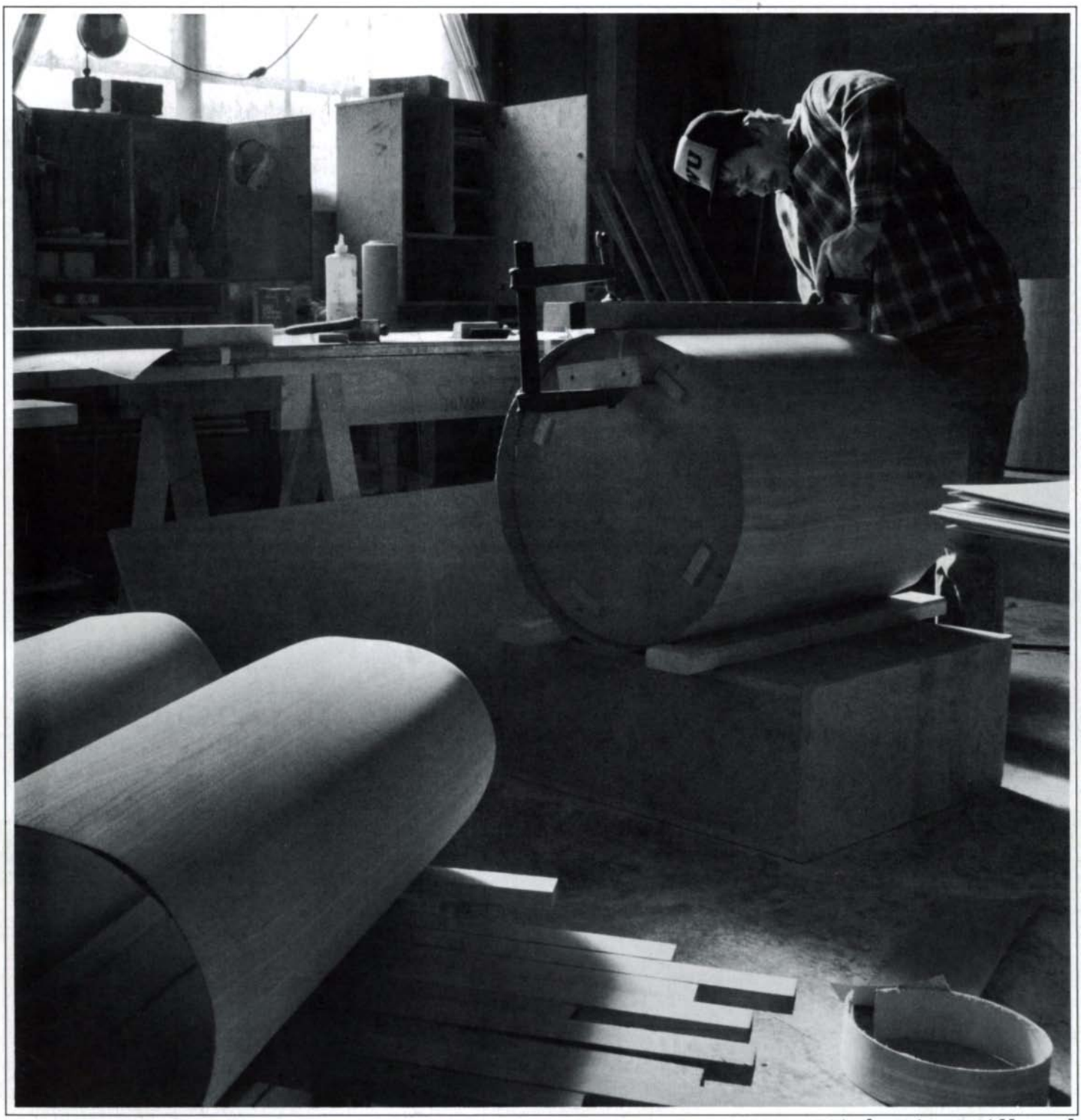
Fine WoodWorking

JULY/AUGUST 1984, NO. 47, $3.50



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Fine WoodWorking®

JULY/AUGUST 1984, NUMBER 47

Cover: Millworker Herman Unger veneers a conference-table pedestal for a high-rise refit. Above, cardboard concrete forms serve as pedestal cores. For more on millwork, see p. 30. Photos: Jeff O'Hearn.

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Letters

Your article on covered bridges in *FWW* #46 contained a common misconception about why these bridges were covered. The roof and sides of covered bridges kept snow and rain off the bridge, but this was, at best, of secondary importance.

Any New England historian worth his salt knows the real reason covered bridges were built. The primary mode of transportation when most covered bridges were built was the horse and buggy. Horses are very reluctant to cross an open bridge over running water. By making the bridge look like a barn, the horses would trot right into it without hesitation.

—Steve Cox, Windham, N.H.

I read with commiseration John Harwood's article on starting a grove of black walnut trees (*FWW* #44). As a forester and landscape architect, I plant trees and advise clients as to how and when to cut them. I anticipated each of the problems Harwood discussed and could have added several more he apparently was not blessed with.

Here's a clearer course of action and, I hope, an easier avenue to any who plan a walnut plantation. First, clear the land to a point where it can be mowed very low with a regular lawn mower. Plow and disc only if it is too rough to mow. This will eliminate the mouse habitat. Plant seeds 2 in. deep and cover them with soil. A bulb planter works very well. Set the seeds in regular and straight rows by using a long rope with flags tied at 10-ft. intervals. Plant where the flags are, then move the rope in 10-ft. increments over the acreage. As added protection against rodents, set 4x4 posts (hawk perches by day, owl perches by night) in the open spaces throughout the acreage, 7 ft. above ground level.

Alternately interplant each walnut with red or white oak. These are equally valuable species, grow at the same rate, and discourage the insects and diseases that prey on pure stands of any species. Since weed whipping and mowing can eliminate ten years of tree growth in the time it takes to look at a songbird, I suggest interplanting the rows with a tall forsythia. This spreads to make a total ground cover, does not become weedy by seeding like privet, multiflora rose or tartarian honeysuckle, and can be removed with a brushog when the trees suppress it. Heartlessly remove any interloping weed trees.

Twenty years later, when the overstory is established and the understory cleared, the real care begins. Fertilize every year with a full-feeding (10-10-10) fertilizer, hand-cast. Healthy plants, of course, play host to only the worst insects and most devastating diseases. Pure stands of anything encourage and make easy the spread of both.

Perhaps I should have mentioned this first. . . start young and plan for your grandchildren to carry out the harvest, since we are talking about at least a 150-year rotation for the kind of nice heartwood that woodworkers like. In the interim, you might consider either raising squirrels or selling black walnut fudge! Or both. *—William C. Paxton, Greensburg, Pa.*

Your Taiwanese tool article (*FWW* #46) included a quote attributed to me that seems to indicate that Rockwell had seriously considered closing its Tupelo plant and importing our machines from Taiwan. This causes great consternation among our work force, especially since we are in the process of becoming Delta International Machinery.

I would like to clarify our position: We are manufacturers of woodworking and metalworking machinery, and we feel that our product line is among the best in the world. We import some machines, such as the RC-33 planer from our own factory in Brazil, and we apply the same rigid quality standards to these machines as to those produced in the United States. We have made large investments to improve productivity and capacity at the Tupelo plant, and will continue our efforts in new-product development and design.

In summary, we are in the machinery business for the long term. We do not plan to impair the reputation we have earned over fifty years in this business by going after short-term goals.

—L.C. Brickner, Rockwell International, Pittsburgh, Pa.

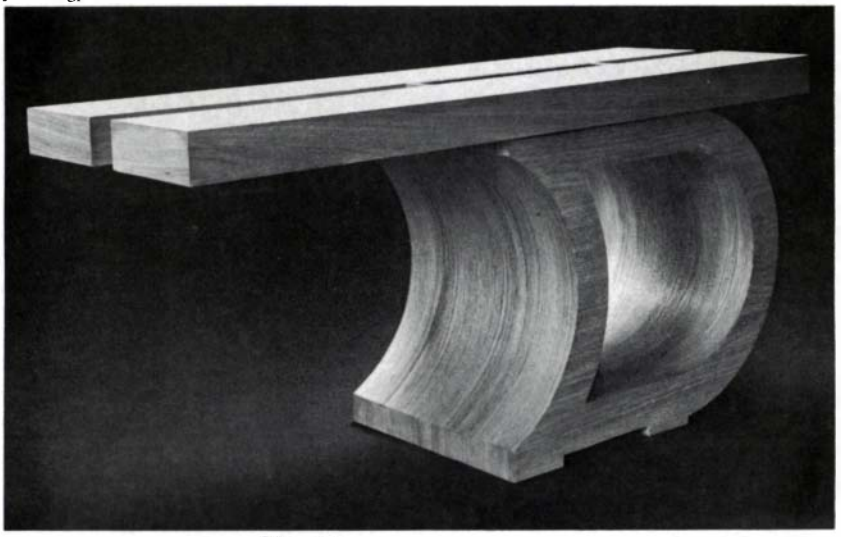
EDITOR'S NOTE: For more on Rockwell's name change, see p. 102.

Like Thad Evans (*FWW* #46, p. 4), I built Carlyle Lynch's highboy out of mahogany and had trouble steambending the ⅛-in. thick strips for the apron cock beading. My solution was to laminate them from mahogany veneer. Perfection—no springback, no splitting, no staining, and perfect color and grain match. *—Milford D. Schulz, M.D., Belmont, Mass.*

For people who don't wish to ruin eight T-squares, as Jeff Sherman suggested in *FWW* #46, p. 10, I discovered long ago that router- and bit-specific fences could be made from almost any piece of scrap plywood. Half-inch Baltic birch is my favorite. Just measure from the bit's cutting edge at its outermost position to the edge of the router base and rip a hunk of scrap to that measurement. With one edge of this piece aligned with the proposed dado, draw a line along its opposite edge, then move it over and clamp it to the line. Mill the dado, using your combination fence/gauge to guide the router. Or ruin a $15 T-square. I can't believe it!

—Elizabeth Regan, Wilton, N.H.

Jean Longpré



When I design a piece of furniture, I try to use rules you've published in FWW. *This drawing-room table was built with plywood and covered with oak veneer. . . it proposes to take a leap into space.* —Daniel Lefaivre, Montreal, Que.

Many of my colleagues here at Formica Corporation very much enjoy reading each issue of *Fine Woodworking*. An article by Jack Gavin appearing in the March/April issue caused us great concern, however. Gavin says, " . . . 'Formica' has become the generic name for decorative plastic laminates. . . ." Formica has been used as our company's trademark and as part of our trade name since 1914. It is a well-known trademark distinguishing decorative laminate and other products of Formica Corporation from products made by other com-

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panies. We own various registrations for Formica granted by the U.S. Patent and Trademark Office and trademark offices in countries throughout the world.
—Stanley V. Silverberg, Formica Corporation, Wayne, N.J.

Jack Gavin's article on plastic laminates was good and certainly overdue. I can add some information, since I, too, have laid miles of the stuff.

Gavin covers the drawbacks of solvent-based contact cement, but glosses over an alternative: latex-based cement. I've used a 3M product called Fastbond 30 that, in my experience, does not take longer to dry, has none of the obnoxious (and toxic) vapors that solvent-based cements do and is not flammable. It costs more, but has about twice the coverage. . . and rollers and paintbrushes can be cleaned with water while the cement is still wet.

I always file the whole chamfer after trimming with a beveled bit; this eliminates the minute ripples left by the bit. Nicholson makes a plastic laminate file called Magicut (#C7917) that removes material quickly with a heavy stroke, yet leaves a very smooth finish with a light stroke.
—Eric Norstad, San Rafael, Calif.

I have been a professional photographer for fourteen years and an amateur woodworker for three years. I have read a number of references in *Fine Woodworking* about using potassium dichromate to darken wood. I am neither a chemist nor an expert in hazardous wastes, but I believe that potassium dichromate is one of the earliest known carcinogens.

Old-time photographers and lab workers who regularly dipped their fingers in the dichromate sensitizing solutions had a nasty habit of getting skin cancer on their fingers. Most often, they suffered from long-term, irritating rashes. Graphic arts texts warn users of dichromates to avoid skin contact, wear gloves and avoid inhalation of the fumes. I question, in addition, whether it's wise to use dichromates on any food utensils (like wooden bowls). I wonder if dichromates, once applied to wood, could continue to emit harmful fumes long after application.

Finally, I questioned a waste-water treatment chemist at our local sewage treatment plant. He said that dichromates are chromium compounds for which no safe minimum levels of dumping are permitted: legally, all spent dichromates should be trucked to a Class 1 dump; practically, only minute dilutions can be poured down the drain without screwing up the sewage treatment process; morally, throwing a pint of spent dichromate down the drain is ecologically reprehensible.
—Bob Carey, Ventura, Calif.

I'd like to comment on Paul McClure's answer to Andrew Brennan's question about importing wood (*FWW* #44, p. 16). Several organizations specialize in inspection of imported/exported goods and can help solve problems with improper shipments. By using an independent inspector to examine a purchase before shipment (not only on the docks but at the manufacturer and on the boat as well), a buyer can be assured that the correct quality and quantity is being delivered. One such inspection organization is the United States Testing Co., 1415 Park Ave., Hoboken, N.J. 07030.
—Jay Hundley, Medford, N.J.

If David Sloan uses his Sears or Dowel-It jigs (*FWW* #45) over a period of months or even weeks, I'm sure he'll realize that the detachable bushings on the costlier jigs are more than an inconvenient nuisance. Drills cut die-cast aluminum quite readily. I've seen several non-bushed jigs with mileage on them; all have had their frequently used holes (⅜-in., ½-in.) reamed oversize and out-of-round through normal use.

Of course, hardened bushings fare much better. When they do wear, you can replace the bushing rather than the whole jig. If you're inclined, like Sloan, to lose the bushings, keep extras on hand. If you're stuck with a worn-out non-bushed jig, try drilling the holes oversize and press in bushings. Drill bushings are available in a variety of sizes from any machine-tool supply house.*—Scott Lowery, St. Paul, Minn.*

David Sloan's desire for a doweling jig to be self-centering is contrary to my experience. I like the fact that the Stanley #59, which I've owned for many years, aligns the holes a given distance from the face side of the boards. All too often boards (and even parts of the same board) of a given nominal thickness will vary substantially in actual thickness. Additionally, the alignment of boards of different thicknesses is a snap. *—Ed Vandenburgh, Elizabeth, Ill.*

Drew Langsner provided what I wanted with his detailed plans for a shaving horse (*FWW* #43). He also told us that his height is 5 ft. 8 in. He could have been even more helpful if he had given us his leg measurement. I modified his design for myself. I am 6 ft. with a 32-in. inseam.

I started by leaving an extra 3 in. on both ends of the bench, fixing the bridge to the bench with a strap hinge to permit trial-and-error adjustments. My second (and current) riser is 5½ in., 2 in. shorter than the minimum Langsner suggests. The arm on my horse is made of 1½-in. hardwood, with 1$^{9}/_{16}$-in. mortises. I mention that because blind adherence to the plans will end with the frustrated builder trying to fit the 1¾-in. thick arm into 1$^{7}/_{16}$-in. mortises. That is my only criticism of the plans. As Langsner states, the shaving horse is a folk tool. It must be fitted to the user.
—D.A. Benson, Carp, Ont.

I find that I must reply to some of the criticisms of my review of jointer-planers. Readers should be aware that my article was shortened before it was published. . . and originally had much more detail about the construction of each machine. I devoted a lot of time to actually measuring the accuracy of the beds on each machine. I must disagree with reader Robert Major (*FWW* #45, p. 6). On my Hitachi F-1000A, all machined surfaces were accurate to within 0.002 in., whereas the outfeed table on the Inca was dished in the center by more than 0.01 in. Before I bought the Hitachi, I will admit that I was somewhat skeptical about the alignment of the jointer-table extensions. I measured the extensions on my Hitachi, however, and they were perfectly aligned.

I do not harbor any feelings of resentment toward Makita because of my accident with the jointer knives. In fact, I purchased their bandsaw and waterwheel sharpener. And I agree with the advice of Randolph Mateer (*FWW* #45, p. 6) about unplugging machines when working on them. I always do this, but my memory was not sufficiently jogged to avoid the accident. I would have sounded much more professional if I had not mentioned this incident, but I felt that my experiences might help others. *—Jim Rome, Oak Ridge, Tenn.*

I am interested in teaching woodworking and home repairs to the visually impaired. I have had some difficulty finding information on crafts and woodworking projects suitable for the sight-impaired. Would you or any of your readers have any knowledge of publications that might list woodworking projects or techniques for use by the visually impaired?
—Clay Sewell, Downers Grove, Ill.

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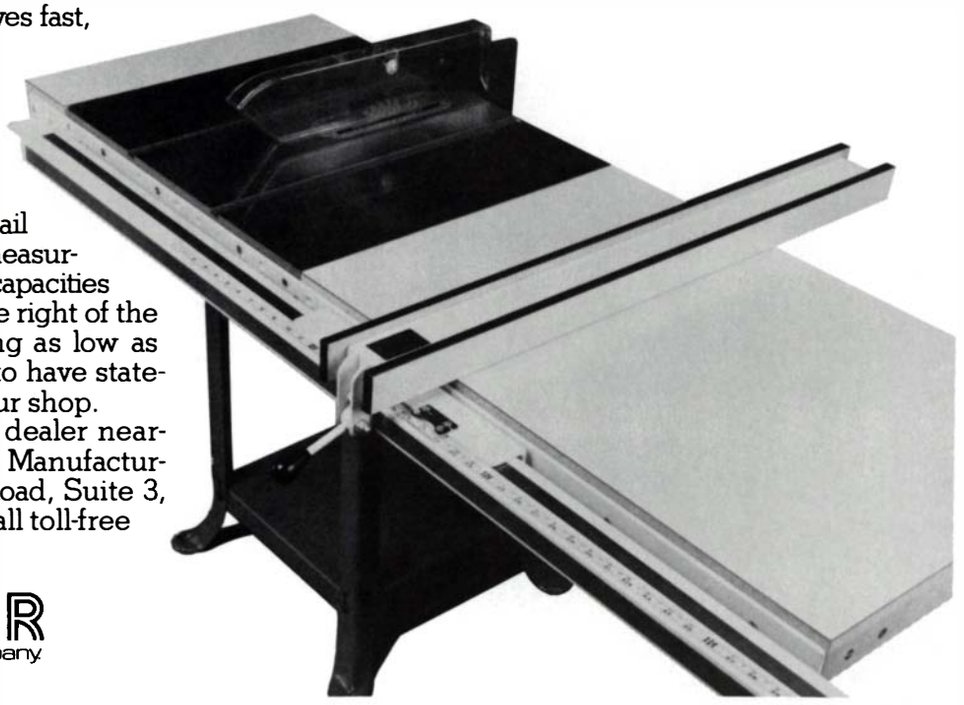

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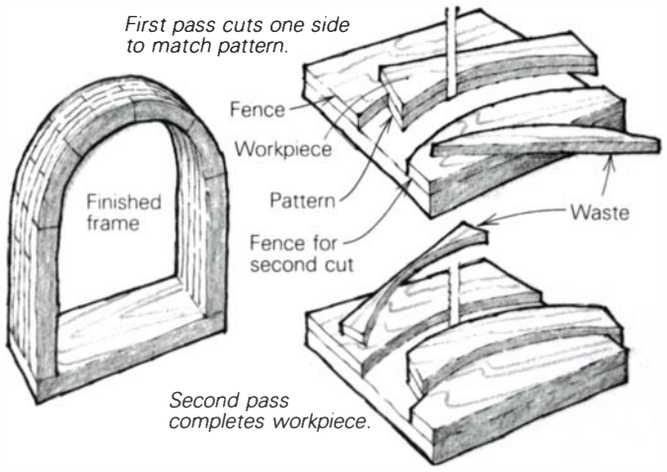
Bandsawn multiples

To fill an order for four round-head window frames, we had to cut more than a hundred identically curved blocks to build up the curves in brick-wall fashion. The bandsaw jig shown here allowed us to cut the blocks quickly and accurately.

First cut a true-to-size pattern and install screws through it so that the sharpened points protrude about ¼ in. Next cut two curved fences (one convex, the other concave) to the radius of the pattern. Clamp the fences to the bandsaw table, leaving a gap the width of the pattern on each side of the blade, as shown in the sketch.

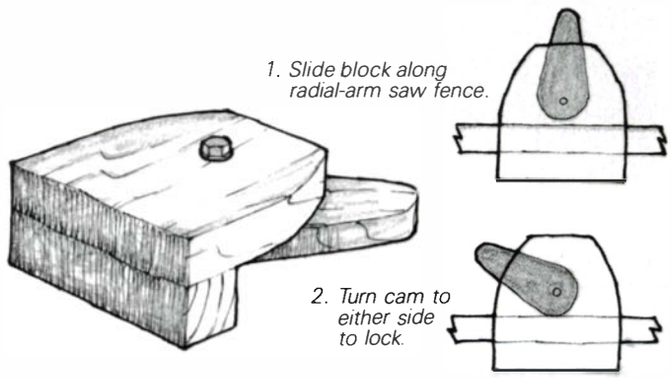


To use the setup, press a blank on top of the pattern, with the screw points holding it in place. To cut the first edge, push the blank through the bandsaw with the pattern riding the concave fence. On the other side of the blade, cut the second edge with the pattern riding the convex fence. Each workpiece will be identical to the pattern.

—William D. Handley, Bishopville, Md.

EDITOR'S NOTE: For other patternsawing setups, see pp. 54-55.

Locking stop block



I made this cam-locking stop block for my radial-arm saw because I often have to cut many boards to the same length. Simply slide the fixture along the fence until it's at the right position, then lock it in place by rotating the cam lever. I left a little room under the face of the block for chip clearance. The fixture works on either side of the blade.

—Orville Otis, Coldwater, Mich.

Stop hinges for jewelry boxes

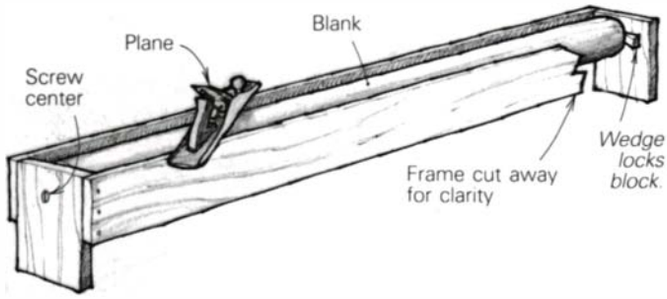
Unable to locate solid-brass stop hinges for jewelry boxes, at any price, I decided to make my own. With David Sloan's article on making brass hardware (*FWW* #41) as a guide, I soldered a 1/16-in. brass rod across the back of two solid-brass

leaf hinges. This rod neatly stops the lid, is unobtrusive, and is, I think, a more elegant solution than a stop chain.

I found the brass rod at a hobby shop, and the silver solder—in a package with the proper flux—at the hardware store. The only trick is holding things in place during soldering. First I separated the hinges by pulling the pins and clamped the two bottom leaves side-by-side in a vise. I held the brass rod in place with locking soldering tweezers (available at Radio Shack stores). Setting up both leaves at once with a single length of rod helps to match the rod's position on both hinges. After the solder has cooled, you can cut the rod to separate the two leaves and then file away any excess solder.

—Jack Warner, Atlanta, Ga.

Turning without a lathe



If you've got a 4-ft. post to turn and only a 3-ft. bed on your lathe, the drawing shows a way out of the dilemma. Bandsaw or tablesaw the blank octagonal, mount it in a scrapwood cradle and plane it round. Position the wood-screw mounting centers the desired radius beneath the parallel sides of the cradle. The final strokes of the plane will rest on the sides of the cradle to ensure a uniform and accurate circumference.

—Blaine Foule, Lincoln, Neb.

Installing threaded inserts

I ran into great difficulty trying to drive threaded inserts into rock maple (sugar maple). The screwdriver slots kept shearing off under the pressure of screwing the inserts into the hard wood. As shown in the drawing, to avoid this problem I now use a hex-head bolt and jamb nut to install the inserts. Simply thread the nut on the bolt, then follow with the insert. The insert can now be driven home easily with a socket and ratchet. Back out the bolt when the insert is in place.

—Timothy H. Doggett, Juneau, Alaska

Installing box hinges, two ways

In a recent issue (*FWW* #44), Jack Warner asked for tips on installing hinges on small boxes so that the top and bottom are aligned. Here's a system I've used with good results. First install the hinges to either the top or the bottom. Make three marking points by chucking a properly sized flat-head wood screw in a lathe (or electric drill) and cutting off the head with a file to form a pointed cone. Place the three cone-shaped points between the leaves of one of the hinges, so that they point out through their screw holes—they will automatically center themselves. Locate the cover on the box and press

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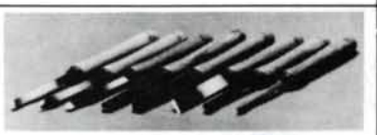

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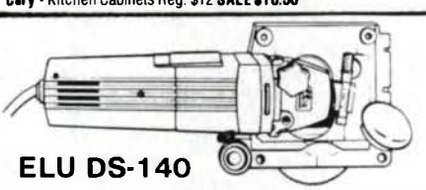

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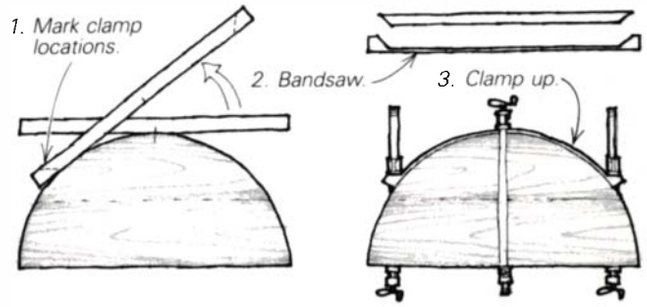
it down when it is perfectly aligned. The points of the cones will leave indentations to mark drill locations. Install the first hinge, then repeat the operation for the second hinge. Scribe and cut the hinge-leaf mortises when you are sure of their exact location. *—M.O. Nichols, Black River Falls, Wis.*

After mounting the hinges to the box bottom, I insert a rectangle of foam rubber about ⅛ in. thick between the hinge leaves. This forces the hinges open slightly. Then I smear a dab of 5-minute epoxy on the top surface of the hinges, put the top in place and hold it down with a weight. The foam rubber "spring" exerts enough pressure to ensure a good bond between the hinges and the top. When the epoxy sets, I open the box, remove the foam rubber and install the remaining screws. *—L. Feldberg, Spring Valley, N.Y.*

Clamp perch for round tabletops

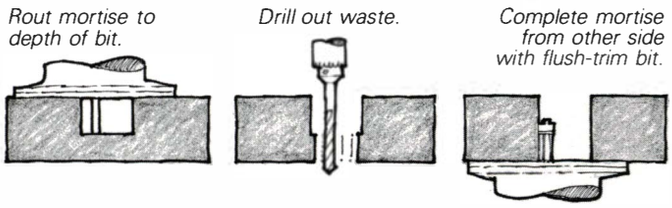


Few things provoke language unbecoming a woodworker more than trying to clamp up a round tabletop. On a restoration project, I found myself having to rejoint and reglue the boards in two half-round top sections of a table. Cussin' didn't work, so I devised another scheme.

I scrounged up a nice straight-grained piece of ash about ¾ in. thick, and marked the center point on it and on the top of the curve of the outside table board. Then, rolling the stick along the circumference, I marked out perch points at appropriate clamping places—the sketch shows one at each end, but you can make as many as you think you need—taking care to keep the flats parallel to the centerline of the table. Then I bandsawed the ash down to a springy ¼ in., leaving the perch spots as shown. To use, I bar-clamped the stick first in the middle, applying enough pressure so that it wouldn't slip. Then, working out from the middle, I bent the stick around the curve and gradually snugged up the clamps on each flat.

—Jim Small, Newville, Pa.

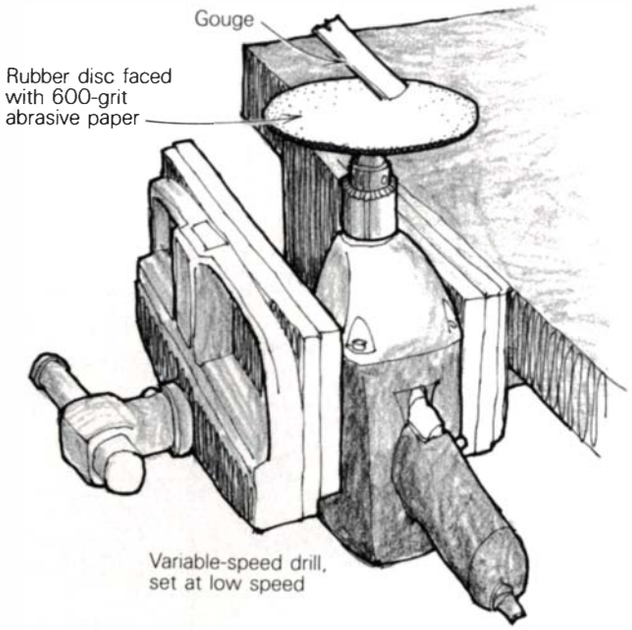
Routing deep through mortises



Here's a simple but effective way to cut deep through mortises. First rout the mortise halfway through from the face edge of the stock. Then drill out the majority of the waste through the member. Mount a ball-bearing flush-trim bit in the router and clean up the mortise from the back edge of the stock. Be sure the trimmer bit's bearing is deep enough to ride on the dressed portion of the mortise. Of course, you will have to square out the corners by hand.

—Patrick Warner, Escondido, Calif.

Low-cost power hone



This low-cost hone will put a mirror-finish razor edge on gouges and chisels. You'll need a variable-speed hand drill, a 6-in. rubber sanding disc, a sheet of 600-grit wet-or-dry abrasive paper and mineral oil. Clamp the drill upright in the vise (not too tight or you'll distort the case). Cut a circle from the abrasive paper and fasten it to the sanding disc with rubber cement.

To use, set the drill for a low speed and lock it on. Apply a few drops of oil to the paper and proceed to hone. At a low speed there's little chance of overheating the edge. I get best results with the paper turning into the blade.

—Jim Van Fossen, N. Ridgeville, Ohio

Outdoor workbench

I made a version of the outdoor workbench shown in *FWW* #33, p. 18, by substituting a sliding-head pipe clamp for the bench hold-down, and it works like a charm—hardly a day goes by that I don't use this bench. Instead of tying up a whole clamp, I took just the sliding head from the standard clamp (which has a fixed foot at the other end, fits ¾-in. pipe, and is available from Constantine's) and attached a different piece of pipe to the log with metal straps at the side and over a standard pipe elbow at the bottom, which grips the log for purchase. This way, I can take the head indoors with me at the end of the day to avoid rusting, and I can slide it back onto its regular pipe for other projects, too. As a bonus, I find that the pipe sticking up makes it easy to shift the block around. *—Don Anderson, Sequim, Wash.*

Routing European-hinge mortises

Several years ago, I remodeled my kitchen and painstakingly arrived at many of the details presented in Bill Pfeiffer's European-style cabinets article (*FWW* #43). I have neither a drill press nor the 1⅜-in. Forstner bit with which he bores the large mortises for the door hinges. Instead, I made a router jig that did the job. To calculate the diameter of the cutout in the jig, add the router-base diameter to the mortise diameter,

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By R.J. DE CRISTOFORO

I work with industrial and homeowner-type sawing machines and I know, no matter what the tool, that it isn't more than a carrier for the component that does the cutting. That's why I would no more equip them with inferior saw blades than I would try to run my automobile on less than all its cylinders. Also, having learned about the characteristics of wood, I can't be enthusiastic about a single all-purpose product, not if I want optimum results no matter which way I saw the wood.

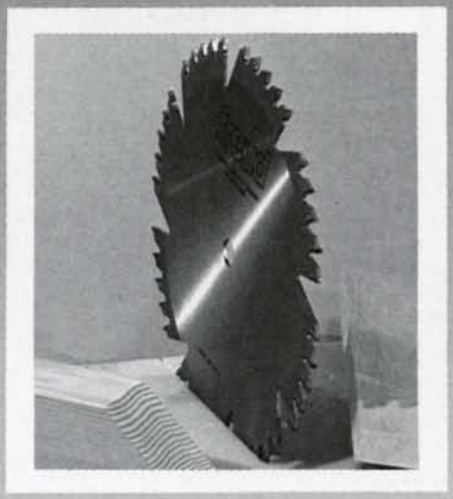
There are respectable combination blades and they're very practical for general ripping and crosscutting, even for some mitering, but for ripped edges ready to join and for crosscuts and miters with burnished edges, I change to super blades that do the best job possible.

There are dozens of blades in the shop, mainly because it's necessary to keep tabs on what is available and how the blades behave, but when constructing for myself or doing a magazine story that must show a photogenic project, I rely on three blades — what I call THE MAGNIFICENT TRIO. They're FREUD products, carbide-tipped, and expertly manufactured. There's more to a saw blade than its teeth.

FREUD'S LU84M-011 — a 10" blade with 50 teeth organized in banks of four ATBs and a raker separated by a generous gullet. It's a fine blade for general ripping, crosscutting and mitering. If there is such a thing as an all-purpose blade, this is it.

FREUD'S LM72M-010 — a 10" blade whose 24 teeth are flat-ground and have a 20° hook. Add generous gullets, expansion slots, and hefty carbide teeth, and you have a true ripping blade.

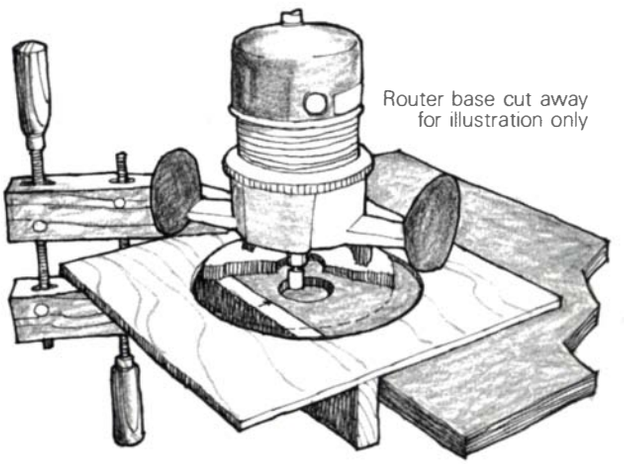
FREUD'S LU85M-010 — this new concept has 80 teeth on a 10" blade, just about as many as you can get on a 10" disc. Much of the clearance is obtained by a unique, concave configuration in the tooth area. This, plus a baked-on, anti-grip coating, lets the blade cut as cleanly and smoothly as anything you've ever seen. It's a new experience in sawing; really a "state of the art" product. You can't get better crosscutting and mitering results. The blade is already famous for use in powered miter boxes.



FREUD'S LU84M-011 — it comes temptingly close to justification as the "all purpose" saw blade. It's the workhorse of many professional woodworking shops. Use it for crosscutting, ripping, even mitering. You judge whether the cut edges need more attention. Be surprised!

FREUD'S LM72M-010 — it's impressive because it leaves the edge you like to see when cutting with the grain of the wood. Special tooth treatment here; the carbide grade is "C2", tooth hook is 20°. It adds up to a true ripping blade that can cut see-through ribbons of wood.

FREUD'S LU85M-010 — you can't find a better blade, especially at this price, that will do a better job of crosscutting and mitering and for forming the clean cuts required in intricate joinery. It's also impressive on rip cuts but that's not what it was designed for. Don't abuse it!



then subtract the diameter of the router bit. For example, if the diameter of the router base is 6 in., the mortise diameter 1⅜ in. and the router-bit diameter ½ in., the cutout diameter should be 6 plus 1⅜ minus ½, which equals 6⅞ in.

To rout the mortise, lock the jig in place with handscrews, lower the router base into the cutout, and move the router around and to and fro. To avoid overloading, especially with a light-duty router, make several passes, lowering the bit gradually to final depth. *—Grant D. Miller, Reno, Nev.*

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 acknowledge contributions when the final decision has been made, and return those with SASE.*

Quick Tips

If you don't have a band clamp and need one, you can build up great pressure by clamping things with ordinary braided nylon cord. Each turn around the work adds more pressure.
—Howard C. Lawrence, Cherry Hill, N.J.

To make a turning square from a rectangular scrap, I use the narrow dimension to set the bandsaw's fence, rip the blank square, and then make two light cuts from corner to corner on each end of the blank. These provide kerfs for the headstock's spur center to grip, and the intersection, of course, marks the exact center for the tailstock. *—L. Green, Bethel, Conn.*

When turning, you can scribe critical lengths with a simple gauge. In a piece of scrap, drive screws the correct distance apart so that their points protrude, then press this against the roughed-out cylinder. *—Jim Ryerson, Guelph, Ont.*

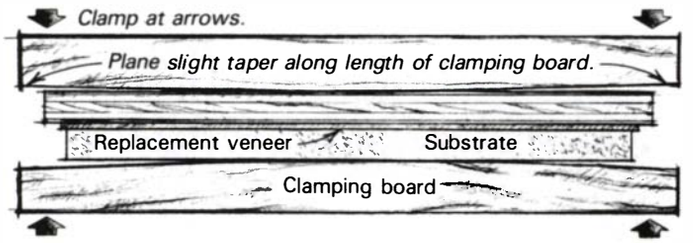
When making threaded dowels, I had considerable trouble because the threads kept breaking out in chunks. The solution is to reduce the diameter of the dowels slightly (about 1/64 in.), then soak them in water for half an hour before threading.
—O.L. Williams, Lincoln, Neb.

My dust-removal system is an ordinary vacuum with a strong magnet clamped to its nozzle. The magnet holds the nozzle just where I need it on most of my stationary machines.
—George Kramer, Ashland, Ore.

CORRECTION: In Edward M. Rosenfeld's Method of Work, "Raising panels with the router" (*FWW* #45, p. 10), there are four rods in the router base, not two. Hence there is no problem disassembling the jig.

Veneer bubbles—*I often need to replace large areas of veneer on furniture that won't fit in a veneer press. I've been gluing with contact cement. After a while, bubbles develop. Can you suggest a better adhesive or a way to overcome the bubble problem?*

—Martin R. Zschoche, Vista, Calif.



TAGE FRID REPLIES: I don't use contact cement for veneering because it never hardens. Later the veneer will crack and bubble. I would use hot hide glue, and either hammer-veneer the surface (I wrote about this in *FWW* #10, pp. 52-54), or, if possible, clamp the veneer under a piece of plywood with paper between the veneer and the plywood. If the piece is too wide for clamps to reach the center, use clamping boards top and bottom, to get the necessary pressure on the plywood. Plane the bottom edges of the boards to a slight taper, so that when the two boards are clamped at the ends, the pressure will be uniform across the plywood.

[Tage Frid is a retired cabinetmaker and professor emeritus at the Rhode Island School of Design.]

Identifying oak—*I have trouble differentiating between English brown oak* (Quercus robur) *and American white oak* (Quercus alba) *in some 17th-century furniture. Both types seem to be equally dark. Is there a way to identify these two oaks by looking at the end grain with a 10X magnifying glass? —Herbert W. Berry, Syracuse, N.Y.*

REGIS B. MILLER REPLIES: Sorry, no. The many species of oak throughout the world can be separated into three distinct groups fairly easily: the red oaks, the white oaks, and the live oaks. The red oaks and white oaks are ring-porous; the live oaks are diffuse-porous. To distinguish between the red and white oaks, you must look at the end grain with a 10X to 20X hand lens. The key character is the latewood pores. In red oaks they are distinct, thick-walled and solitary, whereas in white oaks they are barely visible, thin-walled and not solitary. Also, white oaks have tyloses, red don't. With a hand lens, or even a light microscope, that's about as far as you can go.

Since English brown oak and American white oak are both in the white oak group, there is no positive way to separate them. It is true that the heartwood color of English brown oak is different from that of American white oak, but the variation within each species is too great for you to be absolutely sure of the identification.

[Regis B. Miller is project leader at the Center for Wood Anatomy Research in Madison, Wis.]

Stain-thirsty end grain—*When I stain a piece of wood, the end grain absorbs so much stain that it gets much darker than the rest of the piece. How can I control this so that the entire piece of wood is the same shade?*

—Luke T. Welsh, Middletown, N.Y.

GEORGE FRANK REPLIES: After sanding the end grain, apply a very light sealer coat before applying the stain. You can use thinned rabbit-skin glue (available from Conservation Materials Ltd., Box 2884, 340 Freeport Blvd., Sparks, Nev. 89431) or thinned hide glue. A very thin coat of shellac or thinned-down lacquer will also do the job. You can even apply a concoction of three spoonfuls of sugar in half a cup of water. Experiment on scrapwood first—too much sealer, and the stain won't penetrate at all.

[George Frank is a retired European master wood finisher.]

Storing sawdust—*I burn my sawdust for heat, but it's inconvenient to store it loose over the summer. What cheap, nontoxic binding material can I add to it so that it can be pressed and shaped into handy cubes or cylinders?*

—Paul R. Stempien, Denver, Colo.

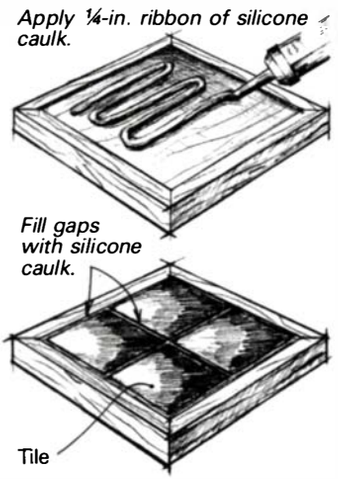
R. BRUCE HOADLEY REPLIES: Without a binder, tremendous pressure (and therefore expensive machinery) is needed to press sawdust into blocks. With an insecticide sprayer, you could spray the sawdust with a dispersion of flour and water, then pack it into a mold. You'd have to experiment with the amount of flour in the water, and the amount to spray on. I haven't tried this, and it doesn't strike me as the most convenient approach, but you might give it a try.

I save the sawdust from my shop in paper grocery bags. I fill each bag one-third to one-half full, roll the top down tightly, and toss it into my woodbin. To start a fire, I pop it into my woodstove, tear one edge of the bag, and light it.

[R. Bruce Hoadley is professor of wood technology at the University of Massachusetts at Amherst.]

Setting ceramic tiles—*What's the best procedure for setting ceramic tiles in a wooden tray? I've used epoxy, but have found that the tiles come loose after a while. What's the best adhesive? —R.J. Farley, Strafford, Vt.*

MICHAEL F. BYRNE REPLIES: The trouble with those wood-trimmed, tile serving trays is that the grout never wants to stay in place, and those little cracks can trap food particles. To eliminate these problems, use silicone caulk for both adhesive and caulk. Dow-Corning Aquarium Silicone, which you can buy at pet stores that sell fish, is nontoxic—it can't hurt sensitive tropical fish, so it should be okay for humans.



Size the tray's inside dimensions to allow a 1/16-in. gap all around and between the tiles. This gap allows the tiles to expand when they get hot.

Finish the outside of the tray, but don't apply any finish to the inside. Press the tiles onto a ¼-in. ribbon of silicone caulk. Hold the tiles in place with weights and let the caulk harden for 24 hours. Fill in the 1/16-in. gaps with more caulk, using the smallest nozzle provided. After this has hardened, scrape or cut off any excess with a razor blade.

[Michael F. Byrne lives in Danville, Vt.]

Battling rust—*My shop is in my basement, which is very humid in the summer. Although I run a dehumidifier, I still have rust on the machined surfaces of my tools and machines. How can I remove this rust, and how can I prevent it from recurring?*

—C.J. Frame, Fredericksburg, Va.

RICHARD PREISS REPLIES: You're wise to keep a dehumidifier running, though this alone won't overcome the problem. The best way I know of to prevent rust on tools and machinery is

Drawings: Brian Gulick

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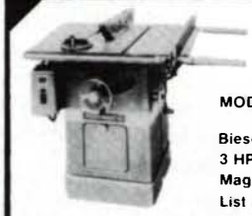

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to use them every day. Short of this, your best bet is to tend to any rust as soon as possible, before it accumulates.

If rust accumulates on my tools, I remove it with Duro Naval Jelly. Apply a liberal coat of jelly and let it stand according to the instructions. Wipe the surface clean with a rag and apply a fresh coat of jelly. Rub with 00 steel wool and follow up by sanding with 320-grit wet-or-dry sandpaper until all the rust is gone. Finally, wipe the surface clean with a rag dampened with a small amount of acetone.

Preventing rust from returning is as tricky as keeping it off in the first place. Stay away from silicone-based lubricants. Silicone will get into the pores of wood and cause "fisheyes" when a finish is applied. To seal porous cast-iron surfaces and prevent moisture from penetrating, I apply a thorough coat of paraffin wax to all machined surfaces and buff it with a clean rag. This wax also reduces friction and permits work to glide more freely. Repeat this process frequently, but avoid gummy buildup with a careful and complete buffing.

Protect your other tools, especially those that aren't used often, by storing them wrapped in rust-preventive paper (available from Garrett Wade, 161 Avenue of the Americas, New York, N.Y. 10013).

[Richard Preiss runs the woodworking shop at the University of North Carolina at Charlotte.]

Semi-opaque underglaze—*I want a semi-opaque underglaze that will make different woods in the same piece of furniture look the same. I believe that this is the technique that furniture companies use to make common woods look like mahogany or walnut. Can you recommend a sprayable product? —Jack Schafer, Fair Oaks, Calif.*

DON NEWELL REPLIES: You want to lay down a semi-opaque film of toned lacquer. I suggest nitrocellulose lacquer. If you can't find the color you want, you'll have to buy several shades and mix your own. The colored lacquer will be opaque, so you'll have to mix this with clear lacquer to get the degree of transparency you want. Some companies also sell tints that you can add to clear lacquer.

Use lacquer thinner to thin the first underglaze coat 30% to 50% for maximum sealing and penetration, then come back with a second coat thinned just enough for good sprayability. When that's dry, scuff-sand with fine sandpaper to eliminate any dust, dirt or overspray. I suspect that you want to lay down a clear-lacquer finish coat over the underglaze. Above all, test your finish on scrapwood before you apply it to the final job.

[Don Newell is a finishes chemist and consultant in Farmington, Mich.]

Removing an oil finish—*Several years ago, I finished an oak coffee table with Minwax Antique Oil. Since then, the table has been cleaned with furniture oil or a mixture of turpentine and linseed oil. This finish isn't tough enough to hold up under the abuse the table is subjected to, and I want to refinish with polyurethane. What can I use to remove all traces of the oil finish so that polyurethane will adhere to the surface? —John O'Leary, Northport, N.Y.*

JIM CUMMINS REPLIES: Stripping your table may not be your best option. Minwax Antique Oil has several advantages, in my opinion, over polyurethane, and I'd suggest that you give it another chance. For one thing, I think it looks better—more like wood than slick plastic. For another, you can repair an oil finish easily, just by rubbing on more oil, whereas polyurethane doesn't adhere well to itself, and you may have to strip the whole table again the next time it gets scratched or wears through. You've just been treating your oil finish wrong since you first applied it: Furniture polishes, which are simply non-drying oils that impart a temporary gloss, won't help the finish. And the turpentine/linseed mixture is so much lighter-bodied than the Minwax—and takes so much

(continued on p. 18)

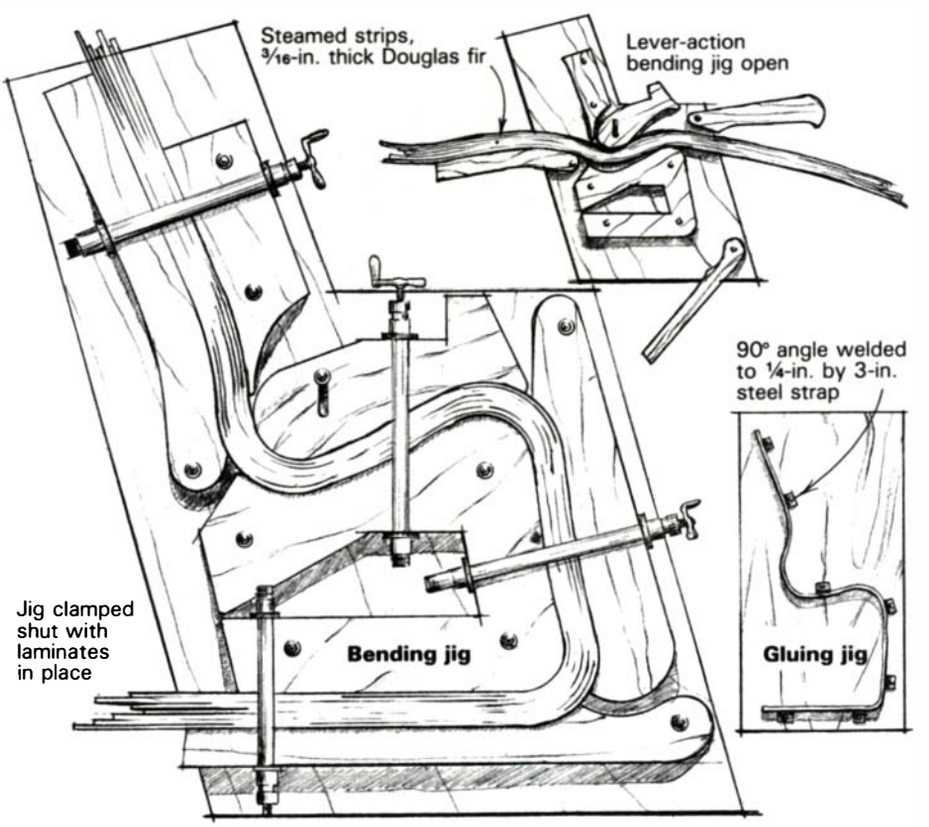
Follow-up: Bending cantilevered legs

After seeing the problem of bending and laminating cantilevered chair legs come up twice in the Q&A section (*FWW* #38, p. 26, and #42, p. 16), I figure I may as well throw in my two cents' worth.

Here are two jigs I've used for years to make those legs. I steam 3/16-in. thick Douglas fir laminates and pre-bend them on that rather complicated-looking, but actually quite simple, lever-action bending jig. The levers open to allow a straight stack of steamed laminates to be inserted at the seat of the chair. Then I tighten the sliding block and close the levers. The levers are clamped with four bar clamps applied as shown in the drawing. The levers provide both leverage and even bending pressure. One person can manage the setup.

When the pre-bent strips are dry, I glue them on the second jig, which is nothing more than a form made from a 1/4-in. by 3-in. steel strap bolted to a plywood base. C-clamps hold the laminates in place against the strap while the glue dries.

—Tim Daulton, Tempe, Ariz.



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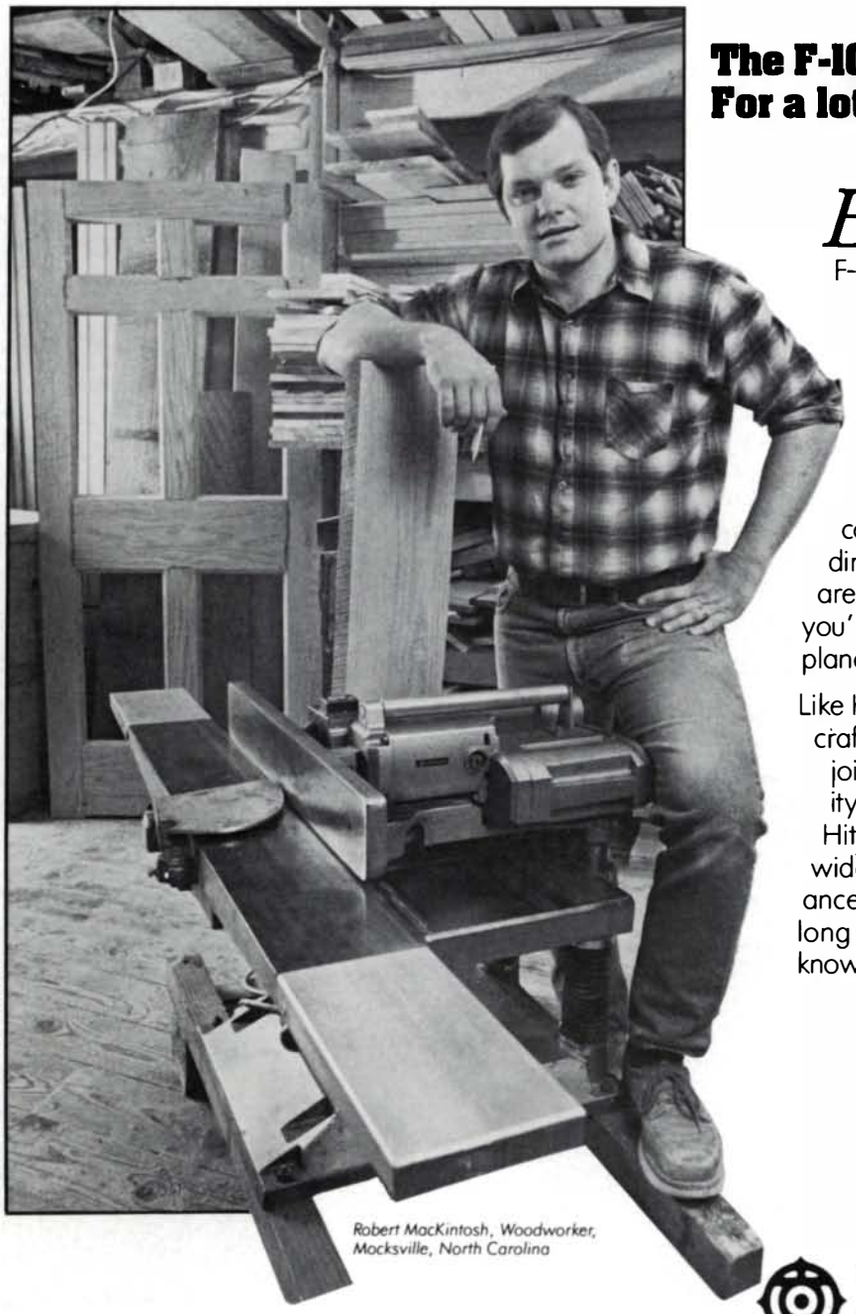

Robert MacKintosh, Woodworker, Mocksville, North Carolina

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longer to dry—that it won't do much good either.

Instead, if you finish a table with three or four very thin coats of Antique Oil and refresh it with a thin coat whenever it shows wear, you'll probably be well pleased. For scratches, you can sand the old finish around the scratch to a feather edge and apply more oil—it will blend right in. For routine maintenance, rub on a fresh coat every few months. This will clean superficial grime off the surface, and should make the finish last indefinitely. Two-year-old oil can look fresh as new, but two-year-old polyurethane will show every scar. [Jim Cummins is associate editor at *Fine Woodworking.*]

Allergy symptoms—*How long will it take for the allergy-type symptoms of a "mahogany cough" to disappear following cessation of exposure? Also, how can you tell if the charcoal filter in a respirator is no longer working? I'm told that painters can tell because they start to smell the fumes again, but some woods have little or no odor when they're being cut.* —*Audrey M. Johnson, Oakdale, Calif.*

GEORGE MUSTOE REPLIES: The respiratory symptoms caused by allergic reactions to wood dust usually clear up within a few days once contact with the irritant has ceased. The severity of the symptoms depends on the length of exposure, the amount of dust inhaled, and the individual's sensitivity to the material. After repeated contact, the intensity of the allergic response is liable to increase and the symptoms become worse.

With freshly milled lumber, irritation may come from volatile oils, but in most cases problems arise from exposure to dust. A good dust mask offers adequate protection. A cartridge-type respirator isn't necessary in this case.

You can test the effectiveness of a toxic-vapor respirator by sniffing an open container of acetone, lacquer thinner or other smelly solvent. If the fumes permeate into the mask, either the filter is worn out, the mask leaks around the wearer's face, or the intake or exhaust ports are stuck open. [George Mustoe is a geochemistry research technician in Bellingham, Wash. He wrote about respiratory hazards in *FWW* #41.]

Readers want to know:

. . . I'd like to hear from woodworkers who own combination machines, such as the Lurem.

—*Richard C. Weaver, Woodbridge, Va.*

. . . how to keep the belt on a Sears 4-in. by 24-in. belt sander on track. Nothing seems to help.

—*Brian DeMarens, Lake Lure, N.C.*

Readers can't find:

. . . small cast-iron wheels for toys.

—*The Woodchucks, Minneapolis, Minn.*

. . . knife-setting tools for a Boice-Crane Model 1000 12-in. planer. —*Robert Manger, Bridgewater, N.J.*

Sources of supply:

—The Steton Combinata, a combination planer, mortiser, jointer and knife grinder, is available from Henry Wiegand Corp., Box 682, 22 Lafayette St., Claremont, N.H. 03743.

—Pacific cloth, a tarnish-inhibiting fabric for lining the inside of silver chests, is available from October Company, Inc., 51 Ferry, Easthampton, Mass. 01027.

Send queries, comments and sources of supply to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470.*

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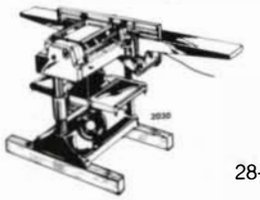

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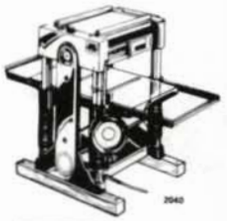

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Books

Techniques of Creative Woodcarving by Ian Norbury. *Stobart & Son Ltd., 67-73 Worship St., London, England EC2A 2EL, 1983. £12.50, hardcover; 159 pp.*

Don't know what or why to carve? The answers are to be found in the carving itself, says Ian Norbury—get a few good tools, a piece of wood, start with a familiar subject, study it, then put everything you have into your work. Norbury makes you believe it's possible. Throughout his lively series of carving lessons, I had the impression that here was a guy who has done many carvings, probably even cut himself a few times, and has developed a strong, realistic sense of what a woodcarving should be and what it takes to be a carver.

Norbury starts with a most familiar topic, the human body, then moves on to a variety of projects, including a still life, a horse, and characters from Shakespeare and *Alice in Wonderland*. Sketches, diagrams and photographs are used to give the reader a method of working, not something to copy slavishly. Norbury stresses that imagination and sensitivity are as important as skill with tools. Before carving a horse, for example, he recommends that you study the real thing up close, so you can see, hear and feel the nature of the animal—without this sort of involvement, your carving will be "as a dressmaker's dummy is to a human being."

But in his effort to improve the carver's mind, Norbury doesn't neglect practical hints for the carver's hand. His handling of details, such as eyes or hair, is excellent. One method I found especially good is his use of a Japanese *netsuke* technique to create surface textures such as warts or the irregularity and knottiness of a vein in an arm. Basically, you use a punch to make depressions in the wood, then carve and sand the area until the depressions are virtually gone. Using a small brush and boiling water, you soak the depressions, and within minutes the compressed fibers will expand and the details appear. Norbury says it takes practice to learn to indent a specific area, rather than sever or crumble the wood fibers, but think of the possibilities. *—Dick Burrows*

The Carousel Animal by Tobin Fraley, photography by Gary Sinick. *Zephyr Press, PO Box 3066, Berkeley, Calif. 94703, 1983. $19.95, hardcover; 127 pp.*

Primarily a picture book, *The Carousel Animal* contains more than fifty outstanding examples of the carver's art beautifully photographed in color. Horses predominate, but the ostrich, frog, rabbit, pig, camel, rooster, lion and even a sea monster are also represented. Each plate is accompanied by a paragraph or two about the carver and the carving, and the short introductory chapter provides a glimpse into the development of the carousel, the famous carvers and the styles they evolved, and the short-lived industry that developed in the late 19th century to meet the demand for carved wooden carousel animals. I even learned why English carousels circle clockwise, while American and European carousels circle counterclockwise.

This is not a how-to book by any means. But it is a great source of ideas for rocking horses (or other animals). You can take it from there. *—David Sloan*

Make Your Own Classical Guitar by Stanley Doubtfire. *Victor Gollanz Ltd., London, 1981, £15. Reprinted by Schocken Books, 200 Madison Ave., New York, N.Y. 10016, 1983. $17.95, hardcover; 120 pp.*

There are several excellent books for people who've never made a guitar, and this one belongs with the best of them. The problem in writing about making instruments is that the author can't hand-pick his readers—what would be a practical procedure for an advanced woodworker might be nearly impossible for a novice. And there's always some purist waiting to heap scorn on new techniques and materials. Doubtfire tells why he does things the way he does, and whenever a craftsman clearly explains his reasoning, the information enriches anyone, even those who might do things differently.

Doubtfire begins with a chapter on sound and vibration, which leads to a discussion of woods and other materials. Then he gets into the 18 basic hand tools a guitarmaker needs. Some of these you can make yourself, such as guitarmakers' clamps and a thicknessing caliper. There are good explanations of how each tool works, how to sharpen, and how to achieve the precision called for—tricks and tips for mating curved surfaces for tight glue joints, and ways of making a sawcut *exactly* where you want it. There are alternatives for many special tools, including the simplest bending iron I've yet seen—a length of copper pipe slipped over a heavy-duty soldering iron.

Anyone who makes a guitar will soon try to make a better one, perhaps with a little more treble, maybe with more lavish inlay, possibly with more expensive wood or a more refined bracing system. Wherever you begin, your fifth guitar will be more advanced than your first. Doubtfire's guitar is immanently makable, and worth building. With this one finished, you'll be well along the road. *—Jim Cummins*

Recreating the American Longrifle by William Buchele, George Shumway and Peter A. Alexander. *George Shumway Publisher, RD7, Box 388b, York, Pa. 17402, 1983. $20.00, paperback; $27.50, hardcover; 175 pp.*

The long, graceful "Kentucky" rifle that evolved during the 18th century is a uniquely American folk art. Every colony had gunsmiths, but southern Pennsylvania was the center of rifle-making activity into the 1840s. In Lancaster and surrounding counties, the American flintlock rifle was refined and perfected. Country gunsmiths married wood, iron, brass and silver to produce a reliable tool that would shoot. They also embellished their rifles with graceful rococo relief carving, engraving and inlays that transformed a utilitarian object into "...a complex sculpture of three-dimensional art with two-dimensional art superimposed." Each rifle was unique.

Recreating the American Longrifle is the best book available for the person who wants to recreate these muzzle-loading rifles. This is a how-to book for both the beginning and advanced rifle builder. Purists may fault the authors for omitting hand barrel-forging and lock-making, but commercially made barrels and locks have rendered these techniques academic. Every other step in making a functional flintlock or percussion rifle is covered thoroughly: historical background, design, wood selection, inletting, metalwork, metal and wire inlay, relief carving, engraving, and finishing.

This well-organized book is full of excellent line drawings showing construction details, tools and techniques. Particularly helpful are the late William Buchele's full-size rifle and pistol drawings. Black-and-white photographs of details on outstanding old rifles are the next best thing to actually examining the originals firsthand. For example, the muzzle ends of five rifles are pictured side-by-side for comparison. A bibliography lists books, magazines and catalogs of interest to the rifle maker and longrifle student.

Several other longrifle-building books are available, but they skim over the fine points of construction and design that this one covers so thoroughly. Well researched and intelligently written, it's in a class by itself. *—David Sloan*

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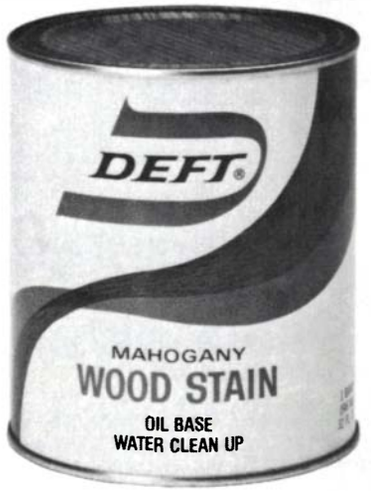

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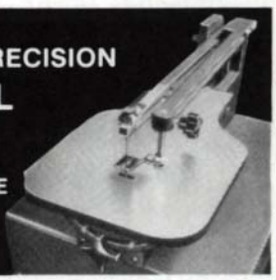

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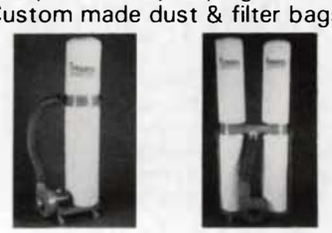

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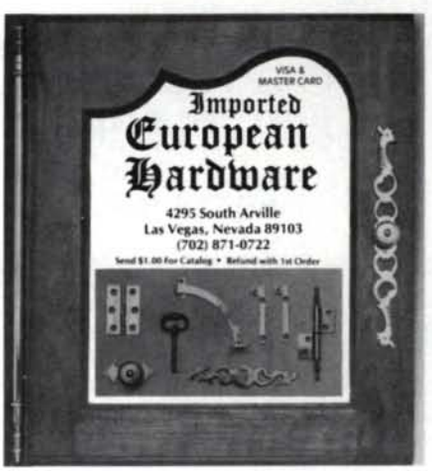

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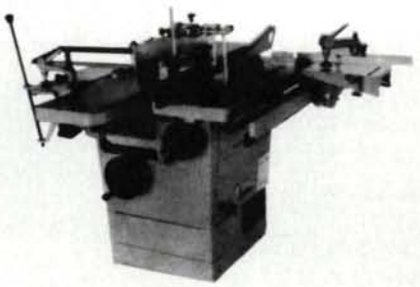

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LU84M10	10"	40	Comb.	42.50
LU84M11	10"	50	Comb.	44.40
LU85M10	10"	80	Cut-Off	72.00
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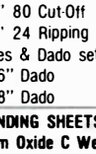

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D13V	½" Var. Sp. Rev. Drill	99.75
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P100F	12" Planer	1095.00
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TR-6	Laminate Trimmer	92.25
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	80	1.00 ea	.86ea
	60	1.05 ea	.92 ea
	50	1.07 ea	.94 ea
	40	1.10 ea	.97 ea
3"x24"	120,100	1.20 ea	.93 ea
	80	1.22 ea	.97 ea
	60	1.26 ea	1.12 ea
	50	1.31 ea	1.15 ea
	40	1.34 ea	1.18 ea
4"x24"	120,100	1.68 ea	1.46 ea
	80	1.73 ea	1.51 ea
	60	1.78 ea	1.64 ea
	50	1.85 ea	1.70 ea
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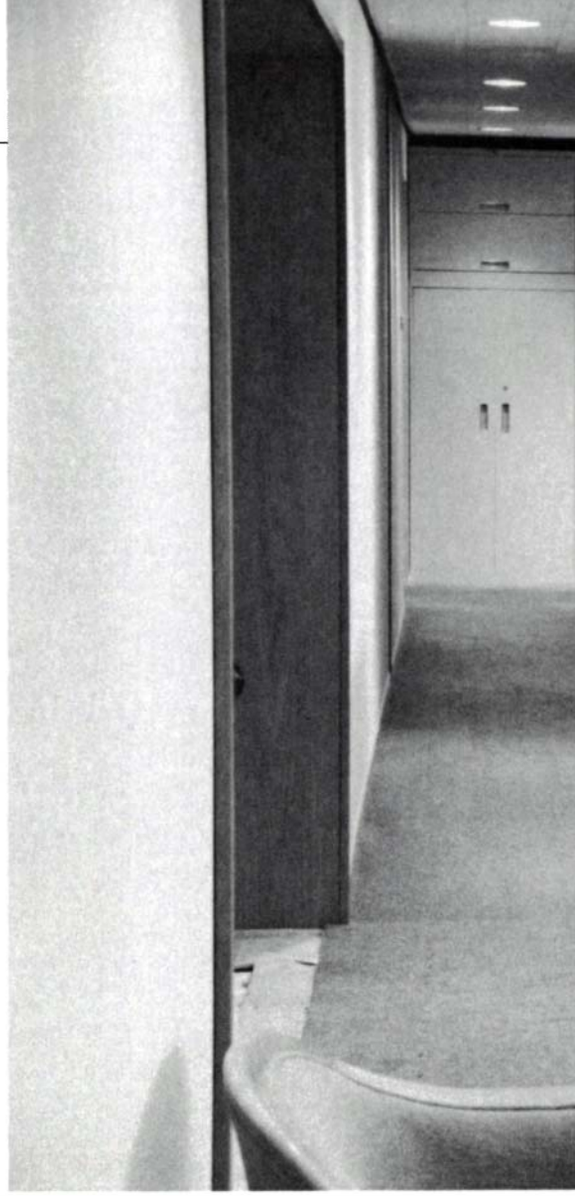


High-Rise Millwork

Working wood inside the glass and steel monolith

by Jeff O'Hearn

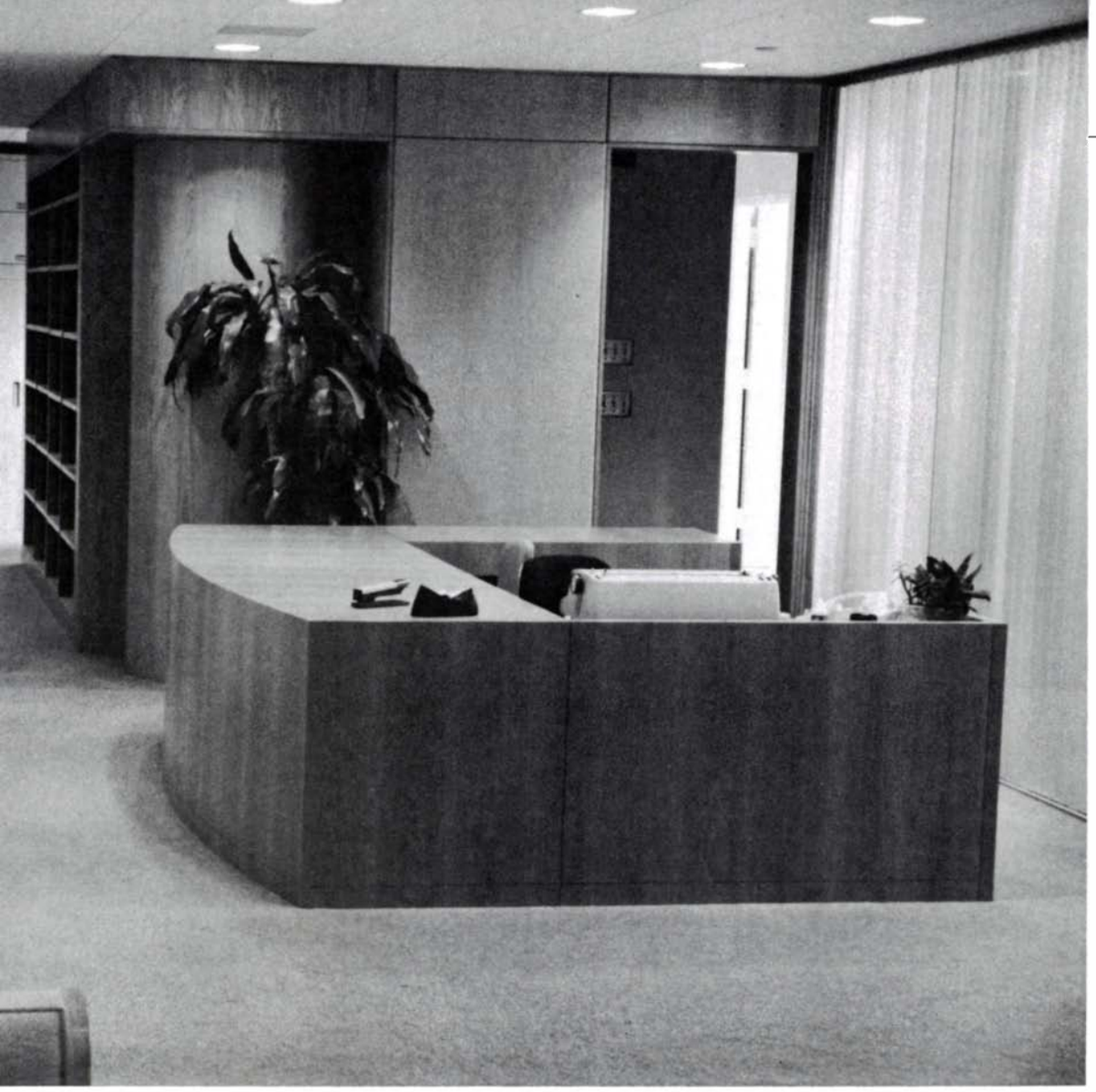
Much of the woodworking in this country is done by millwork shops working from plans developed by architects for commercial clients. The millwork shop—of which there are growing numbers—exists somewhere between the intimacies of the small cabinet shop and the repetitive drudgery of the manufacturing plant. The woodworker's role varies from job to job and shop to shop. Sometimes he's just a materials handler; at other times he might be asked to design, build and install a complicated piece of high-end woodwork.

The range of items custom-built by millwork shops is far more diverse than that of most small manufacturers, who tend to specialize in only a few products. A fully equipped millwork house can simultaneously produce specialty moldings by the linear mile, cabinetry, raised-panel doors, circlehead windows, entire storefronts and matched veneer panels, all in a physical plant that makes no distinctions between departments. These products can be made from any type of wood and brought to any stage of completion, from partially assembled to fully installed.

This ability to meet a customer's unique demands has always been a trademark of the millwork industry, but the industry has undergone a renaissance during the past thirty years. Around the turn of the century, the number of millwork houses began to decline steadily as the products they once made by hand poured off factory assembly lines at low prices. Today, however, the millwork market has bounced back in a new, vigorous form, partly because of the phenomenal growth of the contract-furniture design industry and partly because of the growing interest in renovating buildings and offices. Every year, thousands of new offices are built, and designers want distinctive moldings, bookshelves, paneling and furniture. Working directly with architects and designers, the millworker fills the custom demand in ways that a furniture factory cannot.

Huge sums of money go into office woodwork: a millwork contract might specify scores of individual items totaling a quarter of a million dollars or more. As project engineer at Art Woodworking, a large mill house in Cincinnati, I'm the liaison between the designer and the woodworker, corralling all the details and making sure the work gets done right and on time, all the while satisfying the often divergent interests of the architect, the job superintendent, and the client who's paying for the work. Art Woodworking, founded in the 1920s by Henry Dickman, once produced turnings for Cincinnati's thriving furniture factories. Henry's sons, George, Ray and Bill, all went into the business and today Ray heads the company. With some 38 employees, our production setup is typical of the industry, so a recent renovation job we did provides an interesting glimpse into the mechanics of high-rise millwork.

We had been awarded a contract for a three-floor renovation in the DuBois Tower, a 30-story high rise built in 1972 and located in downtown Cincinnati. A law firm, Dinsmore and Shohl, was expanding its offices in the tower, a project



The elegant, seamless woodwork in a modern high-rise building—such as that in this law office in Cincinnati's DuBois Tower—belies the considerable ingenuity that goes into its construction. Working from the architect's plans, millworkers 'fit up' a building's steel and concrete innards with custom-made paneling, molding, furniture and specialty fixtures such as the nonstructural column, far left, made by veneering a cardboard form called a Sonotube.

that involved first stripping out sections of the old walls and ceilings right back to the building's concrete skeleton. After that, new partitions were built, using drywall fastened to metal studs. Then new electrical wiring, phone lines, ducting and lights were installed, ceilings were hung, and wallcoverings, paint, carpet and trim were applied.

Our job was part of the "fit-up," an industry term for the process that turns a building's concrete shell into comfortable, attractive offices. The architect, Granzow and Guss of Columbus, proposed a fit-up that would exude a quiet, modern elegance. Most of our work was installed in the central lobby of each floor, poised—as is typical with most fit-ups—to give a strong first impression to people getting off the elevator. We paneled the three elevator lobbies in bookmatched white oak veneer and built identical oak reception desks for each lobby. In each of these areas, the architect called for decorative white oak columns with soffits leading into sets of bookcases. On paper, the columns looked straightforward enough, but actually building them provided some troublesome moments.

One of the most difficult parts of the job was a pair of circular staircases, with all the attendant trim and moldings, which were hung in a shaft paneled in gray fabric. We also provided hundreds of other items, including 150 veneered office doors and some plastic-laminate cabinetry for employee kitchens. Later in the job, we were asked to build some additional furniture, including a 26-ft. conference table veneered in ash burl. By any standards, it was a very healthy job.

Before we actually got the contract, we had to give the architect a detailed cost estimate. Sometimes bidding is "open," which means that the architect has sent his plans to a local branch of a national bid-announcement service such as F.W. Dodge Company. Millwork outfits like Art Woodworking subscribe to this service and submit bids on work that interests them. Often, the architect won't risk unknown problems with a new company, and he'll "close" the bidding by specifying as qualified bidders two or three companies he's already worked with. That's what happened with the Dinsmore job. We were written in as one of two qualified bidders. The other, a New York firm, was unlikely to take on a job in Cincinnati.

Estimating a bid accurately is an acquired skill that succeeds most surely through religious attention to detail. Each bid is prepared by closely examining the architect's drawings, dissecting each item into the time and material needed to make it. Labor rates and overhead costs vary from shop to shop and job to job. Some are as low as $20 per hour, others as high as $50. Typically, a profit margin of 15% is aimed for. The most difficult part of the bid is the time estimate—it haunts the cabinetmaker and determines the profits. Les Childress, our senior estimator, figures time estimates with the help of the Architectural Woodwork Institute's *Cost Book* (2310 S. Walter Reed Dr., Arlington, Va. 22206), a manual with tables describing the time required to jig up and make 175 different millwork products. Childress backs up the cost book by referring to our company's own job rec-

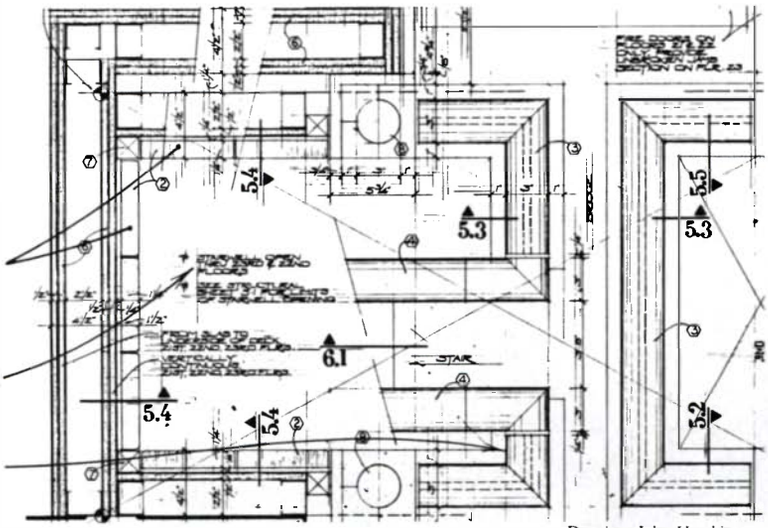
Decoding the architect's shorthand

Though very condensed, this drawing gives enough information about materials, surfaces and dimensions for the millworkers to prepare final drawings and materials lists for the stairwell shown in the photos at right.

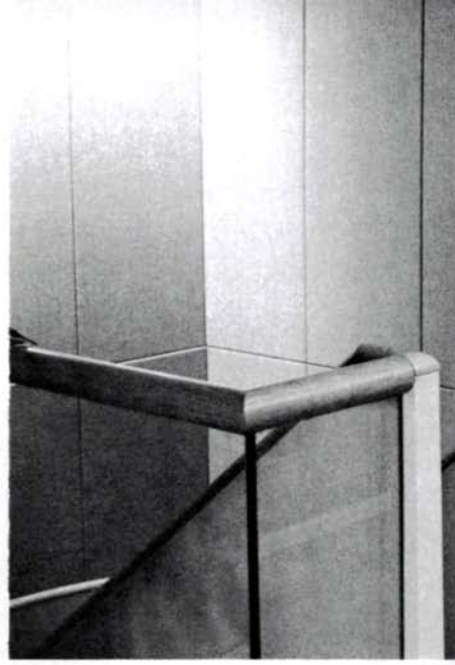
Fabric-covered wall panels are shown schematically; the actual dimensions are calculated after drywalling.

Notes say stairwell connects three floors; numbers refer to detail drawings.

Larger-scale details show the mitered and returned stairway railings.



Drawing: John Hutchinson



ords. In our shop, each job is assigned a code number. Cabinetmakers punch their time cards to record how long they work on each job and the cards are tallied daily. At the end of each job, actual and estimated times are compared to reach the moment of truth: Is the job in the red or the black? More often than not, it's in the black.

The work I most enjoy happens after the contract has been awarded: poring over the architect's plans, refining them into working drawings so that the shop can actually build what the contract calls for. There's a clear distinction between the architect's drawings and the shop or working drawings. The architect's plans solve problems of function and appearance, while the shop drawings address construction, assembly and installation. My job is to interpret the architect's intent, adding details where necessary and generally tidying up the tail end of the design process.

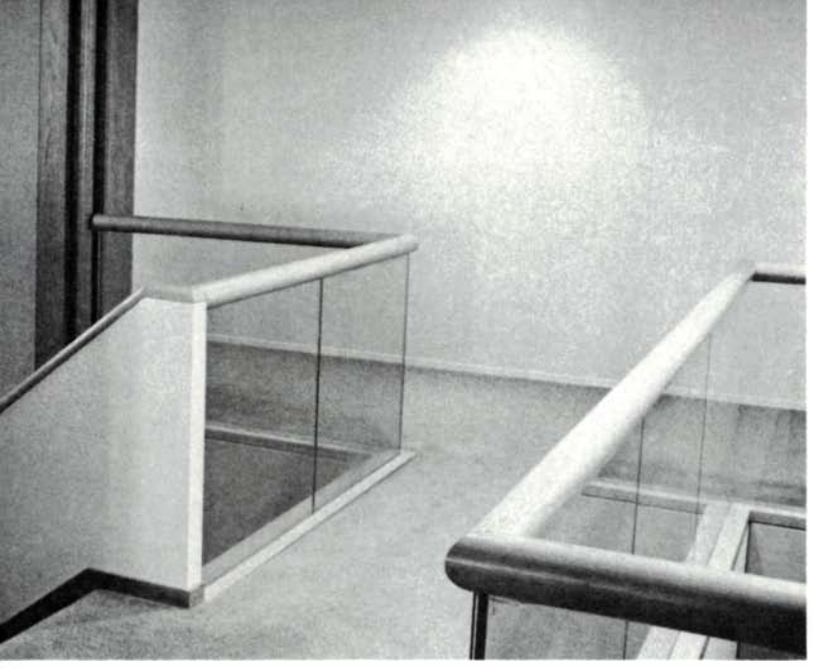
I begin by scaling up the architect's drawings, which are often at a quarter-inch to the foot and are thus far too small to show details such as molding profiles and joinery. The details I need to include in shop drawings vary from job to job. The design drawings for the law firm's reception desks, for example, were adequately dimensioned to indicate overall size and shape, and they included notes about veneer grain direction and finish. But decisions about case joinery, the precise size of drawers and the selection of hardware were left up to me. It's a common misconception that the more detail supplied by the architect or designer, the better. Architects don't always know how furniture and millwork are put together, and a drawing that requests a specific type of joinery will frequently be ignored by the millworker, or the price for strict compliance will be very expensive.

Interpreting the architect's intent is akin to detective work, requiring an unfailing eye for detail. The plan view of the open stairways for the Dinsmore job, shown in the drawing above, appears as nothing but a dense crosshatching of lines, cluttered with circles, dimensions and notes. But from this condensed design shorthand, I was able to discern the relationships and sizes of the various millwork components. Fortunately, I had plenty of time to interpret the design drawings. Any questions I had—and there usually are quite a few—were cleared up when the general contractor and the architect reviewed my drawings. I prefer that my drawings return with red ink here and there. No real review means you're on your own; the architect's approval stamp implies that the shop drawings haven't omitted anything specified in the contract.

Before we can begin making the millwork, we have to fine-tune the shop drawings by adding field dimensions—measurements taken inside the building where the woodwork will actually fit. These are the *real* distances between walls and floors and ceilings, not what the drawings say they ought to be. Even if building construction is behind schedule, we have to wait for field dimensions, in which case the time allotted for our work gets compressed against the tenant's move-in date. To expedite a job, architects sometimes give us "guaranteed" drywall dimensions, but these almost never work out. As the drywallers finish up, I collect field dimensions daily, scheduling work in the shop accordingly. At the same time, I discuss delivery of our portion of the job with the general contractor's superintendent, taking into consideration such factors as the maximum size of shipping entrances and elevators. We prefer to build furniture, cabinets and counters in as few pieces as possible, because the fewer the loose joints, the better the final appearance. On the other hand, particleboard is incredibly heavy stuff. I have been embarrassed to see the agony of seven large men struggling up a small stairway with a plastic-laminate behemoth pinning them into the corners.

While the shop drawings are being reviewed by the architect, there's a bit of a pause, which gives us time to order materials. The Dinsmore job called for 15,000 sq. ft. of white oak veneer, which I was assigned to select from a mid Ohio Valley veneer warehouse. But the most interesting material purchased for this job was the white ash burl veneer for the conference-room tabletop. A Louisville veneer broker had some exceptional burl veneer taken from a truly giant burl flitch—each leaf was 27 in. by 60 in. The flitch we bought had been softened by a chemical treatment, the defects punched and patched, and each leaf glued to a poplar veneer backing for easier handling. The dealer was secretive about the softening process, and I half-expected him to throw in the country of origin and how many elephants it had taken to drag the tree out of the mountains as part of his sales pitch. Such is the effect of a good burl—people seem to enjoy being mystified by the intensity of the wood's twisted growth.

Once the shop drawings have been approved and field dimensions taken, we begin work. Procedures at this point vary



O'Hearn's biggest challenge is understanding the architect's intent and then transforming arcane drawings into woodwork, as shown here. Large-section moldings, which trim the top of the stair's rail, are a main staple of most millwork shops.

widely from shop to shop. At Art Woodworking, we give our cabinetmakers a blueprint of each piece, along with a cutting list describing the size of all the parts. Some of our cabinetmakers prefer only the drawing, accompanied by a careful discussion of critical parts of the design. In other shops I've seen, a senior cabinetmaker does layout and cutting bills, distributes parts lists to machine operators, and supervises assemblers. In our shop, my joinery and construction decisions are often overridden by the foreman or the cabinetmaker, but only after a discussion during which lots of cryptic pencil lines are made on the nearest flat surface.

In the millwork industry, woodwork is done with one constant concern in mind: how to produce the finished product in the least number of steps. As a result, particleboard—veneered or covered with plastic laminates—has become the dominant material for paneling and casework. It's cheaper and stabler than solid wood, and working with it is faster than milling and edge-gluing boards.

The equipment in our shop is geared to particleboard construction. Besides the jointers, tablesaws and planers that any hobbyist woodworker would recognize, we have expensive, specialized machines that greatly speed production. The largest of these are the five machines we use for veneering, which is involved in the majority of the work we do. The steps in production-veneering are the same as in hand-veneering, but we do them a lot faster (see photos, pp. 34-35). First, edgebands are glued to the particleboard substrate by a 20-ft. long machine called an edgebander. The edgebands, which can be either veneer or thin strips of solid wood, are stacked in a feed ramp at the back of the machine. The operator feeds one panel edge into the bander's conveyor, and the machine does the rest. It latches onto the panel and briskly tugs it along, gluing and clamping the edgeband and trimming it flush with the particleboard's length and thickness, all in about 30 seconds.

In hand-veneering, you'd first true the edges of each veneer leaf with a plane, then tape the leaves together to make larger sheets. We do the same, but with a veneer trimmer—a device that trues 15 to 20 leaves at once with a tiny circular saw pulled along a 14-ft. track by a chain. The trimmed (and usually bookmatched) leaves are fastened together by the stitcher, a machine that lays down a very fine thread of hot-melt glue across the seam to hold the leaves together for handling. The stitched leaves are pressed onto the substrate, usually using urea-formaldehyde glue, which sets in about 14 minutes under the 2,000 PSI exerted by the heated press platens. Veneered panels are trimmed, sanded and sent on to the next production step, which might prepare them as wall paneling or as components in casework.

Like virtually all high-rise jobs, the Dinsmore project called for hundreds of feet of custom moldings, some as large as 8 in. in section. We have two molders, an ancient U.S.-made Mattison and a new high-tech Weinig from Germany. Setting up a molder, which is essentially a shaper with many cutterheads, is simple in principle but difficult in practice. Modernist architects often specify that moldings look straight-grained or rift-sawn. It's hard to find thick rift-sawn lumber for big moldings, and we often have to glue up thinner stuff. When we set up the molder, we center the profile cuts so we won't mill too much material off one side, as that could lead to a warp later. Of course, we custom-grind knives when necessary, but most moldings can be constructed from the hundreds of knife shapes that we already have. (These are stored in dusty trays arranged in arcane groups that only Tom Maly, our senior molder operator or "sticker man," really understands.)

In the course of a job, the pace can get frantic, but it's satisfying to see the culmination of two or three weeks at the drafting board pay off. As a building nears completion, meetings have been held and promises made. We'd sure as hell better have some millwork ready by the day circled on the calendar. Two weeks before that day, I'm usually in a frenzy, with three people pushing cutting lists in my face, asking if part 17a isn't really supposed to be $\frac{5}{16}$ in. longer, as I try to handle a phone call telling me that we never did place that order for hinges five weeks ago. All the while I'm thinking about the seven field dimensions I forgot to get, even though I've already visited the job site eight times.

I suppose that the story of any project can be summarized by the problems encountered. The construction business seems particularly chaotic, with deadlines that contractors swear are determined by darts thrown blindly at a calendar, millwork that just won't fit onto the elevator and field dimensions that seem to change mysteriously in the middle of the night. The Dinsmore project had fewer problems than some, but problems nonetheless.

One foul-up involved a machine, which is fairly rare. We

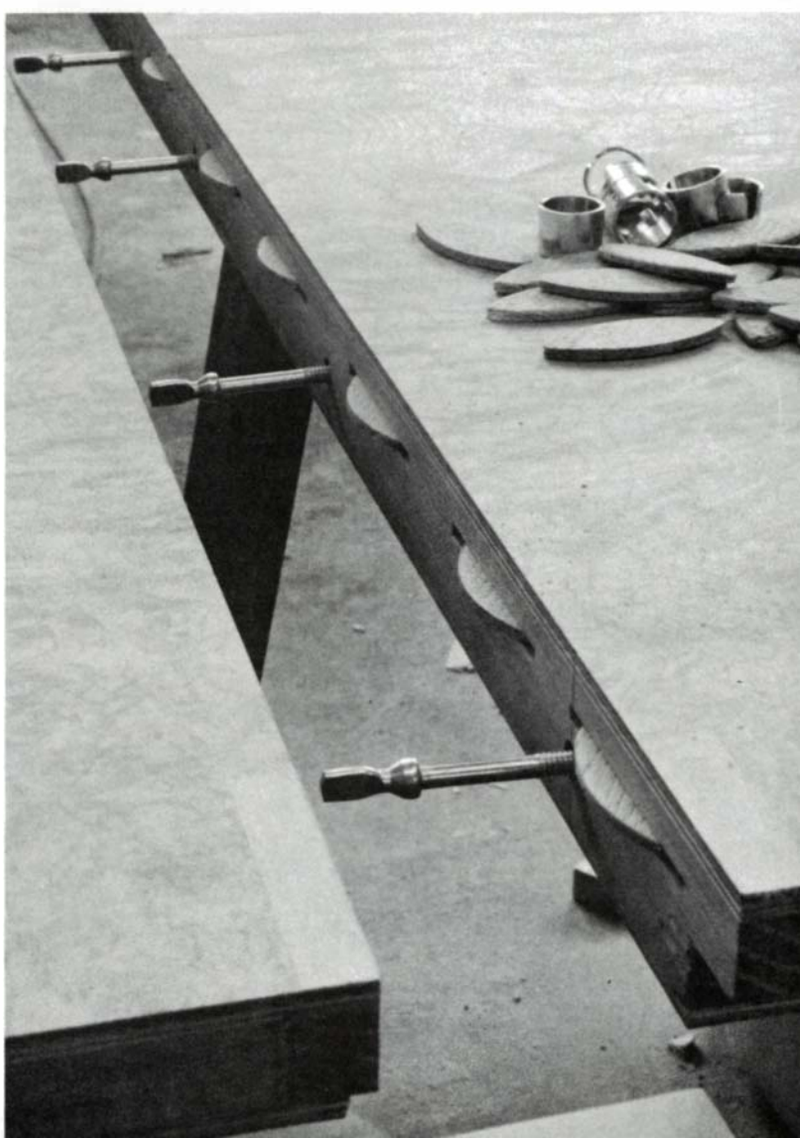
had used our newly acquired edgebander to put 1-in. white oak bandings onto particleboard cores for cabinet doors. While we were milling hinge mortises, we noticed cracks in the face veneer at the banding/substrate joint. In examining the edgebander's glue-capsule data, we discovered that the glue's melting point was 140°F—the same temperature at which we operate our veneer press. The edgeband glue was remelting in the press, then resetting without any pressure against the edge. We couldn't tell how much joint strength had been lost, and we couldn't replace the doors without destroying the veneer sequencing. Our solution was to reheat each panel, then immediately pull the bandings tight with 3-in. screws, plugging the countersunk holes afterward. We've since found an edgebander glue that melts at 400°F, and supposedly won't remelt once set.

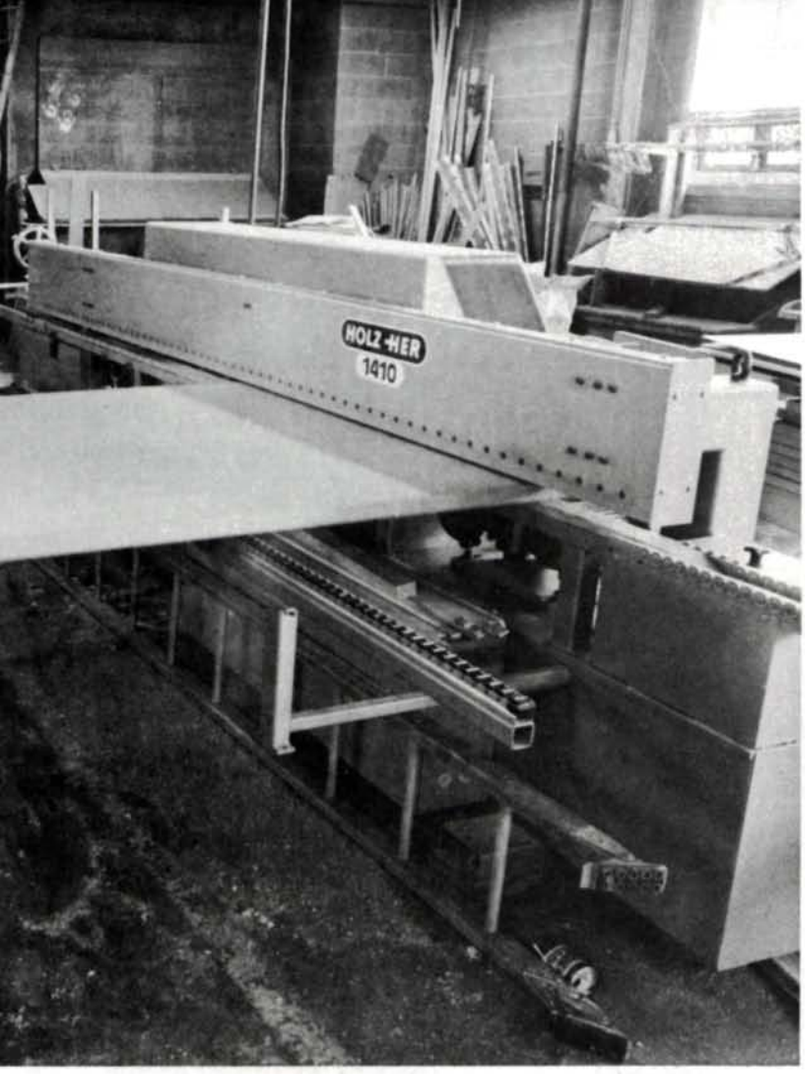
The large lobby columns also posed an interesting construction dilemma. We had never made a 30-in. dia., 7-ft. tall veneered cylinder, and we weren't sure how to go about it. We came up with two solutions: The first was a hollow wooden tube made of 2x4s nailed to circular plywood discs, then covered with layers of ⅛-in. Baltic birch plywood. We trimmed, matched and stitched the white oak veneer, and glued it to lauan door skins (thick veneers used for hollow-core door construction), which served as backings. At this point, we were guessing. Would the lauan/oak composite be pliable enough to bend without cracking? All we could do was glue it up and find out. We screwed cleats along both outside edges of each composite skin, brushed the forms with Titebond glue and clamped from cleat to cleat. The procedure worked beautifully. The second time around, we got even better results by gluing the veneer to Yorkite (a paper backing) and gluing it to similarly prepared Sonotubes (giant cardboard cylinders normally used as forms for pouring concrete columns). We used the same method to assemble the pedestal legs for the conference table.

The installation of the law firm's millwork went smoothly. Except for a problem with the finish on some doors, we weren't having the typical deadline crunch. We did have some trouble in the stairwell, however. The 3-in. dia., half-round handrail molding was milled in three sections from a full-size cardboard template that I'd traced from the steel underpinnings on the job site. We bandsawed, shaped and fitted the molding sections to the stairway wall before it was plastered so that the handrail's curve could serve as the plasterers' template. For reasons unknown, or not admitted to, the handrail's joints were broken by the plasterers. Although we reshaped, puttied and refinished the joints in place, they didn't look good.

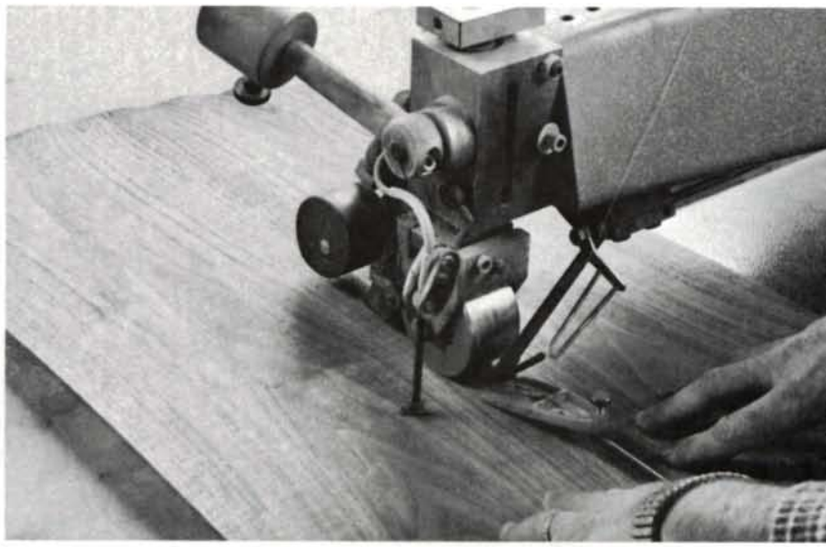
The blame for such a mediocre result should probably rest with the millworker and the architect. We are at fault because we didn't devise a joint strong enough to resist torquing, but some of the blame must fall on the design itself. The cool geometry of modern design sometimes contradicts its own "be-true-to-the-material" dictum by haphazardly combining dissimilar materials in ways that look good on paper but don't necessarily respect the nature of the materials involved. At the stairway low wall, for example, the three materials—sheetrock, oak and steel—did not combine well. Flush Miesian elegance is not very forgiving of materials that don't stay square or round or flush—or generally geometrically pure.

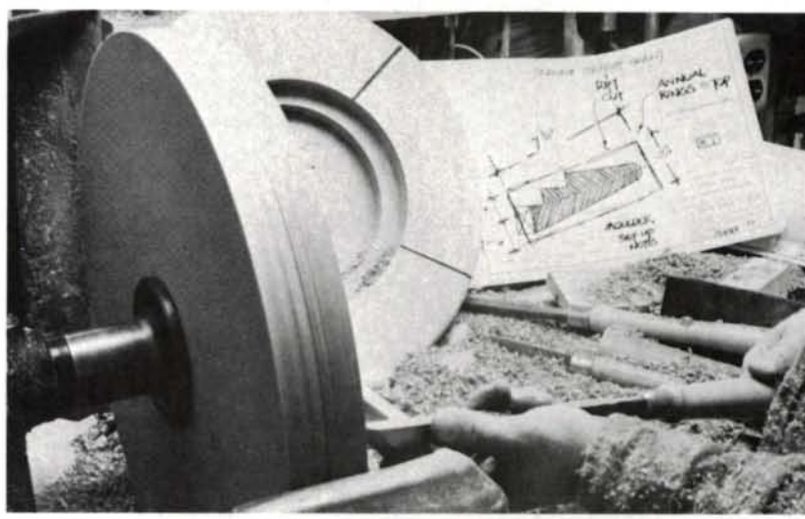
The accumulation of these sorts of imperfections can detract from satisfaction with the completed job. Most of the





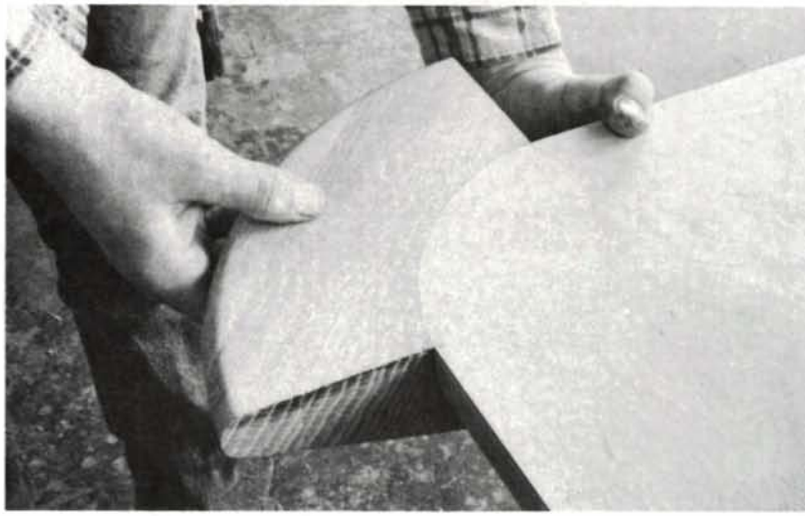
Millworkers get out enormous quantities of work on time by relying on big, expensive machines. In the photo at left, cabinetmaker Herman Unger feeds particleboard through an edgebander, which glues on a solid-wood edge strip before the panel faces are veneered. Below, two veneer leaves are fed through a stitcher, which sews them together with a thread of hot-melt glue.





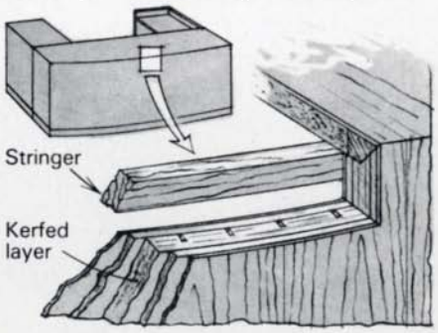
Though sophisticated machines and jigs ensure consistent results, there's a place for handwork in the mill shop. The radiused corner moldings of the conference table shown at left were hand-turned (above) to match the profile of the machine-cut straight moldings. In the photo below, the disc has been bandsawn into quadrants which will neatly connect the straight moldings.

As the height and rent of a commerical building rise, so too do the scale and cost of the furniture that goes inside. The 26-ft. long conference table shown above is particleboard veneered with white ash burl. Too large and heavy to fit in the building's elevators, the table was made in five sections, then assembled on-site with Lamello plates and knockdown fasteners (photo, left). The pedestal legs are oak-veneered cardboard Sonotubes.

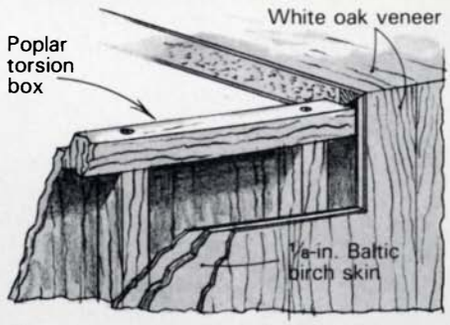


Millwork joinery: engineering, ingenuity

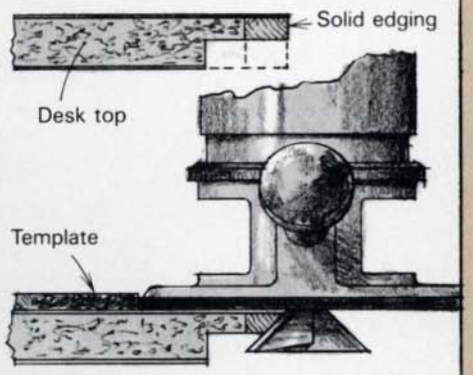
A reception desk—high-rise style



For the desk's curved front, O'Hearn proposed veneering a sheet of kerfed plywood first bent to the proper radius, then mitered to the veneered fiberboard top.



The cabinetmaker who built the desk improvised an easier-to-fit alternative: a poplar torsion box skinned with Baltic birch and white oak veneer. The skin was veneered first, mitered on the tablesaw, and then glued to the torsion box.



To cut the desk top's curved miter, a router fitted with a custom-ground bit was guided against a Masonite template.

Working against delivery deadlines that always seem too near, millwork cabinetmakers don't have the luxury of experimenting with intricate exposed joinery or the fussy hand-detailing that a one-of-a-kind craftsman might lavish on a special piece. Of course, any well-equipped mill shop is capable of executing complex joinery, such as the sticking and coping needed for a multi-pane sash or a fancy frame-and-panel door. By and large, though, the joinery repertoire of a millwork shop consists of the simplest joints strong enough to do the job.

For instance, we usually fasten a carcase together with a dado-and-rabbet, or an offset tongue-and-groove reinforced by screws or staples. Drawer parts are similarly joined. Pieces too large to fit into elevators are built in sections, then assembled on-site with field joints made by the Lamello plate joiner or with a variety of knockdown fasteners. During the past couple of years, I've noticed an accelerating trend toward dowel construction. Using the ingenious combination horizontal/vertical boring machines made in Germany, doweling is faster and more accurate than other kinds of joinery, and it meshes nicely with the particleboard panel construction so basic to the millwork industry. Our doweling machine can bore up to 25 holes at once, either randomly spaced or set 32mm apart, which matches the standard screw spacing on much European hardware, including drawer slides, hinges and shelf standards.

Our shop drawings try to show ways to make simple joints appear seamless, as in the law firm's reception desks shown on p. 31. Though the visually stark design seems straightforward, the desk top is mated to its front with a tricky curved miter that's 8 ft. long. When I prepared shop drawings from the architect's plans, I proposed constructing the desk's gently curving front by veneering over a core formed by fir plywood kerfed and bent to the proper radius. Solid-wood stringers glued to each edge would maintain the curve. The face veneer could then be glued to a thin plywood backing, its mating edge mitered, and the composite easily bent around the curved core.

Ronnie Bright, the cabinetmaker who actually made the piece, offered another solution. He figured that a narrow miter would be easier to fit than the relatively wide one my method entailed. After a quick shop conference, he decided to make the desk front by veneering over a curved poplar framework called a torsion box (*FWW* #32, pp. 96-102), the top edge of which fits into a rabbet milled into the bottom edge of the desk top. He milled the desk top's curved miter with a router guided against a Masonite template. Bright's method had another advantage I hadn't figured on: the back of the hollow torsion box could be left off during assembly, so screws could be driven up into the top for added strength.

Though we rely on sophisticated machinery and jigs, we do a fair amount of of handwork, especially on furniture. The radiused corners of the big ash-burl conference table are a case in point (see photos, p. 35). No machine setup I know of could have milled even that relatively simple (though large) molding in a curved piece. We glued up an oak blank and turned the profile by hand, bandsawing the resultant doughnuts into quadrants which were then fitted between the straight moldings that meet at the table's corners. —*J.O'H.*

estimated labor hours have been used up by this time. Any reworking is painfully time- and profit-consuming. Traditionally, the architect and the owner tour the completed job preparing a "punch list" of glitches that need attention. We try to anticipate the list as much as possible, yet most jobs don't end gloriously with a final day of delivery, but fade away with a piece of trim filled in here, a scratch touched up there.

The millwork business fills an interesting niche in the construction industry, at the crossroads between old-fashioned stick-built practicality and high-rise corporate elegance. Poised between serving the architect's and contractor's functional needs and the aesthetic considerations of the designers who finish the spaces, millwork is becoming more of a service industry. New materials and machinery allow for greater diversity in product appearance and production than ever before. At the same time, designers are delegating more of the detailing to the woodworker. All of this points to healthy, invigorating times for progressive millwork houses, and opportunities for well-informed newcomers. □

Besides overseeing high-rise millwork, Jeff O'Hearn makes sculpture in his basement workshop. Photos by the author. For an article on the small-shop aspect of millwork, see p. 96 in this issue.

Laying Veneer

Meeting the small shop's pressing needs

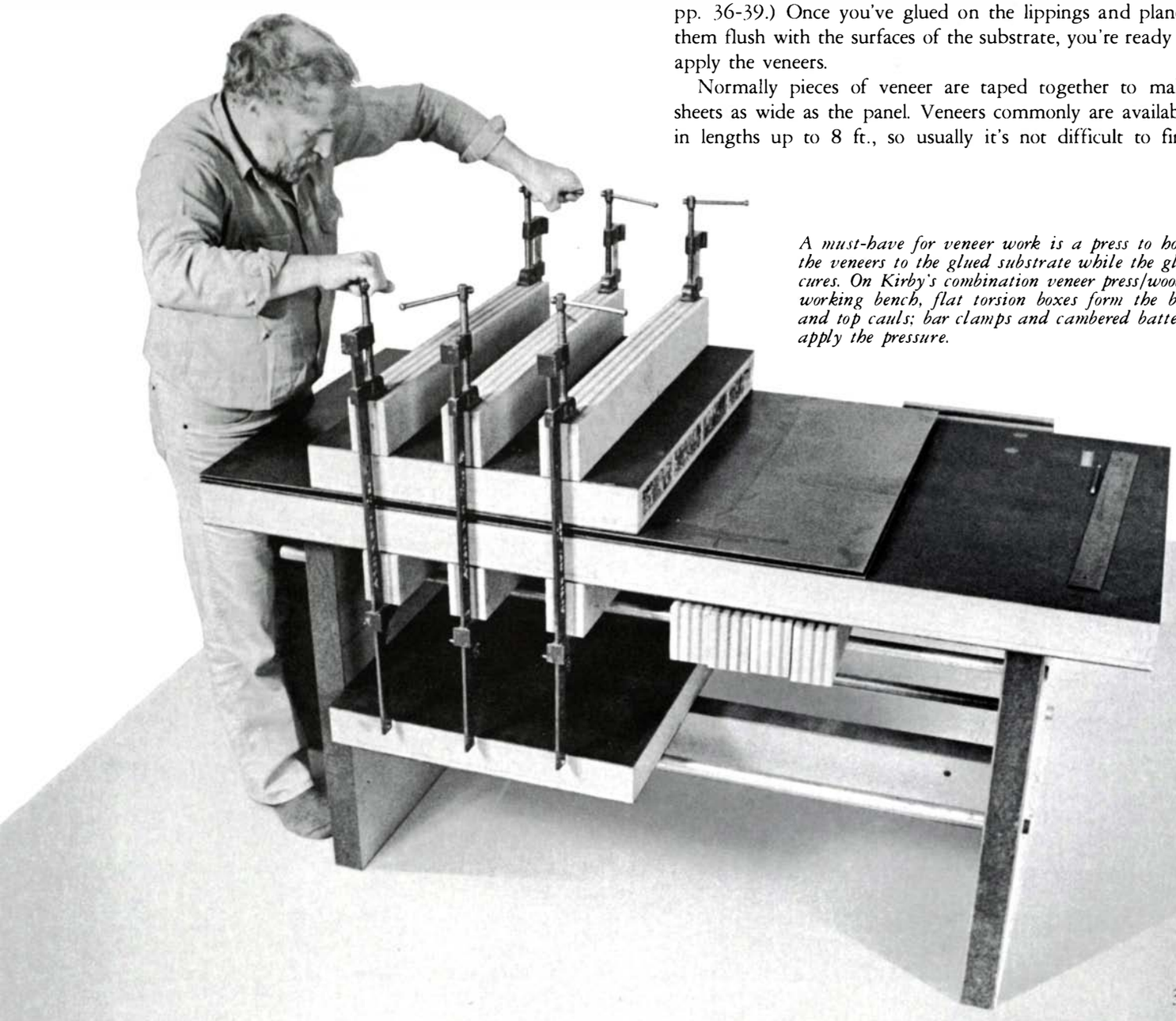
by Ian J. Kirby

Furnituremaking with solid wood is like whittling: you chip away at the tree until you end up with the pieces you need. Working veneer is just the reverse: you stick the bits together to build up furniture elements of the exact size and shape you want. This means you have to think about the work in a different way—you have to plan ahead instead of making dimensional decisions as you go along.

This difference in thinking is in fact the most difficult aspect of veneering. The work itself, the techniques, is well within the skills, tools and budget of the small-shop woodworker. And, you'll find that veneering has three distinct advantages for furnituremaking: you can make panels of any size; you can use woods of rare beauty; and, a design bonus unique with veneered panels based on dimensionally stable substrates, you don't have to allow for moisture-related wood movement, as you would with solid wood.

Any veneered panel is assembled from three components: a substrate or base material, some lipping or edge treatment, and the veneers themselves. Preparing the substrate is the first step, but this is relatively easy with ordinary woodworking tools and dimensionally stable medium-density fiberboard (MDF) or furniture-grade particleboard. For the photos to illustrate this article, I used a piece of ⅝-in. MDF about the size of a cabinet door or small tabletop, and glued a mitered lipping of solid wood onto its edges. This way, the edges can be radiused or shaped in some way, and the finished piece will have the look and feel of solid wood. (For an article on preparing substrates and attaching lippings, see *FWW* #46, pp. 36-39.) Once you've glued on the lippings and planed them flush with the surfaces of the substrate, you're ready to apply the veneers.

Normally pieces of veneer are taped together to make sheets as wide as the panel. Veneers commonly are available in lengths up to 8 ft., so usually it's not difficult to find



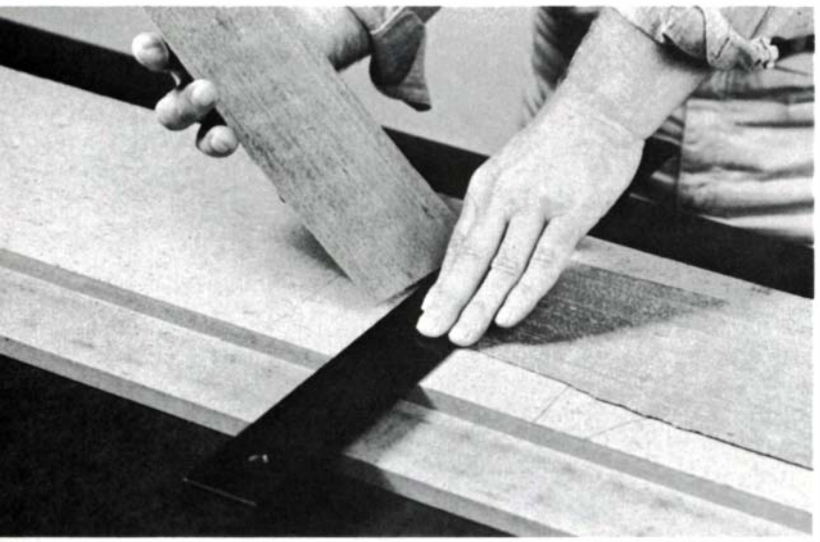
A must-have for veneer work is a press to hold the veneers to the glued substrate while the glue cures. On Kirby's combination veneer press/woodworking bench, flat torsion boxes form the bed and top cauls; bar clamps and cambered battens apply the pressure.

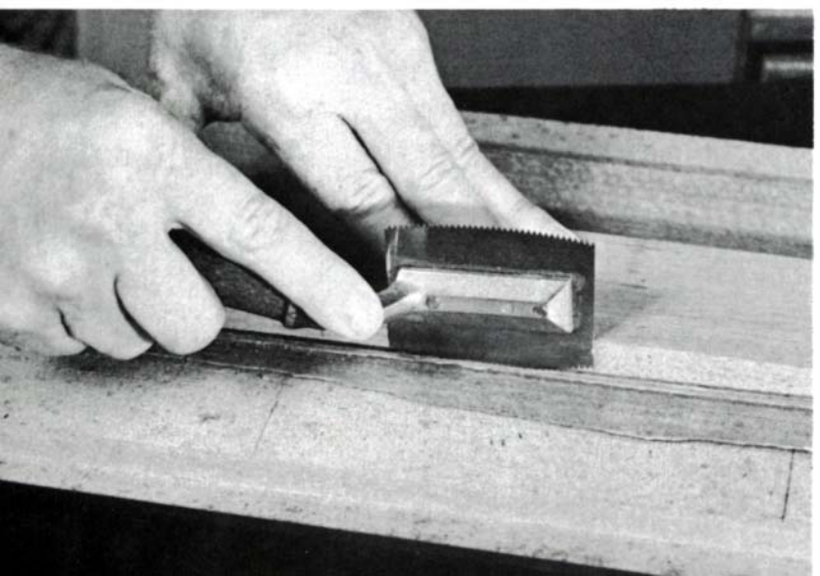
pieces as long as your panel. For very long panels or for special effects, you can join several pieces to make strips as wide as the panel, then end-join the wide strips to make one long sheet. Veneers are easy to cut and join, so you have considerable design freedom here. Books on traditional veneering usually illustrate a variety of patterns, such as bookmatched mirror images or herringbone patterns, but these patterns are somewhat old hat and unnecessarily restrictive. You can match and join veneers in any way you like to create any type of pattern that appeals to you. The only rule for joining veneers is visual—what does it look like? Use your imagination. Experiment with combinations of grain directions and angles, with different species, and with bands, circles and other shaped inlays. Try aligning the grain or color of the veneer so that it accents the lines of the piece you're making.

No matter how much cutting and taping is done, the aim is to prepare a single veneer sheet that's no more than ½ in. larger all the way around than the panel to which it will be glued. A bigger overhang would just get in the way. Covering the entire panel at once enables you to make the veneer joints virtually invisible, without having to cope with glue squeeze-out between pieces, and to position the sheet accurately before placing the panel in the veneer press.

Both sides of the substrate must be veneered, usually at the same time; otherwise, the panel will be unbalanced and will invariably cup. The cupping results from a complex interaction of the glue, substrate and veneers, and from the shrinkage of these components due to moisture changes. You should use a similar species and thickness of veneer on both sides of the panel to maintain a balance. Don't expect a thin, porous veneer to balance a thick, dense one.

When crosscutting veneer, make two hard passes with a sharp knife, then press down on the straightedge while pulling the veneer up to break along the scoring (top photo). A veneer saw, guided against a board, is better for fragile veneers.





For top-notch work, it's common to glue two layers of veneer on each side of the panel. The first veneer, the underlay, is usually an easily worked, mild species such as Honduras or African mahogany. This layer helps prevent the lippings from telegraphing through, and seems to give a richer, more solid feel to the work. Once the underlay has cured and been cleaned, it's covered with a show-wood veneer—anything from a burl or crotch to some exotic species such as ebony. Normally the top veneer is laid with its grain at right angles to that of the underlay veneer. If the top veneer and the underlay are different colors, lip the underlay with a 1-in. to 2-in. band of the top veneer, unless you want this color difference to highlight the edge.

With a fragile material such as burl or crotch veneer, it's common practice to reinforce the delicate material by gluing it onto a thick underlay veneer such as poplar. Those new to veneering should avoid very delicate materials, however, as well as old, cracked or washboard-like veneer, until they have mastered the techniques and gained more experience. There are ways to reconstitute badly buckled veneer, such as pressing it between damp layers of paper to flatten it, then slowly drying it to the proper moisture level, but these techniques can be troublesome and undependable. There are so many types of veneer readily available today, you can save yourself a lot of trouble by buying high-quality, flat veneer to begin with.

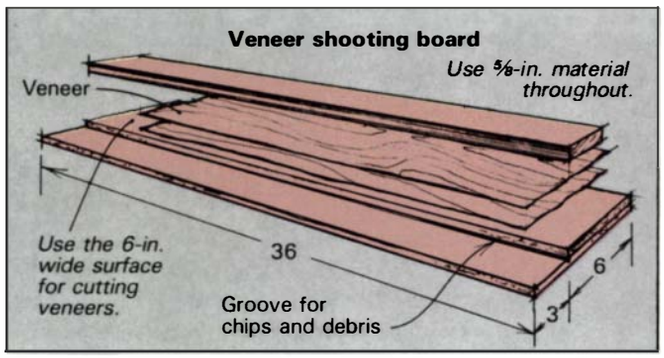
Other than conventional woodworking tools, all you'll need to begin veneering are a veneer press (see box, p. 41), a shooting board (see drawing, facing page), a glue roller and some veneer tape, which is available from most veneer suppliers. You could buy a veneer trimmer, which is a wooden knife-blade holder that looks like a handsaw handle, but a chisel and a knife work well to start with. A sharp knife (a Swiss Army knife is ideal) is good for cutting veneers, but for some hard and tough veneers, you might want a veneer saw, which has a barrel-shaped, serrated blade with no set. Oddly enough, this is also a handy tool for cutting very fragile veneer, such as burl.

Once you've assembled all your tools, you're ready to select, mark out and cut the veneers. To avoid damaging the workbench, cut on the wide surface of the shooting board. To crosscut veneer, hold the knife firmly against a metal straightedge (use the back for cutting to avoid damaging the accuracy of the chamfered edge), press hard as you cut, and chop down when you get to the second edge to prevent splintering. Make two hard passes, then break the scored veneer along the straightedge. The cut end will be slightly ragged, but that doesn't matter if it will be part of the waste overhang. If you want to join veneers end-to-end, however, knifing all the way through the veneer will produce a good joint line. It's rarely necessary to plane end grain.

When cutting along the grain, knife all the way through. Make light strokes, keeping the blade vertical and tight against the straightedge. These knifed edges are not good enough for a butt joint, so you'll have to true them with a jointer plane on the shooting board before you can tape them together.

If the veneer is mild and flat, you can plane up to a dozen

For butt joints, the sheets of veneer must be straight-edged. Hold the veneers in place on the shooting board while truing the edges with a jointer plane.



sheets at once; if it's anything but flat, two may be the limit. To use the shooting board, lay the plane on its side and position its sole ⅛ in. from the shoulder of the rabbet, then move the veneers to the sole. Line up a piece of wood with the rabbet shoulder and hold the veneers down by pressing hard on the top board. You'll be able to see only the top veneer, so you'll have to gauge from the shavings whether you're planing all the sheets. The amount of material removed is small, usually not enough to significantly affect bookmatching or any other pattern you're striving to achieve. When you think you've planed through all the chipouts and wavering edges, split the package apart and check the edges. If there isn't a good edge on each sheet, put the package back together and repeat the procedure.

If the edges look true, you can test the joint by putting two veneer edges together and using your fingers to press down the veneers as you check individual points along the joint. The points should come together perfectly, with no gaps. If the joint is tight at each checkpoint, it likely will be tight along its entire length. You may not be able to put the whole joint together at once, as you would with solid wood, because buckles in the veneer can distort the edges once the veneers are released from the shooting board. Pressing the edges flattens them out as they were on the shooting board.

If you're satisfied with the joint, you're ready to tape the veneers together. Veneer tape looks like brown packing tape, but it's much thinner and stronger. Don't use the thicker packing tape or masking tape, which can cause depressions in the veneer when it's pressed. Tape the top or face side only—never put the tape between the veneer and the substrate, as the tape will show through and it may delaminate.

When taping, the joint is first pulled tight by strips of tape placed at right angles to the joint line. A single long strip placed over the joint helps hold the pieces together and prevents glue from oozing through during pressing. Tear the tape into 5-in. to 6-in. strips, which allows about 3 in. of tape on each side of the joint. Tear the tape—don't cut it—so that you have a feathered edge which is unlikely to mark the veneer. To join flat veneers, place the tape strips 9 in. apart; on buckled pieces, put them 2 in. to 3 in. apart, or as the material demands. First moisten the tape with a damp sponge—warm water on the sponge will make the glue grab a little better, which helps with oily woods such as teak. Attach one end of the tape to the first piece of veneer, pressing hard to make it stick. Then, holding the joint together with one hand, pull hard on the tape to stretch it slightly and attach it to the second veneer. After all the cross tapes are on, put a length of tape over the joint line, leaving the tape about ¼ in. to ½ in. short at each end so that you can check if the joint is tight. At this stage you could run a wooden roller over the tape strips to make sure they're secure. I've never found a

To temporarily join veneers into sheets, stretch pieces of veneer tape across the seams on the face side. The tape keeps the veneers from moving around in the press.

Finish the edges of the veneered panel with a jointer plane, after first trimming with a veneer trimmer, router or knife.

roller to be a vitally important tool, but it's something you should try for yourself.

There are two methods of applying veneer to the substrate: hammer-veneering by hand, or by using a veneer press. Hammer-veneering isn't really done with a hammer but with a squeegee-like tool that presses down the veneer onto a substrate covered with hot hide glue. The glue holds when it coalesces, and the trick is to be pressing on the veneer when the glue grabs. This isn't a skill that can be acquired on the first try, or even the second. Dealing with more than a few square feet of veneer compounds the problem—I think you will find a veneer press to be a much more efficient alternative.

If you use some form of press, any of the modern cold-curing glues work well. White PVA glue is cheaper than yellow glue, and it doesn't set up as quickly, so there is more time to prepare the panels. It will cure in the press in three to four hours, depending on temperature. Urea-formaldehyde glue (such as Weldwood Plastic Resin) can be used, although it takes at least five to six hours to cure at 65°F. Don't use contact cement—it is absolutely out of the question. Contact cement remains elastic and doesn't harden the way woodworking glues do. It is also more prone to attack by the solvents in some finishes.

With a paint roller, apply a thin, even coat of glue to the substrate only. Don't put glue on the veneer, or it will curl and be difficult to control. On a properly glued panel, only little beads of glue will be squeezed out all around the edges. If you apply too much glue, it will be pressed through the veneer's pores and the surface will be glazed. If this happens, the panel isn't ruined—the glue can be cleaned off, so it won't affect the finish—but it will take a lot of work planing, scraping and sanding to remove the glazing. Gauging the amount of glue required is a matter of experience. You'll find that different substrates will soak up different quantities of glue.

Place one sheet of veneer taped-side-down on the bench, and after covering one side of the substrate with glue, position it on the veneer. Apply glue to the second side of the substrate and place the second piece of veneer on it, taped side up. If the joint line has to be centered, pencil a centerline on the edge of the substrate before you begin, then align your mark with the joint line. If precise alignment isn't important, position the veneer by gauging the overhang with your fingertips.

The panel must be placed in the press so that pressure first hits along the panel's centerline and then spreads out to the edges. The spreading pressure prevents glue from being trapped in the center of the panel. If excessive amounts of glue remain trapped in the center, the veneer can ripple.

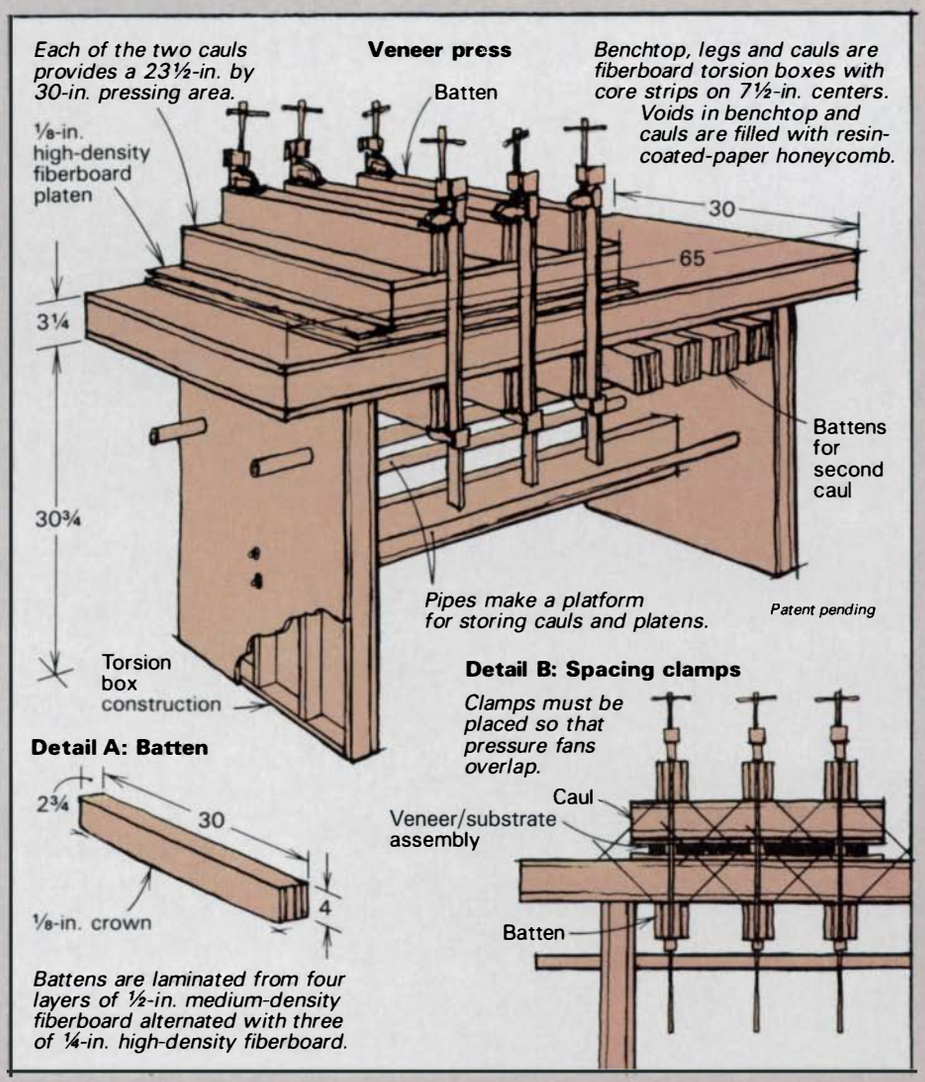
When the panel is taken out of the press, the first thing to do is determine if there are any unglued areas. To check for bubbles, which are usually caused by a lack of glue, tap the panel with your fingernail—there'll be a change in tone where the veneer has lifted. To reattach the veneer, slit into the area with a thin-blade knife, ease in glue with the blade or a syringe, and clamp the section down.

The next step is to remove most of the excess veneer from the panel edges with a veneer trimmer, a trimming bit in a router, or a knife. The greater the excess overhang, the more difficult this process becomes. In any case, what you're trying to do here is to get close; the final edge is achieved by planing. If the edge is to be radiused or shaped, do it now.

At this point, the veneer tape should be removed. One way to do this is to moisten it, give the water about two to three minutes to soften the glue, and pull off the tape. Running an ordinary household iron over the moistened tape also makes it easier to remove. Be careful with water; don't use too much, and try to keep it on the tape so that it doesn't spread onto the veneer. Don't wash off the residual glue left by the tape—blot up excess water with paper towels as soon as the tape is removed and let the area dry before proceeding.

The final cleanup is done by planing, sanding or scraping, or a combination of the three. Careful use of a sharp, finely set jointer plane produces the best surface. Not all veneers will plane, however, and you can't make sweeping generalizations about which species can be planed. You'll have to experiment with each batch of veneer you use. If you sand from start to finish, start with 180-grit, followed by 220-, then

Bench-pressing veneer



A veneer press must have an extremely flat bed and some system for selectively applying pressure to a panel. The press I've designed, and for which I have applied for a patent, uses three torsion boxes: one acts as the bed of the press and the other two are movable cauls that go over the veneer assembly before it's pressed. The torsion boxes are made by gluing fiberboard skins over core strips on 7½-in. centers; the voids between the strips are filled with resin-coated-paper honeycomb. A torsion box is very flat, stable and strong. (For more on building torsion boxes, see *FWW* #32, pp. 96-102.)

Pressure is applied to the veneered panel with a series of clamps and cambered battens (detail A). The cambered side of each batten is oriented toward the panel. One batten is placed on top of the caul, another is placed under the bed, directly below the top batten, and the clamps on each end are tightened. Because the battens are cambered, they transfer the pressure from the center first to the outside edges as the clamps are tightened in unison.

Place the panels in the center of the press on a platen, a ⅛-in. thick fiberboard plate treated with wax so that residual glue can be removed. The veneer and substrate assembly must be in the middle of the platen and sandwiched between it and a second platen. Now add the top caul and battens. It's easy to assess how close to put the battens. As shown in detail B, clamping pressure is diffused in a fan of about 90° from the clamp head. Use enough clamps to ensure that the pressure fans overlap. If both top cauls are used with the bench shown here, ten battens are needed: five on the top and five on the bottom. (For more on pressure fans, see *FWW* #31, pp. 86-89.)

Once the battens are in place, tighten the clamps enough to put a little pressure on the battens. By looking at the gaps between the battens and caul on each side of the centerline, you can make sure you're applying pressure equally. Continue to tighten the clamps on each side until you see the battens flatten out over the area being pressed. You can sense the same amount of pressure coming through the clamp bars.

Don't overtighten the clamps, especially if the panel you're veneering is narrow. If overtightened, the caul will bend around the edges of the panel and leave an area of low pressure or no pressure in the panel center. The glue will migrate to the low-pressure area and the veneer will ripple as it dries. To avoid this washboard center, use a straightedge to check the top edge of the caul to make sure it doesn't become convex as you tighten the clamps. Also, when pressing narrow panels, place dry spacers the same thickness as the veneered panel on each side of the panel to help prevent the caul from bending. —*I.J.K.*

300- or 400-grit. Avoid wet-or-dry paper—the dark abrasives can cause unsightly smudges on light woods. Be careful when sanding, especially near the edges. An awful lot of bad things happen when people let loose with a sanding block or a power sander. Check the edges frequently with a straightedge to make sure you aren't softening or rounding the area 1 in. to 2 in. from the edges. Rounding the edges with a sander is the hallmark of the careless. It shows dramatically once the work has been polished as a lack of crispness and cleanness. It's not easy to describe—it's just a sloppy look about the whole thing. The scraper, to me, is the crudest of cutters—it's difficult to scrape without marking the veneer wherever the scraper is put down or taken off the panel.

Any finish can be used on veneered panels, but the solvents used in the finish may attack the glue. The first coat of finish should be applied sparingly, especially if you're using polyurethane or another material with a great deal of solvent. Applying one or two thin coats creates a barrier against solvents. After the thin coats, proceed as you would with solid wood. □

Ian J. Kirby is a designer, cabinetmaker and educator. He recently moved his woodworking school from Vt. to Cumming, Ga. Kirby wrote about preparing substrates in FWW *#46. For more on hammer-veneering, see #10, pp. 52-54.*

Drawings: Keith A. Bushee

Making a Hepplewhite Card Table

Recapturing an essential delicacy

by Eugene E. Landon

A reproduction of subtle Hepplewhite elegance.

In the restoration and repair of antiques, I sometimes make faithful reproductions of the best that enter my shop. Recently, I had the chance to work on an 18th-century card table, and I copied it for my own home. Unlike today's card tables, most of which are so ugly that they hide in closets during the day, these antique tables have nothing to be ashamed of—they fold in half, so that they can double as handsome hall or end tables. Judging from the many antique gaming tables that have survived, gambling must have been one of early America's passions. The craze lasted from at least the Queen Anne period through the Federal, and table styles ranged from simple country designs to some of the most elaborate and sophisticated of the time. Depending on the period, you can find extensive carving and inlay. Some pieces have dishes carved into the tops for chips, and recesses carved at the corners for candle stands.

The design reproduced here, called a D-shaped card table because of the profile of its top, is a pure, conservative example of the Hepplewhite period, circa 1790. It relies on pristine lines, subtle inlay and figured mahogany veneer to elevate it above the ordinary. Its top and legs are solid mahogany, the hinged rail is walnut, and the rest is white pine. The front rail is veneered with fancy crotch grain, and the sides and curved parts are straight-grain veneer. Similar tables might have been made anywhere along the Atlantic seaboard from Boston to Charleston, but I suspect that this one came from Philadelphia. The family it belongs to has a long Philadelphia history, and the table's secondary woods are just right for that city. Farther north, you would expect maple or cherry instead of walnut; farther south, you'd see some yellow pine.

When it came into my shop, the table stood tremulously, on the verge of falling into pieces. A delicate design to begin with, over the years its cross-grain construction had taken a toll—wood movement in the brick-stacked curved rails had broken loose about half the veneer, and all the glue blocks at the top of the legs had loosened. Somebody had tried to repair them with nails, but the legs require a glue joint at these blocks for strength and were, consequently, very shaky. Even the glue between the stacked bricks had failed—with every change in humidity, each layer had strained at 90° to the next.

With so much glue failure, I had no option but to dismantle the table down to its last piece and then rebuild it completely. Such an experience is a rare privilege for any cabinetmaker. It gave me the opportunity to make a reproduction that duplicated the table exactly, even to the hidden toothing-plane marks left by the original cabinetmaker nearly two hundred years ago.

You might ask what steps I took to counteract the cross-grain joinery that had caused the problems in the original table. For my table, none. The drawing on p. 44 shows a stabler way to stack bricks, however. In this method, the bricks are not at 90°, but are laid up to form a gradual curve around the corner, so that both ends are entirely long grain, and so that the grain in all the layers runs in the same direction. You could employ this method in your copy, but if you do, you won't be making a true reproduction. I've never seen an 18th-century American table made this way, although some French bureaus of the same period have this construction. You would be making merely a modern adaptation of an 18th-century design, and in my opinion you would be making a mistake. The table's fugitive delicacy is essential to its nature; my advice is, don't try to change it. In my mind, the real reward in creating this table is that perhaps in two hundred years someone like me will come along, take my gracefully aged copy entirely apart, and get as much enjoyment from the job as I did.

For the same reason, I use hide glue in my work. A modern glue may seem to have some "advantages," such as a stronger bond and more moisture resistance, but these qualities, in the long run, may not be real advantages at all, especially in period construction. Wood movement will inevitably open any joint, and a hide-glued joint is fairly easy to disassemble, repair and reglue. Not so with some of the modern glues. With these, instead of finding failure limited to within a joint, you'll often find the part itself failing—a split leg instead of just a loose tenon, for example.

If reconstructed faithfully, the table will require many skills of the 18th-century cabinetmaker. Take a look at the interesting joinery shown in the back corner detail on the facing page. There are, in effect, two back rails, one inside the other. The outer rail is hinged so that one leg can pivot out to support the unfolded tabletop. The inner rail is permanently joined to the rest of the understructure. The back legs are mortised and tenoned to the hinged rail. Sawing the tenons on this rail will be one of the last steps in the construction—the shoulders determine how far apart the back legs are and how well they fit the frame. The stationary part of the hinged rail is glued and screwed to the inner rail, and the moving arm is relieved on its top surface so as not to scrape the underside of the table-

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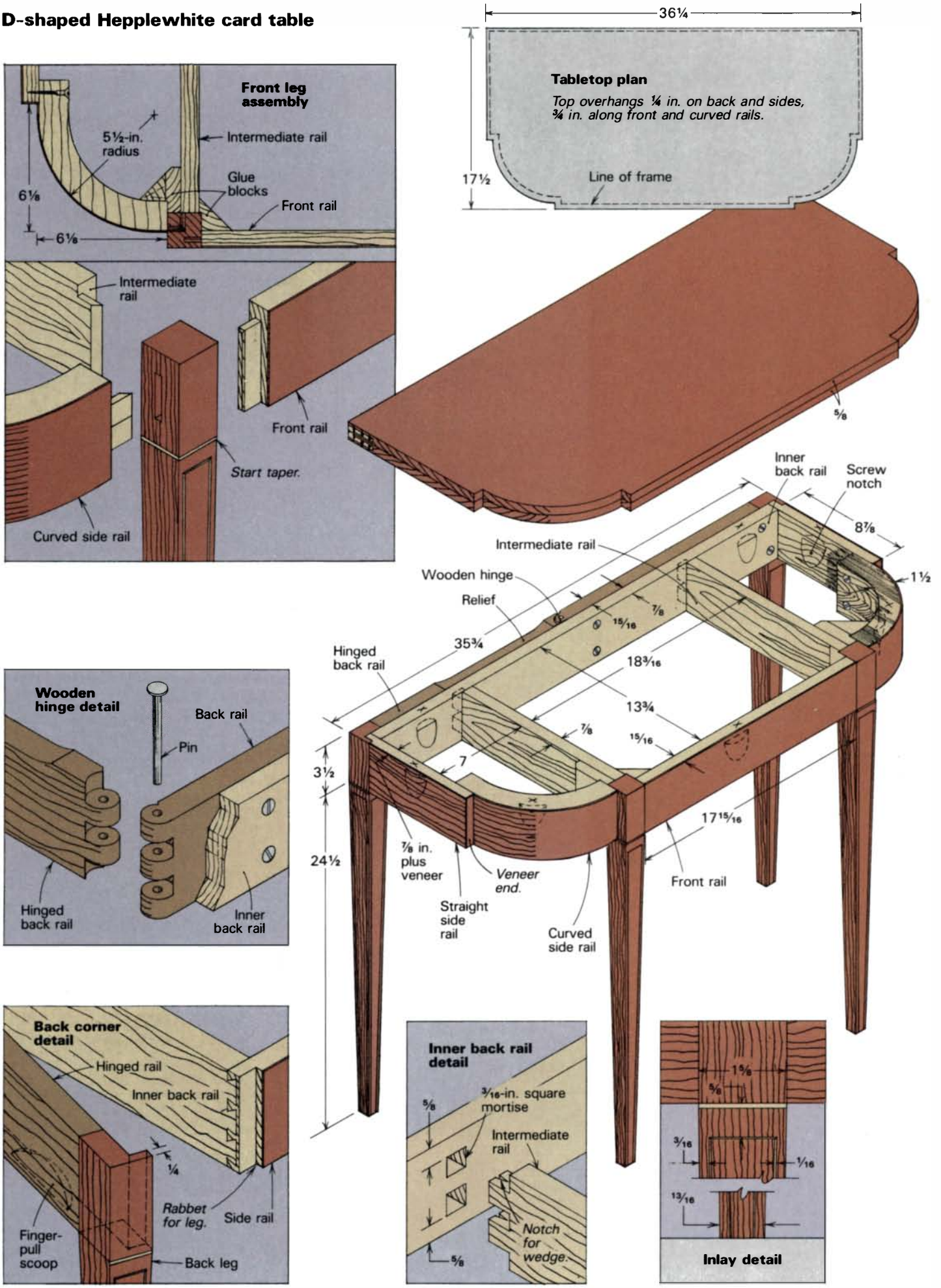
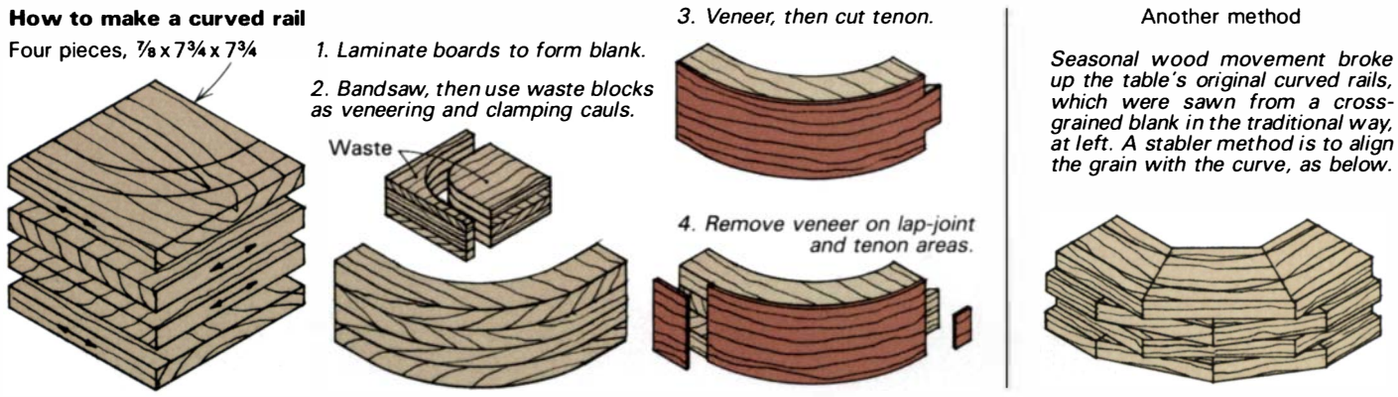
Eugene Landon wrote about making a Chippendale coffee table in FWW *#44. He lives in Montoursville, Pa.*

Photo: The Terry Wild Studio

D-shaped Hepplewhite card table



Drawing: Louis M. Bassler



top. The cabinetmaker attached the inner rail to the side rails with half-blind dovetails.

Two intermediate rails extend back from the front legs and are through-tenoned to the inner back rail. These add rigidity to the frame, but, more important, they provide a bearing surface for the rubbed-on glue blocks, which are essential for strength in the front legs.

To make the table, first bandsaw the tapers on the legs and plane them smooth. Mahogany often tears out unexpectedly when being planed. There was a little tearout on the original table, in fact, and the maker had carefully oriented the best sides of the legs forward to hide it.

The leg inlay is ⅛-in. wide maple strips, sawn and hand-planed to a little less than 1/16-in. thickness, mitered at the corners and then glued edge-down into narrow grooves. In 1790, the cabinetmaker probably had a special grooving tool, for he would have done a lot of inlaying. It was like a mortising gauge with sharp cutters. When run along the side of the leg, it cut the two sides of the groove, and a built-in chisel removed the waste. You can still buy such inlay cutters from many tool suppliers, but I make the equivalent from two razor blades clamped together with a metal washer as a spacer. The blades are so thin that they tend to follow the grain of the wood instead of cutting straight. So I first cut one edge of the groove with a sharp marking gauge, then I use that line and a straightedge to stabilize the razor blades when I cut the groove. It's best to make several shallow passes to achieve the full depth of about 1/16 in. Then clear the waste with a very narrow chisel. Note in the drawing on p. 43 that some surfaces are left plain, and that the additional inlay strip across the top of each leg is a little wider than the rest. After chiseling the waste, apply glue to the groove, not to the inlay, and be sure that the strip is higher than the surface of the leg so it can be pared and smoothed flush after the glue has dried.

The front rail must be perfectly flush with the front face of the legs, so veneer the rail before you mark out and cut the tenons. This not only makes it easier to get a clean shoulder cut through the veneer, but it also allows you to mark both the mortise and the tenon using a single gauge setting. Lay out the tenon-shoulder cuts with a knife, saw the shoulders, then relief-cut them slightly with a chisel to ensure snug surface joints. As was standard 18th-century practice, the backs of the rails in this table are not veneered. Mark out and cut the intermediate rails now, too.

Next glue up the brick stacks for the curved side rails in four layers, as shown above. The grain in the two center layers runs in the same direction, which allows the tenon to be long grain. At the other end of the rail, the top and bottom layers provide long grain for the lap joint. Bandsaw the shape and save the waste pieces from each side. They will later come in handy as clamping blocks when gluing up the frame, and right now you can use them as cauls for veneering. Shape the outside of the waste so you can clamp it to the workpiece, then dry-clamp with the veneer in place to test the fit. The bandsaw kerf is probably about the right width to accommodate the veneer thickness and allow even pressure. If not, pad the gap with layers of newspaper or with a thin rubber sheet.

After veneering, make the tenon's front shoulder by simply knifing through the veneer and splitting it off the tenon. This shoulder obviously doesn't provide any strength, but it does cover the edge of the mortise and conceal any irregularities. The original table's mortise was so cleanly cut that even today's 1/28-in. veneer was sufficiently thick to do the job.

The veneer at the lap joint will also be cut away, because if it's left in the joint, it's just another glueline that can eventually fail. But don't cut away this veneer until you're ready to glue up the frame—the precise position of the cut depends on how much the straight and curved rails overlap.

Make the straight side rails, and veneer their outer faces and front ends. Cut the inner back rail and chop the through mortises in it, two for each intermediate rail. Cut the dovetails, saw the rabbets for the back legs and notch the legs to fit.

Gluing up is best done in stages. On a flat surface, clamp up the two front legs to the front rail, and add the intermediate rails and the inner back rail, wedging the through tenons. Check for squareness and allow this subassembly to dry. Next glue and screw the lap joint between the straight and curved side rails, and add them to the main frame. Then rub the glue blocks into place.

Now make the wooden hinge, as explained on the facing page. Carefully fit the back legs to the back rail, paring the shoulders on the tenons until the legs fit tight in their rabbets. Then attach the assembly with glue and screws.

On your table, determine the profile of the top pieces according to the outline of the frame. The original top was screwed on and hinged as shown. Hinges are available from Horton Brasses, Nooks Hill Rd., Cromwell, Conn. 06416.

The original table had a French-polish finish, which I was able to refresh with a few more thin coats of rubbed shellac. I tried to duplicate the effect on my reproduction, but it will require some time to achieve the old table's glowing patina.

Many old gaming tables have warped tops from standing closed too long—moisture can't escape easily from between the folded leaves. So give your table a chance to stretch its legs and spread its wings once in a while. Besides, it's a good excuse to invite the neighbors over for a game of cards. □

An 18th-century wooden hinge

A few years ago, a collector showed me a Pembroke table for which he'd just paid $6,000. At that price, it was a steal—a relatively rare design in excellent condition, easily worth several times the price. I'd done some restoration for him previously, at a handsome fee. But in this case he wanted me merely to authenticate the table's age, for it didn't need any work. I suspect that he also wanted to gloat a little over his good fortune.

Well, the drawer was old. But several other things made me suspicious. The drawer runners, for instance, were hardly worn. When I showed him this, the owner said that maybe nobody had ever used the drawer much. When I pointed out that the finish was too good to be original and too bad to be a restoration—unless somebody was trying to fake it—he hemmed and hawed and said it looked all right to him. When I saw that the cross-grain glue blocks were all still tight, I knew that somebody had been working on the table recently, and had gone to considerable trouble to dirty things up afterward. The collector began to sweat a little.

But the final proof was the wooden hinge for the back leg. It was nothing an 18th-century cabinetmaker had ever laid a hand to. A good hinge shows no gaps anywhere, and this one didn't even stop at 90°! The man who had faked that table obviously had never seen an 18th-century hinge, had never studied the old scribe marks to see how to lay one out, had never taken one apart to see how it was made. The table was a steal all right. I doubt that it was as old as I am, and I'm no antique.

To his credit, instead of asking me to right the wrongs, the collector quickly disassociated himself from the table, selling it "as is" at the next auction. It brought $3,000, which is about what you would expect for an outwardly handsome reproduction with an old drawer in it. The collector wasn't entirely happy with the way things turned out, but at least he'd learned something. He wouldn't jump so quickly at future bargains, and he'd know an 18th-century hinge the next time he saw one.

Ironically, such a hinge isn't at all difficult to make, not if you follow the method used in the old days. The drawings at right show how it's done, step by step. I'll caution you about only one thing: When you pick up your chisel to round the knuckles, first shave some hair off the back of your hand for luck. If your chisel won't shave, step over to your sharpening stones. —*E.L.*

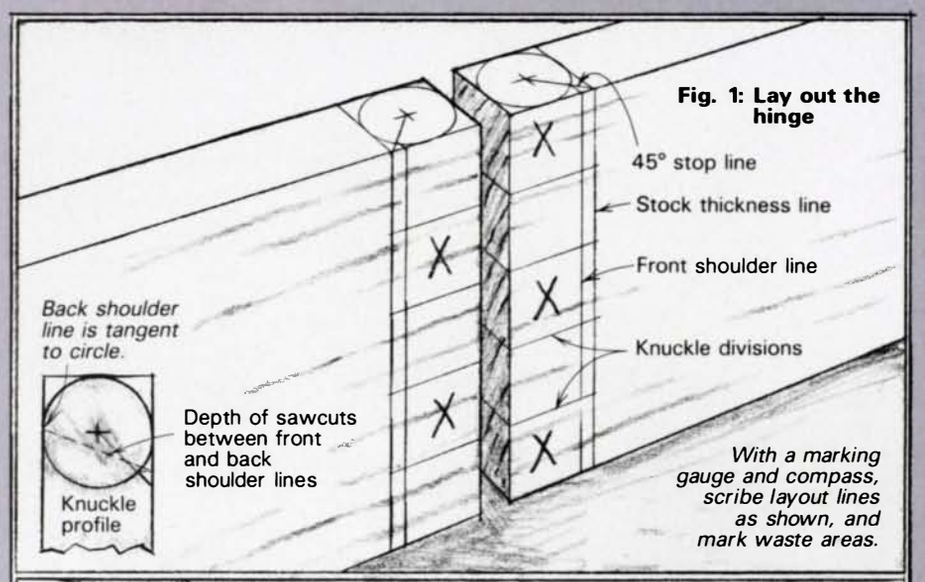


Fig. 1: Lay out the hinge

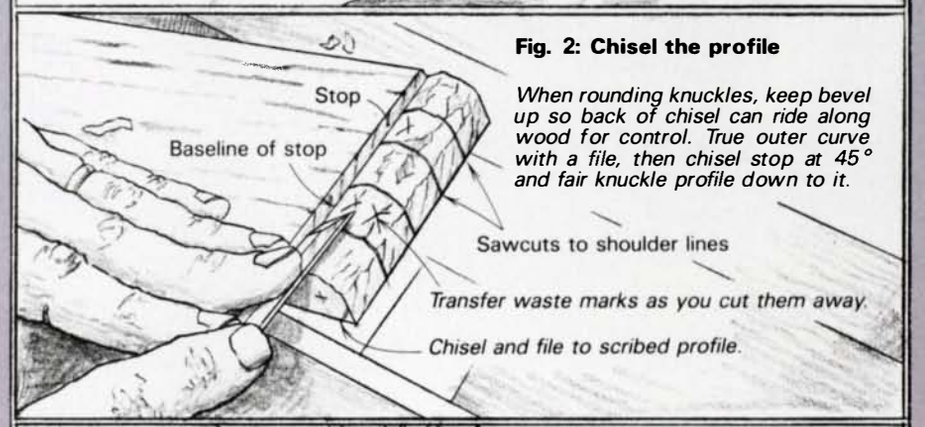


Fig. 2: Chisel the profile

When rounding knuckles, keep bevel up so back of chisel can ride along wood for control. True outer curve with a file, then chisel stop at 45° and fair knuckle profile down to it.

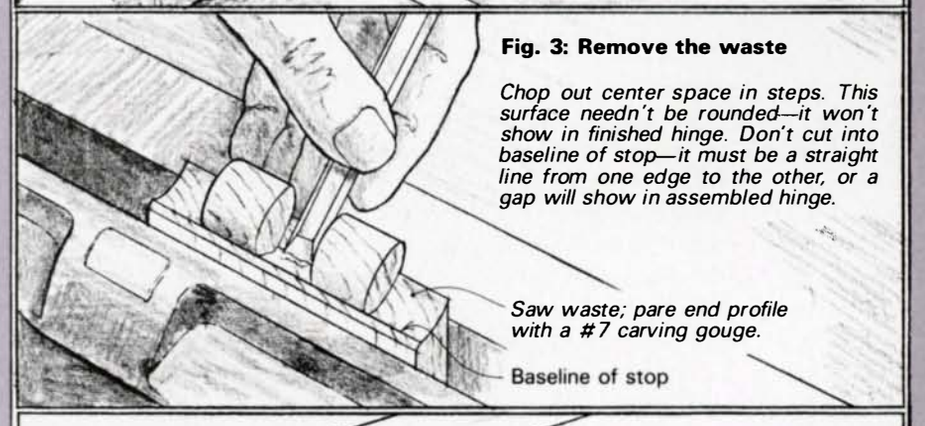


Fig. 3: Remove the waste

Chop out center space in steps. This surface needn't be rounded—it won't show in finished hinge. Don't cut into baseline of stop—it must be a straight line from one edge to the other, or a gap will show in assembled hinge.

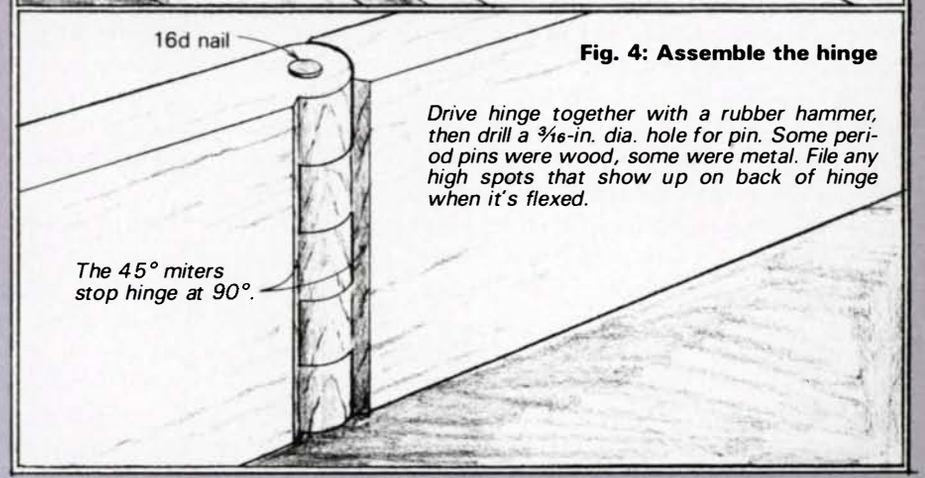


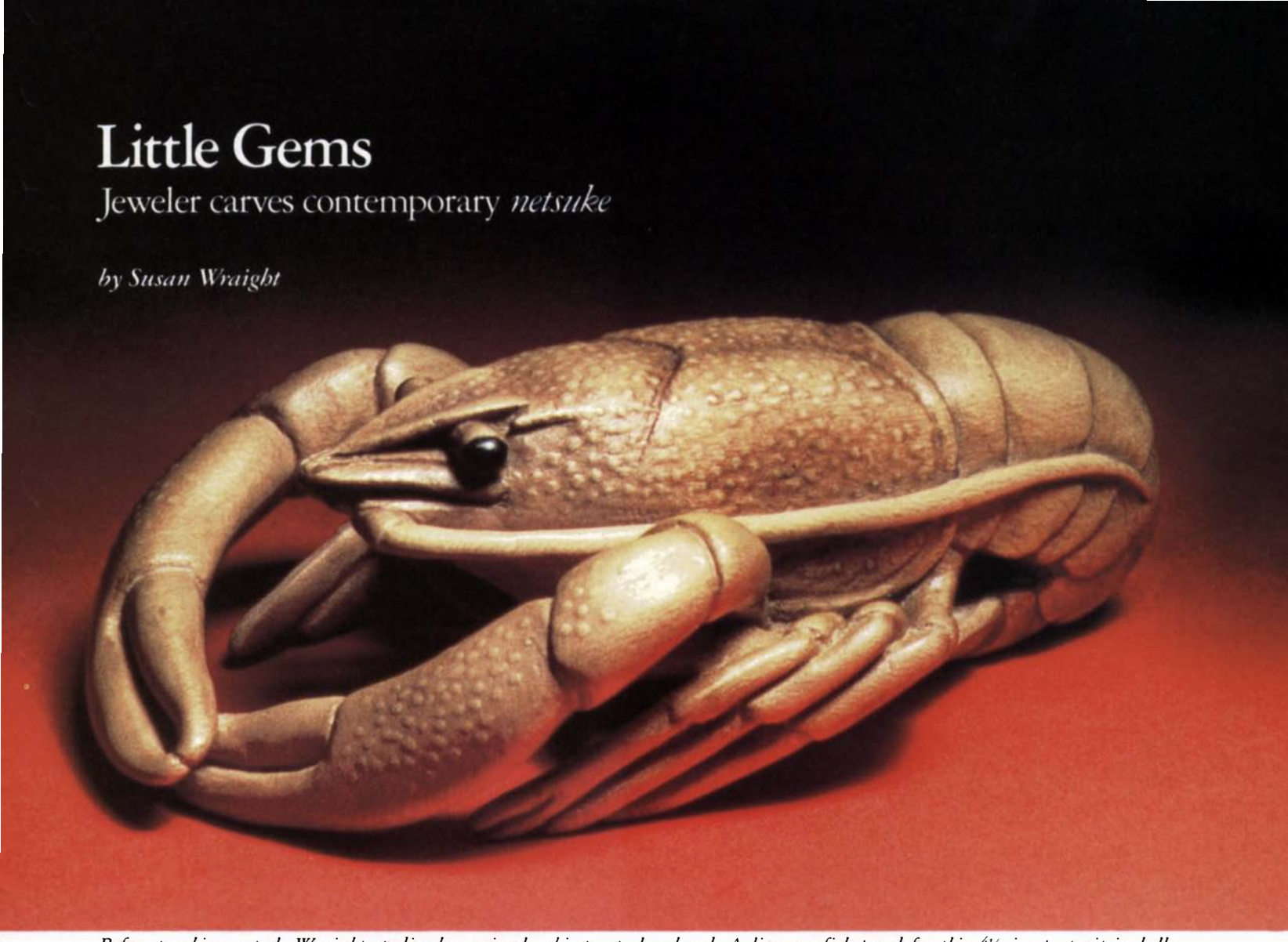
Fig. 4: Assemble the hinge

Drive hinge together with a rubber hammer, then drill a 3/16-in. dia. hole for pin. Some period pins were wood, some were metal. File any high spots that show up on back of hinge when it's flexed.

Little Gems

Jeweler carves contemporary *netsuke*

by Susan Wraight



Before touching a tool, Wraight studies her animal subjects at close hand. A live crayfish posed for this 4⅛-in. portrait in holly.

I became a woodcarver almost by accident. Temporarily bored with the metal engraving I was studying as a jewelry student, I amused myself by carving faces in a scrap of boxwood. I had worked with wood before, at Brighton Polytech in Brighton, England, where I studied wood, metal and ceramics. But I wanted to work in miniature, and at that time wood seemed synonymous with furniture, turnings and large-scale wood sculptures. It didn't occur to me to combine jewelry techniques and wood until my second year at the Royal College of Art in London. Fortunately, I received encouragement from my tutors, and I left college after a degree show featuring nine silversmiths and jewelers, and one woodcarver—myself. I have worked almost exclusively in wood ever since.

The decision to change from metal to wood was made easier by my growing disenchantment with the limitations of jewelry. I scoured the museums and galleries of London in search of background material from which I could develop a style of my own. I discovered for the first time carved English misericords (parts of a church pew), medieval German woodcarvings, and Japanese *netsuke* (miniature sculpture).

It was the *netsuke* (pronounced nets-'kay), however, that influenced me most. As a jeweler, I found their intimate scale and meticulous detailing appealing. The fact that they were designed to be worn rendered them familiar (see box, p. 50). I was intrigued by the narrative element common to many examples, and the wit with which it was translated into three dimensions. *Netsuke* effectively combined all the elements I wanted to use, and I decided to experiment with a similar hybrid of jewelry and woodcarving.

When you're carving on a very small scale, all processes can be done easily by hand and in a remarkably small work area. No elaborate machinery is necessary. This kind of carving is a quiet and unobtrusive activity, and it puzzles me that more people aren't pursuing it. Perhaps it's because people aren't accustomed to thinking of wood as a precious material, and therefore they don't consider wood for purposes that suggest the use of ivory, precious stones or metals—the traditional materials for jewelry and other miniatures. It may just be the scale that puts craftspeople off. For anyone interested in carving miniatures, I can only offer my own experience as an example, and hope that if you do decide to take it up, you will gain the same pleasure from it that I do.

My early attempts at woodcarving were done with the jewelers' tools I had available, and I still use many of these. I did the main work with metal engravers and scorpers, or chisels. Dental probes, needle files, rifflers and burnishers were also pressed into service. I was encouraged by the results that could be achieved with the simplest of tools and a minimum of fuss. Besides my metalworking tools, I've recently acquired a set of tiny gouges that are similar to woodblock-cutting tools in appearance. The steel shaft of each is equal in length

Photos, except where noted: Frank Thurston

to the distance from mid palm to the end of the thumb, which in my case is about 6 cm (2⅜ in.). This shaft is set into a spherical handle which butts up against the palm of my hand. I carved a flat off one side of the handle to give it a better grip.

Research is the first step in any carving. I enjoy this stage enormously because it varies according to the chosen subject. My work tends to fall into three categories. Straightforward studies of animals and birds are probably the most popular, and include such disparate creatures as chameleons, dormice and octopi. I also carve creatures of fantasy and imagination: dragons, basilisks and griffins. These are a wonderful excuse for self-indulgence. The third category can be described as narrative pieces, which take their inspiration from literature and include such subjects as "The Walrus and the Carpenter" (photo, p. 49).

For an imaginary or fictional piece, research may involve just reading. For the animal studies, however, it means getting as close as possible to the chosen subject. This may necessitate spending a couple of days at the zoo, or crawling under hedges, or poring over books and taxidermists' models. Ideally, it means studying the animal close-up. This I managed to do recently when I kept a benevolent and gratifyingly acquiescent toad in my bedroom for a couple of months. I have long thought that a major prerequisite for a woodcarver is having long-suffering companions.

Guided by my drawings and photographs, I make numerous models in Plasticine modeling clay. Planning at this stage is most important. Technique can be beguiling, but form must come first if the piece is to succeed. A badly conceived form covered with beautifully executed detail is not enough. Although I allow myself to stray from the model once I am working in wood, I've solved all design problems before I pick up a gouge, and that instills confidence. Once I have obtained a satisfactory model, I can select my wood.

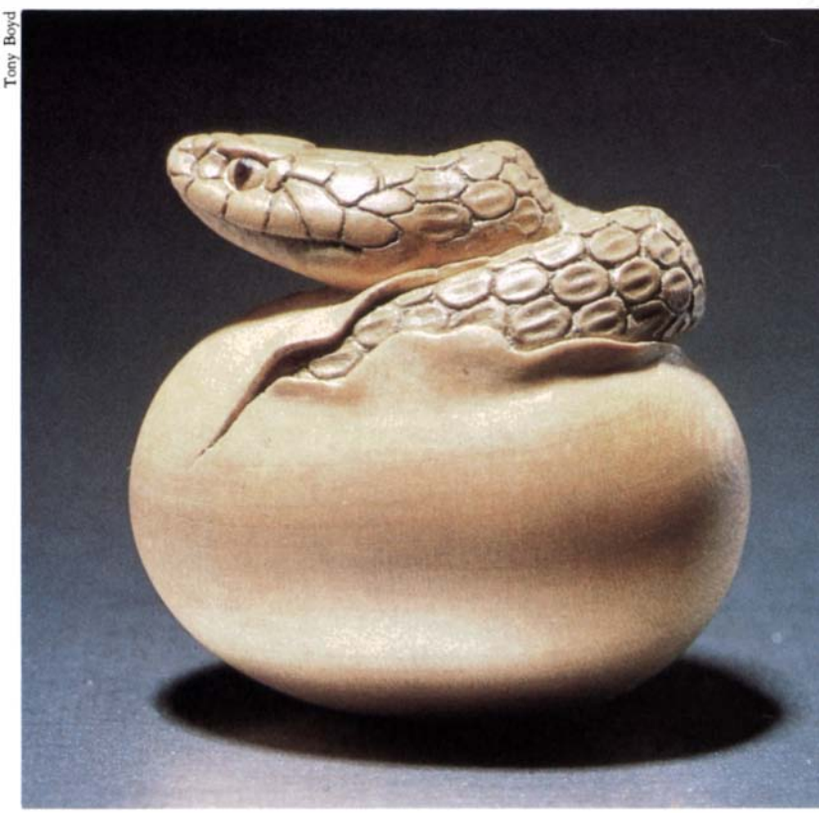
I mainly use English hardwoods, particularly boxwood and holly, the former being my favorite. Boxwood really is remarkable, effortlessly delivering all I ask of it. It holds tight, crisp detail, and gives a superb surface finish. I invariably choose boxwood unless I want to introduce a faint color wash, in which case I substitute holly, because it accepts a stain so well. Occasionally I use lignum vitae or ebony, especially if a subject calls for a dark wood. In selecting wood for miniature carvings, the main criterion is that it be dense, with tight, close grain and no pores, in order to hold the detail.

Referring to the model, I draw my subject roughly on the block. Holding the block in the bench vise, I cut away as much excess wood as possible with a small backsaw. A bandsaw is much quicker, but not essential when working to this scale—most of my carvings are no more than 6 cm (2⅜ in.) in their largest dimension. A belt sander is also useful.

Having roughed out the block, I remove it from the vise, and proceed with small gouges and chisels. Holding the block in my hand, I turn it constantly, working on all sides and frequently referring to the model. From this point, I no longer use the vise, as it is cumbersome to keep undoing it when carving a mere six inches from my nose.

I hold the tool in one hand, the work in the other, and the carving action is very controlled. The best way that I can think to describe it is that it's like wood-engraving on a three-

Tony Boyd



Intricately modeled in boxwood and ebony, 'Wasp on a Blackberry' (top) is only 1⅜ in. high. Patterns produced by careful detailing bring a carving to life. The scales on this 'Hatching Snake' (holly, 1¾ in.) spiral around its body, and help to create a feeling of tension within the creature. The unadorned surface of the egg provides a marked contrast.

Rick Mastelli

'Mountain Hares' (holly, 2 in.), above left, have inlaid ebony and amber eyes. After roughing out a piece, Wraight pencils in details before carving with engravers, chisels and dental probes. Carving action is controlled: movement comes from the fingers, not the arm, with thumbs firm against the wood and each other. The tool slides along the thumb to make a cut.

dimensional object, but with a more robust cut. It's essential to guard against slipping. This is done by holding the thumb of the cutting hand firmly up against either the wood itself or the other thumb. All movement must come from the hand—not, as you might expect, from the arm. Holding my arm and wrist still, I slide the tool along my thumb, cutting a small, neat shaving from the wood. One cut will be enough to show you why you aren't likely to inadvertently chop off a carefully carved arm or leg: the process is so slow and painstaking that it can almost be described as gentle. There is no violent swinging of mallet and chisel. All tools must, of course, be kept as sharp as possible.

I use various grades of abrasive paper to remove the larger tool marks and then I draw in the finer details with a hard pencil, checking for symmetry and ensuring that I do not include detail for its own sake. I then abandon the gouges for engravers and small chisels about 2mm ($\frac{3}{32}$ in.) wide. Old dental probes, honed into scrapers on a stone, are ideal for reaching into difficult areas.

As the carving develops into a recognizable shape, more detail can be added with finer tools. Patterns produced by careful detailing create movement. The scales on a snake's body, for example, can spiral around it and vary in size and shape, to create a feeling of tension within the creature. They draw the onlooker's eye around the piece, and people handling the carving always turn it around to follow the pattern as it twists. But too much detail must be avoided, or the sense of movement will become confused. Also, there's a risk of appearing to use technical skill for its own sake, and such conceit renders a piece sterile. To me, a natural-looking carving never appears labored. As a personal preference, I like to leave some area of the carving plain—to serve as a foil to the detail, and to show the beauty of the wood.

I leave the surface finish straight from the tool as much as possible and avoid using abrasive paper in the final stages. No matter how fine the paper, the scratches it leaves will be all too apparent when a piece is examined as closely as miniatures tend to be. Once all the carving has been completed, I inlay the eyes, when appropriate. Sometimes I inlay just an ebony or horn pupil, but usually I do the whole eye, inlaying horn or amber with an ebony pupil. This is an infuriatingly fiddly process, but worth the effort. I work the eyes as a pair, and carve, rather than drill, the sockets. I taper the inlay slightly to give the tightest possible fit and, just to make sure, fix it with epoxy glue.

For staining, after much experimentation I found that ordinary drawing inks best suit my purposes. They can be diluted and mixed to obtain the subtlest shades, and they are easy to apply with a sable-hair watercolor brush or a cloth pad. Although I understand that these inks will fade in time, the darkening of the wood with age and constant handling will also contribute to a change in the character of the piece. Thus I don't feel the fading to be a disadvantage, but part of

Tony Boyc

A basilisk is a mythological beast hatched from a rooster's egg. The holly carving above is 2½ in. long and its eye has an inlaid ebony pupil. 'The Walrus and the Carpenter' (boxwood, shown actual size at left) was inspired by the poem from Lewis Carroll's Through the Looking Glass. *Octopus (holly, 4 in.), below, has inlaid ebony and amber eyes.*

Netsuke, a tradition of miniature sculpture

by Whittaker Freegard

Picture a group of people excitedly passing around small objects which they look at closely for a few seconds, lovingly cup in their hands and caress, then pass on to the next pair of eager hands. To a casual observer, the handling and passing seem shy, almost furtive, as if the objects might jump away or vanish in a curl of smoke. It is the rubbing hand movements, though, that indicate what these people are doing. They are *netsuke* enthusiasts attending a convention, where they can enjoy the artform that has flourished in Japan for more than four hundred years.

The *netsuke* originally was meant to be worn. It was attached by a cord, often to a small case called an *inro* that held seals, ink or medicinal herbs. The case was worn by slipping the cord under the sashlike belt tied around the *kimono,* with the *netsuke* acting like a chunky button to keep the case from sliding down. Since Japanese clothing had no pockets, items such as purses, keys, flint pouches and clocks—whatever needed to be carried—dangled from *netsuke* and cord. These hanging objects were called *sagemono.*

Early *netsuke,* from the 16th century, are unadorned toggles, made from natural objects such as a piece of root or a stone. (The word *netsuke* derives from the words *ne,* root, and *tsuke,* to fasten.) These soon developed into highly detailed sculptural studies of Japanese life and legend. No subject was spared the close scrutiny of the *netsuke* artist. Often as not, the figure was executed with a humorous twist.

These detailed little carvings of boxwood, ebony or ivory were eagerly collected and worn by the growing merchant and upper classes in Japan. When a 100-year-old ban on tobacco was lifted early in the 18th century, tobacco pouches and pipe cases became common items suspended from *netsuke.* It wasn't until the late 19th century that the wearing of *netsuke,* along with the rest of traditional Japanese clothing, became less fashionable.

Al Abrams

A flute case sagemono *dangles from an ivory* netsuke *by Whittaker Freegard.*

Because *netsuke* were plentiful and no longer in use, they were once relatively inexpensive. Many large collections were amassed in the United States and Europe. Few early collectors, however, knew of the fabulous legends and traditions depicted in *netsuke* art.

All that has changed. Today there are *netsuke* enthusiasts and scholars all over the world. When a sought-after carver's work comes on the market, it is anything but cheap. Some individual carvings with the right pedigree have fetched more than one hundred thousand dollars.

There is also a growing number of contemporary *netsuke* carvers. Most of their work, whether from the East or the West, follows traditional Japanese themes, though there are a few, particularly in the United States, who are interested in applying old techniques to new themes. □

Whittaker Freegard is a flute maker and netsuke *carver. For more information about* netsuke, *write to the Netsuke Kenkyukai Society (Box 2445, Gaithersburg, Md. 20879), the worldwide association of collectors and scholars of* netsuke *and related Japanese arts.*

a natural process. For the final finish, I use the thinnest smear of linseed oil diluted with turpentine, or an enthusiastic application of wax. I never use lacquers or varnishes, as these interfere with the tactile quality so important to a work that will be frequently handled, and with the beautiful patina that handling gives to a carving.

It all sounds easy, and indeed there is no mystery and nothing too difficult about the techniques. A few hours of experimentation will tell you whether you have an aptitude for this style of carving. The tricky part is the design of the piece: conceiving a three-dimensional object in your mind, and then deciding what to leave out, what to include, how far to go and what you want to say. Although these skills can be learned, they are essentially emotional responses, and the more intuitive the better. So much depends on how you feel about your subject, and your ability to communicate that in the finished piece.

Carving, especially in miniature, is time-consuming, and a carver needs discipline, patience, and good coordination between hand, eye and brain. It is, however, immensely rewarding and highly individual. No two carvings can ever be identical, and there is satisfaction in that knowledge. There are also the joys of working in wood which all woodworkers are familiar with, although the carver of miniatures is possibly more aware of these, due to his intimate contact with the material.

Unlike traditional *netsuke,* I don't intend my pieces to be worn, but I do design them to be handled. Many of my clients carry their carvings around in their pockets and play with them like worry beads. This always delights me. The pieces inevitably get dirty, but they also acquire a lovely patina. I'm sure that their owners derive more enjoyment from them that way than from seeing them behind glass. □

Sue Wraight carves her miniatures in her London flat. She has just completed three months as Visiting Artist at Melbourne State College in Australia.

Scroll Saws Compared

Precision for a price

by Silas Kopf

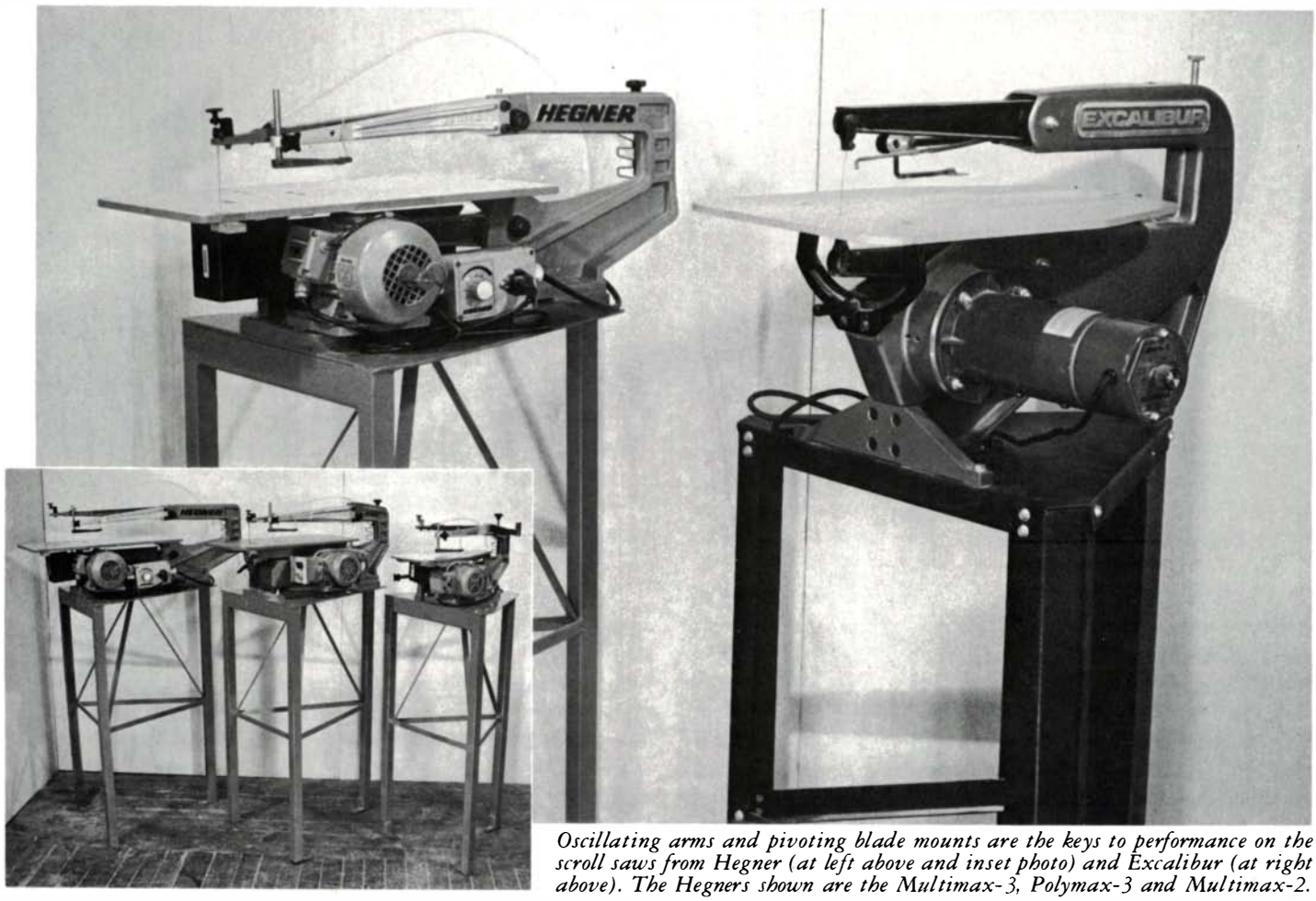
A scroll saw, or jigsaw as it's also called, is the right tool for cutting intricate shapes in wood and soft metal. For years, my Rockwell 24-in. scroll saw served me well, cutting veneers for the marquetry work which is my livelihood. But then I discovered some fancy, expensive scroll saws that perform so well that I bought one, and mothballed my faithful old machine.

Like the Rockwell, conventional scroll saws have a reciprocating blade, the lower end of which clamps into a chuck that's driven by the crankshaft. The upper end of the blade clamps into a chuck on a spring-loaded sleeve at the end of the rigid saw frame. The blade is pushed and pulled from the bottom end, while the spring at the top end struggles to keep tension on the blade. This tension is not constant throughout the stroke, however, and blade breakage is common.

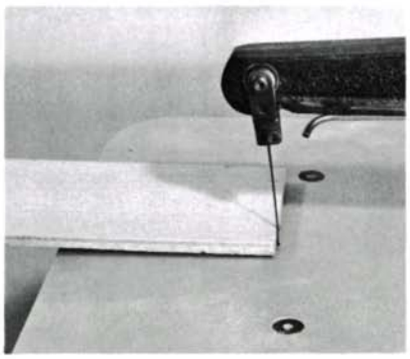
The saws I tested for this article—the Hegner line from West Germany and the Excalibur from Canada—are designed differently from conventional scroll saws. Two arms, one above the table and one below, are connected at one end by the sawblade, and at the other by an adjustable tensioning rod. Only the lower arm is connected to the motor. Each arm pivots on a shaft, and they remain roughly parallel as they rock up and down. The blade is mounted so that it can pivot at its ends from front to back. The whole system—arms, blade and tensioning rod—maintains the shape of a parallelogram. As the blade moves downward on the cutting stroke, it moves forward slightly; on the upstroke, it moves back.

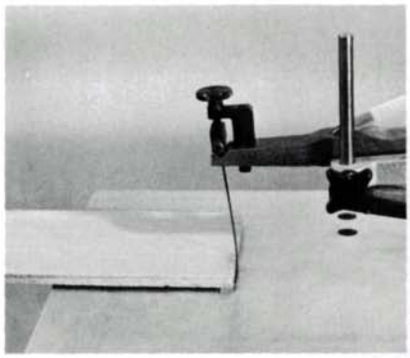
These saws produce an extremely clean cut that needs no sanding. Because tension on the blade remains constant throughout the stroke, sideways deflection is minimal, allowing the use of very fine blades. I quickly discovered that blades break much less frequently with this type of saw than with a conventional scroll saw. In fact, it isn't easy to break one. It's possible to cut a right angle by quickly turning the workpiece 90°. This small turning radius makes the most intricate shapes possible.

Unlike conventional scroll saws, the Hegner and Excalibur saws don't require any guides or support behind the blade. For cutting marquetry, I find this feature especially useful because my vision is unobstructed all around the cut. It's also

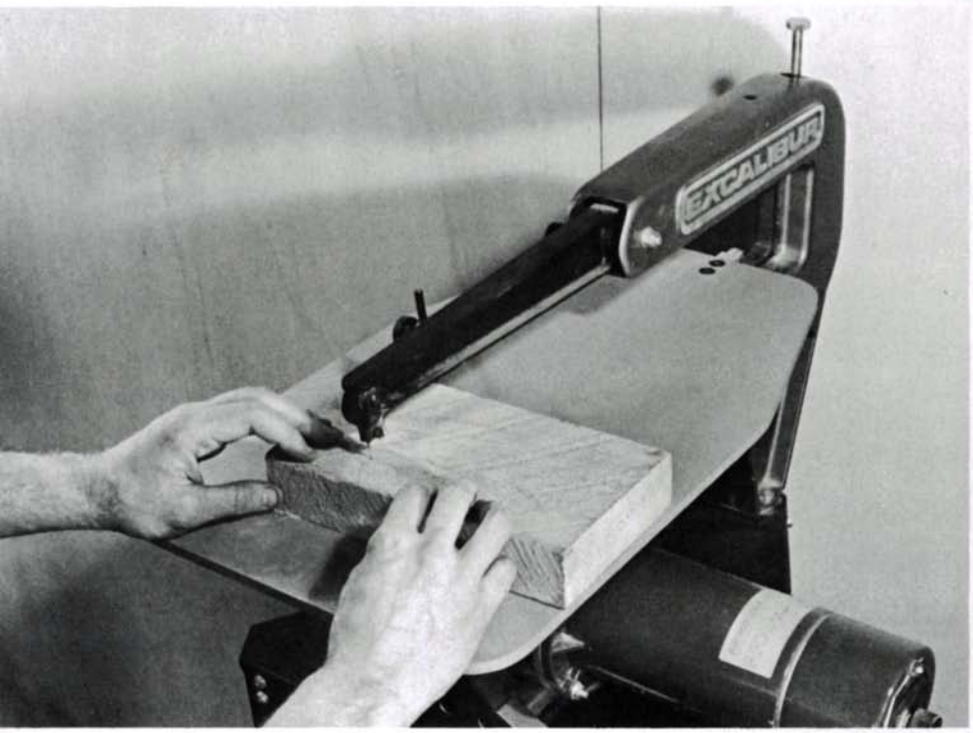


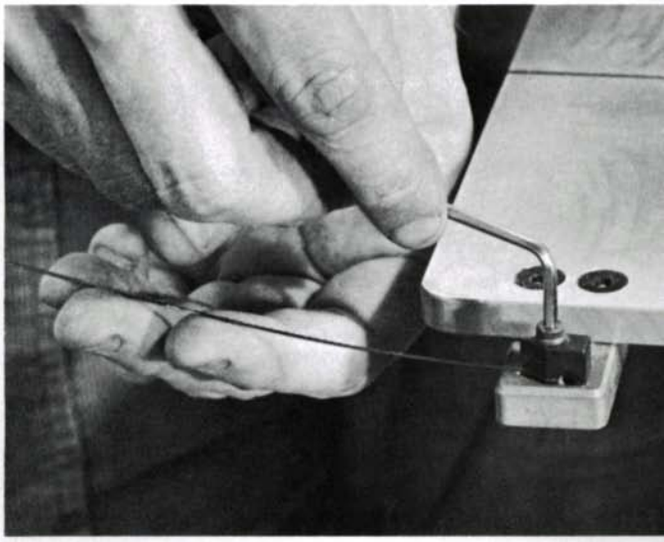
Oscillating arms and pivoting blade mounts are the keys to performance on the scroll saws from Hegner (at left above and inset photo) and Excalibur (at right above). The Hegners shown are the Multimax-3, Polymax-3 and Multimax-2.

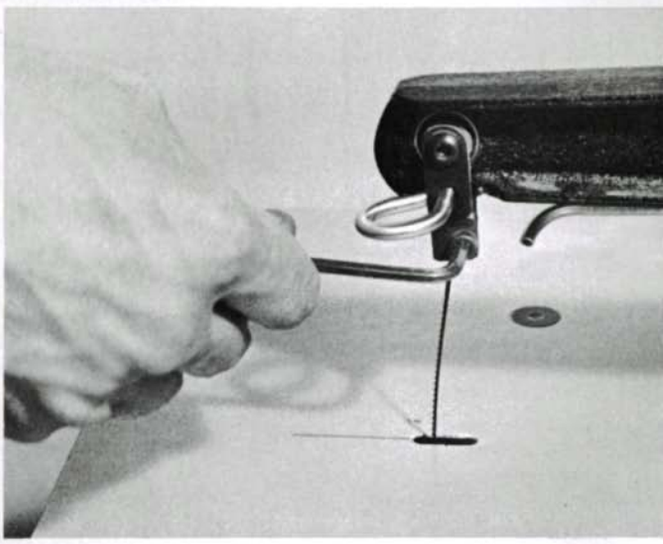




It's not easy to break a blade on these saws. Kopf pushes hard against a fine blade to prove the point. Both the Excalibur mount (above left) and the Hegner mount (above right) allow the blade to pivot from front to back. Even 8/4 maple poses no problem for these scroll saws, as shown below. They'll easily cut intricate curves in thick hardwood.







A holder on the Hegner saw (top) makes it easy to mount the blade ends in the clamps. Excalibur blades are mounted right on the saw (bottom). Inserting a steel hair pin keeps the blade mount from moving under the torque of the Allen wrench.

easy to manipulate around very tight curves since you can get your fingers on all sides of the blade.

The Hegner saw made its U.S. debut in 1978, and there are now three different models: the Multimax-2, Multimax-3 and Polymax-3. The Multimax machines are direct-drive, single-speed saws with an optional add-on variable-speed control. The Polymax-3 is a heavy-duty, belt-driven, 4-speed industrial saw. The Multimax-3 and Polymax-3 have an adjustable, 2-position stroke length. The shorter stroke offers better control on intricate curves.

The Excalibur saw came on the market in January 1983. There's only one model, and it's currently available with either a single-speed motor or a variable-speed DC motor. The variable-speed motor senses load changes and supplies the power needed to maintain the same stroke rate regardless of load. Equipped with this motor, the saw can cut as slowly as 3 CSM (cutting strokes per minute), and even in a hard material like brass, it delivers a constant stroke. You can actually lean your weight on the upper arm and feel the surge of power as the motor compensates for the load. I wasn't strong enough to stop the saw, even at very slow speeds.

One of my favorite Excalibur features is the wide table that tilts both left and right. The narrower Hegner table tilts only to the left. Unlike the Hegner, the Excalibur's oscillating arms are supported on both sides by the saw frame, which seems sturdier. There's a power take-off on one end of the motor, so a flexible-shaft tool can be connected for drilling starter holes for internal cuts. The Excalibur brochure recommends weighting or bolting the saw to the floor, but I found that this wasn't really necessary with any of the machines.

The blade on the Hegner saw is mounted in two small pointed clamps that allow it to pivot. A holder attached to the saw table makes it easy to mount the blade in the clamps: you place a clamp in the holder, insert the end of the blade, and tighten the clamp with a hex wrench.

Although I found it easy to change blades in the holder, the clamping system proved frustrating when I was making interior cuts with fine blades (larger blades were no problem). For this type of cut, I have to slip the end of the blade through a hole in the work, and then into the clamp while the thing's mounted on the machine. Sometimes I was able to get it easily; other times I just couldn't. For piercing work with fine blades, the Hegner clamping system is a drawback.

The Excalibur has a different blade-mounting system: the

	Excalibur	Hegner Multimax-2	Hegner Multimax-3	Hegner Polymax-3
Throat	24½ in.	14¼ in.	25 in.	19½ in.
Maximum cutting depth	2¼ in.	2 in.	2⅜ in.	2 in.
Stroke length	¾ in.	¾ in.	⅜ in. or 11/16 in.	9/16 in. or 15/16 in.
Table	14 in. by 24 in.; tilts 45° left, 20° right	7 1/16 in. by 15⅜ in.; tilts 45° left	10¼ in. by 20 7/16 in.; tilts 45° left	10¼ in. by 19¼ in.; tilts 45° left
Weight with stand	99 lb.	50 lb.	92 lb.	111 lb.
Cutting strokes per minute (CSM)	1650 (single-speed); 3 to 1800 with variable-speed*	1660 with standard single-speed; 150 to 1660**	1200 with standard single-speed; 150 to 1200**	700, 1100, 1270 and 1600 (4-speed belt drive only; no variable-speed option)
Blades	Standard 5-in. flat-end scroll-saw	Standard 5-in. flat-end scroll-saw	Standard 5-in. flat-end scroll-saw	Standard 5-in. flat-end scroll-saw
Warranty	2 years for home use, 180 days for commercial use	2 years (1 year on electrics)	2 years (1 year on electrics)	5 years (1 year on electrics)
Price	$1285 (variable-speed)	$859 (single-speed)	$1499 (single-speed)	$1899

* 3-speed pulley model available soon ($950 without a motor)
** with optional variable-speed regulator ($319)

blade pivots in clevis mounts. The blade clamp on each mount holds fine blades tightly, but thicker blades have a tendency to slip out of the clamps.

All the saws have an automatic air pump that directs a stream of air to blow sawdust away from the cutting line. The air pump on the Hegner saws is a plastic bellows, while the pump on the Excalibur is a piston concealed in the saw frame.

For intricate cuts in veneer, I found that a variable-speed saw is a necessity. The single-speed machines are much too fast. Without the variable-speed regulator, I couldn't control the cut with the precision needed for the double-bevel cutting method I described in *FWW* #38, pp. 61-65. The Polymax-3 set at the slowest speed (700 CSM) and the shortest stroke length (9/16 in.) was also satisfactory for marquetry.

I tried cutting some 1/28-in. thick sheet brass with the recommended blades for metal, and all the machines performed well. Here, too, I preferred the variable-speed models.

All the saws, including the single-speed Hegners, did a fine job on ½-in. thick pine. With the heavier sawblades required for thicker stock, mounting the blade for an interior cut was quite easy on the Hegner.

My final test was to saw 8/4 walnut and maple—the maximum thickness recommended for these machines. It was remarkable how easily these saws cut stock that seems better suited to a bandsaw. The Multimax-3, with its 1200-CSM top speed, cut the maple more slowly than the others, but still performed well. On this thick stock, the Hegner left a perfectly square cut, but the Excalibur cut bowed outward slightly in the middle, enough to trap pieces on tight, intricate curves. I had to make relief cuts and remove the cut-out sections in pieces. Slowing down the rate of feed seemed to improve things, but this would slow down production.

Making a recommendation about these machines is difficult. Because of their cost, they're not for everybody. (But with a price tag of over $1300, a new Rockwell scroll saw is no bargain, either.) You'd have to get a lot of use from one of these machines to make it pay for itself.

If I were making toys, puzzles or signs, I'd choose one of the Hegner saws—if price were no object, the Polymax-3—because of the blade mounts and the nice square cut in thick stock. The Hegner saws are well engineered, and I like the fact that all the machinery is exposed. Nothing to hide. I also like the Hegner's safety feature that stops the saw immediately if a blade breaks. On the Excalibur, a broken blade can damage the work before you can stop the machine.

Because I use a scroll saw for marquetry, and rarely cut more than a few layers of veneer at a time, I bought the variable-speed Excalibur. Fine blades are easier to mount for interior cuts, and a table that tilts both ways is an important advantage for double-bevel cutting. If a blade breaks during a cut, I can restart an interior cut at the original drill hole, tilt the table to the other side, and saw in the other direction. The lower price of the Excalibur also influenced my decision.

There are at least two other companies manufacturing scroll saws with designs similar to the machines discussed here, but I wasn't able to include them in my test. An American-made line of scroll saws is available from RBIndustries, Inc., 201 First St., Pleasant Hill, Mo. 64080. Woodmaster Power Tools, 2849 Terrace, Kansas City, Mo. 64108, also sells a saw. Pedal- and motor-powered scroll-saw kits are sold by Tool Company, PO Box 629, 1306-G S. Commercial, Harrisonville, Mo. 64701. □

Silas Kopf is a professional furnituremaker in Northampton, Mass. He wrote about marquetry in FWW *#38, and his work is pictured in #45, p. 69.*

Patternsawing

Identical pieces without much fuss

by Jim Cummins

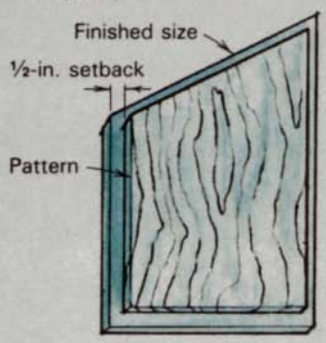
When I bought an old building and moved my shop into it, I removed hundreds of square feet of wainscoting to make room for insulation and new electrical wiring. I used the salvageable pieces in refurbishing, but when the sheetrock and pegboard went up, I was left with innumerable splintery tongue-and-groove strips, which I sawed into short lengths to fit my woodstove. The pile filled one shop corner to the ceiling.

The first winter took care of only half the pile, but spring brought me an idea that would get rid of the rest, get my new shop some publiciry, and raise a little money for the local guild of craftsmen besides. How? By patternsawing birdhouses, inviting the public to an open-house assembly party, and selling the birdhouses—one free to new guild members, $4 apiece otherwise.

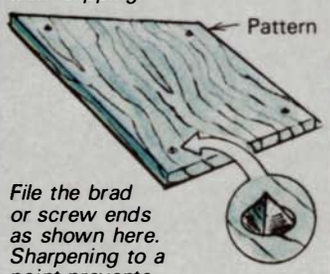
The drawings show a few patternsawing setups for both the tablesaw and the bandsaw. With the appropriate setup, you can cut inside curves, outside curves or in a straight line to produce exact multiples. These ideas aren't new, and most woodworkers will be familiar with at least one or two of them, but listing them together in this article may suggest even more possibilities. (For another patternsawing idea, see Methods of Work in this issue, p. 8.)

Fig. 1: Patternsawing on the tablesaw

A. *Make a plywood pattern with all of its edges set back ½ in. from the outline of the finished work.*

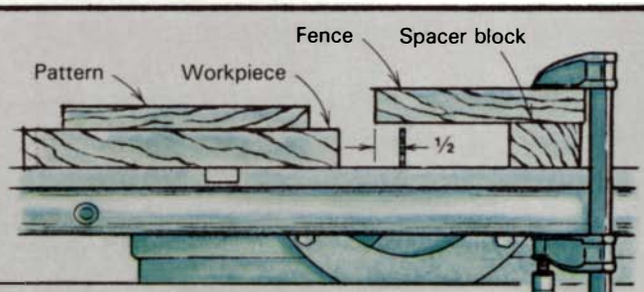


B. *Drive short brads or screws through the pattern so that their points extend slightly. When the pattern is pressed on the workpiece, the points will prevent it from slipping.*

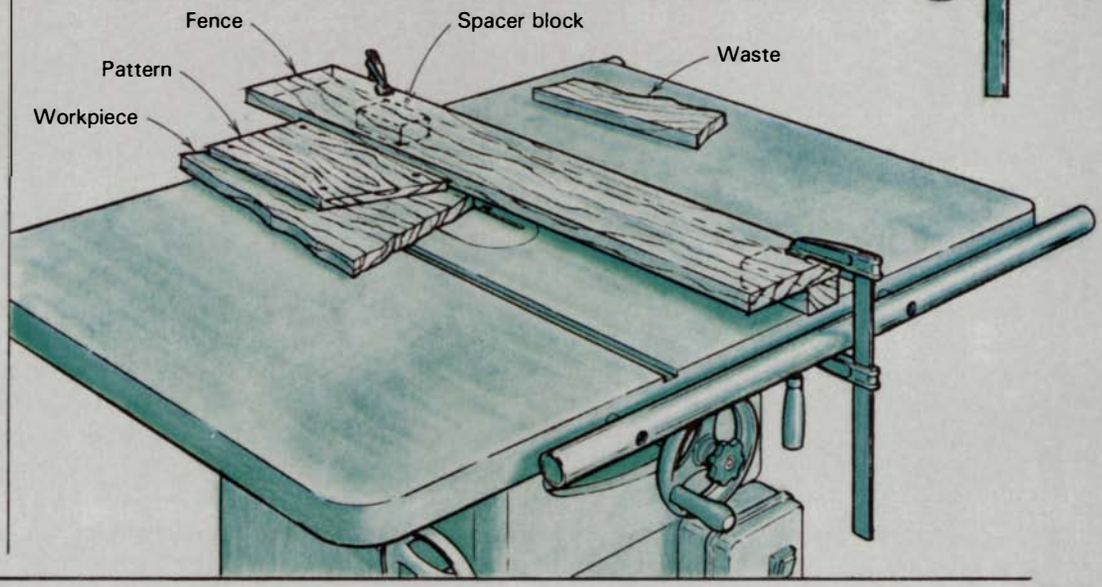


File the brad or screw ends as shown here. Sharpening to a point prevents movement in any direction.

C. *Clamp a fence over the tablesaw blade so that it overhangs the blade by ½ in. The fence must be parallel to the blade and high enough above the table that the workpiece can pass under it to reach the blade, but low enough that the pattern can bear against it.*

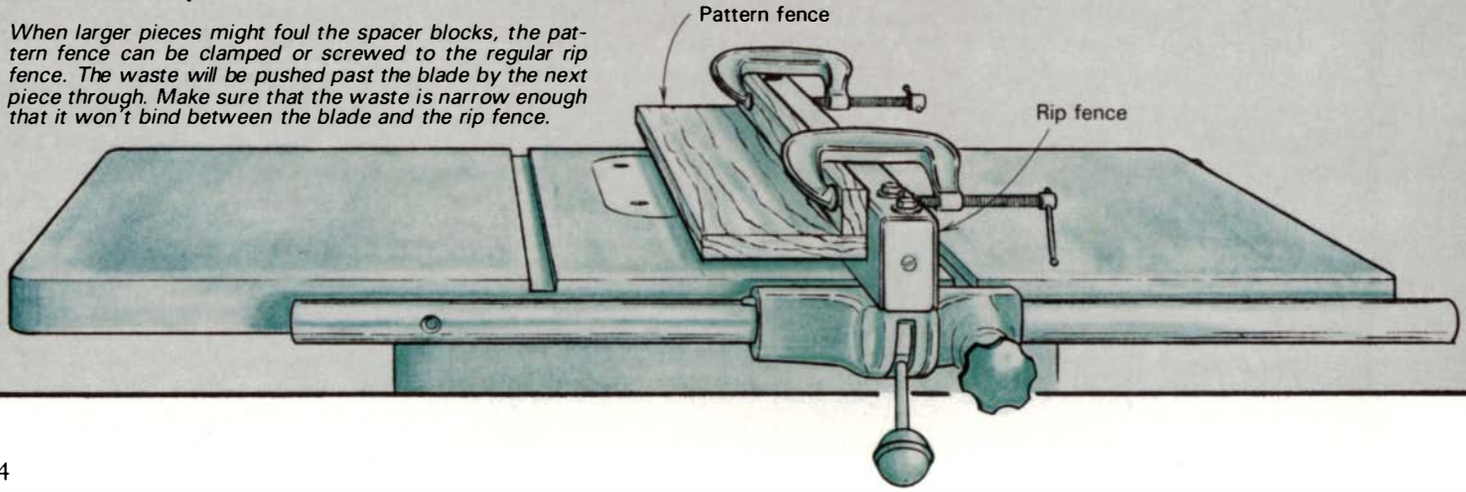


D. *Run the edges of the pattern against the fence to cut the workpiece to size, being careful not to let the pattern shift. The overhanging fence provides a measure of safety. Never reach under the fence—keep fingers away.*



Alternative setup

When larger pieces might foul the spacer blocks, the pattern fence can be clamped or screwed to the regular rip fence. The waste will be pushed past the blade by the next piece through. Make sure that the waste is narrow enough that it won't bind between the blade and the rip fence.



In each setup, the workpiece is fastened to a pattern that controls the line of the cut by bearing against a fence—you don't have to eyeball curved cuts and you don't have to change fence adjustments to make straight cuts of various widths or at various angles. The reference edges are on the pattern, which means that you can saw irregular scraps to size with the first cut, without initially having to establish clean edges to run against the fence.

The pattern and the workpiece usually are held together by something like nails, brads or sharpened screw points driven through the pattern so that their tips protrude just enough to catch the workpiece and hold it flat. With this method, there's no slow jigging and clamping from one workpiece to the next, which is an advantage over other production setups. In my case, I just lined up a couple of pieces of wainscoting side-by-side on the saw table, and pressed the tongue and groove together. Then I could slap the pattern on top, which automatically held things in place, and cut the work to size without having to do a lot of extra trimming. Instead of driving brads through the pattern to keep the work from shifting, I covered the entire bottom of the pattern with non-slip rubber tape. You could use sandpaper, too, but I wouldn't recommend either of these methods for very large pieces.

Patternsawing worked great in my shop. Over the course of about five hours, we made 54 birdhouses, recruited 22 new guild boosters, and raised about $120 in cash for the guild. As a bonus, I had beady-eyed, perky little wrens outside my bedroom window all summer long. I watched four little birds grow up and fly away, and never had to set my alarm clock once until September. □

Jim Cummins is associate editor at FWW.

Fig. 2: "Jointing" irregular edges

This pattern is a moving 'table' that rides in one of the tablesaw's miter-gauge grooves. One pass results in a straight, clean edge on the board.

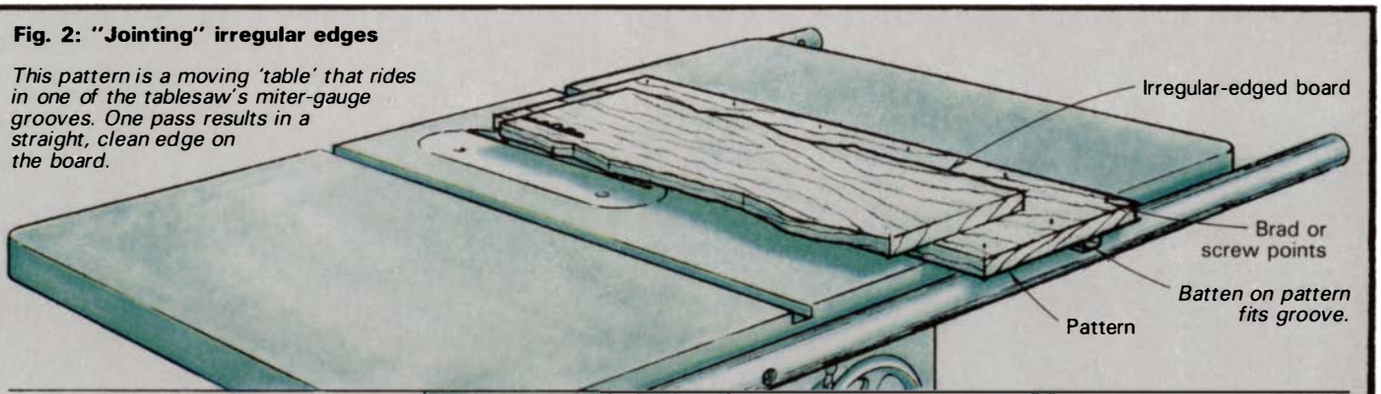
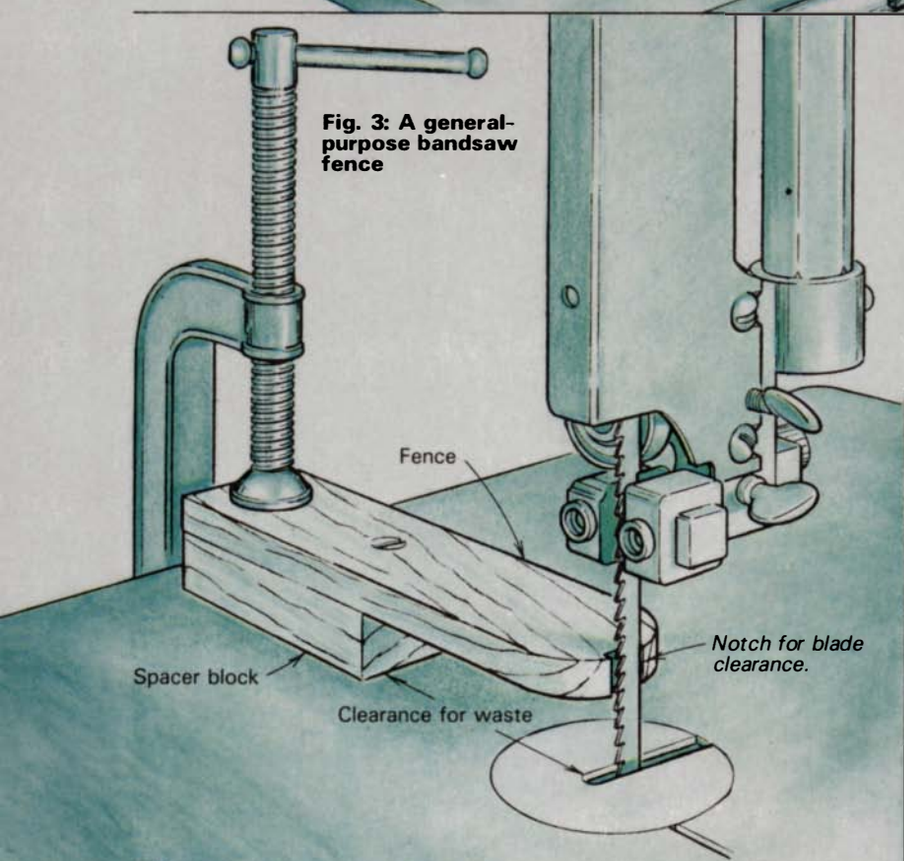


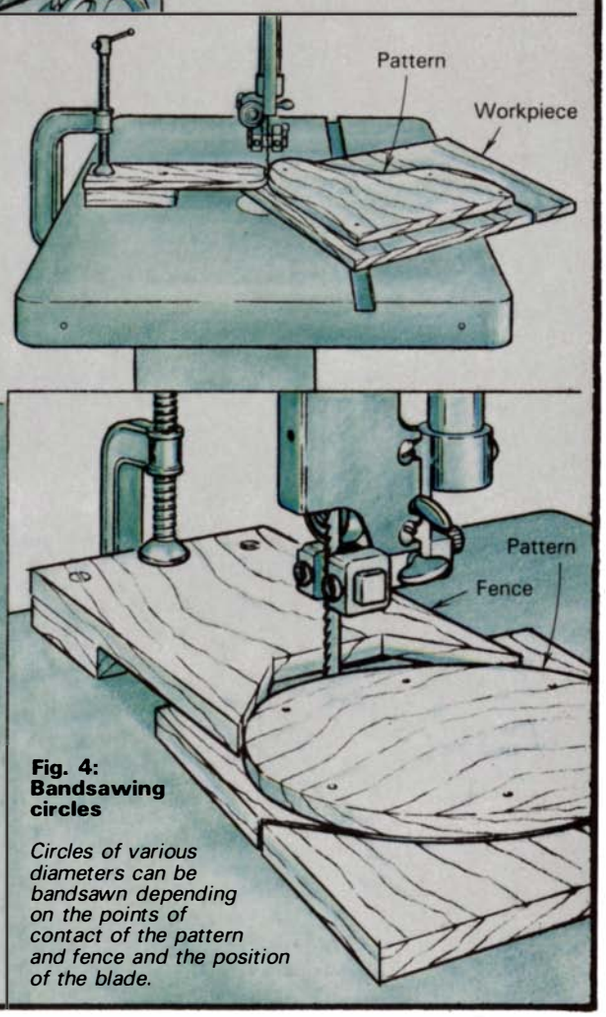
Fig. 3: A general-purpose bandsaw fence



This fence is for patternsawing convex and concave curves as well as straight lines. Make the pattern the exact size of the finished piece. The nose of the fence must have a radius at least as tight as any inside curves to be cut. If these curves aren't severe, make a broader-nosed fence—the more bearing surface you have, the better the control. For straight cuts, such as when making tapered table legs, make a fence with a flat bearing surface.

Fig. 4: Bandsawing circles

Circles of various diameters can be bandsawn depending on the points of contact of the pattern and fence and the position of the blade.



Drawing: Lee Hov

Furniture From Paintings

Off the wall and into the workshop

by Richard Ball and Peter Campbell

About 1916, Marcel Duchamp transformed a tin advertising sign for Sapolin Enamel paints into art (right), so it seemed a good idea to authors Ball and Campbell to ring another change by transforming art into furniture (below).

Photo, top: Philadelphia Museum of Art, The Louise and Walter Arensberg Collection; photo, bottom: authors

Some of the most intriguing pieces of furniture ever designed are trapped in two dimensions, in paintings on the walls of the world's museums. But what would those pieces look like in real life? To find out, we selected 20 paintings and challenged several furnituremakers and sculptors to use them as pattern books. The resulting furniture is described in our book, *Master Pieces,* from which this article is adapted.

Our approach was to make the piece of furniture in the spirit of the artist's interpretation rather than to try to reproduce the piece he may have used as a model. The painter's original decisions do not necessarily reflect the logical world; the maker can also exploit this artistic license, adding and subtracting elements to improve the three-dimensional piece.

The history of art is an unrivaled source book of furniture design. The pieces in our book range from a stool brought to life from a 15th-century Italian fresco to a Picasso sideboard. We are convinced that paintings can provide the amateur furnituremaker with lively and original designs for interesting and usable furniture, such as the bed shown here.

Duchamp's Ready-Made bed—Marcel Duchamp bewildered people. He confused the critics by exhibiting a bicycle wheel mounted uselessly on a stool; he outraged the earnest by exhibiting a urinal—he called it "Fountain"; and he caused titters and snorts by drawing a moustache on a reproduction of the Mona Lisa and adding a rude title.

Eccentric French poet Guillaume Apollinaire, the misspelled hero of Duchamp's "Apolinère Enameled," also had trouble with the Mona Lisa. When the painting vanished from the Louvre in 1911, suspicion fell, quite wrongly, on Apollinaire and he was arrested. But there remains little reason why he should be enameled.

"Apolinère Enameled" is one of Duchamp's Ready-Mades, for which he took an everyday object, deprived it of its name and normal context, and put it in an art gallery. He also suggested taking the opposite route, taking paintings off gallery walls and placing them in the world outside—"use a Rembrandt as an ironing board" was one of his curious proposals. The idea was not taken up.

"Apolinère Enameled" began as a painted tin advertising sign for Sapolin Enamel paints. Duchamp altered the lettering and penciled in a pale reflection of the young decorator in the corner of the mirror.

As Duchamp wanted to abolish the distinction between art and the useful, it is fitting to create a real bed from this bizarre tin image, in which the dictates of perspective are flouted and one of the bed rails is partially missing.

In the interests of making a usable bed, Patrick Daw, the sculptor who designed and made the bed for us, closed the gap between rail and bedpost. This means that someone can sleep peacefully in the bed without propping up the rail on bricks. The picture's perspective is confused, which made the dimensions hard to calculate. The presence of the child and the bed's bright color scheme argued in favor of a child-sized bed. Daw picked a single-bed mattress, 3 ft. by 6 ft. 3 in. (This is a standard English size. Americans should check their mattress before making the bed.)

The bed consists of a headboard and footboard joined by bolts to two long side rails. The mattress rests on slats set in rabbets cut into the inside faces of the side rails. The headboard and footboard of the bed are made in identical fashion, described below, but with slightly different dimensions.

The posts—Daw turned the four posts on a lathe. [See Methods of Work, p. 8 in this issue, for a way to make round posts without a lathe.] Each post is made in three separate parts: a main shaft with a ball-shaped foot, a disc, and a top ball. The ball is fixed to the shaft with a 1-in. dowel, 4 in. long, which passes through the center of the disc. You could also turn the dowel on the ball.

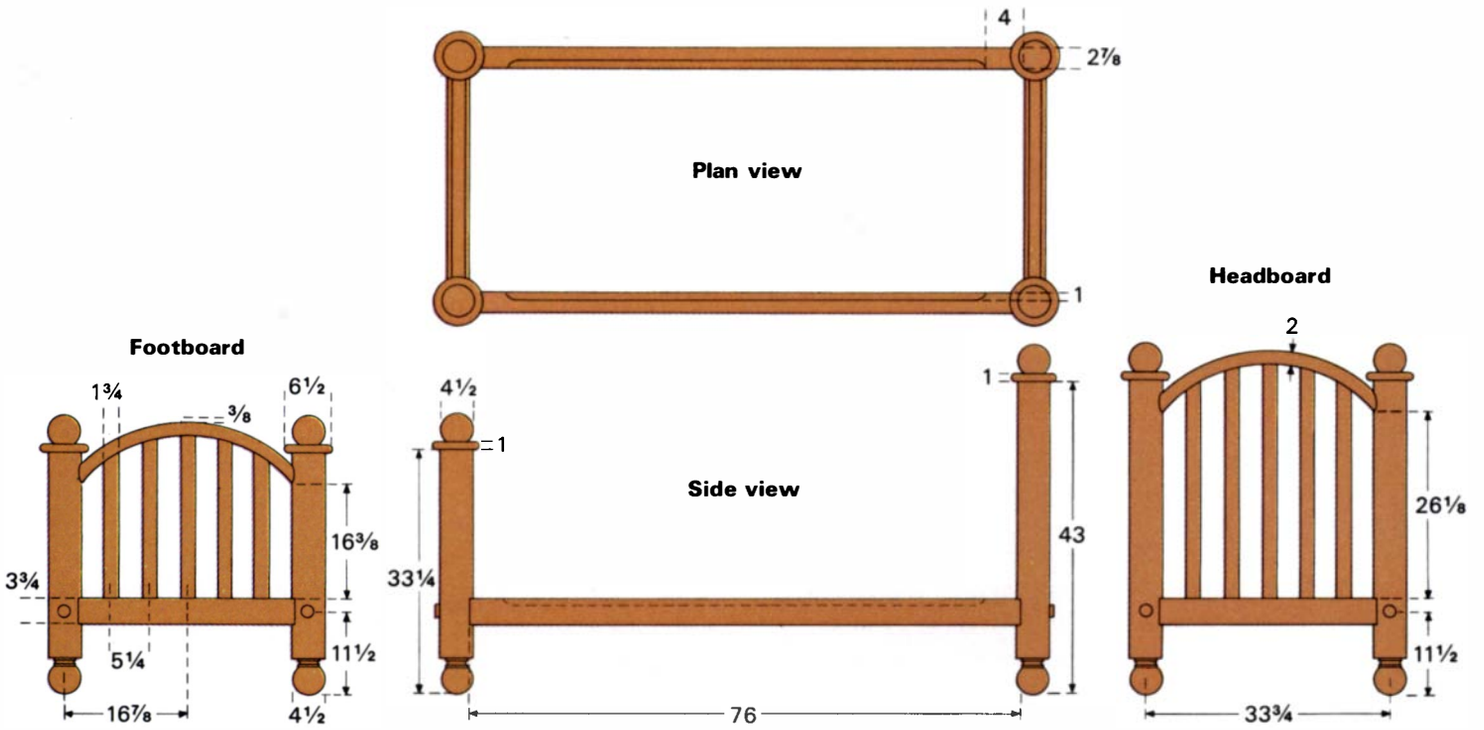
Daw glued up each 5-in. square turning blank from thinner pine boards. Such a glued block presents no problems, as unsightly gluelines will be hidden under a coat of paint. The curved top rail and straight bottom rail on each end are joined to the posts with mortise-and-tenon joints. Trim the turned shafts to length, then cut the mortises. First draw a line down the entire length of the post. Center a 1-in. drill bit on this line 2½ in. from the top of the shaft and drill a 2-in. deep socket. Then square off the corners of the socket with a chisel. On the same line, drill an identical hole centered 11½ in. from the bottom of the ball-shaped foot. Drill additional 1-in. dia. holes above and below it, then chisel them out to form a 1-in. by 3-in. mortise, 2 in. deep.

The rails—The curved top rails are too hefty to steam-bend without a lot of trouble, so Daw bandsawed each one out of a solid 2-in. by 9-in. pine plank. He calculated that to reproduce the arc in the picture and to accommodate the mattress size he wanted, the top of the rail would have to rise 6⅛ in. between posts set 29¼ in. apart. To lay out the arc, he drew a line 29¼ in. long on the plank, leaving at least 2 in. extra at each end for the tenons. He made a crude compass by attaching one end of a piece of string to a chair leg and the other to a pencil. Then, by positioning the chair carefully, he drew the arcs for the top and bottom edges of the rail. Each end of the rail is extended horizontally to make the 2-in. long tenons.

Daw coped the shoulders of the top-rail tenons to wrap snugly around the posts. Many people will find it easier, however, to square off the face of the posts where they meet the rails, thereby avoiding the need for coping. To cope the shoulders, mark out the curves with a cardboard template of the post before cutting the tenons. The arcs at each end of the rail must be 29¼ in. apart at their nearest points, centered on the rail, and must allow for the tenon. Mark and saw out the tenon, then chop back to the shoulder lines with a gouge. Any gaps can be filled later and will be hidden by paint.

At this stage, the rail is still rectangular in section. Use a spokeshave to round off the corners. This is a long job. Daw spent an entire afternoon whittling away until he achieved a satisfactory shape. He found it a pleasant afternoon.

Each bottom rail is 2⅞ in. by 3¾ in. by 33¼ in., including tenons. (Remember, you can glue up thin pieces rather than buying one thick one.) Either square off the posts where the rail enters the mortise, as shown in the drawing, or cope the tenon shoulders using the template as before. Before rounding off the edges of the rail, mark and drill the sockets for the five upright bars. Draw a centerline along the rail's top surface, mark the positions for the bars and drill 1¾-in. sockets, exactly 1 in. deep. Use an expansion bit or a Forstner-type bit for this job rather than a flat bit, as large-diameter flat bits



tend to rip the wood. After the sockets are bored, round off the rail. Make a paper template of the lower rail with the five mortise positions marked on it. Use this template to mark the positions of the bars on the curved top rail.

The bars—Turn the 1¾-in. dia. bars, then saw them at least 3 in. too long. The bars fit directly into the sockets in the bottom rail, but the top ends are coped to fit the top rail and are held in place by doweling through the top rail. Place each bar against the rail to get a rough idea of the finished profile and cut it roughly to shape with a coping saw. Fitting is a laborious job. Shape the ends with gouges and rasps, trying the bar to the rail until they fit properly.

When the ends of the five bars fit the top rail satisfactorily, cut the bars to length. Calculating the lengths accurately is complicated and uncertain. To avoid error, dry-assemble the posts and rails on a bench, place the bars in position against the top rail, mark the point where the bottom rail intersects each bar, and add 1 in. for the tenon.

Now the headboard and footboard can be glued up. (Holes for the side rail bolts are bored after assembly.) When the bars are correctly positioned against the top rail, drill ¾-in. dia. holes down through the top rail and 1½ in. into the end of each bar. Clear the holes of shavings, add glue, and hammer ¾-in. dia. dowels into the holes to secure the bars. Cut a small channel along the length of each dowel to permit excess glue and air to escape. Pare off protruding ends with a chisel.

The side rails—Dimension the side rails to a 3-in. by 4-in. section. Then rout or saw a 1-in. by 1-in. rabbet along the top inside corner of each rail for the slats to rest on. The rabbets begin and end 4 in. from the ends.

The side rails can be shaped and tenoned into the posts in the same way as described for the lower rail on the headboard and footboard. Daw thought that the bed should be easy to dismantle, so he eliminated the mortises and tenons and bolted the parts together. An 8-in. long, ½-in. dia. threaded bolt passes through holes in the post and end of the rail and engages a tapped metal block epoxied in a housing in the rail. A local machine shop made the blocks, which are cylinders of 1-in. dia. mild steel, drilled and tapped for the ½-in. bolts. You can also use standard bed bolts, or house a nut and washers in each rail—make the openings large enough to allow the nut to be held for tightening.

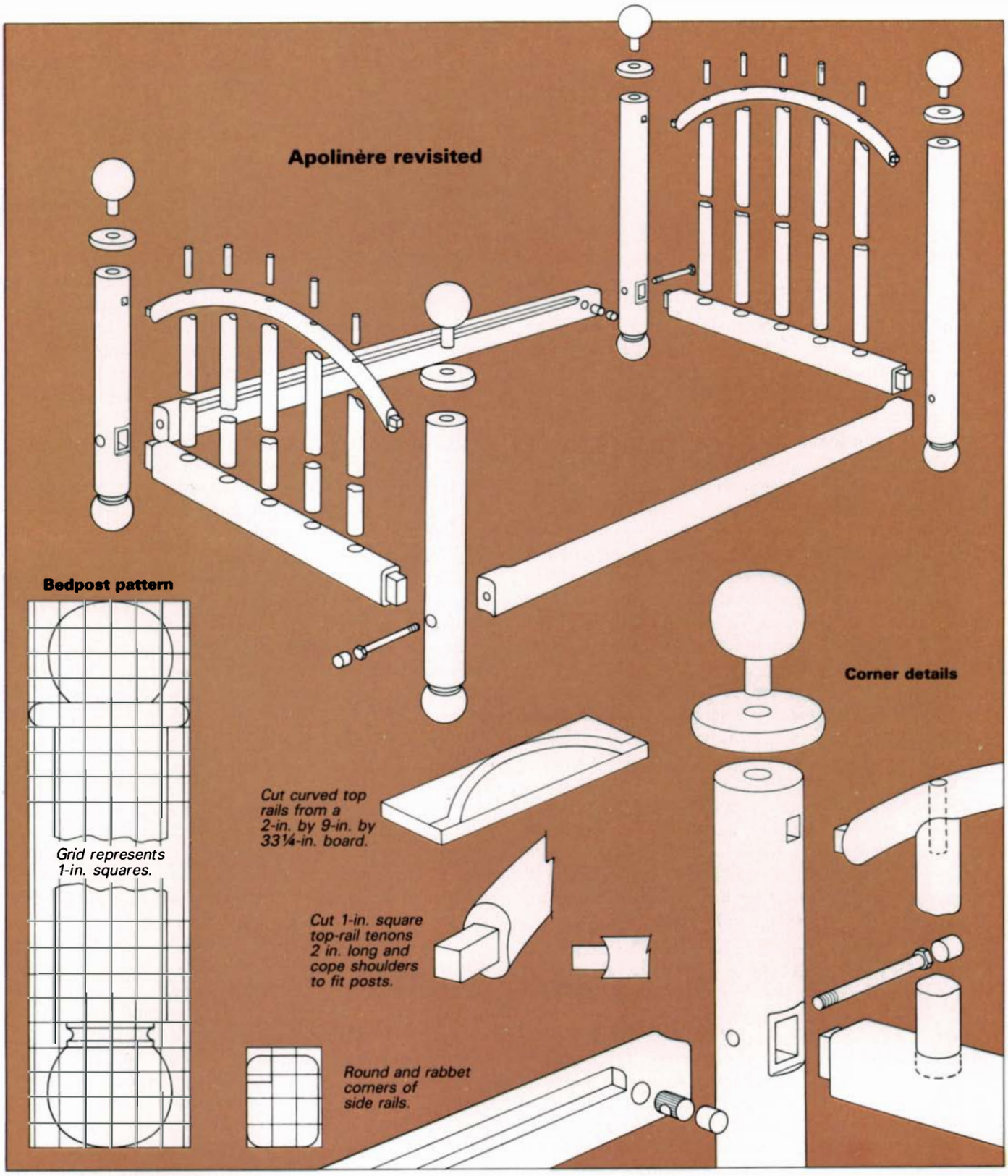
Drilling the bolt holes is difficult, as accuracy is crucial. If the holes stray off-center, the bolt and block will not link up. Mark the position of the bolt holes on the posts 11½ in. up from the bottom ends and at a right angle to the rails of the headboard and footboard. Drill a 1-in. dia. hole 1 in. into each post at this mark. Then counterbore ½-in. dia. holes right through the posts. (If the small holes are drilled first, the center spur won't be able to guide the large bit.) Place the side rails against the bedposts, propped up at the correct height, and drill a hole 5 in. into each rail end.

To fit the metal block, drill a 1-in. dia. hole on the inside face of the rail, 4 in. from the end and as deep as possible without breaking through. Position the hole to intersect the bolt hole. Coat the block in epoxy resin adhesive, push it in, and install the bolt before the glue sets. In this way, you can be sure it will be properly aligned when the glue dries.

The head of each bolt fits in the large-diameter recesses in the post. When you assemble the bed, cover the bolt head with a 1-in. dia. dowel, 1½ in. long, rounded off at one end. Don't glue the plugs.

Finishing—The bed must be painted to remain faithful to its model, as "Apolinère Enameled" began as a paint advertisement. Having sanded the surfaces smooth, paint on an acrylic primer undercoat. This will show up the flaws in the wood surface; fill these with plastic filler and sand smooth. After a further coat of primer, finish with two coats of brilliant flat white enamel. Daw rejected gloss paint because he wanted to suggest that the child had come across a rather plain white bed and had decided to brighten it up with her glossy Sapolin enamels. Enamel paint was, of course, used to paint the bars.

Putting a mattress on a solid base is an unhealthy practice leading to damp beds—air must be allowed to circulate under the mattress. Daw rested 1-in. by 1½-in. slats in the rabbets on 5-in. centers and tacked strips of webbing along each side to join them together. When selecting a mattress, check that it is suitable for use with a slatted base. □



BILL OF MATERIALS

Description	No.	Size
Headboard and footboard:		
Corner posts	2	5 x 5 x 43
Corner posts	2	5 x 5 x 33¼
Discs	4	1 x 6½
Balls	4	5 x 5 x 5
Top rails	2	2 x 9 x 33¼
Bottom rails	2	3 x 4 x 33¼
Upright bars	5	38 x 1¾ dia.
Upright bars	5	28 x 1¾ dia.
Hardwood dowels:		
for corner posts	4	4 x 1 dia.
for upright bars	10	3¾ x ¾ dia.
Side rails and slats:		
Rails	2	3 x 4 x 80
Plugs	4	1½ x 1 dia.
Slats (hardwood)	14	1 x 1½
Threaded steel bolts	4	8 x ½ dia.
Tapped steel blocks	4	1 dia.
Webbing and tacks		

All parts are pine, except where noted. Measurements are given in inches.

Drawings: Hayward Art Group (Alison George)

Clearing the Air

A low-tech way to ventilate the small shop

by David W. Carnell

Airborne wood dust and toxic finishing vapors are less visible shop hazards than the snarling machines that can devour a finger. These substances are easily overlooked, yet they pose an equally serious health risk. They're dangerous to breathe, but it often takes years for the damage to show. If conditions are wrong, they might also cause an explosion.

Shop ventilation is the obvious solution to the dust and vapor problem. A good system should change the air often enough to dilute airborne-contamination concentrations to safe levels, leave as few stagnant areas as possible, and carry contaminated air away from workers to an exhaust fan. This kind of ventilation system, if set up effectively, minimizes the need for uncomfortable respirators.

The ideal air-cleaning system is actually several systems: local collection at each dust-producing machine, local exhaust fans in finishing and sanding areas, and a general exhaust setup to remove the dust and vapors that elude the other systems. The expense of the ideal system, however, forces most of us to compromise.

In a small shop where operations vary throughout the day, a general exhaust system is a good all-purpose solution. You don't need to spend a fortune on fancy equipment to get an effective general exhaust system. It can be as simple as an exhaust fan at one end of the shop and an air intake at the other.

Fans are rated by how much air they move, in cubic feet per minute (CFM). Here's how to find the size fan you'll need: Divide the shop volume (length times width times height equals volume in cubic feet) by 6 to find the fan rating in CFM required for 10 changes per hour; divide by 3 for 20 changes. For example, a shop with a volume of 1200 cu. ft. needs a fan rated at 200 CFM for 10 changes per hour, at 400 CFM for 20 changes per hour.

You can buy a commercially made industrial-size exhaust fan. Or you can hold down cost by using a window fan or a bathroom or kitchen exhaust fan instead. Since these are powered by shaded-pole motors that don't have brushes or internal switches, they don't produce sparks that could ignite fumes.

Window fans are good if they exhaust directly to the outside and move enough air to provide 10 to 20 air changes per hour for your shop. Bathroom and kitchen exhaust fans can feed into ducts to the outside that are up to 10 ft. long, but if you must use a longer duct, you'll need a centrifugal blower that develops enough power to overcome the pressure drop in the duct. These centrifugal blowers are often available from mail-order surplus houses at less than the retail price. A duct should be at least as large as the discharge opening on the blower. The duct should also be as straight as possible, since every bend will increase the pressure drop, and reduce the efficiency of the blower. The blower from a hot-air furnace or a central air conditioner (typically, 750-CFM to 1,000-CFM) can ventilate larger shops. Check heating and ventilation contractors for low-cost blowers from junked equipment.

Another requisite is an air intake large enough to supply the air that the exhaust fan is supposed to move. In its simplest form, this can be a hole in the wall, covered with a furnace or air-conditioner filter to keep outside dust from entering the shop. In most climates, though, incoming air must be heated in the winter. An electric space heater placed in the intake airstream will help some. Commercial air makeup units are available, but they're expensive: $500 to $700 for shops under 1,000 cu. ft. These draw outside air over a self-contained heating element before blowing it into the room. The type most practical for a small shop has electric-resistance heat, but gas- or oil-fired units are also made. If your shop is connected to a house that has steam or hot-water heat, you could place a radiator or a convector over the air intake. If you don't want to buy a heater, you can reduce the amount of heat you lose by running the exhaust fan only occasionally, when you're actually producing dust or vapors.

For thorough ventilation, it's best to make the air flow through the long dimension of the shop, so place the exhaust fan and the air intake at opposite ends of the shop, or at opposite corners of the long diagonal, as shown in figure 1. The exhaust fan should be located high in the shop wall; the air intake, low.

Check your ventilation system with a homemade smoke generator: Put two small plastic or paper cups side by side in a holder that can be moved around the shop without spilling, like the one shown in figure 2. Put two tablespoons of household ammonia in one cup, and the same amount of concentrated hydrochloric acid in the other. Swimming-pool supply houses and chemical supply houses sell concentrated hydrochloric acid (36% to 38%). Be careful, though. This acid is dangerous to handle, and eye protection is a must. Don't allow the ammonia and the acid to come in contact with one another, or they will react violently. The fumes coming from the two cups, however, will react to form voluminous white clouds of ammonium chloride that will show you how the air is flowing. Testing the airflow produced by your ventilation system is the only real check of how well it performs, so run the shop equipment and move about to simulate working in the shop. You may have to relocate your dust- and vapor-producing operations so that the contaminated air will be drawn away from the worker, toward the exhaust fan. When you're done testing, dispose of the ammonia and the acid separately, before they have a chance to spill or to eat through the cups. I suggest that you flush them separately down the toilet, or pour them separately down the drain, running lots of water after disposing of each.

Flammable dusts and vapors can, and do, create potentially explosive atmospheres in industrial operations. But it's unlikely that home workshops or small woodworking shops could develop the conditions required for such large-scale, room-sized explosions—you'd be driven out by the irritation

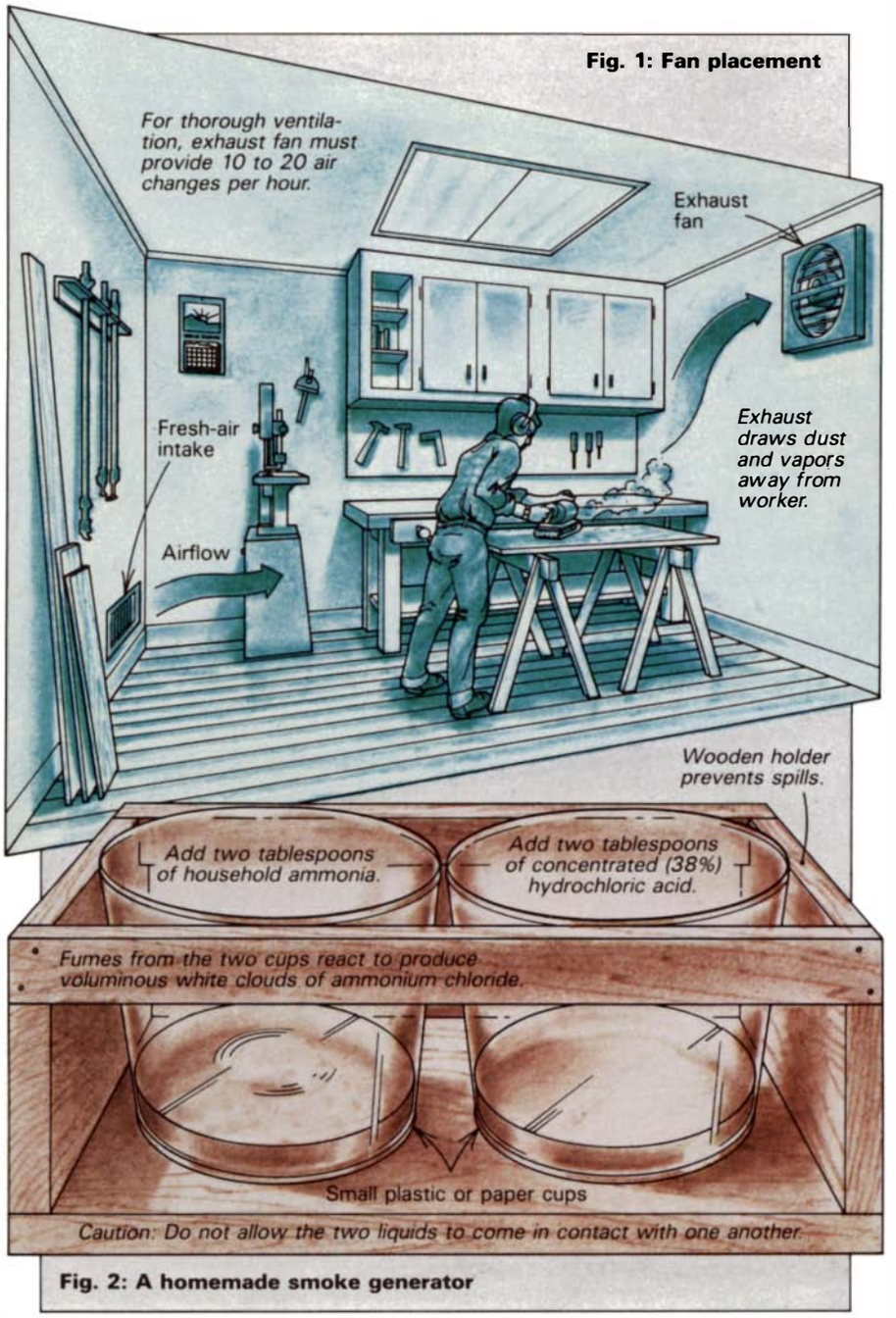


Fig. 1: Fan placement

Fig. 2: A homemade smoke generator

Sources of supply

Exhaust fans: McKilligan Industrial & Supply Corp., 435 Main St., Johnson City, N.Y. 13790; and Brodhead-Garrett Co., 4560 E. 71st St., Cleveland, Ohio 44105.

Centrifugal blowers and electronic cooling fans: Surplus Center, 1000-1015 West "O" St., PO Box 82209, Lincoln, Neb. 68501.

Flexible hose for ducts: Abbeon Cal, Inc., 123 Gray Ave., Santa Barbara, Calif. 93101.

Electric, gas-, or oil-fired air makeup units: Air Economy Corp., PO Box 29, Flemington, N.J. 08822.

Electronic air cleaners: There are two general types of units. *Electrostatic precipitators* contain a blower that draws dust-laden air over a high-voltage grid, where dust particles receive an electrical charge. When the charged particles pass over a collection plate with the opposite charge, they stick fast. Clean air blows out the other end of the unit. Units that are large enough for woodshop applications cost $2,000 and up. These are available from United Air Specialists, 4440 Creek Rd., Cincinnati, Ohio 45242; and Paxton/Patterson, 5719 W. 65th St., Chicago, Ill. 60638.

Negative-ion generators disperse negative ions into the air. The ions impart a negative charge to airborne dust particles, and the charged particles fall to the floor, where they can be swept up. ESI/APSEE units cost $595 and up, and are available from Electron Sciences, Inc., 3916 Riley St., San Diego, Calif. 92110.

before concentrations got that high. Flammable concentrations of vapors are 20 to 100 times higher (depending on the chemical) than the permissible exposure limits set by OSHA. The really fine dust from sanding operations is the only shop dust capable of forming an explosive mixture in air, but it has to be present at a concentration of 1 gram per cubic foot. It would take almost 2 gallons of airborne dust to reach that concentration in a 10-ft. by 20-ft. by 8-ft. shop.

It is possible, however, to have localized explosions. The many fires caused by solvent-based adhesives (such as contact cement), flammable finishes, or gasoline used indoors for cleaning (which is extremely dangerous) are examples of localized flammable vapor concentrations. Because the vapors are heavier than air, they collect near the floor, and they can be ignited by any spark or flame. Most gas-fired furnaces and water heaters have pilot lights that burn continuously, and these are especially likely ignition sources because the small draft through them draws the flammable mixture along the floor and ignites it. These pilots are also out of sight and easy to overlook. Frequently, the vapors flash back to the solvent container and set it afire, too. Oil burners, sparking electric motors, lit cigarettes, even static electricity can ignite the vapors. Tool and machinery motors are all spark producers, as are most switches, except the mercury type. But none of these presents any hazard in a shop with good housekeeping and adequate ventilation.

Dust accumulation on shop motors that is dislodged when the motor is sparking can ignite and flash, so it's a good idea to regularly vacuum motors. If you dispose of sawdust by tossing it into a shop stove, you're inviting a violent combustion. It's better to put the sawdust in the trash can, or use it to mulch the garden. □

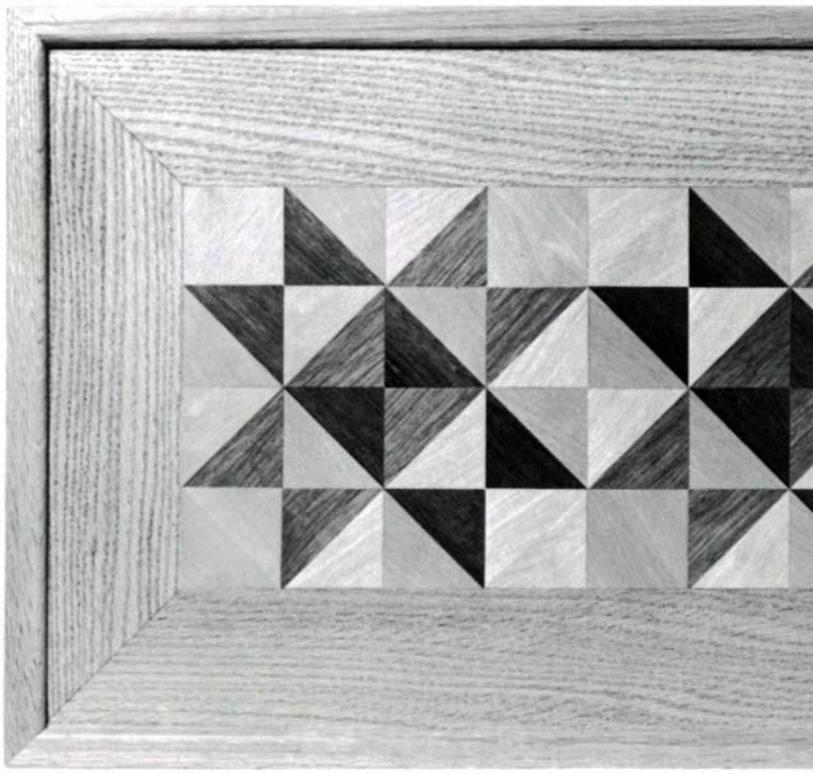
David W. Carnell is a chemical engineer, now retired, and an amateur woodworker. He lives in Wilmington, N.C. *For more on chip and dust collection, see* FWW #12, *pp. 76-78, and #25, pp. 58-59. For information on respiratory hazards, see #41, pp. 36-39.*

Drawing: David Dann

Patchwork Marquetry

Fancy wood, plane geometry

by Mike Peck



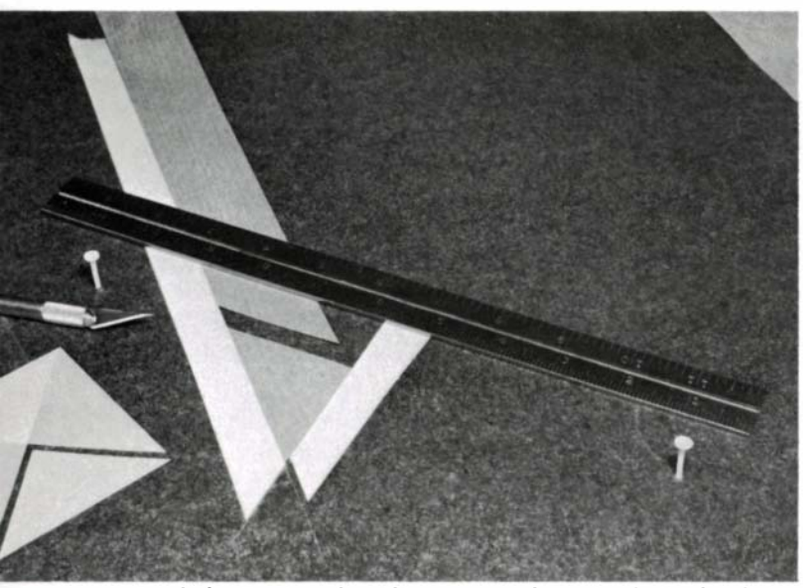
Some of the world's most beautiful woods are available only as veneers, and patchwork marquetry is a good way to show them off. These geometric patterns are copied from traditional American patchwork quilts, so any quilt-pattern book is a good place to look for designs. For the small tables and trays that I make, I glue patchwork marquetry to a hardwood-plywood substrate. The techniques I'll describe can be adapted to make decorative panels for many other projects as well.

The designs are created by repeating a simple geometric motif—a triangle, diamond or other polygon—called a design element. With veneers chosen for color and contrast, and variations in the grain direction, the same pattern can range from soft and subtle to flashy and colorful. The possibilities are endless.

To make my patterns, I borrow a quiltmakers' time-saving trick: in assembly-line fashion, quilters cut out the design elements in advance, and later group them together to make the pattern. Instead of stopping to cut each piece individually, I can draw from a stockpile of pre-cut, interchangeable pieces. This way, when I'm putting the design together, I can concentrate on selecting triangles for color and texture.

The design element I use in my tables is a 45° right triangle cut from 1½-in. wide strips of ⅛-in. thick veneer. You can use any type or thickness of veneer, but to minimize sanding, make sure that all the veneers in the same project are about equal in thickness. The size of your design element will determine the finished size of your pattern.

On graph paper, start by laying out your pattern to determine the total number of pieces, the overall dimensions, and how many species of veneer you'll need to get the effect you want. Next, cut the veneer into strips. To avoid this step, you can use plywood-edging veneer tape, which is sold in ¾-in. to 2-in. widths. It's available at many hardware stores, or by mail from The Woodworkers' Store (21801 Industrial Blvd., Rogers, Minn. 55374) or Constantine's (2050 Eastchester Rd., Bronx, N.Y. 10461). If you want thicker or more exotic veneers, you'll have to cut your own strips. I use the tablesaw jig shown in the box on p. 64 to cut my own strips.



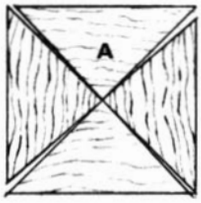
Stacked-up strips of masking tape make a simple jig for slicing 45° right triangles from a strip of veneer. The tape strips form two sides of the triangle; the steel rule, placed across the two nails, forms the third. Adjust the jig by moving the nails.

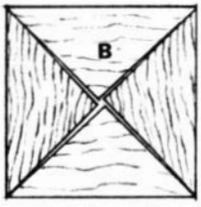
To cut the 45° right triangles from a strip of veneer, you'll need to make the simple masking-tape jig shown in the photo at left below, or you can duplicate the radial-arm saw jig shown on p. 64. To make the masking-tape jig, stick four 10-in. long strips of tape, one on top of the other, to a hardboard or Formica base. With a razor-sharp X-acto knife guided against a steel rule, trim one edge of the tape straight. Hold the blade perpendicular to the work surface while cutting the tape. Next, lay four 3-in. long strips of tape at a 45° angle to the first strips, and trim in similar fashion. Accuracy is critical, so use a good-quality protractor or draftsmen's triangle. Now drive two brads or small nails into the plywood base so that when the steel rule is placed against them, the rule's edge will form the third side of a 45° right triangle.

To use the jig, lay a veneer strip against the longer strip of tape, hold the knife blade perpendicular, and cut a 45° angle on the end of the strip, using the rule as a guide. Never try to cut clear through the veneer on the first pass. Instead, use light pressure on the knife and make several passes. Now flip the strip over and slide the cut end until it stops against the shorter stack of masking tape. Repeat the cut and you'll have your first triangle. Test the accuracy of your jig by cutting four triangles and forming a square with them. There should be no gaps. This is very important, since each small error will multiply itself several times over in the finished marquetry. If there are gaps near the outside of the four-piece square, as

The patchwork marquetry tray/table shown at left features the traditional 'Ohio Star' quilt pattern in oak, mahogany and birch veneers. To reinforce the show side of a marquetry sheet, tape along the seams of the triangles (above). Overlap the border strips at the corners to miter the veneer border (right). With a razor-sharp X-acto knife guided against a steel rule, cut through both strips at once.

shown at **A,** it means the rule is at an angle greater than 45° to the long strip of masking tape. If there are gaps near the inside of the square, as shown at **B,** the angle is less than 45°. Adjust the angle by repositioning the brads. Adjustment is easiest when the brads are as far apart as the length of your steel rule will allow.





When you've cut out enough pieces, assemble the design on a smooth, flat surface. Hold the triangles together at their corners with small pieces of masking tape. Tape only the show side of the triangles. It may be necessary to move some triangles around to distribute tiny cutting errors—it's almost impossible to make all the triangles fit perfectly. Since there is some elasticity in the veneer, small gaps can be narrowed by gently stretching the veneer to close them up.

Next, reinforce the veneer face by taping over the seams. Then flip the veneer over (taped side down) and use the knife against the steel rule to square up the edges of the sheet for the border, which can be veneer strips 2 in. to 3 in. wide, depending on your design. Flip the panel again (taped side up) and place the border strips around, overlapping the corners slightly. Hold the borders in place with masking tape and cut the miters, going through two border pieces at once. Remember to use light pressure and make several passes, cutting from the inside corner outward. Finally, tape the miters and the joint where the border meets the marquetry. At this point, your project is a flexible sheet of triangles with tape all over the good side and nothing on the backing side.

Hold the marquetry sheet up to a window or other light source and mark any gaps. Fill these with wood putty that matches the wood. Use the putty sparingly, and carefully scrape off any excess. Any putty or dirt caught between the veneer and the substrate will cause a bump that's easy to sand through. It's a good idea to bond some veneer pieces to a scrap of plywood and test-sand them to see how easy it is to sand through the veneer. If you know what an impending sand-through looks like, you'll know when to stop sanding before it's too late.

Next, glue the marquetry sheet to the substrate, which in my pieces is furniture-grade hardwood-veneer plywood. I know that it's recommended practice to veneer both sides of a panel to eliminate warp and movement, but I buck tradition and veneer only one side. So far, I've had no problems.

Although many veneering experts advise against it, I glue down the marquetry sheet with solvent-based contact cement. It works fine if you apply two coats. I recommend Weldwood Contact Cement. Follow the label instructions faithfully, and note the safety precautions—solvent-based contact cement is extremely flammable.

With a paintbrush or a short-napped roller, apply a uniform coat of cement to both the untaped side of the marquetty and the best side of the substrate. Wrap the brush or roller in aluminum foil while you're waiting for the first coat to dry (which takes about 20 minutes). The cement is dry when a light touch leaves no fingerprint. Apply the second coat, and when that's dry, recoat any dull spots. A properly prepared surface has a uniform, glossy appearance.

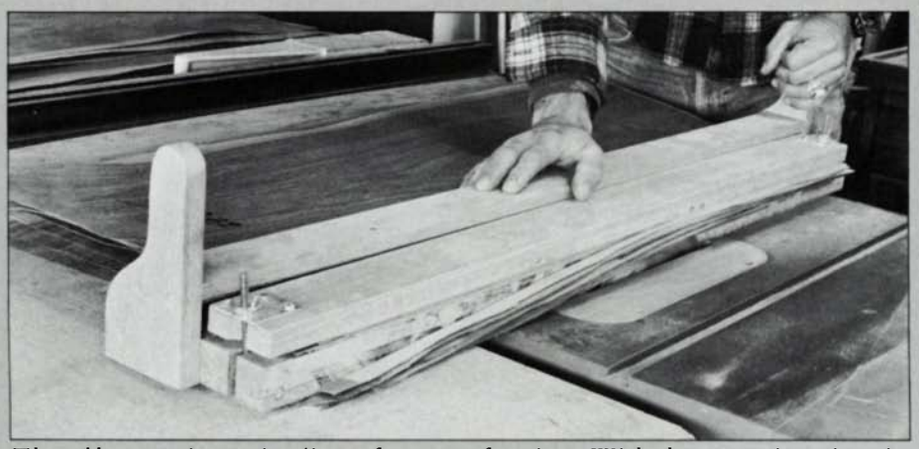
Now lay the marquetry sheet taped-side-down on the bench and place ½-in. dowels on the sheet around the edges at 90° to the borders. Invert the substrate panel onto the dowels, being careful to keep the glued surfaces from touching, because once they do, further adjustment is impossible. Align the substrate with the marquetry and slowly pull out the dowels, one at a time, to lower the substrate onto the marquetry. Roll over the entire surface with a wallpaper-seam roller to ensure a good bond. The masking tape can be peeled off now, but be careful to avoid lifting the grain of the veneer with the tape. Fill any remaining gaps with

Jigs speed veneer-cutting

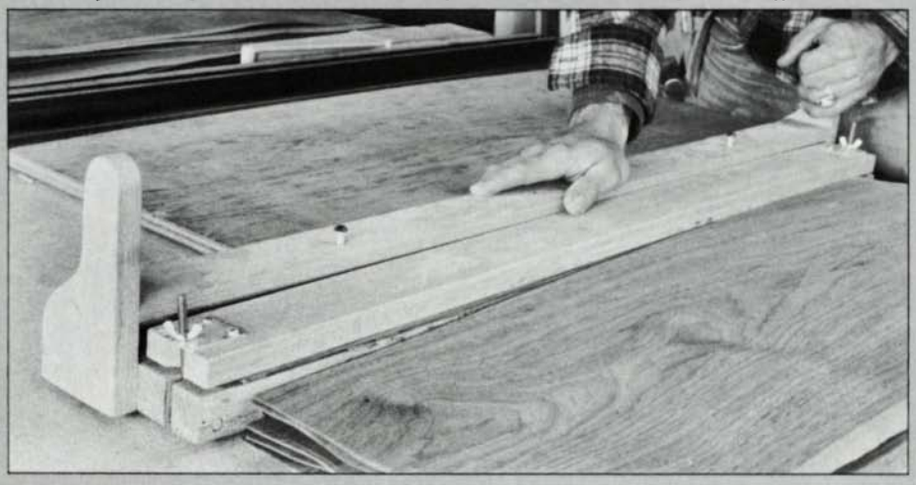
Because I produce lots of patchwork marquetry, I've made two jigs to mechanize the cutting. These jigs are handy for other veneer projects, too. One, shown at right, works on my tablesaw to cut strips of veneer from a large flitch. This jig can also be used for cutting thin stock that would be dangerous to rip on the tablesaw. The other, shown below, fits on my radial-arm saw and produces perfect triangles in large batches.

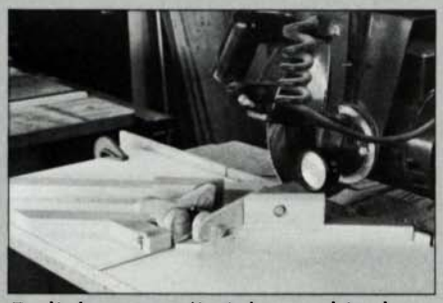
For power-cutting veneer, I use a 10-in., 200-tooth, thin-rim veneer cutoff blade, and I keep it very sharp. If the veneer is flat, I can cut about 15 sheets of 1/28-in. veneer at once. If the veneer is wavy or warped, I wet it first, then dry it in a press before cutting.

—*M.P.*

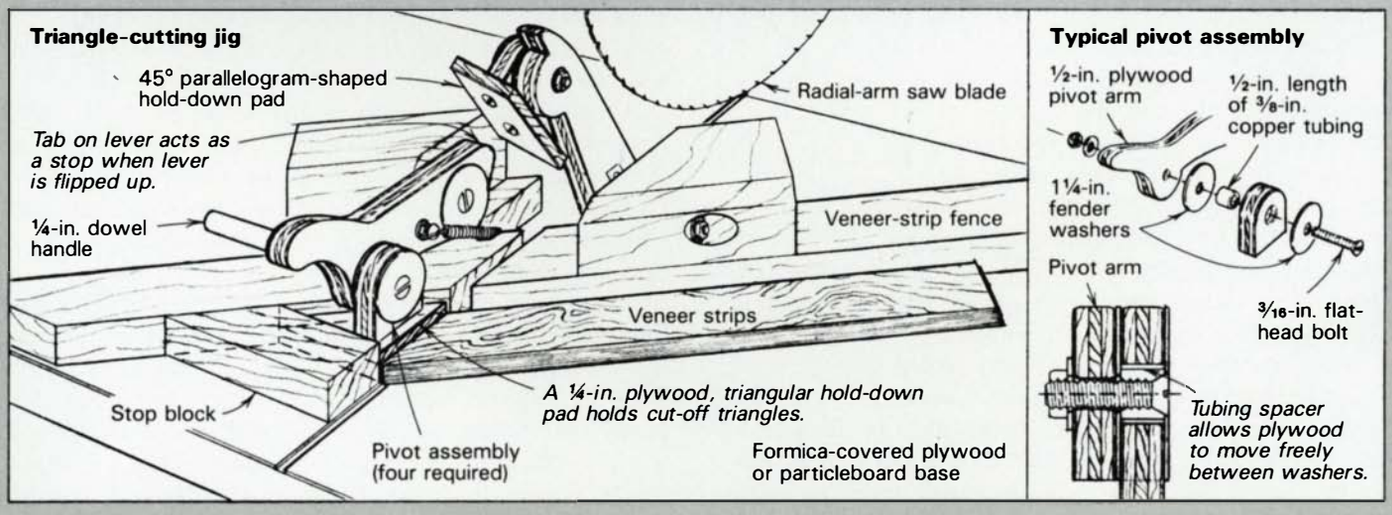


The tablesaw strip-cutting jig performs two functions. With the two registration pins removed (above), you can joint the edge of an entire flitch with one pass. The jig rides against a piece of plywood to allow room for the flitch. With the pins in place (below) and the jointed edge butted against them, you can rip strips. Strip width equals the distance from the pins to the blade. To vary the width, move the pins to different holes.





Radial-arm saw jig (above and in drawing below) produces triangles in quantity.



wood putty, and you're ready to finish-sand.

Before you actually begin sanding, scribble pencil lines over the marquetry. These serve as a reference to help prevent you from sanding through the veneer. Because the grain direction in patchwork marquetry runs in all directions, I just sand with an orbital sander and 220-grit garnet paper. Sand until the pencil lines are almost gone. Go slowly and inspect the surface frequently, especially if you're using thin veneers, such as plywood edging strips. Remove the last traces of pencil with finer paper. I follow up by buffing with 0000 steel wool. A tung-oil and varnish mixture makes a nice finish, but you can use any finish you like. □

Mike Peck designs and builds furniture and hardwood gift items in Atascadero, Calif. Photos by the author. For more on veneering, see FWW *#46, pp. 36-39, and pp. 37-41 in this issue. For more on marquetry techniques, see* FWW *#38, pp. 61-65.*

Water-Based Varnishes

How they compare to the old favorites

by Don Newell

Though you might not have heard of water-based "latex" varnishes, they've been around for about ten years. But they've been easy to overlook because they haven't been advertised very much. I decided to find out if these finishes are good enough to use on a valuable piece of furniture, and, if so, why I should choose one instead of a tried and true conventional varnish. I did some experimenting with different brands to see how well they performed.

Why make a water-based varnish? Two reasons: Brushes clean up in soap and water, as long as the varnish hasn't hardened; and, unlike conventional solvent-based varnishes, water-based materials don't pollute the air with hydrocarbons as they dry. Because these water-based formulas contain negligible amounts of organic solvents, they provide an alternative for woodworkers concerned about exposure to toxic conventional finishes (*FWW* #41, pp. 36-38).

The water-based clan are not varnishes in the traditional sense. With conventional varnishes, after most of the solvent has evaporated, the film begins to harden by first absorbing oxygen (a process called oxidation), then polymerizing: the molecules cross-link to form a hard film that, once dry, is no longer soluble in the original solvent. In contrast, water-based varnishes consist of a solution of film-forming polymers (usually acrylic resins) dispersed in a carrying medium of water. When the water evaporates, the dispersed polymer particles coalesce to form a coherent, protective acrylic film—much the same way that PVA glues cure.

Water-based latex varnishes, as a group, are still evolving. Some have come and gone, while others are still available. Both Valspar and PPG Industries, for example, marketed water-based products in the mid 1970s, but eventually withdrew them because they didn't perform well.

I bought a can of every brand of clear water-based varnish I could lay my hands on, which amounted to five: Sears Interior Latex Varnish, Deft Interior Acrylic Wood Armor, Flecto Varathane Ultra Plastic Finish, Fuller O'Brien Pen-Chrome Super-V Varnish, and Benjamin Moore VaquaKleer. As a benchmark for comparison, I used ZAR Antique Polyurethane Varnish, which is a conventional polyurethane. In general, the price of water-based varnishes is somewhat higher than that of regular varnishes.

All the water-based clears I tested contained about the same percentage of solids, a level considerably below that of their conventional counterparts. And all carried virtually the same directions on the can labels, such as the need to use nylon-bristle brushes or short-hair rollers to apply the material. Although the labels don't mention it, some manufacturers recommend spraying as an alternative to brushing.

I applied two coats of each brand on pine, walnut and mahogany boards, allowing the first coat to dry overnight before laying on the second. I tried to duplicate the brushing of an actual piece of cabinetry by applying the varnishes to both horizontal and vertical surfaces. It was under these real working conditions that I discovered the vast difference in workability between the brands. The Sears Latex and Deft Wood Armor were so thin-bodied that they brushed on like water, though they stayed on the surface with little apparent absorption into the wood. The Flecto Varathane, Pen-Chrome Super-V and VaquaKleer were thicker in consistency, and could be applied in much heavier brush coats, more like regular solvent-based varnish. Before attempting to do serious work with either of the runny varnishes (Sears Latex and Deft Wood Armor), it's a good idea to get the feel of them first. Initially, I found myself trying to load on too much varnish in an attempt to produce a decent film thickness. This was a mistake: heavily applied, the thin varnishes ran and sagged on vertical surfaces. When brushing these thin-bodied latexes, it's best to err on the skimpy side, applying several thin coats (allowing drying time in between) instead of one heavy coat.

Because of the lower solids content, you'll need about two coats of any of the clear latexes to equal the dry-film thickness of a single coat of regular varnish. Since water evaporates more slowly than volatile lacquer thinners, water-based mate-

Each brand of water-based varnish tested had its own brushing characteristics. Some were watery, others were much like regular varnish. Brushing all five brands on the same board allowed Newell to compare the quality of the films side-by-side.

rials don't quickly "flash" as lacquers do. But compared to regular varnishes, the clear latexes do dry quickly. The brands I tested dried to the touch in about one hour. With most, a second coat can be applied after two to three hours, though the first coat will still be somewhat soft. Thus, you can apply two coats in the time that it takes to apply and let harden one coat of solvent-based varnish.

These latex finishes contain about 70% water, and I discovered that every brand raised the grain severely when the first coat was applied. After this coat had hardened, I scuff-sanded the raised grain with 400-grit. No further grain-raising occurred with subsequent coats. Since wood finishers often deliberately raise the grain and sand off any whiskers before finishing (*FWW* #16, pp. 69-71), I don't consider this to be a negative factor.

According to the manufacturers of some of the varnishes, a water-based acrylic clear will not completely cure in less than two weeks. For the finisher's purposes, however, overnight is dry enough for doing about anything you want with the finish. After eight hours, I could wet-sand most of the films with 400-grit paper in the same manner as I would with a conventional varnish after it had dried overnight. I tried both water and mineral spirits as a sanding lubricant, with equal results. After wiping off the sanding slurry, I polished with a fine, white automotive polishing compound, and most of the finishes polished out well. None of the labels mentioned this technique, but I recommend at least wet-sanding to remove brush marks and dust specks.

Though all the varnishes except the Flecto Varathane contain acrylic-resin polymers—the Varathane is an oil-modified, water-soluble polyurethane—I found that each brand has its own characteristics.

Sears Interior Latex Varnish: Thin and watery when applied, this product dried to a hard, even film with few brush marks. The dry film, however, was dead flat in appearance and hid much of the wood's figure. Polishing removed the brush marks, but didn't do anything to help the lackluster surface tone. I wouldn't recommend this one.

Deft Interior Acrylic Wood Armor: Another extremely thin, runny material, this finish produced a film that showed brush marks, and that was uneven and wrinkled where heavily applied. These surface flaws were too deep to sand out. Thus, I found Wood Armor's performance unsatisfactory.

After I reported the test results on off-the-shelf Wood Armor to Deft, they sent samples of a new, experimental Wood Armor, in both glossy and satin finishes. The experimental Wood Armor brushed well (though Deft recommends the use of a foam-brush applicator, which I didn't try) and built an excellent film. It dried without wrinkling, and the finish had a first-rate appearance. Sanding and polishing removed tiny imperfections, but dulled the gloss. Deft won't specify a date, but if and when this new varnish becomes available, it will be one of the best of the water-based latexes.

Flecto Varathane Ultra Plastic Finish: This product is a water-soluble form of polyurethane which brushed and handled much like a conventional varnish. Flow was good, with almost no brush strokes in the dry film. While this varnish eventually dried to a very hard film, complete curing required several days instead of the average overnight drying time. When I checked with Flecto, they told me that the particular lot I had purchased was quite moisture-sensitive, resulting in a prolonged drying time. A newer lot presently on the market apparently doesn't have this problem.

Fuller O'Brien Pen-Chrome Super-V Varnish: This finish, which contains some polyurethane in addition to acrylic resin, appears to have everything going for it. It brushed like a conventional varnish, leaving only a few brush marks, and had a good film build. It wet-sanded and polished as well as the ZAR polyurethane varnish I used as a standard. Of the varnishes tested, this was my favorite.

Benjamin Moore VaquaKleer: This material brushed very easily, appeared to produce excellent film build, and gave good flow with few apparent brush marks. Drying time seemed a bit longer than that needed for the other acrylic materials, especially the Pen-Chrome Super-V and the experimental Wood Armor.

* * *

In general, except for the flat-drying Sears Latex and the wrinkle-prone Wood Armor, the water-based varnishes I tested performed satisfactorily. After final-polishing, it was impossible to distinguish the better ones from a conventional varnish finish. They also seem about as tough as ordinary varnish, and I believe they'll hold up as well. I found that scratches could be easily touched up.

To test durability, I applied a drop of ethyl alcohol to the hardened film, to simulate a spilled alcoholic drink. A distinctive ring remained on every one of the water-based finishes after the alcohol had evaporated, though the Flecto Varathane was less severely marked than the others. I also tested all the finishes by leaving a wet glass full of water on the surface for five hours. Each finish exhibited some whitening and dulling, especially under the outer rim of the glass. After the glass was removed and the film allowed to dry overnight, however, all the finishes returned to a nearly normal appearance, but the ring mark was still clearly visible.

I didn't conduct any heat-resistance tests, but acrylic resin is thermoplastic, and these finishes probably won't resist marking from a hot pan or cup as well as a conventional varnish will.

Because these products contain such a high percentage of water, I ran a separate set of tests to measure how much water actually remained in the wood after the finish had dried. The results showed that the application of a water-based varnish increased the wood's moisture content less than 1%. As these finishes introduce a lot of water into the wood surface when first applied, however, I don't recommend that you use them on veneer or on very wide, thin boards—the wood is liable to warp.

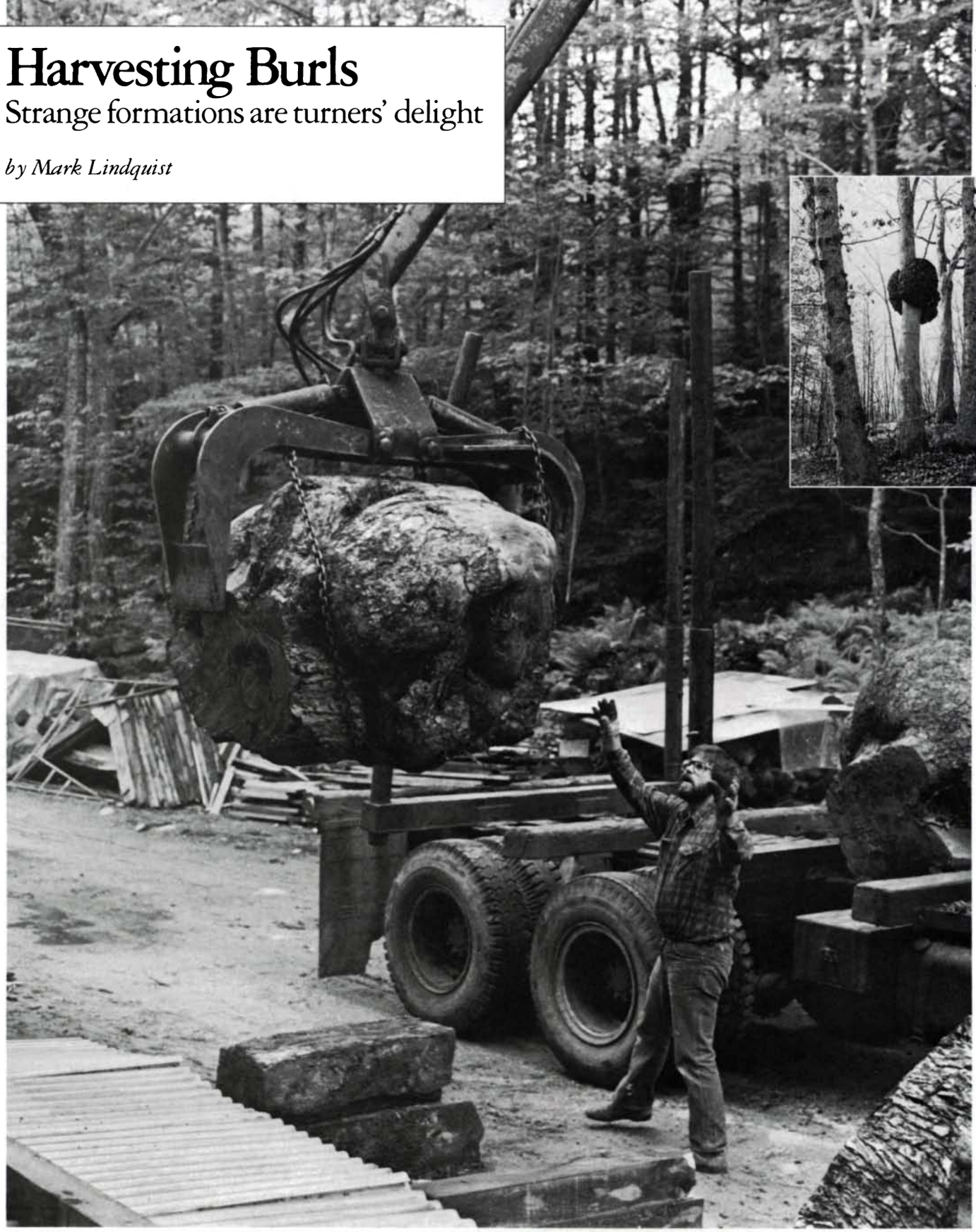
Despite the excellent results I got with the Fuller O'Brien Pen-Chrome Super-V, for serious finishing work I still prefer conventional lacquer or varnish. As a group, the old standards offer a wider choice of properties (e.g., the chemical resistance of polyurethane). From a performance standpoint, there isn't anything that the water-based varnishes can do better, except keep hydrocarbons out of the air. □

Don Newell is a finishes chemist and consultant who lives in Farmington, Mich. Photo by the author.

Harvesting Burls

Strange formations are turners' delight

by Mark Lindquist



Kathy Lindquist

Bill Byers

Lindquist positions a gigantic yellow-birch burl in his woodlot for seasoning. Burls of this size (which can almost engulf a trunk, as on the ash tree in the inset photo) are difficult to move without the aid of professional loggers and special equipment.

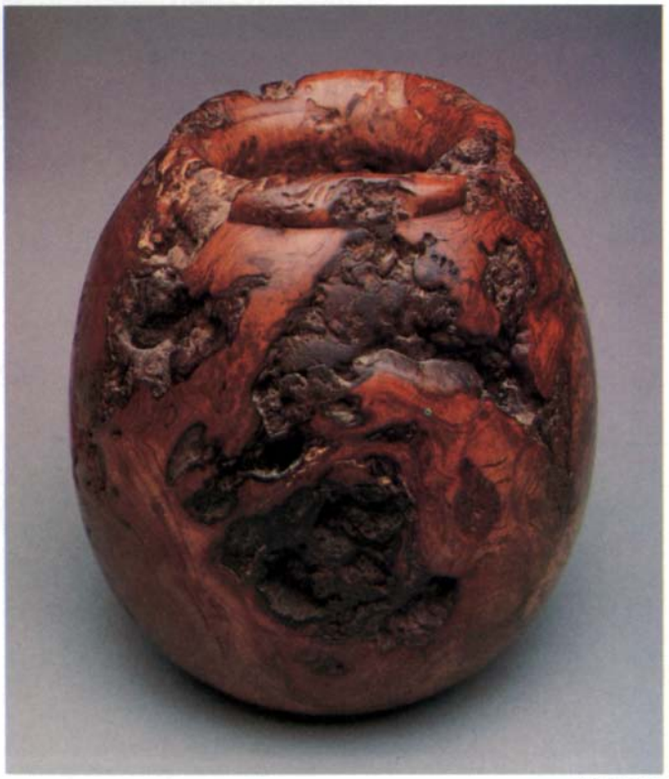
Burls are perhaps the most misunderstood and mysterious material in the woodworker's realm. Most woodworkers and suppliers who use these strange, unpredictable organic formations have very little idea of how they grew or what caused them. And, although burlwood has long been prized for veneer, lumbermen and forest pathologists trying to produce straight and sound stock for the mass-production lumber industry have always regarded the burl as an enemy and a nuisance. But I find burls to be an extremely rich source of material for sculpture and turned and carved bowls, and, most importantly, an inspiration for discovering new philosophies and approaches to woodturning.

Burls are protuberances on a tree that come in all shapes and sizes. They are known colloquially as "burrs," "bumps," "knobs" or "gnarls," and scientifically as "galls." A burl may be a perfect half-sphere on the side of a tree, or look like a

Kathy Lindquist

Bill Byers

Burls come in all shapes and sizes. Shown above are burls from 16 different species, including walnut, hornbeam, ash, beech, spruce, mulberry, birch, cherry and oak. Lindquist chainsaws bowl blanks from rough burls (left), visualizing the final form inside the burl. Notice the burl's layered structure. Below, the chaotic grain of a wild-cherry, dormant-bud burl struggles with a lathe-smooth surface. Linquist's father, Melvin, turned the piece, called 'Ancient Ceremonial Form Translation,' in 1974.



Robert Aude

wreath surrounding the tree, especially if it grows leaves on short stems. Burls may be irregular, twisted and malformed; surfaces may be smooth, or rough and fissured. A burl may grow halfway around the trunk, creating a half-moon that makes a beautiful carved bowl, or along one side of a tree, or sometimes all the way up and around the entire trunk.

Burl forms offer many sculptural possibilities. Some burls are quietly round, whether shallow or deep, definitely suggesting a bowl. Others are twisted and convoluted, evoking a sense of animation. No matter how much energy shows on the outside, though, it is no clue to the incredible explosion of energy inside—a swirling, frozen pot of marbleized color, texture and structure, creating patterns too complex to understand or predict. It is one of nature's amazing mysteries—the starry galaxy within is greater than the form containing it.

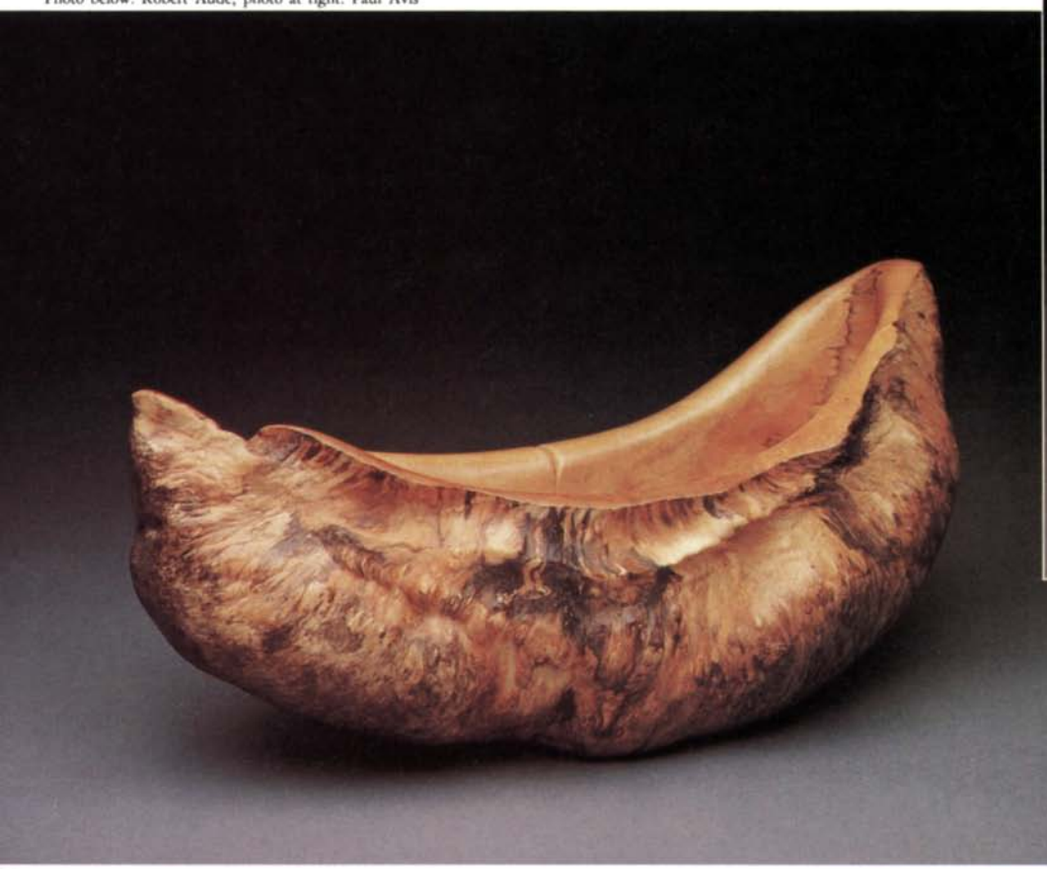
A burl is not a healing over of a broken-off branch, but an irregular growth. Burls are often caused when fire, frost or something hitting the tree injures the cambium, which is the growth layer near the bark. (Interestingly, when trees are repeatedly burned on one side, they form burls on the opposite side.) Fungal or bacterial irritation of the cambium also causes burl formations, particularly the more gnarly, rough-barked ones. Some scientists suggest that a mutation or a hereditary factor, combined with environmental conditions, is responsible for burl growth. This might explain why several trees of the same species growing in a particular area (which quite likely are related) may all grow burls.

Burls generally are divided into two categories: root burls and above-ground burls. Root burls (called "crown galls" by scientists) are caused by bacteria, which possibly entered damaged areas of the tree from infected soil. These formations tend to be softer than above-ground burls because they develop within a controlled atmosphere of soil and water. Usually a large, round ball will form at the base of the trunk, and the roots will grow out of the burl.

Root burls, like above-ground burls, may occur on any tree. They form on cherry, white birch and gray birch in the East, and are extremely common in California on redwoods and manzanita. Redwood root burls may grow to be 12 ft. in diameter, nearly too big to handle. Most of the redwood "burl tables" made in California are constructed of root burls with extraordinary grain and pattern.

On the East Coast, maple and cherry commonly exhibit above-ground burls. Next in prominence is the birch family, then oak, followed by elm, beech, ash, butternut, hornbeam and poplar. Soft-wood burls are rarer, and not as interesting in grain-pattern development, nor will they take as high a polish as the hard-wood burls. California redwood and buckeye burl are exceptions, since they have magnificent grain patterns, although they do not take a high polish.

Photo below: Robert Aude; photo at right: Paul Avis



Lindquist worked the 12-in. long layered maple burl shown at left with a chainsaw, gouges, a die grinder, rifflers, rasps and foam-backed abrasive discs. Its oil finish is buffed with a tripoli/animal-fat-based compound. The piece, called 'Vessel Vessel/Arc Ark,' was made in 1978. A cherry burl yielded the 18-in. high turned bowl above. The burl contains layered and bud formations as well as bark.

An above-ground burl may grow at any height on a tree, on the trunk or on a major branch. Occasionally, more than one burl will grow on a tree, and when this occurs there are usually quite a few. The most exciting burl find is the "burl tree," a tree whose trunk has been entirely encompassed by burls growing into and around each other, forming a giant mass of burl growth and grain. Most burl trees I've found have been elm, maple or white birch.

Within the infinite variety of burl-grain development are three main classifications: annual layering, end-grain budding, and a combination of these two growth patterns. In annual layering, the burl grows in much the same pattern as the tree, though much more rapidly, adding a thicker layer than the tree, causing the bulging and swirling form of the burl. Successive layers within a burl will display inconsistencies in thickness, with thicker layers toward the center of the burl rather than nearer the supporting trunk or branch. Where the burl "hangs" from the tree, there is even apt to be a crotch-wood formation in cell growth of the burl for support.

Compared to straight-grained wood, layered-growth burls display remarkable beauty and complexity of color and configuration, yet their grain is subtle compared to that of the spectacular burls formed by the end grain of dormant buds.

Dormant-bud burls form through an explosion of early bud development that never quite makes it through the bark. All the buds shoot and clash within, causing more shoots to get started and early ones to become dormant. The buds never get past the stage of early development, growing more in width than in length, causing hard, dense wood. This type of burl is most prevalent in cherry and walnut, and also occurs in certain elm, maple, oak and white birch species.

The third classification, which I call "swirl-eye" burl, is a combination of the other two. Often these are the most complex of all burl formations, especially when the patterns are balanced. Imagine that the first two classifications were melted together, then stirred and frozen. The dormant buds, or "eyes," are mixed in with the rest of the swirly grain.

After working with hundreds of burls during the past 15 years, I know that some grain patterns frequently recur within a given species. Yet on cutting into a new burl, I can still be surprised by an entirely new configuration.

Here are a few clues about where to look for burls. Although burls may grow on trees in any terrain, usually the hilly, rocky, heavily wooded areas of mountainous regions yield the most. An individual tree may give signs of burl formation—a gradual change in bark formation, for example, or a gentle widening of the trunk, indicating that a burl is growing on the other side. If you find a burl, keep looking nearby—burled trees sometimes proliferate in certain areas.

Perhaps the most difficult problem in obtaining burls is getting permission to take them. You usually can hunt down the owner of the land on which the trees you are interested in are growing and strike some sort of agreeable deal. Often I've traded small pieces of finished work for larger burls or lots of burls.

When I find a burl in the woods, I consider its quality, its distance from a usable road, cutting problems, and what I am willing to pay. Any woodworker who has harvested a big burl far from a road will probably not do it again, remembering the pain and difficulty of that first deep-woods encounter. One solution is to cut the burl in the fall and leave it in the woods until winter, then haul it out on a toboggan pulled by a snowmobile. Purists may take exception to cutting a burl or a tree during any time other than winter. I prefer the fall, as it

is the best time to find burls because the trees are shedding their leaves—it's also the nicest time to be working in the woods. After years of searching for and harvesting big burls in this old-fashioned way, I've begun to buy them from local loggers, who frequently find them and are equipped to fell them and pull them out. Town dumps are often surprising sources, as are tree-removal services and tree surgeons.

A burl can be removed either by cutting it off the tree, or by cutting down the tree and then removing the section with the burl. If possible, I prefer the former because it eliminates dealing with the branches and other wood of a downed tree. Also, the tree normally lives on after the burl is removed, often becoming healthier. Don't paint the cut—it will dry up, and the tree will gradually grow around and over the wound.

A burl is best cut close to the trunk, as nearly parallel to the trunk as possible. Deep, gouging cuts into the tree are pointless when the best use of the wood is achieved by a clean, straight cut, leaving a neat area on the tree. You will always leave some good burled wood in the tree, but the only way to get it all is to cut down the tree.

When I do cut down a tree, I try to leave a foot or so of trunk on each end of the burl so that as the log dries, checks won't telegraph into the burl. Often the burl will dry better and is less apt to check if left this way for several years.

Drying and storing burls can be as uncomplicated as piling them outdoors or as sophisticated as packing them in layers of sawdust. When cut green, burls usually are very heavy, laden with water. Some woodturners prefer to use green burls. Burls turn most easily when wet, but will warp and twist as they dry. Green burls may be stored under water over a period of time, which prevents drying. Blanketing them in wet sawdust retards checking, promoting slow, even drying.

I prefer to work dry, aged, mellow burls—checks and all. My philosophy of woodworking acknowledges the nature of the material, which is to expand and contract. I allow for the inclusion of checking within my designs, by either accepting

Tips for turning irregular pieces

by Rude Osolnik

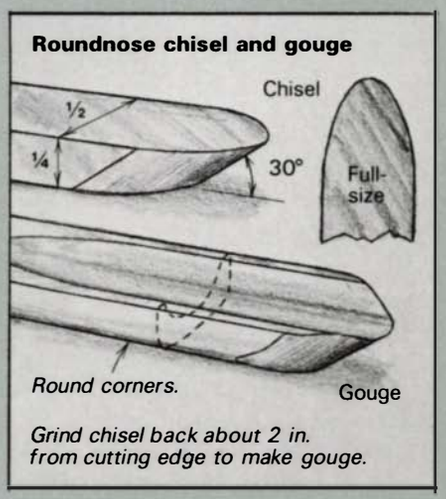
About thirty-five years ago, I started turning irregularly shaped blocks of wood because I had a good source of supply, and because of the challenge and the distorted, discolored grain. I've turned bowls, trays and weed pots from burls and spurs (where a tree root makes the transition from horizontal to vertical), as well as from found wood—chestnut fence rails, oak wagon tongues, just about anything.

I've found that a heavy lathe is crucial when turning irregular pieces. A large, off-center blank, 3 lb. to 15 lb. out of balance, will shake a light lathe apart before the piece can be trued. A heavy bed, preferably of cast iron, will absorb the vibration. Anchoring the lathe with bolts, sandbags or heavy metal bars will also help (*FWW* #25, pp. 80-81, and #41, pp. 48-53).

I turn pieces up to 12 in. in diameter on an 800-lb. Oliver lathe. Even though the lathe is bolted to the floor, I sometimes wedge 2x4s between the bed and ceiling for extra support. For larger pieces, I use a 2,000-lb. metal-spinning lathe with a 13-in. swing over the bed.

Lathe speed is less important than the speed of the block at its periphery—the larger the diameter, the slower the speed should be. In general, I turn pieces up to 12 in. at 1200 RPM to 1800 RPM, and larger blanks at 700 RPM to 800 RPM. For blanks up to 24 in. in diameter, my big lathe turns as slowly as 150 RPM.

Before mounting an irregular turning blank on the lathe, you should trim, balance and shape the general form on the bandsaw or with a chainsaw. Bowls



and trays are best mounted on faceplates. A weed pot or other turning where only the outside is shaped can be mounted between centers.

If there is enough waste material on the blank, or if the bottom won't be seen, screw the faceplate directly to it, using long, heavy screws. If you need a backing block, attach it directly to the blank with a strong glue such as Titebond. (Paper placed in between can separate.) Make the block thick—2 in. or more—so that you can work on the bottom without interference.

You can give a faceplate-mounted, deep bowl blank added support by embedding the tailstock center in the face of the blank. If the blank is very irregular even after you've trued the outside, you can leave a column of wood in the center attached to the tailstock while you shape the inside. After the bulk of the wood has been removed, cut off the column and finish the inside bottom surface.

I make all my turning tools, and I do most of my turning with a heavy ½-in. wide by ¼-in. deep roundnose chisel. Most people use this tool for scraping, but by grinding a long bevel on it, I can get the shearing cut usually associated with a skew chisel. The bevel, which is about 30°, rides the surface and supports the cutting edge, which can then take a smooth shaving. I also made a small, shallow gouge by grinding a groove in the top surface of a roundnose chisel, and I use it to take fine finishing cuts.

Truing up the odd shape of the rough blank is the hardest part. Once the blank has been trued and balanced on the lathe, it can be turned much like any other piece. Because of the irregular shape of the blank, the tool's cutting edge leaves and reenters the wood with every revolution of the lathe, increasing the chances of catching. Obviously, a steady tool rest and firm hand are essential.

Position the rest as close as possible to the blank. Be careful to stand to one side, out of the path of flying debris, particularly when turning burls. Remove the high spots with shallow cuts, moving the tool rest as you go to keep it close. Pay strict attention to where the edge of the work actually is. I watch the back edge where the stroboscopic effect shows the outline of the highest points most clearly.

As the tool makes more contact with the surface, you can take heavier cuts. For truing, I use a cut that is halfway between scraping and shearing. Posi-

the crack as it is, or working it open to relieve its jaggedness. I like the spontaneity of working the dry burl and being able to finish the piece, knowing it will move or shrink very little from its finished dimensions.

When I harvest burls, I usually leave them uncovered outdoors, sitting directly on the ground, for maximum exposure to the elements. Most begin staining and spalting, and I find the resulting colorations desirable. Yellow birch burls, for example, are relatively bland, but become utterly spectacular when colored or spalted.

It's a good idea to either mark the species and date of cutting on the burl, or store specific kinds of burls in separate piles so that they will all dry together. Painting of the sawn surfaces will discourage checking, but it also prolongs drying. I'd rather let the burls sit and let nature have its way. Since the grain is so twisty and gnarly, often the burls dry without checks, or with very few, which can be accepted, or cut out by dividing the burl along the cracks into smaller, usable sections.

After exposing the burls to the weather for a year or two, I move them into an open-air shed, build a lean-to over the pile using corrugated transparent roofing, or simply cover them with plastic. When the burls have sufficiently dried, they must be stored up off the ground, preferably away from sunlight. I pile them one on top of the other in my barn. Due to their various unusual shapes, this storage is awkward and cumbersome, as well as inefficient. I've built shelves and racks, but haven't solved the problem yet.

Like spalted wood, burls are abundant for those possessing the knowledge of their worth. These strange formations offer more than oddity or novelty for the woodturner, more than their hidden beauty. I find in them a profound truth, a truth about life and about the work of an artisan: in acknowledging imperfection, perfection is defined. □

Mark Lindquist turns and sculpts wood in Henniker, N.H. This article was adapted from his forthcoming book on sculpting wood, to be published in 1985 by Davis Publications, Inc., 50 Portland St., Worcester, Mass. 01608.

Osolnik turns a rhododendron-burl weed pot between centers with a roundnose chisel (left). The nearly finished pot is shown above. The hole in the neck is bored after turning.

tioning the rest slightly above dead center, I angle the tool about 10° to 15° above horizontal. I don't worry about the condition of the surface until the blank is basically round. Then I resharpen the tool and take light, shearing cuts to get the final outside shape.

Normally I work very loosely, by feel, letting the grain pattern and shape of the block dictate the final shape, accenting areas that will enhance the finished piece. I like to leave bark on some pieces; the contrast of rough and polished textures adds character. I've even left moss in place on twig pots—the greenish color looks nice against the surrounding finished surface.

On the inside, I work from thick wood to thin—that is, from the center out—to minimize vibration in the wall. Turn the bowl wall 3/16 in. to 1/4 in. thick, then go back for the finishing touches. Check the wall thickness frequently so that you don't unintentionally cut through at an indentation.

When turning between centers, position the centers by eye and turn the blank by hand to check its balance and distance from the tool rest. After taking several initial cuts, you can reposition the centers to improve the balance of the piece, or to accent a particular grain pattern or texture.

I sand the piece on the lathe, by hand or with a disc sander. With quick-change discs and the lathe at 800 RPM, you can start with 60-grit paper—which removes torn fibers—and work through 80-, 100- and 150-grit, finishing by hand with 180-grit. Finer-grit, higher-speed sanding would burnish and polish instead of sanding. The disc will bridge gaps in the surface, so if you want to soften those, hand-sand with the lathe running slowly.

Friction and centrifugal force will dry 3/16-in. to 1/4-in. thick wet wood as you work. Start with a coarse paper—a fine grit will generate too much heat and cause checking. When you're done sanding, immediately bandsaw off the facing block so that the wood won't crack as it continues to dry. □

Rude Osolnik, retired chairman of industrial arts at Berea College, Ky., is a woodturner and turning teacher.

Photos: Rick Mastelli

Plans for a High-Chair/Rocker

Two chairs for the price of one

by R.W. Swinyard

"Dad, will you make us a high chair for Aimee?"

A few months after the birth of my first grandchild, my daughter, Linda, made that request in a phone call from Maryland. What proud grandparent would be able to refuse? This maple high-chair/rocker is the result. I built two bases, one for the high chair and another for the rocker, so Aimee will get a few more years' use out of the piece. When either base is detached from the seat, the chair fits easily into the backseat of a small car.

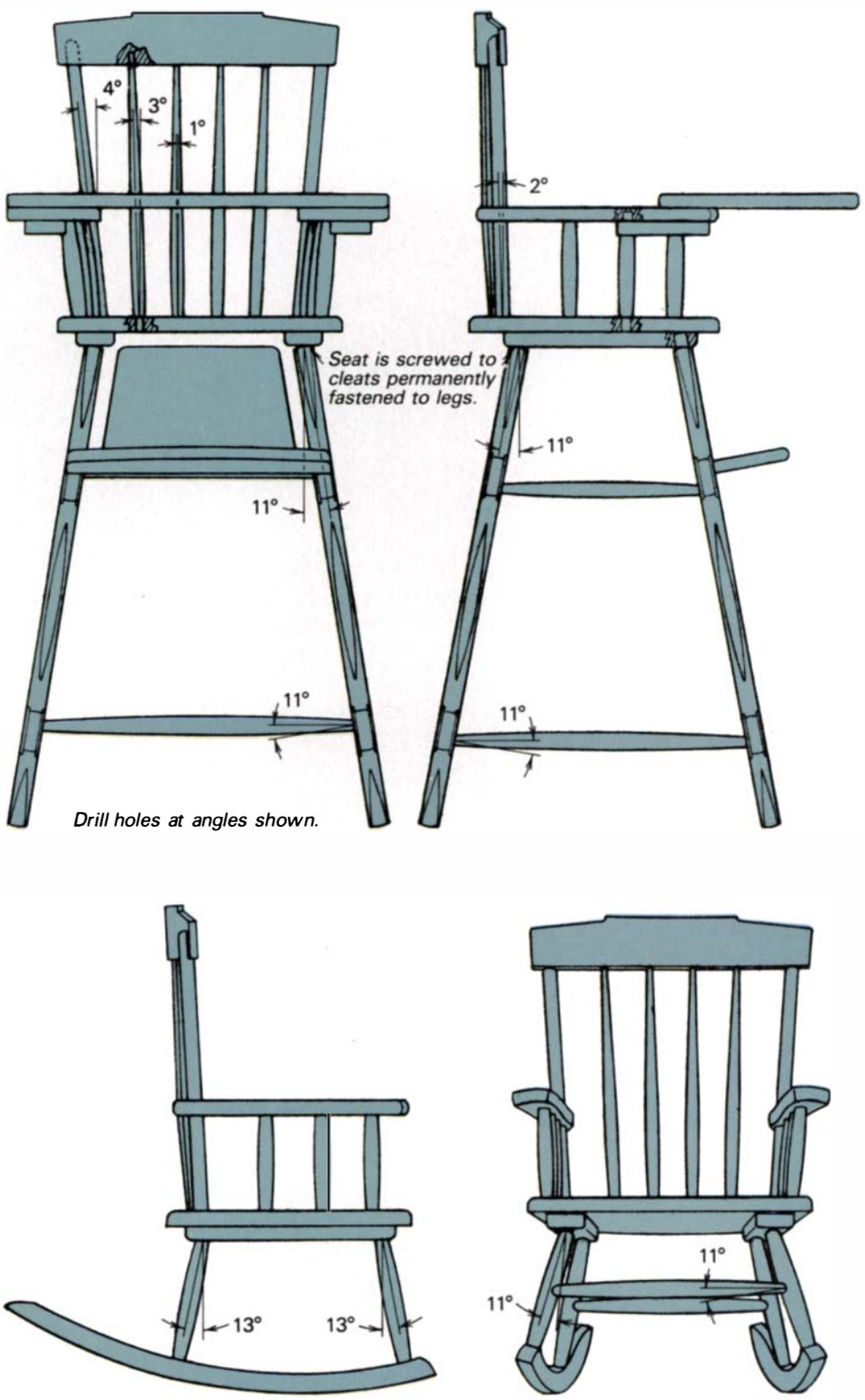
In this article, I'll tell how I use an auxiliary tilted table on my drill press to angle the holes so that all the chair's parts go together. I always test-assemble the parts as I go. Each part in a chair affects the next, and going piece-by-piece gives me a chance to make small changes if necessary.

The auxiliary table is a ramp that tilts the part being drilled to the correct angle. Mine, shown in figure 2 on the facing page, is a piece of plywood about 8 in. by 10 in. I tilt it simply by tacking plywood shims to its back edge. To check the angle, I line up the auxiliary table's centerline under the bit and aim it at the center of the drill-press column. Then I set a T-bevel between the centerline and the column, and verify the angle with a protractor. The various angles at which to tilt the table are shown in the drawings.

Many of the holes are at compound angles, that is, they appear to lean in two directions, one from the front view, the other from the side. I drill such holes in two ways. The cleats at the top of the rocker base illustrate one way. As shown at right, the rocker legs radiate from the cleats at 13° in side view and at 11° in front view. I raise the auxiliary table to the 13° angle by tacking shims under it at the back, then I block up one side of the table to 11°, the second angle. This tilts the workpiece in two directions at once. A second way—which I use to drill the holes in the seat for the back corner

Fig. 1: High chair converts to rocker

The same seat can be screwed to two different bases to extend the life of the chair.



posts—is to determine the axis line along which the "compound angles" actually become a single angle (for more on axis lines, see *FWW* #46, pp. 72-77). In the finished chair seat, for instance, the back corner posts show a 4° tilt in front view and a 2° tilt in side view. You can get the posts to align with these angles by drilling a 6° hole as shown in figure 2. The axis line is shown as line A on the seat plan in figure 3.

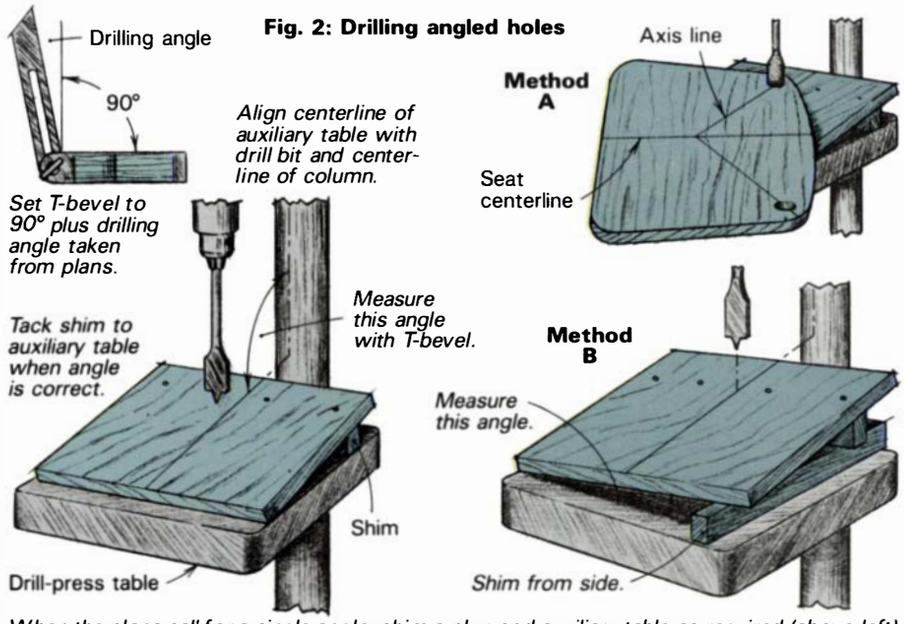
An axis line, whether it be the angled line on the seat or merely the centerline of the part itself—as when drilling the legs—must point in the same direction as the table's centerline, or the angle will not be correct. As an aid in positioning the workpiece, line up the auxiliary table's centerline directly under the bit and point it at the center of the drill-press column. Then when you position the axis line on the workpiece under the bit and point it at the column, the part will be positioned correctly.

Some parts can lie flat on the auxiliary table when being drilled, but others will need extra support. The chair's crest rail can be braced against a block to keep it steady. Round parts, such as the rocker legs, ought to be clamped in a handscrew, and so should the rockers themselves. Spade bits work fine for the through holes, and machine-spur bits or Forstner bits are good for the blind ones.

First lay out the seat as in the drawing and drill the back corner post holes. Next turn the corner posts to the size shown in figure 7 on p. 75, which contains dimensions for most of the other chair turnings as well. The two crucial diameters are the ¾-in. tenon for the seat and the ⅞-in. diameter that fits the hole in the armrest. One way to size tenons is to caliper the diameter of the drill bit that will cut the mortise, then use the calipers to check the size of the tenon while it's still on the lathe. Some experimentation will show you the tolerances you should allow with your particular set of bits. Aim for a snug not a force fit. Set the posts in the seat and make the armrest blanks (oversize for the time being: ¾x3x14½), but don't drill the other holes in the seat yet.

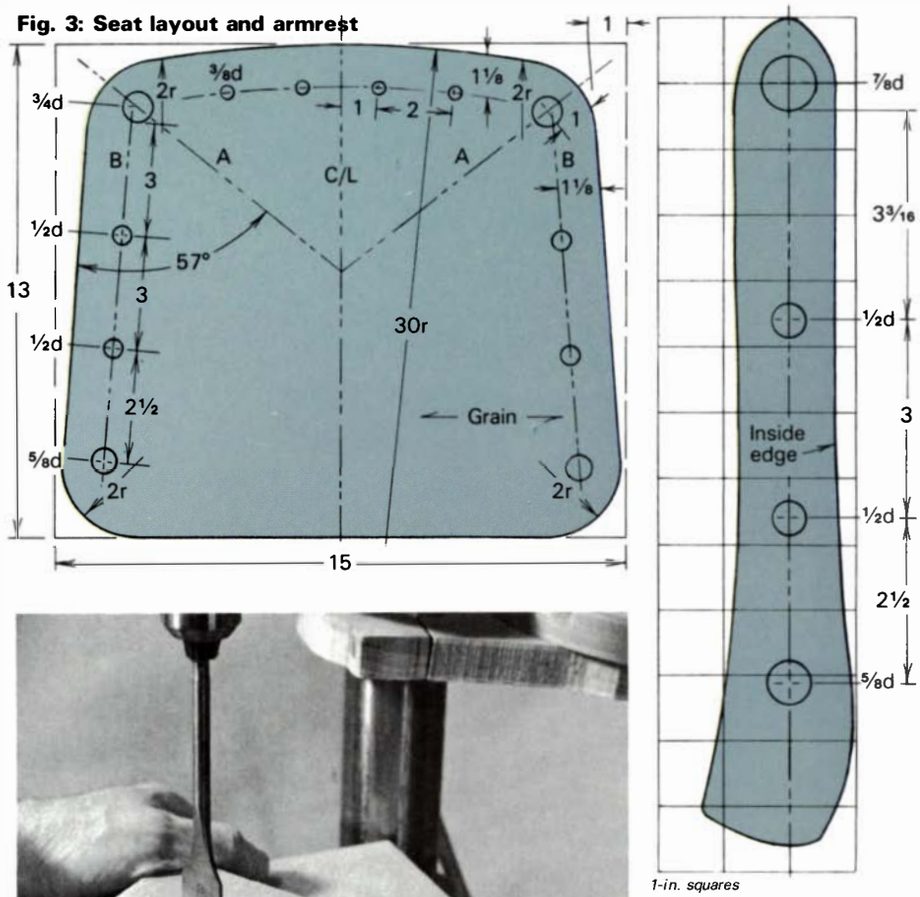
For each armrest to fit over its corner post, the hole in it must be drilled at the correct angle and orientation. In your mind's eye, slide the armrest down the post until it lies flat on the seat and parallel to the seat's edge. Notice that the

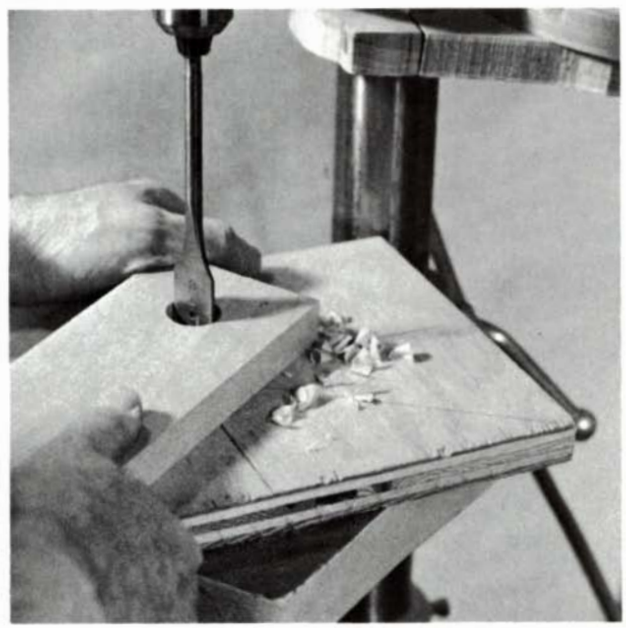
Fig. 2: Drilling angled holes



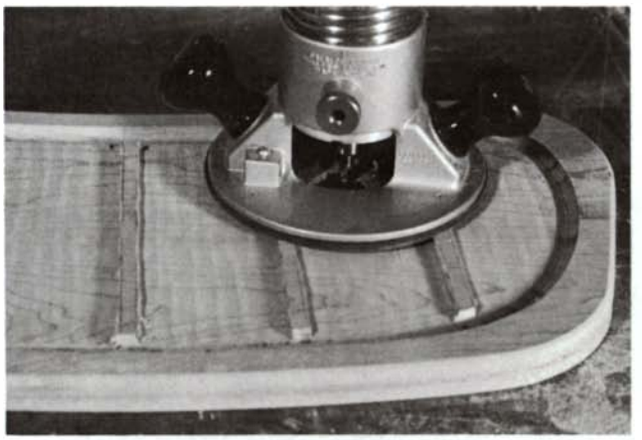
When the plans call for a single angle, shim a plywood auxiliary table as required (above left). Compound angles can be drilled in two ways. **Method A:** *A single 6° hole drilled on the axis line (line A in the seat plan below) yields an approximate tilt of 2° in side view and 4° in front view.* **Method B:** *First shim the table up to one angle, then shim the side to the other.*

Fig. 3: Seat layout and armrest



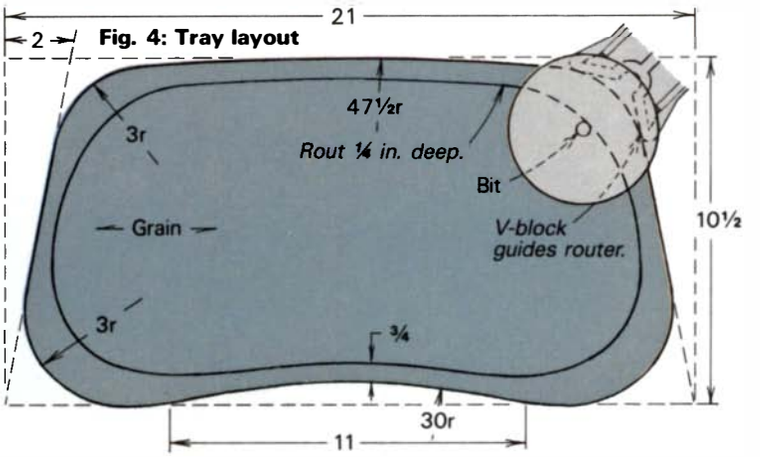


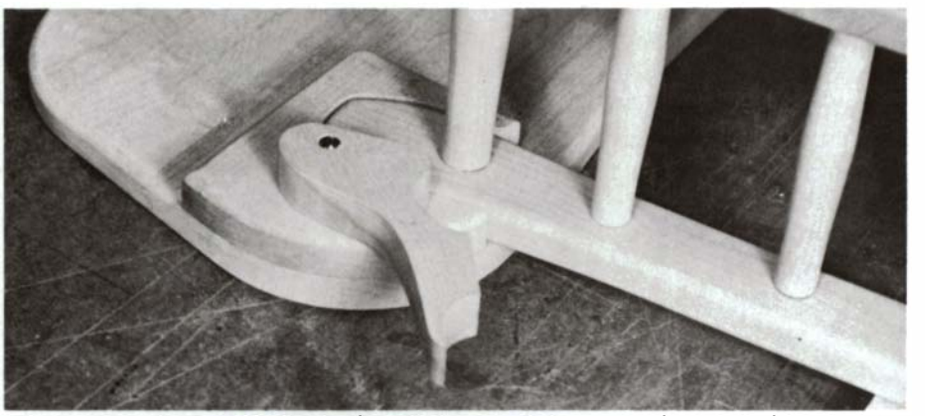
At left, an armrest blank is drilled to fit over its corner post, as explained in the text. Imagine that the seat blank is still on the auxiliary table, with its axis line over the table's centerline. The armrest must be aligned with the seat's edge, radiating out at the 57° angle shown in figure 3.



Cut the tray to shape, then rout the dish's outline with a core-box bit, guiding the router with a V-block as shown in figure 4. Next rout out the center with a straight bit (photo above), leaving bridges to support the router. Then chisel these away and sand.

Fig. 4: Tray layout





The armrests slip into blocks glued to the bottom of the tray and are locked by clamping levers (photo above, plan below). The legs (bottom of page) are sawn square and centered in the lathe. After the tenon at the tailstock end has been turned, the leg is removed and its corners rounded with the router. Back in the lathe, each leg is then turned to the shape shown, with 'squares' where the rung mortises will be drilled.

hole in the armrest lines up exactly with the angle of the hole in the seat. Now imagine that the seat is still on the auxiliary table, and that you have just drilled the corner post hole. If you were to raise the quill and lay the armrest blank in position flat on the seat, you could drill the hole. But this would risk damaging the seat beneath if anything shifted. So instead, you can mark the correct position for the arm on the auxiliary table, and drill the hole as shown in the photo on p. 73.

To determine where to mark the correct position for the armrest on the table, refer to the seat plan in figure 3. There is a 57° angle marked between the axis line on the seat and the centerline of the armrest. When the back corner post hole was being drilled, the axis line on the seat was directly over the centerline of the auxiliary table. The armrest's centerline must therefore be turned 57° from the auxiliary table's centerline when you drill the hole.

Also, as you slide the armrest up and down the post, the higher it is, the farther it moves back in relation to the seat. Consider the arm spindles. I've designed them to be perpendicular to the seat in side view, as shown in figure 1, not to tilt back the way the back corner posts do. I therefore had to compensate for the armrest's backward displacement by offsetting the arm spindle holes farther forward from the corner post hole in the armrest than they are in the seat. I made a trial assembly and found that the offset, measured along the centerline of the armrest, was $\frac{3}{16}$ in., and this is the amount shown in figure 3.

Next verify the angle for the arm

Fig. 5: Tray clamp and crest rail

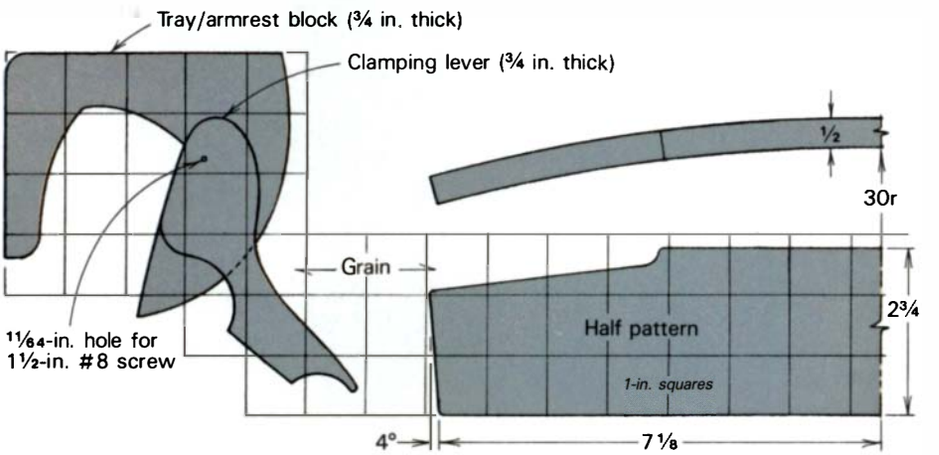
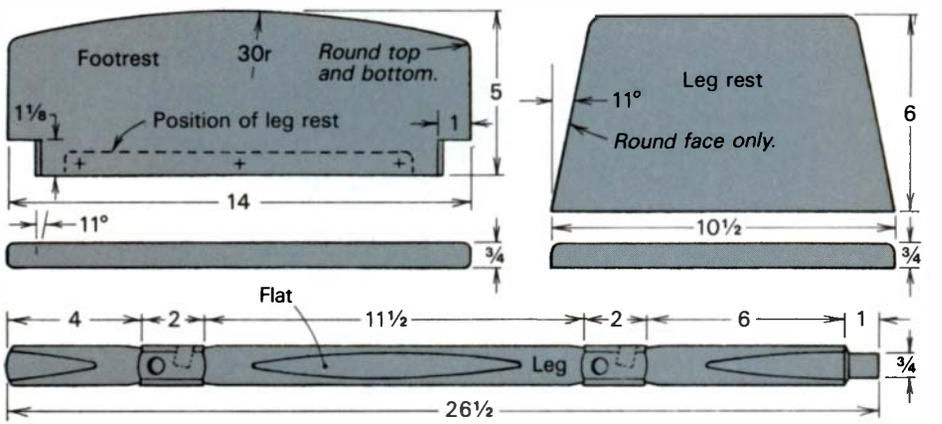


Fig. 6: High-chair legs and footrest



spindle holes. I used a T-bevel, with its handle perpendicular to line B in figure 3, to check that the angle of slant of the corner post in that plane was the 4° the drawing indicated it should be. It was, so I shimmed the auxiliary table to suit, drilling all holes in both armrests to a depth of ⅝ in. Then I drilled the matching holes through the seat.

I bandsawed the curves on both armrests according to the pattern in figure 3. Figure 5 and the bottom photo on the facing page show how the tray bottom locks into the front end of the armrest.

To drill the seat for the back center spindles, first shim the auxiliary table to 2°, the backward tilt of the spindles, then block it up to the necessary side angles, which are shown in figure 1. The crest-rail blank should be tilted only toward the sides of the chair when you're drilling the holes in it, so it will follow the 2° backward tilt of the corner posts.

I test-assembled everything, sanded away all machine marks, rounded the edges with the router where appropriate, and plugged the screw heads. Then I made the tray as shown in figure 4 and the photo at the top of the facing page, and I turned the legs as illustrated in figure 6. I made the footrest and the leg rest to the shapes shown.

For the final base assembly, I attached the footrest and the lower front rung to the legs first, so I could drive the screws holding the footrest with a brace and screwdriver bit. I assembled the back next, then the sides, using web clamps to hold the frame together while the glue dried, and checking for squareness with a framing square.

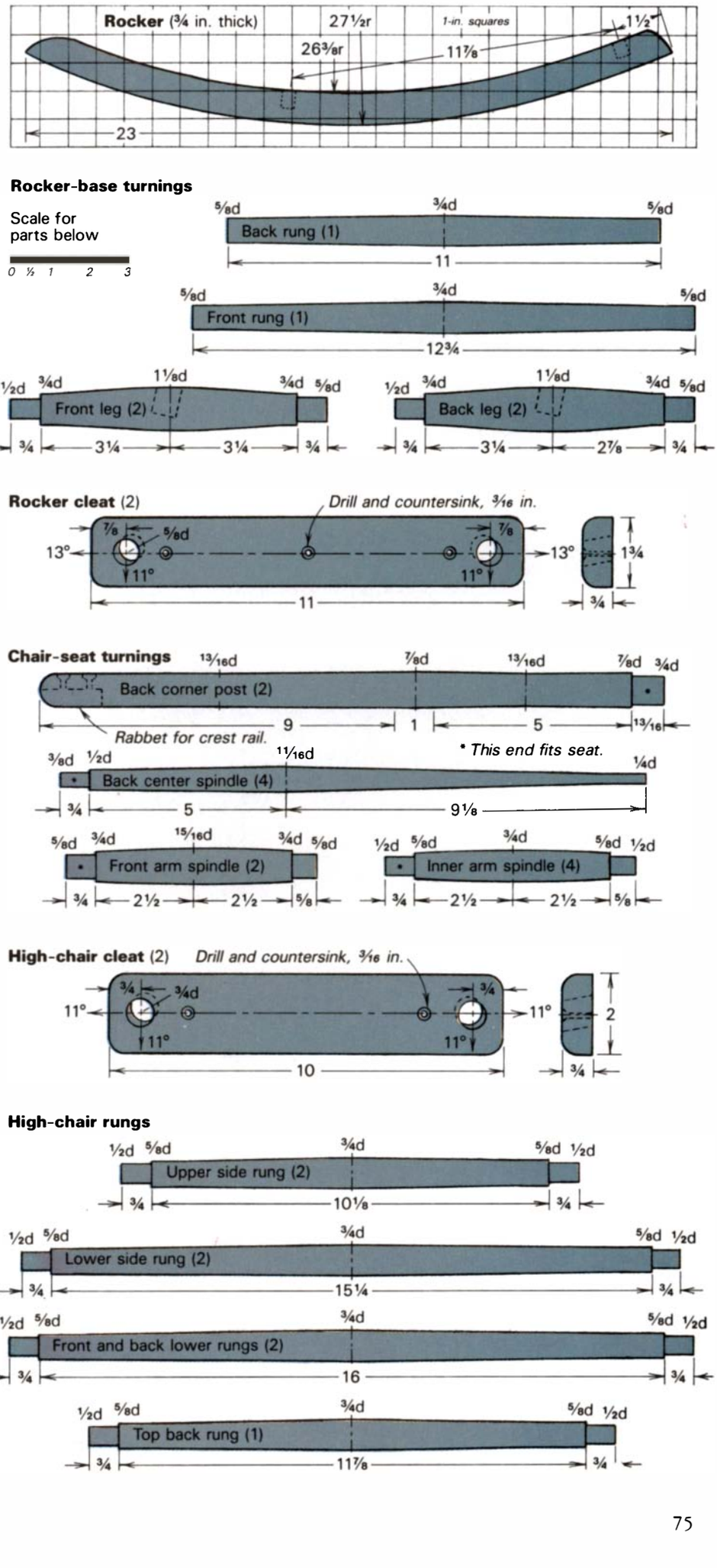
Keep in mind that the chair seat will be screwed to the tops of the cleats. During glue-up, be sure that the top surface of both cleats lies in the same flat plane. You can check this by laying a pair of straightedges from cleat to cleat and sighting along them, then working the cleats into proper alignment. The same concern applies to the rocker base.

When all was done, I applied two coats of urethane varnish to the chair, the base and the rocker, and gave the tray three coats of Constantine's Bowl Seal.

There's one necessary item not shown in the drawings—a safety strap that's fastened under the seat. □

R.W. Swinyard is a retired industrial arts teacher from Kinderhook, N.Y. Photos by the author.

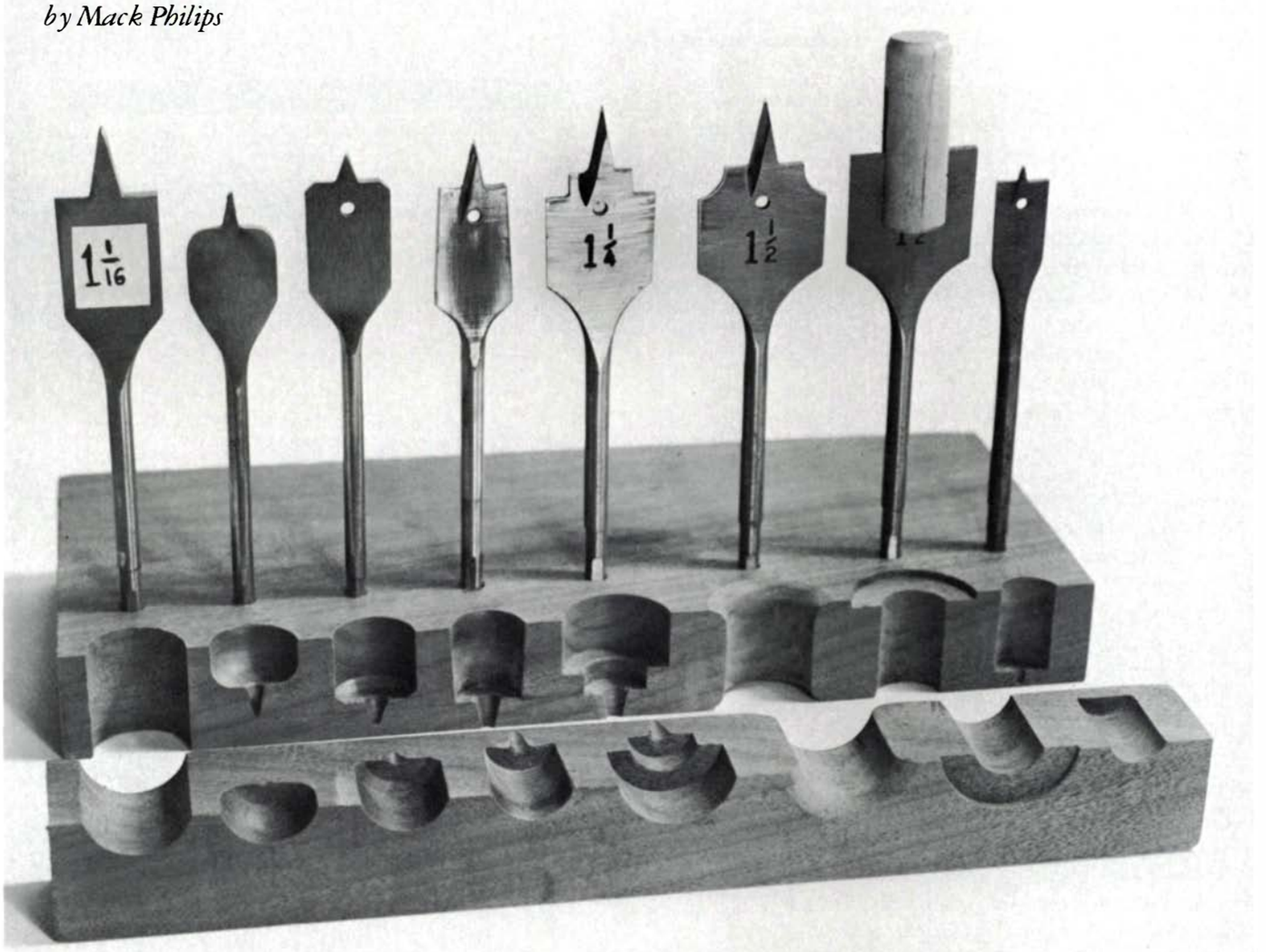
Fig. 7: Rockers, spindles, cleats and rungs



Souped-Up Spade Bits

Ideas for special-purpose, low-cost boring tools

by Mack Philips



For those special wood-boring jobs, inexpensive spade bits are easy to modify to produce the holes shown here. Bit at left has been shaved 1/16 in. less than standard size; others have been reshaped with sharpening equipment, belt/disc sanders, motor tools and files.

When I need to drill an odd-size hole, or want a special contour, I usually just grab a spade bit and regrind it until it's exactly what I want. The procedure is inexpensive, quick and quite satisfactory. Some possibilities, explained later in this article, are shown in the photo above.

Besides being cheap, spade bits are made of relatively soft steel and are easy to alter. A regular bench grinder will do the job, but I've found that my Dremel belt/disc sander is even handier. Coarse belts remove metal quickly without heating up too much, and fine belts leave a good cutting edge. In addition, a motor tool such as the Foredom or the Dremel can help shape curves, using mounted stones of an appropriate diameter. Most bits are soft enough that you can even file them to shape if there's no motor tool around.

Spade bits typically have about 7° clearance on the cutting edges, about 5° on the sides. After you change the shape, restore these clearances. Tilt your grinder's tool rest or table to grind the same angles as on the unmodified bit. If the bit won't lie flat on the rest, put a small block of wood under the bit's face so that the shank is raised out of the way.

Clearance angles don't have to be absolutely adhered to. The main idea is to relieve the edge so that it can penetrate the wood and take a shaving without the metal behind the edge getting in the way. There is a compromise here: if the edge has been relieved too much, the bit will dull quickly and begin to chew up the work or, in hardwoods, to burn it. For cutting softwoods, the edge requires a larger clearance angle than it does for cutting hardwoods. The standard spade bit is ground to work well in softwoods, but dulls faster in hardwoods than it really has to. If you're going to be drilling hardwoods, try a little less relief at first and see how the bit cuts. You can always increase clearance if needed.

Except at the very corners, the sides of a straight spade bit don't actually cut. The clearance angle at the sides is more for

the sake of reducing friction than for efficiency in cutting. Keep this in mind when you're grinding contours. Visualize the action of the bit as it works into the wood and make sure that the clearance is in the right place. On curved sections, maintain the larger clearance angle through the whole extent of the curve. In a stepped bit, relieve the bottom cutting edges more than those on the sides.

Notice, too, that the manufacturer usually grinds larger spade bits so that the corners project slightly ahead of the cutting edge. With the point in the wood, the corners enter next, which aids stability during the cut.

Getting the shape symmetrical is important, but I've found that a bit does not have to be absolutely precise to do a good job of cutting. To get as close as possible, first coat the bit with machinists' layout dye and scribe the shape you want on the bit, measuring as accurately as you can on each side of a centerline. Then grind away material alternately from each side, a little at a time to avoid overheating. Quench the bit in water often. If you notice the metal beginning to change color (the first change is to yellow or bronze), you're grinding too fast and the heat has begun to affect the temper. Quench the bit immediately and slow down.

For odd-size holes, simply take the next larger bit and grind its sides a little. Lumberyard dowels, for instance, are notoriously off-size, either too loose or too tight in the hole they're supposed to fit. If you're trying to get a press-fit hole from a nominal-size bit, just kiss the sides with the grinder. It won't take much. Make trial cuts in scrapwood to avoid going undersize.

Round-bottomed and beveled-corner holes result when you grind curves or chamfers on the corners. This modified bit is good for making finger holes, or for holes where you want bottom clearance.

Tapered bits make holes for candle sockets, chair rungs and special wedge joints. A tapered bit cuts the full length of its side. If you find that a tapered bit is burning the wood, increase the side clearance angle.

For a stepped hole, grind steps on the bit. One useful purpose for this bit is to space nesting tubes in a hole. The larger diameter locates the larger tube, and the smaller bore locates the smaller tube on center.

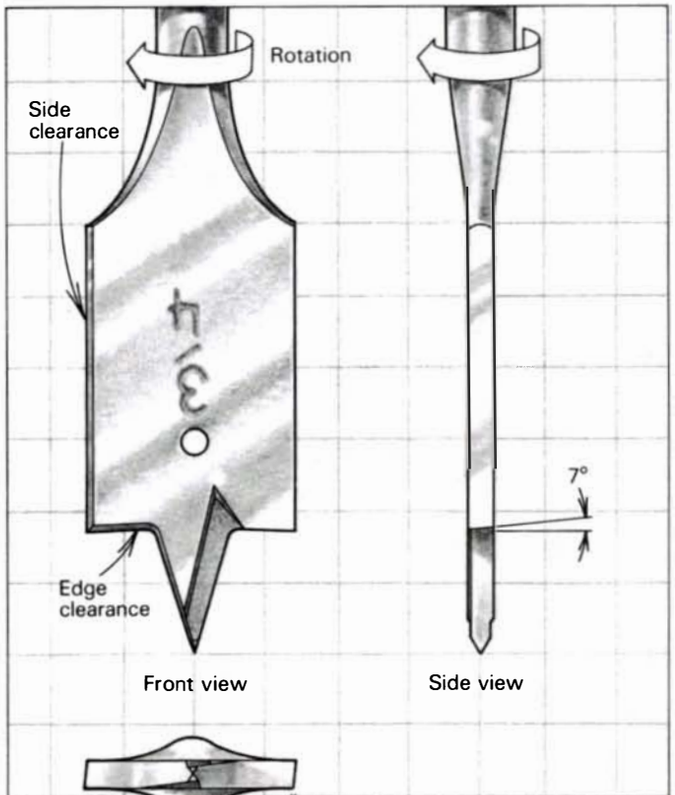
You can easily make a neat rounding-over bit by grinding a concave radius on the corners. To use this bit, first drill a small pilot hole through the workpiece. Form the radii on both sides of the work with the rounding-over bit. Then drill the main hole through.

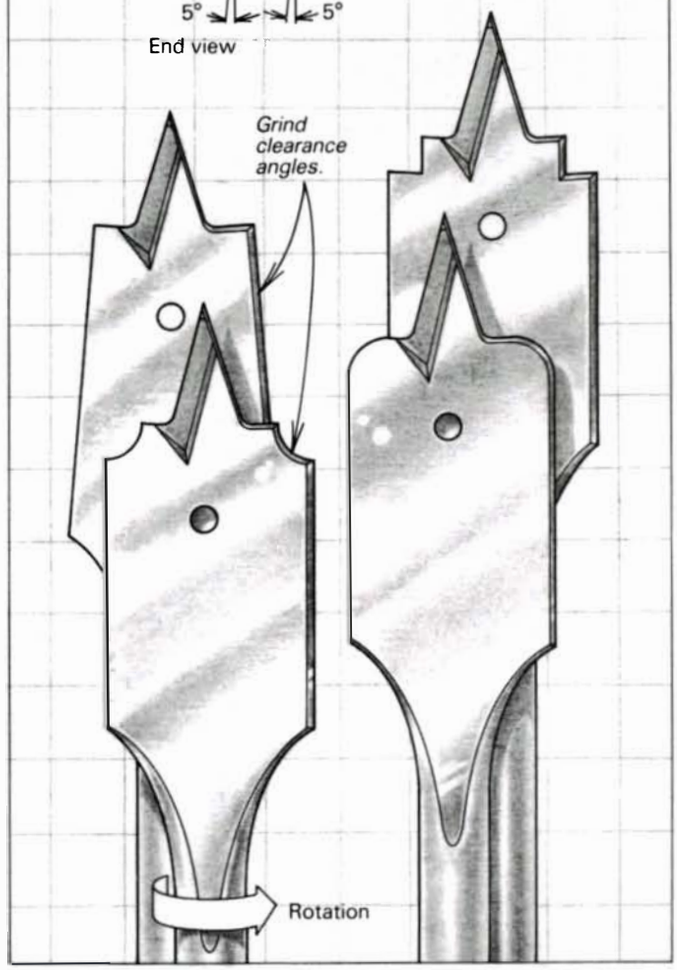
A spotfacer is a counterbore that relieves the surface for a bolt head or a plug. I make piloted spotfacers by epoxying an appropriately sized slotted dowel over the center of the bit. If the dowel doesn't cover the sides of the point, grind them away. Run these bits at a fairly low speed to prevent heat buildup from softening the epoxy. You can use the same trick to enlarge an existing hole on-center.

If necessary, to keep the point from coming through the work, you can shorten it to as little as ⅛ in. or so. This works best when the manufacturer hasn't sharpened the point by grinding a groove down its faces, but you can work around this, too. I've found it best to rough off most of the point with a grinder and then do the final shaping with a file. □

Mack Philips is a midwest-based freelance writer who specializes in woodworking. Photo by the author.

Clearance angles for a standard bit





Modified bits

Drawing: David Dann

My Search for the Finest Period Furniture

Atlanta cabinetmaker won't settle for second best

by Harold M. Scott

Sixteen years ago, I had just given up tennis, had some free time and energy, and decided that woodworking should be my new hobby. My first piece was a bureau that I adapted from a photo in a magazine. It was something like a block-front, but without the moldings and fancy hardware. When it was finished, it was sturdy enough, yet it was lumpy, dumpy, nondescript and totally lacking in character. I still have it, sitting under a sheet in the darkest corner of my basement, next to the lumber pile.

The shock of having made something so heartbreakingly plain taught me two lessons: First, if I was going to spend months of my life making something, I never again wanted to feel that I had been wasting my time—I might as well have been making birdhouses for all the satisfaction that bureau gave me. Second, I had to find out why furniture works, what separates the outstanding from the also-ran, so that I could choose which pieces to reproduce, and faithfully recapture their excellence when I did.

In my opinion, and I think a lot of people would agree with me, American cabinetmaking peaked around 1790, and died when the machine age came in, around 1830. Handwork died. Machines standardized things and took away the fine distinctions in line and ornament that had made American furniture great. Take the moldings and carvings off a

Photos: Gary Bogue

Philadelphia highboy—strip it right down to the bones—and you'll still have a fine piece of furniture, one that's well proportioned, light and full of energy (in contrast, English pieces from about the same time can look like Sherman tanks). Then start to put the ornaments back, one by one, and you'll discover the real genius of the Americans. Every line of the carving and every molding adds to the piece; nothing takes away.

I honestly believe that if there had never been a machine age, people today would still be making the furniture styles found in America between 1760 and 1800. It was perfect furniture. The wealthy class in those days couldn't spend their money on a Mercedes-Benz, so instead they showed off their wealth and their education by buying the finest furniture, and they knew enough about style to insist that cabinetmakers did their best. It was almost a competition between maker and patron, and everybody was the better for it. These days, people don't know what they want; styles last a year or two and are gone. I have a closed mind on this—I admit it—but I just can't *see* what passes for modern furniture.

Thirty-seven years ago, when we were first married, my wife, Dorothy, and I picked out an Early American bedroom set because the general lines of it appealed to both of us. Over the next twenty years, we both fell in love with 18th-century American decorative arts—china, pewter, silver, rugs—and when we finally decided to invest in some new furniture, we naturally wanted it to match the rest of our furnishings.

I have to admit that I would much rather be the wealthy buyer than the cabinetmaker. Yet we looked and looked, and in the end we either couldn't afford such furniture or didn't want it. The finest pieces were locked up in museums and were priceless (I was told that a group of investors actually tried to buy a desk and bookcase from Winterthur for $1,200,000). At the other extreme were some top-of-the-line factory-reproduction pieces for $12,000 and less, but even the best reproductions weren't necessarily copies of the particular pieces we wanted in our home. Some factories that reproduce furniture have an agreement with a particular museum to duplicate pieces in the museum's collection. This guarantees the buyer that the museum has approved the design, but it doesn't guarantee that the piece itself is the best of its kind. And why buy, much less make, anything less?

One book has been of immense help to me. In *Fine Points of Furniture* (Crown Publishers, Inc., New York), Albert Sack sums up the problem neatly. He says that in most books about antiques, "Inferior pieces are so intermingled with the masterpieces that they acquire a false prestige which, in turn, sends many a novice off on an unfortunate tangent."

To straighten things out, Sack's book *compares* pieces of furniture, showing exactly why one piece is better than another. The two factors that really count are design and workmanship. In assigning a piece to his categories of good, better and best, he speaks more frankly than many authors would dare. Describing one 18th-century mahogany secretary (no doubt to the horror of its proud owner), he says: "The crudity of the embryonic claw-and-ball feet is immediately apparent. The bonnet is decidedly cramped, with too little open space under the arch. The doors and interior are far less interesting than those of the masterpiece shown below." In other pieces, which even to my untrained eye lack greatness, Sack pins down exactly what subtle design flaw makes the piece fail: "The legs of this otherwise pleasing piece are too stiff and straight." Or, "This craftsman made three mistakes. . . . He made the body too wide, not allowing enough overhang of the top for proper balance. He made the leg too fat below the knee. He put the fan in the center of the drawer so that it looks lost."

Sack characterizes another piece as "an inferior chair by an ungifted craftsman who reached out of his class. . . " I must say, as I recall my ill-fated bureau, that this particular observation hit me fairly close to home.

For a cabinetmaker, developing a critical eye is only half the job. In addition to knowing what to make, I had to learn how to do it, and I'd had no training as a woodworker at all. In the beginning, I used to haunt the workshop of a gifted cabinetmaker, Horst Scholte, in Atlanta. He'd apprenticed for seven years in Germany, and could make or repair anything. One day, I figured that I'd picked up enough tips to give furniture another try, so I disappeared for a while and came back with a little table. I'll never forget Scholte's expression when I showed it to him. He had thought that I'd lost interest, but here I was again!

I read everything I could find, and on vacation trips I vis-

ited the outstanding collections along the East Coast as far as northern New England. I found the guides at Winterthur especially helpful, but in most other museums the guards wouldn't let me near the furniture. Maybe if I'd approached the curators directly I could have had better access, but I wasn't sure how to go about this, so I settled for what I could get. I've found that seeing a piece of furniture is very important, even if you can't open the doors and drawers. I usually scale furniture from photographs (as explained by Lelon Traylor in *FWW* #16, pp. 61-67), and there is always the chance that distortion has thrown off some dimensions. And if you don't get the little things right, well, the whole piece just won't be right. Once you've seen the real thing, you have an idea of where the distortions are in the photographs.

On the average, it takes me about as much time to research a piece and develop critical drawings of carvings, moldings and so forth as it does to actually make it. When I began to make the Goddard nine-shell secretary shown on p. 79, for instance, I wrote to the Rhode Island Historical Society to get some photographs, and they said that there weren't any. I'd heard that *Life* magazine had shown it sometime in 1955, and months later I tracked the issue down through a rare-book dealer. Those photos, plus a list of overall dimensions, were my basic plans. I couldn't find a photograph that showed the desk open, so I chose the gallery design from another Goddard piece. Ironically, of the ten existing Goddard desks, nine have galleries similar to the one I made. But the nine-shell is the exception, with a much simpler gallery, so my piece differs in this regard from the original. I don't bother with full-size drawings, except when laying out legs, moldings, carvings, pediments and highly detailed sections. For these, if I can find one, I enlarge a head-on photograph to full-size. Otherwise, just having the carcase dimensions and the drawer sizes is enough, without worrying about drawing all the joinery in advance. Of course, once in a while, when I'm in the middle of making a piece, things can get sort of interesting, but that's part of the challenge.

My basement workshop has grown steadily over the years, and I've been very lucky in my choice of machines. I avoided home-shop equipment and bought the best I could afford. That advice wasn't as hard to follow back then as it would be today—my Powermatic tablesaw, for instance, cost me about $400 when I bought it new. My 20-in. bandsaw was $600. In addition, I have a good lathe, a jointer, two jigsaws, a sturdy shaper, a planer, a drill press, an overhead router, and whatever else I thought I needed along the way, including two separate dust-collection systems (I'm satisfied to *work* wood; I don't have to breathe it, too). The cost of the whole shop, however, wouldn't have paid for a reproduction of the nine-shell blockfront, if I'd bought one instead of making it.

Finding good wood has required effort, but it's fun, especially when you're lucky at it. I found two beautifully figured walnut trees on my father-in-law's farm, and by having the logs cut and dried myself, I ended up with a lot of matching grain from adjacent boards. To find mahogany, I made quite a few trips down to Florida. I went to an importer's yard and picked through the piles, taking the same care as an 18th-century cabinetmaker would have, the sort of care that no factory today can afford. Don't get me wrong in all this. I'm not at all opposed to modern improvements where they can make a piece better. Why make a molding entirely by hand when a shaper can give you such a time-saving head start? I also don't worry too much about how accurate my secondary woods are—sometimes you just can't find exact information on this anyway.

When I can, I design jigs and fixtures to ensure accuracy. Of course, there are things that machines just can't do. Carving, for instance, has to be done by hand because the tool marks are part of the quality of the piece. Carvers in the old days sometimes very deliberately left backgrounds with a different texture than that of the raised areas. Light striking the facets of the background creates a bright field that highlights the carving itself in strong relief. It isn't enough to get the shape of the carving right; you have to match its crispness and surface quality as well. All my dovetails, too, are cut by hand, and my mortise-and-tenon joints are hand-fitted. But otherwise I take every advantage my machines can give me.

In all my projects, I've tried to keep within my limits, but I've never willingly settled for second best. Shown here are my copies of what I feel are the finest pieces of furniture ever made. Yes, I see a few things wrong with them today. In the chair shown above, I was misled by distortion in the photos—I should have made the legs a little thinner. There are carvings I'm not entirely satisfied with, too, and I once made a $^{7}/_{10}$-scale highboy, which was a mistake from the beginning. I found, when finished, that it had lost all its dignity. But I did the best I could at the time in every case, and by and large I'm glad I aimed high. □

Harold Scott is a retired research administrator who lives in Atlanta, Ga.

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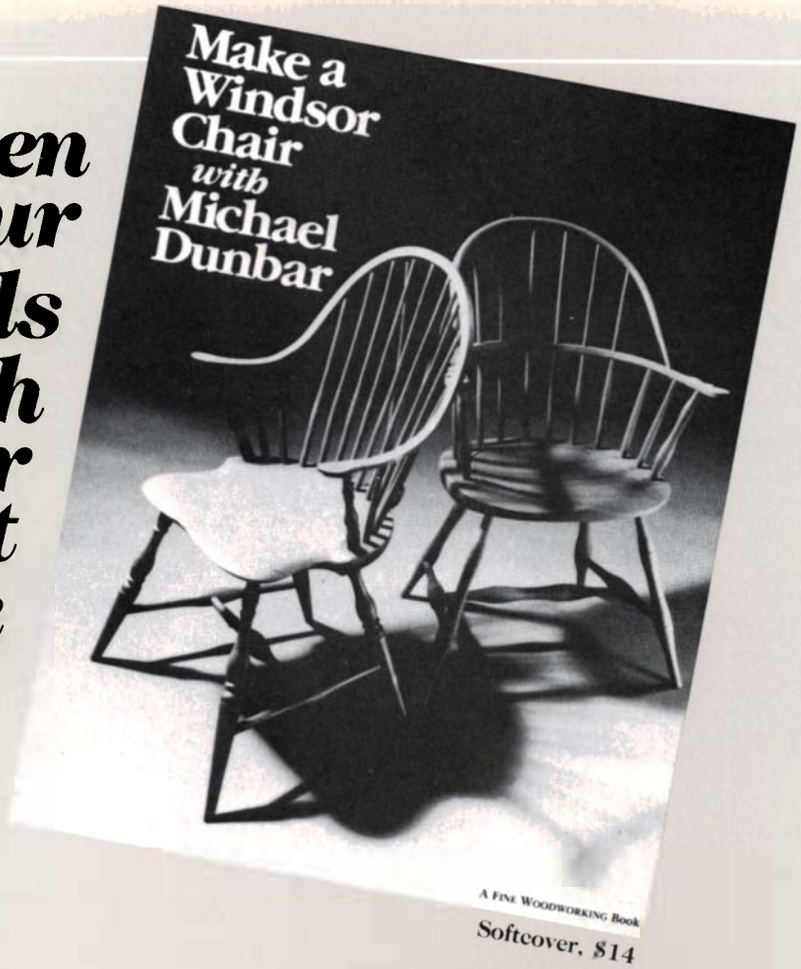

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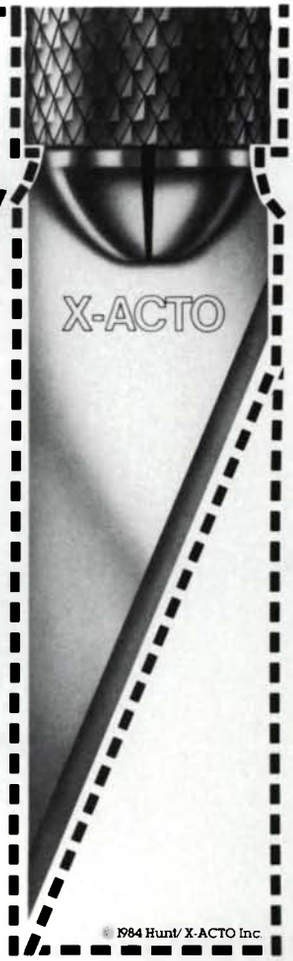

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species of domestic and imported hardwoods in most thicknesses and grades. 85 patterns of oak and hemlock mouldings. Oak stair parts, hardwood plywood, veneer, flooring and paneling. Mantlepieces. No order too small. No sales tax. 9-6, Mon.-Sat.

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San Antonio and South Texas' hardwood store. Austin Hardwoods, San Antonio, 10841 Hillpoint, San Antonio 78217. (512) 657-9994.

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Unique, figured wide planks to 50 in. wide. Hardwoods, pine. M. Biddy, Box 424, Shaftsbury, VT 05262.

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BRANDING IRONS for craftsmen. Logo design. Send your ideas for quote. Heat Mark Co., Rt. 6, Box 828, Mooresville, NC 28115.

ABALONE SHELLS, MOTHER OF PEARL SHELL pieces suitable for inlaid work. Handy Trading Co. (est. 1949), Box 5085, Sherman Oaks, CA 91413. (818) 501-6114.

Musical Supplies

LUTHIERS' SUPPLIES: Imported tonewood, tools, varnishes, books, plans, parts, accessories, strings, cases, for violins, violas, cellos, basses and guitars. Assemble-yourself carved violin kit. Catalog, $.50, includes 10% discount certificate. International Violin Company, Ltd., Dept. WU, 4026 W. Belvedere Ave., Baltimore, MD 21215.

KITS for EARLY MUSICAL INSTRUMENTS! Crumhorn, lute, cittern, psaltery, dulcimer and more, even a modern guitar kit. Write for free illustrated brochure. The Early Music Shop of New England, 59a Boylston St., Brookline, MA 02146. (617) 277-8690.

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BANJO-MANDOLIN-GUITAR plans, kits and parts. Free catalog. Stewart-MacDonald, 21 N. Shafer, Box 900F, Athens, OH 45701. (800) 848-2273.

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STETON—MABO—others. Story, page 32, Jan./Feb. Best deals. Brochure, $2. Henry Wiegand Corp., Claremont, NH 03743.

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PORT ORFORD CEDAR, old growth clears to second growth construction. East Fork Lumber Sales. HC 86 Box 149B, Myrtle Pt., OR 97458. (503) 572-5894.

HARDWOODS. Send $1 for price list. Jamestown Hardwoods, 71 Chambers St., Jamestown, NY 14701.

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KD walnut, $2.50; cherry, $2.25; oak, $2.25; cedar, $1.75. S. Isenhour, 3830 Overview, Clemmons, NC 27012. (919) 766-9032 after 6 p.m.

State 24-in. disc sander 2HP, 3PH motor with electric table raiser, $2100. Rockwell uni-plane, $650. Acme 4-in. by 80-in. edge belt sander 1½HP, 1PH motor and stand, new, $1150. Rawls, (804) 266-4069. Richmond, VA.

New RBI scroll saw, $650. Extra blade holder. (512) 854-2929. Stan Pence, Corpus Christi, TX.

43 moulding planes, sell as set. Several block and primitive planes. (412) 823-5562 or 461-6739. Pittsburgh, PA.

Ten Stanley 45s, two 55s, many other planes. SASE for list. Bob Delk, 324 1st St., Washburn, IA 50706.

Oscillating spindle sander, Boice Crane, $675. Drill press, Powermatic, $600. Delta scroll saw, $550. Treadle metal lathe, Sebastian, $850. (802) 234-9673. J. Bergamo, RD 2, Bethel, VT 05032.

Rockwell 24-in. scroll saw. Sell or trade, deliver within 150 mi. of Aberdeen, MD. (301) 272-0548.

3-drum sander, Smith 404B, 42 in., rebuilt, excellent. Paper and felt included. $2400 firm. Mark O'Brien, VT. (802) 592-3573.

For sale, Powermatic and Delta wood lathes. Also Walker-Turner bandsaw and jointer. W. Clarke, (804) 462-5656.

American chestnut wood, 374 board feet. Contact Dr. M. P. Genser at (215) 649-5471 evenings.

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INCA spindle shaper, never used, accessories. $1675. Box 220, Piermont, NY 10968. (914) 359-4368.

Powermatic bandsaw model #81. 5HP motor. Asking $2,000. Greg Overcashier, 2142 Third Ave. N., St. Petersburg, FL 33713. (813) 821-4780

Hutchinson shaper, ¾-in. spindle, $600. Rockwell Unidrill, floor model, $1,000. Many hand tools, including Stanley 77 dowel machine, 55 plane. Send SASE, T. Dow, 195 River Rd., Nyack, NY 10960. (914) 359-0892.

Jointer, Powermatic 60, excellent. Shaper, Rockwell 370, needs parts. 3PH motors. Details, SASE. Moore, 6105 Brandon Ave., Springfield, VA 22150.

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Shopsmith Mark V. Peter Griffiths, 1097 Commercial St., New Minas, Nova Scotia. (902) 678-1466.

Spalted lumber. Kiln-dried, no rot, any hardwoods. Identify completely. J. Patrasso, 660 North St., Boulder, CO 80302.

Events

Listings are free, but restricted to happenings of direct interest to woodworkers. Our Sept./Oct. issue will list events between Aug. 15 and Nov. 15; deadline July 15. Our Nov./Dec. issue will list events between Oct. 15 and Jan. 15; deadline Sept. 15.

ARIZONA: **Fair**—1984 State Fair, Oct. 19–Nov. 4, handicraft competition sponsored by Arizona Woodcarvers and Warren Tool Co. (16 years of age and under). Contact Sherry Pew, Dir. of Entries, Arizona State Fair, Box 6715, 1826 W. McDowell Rd., Phoenix, 85005. (602) 252-6771.

CALIFORNIA: **Juried show**—3rd Annual Design in Wood, June 14–July 1. Fairgrounds, Del Mar. (619) 297-0338.
Juried exhibit—The Woodworker West, 130 exhibitors, Aug. 17–19. Civic Center, Santa Monica. Contact Craft Market America, Box 30, Sugarloaf, N.Y. 10981. (914) 469-2249.
Show—"Quiet Expressions in Wood," James Krenov and students, June 8–July 8. California Crafts Museum, Ghirardelli Square, San Francisco, 94188. (415) 771-1919.
Exhibition—Lathe work, June 30–July 29, deadline June 25. Artisans Guild, 45050 Main St., Mendocino, 95460. (707) 937-5300.
Exhibition/competition—California State Fair, Aug. 17–Sept. 3, Sacramento. Contact California Living, Box 15649, Sacramento, 95852. (916) 924-2015.
Show—Woodcarving, Whittling Contest, Sept. 9. Carnegie Park, 4th St., Livermore. Contact California Carvers Guild, (415) 447-3186.
Show—4th Annual Western States Invitational Wood, Aug. 18–Sept. 30. Contact Gallery Fair, Box 263, Mendocino, 95460. (707) 937-5121.
Workshop—Design and operation of circular & band saws, Sept. 10–14. University of California Forest Products Lab, 47th & Hoffman, Richmond, 94804. (415) 231-9404.
Demonstrations/workshops/seminars—At Cutting Edge, 7626 Miramar Rd., San Diego, 92126, (619) 695-3990: Makita, June 23; veneering, July 5–26; contemporary chairmaking, July 9–Aug. 13; decoy carving, July 19–Aug. 5; Inca plus annual open house, July 21; bent lamination, Martha Rising, Aug. 11; photographing work, Aug. 18; cabinetmaking, Aug. 20–Oct. 1; furniture design, Joseph Bavaro, Sept. 8. At Cutting Edge, 3871 Grand View Blvd., Los Angeles, 90066, (213) 390-9723: Tablesaw use, July 11, 18; intro to exotic woods, July 17; furniture history, July 19, 26; Japanese tools, Aug. 30–Sept. 20; classic drawer construction, Sept. 11–25; a day with Sam Maloof, Sept. 15.
Workshop/seminar—Tools and techniques, July 2–28, Aug. 6–Sept. 1; James Krenov, Sept. 7–8. College of the Redwoods, 440 Alger St., Ft. Bragg, 95437. (707) 964-7056.
Seminars—Tablesaw, June 18, 25; router I, June 20, 27; Japanese tools and joinery, June 22–24. Japan Woodworker II, 12222 Poway Rd., Poway, 92064. (619) 748-4363.
Show—The Woodworking Show for Craftsmen and Hobbyists, Sept. 28–30. The Orange County Fairgrounds, Building #10, Costa Mesa. Contact Patricia Dillon, (213) 477-8521.

COLORADO: **Show**—Colorado Woodworkers, May 28–June 15. Century Bank, 3300 East 1st Ave., Denver. Contact Tony Brazzalle, (303) 733-3569.
Exhibit—1st national juried craft show, Aug. 24–26. Denver Art Museum, 100 W. 14th Ave. Parkway, Denver, 80204. (303) 575-2793.

CONNECTICUT: **Shows**—Berlin Crafts Expo, Aug. 24–26, Berlin; Hartford Christmas Crafts Expo I, Dec. 7–9, Hartford; Hartford Christmas Crafts Expo II, Dec. 14–16, Hartford. Contact American Crafts Expo's, Box 368, Canton, 06019. (203) 693-6311.
Exhibit—16th Annual Celebration of American Crafts, Nov. 8–Dec. 23, deadline Aug. 1. SASE to Roz Schwartz, Creative Arts Workshop, 80 Audubon St., New Haven, 06511. (203) 562-4927.
Workshops—Summer: Boatbuilding, July 2–7, Aug. 6–10, 13–18, 20–25. Brookfield Craft Ctr., Box 122, Brookfield, 06804. (203) 775-4526.

WASHINGTON, D.C.: **Exhibition**—Renwick Gallery Sales, work about "American Politics and the Presidency," Sept. 7–Nov. 4, deadline July 1. Contact Smithsonian Institution Museum Shops, Room 295, 600 Maryland Ave., Washington, 20560.

GEORGIA: **Fair**—Internat'l Woodworking Mach. & Furn. Supply Fair, Aug. 25–28. Georgia World Congress Ctr., Atlanta. Contact 8931 Shady Grove Ct., Gaithersburg, Md. 20877. (301) 948-5730.

IDAHO: **Workshop**—Musical instruments, John Taye, July 9–13. Boise State University, 1910 University Dr., Boise, 83725. (208) 385-3295.

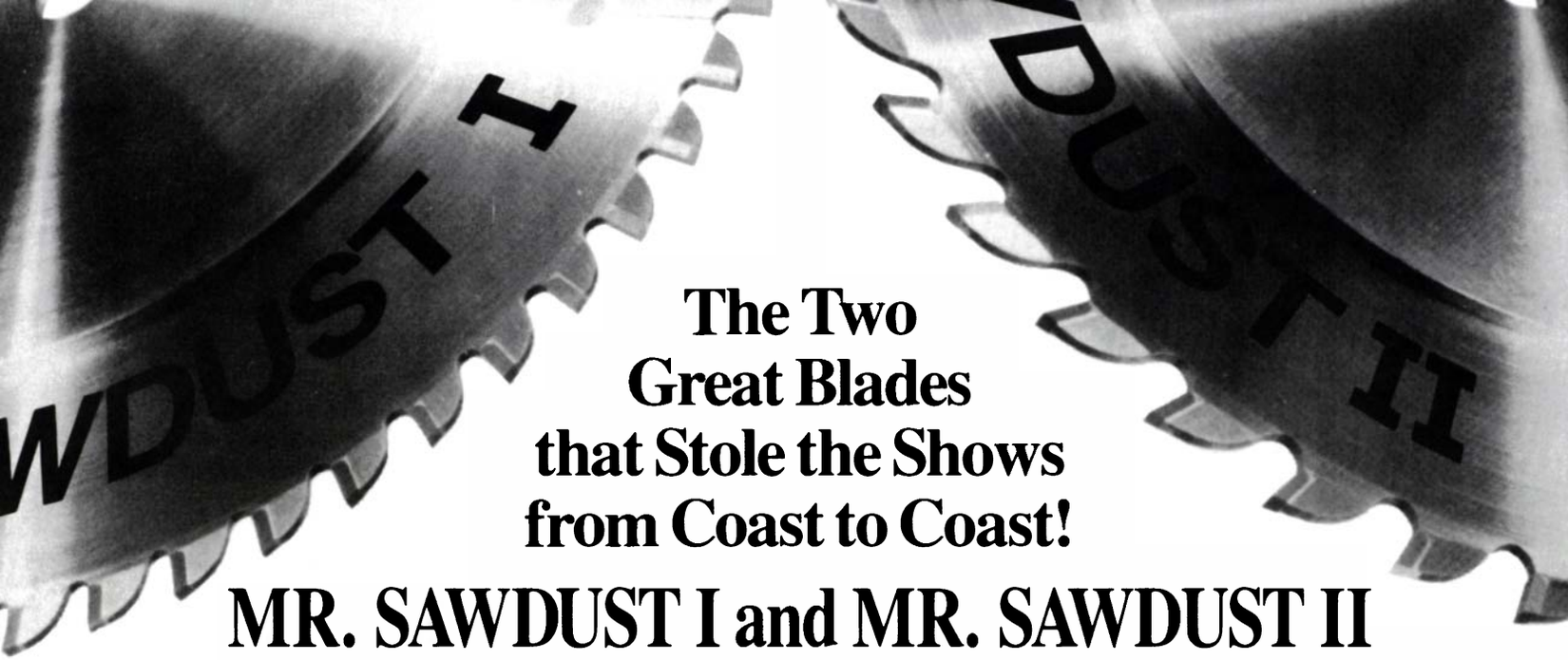
ILLINOIS: **Show**—Woodworking World, Oct. 12–14. O'Hare Expo Center, Rosemont. Contact Box 485, Plymouth, N.H. 03264. (603) 536-3768.
Juried show—Arts/crafts, June 30–July 1. Church St., downtown Evanston. (312) 328-1500.

INDIANA: **Juried show**—15th Annual Chautauqua of the Arts, Sept. 29–30, deadline Aug. 1. Contact Dixie McDonough, 1119 W. Main St., Madison, 47250. (812) 265-5080.

IOWA: **Exhibitions**—International Woodcarvers Congress, June 28–July 1; International Decoy Contest, Aug. 3–5, deadline July 15. Contact Box 406, Davenport, 52805. (319) 332-7484.
Festival—Pioneer Exposition of arts and crafts, Aug. 31–Sept. 1, deadline Aug. 1. Pottawattamie County Fairgrounds, Avoca. Contact 106 Navajo, Council Bluffs, 51501. (712) 366-1136.

LOUISIANA: **Shows**—Craftworks Trade Show, Aug. 3–5, Riverside Centroplex, Baton Rouge; Craftworks Gift Show, Mar. 16–17, 1985, Baton Rouge, application deadline Oct. 15, 1984. Contact J. Martin, Craftworks, Rt. 4, Box 688, Gonzales, 70737. (504) 673-4002.

MAINE: **Workshops**—Teenagers, summer. New England Craft Program, Kent Hills School, Kent Hills. Contact J. Sinauer, 374 Old Montague Rd., Amherst, Mass. 01002. (413) 549-4841.
Summer courses—Stephen Proctor, Don McKinley, Jon Brooks. Haystack Mountain School of Crafts, Deer Isle, 04627. (207) 348-6946.
Craft show—9th Annual Exhibition, Aug. 17–19. Mt. Desert Island High School, Bar Harbor. Contact Professional Craftspeople of Maine, Box 2, Bar Harbor, 04609. (207) 288-5688.
Summer courses—Various courses offered by WoodenBoat School. Contact WoodenBoat, PO Box 78, Brooklin, 04616. (207) 359-4651.



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We'll list our shows into 1985 in the next issue.

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MASSACHUSETTS: **Fair**—Springfield Craft Festival, June 22–24. Across from Civic Center, Springfield. Call (914) 469-2249.
Show—Summerfest '84, July 27–29, Topsfield. Call (413) 733-5154.
Craft fair—Formerly of Rhinebeck, N.Y. Trade: June 18–20; public: June 22–24. Eastern States Expo Center, West Springfield.
Course—Basic furniture restoration, repair and refinishing, July 9–27. New England School of Furniture Restoration, Box 672, Northampton, 01061.
Workshops—Timber framing, July 16–20; cabinetmaking, Sept. 17–21. Heartwood, Johnson Rd., Washington, 01235. (413) 623-6677.
Seminars—Veneering, sharpening, finishing, joinery, marquetry, turning. The Woodworkers' Store, 2154 Massachusetts Ave., Cambridge, 02140. (617) 497-1136.
Exhibition—Student Directions '84, June 14–Sept. 8. Worcester Craft Center, 25 Sagamore Rd., Sagamore. (617) 753-8183.

MICHIGAN: **Courses**—Timber framing: Haslett, June 25–July 1; Evansville, Ind., July 9–15; Ottawa Lake, Aug. 6–12. Also, Riverbend Annual Energy Expo and Timber Frame Reunion, July 14–15, Blissfield. Contact PO Box 26, Blissfield, 49228. (517) 486-4566.

MINNESOTA: **Festival**—14th Annual Renaissance Festival, Aug. 18–19, 25–26, Sept. 1–3, 8–9, 15–16, 22–23. Highway 169, Shakopee. Contact Craft Coordinator, 3525 145 St. W., Shakopee, 55379. (612) 445-7361.
Workshop—Carving, marquetry, drawing, letter cutting, Aug. 5–11. Villa Maria, Old Frontenac. Contact Villa Maria Workshop, Box 37051, Minneapolis, 55437.
Fair—12th Annual Crafts Festival, June 23–24. College of St. Catherine, St. Paul. Contact Minnesota Crafts Council, 528 Hennepin Ave., Minneapolis, 55403. (612) 333-7789.
Lecture/workshop/show—Minnesota Woodworker Guild: Sam Maloof, Aug. 3–4, tickets: "Maloof Tickets," 530 Selby Ave., St. Paul, 55102; 2nd Annual Show, deadline for new members July 15. Contact Guild at PO Box 8372, Minneapolis, 55408.

MISSOURI: **Workshops/classes**—Refinishing, planing, hand tools, polishing, touch-up. Aug.–Nov. Contact Dan Smith, Finishing School, 1629 N. 2nd, St. Charles, 63301.

MONTANA: **Seminars**—Hand-tool joinery, and drawing and design, July 9–15, Aug. 6–12. Primrose Center, 401 West Railroad St., Missoula, 59802. Contact Steve Voorheis, (406) 728-5911.

NEVADA: **Juried show**—Las Vegas, Oct. 27–28, deadline June 30. Contact Craftworks, 5151 Boulder Hwy, Las Vegas, 89122. (702) 456-6695.

NEW HAMPSHIRE: **Workshops**—Violin, June–Aug. Univ. of N.H. Contact Div. of Cont. Ed., 24 Rosemary La., Durham, 03824. (603) 862-1088.

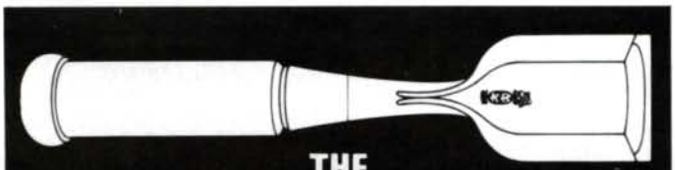
NEW JERSEY: **Workshops**—James Hutchinson, June 24–30; Peter Touhey, July 9–13; Bob Sperber, July 15; Mark Cramer, July 16; Robert March, July 16–20; Edgar Anderson, July 21–22; Giles Gilson, Aug. 4–5; Alan Lazarus, Aug. 6–11; Tage Frid, Aug. 17–19; Emil Milan, Aug. 20–24; James Hutchinson, Aug. 25–26. Peters Valley Craftsmen, Layton, 07851. (201) 948-5200.

NEW MEXICO: **Lecture/demonstrations**—Tablesaw joinery, Scott Taylor, July 14, 423 Walter SE, Albuquerque; turning, Rob Sterba, Aug. 11, 12000 Prospect NE, Albuquerque. Albuquerque Woodworkers Assoc., 615 Mission NE, Albuquerque, 87107. (505) 265-4077.

NEW YORK: **Exhibits**—RISD, June 7–July 7; Tage Frid, Sept. 20–Oct. 28. Gallery at Workbench, 470 Park Ave. So. at 32nd St., New York, 10016. (212) 481-5454.
Festival—Crafts, June 30–July 1 and July 7–8. Lincoln Center, New York City. Contact Brenda Brigham, (201) 798-0220.
Workshops—Japanese tools, Robert Meadow, June 16–17, July 21–22, Aug. 11–12, Aug. 20–24; English joinery and carving, Graham Blackburn, Aug. 4–5. The Luthierie, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207.
Fairs—Arts & Crafts, Aug. 31–Sept. 3. At Ulster County Fairgrounds, New Paltz. Contact Scott Rubinstein, (914) 679-8087.
Juried festival—Arts and crafts, July 6–8, Aug. 10–12. Bestor Plaza, Chautauqua.
Exhibit—"Shavings from the Past," through July 1. SASE for catalog, DeWitt Historical Society, 116 N. Cayuga St., Ithaca, 14850. (607) 273-8284.
Shows—Crafts in the Forest, June 16–17; 7th New York Renaissance Festival, July 28–Sept. 9, weekends only. Sterling Forest, Tuxedo. Contact Creative Faires, (516) 288-5225.
Show—Contemporary N.Y. Crafts, July 6–Aug. 18. The Gallery at 15 Steps, 407 West Seneca, Ithaca, 14850. (607) 272-4902.
Show—Wendell Castle, school and shops, May 19–July 6. Alexander Milliken, 98 Prince St., New York, 10012.
Juried show—Holiday Craft, Dec. 15–16, deadline Aug. 11. Rockland College, Suffern. Contact Quail Hollow Events, PO Box 825, Woodstock, 12498. (914) 679-8087.
Craft fairs—Boardwalk at Playland at Rye, Long Island Sound, July 14–15, deadline July 7; 10th Annual Croton Lions Club and Westchester County Parks Dept., Sept. 15–16, deadline Sept. 1. SASE to Craftspeople Associates, Monya Brown, 33 Lexington Dr., Croton, 10520. (914) 271-5302.
Exhibit—1984 Annual Marquetry Society of America, Nov. 3–Dec. 1, deadline Oct. 13, limit two entries/member. Constantine's Show Rooms, 2050 Eastchester Rd., Bronx. Contact William J. Rondholz, 51 Carlton Ave., Jersey City, N.J. 07306.

NORTH CAROLINA: **Convention/exhibit**—Guild of American Luthiers, Aug. 2–5. Guilford College, Greensboro. Contact David Sheppard, 708 So. Elam, Greensboro, 27403. (919) 274-2395.
Courses—Numerous subjects, Apr.–Sept. John C. Campbell Folk School, Rt. 1, Brasstown, 28902. (704) 837-2775.
Juried shows—High Country Crafters. Fairfield-Sapphire: June 29–July 1, July 20–22, Aug. 17–19. Scaly Mountain: July 6–8, Aug. 3–5, Oct. 12–14. Asheville: Aug. 9–11, Nov. 23–25. Cashiers: Aug. 31–Sept. 2. Contact Elizabeth Kdan, 29 Haywood St., Asheville, 28801. (704) 254-0070.
Workshops—Green woodworking, cooperage, Japanese woodworking, chairmaking, July–Aug.; toolmaking, Oct. 1–5. Country Workshops, Rt. 3, Box 262, Marshall, 28753. (704) 656-2280.

OHIO: **Workshops**—Equipment maintenance, June



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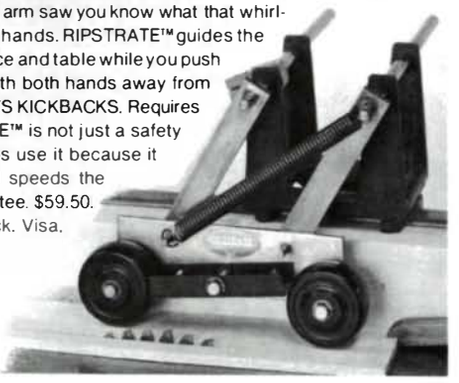

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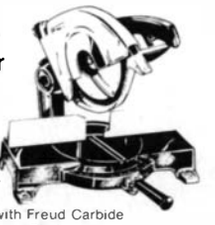

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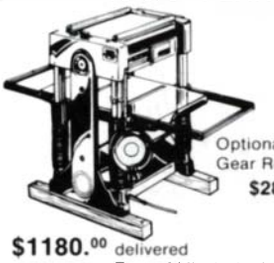

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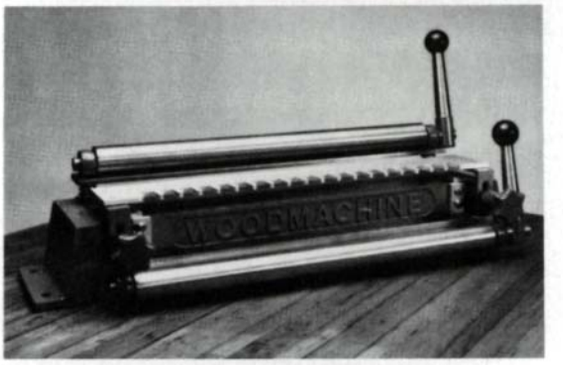

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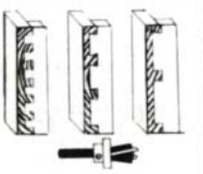

FOR BROCHURE WRITE

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18–23. Bowling Green State University, Bowling Green, 43403. (410) 372-2436.
Seminar—Dovetails, Mark Duginske, June 23–24. University of Akron. (216) 375-7826.

OKLAHOMA: **Show**—8th National Woodcarving Show, July 27–29. Woodland Hills Mall, Tulsa. Contact Eastern Okla. Woodcarvers Assoc., Box 103, Kellyville, 74039. (918) 247-6654.

OREGON: Events throughout the year at Western Forestry Ctr., 4033 SW Canyon Rd., Portland, 97221. Contact Linda Smeltzer, (503) 228-1367.
Lectures/workshops/classes—June through July. Oregon School of Arts and Crafts, 8245 SW Barnes Rd., Portland, 97225. (503) 297-5544.

PENNSYLVANIA: **Show**—Central Pennsylvania Festival, July 8–31. Zoller Gallery, Penn State, University Park.
Show—Furniture, Robert Kopf, June 10–July 3. The Works Gallery, 319 South St., Philadelphia, 19147.
Fair—15th Annual Crafts Fair in the Park, Sept. 7–9, deadline July 15. Sponsored by Craftsmen's Guild of Pittsburgh, Mellon Park, Pittsburgh. Contact Mark Powder, Box 10128, Pittsburgh, 15232. (412) 363-0569.
Exhibition—2nd Annual "The Woodworker," Sept. 21–23. Philadelphia Armory (Drexel Campus). Contact R. Rothbard, (914) 469-2249.

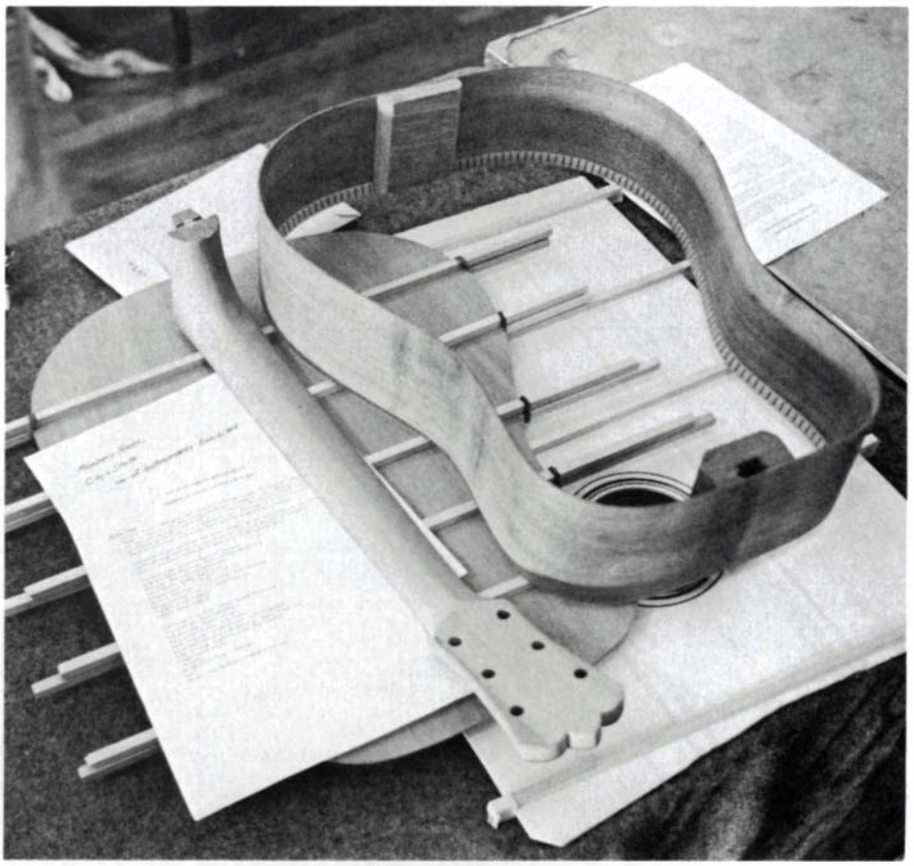
RHODE ISLAND: **Show**—Furniture, to June 27. RISD Museum, 224 Benefit St., Providence. For hours, call (401) 331-3511, ext. 131.

TENNESSEE: **Exhibition/competition/workshops**—Concepts related to the garden, Oct. 12–Dec. 8, slide deadline Aug. 10; turning, Aug. 6–10, Aug. 13–17. Scholarships available. Contact Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, 37738. (615) 436-5860.
Show—18th-century reproductions by Robert Emmett, July 19–29. Dulin Gallery, 100 Kingston Park, Knoxville. (615) 525-6101.
Workshops—Thomas Hill, June 18–29; Drew Langsner, June 25–29; Gail Fredell Smith, July 2–13; Michael Fortune, July 16–27. Appalachian Center for Crafts, Rt. Box 347-A-1, Smithville, 37166.
Tours—Tennessee Hardwood Factory. Daily M–F, 800 Main St., Woodbury, (615) 563-2223.

TEXAS: **Seminar**—Marquetry and inlay with Silas Kopf, Sept. 7–9. Wood & Tool Store, 1936 Record Crossing, Dallas, 75235. (214) 631-5478.

UTAH: **Workshops**—Turning: Alan Stirt, Dale Nish, Mel Lindquist, David Ellsworth, May–July. Craft Supplies USA, 1644 S. State St., Provo, 84601. (801) 373-0917.
Festival—15th Annual Park City Art Festival, Aug. 4–5. Main St., Park City. Contact Kimball Art Center, (801) 649-8882.

VERMONT: **Exhibit**—Rare tools and machines. At the American Precision Museum, Windsor, Vt., publishers of the *Tools & Technology* quarterly. (802) 674-5781.
Exhibits/workshops—Series of craft exhibitions. Contact Vermont State Craft Center at Frog Hollow, Middlebury, 05753. (802) 388-3177.
Workshop—Wood and canvas canoes, Sept. 2–10. Sterling College, PO Box 200, Craftsbury Common, 05827. (802) 586-2561.
Festival—Kennedy Brothers 2nd Annual Crafts, Oct. 5–8, Vergennes. Contact Kennedy Brothers, 11A Main St., Vergennes, 05491. (802) 877-2975.



The Guild of American Luthiers' biennial jamboree is Aug. 2-5 in Greensboro, N.C.

VIRGINIA: **Show**—International Creative Marquetry, Oct. 2–28, deadline June 22. Library, Virginia Wesleyan College, Norfolk. Contact Inter'l Creative Marquetry, Box 4133, Virginia Beach, 23454.
Show—"10 Years Later . . ." J.L. Heatwole, David Ray Pine, John Weissenberger, Sept. 9–30. Staunton Fine Arts Ctr., 1 Gypsy Hill Park, Staunton, 24401.

WASHINGTON: **Seminars/workshops**—Apr.–Aug. Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. Contact Barbara Purdue, (206) 385-4948.
Show—8th Annual Seattle Wooden Boat Show, June 29–July 1. CWB and Naval Reserve Center, Seattle. Contact The Center for Wooden Boats, 1010 Valley St., Seattle, 98109. (206) 382-2628.
Exhibit—Sculpture, Furniture and Constructions, July 21–Oct. 27. WhatCom Museum, 121 Prospect St., Bellingham, 98225. (206) 676-6981.
Workshop—Japanese carpentry, Yoshi Juni Shimoi, Aug. 11–12. Architecture Hall, University of Washington Campus, Seattle. Contact Northwest Gallery of Woodworking, 202 First Avenue S., Seattle, 98104. (206) 625-0542.

WEST VIRGINIA: **Exhibit**—Woodworking 1984, June 24–Aug. 25. Stifel Fine Arts Center, 1330 National Rd., Wheeling, 26003. (304) 242-7700.
Workshops—Turning, July 11–15; basic joinery, July 18–22. The Crafts Center, Ripley, 25271. (304) 372-6263.

WISCONSIN: **Workshop**—Festival of Wood, June 29–July 1. Office of Continuing Education, Univ. of Wisconsin-Stout, Menomonie, 54751. Contact Kathy Mork, (800) 457-8686.

BRITISH COLUMBIA: **Juried exhibit**—4th Celebration of Wood, July 30–Aug. 11. Robson Square Media Centre, Vancouver. SASE to Circle Craft, 348 Water St., Vancouver V6B 1B6. (604) 669-8021.

ONTARIO: **Show**—Handcrafted furniture, sculpture, instruments, Aug. 10–12. Durham Art Gallery, Box 920, Durham, N0G 1R0. (519) 369-3692.

NOVA SCOTIA: **Lecture/workshop**—Lapstrake boatbuilding with Simon Watts, July 10, 7 p.m., Provincial Archives Bldg., Halifax, free and open to public; boatbuilding course, July 9–14, Monocatri Marine, 801 McLean St., Halifax. Contact Richard Tyner, (902) 466-3306.

NOTES AND COMMENT

George Lucas' lavish Victorian-style mansion, above, is a showplace of high-style millwork rarely done today, such as the curved raised-panel wainscot being worked up by Bill Pettigrew and Bob Demo, right.

The house that "The Force" built

Somewhere in the rolling green hills of Marin County, Calif., hidden away in a secret valley, one man's fantasy is slowly taking shape. Armed with an idea, some sketches and a healthy budget—fifty to seventy million dollars—film director George Lucas is building a house.

It isn't an ordinary house. It's a 50,000-sq.-ft. Victorian with a solarium, a porch as wide as a city street, handmade stained-glass windows and magnificent redwood millwork. There are formal Victorian rooms, others with a Victorian-farmhouse flavor, and still others in the Arts and Crafts style. One room has an amazing redwood ceiling the deep-red color of burgundy. The wood came from local wine casks.

The house is the grandest of several Victorian-style buildings at Skywalker Ranch, a 1700-acre production facility for Lucas Film Ltd., producer of the *Star Wars* trilogy. According to general manager Eric Westin, all the work that goes into a film before and after shooting will take place here. Don't expect to see the ranch in a film, though. It wasn't built as a set. George Lucas just likes the Victorian style. The house will be his office. Behind its 19th-century facade it conceals 20th-century touches, such as a built-in computer system and an acoustically insulated editing room with a floating floor.

Lucas knows how he wants things to look. He sketches his ideas, then depends on a full-time resident team of architects, designers, carpenters, millworkers, glassworkers and metalworkers to turn idea into reality. If the result doesn't look right to him the first time, it gets done over until it does. At the ranch, extravagance is the status quo.

Hearing that some local artisans were doing amazing work there on an unlimited budget, I accepted an invitation to drop by for a firsthand look.

All the woodwork is designed and made on the premises. The ranch's woodshop is a basement woodworker's dream come true. A $29,000 abrasive surfacer was the first tool that caught my eye. A huge bandsaw resaws old redwood bridge timbers cut from virgin stands of trees over 1500 years old. Andy Van Duinen supervises the 20 local artisans who work full-time, turning out millwork for Lucas' dream.

I've never seen millwork that equals what this crew produces. Often they're presented with a tricky design that nobody is really sure how to build—such as curved raised-panel wainscoting. Construction details are worked out by making full-scale redwood mockups. Layout man Bob Demo, who for 25 years restored Victorian houses in San Francisco, made many of the molding mockups with his old Stanley #55. The mockups have to pass muster with Lucas. They're made of redwood so that he can see what the finished piece will look like.

Since the house will be used as an office, it has to comply with commercial building codes—something builders in the Victorian era didn't have to contend with. This poses a few design challenges. For example, Lucas wanted raised-panel redwood doors, but interior doors must be fire-resistant. The problem was solved by laminating ¼-in. thick redwood to a core of SLM, a fire-retardant fiberboard. When fitted out with moldings, those doors look like solid-redwood frame-and-panel doors.

The best finish carpenters in the area install the masterpieces that come out of the shop. Even then, after everything is installed, it's not too late for a rip-out if things don't look right.

The finishing crew works a different type of magic. Curved redwood sashes were already installed in a circular turret when Lucas decided that he wanted oak woodwork there instead, so the finishers painted the redwood to look like oak. Even up close, it's hard to tell the camouflaged redwood from real oak.

The house will never be open to the public, but take heart. If you paid to see a Lucas film, you played a small part in building it. *—David Sloan*

Millwork options for the small shop

by Jeff O'Hearn

With money from second mortgages on their homes, and a machine or two from basement workshops, Dennis Rex, Jeff Stuck and Gary Busateri started a small millwork shop in Milwaukee four years ago. All had millwork experience—Rex and Busateri as cabinetmakers, Stuck as an estimator. They wanted their company, American Woodworking, to be big enough to take on profitable, challenging work without becoming a managerial nightmare.

When I spoke with two of the partners at last year's Architectural Woodwork Institute convention in Nashville, they told me that the company now had seven employees, a growing stable of equipment and an established reputation. American Woodworking plans to limit itself to twelve employees, which is, coincidentally, the average size of shops in the AWI. Stuck said that their largest job had been a $30,000 lawyer's office with solid cherry wainscoting and a veneered-pediment lobby structure.

Having worked in the millwork industry for five years, I can see how twelve-man and smaller shops pros-

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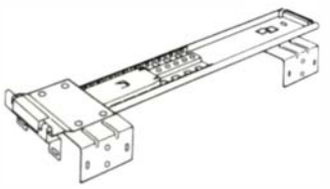
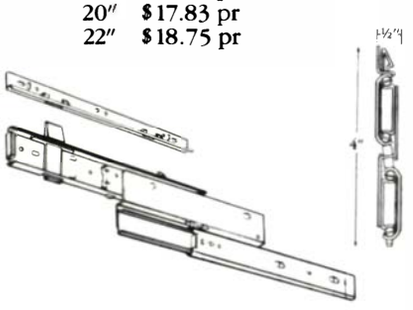


C4017 Full Extension

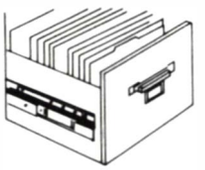
For full extension use — a heavy duty side mount right or left handed slide with an additional 1 1/2" extension — often used where case top overhang requires slide over-travel for ease in removing files. Functions smoothly in 1/2" minimum slide space and carries loads up to 110 pounds. Available in both zinc and black plated finishes. Add 10% to these prices for black plated finish.

12" $15.18 pr
14" $15.54 pr
16" $16.22 pr
18" $16.95 pr
20" $17.83 pr
22" $18.75 pr



C3017 Low Profile

A heavy duty slide which offers full extension plus 1" over-travel. Will support file, desk and credenza box drawers with a load limit of 100 lbs. for 12" slides. Requires a minimum ½" side space. Provided with silent polymer ball bearings and drawer hold-in features. Available in zinc and black finishes. Add 10% to these prices for black plated finish.



10" $11.72 pr
12" $12.03 pr
14" $12.64 pr
16" $13.08 pr
18" $13.80 pr
20" $14.53 pr
22" $15.27 pr
24" $16.10 pr

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For desk and credenza box drawer applications. This is the precision three-quarter extension slide — light duty, side mount — featuring new super silent polymer ball bearings. C2037A is unhanded and easy to install. It is designed to function smoothly in 1/2" minimum slide space and to carry up to 50 pounds. Available in both zinc and black plated finishes — add 10% to these prices for black plated finish.

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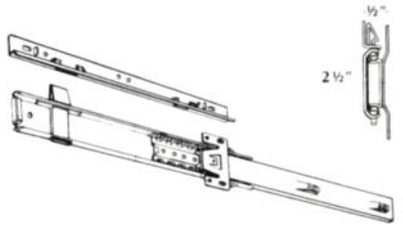
20" $10.35 pr
22" $10.60 pr



C1029 Center Mount

A precision three-quarter extension slide. Mounts to existing drawer bottoms and cabinet frames. No adjustments are necessary. This slide is center-mounted so the available side space between drawer and cabinet plays no part in installation. It eliminates wooden guides, supporting members and brackets. You're assured precision smooth drawer movement.

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#14 $4.10 ea
#16 $4.16 ea
#18 $4.37 ea
#20 $4.54 ea
#22 $4.79 ea
#24 $5.06 ea
#26 $5.40 ea

Slide Number	Fits Drawer Lengths	Fits Cabinet Depths	Drawer Extension
12	10⅝" – 12½"	13" – 14½"	8½"
14	12⅝" – 14½"	15" – 16½"	10½"
16	14⅝" – 16½"	17" – 18½"	12"
18	16⅝" – 18½"	19" – 20½"	12½"
20	18⅝" – 20½"	21" – 22½"	14½"
22	20⅝" – 22½"	23" – 24½"	16½"
24	22⅝" – 24½"	25" – 26½"	17½"
26	24⅝" – 26½"	27" – 28½"	19½"

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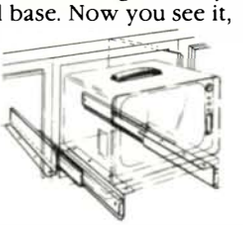

C-302 Pull-Out Shelf Slide

Designed for heavy duty shelf and drawer applications. Features full extension, rated up to 120 pounds load capacity. Mounting tabs are formed out of the drawer member for simple mounting or removal. Minimum side space required is 3/4".

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20" $23.35 pr
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per. Giant veneer presses, molders, drum sanders and the ability to underwrite expensive work distinguish one millwork shop from another, but much of what the industry does—including custom cabinets, desks and furniture—amounts to sophisticated box-building.

Equipped with a tablesaw, a jointer, some hand air tools and an efficient European dowel-boring machine, any small shop can produce much of the cabinetry in today's commercial buidings. And because a small shop's overhead is lower, its products often cost less than those of a larger outfit. Some medium and large millwork houses in my area are already having a tough time competing with three- to eight-man shops for straight casework. A small shop has one more advantage: the architect or designer can communicate more directly with the craftsmen, adding a measure of spontaneity absent from more formal dealings with larger outfits.

A small shop can break into the millwork market in many ways, but learning to crawl before you run is the most important advice. One good way to start is to develop relationships with architects and designers who work on a design/build basis, all the while improving your paperwork. Bid sheets, contracts, purchase orders—whatever you use to control your operations—must be in order before you can compete and survive. Otherwise you may get a job that will do far more harm than good—financially and emotionally.

There's probably room in the millwork market for more small shops, and I'm sure that many one-of-a-kind furniture shops already have the equipment and skill to do commercial work.

When it gets right down to it, there isn't as much difference between one-of-a-kind work and high-end millwork as you might imagine. Bob Leininger, owner of a ten-man shop in Lexington, Ky., fondly recalls his student days with Tage Frid thirty years ago. When I asked Leininger if his schooling had prepared him to run his business, he replied that he had been trained to draw, make materials lists and keep track of time as he worked—just the skills needed in millwork.

"I don't build five-hundred-hour masterpieces with all the pretty joints because cost is such an issue," Leininger added. "You can do good-quality work quickly. You can do plastic-laminate work well and it can be beautiful, just like wood or veneer. The important thing is to care about the work." □

Jeff O'Hearn writes more about architectural millwork on pp. 30-36 in this issue.

Lots of shows and two new magazines

These days, it seems like everybody's in show business—the woodworking trade-show business, that is. Three different promoters are now in on the act, and this spring woodworkers on both coasts had plenty of shows.

The largest of this year's shows, and possibly the largest consumer woodworking trade show to date was The National Working With Wood Show, held Apr. 6-8 at the Trade Show Center in San Francisco. More than 18,000 people turned out to examine and buy the machinery, hand tools, hardware, books, finishing supplies, wood and new gadgets displayed by nearly 150 exhibitors. There was a nice balance between machines and hand tools, with plenty of smaller items for the impulsive woodworker to carry home.

Midtown Manhattan is a tough place to park a car, which probably explains why the East Coast version of The National Working With Wood Show, held May 11-13 in New York's Penta Hotel, was less than half the size of its San Francisco counterpart.

The first Woodworking Show for Craftsmen & Hobbyists took place Apr. 13-15, at the Pasadena Convention Center. It was the first crack at the woodworking-hobby market by the sponsors of the big biennial trade fair at Louisville, an industry-oriented affair not well attended by basement amateurs. Though tiny by comparison to Louisville, the L.A. show's 53 exhibitors drew about 8,000 people. A show of similar size was held that same weekend in Boxboro, Mass.

Meredith Corp., the publishers of *Better Homes and Gardens,* have also noted the growing interest in woodworking and will introduce a new bimonthly woodworking magazine late this summer. The first issue of *Wood* will go on sale Aug. 21, and will be aimed at both novice and advanced woodworkers. It will sell for $2.95 an issue, $12.95 for a year's subscription.

In other publishing news, *Pacific Woodworker,* which is published in Concord, Calif., has changed its name to *Popular Woodworker.* And the newly formed Woodworking Association of North America, 35 Main St., Plymouth, N.H. 03264, has announced plans to publish a quarterly called *International Woodworking.* —*David Sloan*

Making the most of messing up

The whine of the saw . . . the aroma of wood shavings . . . the clouds of sawdust that waft through the house, thick enough to show what species is being pulverized in the basement. These are some of the joys in a woodworker's life, but my wife's favorite is the heart-rending expletive that echoes from my shop when something goes wrong.

Propriety prevents me from detailing my storehouse of vulgar verbiage, but my favorite causes for outbursts include: the last plane stroke that splinters out a chunk of wood; the final tap that breaks the joint being driven home; and those dents, nicks and gouges that we'd call "distressing" if we'd beat the cabinet with chains.

Whenever we become complacent about our skills and arrogant about our craft, the wood manages to remind us who is in charge. Since we work wood because we love it, we must accept the rebuke, and vow never to make *that* mistake again. But it is usually necessary to swear a little and stomp our feet. Then come the moments that I most enjoy—laughing at myself, unleashing an ingenious solution and laughing some more. I believe that we are happier and more creative when we avoid taking ourselves too seriously.

Jack Hubley

Plane shavings are Hunsicker's crowning glory.

I've read hundreds of technical articles whose prose had the snap of the *Congressional Record.* I've read Krenov and Nakashima, and felt as if I had the soul of a Philistine. And I finally decided that I'm no Krenov or Nakashima. My purpose is not pure, my technique is flawed, my designs are somewhat short

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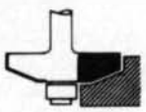	#15	RAISED PANEL	20° Angle	1-5/8"	1/2"	25.00
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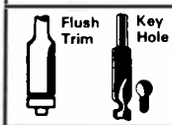	#13	1/2" FLUSH TRIM		1/2"	1"	8.50
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of da Vinci—but I'm getting better, and I have an awful lot of fun.

There are thousands of ways to louse up a project, and I've found most of them. It's not surprising, then, that I have become adept at fixing my mistakes.

For example, my final step in box assembly is installing the hinges. Naturally, as the last chance to spoil the piece, this step is fraught with demons. On one memorable piece, I carefully cut the hinge mortises, shortened the screws so that they wouldn't poke through the lid, and drilled the pilot holes. Unfortunately, too much squeeze on the variable-speed trigger put the drill through the lid. I covered this disaster by cutting a dado on the rear edge of the lid and laying in a piece of walnut. It looks good, and the box opens nicely.

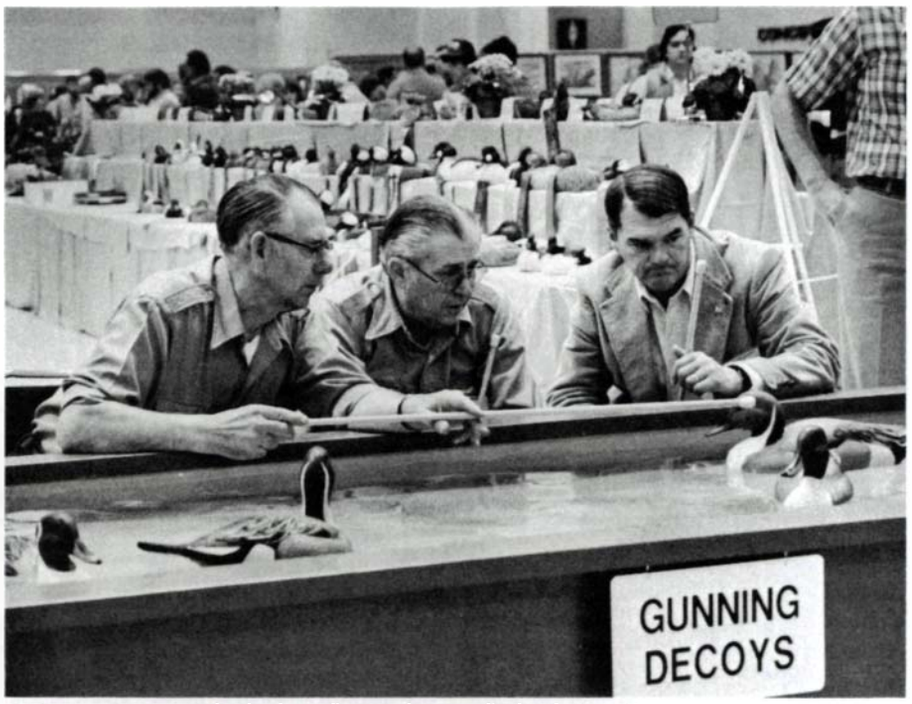
Sometimes the sheer pleasure of working lures us into a mistake. One finished box looked a little harsh to me, so I decided to shave the sides to soften them. So there I was, pulling away with my spokeshave, thinking how marvelous the sound and the feel were, and went right through. I inlaid an ebony plate to cover the hole, and the plate is one of the box's best features.

An entirely different type of mistake can be traced to the twisting, leaning nature of some trees. Face it, some boards simply refuse to emerge from under the plane without tearing. But who says a box must have straight, perfectly flat sides? In my younger days, I erased the tears with a belt sander, but now try to follow Krenov's example and plane them out. Krenov, however, is a master with a plane; I'm not, although I'm working on it. Meanwhile, I've found that texturing the afflicted area with my trusty gouges can make it more inviting to the touch. Krenov's cabinets are exquisite, but such pristine surfaces make me nervous. A little crater here and there lets the owner *use* the thing.

Humans will always make mistakes, and the test of an imaginative mind is to turn those liabilities into assets. Alter the focus of the piece—a technique known to all magicians and pickpockets—and remember that conservative solutions are rarely as successful as bold ones. Whatever you do, do it with style.

Oh, one for the road: I made two maple boxes once. Through the skilled use of a razor-sharp chisel I managed to impale my finger and hemorrhaged on one box. I scraped off most of my A-positive, but one persistent spot remained. I neatly carved: "This is my damn blood," and left the spot. The box with the blood sold first.

—Max Hunsicker, Mt. Gretna, Pa.



Judges strive to pick the best floater from a flock of pintails.

A decoy show isn't just for hunters

There's a long tradition of decoy shows in America. Wooden-wildfowl makers have always vied with each other to produce companionable stools of birds that would pull in passing flocks from afar. Along the way, it became just as important to fool the eye of the duck hunter—after all, if a carver couldn't pull in a passing customer, he wouldn't stay in business. But the liveliest-looking decoys were snapped up by collectors, not hunters, and a special class for these fragile carvings was opened about thirty years ago.

Collectors want other wildlife carvings, too, not just ducks. So at the Mid-Atlantic Wildfowl Festival in Virginia Beach this spring there were classes for miniatures, for animals and for various other things that don't float. At such a show you'll find the whole range of wildlife art: carvings, photos, paintings, presentations by environmentalists, hunting gear, an on-the-spot decoy painting contest, an auction, a bookstore, a calling contest.

About 11,000 people attended the three-day event, which was sponsored by the Back Bay Wildfowl Guild, and I can't imagine that any one of them didn't have a good time. Put a decoy show on your schedule sometime, whether to enter the competition or to just look around. Bring your whole family, too. Everybody else does. *—Jim Cummins*

On jigs

Why do I spend hours planning and building jigs when I know that they save but a few minutes of project time?

I try to convince myself that such a comparison is irrelevant, considering all the things I can make. Besides, time really isn't that important when you're seeking the quality of workmanship that comes from the fixed reference point of a well-constructed jig.

Then I remember all the jigs stuffed between the rafters in my shop. Some I used only once. Now they just collect dust. They weren't designed poorly. It's just that the countless projects that justified each device never materialized. The jigs have helped me become a better workman, but they have also become my crutch, preventing me from developing new skills. Along with my power tools, they have collectively changed the way I work wood.

So why do I keep on making jigs? I guess the reasons are that . . .

. . . I can show them to other woodworkers. Sure, the average woodworker is interested in results. But if you show him how something is done or can be done using a jig, you'll see the shavings flying in his head.

. . . jigs give renewed purpose to my habit of saving plywood and hardwood cut-offs. Others may view their scrap bin as a limbo between the workshop and the firewood pile. I look upon mine as a collection of solutions that I

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can study in search of a problem.

. . . jigs provide a brief respite from the rigors and worries of traditional woodworking. By using plywood, I need only build for one point in time, not account for seasonal wood movement. I can forget the challenges of solid wood. When I can rely on those ingenious T-nut fasteners, I don't have to worry about properly controlling all the variables that ensure a sturdy glued joint.

. . . making jigs is an outlet for the unrestrained creativity that I am unable or unwilling to express in my workpieces. I can take chances because I know that a jig, like a thought, need not be shared with anyone.

No matter how often I analyze my mania for jigs, I still return to one simple conclusion: the marriage of head and hands that occurs every time I design and build a jig is just plain fun.

—Victor Ptasznik, Grosse Pointe, Mich.

Rockwell sold, renamed Delta

Woodworkers who have fond memories of working with a seasoned old Delta tablesaw or jointer will soon be able to buy a selection of stationary power tools by the same name—but they'll be getting Rockwell equipment. A Minnesota firm bought Rockwell's stationary power tool division this spring and will rename it Delta International, the same name the tools wore before Rockwell bought Delta in 1945. Rockwell's Canadian operations will be called Beaver-Delta.

Pentair Inc. paid $40 million cash for Rockwell. In the deal, it gets plants in Tupelo, Miss., Guelph, Ont., and Brazil, where Rockwell manufactures the Invicta power tools that it has been importing to the United States in recent years. Pentair, which bought Rockwell's hand power tool division in 1981 and renamed it Porter Cable, will keep Delta's headquarters and test labs in Pittsburgh. The sale is part of a general shift away from consumer products and toward defense and high technology related manufacturing, which Rockwell has embarked on in recent years.

You'll begin seeing Delta ads right away, but it'll be a few months before the old Rockwell machines appear sporting Delta nameplates. Some new products are planned, and Delta will retain the popular line of tablesaws, jointers, planers, sanders and bandsaws for which Rockwell was best known. Woodworkers will still be able to buy machines and parts through Rockwell's established dealers. *—Paul Bertorelli*

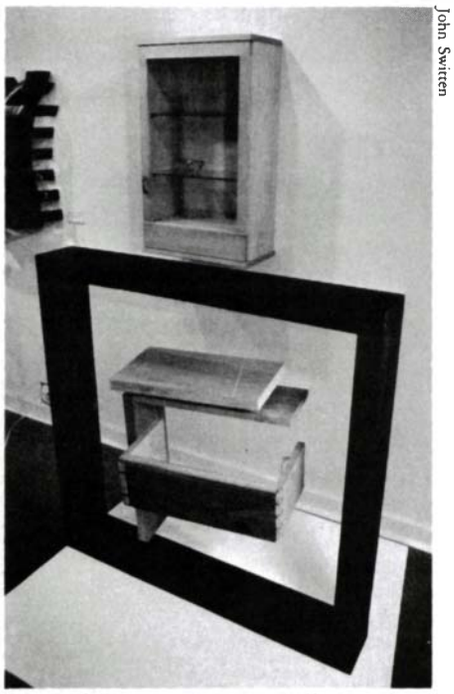
Tracing the craftsman's steps

Galleries usually strive to present the consummation of the woodworker's art: perfectly fitted joints, imaginative designs, gleaming finishes. A Seattle gallery, however, recently took another approach to show the painstaking attention to detail that goes into a piece of quality work.

"Freeze Frames: Tracing the craftsman's steps" showed work-in-progress as well as finished pieces. Graphic, black wooden frames were used to suspend examples of techniques: dovetails, through-wedged tenons, a frame-and-panel, a curved veneer box, a turned bowl, a bent-laminated chair seat and a pinned cove joint. Right next to the freeze frames were examples of furniture using that particular technique.

Some visitors couldn't even resist the temptation to touch the exhibits, as with one gentleman I saw who tried to dismantle the pinned cove joint. The show was held in February at the Northwest Gallery in Seattle's Pioneer Square section.

—Jonathan Cohen, Seattle, Wash.



John Switten

Freeze frame captures partially completed dovetail components in the front of a finished wall cabinet.

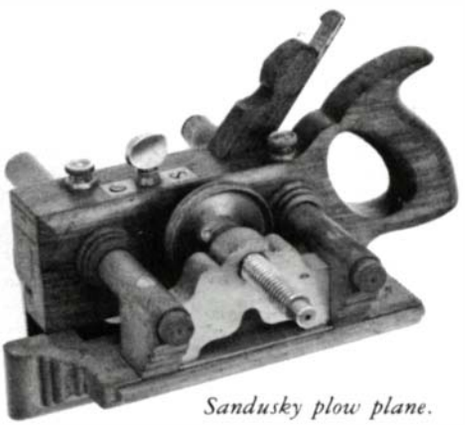
Plane-ly outrageous

Any plow plane will cut a groove in wood, but here's one that can cut a $3,500 swath through your wallet.

Plow planes, the most ostentatiously showy items of all antique woodworking tools, have always been desirable to collectors, but even so, it is astonishing that the Sandusky self-regulating model shown at right fetched that much at one of Richard Crane's auctions in Hillsboro, N.H. It's incredible that so much workmanship and Rube Goldberg design effort went into this single-purpose tool. The price is not just due to scarcity and inflation. Original prices for ornate models (this one has a rosewood body with boxwood fence and arms) were high—craftsmen often paid a week or two's pay for these coveted planes.

Most models have some type of fence-adjustment mechanism, which in the simplest types involves moving the fence manually and securing it with wooden wedges. This Cadillac model is one of the two extant models with a threaded brass adjuster rod and brass center wheel; wooden adjusters were more common. When the wheel is turned, the fence moves toward or away from the skate, which positions the cutter. "Self-regulating" refers to the way the skate and fence remain parallel as they move.

—Norm Vandal, Roxbury, Vt.



Sandusky plow plane.

Notes and Comment

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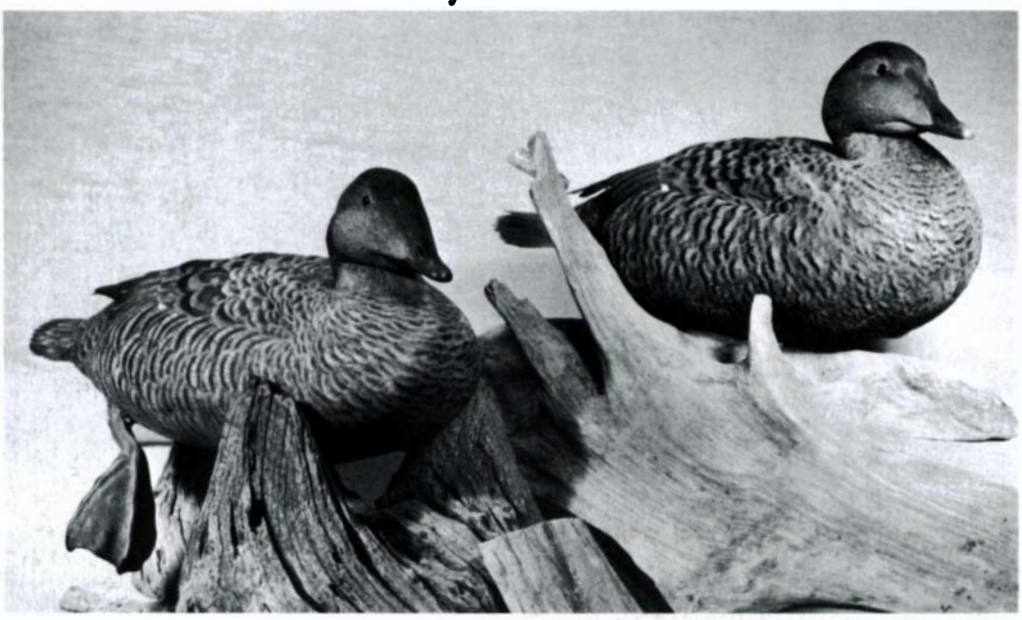

Photos: Tricia Veasey

I'd been carving decorative decoys for a few years, and I wanted to try something really challenging. I decided on a hen eider because its head and bill are so distinctive and unusual. So I borrowed a taxidermist mount from my teacher, Bill Veasey, and started in to copy it as closely as I could. I made templates, carved the body shape from basswood, and then hollowed it out so that it would float right. (At competitions, decorative decoys are judged floating in a tank of water, just as the hunting decoys are.) I'm a stickler for detail, and I worked on burning in the feather detail, carving the feet and painting the bird for so long that Bill finally asked me why it was taking so much time.

One day I figured that I was getting pretty close, because the wood started to look soft, like feathers. So I took the bird down to the school to show it to Bill. A fellow carver took one look and called out, "Hey, Bill, Pat brought your mount back." That was when I knew I'd gotten it right.

In her first competition, the bird won best-of-show at the Mid-Atlantic Wildfowl Festival in Virginia Beach (see p. 100). She's been in five shows so far and has won thirteen blue ribbons, and the lowest she's ever finished has been runner-up. I'll have to retire her from competition at the end of the year, but there are two shows left and I'm keeping my fingers crossed—at home she wears her ribbons around her neck, and I'd like her blue skirt to get a little bigger. That's my bird on the left in both photos. You can tell if you look closely—after all, she *is* wood! —*Sina Patricia Kurman, Alloway, N.J.*