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Fine WoodWorking®
September/October 1988

Barred-glass doors can create a nightmare of angled ribs and mortises. Mac Campbell explains how to simplify this joinery on p. 48. Cover: Spice boxes, once used by colonists to store condiments and valuables, make a good project for contemporary woodworkers. Turn to p. 76. Cover photo: Lance Patterson

Fine Woodworking is a reader-written magazine. We welcome proposals, manuscripts, photographs and ideas from our readers, amateur or professional. We'll acknowledge all submissions and return within six weeks those we can't publish. Send your contributions to *Fine Woodworking*, Box 355, Newtown, Conn. 06470.

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DEPARTMENTS

ARTICLES

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Misconceptions on exotics—Overall, the articles on tropical deforestation in *FWW* #70 present a reasonable picture of the logging of tropical timbers, although several misconceptions about tropical woods were not discussed. The terms exotic woods and tropical woods seem to be used synonymously by most people. The fact is that the majority of tropical timbers are not particularly exotic in appearance. Of the thousands of tropical timber species, only a handful are used by woodworkers in North America and Europe. The perception that vast forests of incredibly beautiful woods are being burned or turned into pulp is misleading. The overwhelming number of tropical woods harvested would not be of interest to most woodworkers.

I also would take exception to several points made by George Putz in his "call for action." Buying up and stacking away rare exotics could only hasten their demise. If every reader of *Fine Woodworking* purchased 5 bd. ft. of Brazilian kingwood, I suspect that the species would be gone forever, well before half the readers received their wood.

I believe that some small impact can be made by woodworkers if they would use some "new" decorative exotics that have not been used in the past. Perhaps this would take some pressure off the depletion of the more traditional exotic timbers.

—James J. Heusinger, Berea, Ohio

Let's give everyone a break—I drool over each issue of *FWW* and especially enjoy the readers' input. Without that, it would be lacking a certain flair. But, I've come to one realization while reading the numerous letters: Simply, woodworkers are egotistical, pompous snobs. It seems someone is constantly criticizing someone else's work, as if they invented the trade. Constructive criticism is understandable, but these people are butchers. Come on guys, let's give one another a break, or at least the benefit of the doubt. No one woodworker knows it all.

—Gary Windish, Marion, S. Dak.

Live center/dead center—I share Richard Raffan's displeasure at seeing traditional vocabulary debased through modern misuse. The "live center" example he cited (*FWW* #70, p. 104) is an apt one, but not, however, as he perceived it. "Live center" truly is the correct designation for the *driving* center on a lathe, and has been at least as far back as the 19th century. It is only recently that a new generation of woodturners, needing some way to distinguish between fixed and ball-bearing *dead* centers, has begun misapplying the traditional term.

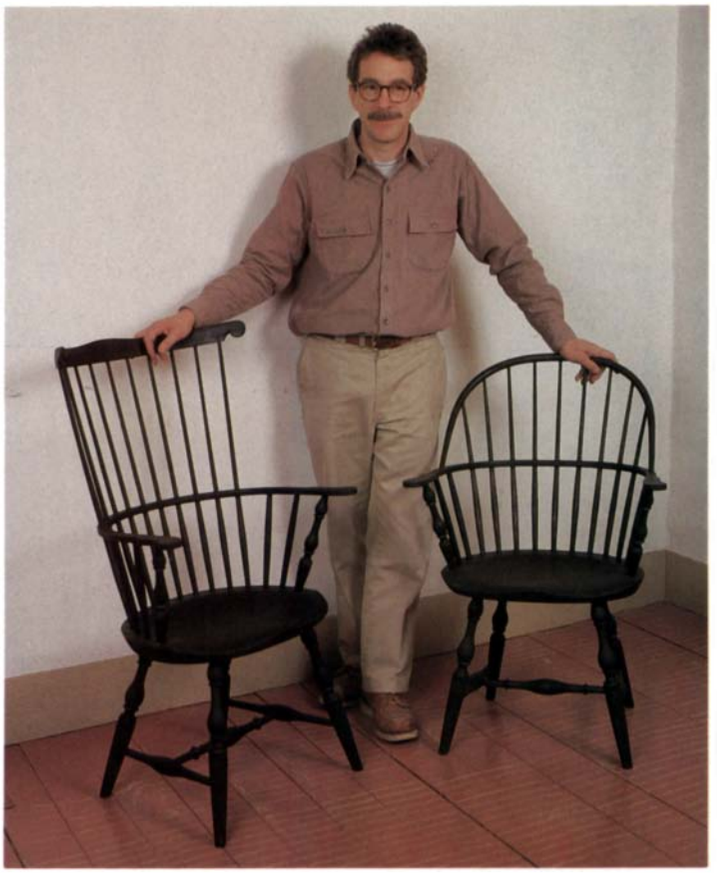
—Ronald E. Kent, Honolulu, Hawaii

A vote for myrtle wood—I missed your request for "Backyard Exotics" (*FWW* #69), but here is my favorite: myrtle wood. Myrtle wood only grows on the southern Oregon coast and in the Holy Land, so it's fairly rare. The most common colors of the wood are beige and gray, with black stripes or flecks, but a lot of the wood has red, yellow, blue and most other colors of the rainbow in lighter shades. Myrtle is frequently used for bowls, clocks and chests.

—Donald Fulton, Roseburg, Oreg.

Chairs by Robert Chambers—Due to an editing error, the wrong photograph was published in the write-up on Windsor chairmaker Robert Chambers of Corinth, Vt., in *FWW* #71. The chairs attributed to Chambers were actually made by Dave Sawyer, who was also part of the article. Sawyer, who graciously informed us of the error, said he hoped we'd find a way to show Chambers' chairs, because "he's made some beauties." We apologize for the error and now present Chambers and his chairs.

—The editorial staff



Woodworking as business—I would have spent my entire subscription over the past few years for the article on making multiples in *FWW* #70. Tony Lydgate has put a business together that many are striving for. It wasn't just an article he wrote, it was an act of generosity. His language is clear, sincere and detailed in such a way that he shows his personal organization, his persistence and the humanitarian way he treats his employees. The information he gives us is so potent, because getting people to share their success secrets is very difficult in the midst of our inflation-ridden capitalistic society. Lydgate's information is inspirational, his work looks well done, and I especially like his one sentence that starts out "Above all," where he mentions how talented people are plagued by their ideological visions.

Some readers may object to business articles, but they are probably the same people who are opposed to 32mm equipment

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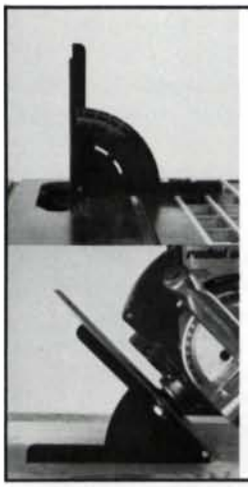

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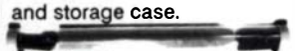

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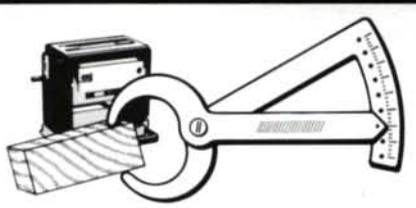

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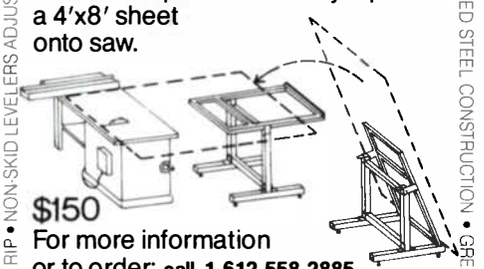

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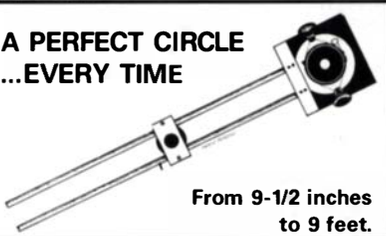

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or anything that resembles woodworking as a production business. To my fellow readers, I say that if I must see yet another article on dovetails, mortise-and-tenon joinery or bandsaw basics, then yes, you must endure articles that refer to woodworking as a business. *–Paul A. Freeman, West Seneca, N.Y.*

Truing up a tablesaw–In *FWW* #70 (p. 14), Rich Preiss advised a reader to have his Sears tablesaw top trued by resurfacing. This may only weaken the top further, and when the rip fence is left engaged (as we all sometimes do), the top will soon cup again. I solved a similar problem on a Sears saw by adding four stretchers under the tabletop–two across and two front to back. The stretchers are 5/16-in. all-thread rod and go through the bottom half of the perimeter lips. If you have table extensions, drill a little bigger hole through them so you can adjust them. Kink the rods around obstacles so they won't interfere with moving parts. Cap nuts can be used on the rod ends to keep your clothes from being snagged, and if you'll use lock washers under them, by the time they're snugged up, your problems will be over. *–Thomas Smith, Southaven, Miss.*

International wood exchange–I read the article "Backyard Exotics" in *FWW* #69, and I really agree that scavenging for wood on road-building projects or house-building sites is a great way to find unusual wood. You can, however, add still another dimension to this: You can trade pieces of wood, preferably with people from other parts of the world. Postage rates being what they are, the trade is limited to pieces of wood suitable for small work and not-too-big turning projects, but you can still get exciting woods at a fair price. As long as you stick to limited quantities for personal use, and no money is exchanged, the customs have no objections. As an added bonus, you will naturally exchange ideas and gain woodworking friends in far-off places.

–Lasse Carenvall, Stenungsund, Sweden

Caution on oven cleaner–The article on carbide sawblades (*FWW* #70) struck a chord with me, especially the references to cleaners. I have a Freud LU73M, which I cleaned with oven cleaner (as I have done for sometime with all my blades). I noticed a thin "film" peeling after it was cleaned, but did not realize until reading this article that the blade was coated with Teflon. Most people who do a lot of kitchen work could tell you that oven cleaners and Teflon are incompatible.

Although I haven't yet noticed any burning or other difficulty with the blade's cutting ability, I think readers should be reminded not to use oven cleaners on Teflon blades.

–Richard Johnson, Caledonia, Ontario, Can.

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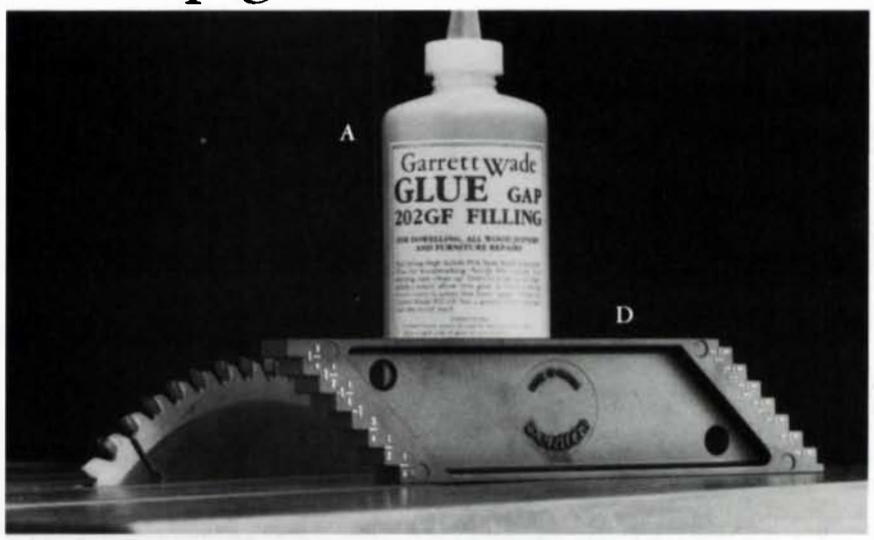

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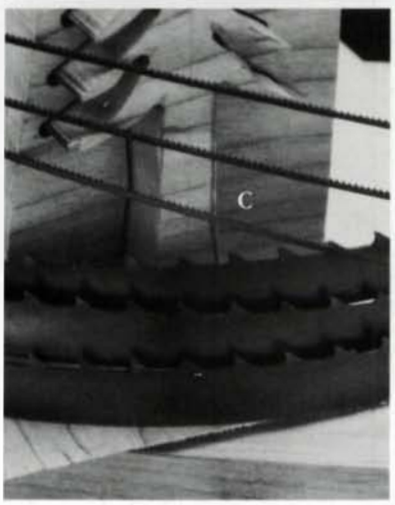

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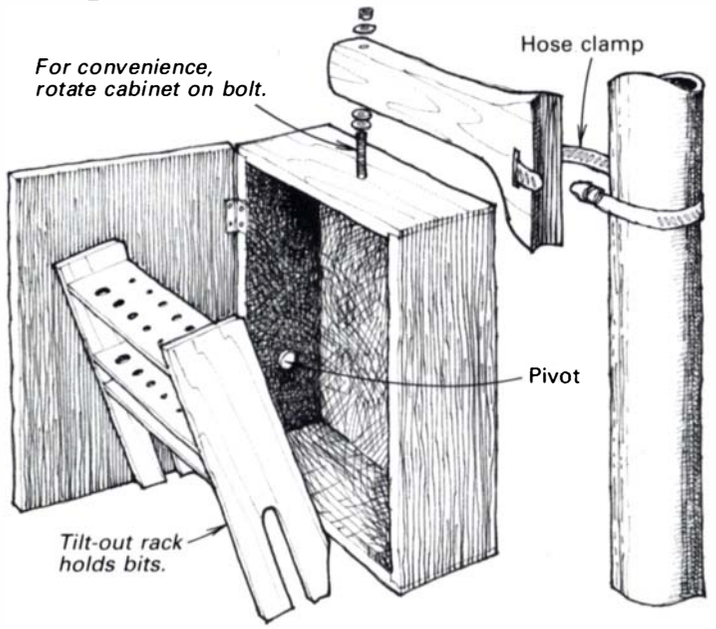
Drill-press cabinet

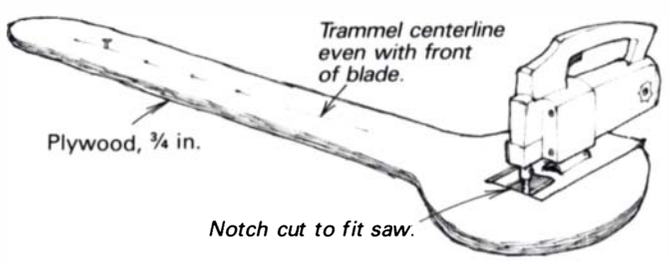


I use a standard stainless-steel hose clamp to attach a small cabinet to the post of my drill press. The cabinet, which holds drill bits and fixtures, hangs from a sturdy 1-in.-thick maple arm that has a shallow V-groove where it bears against the post. A slot cut in the arm receives the hose clamp's strap to hold it to the post. I round off the edge of the slot nearest the post to keep the strap from crimping too much when tightened. This mounting scheme is surprisingly rigid, and the cabinet can be removed quickly or repositioned with just a screwdriver.

The cabinet is a simple box about 15 in. high, 8 in. wide and 3½ in. deep, and it is attached to the arm with a ⅜-in. bolt. I put a couple of washers between the arm and the box so the box can be rotated to a convenient angle. The box is fitted with a standard drill-bit index on the bottom shelf to hold small bits and a shopmade rack above to hold larger bits. This rack flips forward so the bits can be removed easily without hitting the cabinet top. *–James H. Smith, Champaign, Ill.*

Quick tip: Old bowling pins make perfect hard-maple blanks for turning carvers' mallets and other projects. Damaged or worn-out pins are usually available at minimal cost from bowling alleys. *–Stan Carlson, Grand Junction, Colo.*

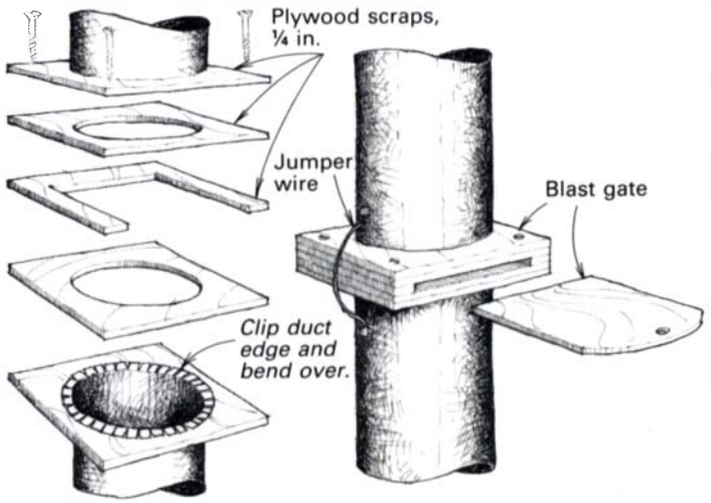
Cutting circles with a jigsaw



A jigsaw can quickly cut circles or large holes with this simple trammel made from scrap plywood. Cut the trammel leg to any convenient length, and make the head large enough so that you can saw a notch in it to seat the jigsaw. With the saw in place, draw a line perpendicular to the front edge of the blade and extend the line down the trammel's leg. Drill a pivot hole at the appropriate distance down the line, using a finish nail for a pivot pin. If you are going to save the circle you are cutting out, the kerf left by the saw must be outside the circle's circumference. The length from the center of the pivot pin to the side of the blade closest to the pin equals the circle's radius. If you are cutting a hole (the cutout will be scrap), the kerf must be inside the hole's circumference. In both cases, apply pressure downward and outward while cutting.

–William S. White, Longwood, Fla.

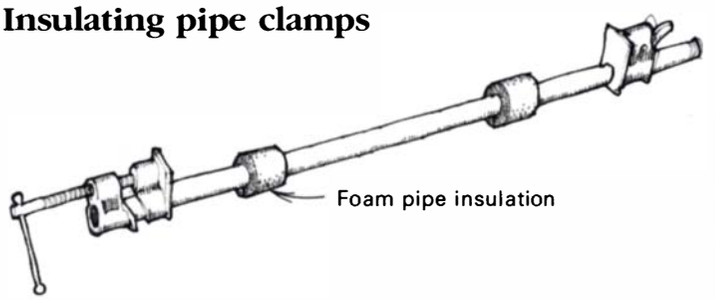
Blast gates



After reading about dust collection systems, I decided to install a system in my shop based on Grizzly's four-bag portable unit. First I fastened a 6-in. main line across the ceiling of my shop with 4-in. branch lines, fitted with blast gates, running down to each of my machines.

I built these blast gates by laminating pieces of ¼-in. plywood scraps as shown in the sketch. To attach the blast gates, I make cuts ¾ in. long, about every ½ in. around the perimeter of the duct, and then bend the tabs over. I slide a piece of plywood up to the bend on each length of duct, then screw through these pieces and the pieces of plywood between them. Although the gates work very well, they break the electrical continuity of the pipes, which can result in a sawdust-igniting buildup of static electricity. I solve this problem by installing a jumper wire from gate to gate. *–Mike Cole, Coeur d'Alene, Idaho*

Insulating pipe clamps



To prevent glue stains and dents while using your pipe clamps, cut two or more 2-in. sections from a length of foam pipe insulation and install the sections on the pipe as shown in the sketch. Foam pipe insulation is commonly available in several sizes at plumbing and building centers.

–Alan C. Sandler, Garnerville, N.Y.

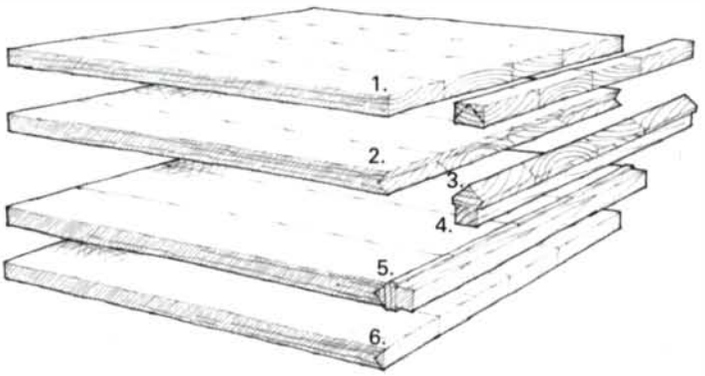
Quick tip: As an aid in cutting straight lines in veneer, I tape garnet paper to the back of my ruler, which makes it much less likely to slip. *–Hugh Aldred, Chester, U.K.*

Sharpening system

I've replaced the sharpening stone and strop in my shop with a two-wheel buffer and two abrasive compounds commonly used by knifemakers and gunsmiths. First I grind the tool's edge on a regular grinding wheel, then I buff the edge on a muslin buffing

wheel loaded with a greaseless buffing compound manufactured by Lea Manufacturing Co. (available from Badger Shooter's Supply, Box 397, Owen, Wis. 54460; 715-229-2101). Even its fine grade cuts fast enough to send a few sparks flying, so I quench the tool often to prevent heat buildup. Next, I polish the edge with white No. 555 Polish-O-Ray (available from Brownells Inc., Route 2, Box 1, Montezuma, Iowa 50171; 515-623-5401). Alternate polishing the top and bottom of the cutting edge. Only a light touch is required to finish the edge to perfection.
–Robert Mordini, Edmond, Okla.

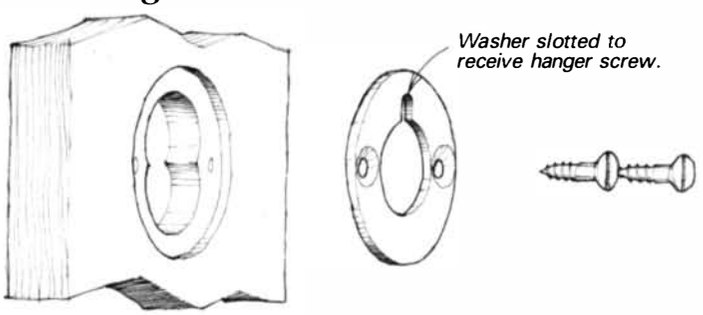
Veneering end edges



I use this process when building veneered period reproduction pieces that have a solid lumber core. This technique provides a better gluing surface than endgrain for the veneer without creating expansion problems as a breadboard end would. Step 1: After gluing up the core, slice a strip off each end that is 1/16 in. wider than the core's thickness. Step 2: Cut a V-notch in the end of the panel. I do this on the shaper, but you can also do it on the tablesaw. Step 3: The strip will have two end-grain edges and two face-grain edges. Pick a face-grain edge and saw a peak on it as shown in the drawing. Step 4: Glue a scrap strip to the piece to act as a caul. Step 5: Glue the pointed end into the notch. Step 6: Saw off the caul, and using a handplane, fair down the glued-on piece so it is even with the core's edges.
–Harold Ionson, Westwood, Mass.

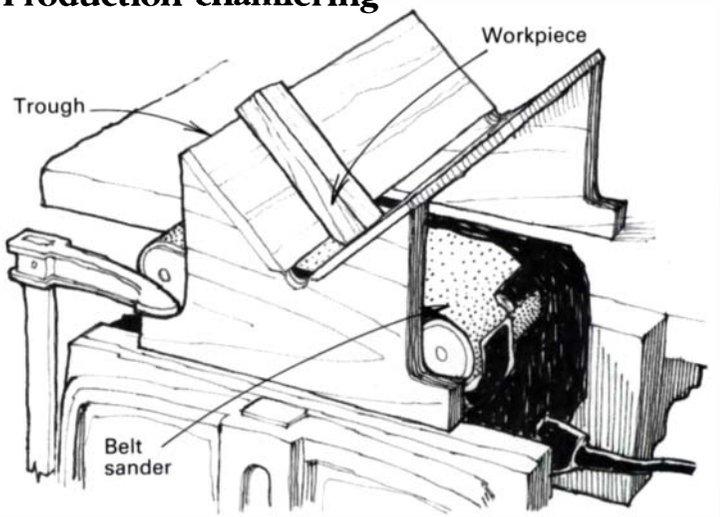
Quick tip: I recently had to plane some Brazilian rosewood to a thickness of 3/64 in. To prevent the work from shattering in the planer, I double-taped the rosewood to a piece of 3/4-in. particleboard as a carrier. *–Max M. Kline, Saluda, N.C.*

Wall hanger hardware



This modified 7/8-in.-OD steel washer lets you hang shelf brackets or wall cabinets flush against the wall. Drill a 9/64-in. hole near the inside edge of the washer and file the space between the hole and the washer opening to produce a slot. Now drill two countersunk holes in the washer for mounting screws. For lighter applications, you can skip the mounting screws and epoxy the washer in the recess. To install the hanger, drill a shallow 7/8-in.-dia. recess in the workpiece so the washer can be screwed flush to the surface. Drill two stopped, overlapping 3/8-in.-dia. holes in the workpiece to make an oval-like cavity under the washer. The cavity allows for the downward movement of the cabinet or bracket over the head of the hanger screw, which is driven into a wall stud. *–Robert W. Terry, Palm Beach, Fla.*

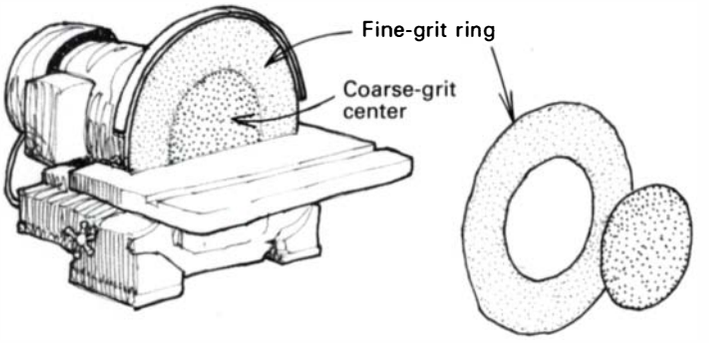
Production chamfering



This setup helps you quickly sand an even chamfer on small parts. Build a trough with a slit in its bottom and position the trough straddling an inverted belt sander clamped in your workbench vise. The amount of chamfer is adjusted by raising or lowering the sander. Two words of caution: Don't obstruct the belt sander's ventilation opening when clamping the sander in the vise, and don't overtighten, lest you crack or distort the sander. *–Fred Palmer, Pensacola, Fla.*

Quick tip: To prolong sandpaper's life, back the sheet with contact paper. *–Donald F. Kinnaman, Phoenix, Ariz.*

Coarse and fine sanding on the same disc



On some of the work I do on my 12-in. stationary disc sander, I often need to switch between 60-grit sandpaper for fast stock removal and 120-grit for finish-sanding. Changing the paper is a chore, and sometimes the paper is ruined in the process. For efficiency, I decided to try this two-grit arrangement. Using a compass, I scribe and cut my adhesive-backed sanding discs as shown in the sketch. This gives me a number of coarse and fine rings and circles. I combine a coarse outer ring with a fine inner circle (or vice versa) to produce the dual-grit sanding capability. Depending on whether the fine grit is in the center or at the circumference, I find it necessary to change sander speeds to avoid burning the work, but this has not proved a drawback.
–Gaylord R. Livingston, Chazy, N.Y.

Securing large vacuum bags

Here's my trick for preventing large dust-collector bags from popping off their flanges. I cut a 4-in.-dia. hose clamp into two pieces that I then pop-rivet to the ends of an appropriate length

of discarded metal band-strapping. This gives me, in effect, a super-long hose clamp that can be tightened quickly around the joint where bag and machine meet. I use the quick-release-type hose clamp, which makes the device very convenient when removing and replacing the vacuum's bags.

—James Christo, Jamestown, N.Y.

Quick tip: Use an old pencil sharpener to chamfer the ends of dowel pins. *—Charles A. Bailey, Davenport, Iowa*

Making finger joints

The finger joint is not only an effective corner joint, but it can also be used for sharp bends and curves. This method for making finger joints minimizes cumulative error. I stack up four identical 6½-in. blades on my tablesaw with spacers between them. The spacers must be made to a prescribed thickness so the slots are the same width as the fingers. To determine spacer thickness, first measure the tooth width and the blade thickness with a micrometer. To calculate the spacer thickness, double the tooth width and subtract the blade thickness. The spacers can be made from items normally found around the shop, such as Formica. Wafers cut from thin sheet metal or soda cans make good fine-adjustment shims. *—Kenneth T. May, Jeanerette, La.*

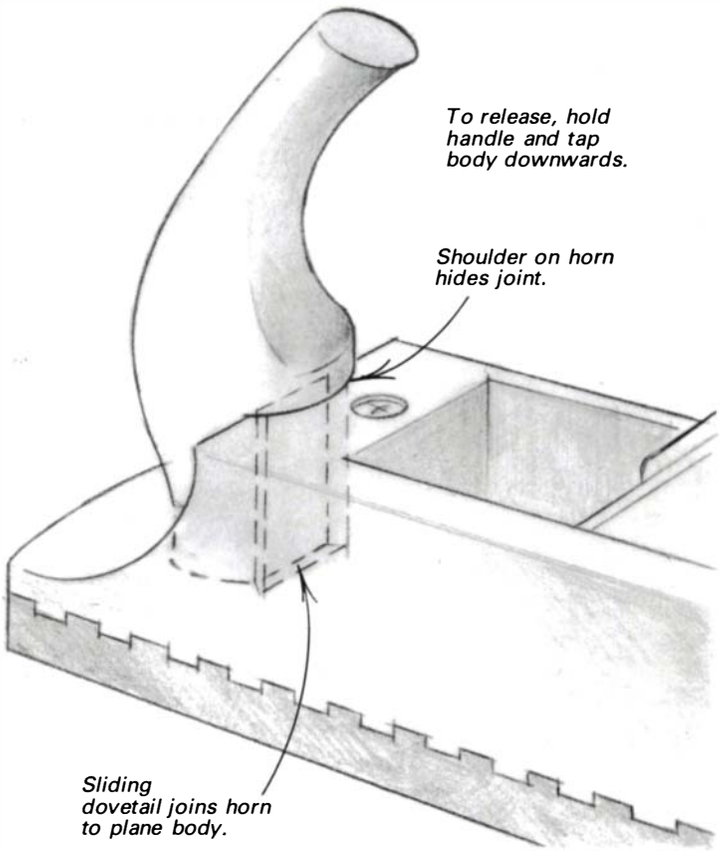
Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We'll return only those contributions that include an SASE.*

Fixing a loose plane horn

I'm restoring a 10-in. wooden Continental plane that I recently purchased. It has a front handle similar to wooden planes currently on the market. Unfortunately, the handle is loose, but I can't get it out of the body. How can I disassemble the plane and restore it for use?

–Lynn Drickamer, Ann Arbor, Mich.

Norman Vandal replies: The handle or "horn" on every wooden plane I've owned was attached to the body with a sliding dovetail. This dovetail is blind: A shoulder at the rear of the horn covers the joint, as shown in the drawing below. Usually the horn will just pull out, so it's curious that your horn won't. See if there are any hidden nails or pins securing it. These would have to be driven out to free the horn. Try pulling the horn upward while simultaneously tapping the body downward. It might help to apply heat from a heat gun to soften the glue. If you do manage to get the horn out, simply shim the dovetail joint so it fits tightly into the body.



If you can't remove the horn and the plane has a separate wood sole, the dovetail might be captured between the sole and the shoulder, making its removal impossible without taking the sole off–something I wouldn't recommend. In this case, try injecting some epoxy or other good gap-filling adhesive (*not* white or yellow glue) into the joint to secure the horn.

[Norman Vandal makes period furniture and architectural furnishings in Roxbury, Vt., and is a consulting editor at *FWW.*]

Gluing a teak table

I want to repair the mortise-and-tenon joints on a small teak end table. The glue in the joints is no longer holding them together. I know teak is an oily wood, which makes it difficult to achieve successful glue joints. Should I use a solvent to degrease the teak before gluing it, and if so, what kind should I use?

–H. William Angevine, Appleton, Wisc.

George Mustoe replies: As you've probably figured out, there's no magic adhesive for oily woods like teak or rosewood. The best choice is epoxy, particularly one of the formulations designed especially for oily woods. One brand I've used is the G-2 resin made by Industrial Formulators of Canada, Ltd. It's available from Flounder Bay Boat Lumber, 3rd and O Avenue, Anacortes, Wash. 98221; (206) 293-2369. Other brands of epoxy formulated for oily woods are available; check local woodworking suppliers.

Wiping the joints with a solvent to remove some of the surface oils before the glue-up can be very effective in increasing bond strength. Of the possible solvents that would work, naptha (also known as VM&P naptha, which stands for "varnish makers' and painters' naptha") is probably the most effective and the least toxic. Ordinary mineral spirits are less effective than naptha, but the liquid has the best safety record among common shop solvents. Lacquer thinner will also work, but it's more toxic and thus requires good ventilation and an organic vapor respirator. Stay away from dry cleaning solvents and other halogenated hydrocarbons, such as trichloroethane, perchloroethylene and dichloroethane. In addition to their high toxicity, halogenated hydrocarbons adversely affect the Earth's protective ozone layer. And don't use carbon tetrachloride–one of the most toxic of the organic solvents–under any circumstances. There are too many risks associated with inhalation of the vapor: It's an acute toxin as well as a known carcinogen.

Before you glue, remove as much of the old glue, dirt and other contamination from the joint surfaces as possible. This will require dismantling the joints. Epoxy's excellent gap-filling characteristics normally will take care of most loose-fitting tenon joints, but be sure to position the work so the adhesive won't run out of the joint while the glue cures. You can also fill out the tenons as described in Bob Flexner's article in *FWW* #67.

[George Mustoe is a geochemistry research technician at Western Washington University in Bellingham, Wash.]

Clearing the smoke smell

I had a fire in my basement. The upper floor was filled with smoke, and my furniture, undamaged by the flames, smells of smoke. How do I clean it, and will the smoke smell come out with refinishing?

–Tammy Wold, St. Paul, Minn.

Bob Flexner replies: The first step is to wash your furniture and woodwork with a good detergent, such as Formula 409 or Pine Sol, to remove any surface soot or dirt that may contain the odor. If the remaining smell is relatively weak, applying a scented furniture polish might be enough to mask it. If not, I have two other suggestions.

The smell will eventually disappear due to exposure to air. If you can do without the furniture for awhile, put it out in the garage and see if the smokey smell disappears on its own. The best solution though, is to call a company that specializes in fire-damage restoration. Businesses of this sort exist all across the country; you should be able to locate one through the Yellow Pages. After thoroughly cleaning the furniture, they will put it in a room containing manufactured ozone, which will chemically eliminate the odor, even from upholstered pieces. You may be able to correct the problem by refinishing the furniture, but this will not always work. In addition, refinishing may be far more expensive than the cost of a professional fire-damage restoration service.

[Bob Flexner is a professional finisher and restorer in Norman, Okla. His video, *Repairing Furniture,* is available from The Taunton Press, Box 355, Newtown, Conn. 06470.]

Splits in a zebrawood table

I built two cocktail tables using 1-in.- and 2-in.-thick zebrawood, and applied a teak-oil finish. Now the wood is splitting across the grain at about 1-in. intervals. I

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resawed the extra zebrawood from the table project into ¼-in.-thick boards, but these show no sign of splitting. What's going on? ***–Ira Falk, Chicago, Ill.***

Jon Arno replies: Judging from your description, I'm quite certain the problem is due to reaction wood. Reaction wood is abnormal wood tissue produced by a tree as it attempts to change its direction of growth. It's most common in wood cut from branches, but it also occurs in the main stem, usually when the tree has to realign itself to the prevailing source of light. When reaction wood dries, it has much higher longitudinal shrinkage than normal wood, and this generally causes lumber to warp or bow. However, when the stress is locked in place by adjacent normal wood growth, often the case in a thicker board, the stress becomes so great that it can produce checking across the grain.

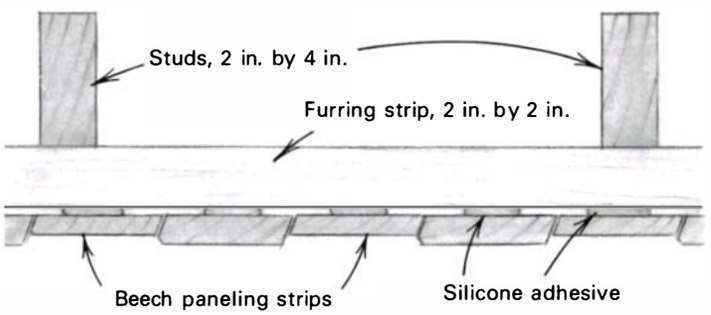
Once these checks appear, there is no remedy. But reaction wood can be detected and avoided. It is denser and more opaque than normal wood, and it has a tendency to fuzz up and produce a "woolly" surface when sanded. Unfortunately, zebrawood is somewhat more susceptible to this problem than most woods. It's very prone to shrinkage as it dries out, and this compounds any stress-producing tendencies.

[Jon Arno is a woodworker and amateur wood technologist in Schaumburg, Ill.]

Homegrown beech paneling

This past fall, I cut down a large beech tree and want to use the lumber to panel my lakeside cabin. To minimize waste, I plan to plane the pieces individually, leaving each at its maximum thickness, and make no effort to make all the boards the same thickness. Then I'll bevel the edges of the unevenly thick boards so they'll overlap when mounted on the wall (see sketch below). Silicone adhesive will be used to hold the beech to 2x2 furring strips nailed to the studs. This adhesive should be flexible enough to allow wood movement. This arrangement should leave a wall with an interesting texture, but is it a workable scheme?

–Jerry Spady, Oak Ridge, Tenn.



Graham Blackburn replies: This is an intriguing idea and might actually work, but I'd like to suggest a few potential problems. First, any gaps that would occur between boards would only be partially hidden by the beveled edges: From certain angles, it might still be possible to see between the boards. Second, you don't say how long each strip would be, but I would not be completely confident in the power of a silicone bond to hold an 8-ft. length of beech with only four 2-in. contact points. In the event of any expansion of the beech, the tendency would be for an individual board to ride up over the adjacent bevel and lift away from the furring strip. I doubt that silicone glue is elastic enough to permit this movement and still keep the boards on the wall.

To be certain the boards will remain in place, and also to allow for any expansion or contraction, I would fix each board by putting a nail through the center of each panel strip. A neatly set and filled finish nail need not look too crude, especially because I gather that your lake cabin is not exactly a Fifth-Avenue drawing room. An alternative would be to groove both long edges of each board at a uniform distance from the back surface and insert loose splines between the boards. As each spline is inserted, it can be screwed to the furring strip before the next board is slipped over its edge. This way, no fasteners will be visible on the face of the boards, and any gaps that might occur between boards will be covered by the splines.

[Graham Blackburn is a contributing editor to *FWW* and has written numerous books on woodworking and tools. His shop is in Santa Cruz, Calif.]

Eliminating saw buzz

Bob Maxwell's question about sawblade stabilizers in FWW #68 brings up a question of my own. When ripping thicker hardwoods, my 24-tooth Freud rip blade will occasionally "buzz" in the kerf. This leaves a slight roughness, burn or both. Proper feed rate is difficult to maintain, and the buzzing seems somehow related to feed rate. The saw has plenty of power and is properly adjusted. Would blade stabilizers help this problem? If not, what would? ***–Tim McCarthy, Oak Harbor, Wash.***

David P. Snook replies: Blade stabilizers will improve the performance of any sawblade. They minimize the vibration by stiffening the blade enough to help keep each tooth directly in line with every tooth on the blade. This results in a truer-running blade that stays sharp longer and cuts smoother. If you purchase stabilizers, be sure they are true; crooked stabilizers will aggrevate any runout or wobble problems. I find machined steel stabilizers or sawblade blanks sold by saw shops to be excellent; I haven't had good results with cast-aluminum stabilizers.

Even without stabilizers, though, sawblades should not buzz in the kerf. A blade that does this has a problem with plate tension and should be taken to a qualified saw service. When the blade cuts, friction heats the rim, expanding the steel toward the center of the blade. This is like trying to scrunch too much steel into a small area, causing the blade to buzz or wobble.

Cutting with an excessively high feed rate, which prevents the blade from clearing chips fast and thus causes heat buildup, amplifies the problems with improperly tensioned blades.

[David P. Snook is a professional saw smith in Salem, Ore.]

Readers Exchange:

A packet of plans for building country furniture is available from Syndication Associates, Inc., P.O. Box 1000, Bixby, Okla. 74008. The collection of plans sells for $22.95 and includes drawings, patterns and extensive directions for building an armoir, wooden filing cabinet, hutch, four-poster bed and three other country-style furnishings.

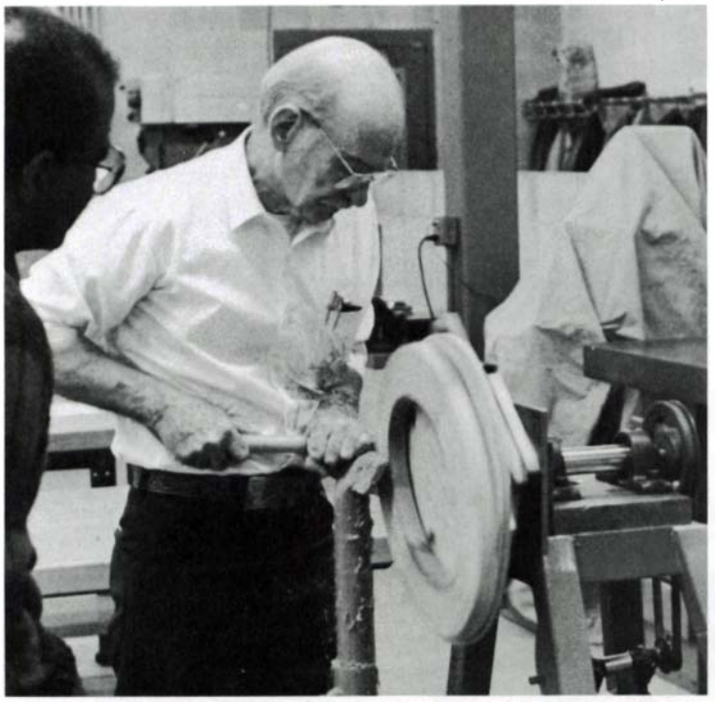
For birdseye and curly maple dowels for fancy pool cues, write to Nils Bradley, Nils Bradley Enterprises, Dodge Road, Plainfield, N.H. 03781. Bradley maintains an inventory of rough, 1⅜-in.-dia. kiln-dried dowels that are 40 in. to 50 in. long and of varying color, figure and price.

Owners of Boice Crane 1700 Series lathes can obtain a copy of the operator's manual and repair-parts list by sending a self-addressed and stamped manila envelope to *Fine Woodworking,* The Taunton Press, 63 S. Main St., Newtown, Conn. 06470. Anyone who has parts for Series 3700 B-C Boice Crane lathes should write to K.C. Steiner, P.O. Box 70, Lemont, Penn. 16851.

Send queries, comments and sources of supply to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We attempt to answer all questions, but due to the great number of requests received, the process can take several months.*

by Jim Cummins

Photo: Edward J. Reed



Ben Kemp demonstrates IVY TECH's new eccentric lathe.

Eccentric turning—Way back in *FWW* #58, p. 76, we published a drawing of how an ellipsograph works and attempted to clarify the gyrations of the eccentric lathe, which turns ovals. Previously, I had known of two oval turners, Johannes Volmer of Salzstrasse, in the German Democratic Republic, and S.W. Levine of Capetown, South Africa. But suddenly, the ranks of oval turners have doubled. Two more lathe makers, inspired by the article, have appeared.

Ben Kemp's oval lathe, shown in the photo above, was a joint project of teachers and students at the Indiana Vocational Technical College (IVY TECH) in Fort Wayne. The project took the better part of a year.

The other new oval turner is Michael Basisty of Belleville, Ontario, who confesses to buying this magazine only when it contains an article on building machines. Basisty first made an ellipsograph, then mocked-up the oval lathe in wood, to be sure he understood the principles. The lathe chuck is made of 3/16-in.-thick boilerplate, with flat stock steel for the slides, which avoids milling work. The lathe's ring is turned on a 12-in. metal lathe. The headstock and base are angle iron, and the lathe is powered by a 1-HP motor, with two V-belts for speed reduction.

Mesquite news—Jon Arno's article on backyard woods in *FWW* #69 and his article about catalpa in this issue remind me of mesquite. Although catalpa has long been touted as the most stable wood in North America, mesquite beats it easily. Green mesquite heartwood, when dried in an oven, shrinks a mere 2.6% tangentially and 2.2% radially. For comparison, catalpa shrinks 4.9% tangentially, and some of the oaks will shrink more than 12%.

So, what does this mean? For one thing, such things as laminated turnings and floors made of mesquite will not open gaps as the seasons change. But is mesquite hard enough for floors? It sure is. Mesquite is 61% harder than sugar maple, and in every strength category except stiffness, it surpasses hickory and white oak. Another feature is the wood's handsome red-orange color, which will eventually darken to a blood red.

Often thought of as a weed tree, mesquite can be found on 72 million acres in the Southwest. If it's a weed, it's a good one. A member of the same plant family as peas and beans, mesquite shares their ability to restore nitrogen to depleted soils. Its seedpods can be toasted and milled to produce a protein-rich flour, with a taste reminiscent of carob. And it's lately getting good press nationwide as a barbeque enhancer, because its smoke imparts a unique flavor to meat and fish.

These facts, as well as information on harvesting, drying and fabricating mesquite, are found in *Mesquite Woodworking,* a booklet based on a workshop/seminar held in 1983. The 36-page booklet is available for $5 ppd. (Texas residents need to pay 35¢ sales tax) from Caesar Kleberg Wildlife Research Institute, Campus Box 218, Texas A&I University, Kingsville, Tex. 78363; (512) 595-3698. If you think there may be a use for this exceptional wood in your shop, more information can be obtained by writing to the address above.

There's also an organization, called *Los Amigos del Mesquite,* for ranchers, barbeque-chip suppliers, lumber dealers and craftspeople. If you're interested in joining the organization or would like details about their workshops, contact Jim Lee, treasurer, Reagen Wells Route Box 122, Uvalde, Tex. 78801; (512) 232-6167. This year's workshop, incidentally, will be the weekend of Sept. 23, in Austin, Tex.

Home-cooked spline weights—The mention of spline weights for laying out curves (*FWW* #71, p. 45) prompted assistant editor Alan Platt to comment that it's common to use more than two. In fact, Platt, who has done some yacht designing, has a set of 16 spline weights. At $14 to $20 each, this could add up.

Platt's solution was to make his own by melting lead in trays meant for baking muffins. The heat supply was a gas-fired barbeque, and the melting took about 15 minutes. Platt got his lead from a roofer who uses the metal in valley work, but it's commonly available in scrap yards at low cost. The molten metal is very hot, so be careful, and work outdoors to ensure adequate ventilation.

In use, a hook on the side of a store-bought weight engages a groove on the top edge of the flexible plastic spline. By moving the weight around on the work surface, you can curve the spline anyway you want. Platt added hooks to his lead muffins by simply screwing hardware-store right-angle wall hooks into the metal. The end of each hook can be cut to length and sharpened to fit the groove in the spline.

Slick canvas—The bullnose sander in *FWW* #71 had a platen (the part that presses the sanding belt against the work) covered with graphite cloth to reduce friction. I did the same thing to the platen of my 6-in. stationary belt sander with extraordinary results. The machine, a vintage Montgomery Ward's powered by a tired old surplus motor, used to bog down and stall at the drop of a hat, but with the graphite treatment, it's now unstoppable. The cloth is available at a 3-ft. minimum order for about $13 ppd. from Derda Inc., 1195 W. Bertrand Road, Niles, Mich. 49120; (616) 683-6666. I fastened my cloth on with spray adhesive about a year ago, and it shows no wear yet, so 3 ft. may be a lifetime supply unless you can think of someone to share it with.

Originally used to lubricate the pressure pads for stroke sanders, the graphite cloth can also be used on hand-held belt sanders. The only catch is that if the edges begin to fray, strands of canvas can get wound up into the roller axles. But the advantages of the cloth are so great that this drawback is worth living with. Just replace the cloth before it frays.

Potential deadfall and some shaper tips—In "Methods of Work" (*FWW* #69), we showed a plywood keeper that caught the attention of Patrick O'Shaughnessy of Wolfeboro, N.H. The idea was to stack the plywood against a wall, holding it in position with cords and sash weights draped over the top. O'Shaugh-

nessy says a similar setup almost broke his leg one time when it overbalanced as he was flipping through the stack.

The article on shapers in the same issue prompted O'Shaughnessy to share a tip for shaper setup. Once he gets the fence adjusted for a particular cutter, he makes a pair of scrapwood T-squares that hook over the front of the table and extend exactly to the fence. The next time he needs to set the fence, he can just bring it up to the ends of the T-squares and lock it in place. Each pair of T-squares is labeled for the cutter and job.

Another fence idea came from David Grant Willemain of Towson, Md., who sets the fence for the final cut even when he anticipates having to make more than one pass to cut the work to full depth. The trick is to set the fence, make a trial cut on scrap, then tack a piece of Masonite to the fence to reduce the depth of cut. With all first passes done, remove the Masonite, and the next pass will cut the profile to full depth without further measurements and trials.

Small parts—In *FWW* #70, we listed a source for small metal parts and bearings in two different articles, one with the company's new address and one with the old. The correct new address is Small Parts, 6891 N.E. Third Ave., Miami, Fla. 33238; (305) 751-0856. One reader at least, E.M. Stacey of Satellite Beach, Fla., reported that the post office returned his order stamped "Forwarding Order Expired." We apologize for any inconvenience.

Temper, temper—Every time I say something about metallurgy, I get it wrong. For example, in "Follow-up" *FWW* #70, a source was mentioned for aluminum channel for building a rip fence. I called it 6061 temper. Both Frank Biewer of San Diego, Calif., and Jack Pettit of Medomak, Me., (effectively bracketing the whole continental United States, you'll notice), corrected my terminology. It turns out that 6061 is a particular alloy that may be tempered by heat-treating to a number of hardnesses, which are designated T0, T1, etc., up to T6, which is what you want.

Biewer says 6061-T6 aluminum is roughly comparable to mild steel, and that he's specified it extensively in a lot of his mechanical designing. The tensile strength of T0 is 18,000 psi, while T6 goes to 45,000 psi.

Storing oils and stains—As a finishing material is gradually used up, air in the can may cause the remaining contents to polymerize into an unusable, rubbery glop. This has cost me as much as $4 per occurrence, and it seems to sneak up on me at least once a year. Solutions are numerous: Some finishers fill the can with marbles or stones to raise the level of the remaining finish, thus expelling most of the air; others use specialized photo-chemical containers that can be collapsed as needed.

Marbles and stones seem messy, and I have no ready source for special photo-chemical containers. Also, I don't like to hang around photo-supply stores much, because such places have ways of evaporating the money in my wallet.

All this is an introduction to a tip we received from Terry Kilgore of Waynesburg, Ohio. He suggests storing stains and other finishing liquids in clear Ajax or Palmolive dish-detergent bottles. It would seem that this could greatly decrease waste, allow easy shake-up mixing and avoid spills and breakage.

I wrote back with a caution that finishing liquids may gradually eat their way through such bottles, eventually surprising you by depositing their contents on the shelf below. I don't have to tell you how I found this out. Perhaps certain plastic bottles may be alright, but not the ones I tried. Kilgore is continuing his experiment, however, and will let us know how things stand up. Formby's (825 Crossover Lane, Memphis, Tenn. 38117; 901-685-7555), by the way, now packages some of its stains and oils in squeezable plastic containers. This, to my mind, is a good reason to try plastic containers.

More about foot switches—A previous "Follow-up" column (*FWW* #70) suggested running a drill press by means of a foot switch, thus freeing both hands. Tom E. Moore of Madison, Va., responded that he performs certain jobs requiring a foot switch, but that at times he prefers the regular switch.

Moore's solution is to have the best of both methods by wiring a standard outlet so that if the drill press is plugged into the top receptacle, it is controlled by its regular switch; but if it's plugged into the bottom receptacle, the foot switch runs it. Moore has the outlet mounted in a junction box on his bench.

The wiring is simple. The outlet is wired and grounded to the junction box as usual, at the top receptacle. In a normal wall installation, the lower receptacle gets its power via two connector links, one tin and one brass, running down the sides. These connector links have screwdriver slots so they can be broken off to separate the two receptacles into individual circuits, which are sometimes desirable. If you break off the brass connector link and connect the switch wires to the top and bottom receptacles on that side, then the lower receptacle will be run by the foot switch and the top receptacle will perform as usual. The foot switch can be grounded inside the junction box.

Smooth carbide—Sam Fletcher of Mechanicsville, Va., wrote to say he's been getting very good service out of low-cost Piranha sawblades (manufactured by Black & Decker) by touching up the factory grind with a diamond hone.

Fletcher, who has been working wood since 1940, observed that his carbide blades could not quite match the cut of the steel blades he was used to. His habit had always been to touch up a steel blade when it began to dull, thus getting the best cut for the longest time. He now applies this same principle to carbide.

With the first couple of strokes of the 1-in. by 3-in. hone on the top of each tooth, the coarseness of the original grind becomes evident. A few more strokes brings the tooth top level and smooth, resulting in a cleaner cutting edge. To hone the curved front of the Piranha teeth, Fletcher uses a ¼-in.-dia. round diamond file originally designed to sharpen chainsaw teeth. He mounts the round file in a Dremel tool or an electric drill. The hones are available (about $9 for the flat, $5 for the round) from Eze-Lap Diamond Products, Box 2229, Westminster, Calif. 92683; (714) 847-1555. Similar hones made of ceramic, which can be used to improve the surface left by the diamond, are available from Spyderco, Inc., P.O. Box 800, Golden, Colo. 80402; (800) 525-7770.

Fletcher notes that his procedure is strictly a means to improve the sawblade's ability to do a good job and is not suggested as a means to recondition a dull blade.

Hot carbide—Ron Fink of Burnaby, British Columbia, dropped us a note warning of the dangers of allowing sawdust and pitch buildup under the throat plate of a tablesaw. When making a bevel cut in heavy stock, Fink's saw actually set itself on fire.

Ironically, for safety, Fink had modified his throat plate so it screwed into place, rather than merely dropping in, and he experienced some anxious moments looking for a screwdriver. But eventually, all ended well. It's easy enough to turn off a tablesaw and wander away without noticing that there's more smoke than usual in the room, however, so Fink can count himself lucky this time. He says he now carries an extinguisher to every job site. □

Jim Cummins is an associate editor at FWW.

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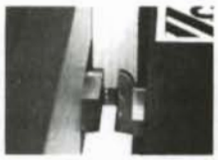

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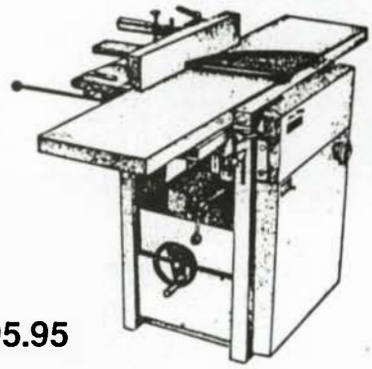

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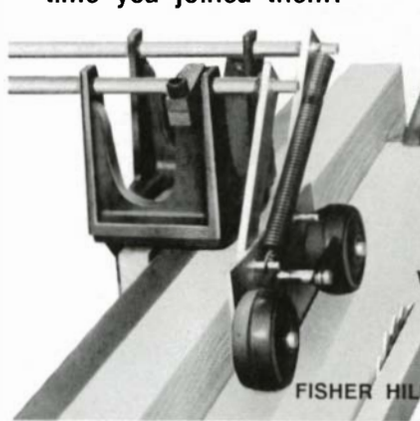

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87075K	3"x21" Belt Sand. w/bag/cse.	237	130
87100	3"x24" Belt Sand. w/bag	281	150
87200	4"x24" Belt Sand. w/bag	351	189
W640	7¼" 13 amp Circular Saw	210	117
TS380	14" Mitre Box	773	385
RA200	8¼" Radial Saw	515	285
TS251U	10" Mitre Saw	392	188
JSE60	V/Speed Jig Saw	234	128
RA2500	10" Radial Arm Saw	679	392
TR30U	Laminate Trimmer	163	90
R150K	1 H.P. Plng. Router w/cse	206	119
R230	1½ H.P. Router	257	165
R331	2 H.P. D-Handle Router	304	189
R500	2¼ H.P. Plunge Router	326	177
L120UK	3⅝" Planer w/cse	206	119
L580A	6⅛" Planer 10.5 amp	548	298
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0222-1	⅜" drill 3.3A 0-1000 rpm	169	95
0228-1	⅜" drill 3.3A 0-1000 rpm	154	85
0375-1	¾" close quarter drill	208	115
0210-1	⅜" cordless drill 2 spd	204	125
0212-1	⅜" cordless drill v/spd.	263	149
6539-1	Cordless screwdriver 190 rpm	108	59
3102-1	Plmbrs rt angle drill kit	295	175
3002-1	Electricians rt angle drill	290	169
5399	½" D-hdle ham drill kit	299	165
1676-1	H.D. Hole Hawg w/cs	395	225
6511	2 sp sazsall w/cs.	209	119
6405	8¼" circle saw	209	120
6750-1	Drywall gun 0-4000 4.5A	149	89
6798-1	Tek screwdriver	173	105
6226	2 sp bandsaw w/case	416	240
6234	TSC bandsaw w/case	427	240
6507	TSC sazsall w/case	219	129
6170	14" chop saw	430	219
6012	Orbital sander 3⅝"x7¾"	179	100
6014	Orbital sander 4½"x9¼"	189	110
6305	6½" cordless circle saw	284	155
6753-1	Drywall gun 0-4000 3.5A	129	73
8977	Var. temp heat gun	109	70
0214-1	⅜" v. spd. cordless drill	220	125
5397-1	¾" v. spd. hammer drill kit	227	145
0211-1	⅜" cordless driver drill	217	120
5371-1	½" v. spd. hammer drill kit	313	199
3107-1	½" v. spd. rt angle drill kit	305	180
6754-1	Drywall gun 0-4000 4.5A	179	115
6232	4¾" bandsaw w/case	432	275
6747-1	Drywall driver-0-2500	149	85
0230-1	⅜" drill 0-1700 rpm	169	103
3300-1	½" v. spd. magnum rt angle kit	289	180
5620	Router 1 H.P.—8 amp	289	175
5660	Router 1½ H.P.—10 amp	299	180
5680	Router 2 H.P.—12 amp	350	220
5455	⅓" polisher 1750 rpm	199	125
5535	7" polisher 2800 rmp	209	130
6215	16" chain saw	280	140
8975	Heat gun	85	55
6366	7¼" circular saw	198	106
6368	7¼" circular saw	226	125
0216-1	2 spd cordless drill Hi-torque	222	139
0235-1	½" drill keyless chuck mag	199	122
6016	¼ sheet pad sander	75	40
6147	4½" sander/grinder w/case	182	110
8950	8 gal wet/dry vac	205	130
8955	10 gal wet/dry vac	279	189
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LU82M010	Cut-off	10"	60	98.89	42
LU84M011	Combination	10"	50	85.25	37
LU85M010	Super Cut-off	10"	80	126.90	62
LM72M010	Ripping	10"	24	74.22	36
LU73M010	Cut off	10"	60	91.16	38
PS203	Gen'l Purp.	7¼"	24	31.42	19
PS303	Plywood	7¼"	40	37.74	22
DS306	6" Dado - Carbide			168.13	92
DS308	8" Dado - Carbide			205.89	108
F0	1¾"x⅝" Biscuits 1000-Qty.				25
F10	2⅛"x¾" Biscuits 1000-Qty.				25
F20	2⅜"x1" Biscuits 1000-Qty.				25
FA	Assorts Biscuits 1000-Qty				28

MAKITA CORDLESS

Model		List	Sale
6070DW	⅜" var. spd. rev. 7.2v	123	65
6071DWK	⅜" var. spd. rev. w/removable batt	190	105
5081DW	3⅛" saw kit	243	130
5600DW	6¼" circular saw	317	167
6010DWK	⅜" cordless drill kit	155	89
6010SDW	⅜" cordless drill	103	55
DA3000DW	⅜" angle drill	238	130
6010DL	⅜" drill w/flashlight	198	113
6012HDW	2 spd. driver drill w/clutch & case*	224	109
6710DW	Cordless screwdvr kit	176	103
6092DW	V/spd. & case*	237	117
6093DW	V/spd. w/clutch & case*	248	119
6891DW	Drywall gun 0-1400	225	120
632007-4	9.6 volt battery	49	35
632002-4	7.2 volt battery	42	30
5007NBA	7¼" saw w/elec. brake	219	127
5008NBA	8¼" saw w/elec. brake	257	145
804510	Sander	97	46
9900B	3"x21" belt sander	254	138
9924DB	3"x24" belt sander w/bag	260	145
9035	⅓ sheet finish sander	100	53
9045B	½ sheet finish sander	204	109
9045N	¼ sht fin. sand. w/bag	206	110
4200N	4⅜" circ. saw 7.5 amp	210	112
5201NA	10¼" circ. saw 12 amp	509	300
4301BV	Orb. v/sp jig saw 3.5 amp	268	145
JR3000WL	2 sp recip saw w/cse	217	122
JR3000V	Vs. recip saw w/case	228	125
LS1020	New 10" mitre saw	426	219
9820-2	Blade sharpener	336	169
410	Dust collection unit	458	269
3705	Offset trimmer	240	125
1900BW	3¼" planer w/case	210	115
1100	3¼" planer w/case	381	199
9207SPC	7" sander-polisher	276	139
3601B	1⅜ H.P. router	228	120
3700B	½ H.P. trimmer	170	90
9501B	4" grinder	137	65
804530	6" round sander	102	55
804550	¼" pad sander w/bag	95	46
DA3000R	⅜" angle drill	234	130
DP4700	½" v/sp w/rev. 4.8 amp	192	110
6300LR	½" angle drill w/rev	316	176
2708W	8¼" table saw	432	250
2711	10" table saw w/brake	728	470
GV5000	Disc sander	120	67
6800D8	2500 rpm 3.5 amp	154	75
6800DBV	0-2500 rpm 3.5 amp	164	83
6801DB	4000 rpm 3.5 amp	154	75
6801DBV	0-4000 rpm 3.5 amp	164	83
2030N	12" planer/jointer	2836	1495
2040	15⅝" planer	2358	1240
1805B	6⅛" planer kit w/case	609	340
JV1600	var. speed jig saw	209	125
JV2000	var. speed orb. jig saw	230	135
5005BA	5½" circular saw	202	113
9503BH	4½" sander-grinder	153	83
DP3720	⅜" drill rev. 0-1800 rpm	104	55
6510LVR	⅜" drill rev. 0-1500 rpm	153	69
6013BR	½" drill rev. 6 amp	224	125
5402A	16" circular saw - 12 amp	550	325
3612BR	3 H.P. plunge router	354	185
9401	4"x24" belt sander w/bag	302	165
3620	1¼ H.P. plunge router w/case	180	92
8419B-2W	½" 2 spd. hammer drill	275	125
4302C	V/spd. orb. jig saw	272	155
5077B	7¼" Hypoid saw	254	145
LS1430	14" Mitre saw	624	439
2414	14" cut-off saw AC/DC	365	200
5007N8	7¼" circ saw 13 amp.	196	114
3612B	3 HP plunge router sq/b	354	187

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Model		List	Sale
5510	(551) 5½" circ saw	130	82
5625	(552) 6½" circ saw	164	108
5656	(553) 7¼" circ saw	164	108
5665	(554) 8¼" circ saw	185	118
5750	(807) 7¼" circ - drop foot	175	115
5765	(808) 8¼" circ - drop foot	204	130
5790	(810) 10¼" circ - drop foot	350	225
5825	(367) 6½" worm saw	257	139
5865	(825) 8¼" worm saw	283	149
4580	Vari - orbit jig saw w/cse.	120	82
3810	10" Mitre saw	349	179
595	3"x21" sander w/bag 5.5A	197	125
7565	¼" palm sander	62	41
2535-04	7.2V drill w/x-tra batt	142	97
77	7¼" worm drive	261	135
5350	2½ HP circ. saw	90	69
5250	2¼ HP circ. saw	66	49

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23-680	6" bench grinder ¼ H.P.	71	55
23-880	8" bench grinder ½ H.P.	122	99
23-980	10" bench grinder 1 H.P.	213	179
11-950	8" drill press	149	119
14-040	14" drill press	284	235
40-150	15" hobby scroll saw	165	130
28-160	10" hobby band saw	176	135
31-050	1" belt sander 2.0 amp.	93	75
31-460	4" belt/6" disc sander	165	125

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3203-HT	3"	5.09	3.00	67.50
3204-HT	4"	8.63	5.15	115.85

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#5/0	4"	2"	12.05	7.25	40.50
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#3/0	6"	3"	13.88	8.35	47.60
#2/0	7"	3½"	14.92	8.95	51.00
#0	8"	4½"	16.61	9.95	56.70
#1	10"	6"	18.98	11.40	64.95
#2	12"	8½"	21.78	13.00	74.00
#3	14"	10"	27.62	17.50	99.95
#4	16"	12"	35.93	24.50	139.95

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3712	12"	9.17	5.95	32.50
3718	18"	10.12	6.85	37.50
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3730	30"	12.35	8.25	45.00
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J06	6	7.38	4.25
J08	8	8.31	4.80
J10	10	9.69	5.75
J12	12	12	6.90

BOSCH

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1581VS	Top hdle jig saw	235	129
1582VS	Barrell grip	220	119
1942	Heat gun 650°-900°	99	69
1272D	3"x24" B.S. w/bag	295	169
1273D	4"x24" B.S. w/bag	315	179
11-212	Bulldog ¾" SDS rotary	339	189
1196VSRK	⅜" vs hammer drill	205	110
1198VSR	½" vs hammer drill	219	125
1608	5.6 amp lam trimmer	135	75
1608L	Same as above w/trimguide	139	81
1608T	5.6 amp tilt base trim	155	89
1609	5.6 amp offset base trim	199	119
1609K	Lam installers kit w/1609	285	169

Offset base, trimmer tilt base, trimguide, ¼" collet, collet nut, wrenches, hex keys and case

1601	1 H.P. 790 watt motor 25,500 rpm	159	95
1602	1½ H.P. 1000 watt motor 25,000 rpm	195	109
1603	1½ H.P. D handle 1000 watt	219	119
1604	1¾ H.P. 10 amp 25,000 rpm	219	119
1606	1¾ H.P. D handle 1120 watt	243	135
3258	3¼" planer w/blade guard 5.7 amp	205	119
3270D	3"x21" dustless belt sander 5 amp	219	129
1273DVS	Var spd. 4"x24" 6 speed range sander 10.5 amp	339	189
1611	3 H.P. plunge router	339	198
1651	7¼ 13 amp. circ. saw	179	105
1922K	Cdlss. jig saw w/cse.	239	169

WORKMATES BY BLACK & DECKER

Model		List	Sale
79-029	#85, 18#	57.95	39.00
79-032	#200, 23#	97.95	65.00
79-033	#300, 28#	107.95	70.00
79-034	#400, 35#	140.95	98.00

BLACK & DECKER!!!
Black & Decker Cordless

Model		List	Sale
1950	Hi-torque drill kit w/case	190	115
1980	Clutch scrudrill kit w/case	193	115
1987	V/spd. scrudrill kit w/case	209	125
1947	V/spd. hi-torque kit w/case	201	117

Black & Decker Deals

Model		List	Sale
2054	Versa clutch screwgun - teks & wd screws	232	140
2037	0-4000 5 amp drywall gun	160	92
1175	⅜" 0-2000 3.5 amp drill	96	54
2034	0-4000 4.5 amp drywall gun	138	87
4015	½ sheet sander 3 amp	190	109
2600	⅜" 0-1200 4.5 amp drill	119	73
4018	½ sheet sander 2.3 amp	122	74
3051	7¼" worm drive 13 amp	246	142
3027-09	7¼ circ. saw 10.5 amp	170	75
3103	2 spd recip w/case	190	95
3028	7¼" circ w/18 tooth carb blade	125	78
1703	10" mitre w/60 tooth carb blade	313	186
3047-09	7¼" super saw cat w/brake	270	164
3048-09	8¼" super saw cat w/brake	285	174
3157	Orb v/spd. jig saw	212	126
3153	V/spd. jig saw	205	123

AEG SPECIALS

Model		List	Sale
EZ505	7.2v cdls. drill, batt., chgr., 2-spd	180	79
EZ506	7.2v cdls. drill, batt., chgr., v-spd	194	120
SSPE800	8 amp., v-spd., orb., recip. saw	209	130
SCRIE	5 amp., 0-2500, drywall gun	150	99
SCRIIE	5 amp., 0-4000, drywall gun	140	94

PORTER CABLE

Model		List	Sale
630	1 H.P. router 6.8 amp	165	110
690	1½ H.P. router 8 amp	205	115
691	1½ H.P. router D hdle	225	135
536	1½ H.P. speedmatic router	300	195
518	3 H.P. 5 speed router	520	338
520	3 H.P. 15 amp router	490	320
309	3.8 amp lam trimmer	135	90
310	3.8 amp H.D. lam trimmer	190	120
312	Offset base lam trimmer	205	130
319	Tilt base lam trimmer	221	145
695	1½ H.P. router/shaper	288	190
696	H.D. shaper table	160	105
351	3"x21" belt sander w/o bag	207	129
352	3"x21" belt sander w/bag	217	135
360	3"x24" belt sander w/bag	302	195
361	3"x24" belt sander w/o bag	282	170
362	4"x24" belt sander w/bag	317	205
363	4"x24" belt sander w/o bag	302	195
587	7¼" speedtronic 14.5 amp circ saw	220	145
315-1	7¼" top handle 13 amp circ saw	185	105
617	7¼" pushhandle 13 amp	185	105
346-1	6½" top handle 12 amp	166.50	115
368-1	8¼" top handle 13 amp	195	131
314	4½" trim saw 4.5 amp	195	125
548	X HD bayonet saw	245	165
9548	X HD bayonet saw w/case	265	175
9629	Recip saw v/sp 8 amp	225	139
9627	Recip saw 2 speed 8 amp	215	133
666	⅜" H.D. vsp drill - Hdl	181	122
620	⅜" H.D. 4 amp 1000 rpm	140	83
621	⅜" H.D. v spd. 0-1000 rpm	148	90
320	Abrasive plane 3 amp	145	98
126	Porta plane 7 amp	280	185
9118	Porta plane 7 amp kit	315	209
653	Versa plane 10 amp	399	250
9652	Versa plane 10 amp kit	419	275
7545	0-2500 v spd. drywall gun 5.2 amp	163	100
505	½ sheet pad sander	187	99
7511	⅜" v spd. drill 5.2 amp	183	100
7514	½" v spd. drill 0-750	188	120
303	Paint remover	220	150
304	7" disc sander 4000 rpm	187	125
305	7" disc polisher 2000 rpm	187	125
367	3¼" planer 6.5 amp	225	135
537	1½ H.P. D hdle router	315	205
7548	Top hdl jig saw 4.8 amp	205	135
7648	Barrel grip jig saw 4.8 amp	205	135
330	Speed block sander ¼ sheet	97	54
555	Plate biscuit joiner 5 amp w/case	269.95	162
345	6" saw boss 9 amp	154.50	99
5060	"Stair Ease" stair templet	194	125
5061	"Stair Ease" hard wood stair templet	204	135
655	0-4000 drywall gun 4 amp	125	74
7540	0-4000 5.2 amp gun	158	99
100	⅞ H.P. router	155	100
59381	Door hanging kit	224	152
399	Drywall cutout unit	104.50	69
43218	Drywall cutout unit replacement bit	6.75	5.50
5008	Dovetail template kit	95	69
97650	½" v/spd hammer drill w/case	221	149
5009	Mortise & Tenon jig	49.95	38
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	80 grit paper 10 yd roll	13	9
	100, 120, 180, 220 10 yd roll	11.50	8

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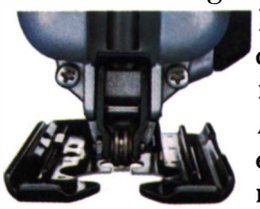

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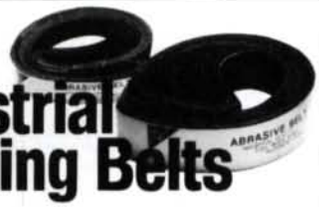

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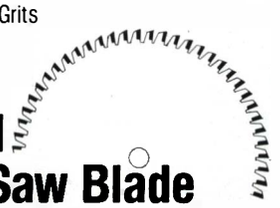

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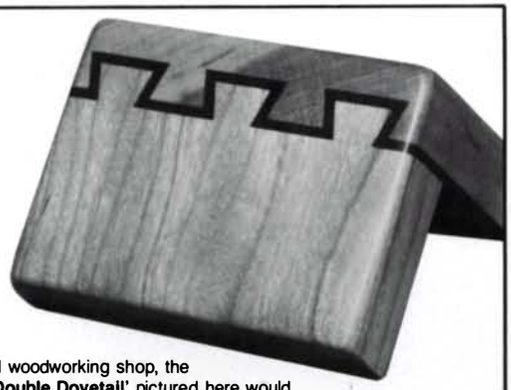

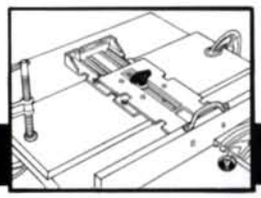

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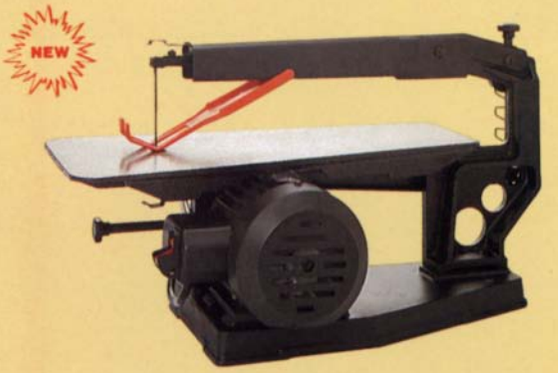

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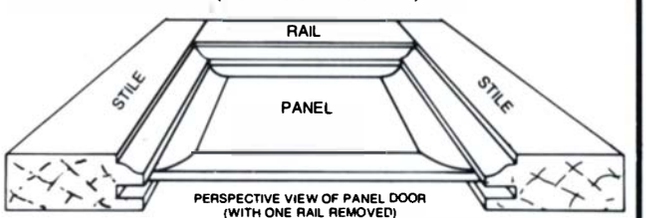

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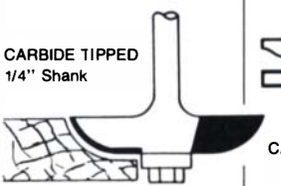

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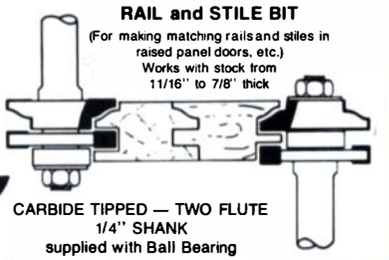

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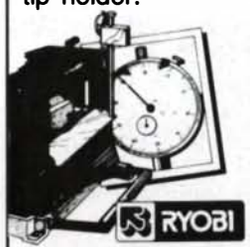

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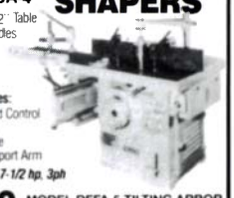

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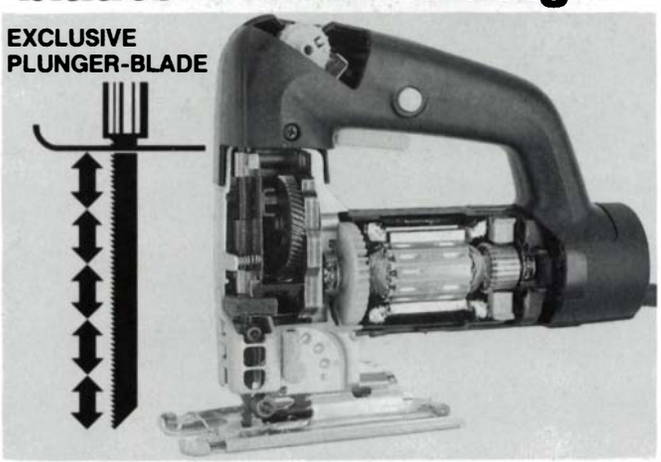

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The Taunton Press Books and Videos
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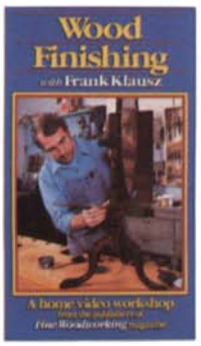
Finishing



Video

Wood Finishing
with Frank Klausz

Learn finishing directly from a skilled professional—in your own home, at your own pace. Here, Klausz shows how to use a smoothing plane, a scraper, and sandpaper to prepare a surface for finishing; how to choose between oil, alcohol, and water stains; and how to apply tung oil or spar varnish for maximum penetration and then carefully build coats for a quiet yet durable finish. You'll also learn how to spray lacquer with professional results and French-polish your work to an exquisitely glossy finish. *110 minutes, $39.95 (Rental: $14.95)*
#603 (VHS), #604 (Beta)

"By the end of the video, you have a good understanding of not only what to do, but why."
—VIDEO CHOICE MAGAZINE

Adventures in Wood Finishing
by George Frank

A master wood finisher shares the secrets and stories of a lifetime in the trade. During the 1920's and 1930's, George Frank was one of Europe's most sought-after craftsmen, and he tackled an incredible range of finishing jobs for an equally incredible array of customers. To meet these challenges, he developed a host of ingenious techniques, many of which are recounted here.

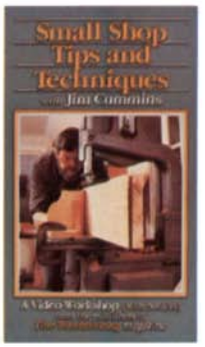
Along with the colorful stories, you'll learn about everything from how old-timers brewed dyes from plant extracts and chemicals to the culmination of Frank's search for the perfect wax; from a mirror finish that shines to an "antique" finish that fools the experts. *Hardcover, 128 pages, $10.95*
#14

Fine Woodworking on Finishing and Refinishing

How can you control the shine of varnish on wood or achieve the glossy black finish of a fine piano? What's the best finish for a salad bowl? When should you stain? When do you need to use a filler, and how? In this collection of 34 articles reprinted from *Fine Woodworking* magazine, finishing experts explain their formulas and methods, and reveal the secrets of their craft.

You'll learn about 18th-century varnish resins, milk paint, gilding, smoke finishing, and more. Plus, in selections from the magazine's Questions & Answers column, the experts answer woodworker's questions about every aspect of finishing wood. *Softcover, 112 pages, 83 photos, $7.95*
#48

Small Shop



Video

Small Shop Tips and Techniques
with Jim Cummins

Learn how to use common tools and machines to achieve uncommon results. A booklet includes notes and sources of supply. *60 minutes, $29.95 (Rental: $14.95)*
#625 (VHS), #626 (Beta)

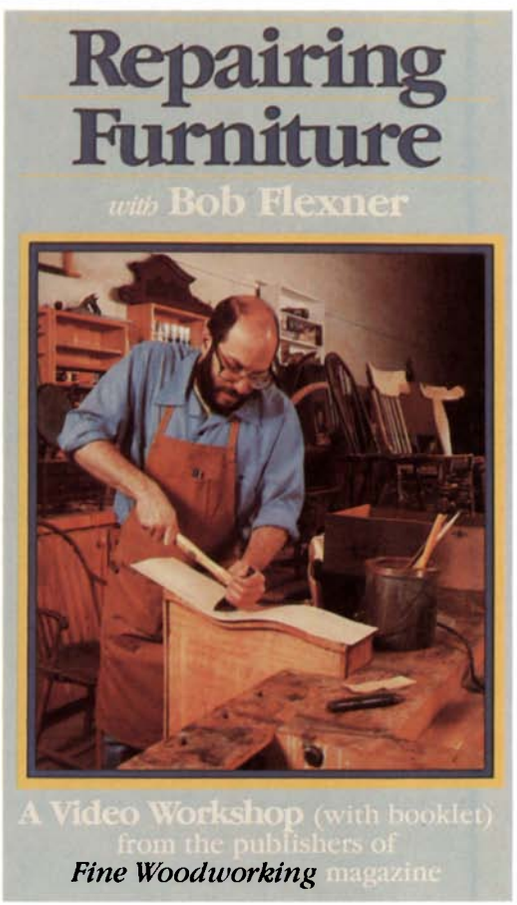
Fine Woodworking on Hand Tools

Straight-from-the-shop information about choosing, using, and making hand tools. Thirty-eight articles from *Fine Woodworking* magazine offer advice about saws, edge tools, marking and measuring devices, and more. *Softcover, 112 pages, 174 photos/105 drawings, $7.95*
#51

Fine Woodworking on Planes and Chisels

Twenty-nine *Fine Woodworking* articles tell you what you want to know about the most important tools in your shop. Expert craftsmen explain how they choose, sharpen, and use almost every kind of plane and chisel. *Softcover, 96 pages, 149 photos/118 drawings, $7.95*
#34

AWARD-WINNING VIDEO



The accolades continue. First, *Repairing Furniture with Bob Flexner* won the American Video Conference award for the best craft video in 1987. Now, *Video Choice* magazine has awarded it five stars in the September issue.

In this tape, expert furniture restorer Bob Flexner demonstrates a vast repertoire of straightforward techniques you can use to repair furniture. Among the things you'll learn: why wood joints fatigue, how to clamp problem pieces like round tabletops, disassemble pieces safely, choose the proper glue, mend broken parts, match missing moldings, and reglue or replace damaged veneer. Best of all, you'll learn to repair furniture without sacrificing its character or introducing new problems. And you won't need an elaborate workshop or extensive experience to perform your repair work. With Flexner's easy-to-follow instructions and the information in the accompanying booklet, those wobbly chairs and banged-up bureaus are as good as fixed. *70 minutes, $29.95 (Rental: $14.95)*
#619 (VHS), #620 (Beta)

To order from The Taunton Press, use the attached insert or call 1-800-243-7252.

CLOSE UP

Explore the strengths and traditions of the world's greatest workbenches. Scott Landis calls on the insights and discoveries of skilled craftsmen the world over as he examines benches for every kind of woodworking and every kind of shop—from a traditional Shaker bench to the mass-produced Workmate®. You'll read about workbenches for cabinetmakers, boatbuilders, carvers, and country chairmakers—from Japan, Scandinavia, England, and rural America.

***The Workbench Book* includes:**

* 19 pages of measured drawings and full plans for 4 benches.
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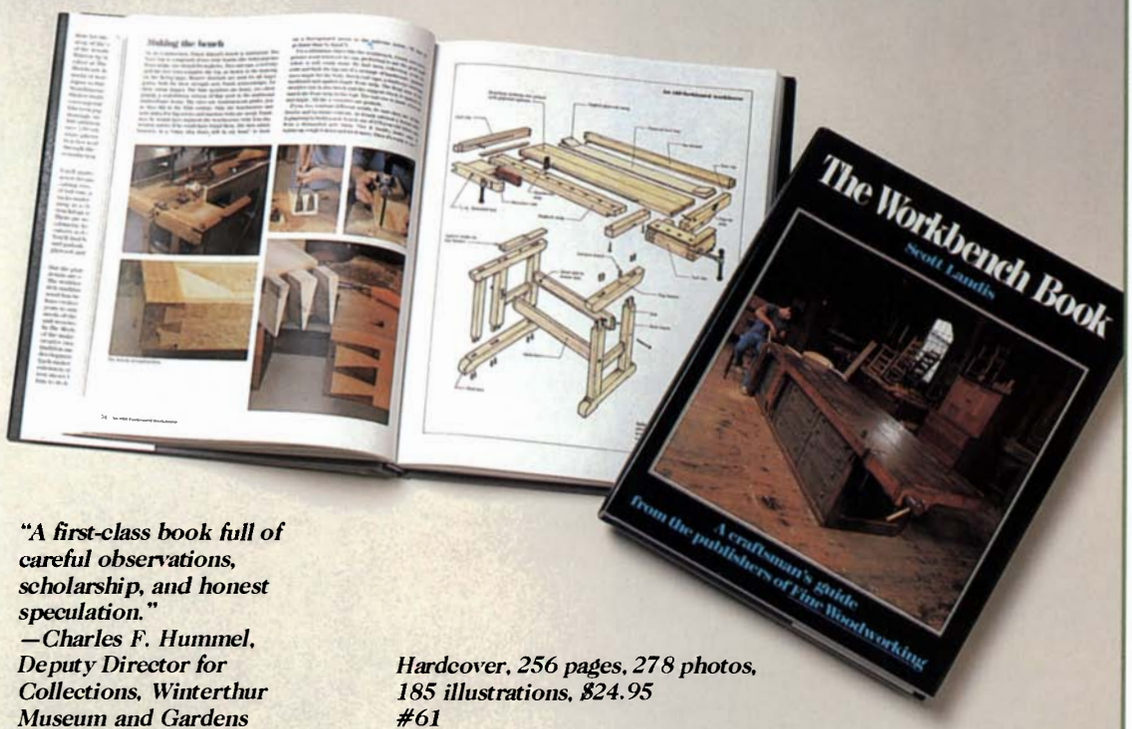
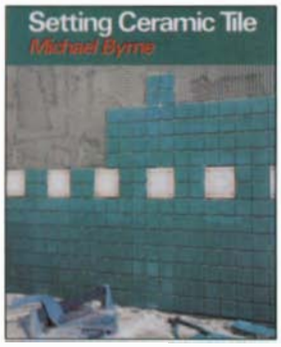
* Detailed coverage of over 70 benches of all levels of complexity.
* Two chapters on vises.



"A first-class book full of careful observations, scholarship, and honest speculation."
—Charles F. Hummel, Deputy Director for Collections, Winterthur Museum and Gardens

Hardcover, 256 pages, 278 photos, 185 illustrations, $24.95
#61

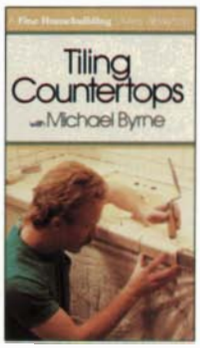
New Tilesetting Series



Setting Ceramic Tile
by Michael Byrne

At last, a clear, comprehensive book on tilesetting. Master tilesetter Michael Byrne begins with the basics: the varieties of tile available, the tools, setting methods, surface preparation, and layout techniques. He then guides you step-by-step through a series of actual home installations—floors, walls, and countertops. For each type of project, he demonstrates both the popular thinset method and the traditional thick mortar-bed technique. He also provides information on repairs, problem installations, and sources of supply.
Softcover, color, 240 pages, 127 photos/113 drawings, $17.95
#53

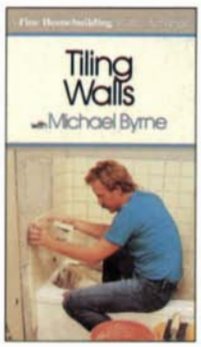
Note: All tapes are keyed to Byrne's book with page references right on the screen.



Video

Tiling Countertops
with Michael Byrne

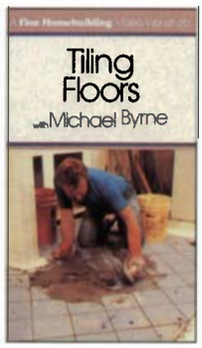
Watch professional tilesetter Michael Byrne demonstrate his craft. In this tape, Byrne shows you how to use traditional techniques and modern materials to tile attractive, easy-to-clean countertops. You'll learn how to prepare and work with backer-board and mortar-bed substrates, lay tile around a sink, and detail your countertop for a clean, crisp look. A great introduction to tiling. *60 minutes, $29.95 (Rental: $14.95)*
#627 (VHS), #628 (Beta)



Video

Tiling Walls
with Michael Byrne

Once you learn what Byrne has to show you, you'll be able to tile any wall in your house. Byrne covers all of the techniques you need, from laying out to grouting. Working on a bathroom job site, he shows you how to handle out-of-plumb walls; maneuver around bathtubs, plumbing, and windows; cut tile using biters and a snapcutter; and see the creative possibilities in awkward situations. *75 minutes, $29.95 (Rental: $14.95)*
#629 (VHS), #630 (Beta)



Video

Tiling Floors
with Michael Byrne

From basic procedures to special techniques, Byrne shows you how to tile a floor that lasts. The focus is on a watertight bathroom floor and a sloping shower pan, but the techniques can be applied anywhere in your home. You'll learn how to prepare a surface for tiling, how a border can simplify a diagonal layout, how to mix and float mortar, and how expansion joints keep your floor from cracking.
60 minutes, $29.95 (Rental: $14.95)
#631 (VHS), #632 (Beta)

Save $5 on each tape that you buy with Michael Byrne's book.

Just write the discounted price ($24.95) on your order form.

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NEW BOOK AND VIDEO SET

Introducing... a foolproof system for making Eurostyle kitchen cabinets

No matter what the size of your shop or level of your expertise, you can now make kitchen cabinets that are better than the most expensive "designer" cabinets. Paul Levine's new book and video will show you how.

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These Eurostyle cabinets are designed to fit the needs and style of any kitchen. Strong enough to take whatever abuse you and your family can dish out, they share features with some of today's highest-quality furniture:

- dovetailed drawers that slide silently out without dropping
- doors that close flush with the cabinet and swing completely open on hidden hinges
- fully adjustable shelves
- colorful laminated surfaces that are easy to clean
- warm wood trim that ages gracefully

Foolproof System

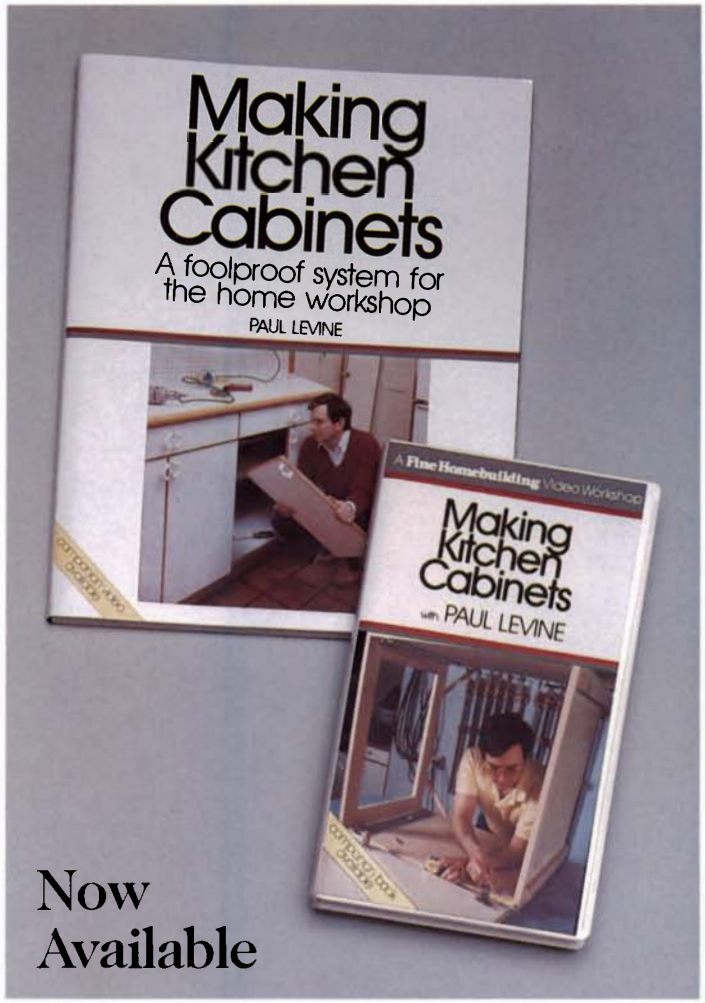
Levine has worked out an innovative system that lets you make these cabinets simply and economically in your own home shop. Adapted from the 32mm-system in Germany, Levine's method doesn't call for any elaborate tools or special machines. All you need are a tablesaw, a router, and a few hand tools, plus some top-notch European hardware you can purchase locally or through the mail-order companies listed in the book.

Best of all, Levine's system actually anticipates mistakes and allows you to compensate for them as you go. You'll be able to make quick work of the routine case construction and, if you're so inclined, devote your skills to design details.

Book and Video Set

The book covers everything from planning your kitchen to installing the finished cabinets, offering detailed photographs and instructions every step of the way. There's even a list of sources of supply for tools and materials. The tape brings you right into Levine's small basement shop to see for yourself just how straightforward and forgiving his construction methods are. By watching him make one complete cabinet, you'll learn how to produce a whole kitchenful. Page references to the book are on the screen, so you can quickly refer back for detailed information.

Together, the book and video offer a wonderfully complete way to learn Levine's system. What's more, the set price of just $39.95 is a small price to pay for so much practical information—especially when you consider the cost of a kitchen remodel these days.



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The Book: 192 pages, 80 color photos, 100 illustrations, $17.95
#67

The Video: 60 minutes, $29.95
#633 (VHS), #634 (Beta)

Order your book/video set today.

To order from The Taunton Press, use the attached insert or call 1-800-243-7252.

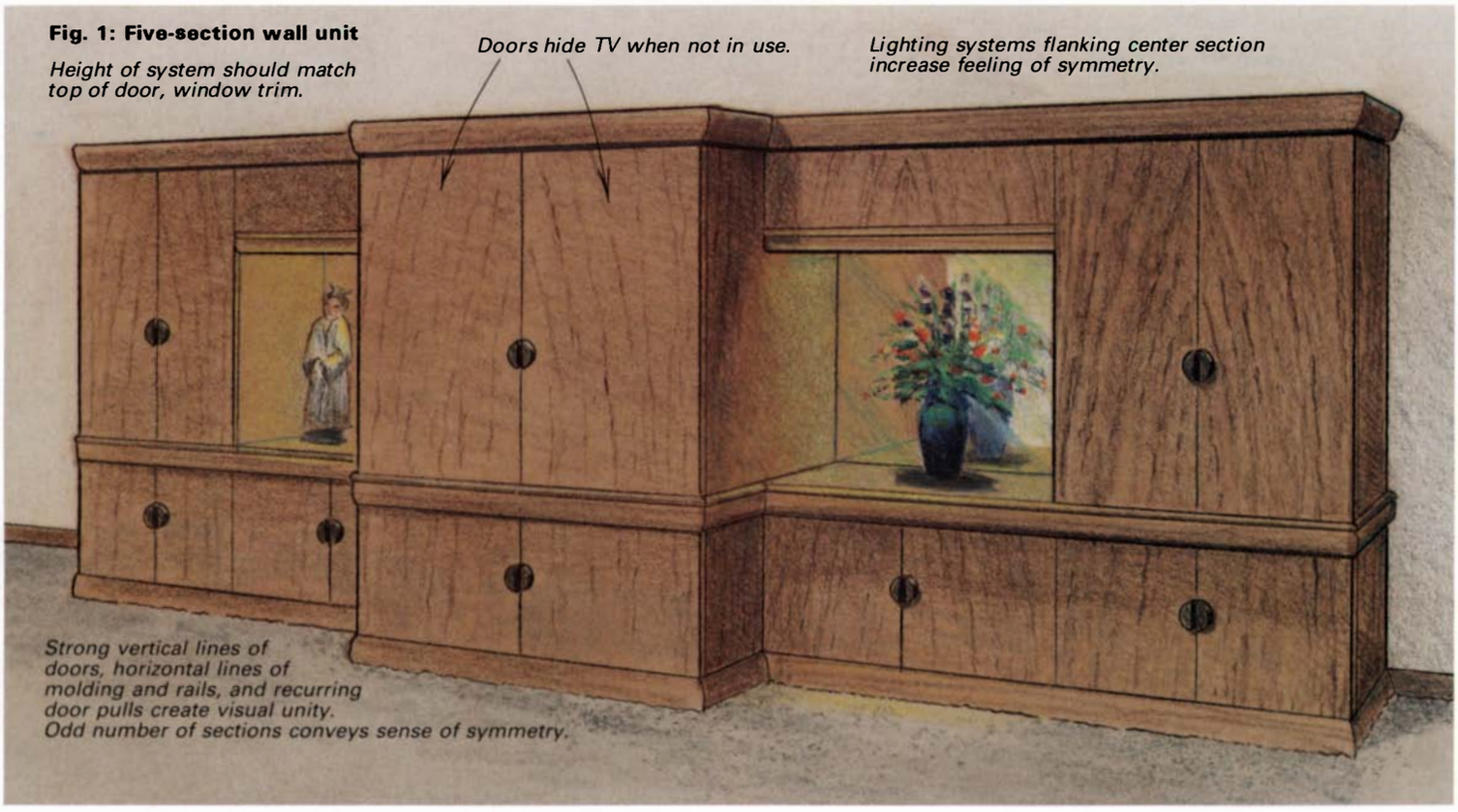
This cherry-and-rosewood wall system was designed by Larry Dern of Trinidad, Calif., to fit into a contemporary great room. The unit is 7 ft. tall and 10 ft. wide and holds stereo components and art objects. The doors and drawers operate on touch latches, so no hardware is visible. Each door is covered with book-matched, ⅛-in. shop-cut veneers; the rosewood is cut so its grain follows each facet of the piece. A recessed light installed in the glass compartments gives the piece a warm glow.

Designing Wall Systems

Creating harmony among the electronic gismos

by Jay McDougall

Photo above: Patrick Cudahy Studio



The popularity of wall units and entertainment centers has soared to unprecedented heights in recent years. Designers have long relied on wall units to consolidate everything from sideboards, bars, china cupboards and display cases into space-efficient furniture pieces, but the whole idea got a tremendous boost when component audio equipment came into vogue in the 1960s. The components originally rested on bricks and boards, fruit crates and other contrivances until the tangle of wires, plugs and connectors lead to present-day entertainment centers, like the one shown at left. Now that audio/visual components are becoming even more common and more compact (large-screen televisions being the glaring exception), we find ourselves at a juncture where wall units and entertainment centers are becoming more integrated. We have entered the age of "wall systems."

These wall systems are an important part of my business as a designer and builder of custom furniture. I've found that many people consider wall systems too formidable for do-it-yourselfers. In fact, building a wall system is more comparable to building a scaled-down house than to building furniture. Both a house and a wall system must be livable, aesthetically pleasing and in tune with their environments. And both must be able to withstand generations of everyday use.

Once the system is analyzed and broken down into components, the actual construction isn't very difficult. Rather than present a "how-to-build-a-wall-system guide," I'll concentrate here on helping you organize your efforts to *design* acceptable wall systems. First, I should admit I'm biased toward movable wall systems. After all, constructing a built-in on site is more akin to finish-carpentry than furniture building. In this mobile society, clients want to take their custom-built pieces with them when they move. Besides, a movable system can be designed to look and function like a built-in.

A movable wall system can be constructed in separate units in your shop. I recommend a minimum of three side-by-side sections for large wall systems. An odd number of sections (3, 5, 7, etc.) establishes symmetry within the system. The middle section should be the widest, with the "wing" sections becoming succeedingly narrower. This visually stabilizes or balances the wall system. I think a movable wall system, like any piece of furniture, depends on quality joinery: Mortise-and-tenon, tongue-and-groove or dovetail joints ensure the wall system will withstand hard use and numerous relocations. Wall systems should be built with backs to create the look and feel of quality furniture and to prevent racking and twisting, especially while being moved. To achieve a built-in look, the only required on-site work is the positioning and fastening together of the individual sections. Unless you enjoy living dangerously, leave about 1 in. between the system's sides and the walls, and between the top of the system and the ceiling to ensure the system will fit. The trim boards used to cover these gaps will complete the built-in appearance.

Architecture of wall systems—"Form follows function" is the rule here, but I find the designing flows the smoothest if I first study the installation site to get a feel for the wall system's form. I begin with a broad view and slowly tighten the focus to concentrate on minute details. A wall system located under the peak of a vaulted ceiling, for example, may need strong vertical elements to establish a feeling of height, or it may interplay with the ceiling through the use of triangulation or an angular facade on top. A curved staircase might be complemented by a wall system with curved and sweeping lines; a bay window works well with a breakfront design; even window shapes and moldings can provide starting points for your design. You should use compatible drawer fronts, edge lippings, mullions and trim throughout the system to establish strong horizontal and vertical lines that will hold the system together visually (see figure 1 above). This sense of architectural unity becomes an integral element of the wall system, instead of appearing as a facade that was slapped on as an afterthought.

Room size will often set the pace. If you're dealing with a large

Photo above: Allan Smith; photo at right: Andrew Dean Powell

room, you and your client will have virtually unlimited design freedom. You may choose a design that harmonizes with the rest of the room by using like tones, colors and simple lines, thus creating a functional wall system that doesn't draw much attention to itself. Or conversely, you can fit the system with all sorts of bells and whistles to make it dominate the room. This second option seldom works in smaller rooms. This doesn't mean a wall system will necessarily make a small or cluttered room even more confining. The wall system will reduce the available floor space, but remember, its primary function is to impose order. This improved space utilization should increase a room's feeling of spaciousness. Strengthen this feeling by sticking to light-color woods in small rooms; darker colors shrink the room and make a large wall system overpowering. You must also keep the design very simple, as there will be no room, visually, for any excess.

When surveying the wall system's proposed location, pay special attention to these details:

Forced-air heating and cooling vents—When vents are located on or near the floor, you must either avoid this location, have the vent moved, vent through the toe kick or design around the vents. Don't build a floor-to-ceiling system if the vent is on or near the ceiling. Working around the vents might mean suspending the system on the wall, leaving an opening or large kneehole in a lower section or ducting the vent through the system (which sacrifices valuable space). If you must vent heat through the system, avoid locating the heat duct near electrical components, artwork or anything else that may be subject to thermal damage or deterioration, unless you can insulate the "heat duct" with rigid foam, spun fiberglass or other insulating material.

Electrical outlets, switches and thermostats—If there is no handy electrical outlet, one must be wired in. The amperage of the outlet must exceed the total amperage consumption of the system's audio/visual components, lamps, display lighting and other equipment plus allow for future expansion. Light switches and thermostats may need to be moved to accommodate the wall system. Actual wiring details are beyond the scope of this article. With any electrical work, make sure you comply with local building codes; if necessary, hire a licensed electrician to help you.

Baseboards or mopboards—Most people prefer the back of their wall systems to sit flush against the wall. If a baseboard or mopboard is present, scribe and cut the profile of the molding into a vertical trim board that can be tacked in place at installation. If there's a cornice molding on the system, it should extend beyond the back edge of the side to avoid a gap when the trim board is applied. An alternative to a trim board is to build the system with a shallow false back that will allow you to scribe the baseboard profile directly into the system's end sections. This creates a problem if the wall system is moved to a different location with different molding. In that case, you'll have to scribe a trim board to hide the cutout and fit the wall.

Furniture—Determine what other furniture will be in the room and where it will be located. In smaller rooms, there may not be enough space for large hinged or pocket doors to be used in the lower parts of the system; design the section to have no doors, narrow doors with a small radius of swing or sliding doors.

Ceiling height—Except in libraries, most wall systems are not floor-to-ceiling pieces, so you'll have to determine the height of the system. Again, use architectural elements as reference points. With few exceptions, I build wall systems so they reach the top of the door trim or window trim.

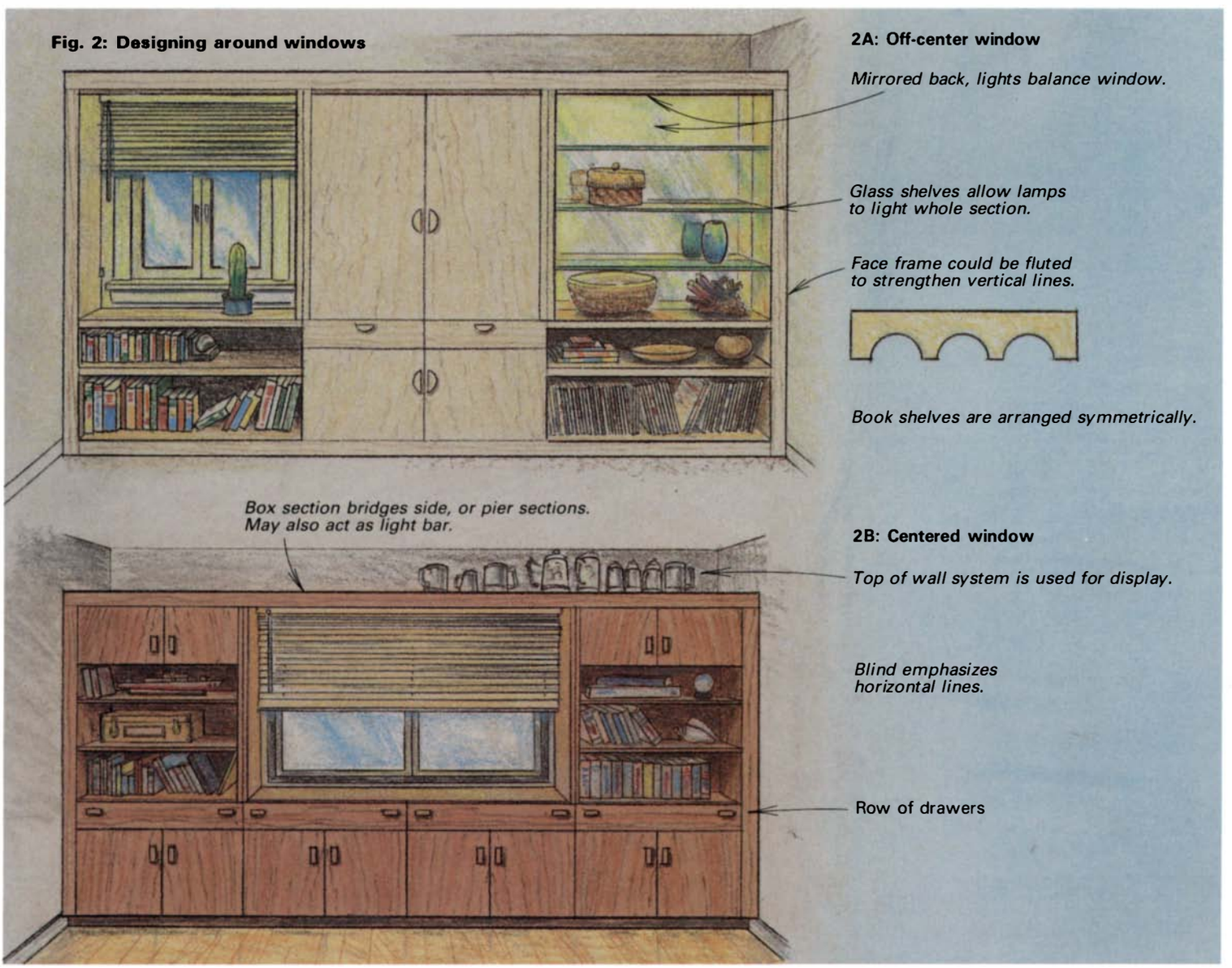
Windows and other openings—You needn't steer clear of a window, protruding fireplace mantel or doorway, as shown in the photo above. The only difference between a window space and the space allocated for any other component is that it won't need a back. Large windows may be put into context by the framing of the adjacent component spaces, as shown in the drawing at right, and the top may be bridged with either a box beam, which might include lighting for a display area, or with a small horizontal shelf or storage space (depending on available headroom.) Smaller or off-center windows are a good excuse for an asymmetrical design, or to create rhythm and balance by repeating this space across the width of the wall system. As you can see in the photo on the facing page, even obstacles like a curved wall need not interfere with the design of a wall system.

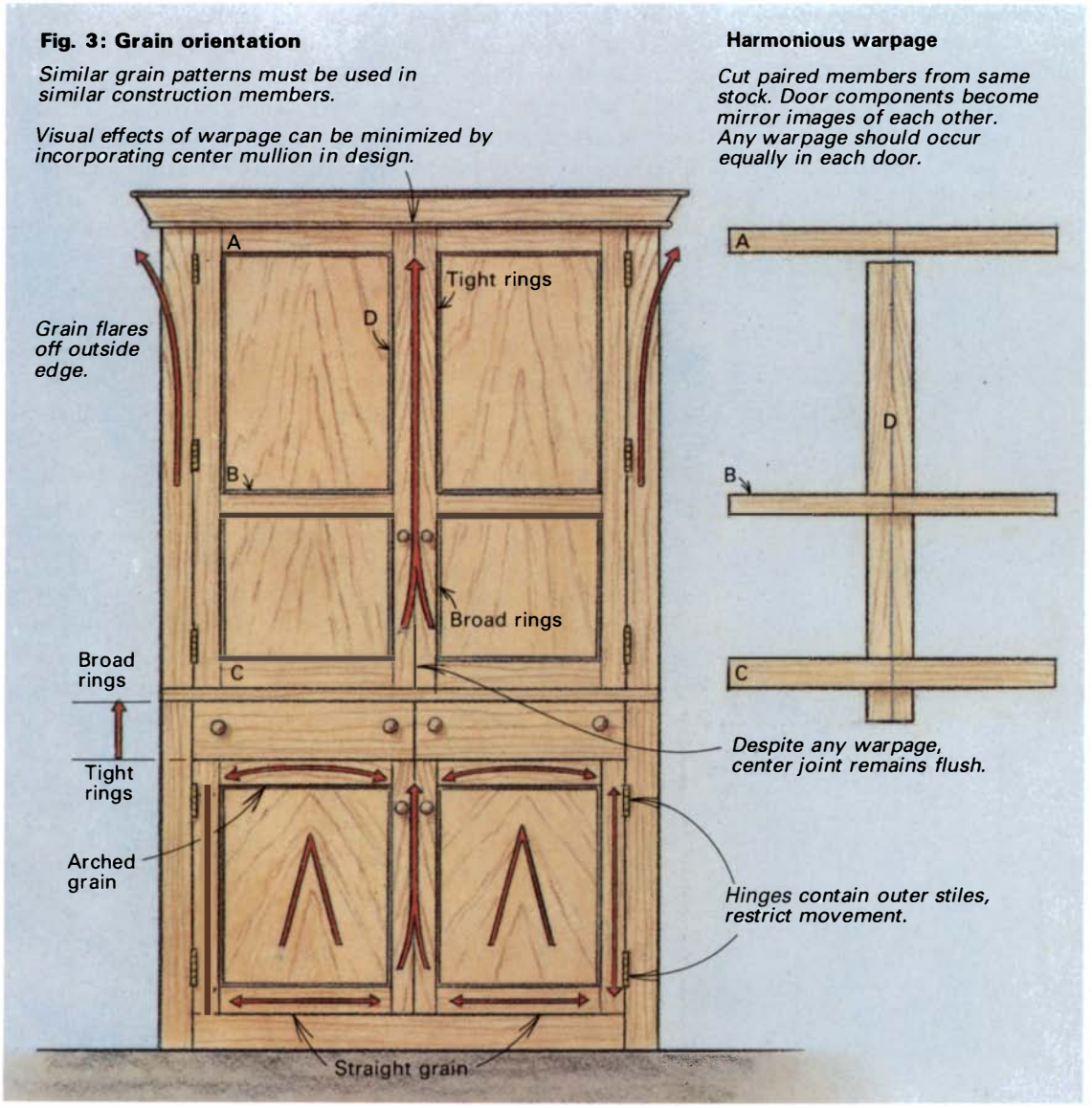
Doors, windows, fireplaces and other apparent obstructions can be attractively framed by wall systems. Allan Smith, a cabinetmaker in Pennington, N.J., designed this wall system, left, to accentuate the lines of an old-fashion doorway. The system is built from Andaman padauk accented with ebonized poplar inlays, which strengthen the visual unity of the piece. Wall systems can be designed to work with any sort of room, as shown with the stereo cabinet below. To fit the cabinet to the curved wall, designer/woodworker Philip Bird of Dorcester, Mass., bent-laminated the avodire doors and end pieces. The sawn-to-shape plywood top and bottom are veneered with kevazinga (which resembles bubinga).

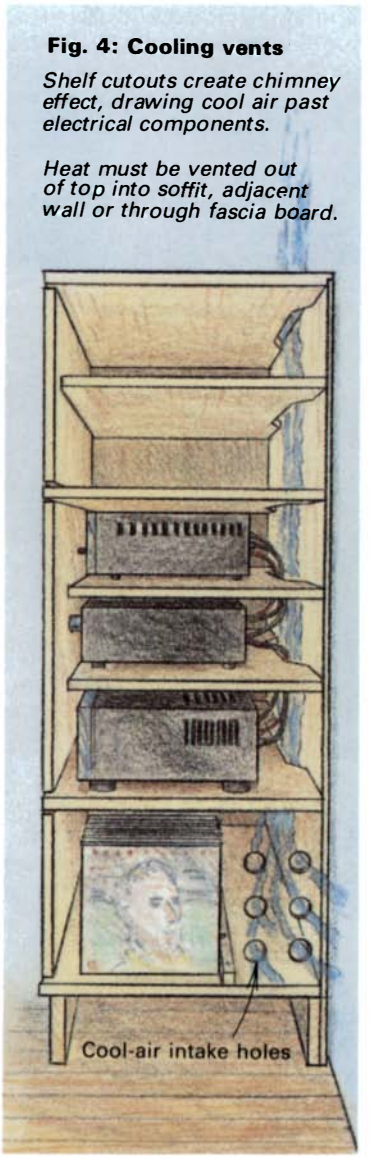
Locating components—Once you determine how to fit the system into the room, you must decide how much space is needed for audio/visual components, storage areas, display areas, book shelves and serving areas. Your client should have a good idea of how the system will be used. I have built systems ranging from 8 ft. to 20 ft. in length and find space allotments are mainly a matter of common sense. Electronic components that are used in conjunction with one another, such as televisions and VCRs, should logically be placed near each other. Tapes, CDs and videocassettes should be stored near the proper machine, but don't store magnetic tape (audiocassettes or videocassettes) near components that contain strong magnets (televisions) or produce damaging magnetic fields (electric motors). Components that must be operated manually are best positioned somewhere between waist and shoulder level. Televisions that utilize external speakers must be positioned in between the speakers; otherwise, all the TV characters will seem to be talking from the sides of their mouths.

Unless space is at an absolute premium, avoid tailoring the space for each component too tightly. Electronic components are sure to become obsolete or replaced much more frequently than a wall system. I think the absolute minimum space allowance is 1 in. on either side of each component. I also recommend installing as many adjustable shelves as are possible without affecting construction. I support adjustable shelves with ¾-in. to 1-in.

Fig. 2: Designing around windows







shelf pins cut from brass brazing rod (available at any welding supply house). I find a regular pattern of small diameter holes (usually 1/16 in. to 5/32 in. in diameter) in the carcase side is much less conspicuous than metal tracking or the standard 1/4-in.-dia. shelf pins. I also cut short grooves on the bottom sides of shelves to accept the small diameter pins; this conceals the pins and secures the shelf from front to back.

Wood selection and layout—Success when building wood wall units depends on controlling warpage and using the wood's grain pattern to its best visual advantage. Assuming you use the accepted joinery methods mentioned before, the only warpage that may create a problem will be in "uncontained" members, such as free-floating adjustable shelves and doors. I highly recommend plywood with solid edgebanding or veneered panels for shelves. I always build frame-and-panel doors to minimize potential warpage. Even so, I prefer to place a center mullion between the closing edges of large swinging doors. Without this mullion, the doors will meet stile by stile, and otherwise-insignificant warpage might become glaringly significant.

To minimize the risk of warpage in doors where a center mullion can be used, I try to use straight quartersawn stock for the rails and stiles. For a pair of doors, I start with a board wide enough to provide both top rails—likewise for the bottom and intermediate rails and stiles. Be sure to mark the outside faces as you saw the stock; flipping one piece over will defeat your purpose. By cutting paired members from the same stock, you will have rendered a pair of doors that are, in terms of warp potential, mirror images of one another. This is not only aesthetically pleasing, it will also result in what I dub "harmonious warpage," as illustrated in figure 3. Any warpage that does occur should happen equally in both doors, resulting in a flush, albeit slightly bowed, center joint.

The inherent beauty of wood makes it possible to execute even a relatively poor design and have it appear somewhat attractive. But don't count on this cop-out to work every time; instead rely on careful planning to transform a good material into a great object. When gluing up solid panels and edgebanding plywood, the objective is to produce a panel that appears to be either one continuous piece of lumber or a combination of book-matched elements; most woodworkers are already familiar with these techniques. Effectively orienting the grain in a wall system's "one-piece" members (face frames, stiles, rails, trim boards, etc.), as shown in figure 3 above, is a much subtler technique. Basically, you must be consistent; similar grain patterns are always used in similar construction members. For instance, if you are building frame-and-panel doors, you can use relatively straight-grain wood for the stiles and bottom rails, and choose pieces with an arched grain for the top rails.

Handling wiring—Cutouts in the back of a wall system's lower sections can provide access to wall outlets. Horizontal and verti-

cal connections between electrical components within the wall system can be made several ways. By building the wall system with a shallow, false back and boring holes in the backs of sections housing electrical components, you can thread patch cords in one hole and fish them out another, which effectively hides unsightly cord webs. For vertical connections, either leave an adequate distance between the back edges of shelves and the wall system's back, or bore holes near the rear of the shelves to pass cords through. These holes also increase ventilation and aid in cooling electronic components, as discussed below. The only practical way I have found to make horizontal connections from one section to another is to bore holes in the sides of the sections. Also, the electronics boom has spawned many new products for making clean connections. I buy mine from Doug Mockett & Co., Inc. (Box 3333, Manhattan Beach, Calif. 90266). The company offers a complete line of grommets that transform ugly wire access holes into things of beauty. Also available are grommets for paper-feed cutouts and wire managers that go a long way toward cleaning up the "wire webs."

Lighting options—Large display areas are most often lighted from the top, commonly by mounting a light(s) behind a fascia board along the top front of the enclosure, or by recessing "can lights" into the top of the enclosure. If you use can lights, you must provide space for recessing them; the amount of headroom varies with the make of the light, but 6 in. is fairly common. Check the manufacturer's instructions and local building codes before installation. This headroom space must be left open or adequately ventilated to avoid excess heat buildup.

Lighting a stack of shelves presents some problems. Unless the shelves are glass, any light generated from the top of the enclosure will be terminated at the top shelf, leaving the lower shelves dark. There are several ways to avoid this problem. One is to place horizontal aprons under the front edges of each shelf and mount individual lights behind these aprons. Another is to run a horizontal piece along either the top or bottom rear edge of each shelf and mount lights behind these boards, which will backlight the shelf spaces. This latter method creates an interesting mood effect, but it doesn't provide enough light for an effective display. Both these lighting systems should be installed with fixed shelves because of the amount of wiring that will be required.

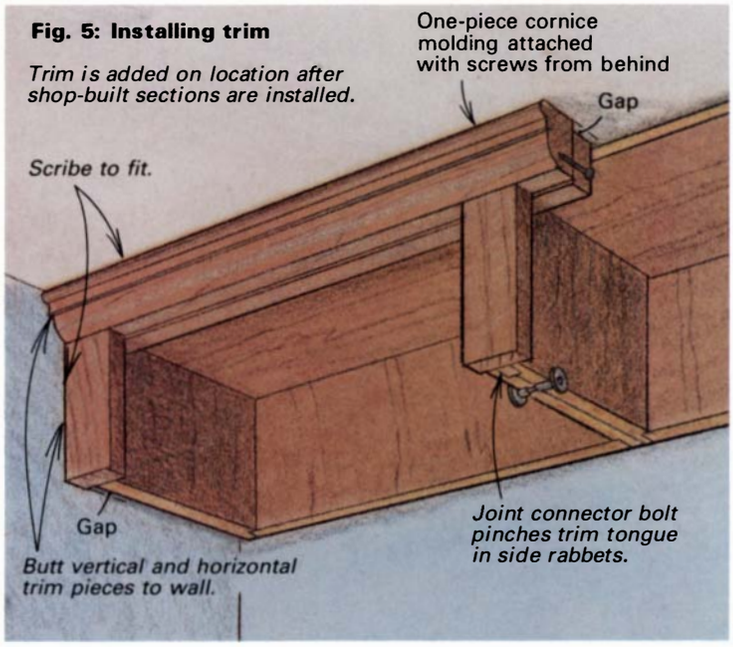
Another way to light solid adjustable shelves is to use a vertical face frame that's wide enough to mount and conceal a vertical tube light or series of individual lights. This method lets you light display items from two sides, and it also allows you to maintain a thin line in the frontal view of the shelves.

Whenever possible, external lighting, such as recessed ceiling spots, track lighting, floor or table lamps, should be used to supplement the internal illumination of the wall system. The added cost can be significant, but it results in a much more flexible lighting system and allows the client to emphasize different sections of the wall system, and room, at different times.

Cool electronics—Modern high-efficiency components don't generate as much heat as their predecessors, so they rarely need whisper fans to ensure adequate ventilation (see "Stereo Equipment Cabinets," *FWW* #34, p. 77). Most of today's systems can be adequately cooled by the convective flow of air past the components, which can be created by providing an unobstructed path, like a chimney, for air movement into the lower portion of the component's enclosure, and up and out through the top of the enclosure. To be sure, however, you should always check the manufacturer's recommendations for specific pieces of equipment. The average depth for most modern components is about 15 in. If these components are placed on 20-in.-deep shelves, the rear 5 in. can be connected to a "hot-air chimney" by notching the shelves as shown in figure 4 or by boring a row of 1-in.-dia. holes. These openings also provide a good route for patch cords and wires between components. If the wall system is to be built snugly against the walls, floor and ceiling, the heat will not have anywhere to go. This may be rectified by venting the heat into a soffit, adjacent wall or concealed vent on the front of the wall system. Another way to control heat is to avoid stacking components directly on top of one another. Providing separate shelves for each component, or placing them side by side, prevents the direct transmission of heat between components.

Fig. 5: Installing trim

Trim is added on location after shop-built sections are installed.



Installation—I bolt individual sections together with joint connector bolts and cap nuts (available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374), as shown in figure 5 above. Not all houses were built square and the ones that were can settle out of plumb (finished basements can be especially troublesome), so only use adjustable hinges. If there is a chance that the floor at the site is not level, include levelers on the wall system's base sections. On The Level Co., Inc. (1401 Timber Drive, Elgin, Ill. 60123) has come up with a slick self-adjusting leveler that uses a spring-loaded cam action to take the wobble out of tables; it also works well with wall systems on floors that are not severely warped or wavy.

Rarely, if ever, will all of the above criteria apply to any one wall system. Use whatever applies to your given situation. One final note: Take precise measurements of the system location and of the route that will be taken in delivering a movable system. Individual components must be able to fit through doors, up or down staircases and in and out of elevators. Allow yourself an extra inch here and there. If you have any doubts, make a trial run with a cardboard or stick mock-up of the largest section. I once missed fitting a section up on an odd-shape staircase by ½ in.; I had to remove the three bottom steps, move the unit and then reassemble the stairs. Even worse, I'm obligated to repeat this costly maneuver if the client moves. □

Jay McDougall is a furniture designer and builder in Fergus Falls, Minn. He wrote about wooden door and drawer pulls in FWW *#64.*

Barred-Glass Doors

Epoxied miters instead of tiny tenons

by Mac Campbell

There are few door treatments as decorative as barred glass. Traditionally found in large china cabinets and bookcases built in the 18th and 19th centuries, authentic barred-glass doors have been replaced in most modern furnishings by a pattern-cut plywood frame that's laid over a single pane of glass. This modern fakery is, no doubt, due to the tedious process of making the lattice for authentic barred-glass doors. Ernest Joyce, in *The Encyclopedia of Furniture Making*, details several traditional framing methods, including dovetails, veneer keys, and mortises and tenons. Since frame members are usually very thin, such joinery can quickly strain both the patience and the eyesight of the most skillful cabinetmaker.

Fortunately, modern adhesives offer an alternative to fakery and eyestrain: Quick-setting epoxy is strong enough to replace hundreds of tiny, elaborate joints at the lattice intersections with simple glued miters. This speeds up the building process tremendously. The two doors on the desk-bookcase I built, pictured on the facing page, contain 88 separate pieces of wood and 38 panes of glass, yet their construction wasn't tedious and required only reasonable care. To illustrate the improved process, I built a duplicate set of doors; the principles outlined here can be adapted to virtually any style or pattern of barred-glass door.

A barred-glass door consists of an outer door frame surrounding a lattice of straight or curved bars that meet at angles to form a decorative pattern. Each bar is made up of two layers: a rib, which divides the panes of glass, and the bar molding, which caps the rib, stiffens the lattice and acts as a stop for the glass. After the ribs are glued together with epoxy, the bar moldings are mitered and installed on top of them. The completed lattice is then set into the door frame, and the individual glass panes are fitted and held in place with glazier points and putty.

Designing the doors—You begin with a detailed drawing of the lattice pattern. The initial sketch need not be done full-scale; working out proportions is often more useful at this stage than determining exact measurements. To design the doors for the desk-bookcase, I divided the space inside the door frame into fourths widthwise, the outer fourth being split evenly on the left and right sides. Similarly, I divided the pattern in half the long way and made it symmetrical between the upper and lower halves. To simplify making the lattice, I designed the pattern so the ends of all bars need mitering at only two angles: 45° and 22½°.

Before you cut out any door parts, you must decide on the shape and size of the ribs, bars and door frame (see figure 1). Whatever molding profile is shaped on the inner edge of the door frame must also be used for the bars; otherwise, the miters will not match where the bars join the door frame. For my door, I chose ½-in.-wide bar moldings with a ¼-in. radius, half-round profile and a quarter-round with the same radius on the inside door frame. The width of the bars isn't critical, but they should be wide enough so that half the width less the thickness of the rib (joined to each bar in the middle) is adequate to conceal the glazier's points and putty that hold the glass. Since the back of the bars will be grooved to slip over the ribs for a stronger frame, I make the ribs as thick as the kerf of a carbide sawblade and groove the bars ⅛ in. deep on the tablesaw. The width of the ribs is not critical, as long as they provide enough room for the putty. I make my ribs ⅝ in. wide, which leaves ½ in. after the bars are fitted. The thickness of the assembled ribs and bars will partially determine the thickness of the door frame (see figure 1). Plan the depth of the rabbet in the door frame so the ribs will be even with the back surface of the door frame when the lattice is installed: It's not absolutely essential, but it looks better and the putty will be neater when the glass is set.

Construction—I build the door frame that will hold the lattice using standard joinery, usually mortise and tenon, though dowel or plate joinery would also work. I prefer to glue up the frame, then rout a rabbet for the glass on the back side and then rout the desired molding profile on the front. Since the router can't reach all the way into the corners, I must do some carving to square up the rabbets and face moldings, but this isn't much trouble. If you prefer, the door frame can be shaped with cope-and-stick cutters on a shaper first, then assembled—as long as you can duplicate the molding profile for the bars. Whatever your method, make each door frame true, square and flat.

After the frame is glued up, I trace the outline of the door opening at the edge of the rabbet onto a piece of plywood. This will serve as a full-size pattern of the door-frame opening and as a base for constructing the lattice. Lay out the pattern for the bars, marking their centerlines on the plywood with a pencil. The ribs will be laid out on these centerlines first, but because they're so thin, it's unnecessary to draw in their actual dimensions. Once you have the pattern drawn, darken the lines, then cover the plywood with waxed paper. This will keep the frame parts from sticking to the plywood as they're glued together.

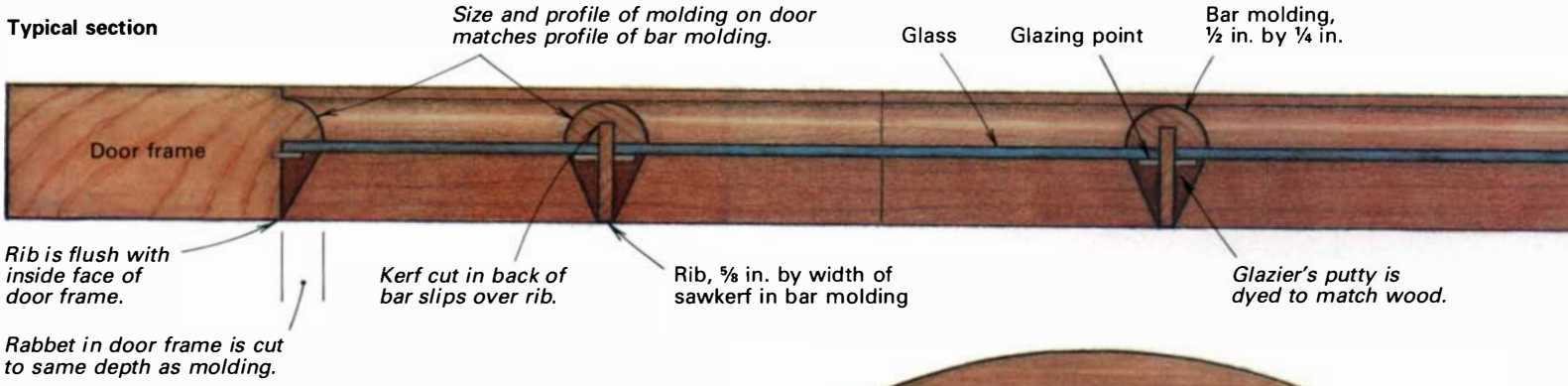
Now you're ready to mill the rib and bar stock. This can be done with a tablesaw and a router or shaper, or with whatever combination of tools you have. It is important to mill all the lattice stock as accurately as possible, because small variations in width or thickness make getting clean joints difficult. Mill considerably more of both bar and rib stock than you think you'll need so you can discard any pieces that warp or are miscut.

A small miter box is handy for cutting the ribs and essential for

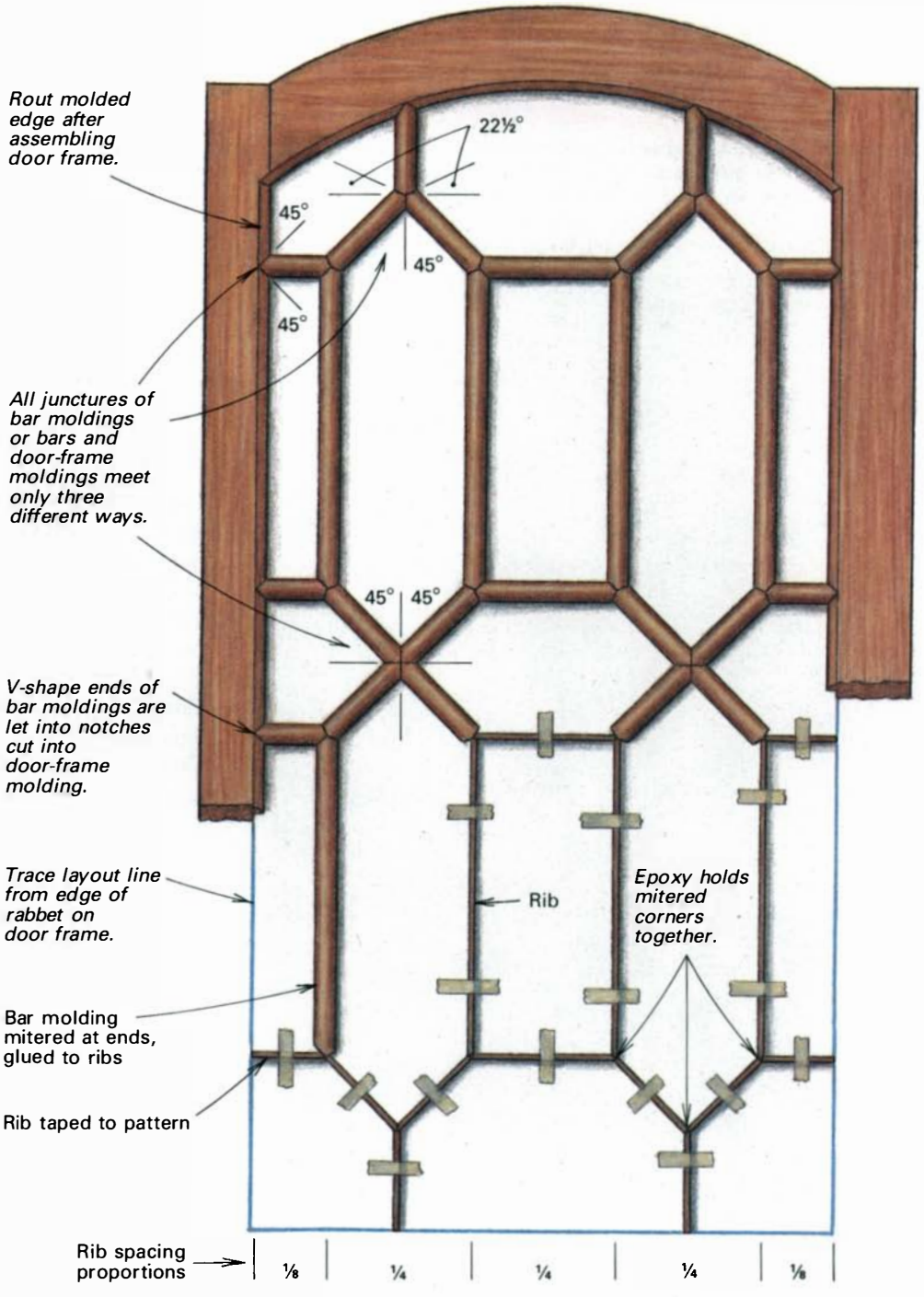
Drawings: Lee Hov

Fig. 1: Frame anatomy

Typical section



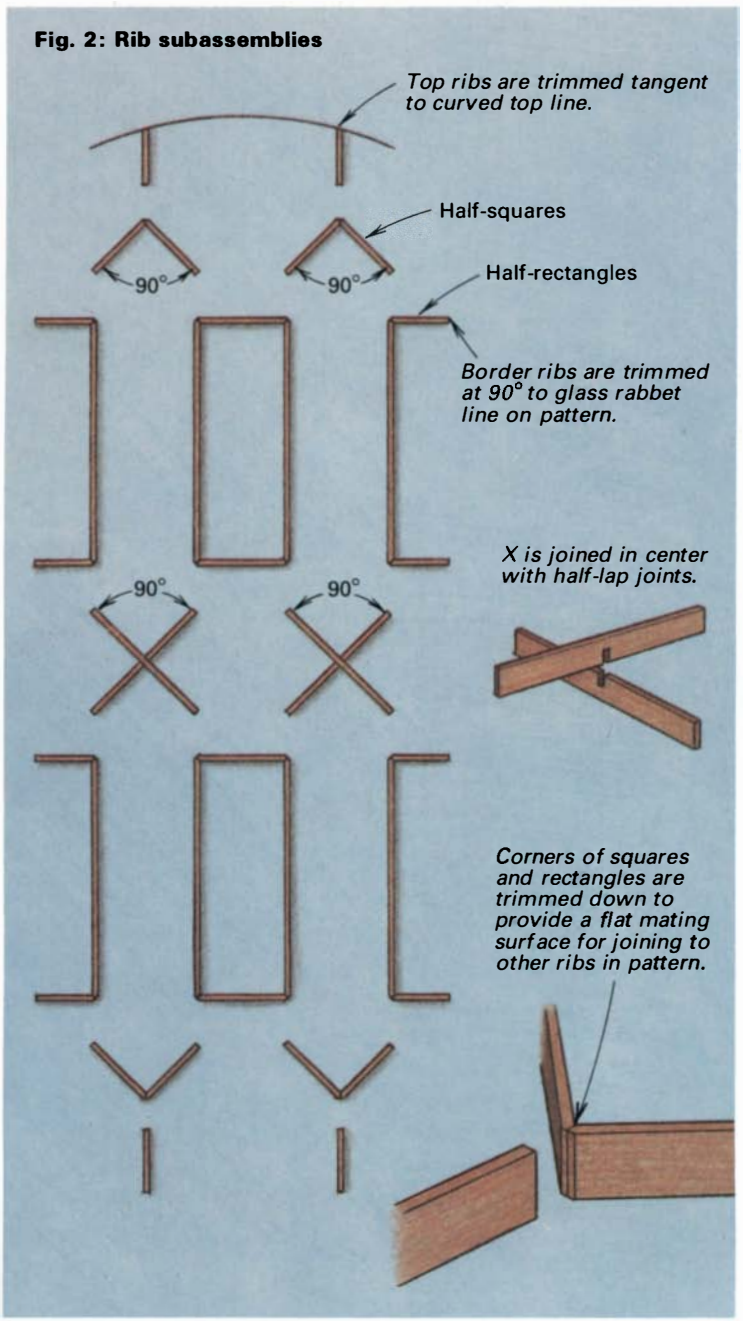
This Chippendale-style desk-bookcase built by the author is enhanced by the visual detail in its pair of barred-glass doors. Though complicated looking, making the doors is simplified by building the lattice frame in subassemblies and using quick-setting epoxy to join the rib frames (in lieu of traditional joinery.)



Underside of typical molding bar

The author made two special miter boxes to cut the angles on the ends of the ribs and bars. The box for the ribs, shown here, has a few stopped holes to provide a place for a finger to hold the thin rib steady while sawing. The other box is made the same way, with a wider groove to accept the bars.

Fig. 2: Rib subassemblies



cutting the more complex miters on the ends of the bars. I made up two miter boxes just for the job: one for cutting ribs and one for the bars. Cut a channel in each miter box to hold each type of stock snugly and slot the boxes for cutting 90°, 45° and 22½° angles with the finest saw you have. (I use a 21-t.p.i. dovetail saw.) Drill several large stopped holes in the rib miter box so your fingers can hold the thin stock while it's being cut.

Rib subassemblies—Instead of cutting and gluing up the lattice of ribs as a series of separate pieces, it will simplify the joinery and speed up the construction if you consider the lattice pattern as a set of connecting geometric shapes: rectangles, squares and X's (see figure 2). In my pattern, the upper half of the door has a large rectangle in the center and two half-rectangles on each side. These are connected on top by half-squares that form the top points. The lower half of the window is designed the same way, with the top and bottom halves joined by two X's.

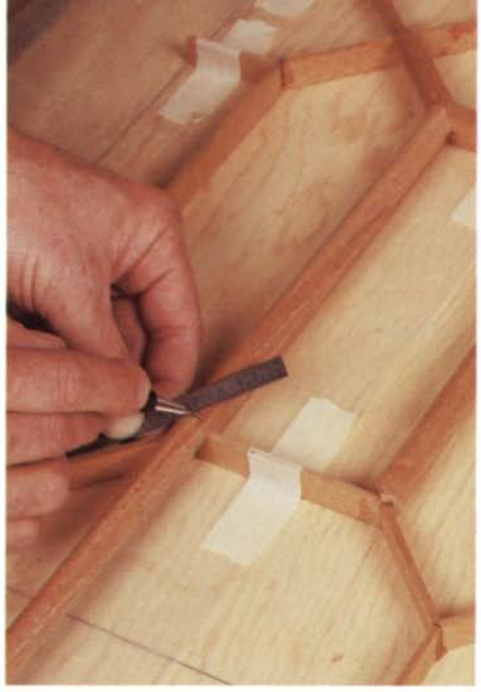
The rectangles and squares are constructed with simple glued-miter corner joinery. After the four pieces, say for a rectangle, have been cut to length and mitered, lay a strip of masking tape sticky-side-up on a sheet of waxed paper taped to the workbench. Place the four parts of each rectangle outer-face-down on the tape with their ends just meeting, and align each rectangle with a straightedge. Leave some extra tape at one end. Mix a small batch of five-minute epoxy, butter all the joints and fold the ribs together, as shown in the top, left photo on the facing page. Close the last joint with the tape that's left sticking out, and put a small weight on the glued assembly to keep it flat as it sets. If the miters are accurately cut, the rectangles will square themselves, but check by measuring the diagonals, just to be sure. Prepare all the rectangles and squares this way, and remove the tape when the glue has dried.

Cut two of the rectangles in half on their short sides, and cut the two squares apart at opposite corners. Lay these components on the pattern board. The corners of the rectangles will have a rib joining them at 45°, as will the corners of the half-squares. Chamfer these corners to create a flat for a butt joint with the rib. I use a disc sander for this, eyeballing the angle, but a sharp paring chisel will work just as well. Each of the two X's for each door are joined in the middle with half-lap joints. Cut these joints to fit snugly, then trim the ends of the X's to fit the pattern. After a section of the pattern is trimmed and fitted, mix up a batch of epoxy and glue the separate components together, then tape them down to the pattern board with masking tape to keep them in place.

After the entire rib frame is done, check to see that the ribs that meet the door frame are flush with the edge of the line that marks the glass rabbet. Trim and square these if necessary, and test-fit the door frame over the assembled ribs. The door frame should fit over the ribs securely, and it's better to have it a little tight than to end up with gaps between the ribs and frame. Wherever epoxy has squeezed up above the top edge of the ribs at the joints, sand it down flush, using a sanding block to keep things flat. Don't worry about squeeze-out around the rest of the joint; the putty will cover everything nicely when the glass is set.

Fitting the bars—The bars are fitted on top of the ribs next. As you can see in the drawing on p. 49, there are only three possible ways the bars meet in the lattice and only two possible end angles to cut: 45° or 22½°. Start with any rib in the pattern and mark and cut the two miter cuts on one end of a length of bar stock. Lay the bar on top of the rib and follow the centerline of the rib to mark the miter angle with a sharp pencil at the juncture of the ribs in the point of the miter. With the special miter box, cut the

Gluing up the ribs in a series of subassemblies is more accurate and faster than gluing the ribs together individually. Once the parts are cut to length and mitered, they're stuck to tape, the joints are buttered with five-minute epoxy and the parts are rolled up to form the subframe—in this case, a rectangle.



After one end of the bar molding has been mitered and fitted into the pattern, the other end can be marked. Using a pencil and ruler, sight where the point of the miter will be (the final length of the bar), and indicate on each half of the mitered point whether it's to be cut at 45° or 22½°.

After the bars have been glued to the ribs, the molding on the door frames must be notched out to accept the mitered ends of the outer bars. Lay the door frame over the lattice and mark each bar's centerline. Saw or chisel out each notch, cutting it a little undersize at first and then trimming to fit.

two miters so they intersect where your pencil marks cross. Mark the other end the same way (see the middle photo above), making sure the already-trimmed end is butted tightly into its corner. Fit the bar in place and continue on with an adjoining piece. For the bars that will meet the door frame, cut two 45° miters on their outer ends. The points formed by these cuts should just reach the end of the underlying ribs. Remove the masking tape holding the ribs to the plywood as you go along, replacing it as necessary to keep everything lined up. It's likely that some bars won't fit all the way over the ribs because of glue squeeze-out in the corner. Rather than trying to remove the hardened epoxy, relieve the miter tip next to the dado groove on the bottom of the molding (putty will cover this later).

I don't glue any of the bars on until the entire pattern is done, but you can glue as you go along if you prefer. To glue the bars, I use regular aliphatic-resin (yellow) glue—it's more than strong enough and it makes removing squeeze-out easier. Once all of the bar moldings are glued down, take a few minutes and clean up any squeeze-out. Then, sand the faces of all joints flush and trim the edges of any moldings that don't line up.

To fit the assembled lattice into the door frame, first lay the frame on top of the lattice. The glass rabbet should be resting on the pointed ends of the bar moldings. Mark each bar's mitered end on the molded edge of the door frame (see top, right photo above). Remove the frame from the lattice and cut out the mitered notches in the door-frame molding with a dovetail saw, leaving them undersize for the time being. Untape the lattice from the base and place it into the door frame. Now, carefully saw down through the miters with a very thin saw (a razor saw is best), angling it slightly so the two pieces will fit together snugly. Repeat this process around the door and gradually work the bars into a good, snug fit. Alternatively, the notches in the door-frame molding can be trimmed with a chisel and a guide block, as shown in *FWW* #64, p. 37. Whatever method you choose, try to avoid having to fill the joint later, as this will spoil the clean look of the bars flowing smoothly into the door frame. When everything is ready, glue the lattice into the door frame with yellow glue. Even though every joint is endgrain, I don't use epoxy for this final assembly, mainly because its open assembly time is so short and the strength of yellow glue is more than adequate for the job.

A barred-glass door with curved bars is made up in much the same way as the method described above. Because they are reinforced by the thicker bar moldings, the thin, curved ribs may be bandsawn instead of bent. The stock for the bars is bent-laminated around a form, then shaped with a router or shaper, as with straight stock. One difference from straight bars is that the dado on the back of a curved bar must be cut with a router, not a sawblade. It's easiest if the router is mounted in a table for this operation, and you'll want to match the thickness of the ribs to the bit you'll use. Also, cutting the miters is trickier than with straight stock, because you can't use a miter box. A sharp paring chisel or knife and some patience will do the trick.

Glass and putty—Once the door has been hung on the cabinet and is completely finished (lacquered, oiled, etc.), it is ready for the glass. Beveled glass is often seen on period pieces, but it's expensive, and I think the lattice gives the door more than enough visual interest. You can take the doors to a glass shop and have them cut plain glass panes to fit, or you can give the shop cardboard patterns to work from. If you make patterns, leave about 1/16-in. clearance to the frame on each side and make sure to mark which pattern fits which opening—in case there are variations in the frame. Unless you're an experienced glass cutter, let the pros handle this tedious job. The glass is held in place first with glazier's points, and then it's glazed with putty colored to match the frame wood. David Pine gives an excellent outline of this process in *FWW* #64, p. 40.

Once completed, barred-glass doors add a distinctive elegance to casework. They reward the effort required to build them generously, setting a piece well apart from the average run. □

Mac Campbell owns Custom Woodworking in Harvey Station, N.B.

Cordless drills are light, powerful and extremely handy tools either in the workshop or on the job site. The 11 cordless drills surveyed and tested by the author and his shopmates represent a cross section of the drill models and features on the market.

Cordless Drills in the Workshop

A survey of 11 battery-powered tools

by Mark R. White

I don't remember when I first saw cordless power drills on the market. They seemed to be expensive battery-powered gadgets that I'd never use in my own shop. But, being a sucker for new tools, I purchased a cordless drill a few years ago, and now I wonder how I ever got along without one.

Since then, cordless drills have brought many changes to my five-man woodworking business, and we now use them for a variety of jobs. They're great for drilling holes for anything from adjustable shelves to dowels, countersinking screw holes and for driving screws when assembling cabinets and setting hardware. These battery-powered tools are light and amazingly powerful. Most have removable batteries that recharge quickly, and because they don't require a wall plug to run or have a bulky cord trailing after them, they're extremely handy. Cordless drills are also safe to use outdoors in wet or damp conditions. In my shop, we always keep three cordless drills set up and ready to go: one with a drill bit, one with a Phillips screwdriver bit and one standing by for whatever task's at hand. We use these tools constantly and rarely use AC-powered portable drills anymore.

The cordless-drill market has expanded considerably in the last few years, and now it seems that every tool manufacturer offers an extensive line of battery-powered drill/screwdrivers, some designed for the home user and some for the professional. Various models have subtly different features that can confuse the first-time buyer. Though I'm sure many woodworkers have never considered buying a cordless drill, even the occasional user could benefit from one. For this article, I surveyed the market and selected 11 cordless drills and tested them for eight months. I've summarized my evaluation of these tools and made a chart of their respective features at the end of this article. The drills I chose to test aren't all equal in terms of features or price range, but are representative of what's available. I'll describe what features cordless drills offer and how our shop tested the drills.

Batteries—At the heart of a cordless drill is the battery, which is made up of several small batteries sealed in a plastic housing. Each manufacturer has its own battery-pack design—they're not interchangeable between brands or, often, between different models of the same brand. Battery packs range in voltage from 4.8v to 12v, with 7.2v and 9.6v being the most common. The nickel-cadmium (ni-cad) batteries inside the packs are rechargeable and have a lifespan of between 300 and 800 charges. With each cordless drill comes a battery charger, which converts 110v household current into DC voltage to replenish the battery. It takes only about an hour to go from a dead battery to a fully charged one. All chargers have an internal switch that turns off the current when the battery is full, so you can keep a battery in the charger, ready for use. Remember to let a battery drain completely before recharging it: Ni-cad batteries have a "memory," and if you recharge a partially drained battery often, the battery's capacity will be reduced to the amount of the partial charge.

In addition to being rechargeable, most battery packs are removeable. The pack mounts either in the handle or the back of the drill body, and is held in place with a quick-release clip. Drills with removable packs let you use the tool while the extra battery is recharging, but continuous use and frequent charging can reduce battery life. Removability also lets you replace a pack when it finally won't hold a charge. In addition to drills, several manufacturers offer entire lines of cordless tools with fully interchangeable batteries. In our shop, we have a Makita cordless drill/screwdriver, a 3-in. circular saw, a jigsaw and a flashlight (the most powerful we own), all of which use the same 9.6v battery pack.

Cordless drills are surprisingly powerful, even when compared

The removable battery packs on most cordless drills slide out of the grip or body for recharging, as shown here with the Makita 6093D (left) and the Milwaukee 0212-1 (right). The Makita's battery is shown in its dedicated charger, shown at far left. For continuous operation, one battery can be recharging while another battery is in the drill.

By offering a grip that's in line with the chuck, a cordless drill can be less fatiguing to hold, and it can thus allow the user to put more pressure behind the bit. Here the author uses a Makita 6093D to drive screws during the screw-driving and drilling tests performed for the survey.

to their corded counterparts. While the drills with higher-voltage battery packs generally deliver higher performance for a longer time than drills with lower-voltage batteries, all of the drills we tested are capable of a respectable amount of work. While more powerful batteries give the added performance a professional woodworker may need, voltage alone shouldn't be the only reason to choose one drill over another.

Size and feel—Because of their battery packs, cordless drills are bulkier than AC-powered drills, but the best are light, easy to grip and well balanced. Most drills house the battery in the bottom of

An adjustable clutch allows a cordless drill to regulate sensitively the maximum amount of drive torque delivered to the chuck—great for driving screws to the same depth. The Bosch cordless (top) has a clutch-adjusting collar just behind the chuck, while the Ryobi's (bottom) is under the body.

While all the cordless drills in the survey have chucks with a ⅜-in. maximum capacity, some drills, like the Skil (right), have chucks that will hold 1/32-in. bits or smaller. The cordless Metabo (center) features a special screw-driving bit holder that replaces the chuck and also allows bit change without a key. Chucks with knurled collars, such as on the Ryobi (left), make it possible to chuck up smaller drill bits without using a chuck-key.

the handle, which counterbalances the weight of the body and reduces the drill's length. Though all the cordless drills are light—averaging 3½ lbs.—some are more comfortable to grip than others. Generally, when the grip is more in line with the chuck rather than below its center, the drill is easier to control. Cordless drills with greatly offset handles tend to break drill bits more readily. When trying different models, look for a grip that fits your hand comfortably.

Adjustable clutch—Many cordless drills have an adjustable clutch, which automatically disengages the chuck at the chosen torque setting. This limits the amount of force delivered to the bit and prevents the DC drill motor from stalling and overheating. The clutch also makes the drill more useful as a screwdriver, because it keeps screws from being overdriven, having their slots stripped or their heads snapped off. When driving small screws, for example, a low-clutch setting will let you sink all the screws to the same depth. Cordless drills usually have four or five clutch settings, plus a direct-drive setting for regular hole boring without a clutch. The lowest settings seem to slip too easily for most work, so in our shop, we usually set the clutch to a high setting and let off the trigger as soon as the motor begins to stall. For adjusting the clutch's torque setting, most drills have a rotating collar just behind the chuck, while other drills have a bottom-mounted dial. I find the latter less desirable, because you have to turn the drill over to see what setting you're on.

Speed control—Since cordless drills have a limited reservoir of power to draw on, it makes sense to regulate the speed and torque of the drill to the job at hand. To accomplish this, most cordless drills offer either two speed ranges, continuous variable speed or variable speed in two ranges. Two speeds are better than one, but variable speed is desirable for delicate boring jobs and for driving screws. Variable speed allows you to start and stop the drill slowly and smoothly, to control bit wandering and to avoid stripping out screws. Having two variable speed ranges makes a drill even more versatile. The faster speeds in the high range are best for jobs that don't require much torque—like drilling small pilot holes. The slower speeds in the low range provide the higher torque necessary for boring big holes or driving long screws.

Most manufacturers offer several models of the same basic cordless drill, one with each type of speed control, so if you don't need precise control, you don't have to pay for it. While variable speed is controlled from the trigger, drills with two speeds or speed ranges have either a dial or slide selector switch. With either type, speed range should be shifted while the drill is coasting. A couple of models feature an automatic electronic brake that stops the chuck almost immediately after letting off the trigger—great control for driving screws.

All the drills tested have forward and reverse drive to allow you to remove a jammed bit or back out a screw. The placement and operation of the forward/reverse switch, however, isn't optimum on all the drills. The switch is usually a lever or slide located near the drill's trigger. While it should be convenient and easy to operate, many of the switches were awkward to use. On several models, you needed two hands to flip the switch back and forth—a terrible tedium if you were running screws in and out while setting metal drawer guides. I liked the AEG forward/reverse switch, which is mounted on the handle's side just above the grip and is thumb-operated. But, it could be awkward for a left-hander to flip. Many drills also sport a trigger lock, which prevents a drill from accidentally turning on.

Chucks—Cordless drills have the same kinds of ⅜-in. chucks as their AC counterparts, and these chucks are typically high quality. But minimum chuck capacity varies considerably. Many drill chucks can hold 1/32-in. or even 1/64-in. bits, good for drilling tiny pilot holes. But a chuck designed for a 1/16-in. minimum bit might not hold that bit snugly once the jaws have worn. The AEG offers an optional, keyless chuck that tightens by hand-turning—a terrific timesaver. All the drills provide chuck-key storage on the drill. The problem is that the keys don't seem to stay put and therefore get lost easily.

Accessories—Though cordless drills come with a battery charger and screwdriver bit, many of the models have an extensive line of accessories. Porter-Cable offers a charger that runs off a 12v car battery—handy for using tools at a powerless job site. But before you rush out and buy all the gadgets, get the single most

important extra: a second battery. Waiting for the battery to recharge is the curse of cordless tools. In our shop, we always make sure there's a fresh battery in the drill and another in the charger.

Besides the usual assortment of fancy drill bits and screw tips, there are a few items worth buying. First is a magnetic screwdriver bit. Its magnet holds the screw by the head and leaves your other hand free to guide the drill. Tool holsters are available for most drills to keep a drill within reach. A molded-plastic or sheet-metal carrying case is a must if you often work outside the shop. Some cases afford storage space for not only the drill and charger, but also for an extra battery and an assortment of bits. Some cases though, like Skil's, are overly bulky.

The testing—My shopmates and I had a chance to test the cordless drills in the survey both in the shop, where we make custom furniture and millwork, and on the job site, where we do remodeling and finish-carpentry. After months of use, we performed two tests on all the drills to see how they compared in drilling and screw-driving capability. First, we drained the battery packs stone dead and then fully recharged them. In the screw-driving test, each drill was used to drive a 2½-in. drywall screw into the edge of a 2x4. We'd run the screws in and out (counted as one) until the drill wouldn't run another. Most drills gave out with little warning. In fact, any cordless drill's battery puts out fairly constant voltage until the charge is depleted, then it runs out suddenly. This is a good argument for having an extra charged battery on hand at all times.

After recharging the batteries, we drilled as many ⅜-in. holes through the thickness of a 2x4 as possible on a single charge. The drilling potential of most cordlesses was comparable to their screw-driving capability, but there are differences in performance due to gearing and speed range. When you look at the test results compiled in the chart on p. 56, remember that we pushed these tools to the limit, not something the occasional user will be likely to do, and not all the drills are in the same price range or designed for professional use. Also, cordless tool manufacturers claim that a battery pack might take four or five charging cycles to develop its full capacity, so your results may differ from our test.

Before we started the testing, we thought we could pick the best drill on the basis of performance and technical specifications alone. But after the tests, it was the minor differences that determined our preferences. Things like the weight or number of clutch settings weren't nearly as important as the ease of operation of the controls. Little design features made some tools feel like high-tech wonders, while others seemed like relics. Here are some observations about the drills we tried:

AEG EZ-506—This modern-looking drill has some nice features. The placement and action of the forward/reverse switch (just over the thumb when grasping the tool) is great for a right-hander, and the variable-speed trigger is smooth. The AEG houses its battery pack in the rear of the body, making for a smaller handle but increasing the length of the drill considerably, offsetting one's grip and spoiling the drill's balance. The AEG's relatively low gearing makes it slow to use, but the testing showed it to have good drilling and screwing capability for a 7.2v model. The bit and chuck-key storage container in the grip is a nice idea, but impractical for quick access. The AEG and the Milwaukee have electronic feedback circuits to keep motor speed at an optimum RPM.

Black & Decker 1985—This drill features good balance and a well-placed forward/reverse switch on the side of the grip. The single speed range didn't seem a drawback, and the drill ran smoothly and quietly. The 1985 is the only drill in the survey with a cast-metal (not plastic) gear housing, which probably has great durability, but the metal did get hot enough during continuous use to be uncomfortable to touch. The clutch adjuster behind the chuck is hard to turn.

Bosch 921VSR—The Bosch is a lightweight drill that's comfortable to hold, with your hand naturally grasping the body in line with the chuck. Its variable-speed trigger and front twist ring for clutch adjustment are well designed and well built, and the drill's relatively small size makes it maneuverable. This 9.6v cordless drill is almost identical to the discontinued 7.2v model, the 1921VSR, which we originally tested. The 921VSR, however, is a much more powerful drill, with better torque and higher RPM in both ranges. The Bosch was great for driving screws and drilling holes, and it had enough torque to perform both tests with the speed selector in high gear. The lever-type forward/reverse switch above the trigger takes some getting used to, but it flips easily, unlike the speed-range slide switch, which clunks between settings.

Hitachi DRC-10—The 7.2v Hitachi drill scored respectably in the screw/drill test. It provided smooth power and didn't stall once during operation. Unfortunately, the drill's long body spoils the balance of the tool. Also, the forward/reverse switch above the trigger is hard to flip with one hand, and we found the trigger guard to be more of a hindrance than a convenience.

Makita 6093D—This drill is a strong, thoughtfully designed tool. The drill's grip is comfortable and balanced, though it houses the drill's large 9.6v battery. The Makita has a convenient forward/reverse switch on the back of the grip that's thumb-operable with either a left or right hand. Though it was one of the leading performers in the testing, it did stall occasionally and trip its built-in thermal fuse, designed to prevent overheating. But this only happened when we pushed the drill very hard for the test. Also, the clutch was sometimes difficult to engage into the direct-drive position. The metal carrying case available for the Makita is compact yet spacious enough for the drill, charger, extra battery and scads of drills and screw bits.

Metabo D80/2VSR—This drill, manufactured in West Germany, feels well made and ergonomically designed. It's also well balanced and easy to grip. The Metabo ran through our screw/drill tests smoothly, and it performed extremely well for a 7.2v drill. It does feature a screw-driving bit holder, which replaces the chuck and shortens the drill. The chief complaints about the Metabo are that the speed-range knob requires a lot of force to twist, and the extra-large chuck-key that clips to the top of the drill for storage can get in the way. The behind-the-chuck clutch adjuster works smoothly, but the hanging clip at the rear of the body was a nuisance, so we removed it immediately.

Milwaukee 0212-1—The Milwaukee cordless drill had more-than-adequate power, but the plastic body felt flimsy and the handle was awkward to grip. Also, its gears made a grinding noise that sounded like someone shaking a bag of marbles. The Milwaukee's clutch (same as the one used on the AEG) was one of the smoothest we tested, though lower torque settings were very weak and suited only for driving the smallest of screws.

Porter-Cable 800—Aside from having a 9.6v battery, this drill is almost a carbon copy of the Metabo D80/2VSR, with exactly the same body. The Porter-Cable incorporates a shorter clutch collar,

Cordless drill test

Drill, model number	List price, (extra battery)	Battery voltage	Speed range (RPM)	Chuck capacity	Clutch settings	Carrying case	Test results Holes /screws drilled/driven
AEG EZ-506	$194 ($48.42)	7.2v	Variable 100 to 600	1/16 to 3/8**	5 plus direct	Optional plastic case	69 / 78
Black & Decker 1985	$199 ($48.35)	9.6v	Variable 0 to 800	1/16 to 3/8	4 plus direct	Plastic case with model 1987	102 / 99
Bosch 921VSR	$230 ($49)	9.6v	Variable HI, 0 to 900 LO, 0 to 400	1/16 to 3/8	5 plus direct	Plastic case	103 / 111
Hitachi DRC-10	$186 ($44)	7.2v	2 speed 300 or 650	1/16 to 3/8	5 plus direct	None	66 / 90
Makita 6093D	$124 ($48)	9.6v	Variable* HI, 0 to 1,100 LO, 0 to 400	1/16 to 3/8	5 plus direct	Metal case with model 6093DW	76 / 105
Metabo D80/2VSR	$274.95 ($47)	7.2v	Variable HI, 0 to 700 LO, 0 to 250	1/64 to 3/8	5 plus direct	None	79 / 77
Milwaukee, 0212-1	$229 ($61.75)	9.6v	Variable HI, 170 to 1,000 LO, 50 to 300	1/16 to 3/8	5 plus direct	Optional, plastic case	73 / 57
Porter-Cable, 800	$230 ($60)	9.6v	2 speed* 350 or 1,000	1/64 to 3/8	Direct or hammer	Metal case with model 9800	101 / 65
Ryobi, BD-1025R	$193 ($63)	9.6v	2 speed 350, 1,100	1/32 to 3/8	4 plus direct	Metal case with model BD-1025RK	73 / 88
Sears, 11132	$79.95 ($29.95)	9.6v	Variable 0 to 600	1/16 to 3/8	3 plus direct	None	134 / 114
Skil, 2735	$210*** ($55)	12v	Variable HI, 0 to 1,650 LO, 0 to 500	1/16 to 3/8	4 plus direct	Plastic case	90 / 94

*Electric brake **Keyless chuck optional ***Price includes case and extra battery

shortening its length, but it has the Metabo's shortcomings of stiff speed-range change and a giant chuck-key. The 800 model is a torque monster, and it drilled the highest number of holes during the testing, though it didn't do nearly as well driving screws. This power comes at the expense of weight: At 4.5 lbs., the Porter-Cable 800 is the heaviest drill in the survey. It is the only drill we tried with a hammer action for drilling in masonry. For its high price, the Porter-Cable is missing variable speed and an adjustable clutch, and it gives you only direct drive and hammer settings. But the 800 model and the Makita 6093D are the only drills in the survey with an electric brake that gives control for bit starting and screw driving.

Ryobi BD-1025R—The 9.6v Ryobi is a solid, powerful tool even though it doesn't offer variable speed or an adjustable clutch. It's also compact: Next to the Sears, it's the shortest drill we tested. Like the Metabo, Bosch and Porter-Cable, the Ryobi has a hand groove at the back of the body for gripping in-line with the chuck. The problem is, it's hard to press the trigger while holding the groove. The Ryobi's forward/reverse switch is easy to manage, either right- or left-handed, and the slide speed-range switch is positive and easy to engage. The Ryobi has a knurled chuck (also featured on the Porter-Cable) that is easy to grip and hand-tighten. This is a no-frills tool, but it has a few handy features, like a bit storage compartment.

Sears 11132—Despite its low RPMs and limited torque, the 9.6v Sears achieved the highest results in the screw/drill test. Even so, the drill has poor balance and a flimsy feel. The forward/reverse switch was very hard on the finger and felt like it was going to break off whenever switched. Also, the drill we tested would sometimes give only a high and low speed, not the continuous variable range it's supposed to. The Sears has three clutch settings, and even the highest setting slipped during the screw test, so direct drive had to be used. This is not a professional-duty drill, but it offers a lot of features and performs a lot of work for the low price tag.

Skil 2735—The Skil model 2735 replaces the discontinued 2725, a clutchless 7.2v drill that performed poorly in our screw/drill test. With its 12v battery, the newer Skil model (called the "Top Gun") features the highest-voltage battery in the sample and also the highest RPMs. However, we did kill the battery by using it continuously, and then recharging it before it could cool down. Although higher voltage batteries are more susceptible to this, charging any hot battery is not a good idea. The Skil is also felt to be poorly balanced, with a grip we found hard to hold comfortably for any length of time. Also, the recessed forward/reverse switch located above the trigger would get stuck occasionally while shifting. However, the speed-range switch on top of the drill body and the clutch adjuster knob on the underside of the body both operated smoothly and without fail. □

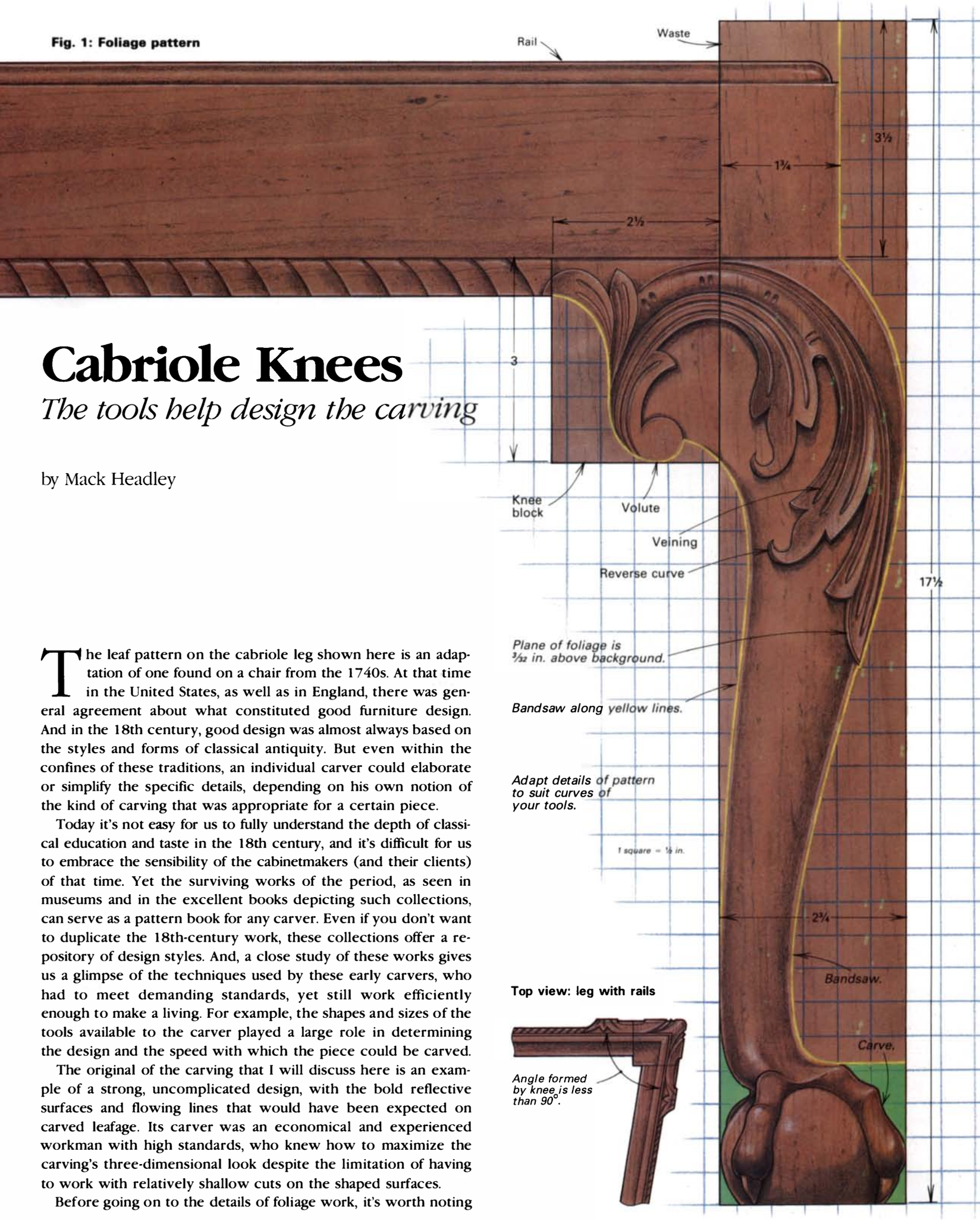
Mark White is a woodworker and runs FineLine Woodworking in Boxboro, Mass. His employees assisted with writing and testing for this article.

Cabriole Knees

The tools help design the carving

by Mack Headley

Fig. 1: Foliage pattern



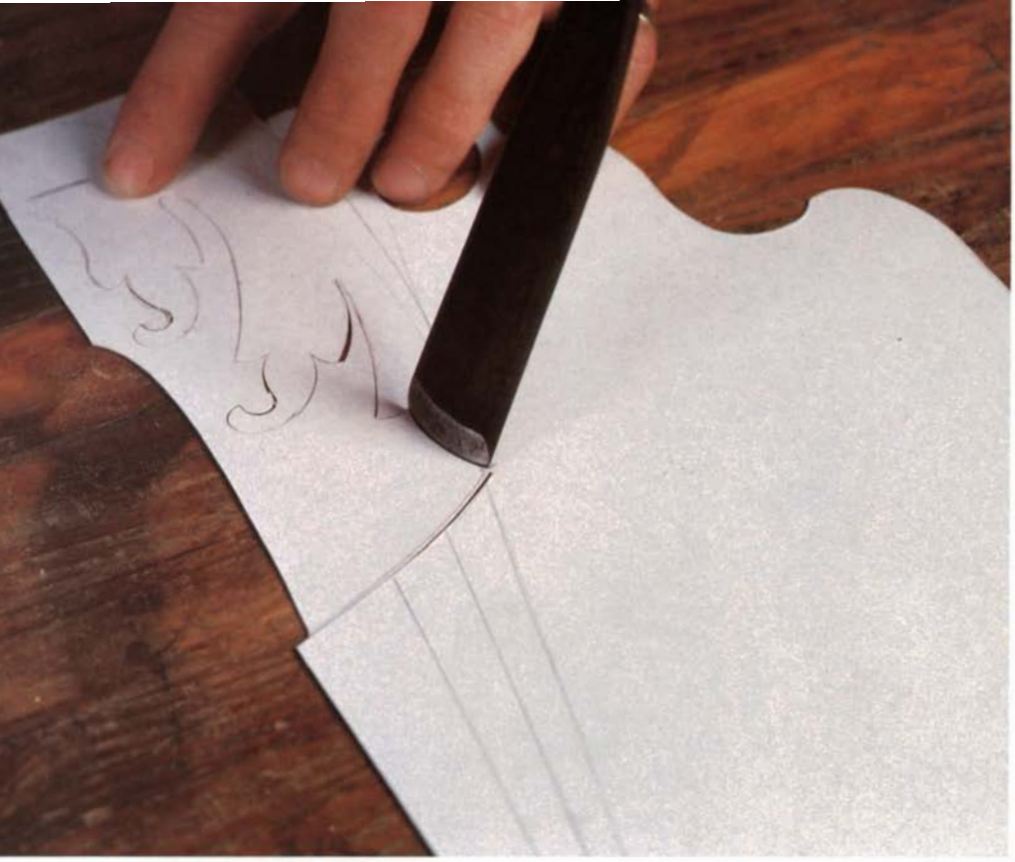
The leaf pattern on the cabriole leg shown here is an adaptation of one found on a chair from the 1740s. At that time in the United States, as well as in England, there was general agreement about what constituted good furniture design. And in the 18th century, good design was almost always based on the styles and forms of classical antiquity. But even within the confines of these traditions, an individual carver could elaborate or simplify the specific details, depending on his own notion of the kind of carving that was appropriate for a certain piece.

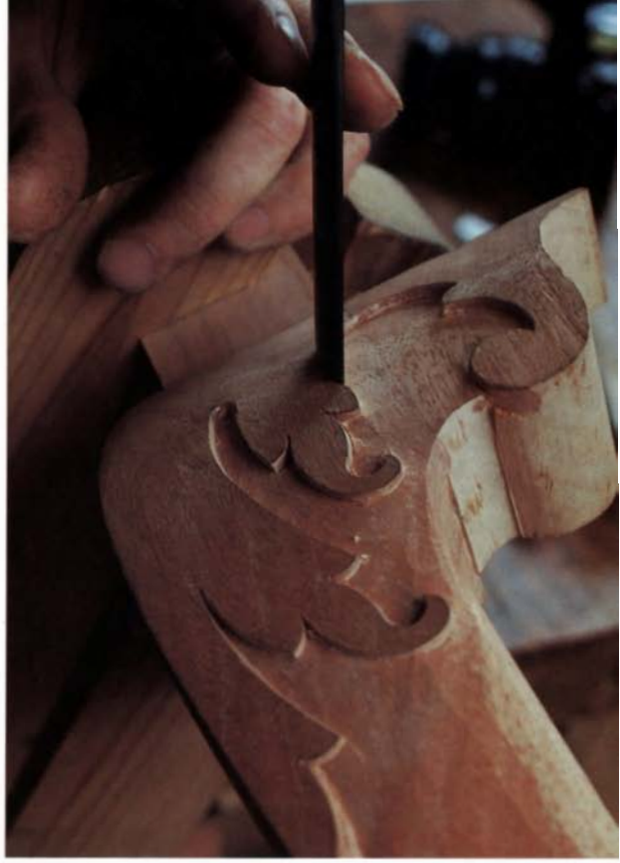
Today it's not easy for us to fully understand the depth of classical education and taste in the 18th century, and it's difficult for us to embrace the sensibility of the cabinetmakers (and their clients) of that time. Yet the surviving works of the period, as seen in museums and in the excellent books depicting such collections, can serve as a pattern book for any carver. Even if you don't want to duplicate the 18th-century work, these collections offer a repository of design styles. And, a close study of these works gives us a glimpse of the techniques used by these early carvers, who had to meet demanding standards, yet still work efficiently enough to make a living. For example, the shapes and sizes of the tools available to the carver played a large role in determining the design and the speed with which the piece could be carved.

The original of the carving that I will discuss here is an example of a strong, uncomplicated design, with the bold reflective surfaces and flowing lines that would have been expected on carved leafage. Its carver was an economical and experienced workman with high standards, who knew how to maximize the carving's three-dimensional look despite the limitation of having to work with relatively shallow cuts on the shaped surfaces.

Before going on to the details of foliage work, it's worth noting

Drawing: David Dann





Left, a template is made by cutting the outlines with the tools that will be used for the carving. Right, a line of stop cuts, to prevent chipping, is made around the penciled template outline in the same manner as the template itself is cut. Here, the background is being leveled down in a series of cuts to full depth. Stop cuts are deepened as necessary.

that a knee carving such as the one shown in figure 1 need not be restricted to chairs: It would work well on a tea table and could be adapted to the long, curved knees of a tripod table. In all these cases, the majority of the curves in the leg flow along the level of the carving's background. Thus all curves appear to be continuous beneath the foliage, and the widest part of the knee below the carving is thinner than it would be on an uncarved leg. There is plenty of bulk in this area to ensure a strong leg, however, and the curve can be gently shaped to blend into an ankle about the same thickness as the ankle on an uncarved leg.

The actual knee-carving process can be broken down into five steps. The same steps can be applied to other types of carving as well. First, a full-leg template is cut, and the design is marked out. Second, another template or pattern for the carving is made and transferred to the leg. I cut the templates and patterns with my carving tools to ensure that these tools can form all the shapes in the design. I have a fairly good selection of tools in my kit, as discussed below, so this isn't generally a limitation; actually, the tools are a great aid in controlling both the design layout and its execution. The third step is to cut vertical stop cuts on the leg around the perimeter of the design and carve out the background areas. Fourth, the main shapes of the leaves are incised and the surfaces carved smooth. Fifth, the veining and other detailing is cut.

Drawing foliage with tools—In the initial planning stages, it is important to envision the effect you wish your carving to have. Drawing is the best way to define these shapes, thus reducing the chance of careless blunders or dead ends during the actual carving. Drawing skills are also important to the carver, because it can be difficult to fit templates and patterns around curved surfaces. Usually the pattern can be used to establish the main lines, but the details must be drawn directly on the wood.

The flow of the foliage should complement the curves of the knee, as outlined on the full-leg template, which is used to draw the lines for bandsawing the blank. The first step, therefore, is to draw the leg template full-size and then draw the foliage upon it to establish the general form and flow of the leaves. The foliage pattern generally begins with the somewhat tedious copying of carved foliage depicted in 18th-century design books. Copying is easier if you lay out the designs on grids of various proportions, yet the leaves must still retain the flow and appear correctly balanced. As a general principle, lines and veins should emanate from a logical point of origin, such as the main stem of the leaf, and flow smoothly, fanning out to their full spread with a balanced progression and then reducing toward the tips.

The shapes I use in drawing the foliage conform to the sweeps of various gouges in my kit. I rely on a few broad gouges of related sweeps to help establish the broad shapes, a few narrower gouges whose curves flow comfortably into the wider ones and several smaller tools for detailing. My basic kit includes 12mm and 30mm #3 sweep gouges; 7/16-, 1/2-, 3/4-, 1- and 1 1/4-in. #5 gouges; 1/4- and 1/2-in. #7 gouges; a 1/8-in. #8 veiner and a 3/16-in. #9 gouge. Flat chisels of various widths, as well as a scraper or two, are handy for smoothing background areas and working in tight spots. If a line doesn't exactly conform to a gouge's sweep, or if I want to expand or contract a curve, I can roll the gouge around the curve like a wheel, steering it as I go. Working *with* a set of tools rather than *against* it is, along with sharpness, a key element in successful carving.

Rounding the leg—After bandsawing the basic leg shape, I round the surfaces with a spokeshave to bring out the flow of the leg. Shaping the leg below the area to be carved provides a reference surface to work from in shaping the foliage area, which must be proud of the main line of the leg. With cabriole legs, the carving should blend with both the leg's vertical curve and its horizontal plane.

The point of the knee begins flat at its junction with the upper post of the leg, and wood is gradually removed in a broad, convex curve. Hold a crisp line down the top two-thirds of the area to be

The main elements of the individual leaves are separated with a gouge whose curvature matches the desired profile. Because of the curves of the pattern, at times, one half of the cut may be with the grain while the other half is against it. The solution is to take light cuts on the side that is cutting well, changing direction as necessary.

carved, then make a transition to a ⅛-in. half-round for the lower third. You want the foliage area to stand about ⅛ in. above the leg surface at the tip of the lowest central leaf. The fullest point of the knee is lowered ⅛ in. on each face in a gradual convex curve beginning at a point about two-thirds of the leg width back from the front of the knee. Extra wood must be left for carving the foliage at the top of the leg, where it meets the post, and for carving the volute at the back of the leg. The leg at its widest point, including the projection of the carved area, should be in proportion to the chair or other piece of furniture supported by the leg.

Leaf template—In addition to the customary whole-leg template used to trace the lines to be bandsawn, I recommend you make another template or pattern to transfer the carving design to the wood. The carver who made the original leg would have been so familiar with this design that he could work without a pattern. After all, even if he produced only one set of a dozen chairs of this pattern, the symmetry of each knee would have required him to repeat the leaf's sculpture and detail 24 times. If you don't have the dexterity developed through numerous repetitions of the same pattern, though, you'll find that a template will be invaluable in helping you avoid mistakes.

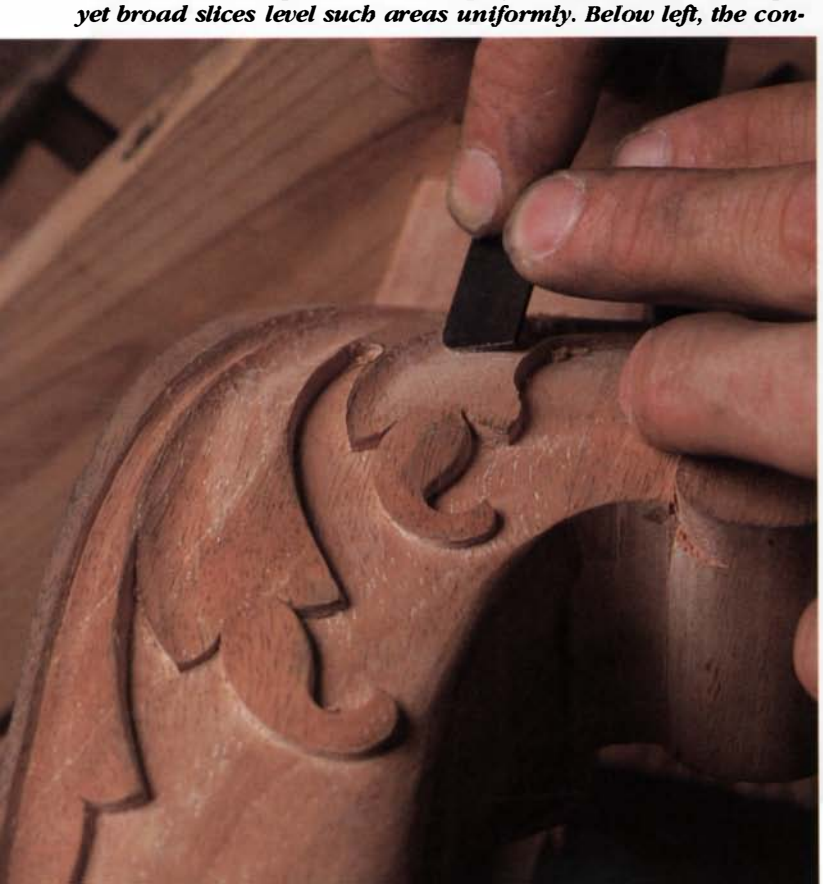
As previously discussed, you should cut out the template using your carving tools, as shown in the top, left photo on the facing page. If the pattern is based on a two-dimensional drawing, as appears to be the case with much 18th-century design, the pattern will have to be adjusted to account for the extra 3/16 in. or so added by the curve from the protrusion of the knee to the leg post. This can be accounted for by transferring the major horizontal elements from the pattern to the frontal curve, then sketching in extended vertical lines to complete the outside shape. The shaping of the front of the leg removes any reference points for orienting a template, but you can line it up by eye.

After sketching in all the details, double-check the lines against your tools to be sure they still fit (see the top, right photo on the facing page). When all is well, use hand pressure alone to outline the carving with the appropriate gouge shapes. The cuts should be perfectly vertical or slightly undercut. These stop cuts will allow the background to be carved away without chipping the border lines of the leaves. In tight corners, you can also make the stop cuts by smoothly slicing with the point of a knife. In the initial stages, don't worry about the surface of the background; concentrate on preserving the border of your leafage. After reaching the depth of the initial gouge cuts, make another series of stop cuts. To lower the background the full 3/32 in. so the surface appears to flow into the line of the lower leg, you'll have to go around the whole design at least twice. Because of the knee's shape, changes in grain direction are inevitable. Work with or across the grain whenever possible. Keep tools sharp.

Prepare the final background using flat chisels of varying widths. The widest chisels possible, in a given area, will ensure the most uniform, even surface. Final smoothing of the background can be done with narrow cabinet scrapers. You should not be too finicky. Traditional carvers often left some chisel marks on background surfaces. In addition, a scraped surface is not as reflective as the surface left by a crisp chisel cut. You can minimize the chatter marks commonly seen on a scraped surface by making alternating diagonal passes with the tool. This technique will prevent you from accentuating the marks left by the previous pass.

Carving the leaves—After the background has been carved to depth, sketch the main flow lines of the leaves, and use a gouge to bring out each leaf's overall contours, as shown in the photo above. To give the strongest impression of movement, make a deep concave cut in each leaf, along the outside of its arc from the volute, as shown above. While cutting these low areas on each of the three major leaves, preserve the full height of the leaf above the background at the extreme inner edge of each arc. Cutting to the full depth of your raised work at the peak of each arc, the concave cuts should diminish to half the raised depth as

Above, a wide gouge of proper sweep is the best tool for defining the knee shape, even when working in cramped areas such as here—the background at the top of the knee block. The light yet broad slices level such areas uniformly. Below left, the contoured flow of the leaf groups should be carefully smoothed (here with a scraper) before detail carving begins. Below right, a gouge, used bevel up, finishes up a diminishing curve that was begun by wider ones in the set.



the cuts end at the leaf tips and begin on the kneeblock. The concave cuts of the two leaves at the highest arc should diverge from a single cut at their beginning, at the top of the kneeblock, to two separate cuts for the center and lowest inside leaf.

Challenging changes in grain occur as the concave cuts move from the top of the knee downward. Regardless of which direction the cuts are made, half of the gouge cuts will be against the grain because of the way the pattern's curve meets the grain direction. A sharp tool will minimize the tearout, but it'll probably be necessary to cut from both directions to get a smooth surface. Skewing the tool slightly will also produce a cleaner cut, because the tool can slice instead of wedge into the wood. In any case, the juncture of the two cuts should meet at the low point of the curve. The veining of the leaves will later help remove any awkward transitions.

A broad, convex gouge cut should run from the full-raised height on the inside arc of each leaf to meet the bottom of the concave cut, with a clean transition between the two curves. The broad convex surface will catch light on a broad plane, while the quick convex curve will either reflect a fine line of light or throw a deep shadow, depending on the direction of the lighting. Throughout the process, the carver should strive for fluid gouge cuts, which produce the brightest, clearest and most continuous reflective surfaces. The best surface can be achieved by matching the gouge to the desired curve. Use the widest gouges possible at all times, as shown in the photo at left. The cut of a single gouge can be extended by cutting while holding the gouge on the diagonal, which will narrow the width of the cut and increase the arc of the curve.

The eye of the volute should be shaped as shown with a broad convex curve. Individual gouge cuts are also made to give the tip of the two internal leaves the impression of flipping back on themselves. This is accomplished by a concave cut on the inside of each leaf's hooked bottom with the continuation of the leaf's major broad convex curve preserved at the leaf's very tip. The shaping of the lowest lobe of the volute should be a continuation of the convex arc that runs around the innermost arc. The two small leaves at the top of the kneeblock should be relieved with medium-sweep concave cuts that terminate ⅛ in. to 1/16 in. short of the leaves' uppermost points, preserving the full background depth.

Make sure the contoured surface is as smooth as possible. Although the detail carving to come will cut much of this surface away, enough of it will remain to define the overall flow. If you try to smooth this later, the carving may end up looking uncertain.

When the flow of the leaves has been established, the veining and other details can be cut in, as shown in figure 1 on p. 57 and in the two middle photos below. The veins should emerge from the volute and slowly separate as they move toward the end of the leaves. The sculptural effect of the leaves turning to the outside of their arc and flipping under at their tips can be reinforced by holding the major weight of the veining high on the arc of the leaves. The veins should end just short of the tip of each leaf, with the central vein of the two major central leaves just entering the leaf-tip area. This lowest central vein is flanked by a slightly higher vein on the outside of the arc and by the highest vein on the inside arc. The arrangement of the inside and outside lobes of the leaves again emphasizes the impression of movement.

Finishing up—Sandpaper isn't much help in producing even, reflective surfaces and crisp outlines and shadows. Sanding will usually round off the transition of details and give an amorphous and doughy character to the work. Until you've had enough practice in sharpening and tool use to cut the wood cleanly with gouges alone, you can blend any slight surface irregularities with cabinet scrapers. Fine files, rifflers or shaped-hardwood burnishers are also useful for polishing carved surfaces. The broad surfaces of carvings on exposed knees and the backs of chairs have usually worn from use, producing a level of polish probably not given, but likely anticipated, by their original carvers. □

Mack Headley is a master cabinetmaker at Colonial Williamsburg in Virginia. He wrote about shell carving in FWW *#61.*

Below left, veining is cut into the contoured surface with an appropriate gouge. The same concerns regarding grain direction apply as with larger tools. Below right, strong side lighting on the finished knee shows not only the crispness of light and shadow possible in low-relief carving, but also the general planes and curves that underlie the detailing. Defining and smoothing these shapes was done before any of the fine-detail carving began.

Rubbing Out a Finish

Fine abrasives, soap and elbow grease

by Michael Dresdner

Many finishers opt to save time by not rubbing out the final finish coat of a completed piece. As a consequence, running your hand over an otherwise flawless tabletop reveals the existence of tiny specs of dust and other particles cropping up defiantly but invisibly from the plane of the finish. High-quality furniture deserves better than this. A creamy-looking satin finish, for example, should have a sensual smoothness that conveys to the fingers the very image it presents to the eye.

I don't think you can achieve this special visual and tactile quality without rubbing out. I'll get to the specifics shortly, but as a quick overview, rubbing a finish is the process of abrading away any small imperfections in the surface so it is completely smooth and level, with uniform sheen. The surface is sanded with fine paper and then rubbed with a lubricant and a fine abrasive to produce a subtle but even pattern of minute scratches. The difference between gloss and satin rubbing is one of degree: The coarser the rubbing material, the deeper the scratch pattern it creates.

The glossiness of a finish is a function of the amount of light that is reflected and the direction in which it is reflected. Think for a moment of a bright new aluminum pot: You can see your face in it almost as well as in a mirror, because the light hitting its polished surface is reflected straight back to your eyes. The same pot, as scouring pads and oxidation begin to etch its surface, becomes gradually less reflective, because light hitting the surface bounces off randomly. Finally, after a few years, the minute scratch pattern covers the surface completely, and the pot is not reflective at all. In a satin finish, the scratch pattern is quite obvious, looking somewhat like the pattern in so-called brushed brass and other metals. In fact, a top rubbed to a satin sheen will look different depending on whether it is viewed head on, with the scratches going toward and away from your line of sight, or from the side, with the scratches crossing horizontally.

While one *can* change the sheen of a finish by rubbing (such as when removing the plastic-like glare from some polyurethanes), it is a good idea to begin with a finish that's already at the intended level of gloss or flatness. Some shops finish tabletops in gloss and then rub them down to satin in the conviction that gloss lacquer or varnish is harder, and therefore more durable, than satin. While this may be partially true, the difference is not significant to justify the added work. Gloss lacquer is clearer than satin, however, so rather than building up the entire finish with satin lacquer, just spray a healthy margin of satin topcoats over a gloss base. Rub carefully to avoid cutting through.

Keep in mind that there is no sense in trying to save any improperly applied finish by rubbing. If the final coat is not smooth and level, scrape or sand it flat and recoat.

Hard cures—Virtually any finish can be rubbed, provided it is thick enough (rubbing does remove some finish) and it is cured. Air-drying finishes, both evaporative ones like lacquer or shellac, and polymerizing ones like oil or polyester, generally dry from the outside in; they may still be soft underneath even though they have formed a dry skin. The curing time will depend on the material as well as on how thick the finish is and how quickly it was applied. For example, a six-mil-thick (0.006 in.) lacquer finish that was applied in six thin coats over a six-day period (one coat per day) will cure considerably faster than the same six-mil coating applied in three sprayings within one day, primarily because there is less solvent entrapment. If your thumbnail can leave an impression in the film, it is not yet ready for rubbing.

Non-air-drying finishes, such as catalyzed lacquer or conversion varnish, usually cure much more quickly, often overnight, and the cure time is not affected by the film thickness. Because they cure through a chemical reaction, they harden uniformly rather than from the outside inward. The quick-and-easy test to figure out whether or not a catalyzed finish has set up enough to rub is to scuff a sample area with 320-grit sandpaper. If the sandpaper clogs up with gummy clots, it is not ready to rub. Manufacturer's directions provide important clues. For example, we use one type of catalyzed lacquer in our shop that dries as fast as regular, but it takes seven days to cure. While it will pass the sandpaper test in a day or two and can be rubbed then, much better results are obtained by waiting past the seventh day.

Certain oil varnishes, and shellacs used for violin finishes, contain chemicals that keep the finish flexible even after it has dried. These finishes can be difficult or impossible to rub out, but it's sometimes possible to do it after they've been topcoated with a thin layer of shellac applied by French polishing (see *FWW* #58).

Abrasives and lubricants—Before rubbing, the finish should be cured and level without a lot of brush marks or orange peel, but it probably will have some tiny dust pimples. Remove these by lightly sanding with the grain; for a low-luster, open-pore finish, 320-grit self-lubricating paper is adequate (such as 3M's Tri-M-ite Fre-Cut). For filled-pore or medium- to high-gloss finishes, however, it's best to work up to 600-grit wet-or-dry sandpaper with a lubricant (we use naptha or mineral spirits). Most any lubricant can be used with the sandpaper provided it does not harm or redissolve the particular finish.

As long as the scratch pattern goes in one direction (with the grain), it will diffract light evenly and give a smooth satiny appearance. The scratching is done either with 0000 steel wool or 3M's grey ScotchBrite (3M, 3M Center, Contractor Products, Bldg. 223-4N-06, St. Paul, Minn. 55144-1000; 612-733-1140), the

Rubbed satin finish | **Rubbed gloss finish**

This sample board shows, from left to right, satin lacquer as sprayed; next has been sanded with 320-grit paper followed by dry steel wool; third has been rubbed with steel wool and a lubricant; fourth has been rubbed with steel wool using polishing compound.

Far right shows moderate orange peel in gloss lacquer. Sanding with 600-grit paper produces a flat surface (center), which can be polished with automotive rubbing and polishing compounds (left).

finest grade. Avoid using steel wool with visibly uneven fibers; it will cause deep scratches.

As with sandpaper, the abrasive pad is kept from clogging by a lubricant. There are many possibilities here, but I'll just offer four. Probably the most common is Wol-Wax (pronounced wool-wax), available from Star Chemical Company, 360 Shore Drive, Hinsdale, Ill., 60521; (312) 654-8650. It is a translucent gelatinous paste that turns into soapy suds when mixed with water. Contrary to its name, it is not a wax, but just furniture soap, and as such, offers the bonus of cleaning your hands while you work. My favorite is No. 61 Dull Wax Polish (available in gallons only, from Industrial Finishing Products, 465 Logan St., Brooklyn, N.Y. 11208; 718-277-3333). Unlike the water-base Wol-Wax, it is a dark-brown wax-base liquid that can be used right from the can or diluted with naptha. Referred to as "black wax" in the industry, its dark color makes it ideal for rubbing open-pore finishes on dark woods such as walnut or mahogany, where a light-color lubricant might leave an obvious white residue in the pores. A similar but more commonly available alternative to black wax is Butcher's Wax thinned with naptha. Finally, there is automotive rubbing or polishing compound, which when used with 0000 steel wool, leaves a slightly more polished surface—sort of a semi-gloss rub—after its residue has been buffed off. This is due to the fine abrasive in the compound. Of the four, the automotive compound leaves the most obvious residue and should therefore not be used with open-pore finishes. I'll talk more about compounds in the section on rubbing to a gloss finish.

In my shop, these new materials have almost displaced the old method of mixing dry, powdered abrasives such as pumice (for satin) or rottenstone (for gloss) with light oil or water on a felt pad. These are messier, and the pumice can clump up. Nevertheless, I often use pumice for spot rubbing, using my bare fingers and palm (for maximum control) with water or oil to feather out a problem area.

Rubbing a satin finish—Top surfaces, being the most obvious, require the greatest care. The edges of the piece present a problem: Because of surface tension, a wet finish tends to pull away from a sharp edge, leaving the finish thinner there. Normal rubbing strokes, if allowed to roll over the edge at the end of the stroke, will cut through. If this happens, there is no quick fix; the only proper solution is to clean off the piece and recoat the area. Out of a natural caution to avoid rubbing through, it is easy to shortchange areas such as the short edges of a tabletop. For this reason, I start by dipping the abrasive pad into the lubricant and carefully rubbing 8 in. to 10 in. of the ends of a tabletop with short strokes, working with the grain and keeping the pad flat to avoid breaking through the film on the corner.

Now, with edges done, you can rub out the top. With both hands stacked above the pad and pressing flat, rub with long, straight strokes with the grain, starting at one edge and overlapping strokes in much the same pattern you would use when spraying, but with more (90%) overlap per pass. Avoid making arcs with the pad, and try to go all the way to the ends without touching the sharp corners. On a top, I like to repeat this process, going side to side from bottom to top and back again at least six times to ensure ample overlap and uniformity. Be liberal with the lubricant, rewetting frequently, and don't be shy about applying the pressure; rubbing a top is a respectable aerobic workout.

Where two pieces of wood join with grain going in different directions, such as a miter joint or a butt joint, it is best to protect one of the members with masking tape while you rub the other. Similarly, a bullnose on a tabletop should follow the grain; roll over the edge at the ends of the boards, and go along the sides. On smooth turned legs, it is easiest to wrap your hand and abrasive pad around the leg and go up and down with the grain. On an intricately turned spindle, it is better to rub around the circumference, as you would if you were sanding the piece on the lathe. Endgrain can go whatever way looks best.

After rubbing, wipe off the excess lubricant while it's still wet (to avoid leaving a film) using a clean, soft, dry cloth. I prefer washed, bleached cheesecloth, because it doesn't scratch, is lint-free and absorbs moisture well. If you've used a wax-base lubricant and not removed it adequately, the surface will look smeary and take fingerprints easily. Sprinkle the surface with water (it will bead up like rain on a newly waxed car), take a fresh pad and ***lightly*** make one more even pass. You'll notice the wax accumulation on the pad, and the water beads will break up and not regroup. Dry it as above.

Now take a step back and admire your work. Depending on which way the light hits the top, it should look like the even graininess of brushed metal with no excessively shiny or dull spots. Now for the best part. Run your hands over the surface. Nice, huh? Your hands should skate across the surface smoothly, with little friction or resistance, and it should feel smooth and "soft" to your touch. That feeling is the lure of a well-rubbed satin finish.

Rubbing a gloss finish—Rubbing a finish to gloss is a lot like rubbing to satin, only more so. It takes more time, more work, requires more finish thickness, and more things can go wrong. A gloss finish is like a mirror; it shows every imperfection, adds depth and reflects a great deal of light, so it must be clear, hard, dry and—because gloss rubbing tends to remove more material—comparatively thick. As a general rule, the more brittle a film is, and the drier, the higher the gloss to which it can be rubbed.

Because most gloss lacquers do not do a very good job of seal-

Photo: Michele Russell Slavinsky

ing the wood, the first few coats will necessarily be some sort of sealer, but the bulk of the film should be gloss so you don't risk rubbing through the topcoat into the duller film beneath.

Because gloss illuminates irregularities, such finishes are usually restricted to filled- or closed-pore woods. On porous woods, such as walnut and mahogany, the grain should be filled with a nonshrinking material that does not redissolve with the application of the finish coat. It is always wise to use a nonreactive material, such as a filler containing silex, rather than attempt to fill the pores by sanding back successive coats of lacquer, a method that will significantly extend the film's curing time and cause the pores to sink when the finish is buffed.

High-gloss rubbing, or buffing, generates a good bit of friction, and thus heat, so it is especially important that the finish be completely cured. An uncured finish scratches easily and seems to resist getting really shiny. The thumbnail test is a good guideline here, and it is always better to err on the side of safety. On a gloss nitrocellulose or butyrate finish, I generally like to wait about six weeks after the last sprayed coat. Again, different finishes require different cure times. At the opposite end of the spectrum, there are many gloss polyesters that are ready to buff in 48 hours or less. Of course, you can convince yourself that a finish is ready to buff when it should by rights sit longer, and the finish will be, strictly speaking, gloss. But, you will notice that the longer a film is left to cure, the easier the work and the brighter the gloss. On large-pore woods, this extra waiting time also allows the lacquer in the pores to settle before they are sanded smooth, so there will be less pore shrinkage after the final buff.

As with satin finishes, there are many variables. The type of resin, the amount of plasticizer and several other factors will affect not only how soon a finish can be buffed, but also the level of gloss you can achieve. Waiting time is also affected by the thickness of the finish and the way it was applied, as mentioned above. One of the more insidious factors—controlled as much or more by the finisher than by the finish manufacturer—is the use of a so-called retarder or blush chaser. Retarder (usually amyl, ethyl or butyl acetate; sometimes called banana oil because of its smell) is frequently added to lacquer in damp weather to prevent blushing, that annoying whitish haze resulting from moisture trapped in the film. By retarding the drying time of the lacquer (hence its name), it appears to allow the moisture to escape. This also allows the lacquer more time to flow out, resulting in less overspray—the roughness caused by partially dried lacquer droplets settling on already sprayed sections—as well as less orange peel, and results in a generally smoother and glossier sprayed film. Brushing lacquer is often heavily laced with retarder, allowing it to be handled more easily and limiting brush marks. However, increased drying time also means increased curing time, and a finish pumped up with retarder may look glossier off the gun but will require more waiting time and be more difficult to buff. If you are building a gloss finish and are using retarder for its blush-chasing properties, you might be wiser to substitute one of the solvents that tend to eliminate blushing without causing so much softening or extending of the cure time, such as MAK (methyl amyl ketone), IBIB (isobutyl isobutyrate) or "No Blush" solvent, which is available from Hood Products, Box 163, Freehold, N.J. 07728; (201) 247-2177.

Because gloss sheens are so unforgiving, the surface must be virtually perfect before the rubbing starts. Sand the finish with fine-grit wet-or-dry paper (at least 600 grit, or finer if it is available) and a lubricant that will not redissolve the finish. Water, either plain or slightly soapy, works well for most finishes; for lacquers, I prefer naptha or mineral spirits.

It may seem a backward step to dull a gloss finish before polishing it, but this is absolutely necessary to show imperfections. As soon as you start sanding, all of the low spots, pits and other defects, will stand out as bright areas. These must be sanded down level, or the final finish will have the appearance of a funhouse mirror. Squeegee the area that you are sanding frequently with your thumb or a bit of rubber to remove the film so you can check your progress; you are removing finish, so you don't want to go any further than necessary, but you do want to remove all of the flaws. When the dullness of the surface is perfectly flat and even, it is time to graduate to rubbing compound.

In contrast to finishing materials, where industrial suppliers often provide materials that are better and fresher than those found in hardware stores, the rubbing compounds available off the shelf in automotive stores appear to be identical to those available in bulk from finishing-supply houses. Two grades are commonly available. The coarser-grit paste, usually orange in color, is called rubbing compound, while the finer white paste is generally referred to as polishing compound. The color is not necessarily indicative of grit, though; I used to buy a black polishing compound for use on ebony and dark finishes. The coarser-grit paste will remove material faster, hence defects and scratches as well, but must be followed by the finer polishing paste to bring the surface up to the higher shine and to remove the minute scratches left by the coarser grit. Depending on how finely the surface was sanded (or in those rare cases when you can buff right off the spray gun), you might be able to save some time and effort by going directly to the polishing compound. You can always go back to the heavier grit if the buffing is going too slowly. As with sandpaper, this material is an abrasive and it *is* removing finish, albeit slowly, so it stands to reason that the less you remove, the better.

Surprisingly, the instructions on the rubbing-compound can are quite adequate. Using a pad of soft, dampened cloth, apply some of the compound and rub it in a circular or back-and-forth motion. You will notice that as long as the mixture remains a slurry, it tends to abrade away finish, but that the actual shining up occurs just at that point when the slurry dries and turns chalky. Although you don't have to rub very hard, it is important to continue buffing briskly. As the shine comes up, switch to a clean, dry, soft pad to remove the last vestiges of chalky residue and to bring up the final shine. This is the type of work where extra elbow grease pays off in better results—buffing a gloss finish is a lot of work.

Because you are trying to eliminate all visible scratches when polishing to a high gloss, the direction you rub is inconsequential, so rubbing rounded or coved sections can simply be done whichever way is most convenient. I like to use my bare hands dipped into a bit of compound to get into hard-to-reach areas. It is easier to feel what you are doing so as to avoid rubbing through sharp edges, easier to control than a pad in tight spots, and I find that for small areas, the finish actually comes up faster.

For that little something extra, many people like to add a final polishing step with wax or an automotive commercial glazing liquid. The glazing liquids, many of which contain silicones, claim to fill minute scratches to give the appearance of an even higher shine. They do impart a shiny glare to the surface, at least temporarily, but for good looks and endurance, you probably won't do much better than a well-applied coat of paste wax rubbed out to a shine.

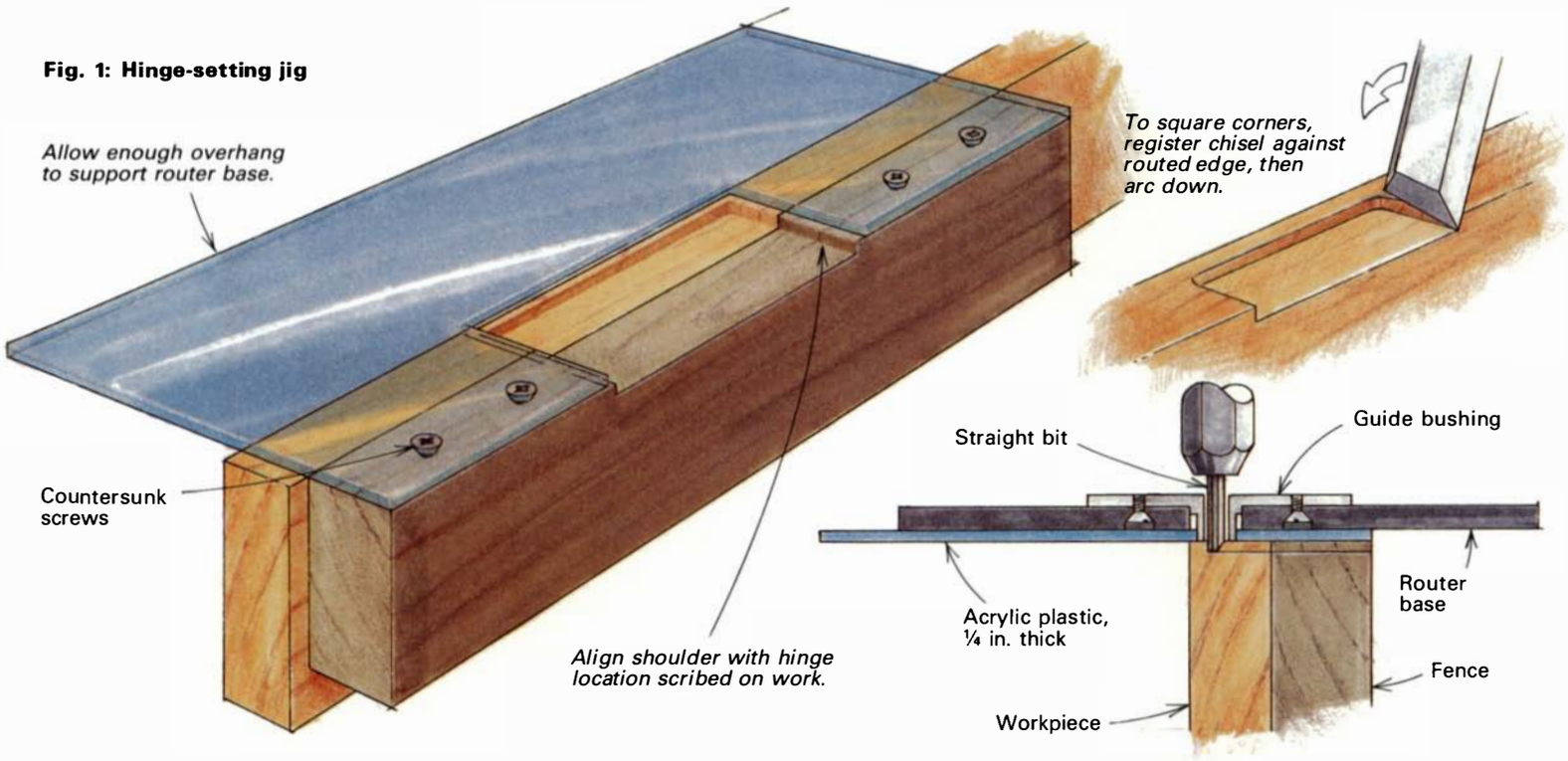
Now, turn on a bright light, step up and look deep into your work. If the rub was right, you'll see your tired but smiling face staring right back at you. *That's* what it's all about. □

Michael Dresdner is a contributing editor at FWW. *His guitar-making shop is in Perkasie, Pa.*

Installing Butt Hinges

by Christian Brisepierre

Fig. 1: Hinge-setting jig



I have a woodworker friend who jokes that hardware is aptly named because "there's nothing easy about putting it on." It's true that the fitting of hinges and locks comes near the end of a project and a mistake at that stage is particularly annoying. However, there are ways to take the Russian roulette out of hardware installations. The hinge-recess routing jig described here is a good example. In use, a guide bushing attached to the router base bears against the inside walls of a plastic window while the router's straight bit cuts the hinge recess to exact size and depth. The jig looks deceptively simple, and it's easy to make. Yet it provides fail-safe checks for positioning the jig, for setting the depth of the router bit and for correctly positioning the hinge pin, regardless of the thickness of the work.

The jig is made of ¼-in.-thick acrylic plastic and a hardwood 1x2, with length to suit. Begin by measuring the hinge and establishing the recess size needed for it. Keep in mind that the hinge's knuckle must protrude from the back of the box to at least the center of the pin; otherwise, the lid will jam against the back of the box. Calculate the window size you'll need, allowing for whatever size guide bushing you plan to use, and scribe it on the plastic.

To cut the window, screw a plywood backup fence to your tablesaw's miter gauge and hold the plastic vertically against it. Use a fine-tooth blade, and cut slowly. Cut both ends of the window first, then clean out the center by making a series of kerfs. Clean up the top of the window by positioning the miter gauge so the plastic is over the highest part of the blade, then slide the plastic slowly from side to side.

Screw the plastic to the hardwood fence and rout out a trial recess in scrap. The first pass will leave a recess in the fence, which will later provide a perfect line-up gauge and a bit-depth setting gauge. If the trial recess is too tight, remove the plastic from the jig and enlarge the window slightly. If the recess is too big, shim the edges of the window. Sticky-back copper foil tape of the variety sold for stained-glass work is ideal for reducing the size of the window by just a hair. An alternative is to use stainless-steel tape from a local hardware or automotive supply store.

The depth of the hinge mortises should be slightly shallower than the hinge leaves. This will ensure that a box lid, for example, does not bind at the back, preventing the front of the lid from closing. The same is true for an inset door: There should be a little space at the hinge side to prevent the door from binding against the hinged side as it closes.

When the jig is fine-tuned and the bit depth is just right, clamp the jig to the workpiece, lining up the recess in the fence with the location you have scribed for the hinges. Rout the recesses and clean up the corners with a chisel.

One pitfall at this point is that it's possible to drill the screw pilot holes off center. Using a Vix bit will prevent this from happening. Vix bits, available in various sizes from most woodworking supply catalogs, consist of a guide tube surrounding a drill bit. The end of the tube is chamfered to perfectly center in the countersunk screw holes in the hinge leaves. The drill bit is adjustable for depth. To use a Vix bit, place the hinge in the mortise, center the tube in the leaf's screw hole, then plunge the bit to depth.

To prevent damage when installing the brass screws, drive steel screws of the same size into the pilot holes first. Then, remove these, polish the hinges and refit with polished brass screws.

The real pleasure in following this procedure to install hinges is not just that it works so well, it's that you'll have the jig and the bit for the next time you want to install hinges of that size. These jigs can be devised to suit whatever size hinges you use, and also for many lock mortises. I have no doubt that the principle can be applied to a number of other "easyware" installations as well. □

Christian Brisepierre and his wife, Jeri, own Imported European Hardware in Las Vegas, Nev.

Drawing: Bob La Pointe

Fireplace Bellows

Wood and leather conjure up a breeze

by Glenn Elvig

I didn't plan on going into the bellows-making business. It started about 10 years ago when a friend asked if I would make her a fireplace bellows with a horse's head carved in it. I suggested it would be easier to buy a nice, plain wooden bellows and just carve the horse's head. But the local stores selling fireplace equipment offered only poorly built, imported bellows that didn't work very well. Carving a horse's head on such a poor product seemed inappropriate at best.

I decided to make a bellows from scratch. The design I came up with worked well and was surprisingly easy to build, and I soon realized that a line of fireplace bellows would complement the wood sculptures and carved signs we were making in my studio. Today, we make more than 200 bellows a year for fireplace stores, gift shops and galleries. They range in price from $75 to $350.

Bellows first appeared sometime in the Middle Ages when blacksmiths used large ones to speed up combustion in their forges. It probably wasn't long after that someone figured a smaller bellows would increase the heat from a cooking fire. By the 17th century, craftsmen were building ornate hand-bellows, inlaid with pewter and mother-of-pearl, for the homes of the rich. But, no matter how fancy the outside of a bellows may be, they all work the same way.

In its simplest form, a bellows is nothing more than an inflated bag with a nozzle at one end. Squeezing the bag expels the air. I once saw a Mongolian nomad employ the same principle by trapping air in a goat skin and then expelling the air through the neck of a broken bottle aimed at her cooking fire. The bellows I make, however, are more attractive and slightly more complicated. They consist of two pear-shape boards joined at their edges by a leather apron, which forms a chamber. The leather apron is widest at the heel of the bellows and tapers at the nose, where it acts as a hinge to hold the two boards together. The leather apron folds loosely when the bellows collapses and expels air; the leather stretches open as the bellows is inflated. A small piece of leather wrapped around the nozzle makes the bellows chamber airtight and reinforces the hinge.

One of the boards has a hole in its center, which is sealed on the inside by a leather flap that forms an inward-opening, one-way valve. Opening the bellows creates a vacuum in the chamber that sucks in the leather valve, breaking the seal over the hole and letting air flow into the chamber. Collapsing the bellows pressurizes the chamber, closing the leather valve. As the bellows collapses, the air is expelled through the nozzle.

I make both small and large bellows, as you can see in the photo below. The pear-shape sides can be easily modified to accommodate a variety of designs. One thing I've found, however, is

The author's leather-and-wood bellows can be built in any size, although overall weight should not be more than about 2 lbs. The smaller bellows here, made from butternut, has a sculptured inlay. The larger partridge-wood bellows has cut-out sides backed up with leather-covered lauan plywood to reduce weight.

Fig. 1: Bellows construction

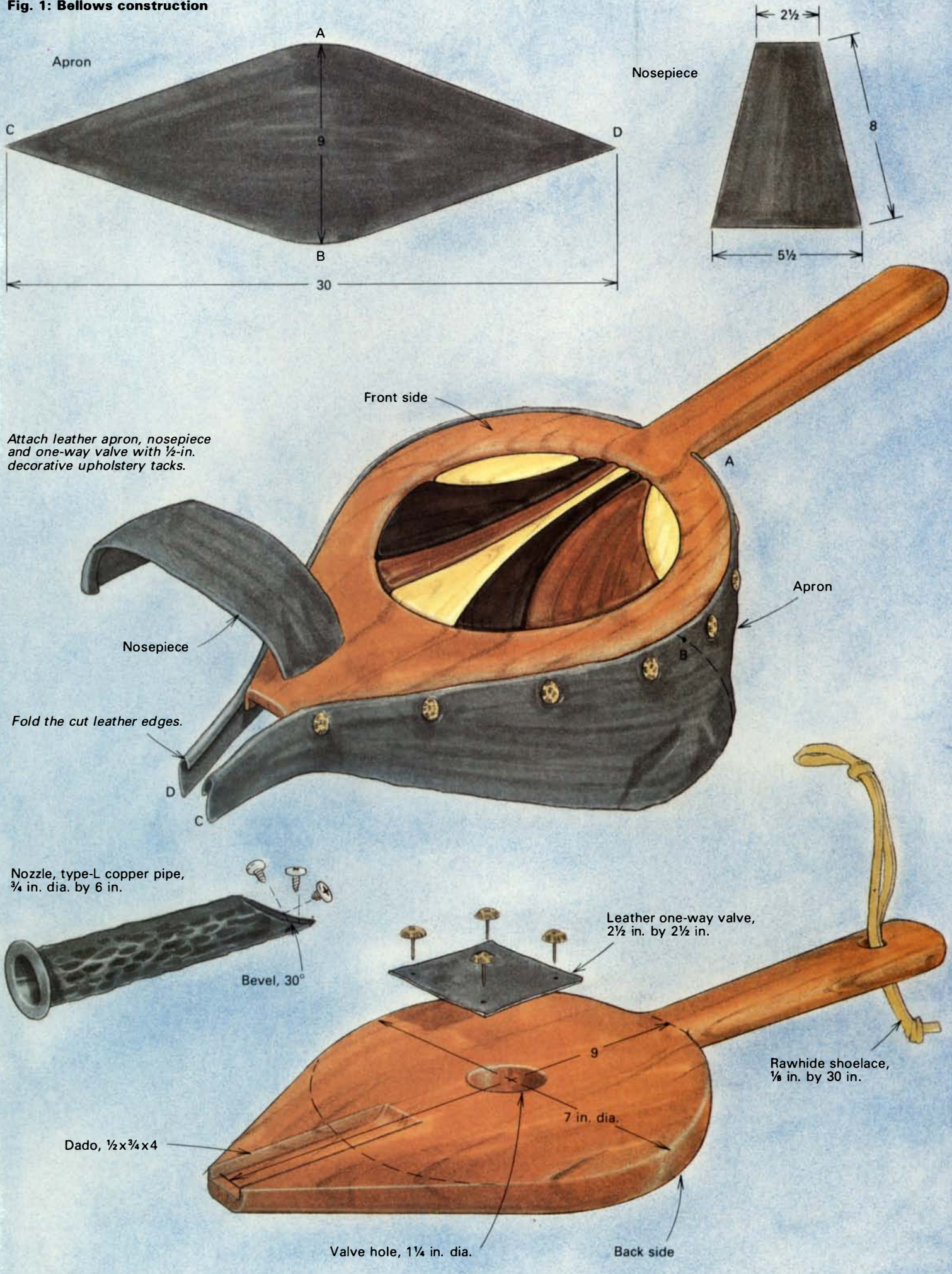


Photo at left: Michele Russell Slavinsky; drawing: Bob La Pointe

that people don't like lifting heavy bellows. That's why the large partridge wood bellows shown has cutout sides. Partridge wood is very heavy, but by cutting out the sides and backing them up with leather-covered ⅛-in. lauan plywood, I reduce the weight of the large bellows until it's only 12 oz. more than the smaller bellows. Ideally, a bellows should weigh no more than about 2 lbs.

You might be tempted to build a large bellows right off, but I recommend you start with a 7-in.-dia. bellows. This size provides just about the right amount of forced air to fan the flames in the average fireplace without blowing ashes all over the room.

Making the sides—You'll need two pieces of 7-in. by 17-in. stock, planed ¾ in. thick, for the sides. The smaller bellows shown is butternut, but you can use any hardwood. Before bandsawing the sides, I dado a slot in the center of each board just wide enough to accommodate the nozzle, as shown in figure 1 on the previous page. I lay out the pear-shape sides so the nose area on each of the mating halves surrounds its dado. After bandsawing the sides, I sand the sawn edges perfectly smooth and square. I also drill the hole shown for the one-way valve and drill and countersink a ¼-in.-dia. hole in the handle for a leather thong.

I round over the outer edges of the main body with a router and ⅜-in.-dia. roundover bit, but I leave the inner edges square. The leather apron will cover the inner edges, and the square edge provides a wide surface to drive the tacks into. I round all the edges of the handles to create a comfortable grip, as well as round the edges of the valve hole on the inner and outer surfaces of the bellows sides. After finish-sanding the sides, I lacquer or varnish them.

Making the nozzle—I make the nozzle from a 6-in. length of ¾-in.-dia. type-L copper pipe (available from building- and plumbing-supply outlets). The first step is to cut one end of the pipe at a 30° angle. (Later, this beveled end will be fastened to the dado with three small sheet-metal screws.) I peen the nozzle's entire surface, to give it the look of hand-forged iron, and flair its end on an anvil made from a ¾-in. lag bolt. To make the anvil, saw the threaded end from the lag bolt, then file and sand the sharp edges of the head. Now clamp it horizontally in a vise. Slip the nozzle over the anvil and make small indentations by hammering the surface with the round end of a ball-peen hammer. The nozzle has been peened sufficiently when the indentations begin to overlap and flow together. Place the front end of the nozzle over the anvil's edge at about 30°. Then, carefully peen the metal to flare the final ⅛ in. of the nozzle. The nozzle is painted flat black.

To fasten the nozzle to the dado in the back side, I drill three ⅛-in.-dia. holes in the angled end of the pipe, and place it in the dado, angle-side-up. Then, using the holes in the pipe as a guide, I drill three starter holes to keep the wood from cracking and secure the nozzle with three pan-head sheet-metal screws.

Cutting and fastening the leather—Bellows leather must be soft and supple enough to fold accordian-like when the bellows collapses yet be strong enough to avoid tearing. Leather is classified by ounces per square foot, which correlates directly to its thickness (1 oz. equals 1/64 in.). I've found that 3-oz. to 3½-oz. soft cowhide works best for bellows.

The bellows discussed here require about 3 sq. ft. of leather. I buy my leather by the half hide—about 20 sq. ft. to 25 sq. ft.—partly because I build so many bellows, but also because that's the only way most leather suppliers will sell it. Buying smaller amounts may be difficult, but some leather outlets, like Tandy Leather Co., occasionally sell scraps. To find a Tandy leather outlet in your area, call (800) 433-5546.

I start my leather work by cutting out the one-way valve flap, the bellows apron and the nosepiece to the dimensions shown in the drawing. Each of the pieces is attached with ½-in. decorative upholstery tacks. Begin by tacking the one-way valve in place. It should be mounted loosely enough so it can pull away from the hole as the bellows expands. If the leather is stretched tightly over the hole, the valve won't open. Air, soot and possibly embers will get sucked back into the nozzle. Simply laying the leather on the hole and tacking the four corners creates just the right amount of slack to allow the valve to function smoothly.

The next step, upholstering the leather apron to both sides to form the bellows chamber, is the most difficult part of building a bellows. You must pay close attention to several things simultaneously: First, the apron must be mounted symmetrically or the handles will be skewed. Second, the apron must narrow gradually toward the nozzle until the noses are held tightly together. Third, the cut edges of the leather must be folded under to give the bellows a finished look. Fourth, the tacks must be spaced evenly and aligned with each other from side to side.

After building hundreds of bellows, I've found it easiest to fasten the apron in place while sitting on the ground, holding a bellows side between my knees. For your first bellows, however, it would be better to clamp the side in a vise. The upholstery tacks are spaced about 1⅝ in. apart. Work with a tender touch as you install the leather, and locate the tacks correctly the first time. Making additional holes by relocating tacks just invites rips later on. I tap the tacks home very lightly with a rawhide mallet to avoid marring the leather and the tack heads. You'll find that the tacks tap easily into the endgrain at the back of the bellows, but the job gets harder in the edge-grain as you work your way around.

Begin by clamping the back side, nose-down, in a cloth-covered vise so the inside of the bellows faces you. You'll notice the widest points of the leather apron (marked A and B in the drawing) fasten directly under the handles. The narrow points (marked C and D) fasten to the nose. Begin by folding the edge of the leather over about ½ in. to hide the cut edge at point A. Then, holding the leather with point A directly under the handle, attach the leather with a tack on each side of the handle. Now remove the side from the vise, fold the rest of the leather edge over on each side of the handle and form the leather around the edge of the bellows. Pinch the leather together at points C and D, as shown in the top, left photo on the facing page. While holding the leather in this position, drive in a few tacks—enough to hold the apron in place—symmetrically around the edge.

Now, remount the side nose-down in the vise, but this time, turn the bellows so the outside is facing you and the leather is facing away. Align the handle of the front side with the handle of the back side. Fold the leather to finish the edge at point B and locate point B under the front-side handle in line with point A, as shown in the bottom, left photo on the facing page. Attach point B with a tack on each side of the handle, then flip the bellows over so the back-side handle is now held in the vise. Fold the cut edges of the leather over on both sides of the handle and wrap the leather around the front side of the body in the same manner that you did the back side.

Before attaching the leather all the way around with tacks, make sure the nose of each side is touching the other and the leather between the two nose sides is taut; otherwise, the hinging action at the nose of the bellows will be loose and the bellows won't work properly. If the leather is not taut between each side of the nose, fold a little extra leather under until the material is taut.

Attaching the leather—*After the apron has been tacked to each side of the handle and the leather has been folded over ½ in. to finish the edge, the apron is wrapped around the body and pinched together at the nose while tacks are installed, as shown in the above photo. In the photo below, the back side of the bellows is placed nose-down in a vise. The two handles are lined up and the leather apron is ready to be tacked on both sides of the front-side handle. To seal the front of the bellows, the narrow part of the nosepiece is tacked to the back side of the bellows. Then, the leather strip is wrapped around the nose until its widest section covers the tacks that anchor the leather on the wood, as shown in the photo at right.*

Once the leather is tacked all around, remove the bellows from the vise and trim off any leather hanging out past the last tacks.

With the apron now in place, you can wrap the leather nosepiece around the nozzle. Fold the leather along the short edge of the nosepiece, then, avoiding the dado, tack the two corners of the narrow portion near the center of the nose on the back side. Fold the remaining edges under, as you did with the apron, and wrap the nosepiece around the nozzle to seal the hinge area and to conceal the tacks, as shown in the top, right photo above. Secure the nosepiece with three or four tacks around the edge.

Decorative treatments—My bellows are often decorated with carved designs or sculptured inlay. To create the sculptured inlay shown in the photo on p. 66, I scroll-sawed a 5⅝-in.-dia. circle from the front side and routed the outer edge of the opening with a ⅜-in.-dia. roundover bit. To lay out the pieces for the inlay, I traced the circle on paper, then drew arcs across the circle with a french curve to form puzzle-like shapes. I cut out the paper shapes and traced them on various species of different colored woods. It is important to consider grain orientation, color and compatibility in the design. I scroll-sawed these wooden pieces, leaving the pencil mark so the pieces would be slightly oversize. The individual pieces were then sanded until they fit tightly together. I used a belt sander to sand convex curves and various sizes of drum sanders to sand concave curves. Once the shaped pieces fit together nicely inside the circle, I rounded the tops of the pieces with the belt and drum sanders to create a pillowy effect. (A similar technique for sculptural inlay by Tom Allen of Silverton, Oreg., is discussed in *FWW* #51, pp. 66-67.) All the shaping operations were done with 100- to 120-grit sanding belts and drums. Then, all the pieces were hand-sanded with 150- to 180-grit paper to remove any machine marks.

To attach the puzzle pieces to the bellows, I glued a piece of ⅛-in. lauan plywood on the inside of the opening, then glued the shapes onto the lauan.

Regardless of whether you make your bellows fancy or plain, you'll find that this shopmade fireplace bellows will provide a healthy amount of air, giving new life to dying embers. □

Glenn Elvig is a sculptor and makes fireplace bellows at his studio in Minneapolis, Minn. The specific designs shown in this article have been copyrighted by the author.

Eye Safety

How to treat and prevent eye injuries

by Dr. Paul F. Vinger

Some woodworkers don't wear eye protection. I do. As an ophthalmologist, I've seen woodworkers who've been blinded, lost an eye or suffered for days after having even just a tiny wood sliver removed from an eye. Eyes are among the most vulnerable parts of the body: They are easily punctured, lacerated, perforated or chemically burned. They should be protected at all times in the shop. The eyelid offers protection from dust, but it is no match for the hazards woodworkers encounter every day. A chip, for example, can fly from a 10-in. tablesaw at 103 MPH. That's 2 ft. in $^{13}/_{1,000}$ of a second. If the object hits your arm, it might sting or even cut it. The same chip could puncture your eye.

When I treat injured woodworkers, I often think the safety glasses, goggles and face shield hanging in my shop might just be among the best woodworking tools I own. These three kinds of eye protection will prevent almost any eye injury a woodworker is likely to encounter. Sometimes you only need to wear safety glasses; other times, especially if you've already suffered a serious eye injury, you need to wear two forms of eye protection.

Protection options—Each woodworker must decide what form of protection to wear, but here are some guidelines to follow. If you're using high-horsepower machinery, especially machines that rotate blades at high speeds and are capable of hurling large objects, it's wise to wear maximum eye protection. Machines that deliver less energy at slower speeds may call for less eye protection. For example, you might wear safety glasses or goggles plus a face shield when using a tablesaw, shaper or other tool where there is a danger of a large piece of wood being kicked back and damaging both the eyes and other parts of the face. I always recommend both safety glasses and a face shield for lathe work. Incidentally, protective eyeglasses or goggles should always be worn under face shields, because woodworkers frequently raise the shield to examine a workpiece or to provide ventilation, thus temporarily exposing their eyes to a potential injury. Safety glasses with side shields may be adequate when using drill presses; slow-speed, electric hand tools; or hammers and screwdrivers. Side shields should be worn with safety glasses, because the effectiveness of the safety glasses is reduced by 25% if the shields are removed. Goggles should be worn over street-wear (non-safety) glasses when there is a risk of many fine flying particles, and for use with chemicals and for welding that doesn't require a full face shield. If you have any doubts, wear more eye protection than less.

Hand tools hurt eyes more often than power tools, so don't neglect safety glasses for even simple jobs. The Consumer Product Safety Commission has reported that 6,719 people suffered eye injuries in 1986 while working with hand tools at home. Most of those injuries came from hammers and screwdrivers. For example, one of my patients, a young carpenter, once hit a ten-penny nail with a glancing blow. The nail rocketed from the wood into his left eye, destroying the eye's lens. The contact lens I gave him to replace his natural lens restored the vision in his eye, but he can no longer focus on close objects without bifocals.

Safety glasses are the first line of defense against eye injuries. If you're a woodworking hobbyist, reaching for your safety glasses should be the first thing you do in any woodworking project. If you're a woodworking professional, think of yourself as a person who wears glasses most of the time. Put on your safety glasses before you enter the shop, and don't take them off until you leave at the end of the day. If you wear vision-correcting glasses already, don't be fooled into thinking regular prescription glasses offer protection: They're not designed to withstand heavy impacts. Get a pair of prescription safety glasses with side shields from a quality eye-care professional. There's no excuse not to, given the wide variety of protective equipment available today. Even designer-style safety glasses have been available for some time now (see the sidebar on p. 72).

Years ago, safety glasses were made of just that—glass. Today, virtually all nonprescription safety lenses are made of super-tough polycarbonate, and prescription safety glasses come with polycarbonate, glass or CR-39 plastic lenses. Tests show that a polycarbonate lens is at least five times stronger than a glass lens and more than twice as strong as a CR-39 plastic lens.

Sometimes even safety glasses or goggles are not enough to stop the power of a flying object. A face shield needs to be added. You may be thinking: "No one wears safety glasses and a face shield at the same time." But, this double protection is often advisable. I once treated a man who worked at the same shop for 30 years. He lost both eyes and severely fractured several bones in his face when a planer shot an oak board at him. The pliable sides of a good pair of safety goggles would have dissipated some of the power in that flying piece of lumber, but much of its damaging force would have been tranferred to the bones surrounding the eye. Even so, the lenses of the safety glasses or goggles would probably have prevented cuts and punctures to the eyeball. I have no doubt that wearing both safety glasses and a face shield would have lessened this man's injuries enough that his sight could have been saved and his disfigurement reduced or eliminated. Remember, eye injuries are not predictable; they happen in an instant. Many woodworkers who ordinarily wear eye and face protection have paid dearly when the unexpected happened after the protective device was removed while doing "a little touch-up."

Chemicals and irritants—Acids and alkalies such as those used in bleaches, stains and dyes can cause permanent, blinding eye

Photo: Michele Russell Slavinsky; drawing: Mark Kara

Safety eye wear

Safety eye wear is available in many types and styles. In nonprescription safety glasses, you can still get the good old "Buddy Holly" model (1), but they are rapidly being replaced by more modern versions that have integral side and top shields (2). Prescription safety glasses are available in a wide variety of styles with clip-on or permanent side shields, and if you need them, bifocal or trifocal lenses (3). Many makers now offer goggles with fog-proof lenses (4). Goggles with rigid lens holders and soft face frames (5) are often worn by people who've lost vision in one eye and want to provide maximum protection for their good eye. Because they have individual lens holders, these goggles can be fitted with prescription safety lenses.

This integral face shield, hard hat and hearing protection system (6), made by Bilsom International, offers a full range of protection when doing heavy, noisy jobs such as chainsawing or lumber milling. For more on makers and suppliers of safety eye wear, see the sources of supply box on p. 72.

injuries. In sufficient strength, these chemicals can rapidly eat through the cornea and into the iris and lens (see the drawing on the facing page), damaging the eye beyond repair. It may surprise you that solvents like lacquer thinner, acetone and turpentine normally only cause topical damage to the eye and rarely cause sight-threatening injuries if they can be completely and quickly flushed from the eyes. Even so, many chemicals that woodworkers use can cause extreme pain if they get in the eye. Whenever you work with chemicals, wear goggles. The goggles should have hooded vents that allow ventilation but prevent liquids from getting into the eyes. If any chemical gets into an eye, treat it as a medical emergency (see the sidebar on the facing page). Thermal burns to the lids and eye from exposure to excess heat are rare among woodworkers. However, if you're going to be exposed to high-heat operations, heat-absorbing or reflecting protective eye wear is available.

I've seen more than one woodworking patient who's had bad experiences working with cyanoacrylate (instantly adhering) glue. They either walk into my office with an eyelid glued shut or a finger stuck fast to an upper or lower eyelid. Repair involves minor surgery. Goggles or safety glasses would probably have prevented the problem.

Contact lenses and woodworking don't mix, especially if you're working with acids or alkalies. If a chemical splashes in an eye, it gets trapped underneath the contact lens. It's hard enough to get a woodworker's eyelid open when acid or alkali is in the eye, and the time needed to pluck out the contact lens just gives these chemicals more time to do their damage. Sawdust and other particles also constantly get under contact lenses, causing pain and scratches to the eye's cornea.

I suspect that every woodworker has had to remove sawdust from an eye from time to time. I've had to do it myself. Most woodworkers know that flushing the eye with water will remove most particles, and many know the old trick of pulling an upper eyelid over a lower one to remove a spec of sawdust. What many woodworkers fail to do, however, is brush away the additional sawdust that has accumulated on the eyelashes, and they end up with more sawdust in their eyes than they started with.

Even if you do a fine job of removing a foreign particle from an eye, the particle may scratch the cornea, and the scratch will make you think the particle is still in the eye. If that feeling persists, seek medical attention, because the particle may in fact still be there, but invisible. This is often a problem with pine sawdust. When pine sawdust is saturated with water, or tears, it becomes transparent. Ophthalmologists use a special dye that makes invisible particles instantly visible, and therefore, much easier to remove.

There's nothing like the natural beauty of wood, especially when viewed up close with the naked eye. But the time for doing such viewing is only after a project has been completed and is out of the shop. Then you can take your safety glasses off, lean over and take a good, close look. At all other times, some form of protection should rest firmly between the work you are doing and that most sensitive part of the human anatomy—your eyes. □

Dr. Paul F. Vinger is a woodworker and ophthalmologist. He lives in Lexington, Mass.

Buying eye protection

by John Decker

A good pair of nonprescription safety glasses only costs about $5, goggles cost about $4 and face shields cost less than $15. Paying for eye protection is not a problem, but knowing how and where to buy it might be.

First, any safety eye wear you buy should have a "Z87.1" logo on it. This logo tells you the eye wear meets a minimum standard for safety set forth by the American National Standards Institute. On safety glasses, look for the Z87.1 logo on the inside of the temples and frames. On goggles and face shields, look for it near the perimeter of the lens or on the lens holder.

You can buy nonprescription safety glasses, goggles and face shields from hardware stores and building supply outlets, but their selection may be limited. Many cities have safety supply outlets that stock a full line of eye safety wear. For one in your area, check the Yellow Pages under safety equipment. Another way to buy eye safety equipment is through mail-order houses such as those listed at the end of this article.

If you wear prescription glasses, buy prescription safety glasses from an eye-care professional. When I visited my doctor, he showed me several pairs of designer-style safety frames, all of which were nearly indistinguishable from regular eyeglasses, save the slightly heavier bridge piece around the nose and the Z87.1 logo stamped clearly on the frame and temples. I found a pair of frames to my liking that cost $56. All of the frames came with permanent or clip-on side shields. Because I planned on making the safety glasses my full-time eye wear, I chose clip-on shields.

Regular safety lenses for my glasses cost $24 each. I assumed my lenses would be made of polycarbonate plastic, but the doctor told me they were regular plastic. "Polycarbonate lenses are for people who play racquetball and other high-impact sports," he said. After explaining to him about tablesaws, lathes and shapers, he readily agreed that polycarbonate lenses would be better. Polycarbonate lenses added $20 to the original $24 price.

Because the frames and lenses both had to be ordered from the factory, it took about four weeks to get my new glasses. The bill came to $130.40, extra side shields included. Quite reasonable, I think, for a pair of glasses I'll wear in the shop and on the street. □

John Decker is an amateur woodworker in Katonah, N.Y.

Sources of supply

Companies making safety eye wear:

American Optical Corp., 14 Mechanic St., Southbridge, MA 01550; (617) 765-9711.

Bilsom International, 109 Carpenter Drive, Sterling, VA 22170; (703) 834-1070.

Titmus Optical, 1015 Commerce St., Petersburg, VA 23803; (804) 732-6121.

Willson Safety Products, P.O. Box 622, Reading, PA 19603; (215) 376-6161.

Mail-order suppliers of safety eye wear:

Direct Safety Company, 7815 S. 46th St., Phoenix, AZ 85044; (602) 968-7009.

Industrial Safety & Security, 1390 Neubrecht Road, Lima, OH 45801; (419) 227-6030.

Kenco Safety Products, 70 Rock City Road, Woodstock, NY 12498; (914) 679-5246.

Lab Safety Supply, 3430 Palmer Drive, Janesville, WI 53546; (608) 754-2345.

Emergency eye care

Sight might be the most treasured of the five senses. Couple that with how horribly sensitive eyes are to pain, and it's a small wonder that dealing with a serious eye injury can strike a sense of fear, shock and even revulsion among many. Regardless, a cool head must prevail in any emergency.

I'm going to give you the basics for dealing with eye injuries. We'll consider the minor ones first, then some more serious cases. But before we start, remember this most important rule: If you have doubts as to the extent of any eye injury, treat it as a serious one. Seek medical help immediately. And, don't ever hesitate to call an ambulance if the injury goes beyond the scope of your ability to handle it.

Particles: If the particle is floating freely on the surface, flush the eye with water. Never remove imbedded or protruding objects from an eye, no matter how small the object may be. Instead, cover the eye with a sterile dressing and seek medical attention as soon as possible.

Blows: If an eye receives a heavy blow, apply ice and cold compresses to relieve swelling and pain. If there is pain inside the eyeball or a change in vision, seek medical help immediately. This is an injury where it's best to err on the side of caution and see a doctor.

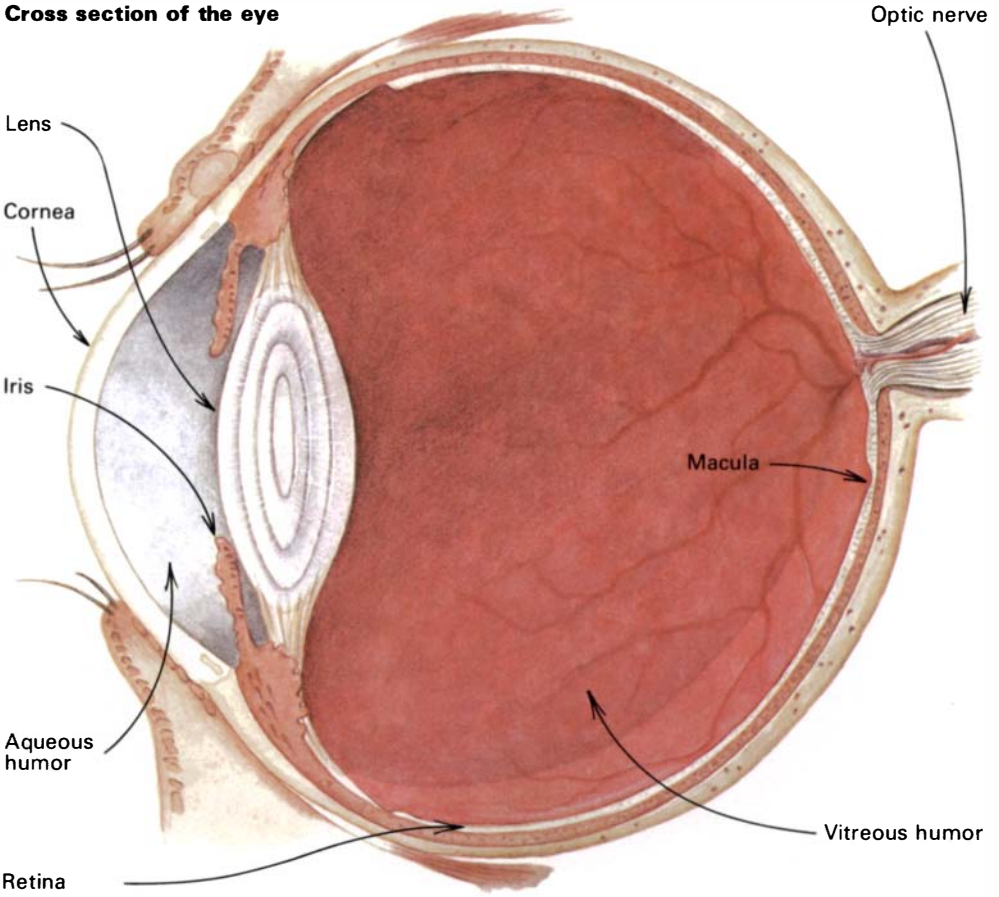
Perforations: The laceration or perforation of an eyeball or eyelid, or signs of blood between the cornea and iris (see the drawing), indicates the need for emergency medical treatment.

If you suspect that an eyeball has been punctured or lacerated, place no pressure on the eye. The instinctive reaction for anyone with this kind of injury is to rub or press the eye. You must stop them, or if the injury has happened to you, you must stop yourself from applying pressure.

The eye is filled with a clear substance called the vitreous humor. It looks like raw egg whites. Pressing a punctured eye can force vitreous humor through the wound, an action that may also cause sections of the retina to detach and exit through the wound. The body can regenerate vitreous humor, but losing part or all of the retina results in permanent partial or total blindness.

If possible, apply a light, sterile dressing to the wound, and cover the eye socket with some type of shield, such as a piece of cardboard, so no additional pressure will reach the eyeball. Don't hesitate to call an ambulance. Keep the injured person as still and as calm as possible, and don't try to remove any object imbedded in the eye.

Cross section of the eye



Chemicals: Most chemicals used in woodworking will cause extreme pain if they contact the eye. Acids and alkalies cause the most damage to an eye, but *any* chemical in the eye should be treated as an emergency. Flush the eye with water for at least 10 minutes as soon as possible—even before professional medical attention is sought. The instinctive reaction of anyone with a chemical in an eye is to tightly shut the eyelid. You've got to force that eyelid open by hand and flush the eye as quickly as possible. If a chemical splashes in *your* eye, hold your eyelid open and flush the eye immediately. It will hurt, but you've got to do it.

Keep in mind that this is an emergency, so you don't have to be picky about the water you use. Soft drinks or even beer will suffice, at least to start with. Never try to neutralize acids or alkalies. If you can, bring the container of the chemical that splashed into the eye to the hospital or doctor's office. If that's not possible, be sure to tell the doctor what kind of chemical it was.

Other problems: Blurred vision that doesn't clear with blinking, or a loss or narrowing of the visual field in one eye are danger signs. Double vision, sharp, stabbing pain or deep, throbbing pain are also signs that medical help is needed. One eye that protrudes farther than the other, or even an eye with a pupil diameter that doesn't match the other, are indications of serious injury. Eye pain that lasts more than a day or two should also be considered serious and referred to professionals.

There are ways you can help both the attending physician and the person suffering with an injured eye. First, never apply ointment to an eye, because it will obscure the doctor's view of the retina. Also, don't repeatedly apply over-the-counter topical anesthetics to a painful eye; continual use can damage the cornea. Above all, remember the first rule I gave you: When in doubt, seek medical attention. *—P.V.*

Catalpa, often planted as a yard ornamental, boasts large clusters of white flowers in June and develops long cigar-like seedpods that make it instantly recognizable in winter. The lumber, below, is similar in appearance to chestnut or brown ash, but is more stable and easier to work. Catalpa's softness, however, makes it prone to dents and wear.

Photo: Michele Russell Slavinsky

Catalpa

Not just a shade tree, but timber

by Jon Arno

Ask any 10 woodworkers you know, even those who pride themselves on their experience with rare woods, what they think about catalpa. Probably all 10 will be able to describe the tree with its unusual, cigar-shape seedpods, beautiful white flowers and heart-shape leaves. You might even get a story or two about how they once tried to smoke a seedpod or how much fun it was to climb the catalpa tree in the backyard when they were kids.

When you get down to business though, most of them will probably confess they are unaware catalpa is used for lumber. Fence posts maybe, but lumber no.

If any of them have used catalpa wood, there is a good chance they liked it so much they have been reluctant to spread the word. Catalpa, given the supply situation, is a secret they would just as soon see kept. Why? Because catalpa is a very fine cabinet-wood, and at least at the present, it isn't that expensive. It is, however, hard to find.

Depending on your luck, you might be able to get kiln-dried, S2S catalpa in a common grade for as little as $1 per bd. ft. at a local lumber supplier. A few of the well-stocked mail-order houses carry it, listed for as much as $4.75 per bd. ft. But the more typical place for a woodworker to find some catalpa is at the local sawmill, where it comes in a log or two at a time and is quickly bought by the first few woodworkers who see it. The only other way to come by the wood is to cut down the tree and air-dry it yourself. With very little care, it will end up as good as any you could buy.

There are two species of catalpa native to the United States. Either tree might be called catawba locally or be known as cigar-

tree or Indian-bean, because of the shape of the seedpods. Southern catalpa, *Catalpa bignonioides,* is found in Gulf Coast states from the Florida panhandle west to Louisiana. Used locally for fence posts and occasionally for lumber, this small tree is not commonly found outside its native range.

The other catalpa, *Catalpa speciosa*, or northern catalpa, is a much larger tree capable of heights in excess of 100 ft. and diameters well over 5 ft., although mature specimens that are 70 ft. to 80 ft. tall and 3 ft. to 4 ft. in diameter are more typical. For more than a century now, northern catalpa has been a widely planted ornamental, especially in the Midwest. It is a fast grower and very hardy, provided it gets adequate moisture. It is also very cold tolerant. I have seen catalpa growing as far north as Minneapolis, where winter temperatures of 30°-below are more frequent than most of the residents care to think about.

Well, if catalpa is so hardy and so often planted, why isn't its wood more plentiful? First, plantings tend to be a tree here and a tree there, or at best, in a windrow or woodlot of a few dozen trees. Trees grown in the open like this branch out quickly instead of reaching up, and as a result, they produce little quality timber. Also, no sawmill gets a lot of the logs at any one time.

Catalpa is also scarce because the only region of the country where, even charitably speaking, the tree could be said to form pure stands is in its native range. In the case of northern catalpa, the native range is one of the smallest of any North American hardwood. Until man began to transplant it, northern catalpa was found only along a narrow band of bottomland near the confluence of the Ohio and Mississippi rivers from around Louisville, Ky., to Memphis, Tenn., with a few small pockets in the surrounding states. The fact that this narrow range was on the path of westward migration has helped the tree spread, but it is still not plentiful anywhere.

What makes all of this important to woodworkers is that catalpa is a wonderful cabinetwood, both visually and in the ease with which it can be worked. Its ring-porous structure makes for a very bold figure on the flatsawn surface, somewhat resembling oak and ash (see *FWW* #51). Because catalpa does not have prominent rays, its quartersawn wood is not as loud and unpredictable to stain as the oaks, and it is much, much softer.

Perhaps the one native hardwood that most resembles catalpa is chestnut. Unfortunately, few woodworkers today have the chance to work with chestnut either. Catalpa, with an average specific gravity (SG) of only 0.38 (oven-dry weight/green volume), is even softer than chestnut, which averages 0.40SG. Virtually all of the oaks are in the tool-dulling range above 0.55SG.

Although catalpa is darker in color and not quite as stringy as chestnut, it is on the splintery side and may fray a little when crosscut. This is an insignificant handicap when you consider how soft and easy it is to work and what beautiful results its open-texture, wavy figure provides. And like chestnut, catalpa has excellent weathering properties. All of these characteristics make it an ideal choice for many cabinetmaking and carving projects, especially outdoor sculpture.

As similar as chestnut and catalpa are, the two are not closely related. Chestnut, like the oaks, is a member of the beech family, *Fagaceae.* Catalpa belongs to the trumpet creeper or bignonia family, *Bignoniaceae,* and is one of that family's few large representatives in North America. Most of catalpa's close relatives inhabit the tropics, and many of them are vines rather than trees. However, several tropical members of the family produce valuable timber, such as primavera, surinam and calabash.

The beautiful white flower of catalpa is one clue that its genetics diverge from those of chestnut. Another clue more meaningful to the woodworker is catalpa's strong scent, which unlike the tannin smell of chestnut, is impossible to put into words. Whether it is pleasant or not is a question I haven't resolved for myself yet, but once you've cut into a piece of catalpa, the musty-spicy odor won't soon be forgotten.

Catalpa is not perfect. Its extreme softness and open grain make it a poor choice for any piece of furniture that will get heavy wear. In this respect, its working qualities remind me of butternut, and like butternut, it is a pleasure to shape and fit. A woodcarver will quickly note that catalpa is more uneven-grained than butternut, which makes controlling cuts a little more difficult. But, the surface left behind is silky smooth to the touch. Catalpa sands better than butternut, too, but be sure to use a block or the soft, porous wood may be abraded away, leaving the harder wood in each annual ring raised. The finish is magnificent when first rubbed out. Once you have experienced the pleasure of catalpa, there is a tendency to use it for everything, but it is so easily dented it really should be reserved for display pieces that are often seen but seldom banged around.

While not germane to woodworking, catalpa packs few BTUs and makes very poor firewood, which I mention mostly to discourage the practice of burning it. Because catalpa is an ornamental species that sooner or later outgrows its available space, mature trees are often cut down by homeowners who are indifferent to the wood's subtler properties. More than once I have rescued a carving blank or two from a neighbor's woodpile.

If a catalpa tree in your neighborhood has outgrown its welcome, it could prove to be more than just "neighborly" to help take it down in exchange for some of the choicer pieces.

You can hack out turning blanks and carving blocks with a chainsaw, and most of them will dry alright. As with any other wood, it is a good idea to coat the endgrain with glue or paraffin as soon as possible. As you do, you'll see another feature that makes catalpa a prime wood: The tree is almost all dark heartwood, with the lighter sapwood seldom more than two annual rings wide. If you cut the wood into boards, make sure the pile is well stickered, weighted down and protected from soaking rain. Because of catalpa's excellent weathering properties, degrade caused by staining is not much of a problem. Fresh-cut catalpa can be very wet, however, and may take longer than you expect to dry. Weigh a sample periodically. When the weight stabilizes outdoors, the wood will be down to about 15% moisture content.

Shrinkage in drying is low and relatively uniform. Catalpa, in fact, is one of the most stable hardwoods in North America. With an average radial shrinkage of 2.5% and a tangential shrinkage of 4.9%, drying tension and warping is minimal. In contrast, elm has a radial shrinkage of 4.2% and a tangential shrinkage of 7.2%, and beech is even worse. By comparison, air-drying catalpa is a breeze. It is sometimes even possible to dry whole log sections in one piece. The wood is weak enough that drying stresses can distribute themselves evenly throughout the wood instead of forming prominent checks.

After air-drying, bring the wood indoors for a while in the winter to reduce its moisture content further. In a month or so, you will be able to share one of woodworking's best-kept secrets firsthand. And by the way, I wouldn't be telling you all this if I didn't have several hundred board feet in inventory and a line on a few logs still on the stump. When I see what looks like an unwanted shade tree in somebody's yard, I can be a very neighborly sort of guy. □

Jon Arno is an amateur woodworker and wood technologist in Schaumburg, Ill.

Spice Boxes

Hidden compartments for special seasonings

by Alex Krutsky

In Colonial times, the spices we take for granted today were rare commodities brought to America at great expense on sailing vessels. The people affluent enough to buy spices would commission local craftsmen to build exquisite little chests of drawers for storing their spices and other valuables. Some spice boxes were scaled-down versions of high chests; others, like the William-and-Mary chest below, were decorated with elaborate inlays.

The spice box was most popular in Europe and the Colonies during the early part of the 1700s, but it continued to be in fashion in Pennsylvania well into the early 1800s. Because of this regional popularity, most of the examples surviving today were probably built in the Chester County area, or as one collector put it, "within a 50-mile radius of the statue of William Penn atop the Philadelphia City Hall." Although I grew up in Pennsylvania, I didn't pay any attention to the local furniture forms until I enrolled at the North Bennet Street School in Boston, where students learn woodworking by building furniture in traditional 18th-century English and American styles. This influence led me back home to the Chester County Historical Society in 1986.

This William-and-Mary spice box has more drawers than first meet the eye: Two are concealed behind shallow conventional drawers, with one, the dual drawer, attached to a sliding partition. A third secret compartment located behind the cornice molding can be accessed only by moving the back panel.

Lee Ellen Griffith, an antique dealer and guest curator, had put together a show and catalog of 58 spice boxes encompassing the popular styles from William and Mary of the late 1600s to Hepplewhite of the late 1700s. I was already aware of the spice-box form and the line-and-berry inlay, but the variety of work in this show inspired me to further study.

As in most traditional casework, the spice box shown here is dovetailed together, and the interior partitions are inserted into dadoes in the case ends after the carcase has been glued up. A separate frame forms the base, and the ball feet are attached to it with wedged tenons turned on top of the feet. The cornice and base moldings are glued and tacked to the cabinet top and base frame. The line-and-berry inlay patterns of these small chests were often very intricate.

Secret drawers, one of the more intriguing aspects of Pennsylvania spice boxes, reflect the value of the spices. Often the back of the case will slide down to reveal compartments hidden behind shallow interior drawers or behind the cornice molding, as in the box shown here. The sliding partition with a hidden drawer attached to it was also used in some of the early pieces.

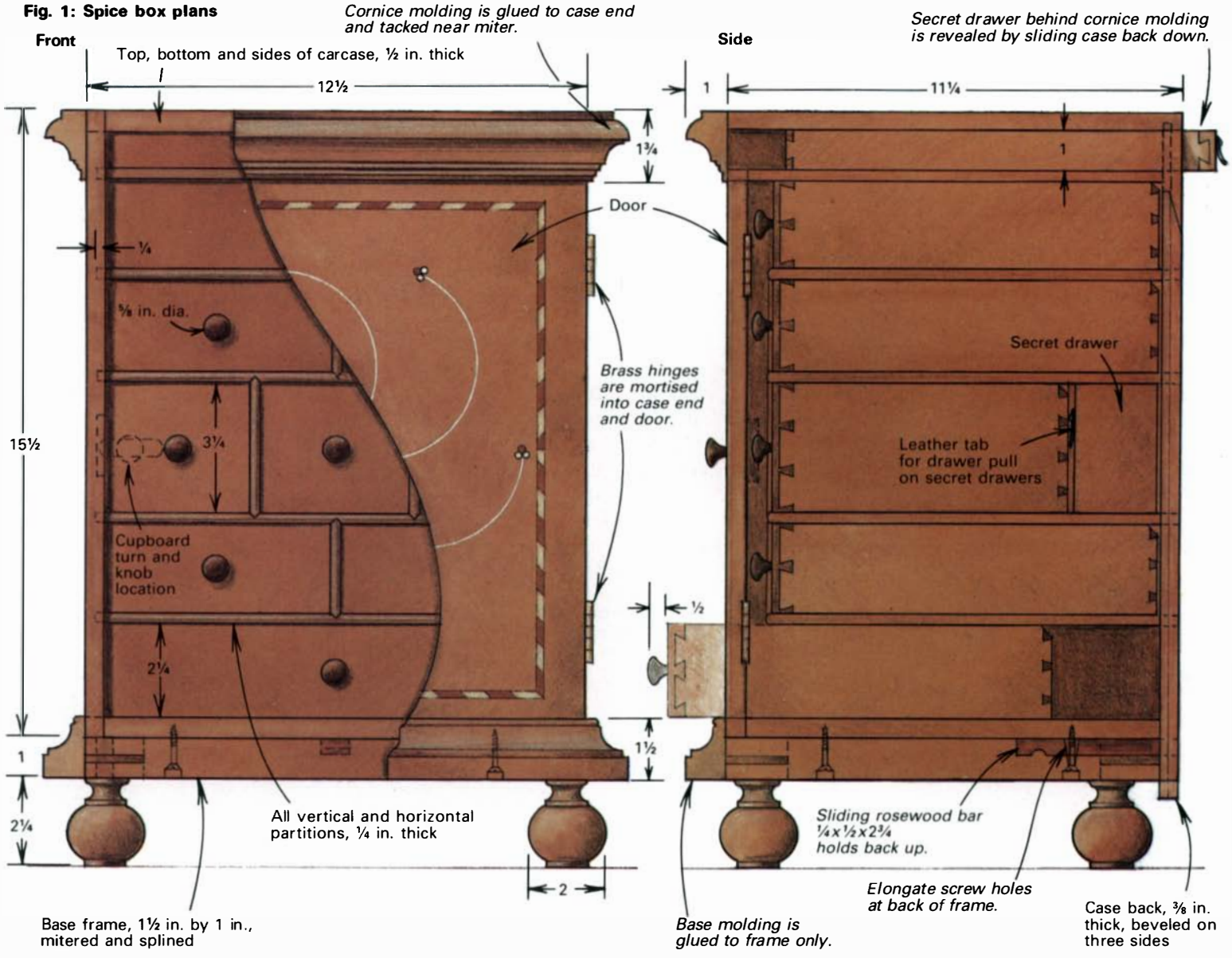
Getting started—It's a good idea to begin with a full-scale drawing to determine dimensions and to lay out the joinery and the arrangement of the drawers. It takes about 25 sq. ft. of wood to build this box. I've designated square feet instead of board feet, because if you resaw thicker stock to get the smaller dimension parts, as opposed to planing them, you'll need much less than 25 bd. ft. I made mine with pieces of walnut left over from other projects. I resawed some old walnut table leaves into thin panels wide enough for the interior partitions and drawer parts, and I picked out some highly figured pieces for drawer fronts.

No matter how you get your wood, you'll need about 7 sq. ft. of ½-in.-thick walnut for the carcase, door and drawer fronts, and about 8 sq. ft. of ¼-in.-thick walnut for the partitions and drawer parts. For drawer bottoms and the case back, you'll need 8 sq. ft., ⅜ in. thick. I used aromatic cedar for these parts to add a pleasant surprise when the drawers are opened.

The molding and base frame require about 2 sq. ft. of 1-in.-thick stock, and the feet are turned from a 2x2x12-in. block. You'll also need a piece of rosewood about ¾x¾x12 in. for the drawer pulls and cupboard turn (latch).

Building the carcase—Before beginning the construction of the carcase, I'd like to point out something I learned the hard way about the layout of the door. On my first box, I inset the door between the carcase ends, but the hinge barrels were in the

Photos: Lance Patterson



way for opening the drawers, so I had to adjust the hinge mortises and plane down the drawers slightly. On the next box, the one pictured on the facing page, I let the door overlay the carcase on the hinged side. This got the hinges out of the way but created joinery problems on the bottom panel and on the horizontal partition immediately above the door. These pieces need to be "notched" to extend past the carcase on the hinged side, as shown in figure 2 on the next page. The notch for the horizontal partition is simply bandsawn. To notch the bottom panel (the top panel doesn't need to be notched), I rip a strip from its front before the top and bottom are cut to final length. With the strip removed, I crosscut the top and bottom panels the same length and cut the carcase dovetails. Then, before carcase assembly, I glue the strip back in place so it will extend past the half-blind dovetails and come flush with the outside of the cabinet.

Half-blind dovetails are better than through dovetails here, because seasonal swelling of the exposed endgrain of the through tails will eventually force the cornice molding from the case ends. The dovetails are laid out with a half-tail at the back of the top and bottom to conceal the back dado (see figure 2). This was a common practice on period furniture, because the backs were usually rabbeted into the carcase and this half-tail allowed the rabbets to run through on all four carcase pieces.

After the carcase dovetails are cut and fitted, the stopped dadoes for the horizontal partitions are sawn in the carcase ends with a dado blade on the tablesaw. Because this requires pieces to be dropped onto the spinning dado blade, use stop blocks for safety and accuracy. The dadoes are cleaned out to the stop with a small router plane or narrow chisel. These dadoes extend through the back, but stop about 1⅜ in. from the front edge to allow for a shoulder at the front of each horizontal partition, a space for drawer pulls and the thickness of the door. The only exception is the top partition: It gets notched and inserted from the front, to allow for the door overlay on the right side, so the dadoes for it run through from front to back. This exposed joinery will be covered later by the cornice molding (see figure 1 above). After dadoing for the horizontal partitions, I run the dado for the case back in both ends. Then, I bandsaw the notch on the right carcase end to allow the door to overlay it (see figure 2) and clean up this edge with a scraper. I also rip a piece off the back of the bottom panel so the case back can slide past it to reveal the hidden drawer behind the cornice molding. I then glue up the case and clean it up with a handplane or sanding block.

Interior partitions—When the carcase is glued together and cleaned up, you're ready to tackle the interior partitions that form the drawer spaces. I measure the case to get the exact sizes of the partitions, and rip and crosscut them to length and width

on the tablesaw. Don't forget: The top partition is wider than the other horizontal partitions. It must be the same width as the case bottom so it can extend over the top of the door, and it should be about ¼ in. longer to allow for the notch on the right end. After crosscutting this partition to length, I bandsaw the notch and set it aside until assembly.

Next, using a scratch stock (see *FWW on Period Furniture*), I slightly round over the front edges of the other partitions. This adds a subtle variation in depth at the plane of the drawer fronts and creates a nice mitered detail where the partitions intersect. I mold the edges before cutting the shoulders or dadoes in the horizontal partitions to avoid rounding over the ends of the partitions where they meet the case or losing the crispness of the miter where the partitions intersect.

To mark the shoulders for the horizontal partitions, I slide them into place and scribe a pencil line on the front edge up against the case ends. I cut a ¼-in. notch from each end (see figure 3 below) with a fine-tooth saw. After cutting all the shoulders, I cut the ⅛-in.-deep dadoes for the vertical partitions. All these dadoes extend through the back edge of the horizontal partitions and stop about ¼ in. from the front edge. I cut the groove for the sliding partition by hand, using a chisel and a 45° angle block as a guide (see figure 3). I use this same angle block to chisel the miter at the front edge of each of the other dadoes, but as I chisel, I alter the angle just enough so the point of this groove is just short of the dado's depth. This lets you lose a little of the partition's height, which is almost unavoidable, when you pare the front edge to fit. Then, I slide the vertical partitions into place, mark the V-shape miter on their front edges, remove them and pare the first ¼ in. of each partition to these lines.

Since squeeze-out could be a problem in the tiny drawer spaces, I use a minimum amount of glue in the dadoes. All the partitions slide in from the cabinet's back, except the top panel, which must be inserted from the front.

Base and moldings—The base is a mitered frame of 1-in. by 1½-in. stock reinforced at the corners with splines. I cut slots for the splines, after the frame is glued together, using a V-block on the tablesaw, and I glue in the splines with their grain perpendicular to the angle of the miters. The frame should be the same depth front to back as the bottom of the cabinet so the back can slide by it. And, the frame should be slightly wider than the carcase so it can be planed perfectly flush with the case ends after it's attached to the bottom.

Fig. 2: Assembled carcase

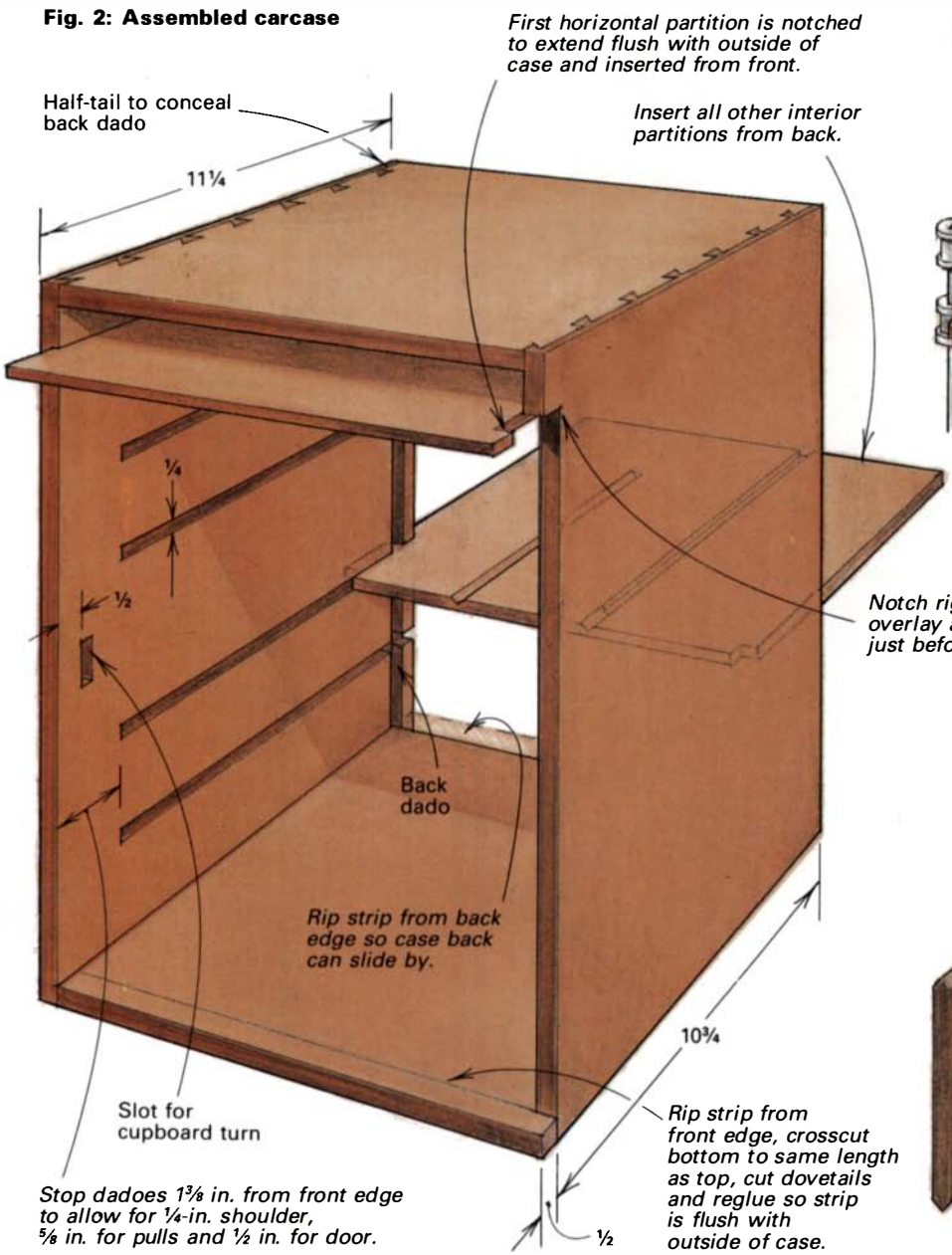


Fig. 3: Chiseling V-grooves

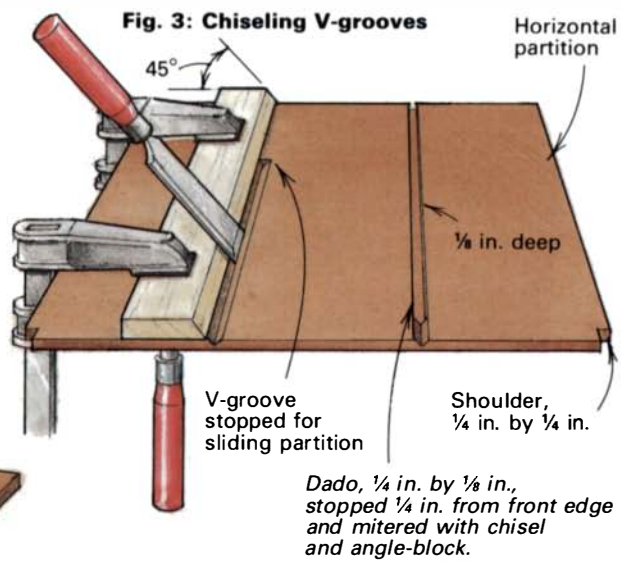
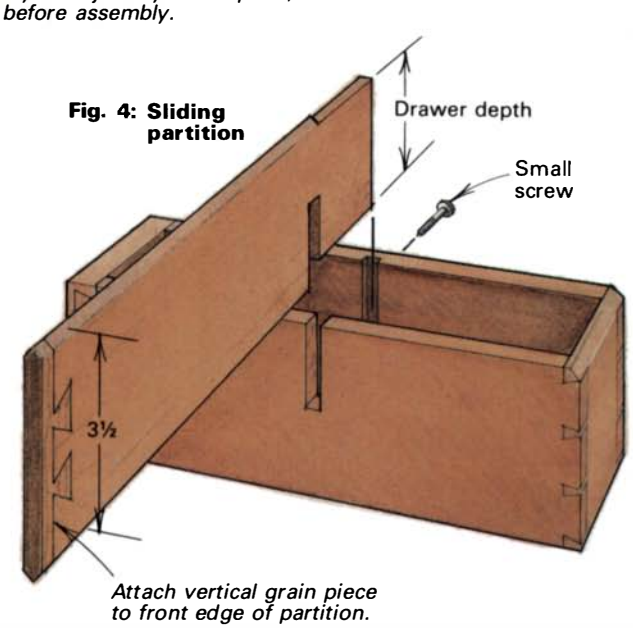


Fig. 4: Sliding partition



The feet are turned with tenons that are glued into holes drilled through the base frame. I wedge the tenons to ensure they stay put. For these wedges to be most effective, I enlarge the holes slightly from the top side of the base frame with a round rasp, and then taper them, preserving the original diameter where the tenon is inserted. As I glue each foot in place, I make a slot in the tenon's endgrain, with a chisel on which I've ground a long bevel, and tap in a wedge. Don't get carried away when enlarging the holes: A 1/32-in. taper and a small wedge will do the job.

The moldings for the cornice and base can be made at this time. When deciding what profile to use, consider the scale of the piece and the fact that one is a cornice molding and one is a base molding. If in doubt, use the profiles in the drawings. I patterned these after moldings on one of the spice boxes I saw at Griffith's Chester County exhibit.

I remove the base frame from the case and glue the base molding to the frame, not to the case, to accommodate wood movement between the molding and case end. Make sure the top of the molding will reach the top of the bottom panel once the frame is screwed back onto the carcase. I glue the top molding to the case front and ends using white glue, because it is the most flexible glue I know of, and I tack the side moldings near the mitered front corner to help ensure that the miter stays tight. I'm wary of gluing the cornice molding cross-grain to the carcase, but doing so helps avoid an open crack between molding and case.

Drawers and door—After I've applied the moldings to the carcase, I rip and crosscut all the drawer components to size and join them with hand-cut dovetails. As you can see in the photo on p. 76, the right side of the hidden drawer on the left, and the left side of the hidden drawer on the right, are beveled along the top edge. Looking closer, you'll see that the conventional drawers have this same bevel on the back. This is because I have a habit of beveling the back of each drawer to make it easier to insert them into the case. With this case, the hidden drawers actually go in sideways.

The sliding partition is attached to the hidden double-drawer with a crosslap and cut to drawer depth where it crosses through the drawer. If you use one of your regular vertical partitions with the grain running up and down, as I did, you will find it pretty fragile, especially where it's notched to lap the drawer side. To remedy this, you can make the partition with the grain running front to back and attach a vertical-grain piece to its front edge, as shown at left in figure 4.

I cut the drawer bottoms and case back from 3/8-in. cedar, with the grain running from side to side. I saw a raised panel bevel on three sides of each bottom and on the back. With the tablesaw blade tilted about 10°, I adjust the fence so I'm left with an edge that fits the grooves. The drawer bottoms extend into a dado in the front and are held in place with a brass screw in the bottom edge of the back. A sliding rosewood bar between the case bottom and base frame holds up the case back.

The door on this piece is so nice, I had to come up with a design for the line-and-berry inlay that would add excitement without obscuring the door's outstanding character and figure. After completing the inlay (see the sidebar at right), a pair of brass hinges are mortised into the door and the case end. The case is finished with Behlen's Super Blonde shellac. □

Alex Krutsky is a part-time instructor at the North Bennet Street School and a member of Fort Point Cabinetmakers, a cooperative shop in Boston, Mass. For further reading, see "The Pennsylvania Spice Box" by Lee Ellen Griffith, Chester County Historical Society, West Chester, Pa. 19380; 1986.

Line-and-berry inlay, with its characteristic motif resembling curved branches ending in three round berries, is found in some of its most intricate patterns on spice-box doors.

Line-and-berry inlay

Line-and-berry's circular sweeps of light wood stringing combined with red and white dots (berries) are occasionally accompanied by initials, a date and a herringbone border.

The grooves for the stringing can be made with a Dremel tool fitted with a router-base attachment and templates, but I prefer a pair of trammel points mounted on a wood bar. The cutting tool is a broken drill bit inserted into one of the trammel points. This bit is sized on a grinder to cut a groove as wide as the thickness of the stringing. Using this rig, I scratch a 1/16-in.-deep groove into the primary wood. On the old work, the centers of the arcs are obvious because of the hole left by the trammel point. To avoid this, I temporarily spot-glue or double-stick-tape a maple scrap at the center points.

The white stringing is holly veneer, tablesawn with a fine-tooth veneer blade into strips slightly more than 1/16 in. wide. I make a wood table insert that snugly fits the blade, and put a small finish nail at the end of the blade slot to spread the cut veneer. I clamp a wood auxiliary fence to the rip fence, extending just to the arbor. I press the fence tightly against the saw table to keep the veneer from catching under. A featherboard clamped to the auxiliary fence holds down the veneer as it's cut and also covers the blade.

I cut the holly stringing to length with a knife or chisel, spread glue into the grooves with my finger and then lay the stringing into the groove. Using the bevel of a chisel as a burnisher, I seat the stringing, working quickly because the glue causes the stringing to swell. Where the lines intersect, it helps to glue in one string first, and when it has set, scratch through it.

The white "berries" are holly, and the red are aromatic cedar. I make the berries by cutting several plugs in a narrow board that I then resaw to release 1/16-in.-thick discs. As a rule, I run the stringing first, sand it flush and then drill for the berries with a brad-point bit.

To make the herringbone border, I glue together alternate pieces of light and dark wood, such as ash and cedar, then true up the block on the tablesaw and cut a 45° angle on one end. Running that angled face against the fence, I saw 3/8-in.-wide pieces and then resaw these into 1/16-in. strips that I inlay into the panel. ***A.K.***

Cross-Grain Constructions

Four clever ways around problems

by Jim Cummins

Wood swells and shrinks in width and thickness as it absorbs and loses water according to the changing relative humidity of the air around it. But humidity hardly affects length at all. Therefore, any furniture construction that restricts wood movement by fastening one piece of wood cross-grain to another courts problems. Many old pieces built this way have cracked or warped because they couldn't withstand the drastic moisture changes caused by central heating. Contemporary builders can avoid cross-grain problems by using plywood and particleboard. Because of their balanced internal structure, both are very stable and may be glued "cross-grain" with impunity. Yet plywood and particleboard are not the most pleasant materials to work with, and they result in a contemporary look that's not always what a woodworker wants.

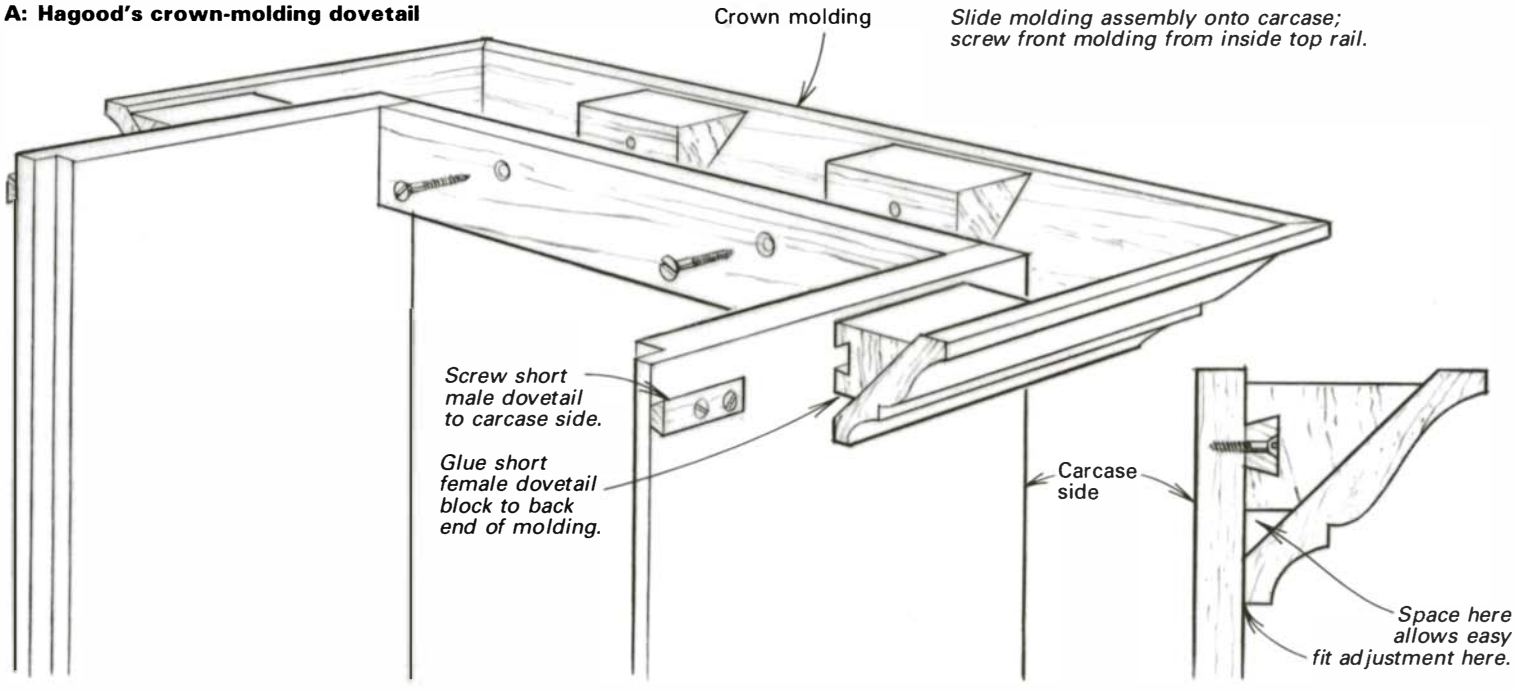
Modern solid-wood furniture usually leans toward the old designs and the old construction methods, making it prone to all the old problems. Yet ways have evolved to allow cross-grain movement while still using traditional design elements such as drawer runners and applied moldings. Typically, one piece is allowed to slip along the unmoving long-grain piece by means of sliding dovetails, screws fastened through slots rather than tight holes, or other devices (such as the buttons that hold tabletops to aprons) that allow movement without compromising strength.

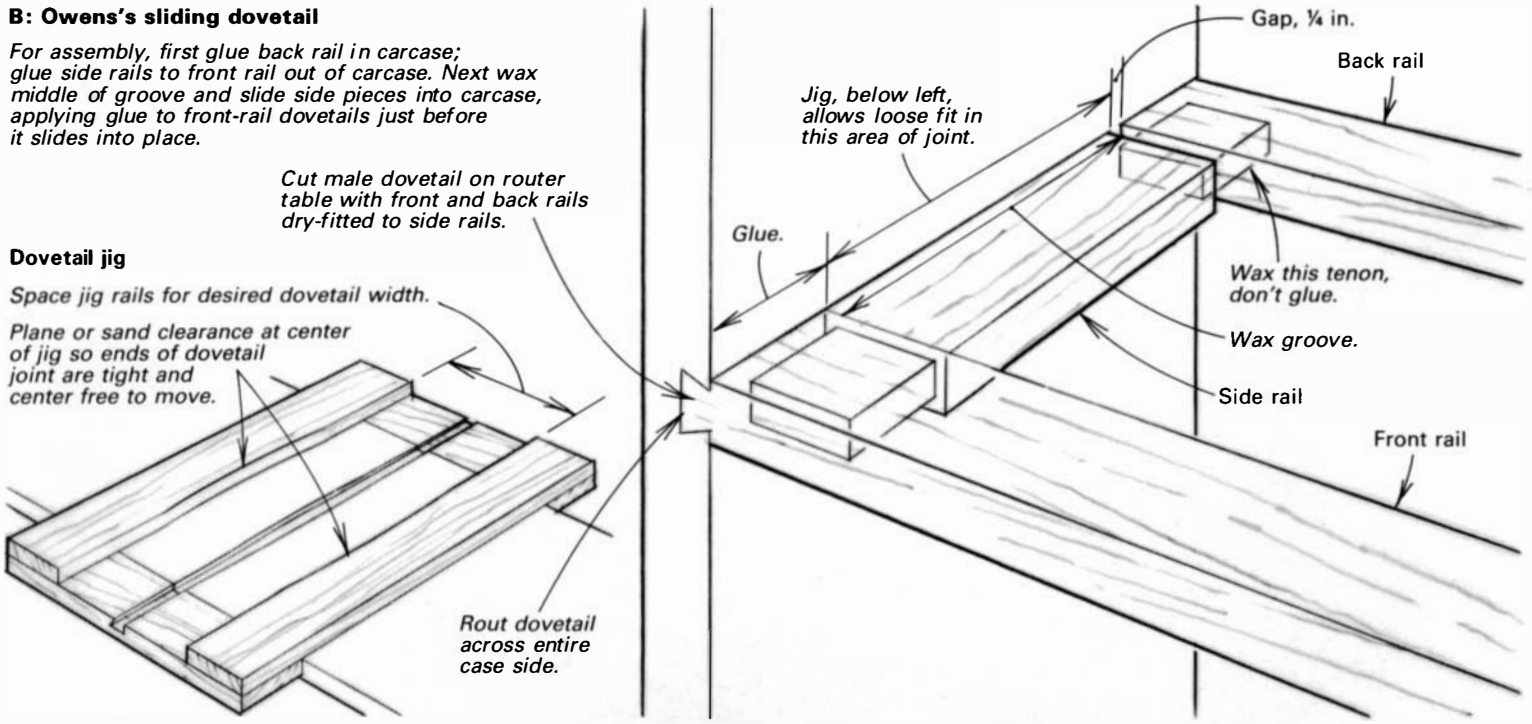
Many of these solutions are very familiar because they have appeared in construction drawings for project after project. Here are a few less obvious ideas and embellishments that have recently come to our attention:

Tom Hagood of Birmingham, Ala., came up with a way to attach crown moldings, as shown in drawing A. The advantages are that it's relatively easy to make the joint using a router and dovetail bit, the applied dovetail piece replaces the screws-in-slots that would otherwise be visible inside the case and the molding may be easily removed if the piece has to be moved through doorways. Crown moldings typically leave a gap at the top between the molding and the case. This may be filled in with another strip of wood, but the usual treatment is to apply a solid top, with molded edges, that overhangs on front and sides, complementing the molding profile.

Walter Owens of Bloomington, Ind., routs full-width sliding dovetails to fasten drawer frames into carcases, as shown in drawing B. The inherent problem with sliding dovetails is that friction increases as the joint is assembled, often to the point where things jam. There's further risk of breakage when attempts are made to disassemble the parts so the joint can be adjusted. In the old days, sliding dovetail joints were usually tapered: Assembly was easy until the joint finally wedged itself tight, hopefully at just the right position. Skilled use of specialized hand tools is required to fit one of these joints correctly. Owens' method solves the problem neatly by adapting a router jig to make a

A: Hagood's crown-molding dovetail





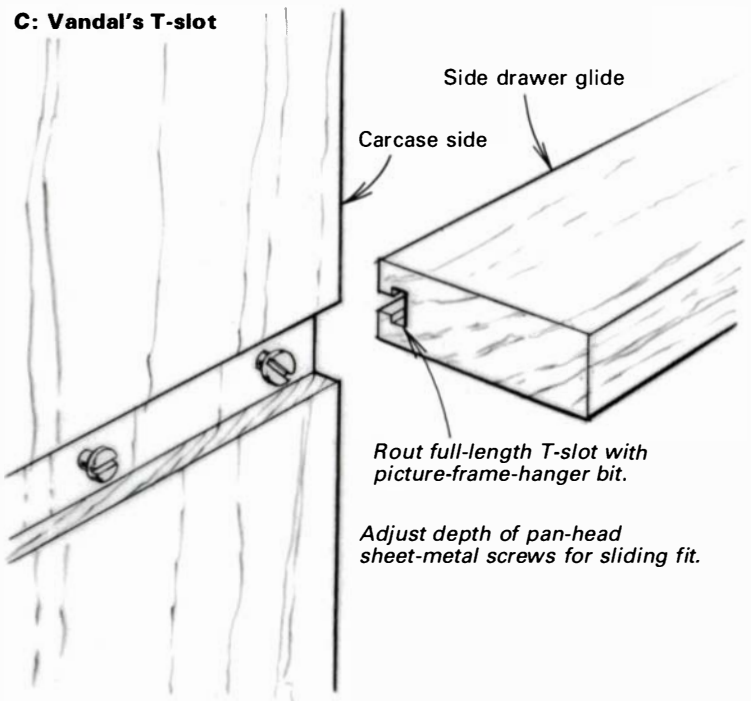
dovetail that's tight at the ends, where the fit shows, and looser in the center, where movement is desired.

Norman Vandal of Roxbury, Vt., a contributing editor at *Fine Woodworking*, has come up with a trick of his own (drawing C). It requires a picture-frame-hanger bit (also known as a hang-slot bit) to rout a T-shape slot along the length of the drawer glide. This bit is normally used to plunge a hole in the back of a frame, and then to undercut it so that the frame may trap a nail head or screw head protruding the correct distance from the wall. (Hang-slot bits are available from most woodworking-supply companies.) Advantages are that the drawer guide rides in a simple dado rather than requiring a dovetail; the fit may be adjusted during assembly by adjusting the height of the screw heads, and after assembly, nothing shows.

Our final cross-grain tip, at least for now, comes from Warren May of Berea, Ky., who is partial to a casework style he calls "Kentucky." He wrote about constructing a quilt cabinet in this style and illustrated his router methods for straightforward joinery and assembly in *FWW* #57. In addition, May has devised a way to hold small applied moldings to case parts (drawing D). The miters at the front are glued tight, as is the front of the molding to the case. The back of the molding is secured with screws in slots from beneath or above, and these are hidden by other case members. May notes that this approach can work for attaching tiny transitional moldings as well.

These ideas prove that the visual appeal of traditional furniture designs doesn't have to be compromised simply because we choose to live in dry hotboxes all winter. No doubt more of these clever, slippery solutions are even now forming in the minds of creative woodworkers who want the best of both worlds. □

Jim Cummins is an associate editor at Fine Woodworking.



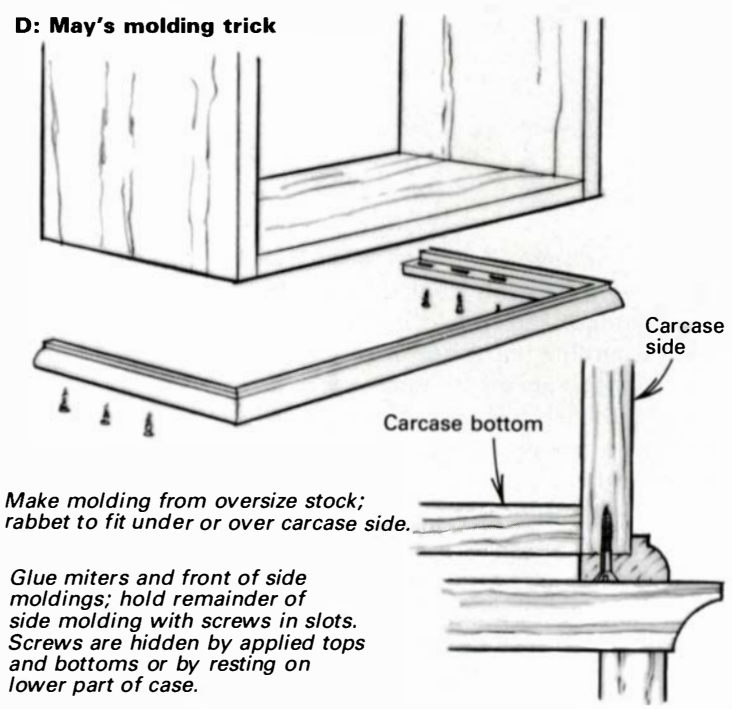
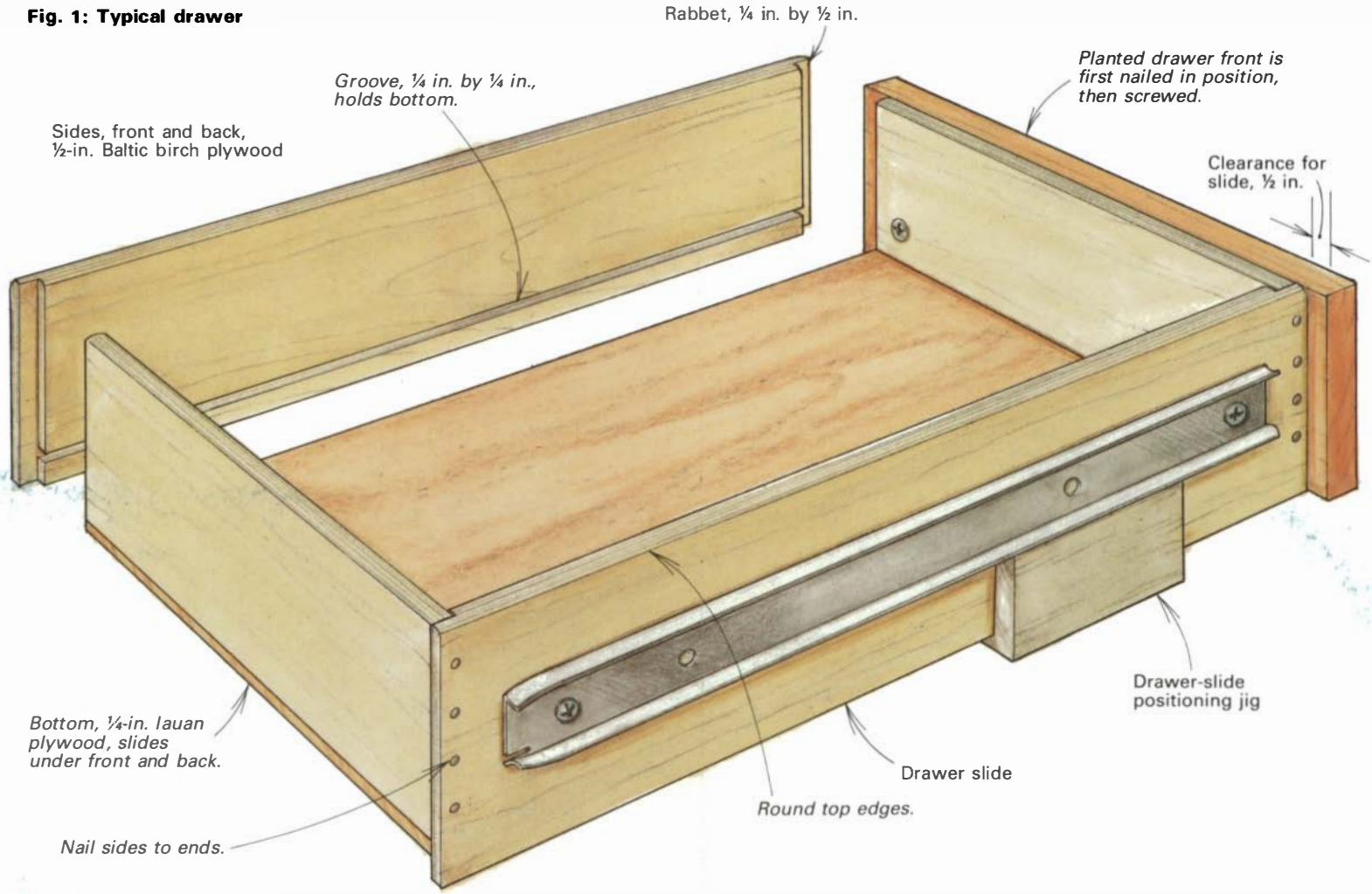


Fig. 1: Typical drawer



Production Drawermaking

Multi-router setup makes quick work of joinery

by Claude E. Graham III

Like many small-shop woodworkers, I've chosen to work in that vast middle ground of woodworking between the furniture studios producing one-of-a-kind pieces and the local shops churning out truckloads of doweled-together boxes with printed wood-grain exteriors. I prefer to stay close to my work and my fellow craftsmen rather than invest in computer-controlled routers or become a people pusher. I do my share of signed gallery pieces, but high-quality commercial furniture contracts make up more than half my business, and that's what pays most of the bills.

Since many of these contract casepieces contain several drawers, it seemed appropriate to devote some time, money and thought toward simplifying my drawermaking procedure. To make these jobs profitable, I needed an efficient system that would work for everything from a pencil tray to a file drawer, yet still be simple enough to be managed by anyone in the shop, even that guy in the back who alternates his stare between the window and the clock. What I came up with was the simple, unvarying design for plywood drawers shown in figure 1 above—rabbet joints at the corners, rounded top edges and grooves to house plywood bottoms.

To handle the joinery, I set up a router table with three routers, as shown in the photo on the facing page. Shopmade fences and featherboards allow anyone to machine a drawer in about 30 seconds once the drawer parts are sawn out. The operator simply takes a stack of parts and works from router station to router station until all the rabbets, grooves and molded edges are cut. Although I just use the table for drawers, this multi-router

system could be adapted to many other production situations.

The whole system, complete with stock routers and cutters, costs about $600. I've yet to find a commercial machine that can do the same work for under $4,000. If you don't produce great quantities of drawers, you could adapt the system to a one-router table with interchangeable fences. I find that leaving the router table permanently set up and ready to go takes the headache out of drawermaking runs. My router table is just a freestanding base made by rabbeting and screwing pieces of 1⅛-in.-thick particleboard together. The table itself is a 4-ft. by 2-ft. sheet of particleboard with a 1-sq.-ft. opening cut in the center. The 34-in.-high work surface is covered with plastic laminate, which makes it easy to slide workpieces past the cutters. I built a 2-in.-high box fence around the opening, as shown at right, so I could add a cover to contain dust and chips. A door installed in the base makes for easy cleanup.

Drawer design—Before describing the router operations in detail, I should explain how I designed the drawers. The budget for my typical project will not allow hand-cut dovetails even though I'm partial to them. Machine-cut dovetails, which I don't find objectionable at all, also chew too deeply into the profit margin. Dowels and knockdown fasteners are popular in Europe and in many American shops, but I don't care much for them. Butt joints are also not my cup of tea. The practical solution for me is a rabbeted joint. Besides being more than strong enough, the rabbeted joint is well suited to plywood, my material of choice for quality drawers in commercial work. Solid wood is fine, but cranking up the planer to make a drawer or two isn't very efficient, and then there is the question of warping and swelling.

Although many shops use standard 5-ply, ½-in. birch or other hardwood plywood, I've found that no amount of sanding will smooth the edges nicely. Most of my drawer sides are ½-in. Finland or Baltic birch plywoods, which have high-quality birch laminations and no voids. My only problem with imported plywoods is that they are often out of square, so I routinely square up the sheets before cutting out parts. Another quality product is Appleply, which can be obtained from some local lumber outlets and The Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374. This American-made plywood consists of nine plies of maple and alder that create a close-grain, easily finished edge. Bottoms are cut from ¼-in. lauan or similar plywood.

My next design decision involved drawer slides. If you like wood slides, I won't try to change your mind. Aesthetics aside, metal slides are simpler to install and easier to adjust, and they give years of trouble-free service. Oddly enough, they seem to work best when under full load. Generally, there are two categories of metal slides: Three-quarter-extension slides designed for chest and desk drawers and full-extension slides for file drawers or any drawer to which 100% access is required. In both cases, I prefer Accuride slides. (For the name of the nearest distributor, contact Standard Precision Inc., 12311 S. Shoemaker Ave., Santa Fe, Calif. 90670; 213-944-0921.)

Cutting lists—Once I had designed my standard drawer, I established a cutting-list system that helps me size all the parts. I first measure the drawer openings, then determine the drawer size that will allow a total of about ½-in. clearance in the drawer height, about ¼ in. above the drawer and ¼ in. below. Next, I make two headings on the cut sheet: one for sides and one for fronts and backs. The side measurements are simply the drawer height by the drawer length. For example, a drawer size of 5 in. high by 12 in. wide by 20 in. deep would need 5-in. by 20-in.

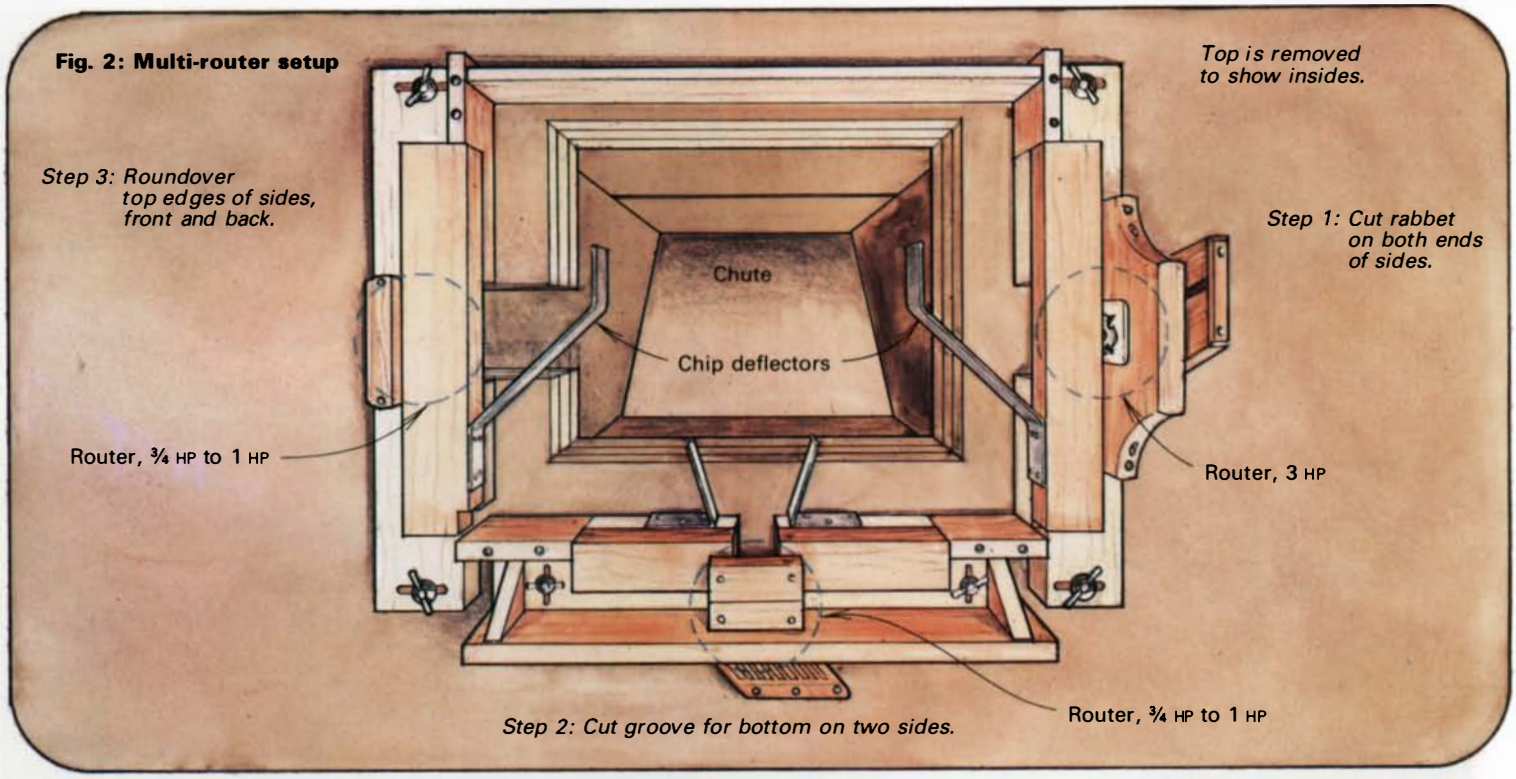
A freestanding table equipped with three routers is the key to the author's efficient and accurate drawermaking system. By moving drawer parts from station to station, a single worker can cut rabbet joints, groove the sides to house the drawer bottom and round all edges in a matter of seconds.

sides. Don't forget to account for the slides when determining part sizes. Slide lengths are typically on 2-in. even increments, so size your drawers accordingly. Most metal slides require ½-in. clearance per side or 1 in. total. The rabbet on the sides reduces the width of the drawer by ½ in.; therefore, you must make the fronts and backs only ½ in. less than the drawer width.

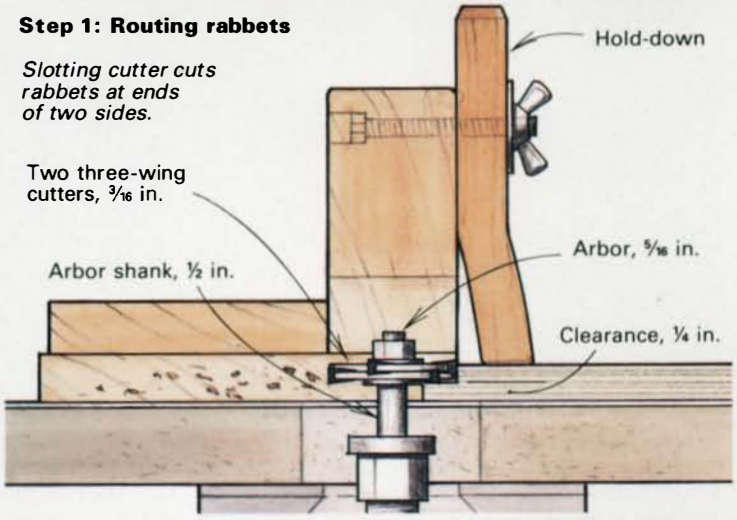
The drawer bottom fits into grooves on the sides, but slides under the front and back. To allow for the thickness of the bottom and the distance between the bottom of the groove and the bottom of the drawer side, the front and back pieces must be ⅝ in. less than the drawer height. For our example, therefore, the front and backs should be 4⅜ in. high by 11½ in. wide. Drawer bottoms are the width of the fronts (11½ in.) and the length of the sides (20 in.). The width measurement is critical. The bottoms are slid into place after the other components are assembled and nailed or screwed together at the front and back corners.

Routing procedures—The most efficient routing method is to perform one operation on all like parts before moving on to the

Fig. 2: Multi-router setup

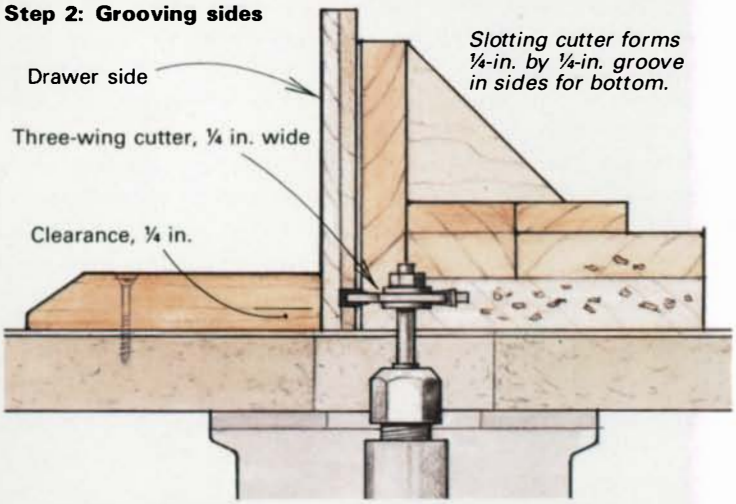


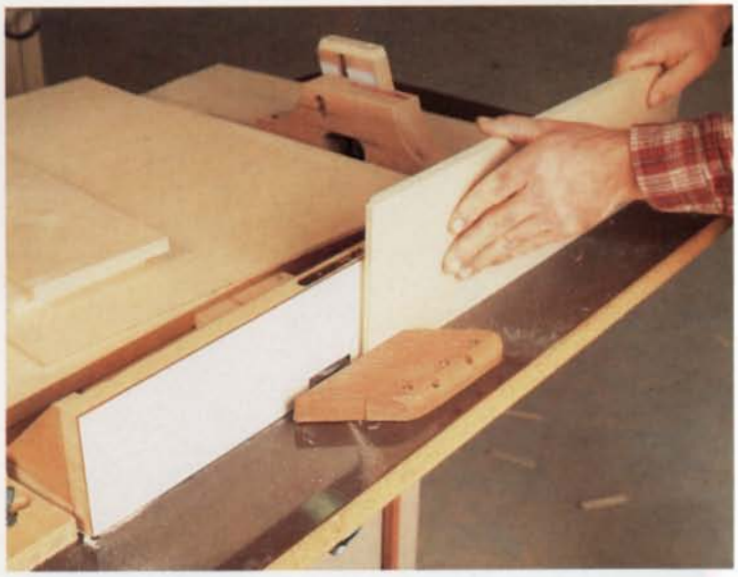
Step 1: Routing rabbets



A single pass under a three-wing carbide cutter rabbets the front and back ends of the side pieces. The cutter is set above the table to compensate for any variations in plywood thickness. A hold-down keeps the pieces flat on the table.

Step 2: Grooving sides





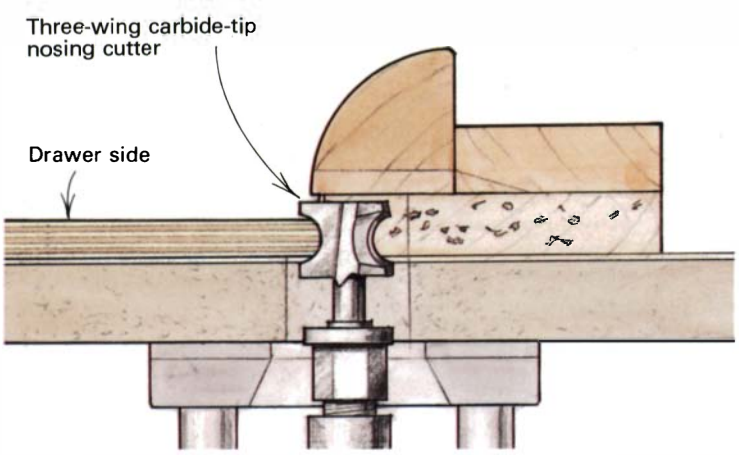
The second step in the drawermaking process is to groove the sides to accept plywood bottoms. Each side piece is run on edge past a ¼-in. slotting cutter. Because the bottom slides under the front and back, these pieces aren't grooved.

next. Step one is to cut the ¼-in. by ½-in. rabbet on the front and back ends of the side pieces. This operation uses a large cutter and removes a fair amount of stock from the edge of the plywood. I use a 3-HP router, which makes it possible to remove the rabbet with a single pass under two 3/16-in. three-wing carbide-tipped cutters. These cutters, part #TF56110, available from Trend-lines, 375 Beacham St., Chelsea, Mass. 02150, are mounted together on a 5/16-in. arbor, also available from Trend-lines, part #TF60100. To account for any variations in the plywood panel's thickness, I have permanently set the bit from the table surface so I'm sure I have ¼ in. of stock remaining against the table. The cutter is thick enough to eliminate any irregularities. The hold-down and cutter guard, shown in the bottom, left photo on the facing page, also increase the chance of an accurate cut and increase safety. Because the width of the pieces provides a good bearing surface on the fence and the opening for the cutter is so small, I carefully push the pieces past the cutter freehand. You could also dado the table for a miter gauge. One fine point: I always cut the stock so the crowned side of the plywood faces the inside of the drawer; when the bottom is inserted, the sides are pushed out straight.

Step two is to rout the ¼-in. by ¼-in. groove for the drawer bottom. This step is usually only performed on the drawer sides.

Step 3: Rounding over edges

Nosing cutter rounds over top edges of both sides, front and back.



Graham rounds the edges of all the drawer parts with a single pass through the third router station, which is equipped with a carbide-tipped nosing cutter. The same operation could be done by making two passes by a roundover bit.

If you prefer to have the drawer bottom fully enclosed, then the fronts and backs should also be grooved, just be sure to adjust your cutting list if you do. The setup for this step is very similar to step one, and it uses the same arbor. But this time a ¼-in. three-wing carbide slotting cutter is used (Trend-lines, part #TF56112). This cutter can be powered by a ⅞-HP to 1-HP router. Again, I measure from the table surface to ensure proper placement of the groove and run the pieces on edge, bottom-side-down, past the cutter, as shown in the bottom, right photo on the facing page.

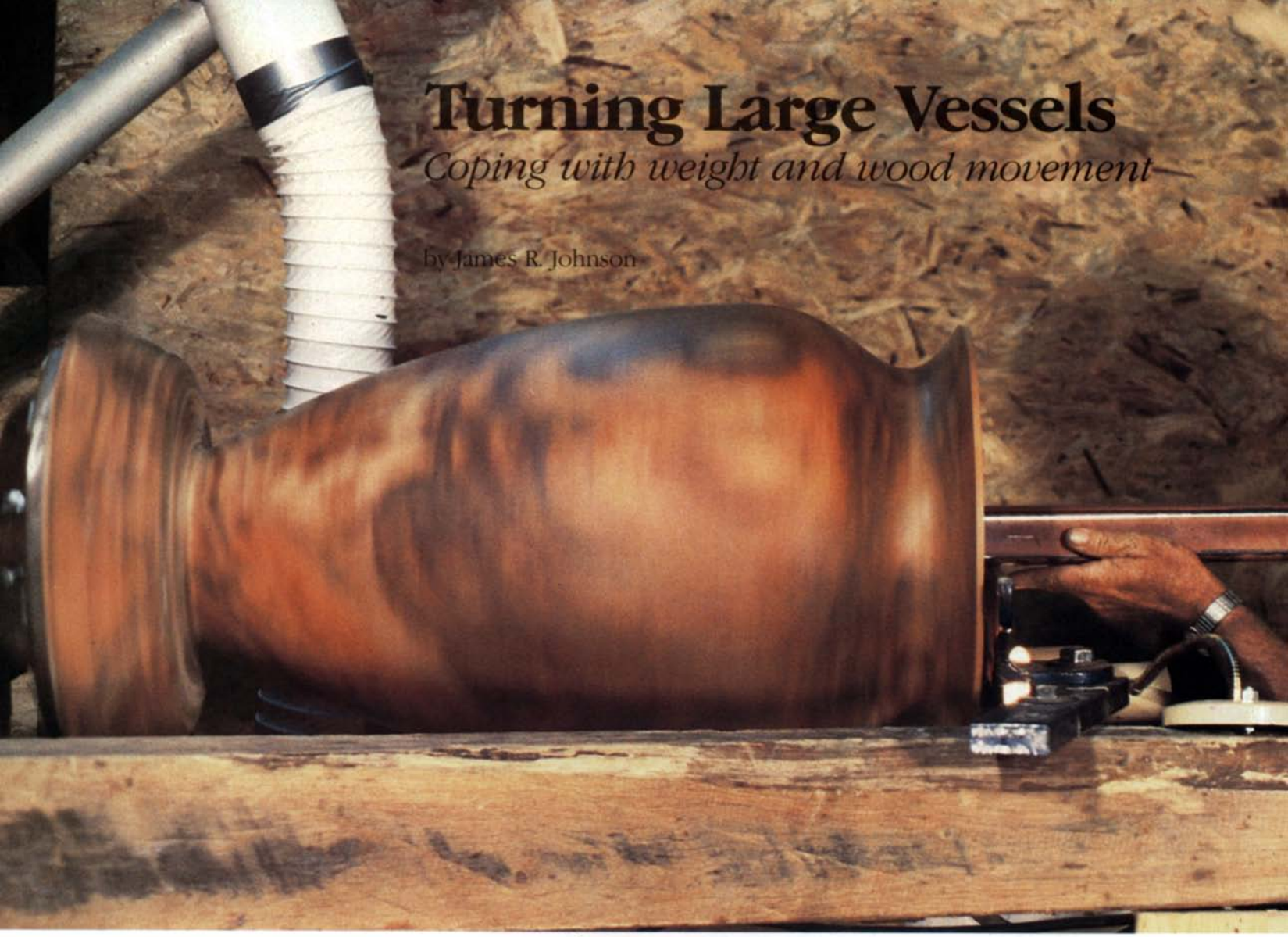
Step three entails nicely rounding the top edges of the sides, fronts and backs. This roundover effect also conceals small alignment blurbs during assembly. The bit here is a two-wing carbide-tipped nosing cutter (Trend-lines, part #TF82116), which rounds both edges at once, as shown in the photo below. You could also use a roundover bit and make two passes, but that seems inefficient to me. After all the parts are machined, the next step is to drill countersunk screw holes into the fronts so you can attach the show-wood drawer fronts later. Next, whip out the old orbital sander and smooth what will be the drawer interior with 100-grit paper. The exteriors are sanded after assembly and puttying of the nail holes.

Drawer assembly—If you have an air nailer, assembly should take about 2.5 minutes to 3 minutes per drawer. If you don't have an air nailer, 3d finish nails work fine, just hammer them in the old-fashion way. If you are going to use this drawer system frequently, though, I think you'll find the method will pay for an air nailer in short order. Either way, my advice is to keep the glue to a minimum and turn the parts top-down on a flat surface while nailing. When the assembled drawers are dry and the nail holes puttied, finish-sand the exterior sides to taste. Finish as desired; I prefer lacquer because it is fast and sprayable.

Installing drawer slides—Put your clock-watching helper to work installing the slide rails on the drawers. Tell him to put a screw in a nonadjustable hole at the back and a screw in a vertically adjustable hole in the front. Make the quickie positioning jig shown in figure 1 to provide horizontal alignment. The next task is to install the case members. It may be necessary to cut some temporary supports to align the case part of the slide. If this is a factor, it's always better to start at the top of the case. In our shop, we put four to six screws in nonadjustable holes, depending on the anticipated load and how fast the clock is ticking. Cordless screwdrivers are ideal for this detail.

Next, you should put a bottom drawer in its new home and check for fit. Grab the appropriate drawer front and your air nailer. Align the front over the drawer and case opening. Reach inside the case, and with your air nailer, blast two or three nails through the drawer into the front. This will hold the front in place until all fronts are aligned, and it also allows a little fine-tuning, if needed. Continue this procedure, working up from the bottom. Quite often the top drawer opening is not accessible from the top for your air nailer. In this case, just pull out the drawer directly below and insert a shim or spacer to support the front directly above. Blast as needed. If you don't have an air nailer, you can screw your drawer fronts in place while they are held in the opening. When you are happy with the alignment, put a couple of screws in the front. The final adjustments for vertical positioning are made using the slide rail on the drawer. When you're pleased with the alignment, screw each rail securely in place. □

Claude E. Graham III operates Masterworks In Wood in Jacksonville, Fla.



Turning Large Vessels

Coping with weight and wood movement

by James R. Johnson

A chunk of wood the size of a tree stump rotating on your lathe at more than 100 RPM can be scary indeed. But if your equipment and the techniques are properly matched to the task, you can do large-scale work with no more trepidation than turning a table leg. But before I describe the tools and methods I've developed specifically for turning large, deep vessels, I want to talk about the shapes and materials I like to work with.

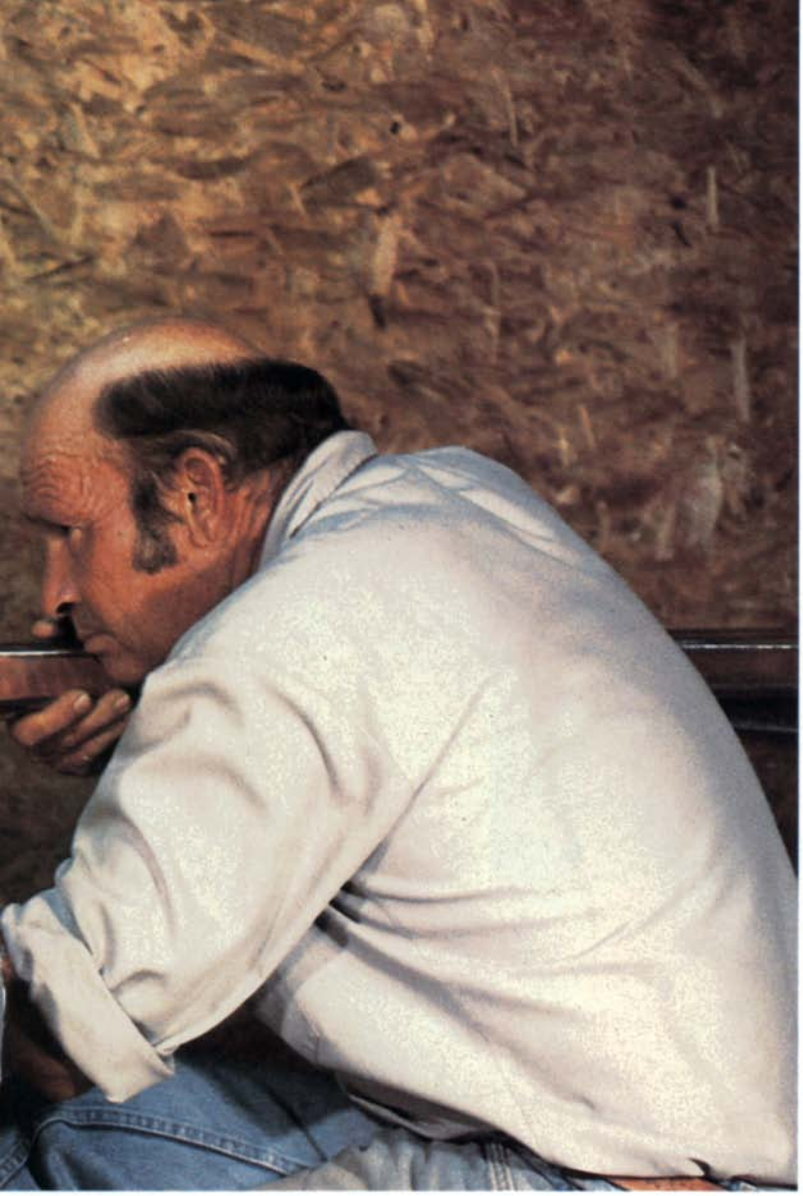
Most turners want to develop a form that is recognizable as "theirs," but a persuasive case can be made for the classic shapes, which potters have used for centuries. The classic shapes of the urn and vase are very familiar to all of us and are accepted as "natural." If they weren't friendly shapes, they wouldn't have persisted through the centuries. Besides, they offer several advantages to the woodturner. The double-curve lip can resist distortion by having a portion of the wood oriented perpendicular to any movement. The narrow bottom not only minimizes the amount of wood that has to be removed on the inside, with a tool at its maximum projection over the tool rest, but it also reduces drying stresses and consequent checking.

Along with shape, wall thickness is a primary concern. A large vessel with ⅛-in.-thick walls does not have the stiffness to withstand warping, unless you are turning burl wood, while a wall thickness of ⅜ in. or more is liable to develop longitudinal cracks due to uneven drying through the walls. As a compromise between two undesirable extremes, I generally turn my vessel walls to a thickness of ¼ in.

My favorite wood for big turnings is walnut: It's stable, easy to turn and finish, and my customers love it. Next to walnut, I like mimosa, also a stable, open-grain wood with magnificent figure. Unfortunately, its dust can be toxic. Hackberry, if you can catch it at the proper time in the spalting process, is also very good. Elm is nice. Osage-orange, (known as *bois-d'arc* here in Texas where it's pronounced "bowdark") cuts and works nicely, though to prevent cracking, it requires particular care in drying, as do our native oaks and pecan. My least favorite is cottonwood. It takes a horrendous amount of sanding to get a nice surface, but because the wood is lightweight, large pieces are easy to manage; too, favorable public reaction makes working cottonwood worthwhile.

Standing trees that have been dead for a year or so are best. Often spalted enough to be colorful, they are usually dry enough to turn right away and are more stable than green wood. Green wood needs to be air-dried six to 12 months before turning. Always use a sealer—paint, glue or one of the commercial products—on endgrain to help prevent checking.

A heavyweight faceplate lathe—The first requirement for deep-vessel turning is a lathe that can handle a 100-lb.-plus piece of wood. The lathe I built, pictured on the facing page, was inspired by the one designed by Ed Moulthrop (see *FWW* #41, pp. 48-53), though my version is different in several ways that make it more versatile. The basic frame is a box made from plywood and exterior solid-core doors. It measures 35 in. high by 48 in. long by 21 in. wide. The top is reinforced with ¼-in.-thick



Using a modified boring bar, the author, left, hollows the inside of a large urn. The bar is tipped with a cutting tool, shown in the drawing on p. 88, that can be adjusted to take an automatically controlled cut, and so it can't catch or hang up. This kind of turning is not for the impatient. A vessel this size can take as long as a week to complete.

The author's faceplate lathe, below, made from scavenged parts, is driven by an electric motor through a riding-lawn-mower transmission, which provides variable speed without the need to move the belt from pulley to pulley. Note that the stock is securely lag-bolted to the faceplate.

2-in. by 2-in. angle iron along the front and back edges. The headstock is machined from a scavenged 2 3/16-in. shaft and rides in pillow blocks 16 in. apart. Faceplate threads are 1½x8 tpi, so I can use standard accessories.

The tool-rest support is a 6-ft.-long 6x6 oak beam that's clamped to the underside of the lathe top with a toggle system, which also supports the beam when it is being moved to a new position. The tool rest is torch-cut from ½-in. angle iron and supported by a 1x2½x16-in. connector bar. A series of holes bored on 1-in. centers in the top of the tool rest let me position a hardened masonry nail to act as a lateral pivot point, or fulcrum, for the long tools I use. These holes have ¼-in.-dia. holes bored through their bottoms to allow dust and chips to be pushed down and out.

Instead of relying on step pulleys for speed control, as Moulthrop's lathe does, mine is driven through a riding-lawn-mower transmission by a 1½-HP, 1750-RPM electrically reversible motor. The transmission not only acts as a gear reducer but also gives four speeds, from 50 RPM to about 475 RPM, with just a tug on a handle. I made a couple of two-step pulleys from turned discs of 14-ply, ¾-in. plywood to double the range.

A threaded motor-support rod with a handle projecting above the bed of the lathe makes belt changing easy and allows the belt to slip when roughing out a piece, where a catch could result in a sprained wrist, or worse. It also helps prevent wear to the bearings and belt caused by the not-inconsiderable weight of the motor, transmission and mounts.

Turning strategy—I turn almost all my large work pithwise, rather than the more conventional plankwise. Several advantages accrue. The grain is oriented along the major axis of the piece, which means shrinkage is more or less even all the way around, and warpage is minimized. And to my mind, the exposed side grain is more attractive than endgrain.

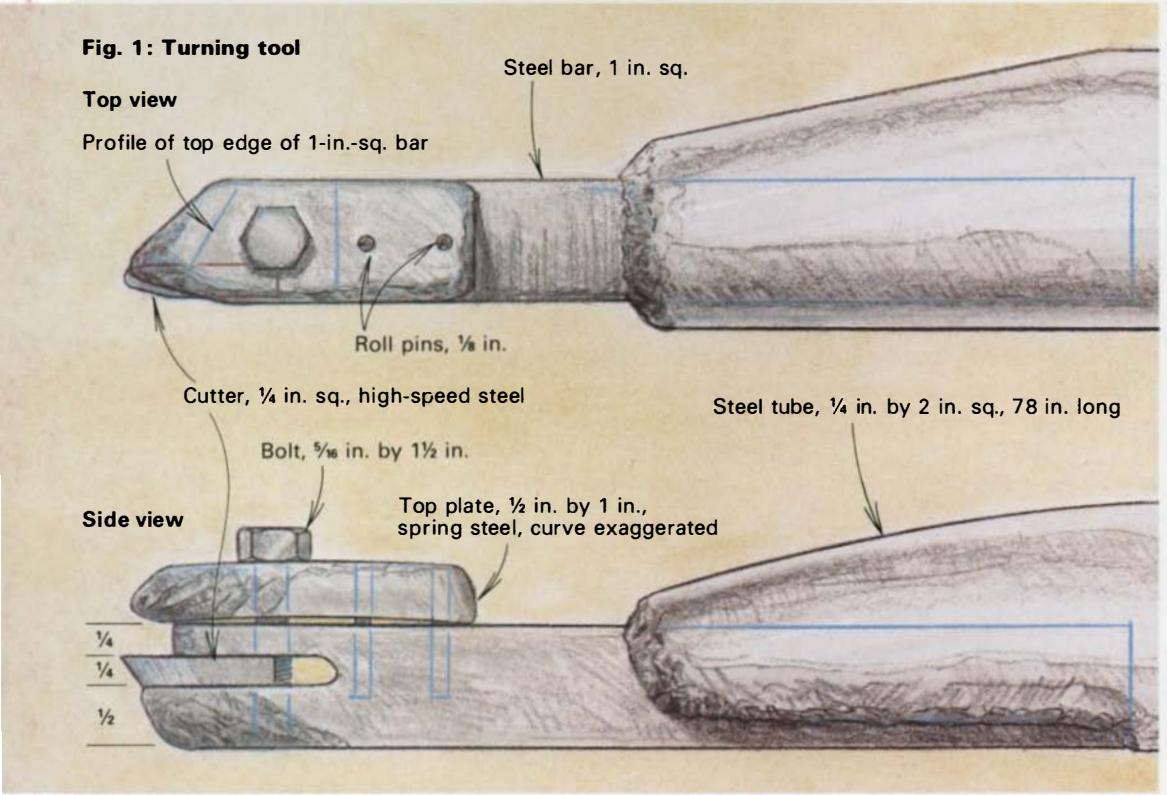
For pieces that incorporate crotches, knots or contrary grain, and for the occasional pieces I turn plankwise, I first rough them out to a wall thickness of about 10% of the maximum diameter and dry them in paper bags for several months. Then, I turn them to within 5% of the maximum diameter and dry them some more. By turning and drying in stages, the familiar oval shape and the ripples caused by uneven shrinkage of end/side grain conjunctions is eliminated.

My usual procedure is to turn the outside of the vessel first (base excluded), as shown in the top, left photo p. 88, and then to turn just past the curve on the inside. Next I sand, apply a coat of oil and continue hollowing the inside. To prevent the base from being stressed and flexed, I leave the diameter there pretty fat until I have hollowed close to this depth and lightened the piece appreciably. By starting to hollow immediately after the outside contour is established, the rim thickness will be the same all the way around, an important part of a good appearance. If I wait until the next day to begin hollowing, the piece will have warped slightly out of round, and it will be impossible to achieve a uniform thickness around the mouth of the vessel.

Anytime I stop work, I fit a large plastic bag over the piece to

Johnson first rough-turns the outside, left, but waits until he's hollowed the inside to finish turning the base. If he completed the base before lightening the vessel, its weight could cause it to break loose and go flying through the shop. To begin hollowing, Johnson uses a lance, which he levers against a hardened masonry nail inserted in the tool rest, as shown above. Too much pressure will cause a catch, possibly with disastrous results, so he takes his time and doesn't crowd the cut. The 27-in.-tall, 16-in.-dia. elm vessel shown below has what the author calls a "classic shape" and is surprisingly lightweight at 7 lbs.

Fig. 1: Turning tool



hold in the moisture. This is particularly important for the rim. I have had rims crack, but was able to repair them by wetting them thoroughly, wrapping a long strip of inner-tube rubber around them and gluing the crack with Hot Stuff cyanoacrylate glue when the crack closed. I have to emphasize the importance of keeping the work uniformly moist. Sometimes the wood dries so fast that I have to dampen it with a wet sponge as it turns.

A lance and a pair of boring bars—The tool I use for turning the outside of a large vessel and the first 8 in. to 10 in. of the inside is a lance, patterned after the one Moulthrop uses. It is made from a 30-in. length of ⅞-in.-dia. air-hardening, high-speed tool steel. Generally levered against a concrete nail dropped in holes in the tool rest, the lance can remove palm-size shavings or a minute quantity of wood with equal ease. The nail serves the same purpose as the bevel on a conventional gouge, but gives much more control. After a cut is initiated, the tool's rounded bottom can be used as a bevel and the cut continued, but with care, as the risk of a catch is increased.

For internal turning, I bore to depth with a 1⅜-in.-dia. twist drill held in a T-handle. Next I use the lance as a scraper, with the flat top held horizontally, but again levered against the concrete

nail, as shown in the top, right photo on the facing page. Only after the bulk of the wood has been removed is the tool used in a shear-cutting action to trim the wall down to the desired thickness. The lance, although a very efficient tool, is liable to catch after it reaches a depth of about 10 in. So to finish hollowing, I use another tool, which is similar to a boring bar.

The boring bar is made from a slotted 1-in. bar welded to a 6-ft., 6-in.-long piece of 2-in. by 2-in. square tubing. A cutting tip of ¼-in. high-speed steel is clamped in the slot of the 1-in. bar. This thing is so heavy that I have to have an auxiliary support under the back of the tube. I sit between the tool rest and auxiliary support, with the handle under my arm, as seen in the photo on p. 86 and 87. Because I designed this tool so its cutting-edge exposure is limited (see figure 1 on facing page), it cannot hang up. I can make cuts in any direction, but cuts from center out or down the side are fastest. I make finish cuts by withdrawing up the side so the cut is with the grain.

After cutting about 2 in. deep and to about ½-in. wall thickness, I sharpen the cutter and trim to final thickness, then cut another 2 in., sharpen and cut again, until the inside walls are finished. Most of the problems I have in cutting are caused by a dull cutter. The very tip and left side of the cutter is doing all the work, and although made from high-speed steel, it dulls more rapidly than you would think. If there is any one secret to easy turning, it is to keep the tools as sharp as possible at all times.

I control the wall thickness by using a pair of calipers where possible. Where calipers can't reach, I bore a tiny hole with a drill bit made from a sewing needle. To gauge the thickness, I insert a blunted needle through the hole with one hand and push it flush with the inside wall with the other. Pinching the needle and withdrawing it shows the thickness of the wall. A chalk mark around the hole lets me find it again after further trimming.

Refining the shape and finishing—Final shaping on the exterior is done using a 7-in. auto-body sander with 80- or 100-grit paper. The sander is applied while the work turns at a fairly low speed and only long enough to remove tool marks. I locate invisible imperfections in the contour by running my hand up and down the piece. A few seconds with the body sander will fair the hills and valleys. Final sanding is done with the lathe stopped.

Because I hate sanding, I tried foam-backed sanding pads. They did very well, but had a number of disadvantages. First was cost. A 3-in. disc of sandpaper costs 50¢ and lasts about two minutes. Second, the foam is much too hard for the kind of work I do, and finally, the only source for these discs is 2,000 miles away. So, I developed my own.

Easily made from discs of ½-in. plywood, 1-in. foam rubber from computer packing crates and thin leather, these sanding pads are the best I've ever used. I have a couple dozen of them, in diameters from 1½ in. to 5 in., with sandpaper grits from 60 to 600. The foam-and-leather pad softens the edge of the sandpaper, preventing swirl marks and allowing the paper to conform to almost any contour. If you make your own pads, be sure to face the foam with leather: The leather keeps the paper from squirming around on the foam and wrinkling or tearing loose. I stick the sanding disc to the leather with double-sided carpet tape.

For sanding the outside, I like to use a 2,500-RPM drill; faster burns the paper, slower prolongs the sanding. The disc will last a long time, because you never have to sand the entire circumference of the piece to smooth a single spot, as you would if the piece were rotating.

I rough-sand the inside of my pieces with floor-sanding paper backed by foam. If there is sufficient room to get a drill or flexible shaft inside, the soft foam discs are used to finish-sand; otherwise, I sand by hand before applying the finish.

The old traditional oil/wax finish is what I use. Not only can the oil be applied to a damp piece, but also it is relatively unaffected by dust. Just wipe the piece down before quitting for the night. Applying oil also is reasonably fast. Since the bowl must be cured for several weeks anyway, it is almost no trouble to wipe on a few coats of oil while the piece is drying, so the overall time is not lengthened. I use boiled linseed oil because it is available (try to find pure tung oil for example) and affordable (price pure tung oil if you find it), and it works. Other oils, such as walnut oil and some of the lighter cooking oils, do not contain dryers and can become rancid while you sit around waiting for them to set up. Believe me, you can't sell a piece that smells bad.

When thoroughly dry and impregnated with oil, I wet-sand using thinned oil and 400-grit paper on the soft foam pad. This restores the smooth surface the wood had before drying and produces a wood slurry, which I wipe into any open pores. The next day I burnish, using the same 400-grit disc I used to wet-sand, then wax. The major drawback to linseed oil is that it darkens with age, but this can be overcome to a large extent by applying two coats of Armour All—a spray-on protective liquid available at auto-supply stores—before waxing.

Parting off—Special care must be taken when parting off the finished bowl. Due to the weight of the piece, at some point in the parting-off process, the bottom will break around the uncut portion and the bowl will go flying. After losing several bowls this way, I now part 1 in. to 2 in. deep, just enough to form an even rim. Then I saw the bowl free. A ball mill in a die grinder removes the excess wood to recess the bottom within the turned rim. The bottom is then smoothed with a foam-backed sanding disc. If the bottom should warp slightly, the rim keeps the bowl standing straight.

Safety—Any lathe work is inherently dangerous. Turning big pieces is especially so because of the mass involved and the potential for injury if it comes loose from the lathe and goes flying through the shop. This means making for a sure connection between the turning blank and the faceplate.

When I bought the spindle for my lathe at the salvage yard, I also picked up five blind flanges for pipelines. These I had drilled and threaded for faceplates. They are 6½ in. in diameter, ½ in. thick on the flange and have a massive amount of steel around the threaded portion. One of these I subsequently modified by welding on a disc of ¾-in. steel 14 in. in diameter to make a faceplate for pieces over 250 lbs. or so. I fasten the faceplates to the turning blanks with ⅜-in.-dia. lag screws from 2 in. to 5 in. long. I have never had a piece come loose and never intend to have it happen. The thought of a 200-lb. log section ricocheting around my shop is not something I like to contemplate.

Tool design also affects safety. The cutting edge of the boring bar tool I use to hollow is ground and positioned on the bar to limit the amount of cut that can be taken. By reducing the cutting-edge exposure, I can eliminate catches. Of course, the cutting tip projection can be increased, but being able to hog the cut isn't worth the risk of a catch, which could break a jaw, or fracture a skull.

One last thing: Never even try to use a skew chisel on large-diameter turnings—the point is too close to the work and the slightest jiggle will cause a catch. □

James R. Johnson is a computer operator and woodturner. He lives in Bastrop, Tex. Photos by author.

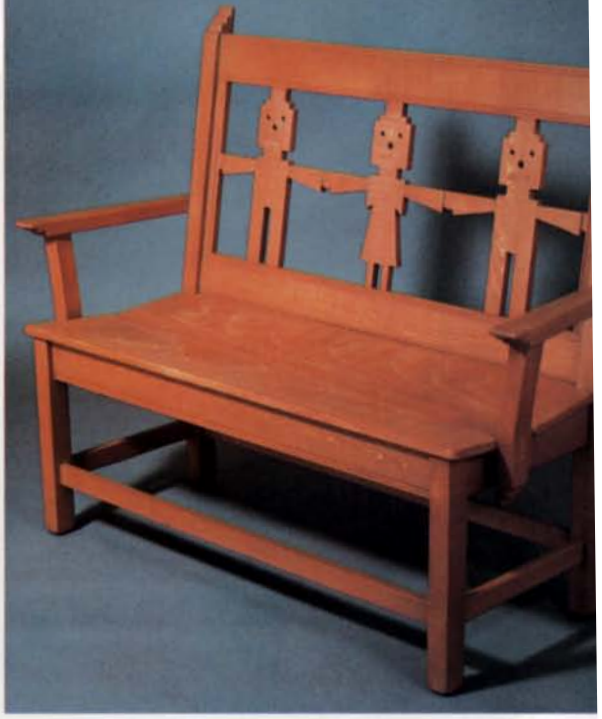


Photo below: Tony Searer

The lizard coffee table by ***The Cimarron Collection***, above left, is based on designs from Mimbres pottery. Such circular patterns always have a break so as not to trap any evil spirits inside. The kachina bench, above, shows both male and female characters. The tilt in the seat boards serves the dual purpose of drainage, if the bench is left in the rain, and comfort. This reproduction of a New Mexican armchair by ***Southwest Spanish Craftsmen***, left, is often called a priest's chair, although these chairs were not used exclusively in churches. The carved step-ups on the seat-back finials are a traditional design.

Southwestern Furniture

Works by eight contemporary makers

by Gary A. Zeff

The blanket chest above by *James Weller* is an interpretation of pieces circa 1850. The carving and endgrain have been highlighted with a darker stain. The latch pin is hand-whittled padauk, obviously not indigenous to the area. Its use is in keeping with Weller's philosophy of poetic license and a statement that this is not meant to be a reproduction. The construction at the top of the stiles is a combination of bridle joint, lap joint and pinned tenon: The bridle, lap and tenon atop the stile can be cut entirely with a saw; the mortise in the top rail can be either chopped or drilled. At right is a large trastero, or freestanding cabinet, by *Interiors de Mexico*. Such pieces are popular because they have many contemporary uses, ranging from storing clothes to housing entertainment centers. The frame-and-panel and through-tenon construction exemplifies rustic joinery.

Furniture made in New Mexico from about 1700-1850 is correctly referred to as Spanish-Mexican period furniture, although it is more often called Southwestern, Santa Fe, Northern New Mexican, Spanish Colonial or Spanish New Mexican. Whether authentic reproductions, modifications of original designs or contemporary interpretations, it is clear that the popularity of this furniture is based on the blending of the region's Spanish, Anglo and Indian cultures and is increasing around the country.

There is so much demand that Santa Fe, N.M., has more than 60 furniture producers in a city of about 65,000 people. Craftsmen in Taos and Albuquerque, each about 75 miles from Santa Fe, add to the quality furniture being made in this area. Shops working in the Southwestern style share many characteristics. Most of the furniture is made from ponderosa pine or sugar pine, and most shops offer the option of hand-rubbed oil finishes, lacquer or polyurethane.

Shop size ranges from one to about 30 people. The craftsmen featured here have various opinions on where the line should be drawn between traditional and stylized furniture; some retain the traditional wedged or pegged mortise-and-tenon joints of the originals, while others rely on modern plate joinery. Nevertheless, it is clear that the builders are immersed in their work, continue to redefine their approach and are comfortable with the New Mexican life-style. Here are a few details about the various shops represented by the photos in this article.

Southwest Spanish Craftsmen (116 W. San Francisco, Santa Fe, N.M. 87501). Founded more than 60 years ago, this company of nine employees specializes in Southwestern and Spanish furniture but produces other period pieces as well. President Tony Searer, who purchased the company in 1985, publishes a catalog but considers it only a starting point, because 60% of his orders are custom designs.

The Cimarron Collection (Charles-David Interiors, 205 Delgado St., Santa Fe, N.M. 87502). Interior designer Gene Law has created the Cimarron collection, a contemporary line of furniture based on Santa Fe and Northern New Mexican traditions. Because this furniture originally was meant for outdoor use, it was made of cedar, a wood still used today because its texture and grain complement the designs. Ian Harley and four assistants produce the collection in Harley's Santa Fe shop. With nine different panel designs, five chair-back designs and a dozen finishes, each piece is virtually custom-made.

A review of Southwestern furniture would not be complete without mention of the furniture being made in Mexico and sold in the United States. The inferior quality of some shops and exact "knock-offs" of others have justifiably irritated many New Mexican craftsmen. However, there are also quality pieces being produced in Mexico. Since good Mexican craftsmen may earn only the equivalent of about $50 per week, it seems logical that there is a market for their furniture in the United States, where the same craftsmen would demand much higher wages.

One reputable source for quality Mexican pieces is ***Interiors de Mexico*** (264 N. Highway 101, Encinitas, Calif. 92024). Professional interior designer Cheryl Dergins conceives the pieces, specifying colors and patterns. Partner David Hall is in charge of manufacturing in Rosarito, Mex., about 40 miles south of San Diego. His 55 employees produce a variety of standard and custom furniture and also finish other furniture made to their specifications deeper in Mexico.

James Weller (Route 9, Box 90JW, Santa Fe, N.M. 87505). Weller, who has a doctorate in philosophy, gave up a teaching career in 1980 for full-time woodworking, a hobby he had enjoyed for years. In an effort to make his pieces as authentic as possible, he uses only hand tools and one power tool—a tablesaw. Whereas others make a perfect piece and then distress it, Weller,

The detail on the bench back above, by ***Doolings of Santa Fe***, is seen often in Dooling's pieces. His stuffed cushions are usually fabrics handwoven by New Mexican artists. ***Taos Style*** spent 12 hours painting the trastero at left. The turquoise and terra-cotta palette represents the sky and mountains. The geometric horses on the bench below are taken from an Indian petroglyph (rock carving). The seat opens for storage. Cutouts in the front of the bench allow for air circulation and are echoed by the design carved into the back rails and by the stepped carving at the top of the back posts.

Photo: Taos Furniture

The pie safe above, by *Taos Furniture*, served the same function in the parched Southwest as its country cousins did on misty Cape Cod. Small openings allowed air to circulate but kept flying insects away from food. Note the crossing, pinned through tenons. Chests of this type by *Ernest Thompson*, below, date from the early 1700s, and the design is still used in rural areas today for storing grain and flour out of reach of dampness and vermin. In the kitchen, it can double as a bench.

Photo: Pat Berrett

who works alone, matches the techniques used in the period the original piece was made. He uses only ponderosa pine and prefers the heartwood. Weller is always experimenting with finishing materials and prefers homemade formulas. He states: "The intention is not to make a piece look old, but rather to preserve the primitive manner in which the furniture of this area was constructed in the past."

Doolings of Santa Fe (525 Airport Road, Santa Fe, N.M. 87501). Rob Dooling moved to Santa Fe in 1976 following seven years of cabinetmaking in New England. He began with a tablesaw, router and some hand tools in a 12-ft. by 24-ft. building that used to be a stable. He characterizes his furniture as a "Northern New Mexican attitude applied to American country furniture," a blend of the three cultures in the area–Spanish, Indian and Anglo. This interpretation, he feels, makes the furniture usable in more homes across the country. Although most of his sales are from his series of more than 100 pieces, he enjoys doing a few museum-quality reproductions each year. He is very proud of a recent commission to build a chair that the Pope used in Phoenix during a Papal Mass for the Southwestern clergy.

Taos Style (Box 858, Taos, N.M. 87571). James and Andrea Rannefeld own and operate their shop and showroom, producing what they term "folk furniture." Jim is in charge of designing and building the pieces, while his wife, Andrea, is in charge of finishing and painting. Their collection includes various small tables, dining tables, trasteros (freestanding, upright cabinets), chairs, couches, bedroom sets, desks, alaceñas (wall-hung cabinets) and others. Their clients have a choice of four finishes, including handpainting, where eight motifs in 10 color combinations are available. The colors and patterns are interpretations of designs found on Navajo Indian petroglyphs (rock carvings), pottery and blankets.

Taos Furniture (Box 2624, Santa Fe, N.M. 87501). This shop is one of the largest in the reproduction and adaptation of Southwestern-style designs, yet each piece of furniture is made by a single employee from start to finish. The company has 20 employees and more than 60 designs with roots in the originals, including a line of office furniture. They accept custom work from anywhere in the country as well.

Ernest Thompson (2618 Coors Road S.W., Albuquerque, N.M. 87105). Started 17 years ago in a one-car garage, this shop now has 30 employees and ships furniture nationwide. Thompson himself, a fifth-generation New Mexican, grew up on a ranch in the northern part of the state. His Mexican and Indian childhood playmates were his entryway into an early familiarity with the cultures and their use of design motifs.

Once an aspiring painter, Thompson feels furniture can be a functional type of art. He believes that some of the current crop of Southwestern furniture verges on trendy and funky. But, he aims his own work to be easy to live with and to have a design integrity that will last.

The best of the Southwestern furniture certainly will do that. I would not try to make a case that every formal Queen Anne room should have its trastero. But as public consciousness of the period grows, these designs are beginning to appear in rooms currently inhabited by Colonial pine pieces, or Mission oak. These styles all share a common ancestry of honest, simple living and straightforward craftsmanship, and hence get along with each other very well. □

Gary Zeff visited Santa Fe several times while gathering ideas for building a Southwestern-style home in Rancho Santa Fe, Calif. Photos are by the author and his wife, Nancy, unless otherwise noted.

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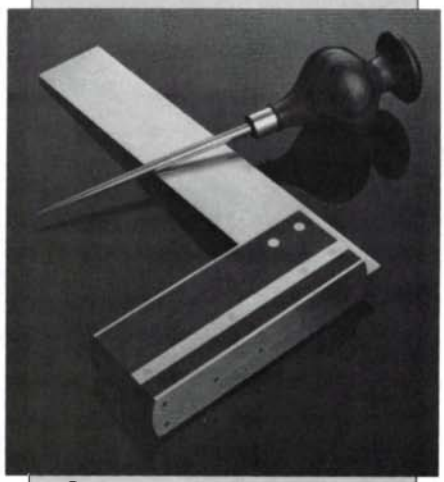

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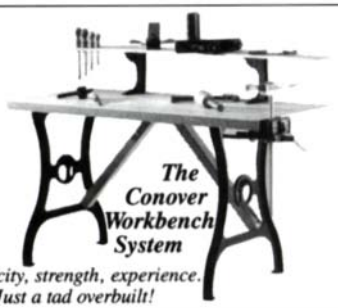

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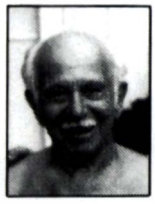

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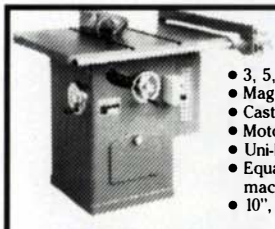

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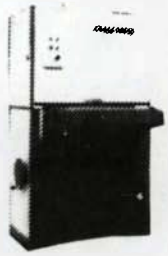

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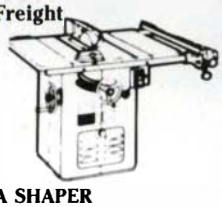

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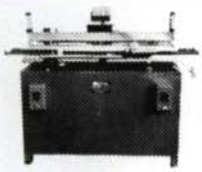

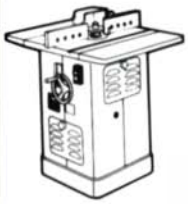

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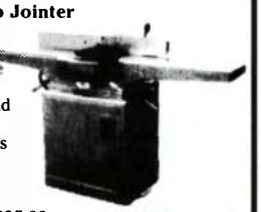

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Expansion slots on the Freud industrial saw blade are cut with a laser and are only .003 or less wide (about the thickness of a human hair). This assures tensioning strength for a true cut. It creates a quieter blade because there are no large holes or wide expansion slots for the air to whistle through. It guarantees a safer saw blade as there are no plugs in the expansion slot that can fly out when the blade is in use.

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Special Carbide Mix

Freud produces a special mix of carbide at their own factory. It is produced from titanium and carbon using cobalt as a binder. Producing this important part of the saw blade within their own factory assures the consistency and quality needed to hold a sharp edge.

The carbide is induction brazed onto Freud's laser produced blade bodies. This process is computer controlled to guarantee uniformity of brazing. A razor edge is then put on the teeth with a 400 grit diamond wheel. This guarantees you of a blade that will provide a maximum of production hours before sharpening is needed.

Item No.	Diameter	Teeth/ Grind	General Purpose	Cross Cut Wood	Plywood	Plastic	Rip Wood	List	Sale
LM72M008	8	24 Rip						68.48	51.48
LM72M010	10	24 Rip	NR	NR	NR	NR	E	77.93	50.68
LM72M012	12	30 Rip						104.03	65.98
LU78M008	8	64 TCG						112.57	93.98
LU78M010	10	80 TCG	G	G	E	E	NR	140.63	104.48
LU78M012	12	96 TCG						169.29	135.68
LU78M014	14	108 TCG						199.80	141.98
LU84M008	8	40 Comb						85.96	59.58
LU84M009	9	40 Comb						85.31	59.58
LU84M011	10	50 Comb	E	G	G	NR	G	89.54	52.18
LU84M012	12	60 Comb						135.31	97.98
LU84M014	14	70 Comb						161.34	116.48
LU85M008	8	64 ATB						112.08	73.98
LU85M009	9	72 ATB						122.56	76.98
LU85M010	10	80 ATB	NR	E	G	G	NR	133.25	85.58
LU85M012	12	96 ATB						161.40	114.98
LU85M014	14	108 ATB						179.06	124.88

E = Excellent G = Good F = Fair NR = Not Recommended
8", 9", and 10" have 5/8" Bore.
12" and 14" saws have 1" Bore.

...ON ADVANCED LASER-CUT DADO SETS!

		Bore	List	Sale
DS306	6" set	5/8"	176.54	110.98
DS308	8" set	5/8"	216.18	118.98

Freud Carbide Tipped Dado Sets will produce a smooth and accurate groove when cutting either with or across the wood grain. Properly stressed and tensioned outside blades feature extremely sharp and steeply beveled carbide teeth that leave clean edges.

The laser cut blade bodies ensure the quietest running dado you can buy.

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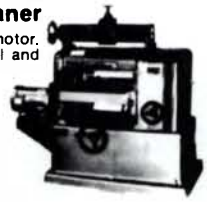
Model 66 Table Saw

50" Biesemeyer Rip Fence, 3HP, 1PH or 5HP, 3PH motor.

F.O.B. Our Warehouse

Model 180 18" Planer

7½HP, 3PH or 5HP, 1PH motor. Knife Grinder, Sectional Roll and Chipbreaker.



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World's Best FS35 Jointer-Planer

Length 63" Width 13¾"
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Weight 719 lbs.

$45 18" Bandsaw

$1099 10.4" Resaw Capacity 1½HP Motor, 330 lbs. **$2295**

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312	Offset Laminate Trimmer	$133
319	Tilt-Base Laminate Trimmer	$138
330	Speed-block Sander	$ 63
352	3x21 Dustless Belt Sander	$130
360	3x24 Dustless Belt Sander	$185
362	4x24 Dustless Belt Sander	$198
555	Plate Joiner	$169
345	Saw Boss	$ 98

HITACHI

F-1000A	Jointer-Planer	$1395
CB75F	Resaw Bandsaw	$1645
C15FB	15" Miter Saw	$409
C10FB	10" Miter Saw	$279
TR12	Plunge Router	$173

MAKITA

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1100	3¼" Planer Kit	$209
1805	6¼" Planer Kit	$309
2708	8¼" Table Saw	$229
3612BR	Plunge Router	$189
GUIDES	for 3612BR	$28
3601B	½" Router	$118
3700B	¼" Trimmer	$95
4301BV	Orbital Jig Saw	$139
5007NB	7¼" Circular Saw	$109
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LU84M	10", 50T. Combination	$ 38
	Set of Three Above	
LU82M	10", 60T. Triple Chip	$ 42
LU85M	10", 80T. Super Blade	$ 59
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DS308	8" Dado	$109
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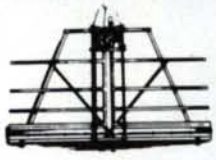

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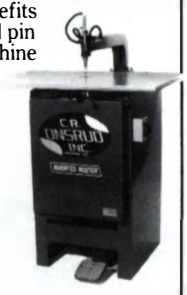

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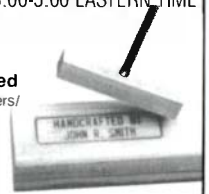

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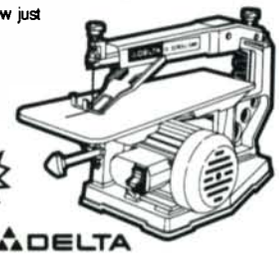

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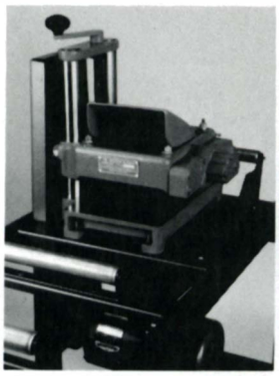

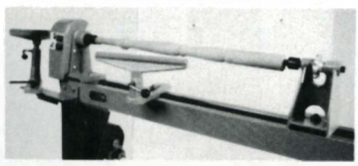

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SY-1225-5 1"R $49.95
SY-1225-6 1¼ "R $49.95

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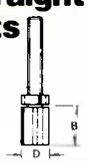
PART NO.	B	D	PRICE
*SY8-12	2	1/2	$15
*SY8-16	2	5/8	$15
*SY8-19	2	3/4	$15
*SY8-30	2	1-1/8	$30

Flush Trimming

PART NO.	A	PRICE
S8012Y	3/8	$7
S8016Y	1/2	$8
*S8016Y½	1/2	$8
S8020	5/8	$10
*S8020½	5/8	$10

Shank Mounted Bearing – Pattern Cutting Straight Bits



PART NO.	B	D	PRICE
SY4-12SM	3/4	1/2	$15
SY4-16SM	3/4	5/8	$15
SY4-19SM	3/4	3/4	$15
SY8-19SM	1-3/16	3/4	$20
SY8-19SM (2CE)	2	3/4	$30
SY8-30SM	1-1/4	1-1/8	$25
SY8-30SM (2CE)	2	1-1/8	$35

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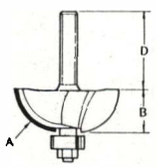
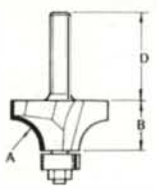


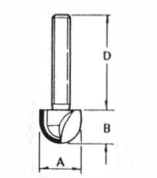
PART NO.	A	PRICE
S702Y	1/16	$11
S704Y	1/8	$11
S706Y	3/16	$11
S708Y	1/4	$12
S710Y	5/16	$12
S712Y	3/8	$12
S716Y	1/2	$13
* S716Y½	1/2	$14

Roundover



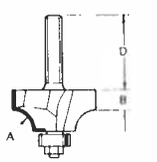
PART NO.	A	PRICE
S502Y	1/16R	$10
S504Y	1/8R	$10
S506Y	3/16R	$10
S508Y	1/4R	$10
S510Y	5/16R	$11
S512Y	3/8R	$13
S516Y	1/2R	$15
* S516Y½	1/2R	$15
* S520Y½	5/8R	$18
* S524Y½	3/4R	$18
* S528Y½	7/8R	$30
* S532Y½	1R	$30
* S536Y½	1-1/4R	$38

Core Box



PART NO.	A	PRICE
S408	1/4	$9
S412	3/8	$10
S416	1/2	$11
S420	5/8	$12
S424	3/4	$14
* S424½	3/4	$14
* S432½	1	$15

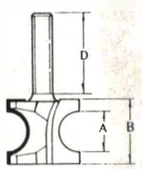
Beading



PART NO.	A	PRICE
S602Y	1/16R	$11
S604Y	1/8R	$11
S606Y	3/16R	$11
S608Y	1/4R	$12
S610Y	5/16R	$13
S612Y	3/8R	$15
S616Y	1/2R	$15
* S616Y½	1/2R	$15
* S624Y½	3/4R	$18

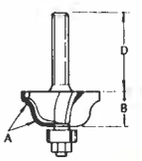
*Indicates ½" shank.

Bull Nose



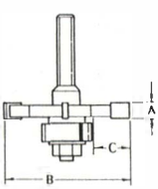
PART NO.	A	PRICE
SY9-1	1/4	$12
* SY9-1½	1/4	$12
SY-9-3	3/8	$14
* SY9-3½	3/8	$14
SY9-4	1/2	$14
* SY9-4½	1/2	$14
SY9-5	5/8	$15
* SY9-5½	5/8	$15
SY9-6	3/4	$15
* SY9-6½	3/4	$15
* SY9-8½	1	$17
* SY9-9½	1-1/8	$25
* SY9-10½	1-1/4	$30
* SY9-11½	1-1/2	$38

Roman Ogee



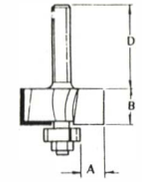
PART NO.	A	PRICE
S5705Y	5/32	$15
* S5705Y½	5/32	$15
S5708Y	1/4	$16
* S5708Y½	1/4	$16

Slot Cutter - 4 Flutes



PART NO.	A	PRICE
SY7002	1/8	$20
* SY7002½	1/8	$20
SY7004	5/32" (4mm)	$20
* SY7004½	5/32" (4mm)	$20
SY7006	3/16	$20
* SY7006½	3/16	$20
SY7008	1/4	$20
* SY7008½	1/4	$20

Slot Cutters/ Rabbeting Bit



PART NO.	B	PRICE
S1702Y	1/16	$10
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* S1704Y½	1/8	$10
S1706Y	1/4	$11
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S1708Y	3/8	$11
* S1708Y½	3/8	$11
S1712Y	1/2	$12
* S1712Y½	1/2	$12

Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We'll list events (including entry deadlines for future juried shows) that are current with the months printed on the cover of the magazine, with a little overlap when space permits. We go to press two 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.

ARIZONA: **Exhibit**–Dyed and laminated wood objects, featuring Peter Chatwin and Pamela Martin, Oct. 6–Nov. 3. The Hand and The Spirit/Joanne Rapp Gallery, 4222 N. Marshall Way, Scottsdale, 85251. (602) 949-1262.

ARKANSAS: **Show**–2nd Annual "Turned Wood Objects Show," Oct. 1–Nov. 6. For more info., contact Tony Bilello, Gallery B, 11121 N. Rodney Parham Road, Little Rock, 72212. (501) 221-0266.

CALIFORNIA: **Show**–11th annual woodcarving show, Sept. 24–25. Coast Union High School, Cambria. Admission: $1. For more info., contact Bill Youngs, show publicity, Cambria Wood Carving Show, Calif. Carvers Guild, Box 1195, Cambria, 93428. (805) 927-4718.
Workshops/demo–Traditional Japanese woodworking, Shoji screen Tansu chest, joinery and hand sharpening classes. Mr. Chutaro Imai Master chisel maker's demonstration (Fujihiro brand), Oct. Contact Hida Tool Co., 1333 San Pablo Ave., Berkley, 94702. (415) 524-3700.
Symposium–4-day archaeological wood symposium, Sept. 26–29. 196th Nat'l American Chemical Society Meeting, Los Angeles. Contact Dr. Roger M. Rowell, USDA Forest Service, Forest Products Lab, 1 Gifford Pinchot Drive, Madison, 53705-2398.
Show/workshop–"Woodworking Tools & Techniques Show & Open House," Nov. 12. 9 A.M. to 4 P.M. "Santa's Toy Workshop," Nov. 19. Nemy Electric Tool Co., 7635-A Auburn Blvd., Citrus Heights, 95610. (916) 969-1088.
Show–1988 Woodworking Show, Sept. 23–25. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. Del Mar Fairgrounds, Crosby Hall, 2260 Jimmy Durnate Blvd., Del Mar, 92014. For more info., contact (213) 477-8521 (in CA); (800) 826-8257.
Class–Dory building with Simon Watts, Oct. 1–8. National Maritime Museum Assoc., Bldg. 275, San Francisco, 94129. Contact Crissy Field at (415) 929-0202.
Show–1988 Woodworking Show, Oct. 28–30. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. LA County Fairgrounds, Bldg. 5, 1101 W. McKinley Ave., Pomona, 91769. For more info., contact (213) 477-8521 (in CA); (800) 826-8257.
Seminar–9th Int'l Wood Machining Seminar, Oct. 10–12. Univ. of Calif., Forest Products Lab. For info., contact Richard Lemaster or Mary Hills: U.C. Forest Products Lab., 1301 S. 46th St., Richmond, 94804. (415) 231-9452.
Show–1988 Woodworking Show, Oct. 7–9. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. Brooks Hall, Fulton and Hyde Streets, 99 Grove St., San Francisco, 94105. For more info., contact (213) 477-8521 (in CA); (800) 826-8257.
Show–Nat'l Working with Wood Show, in conjunction with The Great American Home Craft Expo, Sept. 9–11. San Mateo Fairgrounds. For booth space and info., contact J.D. Productions, Inc., at (408) 296-0161. The National Working with Wood Show, 467 Saratoga Ave., Suite 110, San Jose, 95129.

COLORADO: **Workshop**–Greenwood chairmaking with Drew Langsner, Sept. 26–30. Pingree Park, Colo. State Univ. Mt. Campus. Contact Peter Haney, Box 581, Ft. Collins, 80521. (303) 224-3324.
Classes–New woodworking program taught by Tim Hinz. Red Rocks Community College. 15 college credits. For more info., call (303) 988-6160, ext. 366 or write RRCC, 13300 W. 6th Ave., Lakewood, 80401-5398.

CONNECTICUT: **Exhibition**–"Black & White," a mixed media exhibit, Oct. 12–Nov. 12. Gallery for Fine Contemporary Crafts, 14 Liberty Way, Greenwich, 06830. (203) 661-0014.
Workshops–Unique arts & crafts workshops for Fall '88, beginning Sept. 17. Call or write for free catalog. Brookfield Craft Center, 286 Whisconier Road, Brookfield, 06804. (203) 775-4526.
Exposition–10th annual Holiday Exposition of crafts and fine art, Nov. 5–Dec. 24. Mill Gallery and The Shop. Application deadline Sept. 19. Send SASE and resume to Patricia Seekamp, Guilford Handcrafts, Box 589, Guilford, 06437; (203) 453-5947.
Exhibition–Custom small boat exhibit, Oct. 1–Nov. 27. Maritime Center, South Norwalk. 11 A.M. to 6 P.M. Call the Brookfield Craft Center (203) 775-4526 or the Maritime Center (203) 838-1488 for more information.

DISTRICT OF COLUMBIA: **Show**–1989 Washington Craft Show, Apr. 20–23. Applications must include 5 color slides & nonrefundable $20 and be postmarked by Oct. 15. Send self-addressed mailing label to the Smithsonian Assoc. Women's Committee, Arts & Industries Bldg., Rm. 2475, Smithsonian Institute, Washington, 20560; (202) 357-4000.

FLORIDA: **Juried show**–26th annual Coconut Grove Arts Festival, Feb. 18–20, 1989. Closing date: Sept. 15. Contact Terril Stone-Ketover, Coconut Grove Arts Festival, Box 330757, Coconut Grove, 33233-0757. (305) 447-0401.

GEORGIA: **Juried exhibit**–1988 (35th) Arts Festival of Atlanta "Artists Market," Sept. 10–18. For more info., contact Arts Festival of Atlanta, 1404 Spring St., N.W., Suite 1, Atlanta, 30309. (404) 885-1125.
Seminar–Woodworkers Guild of GA's cabinetmaking seminar, Sept. 3–4. Highland Hardware, 1045 N. Highland Ave., Atlanta. For more info., call John Gorrell at (404) 460-1224 or Mike Hare at (404) 972-7121.

ILLINOIS: **Show**–5th annual, Woodworking Assoc. of N. America, "The Chicago Show," Oct. 7–9. The Metro Center, Rockford. Contact The Image Group, Box 367, Plymouth, NH, 03264. (800) 521-7623 or (603) 536-3876
Seminar–Lynda Primrose, carousel horse carver, Sept. 11. Free: 12 P.M. to 5 P.M. Tom's Woodshop Inc., 106 South 3rd St., Bloomingdale, 60108. For more information, call (312) 894-6282.

INDIANA: **Juried show**–47th Madison Chautauqua of the Arts, Sept. 24–25. For more info., contact Dixie McDonough, Madison Chautauqua of the Arts, 1119 W. Main St., Madison, 47250. (812) 265-5080.
Show–Nat'l Working with Wood Show, in conjunction with The Great American Home Craft Expo, Oct. 21–23. Indiana State Fairgrounds, Indianapolis. For booth space and info., contact J.D. Productions, Inc., at (408) 296-0161. The National Working with Wood Show, 467 Saratoga Ave., Suite 110, San Jose, CA 95129.

LOUISIANA: **Juried show**–13th annual fall crafts festival, Oct. 21–23. Outdoor show, North Blvd., Baton Rouge; booth fees: $100–$110. For more info., contact River City Festivals Assoc., 427 Laurel St., Baton Rouge, 70801. (504) 344-3328.

MARYLAND: **Juried show**–12th annual Maryland Crafts Festival, Oct. 14–16. Maryland State Fairgrounds, Timonium. For info., contact Deann Verdier, Sugarloaf Mountain Works, Inc., 20251 Century Blvd., Germantown, MD 20874. (301) 540-0900.
Show–1988 Woodworking Show, Sept. 16–18. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. Baltimore Convention Ctr., Festival Hall, Sharp and Camden Streets, Baltimore, 21201. For more info., contact (213) 477-8521 (in CA); (800) 826-8257.
Juried show–13th annual Autumn Crafts Festival, Nov. 18–20. Montgomery County Fairgrounds, Gaithersburg. For more info., contact Deann Verdier, Sugarloaf Mountain Works, Inc., 20251 Century Blvd., Germantown, MD 20874. (301) 540-0900.

MASSACHUSETTS: **Show**–5th annual, Woodworking Assoc. of N. America, "New England Show," Oct. 21–23. The Big E, Springfield. Contact The Image Group, Box 367, Plymouth, NH 03264. (800) 521-7623 or (603) 536-3876.
Show–1988 Woodworking Show, Sept. 30–Oct. 2. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. Royal Plaza Trade Ctr., 181 Boston Post Road W., Marlborough, 01752. For more info., contact (213) 477-8521 (in CA); (800) 826-8257.
Workshops/seminars–Numerous events. Contact The Woodworkers' Store, 2154 Massachusetts Ave., Cambridge, 02140. (617) 497-1136.
Exhibition–"Art at Work: Handmade Furniture for the Office," Sept. 30–Nov. 12. The Society of Arts & Crafts, 175 Newbury Street, Boston, 02116. (617) 266-1810.

MICHIGAN: **Show**–1988 Woodworking Show, Nov. 4–6. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. Cobo Conference/Exhibit Ctr., Michigan Hall, 1 Washington Blvd., Detroit, 48226. For more information, contact (213) 477-8521 (in CA); (800) 826-8257.
Workshop–Shaker oval box workshop with John Wilson, Sept. 16–17, and wooden plane workshop, Sept. 18. Sponsored by Eastern Michigan Woodworkers. Contact John A. O'Brien, 3718 Beechwood Ave., Flint, 48506. (313) 743-0782.
Show–Nat'l Working with Wood Show, in conjunction with The Great American Home Craft Expo, Oct. 7–9. Michigan State Fairgrounds, Detroit. For booth space and info., contact J.D. Productions, Inc., at (408) 296-0161. The National Working with Wood Show, 467 Saratoga Ave., Suite 110, San Jose, CA 95129.

MINNESOTA: **Class**–11th annual Kiln Drying Short Course, Sept. 12–16. Univ. of Minn., St. Paul Campus. For info., contact Harlan Petersen, Extension Forest Products Specialist, 202 Kaufert Lab, Univ. of Minn., 2004 Folwell Ave., St. Paul, 55108. (612) 624-3407.
Show–1988 Woodworking Show, Sept. 9–11. Featuring machinery, power and hand tools, supplies, demonstrations, seminars, free workshops. St. Paul Civic Ctr., Wilkins Auditorium, Main Level, 143 W. 4th St., St. Paul, 55102. For more information, contact (213) 477-8521 (in CA); (800) 826-8257.
Exhibition–6th annual guild sponsored "Northern Woods Exhibit," Oct. 6–9. Bandana Square, Energy Park, St. Paul. Deadline: Sept. 1. For info., contact Bruce Kieffer, Kieffer Custom Furniture, 2269 Ford Pkwy., St. Paul, 55116. (612) 698-5033.
Workshops/seminars–Numerous events. Contact The Woodworkers' Store, 3025 Lyndale Ave. S., Minneapolis, 55408. (612) 822-3338.

MISSOURI: **Show**–"Wood 1988," 4th annual show of custom-made furniture and woodcraft, Oct. 1–9. Reception: Oct. 1 from 2 P.M. to 6 P.M. Crown Center Exhibit Hall, 2450 Grand Ave., Kansas City, 64108. Free admission. Contact The Kansas City Woodworkers' Guild, 3023 Holmes St., Kansas City, 64109. (816) 756-0128.
Show–9th annual Atlanta Art Buyers Caravan (ABC), Sept. 24–26. Atlanta Merchandise Mart. One-time $3 fee. Register by contacting Paul Karel, 408 Olive St., St. Louis, 63102. (314) 421-5445 or FAX (314) 421-1070.

NEW JERSEY: **Show**–4th annual, Woodworking Assoc. of North America, "The Philadelphia Area Show," Nov. 11–13. Hyatt Cherry Hill, Cherry Hill. Contact The Image Group, Box 367, Plymouth, NH 03264. (800) 521-7623 or (603) 536-3876.
Show–First Anniversary Showcase, Sept. 30–Oct. 28. Featuring woodturned vessels by Michael Foster. Sheila Nussbaum Gallery, Princeton Shopping Center, N. Harrison St., Princeton, 08542. (609) 683-7474.
Show–Super Craft Star Show, Oct. 28–29. The Giants Stadium Club, Meadowlands Complex. Friday: 3 P.M. to 10 P.M.; Sat.: 11 A.M. to 10 P.M. For more info., contact Creative Faires Ltd., Box 1688, Westhampton Beach, NY 11978, (516) 325-1331, or 134 Fifth Ave., New York, NY 10011, (212) 645-1630.
Exhibition–American Folk Art from the collection of Herbert Waide Hemphill, Jr., thru Sept. 11. Curated by Sid Sachs. The Noyes Museum, Lily Lake Road, Oceanville, 08231. (609) 652-8848.

NEW YORK: **Workshops**–Hand tool workshops by Robert Meadow, Sept. 10–11, 24–25, Oct. 8–9, 22–23, Nov. 4–5, 19–20. Contact The Luthierie, 2449 W. Saugerties Road, Saugerties, 12477. (914) 246-5207.
Classes–Annual woodworking classes, Sept. 10 thru Dec. 17. Constantines, 2050 Eastchester Road, Bronx, 10461. Two sessions–Sat. and Wed.; $10 per person for the two sessions. Call (212) 792-1600 for registration form.
Exhibition–"The Trademan's Tool Chest," as of May 1. The Farmer's Museum, New York State Historical Assoc., Lake Road, Box 800, Cooperstown, 13326. (607) 547-2533.
Classes/demo–Full woodworking classes, beginning Sept. 19. Craft Students League, 610 Lexington at 53rd St., New York, 10022. 15 weekly, day and evening 3-hour sessions: $180. Free shoptime for students; 3 levels of woodworking by Maurice Fraser, refinishing by Susan Perry and lathe classes by Bill Gundling. Free demo on Sept. 12 at 5:15 P.M. For more info., call (212) 735-9732.
Show–3rd annual, Woodworking Assoc. of N. America, "New York Show," Sept. 23–25. Westchester County Center, White Plains. Contact The Image Group, Box 367, Plymouth, NH 03264. (800) 521-7623 or (603) 536-3876.
Competition–"Art Horizons, NY–1988, leading annual int'l art and craft competition, deadline Nov.2. Open to all artists and crafts persons; winners to be exhibited at Art 54 Gallery, Soho, NYC. For application, write Art Horizons, Dept. RW, Box 1091, Larchmont, 10538. (914) 633-6661.
Show–3rd annual "Art of the Wooden Bird Decoy and Wildlife Art Show and Sale," Sept. 24–25. Niagara Power Vista, Niagara Falls. 10 A.M. to 5 P.M.; $35 per exhibit space; no mail-in entries. Contact Melvin J. Ott, 324 Ward Road, N. Tonawanda, 14120. (716) 694-6075 (evenings).
Show–2nd annual, Woodworking Assoc. of N. America, "Central NY State Show," Nov. 4–6. NY State Fairgrounds, Syracuse. Contact The Image Group, Box 367, Plymouth, NH 03264. (800) 521-7623 or (603) 536-3876.

NORTH CAROLINA: **Juried show**–"Indian Summer Art & Craft Show," Oct. 6–9. Asheville Mall. "High Country Christmas Art & Craft Show," Nov. 25–27. Asheville Civic Center. All media, all categories; original work only; fee $140 and $130; legal SASE. Contact Gail Gomez, High Country Crafters, 29 Haywood St., Asheville, 28801. (704) 254-7547 or 254-0070.
Show–4th annual, Woodworking Assoc. of N. America, "The Carolina Show," Sept. 30–Oct. 2. The Merchandise Mart, Charlotte. Contact The Image Group, Box 367, Plymouth, NH 03264. (800) 521-7623 or (603) 536-3876.
Show–41st Annual Guild Fair '88, Oct. 21–23. Asheville Civic Center, Asheville. Adults $3.50; children under 12 free with parent. For more info., contact Guild Fair, Box 9545, Asheville, 28815. (704) 298-7928.

OHIO: **Show**–1st annual, Woodworking Assoc. of N. America, "The Cleveland Show," Oct. 28–30. International Exposition (IX) Center, Cleveland. Contact The Image Group, Box 367, Plymouth, NH 03261. (800) 521-7623 or (603) 536-3876.
Seminars–Woodworking, by Earl Richard, Oct. thru March. Contact Richards' Cabinetry & Mill Co., 410 W. Harrison St., Lewisburg, 45338. (513) 962-4788.
Show–1988 Woodworking Show, Sept. 9–11. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. Cincinnati Convention Ctr., North Hall, 525 Elm St., Cincinnati, 45245. For more info., contact (213) 477-8521 (in CA); (800) 826-8257.

OREGON: **Show**–1988 Woodworking Show, Nov. 18–20.

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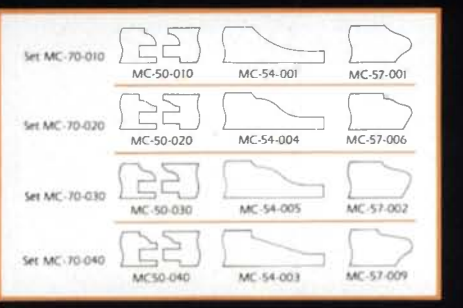

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3601B	1-3/8HP D-Handle Router	134
9030	1 1/8x21 Belt Sander	135
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Classes–Over 60 classes and workshops beginning Sept. 21. Call (503) 297-5544 for a free schedule. Oregon School of Arts & Crafts, 8245 S.W. Barnes Road, Portland, 97225.

PENNSYLVANIA: **Juried show**–International Turned Object Show (ITOS); eligible objects include sculpture, furniture, bowls, vessels, functional and non-utilitarian production items, miniatures, architectural forms, etc. Show will open in Oct. '88; international tour planned. For more information, write to the American Assn. of Woodturners, ITOS Show, Box 982, San Marcos, TX 78667 (indicate if an AAW member).
Juried show–America's Masters, Nov. 25–27. PA State Farm Show Complex. Now accepting applications; deadline Sept. 15. For more info., call or write I.M.K. Productions, Kay Kishbaugh, director, Box 3279, Shiremanstown, 17011. (717) 697-8288.
Show–1988 Woodworking Show, Oct. 14–16. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. Expo Mart, East Hall, 105 Mall Blvd., Monroeville, 15146. For more information, contact (213) 477-8521 (in CA); (800) 826-8257.
Symposium–The Use of the Lathe: Ideas for the Classroom, Nov. 11–13. Bucks County Community College, Newtown. Contact The Wood Turning Center, Albert LeCoff, executive director, Box 25706, Philadelphia, 19144. (215) 844-0151.
Exhibition–"Selected Works from the Wood Turning Center," Oct. 5–Nov. 13. Curated by Mark Sfirri. Hicks Art Gallery, Bucks County Community College, Newtown. For more info., contact Continuing Education Dept., BCCC, Swamp Road, Newtown, 18940.
Exhibition–"PA Council on the Arts 1987 Craft Fellowship Recipients," Sept. 16–Nov. 6. Tues.–Sat. 10 A.M. to 5 P.M.; Sun. 1 P.M. to 4 P.M. The Society for Art in Crafts, 2100 Smallman St., Pittsburg, 15222. (412) 261-7003.
Juried show–12th Annual Philadelphia Craft Show, Nov. 10–13. Armory in W. Philadelphia. Contact Women's Committee of the Philadelphia Museum of Art, Box 7646, Philadelphia, 19101-7646. (215) 787-5448.
Symposium–Gilding conservation symposium, Oct. 16–28. Philadelphia Museum of Art. For more info., contact the American Institute for Conservation of Historic and Artistic Works' National Office, The Klingle Mansion, 3545 Williamsburg Lane, NW, Washington, DC 20008; or project director Deborah Bigelow at (914) 561-6011.
Seminars–Woodworking with Tage Frid, Sept. 9–11; making a continuous arm Windsor chair with Michael Dunbar, Sept. 24–25. Contact the Olde Mill Cabinet Shoppe, RD3, Box 547 A, Camp Betty Washington Road, York, 17402. (717) 755-8884.
Juried exhibition–Luckenbach Mill Gallery Juried Exhibition of Contemporary Crafts, Oct. 1–30. For more info., contact Janet Goloub, Historic Bethlehem, Inc., 459 Old York Road, Bethlehem, 18018. (215) 691-5300.
Juried show–State Craft Festival, Sept. 23–25. Tyler State Park, on Rt. 332 between Newtown and Richboro; 10 A.M. to 6 P.M.; $4 admission; children 12 and under 12 free. Contact Penn. Designer–Craftsmen, Box 718, Richboro, 18954. (215) 860-0731.
Juried show–Penn. Christmas Craft Market, Nov. 12–13. Memorial Hall, York Fairgrounds, York. 10 A.M. to 6 P.M.; $3 admission; children 12 and under free. Contact Penn. Designer–Craftsmen, Box 718, Richboro, 18954. (215) 860-0731.

TENNESSEE: **Juried exhibition**–"Animal Imagery: New Forms, New Functions," Feb. 24-May 20, 1989. Deadline is Dec. 30; artists must reside in U.S.; 35mm slides (3 entries) and $15 entry fee. For prospectus, write Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, 37738, or call (615) 436-5860.

TEXAS: **Festival**–15th annual Winedale Oktoberfest, Oct. 1–2. Winedale Historical Center, 4 miles east of Round Top. For info., call (409) 278-3530 or write the Winedale Historical Center, Box 11, Round Top, 78954.

VERMONT: **Exhibition**–"The Cow Jumped Over the Moon," Sept. 24–Oct. 27. Five artists' interpretation of bowls and spoons. Reception open to public, Sept. 25; 6 P.M. to 8 P.M. Contact the Craft Center at Frog Hollow, Middlebury, 05753. (802) 388-3177.

VIRGINIA: **Juried show**–8th annual Virginia Crafts Festival, Sept. 23–25. Prince William County Fairgrounds, Manassas. For more info., contact Deann Verdier, Sugarloaf Mountain Works, Inc., 20251 Century Blvd., Germantown, MD 20874. (301) 540-0900.
Conference–"State of the Craft, A Call to Conference," the 1st comprehensive effort to study the craft arts in VA, Sept. 16–17. Virginia Museum of Fine Arts, Richmond. For registration, materials or info., contact the Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.
Juried show–13th annual Richmond Craft Show, Nov. 19–22. Richmond Centre for Conventions and Exhibitions. For more info., call or write the Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.

WASHINGTON: **Show**–1988 Woodworking Show, Nov. 11–13. Featuring machinery, power and hand tools, supplies, demos, seminars, free workshops. Seattle Ctr., Exhibit Hall, 305 Harrison St., Seattle, 98109. For more info., contact (213) 477-8521 (in CA); (800) 826-8257.
Workshops/demos–Tools-In-Action series, free, every Saturday, 10 A.M. Boatbuilding, woodcarving, sharpening, other woodworking topics. The Wooden Boat Shop, 1007 N.E. Boat St., Seattle, 98105. (206) 634-3600.
Exhibitions–"Chests," a show of cabinetry with drawers, doors & other decorative wood artisanry, Sept. 1–Oct. 2. "Furniture as Form, Function as Furniture," 2nd annual NW furniture exhibit, Oct. 6–Nov. 6. Northwest Gallery, 202 First Ave. S., Seattle, 98104. (206) 625-0542.
Workshops–Deck and cabin construction, Sept. 17; flat bottom skiff, Sept. 24–25; tool and sharpening, Oct. 15; block making, Oct. 22; sailmaking and repair, Oct. 29. Contact Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. (206) 385-4948.

WISCONSIN: **Show**–Nat'l Working with Wood Show, in conjunction with The Great American Home Craft Expo, Oct. 28–30. Mecca Center, Milwaukee. For booth space and info., contact J.D. Productions, Inc., at (408) 296-0161. The National Working with Wood Show, 467 Saratoga Ave., Suite 110, San Jose, CA 95129.

AUSTRALIA: **Exhibition**–9th annual exhibition of woodcraft by the Woodcraftsmens Guild of Queensland, Oct. 27–30. Mt. Coot-tha Botanic Gardens Auditorium, Brisbane. For more info., contact Paul Comino, 4 Igerne Court, Carindale, Q. 4152. 398-7583.

CHINA: **Study tour**–Visits to famous woodworking factories, Imperial Palace Museum, the Shanghai Furniture Factory, Xian Raw Lacquer Research Institute, June 3–19, 1989. $3,505 includes air fare. Contact Eva Frank, 3504 Beneva Road, Sarasota, FL 34232. (813) 923-3377.

ENGLAND: **Show**–5th Annual International Creative Marquetry Show, Nov. 14–19. Exhibition Hall, The Corn Exchange, Ipswich, Suffolk. For details and application forms, write ICMS Founder/Director, 63 Church Lane, Sproughton, Ipswich, Suffolk, IP8 3AY.

The Complete Book of Stationary Power Tool Techniques by R.J. De Cristoforo. ***Sterling Publishing Co., Inc., 2 Park Ave., New York, N.Y. 10016; 1985. $14.95, paperback; 388 pp.***

Prior to any project, I thoroughly review my working drawings to reduce the time spent wondering what to do next and how to do it. Planning each procedure is essential for a successful and speedy job, and R.J. De Cristoforo's latest book, *The Complete Book of Stationary Power Tool Techniques*, offers many hints for improving these essential operations.

While stressing safety throughout, the author begins each chapter by dissecting the basic setup and operation of a stationary tool. He then springboards into hundreds of brief but very descriptive procedures for precise, time-saving techniques. Many of these are basic, many are extremely clever, and many represent oft forgotten or overlooked ways of accomplishing unusual tasks.

As you would expect, the book includes clear how-to instructions for most of the basic machine processes. What you soon discover is that De Cristoforo's system is first and foremost jig dependent. The author clearly reveals how to build and use simple jigs through the plentiful use of explanatory photographs and drawings. Utilizing his jigs will ensure more consistent and safer workmanship for both novice and experienced woodworkers and is likely to encourage creative problem solving. In addition, the book includes many reference charts to further speed the reader through time-consuming calculations and precise setups.

Because this book concentrates on equipment that would be found in small shops, it stands out as a manual for craftsmen and hobbyists who want to save time by avoiding trial-and-error procedures. Anyone who wants to get to the crux of machine woodworking or to extend his or her shop capabilities with ingenuity and speed will enjoy having this book right next to their bench. ***–Richard Preiss***

Green Woodworking by Drew Langsner. ***Rodale Press, 33 E. Minor St., Emmaus, Pa., 18098; 1987. $12.95, paperback; 304 pp.***

There's a real romance to working green wood, right from the tree. More years ago than I like to acknowledge, it was my gentle, low-tech introduction to the craft. Absent were the screeching sounds, grumble and dust I'd associated with woodworking. Instead there were wonderful smells, long curly shavings and finished products that described their origins and the hands that made them. It seemed to me that wet wood cooperated with the maker, splitting and shaving without complaint.

In *Green Woodworking*, Drew Langsner has written down just about everything he knows on the subject. He covers harvesting, riving, shaving and bending techniques and the ways to make bowls, chairs, rakes, baskets and other products. From long, hands-on experience, he knows well what he writes, and he's easy about invoking folks who have more expertise in a given area: people like spoonmaker Jogge Sundqvist, basketmaker Rachel Nash Law and chairmaker Dave Sawyer.

When I started, I quickly learned that romance is a minor part of working from the log. There's plenty of grunt work and green wood isn't always cooperative. What I like best about Langsner's book is its pragmatism. He always warns of pitfalls and how to get around them. No 18th-century purist, he uses a chainsaw to harvest trees. To explain good technique and debunk sometimes faulty folklore, he regularly invokes the 20th-century science of wood technology. Langsner tells us how to produce maximum effect with minimum effort through efficient use of body position and balance, reflecting our recent interest in techniques Japanese. And, while the book is about the pleasures of green woodworking, it often reflects the views of a craftsman who has been to the marketplace and knows how to make his work reasonably profitable. ***–Richard Starr***

Metalworking in the Home Shop by E.F. Lindsley. ***Sterling Publishing Co., Inc., 2 Park Ave., New York, N.Y. 10016; 1988. $14.95, paperback; 309 pp.***

This book offers woodworkers a good way to learn about metalworking, because the author makes so many comparisons between woodworking procedures and their metalworking counterparts. In many ways, working metal is like working wood, just slower.

E.F. Lindsley begins with a discussion of metals, goes on to describe basic tools and layout procedures, then covers cutting, drilling, bending, soldering, brazing and other fastening methods, including taps and dies. A section on fine-arts work, including lost-wax casting, follows. The "advanced" section covers grinders, drill presses, bandsaws, metal lathes, sand casting and blacksmithing. The sand casting section is the clearest I've ever read.

With only 300 pages of text, however, no author could encompass the entire subject thoroughly. Bearing this mild caveat in mind, I'd venture to say that I've never seen a better introductory book. Lindsley clearly is a very experienced man in the shop, and he shares here not only the ordinary sort of basic advice but also the hard-won tips that come only from painful experience. The whole is built on a groundwork of *why* things are done certain ways—an invaluable understanding for those inevitable times when a job is not quite standard.

Lindsley is refreshingly honest about real-world happenings. For example, there's talk about removing taps that have broken off in the work. Candidly, the author says: "You may stop reading here if you wish, because the rest is not pleasant, but you'll come back and look it up someday." Yes, indeed. ***–Jim Cummins***

Painting Shorebird Decoys: 16 Full-Color Plates and Complete Instructions by Anthony Hillman. ***Dover Publications, Inc., Mineola, N.Y. 11501; 1987. $4.95, paperback; 40 pp.***

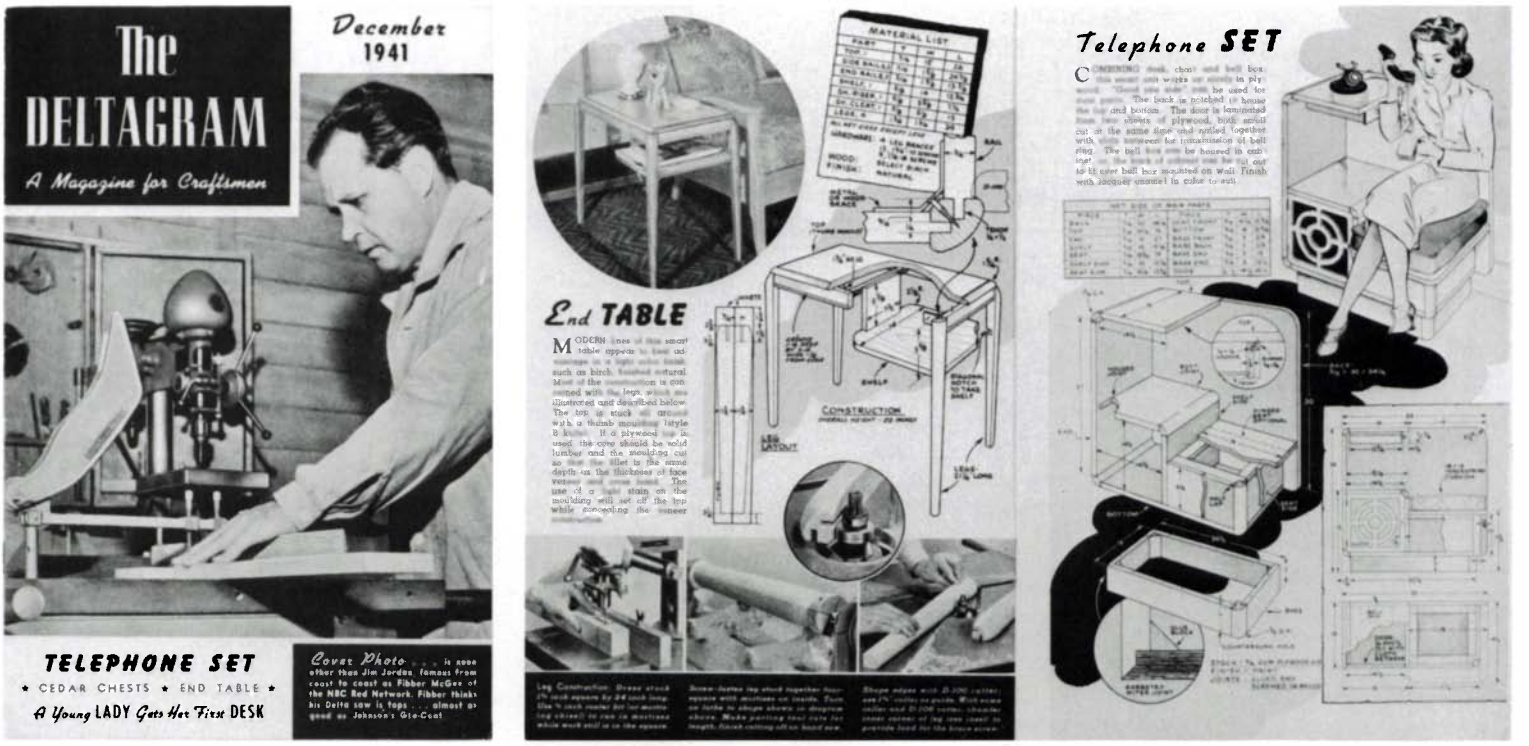
In *Painting Shorebird Decoys,* Anthony Hillman fulfills his intention to "provide instructions and helpful tips to modern-day painters of shorebird carvings." The reader will find 16 full-color examples of some of our more recognizable migratory shorebirds in their attractive spring plumage.

Hillman also presents the reader with background about the birds, bringing the subject even closer to the artists, and a wealth of information on brushes and paints, color selection, preparation before painting, as well as a step-by-step painting procedure adaptable to all the birds in the book.

The profile patterns are well done, but the top views tend to be on the lean side, and some heads seem thin. Most of the examples are close to life-size, with an accurate eye color and size example in each color plate. Each bird is printed on its own page, which can be removed for easy reference at your workbench.

I found this book to be very informative, a valuable investment to any carver or painter's library and of interest to most casual bird-watchers who find it difficult to recognize some of our shoreline inhabitants. ***–Bruce Chidester***

Richard Preiss supervises the architectural woodworking shop at the Univ. of North Carolina at Charlotte. Richard Starr teaches woodworking to children in Hanover, N.H. Jim Cummins is an associate editor at FWW. *Bruce Chidester, a professor of music at the Univ. of Northern Iowa, is also an avid sportsman, photographer and wildlife artist.*



Plans like the ones shown above were included in each issue of The Deltagram. The designs were kept simple to encourage the novice woodworker and stimulate the budding home-woodworking tool market.

The Deltagram

How many readers are old enough to remember *The Deltagram*? It was a small 6-in by 9-in. booklet, 20 pages long, first published in 1932 by the Delta Manufacturing Co. to teach woodworking machine skills and provide project plans. Thus, the booklet also served to promote the sale of Delta tools. A first of its kind, the story of its inception, phenomenal growth and historical importance to the home woodworker is an interesting one.

It began with the arrival of Herbert Tautz in Milwaukee, Wis., shortly after World War I. A German immigrant trained in tool design and metal fabrication, he almost immediately got a job as a tool and die maker. In his spare time, he set up a drafting board at home and designed a toy sewing machine. This was quickly followed by a crank-operated scroll saw for boys. The manufacturing was done in a nearby garage. Both units were sold through department and hardware stores, and both were successful. Later on, a small motor was added to the scroll saw, and the first of the famous Delta scroll saws was born.

To build on this initial success, Tautz assembled a small group of machinists to form what was to become the Delta Manufacturing Co. This wasn't difficult to do in those early days; Milwaukee was already home to many skilled German machinists. New tools including a drill press, tablesaw, lathe, jointer and bandsaw soon became available. It was also at this time that a combination machine, the forerunner of today's Shopsmith, was made available. All of these light- to medium-duty tools were sold through local hardware stores. Instructions on using the tools and project plans were only sparsely available, *Popular Mechanics* magazine being one of the few sources. Few people had the time or money to indulge themselves in home woodworking.

Tautz was quick to recognize that his tools' availability would have to be augmented by the public's increased awareness of how to use them and the possibilities they offered: People would have to learn more about tool use if his market was to expand and grow. Tautz advertised in all available magazines. He established the Woodworker's Educational Dept. within Delta. Out of this department soon came hard-bound books, which were well written and profusely illustrated. Typical was *The Modern Motor-Driven Woodworking Shop,* which had as its subtitle: *How to Plan-Operate and get the most out of it.* The books were primarily operating manuals, however, and did not fill the need for ready availability of project plans.

Then around 1930, Tautz hired Jim Tate, the editor of *Popular Mechanics,* to be his advertising and sales-promotion manager. Tate had all the experience and contacts needed to do an excellent job at Delta, the name now used by this young growing company. In January of 1932, he produced the first issue of *The Deltagram*, and as Tate stated on the first page, it was considered another "tool" for the craftsman and would be "as dull or sharp depending upon the quality of what the reader sent in." Tautz added a personal note of his own on the inside cover: "Consider this your own special journal and send along anything you have which you believe others would want to see." *The Deltagram* rapidly began to fill the demand for interesting and practical home projects; it took off like a rocket. It was sold on a subscription basis of six issues a year for 50¢.

The influence of *The Deltagram* became increasingly widespread. It stimulated and nurtured the growing number of home woodworkers. Well-thought-out ideas and plans for building home-shop areas helped people get started. Each month, popular and attractive projects with easy-to-understand plans were provided, which further encouraged participation. Of course, Delta's interests were not overlooked; *The Deltagram* became the vehicle to introduce new Delta tools and accessories. Schools with industrial-arts departments (called "manual training" in those days) purchased the booklets in quantities to use as textbooks. Woodworkers responded to all of this enthusiastically; their ideas and suggestions rolled in and provided a reservoir of material for future issues.

In the early 1940s, Delta Manufacturing Co. underwent a number of management and structural changes. Tautz had sold his interest in 1939, and the company ultimately ended up as a division of the Rockwell Manufacturing Co. Tate also disappeared from the scene, and I assumed his role with *The Deltagram.* The country, by this time, had entered the war, and Delta went with

it. The plant was busy 24 hours a day, producing only the larger Delta drill presses and similar Delta heavy-duty industrial machines. There was neither material nor production time available for hobby tools.

There was, however, money available for promotional purposes, and I exploited the opportunity. Even then, plans for the post-war years were under consideration. Nationwide advertising in craft and wood magazines had already been exploited, but this represented a narrow audience. The Sunday newspaper supplements—*Parade, This Week*—provided the vehicle for the Delta message to reach a wider audience. The first ad, for example, ran on a Fourth of July weekend and featured a brightly enameled red, white and blue lawn chair. As a result, subscriptions to *The Deltagram* shot up from about 9,000 in 1940 to well over 92,000 by 1948. This was largely responsible for a tremendous backlog of orders for Delta tools. These, of course, could not be satisfied at this time because of the war effort, but with the end of the war, Delta had no problem making the transition to peace-time production.

These were *The Deltagram's* heydays. Its success, along with that of the Delta tool line, soon spurred competition. Woodworkers were courted by *Popular Science, Mechanix Illustrated* and others anxious to capitalize on Delta's success. The widespread availability of tools for the home woodworker and the ever-growing number of "how-to" books and magazines that we see today is its legacy. *The Deltagram* was last published in the early 1950s, and for those of us who remember, its demise was the sad end of an era.

I enjoyed working on *The Deltagram*, but since leaving Rockwell, have found plenty to do. I've designed a line of weaving looms, created *Benchwork* magazine for model railroaders and started and operated the Sievers School of Fiber Arts. At age 88, I've again "retired" to write a book about life in middle-class Milwaukee between 1905 and 1920. *—Walter E. Schutz*

Washington Island, Wis.

Olympic effort

Years ago, as an amateur athlete and woodworker, I set out to compete on the United States National/Olympic Rowing Team.

Throughout those years of training, I supported myself by building furniture. Eventually, the simultaneous pursuit of these two very consuming endeavors helped scuttle my Olympic aspirations. After retiring from competitive rowing, I set out to achieve my alternate goal: to attend the furniture design program at the Wendell Castle School in Scottsville, N.Y.

Photo: Jonathan Bregman

"Olympic Effort" displays Puksta's interests in skulling and woodworking.

Not surprisingly, my final school project blended both my interests into a chair entitled "Olympic Effort," shown at left.

In a way, I shifted the energy and concentration I had been putting into my dream of rowing in the Olympics into designing and building this piece. It became an Olympic effort to resolve the technical and aesthetic challenges of my concept.

The concept was to take the ultra-light wooden framework depicting the unskinned hull of a rowing shell (boat) and "fold it" to produce a seat, then sever it to expose a cross section. It then seemed logical to construct a supporting base from a rowing shell's outriggers that also had been folded.

The chair's design and construction are intended to convey the characteristics of the sport of rowing—simplicity and sophistication, strength and technical ability.

The skeletal frame of the "shell" is constructed in fairly authentic boatbuilding fashion. The frame is solid mahogany. The back and gussets are ribbon-stripped mahogany-veneered plywood. The simulated rigger base is stainless-steel tubing. Jigs are made to cut the tubing at the correct bisecting angles as they lay in their respective intersecting planes. The same jigs also hold the tubing in position during welding. Bill Schaefer, a student from the nearby School for American Craftsmen at the Rochester Institute of Technology, collaborated on the welding. Completing the rigger motif are antique bronze oarlocks acquired from friend and retired Dartmouth College rigger (boatwright) Wendell Badger.

At the cross section of the piece, the frame terminates with hand-soldered brass ferrules. The upholstery is padded leather. The finish is clear lacquer. The piece stands 72 in. tall and is about 24 in. by 24 in. at the base.

The chair is the culmination of two very consuming and rewarding aspects of my life: rowing and furnituremaking. Through this piece of furniture, I have made a contribution toward the awareness of the sport of rowing, while extending myself as a furniture designer/craftsman.

—Fred Puksta, Scottsville, N.Y.

By way of the river

While working summer jobs in North Carolina's coastal plains during the early 1960s, I would often stop to look at the slow, dark rivers and streams that slipped silently under the rich, green foliage. So quiet, peaceful and mysterious they seemed. For the first time, I wanted to build a small boat and follow these intriguing rivers to the sea. Often, someone would be patching or building a simple boat at a country shop. The seed was sown then, but it was years before the tree was to bear.

In 1976, my wife and I found a spot of land on a quiet, little run of the Black River, and in the years that followed, we built our house and set up shop. I made that trip to the sea—five very nice days in a canoe, camping nights on the dry sandbars. There was always the next bend in the river to experience; the river never lost its mystique.

The business of earning a living was to take a course as a river does, forever changing as obstacles are encountered and clearer runs are found. By the early 1980s, most of our work revolved around wood. We were fortunate enough to have a sawyer and his mill some three miles downstream, so we were able to harvest all our own lumber.

A tree's magnificence in nature easily surpasses most anything a man can do with its wood. We rarely felled a living tree, because changes in the environment killed many trees and an ample supply was usually being pushed down in nearby clearing and logging operations. We gathered a lot of juniper (white cedar), as well as walnuts, oaks, and pines. Because we make a lot of furniture, hardwoods have always been prized, and we still travel a ways for a blown-down walnut. But it was the juniper

You can be sure your Unisaw® will last longer than our sale.

Unless you think we're having a 30-year sale.

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3HP UNISAW $1499.00*

For the homeshop craftsman, our Unisaw** with the 1½ HP motor and Jet-Lock, Micro-Set rip fence is just what you need. Especially since it's only $1199. In case you're interested, that's a savings of over $500. And it delivers perfect precision ripping, crosscutting, dadoing, moulding and tenoning.

Now these prices aren't going to last for long. So choose the model that best suits you. And get ready to spend a long time with it.

1½ HP UNISAW $1199.00**

Call-toll free for the name of your Delta distributor. Delta International Machinery Corp., 800/438-2486 (in PA, 800/438-2487).

*Model 34-782 shown with accessory table boards and motor cover.

**Model 34-761 shown with accessory motor cover.

Offer good only at participating distributors in the continental U.S., Alaska and Hawaii from July 1 to December 31, 1988.

Building On Tradition

DELTA

A Pentair Company

Photo: Douglas Little

"Najos," one of Little's shallow-draft, battery-powered riverboats, is ideal for navigating the waterways in the coastal plains of North Carolina.

that was to cement our bond to the river.

Felling, loading and milling logs is such a rich experience, that when those boards show up in the shop, they have their own stories to tell as we work together toward some common goal: a table, chair or boat. Juniper has always been my favorite, because it's so easy to work with. You can carry some logs on your shoulder, and the ones you can't, roll easily, unlike pine, cypress or most other logs. At the mill, juniper is rarely a problem, except it heats up the sawblade because it's so dry.

We were not masters of traditional boatbuilding, but that didn't deter us. Our philosophy was, "If it looks enough like a boat, it will float like a boat." Besides, we had the river to prove us right or wrong, and with that behind us, we set out to build furniture-quality juniper canoes and fishing boats. Most of our work was strip-on-strip, flat-bottom boats. Our river is very shallow in the summer and fall, the best times for travel, and there are always snags to pull the boats over or around. The boats had to be shallow-drafted, quick to turn in the bends, light to portage and tough enough to drag. Canoes with a shallow draft and little or no keel easily filled the bill. Speed was second to maneuverability, safety and comfort, as most all trips are downstream. The canoes are nice, but the little electric fishing boats presented the best challenges.

These little boats are laid out so everything is at hand or foot, as it be. We usually unloaded the boats from a truck bed and fished while traveling upstream so we could drift easily back to the truck. We tried a variety of designs based on transom-mounted electric outboards. They worked well, but there was the inevitable vine or branch to catch above or below the water, and clearing these was difficult. Therefore, the boats needed to be sleek so nothing could catch them. We settled on two types: A two-man design like the one in the photo at left and a smaller, double-ender for a single person. Both have controls on the left side and allow a person to fish while running. These shallow draft boats are well balanced, with most of the weight kept low and toward the rear, making for a stable ride with good control.

For river trips that extend beyond the life of one battery charge, the larger boat carries a generator. It's a lot of noise for only 18 lbs., but charging is only done at night or during breaks, leaving the important time—fishing and observing—to the quiet electric motor.

We continue to modify the boat designs to meet new needs, running with what works best. It may take hours to evaluate a newly designed boat, but it is time well spent, as we continually strive to have our work match the elegance and mystique of the river.

—Douglas Little, Rose Hill, N.C.

Craftsmanship versus the machine age

I once saw an English Queen Anne side chair of fine quality with a splat that had been rough-cut on its backside with an axe or a drawknife, and with the edges beveled away to give the chair a lean look from the front, which was inlaid. This proximity of axe work to inlay said a lot to me: Front and back were treated differently for reasons of presentation and economy, but deft handwork was evident on both sides. This satisfied my sense of balance, purpose and thrift. I liked the shop and workman it called to mind from the time when roughing out work had to be done with a tool like an axe—the sort of tool that thickens the fingers with steady use, and at the same time, sharpens one's judgement. It needs muscle to work at all and dexterity to work well. These are the same elements of workmanship that go into precise, refined handwork, like inlay.

The Industrial Revolution lies between us and the era that produced that Queen Anne chair. I often ponder that momentous change in civilized life, and when I do, it's easy to roll right off the log of reason into a great romantic quicksand: Oh, for the days when men were men and chairs were made by hand.... Well, recently I put aside my customary work of making Windsor chairs in small sets by the old green-wood method and took on the woodwork in reproducing six maple stools originally built in the shop of the 20th-century designer Emile-Jacques Ruhlmann. It was a chance for my hands to help my head think through some of the changes brought on by the machine age.

The Ruhlmann stool had a turned, slightly dished top fastened to quarter-circular apron pieces joined by mortise and tenon to the four legs. The legs were rectangular in section where they joined the apron, but below the apron, the inside face was narrower than the slightly rounded outside face. The legs tapered to pointy feet, and curved in, then out from the side view, below metal stretchers. I traced a pattern of the legs, roughed them out on the bandsaw, then planed the cut smooth. The apron pieces, including tenons, were also cut onto a pattern on the bandsaw, then smoothed up with a drum sander on the drill press. Using jigs, I routed the critical leg-to-apron joint, trimming the bandsaw tenons and cutting mortises in the legs. After assembly, I finished up the job with spokeshave, scraper, handsaw, chisels and sandpaper.

Compare that job with my usual Windsor routine. I start out using an adze, a drawknife, shaves and scrapers to shape up a seat from a bandsawn blank of soft wood. With a wedge, maul and froe, I split billets from freshly cut hardwood logs for turned undercarriage parts and shaved spindles. From a longer log, I split stock for a bow, shave it down, following the grain of the split stick, trying not to cut across the growth rings. The bow isn't straight, but it has maximum bending strength and takes a fair curve after steaming. I gauge angles with a bevel set, and bore the holes with a hand-held drill.

So what's the difference? Some would say I did the Ruhlmann job "by hand," because other woodworkers might have used a shaper setup to make the legs. Instead, I cut to a line on the bandsaw and finished up with edge tools. Yet the two jobs are worlds apart from the workman's point of view. In the Ruhlmann job, the handwork was concentrated in the finishing touches, where the objective was a smooth surface and subtle changes in shape—designer details. It was incredibly tedious. Also, I did all the routing, bandsawing, turning and hand-finishing for six stools at once. A few days of noise and dust were followed by several days of quiet handplaning, shaving, scraping and sanding. Overall, it demanded less dexterity and more patience than my usual work. The joinery came under control early on, and then it was done. The rest was repetitive in a way that soon became boring.

Old-style chairmaking begins with the

INDEX TO ADVERTISERS

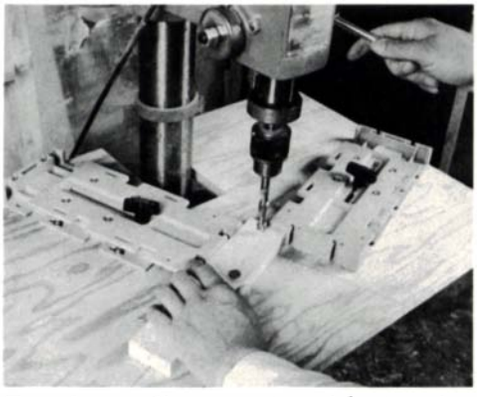
free and vigorous work of splitting and chopping, then moves on to turning and shaving precise diameters. Green-woodworking techniques don't allow stockpiling of parts: Fresh billets have to move rapidly into an assembled chair where the parts season together, so a set of six chairs is made more or less one after another. Hand and eye are warmed up and sharp by the time one gets to the fussy stuff, and when one chair is done, there's a welcome chance to work broad and strong when starting in again. There's a rhythm to this work, which is good, because the free work of the early stages provides relief from the tension of joinery, which is never under mechanical control, as with the Ruhlmann job. Old-style chairmaking is full of risky workmanship, to paraphrase British craftsman and philosopher David Pye.

The difference in work routine on these two projects parallels differences in the objects made, and it all turns on the mechanical methods that came to prevail with the Industrial Revolution. Quick, precise results in enormous quantity suddenly became commonplace, whereas in the age of reason, a workman cultivated precision over a lifetime of constant practice. Now mechanical tools appear to have slipped efficient precision into his hip pocket. In terms of objects made, the effect has been to isolate this element of refined work, making it an end in itself. Design in the machine age celebrates uniform precision and polish. So does 18th-century work, but not so exclusively: There always seems to be room for some rough or irregular elements, reflecting a more natural balance.

I'd say the older world follows a natural, as opposed to mechanical model. In nature, any leaf on a tree is perfect in the sense that there is no other leaf it could be. There is no pattern-perfect leaf for it to duplicate precisely, or fall short of, to become merely an okay leaf. Precise uniformity doesn't apply. The perfection of nature is a matter of wholeness and integrity; the natural order is one of general patterns repeated with infinite specific variety. At the same level that we ordinarily confront the things we make, nature presents us with stimulating, quiet variety.

Making furniture that reflects this aspect of the natural world is the challenge beyond precision and control. It contains an element of unpredictability. Handmade Windsors are well suited to meet the challenge. I hope the woodworking trade never gives them up. A bow's looping curve and the sweep of spindles, the deep contours of a robust seat connected to the floor by legs joined at a rakish angle, all present a looser geometry to the woodworker used to the rigors of rectilinear stuff. The chairs invite a maker to try the less critical handwork of earlier times. Once the imprecise maker and his material are combined in the perfect chair, made like no other in the same set, there's a comfortable place for a person, who's likely to feel around absentmindedly for the rough underside, the sharply carved handhold and the fine bead around the bow. The method that makes these chairs is as nicely balanced as the work itself, and over the generations, that's what makes a thing stand up.

—Peter Murkett, Monterey, Mass



Two Incra Jigs can provide precise alignment and repeatable positioning.

Product review

Incra Jig, *available from most woodworking stores and mail-order houses or from Taylor Design Group, Inc., 3615 Courtdale, Dallas, Tex. 75234, for $39.95; standard rack, 1/32 in.; $8.95 for each accessory rack, available in 1/20 in. and 1 mm.*

Every year, gadgets appear on the market for those of us who have more cash than sense. Most of the gadgets, however, aren't worth a darn; this one's different.

I hadn't expected much from this plastic gadget, but now that I understand its operation, I cannot imagine doing close work without it.

The jig's fiberglass-reinforced, engineering-grade styrene is tougher and more durable than it first looks: The jig is rigid, even when extended to its fully opened position. The racks, which permit close-tolerance adjustment, are made from acrylic, chosen for its precision molding characteristics, its strength and its resiliency. Grinding the racks together makes a horrible racket, but I've never chipped any of the teeth. Lifting the top eliminates the noise and doesn't take much effort when setting the jig.

Setting the jig to any position within its range will take 10 seconds or less, thus saving time as well as making your work more precise. Part of the Incra Jig's value is in its excellent manual. Here's how the jig works:

The interlocking sawtooth positioning racks, with a tooth-to-tooth spacing of exactly 1/32 in., mesh perfectly at every location along their length, allowing you to position your work precisely where you want it at any multiple of 1/32 of an inch over the full 8-in. range. Assembly of the jig is easy: Install the racks loosely, and put the body halves together fully closed. Wiggle these halves to ensure that the racks are meshed perfectly and that the unit is fully closed. Secure the two halves tightly together, and tighten the screws that lock the racks in place.

The Incra Jig will serve as a sturdy, nonflexing (but not inflexible) incremental fence or stop block for the tablesaw, router table, drill press or other tool. Used in pairs, Incra Jigs work as X - Y positioners on the drill press. Pencil marks are about 20/1,000ths of an inch wide—about five times as wide as the bit-positioning accuracy you get with the Incra Jig.

The precision, accuracy and ease of setup make the jig an ideal tool for production runs and a real time-saver, too.

—Hugh Foster, Manitowoc, Wis.

Notes and Comment

Do you know something we don't about the woodworking scene in your area? Please take a moment to fill us in. Notes and Comment pays for stories, tidbits, commentary and reports on exhibits and events. Send manuscripts and color slides (or, black-and-white photos—preferably with negatives) to Notes and Comment, Fine Woodworking, *Box 355, Newtown, Conn. 06470.*

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Photo: ©1986 Joe Coutts, courtesy The Greenwich Workshop

Photo above, photo at left:
Al Tone, courtesy Dofasco Inc.

FLIGHTS OF FANCY

Sculptor/carver Joe Coutts captures a sense of imminent action in his life-size wood bird carvings, which forcefully express his lifelong passion for winged creatures. Shown here are three of the self-taught carver's pieces: the great blue heron, a red-tail hawk and a great horned owl. The 38-year-old Canadian craftsman, who began carving as a teenager, begins with a plywood and metal skeleton, then bolts and glues carved hardwoods such as black walnut, Honduras mahogany, cherry, ash and ebony to this frame to represent each bird's anatomical features, natural markings and plumage. Each hand-carved feather is glued into place individually. A typical carving can take more than 200 hours. Coutts believes the combination of different woods expresses a dynamic quality not readily achieved in carvings formed from a single piece of timber. His work, now commanding up to $10,000, is done in his basement workshop at 320 Shantz Hill Road, Cambridge, Ontario.