skip, chatter or just tear up the wood. A quick tune-up, the right grip and a basic technique will eliminate these problems.

The evolution of the spokeshave

The earliest spokeshaves, dating at least to the 15th century, were wooden affairs with U-shaped, friction-fitted blades. Adjustments were made by tapping the tangs of the blade with a hammer. Many shaves of this type can still be found in antique-tool shops and auctions. Because they're so light and have such a low blade angle, these spokeshaves are a delight to use.

Over the years, the addition of threaded adjustment mechanisms improved the spokeshave. Toolmakers also began introducing spokeshaves with wear plates of boxwood (which is a very dense, tight-grained wood) and brass (see the bottom left photo on the facing page).

However, the real change came with the introduction of the metal spokeshave in 1860. The blade in a metal spokeshave is flat so that it can be sharpened easily—just like a plane blade. With a wooden spokeshave, the easiest way to sharpen its U-shaped blade is on a buffing wheel. This is a freehand operation that takes some practice.

The flat blade in a metal spokeshave also affects the cutting angle. Wooden spokeshaves have a low cutting angle, somewhere between 19° and 27°. Metal spokeshaves, however, are set like bench planes, at 45°, with the bevel facing down. Though the metal spokeshave's higher angle doesn't cut the wood as well, most woodworkers prefer the ease of sharpening its flat blade and willingly accept the trade-off. Metal spokeshaves also eliminated the problem of wear at the throat of the spokeshave.

Choose a set: round- and flat-bottomed

Spokeshaves are available in a bewildering variety of sizes and materials and with a number of sole shapes and means of adjustment. I use a half-dozen or so different spokeshaves, but I could get by with just two metal ones: one flat-bottomed and one round-bottomed (see the bottom photo at left). They belong in every woodworker's toolbox. With these two tools, you can shape just about any inside or outside curve.

The least complex spokeshave available today is set by eye or by feel, much like an old wooden spokeshave. The blade is held down with a cap iron secured with a screw. With a little practice, any woodworker can set it for a fine cut. Stanley manufactures a pair of full-sized, manually adjustable shaves, the No. 51 (flat-bottomed) and the No. 51R (round-bottomed), as well as a pair of lightweight, manually adjustable spokeshaves, the No. 63 (round) and the No. 64 (flat). The lightweight spokeshaves are smaller, so they cut tighter inside curves.

The most popular spokeshaves being manufactured today are the Stanley No. 151 and the No. 151R (and the Record equivalents, the No. 0151 and the No. 0151R). These spokeshaves have shallow metal bodies, slightly arched handles and mechanically adjustable, 2 1/8-in.-wide blades.

The blades on these spokeshaves hang on two knurled nuts that travel on threaded posts (see the bottom right photo on the facing page). This design not only allows precise adjustment but also enables the woodworker to set blade projection to take heavy cuts on one side and light cuts on the other, without readjusting the blade. This feature can come in handy. The Stanley and Record tools are also available in unbreakable, malleable iron.

Prices will vary depending on where you buy them, but a pair of

TUNING A SPOKESHAVE

1. Flatten the sole with a file and then a sharpening stone. Polish round-bottomed spokeshaves with emery cloth followed by 600-grit wet-or-dry paper. This helps the tool glide across the wood.



2. File the bed flat to seat the blade properly. Check for flatness with the blade of a small square, and take down the high spots.



3. Flatten the cap iron so it exerts uniform pressure against the blade and across the cutting edge.



4. A well-tuned spokeshave—With all surfaces that bear against the blade flattened, this spokeshave isn't likely to chatter.



even the most expensive of these spokeshaves, mechanically adjustable and made of malleable iron, will cost less than \$45.

Tuning up your spokeshave

Any new hand tool needs tuning before it works properly. But take heart. This initial tuning goes quickly with spokeshaves. First, with the blade removed, carefully file the sole flat, and then clean it up on a sharpening stone (see the top left photo). This usually takes only a few minutes. Next inspect the bed where the blade seats. If it looks rough or uneven, file it flat (see the center left photo). The blade should sit on the bed without rocking. File and then stone the cap iron, too, so that it will exert uniform pressure on the blade and across the cutting edge (see the bottom left photo). Mating parts in a properly tuned spokeshave are flat and seat well—that's what eliminates blade chatter (see the photo at right).

Sharpening your spokeshave blade properly is also crucial to smooth performance. I grind my blade at a 25° primary bevel and finish it off on my waterstones with a secondary bevel of about 2°.

To get even better performance from my Stanley No. 151, I replaced the stock blade with a thicker, aftermarket blade made by Ron Hock (available from a number of woodworking supply catalogs). These blades are hardened to Rc62, measure a full $\frac{3}{32}$ in. thick and cost a bit less than \$20. The thicker blade creates a finer, or narrower, mouth opening and reduces chatter.

Using the spokeshave

A spokeshave is a fairly simple tool, but there are some basic techniques that will go a long way toward reducing frustration and achieving smooth cuts.

Maintain three points of contact—When using the spokeshave, always maintain three points of contact between the spokeshave and the workpiece: front of the sole, back of the sole and the blade (see the drawing on the facing page). A good grip will help prevent the tool from rocking and skipping across the workpiece.

The spokeshave is designed to be a push tool, and that's how it

USING A SPOKESHAVE

Proper grip eliminates rocking.

When pushing the spokeshave, hold it loosely with forefingers wrapped over the top and ahead of the blade, thumbs behind the blade. Maintain even pressure on the workpiece ahead of and behind the blade.

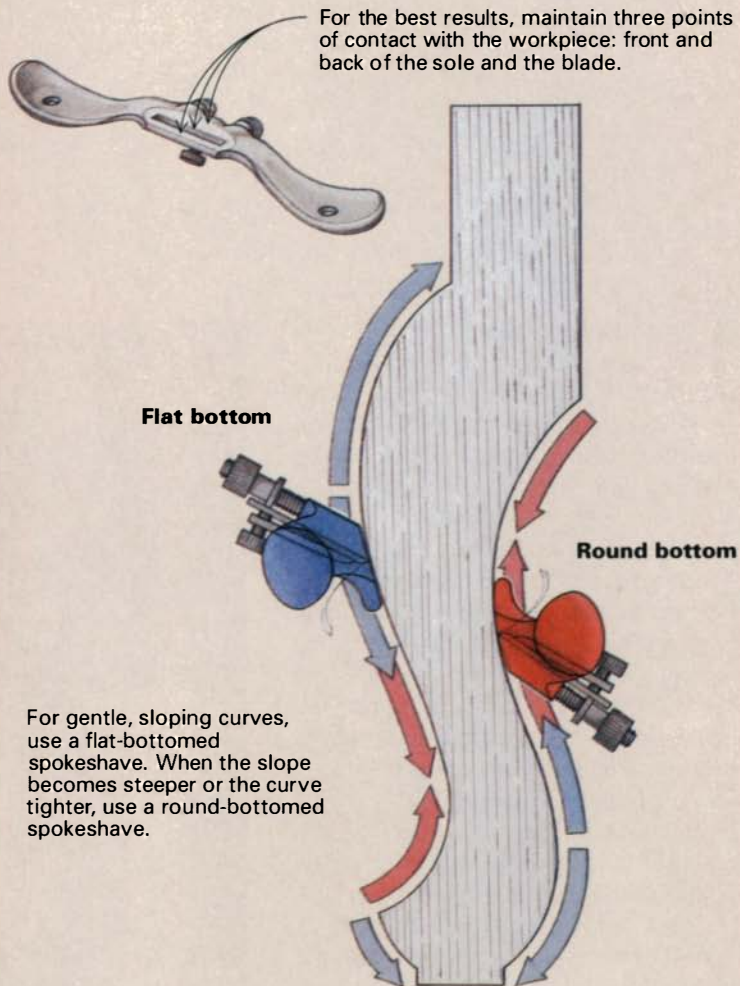


When pulling the spokeshave, flip it around so your thumbs lead and your forefingers follow. Maintain even pressure on the work.



Cutting curves: Go with the grain

The general rule is to cut down, from high to low. This works as long as the grain is straight and in line with the workpiece. Otherwise, observe grain direction, and cut with it.



works best. Sometimes, however, pulling it is necessary because of sharp grain reversals or the position of the workpiece in a vise. I find that pulling the spokeshave is less efficient and more tiring, though, so I try to push it whenever possible.

When I'm pushing the spokeshave, I grip it loosely. I rest the handles in my palms and position my thumbs almost directly behind the blade. My forefingers go over the toe and just in front of the throat (see the top photo above). This grip is comfortable and provides excellent control and even pressure across the sole. For a pull stroke, I simply flip the spokeshave around in my hand so that the blade is facing my thumbs (see the bottom photo).

Set the blade for a light cut—As with a bench plane, I set the spokeshave with almost no blade showing. When I run my finger over the mouth of the spokeshave (carefully, mind you), I can just barely feel the blade coming through. If I don't get a shaving, I advance the blade just a little at a time.

Skewing the spokeshave can help the cut, too. A skewed blade

meets with less resistance and comes closer to imitating the slicing action of the antique wooden spokeshaves. And because curves always present a significant amount of end grain to the blade, the lower angle leaves a smoother, cleaner surface.

Cut with the grain—It's just as important to cut with the grain when shaping curves as it is when you're smoothing a flat board. If you try cutting against the grain, you're sure to get chatter and tearout. The general rule is that you always cut down, from high to low (see the drawing above). But that doesn't always work. Sometimes you need to read the grain and make adjustments accordingly. For gentle curves, a flat-soled spokeshave works well, but for tighter areas, you may need a round-bottomed version. □

Mario Rodriguez teaches woodworking at the Fashion Institute of Technology in New York City and at Warwick Country Workshops in Warwick, N.Y. He's also a contributing editor to Fine Woodworking magazine.

Resawing on the Bandsaw

For predictable results, use a high fence and a very tight blade

by Ronald Volbrecht

I buy quilted maple for the backs and the sides of the guitars I make from a friend who is a lumber grader. Each year he inspects more than a million board feet of lumber, and if I'm lucky, he will find three good 2½-in.-thick planks. Some of the hardwoods and old-growth spruce I use are no less rare.

When it comes time to resaw these irreplaceable planks, I don't want anything to go wrong. Over the years, I've learned to adjust my bandsaw for consistent resawing with very little waste. I can get finished, ¾-in.-thick guitar backs from resawn boards that are only ⅛ in. thick.

I do all my resawing on a 21-year-old Delta 14-in. bandsaw. It has a 6-in. column extension, which allows me to resaw planks that are up to 12¼ in. wide. The boards I resaw are usually 8 in. to 10 in. wide. I use a ½-in. blade with 3 teeth per inch (tpi).

Other than replacing the motor, I have not made any modifications to the saw, and I have no magic tricks. But there is more to getting good results than just running a board through the saw.

I tune my blade, set the guides close to the blade and then make sure that the blade is good and tight (for more on this, see the story on p. 79). I use wrenches to lock down all the adjustment points on the saw so that they can't vibrate loose. Then I feed the plank slowly against a high fence (see the photo on the facing page), judging the feed rate by the sound of the blade.

A heavy-duty motor and new pulleys

When I bought the saw, it had a ½-hp, 1,750-rpm motor, but I soon replaced it with a ¾-hp, 3,450-rpm motor. Because the bigger motor turned faster, I had to change the pulleys to keep the blade running near the factory speed of 3,000 feet per minute (fpm).

I used the formula given in the box above to determine the right combination of pulleys. I kept the 2-in. pulley that came with the



Blade-tension scales aren't exact. The author tensions the blade by ear, not by the calibrations on the saw.

A formula for blade speed

When I switched my motor for one with more horsepower and higher rpms, I had to change the pulleys to reduce the blade speed. Factory blade speed is 3,000 feet per minute (fpm), and I wanted my blade to turn slightly slower than that.

Here's a formula to determine blade speed of any combination of motor and pulleys:

Motor speed x (motor-pulley diameter ÷ saw-pulley diameter) x π x wheel diameter (in feet)

For example, this is the formula for blade speed on my 14-in. bandsaw with its new motor:

3,450 rpm x (2 in. ÷ 11 in.)
x 3.1415 x 1.167 ft. = 2,299.7 fpm

—R.V.

motor. That pulley and an 8½-in. pulley on the saw would have given me the right blade speed, but the big pulley wasn't in stock locally. I tried a 12-in. pulley, but the blade ran too slowly (about 2,100 fpm). Each time the weld went through the guides, the saw lurched. I ended up with an 11-in. pulley, which turns the blade at about 2,300 fpm. That's just about right for the work I do.

Choose a good blade, and keep it tight

I use the same type of blade for every cut I make on the bandsaw. It's a ½-in. skip-tooth blade with 3 tpi and a thickness of .025 in. I



Press the plank against the fence while pushing it through the blade. The right hand pushes the board while the left hand is positioned down low to press the workpiece against the fence. Use a push stick at the end of the cut.

don't think the brand of the blade matters, but the quality of the welds does. I look for blades with good alignment at the weld and no blobs of metal. I check the back of the blade at the weld to make sure there is no offset. Problem welds cause the bandsaw to vibrate, and that makes the results inconsistent. I can tolerate a little offset or lumpiness because I carefully grind these defects smooth with a Dremel Moto-Tool and then dress the blade with a diamond stone.

I determine the correct tension by removing the blade guard on the left-hand column and plucking the blade as if it were a giant guitar string (see the photo at right). The sound will go from a sloppy vibration to a smooth, low tone. At that point, you've reached the proper tension (see the photo on p. 74). For guitar players, the tone roughly corresponds to an E note on a bass guitar. When the blade sounds right, I replace the guard.

I've never bothered to release the blade tension when the saw's not running. In theory, constant tension will shorten the life of the saw's bearings, but I'm still using the originals. I'd rather keep my saw ready to roll than fiddle with blade tension every time I want to use it.

After the blade is tight, I turn the upper wheel by hand to check the blade tracking. I spin the wheel and adjust the thumbscrew near the blade tensioner until the blade runs in the middle of the tires. When the blade tracks true, I tighten the thumbscrew and its locknut with Vise-Grips.

Next I set the table perpendicular to the blade. I raise the guides full height and use a long combination square. I put a light behind the square so I can detect and correct even small discrepancies (see the photo at left on the facing page). I tighten the knobs that lock the table in place with a wrench, so they don't loosen while I'm resawing. Before the next step, I check the squareness again.

Use a wrench to tighten the adjusting screws

Before I set the blade-guide adjustments, I raise the guide bar so the upper guides are about 9½ in. off the table—high enough to clear my resaw fence. I tighten the thumbscrews that hold the guide bar in place as tightly as I can. For leverage, I use a pair of Vise-Grips. With this kind of pressure, the end of the thumbscrew becomes slightly mushroom-shaped over time. This can cause the guide bar to rotate slightly each time the thumbscrew is tightened, and the motion can twist the blade. To prevent this, I periodically remove the thumbscrews and file the ends square. With the guide bar set, I turn my attention to the guide blocks and thrust bearings. I usually adjust the lower guides first and then the uppers.

Some woodworkers prefer aftermarket guide blocks made of phenolic resin, but I've kept the original steel guide blocks that came with the saw. I prefer that the blade bear against a hard, flat surface, so I grind the guide blocks square and set them close to the blade to minimize its side-to-side motion. Because I clean up the welds on the blades, I can position the guide blocks only .002 in.

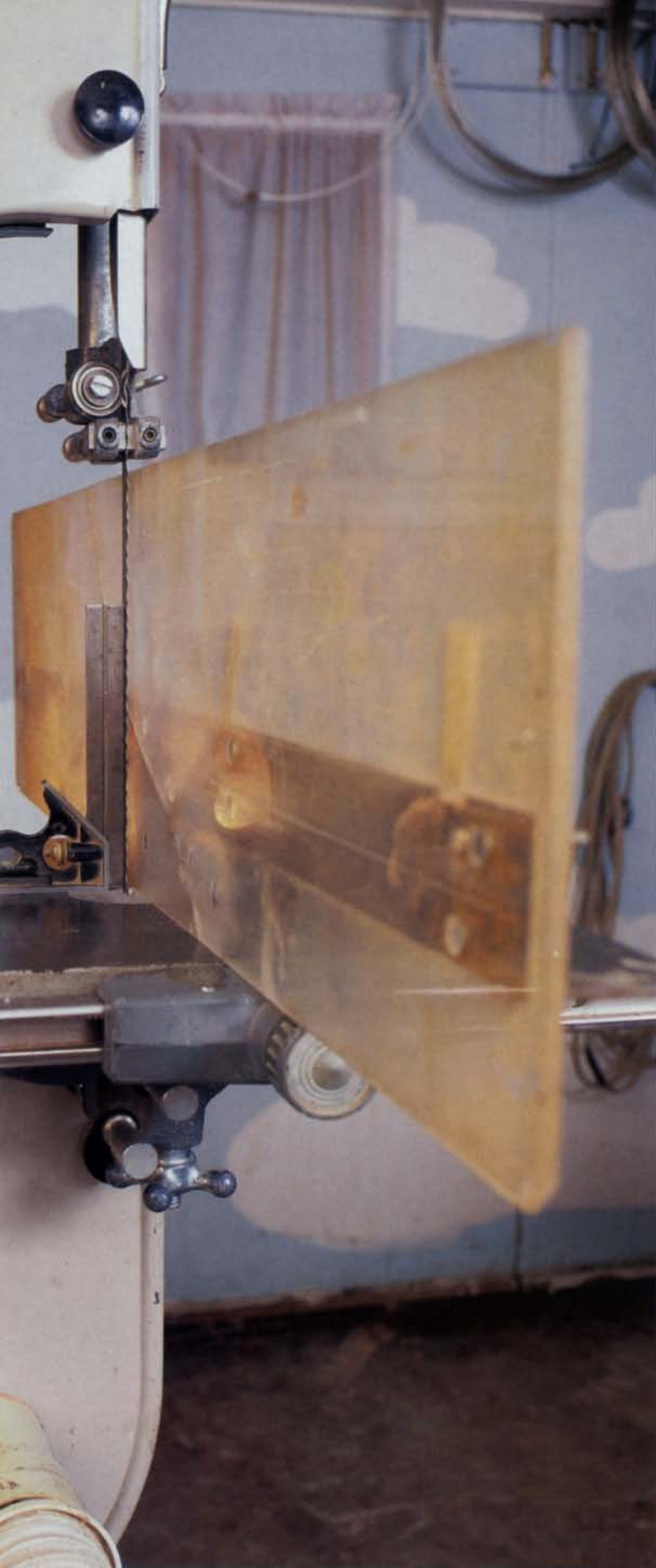


Pluck the blade to check the tension. Listen for a clear note, roughly an E on a bass guitar. The author replaces the blade guard after tensioning the blade.

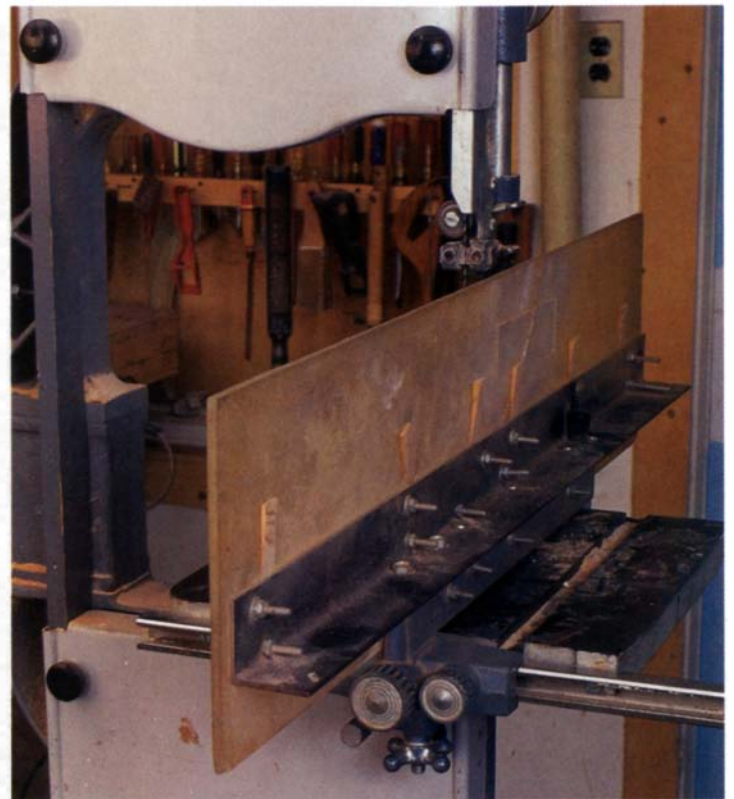


Raise the guide bar, and adjust the blocks and thrust bearing. Set the gap between guide blocks and blade to .002 in., and bring the thrust bearing in light contact with the back of the blade.





Make the table perpendicular to the blade. The author uses a light behind the square to highlight small misalignments. An out-of-square adjustment can ruin stock.



A wide board needs a high fence. A length of angle iron bolted to the top of the bandsaw's original fence supports a facing of 1/4-in. Plexiglas. Wedges help square Plexiglas to table.

from the blade. I use a feeler gauge to set the gap, and I tighten the setscrews carefully against the guide blocks so they don't shift. After they're locked in place, I double-check the gap. I locate the blocks just behind the blade gullet (see the photo at right).

Before moving the bearing, I spin it to make sure it turns freely. If necessary, I give it a little oil. If one side of the bearing shows wear on the outer rim, I turn the bearing around. Then I move the bearing up to the back of the blade. It should just touch the blade but not spin until the saw is cutting wood.

When I first started resawing, I ruined a few boards because my carefully set adjustments vibrated loose. I tightened the adjustments as much as I could by hand, but that wasn't enough. I finally added locknuts to the lower guide adjusting screws. The nuts won't vibrate loose even after hours of resawing. I make them wrench-tight, which would be 20 to 25 ft. lbs. on a torque wrench. On the upper guide adjustments, I use Vise-Grips locked onto the thumbscrews to torque them tightly enough to be vibration-proof. These adjustments make my cuts very precise, but the tolerances are so close they have to be reset each time the guide-bar height is altered.

A high fence supports the plank

The resaw fence needs to be almost as high as the piece being sawn. If the fence is too low, when feeding a plank through the saw, the bottom of the board will tend to move away from the fence. The face of the fence must be 90° to the table. Even if the fence is out of square by only 1/2°, finished boards resawn from wide planks will have a pronounced wedge shape.

I built my resaw fence by adding a 9-in.-high piece of 1/4-in. Plex-



Slow, steady pressure—The author maintains a steady feed rate as he moves the workpiece through the saw. Stopping even briefly will produce a thin spot in the board.



The proof is in the pudding. By adjusting his bandsaw carefully and feeding the workpiece through the cut steadily, the author gets consistent results like this.

iglas to the face of the rip fence that came with the saw. I used Plexiglas simply because it was handy. Plywood, Lexan (similar to Plexiglas but stronger) or aluminum might be better. Even a crack in the resaw fence hasn't affected its performance. To better support the Plexiglas, I bolted a length of 3-in. by 3-in. angle iron to the top of the fence (see the photo at right on p. 77).

When I first set up my resaw fence, the original rip fence wasn't square to the table. As a result, the top edge of the resaw fence was out of square. I fixed it by inserting wooden wedges between the Plexiglas and the angle iron (see the photo at right on p. 77). The wedges are about 1½ in. long and taper from ¾ in. to ¼ in. along their length. Each time I set up the fence, I make sure the Plexiglas is square to the table and adjust the wedges as necessary.

You may have to adjust your bandsaw fence for lead or drift. That's when the blade won't make a cut parallel to the edge of the table. To adjust the fence to account for it, I draw a line parallel to the edge of a jointed board and make a freehand cut along the line for about half the length of the board. Then I stop sawing, clamp the board to the table and set up the fence along the jointed edge of the board. Now the fence is parallel to the cut, and the blade will have no drift. I periodically check for drift, but I've never found any on my saw. I hear the same from other woodworkers who use the same saw.

When I'm ready to resaw, I install the fence ⅛ in. to the right of the blade and lock it to the table at both ends with the clamps on the original fence. Then I prepare the plank by jointing both edges

Keep your bandsaw singing, not whining

by Anatole Burkin

Like a stringed instrument, a bandsaw likes being under tension to perform well. But too much tension can de-tune your machine. We asked two tool manufacturing representatives to comment on what happens to a bandsaw when too much tension is applied. And we asked how to keep a bandsaw running smoothly.

Louis Brickner, vice president of engineering and product development for Delta International Machinery, says one way to spot overtensioning is to slide the guide bar up and down after tensioning the blade and setting the guide blocks. "If you have to readjust the blocks, it's a clue that you're bending or flexing the machine beyond its design capability," says Brickner.

Most woodworkers adjust blades by using the markers on the machine's tensioning adjustment screw and/or listening for a low tone by plucking the blade as it's tightened. Either method should get the blade in the 7,000 to 15,000 psi tension range (the low figure is bare minimum, and the high number is optimum). These numbers apply to carbon steel blades and bimetal blades, which make up the bulk of what's sold for small- to medium-sized bandsaws. If you have an industrial-grade saw, higher tensions may be possible.

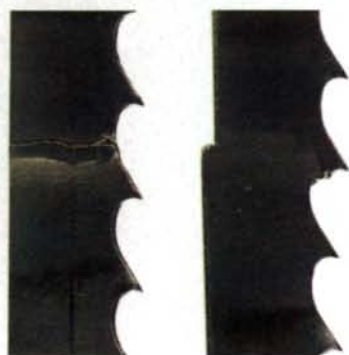
The only way to measure the precise

tension of your blade is with a tension gauge. You can order one through Starrett, but it will set you back \$294.

Brickner also advises against keeping a guide bar raised too far above the work. The upper guide should just clear the surface of what's being cut. That greatly reduces the risk of injury.

A common problem customer's have is tires flying off the bandsaw because the motor they installed runs too fast, says Brickner. To upgrade the motor, pick one that runs at the same speed as the original (1,750 rpm), or change the pulleys after installing a faster motor (see the box on p. 74).

Another problem is using a blade too wide for a 14-in. bandsaw. Machines of this size are not meant for 1-in. or wider



Get rid of the bumps. Ronald Volbrecht uses a diamond stone to smooth out a rough weld (left) or a Dremel Moto-Tool to feather out a misaligned blade (right).

blades. Tensioning them can bend or twist the machine. Best results are obtained with blades ½ in. wide or less.

As with all machines, proper maintenance can prevent problems and injuries. Brickner says it's important to inspect for wheel-bearing wear regularly. Unplug the machine, take off the blade and pulley belt, and spin the wheels. A clicking noise in the shaft spells bearing trouble.

Ray McPherson, product safety manager at Powermatic, says it's important to inspect the spring in the blade-tensioning screw occasionally. A broken spring can make it easier to overtension a blade.

Some woodworkers touch up bandsaw blade welds with a file or grinder. McPherson cautions against taking off too much metal. "A welded joint is stronger than the rest of the blade simply because there's more metal there. Just don't overdo it (grinding). Make sure the weld is complete and there's metal-to-metal contact," says McPherson.

For a comprehensive book on using and tuning bandsaws, a good source is *Band Saw Basics* by Mark Duginske (Sterling Publishing Co., 1989). □

Anatole Burkin is an associate editor of Fine Woodworking.

and one face. I run the jointed face against the fence. When using rare woods, it's important to waste very little. So I run the plank through a thicknessing sander to resurface it after each cut. The sander takes off less wood than a planer and without tearout.

Feed slowly, and support the piece

When resawing, I keep both hands on the piece, as shown in the photo on p. 75. My right hand is on the end grain, pushing the board through the saw (use a push stick for the last few inches of the cut). I keep my left hand low, and I spread out my fingers to press the planks against the fence across a wide area. Slow, constant feed pressure is the key to success. If you stop sawing for a moment, the blade will bite a little deeper.

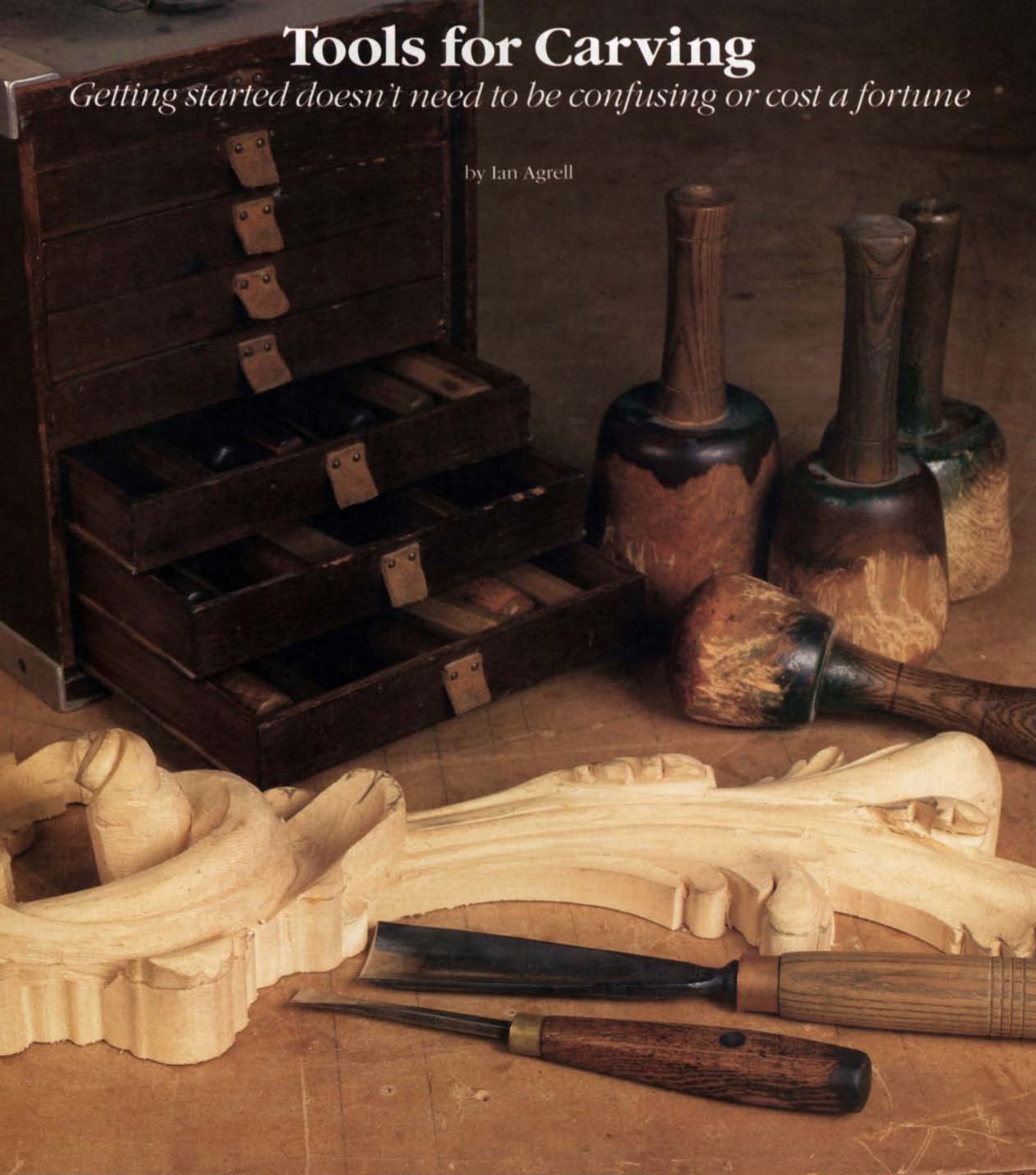
I start out sawing slowly, listening to the sound of the blade. It should make a smooth, steady rasp with a light blip as the weld goes through the guides. I gradually increase the rate of feed, still listening. I feed steadily and strive to keep the sound of the blade steady as well. If I feed too fast, the sound switches to an uneven scraping as the saw vibrates more rapidly. If I push faster still, the vibration will smooth out, but the blade will wander, making an uneven kerf. I just keep the feed rate slow. It takes me about six minutes to resaw a quilted maple plank 8 in. wide by 3 ft. long. □

Ronald Volbrecht builds and repairs guitars. He has built instruments for John Mellencamp, Richie Sambora, Hoyt Axton and other artists. He lives and works in Nashville, Ind.

Tools for Carving

Getting started doesn't need to be confusing or cost a fortune

by Ian Agrell



Carving tool kits are best built over time. You can do a lot of different work with just a few tools. As your work progresses, you'll figure out which tools you will need and not buy the ones you don't.

I've been carving wood for 34 years and teaching others for 18, so I'm often asked what tools to buy for woodcarving. My standard reply consists of a few questions of my own: What sort of carving do you want to do? What size? What woods? The answers to those questions will help determine the tools a carver will need.

A beginning carver can get by just fine with a few general-purpose tools (see the box on p. 82). As a rule, I would avoid buying a prepackaged set. No matter what the quality of the tools, usually one or two are a waste of space and negate the savings of buying them as a set.

High-quality carving tools, well-looked after and properly used, will last a lifetime and more—some of mine are more than 150-years old. Buy the best, and buy just a few tools at first. You can always add more when you need them. That way, you don't end up with tools you'll never use.

Where to find them

Carving tools are readily available at woodworking stores and in mail-order tool catalogs. Of the current offerings, I prefer the Pfeil tools (marked "Swiss made" on their handles), distributed in the United States by Woodcraft (210 Wood County Industrial Park, P.O. Box 1686, Parkersburg, WV 26102-1686; 800-225-1153). I think they're the most refined carving tools made today. This is especially obvious in the smaller sizes, which are lighter and better machined than any of the others generally available.

The second-hand market also is a useful source of tools. At any decent-sized flea market, you can usually find someone selling these tools. If you research current prices before you go tool hunting, you're more likely to get a good deal. You should be able to find good second-hand tools for half, or less, of what they cost new. The best tools were made by Addis and Herring Bros., but neither of these companies has been in business for years.

Homemade or custom carving tools also can be superb. I have some that were made about 100 years ago. They are light, delicate and well-made. Homemade tools often can be found at flea markets and used-tool dealers right alongside the commercial offerings, or you can have them made for you (there are a number of specialty forges).

You can learn to make your own carving tools by reading toolmaking books or by

An array of common carving tools



attending courses on the subject.

Homemade tools are an especially attractive option when you need a specific chisel for a particular carving. I have some excellent fishtails that are very handy—I've never seen any comparable ones available commercially.

Don't pass up chisels without handles. Making new handles is a good opportunity for you to practice some carving. If you're not inclined to spend time carving handles, replacement handles are generally available through woodworking catalogs.

Tool types: Start with the basics

Carving tools come in a huge variety of shapes and sizes, but what you need to know is really pretty basic. I use a relatively limited range of tools, and that hasn't impaired my carving. The types of carving tools I find most useful are straight gouges, V-parting tools, fishtail and spoon gouges (see the photo above).

Straight gouges are all-purpose tools that do most of a carver's work. Depending on the profile of the gouge, which is called the section or sweep, a gouge may be used for rapid stock removal, for rendering detail on a carving or for leaving a polished, finished surface in its wake. Gouges with a very high section are called veiners.

V-parting tools are used to define and separate areas of carving. Carvers make a sketch on the wood with a V-parting tool



Same size, different section—Both of these carving tools are 25mm wide. The one on the right is a No. 11, the highest section (or profile) commonly made. The one on the left is a No. 1. It's flat.



The same section, different size—Both of these tools have No. 5 sections, one of the most useful profiles. But one is only 5mm wide (about 3/16 in.), and the other is 35mm wide (about 1 3/8 in.).

Carving tool list

Here is a list of 22 carving tools to obtain, in order of priority. Don't worry if you can't get the same size and section (profile); something close will do. The curve of the sections vary slightly from manufacturer to manufacturer. —I.A.

Buy these three first



8mm V-parting tool
13mm No. 9
20mm No. 5

Second



4mm No. 11 veiner
18mm No. 11 veiner
25mm No. 5
25mm No. 8

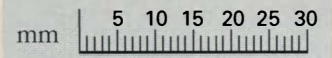
Third



5mm No. 5
12mm No. 3 fishtail
13mm No. 8
16mm No. 1
16mm No. 8 spoon

Fourth 7mm No. 9, 10mm No. 9 spoon, 12mm No. 5, 16mm No. 3, 25mm No. 11

Fifth 8mm No. 5, 8mm V-parting tool, 25mm No. 1, 30mm No. 3, 35mm No. 5



and then use a gouge to shape the carving.

Fishtail chisels and gouges are useful because they flare out from the shaft at the cutting end. They let you see the carving better (there's less metal to block your view of the work) and allow you to get into tighter corners and more restricted areas.

Spoon gouges are essential for getting into interior curves and any deeply concave areas. I prefer spoon gouges to bent gouges, which curve gently from just in front of the handle all the way to the end of the blade. When I put pressure on a bent gouge, it's not transmitted as directly to the end of the blade.

I don't think flat-section (No. 1) straight chisels or back-bent gouges are essential, though I sometimes use them. Flat-section chisels are more a tool for letter carvers. Most of what a back-bent gouge does I can do by inverting a regular gouge and using the inside to cut convex shapes (see the top right photo on the facing page).

I don't find skew chisels of much use because I have heavy, flared fishtails that

can get into the same tight spaces. And I haven't yet come across a situation in which I needed a dog-leg chisel or a macaroni tool (even though they look like they'd be fun to have).

Section and size: What do the numbers mean?

Woodcarving gouges, like golf clubs, are numbered for different uses (see the center photo on p. 81). Basically, they go from No. 1 to No. 11. A No. 1 is flat, a No. 2 curves slightly, a No. 3 a little more and so on to No. 11, which has a U-shape. For general carving, gouges with a No. 5 section are the most useful. Sections around No. 9 are better for going deeper. These remove wood faster, which is helpful when creating a background or roughing out a carving. Also, because their sides are steeper, they're less likely to catch and rip the wood.

In addition to having different sections, all carving tools come in different widths (see the bottom photo on p. 81). You can have a 3mm No. 5 or a 30mm No. 5 (most

carving tools are sold in metric sizes). As a general rule, I tell my students to use the biggest chisel they can for any given task. The work will flow better, be cleaner (fewer tool marks) and go faster.

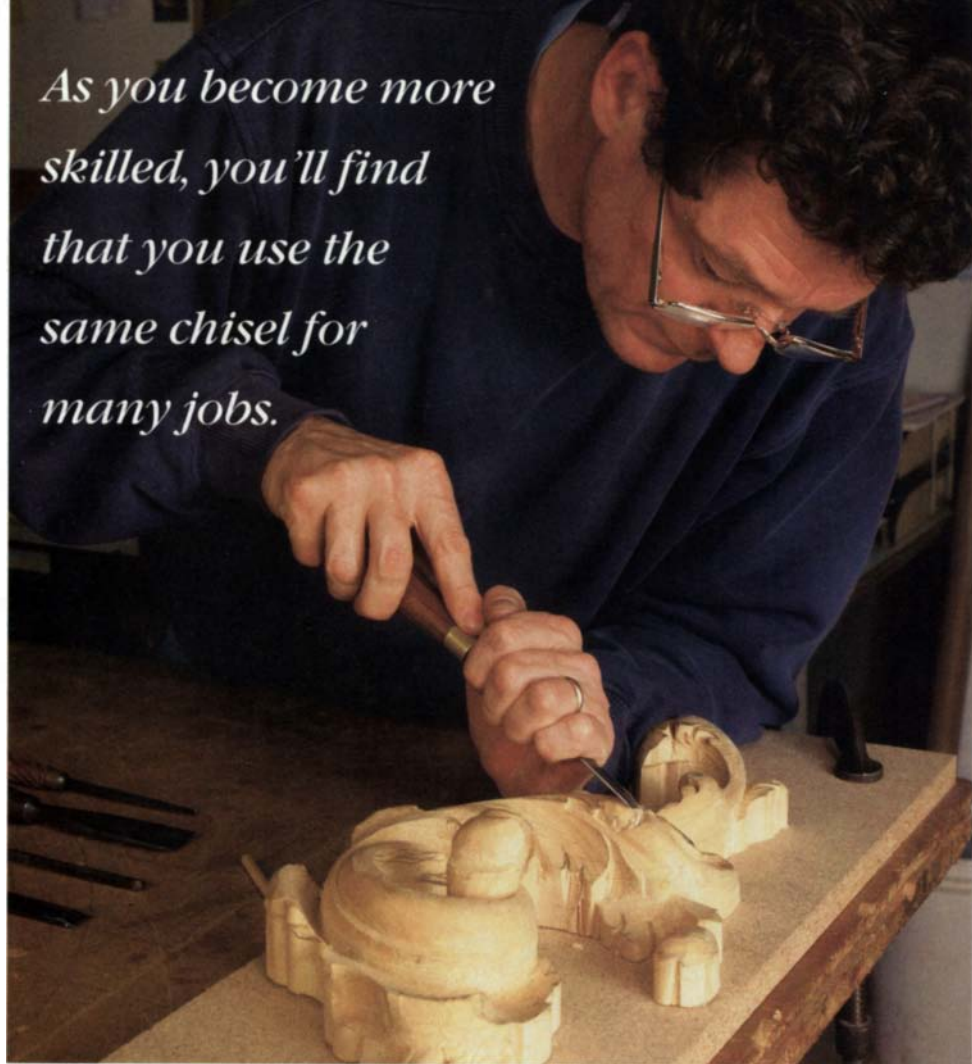
There are no definite rules or laws about which chisel does what. Trying to find this information is like searching for the meaning of life, except less rewarding. Any chisel can be rotated or even used upside down so you can cut with the inside of the chisel (see the photos at right on the facing page).

As you become more skilled, you will find that you use the same chisel for many jobs. For example, a carver might turn a No. 11 on its side and use it as a No. 3. This saves time, which is important if you're a professional. A really skillful carver can form a ball with a No. 1 flat chisel or a flat surface with a No. 11.

Driving carving tools: Use a heavy wooden mallet

Most of the time, you'll be tapping the carving tool with a mallet, not pushing it

As you become more skilled, you'll find that you use the same chisel for many jobs.



with your hand. Don't use a steel hammer because you will ruin the ends of your carving tools.

You will need mallets of different weights depending on the work that you'll be doing. Pecking at a large sculpture with a small chisel and a ½-lb. mallet is just a waste of time.

I prefer mallets with a head of lignum vitae, a dense, hard tropical wood. When driving a chisel with a lignum-headed mallet, there's no rebound. All the impact is directed to the blade. I like sculptor's mallets, which are turned and have no front, back or sides.

I've also seen urethane and laminated beech mallets, both of which will work fine. However, I would stay away from bronze or rubber mallets. Bronze mallets will rough up the ends of your carving tools like a steel hammer, and a rubber mallet doesn't make much sense unless you are concerned about noise. And if you turn your own mallets, make sure that they can be rested on their heads, so they don't roll off the bench.

Storing your carving tools

You'll need a proper box for your carving tools (see the photo on p. 80). Mine is made of mahogany. Because I often take my tools with me when I fly around the country, I added aluminum angle at each of the four corners of the case to protect it. (The airline attendants have to put it in the hold to save the pilot from a nut-case woodcarver.)

If you don't build a box for your carving tools, a chisel roll also will help keep your chisels safe. Even wrapping your tools carefully in an old towel will help prevent them from bashing against each other, damaging their blades. You'll appreciate this more after you have spent some time sharpening them properly.

Whatever you do, don't just dump your chisels into a cardboard box to get chipped and rusty. But if that does happen, make sure you sell them to that man at the flea market. □

Ian Agrell is a professional carver and teacher in San Francisco, Calif.



A tool can be used in many ways. A regular gouge can be used upside down for a convex curve. The more skilled you become, the fewer tools you'll need.



Using the full section—With the center of its profile biting wood, this gouge is doing the work it was designed for, taking a deep, hollowing cut.



Different sections from the same gouge—Partially on its side, this deep gouge is doing the work of one with a much flatter section.



Order, punctuality and the timely completion of tasks were the rules of the day in Shaker communities. Even so, watches were considered inappropriate under the dictates of the faith. Tall clocks as well as wall-hung clocks were another story. They readily found a place in the community dwelling houses of the Shakers. Usually found in central hallways, tall clocks could be viewed easily by Shaker brothers and sisters as they went about their chores.

Shaker clocks, especially tall clocks, are most often associated with the Watervliet community in upstate New York. This is where Benjamin Youngs, a skilled clockmaker, became a convert to Shakerism. Youngs had been an apprentice to his father, a clockmaker in Hartford, Conn. Benjamin converted to the Shaker faith after he moved his family to a farm near the Watervliet community.

Brother Benjamin's early clocks, made before and shortly after his conversion, show an awareness of the fashion of the day. After his conversion, his clocks have the straightforward, functional and modest properties associated with Shaker design.

You don't need hard-to-find stock

The clock shown on the facing page is based on one that's believed to be the work of Benjamin Youngs. That clock is illustrated in John Kassay's *The Book of Shaker Furniture* (University of Massachusetts Press, 1980). Kassay's measured drawings, in meticulous detail, give accurate dimensions of the parts down to a thirty-second of an inch. I modified the dimensions slightly, so I could get the required parts from clear pine in nominal 1 in. thicknesses.

I can make this clock from standard lumberyard material, sur-

Shaker Tall Clock

This graceful case piece is made with readily available materials and simple techniques

by Robert Treanor



faced on all four sides (S4S), with only a small amount of waste. It pays to take your time at the lumberyard when selecting stock. Because some pieces, like the case front, are made with the full width of standard dimensioned material, you should pick only stock with straight, parallel sides. It's a good idea to take a straight-edge with you to make sure the material is flat across its face.

The original clock was made with pine, and so is this one. The front and back of the case are made from 1x12s. The remaining parts are made from standard 1x10 and 1x8 pine. A painted finish is simple and authentic. I've also used hardwood with a clear finish.

Case joinery is simple but strong

I begin construction of the clock case by ripping the 6¼-in. sides from 1x10s, saving the rippings for later use. After carefully squar-

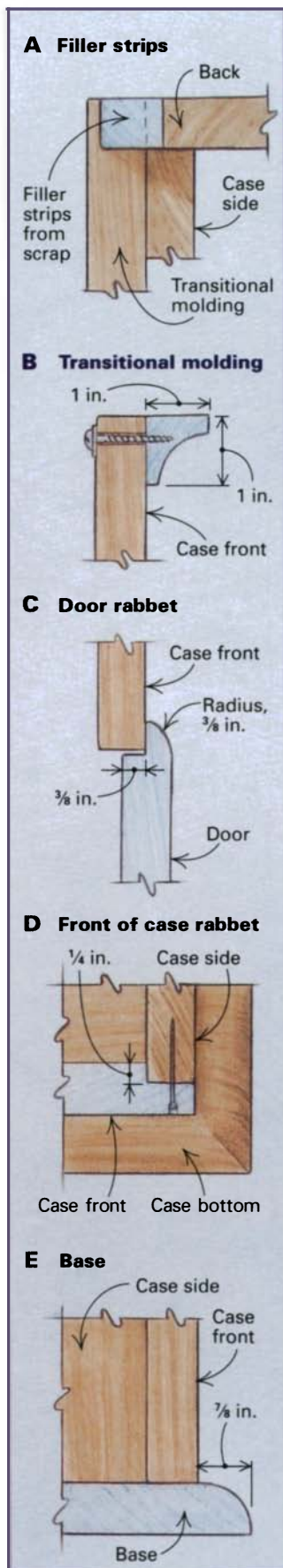
ing the sides to length, I make a simple doweling jig (see the top photo on p. 87) from some square ¾-in. by ¾-in. material. The outside faces of the case sides must be exactly 11¼ in. apart. By orienting the jig along baselines accurately laid out on the case bottom and across the end grain of the case sides, I can bore holes guaranteed to align (see the center photo on p. 87). A stop on the drill bit prevents boring all the way through the bottom. I use ⅜-in. dowels, cutting them to length carefully so they don't bottom out in the holes.

The front of the case is made from the full width of a 1x12, which is actually 11¼ in. I attach the front to the sides with a nailed and glued rabbet joint. I often cut the rabbet at the tablesaw with a ¾-in.-wide dado head. But for this case, I used a router with a rabbeting bit. The rabbet is cut ¼ in. deep and runs the entire length



Case joinery is simple. Sides are glued and nailed into rabbets cut in the case front. The back is screwed on, and the case is joined to the base with glue dowels.





of the front. Then I cut out the opening for the case door with a hand-held scroll saw at the bench.

While the dado head is still in the saw, I cut rabbets in the back edge of the case sides to accommodate the back. I keep the width at $\frac{3}{4}$ in., but I increase the depth to $\frac{1}{2}$ in. (I leave the back thickness at $\frac{3}{4}$ in., though it easily can be reduced to $\frac{1}{2}$ in.) I rip the back to width from a 1x12. Ultimately, I will screw the back onto the case. Before doing so, I attach narrow filler strips, cut from the side rippings, to the top to span the gap created by the difference in width between the case and the hood.

Gluing up the case and applying the molding

Before gluing the case together, I round over the front and ends of the case bottom with a $\frac{3}{4}$ -in.-radius router bit. I also give all case parts a preliminary sanding. You'll need a few long bar clamps to glue the dowel joints at the bottom of the case. The front is glued and nailed, and the back is simply screwed on. The front and back will help to hold the assembly square while the glue has time to dry. After the glue has dried and the nail holes have been filled, the case can be given its final sanding.

There was one part of this clock I couldn't cut from my standard material: the transitional cove molding attached to the top of the case. But in keeping with the frugal nature of this exercise, I took the molding from some rippings left over from a Windsor chair seat blank. I cut the molding profile with a $\frac{3}{4}$ -in.-radius cove bit in the router. For safety's sake, I left the blank wide, cut the profile and then ripped the molding to width.

Of the myriad ways to attach the molding, my choice was one of the simplest: gluing the miters and screwing the length of the molding to the case through slotted holes from the inside. Although there's no guarantee the miters will never open up, the slotted holes give the case a way to expand and contract seasonally without cracking. The case door is lipped and rabbeted all the way around and attached with offset hinges, like those often found on kitchen cabinets.

Sliding dovetails join hood top and sides

As in most tall clocks, the hood of this one is removable, providing access to the movement. After double-checking the dimensions, I cut the sides and top of the hood from a length of 1x10. The joint of the side to top easily could be the dowel joint used in the case, but for variety, I used a sliding dovetail on this clock (see the drawings on p. 88). Easily cut with a router inverted in a table, the sliding dovetail is a strong and appropriate joint.

Location of the joint is critical. The outside face of the hood sides must line up with the outside edge of the transitional molding. I mark the location of the joint on the underside of the hood top and set the height of the $\frac{3}{4}$ -in. dovetail bit at $\frac{1}{2}$ in. Then I carefully adjust the fence on the router table. With soft pine, there is no need to plow out a dado before cutting the dovetail; the joint is cut with one pass of the dovetail bit. A stop placed on the fence limits the length of the cut.

After cutting both ends of the top, I relocate the fence while the height of the bit remains constant. I extend the height of the fence to provide stability while cutting the hood sides. Using a piece of scrap pine the same thickness as the hood sides, I dicker with the fence until the joint is a firm press-fit. When satisfied, I cut the



Doweling jig—Holes bored in a hardwood scrap guide the bit as the author drills out a case side for glue dowels.



Flip jig, and drill bottom. The jig, with its fence removed, is flipped over and aligned with layout lines on the case bottom to drill matching holes.

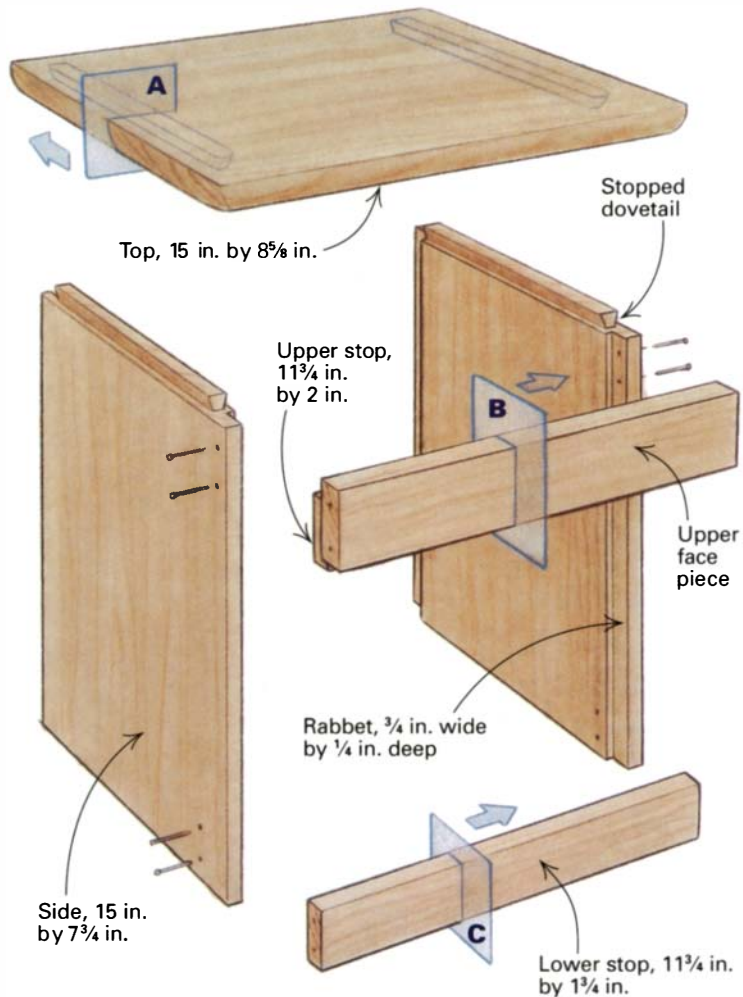


Test-fit. The jig ensures that dowels line up correctly, even if guide holes are not perfectly spaced or centered.



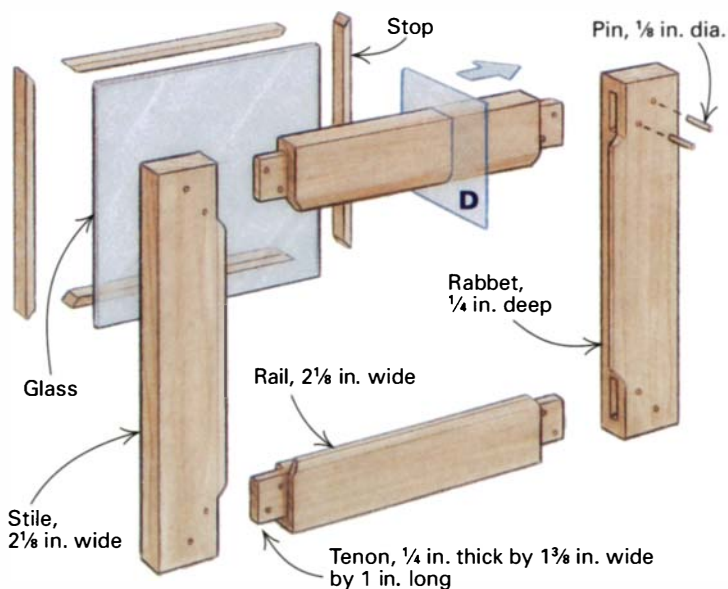
Slide-on bonnet—The bonnet for this Shaker tall clock rests on transitional molding at the top of the case. It slides on and off to provide access to the clock's movement.

Bonnet construction

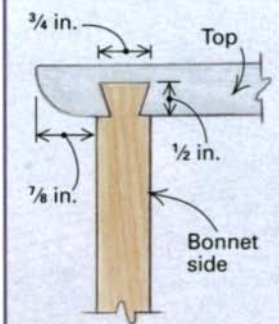


Door construction

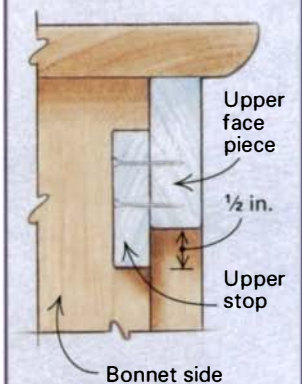
Finished door is 12 $\frac{1}{4}$ in. sq.



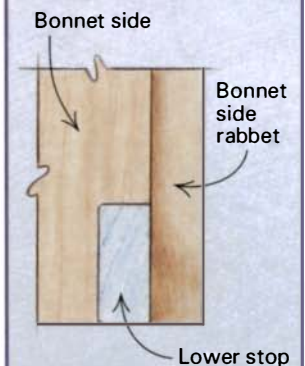
A Sliding dovetail



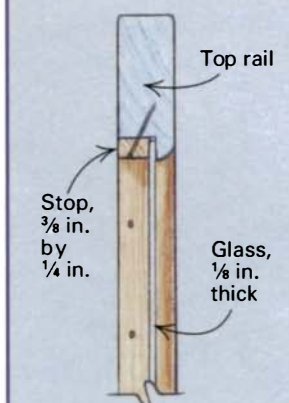
B Door stop



C Lower door stop



D Bonnet door



dovetails on the ends of the boards. Even though the dovetails extend across the entire width of the boards, the first inch closest to the front edge must be trimmed off for the rabbet cut into the inside faces of the sides.

Protect the clock movement from dust

The rabbets cut into the inside faces on the sides have a double purpose. First, they act as a door stop, and second, they keep out dust, the main adversary of clock movements. I cut the rabbets in the same manner as I cut the ones in the clock case. Before gluing up the hood, I rout the front and ends of the top with the same roundover bit I had used on the case bottom.

The hood has no bottom, so for rigidity, I added a rail at the bottom of the hood behind the bottom door rail. I simply glue and nail the rail in place (see the drawing on the facing page). The upper rail, located above the door, is cut to fit within the rabbets and also is glued and nailed in place. An inner rail is glued and nailed behind the upper rail to act as a dust stop. The three rails are taken from what's left after ripping the case sides.

Hood door is rabbeted for a glass insert

The hood door is assembled with the ubiquitous mortise-and-tenon joint. Because this clock has only one door, and a small one at that, I cut the joints by hand. After cutting the door parts to size from the rippings left over from the case sides, I lay out the joint using a square and a marking gauge. I rout the edge with a 1/4-in. roundover bit and cut the rabbet for the glass before cutting the joint.

The joint is easily cut by boring out the mortise with a brace and bit and then clearing out the waste with sharp chisels. I use a backsaw to cut the tenons on the ends of the rails, first making the cheek cuts and then supporting the rails in a bench hook to make the shoulder cuts.

Trimming the miters at the joints requires a mitering template to guide the chisel (see the top photo). With the template cut to an accurate 45° and set at the layout line, it's a simple matter to cut a perfectly fitting miter (see the center and bottom photos). I make the door slightly oversized and trim it to a close fit after glue-up. Once I'm satisfied with the fit, I hang the door in the hood with simple butt hinges.

I bought the weight-driven, eight-day movement for this clock from Frei and Borel (126 2nd St., Oakland, CA 94607; 510-832-8148). It sits on top of a seat board made from three pieces of the wood I had left over. Appearing as the letter C sitting on its side, the seat board is attached to the ends of the case sides with dowels and without glue. Holes are bored into the seat for the pendulum as well as the weight chains. Another option would have been to extend the case sides and place a horizontal board bridging the sides where the movement would have been. The clock face, painted onto wood, is screwed to the seat board. The time ring on this dial is 7 in. dia. Paper dials are available from mail-order houses.

According to Kassay, the original clock was painted red, so I followed suit. I used Covered Bridge red paint available from Primrose Distributing, 54445 Rose Road, South Bend, IN 46628; (800) 222-3092. □

Robert Treanor lives in San Francisco where he builds Shaker furniture and writes about woodworking.



For clean miters, use a guide. Rabbets on door stiles and rails meet in a miter at inside corners. For tight-fitting joints, the author pares pieces with the help of a guide block cut to a 45° angle.



Clamp and pare. With the rabbet cut away at the end of the door stile, the author pares the miter with a sharp chisel. The mitering template is clamped to the stile along the layout line.



The fit is right. The mitered rabbet at each corner is a pleasing construction detail, and a practical means of building a door frame that will accommodate a piece of glass.



Violin Virtuosos

*Repairing fiddles
worth millions is no
job for the unskilled
or faint-hearted*

by William Duckworth

John Becker is the only woodworker I've ever met who comes to work in a white shirt, tie, pressed pants and polished shoes. Then again, Becker and his two employees don't generate a lot of dust as they go about repairing rare and expensive violins, some of them more than 300 years old. Except for the occasional use of a beautiful old Oliver bandsaw tucked away in an adjacent room, they do all their work with hand tools. A major restoration job can mean as much as 2,000 hours devoted to a single instrument. The goal is always to avoid

removing very little, if any, of the original wood.

Becker's shop is in the Fine Arts Building, a turn-of-the-century landmark on the shore of Lake Michigan in downtown Chicago. A little brass plaque by the front door tells you that he and his two employees occupy a space that served as Frank Lloyd Wright's studio in 1908 and from 1910 to 1911. The space is not large, but generous skylights above the windows bathe the room in an even stream of northern light. This looks like a nice place to work (see the photo on p. 92).

Nicolaus Amatius Cremonensis Hiero-
nimi filii Antoni Nepos fecit Ao. 1677

*“the best teachers
are the dead masters”*

Becker is a master restorer, which is the top of four skill levels in the violin trade. In the 18 years he's been working at it (Becker is 38), he's moved through the ranks—apprentice, repairman, restorer. Keisuke Hori has been with Becker for five years; he's a restorer. Takeshi Nogawa has worked there for a little over one year; he's a repairman. Both men studied violin making before coming to work for Becker. In this field, the demonstration of learned skills means more than time of service.

Learning the trade from the ground up

How does one go about becoming one of the half-dozen or so people on earth who are allowed to work on some of these instruments? Schools exist—in Mittenwald, Germany, others in Tokyo and Salt Lake City—but that's not the route Becker took. As he says, “the best teachers are the dead masters,” meaning the Italian craftsmen who produced the very best fiddles.

He worked his way into the craft, starting by making guitars, but he soon realized there was no money in it. After that, he took a job at Lyon & Healy in Chicago, a venerable name in the musical instrument business, where he was an apprentice making grand-concert harps.

Then in 1981, he answered an advertisement he had seen in an issue of *Fine Woodworking*. Bein & Fushi, a prominent Chicago violin dealer, was looking for someone to work in its in-house repair shop. Becker moved in and moved up to take over the management of the Bein & Fushi shop. Three years ago, he decided to go on his own and worked out a deal with Bein & Fushi. He still works exclusively for the company (its showroom is right down the hall), but the business is his.

Who are the dead masters?

Scores of really fine violin makers abound (English, French and German). But only several generations of a few different families from Cremona, Italy, are considered the best. Andrea Amati (1511-1577) invented the instrument, deriving the basic design from the viol, a sort of clunky predecessor to the violin that had anywhere from three to seven strings. His earliest violins are dated to the year 1564. His grandson, Niccolò Amati (1596-1684), produced what are considered the best violins to come from the Amati family. Like most of the old masters, he also made violas and cellos.

Antonio Stradivari (1644-1737), regarded as the unequaled master of violin making, studied under Niccolò Amati. The only other maker whose fiddles come close to being ranked with those of Stradivari is Giuseppe Guarneri (1698-1744).

Guarneri apparently was a deeply religious man. He signed his violins with the mark of a cross and the initials *IHS*, which is a reference to Jesus Christ. People in the know refer to Guarneri



Back in the shop—John Becker (above) works on the neck of a violin made in 1725 by Guarneri del Gesù.

Old masters—Label from a 1677 cello made by Niccolò Amati (top of page). Makers signed their names in Latin.

Two classics, still making music—A 1742 Guarneri del Gesù called The Wieniawski (left, facing page). A 1708 Stradivari called The Ruby, for its red varnish (right, facing page).

simply as *del Gesù* (of Jesus). He was given to bold innovations in the design and execution of his instruments, especially those made in his later years. Becker compared the two men like this: Think of Stradivari as Leonardo da Vinci and Guarneri as Van Gogh. Becker estimates that he's restored approximately 40 Stradivari violins and close to a dozen of those made by Guarneri del Gesù.

So how much are these fiddles worth?

I was surprised to learn that some 650 or so "Strads" are still with us, along with approximately 130 del Gesù violins. Prices for these instruments are like Olympic pole-vault records—they keep going higher. When you talk about money for these fiddles, it depends on whether you mean the auction price or the cost of one purchased privately. The figures for private sales are higher, but they're not always made public. Some

people don't want to advertise to the world that they have one of these things stored in a closet.

According to Becker, the current record prices paid for a single instrument are \$2 million at auction and \$3.7 million privately, both for violins made by Stradivari. Becker recently restored a violin by del Gesù that may top that (see the photo on p. 90). It is nicknamed *The Wieniawski* after a former owner, a Polish virtuoso. (Most of these instruments have some sort of affectionate handle.) Becker spent a considerable amount of time restoring this instrument. Bein & Fushi has it up for sale, on consignment. The asking price is \$4 million.

Many young prodigies who can play like Paganini can't afford to buy one of these violins. But the musical world has found a way around that problem. Becker is a curator with an organization called The Stradivari Society, which keeps track of some 20 instruments made by the two masters. The society



They work sitting down. Shown left to right, Takeshi Nogawa, John Becker and Keisuke Hori work on different instruments in Becker's shop in Chicago. The space was once Frank Lloyd Wright's studio.

strives to keep the instruments in the hands of those who can play them by finding private patrons (individuals, not corporations) to purchase the violins and then loan them to the violinists. The Stradivari Society absorbs the cost of maintaining them.

Considering the prices of these violins, I could only imagine the stress that these guys must work under. So I had to ask Becker if he had ever dropped one of these fiddles. The answer was no.

Horacio Piñeiro copies the masters

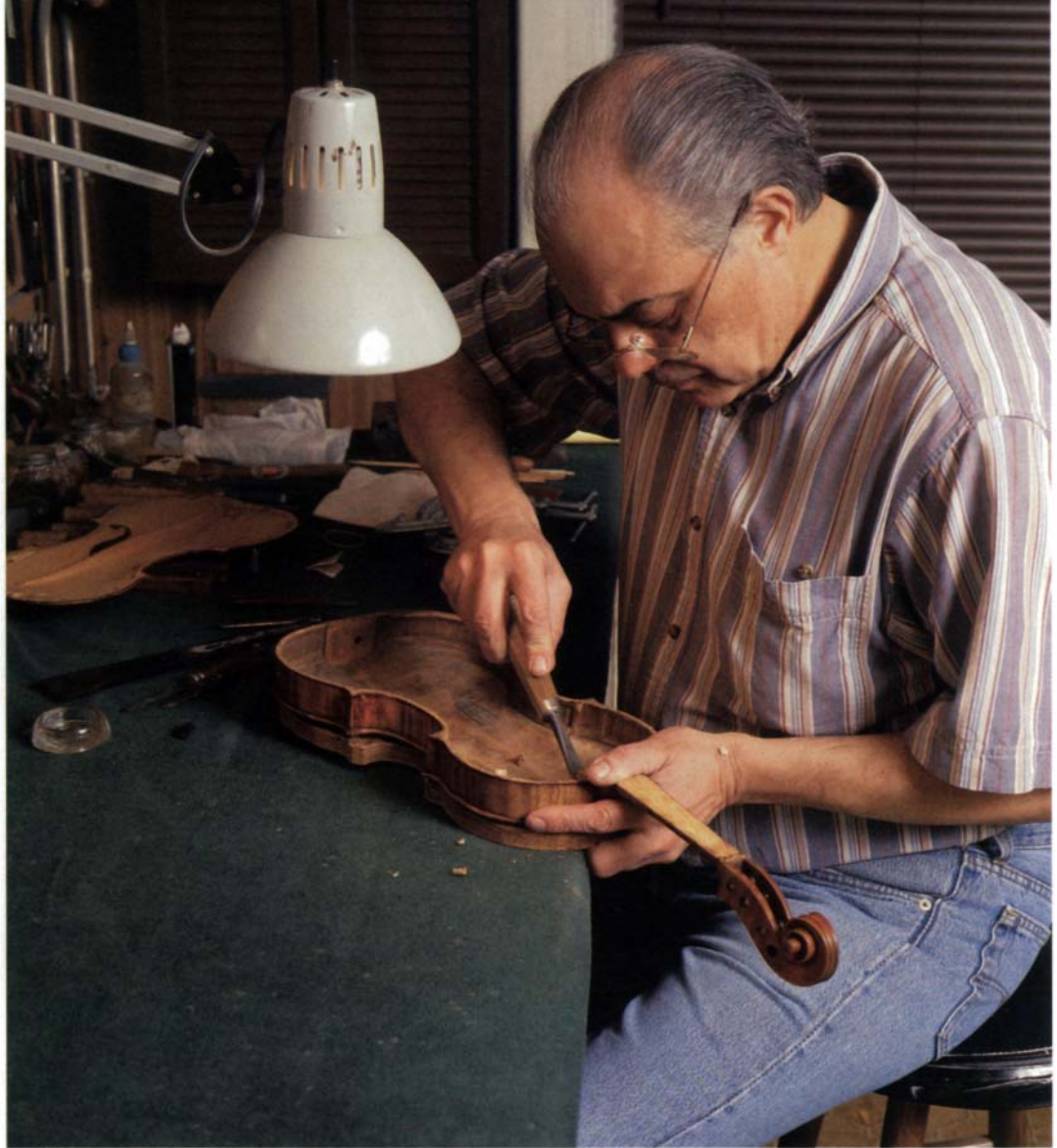
Horacio Piñeiro runs his restoration business a little differently. For one thing, he works alone. His shop is in a spare bedroom on the third floor of his house in Jackson Heights, Queens—across the 59th Street bridge from Manhattan. Unlike Becker, he'll work on cellos too. Piñeiro showed me one of the violins he was making, a copy detailed after a Stradivari. His own label credits the original.

When I first met Horacio Piñeiro, he was prying apart the belly of a 200-year-old violin. He took it apart with a gusto akin to my old neighborhood butcher yet with the care and self-confidence I'd want from a brain surgeon. I had the feeling that this man knew what he was doing and that he didn't waste his time.

When I asked Piñeiro about the process, I learned that these instruments were designed to be taken apart (see the photo above). All the seams are fastened with hide glue. The bond is reversible with a butter knife dipped in hot water and lubricated with a little soap. The original instrumentmakers anticipated the problems wood movement causes over time, and they were certainly familiar with the tremendous pressure exerted on the instruments by those four stretched strings.

Piñeiro got his start studying furnituremaking in his native Argentina before moving to New York 20 years ago (he's in his 50s). He took a job in the workshops of Jacques Français, near Carnegie Hall. He spent 14 years there before deciding to go on his own, and he's happy he made that decision.

If you want to place an order with Piñeiro for a new violin, expect to pay \$10,000 to \$15,000, depending on the wood he uses. He has a stash of curly maple from the former Czechoslovakia that's 80 years old and some quartersawn spruce that's more than 100 years old. He showed me a piece of the maple that looked like something close to 2 bd. ft. of lumber. He



These instruments were designed to be taken apart. After removing the belly of this violin, Horacio Piñeiro uses a gouge to carve away some of the end block that supports the neck.

said that if I offered him \$1,000 he would refuse to sell it. He wasn't joking. That lumber is a lot more stable than your local kiln-dried stock. He wants his violins to last.

Finish formulas are a secret

Violins are often described in terms of the color of the varnish used by the maker. According to John Becker, many thousands of dollars and countless hours have been spent trying to analyze the varnishes of the masters, especially Stradivari. Still, no one knows exactly what the recipes were.

And neither John Becker nor Horacio Piñeiro is anxious to share his own formula. Becker told me that his finish was his secret and would remain that way. He did add that he uses the same one on every fiddle, and it's meant to be reversible. Piñeiro was a little more diplomatic in his response. But from what he told me, I certainly wouldn't have been able to run back to my shop to whip up a batch. □

William Duckworth is an associate editor of Fine Woodworking.



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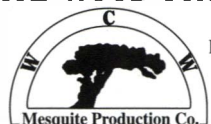
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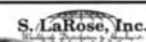


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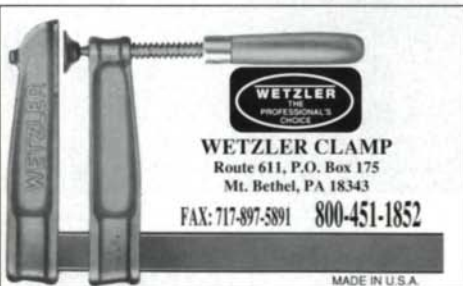
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B. Paid and/or requested circulation	369,334
1. Sales through dealers and carriers, street vendors, and counter sales	61,358
2. Paid or requested mail subscriptions	202,923
C. Total paid and/or requested circulation	264,281
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Fine Woodworking

Index to issues 116 through 121

This alphabetical index covers all the issues of *Fine Woodworking* magazine published during 1996 (FWW #116 through #121). 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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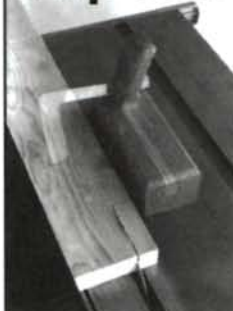
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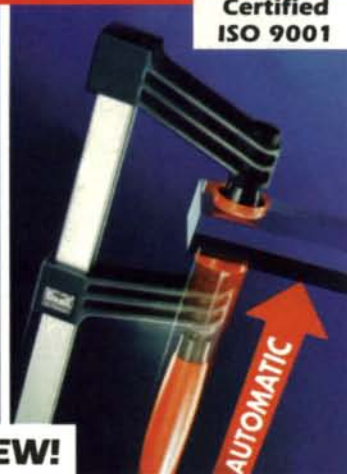
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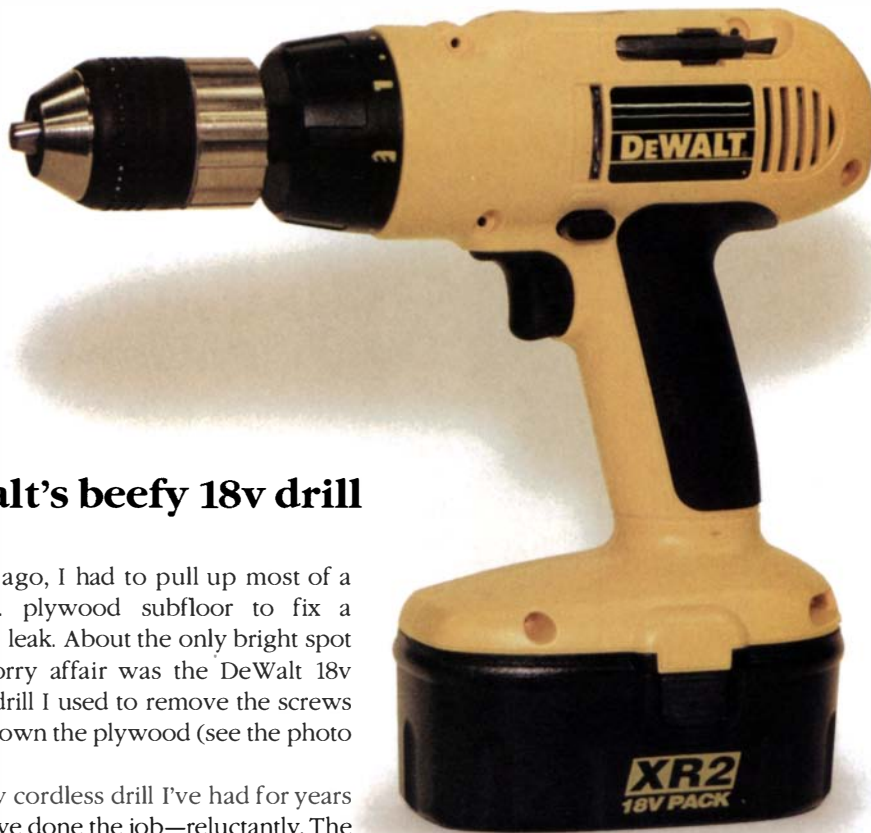
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READER SERVICE NO. 153



DeWalt's beefy 18v drill

Not long ago, I had to pull up most of a 250-sq.-ft. plywood subfloor to fix a plumbing leak. About the only bright spot in that sorry affair was the DeWalt 18v cordless drill I used to remove the screws holding down the plywood (see the photo at right).

The 9.6v cordless drill I've had for years would have done the job—reluctantly. The DeWalt had no problems winding out the small mountain of 1 $\frac{3}{4}$ -in. #10 screws, and it didn't get appreciably slower as the job went on. Although I didn't run any bench tests to measure the DeWalt's torque or battery run times, the manufacturer says maximum torque is 325 in. lbs., about 100

in. lbs. more than its 14.4v model.

The kit comes with one battery and a one-hour recharger, plus several bits that snap into the handle and a plastic carrying case. The $\frac{1}{2}$ -in. keyless Jacobs chuck provides a positive grip on round drill shanks.

Heavy-duty cordless—DeWalt's 18v cordless drill is well adapted to heavy jobs, but it is bigger than most woodshop jobs may require.

Unlike chucks on some other cordless drills I've used, this one has locking rings big enough to provide a sure grip for both hands. Because the chuck gets a good grip, it didn't chew up drill shanks or slip when the drill was under load.

No-load speeds are 0-450 and 0-1,400 with the smoothly operating speed selector located on top of the drill casing. The chuck has 17 different torque settings.

The drill's only real down side is what you would expect in a tool with this kind of capacity: size and weight. If I were limited to one cordless drill in the shop, I probably wouldn't choose this one. It's on the heavy side (nearly 5 $\frac{1}{2}$ lbs.), and the drill's large size makes it awkward in tight places. But as a job-site tool where heavy work could be expected or where a $\frac{1}{2}$ -in. capacity chuck was important, this drill is a perfect choice.

The DeWalt cordless drill is generally available through mail-order houses for about \$230.

—Scott Gibson

DeVilbiss HVLP conversion spray guns

High-volume, low-pressure (HVLP) finishing equipment has a lot going for it. The turbine-driven sprayers atomize finishes with air pressure much lower than conventional compressed air systems. As a result, HVLP spray guns tend to produce less overspray and contribute to cleaner air in the shop.

These advantages spurred the development of HVLP conversion guns, which are capable of running on conventional high-pressure air systems. Unfortunately, first-generation conversion guns were expensive, and they were air hogs.

DeVilbiss has solved both of those problems with two guns: the model MSV-531 production gun and the EGHV touch-



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Hitachi 8-1/2"x60Tx5/8"	\$179	\$109
DeWalt 8-1/2" & Ryobi 8-1/2"x60Tx5/8"	\$179	\$109
Delta 9"x80Tx5/8"	\$204	\$119
Ryobi-Makita & all 10"x80Tx5/8"	\$207	\$129
DeWalt, Makita, B&D, Hitachi 12"x80Tx1"	\$229	\$139
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10"x60Tx5/8" 3/32"K	\$162	\$129
9"x60Tx5/8" 3/32"K	\$156	\$119
8"x60Tx5/8" 3/32"K	\$150	\$109

8-1/4"x60Tx5/8" 3/32"K	\$150	\$109
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SIZES AVAILABLE	LIST	SALE	SIZES AVAILABLE	LIST	SALE
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8"x80Tx1/8" & 3/32" K	\$202	\$169	14"x80Tx1"	\$232	\$197
9"x80Tx1/8" & 3/32" K	\$207	\$179	14"x100Tx1"	\$266	\$226
10"x80Tx1/8" & 3/32" K	\$207	\$159	16"x80Tx1"	\$262	\$223
12"x80Tx1-1/8"K	\$212	\$181	16"x100Tx1"	\$294	\$243

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12"x30Tx1"	\$162	\$119	\$107	\$ 95
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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**6"x40T 3/32"	\$136	\$ 89	\$ 80	\$ 71

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up detail gun (see the bottom photo on p. 106). If you already own a compressor, these guns will give you the benefits of an HVLP system without sacrificing the flexibility of compressed air and without forcing you to buy a separate turbine. You can buy both guns for about the price of an HVLP system.

Recently, I tried both of these guns in my shop. The MSV-531 production gun is lightweight and well-constructed (the list price is \$655, including the cup and the regulator, which are sold separately). All parts are stainless steel, and the pressurized cup is lined with Teflon. The gun is set up to run with an inlet pressure of 50 psi, with 10 psi at the air cap. My 5-hp compressor had no problem spraying continuously at that pressure. The MSV-531 also can run off a smaller compressor, but not for continuous spraying.

This gun atomizes material as well as my turbine-driven gun, but it has a much faster delivery rate. I found it could spray a lot of finish fast and well.

Adjusting the spray pattern and flow rate was easy. I could get a spray fine enough for detail work, but I think the EGHV detail gun is better suited for small jobs. Decreasing the inlet pressure to as low as 35 psi still atomized most finishes and reduced the bounce-back when spraying inside cabinets. The MSV-531 did especially well with waterborne finishes.

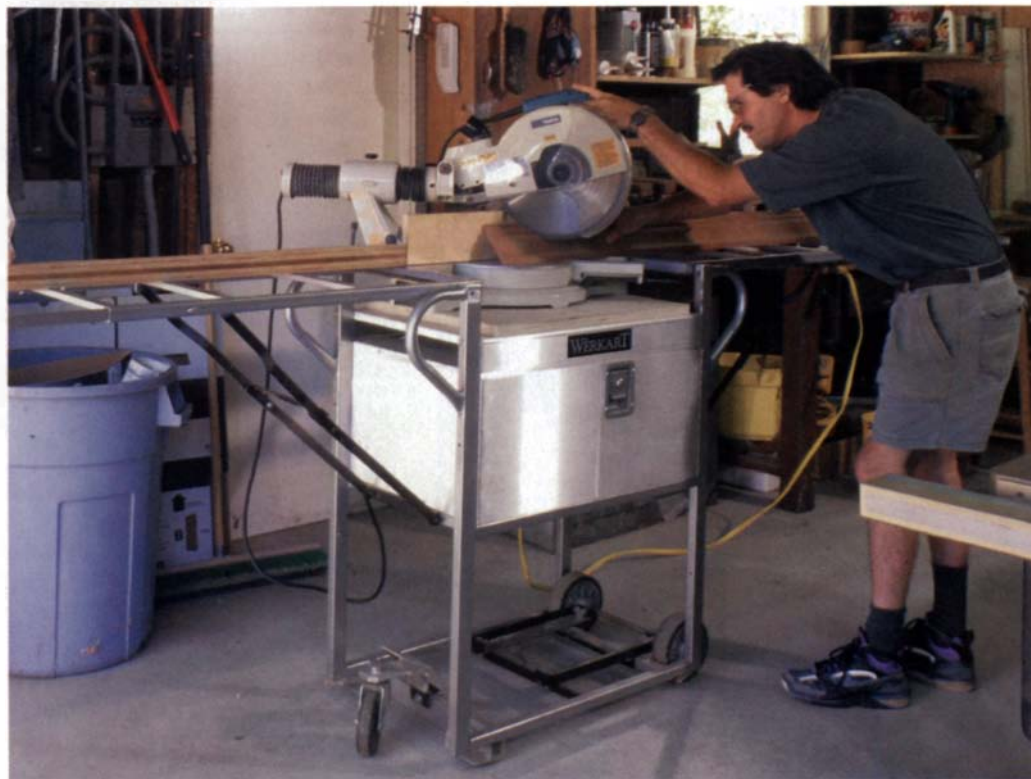
The EGHV detail gun (\$230) is a gem. It's designed to run at 80 psi and requires only 4.3 cu. ft. of air per minute. This means it easily can run off a 1½-hp compressor. Although it's not designed to spray large items, it can handle things like night stands and guitars with ease. I atomized most finishes with an inlet pressure as low as 60 psi.

This small gun is ideal for custom work like shading and toning. The overhead trigger is made for precise control. The gun is ideal for spraying edges. It has a quick-change color cup, and at about \$20 per cup, you can have several without a significant investment. This gun uses only one fluid tip/needle assembly, so you'll have trouble spraying high-viscosity finishes without thinning them first.

For more information on the MSV-531 and EGHV conversion guns, contact DeVilbiss Industrial Coating Equipment, 1724 Indian Wood Circle, Maumee, Ohio 43537; (419) 891-8100.

—Jeff Jewett

The Werkart stand for power miter saws



Werkart's miter saw work station—Wings swing up on scissor-locks to support the work 5 ft. on either side of the cart with little or no deflection.

Portable chop-saw stands have obvious advantages if you are a carpenter who travels to job sites. But these stands also have a place in woodworking shops, especially if you're in cramped quarters. If you're forced to move your power miter saw out of the way to run plywood over the tablesaw, a portable stand like the Werkart might be worth considering.

I've been giving the Werkart stand a workout in my shop for a few months now, and I can't seem to beat it—or beat it up (see the photo above). The frame is manufactured from ¼-in.-thick powder-coated tubular steel. The ¼-in. aluminum mounting plate is pre-bored to accept the bolt locations of most commonly available power miter saws. The height of the saw table can be adjusted to flush out perfectly with the extension wings, which are available in tubular steel or solid aluminum. The wings are 16 in. wide and extend to 5 ft. with no deflection.

One of the best things about this stand is how easy it is to set up. I had no difficulty

mounting my 12-in. Makita sliding compound saw on the stand, though if it were an inch bigger, I might have had trouble. I was able to mount it back far enough to take full advantage of the wide extension tables. When not in use, the tables are held against the side of the cart with ball catches. They pop loose and lift into place on strong, adjustable locking scissors. The stand does not come equipped with a fence for a repetitive stop system, but I had no difficulty attaching my own.

It's a breeze to move the stand around my shop. The Werkart has two rear wheels and an optional third rotating wheel that allows the stand to maneuver in a confined area. Flip a lever with your foot, and the third wheel lifts off the ground. The cart settles firmly on a long self-leveling bar.

At the back of the mounting plate is an electrical raceway set up to receive a duplex receptacle. The space below the saw is designed to hold a portable air compressor, as well as optional power-cord and air-hose reels. Also available as an ac-



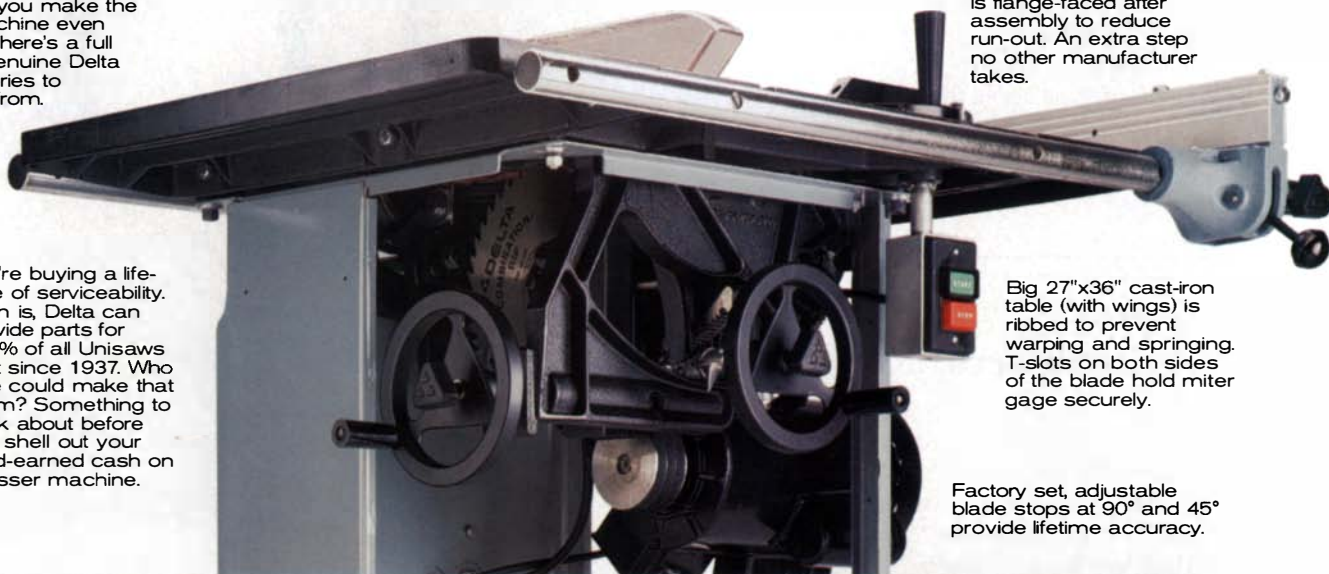
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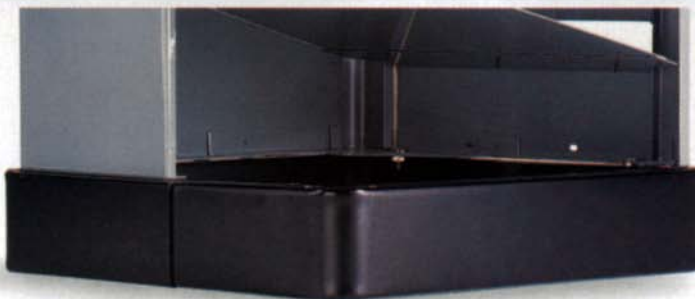
You're buying a lifetime of serviceability. Truth is, Delta can provide parts for 100% of all Unisaws built since 1937. Who else could make that claim? Something to think about before you shell out your hard-earned cash on a lesser machine.

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cessory is a lockable aluminum storage compartment that fits between the mounting plate and the compressor.

If woodworking isn't your only interest, Werkart also sells stands designed for tile saws, steel cutoff saws, portable tablesaws, and even car detailing. Without accessories, the stand weighs 75 lbs. The list price is about \$400.

For more information about the Werkart stand, contact Wise Designs Ltd., P.O. Box 750639, Petaluma, CA 94975; (800) 515-1551.

—Gary Katz

Vision tools for woodworkers

In my 40s, I had to get reading glasses to bring close-up work into focus. I bought a pair of bifocals and had them made with clear glass in the upper part of the lens and a magnifying lens at the bottom. They were a help but not when I needed to see something above my head.

So an optician friend and I designed a pair of trifocal shop glasses. In addition to the magnifying portion of the lens at the bottom, these glasses also had one at the top. The glasses allowed me to see clearly, whether I was looking up or down.

My glasses cost about \$300, but there's another way to add close-up capability to the upper part of your glasses: Magna-vue plastic lenses. You can stick these small, crescent-shaped lenses onto the upper part of your regular glasses (see the photo below). Your optician can help you choose the right strength.

The lenses cost about \$30 per pair. For more information, contact Neoptx, 2205 152nd. Ave. N.E., Redmond, WA 98052; (800) 662-2460.

—Bill Nyberg



Bifocals where you need them—*Magna-vue plastic lenses are an economical way of adding magnification to the top or bottom of your glasses.*

A new clamp from Gross Stabil



New Gross Stabil clamps—*The large surface area of these parallel-jaw clamps eliminates the need for cauls in edge-gluing.*

If you work with panel stock, at one time or another you've probably been frustrated by the clamps you use. Cumbersome pipe clamps, bar clamps and sliding-arm speed clamps concentrate their force in a very small area, so they need cauls to distribute the pressure. And clamp jaws can flex out of parallel under a load, which will distort the work that's getting glued up.

The K-body clamp, introduced by Bessey in 1988, solved those problems. Its steel jaws are covered with a high-strength plastic casing and provide a surface area of more than 7 sq. in. The sliding jaw runs on a heavy-gauge steel bar; the jaws remain perfectly parallel while exerting more than 1,000 lbs. of clamping pressure. Cauls aren't necessary, and you need fewer clamps.

The flat head allows you to stand a clamped assembly upright while it dries, saving space in the shop. And the distortion that can set in when pipe-clamped assemblies lean against a wall is eliminated.

Bessey's K-body clamp has been unique. No longer. Gross Stabil has introduced its own version of the K-body clamp (see the photo above). A close look reveals some design variations. The Gross Stabil clamp has a slightly wider and longer jaw, and the

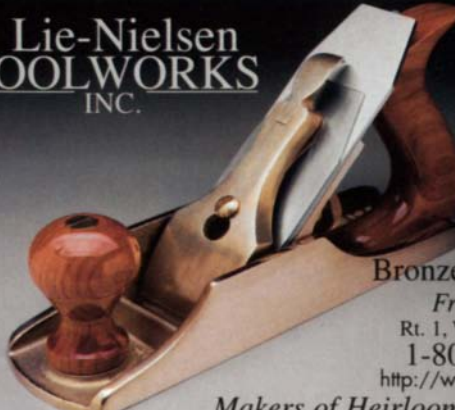
contact surface is covered with a removable plastic sleeve. This allows you to replace a deeply scratched or cracked sleeve. If the plastic casing on the Bessey clamp cracks (which can happen if you drop the clamp on a concrete floor), the entire head assembly must be sent back for repair or replacement. And the sliding head on the Gross Stabil is a bit easier to move, probably because the lock bar is more exposed, making it easier to see and grasp.

The list price of these clamps starts around \$50 for one with a 12-in. bar, up to about \$85 for an 80-in. bar. Bessey clamps are available through American Clamping (800-828-1004). Gross Stabil clamps are available from Gross Stabil (800-671-0838).

—Jim Tolpin

Scott Gibson is editor of Fine Woodworking. Jeff Jewitt repairs and restores period furniture in North Royalton, Ohio. Gary Katz is a carpenter and woodworker in Tarzana, Calif. Bill Nyberg is a woodworker and the director of ophthalmic photography at the University of Pennsylvania. Jim Tolpin is a woodworker and writer in Port Townsend, Wash.

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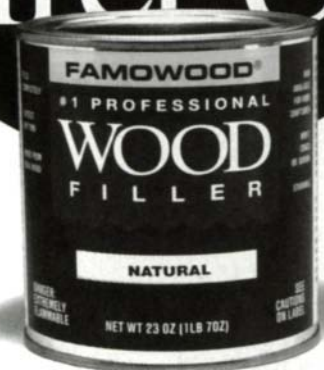
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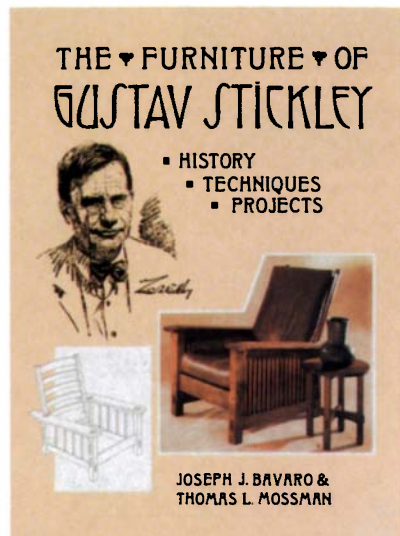
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READER SERVICE NO. 658

The Furniture of Gustav Stickley by Joseph Bavaro and Thomas Mossman. *Linden Publishing, 3845 N. Blackstone, Fresno, CA 93726 (800-345-4447); 1996. \$19.95, paperback; 175 pp.*



With the continuing strong interest in American Arts-and-Crafts furniture, I was surprised that this book, first published in 1982, had not been reprinted earlier.

The authors have researched their topic thoroughly and present it in a logical, easy-to-read style. They begin with a concise and informative history of the Arts-and-Crafts movement in America at the turn of the century, followed by an equally informative and enjoyable history of the life of Gustav Stickley and the evolution of his design style.

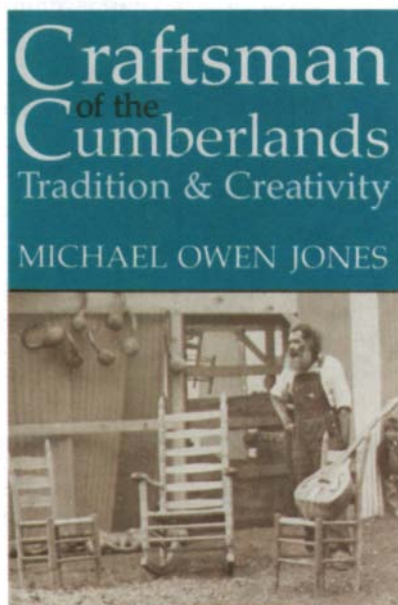
The section on materials and methods is extremely informative, detailed and easy to follow. Alongside the text are many well-planned and uncluttered black-and-white photographs depicting the methods used by Stickley. From beveling the ends of through-tenons to clamping, fuming and finishing, everything is clearly explained, often from Stickley's own notes and reprints from his writings.

The final section of the book is devoted to projects, nine in all. Each project is adequately presented with photographs, drawings, cut-lists and special instructions where needed. My only minor misgiving with the book lies here. The authors seem to have chosen the projects for their ease of construction more than for their quality of design. Though Stickley was a prolific

designer, not everything he made had that classic sense of proportion and scale evident in one of his better Morris chairs. Nevertheless, I would recommend this book to any woodworker with an interest in the Arts-and-Crafts period.

—Kevin Rodel

Craftsman of the Cumberlands by Michael Owen Jones. *The University Press of Kentucky, 663 S. Limestone St., Lexington, KY 40508 (800-666-2211); 1989. \$19.95, hardback; 304 pp.*



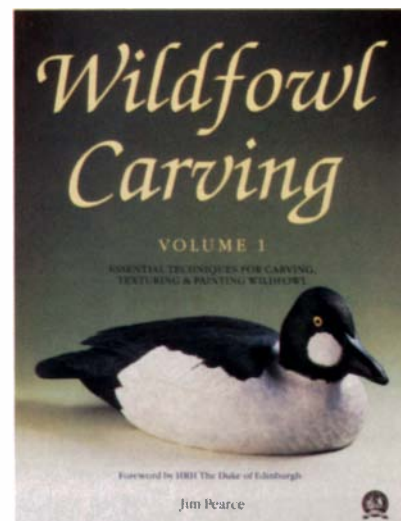
Craftsman of the Cumberlands is really more of a biography than a woodworking book. In the late 1960s, a graduate student named Michael Owen Jones drove to the Kentucky mountains in search of a doctoral thesis. His intention was to document the craft of chairmaking and the people who practice it.

He found Chester Cornett, a great naive genius who designed and made very unusual chairs. Some had large, rabbit-ear finials; others had peculiarly wavy slats. His masterpiece was an eight-leg rocking chair riding on four rockers with a solid paneled back and bookcases fitted like outriggers on each side. All of his chairs are unique and commanding.

What affected me most was Cornett's total devotion to his craft. Life was hard in the Kentucky mountains, and he could have given up chairmaking for better pay in town. Chairmaking seemed to provide

personal ballast and gave his life a purpose and direction. —Mario Rodriguez

Wildfowl Carving Volume 1: Essential Techniques for Carving, Texturing and Painting Wildfowl by Jim Pearce. *Guild of Master Craftsman Publications Ltd. Distributed by Sterling Publishing Co., 387 Park Avenue S., New York, NY 10016 (800-848-1186); 1995. \$16.95, paperback; 160 pp.*



Magnificently illustrated, thoroughly researched and clearly presented, *Wildfowl Carving* is a must for the beginner and professional alike.

Pearce supplies some of the background history of decoy carving but quickly embarks on a simple but very detailed carving project. You will learn how to shape, texture, burn and paint a European Goldeneye through simple instructions and step-by-step photographs. I have carved decoys for 23 years, and this book showed me a clever technique or two I did not know.

The exhaustive appendices on the characteristics of carving woods and on the dimensional characteristics, eye size and color of ducks, shorebirds and game birds will be of great use to professional carvers.

—Kevin Kerrigan

Kevin Rodel is a cabinetmaker in Pownal, Maine. Mario Rodriguez teaches woodworking in Warwick, N.Y., and is a contributing editor to FWW. Kevin Kerrigan is a decoy carver and painter living in Ridgefield, Conn.

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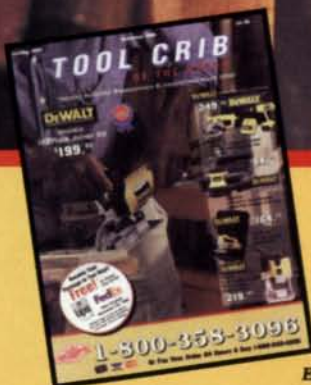
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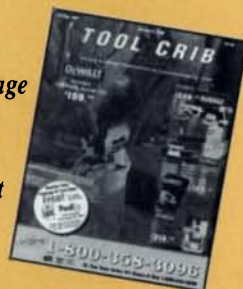
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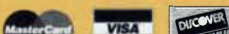
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January/February 1997 115

Listings of gallery shows, major woodworking fairs, lectures, workshops and exhibitions are free but are restricted to happenings of direct interest to woodworkers. Only workshops sponsored by not-for-profit groups are listed. 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.

ALABAMA: Meetings-The Alabama Woodworkers Guild meets the second Thursday of each month at 7:00 p.m. at Acton Moulding & Supply Company, Helena. Contact Steve Onisick at (205) 942-8075.

ALASKA: Meetings-Alaska Creative Woodworkers Association meets at 7:00 p.m. on the fourth Monday of each month at the Anchorage Museum. (907) 345-3077.

ARKANSAS: Meetings-Woodworker's Association of Arkansas meets the first Monday of each month at 7:00 p.m.; Central Arkansas Woodcarvers meets the second Tuesday at 7:00 p.m. and the fourth Tuesday at 6:30 p.m. J.T. Shannon Lumber Co., Woodworkers Center, 6200 Sears Drive, Little Rock, 72209. (501) 565-1510.

Meetings-Ozark Woodturners meets the third Saturday of each month in Mountain Home. For more information, call Michael Kornblum at (501) 424-5893.

CALIFORNIA: Show-California Design, Jan. 23-Feb. 28. Contract Design Center, San Francisco. For more information, contact California Contemporary Craft Association, P.O. Box 2060, Sausalito, 94966. (415) 461-0321.

Show-Carvers competition and wildlife arts show, Feb. 15-16. Pacific Southwest Wildfowl Arts, Poway. For info, contact Thelma Jennings at (619) 748-6643 or (619) 486-4614.

Lecture-The Society for the Preservation of New England Antiquities presents New Discoveries in Shaker Paints and Varnishes by Susan L. Buck, March 11. American Decorative Arts Forum, San Francisco. For more information, contact Carol Fox at (415) 387-0905.

Lecture-The American Decorative Arts Forum presents Leon Marcotte: New York Cabinetmaker and Interior Decorator by Nina C. Gray, April 8. M.H. de Young Museum, Golden Gate Park, San Francisco. For more information, contact Pat Newman at (415) 499-0701.

COLORADO: Exhibition-12th annual American Craftsman custom woodworking exhibition, Feb. 1-15. Vail public library, Vail. For info, call Tim O'Brien at (970) 328-7253.

CONNECTICUT: Classes-Winter program featuring 60 arts and crafts workshops. The Brookfield Craft Center, 286 Whisconier Road, Brookfield. For info, call (203) 775-4526.

DISTRICT OF COLUMBIA: Show-15th annual Smithsonian craft show, April 24-27. For more information, call (202) 357-4000.

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.

Meetings-Central Florida Woodworkers Guild meets the second Thursday of each month. Woodcraft Supply, 246 E. Semoran Blvd., Casselberry. For more information, contact Bob Elliott (407) 695-8960.

Meetings-Tallahassee Woodcrafters Society meets the second Tuesday of each month. Contact Walt Behrle at (904) 668-6653 or Austin Tatum at (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. Contact Don Montgomery at (813) 898-0569.

Call for entries-12th annual fine furniture show, sponsored by Woodcrafters Club of Tampa, Feb. 6-17. Florida Expo Park, Tampa. Deadline: mid-January (Florida residents only). For further information, call Lois Dinsmore at (813) 962-8333.

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.

ILLINOIS: Classes-Ongoing woodworking classes, all levels. Elston Woodworking School, 2228 N. Elston Ave., Chicago, 60614. (312) 342-9811.

Meetings-Fox Valley Woodworkers Club meets at 7:30 p.m. on the first Tuesday of every month in Batavia. For more information, call (708) 469-9517.

KENTUCKY: Meetings-Kyana Woodcrafters meets the first Thursday of each month. Bethel United Church of Christ, 4004 Shelbyville Road, Louisville, 40207. (502) 426-2991.

MAINE: Meetings-Guild of Maine Woodworkers meets the first Wednesday of every month. Call (800) 805-5100.

MARYLAND: Call for entries-Columbia art and craft show, June 27-29. Deadline: Feb. 15. Columbia Art Center, 6100 Foreland Garth, Long Reach Village, Columbia. For more info, contact Rebecca Bafford at (410) 730-0075.

MASSACHUSETTS: Classes-Woodworking classes, most of the year. Contact Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430. **Workshops**-Joinery, cabinetmaking, more. Hancock Shaker Village, Box 927, Route 20, Pittsfield, 01202. (413) 447-9357.

Classes-Year-round intensives in woodworking and wood carving. Horizons New England Craft Program, 108 N. Main St., Sunderland, 01375. (413) 665-0300.

Classes-Certificate training program in architectural woodworking, 37-week course begins in February. New England School of Architectural Woodworking, One Cottage St., Easthampton, 01027. (413) 527-6103.

Workshops-Woodworking with Bob Trotman, April 12-13. Worcester Center for Crafts, 25 Sagamore Road, Worcester. (508) 753-8183.

Workshops-Wood Identification Workshop, Jan. 14-17. University of Massachusetts, Continuing Education, Box 33260, Amherst. (413) 545-1834.

MICHIGAN: Meetings-Metro Carvers of Michigan meets second Tuesday of each month (except July and August) at 7:30 p.m. Helen Keller High School, 1505 N. Campbell Road, Royal Oak. (810) 771-1040.

Meeting-Michigan Violinmakers Association will meet Jan. 26 at 10 a.m. Demonstrations and discussions. Woodcraft Supply, 42102 Ford Road, Canton, 42102. For more information, call (313) 665-4255.

MINNESOTA: 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.

MISSOURI: Meetings-The Kansas City Woodworkers' Guild meets the third Wednesday of each month. For more information, contact Eugene Caples at (816) 452-6379.

Classes-Wood furniture design with Ron Diefenbacher, 15-week course begins Jan. 14. 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 information, contact John Cahill at (402) 334-5550.

NEW HAMPSHIRE: Classes-Various woodworking classes. The Hand & I, P.O. 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.

NEW YORK: 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-Traditional and contemporary woodworking with Maurice Fraser, Bill Gundling, Jack Van Deckter and Susan Perry. The Craft Students League at the YWCA, 610 Lexington Ave., New York City. (212) 735-9731.

Meetings-Long Island Woodworker's Club meets the first Wednesday of every month, September thru June. Brush Barn, 211 Jericho Turnpike, Smithtown. (516) 360-1216.

Show-Woodcrafters of the Valley show, Feb. 8-9. Utica Memorial Auditorium, 400 Oriskany St. W., Utica. For more information, contact Community Relations Department, Heritage Home (315) 797-7392.

Show-Woodworkers Expo 97: Sixth annual fine woodworking show, April 5-6. Northeastern Woodworkers Association, Rexford. For more information, call (518) 371-9145.

Classes-Intermediate woodworking and furniture design, Jan. 28-May 13 (Tuesdays). Purchase College, State University of New York, 735 Anderson Hill Road, Purchase, 10577-1400. Deadline for registration is Jan. 21. For more info, call (914) 251-6500.

Exhibition-Turned and carved objects by Michelle Holzapfel, thru Jan. 18. For more information, contact Carole Hochman, Peter Joseph Gallery, 745 5th Avenue, New York City, 10151. (212) 751-5500.

Call for entries-Quail Hollow Events' spring and fall handcrafted furniture and architectural crafts exhibits. Deadline for both is Feb. 1. For more information, contact Scott or Neil Rubenstein at P.O. Box 825, Woodstock, 12498. (914) 679-8087.

NORTH CAROLINA: Meetings-North Carolina Woodturners meets the second Saturday of each month. For more information, contact the North Carolina Woodturners, P.O. Box 1833, Hickory, 28603. (704) 324-5960.

Exhibition-Gallery Americas Southern Furniture exhibition, May 1-June 16. For more information, contact George Melone, Gallery Americas, Historic Carr Mill, Carrboro, 27510. (919) 929-1002.

Call for entries-The Chair Show II. Deadline: June 4. Judges include Sam Maloof and Wendy Maruyama. Contact Katherine Duncan, Chair Show, Southern Highland Craft Guild, P.O. Box 9545, Asheville, 28815. (704) 298-7928.

OHIO: Meetings-Cincinnati Woodworking Club meets from 9:00 to noon on the second Saturday of January, March, May, September and November. Reading High School, 801 E. Columbia Ave., Reading. For more info, contact the club at 10125 Montgomery, Cincinnati, 45242.

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.

OREGON: Meetings-Cascade Woodturner's Association meets every third Thursday. For more information, contact Cascade Woodturners, 11575 S.W. Pacific Highway, #104, Tigard, 97223. (360) 834-6325.

Meetings-The Guild of Oregon Woodworkers meets the third Wednesday of each month (except December) at 7 p.m. For further information, contact the guild at P.O. Box 1866, Portland, 97207-1866. (503) 492-1515.

TENNESSEE: Workshops-Turning, carving and more, year-round. For more information, contact Arrowmont School of Arts and Crafts, P.O. Box 567, 556 Parkway, Gatlinburg, 37738-0567. (615) 436-4101.

Classes-Lumber selection and more. For more information, contact Tennessee Valley Authority, 17 Ridgeway Road, Box 920, Norris 37828-0920. (615) 632-1656.

TEXAS: Meetings-Woodturners of North Texas meets the last Thursday of every month, 7:30-10:00 p.m. Paxton Beautiful Woods Store, 1601 W. Berry St., Fort Worth, 76110. (817) 927-0611.

Meetings-North Texas Woodworker's Association meets the third Tuesday of each month. For info, contact Bruce May, P.O. Box 831567, Richardson, 75083. (214) 271-0125.

Show-Rio Grande Valley Woodcarvers show, Jan. 17-18. McAllen Civic Center, McAllen. For more information, contact Dorothy Chapapas, RR 2, Box 150, McAllen, 78504. (210) 581-2448.

VERMONT: Workshops-North Country Studio Conference presents woodturning with David Ellsworth, Feb. 5-9. Bennington College, Bennington. For more information, contact Joanne Wise (603) 795-2889.

WASHINGTON: Juried show-The Kitsap County Woodcarvers 11th annual show, March 15-16. Westside Improvement Club, Bremerton. For more info, call (360) 373-6173.

WEST VIRGINIA: Workshops-Progressive Windsor Chairmaking, March 9-14. Crafts Center, Cedar Lakes, Ripley, 25271. (304) 372-7873.

CANADA: Association-Canadian Woodturners Association, Markham, Ont. For more information and to receive newsletter, call (905) 479-0755.

Meetings-West Island Woodturners Club (Montreal) meets every Tuesday, thru May. For more information, 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. Contact Vic Germaniuk at (807) 767-5964.

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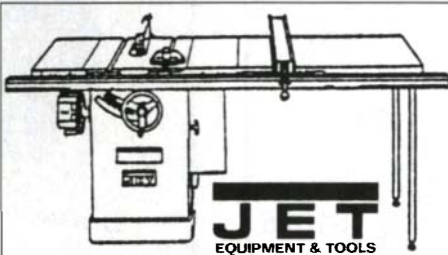
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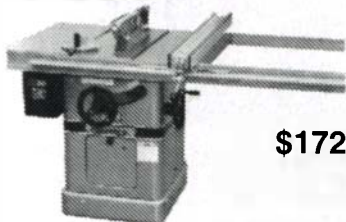
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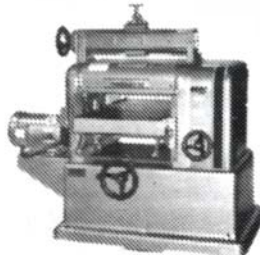


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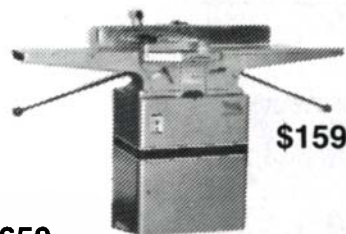
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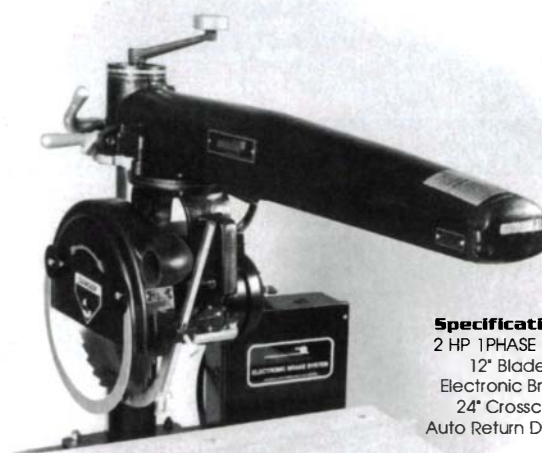
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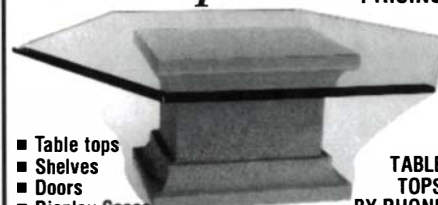
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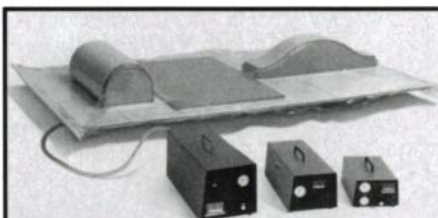
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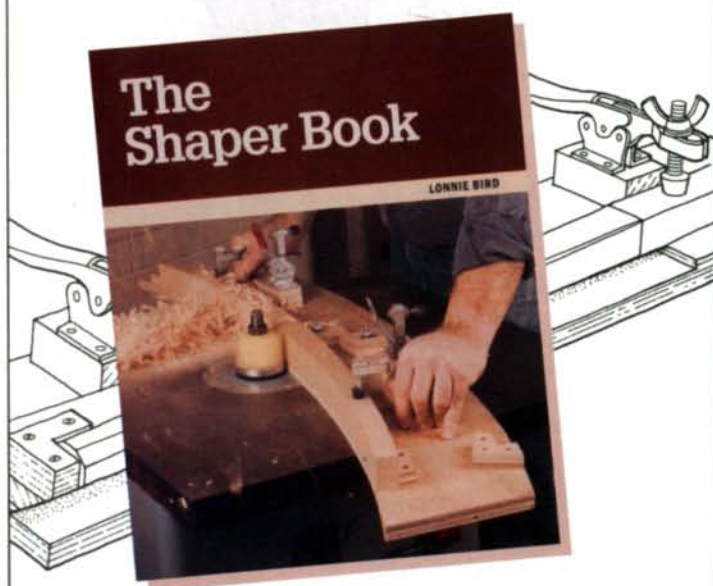
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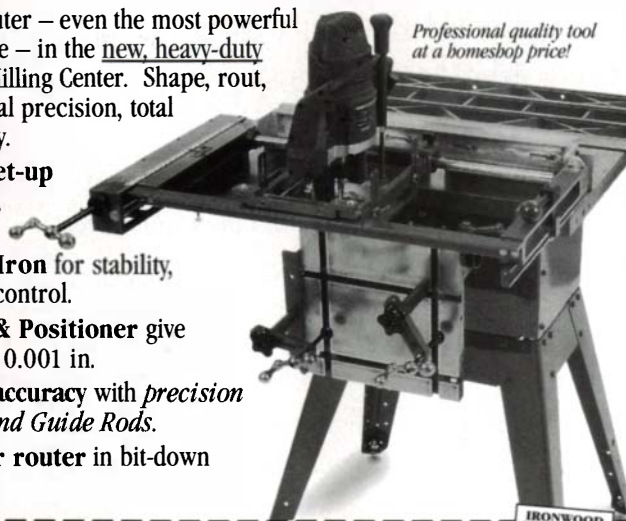
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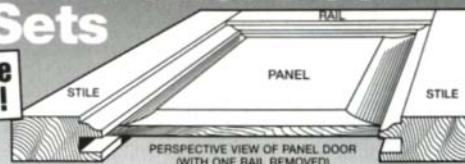
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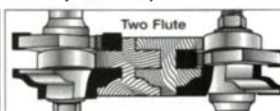
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Look what's Shaker

Cabinetmaker Ian Ingersoll has built hundreds of slim Shaker chairs in his West Cornwall, Conn., workshop over the years. When he was approached by artist Barbara Broughel who needed a giant rocker for an exhibit she was preparing, Ingersoll was up for the challenge. After all, one of his employees had just spent months restoring a heavy-duty Oliver lathe, just what they'd need to turn the chair's oversized parts.

Working with Broughel, Ingersoll multiplied the dimensions of a standard chair by a factor of three to get the 12-ft.-tall Shaker rocker (see the photo at right) that was exhibited at the Katonah Museum of Art in Katonah, N.Y., late last year.

Thematically, the exhibition focused on the human senses, and Broughel was exploring the experience of taste. She wove a seat from grape vines as well as other food vines.

"The piece is based on a very romantic idea I have about seasons and about how Native Americans and the settlers lived in this landscape," said Broughel. "As soon as I scaled the piece to compete with the architecture and the trees, it took on a kind of fantasy quality."

Indeed, it's a chair fit for Gulliver. Ingersoll's job was to figure out how to build the behemoth in such a way that it could be broken down into three pieces and hauled atop Broughel's compact car.

The back posts had to be turned in two separate pieces and joined with 1¼-in. pins. The rungs were shaped from 12/4 stock and the arms from 8/4 lumber.

Although Broughel owns the chair, she has asked Ingersoll to store it. "What do you do with something like this?" wondered Ingersoll. "I thought about mounting it (on pilings) in the middle of the Housatonic River. (But) we'll probably just find a spare lawn to put it in," he said.

—Anatole Burkin, associate editor

Thinking big—Furnituremaker Ian Ingersoll of West Cornwall, Conn., and artist Barbara Broughel of Boston, Mass., collaborated to make this 12-ft.-tall Shaker chair. Pictured with the chair is the artist's assistant, Elise Co, a student at Massachusetts Institute of Technology.



Photo: Barbara Broughel

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NS100	NARROW CROWN STAPLER KIT 1/2" - 1"	516
NS150	NARROW CROWN STAPLER KIT 1/2" - 1 1/2"	691
	7/8 HP ROUTER	107
314	4 1/2" TRIM SAW	152
330	SPEED BLOCK FINISHING SANDER	62
332	QUIKSAND 5" RNDM ORB W/STKIT PAD	72
332K	332" W/CASE & 100 SHEETS PAPER	99
333	QUIKSAND W/HOOK & LOOP, DUSTLS	76
333K	333" W/CASE & 50 SHEETS PAPER	106
334	QUIKSAND W/STKIT, DUSTLESS	76
334K	334" W/CASE & 100 SHEETS PAPER	106
340	1/4 SHT FIN SANDER W/DUST PUJ	49
347	7 1/4" FRAMERS SAW, 15 AMP WITH CASE	128
352	3" X 21" BELT SANDER W/DUST BAG	168
352VS	3" X 21" BELT SANDER DUSTLESS W/VAR SP	164
360	3" X 24" BELT SANDER W/DUST BAG	212
361	3" X 24" BELT SANDER	203
362	4" X 24" BELT SANDER W/DUST BAG	218
363	4" X 24" BELT SANDER	213
505	1/2 SHT FIN SANDER	126
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552	PRODUCTION POCKET CUTTER	569
556	BISC JOINER W/CASE & TILTFENCE	132
556K	SAME AS ABOVE W/1000 BISCUITS	152
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691	1 1/2 HP D" HANDLE ROUTER	158
691K	691 W/CASE, EDGE GD & TEMP GD KIT	209
90690	SPECIAL EDITION 1 1/2 HP ROUTER W/CASE	158
693	PLUNGE BASE ROUTER, 1 1/2 HP	178
697	ROUTER TABLE WITH 1 1/2 HP MOTOR	228
698	ROUTER TABLE ONLY	134
743K	7 1/4" FRAMERS SAW, LEFT SIDED WITH CASE	128
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2621	3/8" VSRDRILL, 0-1200 RPM, KEYLESS	96
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7335	5" RANDOM ORBIT SANDER	132
7336	6" RANDOM ORBIT SANDER	136
7335K	5" RANDOM ORB W/CASE, 7333K & PAPER	168
7336K	6" RANDOM ORB W/CASE, 7333K & PAPER	176
7499	CUTOOUT TOOL	68
7518	3 1/4 HP FIXED BASE ROUTER-5 SPEED	274
7519	3 1/4 HP FIXED BASE ROUTER-1 SP	248
7536	2 1/2 HP FIXED BASE ROUTER	209
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7538	3 1/4 HP PLUNGE ROUTER-1 SPEED	248
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7810	POWER TOOL TRIGGERED WET/DRY VAC	258
9118	PORTA PLANE KIT W/CASE, CRBD BLD	228
9125	3 1/4" PLANER WITH CASE	138
9341	1/4 SHEET FINISHING SANDER WITH CASE	58
9444	PROFILE SANDER KIT WITH ACCESSORIES	108
9647	TIGER CUB RECIP SAW KIT	129
9737	RECIP TIGER SAW, 9.6A, QUICK CHNG CHUCK	162
9830	9.6V CORDLESS KIT W/2 BATTERIES, CASE	148
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9862	12V CORDLESS KIT W/2 BATTERIES, CASE	178
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Seeing with the grain

The fashionably chic, nearsighted 16th-century aristocrat wouldn't have been caught dead wearing anything *but* hand-crafted, wood-framed spectacles. Fashion has a way of recycling its ideas, and the latest example comes from sun-plagued California. Woody's Originals sunglasses (see the photo at right) are manufactured from pressure-laminated wood veneers. The company says these veneers, made from oak, ash or birch, are 250% stronger than ordinary wood.

The lenses are gray, polarized polycarbonate, which block out UVA and UVB rays. A variety of colors are available, including ebony, aqua and rosewood. Prices range from \$130 to \$260.



Natural shades—Woody's Originals sunglasses are made with laminated hardwoods. These glasses are made of oak and come with a matching case.

Photo: Anatole Burkin

If you hung out with the surfer crowd in the '60s, these glasses might give you a case of *déjà vu*, assuming you could remember that far back. In those days, denizens of the surf who couldn't afford Ray

Bans occasionally crafted hand-carved driftwood sunglasses. Woody's frames are made with sophisticated machines used in the aerospace industry and finished and assembled by hand. —A.B.

Creative collaboration

To most of the world, Saskatchewan, Canada, is as obscure as Timbuktu. To a cadre of woodturners and furnituremakers who meet here every other summer for the Saskatchewan Craft Council's symposium, it's a hotbed of innovation and creativity.

"Conservation and Collaboration" was the theme in July 1996, the seventh anniversary for the event. It was held at Kenderline campus, an artists' retreat 125 miles north of Saskatoon.

We had the opportunity to experiment with a wide variety of materials, including fused and sandblasted glass, cast bronze and aluminum, forged steel tools and accessories, non-traditional use of traditional Japanese lacquer, various paints and stains, layered acrylics, relief and in-the-round carving, metal spinning, and an incredible array of turning chucks and tools.

We used a hands-on approach to promote the ideals of conservation. Rather than lecturing on disappearing resources, we taught by example and provided participants with under-used, sustainable materials and environmentally safe finishes.

The piece I thought best exemplified both interactive and reactive collaboration and the essence of the event was conceived by Michael Brolley of Hamburg, Penn., and John Kingsley of Ithaca, N.Y. Half a dozen others worked on the project,

and I became indirectly involved after the group pirated a table leg, made by Reg Morrell, from a project I was working on.

The 3-ft.-tall finished work (see the photo at left) consists of a massive arc and two tusks carved from fir. The tusks are each wrapped in a spiral of wrought iron extending into a rod supporting a curtain of semitransparent, porous black paper. The tusks pivot to reveal an alien figure in front of a disc of curly maple, stained blue and centered in a larger disc of black.

The primary wood came from old-growth fir salvage, reinforcing the conservation aspect. By a karmic twist, this fir came from the building that housed the University of Saskatchewan drama department for several decades.

—Jamie Russell, Vanscoy, Sask., Canada



Artists working together—This sculpture was created at the biennial Saskatchewan Craft Council symposium by Michael Brolley, John and Chelsey Kingsley, Del Stubbs, Mary Thouin, Reg Morrell, Toni Bernard and Laurie Afseth.

Notes and Comment

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What Store-Bought Tools Don't Have

I never heard anyone in the family call my grandfather a furniture-maker. It would be better to say that Elbert could fix just about anything and that he liked to tinker at his workbench. Elbert came by those skills out of necessity. He owned a small farm in southern Maryland where he raised a half-dozen children during the Depression. I'm not sure a man in his shoes would have much spare time. But when he did, his woodworking interests tended toward elaborate martin houses, a species of bird that apparently relishes communal living. Elbert's two- and three-tiered martin houses, mounted atop poles around the yard, were really grand.

Owning a farm basically amounts to an around-the-clock commitment to feeding things or fixing things, and Elbert's tool collection reflected the work he had to do. He patched roofs, rehung doors on his tobacco barn, fixed tractors, cut tons of firewood and otherwise took care of business. He learned to cut hair with a pair of electric clippers. He picked up a cobbler's skills and even owned an iron jig that held shoes in place as he hammered them back into usefulness.

His tool collection covered all of it. There was an enormous foot-powered grinding wheel that ran through a water bath. There were hammers, screw drivers, punches, saws, chisels, pipe wrenches. There were boxes of nuts and bolts, drive belts, screws, unknown parts to forgotten machines. There was an adze, which he'd acquired when he worked in a Baltimore shipyard at about the time of the first World War. I still associate the adze with a less enduring memento of his shipyard days—a tattoo of a three-masted schooner across his chest. He showed it to me once, a little shyly.

His shop was a shed out beyond the gate, in a warren of out-buildings between the tobacco barn and the chicken house. In the summer, it was cool and dark inside, packed with tools, dust and lazy wasps. My cousins and I would poke our heads in now and again, but Elbert was usually elsewhere so we didn't stay long.

When Elbert and my grandmother sold the farm and built a small house nearby, Elbert made sure it had a full basement with a poured concrete floor. I guess he worked on martin houses there during the winter, and when he died at something past 90, he left boxes of tools and hardware stacked neatly under the bench and against the walls. Those tools were split up among the family.

The adze came my way, as did a two-man, 6-ft. crosscut saw used for bucking up wood. There was a jack plane and a countersink for a brace that still cuts crisp holes in the hardest wood. There were other odds and ends: an incomplete set of heavy metal taps, a delicate little ball-peen hammer, the cobbler's hammer with a long snout that's perfect for setting brads, and a bevel gauge. Some of the stuff is still packed in the old steel case it arrived in. I haven't yet found a use for a metal tap that will cut threads in a 1-in.-dia. hole. But many of Elbert's tools have found their way onto shelves in my own shop.

I had to straighten up a red oak beam in my house last winter to make a new wall look somewhere near plumb. Ordinarily, I'd

reach for my old pal the Sawzall, a tool that should be given to anyone who owns a house more than 50 years old. But here was one situation where a Sawzall wouldn't work. So I got Elbert's adze. Standing on a step ladder, chopping the old wood out in great chunks, I couldn't help but think of Elbert and how he might have wielded the same tool in a boatyard three-quarters of a century before. Same curved handle. Same steel. There was energy there that was not mine alone.

I try not to be overly sentimental about Elbert's tools. They're tools, not religious relics. But there's no getting around the fact that they have a mysterious life of their own, a personality lacking even in tools far finer than anything he ever owned. This became clear not long ago when I bought another jack plane. There wasn't anything wrong with Elbert's plane. But I was seduced by the new one, a plane with an adjustable throat and a low-angle iron. It's a terrific tool. Its thick iron holds an edge nearly forever, and its handles are of polished cherry. The throat closes down to allow the escape of only the barest of shavings.

Strangely, though, this new plane doesn't seem to have as much heart as

Elbert's old plane. It hasn't had enough time to develop any sense of itself. It's too new.

There are no nicks or rough spots, and none of the steel has picked up the gray hue that old metal gets. When I pick up the new plane, I have an instrument I know will do a job exactly and precisely. It is efficient, to be sure, but not so likable as Elbert's old plane. When I pick his up,

I feel a warmth, a connection. Without even trying, I see an old man in thick glasses cupping a Winston cigarette in his left hand as he ponders a martin house. It doesn't seem to matter that I have few memories of Elbert using any of these tools.

Barring fire, flood or some other disaster, the plane I bought will be around for a long time, and it will be better for the experience. I'm delighted to think of it planing a piece of curly maple on someone's bench in some unforeseeable place and time.

I hope the owner reaches for my plane because he or she needs exactly the right touch from exactly the right tool. With any luck at all, the finish will at last be worn off the plane's cherry handles, the lacquer replaced by ordinary shop grime. Its brass adjustment knob will be tarnished, and there may even be a chip or two on the edge of the sole.

As to Elbert's old adze or plane, I doubt anyone else will see quite the magic or feel the same kind of energy in them that I do. That's okay. It's enough that I can enjoy them. □

Scott Gibson is the editor of Fine Woodworking and an amateur woodworker with an old house of his own.



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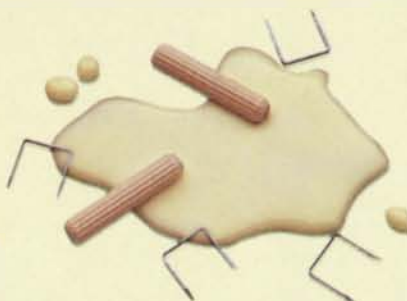
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Mantel masterpiece

For Adam Thorpe, then just 30 years old, the 1995 commission was the job of a lifetime. Twenty months and 3,500 hours later, this mantel, carved in the Rococo Chinese Chippendale style, was complete. The mantel was glued up from blocks of ponderosa pine, roughed out and carved by Thorpe. Two gilders were brought in to complete the mantel. At just over 12 ft. high, 6 ft. wide and 1 ft. deep, the mantel is on a par with the best and most ornate work of the 18th century.

Thorpe began carving at the age of 15, apprenticed with carving teacher Ian Agrell the following year and joined with Agrell to form Agrell & Thorpe in 1988. Observing Thorpe's work one day, Agrell told his former student, "Adam, I couldn't do that." Thorpe replied, "It's a poor student who doesn't improve on the work of his master." Agrell's story on choosing carving tools is on p. 80.

