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JANUARY/FEBRUARY 1984, NO. 44, \$3.50



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Fine Woodworking®

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Letters

I am writing to you in regard to Sam Maloof's article in *FWW* #42, "How I Make a Rocker." I've been a professional woodworker for six years now, and after talking to and reading about other woodworkers and their techniques, you almost feel like you should have a degree in engineering before you build a piece of furniture. So it was refreshing for me to read how Sam Maloof, no doubt one of the best-known chairmakers, builds his rockers. For instance, to get the curve of the back spindle he simply sits down and holds it to his back. That's it. That's "seat of your pants" woodworking the way it ought to be.

—Bud Gabriel, Mt. Angel, Ore.

Re the articles on boxes (*FWW* #43): I wish *Fine Woodworking* would fill a very noticeable gap in the literature by carrying methods used by experts to install brass hinges on small boxes. I have searched through everything I can get my hands on, and the matter is either dodged entirely by not using hinges or fobbed off with instructions to "install the hinges."

Also, I have to quibble with your reasons for rejecting the Inca machine (Notes and Comment section)... obviously because I have one. In the first place, it really doesn't cost anything like the Unisaw... it's about \$500 less, I believe. Second, the awkwardness of not being able to lower the 10-in. blade sufficiently is solved by simply using an 8-in. blade, which will still cut through 8/4 stock. I don't really regret the tilting table, though. I don't tilt it very often and it is a very fair tradeoff for the excellent mortising table on the side.

—Jack Warner, Atlanta, Ga.

Every so often in the pages of *FWW* and in other fields, a certain semi-religious phrase appears: form follows function. I equate that phrase with the board stretcher. Form absolutely in no way has to follow function. Take a table leg, for example. The function is to carry the load of the tabletop to the floor. Old crates, a tree branch from the woodpile, or something that in no way resembles a leg can be the form. For proof, look in any *FWW* issue or the *Design Books*. What does form follow? Form follows cost. A tree branch will be infinitely less costly than something of exotic wood, massive, carved or bent. The only way form is related to function is that form must answer to the demands of the function in some way. Without something to hold it up, a tabletop is only an expensive slab of wood. The most efficient form is again the least costly, not the most functional... the form can be any shape or type, regardless of cost, so long as it answers to the demands of the function.

—Edward J. Mattson, Norwalk, Conn.

Re *FWW's* *Design Book Three*: I would like to alert readers to a trap of thievery that exists for almost every craftsman attempting to support himself by his avocation. Be damned careful of your designs. Few of us can afford, let alone qualify for, the legal protections available for our designs. During a presentation of one of our items, it dawned on me that the retailer I was so dil-

igently trying to sell had seen all he wanted when I waltzed my prototype for a hanging wall secretary into the room. He asked that I leave behind my "technical data" and photographs for "buyer evaluation." The bait was the 35 stores in the chain and the dollar signs were blinding. During the discussion following my pitch, the argument wheeled on prices, and my scoffing response generated an angry response in turn. Did I presume to know retailing better than he? He then tried to beat my price back by showing me an 8-in. high stack, collected over three months, of product submissions similar to mine. I was shocked to learn that he intended to pack them up for a tour of Taiwan, where he planned to collect competing bids. Friends verified that he did take the trip to Taiwan and I later saw a product equivalent to ours retailing for exactly my modest wholesale price.

Designs are extremely difficult to protect. If readers have something valuable, I urge them to do it all themselves. Loading up for craft fairs may be a pain in the butt, but close-to-the-vest control is the only way to get the most from your designs.

—Robert Westra, Rolling Meadows, Ill.

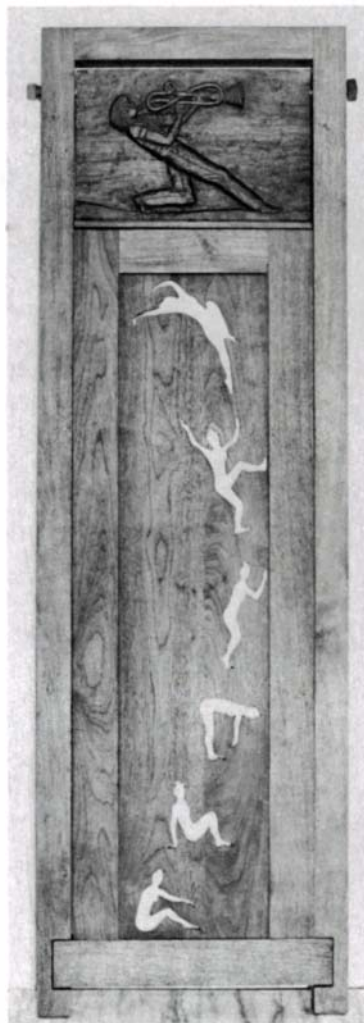
I hesitate to take issue with an electrical engineer, but I don't believe Mr. Rekoff gave Charles Carpenter a complete answer about using European motors in the United States (*FWW* #42, p. 14). In my experience, most European current is 220/240 volts, but it comes through two wires—one hot and one ground. In this country, 220/240-volt is three-wire and is obtained by adding two 110/120-volt hot lines to a ground. Mr. Carpenter will need to buy a step-up transformer in order to get two-wire 220/240-volt current for his European motors. It should be sized to handle any combination of motors used simultaneously.

—George Brooner, Chestertown, Md.

MICHAEL REKOFF REPLIES: If, for some reason, one end of a European motor's winding were connected at manufacture to ground or to the motor's metal case, a potential shock hazard could exist if the motor leads were inadvertently reversed. In this case, a transformer could be used to conductively isolate the motor winding. As far as I know, however, European motors are built like their American counterparts, that is, the motor connections are brought out by leads which isolate the winding from ground. Thus, all you need do to connect a two-wire European motor to the U.S. three-wire system is to install a new cord and plug, connecting the new cord's third wire (the green ground) to the motor case or to the frame of the machine.

Whenever you're working with a motor whose leads or terminal connections aren't clear, it's a good idea to check the winding for continuity to ground. Do this by connecting an ohmmeter between each of the terminals and the motor case. If you find continuity, have the motor checked by a motor shop—it could be shorted.

About a week ago I picked up a copy of your magazine and read Donald Bjorkman's router-table article after just completing my own router table, which offers several ad-



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—Richard Newman, Amherst, Mass.

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vantages (photo, right). I purchased a double-sink cutout of Formica-covered $\frac{3}{4}$ -in. particleboard from a local cabinet shop for \$5. The top was 19 in. by 27 in., the same size as my 10-in. tablesaw. I had gotten a fence slide gear rack from the manufacturer of my saw, and I mounted this to a length of angle iron rabbeted into the front of the table and flush with its surface. I then screwed a wooden auxiliary fence to the saw's regular fence so that the router bit could work through it... the miter gauge rides in a piece of aluminum channel contact-cemented into the table. The table is hinged to heavy sawhorses so that I can tilt it up for router and bit removal. The dust pick-up system is made from a dog-food can that fits very nicely to my dry vacuum. It gets 80% to 90% of the dust. The switch turns on both vacuum and router.

As I had to buy a fence gear rack at \$14, I may have a little more in my table, but Bjorkman's fence is frustrating to set accurately. The biggest design fault is the enclosed base for the router. After a period of use, a router will get quite warm. With no air circulation, you risk cremating a good router.

—Robert C. Bretz, Decatur, Ill.

If it hadn't been for Donald Bjorkman's article on the router table, I'd still be struggling with a makeshift table that was cobbled together from the scrap of an electrical control panel some time ago. Two ideas from the article are particularly good: using maple for the miter-gauge insert and putting Formica on the working surface. Right on! I cannot understand why anyone would cast aspersions on small router tables... I find mine indispensable in most of my work and it is extremely convenient to use. —Tom E. Moore, Springfield, Va.

With regard to Carlyle Lynch's small highboy (FWW #42), your terminology is somewhat cockeyed. Those are not cabriole legs on that piece. Legs like that, turned on the lathe, are known as dutch legs.

—Charles F. Riordan, Dansville, N.Y.

Having read FWW since its inception, it seems to me that almost everything known to me has been mentioned except one thing. I don't remember having seen anything about one of my favorite woods—dogwood. I grew up taking my woods directly from the forests around me, and it wasn't long before I tried dogwood as a substitute for hard maple. I can now say that dogwood is one of the nicest working woods in the United States. It will bend better cold than any wood I know... and it requires a great amount of force to break it. Almost every drawer I have installed in the last 30 years slides on dogwood and it is probably equal or superior to all others in that service. Before you decry the cutting of such a beautiful tree, visit a recently logged-over woods and you will probably find all the ruined dogwoods you can use.

—John W. Wood, Tyler, Tex.

As an upholsterer and refinisher, I found George Mustoe's article on respiratory hazards (FWW #41, pp. 36-39) to be of great value. There is one point, though, that neither Mr. Mustoe nor the manufacturer of my respirator mentions: once the organic-vapor cartridges are exposed to air, they will



Bretz's router table shares his tablesaw's fence.

continue to absorb substances until they become saturated. Thus a mask used for a few hours and left overnight near brushes and solvents might be spent the next day. To prolong the life of cartridges, I wipe off the mask and seal it in a plastic bag. For a few pennies and a couple of minutes of time, I save about \$7 or \$8 and make safety really pay.

—W.G. Battestin, Cambridge, Mass.

I have used power tools for five decades and still have ten essential surgeon's fingers. There are rea-

sons. When I was 17, I confronted a coiled rattlesnake. When I took my eye off it to pick up a stick, it bit me. Since then, I regard any moving power tool as a rattlesnake and I never take my eye off the moving part until *all* movement has stopped. I stress *all* because after cutting the current on a tablesaw, the kinetic energy in the still-whirring blade is unbelievable. It can shoot a strip of wood the size of an arrow right through you.

If you have children, my God, lock the shop! My boys were forbidden to touch power tools. I turned off the master switch to the shop and locked the switch box. So my son reached down with his right hand and turned the belt of the bandsaw while his left pushed a piece of wood against the blade. He didn't cut his thumb off, but he almost did.

I have found that the best instrument for removing a splinter is a surgical hypodermic needle, about size #20. A lady's sewing needle is circular in cross section and slips around a splinter instead of raising it. A hypodermic has one flat side which can be worked under the splinter to lift it out. Your doctor will give you a couple of used ones. Keep them stuck in a cork and dip the needle in Merthiolate before using it. Eyebrow tweezers are also helpful.

—Pendleton Tompkins, San Mateo, Calif.

From Tage Frid's article on veneer (FWW #42), may I suggest a very simple tool—a lead brick. Not cheap, but a few lead bricks and a roll of plastic wrap are indispensable in my shop. My main use is for repairs to "blows" (plywood with bubbled or damaged veneer sold as seconds). Blows are reasonably priced and good as new when repaired. I just slit the bubbled veneer, syringe in some glue and clamp with my lead brick. A bit of plastic wrap keeps the brick from sticking. I also use the bricks to clamp nuts and bridges on harpsichords and pianofortes.

—Warren Foote, Olympia, Wash.

Errata

In *Fine Woodworking* #43 (November/December '83), two pieces of furniture were mistakenly attributed to the wrong makers: On p. 104, the prize-winning ash and walnut desk shown in the photograph was made by Gregory Bernard of St. Louis. On p. 108, the wavy chair from the Danceteria exhibition was made by Alex Locadia and is titled "Marilyn Monroe lounge chair."

In *Fine Woodworking's Design Book Three*, the captions belonging to two pairs of photographs were transposed. On p. 33, the bow-front chest of drawers in bubinga, pictured at top right, was made by Eric Hoag of Milford, Conn., while the walnut-and-maple chest at the lower left was made by Barrie Graham of Arundel, Que. The chair on the left side of p. 106, attributed to Dan Mosheim of Arlington, Vt., was actually made by John Bickel of Ossining, N.Y. Mosheim's chair appears on the right side of p. 111, where it is erroneously attributed to Bickel.

The editors apologize, and regret the inconvenience these errors have caused the artisans involved.

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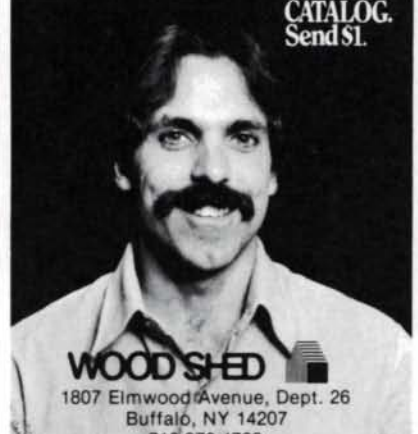
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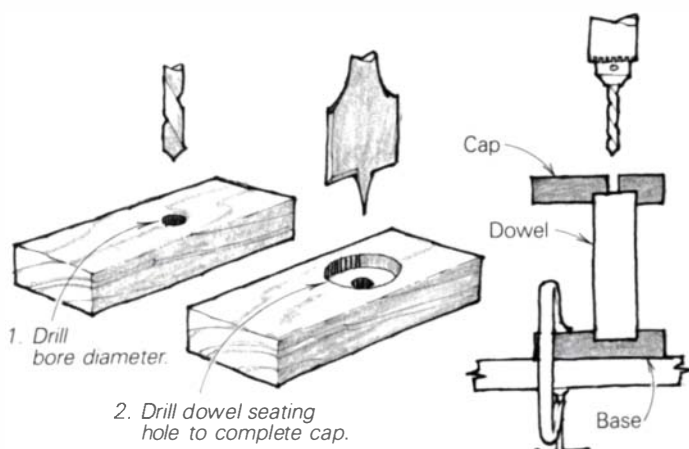
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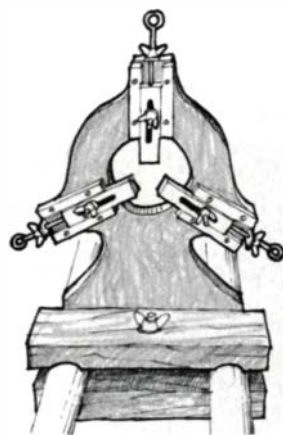
To make a base, clamp another piece of scrap to the drill-press table and drill a seating hole in it. Place the dowel in the base hole, and cap the top end so that the boring bit is centered. For long dowels, drill first from one side, flip, and complete from the other side.

—Robert J. Harrigan, Cincinnati, Ohio

Lathe steady rest

This shopmade steady rest can be set up to support the middle of a long, thin spindle, or it can be used as a tailstock for center-boring. Derived from a metalworkers' steady, the rest consists of a rigid plywood upright, three adjustable hardwood bearing blocks, and a base that locks in place on the lathe bed. The bearing blocks adjust by means of $\frac{3}{16}$ -in. eyebolts threaded through tapped right-angle braces screwed to the upright. Each bearing block slides between two guide blocks, and locks in place with a wing nut. Apply beeswax to the bearing blocks for ease of adjustment and to reduce friction on the workpiece. Of course, the base arrangement depends on your particular lathe.

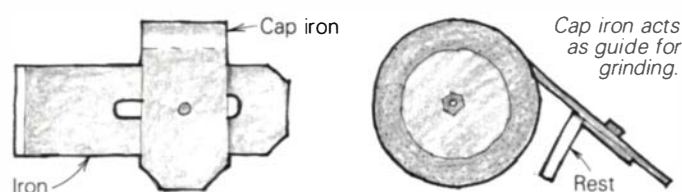
—Robert L. Koch, Tarkio, Mo.



Regrinding plane irons

To grind an accurate bevel on a plane iron, remove the cap iron and replace it on the beveled side of the iron at 90° to its usual position, as shown in the sketch. The cap iron will work as a stop against the tool rest, maintaining a perfect bevel angle while allowing you to slide the plane iron to and fro. Vary the bevel angle by positioning the chip breaker closer to or farther from the cutting edge.

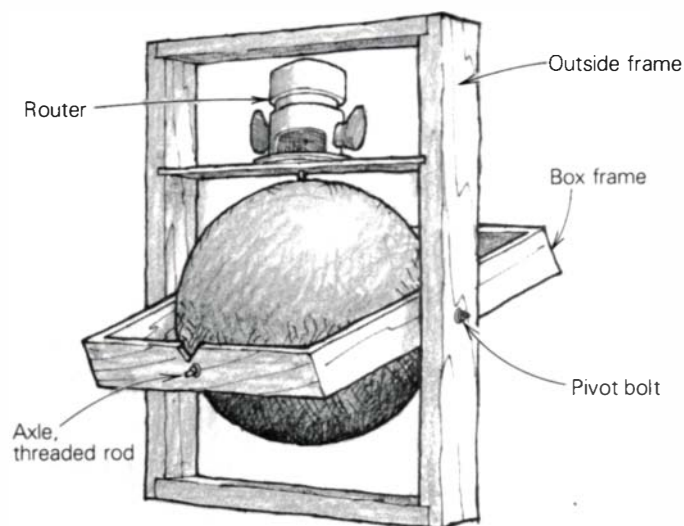
—Drew Woodmansee, Fairbanks, Alaska



Routing wooden spheres

Last Christmas, I wanted to give my wife a sphere covered with $\frac{1}{2}$ -in.-sq. mirrors. Styrofoam was my first thought, but a plastic ball would have cost \$32, so I decided to make one from wood, and devised this simple router fixture to do it.

First, glue up a rough sphere by laminating graduated discs of plywood or solid wood; the larger discs should be rings, to save weight and material. Drill a hole through the north and south poles so that the blank can be mounted on a threaded-rod axle inside a box frame, as shown in the sketch. Washers serve as shims to center the blank in the frame.



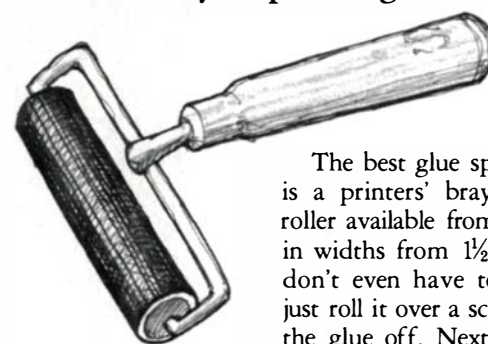
The outside frame is just wider than the box frame, which pivots inside it on two mounting bolts. The sphere should rotate smoothly within the box frame; the box frame should turn smoothly within the outside frame.

Center a router on a platform so that the bit is suspended over the sphere.

To rout the sphere, first clamp the fixture to the bench. Then rotate the rough sphere to find its high spot, and set the router bit a little lower than this. Turn on the router and rotate the sphere inside the box frame, occasionally pivoting the box frame a little within the outside frame. Continue lowering the router bit until the sphere is true. Except for a small area at each pole, the router bit can reach every point on the sphere. The small flat spots at the poles can easily be rounded off by hand.

—Frank D. Hart, Plainfield, Ind.

Printers' brayer spreads glue



The best glue spreader I've found is a printers' brayer, a soft-rubber roller available from art supply stores in widths from $1\frac{1}{2}$ in. to 6 in. You don't even have to wash it clean—just roll it over a scrap to get most of the glue off. Next time you use it, any residue will disappear.

—Floyd Foess, Federal Way, Wash.

Machining octagonal turning stock

Spindle-turning goes faster and smoother if you begin with octagonal stock rather than square, but often it seems more trouble to machine an octagon than to simply whack the cor-

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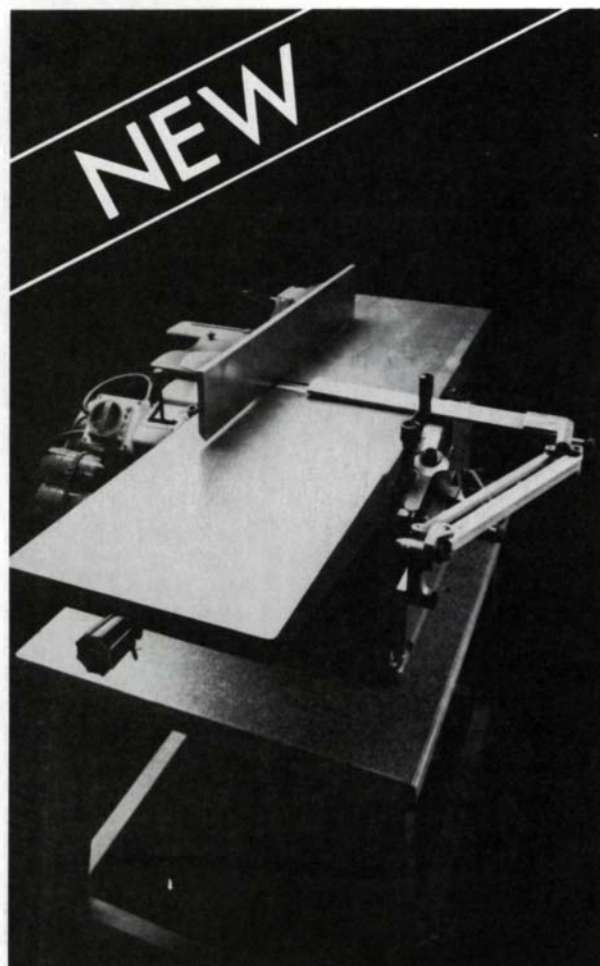
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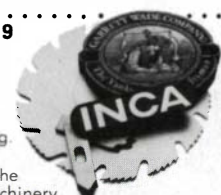
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—T.R. Michigan

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ners off on the lathe. Here's a tip that lets you easily machine octagonal stock on the jointer. Multiply the width of the square stock by 0.2071. The result is the amount, measured diagonally, that must be removed from each corner to produce eight equal sides. To make the cuts, set the jointer fence to 45°. For a safe depth of cut, you can divide larger measurements into a number of equal parts and make several passes.

—Robert M. Vaughan, Roanoke, Va.

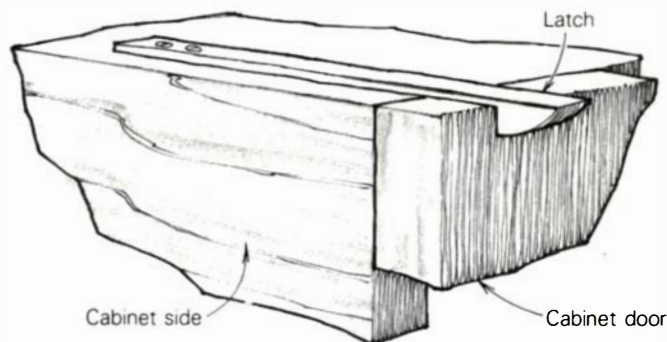
Squaring bandsaw cuts



Here's a bandsaw trick that lets you true the end of a turning square without pausing to use a try-square. All you have to do is begin a crosscut on one side of the blank, then turn that side up and use the mark as your cutting line. As long as your bandsaw blade is at 90° to the table, you can't miss.

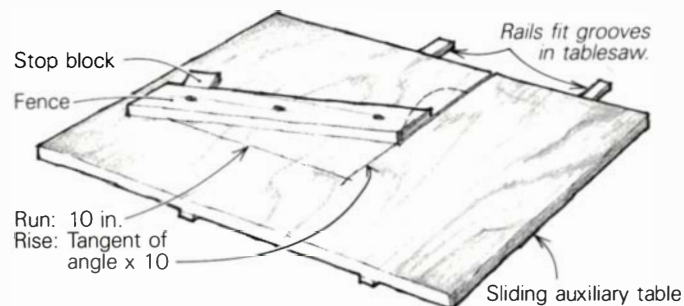
—Jim Ryerson, Guelph, Ont.

Cabinet latch



To make this handy latch for tool-cabinet doors, bandsaw the shape shown from a 6-in. long, 3/4-in. thick piece of springy hardwood, such as ash. Screw the latch to either the top or the side of the cabinet. —James F. Dupler, Jamestown, N.Y.

Trig jig for accurate angles

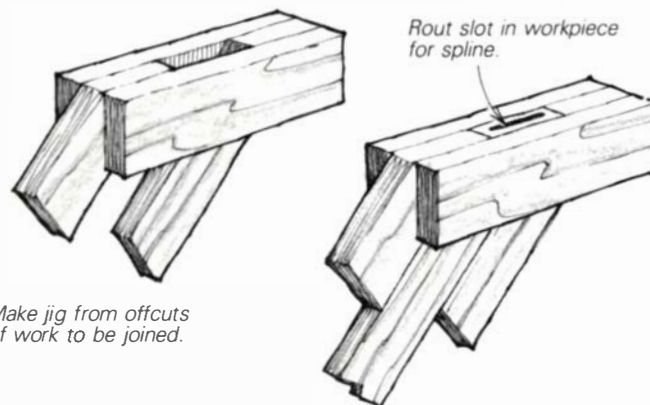


With this simple jig and a little trigonometry, you can cut odd angles on the tablesaw more accurately than with the saw's miter gauge. First, construct a sliding table using two maple rails and a piece of 3/4-in. plywood. To ensure perfect alignment, lay the rails in the saw's grooves and tack the plywood to them temporarily, then flop the plywood over and screw the rails down. Next, raise the sawblade and cut about halfway across the jig.

Trigonometry provides an easy and accurate method for

laying out the angled fence. Find the tangent of the desired angle from a trigonometry table or with a pocket scientific calculator. The tangent gives you the ratio of the angle's vertical rise to its horizontal run. If your angle is 11.25°, for example, the tangent is 0.19891 (rounded to 0.2). Therefore, for each inch of horizontal run, the vertical rise is 0.2 in. To make layout easier, scale up the measurements by multiplying by 10. This results in a base horizontal line of 10 in. and a vertical rise of 2 in. Mark these measurements on the jig as shown in the sketch and draw a line between the two points to locate the fence. —Eric Schramm, Los Gatos, Calif.

Routing spline slots in mitered frames



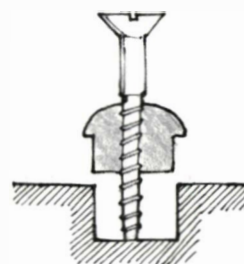
This simple little jig is extremely useful for routing blind spline slots in spline-mitered frames. Nail or glue together scraps of the frame lumber into the configuration shown in the sketch. The workpiece should fit accurately into the slot, where it can be pinched in place with a clamp. A plunge router is desirable, both for ease of starting the cut and because it has a built-in fence for centering the slot. But I imagine that with a little courage a regular router would do—you could add an integral fence to the jig itself by tacking on more scraps, shimmed with cardboard where necessary. I scribed marks on the jig to show where to start and stop.

—Jim Small, Newville, Pa.

Extracting wooden plugs

To extract a wooden plug, drill a 1/8-in. pilot hole through its center, carefully, so as not to drill into the dowel or screw beneath. Then grind the point off a #8 steel wood screw, and screw it into the hole. When the screw bottoms out, the plug will pop.

—Gerald Kaufman, Halstead, Kan.



Reground parting tool



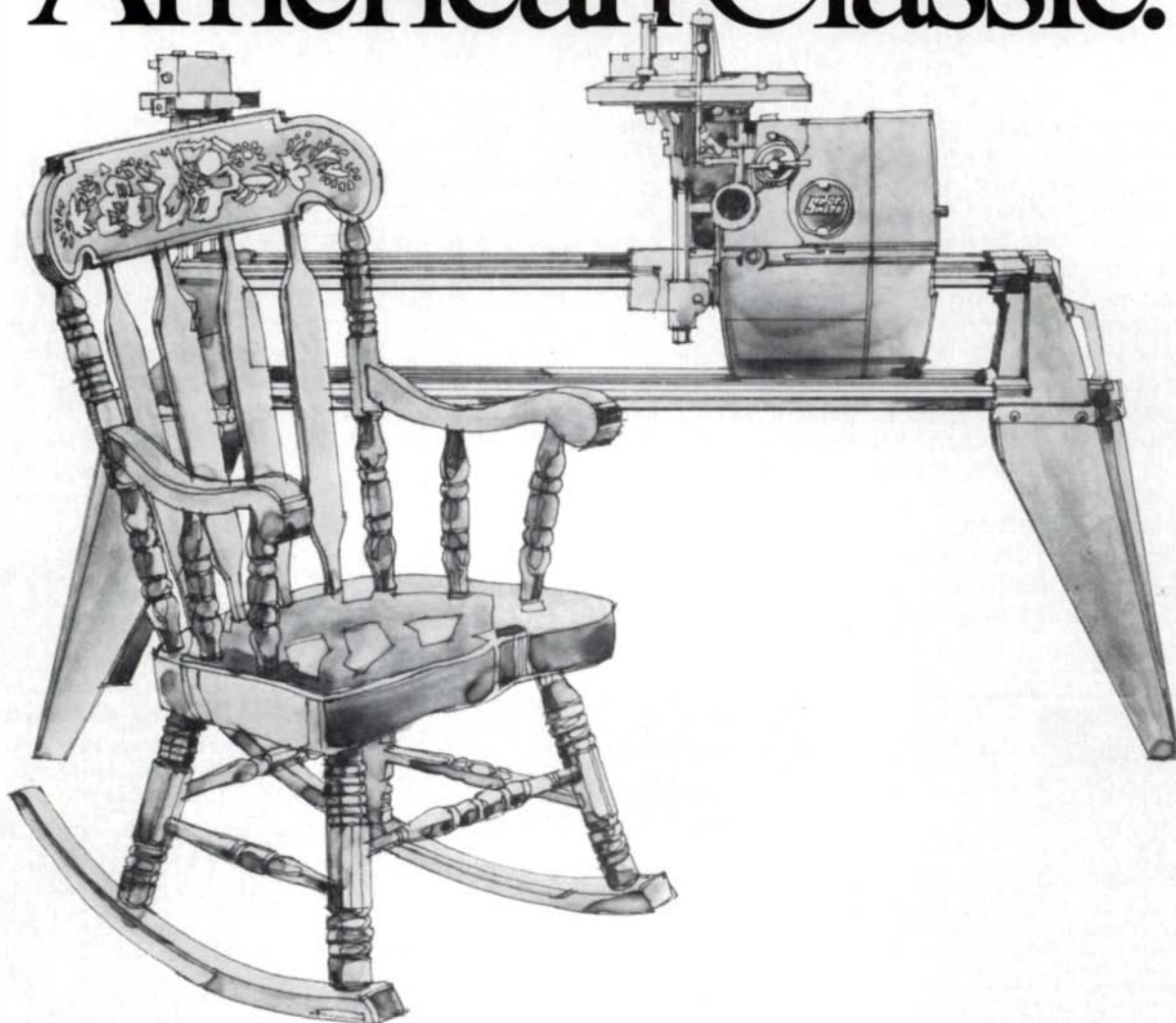
I've found that when reground to the shape above, a parting tool cuts cleaner and faster—and is easier to handle, too.

—Howard W. Escher, Seattle, Wash.

Tablesaw jointing fixture

I wouldn't try this setup on a board shorter than 10 ft., but one of the handiest jigs in my shop is a tablesaw setup for straightening the edges of 1-in. hardwood boards. It does the

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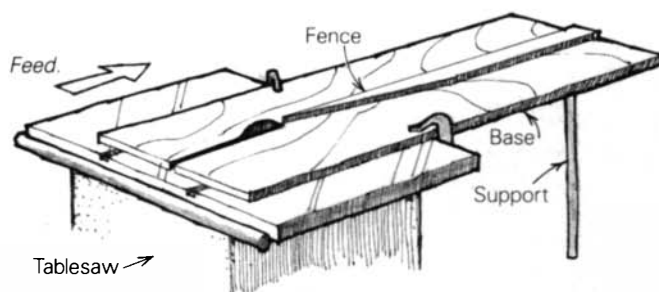


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same job as the jointer, but it is faster and more convenient for the 18-ft. boards I use in my boat shop.

To build the jig, joint a 7-ft. long 1x2 and cut a long tapering point on one end. Glue the 1x2 to a 3/4-in. plywood base, about 8 ft. long. Cut a slot in the base in front of the fence for the tablesaw blade.

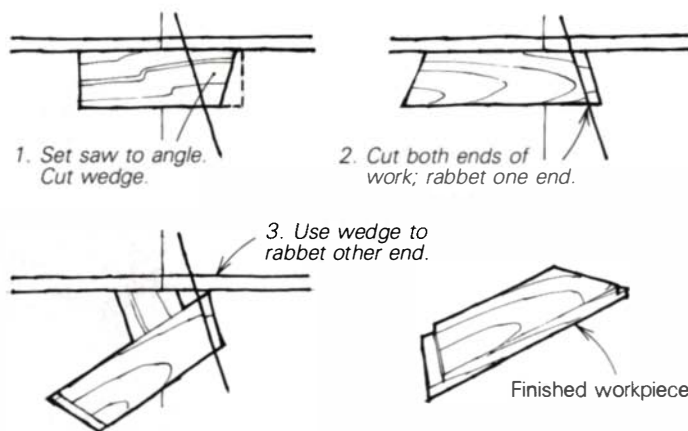
To use, clamp the fixture to the saw table with the 1x2 fence flush with the left-hand face of the sawblade at its rear edge. Support the tail of the fixture so that it's level. As you pass a board over the sawblade, the waste edge is split away by the long bevel. Press the board tight to the 1x2 fence to get a straight edge.

You do have to freehand the first 6 in. or 7 in. of the cut, as the board must pass the sawblade before it picks up the fence. Freehand cuts can easily kick back, so be careful.

—Colin Pittendrigh, Bozeman, Mont.

Cutting angled rabbets

This simple radial-arm saw method makes it easy to cut mirror-image angled rabbets on the ends of a workpiece, as required for the skirt of a splay-legged table for instance. This



approach makes it unnecessary to reset the saw to the same angle on the other side for the second cut.

Set the saw to the necessary angle and cut a wedge from a wide piece of waste stock. Don't cut the wedge to a point—the blunt end allows a little overhang, which will be needed. Leaving the arm at the original angle, cut one end of the workpiece, then turn the work over and cut the matching angle on the other end. Next, raise the saw and cut the first rabbet. Finally, place the wedge against the fence and cut the second rabbet, as shown, taking precautions that the workpiece doesn't pivot. The angle is bound to come out right.

—Wendell Davis, Hampton, Conn.

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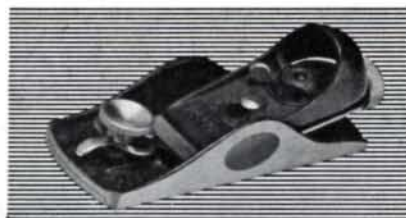
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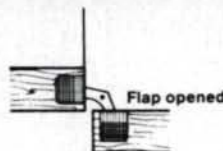
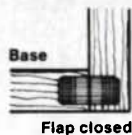
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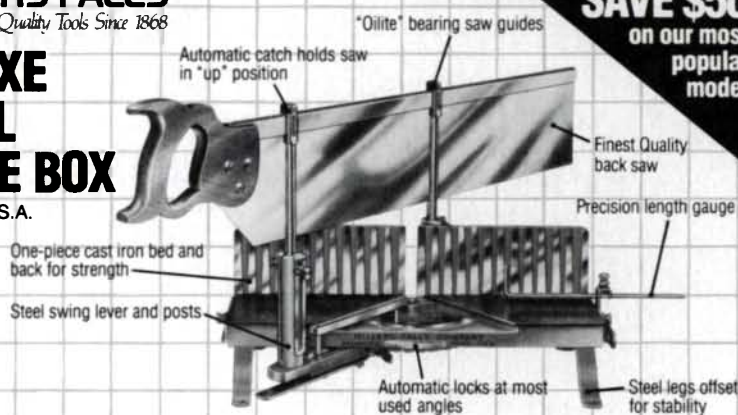


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Drilling long stock—*I am interested in your experts' methods of drilling a true lengthwise hole in the end of a bedpost or other long piece of stock, with a brace and bit or a power hand drill. Whenever I try to join two long pieces end-to-end, I have great difficulty getting them accurately aligned.*

—J. Hockenberry, E. Brunswick, N.J.

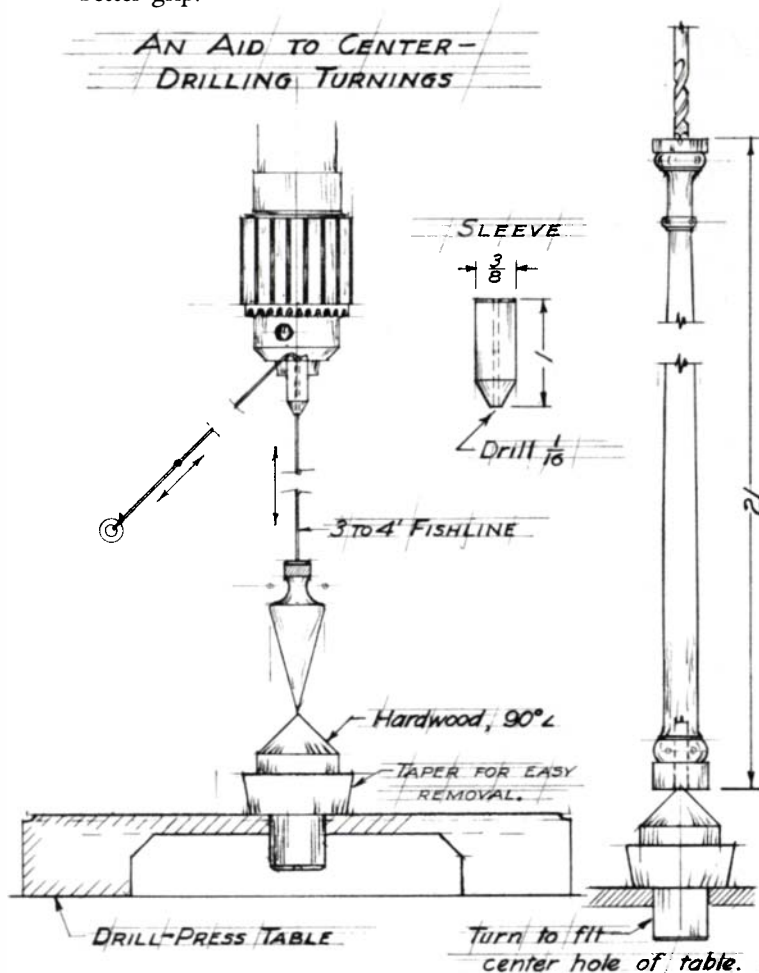
CARLYLE LYNCH REPLIES: Here's a way to drill accurate holes in long, turned columns using a drill press:

Turn a hardwood cone with a taper between 60° and 90°, a tenon that fits the center hole of your drill-press table, and a base to keep it from falling through the hole.

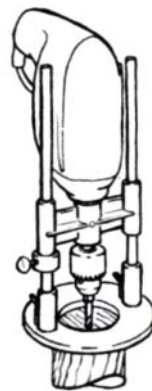
On a lathe, center a 1-in. length of 3/8-in. dowel in a 3-jaw chuck, and with a 1/16-in. bit in a Jacobs chuck in the tailstock, drill a hole through the center of the dowel. Turn one end of the dowel to a taper. Thread 3 ft. to 4 ft. of fishing line through the hole in the dowel. Attach one end of the line to a plumb bob, and tie the other end to a washer to prevent that end from slipping through the hole in the dowel.

Chuck the dowel hand-tight in the drill press, making sure that the fishing line isn't trapped between the jaws, but slides freely through the hole in the dowel. Put the cone in the table center hole and lower the table far enough so that the column, drill bit and cone all fit. Lower the plumb bob until it's just above the point of the cone, and clamp the table when you've lined up the points. Remove the dowel, line and plumb bob, and chuck up the drill bit.

Place the tailstock center point in the end of the turned column on the table cone and drill into the spur center point on the other end. Switch ends, putting the hole you just drilled over the cone, and drill into the tailstock center point on the other end of the column. If the column spins while you're drilling, wear a glove or wrap a cloth around it to get a better grip.



DAVID SLOAN REPLIES: Carlyle has a great method if you have a drill press, which I don't. Instead I have one of those \$20 Portalign things that fastens onto my gun drill. Sometimes I need four hands to manage it, but all I do is clamp my turning in a vise, make sure the end is faced off square, square up the Portalign on the end, and drill a little pilot hole. Then I switch bits and drill the dowel hole. If the end of the turning is so small that it slips through the hole in the Portalign, I screw plywood on the Portalign base and drill right through it into the turning.



Cratered finish—*I'm having problems refinishing a tabletop. I removed the original finish with Hope's Furniture Refinisher and then applied a polyurethane finish, but it cratered in small spots. I removed the polyurethane finish with Formby's Paint Remover, sanded the top down to bare wood, and restained it. Next I applied Deft. This finish also cratered. I don't know what to do now. Can you help?*

—R. William Furman, Ft. Collins, Colo.

DON NEWELL REPLIES: At some time, silicone must have been applied to the tabletop—perhaps in a polish. Silicone is very tenacious stuff, and solvents and removers tend to spread it around rather than remove it. These craters, called “fisheyes,” happen when silicone prevents the finish from adhering.

Wet 400-grit wet-or-dry sandpaper with mineral spirits, and sand down to bare wood. Dry the wood and wipe off all the sanding dust. If you're going to restain, do it now. Next, brush on a very thin coat of shellac, thinned three parts denatured alcohol to one part shellac. Don't build up a thick layer. Let this dry, and apply Deft normally. You should not have cratering this time. To be absolutely sure, I'd add a small amount of fisheye remover (available from Constantine's) to the Deft; it's an additive designed to eliminate fish-eyes caused by silicone and other impurities.

Underpowered bandsaw—*I recently purchased a Hitachi B600A bandsaw. When I'm resawing 10-in. to 12-in. thick hardwood, the power seems inadequate. The saw lugs at even the slowest rate of feed. Can the power be boosted by switching to a 3-HP or 4-HP 220-volt motor? I also get vibration in short sections of the blade. The teeth vibrate and produce ripples on the cut surface. Neither a new blade nor a careful check of all adjustments has helped this problem.*

—Robert F. Anderson, Salem, Ore.

RICHARD PREISS REPLIES: I used the Hitachi, with a 2 7/8-in. Stellite-tipped blade, for two months in my shop (FWW #40), and wasn't thwarted by any severe power lags. I am accustomed to using extreme care and patience in manual resawing, and I was not disappointed with the machine's performance. You don't mention what blade you have, but if you're using a narrower blade, I suggest you switch to the 2 7/8-in. size. This is available with all-Stellite teeth, or with every second tooth tipped with Stellite. You shouldn't have problems with this blade.

The blade vibration could result from incorrect adjustment on the saw or deficiencies in the blade itself. Make sure that the blade is centered on the wheels and guides, and recheck all your settings, especially blade tension. Increase the tension and see if the vibration decreases. If it does, continue to increase the tension until the tremor stops. It is possible that your blade was improperly tensioned (this is common with the wider 2 7/8-in. type), in which case it should be exchanged for a new one, even if you've already done this once. If your

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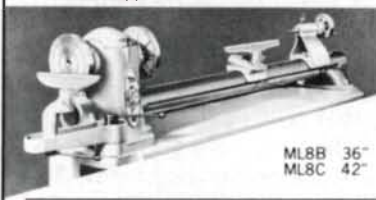
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troubles persist, I suggest you contact Hitachi and consult with one of their engineers before you change motors. It is possible to swap a higher horsepower motor for the stock one. The new motor should either have a similar RPM or have the difference compensated for with a suitable pulley change.

Bluestain fungi—*I have several hundred bd. ft. of 3-in. and 4-in. thick basswood which someone stacked, just after it was sawn, without sticking the pile. The wood developed what looks like a blue mold or mildew, which goes all through the timber. The wood doesn't appear to be structurally affected.*

I intend to use the wood solely for decorative decoy carving. Should I invest any time working with this wood, or should I just feed it to my stove this winter? Would high humidity reactivate the mildew spores and cause future weakness to develop? —Jim Smith, Minneapolis, Minn.

R. BRUCE HOADLEY REPLIES: Your sample of basswood has a moderate infestation of bluestain fungi, a common sapstain "discoloration." Once the wood is dry, the fungi's progress will be arrested and no further development will occur. Since this type of fungus merely lives in the wood, but causes no cell breakdown, the wood should be perfectly fit for use in decorative decoys. A good base coat of paint should hide the streaks of discoloration. I doubt if a carved decorative decoy will ever be subjected to a high enough humidity to reactivate the fungi. No need to feed the stove!

Water-based finishes—*Do water-based finishes offer a practical means of avoiding the toxic solvents in conventional finishes? What are the performance characteristics of the water-based products?*

—Bruce Jacobson, Makanda, Ill.

DON NEWELL REPLIES: Yes, it's true that water-based (so-called latex) finishes do not contain the organic solvents found in conventional finishes. They perform very differently from conventional finishes, but not better, in my view. I've run comparative tests on wood using Valspar Water-Based Varnish, Sears Latex Varnish, Deft Acrylic Wood Armor, and Flecto Varathane Ultra Plastic Finish. Some of these are clear liquids and others are milky, but all dry to a clear film. The solids content varies from about 21% to 34%, compared with a solids content of up to 45% in conventional varnish, so it takes about two coats of latex varnish to equal the film thickness of one coat of conventional varnish. Compared to lacquer, the latex gives about the same film thickness, coat for coat.

The one major disadvantage I found was that, because of their water content, they all raised the grain of the wood. Frankly, they didn't handle or work as well for me as the conventional varnishes or lacquers, nor did they produce what I feel is a "good" finish. They seemed compatible with most types of stains, but they were all hard to rub out. The Valspar and Deft latexes were very runny for brushing, while the Sears and Flecto felt more like genuine varnish. But all flowed out well, leaving few, if any, brush marks. All had excellent adhesion when dry and did not show marks when tested with water or alcohol, with the exception of the Deft, which was severely affected by alcohol.

Surfacing crosscut slabs—*Is there any way to plane and level crosscut slabs to a uniform thickness? I've been told that surface planers can't be used on end grain.*

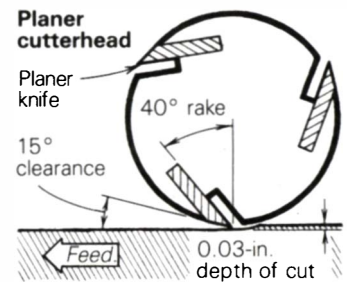
—Steve Ketch, Morris Plains, N.J.

PETER KOCH REPLIES: An abrasive planer is probably the easiest way to accomplish this, but such equipment is very expen-

sive, though some commercial shops will rent time on one.

It is possible to surface end grain on a planer by taking extremely light cuts (e.g., 0.03-in.), using very sharp planer knives with a high rake angle (40° or more) and a clearance angle of about 15°. Follow this by belt-sanding. Even with this procedure, some splitting may occur at the edges where the knives leave the workpiece.

You could also rig a router vertically on a long-reach (but very deflection-resistant) radial arm, fit the router with a large-diameter facing bit, and make successive sweeps across the stock to thickness it. Follow up with a belt sander. There's a jig for doing this in *FWW* #25, p. 56.



Cracked-paint finish—*I reproduce antique furniture and distress my painted finishes to make them look old. One technique that I have seen is the "alligatored" or cracked paint finish, which involves placing a fast-drying paint over a slow-drying paint. How can I achieve this type of finish?*

—Robert J. Doolittle, State College, Pa.

GEORGE FRANK REPLIES: Varnish or paint will crack when a fast-drying coat is put over a slow-drying one before the slow-drying first coat is completely dry. You can buy crackling varnish in any good paint store. Crackling lacquer is available too, but it's a little harder to find.

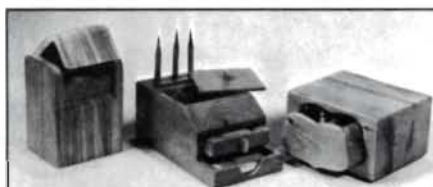
We old-timers had our own way, which is more fun. Paint your piece and let it dry at least a week. Next, skim over the surface with the finest wet-or-dry sandpaper, making the surface as smooth as possible. On this dry, clean and smooth surface, apply a coat of varnish. If the instructions say that the varnish dries in 5 hours, do the next step in 4 to 4½ hours. At any rate, before the varnish dries, apply an uneven, irregular, ½-in. to 1-in. thick coating of good potters' clay. Keep your fingers crossed for the next two or three days... at least. When the clay is dry, it will chip off easily. If the timing was right, you'll get the loveliest cracks and "alligator skins." The potters' clay is a big gun in the antique reproducer's arsenal, but please don't use it before you experiment on scraps. Good luck.

Importing wood—*I enjoyed reading "The Trade in Exotic Hardwoods" (FWW #38). The last sentence in this article states, "Shops using large quantities of rare woods might even find it worthwhile to import their own wood, rather than buying it on the domestic market." Someday I may want to import my own wood. Can you buy wood that has been kiln-dried? Any information on importing from abroad, especially Brazil, would be most helpful.*

—Andrew Brennan, Westlake Village, Calif.

PAUL MCCLURE REPLIES: Importing wood may seem to be a money-saving venture, but it can be quite the opposite. Buying "sight unseen" lumber is a risky business. There are the obvious problems of language, and massive amounts of paperwork and red tape. You will be tying up your money for as long as a year while the lumber is logged, milled, partially air-dried, bundled, and loaded aboard a ship.

Most countries, including Brazil, require a minimum order of 5 cubic meters (2,120 bd. ft.). Find a trustworthy lumber supplier and try to meet in person, if possible, before starting negotiations. It is essential that you order "first European quality lumber" if you expect good, usable stock. Once your lumber has been shipped, you'll need a port broker in the



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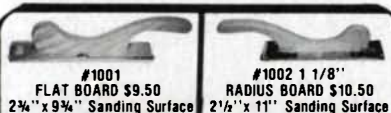


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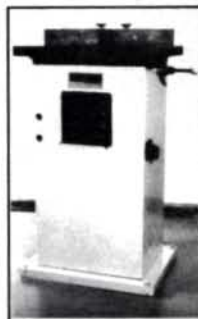


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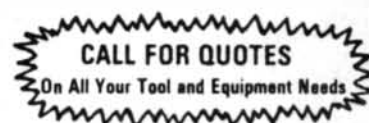


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A friend of mine ordered African padauk, 6 in. and wider in 6-ft. lengths, and inspected it on the Ivory Coast dock before it was loaded on the ship. The shipment of padauk that arrived in New Orleans, however, consisted of 6-ft. and 10-ft. 1x3s. It seems that his wood had been switched with another load of padauk for a flooring mill in Italy.

Follow-up:

Re spreading contact cement (*FWW* #42, p. 18). In the early 1950s, a gallon of contact cement always came with a notched spreader—a strip of sheet metal with a row of small pointed teeth along the edge. After experimenting with rollers and sprayers, I feel that there's still no better method of application for small jobs. You can make a spreader out of galvanized duct metal or something similar. The notches should be about $\frac{3}{8}$ in. deep, with the points of the teeth about $\frac{5}{32}$ in. apart.

—Bill Newman, Savannah, Ga.

Sources of supply:

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—Ferrous sulfate and other chemicals for woodstaining are

available from Wood Finishing Enterprises, Box 10117, Milwaukee, Wis. 53210.

—Two more sources for cabriole legs: Windsor Classics Ltd., 15937 Washington St., Gurnee, Ill. 60031; and Clifton Cabinet, 22120 Woodland Ln. N., Rogers, Minn. 55374.

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—Jerry Sass, North Anson, Maine

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—Kenneth D. Vaughan, Juneau, Alaska

About our answer people:

Carlyle Lynch is a retired furnituremaker who lives in Broadway, Va. David Sloan is an assistant editor of *FWW*. Don Newell, of Farmington, Mich., is a former paint and varnish chemist. Richard Preiss runs the woodworking shop at the University of North Carolina at Charlotte. R. Bruce Hoadley teaches wood technology at the University of Massachusetts. Peter Koch is chief wood scientist at the Intermountain Forest and Range Experiment Station in Missoula, Mont. George Frank is a European master wood finisher, now retired. Paul McClure is a dealer in exotic woods in Tempe, Ariz.

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2040	15-5/8" Planer	1295.00
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3600B	Plunge Router	188.95
3600BR	Plunge Router	183.70
3601B	Router	129.95
3608BK	Router w/case	81.50
3700B	Laminate Trimmer	82.50
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4300BV	Jig Saw Var. Sp.	119.95
5007NB	7 1/4" Circular Saw	93.95
5012B	12" Chain Saw	119.95
50810W	3-3/8" Cord. Saw	110.40
5201NA	10 1/4" Circular Saw	219.55
6000R	Uni-Drill	106.00
6010D	3/8" Cordless Drill	77.75
6010DL	Cordless Drill w/charger	87.50
6010DW	3/8" Cordless Drill w/Charger	84.95
6010DWK	Cordless Drill w/Charger & case	83.95
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6013BR	1/2" Reversible Drill	119.00
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6800DBV	Drywall Screwdriver	97.50
9030	1-1/8"x21" Belt	120.50
9035	Finishing Sander	49.95
9045B	Finishing Sander	105.50
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92075PB	7" Sander Polisher	136.95
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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
	30 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
	30 1.38 ea 1.22 ea
	20 1.42 ea 1.26 ea
	10 1.46 ea 1.30 ea
	8 1.50 ea 1.34 ea
	6 1.54 ea 1.38 ea
	4 1.58 ea 1.42 ea
	3 1.62 ea 1.46 ea
	2 1.66 ea 1.50 ea
	1 1.70 ea 1.54 ea
	0 1.74 ea 1.58 ea
	0 1.78 ea 1.62 ea
	0 1.82 ea 1.66 ea
	0 1.86 ea 1.70 ea
	0 1.90 ea 1.74 ea

SUNGOLD X-WEIGHT SANDING BELTS	
Size	Grit 10 50
3"x21"	120,100 .98 ea .84 ea
	80 1.00 ea .86ea
	60 1.05 ea .92 ea
	50 1.07 ea .94 ea
	40 1.10 ea .97 ea
	30 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
	30 1.38 ea 1.22 ea
	20 1.42 ea 1.26 ea
	10 1.46 ea 1.30 ea
	8 1.50 ea 1.34 ea
	6 1.54 ea 1.38 ea
	4 1.58 ea 1.42 ea
	3 1.62 ea 1.46 ea
	2 1.66 ea 1.50 ea
	1 1.70 ea 1.54 ea
	0 1

Contemporary Furniture: An International Review of Modern Furniture, 1950 to the Present edited by Klaus-Jürgen Sembach. *Architectural Book Publishing Company, 10 East 40th St., New York, N.Y. 10016, 1982. \$37.95, hardcover; 308 pp.*

This is a useful condensation of the 11 volumes of the *New Furniture/Neue Möbel* series, those heavily illustrated reviews of current furniture design published in Germany every couple of years or so from 1951 until 1974. *Contemporary Furniture* has good, clear, black-and-white photographs of over a thousand different pieces introduced during those years. The editor's claim that the book contains much that postdates the last volume of *New Furniture* is not borne out by the scanty representation of furniture dating from after about 1972, however, and what is included does not adequately convey what was happening to furniture design in the 1970s. The book is best thought of as the most exhaustive history available of serially produced furniture of innovative design during the '50s and '60s.

The illustrations in *Contemporary Furniture* are organized under six headings: chairs and armchairs, sofas and beds, tables, office furniture, cabinets and shelves, nursery and school furniture. This arrangement makes it possible to follow closely the evolution of styles. Within each group, the editor abandons chronology and juxtaposes stylistically similar pieces from different years, making it easy to see who was borrowing what from whom. For the woodworker intent on coming up with, say, a new and striking bed design, a close study of the relevant pages may suggest anew that originality is mostly a matter of finding novel combinations of what already exists.

In the section on cabinets and shelves, one can trace the decline of the freestanding cabinet and the rise of wall systems, a Bauhaus-era invention widely adopted in the cramped quarters of postwar Europe. The photographs of the many, varied wall systems detail lots of ingenious ways of suspending and supporting shelves and cabinets, and these might serve as points of departure for a cabinetmaker's own designs. (Undoubtedly many of the connecting gadgets are patented, so best experiment in the privacy of your own workshop.)

Comment on the furniture is limited to a short essay at the beginning of each section, and these are of little value. The German text of the general introduction is heavy with philosophical and sociological speculation, and the parallel English translation is charmingly inept. Fortunately, this is by no means true of the picture captions, which, while refraining from making any critical assessments or giving historical commentaries, are technically informative.

This is not an attractive book: no color, no explanatory text to tell the reader what to think. Using it requires visual concentration, but its 1,033 photographs repay close scrutiny.

—Urbane Chapman

A Logbuilder's Handbook by Drew Langsner. *Rodale Press, 33 East Minor St., Emmaus, Pa. 18049, 1982. \$9.95, paperback; 236 pp.*

Few casual admirers of the neatly dovetailed, hand-hewn log homes that grace the American scene have any concept of the tremendous task that confronted the pioneer raising his home with only the most primitive of tools. There are even fewer builders today who would choose to bypass the sawmill or to discard their chainsaw in favor of the broadax and peavey.

A Logbuilder's Handbook will appeal to the intrepid soul who seeks to build his own log home, using wherever possible the methodology of his pioneer forbears, substituting his own

sweat not only to defray costs but in the firm knowledge that building such a home fulfills a creative urge. As Langsner observes: 'I wanted to know the feelings of wielding broadax and adze, of hewing and notching logs by hand, and of building a house which belongs in tradition and spirit not just to our farm and our region, but to the entire heritage of craftsmanship that finds its expression as much in the American owner-built home of today as in the pioneer homestead of the past, and in their European and Scandinavian antecedents of long ago.'

The book deals specifically with hand-hewn, dovetailed logs with mortar-filled interstices, and it abounds with photographs and clearly labeled drawings. Other than in the lengthy treatment of notching, which is at times confusing, and in the total omission of the double-roof principle so vital for insulation in northerly climates, it clearly treats each aspect of the hand-hewn technique: site selection, design, logs, foundations, hewing, notching, raising, roofing, chinking and finishing work. Appendices include a comprehensive list of tool suppliers and a practical bibliography. The book offers an attractive, viable alternative to 2x4 balloon framing, and is a valuable addition to the logbuilder's library.

—Alasdair G.B. Wallace

The Craft of Log Building by Hermann Phleps, translated by Roger MacGregor. *Lee Valley Tools Ltd., 2680 Queensview Dr., Ottawa, Ont. K2B 8J9, 1982. \$19.95, paperback; 328 pp.*

Hermann Phleps, born in 1877 in Transylvania, was an architect, builder, scholar and teacher, specializing in the log buildings of Europe, many of which had already been standing for hundreds of years. This book, written at the midpoint of his career (he died in 1964), sums up his encyclopedic knowledge of the craft. The drawings, photos and descriptions are enlivened by a text that's full of contrasting elements. On one page Phleps is a designer, pointing out how designs in wood should be different from designs in stone (and lamenting that many wooden structures aren't in harmony with wood's elegant structural properties). On the next page he's a link with traditional mountain folklore, as he explains which phase of the moon yields a lumberjack the soundest timber. There's much food for thought here, and some startling perceptions. Much of what we take for granted in architecture, for example, and think of as "style," was once purposeful and necessary. This isn't a how-to book per se, but a reference worth any logbuilder's attention.

—Jim Cummins

The Beginner's Handbook of Woodcarving by Charles Beiderman and William Johnston. *Prentice-Hall, Englewood Cliffs, N.J. 07632, 1983. \$10.95, paperback; 173 pp.*

Slow-paced, chatty, filled with patterns of the old-boot, woe-ful-puppy sort, this is still the best of the carving books to cross my desk in the past few months. It's aimed at helping people have fun in the amateur class at the local woodcarving club, and it hits the mark. The book gives a good overview of the state of carving as a hobby—the kind of work you'll most likely see at shows, the kind of people you'll meet, how a club can put on a show of its own.

—Jim Cummins

Urbane Chapman makes furniture in Northfield, Mass. Alasdair G.B. Wallace lives in a log house he built near Lakefield, Ont. Jim Cummins is an associate editor at Fine Woodworking.

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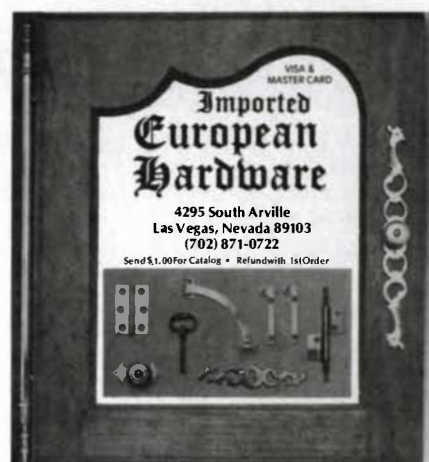


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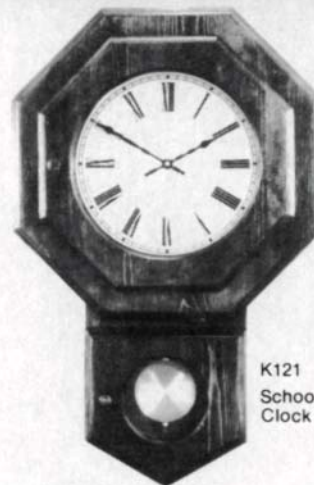
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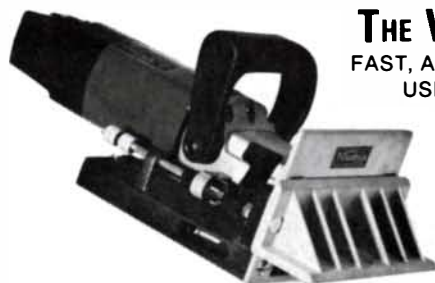
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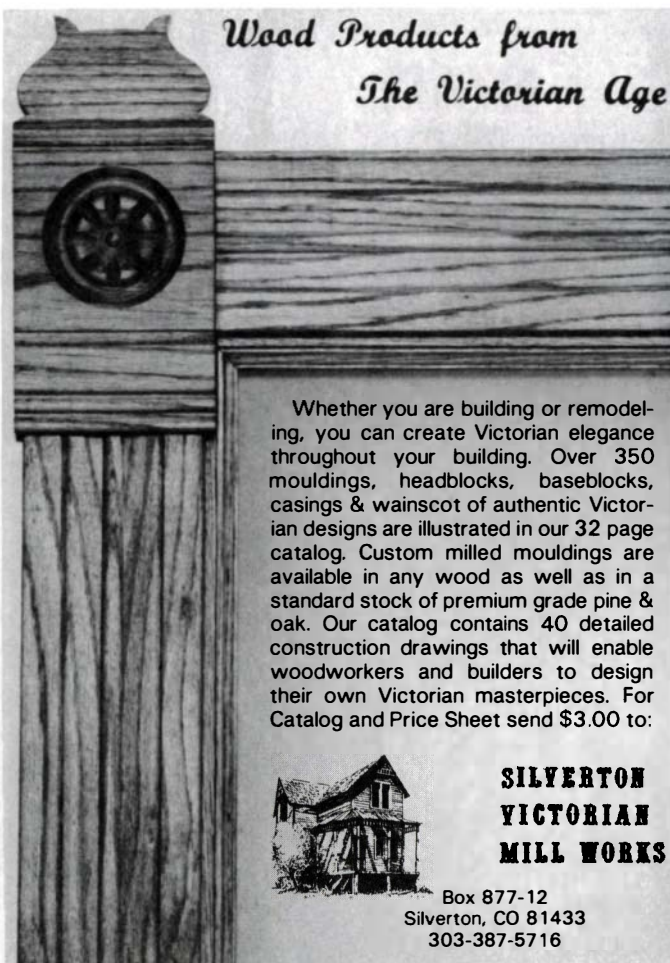
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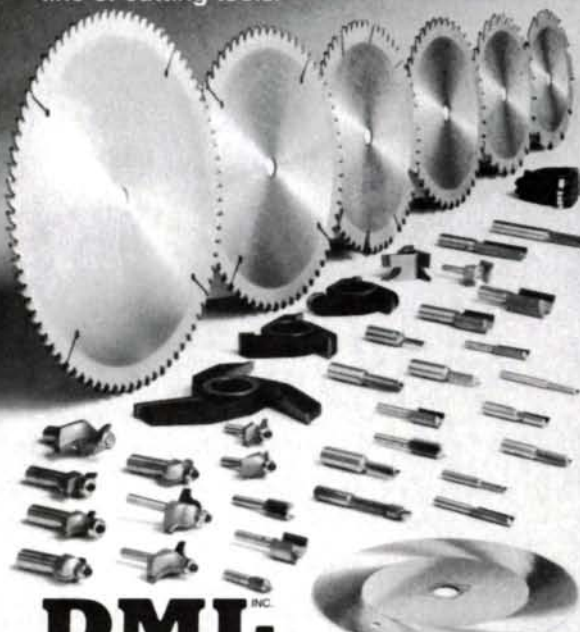
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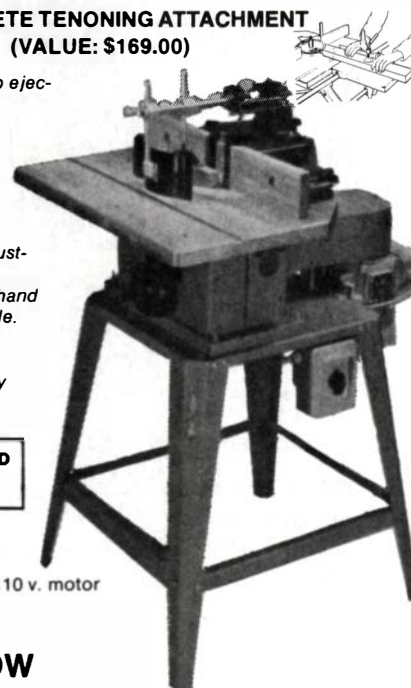
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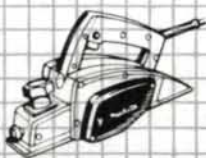
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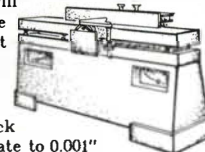


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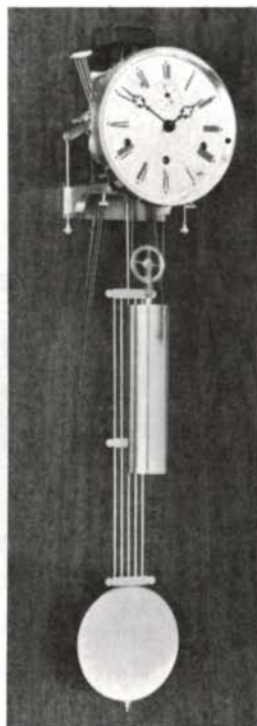
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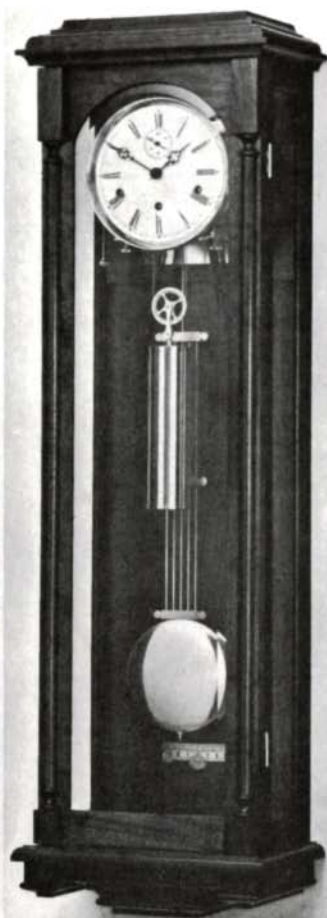
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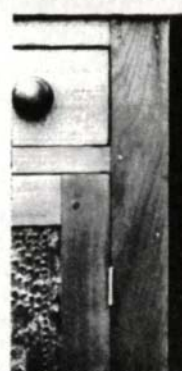
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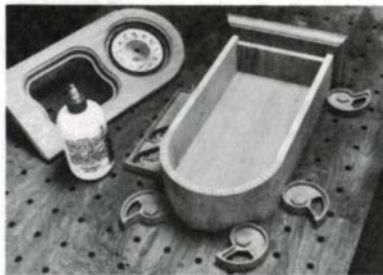
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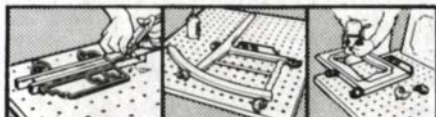


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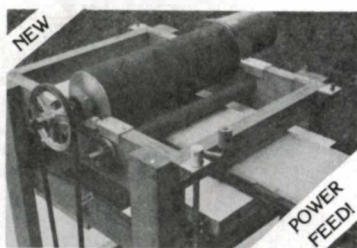
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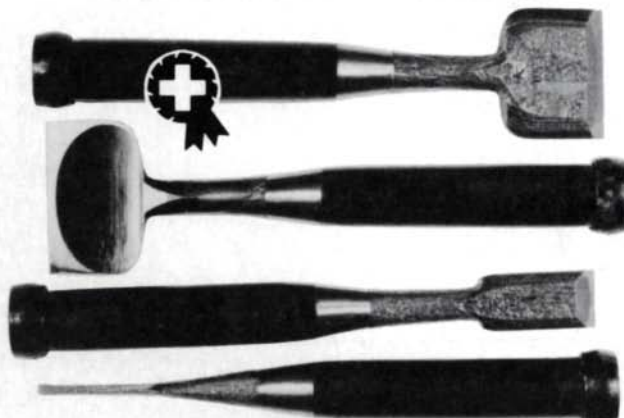
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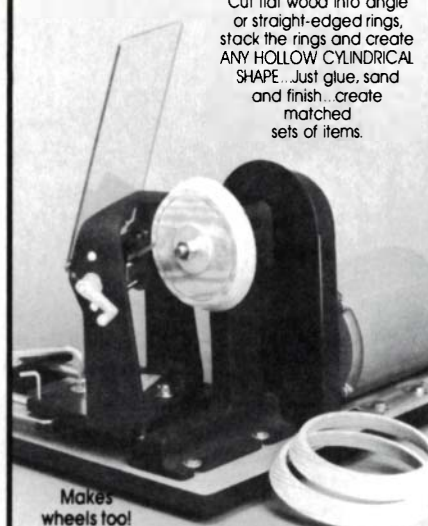
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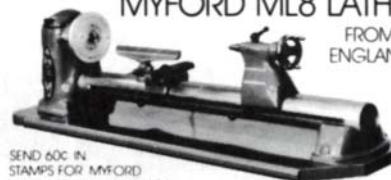
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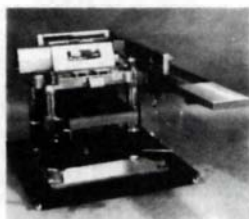
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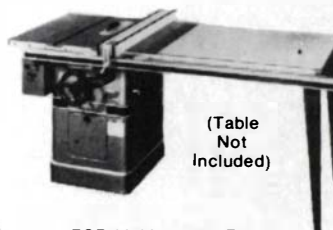
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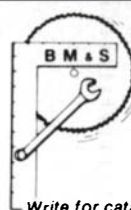
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Could you build one of these tables in eight hours for \$225? Joe Tracy and Peter Pennypacker did. Using the production methods described in this article, they made 50 of them.

Making 50 Tables

Jigs and fixtures do the job

by Peter Pennypacker

After years of throwing countless pots, a potter friend surprised me when I asked if he was still challenged by his work. "I'm finding new enjoyment in pottery by simplifying the steps," he said, "streamlining the process, enjoying the exactness of efficiency."

Not long ago, I found out what he meant when I helped a fellow woodworker with a furnituremaking operation entirely new to me—a limited production run. Until that time, I had built only one-of-a-kind furniture, all commissioned by clients after lengthy discussions about how a certain design should look. I'd found one-off work gratifying and certainly instructive, since I often had to experiment with new tools, techniques and materials to satisfy my customers' demands.

Competence and speed came with practice, but my work still consumed enormous amounts of time, and with the time came a large price tag. I began to feel that some of my pieces assumed a more exaggerated posture than handcrafted, functional furniture ought to have. I became uneasy with the preciousness I was bestowing upon single works. I was anxious to find more efficient work patterns, and to repeat some of my favorite pieces, applying the refined technique and clarity of vision I'd learned from the first tries.

I was eager to try a production run. I had seen fine examples of production-run furniture from the more discerning manufacturers—much of it slippery-looking stuff from Italy—so I knew it could be done well. But did it take a factory? Joe Tracy provided the answer. He had just contracted to build 50 oak restaurant tables and needed help. A woodworker trained at the Rochester Institute of Technology, Tracy specializes in one-of-a-kind furniture, but he has also done a fair amount of production work. He has a natural ability for designing and engineering jigs and fixtures for the process.

Working with Tracy, I learned that in a moderate-size, well-organized shop with good though not prohibitively expensive machines, limited production is an enjoyable—and profitable—way to work. Jigs that favor choreographing repeated movements into concise, economical patterns produce a great quantity of work with minimum effort. And with just two of us working, there was always a variety of tasks to choose from, relieving tedium and making the process relaxing and rewarding. With careful planning and Tracy's simple, effective jigs, we were able to produce each table, from raw lumber to final finish, in a little less than eight hours. Henry Ford and the Puritan Ethic hummed over our shoulders.

The 50 tables were for the newly rebuilt Jordan Pond House restaurant, a historic landmark in Acadia National Park, near Tracy's home/shop on Maine's Mt. Desert Island. When the Pond House was nearing completion, Tracy had

taken the rather bold step of designing and building an unsolicited prototype dining table that he thought would harmonize with the restaurant's contemporary decor. The Acadia Corporation overseeing the work was impressed with his initiative, but not convinced his design would hold up to commercial abuse.

Undaunted, Tracy built another prototype. Though sturdier, his second design was still a beauty—a delicate, flared leg-and-apron piece that shows the influence of James Krenov, with whom he had worked for six months in Sweden during 1972. The table's white oak top was supported by red oak aprons joined to the legs with floating tenons, a joint that's strong and readily made with Tracy's equipment.

This time the design was approved, and Tracy was asked to quote prices for four sizes of tables. Working out a time/cost sheet, he outlined each construction step on paper, drawing on his experience to calculate how long each would take and adding a 10% safety margin for potentially troublesome operations. To figure labor costs, Tracy multiplied the total number of hours by his \$20 hourly shop rate, which, for this job, included our hourly wages plus shop overhead—the mortgage, power and heat bills, machine loans and maintenance, and incidentals. To this figure, he added the prices of lumber, lacquer and varnish, glue, screws, abrasives, and \$150 to rent a truck to haul the finished tables to Pond House.

The price came to \$225 per table, a figure within 5% of what a big Maine furniture company had quoted for a somewhat heavier-handed design. Because he was a local craftsman, the Acadia Corporation gave Tracy the job. The risk of making the prototype had paid off.

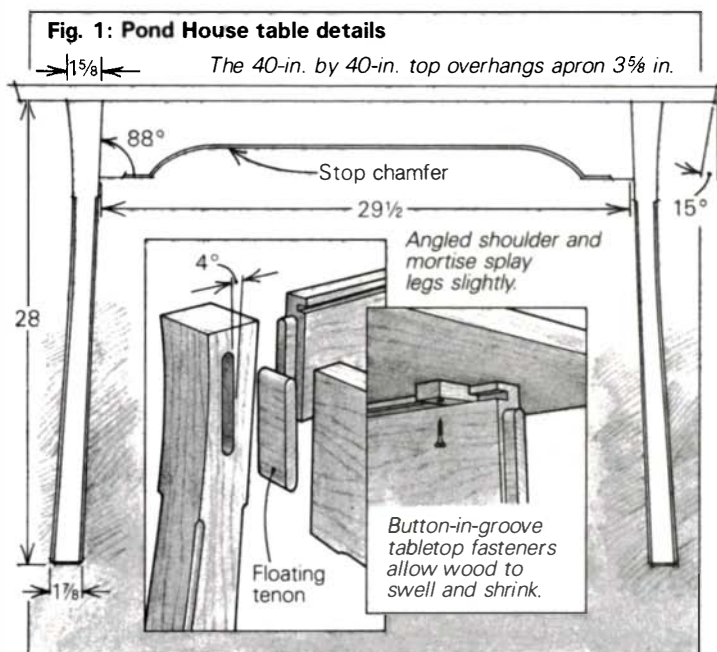
Tracy's 30-ft. by 40-ft. shop, on the ground floor of his house, seemed too small to hold the hundreds of parts we would be making. His equipment includes an old but accurate 10-in. tablesaw, a drill press, an ancient 34-in. bandsaw, a real prize of a machine called a Steton Combinata (planer, jointer, mortiser and knife grinder), a 1-in. spindle shaper, and a beast of a stroke sander that impressed us by speedily sanding the tabletops. Despite his limited floor space, Tracy's big machines are spaced well apart to allow plenty of swing plus room to dolly parts from one machine to another.

While Tracy designed and built the production jigs, I began thickness-planing and cutting to width and length 1700 bd. ft. of red and white oak. Milling the lumber was pretty tiresome—the only shortcut we could take was to rip stock to width first, bypassing the task of facing warped or twisted wide boards on the jointer. Following Tracy's detailed cutting list, I crosscut each part to rough length, then to final length, using stop blocks on the tablesaw miter gauge to ensure consistency. Cutting the longest pieces first and using the offcuts for shorter components minimized waste.

Before working with Tracy, my experience with jigs and fixtures had been limited to the occasional stop block or router template. I hadn't felt the need to construct jigs for single pieces. Tracy was soon to enlighten me on jigs and fixtures. Old woodworking texts suggest that a jig clamps the work and guides a cutting or shaping tool to produce identically shaped parts, independent of the operator's skill. A fixture, on the other hand, merely holds or positions the work, leaving the tool to be guided by other means. Tracy put it more concisely: a jig is portable, a fixture attaches firmly to the



Tracy's table design adapted readily to jig and fixture work.



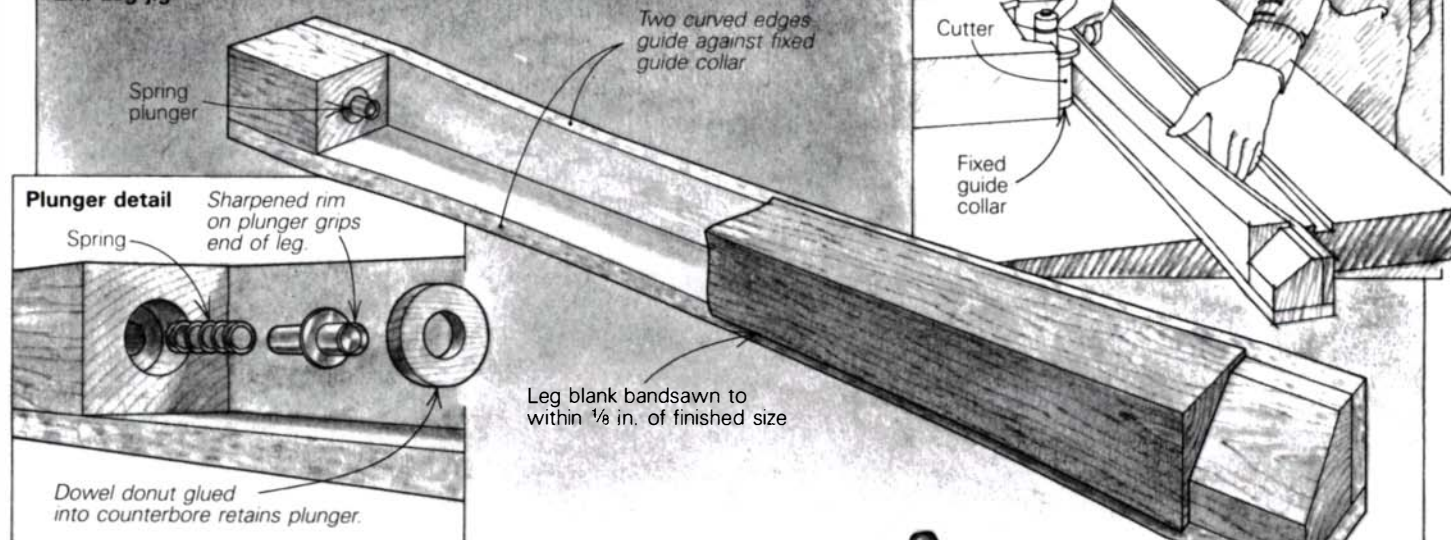
machine or tool. Either way, the purpose is to increase the accuracy, safety and consistency of machine work.

Jigging is most useful when you must make many identical parts, as in our table job, but there are good reasons for jigs when fewer pieces are required. Safety is probably the best one, especially if you're making small, odd-shaped or hard-to-hold pieces, which are liable to be hurled or kicked back when fed past a whirring cutter. A well-designed jig will solidly grip the stock, so you can feed it with your hands well away from the danger zone. A jig also promotes an orderly work rhythm that lessens the chance of an accident. In addition, the consistency of jigged parts all but excludes the inaccuracies that would otherwise have to be corrected at assembly.

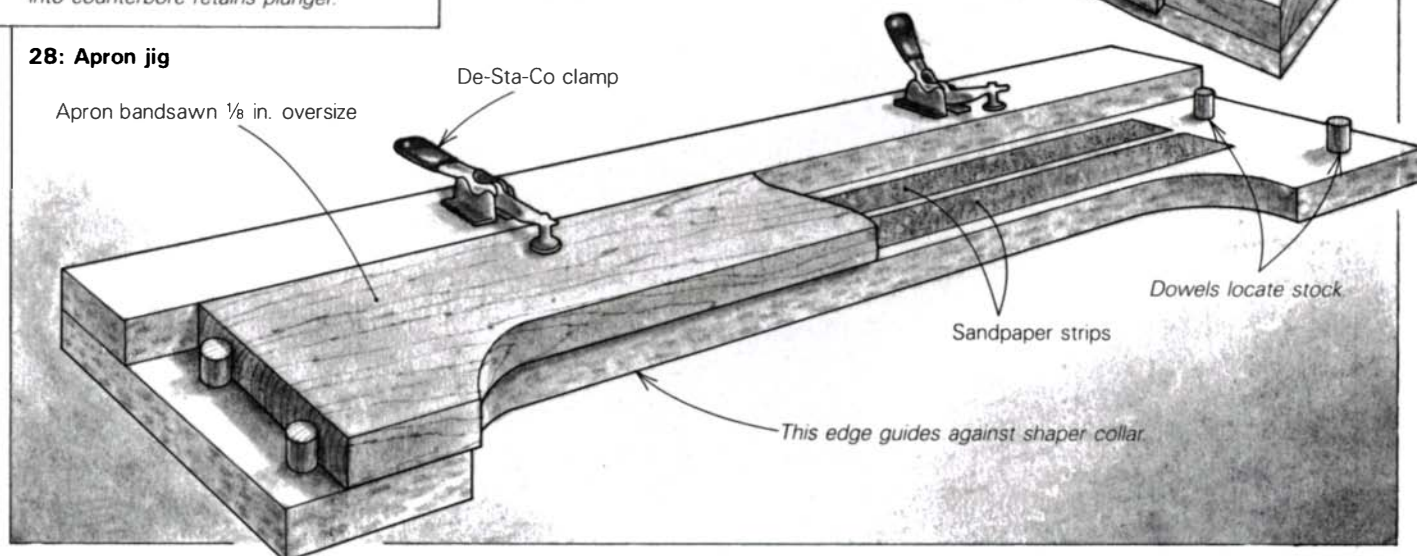
Obviously, there's a break-even point. Sometimes too few parts are needed, or they're so complicated that you'd spend more time devising the jig than you would making the pieces by hand. Yet even in this case, Tracy, like other woodworkers who derive as much satisfaction from process as from prod-

Fig. 2: Making multiples on the shaper

2A: Leg jig



2B: Apron jig



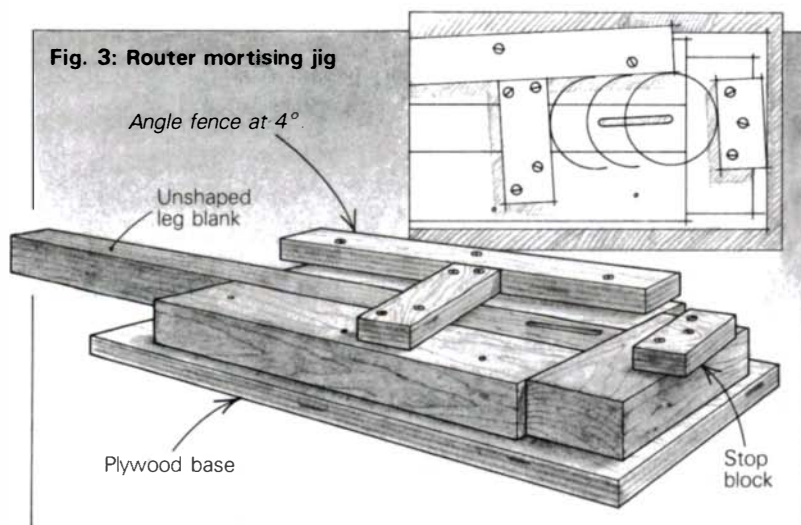
uct, will sometimes go ahead with the jig anyway. He designs much of his furniture with repeat commissions in mind, reasoning that a jig hung on the wall is a lasting resource that will save him the trouble of rethinking the problem months later when another job arrives.

Tracy's jigs for straight or angular parts are usually guided by a fence clamped or screwed to the machine table. Jigs for curved pieces are fed past a single-point guide—the fixed collar on his shaper or a router pilot bearing. Whether straight or curved, Tracy's jigs have some common features, the most important of which is a way to position and clamp the wood so that it won't slip or fly out under the stress of cutting. Blocks, fences or pins can be arranged so that blanks go into the jig only in the correct position. Quick-action toggle clamps (available from De-Sta-Co, PO Box 2800, Troy, Mich. 48007) are best for anchoring the blank, though screw hold-down clamps do a good, if slower, job. If a jig has no flat surface for mounting clamps, the blank can be held between blocks by a spring plunger, as in figure 2A. As extra insurance against slippage, Tracy glues strips of sandpaper to the jig's supporting surfaces.

Controlling a jig is vital, so Tracy puts handles on his, or makes them big enough so there's plenty of material to hold on to. Also, so it can be aligned with the machine's guiding

fence or collar before the blank engages the cutter, he extends each jig at least 3 in. beyond each end of the blank. Most of the jigs we used were made of 3/4-in. medium-density fiberboard, with pine fences and stop blocks glued and screwed in place. Fiberboard, also called Baraboard, is ideal for jigs—it is dimensionally stable, can be accurately shaped, and won't wear out when repeatedly passed by fences and guide collars. Plywood also makes decent jig stock, if its interplies are free of voids. Applying lacquer or spray graphite to the edge of a jig eases its passage.

For the table job, Tracy designed the shaper jigs illustrated in figure 2. Even though his shaper has a 1-in. spindle and plenty of power, shaping the raw blank in a single pass would have provoked chattering or a dangerous kickback. To avoid this, we used the jigs as templates, marking out the curves and bandsawing off most of the waste to within 1/8 in. or so of the finished profile. The pieces could then be shaped safely and smoothly in one pass by running the jig against the fixed guide collar attached to the shaper. To make the legs, I first bandsawed the waste off all the blanks. Next, with a blank in the jig, I shaped one curved side, then flipped the jig 90° to shape the other. The aprons were similarly shaped, using a version of the jig shown in figure 2B for each of the four different length aprons (for the four different size tables).



To mill angled mortises in 200 legs, Tracy bolted a 4° ramp to his Steton Combinata. A mirror taped to the machine lets him view the action.



If production work is to proceed apace, like parts should be stacked together to be machined as units of work. These table aprons, which have been shaped, mortised and grooved, await assembly. The box contains the floating tenons that will join aprons to legs.

I had never used a shaper of this size before, and I was a little intimidated by its size and power. With only small amounts of wood to remove, however, the process was smooth and free of kickbacks. By the end of the job, shaper work felt safe. Shops not equipped with spindle shapers could adapt these jigs to routers, using $\frac{1}{4}$ -in. tempered Masonite templates to guide a bit's pilot bearing. A 2-HP router driving industrial-quality $\frac{1}{2}$ -in. shank bits would do the job, but to minimize the cutting load, waste should be bandsawn to within $\frac{1}{16}$ in. of the finished surface. These router techniques are described in *FWW* #35, pp. 46-53.

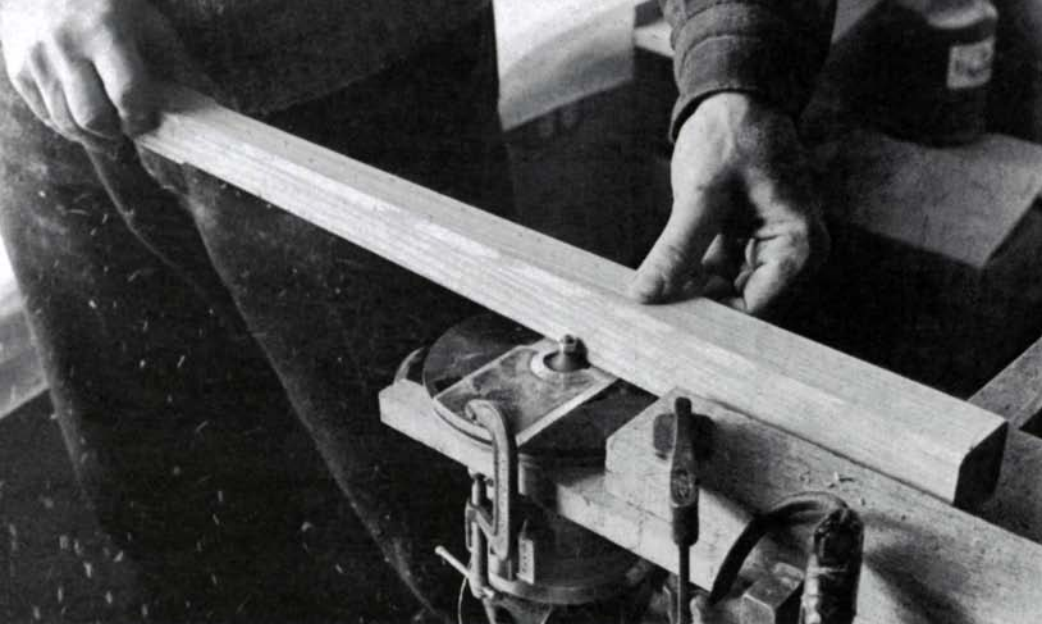
As our job progressed, I began to understand why so much factory production furniture is so lifeless. Churning out chairs or tables by the thousands, a big furniture plant would squander its profit on the extra steps and special tooling that distinctive designs require. Tracy proved to me that a resourceful small-shop craftsman needn't be similarly constrained. To accentuate the sweep of each table's flared legs, for example, Tracy splayed them slightly by cutting 88° shoulders on the ends of the aprons and milling the leg mortises at a 4° angle, as shown in the construction detail in figure 1. The operation added one jig, but without this refinement the tables would have looked just ordinary.

I cut the 88° shoulders (before shaping them) on the ta-

blesaw miter gauge fitted with a stop block. To mill the mortises in the shaped legs, we bolted a 4° ramp to the Combinata's mortising table and cut all the mortises on one side of all the legs before reversing it to mortise the other side. After milling 400 mortises on this machine, I can only sing its praises. It made what could have been a time-consuming chore a concise process that took about two minutes per leg. If you don't have a slot-mortiser—and most of us don't—you could dowel the legs, or use the router jig shown in figure 3.

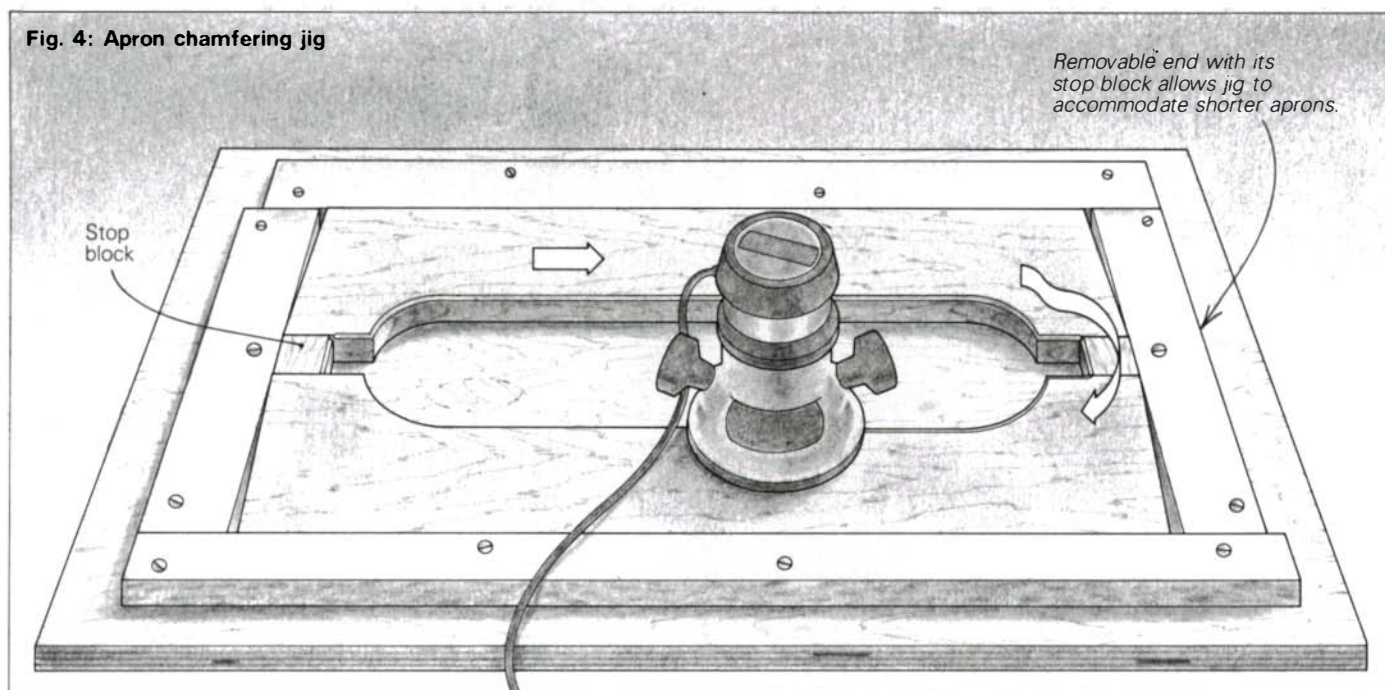
As material went from rough to final size, the pieces became stacks of multiples, crisscrossed on dollies, sorted by size or function. Parts were processed as units of work, the entire pile passing through one operation before moving on to the next. This saved us hours of redundant set-up time, and is the key difference between production and one-of-a-kind work, where, at best, you're more likely to carry individual parts through a series of steps to completion or, at worst, move them around the shop in chaotic bundles.

Tracy varies the order of events according to the job. He shapes parts before cutting joints, as long as the part isn't so odd-shaped that it can't then be accurately fixed in the joint-cutting machine. Sometimes, though, a mortise or a tenon offers a handy way to hold the part in the shaping jig, so it makes more sense to cut joints first. Sanding should come



Gluing up tabletops can be a slow, frustrating job. To speed it along and minimize sanding later, Tracy aligned the surfaces of the clamped-up boards with the pressure of a hydraulic jack, above. He fabricated a Plexiglas ramp, left, to allow the curved edge of each leg to feed uniformly against the router's chamfering bit.

Fig. 4: Apron chamfering jig



after joint-cutting. That way, you can manhandle pieces without fear of damaging them and you won't ruin the accuracy of your joinery by knocking off the crisp reference edges.

Next we began the detail work that makes the Pond House tables look more like one-of-a-kind custom work than the fruit of a production run. First, I stop-chamfered the four edges of each leg. Because two sides of each leg are curved, feeding them over a flat router base would produce an uneven, tapered chamfer. We solved this problem with a Plexiglas ramp clamped to the router base. It kept the leg edges in uniform contact with a 45° chamfer bit. The jig shown in figure 4 speeded the stop-chamfering of the aprons.

We had several hundred boards to pick from for gluing up the 50 tops. Finicky grain- and color-matching could have eaten up weeks, so Tracy set a reasonable minimum standard and sorted the boards accordingly. To eliminate the usual pounding and cursing, and to minimize having to sand boards whose surfaces were misaligned, we suspended a hydraulic pump on a long pipe anchored to a ceiling beam. We rolled our glue-up table under this setup and used the jack's pressure—distributed by a 2x4 batten—to force the boards into the same plane. Spreading the glue with a 3-in. paint

roller, we could glue up a top in three minutes.

In a crowded restaurant, the squared corner of a dining table can be a leg-jabbing, purse-snagging menace. Tracy eliminated this hazard by rounding the corners and undercutting the tabletop edges by 15°. The tops were first sized on the tablesaw, with the arbor set to cut the 15° undercut, then the corners were rounded with a saber saw set to the undercut angle. We used one of the router methods illustrated in figure 5 to clean the rounded corners. The top edges of each tabletop were eased with a roundover bit whose pilot bearing Tracy modified with a brass bushing.

By now we had 450 table parts neatly stacked around the shop. We were ready to glue up the bases, which went faster than I expected. I swabbed glue in both leg and apron mortises, inserted a floating tenon, and drew the joints up with leather-padded bar clamps. After 30 minutes in clamps, the table bases were stacked, to await touch-up sanding. Tracy, meanwhile, sanded the tops on the stroke sander. To pinpoint irregularities, he positioned a fluorescent light behind the sander, throwing oblique, shadow-making light across each top.

Finally, we were ready to spray-finish the tops and bases. While I carried out the last barrel of chips and sawdust, Tracy tacked up plastic sheeting to create a makeshift spray booth

Fig. 5: Edging the tabletops

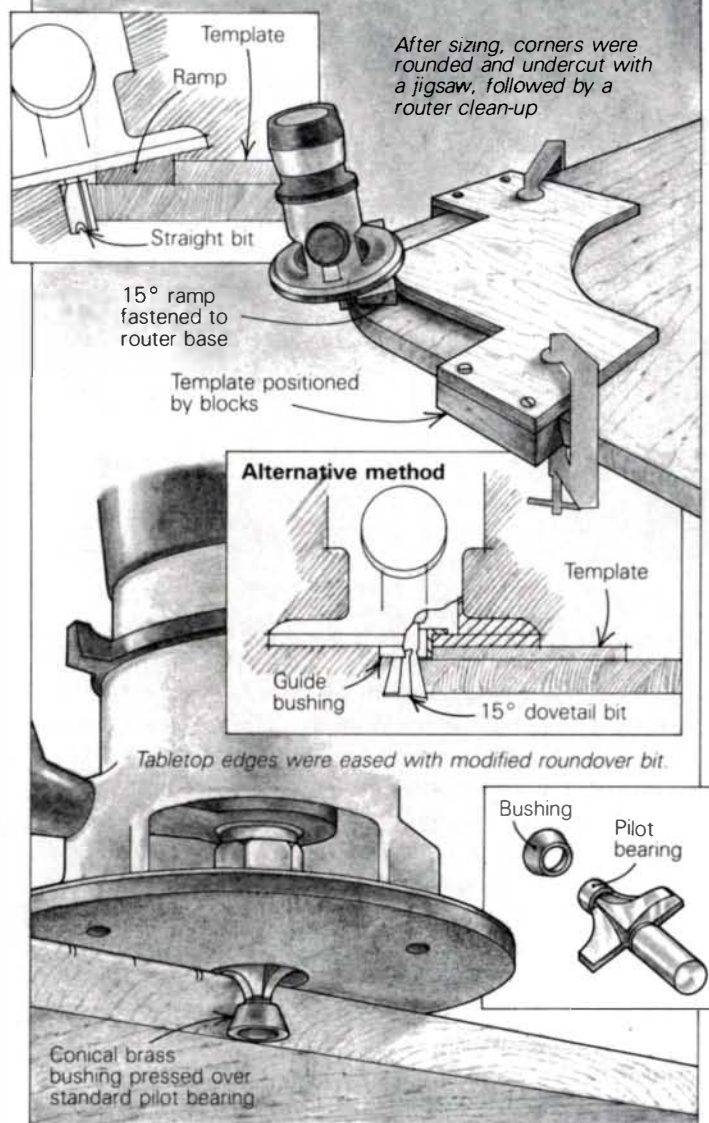


Fig. 6: Cutting buttons in one pass

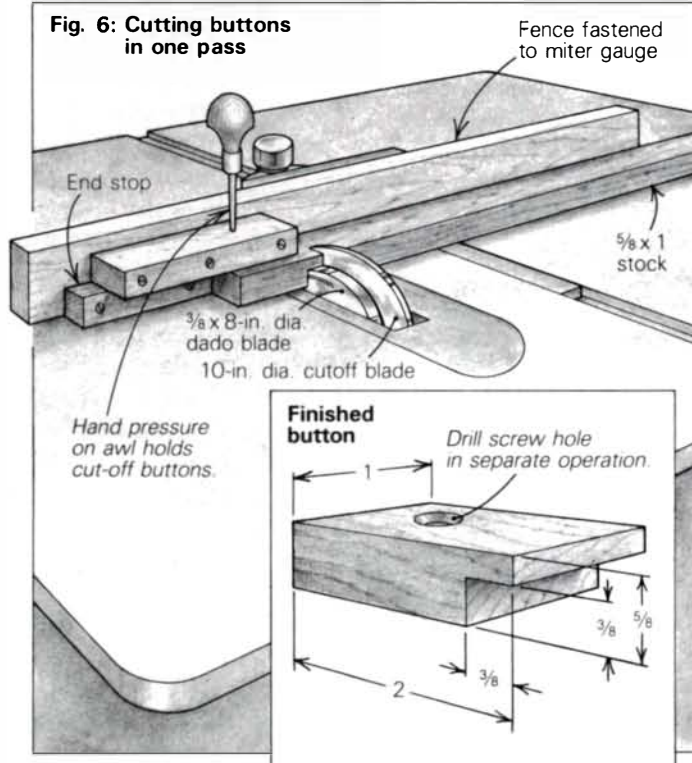
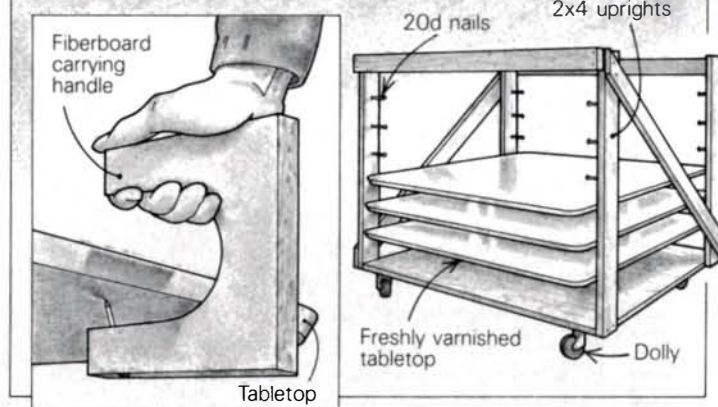


Fig. 7: Carrying handle and drying rack



in the corner of the shop, ventilated by the exhaust fan. His spraying equipment consists of a good-quality gun with a separate pressure feed tank and 1½-HP compressor.

Since the tabletops would see heavy commercial use, they needed a tough, water- and alcohol-resistant film. Tracy chose a natural resin varnish called Rock Hard (available from H. Behlen & Bros., Rt. 30 N., Amsterdam, N.Y. 12010). The bases received a nitrocellulose lacquer, tinted to match the tops. Each top and base took three coats of finish. Since lacquer dries almost immediately, we stacked the bases as they were sprayed. Rock Hard, however, is a slow-setter. As we sprayed the tops, we grabbed them with the shopmade carrying handles shown in figure 7, and stacked them in a 2x4 rack bristling with 20d nails to allow air movement between the tops. When the last coat was dry, we buffed the tops to a flat sheen on the stroke sander, using fine Scotch-Brite pads glued to an old belt.

When we delivered the tables to Pond House, we fastened the tops to the aprons with wooden buttons let into mortises, as shown in figure 6. Tracy's final touch was to brand his logo into each table apron. I remember that the day was beautiful. Spring was in the air and the island sparkled. We had done it.

The tables have seen two seasons of hard use, and apart from a few dings and dents, they show little sign of wear. Tracy keeps extra parts on hand in case they're needed and the jigs stand ready for another run. The tables were so well-received that the Acadia Corporation ordered additional furnishings, including display cabinets for the restaurant gift shop, cash register stands, and several large *shoji*-style folding screens papered in birch bark, a material much in vogue when Pond House was first built.

This production run led me to agree with Tracy's philosophy. Mass production needn't compromise the quality of a piece of furniture. The production prototype can be as vital a design vehicle as any one-off piece. Imagination and skill must remain paramount—properly developed designs and techniques can produce high-quality multiples. Efficiency helps create comfortable and competitive work patterns. Many small shops are more than capable of completing a job like this, which will pay the bills during many lean months of custom furnituremaking. □

Peter Pennypacker lives in Sullivan, Maine. Photos by the author.

How to Market?

A comment on small-shop economics

by Josh Markel

Two years ago, eight woodworkers gathered in a cold Philadelphia shop for the purpose of mutual aid. After several months of intermittent meetings, two main goals emerged: to form an organization, and to put on a large, juried and, we hoped, impressive area show of woodworking (FWW #42, p. 120). By now both of these goals have been achieved, and yet our questions about how to make a living as designer-craftsmen remain: what to make, for whom, in what style, how to market it, and, more generally, what constitutes integrity in this profession?

The experience of a few of the founders of the Society of Philadelphia Woodworkers is illustrative. Of these "founding fathers" only one, myself, was in fact a father when the organization was begun. This itself says something about the kind of life one must lead to be a designer-craftsman. Typically, my friends spend most weekends and many evenings in their shops, leaving little time or energy for lasting close relationships. Typically, they survive on incomes so low that family life is all but ruled out anyway.

Consider Bob Ingram. He routinely sells furniture at the best galleries in the area, appears in the most esteemed juried craft shows, and has won awards for his work. He would seem to be a success. Last year, however, he made furniture he priced at \$28,000, sold \$22,000 worth, and had expenses of \$19,000, even though he shares a low-overhead shop. The numbers don't work out very well.

Ingram has very carefully developed his work for that niche of the furniture market that craft woodworkers are uniquely suited to fill. His furniture emphasizes types and cuts of wood generally unavailable in production furniture, though he does not favor expensive, exotic woods. His designs cleverly mix hand-shaping with jig-shaped pieces, or else they are completely jigged for small-batch production.

Ingram had hoped to stake out his market in the furniture galleries, so for two years he solicitously built toward his debut last June at the prestigious Rhinebeck fair. It was a total disaster: "They wanted either low-priced stuff in quantity, or else funky stuff where price was no object," he says. "I had neither." Now Ingram is shifting his strategy toward short-run production for the contract-furniture market on one hand, and toward fanciful constructions for the furniture galleries on the other. He is opening his own by-appointment showroom, and has been showing his portfolio to manufacturers and marketers who sell primarily to architects and interior designers.

Demand for his work has recently increased, and in response to it Ingram has hired helpers. He feels ambivalent about this because he is accustomed to having control over every aspect of his operation. In addition, he finds that the craftsmen he would prefer to hire aren't content working for somebody else. They all want to be on their own.

Ingram shares a shop with Jack Larimore and Larimore's skillful helper, Dave Page. Last year, Larimore's economic tale



Bob Ingram's table can be made in various woods, colors and sizes—whatever the customer desires.

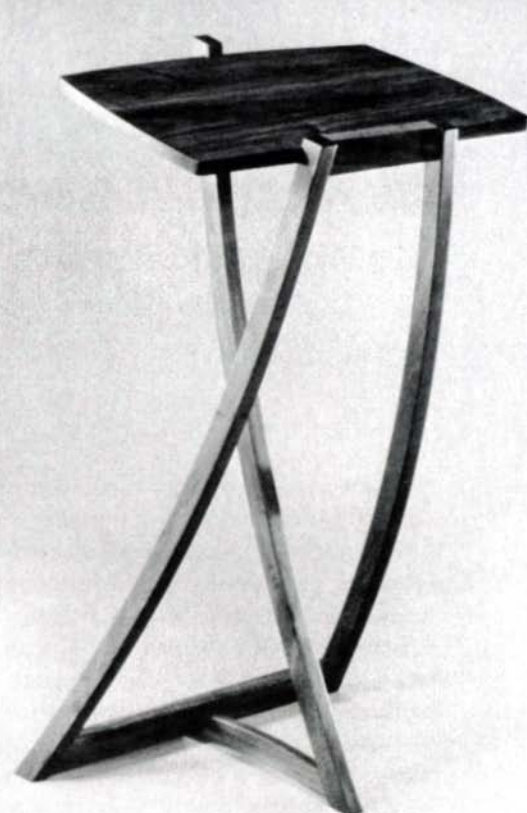
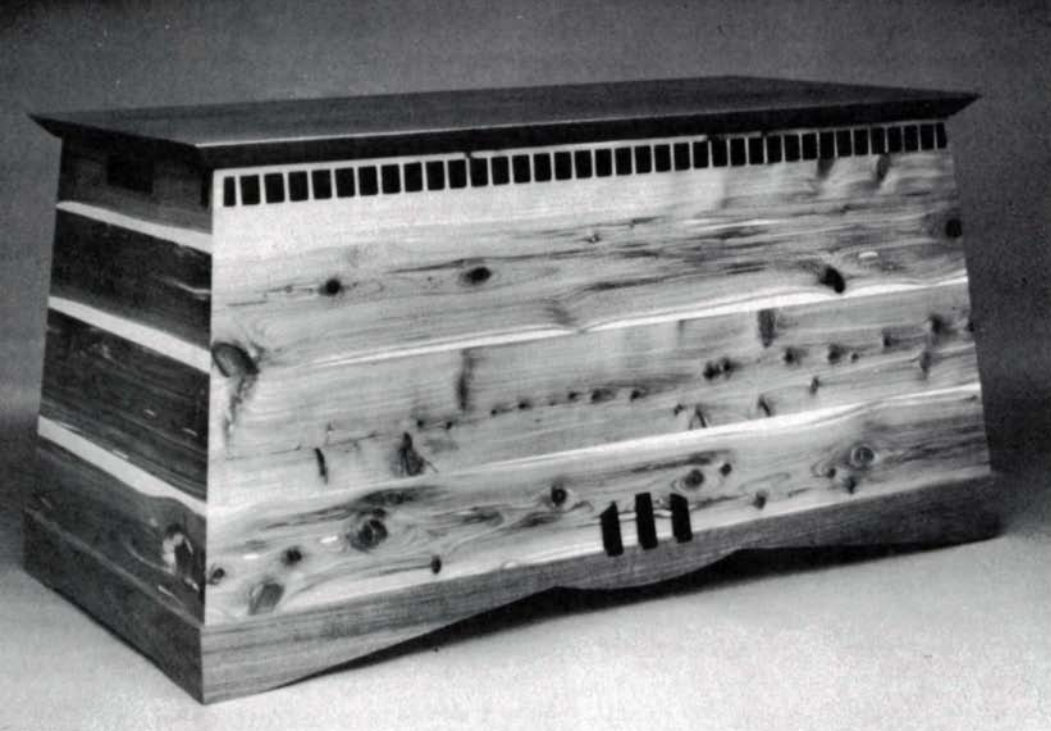
would have been even more woeful than Ingram's. As for so many others, the wife with the steady job is the unsung heroine. But Larimore's persistence and talent, and the patience of his wife, Gretchen Hoekenga, have begun to pay off. His sales are increasing through the galleries and craft shows, and by word of mouth. It's about time, too—he's just become a father and can no longer depend on his wife's steady income.

Larimore seems to have hit a design style that taps into the current interest in ornament, using a mixture of color and natural, mostly local woods. The style evolved from the casegoods projects he does to pay the bills, in which he attempts to get away from unadorned boxes by adding decorative elements keyed to the client's decor. The pieces look one-of-a-kind and in fact are, but they're also quick to make.

I asked whether this Post-Modernist style was a deliberate response to a market trend. Larimore agreed that it was, adding, "I see myself as a designer rather than an artist, and so I have a responsibility to suit my client's tastes in ways that satisfy my own sense of aesthetics and theirs too. Furniture, being a decorative art, is quite susceptible to style changes, and the best pieces in each style will be timeless." Going with the trends needn't be devoid of integrity.

As an antidote to a steady diet of one-offs, our show last spring offered an award for the best piece designed as a multiple. We hoped to encourage craft woodworkers to think in new ways, as well as to draw some notice from those segments of the furniture industry open to external design and development work. Peter Korn's dictionary stand (facing page) won the award. It is an excellent example of an unpretentious and graceful piece that does not require hand-shaping.

Korn's evolution has been different from Larimore's: "I always avoided taking casework jobs just to make money. I felt that if I invested in the machinery necessary to do these jobs profitably, I would have to cover the investment by keeping the machines busy all the time. I'd never get back to furniture." Even so, his walls are decorated with prototypes and jigs revealing many clever attempts to crack the production-furniture market. Like most designer-craftsmen, Korn has yet to get a serious opportunity to develop a product for



Jack Larimore's ornamentalist blanket chest (above) is made of aromatic cedar—an exotic, though domestic, wood—with inlaid ebony tiles. He's made and sold three of them, and will be happy to make more. Peter Korn's dictionary stand (right) may look hand-shaped, but it's jigged and made in a short production run.

mass-marketing, though he's been at it for ten years.

I suggested that woodworkers need to develop their own direct-marketing methods. Korn replied that the costs of advertising and the amount of time necessary make this less attractive than persuading some firm to buy a design. Time spent on business instead of on woodworking is also a factor in the gallery market—Larimore has recently employed a half-time secretary just to answer inquiries and to send slides to prospects. Korn says that when he started out, “the commissions the galleries took really rankled, but now I think the galleries perform a valuable service in cultivating the market.”

Korn is doing better this year than before, and he feels that the market for craft furniture is growing. Nevertheless, he says, “I would be making more money if I had stayed a carpenter.” He supplements his income by teaching, at the Anderson Ranch in Colorado in the summer and at Drexel University in Philadelphia during the winter.

With rare exceptions, furnituremakers who appear successful in galleries aren't making any money. None of my acquaintances has yet been able to use a well-established small shop as a springboard to design or production-prototype work for the furniture industry. None has managed to build up his own mail-order or showroom business. I sampled the more than thirty people who exhibited in our recent Philadelphia show. Overwhelmingly, these craftsmen are young white males without families of their own. Harsh economics seems to govern not only who can make furniture, but what kind of furniture is made as well. These artisans tend to make expensive gallery pieces, intended for clients who, as Larimore says, “buy them for display in their homes or collections.”

Pieces that command high prices generally are vigorous and flamboyant assertions of the skill and imagination of their makers. They also tend to be overly precious and self-consciously artsy, in order to please the jaded tastes of those who can afford them—it's a truism that if you want to sell to the rich, you must study and emulate what the rich are buying. More and more, this category of contemporary work refers to the imagery of sculpture, painting and architecture, to cash in

on the critical credentials of these other art forms. Less and less does it refer to requirements that originate either in how the product will be used or in how it was made. These pieces of furniture shout to be seen by themselves, but not to become integrated into the life of a home.

By way of contradicting myself, let me say that I very much enjoy both seeing and making furniture that results from an unhindered play of the artistic imagination. I enjoy the best of this work, much as I enjoy an occasional trip to a fancy French restaurant. It's fun, but it's not a steady diet.

There is much to learn. I'd like to know more about craftsmen who have built small shops into successful, short-run production operations. Some craftsmen, such as Thomas Moser of New Gloucester, Maine, have effected successful production shops that sell through direct mail, and I'd like to hear more about them. I'm especially curious about the many 5- to 30-man shops in northern Italy that produce much of the clever furniture seen in *Abitare* magazine.

It will be difficult for craftsmen to pursue design directions that engage a broader audience than rich collectors, even though this is where the rewards currently are, both monetarily and in terms of the critical approval of their peers. A different design direction requires a public that knows that good furniture is a lifetime investment and therefore worth the bucks—not the large bucks of a few collectors, but the collective bucks of a middle class which could forgo an Olds for a Chevy and buy a beautiful desk with the change. We can learn from industry what works and what doesn't, without being blinded by industry's constraints. We will have to devise sophisticated designs that can be jig-produced rather than hand-shaped. The challenge of industrial society is neither to be swamped by the conformity of enormous scale, nor to reject it by returning to hand-production. There has got to be a middle path that will utilize the tremendous creativity of the craft-woodworking renaissance—before we all go broke. □

Josh Markel, a professional woodworker for the past six years, is a director of the Society of Philadelphia Woodworkers, 4101 Lauriston St., Philadelphia, Pa. 19128.

Movement and Support at the Lathe

A steady hold improves your turning

by Richard Raffan

Many aspiring turners experience problems because they fail to develop basic tool control. How you hold and move your tools, even how you stand at the lathe, affects the quality of your work. A solid, vibration-free lathe is of little use if an improperly held tool chatters about on the wood. In this article, I'll cover the basics—how to support yourself, the tool and the work—which are the same for all aspects of face or center work. Practice will greatly improve your technique.

Stance—When a tool contacts a spinning block of wood, the wood exerts considerable downward pressure on the cutting edge. Think of the tool as a lever and the tool rest as a fulcrum. When force is applied on the cutting end, there is an opposite reaction at the handle end. The farther the cutting edge is from the tool rest, the greater the leverage, and the more difficult it becomes to control the tool, so keep the rest as close to the wood as practicable.

To move the tool precisely where you want it, without the wood having a say in the matter, you must get your weight behind the tool. Stand in a balanced position, feet apart. Maintain contact between your body and the machine—keep a hand on the rest and lean against the lathe bed, or keep a leg against the stand. This gives you extra support and stability, and provides a point of reference for tool movement.

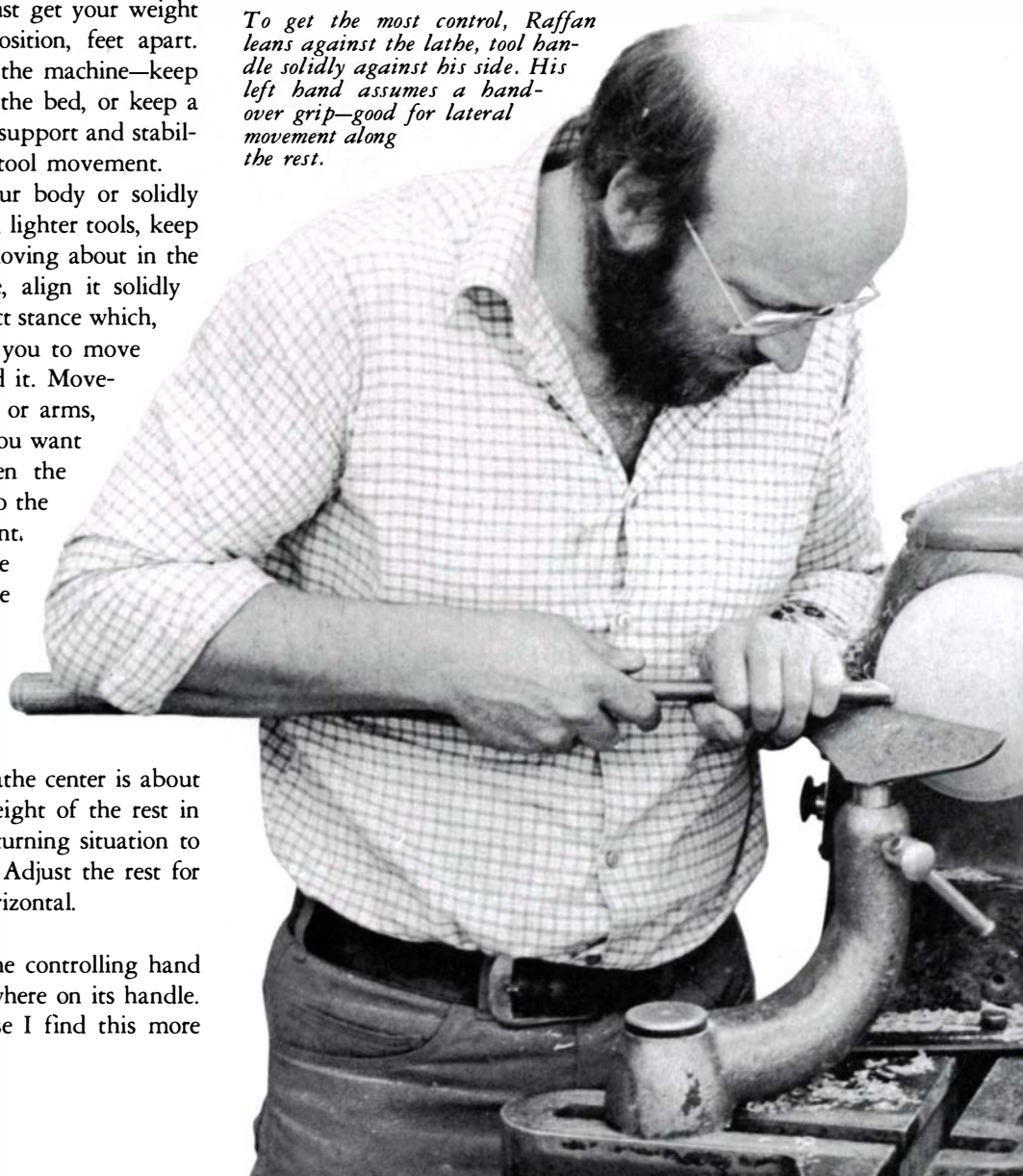
Keep the tool handle tight against your body or solidly braced against your forearm. With shorter, lighter tools, keep your elbows tucked into your sides, not moving about in the air. If the handle has to leave your side, align it solidly along your forearm. Your goal is a compact stance which, when combined with a firm grip, allows you to move the tool precisely with your weight behind it. Movement comes not so much from the wrists or arms, but from the shoulders, hips and legs. If you want to move the tool edge slightly left, then the movement comes from a shift of the hip to the right rather than from a hand movement. That way your hand stays close to your side and you're more compact. If you want the tool edge to drop, raise your whole side, standing on tiptoe if necessary, to bring the handle up, with the weight of your torso and shoulders behind the tool.

Lathe height is important. Block up the lathe or stand on boards so that the lathe center is about 50mm (2 in.) above your elbow. The height of the rest in relation to center height varies from one turning situation to another, but it should be close to center. Adjust the rest for comfort and try to keep the tool near horizontal.

Holding the tool—Hold the tool with the controlling hand (right hand if you're right-handed) somewhere on its handle. I grip the handle near its ferrule, because I find this more

comfortable than holding it at the end, and I can use my forearm and body along the length of the handle to stabilize the tool. Gripping the tool this way, nearer the rest, also means that when I pivot the tool, my right hand need not move in quite so large an arc as it would if it were at the end of a long handle. Hold your upper hand (left hand if you're right-handed) on the rest near the cutting edge. This hand provides fine control. You must be able to control the tool at the point where it pivots on the rest if you are to dictate the precise path of the cutting edge. You can grip the tool from either above or below. Gripping from above gives firm support when you need to move the tool sideways along the rest, and by raising a few fingers, you can direct shavings away from your face. Gripping from below allows you to clamp tool and rest together to make a solid pivot point, while permitting you to watch the edge. No matter which grip you use, the object is the same: to keep hand and tool in contact

To get the most control, Raffan leans against the lathe, tool handle solidly against his side. His left hand assumes a hand-over grip—good for lateral movement along the rest.



with the rest, and to prevent the tool from moving sideways when you don't want it to.

Don't grip the tool as though your life depended on it. Just use a light, firm grip—relaxed, but ready to tighten instantly if necessary. This will provide a kind of recoil pad so that a catch will be less disastrous. It's possible to turn while holding the tool lightly between a finger and the thumb of your right hand. You have no fine control this way, but the trick illustrates how little power is required.

As your skill develops, you'll be able to adapt these grips to suit yourself. I enjoy the control I've gained through their application—moving the edge with a little squeeze or push here and there, in conjunction with broader movement from the rest of my body.

Cutting—Begin the cut with a firm grip on the tool, and always start above the center, or axis, of the wood. Don't push the tool straight across the rest into the wood—you get better control if you tilt the edge up 10° and bring it down in an arc by slowly raising the handle (figure 1).

I have three basic rules for cutting. First, whenever possible, cut the wood with the tool moving parallel to the lathe axis. This allows you to exert pressure in a direction where it will be absorbed by the headstock or tailstock (figure 2). Put as little forward pressure as possible against the axis of the wood, to avoid chatter. A sharp tool held in the optimum position will produce a large shaving with virtually no for-

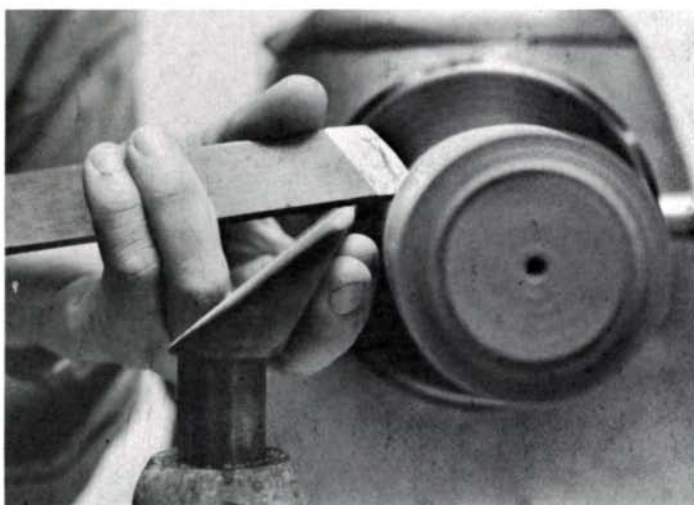
ward pressure against the wood. Experiment by rolling the tool to find this point.

Second, have the bevel of the gouge or chisel rubbing (which is impossible with any scraping technique.) This provides a secondary fulcrum and a guide to aid fine control of the tool's edge. Sometimes, when beginning a cut, this is not possible. In this case, use a firm-fulcrum grip, and move the tool into the wood through an arc. Then move the bevel so that it can rub the newly cut surface.

Third, avoid using the tools at right angles to the surface being cut. It is much more difficult to achieve flowing or straight lines this way. Hold the tool so that the edge is tangent to the work, and move the tool in the same direction as the curve (figure 3).

Learn to move the tool precisely and evenly along a definite path. Plan what you want to cut, and have a beginning, middle and end to your movements. Don't poke at the wood. Any shape poked at and messed about tends to look it, so make your cuts smooth, flowing and definite. The tool should move forward only after the wood in its path has been removed. In the hands of an expert, this becomes a rapid, flowing action.

Practice slowly. Don't try to cut too much at one go. If you push the tool in too fast, the sudden force will lead to a catch. If the tool begins to cut less efficiently or stops cutting, adjust the tool angle and roll the tool to a different position. If you push forward to find an edge, the tool will often skate over



Gripping the tool: The overhand grip, top, gives firm support when moving the tool sideways along the rest. The hand-under grip, bottom, gives good control of the tool where it pivots on the rest, and prevents the tool from moving sideways.

Fig. 1: Arcing the tool into the wood

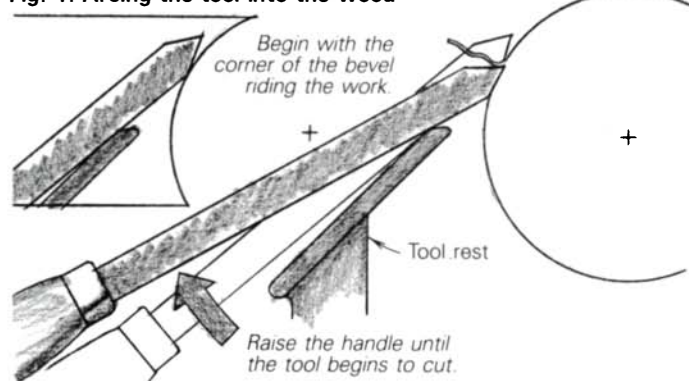


Fig. 2: Applying force

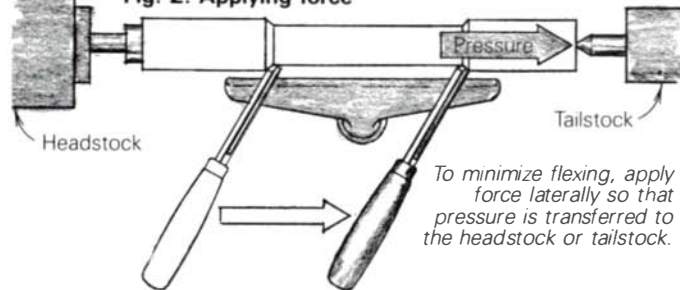
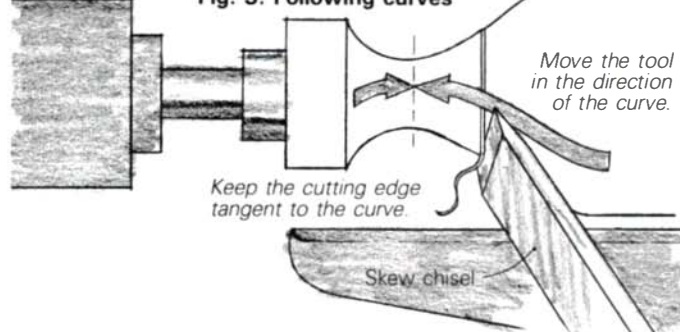


Fig. 3: Following curves





Supporting the work: Any grip can be modified by extending fingers around the work to the back side to keep the wood from flexing (top left). Note how Raffan steadies his body on the lathe in the photo at left. To back up the thin wall of a bowl, above, Raffan uses his left-hand thumb to pin the tool to the rest, while the other fingers support the wood behind the cut.

the surface without cutting. The tool should never shoot forward if you lose an edge—that indicates a lack of control.

As a cut gets close to center, slow up for the last few millimeters and float the edge in gently, turning and adjusting the tool to maintain the most effective cut. Stop at dead center—don't cut below, or you risk tearing or pulling out fibers.

To improve your control, learn to stop in mid-cut. Practice easing pressure so that the edge of the tool is barely in contact with the wood. Then proceed again and stop again. Soon you should be able to remove the tool and bring it back to exactly the same position.

Practice and experience will teach you what each lathe tool can and can't do. If you have trouble, and don't know why, there are a few things to consider: First, check that the tool is sharp. If it is, but is still not cutting properly, experiment with different angles or roll the tool slightly. If this doesn't work, you may be using the wrong tool, so try another. If nothing seems to work, do some other job for a while, or go for a walk and try again later. Everyone has off days.

Supporting the wood—As you become more adventurous and turn slender pieces or bowls with thin walls, the wood will flex when a tool presses against it. If the wood flexes under power, it will vibrate, causing spiral chatter marks or worse. You'll hear a high, almost screeching sound if you're really overdoing it. You must support the wood. I always use my hand, which is far more flexible and sensitive than any mechanical support. One part supports the wood, while the other part remains in contact with the tool and rest. You can develop your own techniques, but your fingers or hand should support the wood from behind to provide counterpressure to the tool's pressure. If your hand gets hot, you're pushing too hard on the tool. Your hand should be warm, but not burning. Provide just enough support to keep the wood from flexing away from the center.

Sounds—Sounds are important in lathe work and you must learn them. Turning sounds should be a series of crescendos and decrescendos resulting from smooth, flowing cuts. Stop the lathe whenever you hear a new sound, to discover the cause. This is time-consuming at first, but you'll soon learn to recognize the basic noises—a sharp tool hisses; a dull tool makes a grinding sound. Once you hear the difference, it's easy to tell when your tool needs sharpening. With practice, you'll also be able to judge the thickness of a bowl wall, detect a loose block, or tell if you've hit a split or a knot, just by listening to the sound.

Attitude—It is worth pushing yourself. Don't be afraid to risk ruining a job with one chancey final cut. Sometimes just one more cut can make a lot of difference in the curve of a bowl. Once, when I checked the 8mm wall thickness of a large elm-burl bowl, I found it to be only 2.5mm thick near the base. I took a chance and turned the whole wall down to 2.5mm, and ended up with an even thickness—cut in one minute, not bludgeoned into submission with 20-grit abrasive in ten. That time I was successful. I've had smaller bowls shatter on me, but it is always worth the risk. Now and then you should cut bowls or boxes in half to examine the section. You can learn a great deal by doing this, and it's worth sacrificing some less-than-satisfactory pieces to help find out where you're going wrong.

As you develop your skills, beware of complacency. No matter how good you become, aspire to doing better. I find I am rarely satisfied with yesterday's masterpiece because it becomes today's run-of-the-mill. □

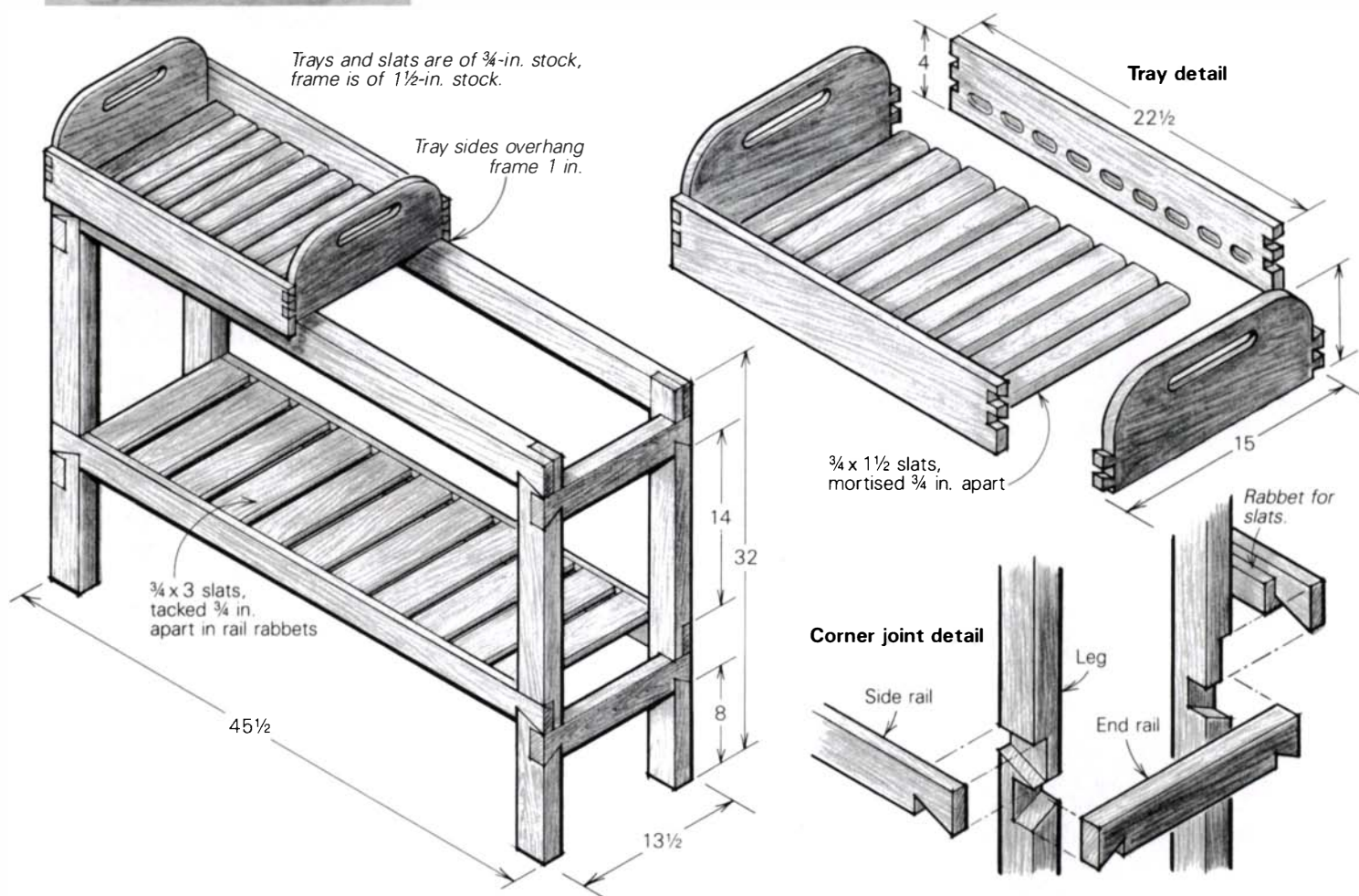
Richard Raffan, a professional turner who lives in Mittagong, N.S.W., Australia, trained briefly in Devon, England, but now regards himself as mostly self-taught. He is currently writing a book about woodturning techniques.



Versatile Plant Table

Redwood slats support your fine-foliaged friends

by Frederick Wilbur



For those of us who have a house full of herbaceous friends crowding every windowsill and end table, this redwood plant stand will make them more enjoyable. The stand supports two removable trays at a height that makes admiring and caring for their occupants convenient. And the trays also allow you to carry the plants outside for sun, or for a bath—the tray bottoms are slatted for drainage. The stand includes a bottom shelf for more plants, ones that require less direct sun, or for the paraphernalia that accompanies enthusiastic plant care.

I recommend using redwood, though cedar or cypress would last as well. If you have an absolute jungle and plan to produce these stands by the score, consider the economy of pressure-treated lumber. One could, I suppose, adapt the design, fabricating copper tray inserts and making the trays and frame of any fine cabinet wood.

The plant stand requires a modest amount of both 3/4-in. and 1 1/2-in. stock. I make the two trays first from the 3/4-in. stock, using through dovetails for strength, although finger joints would also work well. Cutting dovetails in redwood takes a little patience because the wood is brittle and easily splits. When laying out the joint, note that the sides project below the ends so that they straddle the frame. The end curves are bandsawn, and the handles cut out with a coping saw. To mortise the sides for the slats, I used a simple router template made from 1/4-in. plywood, and positioned the mortises so that the slat bottoms would be in line with the bottom edge of the ends. I rounded the slats on a stationary sander to fit the round-cornered mortises. The length of the slats must ensure that they don't fall out after assembly.

The supporting frame is made from

the 1 1/2-in. stock. The top rails of the frame must be spaced close enough that the sides of the trays fit outside them. Other than this, the configuration of the frame can vary to suit. I lay wide slats into rabbets in the long rails at the bottom for a balanced appearance. Though this stand is lap-dovetailed and glued into one unit, through mortise-and-tenons or bolted lap joints (for a knockdown version) would work well too.

I sanded the trays for this stand and rounded their corners, but I didn't apply any finish to the redwood, not knowing what effect some chemicals might have on delicate houseplants. Water stains are inevitable, so I didn't worry about preventing them. Redwood turns a mellow gray in time, contrasting nicely with the lush greenery of happy plants. □

Frederick Wilbur operates Braintree Woodworks in Lovington, Va.

Black Walnut Woes

A tree-grower learns from the roots up

by John R. Harwood

Like most woodworkers, I admit an emotional attachment to trees. When I decided to plant black walnut trees in an abandoned field on our property in Upstate New York, I understood that their lumber wasn't likely to ever find its way onto my workbench. Yet I wished to replace some of the trees cut, often before their time, to meet the demand for lumber that I was helping to place upon the forests. I chose walnut for its uncommon beauty and outstanding workability, as well as for the scarcity of this valuable species in our area. Needless to say, I did not know what I was getting into. Stick a bunch of seedlings into the ground and sit back and watch them grow, right? Not quite! I found that if you sit back after planting hardwoods, you won't have much to watch grow except weeds.

I began in the winter of 1976 by placing an order with Van's Pines, in West Olive, Mich., for 100 black walnut

bare-rooted seedlings, 3 ft. to 4 ft. tall. For the remainder of the winter I read anything I could find about tree-planting in general or walnuts in particular, and I also enrolled in courses in environmental science and forestry. Most of the literature I found was directed toward establishing conifer stands. The little bit of available material about walnut plantations presumed machinery far superior to my lawn tractor, and manpower greater than my two hands. I found that I would have to learn as I went along.

Spring came, and with it two parcels—a long, soft one containing the seedlings, and the other, which looked like a manual jack-hammer, my dibble bar. A dibble bar is a planting tool used for conifers, but ignorance, if not bliss, is at least a postponement of unhappiness. I decided to plant that day since the weather was gray and drizzly—the seedlings would not dry out as they were being handled and the trees would not need immediate watering. I sloshed my way up to the “plantation” site, with visions of walnut trees dancing in my head.

Ceremoniously, I extracted the first seedling for planting, only to find that its taproot was a good 4 in. longer than the spade on the dibble bar. The ground was so saturated, however, that I was able to force the bar far enough down to place the root without breaking it. Fortunately, the average root on the remaining seedlings was only slightly longer than the spade. As I untangled the bundle, the quantity of seedlings seemed to grow, as did the effort required to plant each of them. I began to wonder why I had ordered so many. The final count was 112 walnut

seedlings standing proud, albeit in crooked rows, at a spacing of 8 ft. by 8 ft., or two big steps and one little one—a rather small plantation of less than 6,000 sq. ft., barely an eighth of an acre. Though my goal was 10 acres of walnuts, I proudly gazed upon my modest accomplishment, then headed home for a hot bath and some muscle liniment.

Two weeks later the still-dormant walnuts could barely be seen through the lush growth of spring grasses. By midsummer the seedlings showed signs of transplant shock, insect damage, and stress from competition. I mounted furious warfare against the weeds. Somewhere between blisters and backaches, I decided that a gasoline-powered weed whacker was just what I needed, only to learn that this monster does a fine job of gashing the tender bark off of seedlings when its operator grows weary. The insects had already eaten most of the sickly leaves, so pesticides seemed of no use at this point.

I could see that my simplistic approach to planting hardwoods was futile, so I began to plan the next spring's endeavor with a little more forethought. I continued my part-time



A woodworkers' rite of spring: the black walnut tree beginning to bloom.

studies. I met with the regional state forester. Meanwhile, to my amazement, most of my bedraggled walnuts set healthy winter buds, and were obviously interested in surviving. I ordered another 200 seedlings.

As spring drew near, I finalized my plans. I would again plant in wet weather, and this time I would discourage the weeds by scarifying the soil around each hole with a shovel. I would drop a timed-release fertilizer tablet into each hole, and I was prepared to apply insecticide at the first sign of damage. I theorized that the dibble-bar method might cause trapped air around the bottom of long taproots, so I had ordered smaller planting stock. I had also ordered 50 black alders to intermix as trainers: alders grow faster than walnuts, encouraging the slower-growing trees to head straight up for light and not branch out too much. When the alders began to suppress the more valuable walnuts, I would thin them out for firewood. I was becoming a more sophisticated tree-planter.

As I trudged through my plantation that spring, I discovered that deer and rabbits love healthy walnut buds—only two trees, fortuitously planted within a blackberry bramble, had escaped the forage. Discouraged, I nevertheless resolved to stick to my plans, and I set to work. After several hours of back-breaking scarifying, though, I gladly dropped that idea. It was all for the best: by midsummer no difference could be detected between the seedlings whose sod I had scarified and those I had not. By then the alders had all perished, presumably due to root damage. Their roots are really too crooked and multi-branched for dibble-bar planting.

Things looked pretty bad at that point, but I was due for a little beginner's luck. While contemplating the relative costs and benefits of fencing the whole plantation versus constantly spraying various animal repellents, I decided to salvage some old 4-ft. welded-wire fencing. I had only enough to make six 3-ft. dia. cages, but at least I would be able to protect the

In a nutshell

by Charles Leik

My father has spent his life farming within sight of where he was born in central Michigan 78 years ago. Over the years he has planted acres of corn, wheat and beans, but nothing has given him as much pleasure as growing trees. His stands have included tens of thousands of pine planted in the poorer soil and more severe winter climate a short distance to the north, yet his greatest satisfaction comes from the one hundred black walnut trees surrounding the farmstead in Portland. As a youngster, I learned real patience picking out nut meats over the kitchen table on wintry Sunday afternoons—but the black walnut was a delicacy well worth the effort. Now, with Dad's careful attention, each year these trees progress a bit more toward the quality veneer logs that my children will harvest toward the middle of the next century.

Black walnut (*Juglans nigra*) develops best on deep, moderately well-drained, nearly neutral soils that are generally moist and fertile. It is native to the area from the East Coast to the Missouri Valley and from the Southern Appalachians to the Canadian border. Dad's walnut plantings are on the northern fringe of their natural habitat, and growth is considerably slower than, say, in the Shenandoah Valley of Virginia. Slower growth isn't all bad, though, as the most desirable veneer patterns result from the smaller annual rings of trees from north of the Ohio Valley. It isn't unknown for unscrupulous sellers to truck southern logs to northern locations and represent them as locally grown.

Dad dates his interest in growing

walnuts from the Depression era, when he shucked walnuts from trees growing wild in fencerows and sold the nuts for a dollar a bushel in Detroit. He planted his first trees from nuts in 1929. These trees are now 50 ft. tall and 19 in. in diameter at breast height (DBH). In late autumn of 1968, Dad made preparations for his largest planting. After shucking the nuts, he placed them in a leaf-lined pit, where they would be kept moist but would not freeze. He planted these nuts the following spring. In some cases germination was delayed quite a while, as seedlings continued to appear for several springs. Before long, the stand was so thick that many trees had to be transplanted. After 15 growing seasons, these trees average 32 ft. in height and over 8 in. DBH.

A danger of planting nuts instead of seedlings is that squirrels and chipmunks may mistake them for a winter food cache. Some foresters recommend burying the nuts in a perforated tin can, which deters animals while allowing the nuts to germinate. Tin cans (don't use aluminum cans) soon rust away, posing no problem for a growing seedling.

Dad's goal is to produce 16-ft. logs, so he approaches training and pruning with considerable thought. He trims the branches as high as possible without shocking the tree by taking off too many in a season. Trees planted in open country will usually fork, and then Dad has to decide which branch should be lopped off and which can be trained as a new leader. He studies the alternatives like a gem cutter, solicits opinions from visitors, and by fall has generally

made his decisions for pruning.

After a new leader has been established, or when a tree leans away from the prevailing westerlies, a guy rope is necessary to encourage straightness. At first Dad installed a taut rope between the limb and a stake, but in high winds either the tree or the rope was liable to snap. Now he runs the ground end of the rope through a pulley-type device and attaches a weight to the end. This allows the tree to flex in a wind, yet continuously tugs the tree or branch in the desired direction.

If a tree does break off, or has undesirable characteristics, Dad cuts it off at ground level. A 4-ft. to 5-ft. leader usually comes back the first year. Without such drastic cutting, the stub would just send out bushy branches, which would make the tree useless for lumber.

Now that the 1969 planting is well along, Dad has started a new enterprise. My brother and I bought a small farm several years ago that has eight acres of small hardwoods, many of them walnuts. Dad is trimming these trees and eliminating less valuable species that compete for sunlight and moisture. This approach to walnut-growing gives him a 10- to 20-year head start by utilizing already thriving trees.

Walnut-growing is not a short-term proposition, but Dad gets satisfaction from the thought that his efforts will allow those not yet born the opportunity to make fine furniture from this premium lumber. □

Charles Leik is a banker and woodworker who lives in Great Falls, Va.

best-looking survivors from the first year's planting. I secured each cage with two 5-ft. long stakes woven through the fencing. Then in July I discovered that several seedlings I had written off had resprouted from the root, and were growing at a rate far greater than those with original stems. I thought I was finally on to something.

I was not positive the cages would provide total protection. They were also expensive, averaging \$6 per cage plus the stakes and the time required. Then, too, I had to consider the risk of rot in stems resprouting so near the ground, especially with dense grass maintaining a moist environment. The books emphasized the grave importance of avoiding all injuries to the bark, since a walnut tree with heart rot is of no value. I would just have to wait and see. Perhaps it was cabin fever that drove me to complete madness—that winter I ordered 400 new seedlings.

As to why my lunacy doubled every year I cannot say; perhaps I hoped to overwhelm the odds. I decided to drop the dibble-bar method. Though no walnut mortality could be attributed to its use, no tree had gotten off to a good start being forced into such a small hole. I rented a hand-operated, gas-driven post-hole digger and purchased several cubic yards of weed-free topsoil.

Planting day arrived and the weather was beautiful, 70°F with bright sun and a steady breeze. Perfect for the friend I had persuaded to help me, but bad for the seedlings. The weatherman had promised rain, so I had made no provision

for carrying enough water up to the field to give the seedlings a good soaking. The post-hole digger, which I was to operate, was like a lawn mower connected to a 6-in. auger drill by a flexible shaft—a real torture machine. My companion was to fill each hole with a tree and soil brought up in a small cart, towed by the lawn tractor, from where the truck had dumped it. Somehow, we managed to plant all 400 seedlings. The rain clouds I had been watching as the sun set dropped a foot of snow that night, and the temperature dropped 50°F. Nature's watering remained frozen above the ground long enough to either kill or hopelessly weaken most of the trees within a week.

Each of the past four springs, I have ritually planted about 100 trees, though I've concentrated on species with a greater chance of success, such as spruce and larch, plus small numbers of birch and oak. Because it takes so long for a particular acre to grow quality cabinet lumber, I've made an experimental planting of 30 Japanese larches, as a cash crop, intermixed with 10 black cherries.

I have by no means forsaken the walnuts, or hardwood reforestation in general, and have continued to care for the trees that have survived. The only trees that have had a predictable chance have been those placed in cages, so I dutifully purchase several rolls of fencing each year and delegate its use as best as possible. I have managed to cage, and in some cases cut back and resprout, more than 50 of the trees in the walnut plantation. Two years ago I begrudgingly applied simazine, a pre-emergence herbicide, around some. With one application, second- and third-year seedlings grew above their cages that year, and out of the reach of the insects in the surrounding high grass the following. All of the first six trees caged were treated, and they are now true saplings, beyond the possibility of deer and rabbit browse, so I've moved their cages on to other needy recipients. The trees without cages resemble gnarled bushes.

This year I have the inclination to plant walnuts again—no, not 800, but maybe 25. Last spring I sprouted nuts collected from local trees, and knowing that the parents had good growth habits and were well adapted to our climate gives me confidence. But I will not be tempted to plant more than I can care for. With a garden tiller on the tractor, I'll be able to loosen the soil and subdue competition without much effort. I'll consider one application of herbicide next spring, if called for based on the competition present late this summer. If planted and cared for properly, walnuts can grow 3 ft. or more a year, allowing the cages to be reused after three or four years. Once the trees are out of the cages, I have only to worry about insect infestation and disease, winter die-back, and storm damage. I have learned a lot, and I have gained a great sense of satisfaction from helping the trees grow. □

A 4-ft. wire cage protects a young seedling from animal forage.



John Harwood, a designer and woodworker, operates Grassy Lane Studios in Cazenovia, N.Y. For more on how to grow black walnut trees, read Nut Tree Culture in North America edited by Richard A. Jaynes (Northern Nut Growers Association, Broken Arrow Rd., Hamden, Conn. 06518), Black Walnut for Profit by Bruce Thompson (Graphic Publishing Co., Inc., Lake Mills, Iowa 50450), and Black Walnut as a Crop (publication #S/N 001-001-00403-1, available from the U.S. Government Printing Office, Washington, D.C. 20402).

Machining Backwards

Power-fed climb-cutting reduces tearout

by Lew Palmer

Several years ago some friends decided to expand their repertoire of woodworking machinery, so that they could better fill their rapidly increasing orders for oak accessories. On their list of must-haves was a nifty SCM R-9 over-arm router, a power-fed affair which they ordered tricked out with all the options. But when they started running their new line of oval mirror frames on it, alas, they suffered a staggering number of ruined pieces, which threatened their anticipated profits.

An anguished call to their machinery supplier brought forth a knowledgeable rep. He took a quick look at their procedures and promptly prescribed the cure: use the power feed to climb-cut, and thereby eliminate almost all machining rejects.

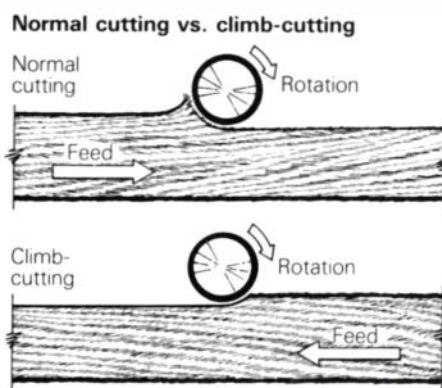
He was right. And the solution to their router problem also worked on their shaper and their more sophisticated machinery to come—and for me. I've found climb-cutting to be one of the most important machining techniques for any profit-minded (thus waste-conscious) woodworker.

Climb-cutting is nothing more than power-feeding (*never* hand-feeding, for that would be terribly dangerous) in the same direction that the knives of your shaper (or whatever) are rotating. This forces each knife to remove only a tiny slice of wood with each cut, which largely eliminates blowouts. The method contrasts with the traditional way cabinetmakers machine wood: feeding against cutter rotation, a technique probably necessitated by hand-feeding, but one that can cause the wood to lift and tear unpredictably.

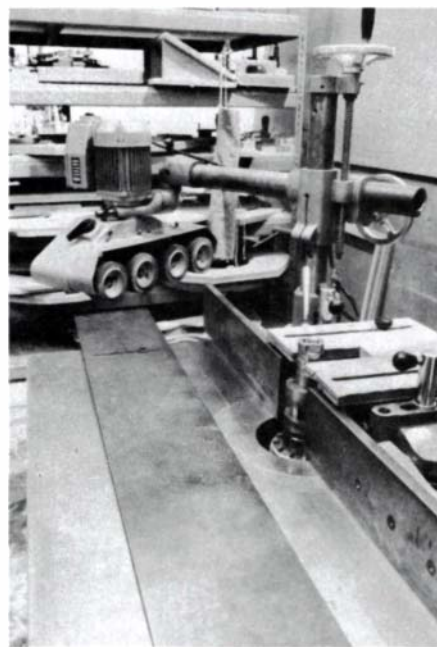
Climb-cutting, and therefore power-feeding, are indispensable in my shop, where I often have to machine stock to precise dimensions and profiles—stock that's too expensive to replace. I do it on a rather hefty (1500-lb., 1½-in. dia. spindle) SCM TC-120 shaper, equipped with an 8-speed, 3-roller Univer power feed. This attachment offers a relatively slow 2.7-meter-per-minute (about 9-FPM) feed rate which I prefer when shaping unusually deep raised panels. I regard the power feed as essential, even on those rare occasions when I do not

climb-cut. Only a power feed can safely feed material at an optimum, consistent rate, hold it flat and indexed against the table and fence, and shield the operator from blown material.

To me, the only acceptable power feeds are the industrial models you can securely bolt to your shaper table. They weigh in at 150 lb. or so, one reason to operate a more massive shaper. These power feeds consist of a multi-speed 3- or 4-wheel drive unit, a base, and a post-and-arm assembly that allows you to position the feed variously. They retail from industrial woodworking ma-



Feeding against cutter rotation allows feeding by hand, but the cutter tends to lift and tear out the wood. Climb-cutting virtually eliminates tearout, but necessitates using a power feed, or else the cutter will grab the stock.



Substituting for the standard two-part shaper fence, Palmer's one-piece fence, used in conjunction with the Univer power feed, makes for safe, precise shaping.

chinery suppliers for \$1100 to \$1500, with the more expensive ones offering more speeds and feed wheels. For maximum versatility, instead of hard-wiring the feed to a box, you can attach a plug to one end of the cord and plug it into a receptacle on the side of the shaper. Then you can easily transfer it to another machine, such as a tablesaw.

These feeds, for the most part, are limited to working linear stock. One technique I've found advantageous for jointing, profiling and dimensioning a large amount of stock is to feed material against a one-piece auxiliary fence, instead of or in addition to the standard two-part shaper fence (photo, below left). A piece of straight phenolic plastic, steel, or even Baltic birch plywood will suffice. My fence, for example, is ½-in. thick steel plate, 6 in. by 84 in., slotted to allow for bolting to the shaper table on the operator's side of the spindle. I position the feed so that the first and second infeed wheels straddle the spindle, and I tilt the feed toward the auxiliary fence, so that the stock is held tight.

The auxiliary fence has two shortcomings. When you need to profile extremely narrow or thin stock, the feed wheels can't grab it properly. In such situations, I use a thinner fence (¼ in. or so), or I rabbet the side of a Baltic birch fence, which creates a flat running surface and raises the stock above the face of the fence. For wide stock that won't fit between the auxiliary fence and the spindle, a dimension dictated by the size of the shaper table, I revert to the regular shaper fence, which straddles the spindle.

While climb-cutting linear stock has eliminated up to 20% of the waste and machining hassles I once suffered, the technique's real advantage is with curved stock, where some part of the material must necessarily be machined against the grain, as with my neighbors' oval picture frames. Power-feeding curved stock requires more sophisticated equipment than I have, such as the R-9 over-arm router, but for those shops moving into such production, cutting backwards may be a big step forward. □

Lew Palmer has a cabinet shop in Carmichael, Calif. Photo by the author.

Glues for Woodworking

Part two: Synthetics solve some problems, pose new ones

by George Mustoe

Adhesives have changed enormously since the days when artisans prepared their own crude glues from meat scraps or milk curds. Twentieth-century chemistry has given us hundreds of new synthetic adhesives, some of which are of interest to the woodworker. Generally these adhesives—epoxies, cyanoacrylates, hot-melt glues and contact cements—are far more expensive than the hide glues, polyvinyl acetates and water-resistant glues that I discussed in the first part of this article in *FWW* #43, although they aren't necessarily more effective. In the small woodshop, cost alone limits use of most of these glues to special jobs.

Epoxy resins—Although epoxies are among the more expensive adhesives, their physical properties—high strength, low shrinkage, transparency, insolubility, and ability to bond to a diverse array of materials—make them ideal for certain applications. The extreme strength of epoxy is seldom essential in joining wood to wood, but it makes it possible to bond wood to glass or to metal. Cured epoxy machines well, and its dimensional stability makes it an excellent choice for filling gaps and mending holes.

All epoxies are two-part systems: a resin, and a liquid catalyst or hardener. They harden by chemical reaction between the two components, not by solvent evaporation. The glue is activated by mixing the resin and hardener together, usually in equal proportions. Changing the resin/hardener proportion affects the properties of the cured epoxy: slightly increasing the hardener by up to 10% makes the bond more flexible, while increasing the resin by up to 10% makes the bond more brittle. Using a larger proportion of either component weakens the bond.

Curing time for epoxies varies according to temperature. Epoxies generally require temperatures of 65°F or higher to set, although special formulas have been developed for use at lower temperatures. Heating the joint to 100°F to 150°F speeds the setting rate, but also increases the health risk: the vapors from hot epoxy are very toxic. Viscosity drops dramatically at higher temperatures, causing the epoxy to flow out of the joint onto other areas of the work. Whatever the temperature, uncured epoxy is toxic, and repeated skin contact can provoke allergic reactions in some people. Acetone is recommended for cleaning up uncured epoxy, but denatured alcohol works just as well and is less flammable.

Epoxies come in a variety of different types. "Quick-set" or "5-minute" epoxies are convenient where you need a strong, fast-setting bond, but their brief pot life can be frustrating if your assembly takes longer than you expected. They also have less strength and water-resistance than conventional epoxy. Hand-moldable sticks of epoxy putty are easy to mix, and work well as a filler. Opaque "filled epoxies" contain suspended solids such as clay or powdered metal to provide increased strength, higher viscosity or other desired proper-

ties. Filled epoxies have a putty-like consistency that makes them perfect for filling large voids or repairing surface dents, but they have a limited shelf life because the filler eventually settles out of suspension. Vigorous stirring will sometimes restore old stock to a usable condition. When clear epoxy resin gets old, it may become thick and granular (some preparations have recommended shelf lives of only 6 to 12 months), but warming the container to about 100°F in a hot water bath will return the epoxy to its original state.

Many retail brands of clear epoxy are bought in bulk from the manufacturer and repackaged into small containers. There isn't much difference between brands, and you can save money by purchasing epoxy in larger quantities. One ounce of epoxy in a tube costs about \$2.25, but Sig Model Airplane Epoxy, an excellent transparent glue found in hobby stores, costs about \$7.50 for 12 ounces. Though epoxy manufacturers won't often sell bulk quantities directly to the public, they'll usually provide technical assistance and lists of local distributors. Armstrong Products Company, PO Box 647, Warsaw, Ind. 46580, makes a clear all-purpose epoxy called A-271 resin, a "quick-set" resin called A-36, and several other types. Devcon Corporation, 30 Endicott St., Danvers, Mass. 01923, also distributes epoxy in bulk. As another example of the money you can save by buying in quantity, Devcon 210 epoxy costs \$2 an ounce in hardware stores, but about 62¢ an ounce in gallon lots.

Several epoxies have been marketed specifically for woodworkers by Industrial Formulators of Canada, Ltd. Their G-1 epoxy is a general-purpose clear resin; G-2 is recommended for oily and acidic woods such as teak and oak. Cold Cure is meant for use at temperatures as low as 35°F, Five Cure sets in 15 minutes or less at temperatures above 40°F, and Sun Cure is a low-viscosity laminating resin. You can mail-order these epoxies from Flounder Bay Boat Lumber, 3rd and "O" Ave., Anacortes, Wash. 98221.

An extensive line of epoxies, additives and dispensing pumps is sold by Gougeon Brothers, Inc., 706 Martin St., Bay City, Mich. 48706, under the trademark West System. Developed for boatbuilding, the Gougeon system uses epoxies both as adhesives and as saturation coatings to prevent transfer of moisture and improve dimensional stability.

Polyester resins—If you want to reinforce wood with fiberglass cloth, your best choice is epoxy resin, but because of epoxy's high cost, polyester resin is commonly used instead. It is also less toxic and much cheaper. Like epoxies, polyester resins are two-part systems: a low-viscosity liquid which hardens when a small amount of catalyst is added. Although polyester resin performs well for reinforcing fiberglass, it lacks sufficient wetting ability to bind to wood fibers. It will adhere to wood only if the solidified resin can interlock with surface irregularities. You can get an adequate bond if you roughen

ADHESIVE SELECTION GUIDE

Adhesive	Application characteristics	Properties after curing	Recommended uses
Epoxy Armstrong A-271, Cold Cure, Devcon 210, Five Cure, Industrial Formulators' G-1 and G-2, Sig Model Airplane Epoxy, Sun Cure, West System	Moderate viscosity, decreasing greatly at warm temperatures, min. curing temp. 65°F**, excellent gap-filling ability, two-part system, liquid and vapors are toxic, may cause skin irritation	Highly transparent, waterproof, bonds to many materials, sands and machines well	Marine and outdoor use, excellent for bonding nonporous materials
Cyanoacrylate Devcon Zip Grip 10, Duro Super Glue, Eastman 910, Elmer's Wonder Bond, Hot Stuff, Krazy Glue, Scotchweld CA-3	Very fast bonding***, very low viscosity, min. curing temp. 60°F, poor gap-filling ability, odor may be irritating, bonding may be inhibited by oil or acidic residues, excess is very difficult to clean up	Highly transparent, very water-resistant	Small repairs, modelmaking, bonding nonporous materials
Hot-melt stick Bostik Thermogrip, Swingline Fix Stix	Sets almost instantly, high viscosity, excellent gap-filling ability, does not penetrate well, difficult to apply over large areas, nontoxic, glue gun needed	Neutral opaque color, moderate strength, remains slightly flexible, cannot be sanded, softens when heated	Furniture repairs, small projects such as toys, construction of jigs and patterns
Hot-melt sheet	Instant bonding, applied with hot iron, poor gap-filling ability		Veneering
Contact cement, solvent-based Weldwood Contact Cement, Wilhold Contact Cement	Instant bonding, min. curing temp. 70°F, poor gap-filling ability, highly toxic, very flammable, difficult to clean up	Low strength, creeps under load	Bonding plastic laminates to plywood, not recommended for veneering, though it is widely used for this purpose
Contact cement, water-based (latex)* Elmer's Cabinet Maker's Contact Cement, Weldwood Acrylic Latex Contact Cement	Instant bonding, min. curing temp. 65°F, poor gap-filling ability, low toxicity, easy to clean up, "open time" must be carefully monitored according to label directions	Very low strength, water-resistant, creeps under load	Recommended when limited ventilation conditions prevent using solvent-type cement

* Water-based adhesive may cause warping of veneer or thin panels.
 ** May be rapidly heat-cured at 100°F to 150°F.
 *** Surface activator speeds set.

the surface with a rasp or coarse sandpaper. Brush the catalyst-activated resin over the wood and allow it to soak in thoroughly. Before it begins to set, apply glass cloth and brush another coat of activated resin over the cloth.

Unlike epoxy, polyester resin shrinks considerably after curing, and it may remain slightly tacky long after solidification. To produce a smooth surface finish, polyester finishing resins sometimes contain emulsified wax which floats to the surface as the resin cures.

You may be able to save up to 50% by purchasing polyester resin and fiberglass cloth from a local business that uses them. Boatyards are usually willing to sell a gallon or two of resin from their 55-gallon drums at minimal mark-up. These industrial-grade resins are sometimes slightly red or purple in color, compared to the water-clear retail resins. You can color clear polyester resin by adding pigments specially made for this purpose.

Cyanoacrylate glues—No adhesive has received more attention in the last few years than cyanoacrylate, commonly known as "superglue." Rumors abound, but cyanoacrylate is not made from barnacles as stated in an earlier article that appeared in *FWW*. Nor is it new—the first cyanoacrylate adhesive, Eastman 910, was discovered by accident during a test

of the light-refracting properties of a new organic compound when a drop was placed between glass prisms and they stuck fast. The glue was patented and first marketed in 1958, and industry has been using it ever since.

Cyanoacrylate will bond most plastics and rubber, and is good for gluing rubber to wood or to metal. Higher-viscosity formulas are sold for use on wood and other porous materials. Elmer's Wonder Bond Plus and Krazy Glue for Wood and Leather are two brands available in small retail packages. As most users have discovered, cyanoacrylate also has a remarkable ability to bond skin. Glue distributors now sell solvents to dissolve unwanted bonds, although acetone and nail polish remover are somewhat helpful for this purpose.

Cyanoacrylate provides a very water-resistant, but not completely waterproof, bond. Prolonged immersion in water eventually weakens the joint. This adhesive will also resist most organic solvents.

Cyanoacrylate glue is most useful in modelmaking, musical instrument building and other small-scale applications. Its main advantage is its extremely rapid set—3M's Scotchweld CA-3, for example, sets in about 30 seconds. You can reduce this setting time to as little as one second by brushing on 3M's Scotchweld Surface Activator for Cyanoacrylate Adhesives before you apply the glue. Moisture will also speed cur-

ing, but on wet surfaces the glue will leave chalky stains. I sometimes use the moisture of my breath to humidify small parts before gluing. The strength of the cyanoacrylate bond continues to increase slowly during the first 48 hours.

Shelf life of most cyanoacrylates is about 6 to 12 months—the glue thickens as it gets old—but storing the adhesive in the refrigerator will prolong its useful life. Since moisture speeds the setting time, however, allow the container to warm up to room temperature before you open it, or condensation in the bottle will offset the advantage of refrigeration.

Early cyanoacrylates did not work well on wood or other porous materials because the glue's viscosity is extremely low: the glue soaked into the surfaces, producing a starved joint. This same property, though, allows the adhesive to penetrate hairline cracks. Cyanoacrylate dripped into a ragged break will reinforce the fracture, and it can strengthen joints already glued with another adhesive that have loosened slightly if it is dripped along the existing glue line. You can repair a large gap by packing it with baking soda, then dripping glue on, which turns the powder into a hard, white filler. To fill a small crack or hole, put a few drops of glue in the crack, then sand immediately with wet-or-dry sandpaper before the glue sets. The wood dust mixes with the glue to form a hard filler that matches the color of the wood. This works best on dark woods; on light-colored woods the patch will be slightly darker than the surrounding wood. On thin stock, it's a good idea to put a piece of masking tape on the back of the crack, to keep the glue from sticking to the bench.

Cyanoacrylates do not set as quickly if there is acid present in the joint. If you're gluing an acidic wood such as oak, you'll get better results if you prepare the surfaces by brushing on a surface activator. These activators are mildly basic and neutralize the acid.

Cyanoacrylate is the most expensive adhesive generally available. Like epoxy, most brands are purchased in bulk and repackaged for retail sale, but you can save by buying in larger quantities. C.F. Martin Co. (of guitar fame), 510 Sycamore St., Nazareth, Pa. 18064, sells 3M Scotchweld CA-3 in 1-oz. containers for \$12, Scotchweld Surface Activator for \$8, or a kit consisting of two ounces of CA-3 and one container of surface activator for \$25. Although there isn't much difference in glue quality between brands, there is a difference between the containers the glue is packaged in. Some styles clog before the adhesive is gone, when glue solidifies near the tip. Polyethylene dropper bottles are less likely to clog than metal squeeze tubes or rigid plastic containers. It helps to clear the nozzle by squeezing a little air out of the upright container before closing it.

Hot-melt glues—Synthetic hot-melt glues are easy to apply and they set up quickly. Most are made of polyamide resins which melt at around 400°F. Hot-melts are widely used in industry, where their quick set is an advantage on assembly lines. Their good gap-filling properties make them ideal for repairing worn, sloppy joints in old furniture. Hot-melts form thicker glue lines than most other adhesives, and have relatively low strength and poor penetrating ability. They're good for temporary jigs or tack-on fastenings, where extreme strength is not required. They're also well suited for joints that may need to be disassembled, but the heat necessary to break the glue bond may also damage the surrounding finish. Hot-melts develop 90% of their final bond strength within 60 sec-

onds. The glue remains somewhat flexible and does not sand well. When the glue has cooled, excess can be removed with a sharp blade.

Hot-melt sticks are sold for use in an electric glue gun. Manufacturers make several grades that cool at different rates. Those sold in retail stores allow you only about 10 seconds to assemble parts, but you can increase open time slightly by preheating the parts. Hot-melts are also sold in thin sheets for veneering (available from Woodcraft Supply). You can use an ordinary household iron to provide heat, then weight or clamp the veneer until the glue has cooled.

Contact cements—Contact cements are rubber-based (usually neoprene) liquids that dry by solvent evaporation. They are used most often to bond high-pressure plastic laminates, such as Formica, to plywood or particleboard, without the need for clamps or prolonged pressure. Contact cements are sometimes used to attach veneers, but the glue bond can fail in spots because of seasonal moisture changes in the veneer, causing bumps in the veneered surface or separation at the edges.

There are two types of contact cements: solvent-based and water-based. Solvent-based cements, most of which are extremely flammable, dry in about 5 to 10 minutes. The non-flammable solvent-based cements are made with chlorinated hydrocarbons, and their vapors are toxic. These vapors are not trapped by an organic-vapor respirator, so you should use adequate ventilation with this and any solvent-based adhesive. Water-based contact cements are nontoxic and nonflammable, but they take longer to dry—about 20 minutes to an hour before parts can be assembled. The uncured adhesive is water-soluble, so you can clean your tools in water if the glue hasn't dried. Water-based contact cement provides better coverage than the solvent-based type, but it should not be used on metallic surfaces.

Contact cements are heat-resistant and water-resistant, although adhesive strength is low and the pliable glue film is likely to creep under load. Both types can be applied by brush, roller or spray. Apply adhesive to both surfaces to be mated and assemble when dry, but be sure that the parts are properly aligned. Adjustment is impossible once the two surfaces contact. Go over the glued surface with a roller to ensure an even bond.

"Construction adhesive" is a thick mastic used by carpenters to fasten flooring or wall paneling. As yet, it has not been widely used in other areas of woodworking.

A few other adhesives that may have limited use in woodworking are the acrylic cements, most commonly encountered as pressure-sensitive contact adhesives. Liquid acrylics are also used in some linoleum cements and other mastics. "Anaerobic adhesives" remain liquid when exposed to air and solidify when deprived of oxygen. The Loctite Corporation markets a variety of anaerobic adhesives which are widely used for securing nuts, bolts and threaded studs. Because of its high porosity, however, wood contains too much oxygen to allow anaerobic adhesives to set. □

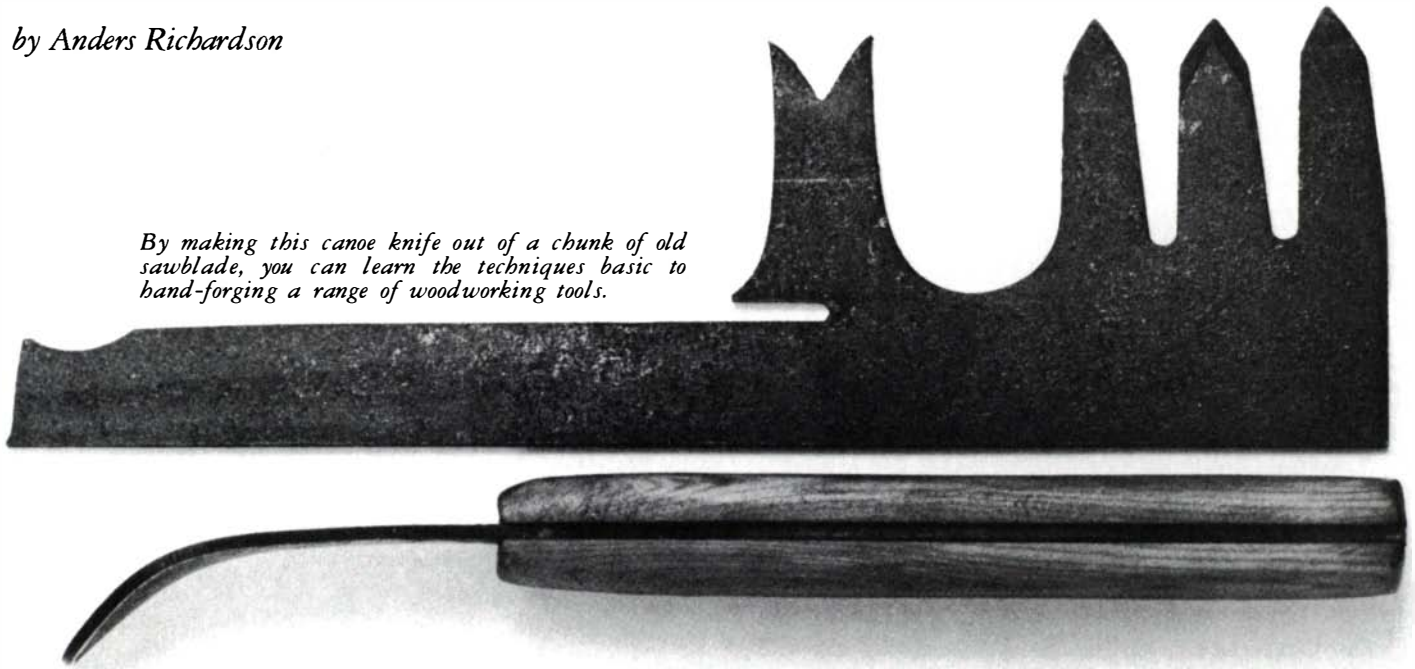
George Mustoe is a geochemistry research technician at Western Washington University in Bellingham, Wash. He wrote about respiratory hazards in FWW #41 and about making cross-country skis in issue #31. For more on woodworking glues, see "Which Glue Do You Use?" in issue #43.

A Blacksmith's Bleak View of Modern Tools

And how to go at hammer and tongs yourself

by Anders Richardson

By making this canoe knife out of a chunk of old sawblade, you can learn the techniques basic to hand-forging a range of woodworking tools.



America, you were sold a bill of goods back in '05 when they said drop-forging was the improved, modern way to make hand-woodworking tools. It was modern all right, but far from an improvement. Drop-forging merely favored mass production, encouraging the design of tools that could be machine-made out of alloy steel instead of true, high-carbon tool steel. Toolmaking, once an industrial art, was reduced to brutal economics; companies that produced barely tolerable tools at the lowest cost survived the competition. We became a nation of buyers instead of makers.

Accustomed as craftsmen were to the superior edge-holding qualities of hand-forged tools, they could tell the difference and said so. Since the turn of the century, research metallurgists have busied themselves with the task of making drop-forging better. Because of the sudden, violent shock of the drop hammer's swat, forging is incomplete, and the steel is left unrefined and full of stress. Many of these tools would crack if subjected to a proper hardening process. Instead, they're made thicker than they should be, out of inferior (but tough) alloy steel. Hardening is minimal. Tempering of the tool—softening it slightly to strengthen the metal and to ease sharpening—is rarely done, despite factory claims to the contrary.

The best way to make an edge tool is with 1% carbon tool steel. You forge it by hand, anneal it (soften it for working) and then grind or file it to shape. Heating the metal and immediately quenching it in water or oil hardens the tool; reheating the cutting edge to a lower temperature tempers it. Hardening and tempering are separate operations in fine toolsmithing. Only the blade should be hardened, not the entire tool, as is done in hit-or-miss factory ovens. None of this applies to cold chisels, wrenches, hammers and the like. These shapes can be made of alloy steel to good effect, if edge-holding is not an issue.

I'll admit that if everything were done conscientiously, fac-

tory tools could be much better. But the assembly line is numbing and factory production so fragmented that workers cannot take care. In olden days, smiths truly competed, striving for thinner, stronger tools or ones with keener, harder-tempered blades, or making more shapes and sizes than did the forge down the street. Tools used to outlive the men who made them and those who originally bought them.

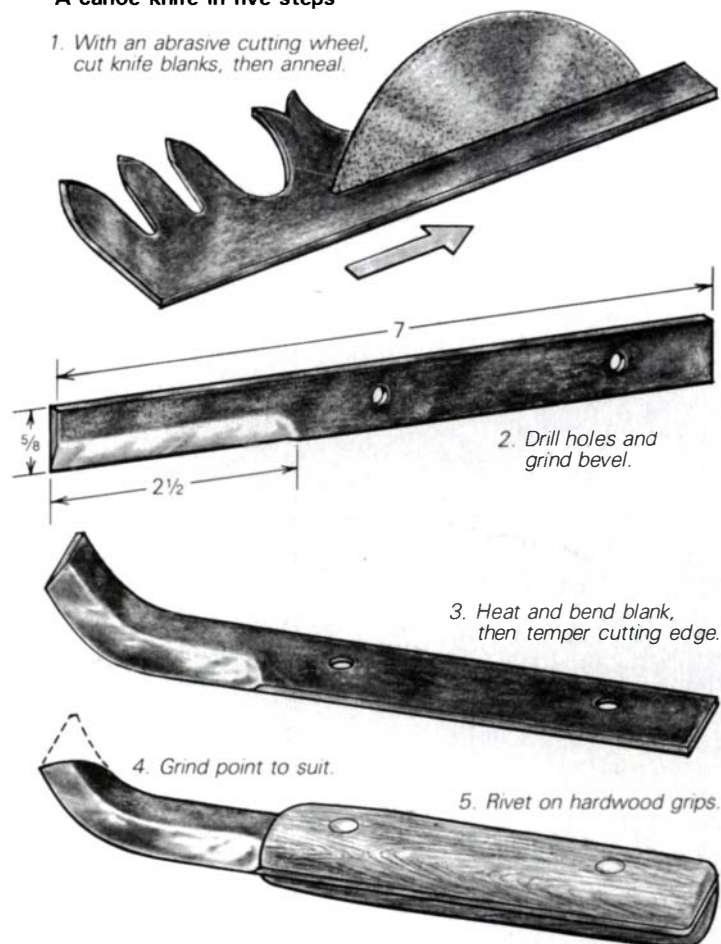
But it's not as though there's nothing to be done about it. You can still buy serviceable old tools, or redress damaged ones. Lots of junk-store and flea-market finds need only handles and sharpening to be good as new. You can patronize your local blacksmith, or take up the hammer yourself. Even the novice stands a good chance of forging better tools than he can buy. Tool steel has never been cheaper, more available, or of better quality than today's water-hardening 1% carbon drill rod. Buy it new at the local machine shop or steel jobber—it's the cheapest stuff around. Coal should be so good and so plentiful.

If you want to forge things for real, you can make a simple forge and burn coal, coke or hardwood-lump charcoal. Experiment. Old-timers in the Pacific Northwest supposedly used Douglas fir bark scales for fuel. There are now electric forges and gas furnaces, too. What's handiest for the half-serious toolsmith is the new Bernzomatic Jet II torch (part #JTH-79), available by special order from the local hardware store for about \$25. It will do a lot more than just heat tool steel to forging temperature. I use mine to harden the tools before tempering and to anneal pieces. It also brazes. Put two opposite each other and you'll have all the heat of a coal fire.

But let's get on with it. You'll have to do some research. You'll want to read about the basics, analyze that information, experiment, and then see for yourself what you want to believe. Look at Alexander Weygers' books (see box, p. 53).

You've got to start someplace, so try a canoe knife—a handy style of crooked knife capable of fast stock reduction,

A canoe knife in five steps



originally used to make canoe thwarts and paddles. Get an old crosscut-saw blade, rusty, even pitted some. Cut it lengthwise into strips with an oxyacetylene torch (or have the local garage do it for you), or with an abrasive cutting wheel on your tablesaw. Anneal the metal in a woodstove by tossing the strips into a good fire, heating them to a bright orange-red, and then cutting the draft, letting the fire die overnight. That's the best, slowest method. Fish the pieces out of the ashes before you fire the stove the next morning.

Now cut the strips to the shape of a knife-blade blank, as in the drawing above. Use a hacksaw, cold chisel, hot chisel, grinder, or abrasive cutter in a tablesaw. On one side of a strip, grind or file a flat bevel (20° to 25°) for $2\frac{1}{2}$ in. from one end, but don't make it too sharp, else the thin edge will heat too quickly later. File the other side of the strip dead flat, if it isn't that way already. Remove nicks, pits and scratches near the cutting edge. Drill two or three holes at points along the other half of the blank's length, where you'll later rivet on the handle.

Grip the blade with a pair of vise-grip pliers and heat the first $\frac{3}{4}$ in. to 1 in. of the business end with a propane torch. Bend the end up toward the beveled side by pressing down on a benchtop, or by tapping lightly with a hammer. Work it soft and easy. Let it cool, and then grind a point that suits your fancy, or wait until you've tempered to grind the point.

Now, with two torches or an oxyacetylene rig, evenly heat the entire cutting edge, turning the blade over and moving it back and forth in the fire until the metal glows orange-hot along the $2\frac{1}{2}$ -in. length of the cutting edge. Touch a magnet

to the blade—it shouldn't stick. If it does, heat the knife blade hotter and test again with the magnet. At the proper moment, the color will suddenly brighten right before your eyes, and the magnet won't stick. Now, quick, plunge the blade into a pail of water, horizontally, either edge-first or back-first, and agitate it up and down. The blade, if it didn't crack or warp, is now successfully hardened. If there's a sharp corner on the edge of the knife, scratch a window. The edge should be harder than glass. Yes? Congratulations.

Now polish the steel all over where it has been hardened. Use sandpaper, a disc sander or belt sander, or, better yet, a buffing wheel.

Go you now to the kitchen for tempering. Turn on the electric range or hot plate. Or put a piece of $\frac{1}{4}$ -in. steel plate over a gas flame. Or use the top of the woodstove the next time you see it red-hot. When the heating element of the range burner is glowing righteously, take the blade, vise-grips still attached, and hold it with the back flat on the element. Move it around so that it heats slowly and uniformly. Watch the blade closely, in natural light if possible. The shiny metal will begin to turn vaguely yellow down near the source of heat first. That color will move up the blade toward the beveled edge as the back turns brown. These colors indicate oxidation of the shiny metal surface at temperatures much below where the metal begins to glow visibly.

Look out! You don't want to go too fast here. Remove the blade from the heat and inspect it—if the colors proceed on their own, let them go no further than purple overall. Maybe tinged with blue, but not all the way to gray. Purple at the back with dark brown at the cutting edge suits me best. If you have to stop the progression before it goes to the purple color, quench as before in water.

That's it, you've done it. Rivet on a couple of hardwood scale grips, draw a burr when you sharpen, and it's done—a canoe knife, more or less. Depending on which side of the blade you put the bevel, it's either right- or left-handed. No matter, this first one is just for learning. Likely as not, some step didn't go as well as it might have. Next time you'll get the whole thing right and smart. By the time you've made five or six such items, they'll be heirloom-quality tools.

Steel stock up to $\frac{5}{16}$ -in. can be heated with the Jet torch—that's plenty of metal for tools $\frac{3}{4}$ -in. to 1-in. broad, for chisels and gouges. For bigger stuff, you'll need a hotter torch, or a forge. You'll need an anvil, too—a scarce item today. Could take months or years of looking and haggling.

There's much more to the blacksmith's trade than this, of course, but you can still get started in the garage, shop or basement. Learn the refinements (secrets) yourself as you struggle along—it's largely a matter of developing personal superstitions and acting accordingly, looking always for improvements. There are hammering techniques to discover: "packing the steel," "double-fullering," and "drawing out over the horn." There's analyzing scrap metal and learning how to treat various alloy steels. Learn, if you can, from old craftspeople and artists—they can teach all this and more.

Enough said. There should be thousands, if not millions, of blacksmiths in this nation. Hobbyists, at least. It's fun for me, what else can I say? □

Anders Richardson operates Savage Forge in Clear Lake, Wash. For more on making your own tools, see FWW #9, pp. 58-61, and #10, pp. 22-24.

Alexander G. Weygers: a woodworker's blacksmith *by J. Petrovich*

I first became acquainted with Alexander G. Weygers through his books. In clear, direct prose, they describe the metalworking principles and processes you need to fabricate hundreds of items, from a small engravers' burin to the fittings for a one-ton trip hammer. As a woodworker, however, what captured my interest were Weygers' fine chisels, gouges and knives, all logically designed and elegantly made. It didn't take long for my imagination, stimulated by Weygers' books, to supply some of the tools I would otherwise have bought from the foot-high stack of "wishbook" catalogs I keep on hand.

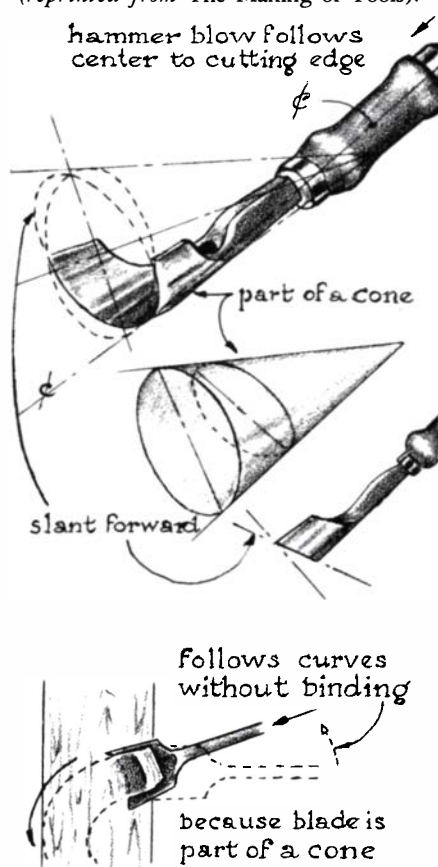
Weygers' three books, *The Modern Blacksmith*, *The Making of Tools* and *The Recycling of Tools* (all published by Van Nostrand Reinhold Co.), are modest in size and cost. Together, they tell a remarkably complete story of toolmaking, full of the anecdotes and tricks learned over a lifetime in the shop, yet rich in the fundamentals as well. All three books are illustrated with Weygers' own lucid pencil drawings, many of which are informative enough to stand alone, without text.

As my reliance on his books grew into successes at toolmaking, I wondered if it would be possible to study with Weygers. His home in Carmel Valley, Calif., is not that distant from my own in Salinas, but I had read in a newspaper feature that he had undergone open-heart surgery. Figuring it couldn't hurt to ask, I phoned Weygers in February 1982. Mrs. Weygers answered. Yes, she said, Alex was going to teach one more class. It would be his last, and it would start in mid-April. I was delighted, but a little concerned, imagining a frail old man passing along his trade secrets with his final breath.

My concerns proved groundless. The class met or exceeded all my expectations, and it wasn't without its surprises. Though 83 years old, Weygers wields hammer and tong with the precision and enthusiasm of a man half his age. Far from the elderly invalid I had imagined, he works nearly every day, forging tools or creating the wood sculptures and engravings that have earned him an international reputation. Born in Java and



At 83, Alexander Weygers is still an active toolsmith. He has chronicled the theory and technique of his craft in three books, all illustrated with his pencil drawings, like this one of a carving gouge (reprinted from *The Making of Tools*).



educated in Holland as a marine engineer, Weygers exudes resourcefulness.

There were no lesson plans, no blackboard or even notes. We were carried through projects by demonstrations and the kind of hands-on training that teaches you what a book cannot. Weygers spoke as he worked, a Dutch accent adding crispness to his speech. "First we must upset the steel. We will upset it here for the blade and here for the shoulder of the tang. First we strike hard, then correct, correct, correct. We are constantly correcting, little corrections. A tap here, a tap there. Little corrections. With the little corrections, we avoid the big corrections."

If the man, an active octogenarian blacksmith, came as a surprise, the week that I and ten other students spent with Weygers was a continuing revelation. I had secretly suspected that many of the tools illustrated in his books were products of a talented pencil and a fertile imagination. I was wrong. Everywhere I looked around Weygers' spacious forge and shop, I saw the marvelous products of this man's skill—real and functional objects, not prettified pencil drawings. Watching him work, I gained an appreciation for his apt comparison of hot metal to wet clay, even if my own efforts made it seem as though the glowing steel had a mind of its own.

I still refer to Weygers' books constantly. The number of tools I've made and modified from them would pay for dozens of copies of each, and I've gained an understanding of sharpening and cutting edges I never could have accumulated if I had bought all my tools. Beyond the economics and versatility of the forgings are the designs themselves. From the large and graceful gull-winged gouge to the small engravers'-style chisel, each tool seems aesthetically independent of its function and yet enhanced by it. Each is the result of what Weygers would say is "doing what we are doing because it is the most important thing in the world... or else we wouldn't be doing it." □

J. Petrovich is a professional furnituremaker in Salinas, Calif. Photo by Jim Ziegler.

Blanket Chests and Record Cabinets

Contemporary versions of traditional frame-and-panel designs

by Simon Watts

Many of today's craftspeople feel compelled to make each of their designs original, but I think very few of us are truly original, except when aided by the arrival of a new material, such as steel tubing, or a technical innovation. As a designer, I borrow freely from the past and enjoy making contemporary versions of classic pieces. Occasionally I even make exact copies. I see nothing wrong with copying, as long as it is done honestly, the materials and construction of the copy are comparable to those of the original, and no attempt is made to deceive the buyer by antiquing. Besides, furnituremaking is a deliberate craft, not a spontaneous art form. If you don't start with a clear idea of what you want, the result will most likely be a muddle.

I used traditional designs and methods as a starting point for developing my own ideas for the blanket chest and record cabinet shown here. Both pieces utilize panel frames, and today's methods of constructing this type of chest have changed little since medieval times. Other variations are possible. You could make a liquor cabinet, for example, by slightly altering the record cabinet: Adjust the bottom shelf to hold bottles and glasses, add doors, and extend the legs 5 in. to 6 in. Make the top of slate or other impermeable material to provide a good surface for mixing drinks.

The blanket chest combines two traditional methods: its ends are solid boards, and the front, back and lid are paneled frames. The frames and panels can be treated in many different ways. Some 18th-century panels were beautifully carved and inlaid. A molded frame

Simon Watts, of Putney, Vt., has been making furniture for 20 years. This article is adapted from his recently published book, Building A Houseful of Furniture (Taunton Press, \$19.00, 224 pp.). The book has complete plans for the blanket chest and record cabinet as well as 41 other pieces, including beds, sofas, chairs and tables.



The blanket chest is 52 in. wide and 27½ in. high. Its ends are solid boards; the front, back and lid are paneled frames.

and raised panels create a subtle interplay of shadows. Medieval chests, on the other hand, often had plain, flat panels and heavily chamfered frames.

For a decorative effect, I used red birch panels with walnut frames and ends. The proportions of each panel and the relation of the panels to each other and to the whole are very important. These proportions are difficult to visualize on a scaled-down drawing, so I always draw the panels and framing full-size on a large sheet of paper, hang it on the wall and live with it for a bit—ungainly proportions soon become apparent.

The ends are 1¼ in. thick to support the tenons of the frame rails. If you can't find boards wide enough, join up several boards. The frame members should be fairly uniform in grain and color so that they don't detract from the panels. Plane the material for all three frames (lid, front and back) to ⅞ in. thick.

Lay out and cut the mortises in the ends, then cut the bare-face tenons (tenons with one face flush to the rail) on the rails of the front and back frames. The bare-face tenon allows you to leave as much wood as possible between the mortise and the edge of the chest end. Even so, be careful not to lever the rails from side to side when fitting the tenons, because you could break out the mortises.

Next cut the mortises and tenons that join the stiles to the rails on the front

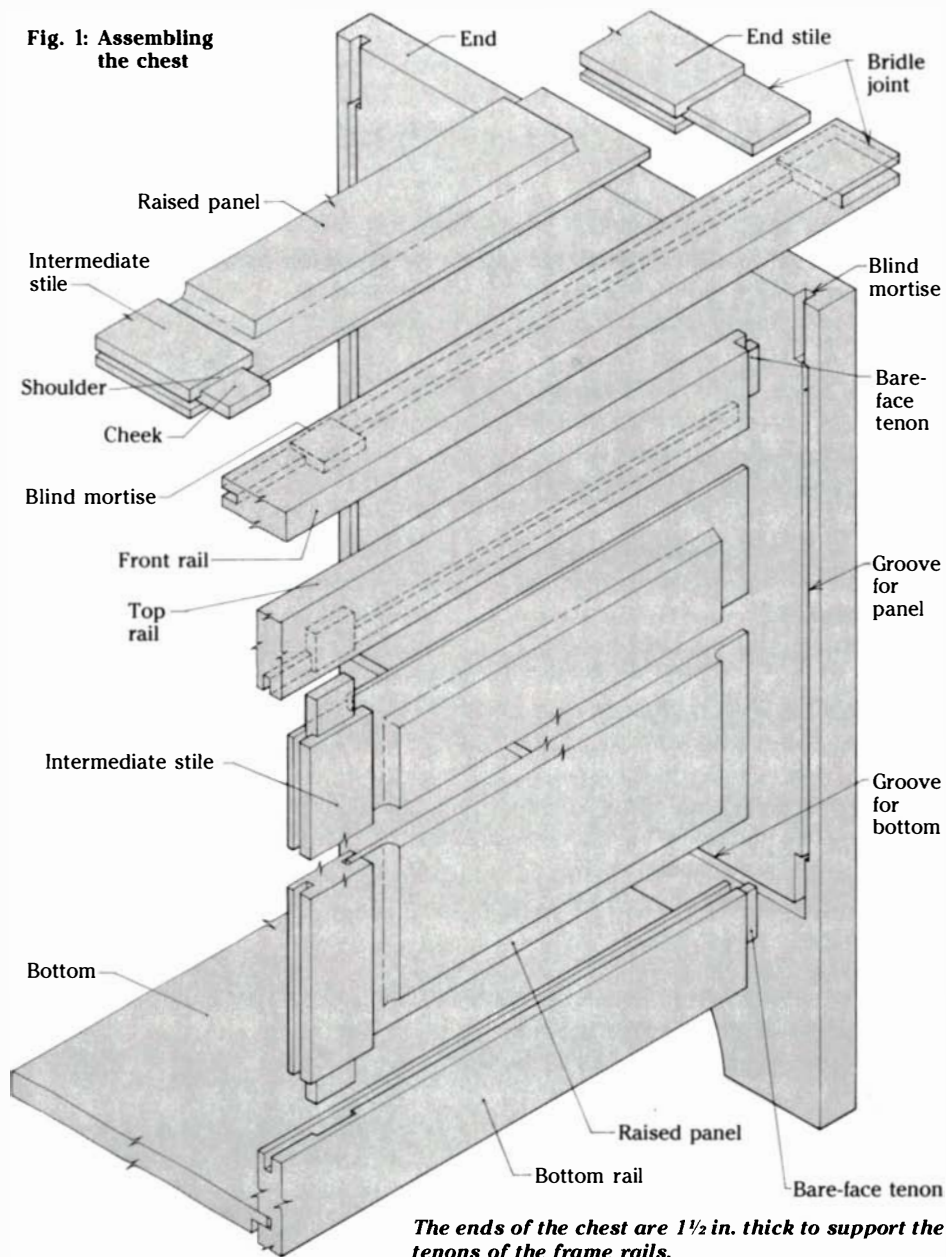
and back frames. When you lay them out, make sure that one side of the mortise cheeks and tenon cheeks will line up with the groove, as shown in figure 1. This way, you can be sure that the grooves for the panels will fall within the thickness of the mortises and tenons.

You can now push the carcass together dry while you work on the lid. Because the lid is held only by hinges along its back edge, it must be flat, so it's important to cut the joints accurately. The intermediate stiles are tenoned into the rails as for the other frames; the end stiles and rails are bridle-joined.

I make bridle joints using the table-saw and a good carbide blade. Lay out the bridle joint for one corner (the saw will be set to this layout, so you needn't mark the other pieces). Use a marking gauge, or knife, and a square to mark the tenon shoulders on the stile—the tenon should be ⅛ in. longer than the width of the rail. The width of the tenon equals the width of the stile minus the depth of the groove for the panel. The thickness of the tenon is customarily two-fifths the thickness of the stock—⅜ in. here. You can mark the cheeks of the mortise and the tenon with one setting on a mortise gauge; remember to gauge both pieces from the outside face.

Cut the tenons first, holding the stiles vertically against the rip fence. I use a homemade wooden table insert with a blade opening just a sawkerf wide, so

Fig. 1: Assembling the chest



that the pieces will be supported right next to the blade, and I screw an 8-in. high wooden fence to the rip fence. Set the saw $\frac{1}{8}$ in. below the shoulder lines, and adjust the fence to cut right to the cheek lines. Saw the shoulders next, using an accurately set miter gauge. You can use the rip fence as a stop block, but don't saw through the waste or it will come whistling back at you. The remaining waste is easily cleaned up with a chisel or a shoulder rabbet plane.

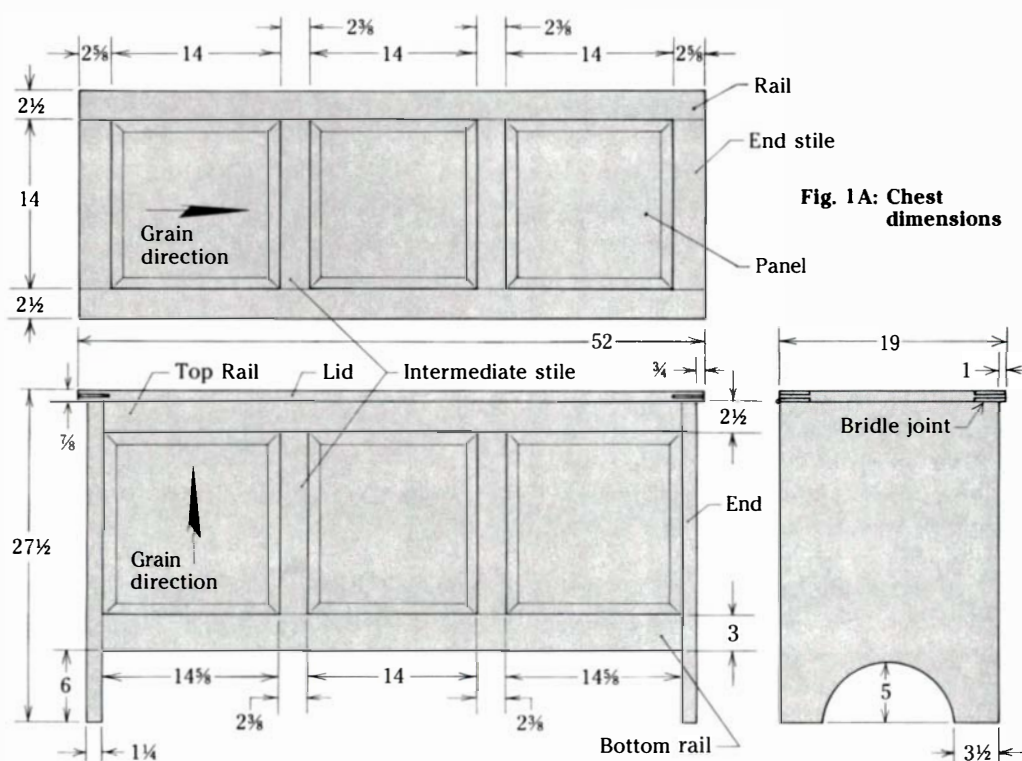
Next saw the cheeks of the mortises in the same way as the tenon cheeks. Saw a scrap piece to reset the rip fence—the tenons should fit into the mortises snugly, without force. Remove the waste by boring a hole in from both edges, or by cutting it out with a coping saw. Chisel to the gauge mark to complete the mortises.

To lay out the grooves for the panels, I assemble the frames without glue and mark the four inside edges of each panel opening with a crayon—a groove in the wrong place, even when repaired, looks terrible. Disassemble the frames and cut the grooves. I use the tablesaw and dado head, though you could rout. Set the rip fence so that the outside face of the rail or stile will run against it. This method is possible because one side of the groove lines up with one cheek of the mortises and tenons on all but the bare-face tenons, as shown in figure 1. I make the grooves about $\frac{1}{2}$ in. deep to allow for movement of the panels. Using the same setting, cut the panel grooves in the ends—but here you must remember to stop the grooves at the mortises—and trim square with a chisel.

Make the panels next. The grain of rectangular panels should run parallel to the panel's longest dimension to minimize the effects of shrinkage. The grain of the square panels on the lid runs along the length of the top, which is customary for paneled chest lids.

It's best to make all the panels at one time. I make the three panels for each frame from a long board, for consistency in grain and color. A single, wide board would be ideal, but I usually have to edge-join two or three boards.

Plane the long piece flat and $\frac{5}{8}$ in. thick, then saw the panels to size. Their widths and lengths depend on the size of the frame openings and the depth of the grooves. I leave about $\frac{1}{8}$ in. of clearance between the edges of the panels and the bottoms of the grooves, allowing shrinkage to be taken up inside the



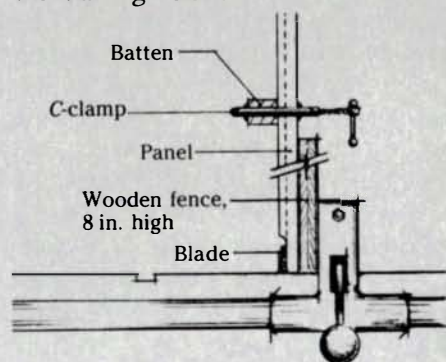
Cutting panels with a router

The center on the face of each panel on the blanket chest is raised by using a router with a $\frac{5}{8}$ -in. corebox bit and a tablesaw.

Use a sharp bit and sawblade—you won't have to sand as much later. Mark the outline of the raised center on the panels and on a few pieces of panel scrap with a pencil gauge (a marking gauge with a pencil instead of a metal point—you can make one from an old marking gauge).

Now set the router fence so that the widest part of the corebox bit just touches the line. Check the setting on a scrap piece of panel wood, then rout four grooves in the face of each panel. To avoid burning and chattering, it's best to take a heavy cut initially, almost to full depth, followed by a light final cut, which will leave a clean, burn-free surface.

Saw off the waste on the tablesaw, holding the panel vertically with its back to the fence. Set up the tablesaw for tenoning as described in the text, using the wooden table insert and high fence. Check the setup on a scrap piece to ensure that the panels slip into their grooves without rattling. If a panel is slightly bowed, you can clamp it to a stiff batten while sawing, as shown in the drawing below.



Now sand the panels. The end of an orbital sander will conform to the curve on the raised panel, and will remove any router marks.

It's not a bad idea to finish the panels before you install them, so that any subsequent shrinkage won't expose unfinished wood. Also, glue won't adhere to most finishes, so if you finish the panels before joining up their frames, there will be less chance of the panels sticking to the frames, then cracking with seasonal movement. —S.W.

groove. The ends of the panels should almost make contact with the grooves. Then I raise the panels following the tablesaw and router procedure described in the box at left.

I use aromatic cedar for the bottom, to keep moths at bay. You could attach ledger strips to the rails and rest the bottom on them, but I prefer to rabbet the bottom into grooves in the ends and bottom rails, and glue it to the ends.

Before gluing up the carcass, sand the pieces. You should also sand and put a light chamfer on the frame edges that surround the panels, as this is difficult to do once the panels are in place.

Glue the lid together, pull the shoulders of the joints tight with pipe or bar clamps, and then C-clamp the bridle joints with softwood pads to squeeze the cheeks tight. I glue the whole carcass at once with a plastic resin glue, which has a long assembly time. Center the panels in the openings, and after the clamps are off, peg through the back of the rail into the center of each panel end, so the panels can move equally in each stile groove. I use brass sliding stays and $\frac{3}{4}$ -in. offset brass hinges for the lid.

Frame-and-panel techniques also provide an attractive solution to a modern decorating problem: cabinets are needed to store record albums and to display modern, often elegant, high-fidelity equipment. The 66-in. walnut record cabinet shown in the photo on the facing page is designed to stand behind a couch. The turntable, amplifier and so on are placed on the 15-in. deep top surface, with space for about 300 records below. The lower shelf, 8 in. above the floor, slopes toward the back to keep the records in place and to make it easier to see the name on the spine of each record jacket. Unlike the blanket chest, this cabinet needs its center legs to support the weight of the albums. All the legs are cut from $1\frac{3}{4}$ -in. square stock.

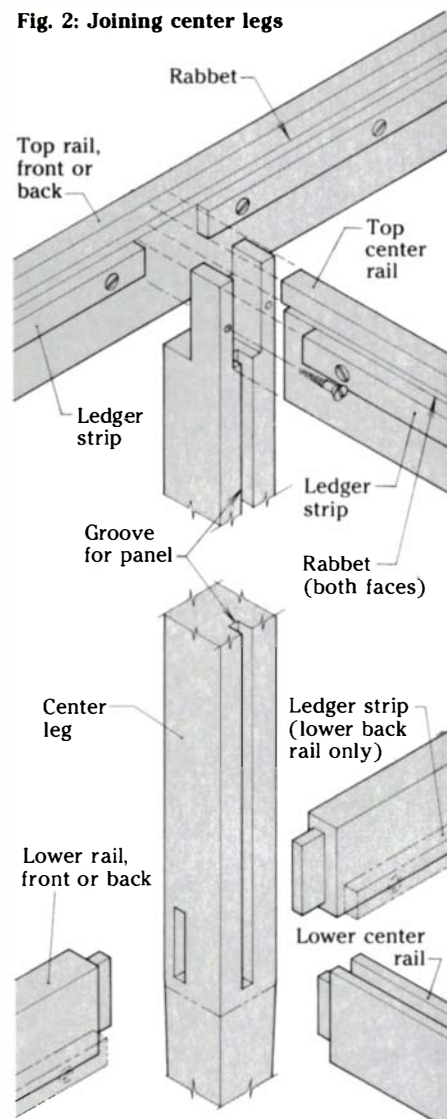
The two ends and center section are frame-and-panel constructions—in each, two 25-in. legs and two short rails surround a solid-wood panel. These three sections are joined by long rails—four $2\frac{1}{2}$ -in. wide bottom rails are tenoned into the end and center legs, while two 3-in. wide top rails run from end to end, notched into the center legs. The top, made of narrow random-width slats, is supported on ledger strips screwed to the top rails. The shelf, made of 3-in. wide strips, rests on the front bottom

rails and on ledger strips screwed to the back bottom rails.

Cut the legs and rails to size, then lay out and cut the mortises and tenons. Center all the tenons on the rail ends. I made them $\frac{3}{8}$ in. thick, with $\frac{1}{4}$ -in. wide shoulders—a thicker tenon would put the mortises too close to the face of the legs. To avoid misplaced mortises, first mark the faces of the legs that are to be mortised. Then place the legs together, with the marked faces up. Align their ends and mark the mortises with a square. Do the same for the other mortised faces. Make the front and back rails flush with the faces of the legs, but set the end rails back from the faces.

The joints between the rails and center legs are complicated. The top of each center leg is notched twice: one notch takes the long rail, which finishes flush with the face of the leg, and the other forms a bridle joint for the short rail (fig-

Fig. 2: Joining center legs

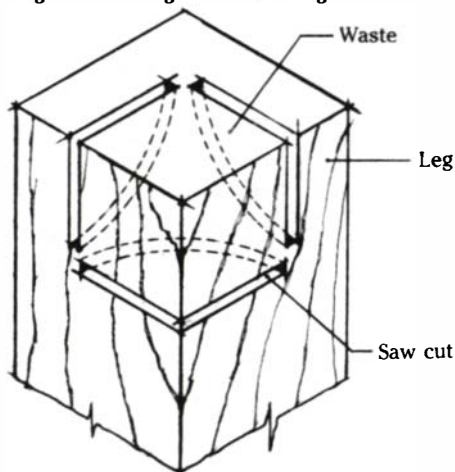


Cut the notch for the long top rail before cutting the bridle joint for the short rail.



This walnut record cabinet is designed to stand behind a couch. The turntable and other high-fidelity equipment are placed on top.

Fig. 3: Notching the corner legs



Notch the legs by making three cuts on the tablesaw, then chiseling the waste.

ure 2). Both can be cut on the tablesaw, the same way tenons are sawn. The bottom center rail and two long bottom rails are tenoned into each center leg. Make sure the three mortises don't meet inside the leg, as that would weaken it.

When all the mortises and tenons have been cut and fitted, rabbet the top rails. (The rabbets position the ledger strips that support the slat top, and they make the rails appear thinner.) Cut $\frac{1}{4}$ -in. by $\frac{1}{2}$ -in. rabbets on the inside faces of the front, back and both end rails; cut a $\frac{1}{8}$ -in. by $\frac{1}{2}$ -in. rabbet on both faces of the center rail. The top center rail butts into the front and back top rails, and its ends must be notched into the rabbets in those rails, or a gap will show.

Dry-assemble the whole cabinet frame. Mark the notches for the slat top on the corner legs. Mark where to cut off the

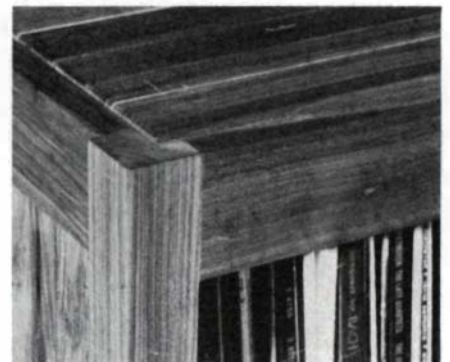
top ends of the bridle-joined center legs even with the rabbets of the rails. Notch a corner of each leg by making three cuts on the tablesaw, as shown in figure 3. Then clear the waste with a chisel. At the same time, mark with a crayon the position of the panel grooves in the legs and rails. Trim the center legs to length, and saw or rout the grooves, stopping the grooves in the mortises.

Glue up the $\frac{3}{8}$ -in. thick panels, running the grain parallel to their long dimension and leaving room for seasonal wood movement.

Sand the legs, rails and panels, and chamfer all the arrises of the legs and rails. I finish-sand all the pieces before gluing up. After sanding the rails, align the ledger strips with the rabbet on the top rails and screw them in place. Screw the ledger strips for the shelf along the bottom edge of the back bottom rails. Bore and countersink clearance holes in the center legs for the screws that will fix the long top rails to the notch.

It's easiest to glue the frame-and-panel ends and center section together first. Set the cabinet on a flat surface while gluing and clamping the remaining rails, to prevent twisting. Make sure the openings for the slat top are square. Clamp the long top rails tight to the notches in the center legs, then screw them in place and remove the clamps.

I made the top of narrow slats of solid walnut. A stable wood such as walnut, teak or mahogany, when cut in narrow strips and left loose in a top like this, won't expand enough to destroy

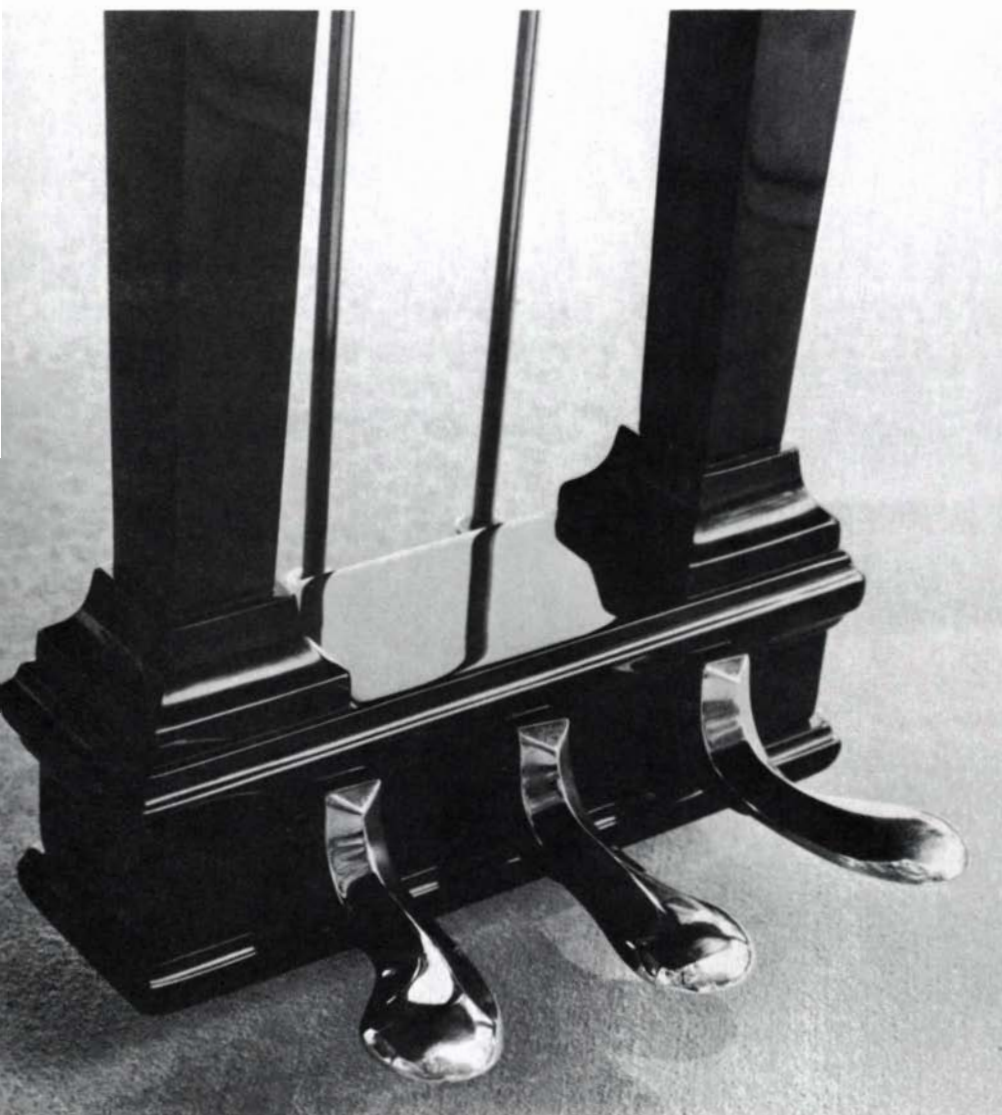


The record-cabinet ends are frame-and-panel construction. Setting the face of the rail about $\frac{1}{4}$ in. back from the faces of the legs adds depth to the end.

the top. Bevel the ends of all the slats and one edge of each outer slat at 5° for a better fit. Groove the edges of the slats for splines, which will keep adjacent slats even. The splines shouldn't be glued in. After fitting the slats to the openings, put a light round or a small chamfer on all four top arrises of each slat.

Finish all the surfaces of the slats before final installation. I didn't screw the top down, but you can put one screw in the end of each slat.

Cut the shelf slats to dimension and rabbet their front ends to fit over the front bottom rails. These slats are wider than the top slats, and their combined widths run the length of the cabinet. Allow $\frac{1}{32}$ in. to $\frac{1}{16}$ in. per slat for movement. Finish all the slats before final installation. You needn't fasten the slats—the weight of the records will keep them in place. The shelf slats are short and stiff, so splining for alignment is also unnecessary. □



Gleaming ebony piano finishes, traditionally achieved by patient polishing of many coats of black nitrocellulose lacquer, can be ruined if the wood's figure telegraphs through the film. Before he lacquered the piano pictured here, Steinert masked the wood grain with smoothly sanded coats of polyester surfacer.

That Piano Finish

Modern method makes opaque lacquer gleam

by Donald M. Steinert

For sheer elegance, few wood finishes approach the black-lacquered gleam of an ebony-finish grand piano. As many contemporary furnituremakers are discovering, however, there's really no reason why such a finish should be limited to pianos, or to one color. Opaque lacquers are sold in many colors which, if polished to a glowing sheen, can impart a vitality to wooden objects that clear finishes can't match.

Traditional piano finishes consist of many coats of nitrocellulose lacquer painstakingly built up over a carefully filled and sanded wood surface. Brought to a high gloss by hours of polishing, such a finish is more time-consuming than difficult to achieve. In the interest of expediency, some modern piano-

makers, particularly in Europe and Japan, have turned to clear and colored polyester finishes. This material dries and builds faster than lacquer, so fewer coats are needed. It also forms a harder, stabler surface that masks wood figure, keeping it from telegraphing through the top coats.

Polyester finishing requires equipment that is impractical for the small shop, so I've experimented with a polyester/nitrocellulose finish. My method combines the stability and surface-smoothing qualities of polyester with the workability of nitrocellulose lacquer. While not easy, especially for the beginner, this technique can be mastered by anyone willing to take the time to experiment.



Preparing the surface—The success of any lacquer finish, opaque or clear, depends on the smoothness and stability of the surface to which it is applied. Mahogany is traditionally the favored wood of pianomakers because it is fine-textured and relatively stable, so the lacquer film is less likely to stretch and crack as the wood swells and shrinks with the seasons. Maple, poplar and most cabinet plywoods are also excellent for lacquering. Oak, fir and pine are poor choices.

Even a mild-figured wood such as mahogany has open-pored grain which must be filled before lacquering. Paste wood-fillers and/or sanding sealers are usually used for this purpose, but I've had better luck with my polyester system. Paste filler, a fine silica powder suspended in an oil vehicle, is messy to apply. Unless you allow plenty of drying time, at least several days, the oil may react with the lacquer, possibly dimpling the lacquer film later. Though easier to work with, lacquer sanding sealers are formulated to be readily sandable, which makes them brittle and prone to cracking.

The polyester filler I use is Prestec 2090 gray sanding surfacer, and it's available in quantities as small as one quart from Simtec, 1188 North Grove, Bldgs. K&L, Anaheim, Calif. 92806. Prestec also comes in white and black. Like the fiberglass compounds to which it is related, Prestec is a two-part system: a viscous resin, and a methyl ethyl ketone peroxide (MEKP) hardening catalyst which you buy separately from a body-shop supply house. The hardener may be sold under different brand names, so just ask for MEKP polyester catalyst. Prestec is about 97% solids, so one coat of polyester is about equal in thickness to six or seven coats of lacquer. It adheres well to wood, cures in one to 24 hours, and is fairly elastic, thus it serves as an effective intermediary between the wood and the nitrocellulose lacquer that goes over it.

Prestec 2090 must be sprayed, and it's only fair to point out that this material is demanding and somewhat hazardous to handle. MEKP is toxic and extremely flammable. A drop of it accidentally splashed into an eye can blind you, so wear proper eye protection. Work in a well-ventilated shop, or outside if the weather is warm and dry. Wear an organic vapor mask when mixing and spraying, and a dust nuisance mask when sanding the dry film. (For an article on respiratory protective equipment, see *FWW* #41, pp. 36-39.)

The biggest disadvantage of polyester is its limited pot life. The resin will set up in 20 to 40 minutes, and if it hardens before you've emptied and cleaned your spray gun, the gun will be ruined. Mix only as much resin as you will be able to spray within the pot life.

To prepare a surface for polyester, sand it to at least 100-grit or finer. Knots, gouges and other defects should be filled with automotive body compound, then sanded flush. I don't use plastic wood fillers because they usually shrink. Unless you're ready to clean up a major mess, don't spray polyester over an old finish. The old finish will soften and you'll have a hard film floating on jelly. Strip off the old coating, sand well, and dust the surface with a lacquer-thinner-dampened rag, allowing 24 hours for drying.

Prestec should be mixed according to the directions on the can. For safety, I add the catalyst with a laboratory pipette (photo, above right). Thinned to the appropriate viscosity with acetone, polyester is actually easier to spray than lacquer. With the compressor's air regulator at about 40 PSI, I hold the gun 8 in. to 16 in. from the work, applying a mist coat first, followed by a heavier hiding coat 3 to 5 minutes later.



Polyester catalyst is toxic and extremely flammable. To avoid splashing it, Steinert adds it to the resin with a glass pipette, available from laboratory supply houses.

You don't have to wait until one coat cures before applying the next. Keep building the film until it's as thick as you want. Open-pored woods will require a thicker coat than will closed-grain ones.

Polyester takes longer to surface-dry than lacquer does, and it will collect dust. But that doesn't matter because it will be thoroughly sanded before the top coats go on. Depending on how much catalyst you add and on the temperature and humidity, Prestec will dry in about 45 minutes. I usually allow 8 hours of air-curing before sanding. Small objects can be force-dried in an oven set at 110°F to 150°F. If you try this, let the polyester air-dry for a while first to avoid blistering.

Spraying the top coats—Sand the hardened polyester with open-coat garnet paper, starting with 100-grit and finishing with 220, without skipping any grits. Sand by hand or with a straight-line power sander. But don't use an orbital sander—the swirls will telegraph. Don't rush sanding, either; the smoother you get the polyester, the smoother the lacquer coats will be. If you decide to sand finer than 220-grit, switch to silicon carbide paper. I vacuum the dust between grits, then wipe the surface with a naphtha-dampened rag.

Of all the materials suitable for opaque finishes—lacquer, enamel, polyurethane and even colored polyester—I think nitrocellulose lacquer is the most practical because it's a solvent-release finish, which means its volatile solvents evaporate to leave behind a film of coalesced nitrocellulose particles. Each successive coat softens the previous one, so, in effect, multiple coats of lacquer blend into one integrated coat, with none of the intercoat adhesion problems often encountered with polymerizing finishes (such as polyurethane or epoxy), which dry irreversibly by molecular cross-linking. Lacquer films remain dissolvable indefinitely, so scratches and sand-throughs are easily repaired, and refinishing can be done at any time, even if the cured lacquer needs to be stripped off.

Opaque lacquers are sold in hundreds of types, colors and

gloss ranges. In ten years of experimenting, I've found that the nitrocellulose lacquers developed for the automotive industry are tougher and polish out better than those formulated for wood, though both types have essentially the same working properties. Also, colored automotive lacquer is easier to buy because it's sold or can be ordered by any local auto-body supply house, as can most of the materials and tools I've mentioned. If you can't buy opaque lacquer locally, try my supplier: Bay City Paint Company, 2279 Market St., San Francisco, Calif. 94103. Bay City will custom-mix colors to match your sample, in quantities as small as one quart. You can fine-tune the color by adding universal colorants.

Though some craftspeople prefer the acrylic lacquers that industry is increasingly using (see box, below), I don't much care for them. Acrylic lacquer builds faster by virtue of its higher solids content, but I've had trouble getting it to adhere to wood and it's not compatible with polyester. It neither flows out as well as nitrocellulose nor polishes as nicely when dry.

I start top-coating with four double coats of lacquer, sprayed on at 40 PSI to 50 PSI with the gun 8 in. to 12 in. from the work. A double coat is just that—two coats sprayed one right after the other without allowing the initial concentration of solvent to evaporate or “flash,” which it will do in 5 to 10 minutes in moderate weather. Lacquer has flashed when you can run the back of your hand over it lightly without sticking. Between double coats, I do wait for the flash, during which time some dust always gets into the film, creating nibs which must be sanded out later.

You may be tempted to spray the lacquer at a thicker viscosity, hoping to build the film faster. But solvents are trapped by a thick, wet coat, causing the film to shrink unevenly into a crazed or checked surface. On the other hand, the lacquer will run on vertical surfaces if it's too thin. Experiment to find the right viscosity. To avoid fisheyes—small,

circular flaws where the lacquer won't adhere due to minute surface contamination—I add Du Pont fisheye eliminator to the lacquer. By the way, polyester filler can also fisheye. Prevent it with Simtec's eliminator, which is called B-32.

After spraying four double coats, forget about the project for at least 24 hours. Fooling around with the finish at this point will compound any problems, or cause new ones. If the first four coats dry trouble-free, dry-sand with 400-grit silicon carbide paper to knock off the dust nibs. Major imperfections, such as drools, runs and sags, should be wet-sanded out by hand with naphtha or mineral spirits as the lubricant. Clean the surface with a fresh naphtha-soaked rag, let it dry, and then spray four more double coats, exactly as before.

Let the lacquer dry for at least two weeks at 65°F to 70°F before polishing it. A month would be even better.

Final-sanding and polishing—Wet-sand the cured lacquer with 400-grit silicon carbide using either naphtha or a half-and-half mixture of paraffin oil and mineral spirits as the lubricant. Don't lubricate with water, though. If you accidentally sand through to bare wood, water will raise the grain. On small pieces, hand-sand, backing your paper with a felt or cork block. Sand a larger piece, such as a piano, with a pneumatic straight-line power sander. *Never* wet-sand with an electric power sander—the risk of shock or fire is too great. I used to be miserly with costly silicon carbide paper. I've since learned that using dull paper is slow, and it will never leave the uniformly smooth surface that fresh, sharp paper will.

Sanding through the top coats at the arrises—the line where two surfaces meet at an exterior angle—may be unavoidable. I minimize this problem by “banding” or spraying a heavier build along the edges. Where sand-throughs do occur, repair the damage by thinning a teaspoon of lacquer to brushing consistency, then laying a thin bead of the lacquer on the bare

Colorful finishes with acrylic lacquer

by George Morris

Fast and richly colored opaque finishes are easily achieved by spraying clear nitrocellulose lacquer over acrylic-lacquer color base coats. I combine these two very different materials for two reasons. First, colored acrylic lacquers are readily available in any quantity at automotive supply stores in my area, while opaque nitrocellulose lacquers are much harder to find. Second, acrylic lacquer dries to a hard film much more slowly than does nitrocellulose, remaining tender and imprintable for as long as two to three weeks after spraying. A clear top coat of fast-drying nitrocellulose solves this problem.

Since opaque color is the desired end, you can skip the otherwise necessary step of using paste wood-filler by choosing a dense, nonporous wood or plywood for the lacquered object. I prepare wood for colored lacquer just as I would for clear lacquer, smoothing surface ir-

regularities with a scraper, followed by sanding with a felt or wood block wrapped in 120-grit, then 220-grit.

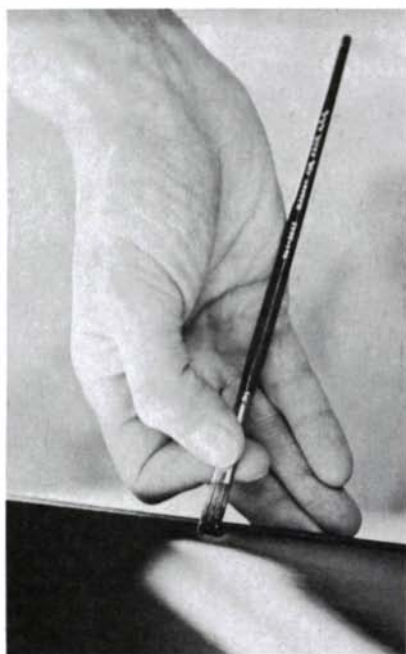
Using an alcohol-based aniline dye, I stain the wood to match the color of the acrylic lacquer I'll be using. Dyeing the wood has two advantages: it makes strong colors more achievable with only two or three color coats, and the inevitable dings and dents are less noticeable. Avoid water-based dyes because they raise the grain. I let the dye dry for 5 minutes, and then with a soft cloth I clean off the powdery residue left behind before proceeding with the color coats.

I spray on two coats of acrylic, waiting 10 minutes between coats. Before each coat flashes, I check for flaws by examining the wet film in oblique light, and I correct them right away, knocking down runs and sags with a finger or a brush before the film sets any further.

Sanding them out later is as messy as sanding slightly wet paint.

I wait an hour, and then spray on three coats of clear nitrocellulose lacquer, allowing an hour between coats. After the initial three clear coats have dried overnight, I sand with 320-grit stearated paper to level the surface. Then I clean the surface with a tack rag, and spray three or four more coats of clear lacquer to complete the job. It's best to wait a few days before wet-sanding, using water as a lubricant, with 600-grit wet-or-dry paper. I follow this with a final buff with McGuire's Machine Glaze Nos. 1 and 3 or equivalent polishing compounds for high gloss, or 0000 steel wool for a satin finish. □

George Morris teaches guitarmaking at The Vermont Instrument Workshop in Post Mills, Vt. He wrote about lacquering in FWW #31, pp. 90-94.



Sand-throughs at the arrises may be unavoidable. Fix them by painting a bead of lacquer over the exposed area. As the bead dries, it will shrink into an invisible repair.



Steinert polishes built-up lacquer by hand or with an automotive lamb's-wool bonnet. He starts with medium-grade compound, finishing with a fine-grit called swirl-mark eliminator.

spots with the edge, not the tip, of a ¼-in. wide sable artists' brush (photo, above left). As the lacquer dries, the bead will shrink flat, making the fix virtually invisible. If you accidentally sand through to the polyester on a flat surface, scuff the area with 600-grit paper and spray on several thin coats of lacquer. Let the repaired surface dry thoroughly and pick up where you left off. You can accelerate drying with a heat lamp, but be careful; the lacquer will blister if you get it too hot.

Once the entire piece has been wet-sanded, clean it up with a soft, naphtha-dampened rag. Check for flaws, then wet-sand again, this time with 600-grit paper. When you complete this step, the lacquer should be dull but absolutely smooth and delightful to touch.

I let the lacquer dry for 24 hours before beginning to polish it with any one of a range of auto polishing compounds made by Du Pont, Ditzler or 3M. Small objects are best polished by hand, but for large surfaces I use a Bosch rotary buffer with a lamb's-wool bonnet, cleaning it often with a tool sold for this purpose. Any buffer will do, except high-speed body grinders, whose friction is likely to heat and soften the lacquer. For hand-polishing, I use old diapers.

For both power- and hand-polishing, three grades of compound will be adequate: a medium-duty rubbing compound and two finer compounds. Start with the medium compound. If you're hand-polishing, smear a ribbon of compound on the surface and rub in a straight-line motion, with the grain. Bear down hard when you begin, and try to overcome the natural tendency to polish in an arc. As the compound dries and the shine begins to show, reduce pressure to a light buffing. Repeat this procedure with the fine compound.

Follow the same steps if you machine-buff. Be careful, though; if you park the buffer in one place or push down too hard, the lacquer will heat up and wrinkle or "orange peel" slightly. If this happens, stop polishing, let the surface cool, then resume with a gentler action. A bad burn will have to be

wet-sanded and/or sprayed again.

Hand-polishing leaves streaks in the surface; the power buffer leaves minute swirls. Both kinds of marks can be removed with a very fine compound commonly called swirl-mark eliminator (photo, above right), which can be hand- or power-buffed.

By now, you should have a brilliant, mirror-smooth surface. All that remains is to blow off the compound residue with compressed air and give the piece a light dusting with a tack cloth. I use a toothpick to get compound out of the nooks and crevices. To enhance the depth of the sheen, some piano finishers spray on a clear lacquer top coat after polishing. But I've found that this is just another opportunity for dust to collect, and a clear finish over a colored one is harder to repair.

Fresh lacquer needs more babying than do other finishes. I caution my customers not to place heavy objects such as lamps or vases on a new lacquer finish for at least two to three months, to avoid imprinting. For periodic polishing and dusting, I use swirl-mark eliminator or automotive waxes and polishes. Furniture care products that contain silicon, Johnson's Pledge for example, will likely turn hazy a day or two after application. Never dust a lacquer finish with a dry cloth, regardless of how soft it is.

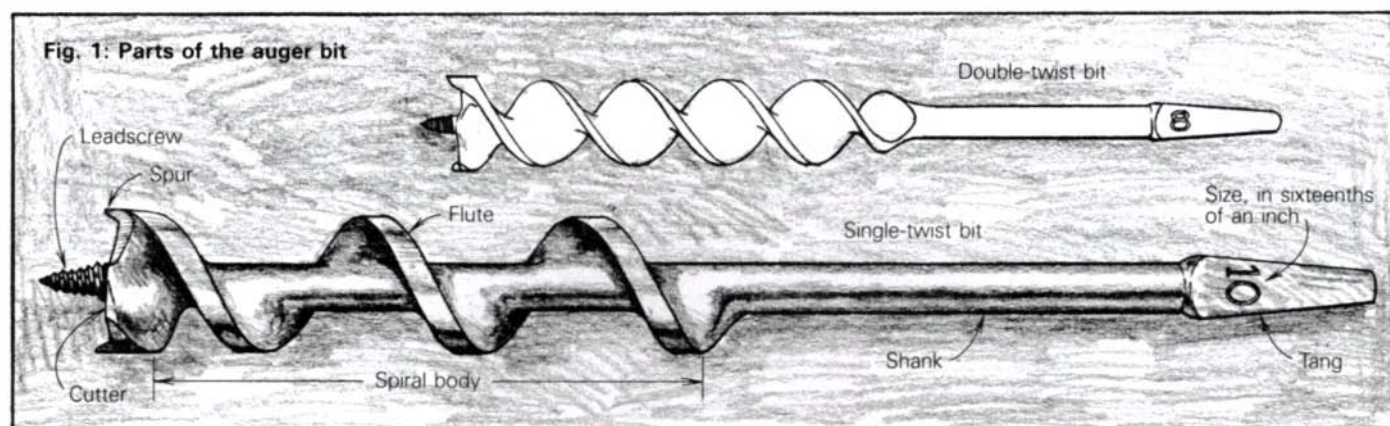
I've found that producing a polished lacquer finish is a very physical, almost athletic activity which demands patient practice, not to mention the ability to survive a fair number of setbacks, to get right. Try it first on scrap plywood or on an unimportant piece. Once you've developed a feel for the materials and tools—particularly the spray gun—I'm sure you'll be amazed with the classy, colorful surfaces you'll be able to produce. □

Donald Steinert, of Grants Pass, Ore., restores and refinishes pianos, furniture and Rolls-Royce woodwork. He wrote about his work in FW/W #32, p. 42.

Auger Bits

How to tune these deceptively simple tools

by Richard Starr



I once knew an auto mechanic who didn't believe in gremlins. He felt that it was natural for a car to run well—if it didn't, there was a good reason. Like a car, an auger bit should work well. If you have a bit that has lost its bite and requires hard pushing to get it to drill, you needn't put up with its misbehavior. There's nothing mysterious going on; something specific is amiss, and it usually can be fixed. Even new bits can be tuned to cut more smoothly and easily.

The auger bit has probably the most complex shape of any piece of steel in the shop, with several parts that must work in concert. First into the wood goes the leadscrew, which pulls the bit forward with enough force so that once it gets a bite, no further pressure is required on the head of the brace. Next, the spurs score a circle in the wood, severing fibers across the grain so that the cutters, which follow the spurs, can lift a shaving without tearing the walls of the hole. The spiral flutes lift the shavings away from the cutters, while bearing against the walls of the hole to keep the bit running straight and true. To allow the bit to turn freely, the spiral body of an auger must be slightly smaller than the hole diameter. The diameter of the hole is determined by the distance between the tips of the spurs, so the manufacturer makes clearance for the flutes by flaring the spurs outward slightly.

There are many variations on this basic design. Some are intended for rough construction work and for power drive. The two varieties suitable for use in a hand brace are the solid-center single-twist bit and the double-twist Jennings type (figure 1). The double-twist is reputed to do a better job of lifting shavings from a hole, and it has more flute surface bearing on the walls of the hole to keep it boring true. On the other hand, the single-twist bit is less likely to bend, because of its sturdy core, and is cheaper to manufacture. In practice, the differences are insignificant.

While many rough-construction bits have a single cutter and one spur, workbench bits have two of each. Each of the paired parts does only half the work that a single cutter or spur would have to do. Because wood is removed more gently

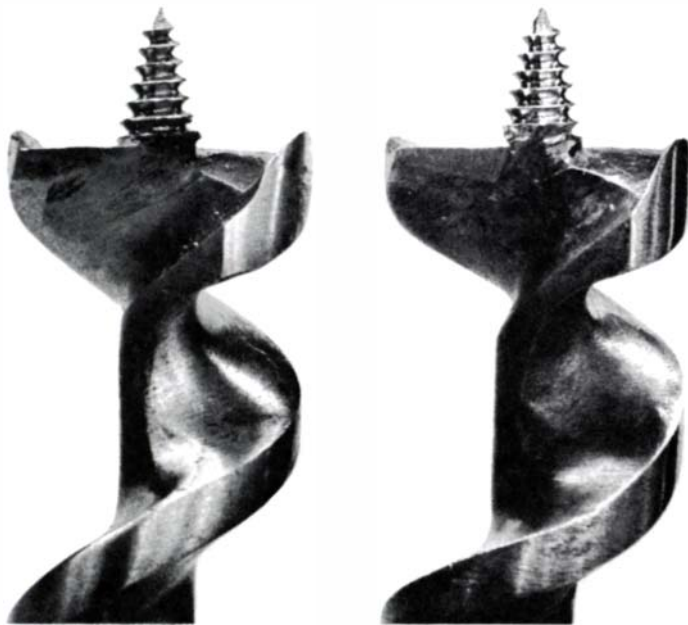
this way, less effort is required and a smoother hole results. A well-tuned bit is balanced: the spurs do equal work and the cutters take shavings of equal thickness.

The pitch of the leadscrew determines how fast the bit will cut. Bits available at hardware stores are usually single-twist types with coarse-pitch or fast screws, while most of the double-twist bits have fine-pitch leadscrews. The slow-lead bits take thinner shavings and leave a smoother surface. Fast bits are harder to turn because they take a bigger bite, and in harder woods the effort required may be excessive. By using a brace with a wider sweep (twice the radius of the crank), you can reduce the amount of force required to turn any bit. Most braces today have a 12-in. sweep, but I prefer a 14-in. sweep for bits larger than $\frac{3}{4}$ in. in diameter. These braces are no longer made, though they can be found at flea markets.

Auger bits sold in the United States are made in $\frac{1}{16}$ -in. increments, from $\frac{1}{2}$ in. to about $1\frac{1}{2}$ in. in diameter. The bit diameter is usually stamped on the tang with a number that represents sixteenths of an inch: a number 14, for example, is a $\frac{7}{8}$ -in. bit. Most auger bits are made to cut $\frac{1}{64}$ in. oversize, unless they are designated as doweling bits (made by The Irwin Co., PO Box 829, Wilmington, Ohio 45177), which are sized right-on. Doweling bits are shorter than regular auger bits, being about 4 in. to 5 in. long, with flutes about $2\frac{1}{2}$ in. long.

If an auger bit doesn't drill well, any of the three cutting parts—leadscrew, spurs or cutters—may be the culprit. First, check the screw. It should have a sharp point and clean, undamaged threads along its full length, or it will load with ground-up fibers, preventing it from biting. Bent threads can sometimes be straightened with the point of a knife. If this fails, true them with a small jewelers' file. Remove as little metal as possible but as much as necessary—a low section of thread will cause less resistance than a pinched section. Even broken points can sometimes be filed to shape.

Spurs are often too long and thick, even on new bits. A long spur, by scoring the wood much deeper than the thick-



The single-twist auger on the left is new, while the bit on the right is a well-cared-for veteran with modified spurs. Starr drilled sample holes in cherry with these bits, then cut the wood in half (below). You can see the difference in scoring depth—the new bit scored too deeply. The thinner, shorter spurs of the modified bit made the smoother surface at right.

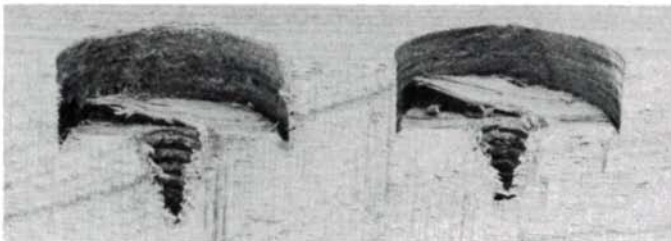


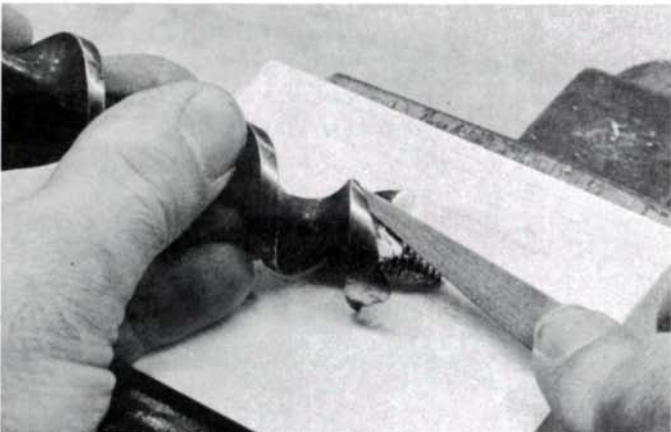
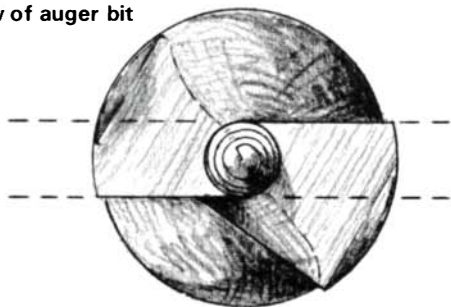
Fig. 2: Auger-bit file

This end is safe on the edge.

This end is safe on the face.

Fig. 3: End view of auger bit

To cut evenly, the cutter edges should be parallel.



When sharpening a cutter with an auger file, it's easy to file accurately if you support the bit against a piece of scrap wood.

ness of the cutter's shaving, wastes effort. A thick spur wedges its way through the wood rather than cutting cleanly. On the other hand, if the spurs are too short, the cutter will reach the surface of the wood first and tear out unsevered fibers, leaving rough walls. A spur that's too thin will dull quickly and may bend. Since the spurs are flared to provide clearance for the flutes, shortening them reduces the hole diameter slightly, but since most auger bits are designed to cut $\frac{1}{64}$ in. oversize, this may not be a problem.

Use an auger-bit file (available from mail-order tool suppliers and hardware stores) to sharpen or modify the spurs. Its tapered ends let you work on wide or narrow surfaces. One end has no teeth on the face, while the other end is safe on the edge, as shown in figure 2. This allows you to file without damaging adjacent surfaces. You can finish up with an auger-bit stone, but I'm satisfied with the edge I get from the file.

To file spurs, I secure the shank end in a vise and support the upper end of the bit with my left hand. Since the spur is thicker at its base than at its tip, you should file the entire inside surface to avoid thickening the spur's profile as the spur gets shorter. If you wish to thin down the entire spur, file the base thinner first, then work all of the inside surface. Though only the tip actually cuts wood, any nicks along its leading edge will scrape the walls of the hole, so these should be filed out. Never file the outside edge of the spur, except to gently brush away burrs. To check that the spurs are of equal length, drill into a board with the bit square to the surface, watching to see if one spur touches the wood first. If it does, shorten that spur slightly and try again.

Dull cutters make a bit difficult to turn, and may even cause the leadscrew to slip and load up. Even new cutters may need a touch-up, but be sure to file on the flute or bevel side, not on the leadscrew side. Most problems with cutters come from filing the wrong side. To file, I hold the bit in my left hand, and press its business end firmly against a piece of scrap wood for support. A 30° bevel angle is about right. A damaged cutter may be filed back quite a bit, but be sure you file both cutters to maintain balance. You can judge this by looking at the end of the bit—the cutter edges should appear parallel, as shown in figure 3. To fine-tune, drill a hole, compare the shavings made by each cutter, and file a little more off the cutter that makes the thicker shaving. If the cutters are filed back a lot, check the spurs for depth of cut; they may need to be shortened.

Have you ever noticed how difficult it is to drill into end grain with a regular auger bit? The spurs are the problem. They have no function in end grain, and just get in the way. You can recycle a damaged auger bit for use in end grain by grinding off the spurs. The leadscrew does tend to follow the grain, so for really accurate deep holes in end grain, grind the leadscrew off too. Then use a file to angle the cutters toward the center where the leadscrew was, so that the end of the bit resembles the point of a machine drill. You'll have to start the hole with another bit that still has its lead.

It takes experience to get the hang of filing auger bits. Practice on some worn or damaged ones. If the back of your tool cabinet doesn't contain the usual pile of ineffective bits, you can probably pick some up cheap at a flea market. You'll be surprised how easy it is to resurrect them. □

Richard Starr is a teacher and the author of Woodworking with Kids (The Taunton Press). Photos by the author.

How to Make a Wooden Flute

Lathe-boring long holes, and keeping them centered

by Whittaker Freegard

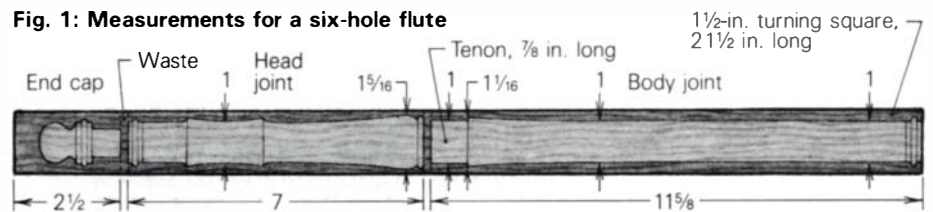
My first attempt at making a flute was a turned piece of pine, bored with a brace and bit. It didn't work. The next time, I drilled the tube with spade bits in a Jacobs chuck in the lathe. The flute could be played, but my processes were slow and uncertain, and the results sometimes unpredictable.

Over the years, I've improved my techniques, and learned enough about the precise anatomy of flutes to make one with precision and within a reasonable amount of time. Basically, a blank is rough-turned round, the inner diameter is bored, then the blank is mounted on a wooden mandrel for turning the tube to its final diameter. This ensures that the bore is exactly centered, one of the most important details in flute making. Length, finger-hole location and wall thickness all must be in balance for a successful instrument. I rely heavily on lathe accessories to make my flutes, but you don't actually need all the equipment I have to make a single flute; I've outlined some alternatives on p. 66. If you would like to increase the versatility of your lathe for such projects as tall lamps, drilled-out containers, and even a little metalworking, however, the bits and chucks I talk about here are a worthwhile investment. Mine paid for themselves a long time ago.

Preparing the blank—The flute shown here has a detachable head joint and is tuned to a G-major scale. If you want another pitch or a different sound qual-

Whittaker Freegard has made flutes under the shop name of Garrett Alden for ten years in Mendocino County, Calif., and Eureka Springs, Ark.

Fig. 1: Measurements for a six-hole flute



Cut the flute blank with minimal waste between sections to ensure matching grain. Dimensions are important if the flute is to play in tune.

ity, you can experiment with other dimensions. Generally, large or long bores produce lower tones; narrower and shorter bores, higher ones. Thick walls give a richer but less responsive sound; thin walls, a thinner, breathier tone.

The denser and more resinous a wood, the fuller and richer the tone. My consistent favorite is cocobolo, although many exotic and domestic hardwoods produce excellent tones. In general, select a wood with as closed grain as possible, but avoid rock maple. It is exasperatingly hard on shell augers, and unless sealed with epoxy, it has a dry, thin tone. My favorite native hardwoods are black walnut and cherry, especially when the wood is burlled or compressed. I buy 6/4 or 8/4 lumber and bandsaw the planks into 1 1/2-in. turning squares. To allow for the jointed flute's body tenon, and the end cap for the head joint, I cut each blank to 2 1/2 in., making sure that the blank is free of checks.

Measuring as shown in figure 1, I cut the body, head joint and end cap to length, and mark the top and bottom ends of each piece. The figure pattern will appear different when the square is rounded, and it's all too easy to end up with mismatched sections.

I use a spur center in the headstock to mount the head joint and body section

in the lathe. To reduce vibration, I round each blank with a large gouge, then I use a wide cut-off tool to make a 1-in. long tenon on the tailstock end, so it will slide snugly into my shopmade ball-bearing hollow tailstock, shown in figure 3. The drill bits pass through the center of this hollow tailstock to bore out the instrument. Then I cut a 1/2-in. long step in the headstock end to fit a 3-jaw chuck. I cut this step larger than the final flute diameter, because the full length of the blank is needed.

Boring out—At this point, the lathe changes from a turning tool to a boring tool. As shown in figure 3, lathes can bore from either end. Boring each section of a flute to final diameter is best done in three steps, beginning with a short pilot hole. In the second step, a hand-held bit extends the pilot through the blank, and the third step expands the center hole to its full diameter. To begin the pilot hole, as shown in figure 3A, I hold the work in a 3-jaw chuck and support the tailstock end in the ball-bearing hollow tailstock. I mount a 1/2-in. twist bit in a Jacobs chuck in the tailstock. The hollow tailstock must be adjusted so that the bit lines up exactly with the center of the blank. With the work turning at the lathe's slowest



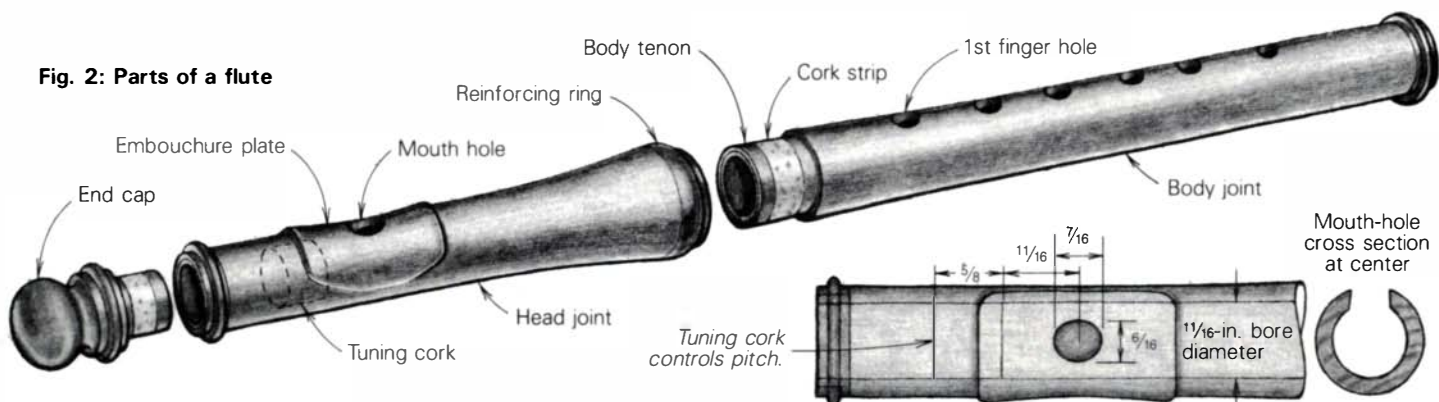
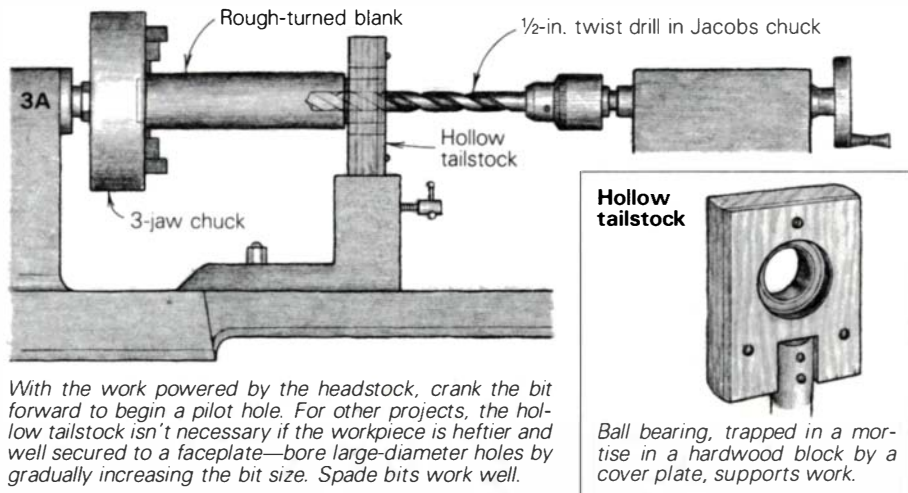
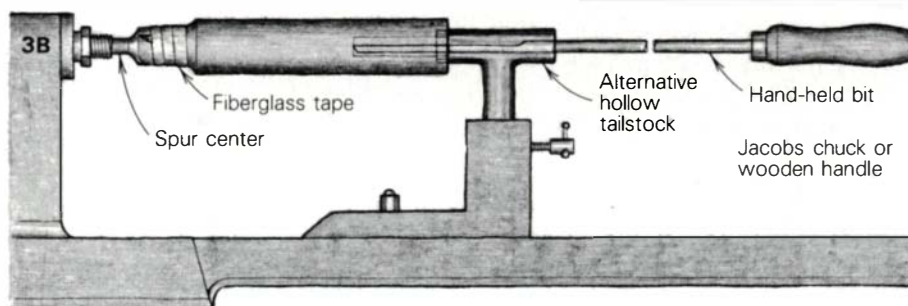


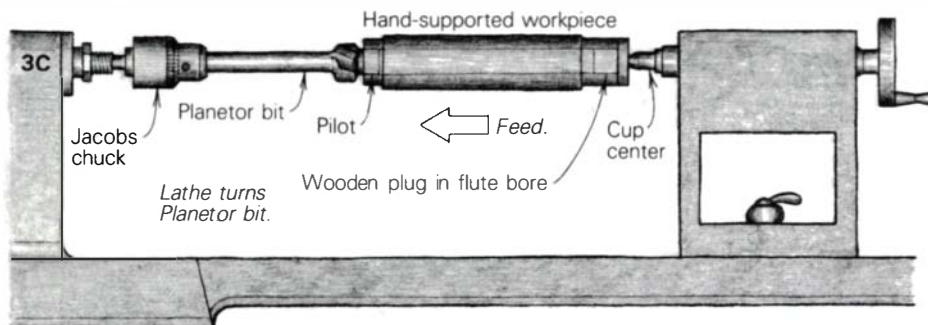
Fig. 2: Parts of a flute



With the work powered by the headstock, crank the bit forward to begin a pilot hole. For other projects, the hollow tailstock isn't necessary if the workpiece is heftier and well secured to a faceplate—bore large-diameter holes by gradually increasing the bit size. Spade bits work well.



Bore a full-length pilot hole with a hand-held shell auger. The author uses the chuck and tailstock shown in step A, but the setup shown in B will work too (see box, p. 66). As explained in the main text, full diameter is next bored with a hand-held Planator bit, following the pilot hole.



To slightly enlarge the bore to accept the body tenon, fit a Planator bit with a pilot that matches the bore diameter, then crank the work forward into the bit's cutting spurs. A piloted spade bit will also enlarge holes, but may split thin-walled turnings.

Bored and turned on the lathe, this 19-in. rosewood flute (left) has ends and center joint reinforced by rings of water buffalo horn. To make a flute, a 1/2-in. dia. pilot hole is first bored with the 30-in. long shell auger (bottom), which cuts into end grain without wandering. The Planator bit (center) follows the pilot hole by means of a shopmade center insert, a wooden or metal plug turned to fit the pilot hole. The coiled spring ejects chips. Both bits are hand-held and fed into the work as it turns.

speed, about 750 RPM, I crank the tailstock forward to drill a 2-in. deep hole. The rigidity of the tailstock ensures that the hole starts straight. Then I remove the tailstock from the lathe bed.

To bore the full length, I use two specialized bits, shown in the photo at the bottom of these pages. Unless the wood grain is particularly uneven, a shell auger will bore a long, straight hole without wandering. Once started into the pilot hole, it cuts on-center, aligning itself with the stationary centerpoint of the turning work. As shown in figure 3B, the bit is held freehand, not in the tailstock chuck, and is pushed into the work in short steps. Feeding the bit into the wood by hand is a great pleasure, and not nearly as difficult as it may sound. Withdraw the bit from time to time to clear the chips, and be careful that you don't get the bit so hot that its cutting edge loses its temper. This full-length hole is the pilot for the final bore.

To bore to full diameter, I use an 1 1/16-in. Planator bit, which has an 18-in. shank and a coiled chip ejector. My model is an older one, but you can still get the equivalent from the source listed at the end of this article. The Planator bit is also hand-held, but for a better grip I tighten it into a Jacobs chuck. This completes the boring in the body joint, but the head joint still requires a socket to accept the tenon on the body.

To make the socket, I bore from the headstock end, as shown in figure 3C. I remove the 3-jaw chuck and install a 1/2-in. Jacobs chuck, fitted with a short 1-in. Planator bit with an 1 1/16-in. pilot center. I remove the hollow tailstock and remount the regular tailstock, fitted with a cup center. To center the flute blank on the tailstock, I push a hardwood plug into the end of the bore. The tailstock should be adjusted so that the blank is supported by the Planator bit's pilot, but not pressed against the cutting spurs. With the lathe at its slowest speed, I support the blank with my left

hand and slowly turn the tailstock crank to push the blank $\frac{7}{8}$ in. into the bit. This completes the head-joint boring.

Turning the outside on a mandrel—To turn the outside of the flute, I support the blank on a mandrel, a rod that extends through the blank and projects an inch or more at each end. I make mandrels from birch dowels, turning them down until they make a snug sliding fit in the bore. Better a little loose than too tight, so occasionally I use some thin paper or wooden shims between the mandrel and the blank, taking care that the mandrel is centered in the bore.

To help protect the ends of the flute from splitting, you may want to add reinforcing rings, which also provide a visual transition between the sections. I used water buffalo horn on the flute shown here, but rings can also be made from brass tubing, soldered silver sheet, or cow horn. To make them from brass tubing, mount the tube on a mandrel on the lathe, and with a jeweler's saw, saw off as many rings as you need. Rings should be put onto the blanks before the outside profile is turned. Cut a seat into the blank to fit the inner diameter of the ring, apply some glue, and

tap the ring into place. Horn rings are fitted oversize, then turned down at the same time as the blank.

Turn the tenon on the body so that it makes a good sliding fit in the head-joint socket. To ensure an airtight seal, I glue a $\frac{1}{2}$ -in. wide strip of cork in a shallow groove around the tenon. Bevel one end of the cork strip so that the joint overlaps, apply yellow glue, and clamp with a rubber band. When the glue is dry, carefully sand the strip down while the body is turning. When checking the fit, apply a little cork grease (available from any music store) for lubrication. Otherwise, the fit will end up too loose.

Next I turn the outside profile of the flute. Pay careful attention to the diameters in figure 1, because they determine final wall thickness. If you'd like a raised mouthpiece, called an embouchure plate, which some people feel makes a flute easier to play, turn the area oversize and carve away the unwanted wood by hand before sanding. Sand and polish the flute with progressively finer grades of paper, finishing with a worn 600-grit. Final polishing is done with the grain, with the motor off. After I have polished the flute sections, I make the end cap, a short section that slides snugly into the top end of the

Fig 4: Drilling guide



Measurements from bottom end to center of:	Approx. dia. after shaping and tuning
Mouth hole	15 $\frac{14}{32}$ oval
6th finger hole	8 $\frac{31}{32}$ $\frac{6}{16}$
5th finger hole	7 $\frac{22}{32}$ $\frac{5}{16}$
4th finger hole	6 $\frac{16}{32}$ $\frac{5}{16}$
3rd finger hole	5 $\frac{9}{32}$ $\frac{4}{16}$
2nd finger hole	4 $\frac{6}{32}$ $\frac{6}{16}$
1st finger hole	2 $\frac{23}{32}$ $\frac{5}{16}$

head joint. It, too, has a cork inlay, and can be topped off by turning a short ornamental end. All of the sections can now be put together. Remember to use a liberal amount of cork grease, and don't force the fit, or the socket may split. If the socket is too tight, carefully sand or file the cork.

The holes—Measuring as shown in figure 4, and keeping the mouth hole and finger holes in a straight line, mark and indent the center of each hole. To prevent tearout, insert a softwood dowel in the bore before you drill. To drill the mouth hole, support the head joint in a V-block or a handscrew on the drill-press table, and use a $\frac{3}{8}$ -in. brad-point bit. To ensure that the hole will be in the right place, align the point of the bit with the mark on the blank, and clamp things down before you drill. Change to a $\frac{1}{4}$ -in. bit and drill the finger holes.

I undercut and shape the mouth hole with round files and narrow knife blades. Figure 2 on p. 65 shows a typical cross-section at the center of the hole. I prefer an oval mouth hole, but its shape has been a subject of debate throughout the flute's history. Most mouth holes are undercut on the edge against which your airstream is directed, although the amount of undercutting is again a matter of preference. I feel that too little angle rather than too much is better, to achieve maximum control and flexibility in playing. The finger holes, too, will require undercutting and enlarging for the flute to play in tune.

After the holes are drilled, sand the bore. I slit a dowel, slip the edge of a sandpaper strip into it and wrap the paper around the dowel. You can use the sanding rod manually or chucked in the lathe headstock, using progressively finer grits to produce a smooth bore.

Next make the tuning cork, which blocks the tube just above the mouth hole and controls the pitch. First, run a

Some low-tech boring setups

The simplest hollow tailstock consists of a copper-pipe T-fitting, as shown in figure 3B on p. 65, supported by the tool-rest base. To make the blank fit it, bore a shallow seating hole, the outer diameter of the pipe, in the end of the blank, using a spade bit. An electric drill will be accurate enough. Lubricate the seat with spray silicone once in a while as it turns. Silicone will penetrate the wood and interfere with any finish you apply, so to prevent problems, cut off the end of the blank after boring. Chances are that the first couple of inches of the bore will be enlarged because of the number of times you have to remove and reinsert the bit, so you should plan some extra length to be cut off anyway.

The copper won't be stiff enough to hold the blank firmly against a spur center in the headstock, but if you rough-turn the end round and tape it to the headstock with fiberglass tape, the setup will work without a 3-jaw chuck.

Extra-long twist bits (bellhangers' bits) are no substitute for a shell auger.

Twist bits wander when boring end grain, and you will scrap a lot of blanks before you get a straight hole. Twist drills can enlarge a pilot hole, however, working up bit by bit until the bore is full-size. A series of larger and larger spade bits with extensions could also be used. Extend a spade bit for light-duty boring by lapping and silver-soldering it to $\frac{1}{4}$ -in. steel rod stock. This modified spade bit has the advantage of being able to bore a long hole without clogging on its own chips, which twist bits invariably do. Clamp vise-grips to the end of the rod as a handle, and mark any long bit so that you don't bore too far. There's nothing quite like the sound of a shell auger jamming into the spur center—expensive "music."

Another way, adequate for shorter holes, calls for spade bits in a Jacobs chuck in the headstock. Leave the blank square. Clamp blocks to the tool rest to form a support track that will let you move the work into the bit by advancing the tailstock.

—W.F.

Playing the flute

Some people produce a sound the first time they try, others may have to practice for days. Blowing across, not into, the mouth hole (as in blowing across a bottle top) causes the stream of air to be split by the opposite edge of the hole, creating the tone. By slightly rolling the mouth hole toward or away from your lips, you can hear the tone become clearer, then fade. Aim the airstream carefully, and use the least amount of air that will produce a strong, clear tone.

When you can confidently produce a tone, try playing a scale. Be sure the pads of your fingers completely cover the finger holes. The fingering chart shows a major scale as Do, Re, Mi, with sharps and flats between. Another way to play sharps and flats is by covering only half of the finger hole. The second octave is fingered the same, but with more air pressure. You can add color and variety by rolling or sliding your fingers off a hole, a more advanced technique that allows you to subtly change the pitch of any note. —W.F.



Freegard and wife, Nanita, show correct hand and mouth positions for flute-playing.

Fig. 5: Fingering chart, chromatic scale

		Do	Re	Mi	Fa	Sol	La	Ti	Do
Left hand	1st finger	●	●	●	●	●	●	○	○
	2nd finger	●	●	●	●	●	○	○	●
	3rd finger	●	●	●	●	○	○	○	●
Right hand	1st finger	●	●	●	○	○	○	○	●
	2nd finger	●	●	○	○	○	○	○	●
	3rd finger	●	○	○	○	○	○	○	●

pencil point around the top inside edge of the bore, and then press the head joint against the end of a $\frac{5}{8}$ -in. long piece of bottle cork. The graphite will leave a mark of the bore's diameter. With a knife, shave the cork around the pencil line, test it for fit, then push it into place, $\frac{1}{16}$ in. from the center of the mouth hole. Once the cork is in place, you should be able to get a clean, flute-like tone by blowing across the mouth hole. The tone will be much improved when you oil the flute—use a light, non-toxic oil (such as mineral oil or safflower oil), and be sure to wipe off all the excess, so that there is no oil buildup.

The tuning process may sound mysterious and complicated, but it is neither if done methodically. We have deliberately drilled undersized holes, because it's best to tune each note by enlarging the hole, rather than by constricting it by adding substances such as beeswax.

It may take some practice to produce a clear, reliable tone, necessary for tuning your instrument. Refer to the playing instructions in the box above, and if you are still uncertain, enlist the aid of a flute-playing friend. If you can't hear when the flute is in tune, try playing the scale along with a well-tuned piano, another instrument or an electronic tuner.

With all of the sections together, the

tonic note (all six finger holes covered), G in this case, should be in tune, while the finger holes will sound flat in various degrees. If the tonic note itself is flat, you can sharpen it by flaring the end of the tube up to the first finger hole. If the note is sharp, pull out the tenon a little. Start the finger-hole tuning at the bottom hole (A) and slowly work your way up the scale, playing back and forth to recheck previous tuning. In the first octave, enlarge the diameter of each hole to sharpen the pitch. Undercutting the inside edge of a hole will also sharpen the pitch, and help the response of a sluggish note, but this is best saved for tuning the second octave. As a tuning overview, leave the third hole from the bottom (C) small. The two holes you will have to enlarge the most are the second finger holes on both hands—B on the right hand, E on the left.

Tuning the two octaves together is called the fine-tuning, and is done completely with undercutting after the first octave is in tune. Undercutting the upper edge of a hole raises the pitch for the first and second octaves; undercutting the lower edge raises the pitch in the second octave, and has only a very slight effect in the first octave. This is especially helpful since the second octave tends to be flatter in general than the first. If

you remove too much wood, add a little beeswax. Heat the tip of a nail, melt a drop of wax with it, and transfer the wax to the rim of the hole.

Lightly oil the wood once or twice a year so it doesn't dry out, and try to keep the flute from extremes of temperature and humidity. After playing, gently swab the moisture from the bore. If you leave the flute assembled for too long a period, the tenon cork may become compressed, loosening the fit. A remedy is to dampen the cork and heat it briefly with a match, but be careful not to scorch it. □

Sources

Shell augers: Woodcraft Supply, 41 Atlantic Ave., PO Box 4000, Woburn, Mass. 01888. About \$30.

Planetor bits: Rule Industries, Cape Ann Industrial Park, Gloucester, Mass. 01930, (617) 281-0440. Catalog PB-83.

Bore—P-69L (12-in. shaft with chip ejector), $\frac{1}{16}$ -in. dia., \$22.50; $\frac{5}{16}$ -in. shank extension XJ-55, \$5.75.

Socket—P-100 (1-in. dia. bit), \$12.75; $\frac{3}{16}$ -in. shank SB-35, \$5.35.

Sheet cork: International Violin Company, Ltd., 4026 West Belvedere Ave., Baltimore, Md. 21215.

Water buffalo horn: Don Kostecki, 6245 N. Fairfield, Chicago, Ill. 60659.

Modular Chairs Around a Standard Seat

With comfort settled, visual and structural design can blossom

by Kenneth Smythe

Most chairs seem to be designed from scratch—within certain dimensions dictated by the human form, the designer refigures the basics for a comfortable sit with each chair he creates.

After about a dozen attempts, I have developed a standard seat and backrest system that is consistently comfortable while still affording me great flexibility in designing the rest of the chair. For all my chairs, the size and relationship of the seat and backrest are the same, so that when I begin a new design, I can concentrate on the visual and structural

aspects of supporting and presenting this seating.

My designs are based on a large vocabulary of modular shapes, and are supported by a goodly number of non-traditional connectors and locking devices appropriate to my material. I work with Finnish or Baltic birch plywood, but any sheet material of comparable strength would do.

My design philosophy is based on a concept that I call "integrated fragmentation," which I find provides both variety in design and economy in the use of material. The most important fragment I have designed is a multiple-hole

Plywood can be made into sturdy rails by cutting and drilling the sheets to form multiple-hole donuts, then stacking the donuts on steel rods. At each end, a disc with an embedded T-nut tightens the assembly.



Steele 1 chair (Cro-Magnon Epitaph), above. Below, Synergistic Synthesis.



donut (drawing, facing page), which can be cut and drilled from almost any small scrap. This element, stacked on steel rods and sandwiched between end discs embedded with T-nuts, turns sheet stock into linear structural members.

The first step in making one of my designs is to draw the main components on Masonite, then cut the shapes out to serve as templates. I trace the templates onto plywood, rough out the parts with a saber saw, and trim them with a router and flush trimmer bit, guided by the template.

I drill the holes to receive the central $\frac{3}{8}$ -in. rod, threaded at both ends, for each connection, and insert the rods to mock up the plywood parts. The parts that are connected at only one point can pivot, so I determine their angular relation to one another and drill the holes for the $\frac{1}{4}$ -in. rods, three of them for each donut stack; these will reinforce the stack and fix the parts from rotating. I now cut and drill the donuts themselves, using a hole saw and the drill press with an indexing jig. For tightening the donut stack, I laminate a steel T-nut into each end disc.

Before assembly I sand all the wooden parts to 320-grit,

rinse them in mineral spirits, then apply a heavy coat of varnish, which I wipe off after 15 minutes. Two or three days later, I sand the pieces with 600-grit paper and polish them with carnauba wax. The chair frame can now be assembled.

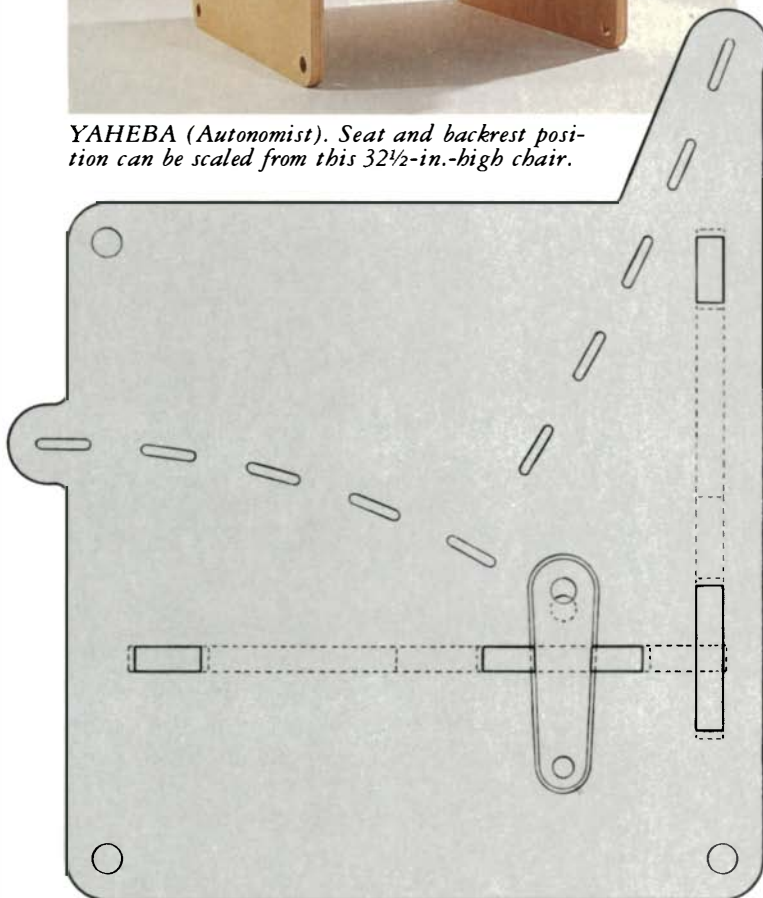
I job out the seat and backrest to a local upholsterer, but these components don't require inordinate skill with needle and thread. Each is a canvas sandwich, 24 in. wide (the standard inside width of all my chairs), filled with a 2-in. pad of high-resiliency foam. Loops of leather along the edges of the sandwich fit through slots in the chair frame and are secured with $\frac{1}{2}$ -in. maple dowels. I bend the dowels by soaking them overnight in water and drying them bent on a simple form I made.

I've designed more than a hundred chairs using this basic approach, and I title each design—my metaphoric expression. I see the chairs as a series of functional sculptures, with comfort as a given. □

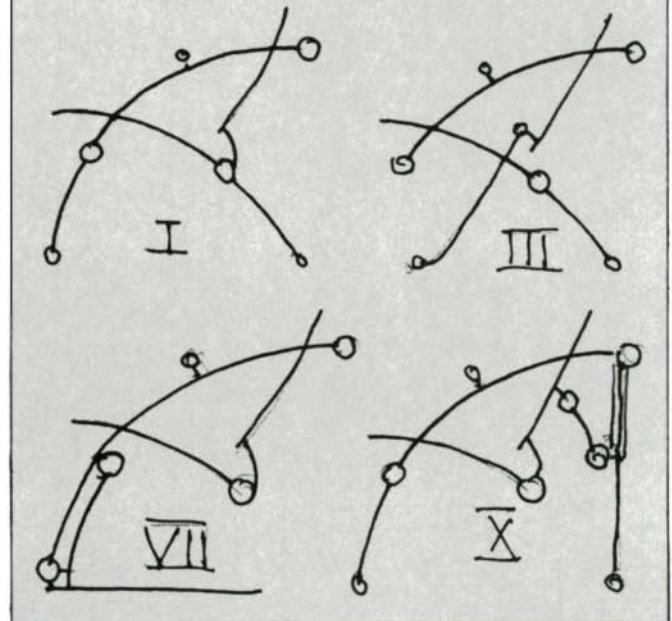
Kenneth Smythe designs and builds furniture in Berkeley, Calif. Photos and drawings by the author.



YAHEBA (Autonomist). Seat and backrest position can be scaled from this 32½-in.-high chair.



Author's sketches for IRENKE chairs



IRENKE, Variation 1, began with the sketches shown above.



Two methods for making leather seats: In the Chariot chair, left, the leather sling (seat and backrest) is laced to the ash frame. In the elm chair, right, the seat is a cushion of leather resting on mortised slats.

Leather Seats for Wooden Chairs

Straightforward combination enhances both materials

by Stefan During

In nature, the place where two elements meet is always interesting and dynamic—if you have ever turned over a stone, you will have witnessed this. Likewise, in the world of artifact, the combination of two materials is special. In the best case, the result can be synergistic: more than the sum of the parts. Take an ax head and handle. Apart they don't look like much. Put them together (with a wooden wedge and all that) and there is meaning, beauty even.

To successfully combine two materials, you need a good understanding of both. As a woodworker this means you have to get out of your wood for a while and into the secondary material. By reading about it and trying things with it, you discover the stuff, and you become better able to combine it harmoniously with wood.

I prefer natural materials to complement my wood. In chairmaking I use leather, rope, webbing and rushes. I like a visible and uncomplicated construction that shows the way things are attached, and makes the attachment an attractive design element.

I use vegetable-tanned, as opposed to chromium-tanned, leather of some 3mm (1/8-in.) thickness. Yellow when new, it turns a rich chestnut brown in a matter of months. According to the choice of my customer, I can combine it with a light-colored wood such as ash or sycamore for maximum contrast, or with a medium-dark wood such as elm or oak for a more subtle combination. I have two types of leather-to-wood attachment. The first is what I call thong-lacing, the second is the cushion-on-slats method.

Thong-lacing—In this method, a leather slab spans a wooden frame by means of a stout leather thong. The thong passes alternately through holes in the wood and in the leather slab, like stitching. On the outside of the frame, I use a gouge to cut a shallow groove between alternate pairs of holes, so that the stitching is let into the wood surface (figure 1).

The leather slab consists of two layers of leather, sometimes with a layer of nylon fabric sandwiched between. The upper layer should be without blemish; the lower one, which is out of sight, can have some flaws. The upper layer should be cut about 15cm (6 in.) wider than the lower one, so that it can be folded around it at both sides, leaving a casing (a tunnel-like opening) running the length of the slab. Into this casing I insert a willow stick or a length of rattan. The stick distributes the tension of the thong along the entire length of the slab, and pulls the slab evenly.

To sew the leather, first fashion a piece of hardwood to the shape of a worn screwdriver, flattening and rounding the tip. Pressing firmly with this wooden marker on the good side of the upper piece, draw the lines along which you will sew. Next, bevel the leather edges that will be exposed (I use a spokeshave). Now tack the sandwich together with small nails along the lines you have drawn, backing each nail with a piece of wood at intervals of about 10cm (4 in.). This way, the whole construction is secured.

Now sew both seams, either by hand or by machine. I use thick linen thread and an old hand-operated cobblers' machine that goes through leather like butter. The machine is so

small that it fits on a shelf when not in use, a definite advantage in my workshop. Also, it is simple and sturdy. Nothing is more frustrating than laboring over an expensive piece of leather with a machine that loops and skips for unknown reasons. Sew away, taking out the nails as you reach them. The lower layer of leather will sometimes “skate” out in spite of the nails. If this starts to happen, skip this part of the seam, to be filled in later. The more closely the nails are spaced, the less chance there is of this happening.

When the slab is sewn, punch holes in the overlapping border about 3cm (1 in.) from the sides for the thong to pass through. With a knife, cut these holes into slots, open at the sides of the slab, so that later the thong won't protrude above the surface of the slab.

For finishing the leather, I use acid-free petroleum jelly (Vaseline), worked in with the hands, especially at the edges and the stitching. Now slip in the sticks. These should be bendable if they are to follow a curved frame member, so soak them overnight or steam them if they are dry. Easiest is using them right off the tree.

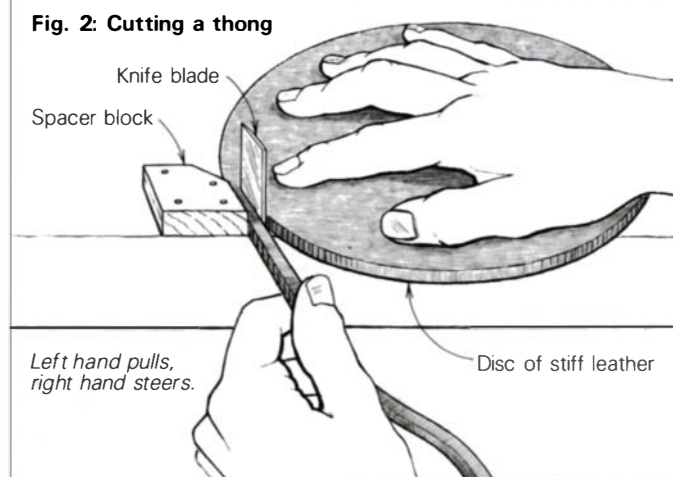
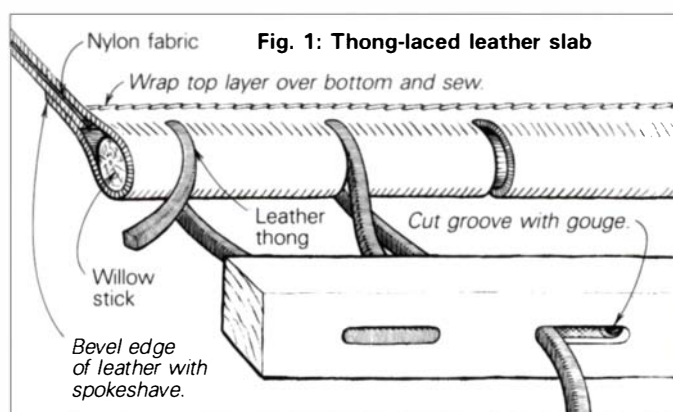
The slab can now be mounted in the frame. For the slung seat of the Chariot chair (facing page), I fasten the top and bottom edges first. The top is held in a rabbet in the chair back by a thin lath and screws. The bottom is fastened similarly, but without the rabbet.

This leaves the thongs. From a piece of firm leather, preferably thicker than the leather of the slab, cut a disc about 30cm (12 in.) in diameter. By means of a fixed, vertical knife blade and a spacer block, you can cut a nice, even thong by “unrolling” the disc (figure 2). Position the spacer block to cut a thong slightly wider than the holes in the chair frame—I use 7mm ($\frac{1}{4}$ -in.) holes. Next, soak the thong in water for a few minutes. In a piece of scrap wood, drill a hole the same size as in the frame, and pull the wet thong through. This will round the corners of the thong, and stretch the fibers, so that less retensioning will be needed later on. I start lacing by tying a knot on the leather slab, and finish by wedging the end of the thong in a hole drilled obliquely in the underside of the frame. If after some time the thong stretches, remove the wedges and repull it tight.

The leather-and-wood structure thus made is nice to look at and very strong, and provides a comfortable seat. But it does not by itself give positive support to the lower back. In the Chariot chair this problem is solved by a small leather cushion laced with thong to the top of the slab. It is a simple envelope of leather filled with raw wool. By varying the amount of filling, I can accommodate differently built people. I leave the filling easily reachable, for later adjustments.

Cushion-on-slats—In the other kind of leather-and-wood chair I make (facing page), the seat, and sometimes the back, consists of two to four slats which hold a leather cushion. The slats support the body firmly, the cushion supports softly. Softness is more important in the seat than in the back, which I usually leave uncovered, or cover with a thinner cushion. Benches can be made in the same manner, although for larger cushions it is necessary to incorporate an inner, quilted cushion, to keep the stuffing from shifting.

In the rails that receive the slats, rout slots 2cm ($\frac{3}{4}$ in.) deep and somewhat narrower than the thickness of the slats. Slat thickness is best when the slats will give a little under the weight of a body—I make mine 1.5cm ($\frac{9}{16}$ in.) thick. The



edges of the slats are rounded with a plane or a router, and the ends are beveled on the underside until they enter their slots snugly. Make sure that the wood of the slats is at least as dry as the rails are. Alternatively, you can cut proper tenons on the slats. This takes more time, but if you want the slats to go right through the rail and protrude a little on the outside, tenon shoulders are necessary.

Cushions consist of a piece of leather folded at the front and sewn along the sides and back. For filling, again I use raw wool. As my wife is a great spinner, I use the pieces that are less suitable for spinning. The lanolin in the wool oils the leather while the chair is sat in. Avoid including very lumpy pieces of wool; these should be carded first. Overfill the cushion, for the wool does compress. Of course, another kind of filling material will do the job too, but the idea of a quality material used even where you can't see it appeals to my customers, as it does to me.

Cut the leather, draw in the stitching line with the wooden “pencil” and nail together, as explained earlier. Then start sewing. When you've sewn all but the last 20cm (8 in.), without taking the leather from the sewing machine, work in the filling, stuffing the corners extra well. Then finish sewing. Leave a long end of thread at the beginning and end, and finish up with a few double stitches by hand.

Bevel the edges and work in the petroleum jelly. Now you have a cushion that can be used on both sides. For fastening it, I punch a hole near each corner, and through these I tie the cushion to the chair rails with thin leather thongs. This is all, and a very simple and straightforward combination it is. The more I use this method, the better I like it. □

Stefan During is a furnituremaker in Texel, Holland.

Inventing the Coffee Table

Antique tray generates a mahogany “reproduction”

by Eugene Landon

Though I am committed to producing exact American reproductions, I’m sometimes required to make a furniture form that simply did not exist in the 18th century. Recently a client approached me with a mahogany tray, a family heirloom, and asked if somehow it could be used to make a coffee table that would blend with her 18th-century home and other period furniture.

More than likely, the tray was not meant originally to be used as a service tray: it has through dovetails at the corners, and the practice in the 18th century was to hide the joinery. Perhaps it might have been a linen tray from inside a cabinet, where it would have been out of sight behind the doors. The tray’s dimensions dictated the size of the tabletop. I stepped the rails back from that, made them 2½ in. deep, a typical size, and chose a table height of 17 in., which would match the usual height for a chair seat.

Despite the fact that there was no original to copy, I still like to call this table a reproduction, because I made it the same way a cabinetmaker would have made it then. The top, for instance, is held on with glue blocks all around. Admittedly, it may split; a lot of tops secured in this manner did, and a lot of them didn’t. As far as I’m concerned, it would be nice if it did split, because it then would look old and would be a better match for the tray itself, which is split in two places. For me, doing the job right means doing it the way it would have been done originally—that’s implicit in the definition of the word “reproduction.” An “adaptation” is something entirely different, where one can certainly try to improve on the old methods and designs. I’m not saying you’ll succeed, but you can try. Just remember that for anything you gain, there is something you can lose.

The drawback in making a tray table this long is that its tray is a bit unwieldy to carry through standard doorways. The table’s size, however, is properly proportioned to go with most period sofas, and I wouldn’t make it too much shorter, because it will lose some of its presence. I also recommend that you retain the lower side on the front of the tray. It gives the table an orientation, thereby adding to its character.

I’d build this table out of mahogany, walnut or cherry, since those were the woods most often used in the 18th century. Even a nice piece of curly maple could be another possibility. There are other options as well. The legs are straight Chippendale, but they could have fretwork knee blocks and other fancy decoration. The stretchers could be more elaborate and pierced, and the rails could be pierced and gadrooned, too. To focus attention on my client’s antique tray, I wanted the emphasis placed on it rather than on the table. I guess you could call the effect “country high style.”

When building the tray, you can make through dovetails or blind ones, whichever you prefer. For the handle cutouts, drill pairs of large holes, cut between them with a fretsaw, then round all the edges. I attached the bottom with counter-

sunk flathead screws, just as the original bottom was attached with handmade ones.

For the table itself, I first cut the leg blanks and the mortises. When laying out the mortises, plan for a shoulder at the top of the rail so that the leg has some strength. The sides also should have shoulders, but you don’t need one at the bottom. After making the mortises, I chamfered the inner corners of the legs. Next, I planed the flutes in the legs with an old wooden fluting plane, but you could make them with a router, drill press, tablesaw or carving tools. I like the plane because it always leaves a slight irregularity. This is very difficult to see straight-on, but if you look down the length of the leg, you will be able to spot a little wander. If the legs are too perfect, they won’t look right, lacking that very subtle 18th-century character. The same goes for all of the table’s rounded edges. It is best to plane them by hand, and where the plane won’t reach, pare them with a chisel.

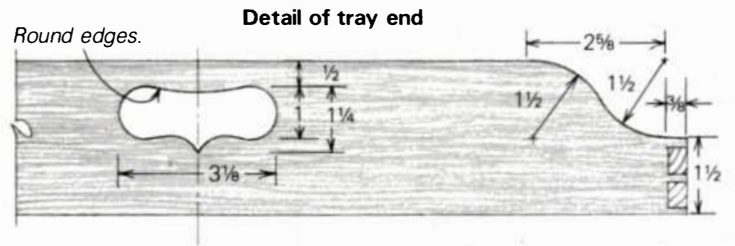
When making the rails, miter the ends of the tenons so that each has the greatest possible purchase to the mortise, but don’t allow the tenons to butt against each other. You have to leave some room so that the leg can shrink without splitting.

To make the joint in the middle of the stretchers, I scribed the lines with a knife, cut inside them with a fine-tooth tenon saw, then pared with a chisel to the final fit. Notice how the overlap is offset to leave plenty of material in one stretcher for strength. Cut the tenon shoulders to match the chamfer angle on the legs. Make the tenons a little bit short at first, to establish the angle, then pare the shoulders back to fit.

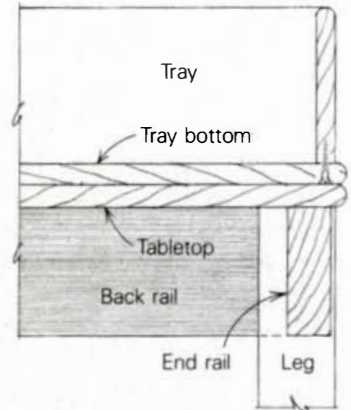
I left the tray its natural color after stripping and cleaning it, and I stained the rest of the table to match by rubbing in stains and dry powders. The finish is shellac, rubbed on with a rag and some linseed oil—the usual French polish. There was a big dark stain in the center of the tray—a typical sign of an old accident, old age, so I left it. Sometimes I’ll add black streaks and marks to pieces, but nothing that would be too noticeable. When I make a reproduction, I expect that my client will be able to set it down in the middle of a room full of 18th-century furniture and have it disappear. This takes a little work. I have a friend who wanted to learn woodworking. So I got him into my shop every Friday from four in the afternoon until about eleven, and we each made identical pie safes. Finally the pieces were done, and it came time to do the antiquing. I handed him a chain and said, “Go to it,” and he handed it right back and said, “You first, I can’t bear it.” So I started beating up my cabinet, then I kicked it across the room until I could hear it crack. I said, “Now we’re getting there . . .” And pretty soon he got the idea. You can use your own judgment, but remember that many old pieces have led a hard life, and look it. □

Gene Landon makes and restores period furniture in Montoursville, Pa. He wrote about tall-case clocks in FWW #26.

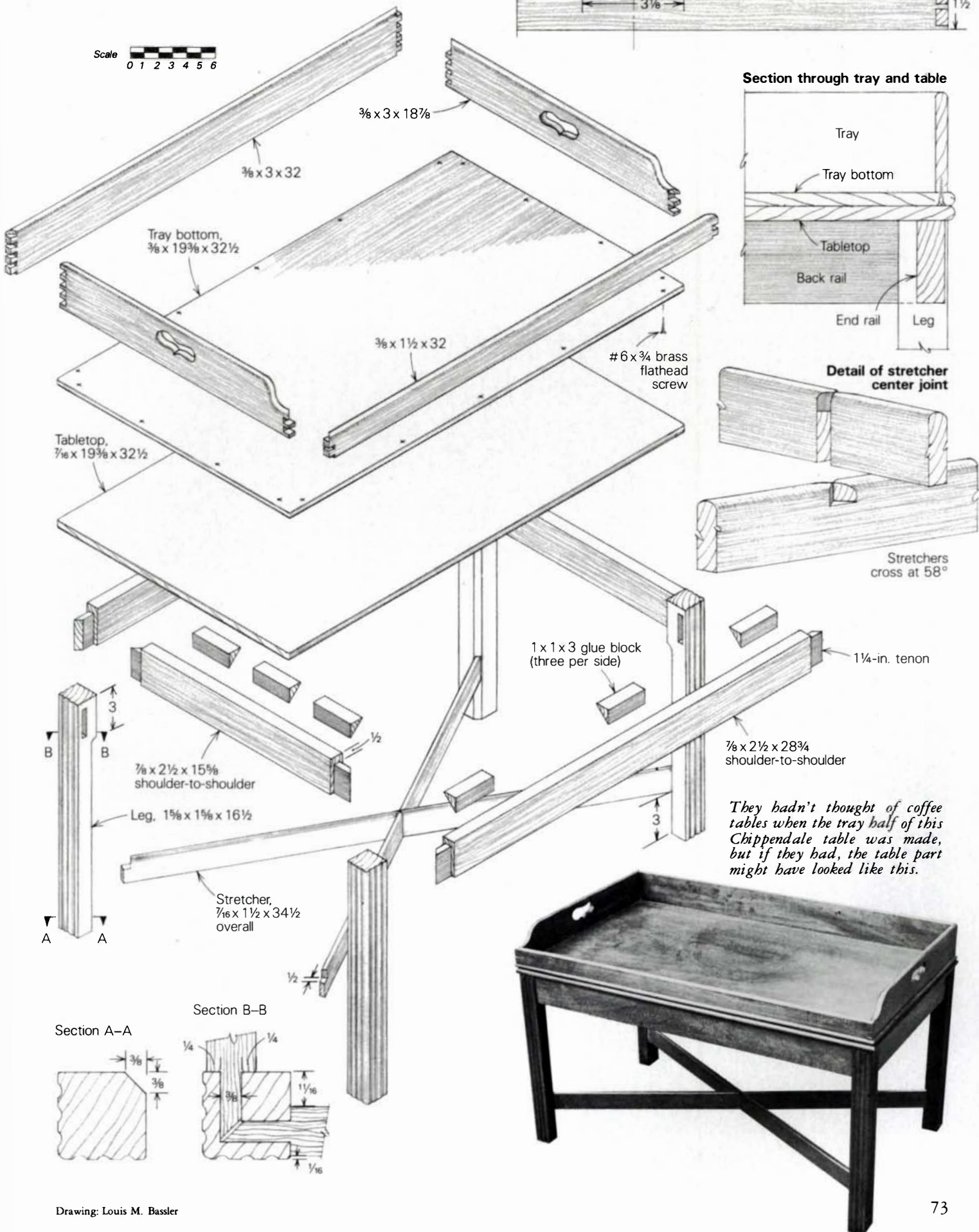
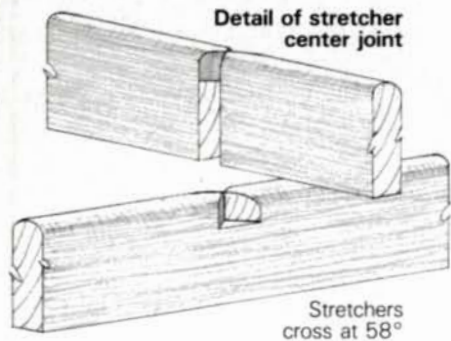
Mahogany table with tray



Section through tray and table



Detail of stretcher center joint



They hadn't thought of coffee tables when the tray half of this Chippendale table was made, but if they had, the table part might have looked like this.



Rethinking the Federal Style

The work of Ruppert Kohlmaier, Sr.

by Robert D. Mussey

For 50 years, Ruppert Kohlmaier, Sr., has graced New Orleans with fine reproductions of furniture in the American Federal (1788-1820) style. The 22 pieces assembled for a retrospective exhibition held at the city's Longue Vue House and Gardens last May showed how Kohlmaier has masterfully interpreted the period's features: delicate, understated designs; a profusion of decorative veneer, marquetry and stringing; reeded legs; and light, sensitive carvings.

A native of Kransberg, Germany, Kohlmaier became a cabinetmaker's apprentice at age 13. He sharpened his skills as a journeyman, working in and around Munich. In 1926, when he was 21, he left Germany for Brazil, and after short stays in Rio de Janeiro and New York, he settled in New Orleans. In his own shop since 1931, Kohlmaier has made thousands of pieces, mostly for a very select local clientele.

Though the show included Queen Anne and Chippendale style work, Boston and Salem Federal styles are clearly Kohlmaier's favorites. He traces his admiration for Federal furniture to restora-



Kohlmaier brilliantly reinterprets a Federal favorite by simplifying the design of its drawer fronts. His sweeping ovals (above) are figured poplar; the original's busy inlay (below) is birch.



Kohlmaier embellished much of his furniture with local exotica—richly figured cypress veneer he cut himself.



Courtesy of the Henry Francis du Pont Winterthur Museum



Exquisitely detailed designs top the Kohlmaier chests, here shown back to back.

tion work he did when he first arrived in this country. Later American furniture, heavier and with relatively crude carvings, didn't square with his own training, which emphasized precise and immaculate detailing. Drawing from a small collection of antique-furniture encyclopedias of the 1920s and a look at the Boston Museum of Fine Arts' Federal collection, he began to develop his own style.

Kohlmaier's work is not the strict reproduction of existing antiques. Rather, he modifies and "improves" basic ideas. His furniture *feels* Federal, but is detailed with his own touch. One bow-front chest of drawers (facing page) illustrates the originality of his interpretations. Each drawer front of the original, which is in the Henry Francis du Pont Winterthur Museum collection, is decorated with three flame birch veneer pan-

els, one oval bordered by two rectangular—perhaps busy, but a typical Federal facade. Kohlmaier's version has simply one large oval per drawer, of a wildly figured poplar crotch veneer. The stringing and banding, which he makes himself, are also reinterpreted from the original dimensions and patterns. While the Winterthur chest has a plain, solid mahogany top, Kohlmaier has inlaid his with an exquisite marquetry panel. The panel features a sunburst pattern of sequence-matched and highly figured cypress veneer, radiating from a stylized nautilus shell, which has been delicately shaded in hot sand. Two such chests put back to back, as in the photo above, amplify the sunburst effect.

This glorious use of cypress veneer is original with Kohlmaier, developed serendipitously in the mid 1930s. He had always liked vividly figured woods, and

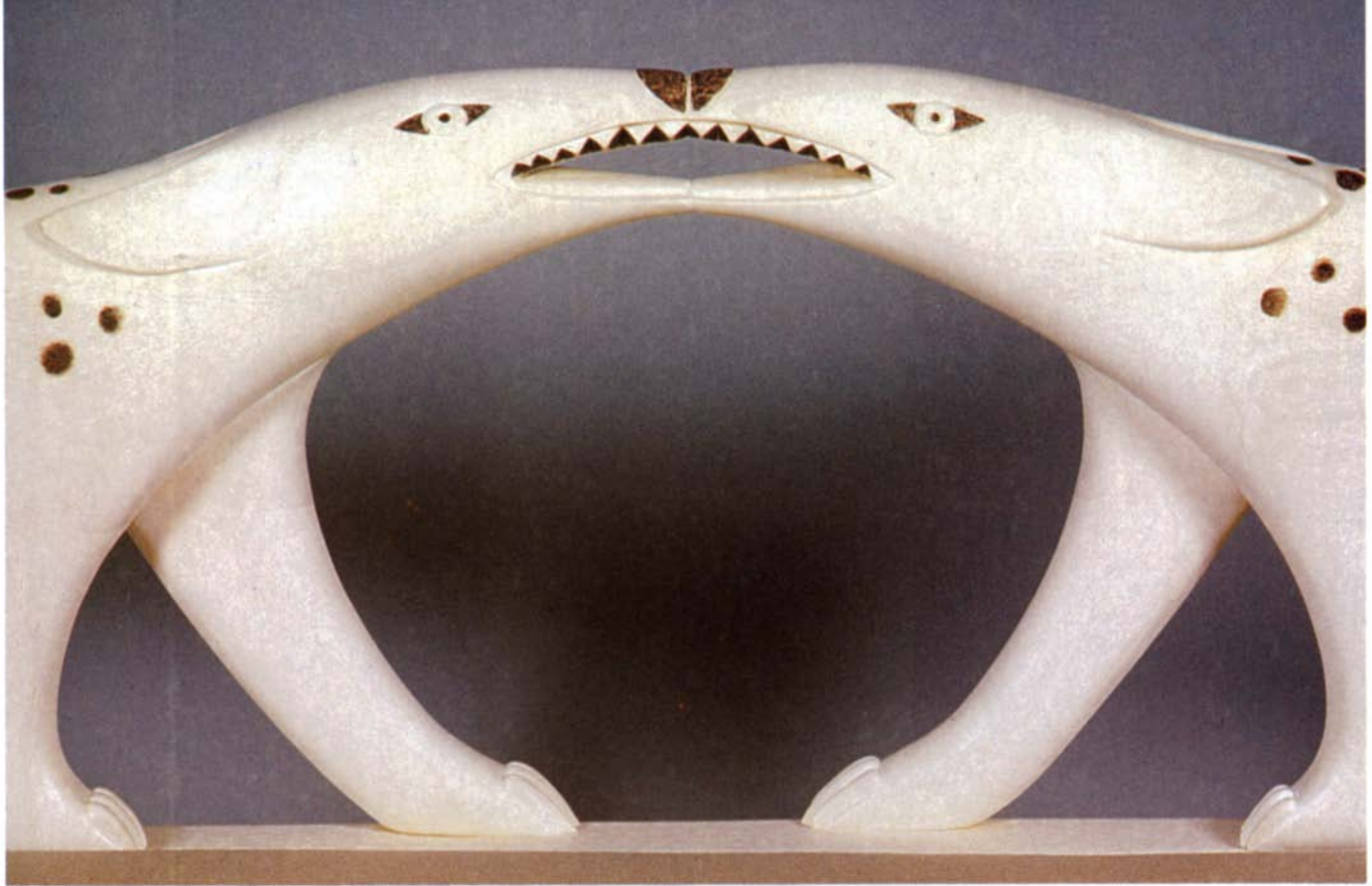
while experimenting with a piece of cypress, used by the local carpenters in building construction, he began ripping veneer and was astounded at the richness the wood revealed. When he later showed one of his principal customers the result, they discussed the possibilities, and it turned out that this local tycoon, who had an interest in a local lumber business, just happened to have 5,000 ft. of cypress he wanted to be rid of. Scores of Kohlmaier's chests, tables and cabinets now feature this exciting veneer. Sadly, this once plentiful wood has been so overcut that it's hard to find today.

Kohlmaier favors French polishes and heavily cut varnishes, and he finishes the inside of a piece almost as meticulously as the outside. He uses very few stains because, he says, "color comes from the air . . . after three or four months, a poor piece has a much finer color." Mahogany, cherry and walnut are his most common primary woods; sugar pine, poplar and fir serve him for secondary parts and for core wood.

Although Kohlmaier has been "retired" for 12 years, he continues to work a regular schedule. During peak years, he employed as many as seven craftsmen in his shop, and in addition he jobbed out carving, such as to master carver Maurice Heullant, with whom he had a 20-year working relationship. Kohlmaier has had apprentices, but found them unwilling to make the commitment and muster the discipline needed to master the craft. Instead, his son, Ruppert, Jr., joined him in the 1950s, and the business has operated under the name Kohlmaier and Kohlmaier ever since. While Ruppert, Jr., practices the same skills as his father, he has specialized in carving and upholstery. The shop continues the long-standing practice of repair and restoration of antique furniture for local museums and collectors.

Purists might be unhappy with Kohlmaier's liberal reinterpretation of supposedly timeless Federal styling and detailing. For me, the compelling integrity of his work refreshes the Federal style. It's unfortunate that all of Kohlmaier's work remains in private collections, but I hope some of it will soon make its way into museums. We would all benefit from sharing such a pure vision. □

Robert Mussey is furniture conservator of the Society for the Preservation of New England Antiquities in Boston.



Detail of leopard couch. Made of bleached mahogany with burnt decoration, the couch is shown in full on p. 80.

Portfolio: Judy Kensley McKie

An innovative designer talks about making a living

I met Todd, my future husband, while we were both studying art at the Rhode Island School of Design in the mid 1960s. Before we were married, Todd moved to a bleak, unfurnished apartment in Cambridge, Mass. Neither of us liked the usual factory furniture, and we couldn't afford better, so I bought some materials cut to size at the local lumberyard and made him a table as a present.

After we were married, I taught school for a year. Then for about five years Todd and I made appliquéd banners and wall hangings. We even made some giant ones for the Woodstock Festival, where, I'm told, people tore them down when it started to rain and made tents out of them.

All the while, I continued to make furniture for us and for friends. My workshop was the basement, and I never had much in the way of tools. I remember that when I made my first chair, from a leather sling and a bunch of standard-size dowels, I had to buy a spade bit to make the holes. My mortiser was a \$10 electric drill. I eyeballed the mortises, and when I put the pieces together, three legs were fine, but the fourth was twisted up about seven inches from the floor. I plugged and redrilled the bad holes, then slid the dowels back and forth until the chair was comfortable. Then I glued the dowels, cut them off and pinned them.

People seemed to like the chair, so I made a scale model and displayed it in a local bank window along with some sample swatches for the seat. I expected a lot of orders, and I did get two phone calls—one person wanted to know what kind of wood it was, the other one asked me if I was hiring any help.

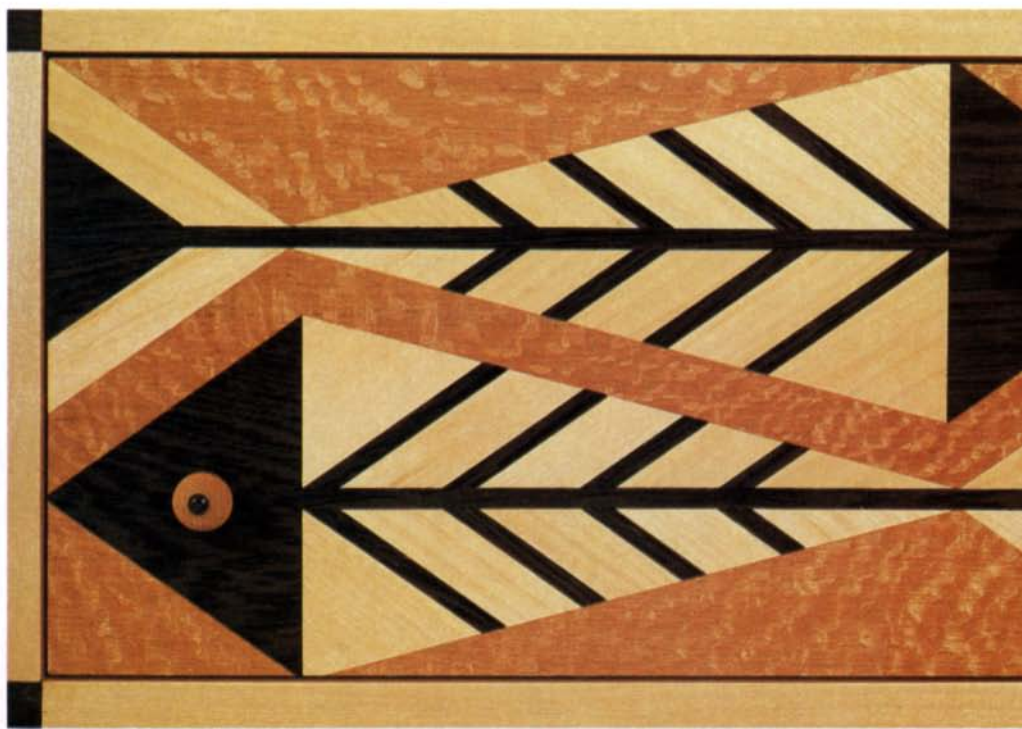
About that time, I discovered the New Hamburger Cabi-

net Works, a co-operative shop whose members were mostly college graduates interested in alternative careers—in making useful things. The co-op allowed outsiders to work there on weekends, and I gradually began working weekdays, too. I was there so much that after a while they all voted that I might as well join.

For about eight years I made very normal furniture and cabinets, but in my spare time I began to make different things for myself. One customer wanted a coatrack, but the sale never materialized, so I turned the piece into a Shaker-style table for my son's room. I decorated the top by cutting a V-groove with a mat knife and filling the groove with dark wood filler, sanded flush so that it looked like inlay. I learned much later that old Pennsylvania-German cabinetmakers had a similar process, with the inlay made of fused sulfur.

I soon made some little boxes with carved, low-relief designs (p. 78). Todd liked them, and for Christmas he gave me a canvas tool roll, empty except for a gift certificate. I asked around about which tools I should buy. Even so, I suppose I still bought a lot of the wrong ones, but it got me started seriously.

My first pieces were not too different from the plywood furniture I'd been making. I'd try to design good proportions into a box, table or chest, then add decoration, using the outline of the furniture like a frame to contain the design. Some early pieces were plainly sculptural, but it has taken me time to learn how to integrate several techniques into the same piece. The leopard couch (above and on p. 80) combines mortise-and-tenon joinery, bent-lamination, carving and sanding to get the shape. It's just basic woodworking, but the



Details from McKie's current work: relief-carved 'frogs' and marquetry fish. Full pieces are shown on p. 80.

bending form was humongous, an adventure. And that was the first time I'd ever bleached mahogany—with lye and peroxide. I had to repeat the process three times before I got good results. What finally worked was doing the job outdoors, in bright sunlight. Then I burned in the spots with a propane torch, another adventure. I'm always feeling my way as I go. I remember making one mahogany table with a deeply carved and pierced apron, a bird and fish design. I'd intended to paint the carving, but when I had the woodworking done, and had gotten a couple of coats of oil on the table, it looked so finished that I stalled for days, afraid I'd ruin all that work. One evening I finally said "this is it," and I colored the apron with artists' oil paint, blending and shading the colors with Watco. The table suddenly lightened up, seemed to rise, and I knew I'd done the right thing. Sometimes it goes the other way: some ideas just don't work, a few pieces never get finished.

The pieces shown on these first two pages are from the show I had last fall at Elements Gallery in New York City, and they were all made in 1983. The frog cabinet shown at left above is a lot like some of my first carved boxes. It's finished in lacquer with a little white pigment in it. My pieces take a long time to make, and I get used to the way they look in raw wood. Sometimes the finish changes the color, yellowing it, and suddenly the piece looks entirely different. A touch of white pigment keeps the wood looking light without hiding its real color. I used the same technique on the leopard couch.

My mother gave me a Shaker-style cabinet a few years ago, and the cabinet at right has similar lines. I had the casework completed before I finally settled on the painted design. I knew I wanted a pattern as strong as the marquetry fish cabinet (above and on p. 80), but I needed something for the show that would take much less time and be less expensive. I made about thirty outline drawings of the cabinet and filled them in with various possibilities before I chose this one.

My designs have always gone through a lot of drawings



Shaker-inspired cabinet is decorated with milk paint.



Marquetry cabinet was built to hold a client's Indian jewelry.



After seven years of making plywood furniture for clients, McKie began incising designs into the tops of small boxes.

and variations before I've been happy with them. My first boxes (above and at left) began with sketches, almost doodles. I like the dog box because it looks fresh and easy, but it took a lot of drawing before I got the head and the tail right. I made eight or ten boxes, and one of my favorites is the bird box. It was the first one where I tried to activate the surface of the wood instead of just carving a shallow pattern. The frog box was inspired by a weekend Todd and I spent in the country—everywhere you looked there were frogs. The ground was alive, the water was alive, everything was new.

The marquetry fish cabinet reminds me of a job that I did back in 1979. I'd once made a plywood sewing center for a customer, and she came back when she needed a case for her collection of Indian jewelry. I eventually convinced her that she wanted something unusual, with a Navajo quality (left). We agreed on a price of \$250—that tells you how much I wanted to break away from Baltic birch.

Todd used to kid me when the phone rang. He'd announce that some museum was on the line, or a major gallery wanting my work. Then one day the Boston Museum *did* call. Todd left me a note, which I of course ignored, but it turned out that they wanted to commission a bench. I made three drawings for them to choose from. I was disappointed when they chose the horse bench, because the drawing didn't really look very good. At \$2,000, however, it was the least expensive of the three, and it fit their budget. The drawing was mostly straight lines, very plain and stiff, without any character. After I got the job, I worked hard on each part of the bench to try to get it to come to life (facing page). The other two bench drawings went into my stack of designs.

The white table shown on the facing page is a variation of some earlier dog-table designs. I made the first one on speculation, and somebody saw it and bought it for \$800. I showed a second version at the American Craft Museum, and there was a lot of interest in it, so I decided I'd better try a small production run. I've made ten in all. The one at the ACM sold for \$2200, and I kept \$1800 of that. The last one sold in a gallery for \$4500, and I'll get about half. If a good gallery is doing its job, that's a fair commission. I brought one of the earlier tables home to store it between shows, and I've gotten very attached to it—I'd like to keep it.

The bird stand (facing page) was another production run. I used to call these tables my homing pigeons because I'd send them away to shows and they'd fly right back. I originally



J.K.M.

McKie's furniture is often sculptural. The one-of-a-kind table, above, developed from a production table whose glass top rested on two straighter, taller dogs with bones in their mouths. The horse bench, below, was commissioned by the Boston Museum of Fine Arts. The bird stand, below right, was an edition of ten.



Museum of Fine Arts, Boston



For a sturdy table, McKie took pains to include long-grain lines running straight from the top to the floor. A thicker-than-usual oval glass top visually counterbalances the massive carvings.



McKie's creatures are abstract and whimsical—she aims to animate her furniture without pinning it down. The organic, unpredictable curves in the pieces shown here were all first fully detailed on paper. The frog cabinet's vines, below, deliberately don't line up, in keeping with the jungle's rampant confusion.



made ten, but now only one is left, in a gallery, priced at \$1800. Drawings weren't a lot of help when it came to planning the production run—the table is a tripod, and there isn't any single front view to draw. So I had to work out the final design at the same time that I made the templates. I haven't found that production runs save much time. Too much hand work has to be done. If you're making a piece that takes a couple of days, then making thirty makes sense. But some of my pieces take me months to make. Making thirty would take me half my life, and I'd feel as if I were standing still. I always want to get on to the next piece.

I've been lucky so far. I've been able to please my customers and still make what I wanted. A few years ago I got a small grant from the National Endowment for the Arts, and then last year I applied again and they gave me \$25,000. The money came at exactly the right time—I'd already contracted for the show at Elements, and feared that I'd have to take out a loan to survive the year.

—Judy Kensley McKie

Whether furniture or art, it's hard and dusty work *by Jim Cummins*

Judy McKie jokingly says that when too many of her pieces are seen too close together, they suggest a menagerie. In the back of her mind, she has a vision of the spacious room each piece will someday occupy. In reality, as far as she knows, people eat breakfast at her breakfast tables and the hall tables gather clutter; daily life becomes part of the designs. In spite of this, or maybe because of it, the furniture is cherished even more.

In her own apartment, with its small, high-ceilinged rooms, McKie's furniture is crowded by living and use. Her kitchen cabinet has a carved pattern on its splashboard, but it's completely obscured by canisters and kitchen gear. You can't get far enough away from her kitchen table to appreciate its carved apron, and the "inlaid" round table in her son's room is covered with books, papers and fishing tackle. Nothing could better prove that this furniture is functional, fashioned by someone who needed furniture. A legless, boxy chest, made some years ago by McKie's father in his garage, stands in the hall—absolutely utilitarian, yet it has personality, a pleasing and tolerant character. McKie recalls that when she was a child, her family spent some time winterizing a vacation cabin. Ducking the chore of hanging insulation, 13-year-old Judy spent days sawing out decorative splats for a railing around the sleeping loft.

When she began making furniture 15 years ago, McKie, like many self-taught woodworkers, often did things the hard way. If she had an idea, she had to discover a way to implement it. It seems to me that this is one of her strengths—she could never accept a job as being "right" simply because she had done it the right way. Instead, each piece had to pass on its own merits.

One evening, after maybe seven years of making birch plywood furniture, McKie made an expansive list of everything she could think of that would change the way wood looked. Carving, painting and staining were obvious, but she didn't exclude the outrageous—crushing, piercing, burning. Once, she loaned her kitchen table to a chain-smoking friend and it came back spotted with cigarette burns. The intense black centers, with their hazy outlines, went on her list of techniques, and later became the spots on the leopard couch.

Her designs remind some people of pre-Columbian art, others of Egyptian work. Animal imagery has always had a powerful, totemic impact on furniture-makers. One observer calls her work a



McKie with a breakfast-table template.

generalized "equatorial art," another thinks she touches things that might have haunted a Shaker's subconscious. The designs are, despite reminding everyone of something else, uniquely her own. Her creatures, instead of representing society's domination over nature, are a reaching out to nature, a participation in a wild riot of life.

Sometimes her goals are very basic: in her bedroom, squeezed between radiator and doorway, stands one of the homeliest pieces of furniture I've ever seen—pine, brown, about a foot wide and seven long, featureless except for a saber-sawn curve between the feet on the side. I asked what sort of proportions she'd been thinking about. "Proportions? It has the proportions that give me the biggest laundry hamper between the radiator and the door, that's all... no proportions." In contrast, against one kitchen wall, there's an unashamedly elegant dog table, with nothing on it but a pair of brass candlesticks and a fruitbowl. In a home where even the windowsills are crowded, it's something of an enigma. "Well, that's what that kind of table is *for*," McKie says, "that's its function. It belongs to the whole line of fancy hall tables and sideboards, display pieces. You can't eat at it, you can't use it to keep a lot of things on, but there's always been a tradition for pieces like this. You might not guess it, but I think of my work as classical furniture. This is a classical hall table."

McKie's workspace is part of a warehouse-like building that's a full city-block deep, broken up into good-sized individual areas with a communal lum-

ber pile and centrally located heavy machinery. There's a spray room, a room for storing finished pieces, and a general air of work being done. The place is more commercial than arty, with piles of kitchen cabinets growing in one spot, architectural components in another.

In the shop, McKie works steadily and hard. In the month before her show at Elements, she is finishing up four major pieces at once: lacquering, painting, carving, deciding on fabrics and installing hardware all at the same time. Yet every tool is where it should be, there's no litter of scraps on the floor. When she goes to mix paint, McKie scoops up the solvent, dry colors, stir-stick and mixing cup all in one trip, and her mixing cup turns out to be big enough for the job. To show me an old template, she goes straight to a dark corner and pulls it out. All its parts are labeled, and prudently taped together. In everything, she's thrifty with effort—she's been at this for a long time.

Making a living from her work has been, so far, very hard. Entering the big-money art world, becoming an art star, has never been McKie's intention. She wants to make things that affect her the same way as certain things she's seen and remembered: objects made with thought and love, showing the concentration and involvement of the maker, utilitarian things that go beyond mere utility, sculptural things that will last in the mind. Yet she still must make a living. If she is to clear \$10 per hour for her work, the marquetry fish chest will have to sell, including the gallery's share, for maybe \$14,000. That allows nothing for all the time spent on all those pieces, stillborn, that haunt the corners of her shop. She has spent a year of her life, and exhausted a \$25,000 grant, making seven pieces of furniture.

The show at Elements was a success, and will stake her for another year. But McKie is concerned that a gallery's markup will put her work beyond the reach of the clients who have so far been her main support—her friends, people who love her work as furniture rather than as an investment. Yet, with a good gallery behind her, doing its job, she would never again have to bargain for a fair price, never have to scale down an idea to fit a budget. She always comes out on the short end in such transactions, because the furniture she makes is as much hers forever as it is the person's who buys it. Whatever the piece, and whatever the price, Judy McKie digs down deep and makes it work. □

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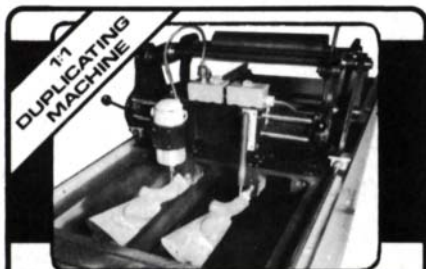
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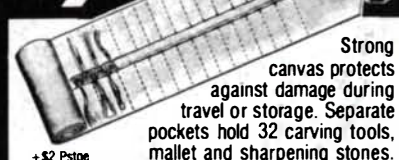
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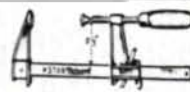
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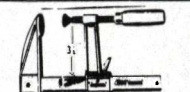
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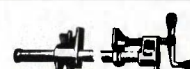
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80x	1.85	11.10	50.75	80x	2.20	12.90	56.40
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36x	2.10	12.30	56.05	40x	2.35	13.90	63.15
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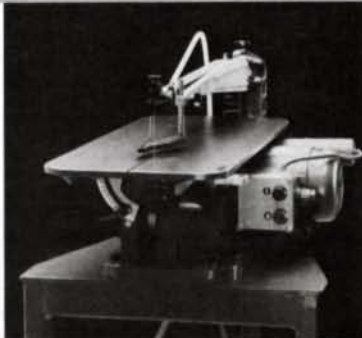
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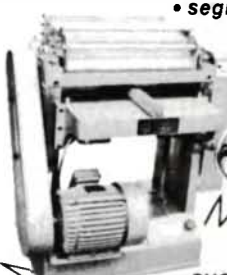
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Events

Listings are free, but restricted to happenings of direct interest to woodworkers. Our March/April issue will list events falling between February 15 and May 15; deadline January 15. Our May/June issue will list events between April 15 and July 15; deadline March 15.

ARIZONA: Fair—Festival 15, Mar. 30–Apr. 1. Scottsdale Center for the Arts, 7383 Scottsdale Mall, Scottsdale, 85251. (602) 994-2301.

ARKANSAS: Exhibit and sale—Toys, until Jan. 2. Arkansas Art Center, Little Rock. (501) 372-4000.

CALIFORNIA: Juried fair—Crafts, Sept. 19–23. Slides by Mar. 10. Showplace Square/Tradeshow Center, San Francisco. American Craft Enterprises, Box 10, New Paltz, N.Y. 12561. (914) 255-0039. Show—Wood, Feb. 9–12, San Mateo Fairgrounds. Working with Wood Show, 2156 The Alameda, Suite C, San Jose, 95126. (408) 249-0190.

Juried exhibit—Woodworker West, Aug. 17–19. Deadline Mar. 27. Craft Market America, Box 30, Sugarloaf, N.Y. 10981. (914) 469-2249.

Workshops/seminars/lectures/exhibits—Berkeley: Simple musical instruments, Saturdays, Jan. 7–28; rocking horse carving, Anton Lognell, Saturdays, Jan. 7–Feb. 11; African carving, Geoffrey Nwogu, Jan. 13, 15; untraditional furnituremaker, Garry Bennett, Jan. 26; lapstrake sailboat, Simon Watts, Jan. 30–Feb. 3, Feb. 6–10; Grew-Sheridan chairmaking, Feb. 18–19; Shaker boxes, John Kassay, Mondays, Feb. 27–Mar. 12; basic tools, Simon Watts, Mar. 24. Los Angeles: Japanese tools, Fridays, Jan. 6–27; day with Sam Maloof, Jan. 14; bent lamination, Martha Rising, Wednesdays, Jan. 11–Feb. 1; lapstrake sailboat, Simon Watts, Feb. 20–24, Feb. 27–Mar. 2. San Diego: Comprehensive cabinetmaking, Feb. 25–Mar. 31; hands-on boatbuilding, three weeks in Feb.; bent lamination, Martha Rising, Feb. 25. The Cutting Edge, Los Angeles: (213) 390-9723; San Diego: (619) 695-3990; Berkeley: (415) 548-6011; Phoenix: (602) 997-8665.

COLORADO: Juried exhibit—Crafts, \$1500 prizes, Aug. 25–26. Deadline Mar. 1. Art of Crafts, Box 38233, Denver, 80238. (303) 771-0042/4544.

GEORGIA: Workshops—Woodworking, design, Ian Kirby, Apr. 30–June 17. Deadline Mar. 30. Professional scholarships. Kirby Studios, 811 Atlanta Rd., Cumming, 30130. (404) 889-9823. Exhibit—More than 100 pieces of 19th-century handmade furniture, Dec–May. Atlanta Historical Society, McElreath Hall, 3101 Andrews Drive NW, Atlanta. (404) 261-1837.

Seminar—Woodworking skills and techniques, Tage Frid, Feb. 24–26. Highland Hardware, 1034 N. Highland Ave., Atlanta, 30306. (404) 872-4466.

HAWAII: Seminar—Torsion boxes, veneering and furnituremaking, Ian Kirby, Jan. 14–15, 21–22. Norm Boyajian, Hickam Arts and Crafts, 15 ABW/SSRC Hickam AFB, 96853. (808) 449-1582/1568.

INDIANA: Course—Hardwood lumber grading, Feb. 13–17, Purdue University. Daniel Cassens, Dept. Forestry, Purdue University, West Lafayette, 47907. (317) 494-3644/7231. Meeting—Indiana Hardwood Lumber Association annual meeting, Feb. 2–3, Marriott Inn East, Indianapolis. Daniel Cassens, IHLA, 600 N. 400 West Lafayette, 47907. (317) 494-3644.

LOUISIANA: Seminars—Chair design and construction, woodshop economics, Thomas Moser, Feb. 11–12, Louisiana State University, Baton Rouge. Louisiana Crafts Council, 7214 St. Charles Ave. #922, New Orleans, 70118.

Crafts exhibit—Louisiana crafts competition, Feb. 26–Mar. 16. Clark Hall Art Gallery, Southeastern Louisiana Univ., Hammond.

Festival—“Mardi Gras” juried craft exhibit and sale, Mar. 8–11, Hyatt Regency, New Orleans.

Juried shows—Crafts, Apr. 14–15, Aug. 3–5, Riverside Centreplex, Baton Rouge. Slides by Jan. 30, Apr. 30. Jennifer Martin, Craftworks, Rt. 4, Box 688, Gonzales, 70737.

MARYLAND: Craft fair—Baltimore Convention Ctr. Trade: Feb. 15–16; public: Feb. 17–19. American Craft Enterprises, Inc., Box 10, New Paltz, N.Y. 12561. (914) 255-0039.

Craft fairs—For information on entering seven spring and fall craft fairs at locations in Maryland and Virginia, contact Sugarloaf Mountain Works, Inc., Ijamsville, 21754. (301) 831-9191.

MASSACHUSETTS: Craft fair—Formerly “Rhinebeck,” Eastern States Exposition Center, West Springfield. Trade: June 19–20; public: June 22–24. Slides by Jan. 12. American Craft Enterprises, Inc., Box 10, New Paltz, N.Y. 12561. (914) 255-0039. Seminar—Antiques identification and care, generally held on the last Thursday of each month. Contact Frank G. White, Old Sturbridge Village, Sturbridge, 01566. (617) 347-3362.

Lectures—Lute Morphology as Structural Design, Joel van Lennep, Feb. 15; Work in Wood, Toshio Odate, Mar. 14. Morse Auditorium B1. Contact Program in Artisanry, Boston University, 620 Commonwealth Ave., Boston, 02215. (617) 353-2022.

Juried fair—Heart of Springfield Craft Festival, June 22–24. To enter, contact Craft Market America, Box 30, Sugarloaf, N.Y. 10981. (914) 469-2249.

Exhibit/workshop/juried fair—Crafts from Canada, Jan. 13–Feb. 19. Marquetry workshop, Silas Kopf and Gary Wright, Mar. 3–4. Annual craft fair, May 18–20, deadline Feb. 15. Worcester Craft Center, 25 Sagamore Rd., Worcester, 01605.

Juried shows—Furniture, Interiors I, II, III, Feb.–June. Slides by Mar. 31. Society of Arts & Crafts, 175 Newbury St., Boston, 02116. (617) 266-1810.

MINNESOTA: Fair—12th Annual Crafts Festival, June 23–24. College of St. Catherine, St. Paul. Deadline Mar. 1. Contact MCC-Festival, 528 Hennepin Ave., Rm. 210, Minneapolis, 55403.

MISSOURI: Classes—Veneer repair, Jan., Apr.; glazing and graining, Feb.; basic furniture refinishing and conservation, Mar. SASE to The Finishing School, 1607 N. 2nd St., St. Charles, 63301.

Seminar—Fundamentals of woodworking, Ian Kirby, Feb. 25–26, St. Louis. Contact Fine Tool & Wood Store, 7923 North May Ave., Oklahoma City, Okla. 73120. (800) 255-9800, (405) 842-6828.

NEW HAMPSHIRE: Juried show—New Hampshire craftspeople, Mar. 17–Apr. 26. Slides by Feb. 20. Manchester Institute of Arts and Sciences, 148 Consora St., Manchester, 03104. (603) 623-0313.

NEW JERSEY: Juried show—Westfield Craft Market, Oct. 26–28. New Jersey State Armory, Westfield. Deadline Apr. 27. Craft Market America, Box 30, Sugarloaf, N.Y. 10981. (914) 469-2249.

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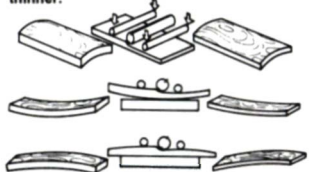
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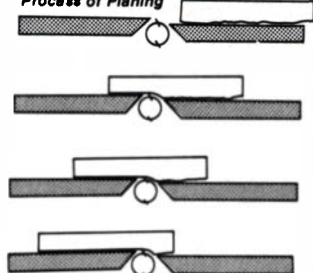
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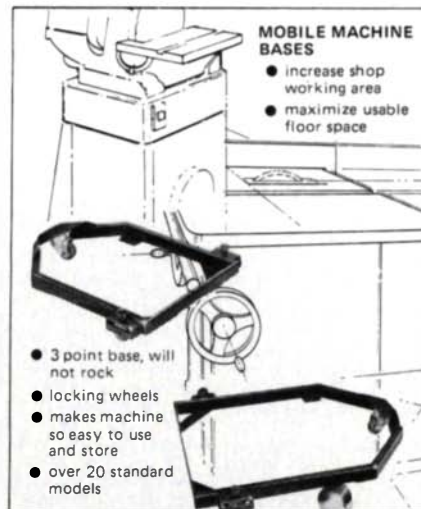
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Juried show—New Jersey woodworkers, Mar. 11–Apr. 1, Bloomfield Cultural Ctr. Deadline Feb. 15. Guild of Designer-Woodworkers, 79 Overlook Rd., Cedar Grove, 07009. (201) 599-0177, 262-2766.

NEW MEXICO: Exhibit—New Mexico furniture, 1600-1900, through mid-Apr. New Mexico Museum of International Folk Art, Santa Fe.

NEW YORK: Demonstrations—Professional woodworking techniques, Mr. Sawdust, Jan. 19–22. Sunrise Mall, Massapequa, L.I.
Exhibition—Small Works National '83, through Dec. 30, 1983. Zane Gallery, 100-I Alexander St., Rochester, 14620. (716) 232-7578.
Juried exposition—"Rhinebeck '84." June 19–24. Dutchess County Fairgrounds, Rhinebeck. Apply by Jan. 15. MII Productions, Inc., Box 93, Vernon, Conn. 06066. (203) 745-5071, 871-7914.
Courses—Marquetry, veneering, restoration, finishing, chair caning. Constantine's, 2050 Eastchester Rd., Bronx, 10461. (212) 792-1600.
Courses—Woodworking, Maurice Fraser, Jan. 21–May 12. Craft Students League, 610 Lexington Ave. & 53rd St., New York, 10022. (212) 755-2700.
Workshop—Japanese tools, Robert Meadow, Mar. 10–11, Apr. 7–8, May 5–6. The Luthierie, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207.

OKLAHOMA: Seminars—Kitchen cabinets, Jere Cary, Feb. 17–19; joinery, Ian Kirby, Mar. 9–11. Fine Tool & Wood Store, 7923 N. May Ave., Oklahoma City, 73120. (405) 842-6828, (800) 255-9800.

OREGON: Numerous events throughout the year at Western Forestry Center, 4033 SW Canyon Rd., Portland, 97221. Linda Smeltzer, (503) 228-1367.

PENNSYLVANIA: Juried exhibit—The Woodworker, Sept. 21–23. Deadline Apr. 27. Philadelphia Armory. Contact Craft Market America, Box 30, Sugarloaf, N.Y. 10981. (914) 469-2249.
Symposium—Wildfowl art and carving with Muelh-matt, Briddell, Walker, Forehand, Arbogast, Feb. 4. Workshop series, Jan. 31, Feb. 7, 14, 21. Contact Jon Alley, Fine Arts-Woodworking, BCCC, Newtown, 18940. (215) 968-8431.
Juried show—Pennsylvania crafts, Mar. 3–25. Deadline early Feb. Market House Craft Center,

Queen & Vine Sts., Lancaster. Contact Kai Pedersen, 2741 Lititz Pike, Neffsville, 17601. (717) 687-7102 days, 569-8442 evenings.

RHODE ISLAND: Show—Bentwood and Lamination, Jan. 13–Apr. 29. Rhode Island School of Design Museum, 224 Benefit St., Providence. For hours, call (401) 331-3511, ext. 131.

TENNESSEE: Workshops—Carving, Robert Lockhart, Mar. 12–16; turning, Stephen Hogbin, Mar. 26–30. Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, 37738. (615) 436-5860.
Juried fair—West Town Mall, Knoxville, Apr. 13–15. Deadline Feb. 8. Dogwood Crafts Fair, 203 Fort Hill Bldg., Knoxville, 37915. (615) 637-4561.

WEST VIRGINIA: Juried exhibition—June 24–Aug. 25, Stifel Fine Arts Center. Open to craftspeople in Ohio, W.Va. or Pa. Deadline Apr. 2. Write Woodworking 1984, Stifel Fine Arts Center, 1330 National Rd., Wheeling, 26003.

Workshops—Marquetry, inlay, joinery, sculpture, turning. Winter, spring sessions. Tim Pyles, Crafts Center, Cedar Lakes Conference Ctr., Ripley, 25271.

WISCONSIN: Seminars/workshops—Hand tools and woodworking techniques, Bill Stankus, through Jan.; tablesaw joinery, Mark Duginske, Jan. 14. Contact The Woodworking Center, 714 E. Standish Pl., Milwaukee, 53217. (414) 351-6573.

BRITISH COLUMBIA: Exhibition—"Beyond the Bowl: Contemporary Turned Vessels in Wood," through Jan. 29. Cartwright Street Gallery, 1411 Cartwright St., Vancouver, V6H 3R7.

MANITOBA: Crafts show—Winnipeg Gallery, Mar. 4–Apr. 15. Manitoba Crafts Council, 202-89 Princess St., Winnipeg, R3B 2X5.

ONTARIO: Exhibit—Toys, games, dollhouses, through Jan. 9. Craft Gallery, Toronto. Contact Marie Show-Rimington, Craft Gallery, 346 Dundas St. West, Toronto, M5T 1G5. (416) 977-3551.

Show—Woodworking World Toronto, Feb. 3–5. Constellation Hotel, Toronto. For information, contact Convention Designs, Inc., Box 485, Plymouth, N.H. 03264. (603) 536-3768.

Connections

In Connections we'll publish membership calls for guilds, queries from authors, and appeals from readers who want to share special interests.

East Tennessee Woodworkers Guild: New membership. Contact Grover Floyd, (615) 690-2973.

Woodworking club: Area woodworking club forming, southern Michigan, northern Ohio. Rudolph Kaminski, 4045 Lexington, Trenton, Mich. 48183.

Woodworkers tour: Tour Japan, Apr. 17–May 4. Show work, attend workshops. Deadline Jan. 15. Santa Cruz Woodworkers Assoc., 406 Dakota Ave., Apt. D, Santa Cruz, Calif. 95060. (408) 423-0351.

Tour England: Feb. 11–19. Contact Russ Zimmerman, (802) 387-4337, evenings.

Co-operative: Furniture manufacturers are forming a co-operative to develop standard product tests. Contact Dan Cassens, Furniture Research Center, Dept. Forestry, Purdue University, W. Lafayette, Ind. 47907. (317) 494-3644.

Tampa Woodworkers meet one evening a month at Blake Jr. High woodshop. Contact Gordon Palmer, 3103 Lawn Ave., Tampa, Fla. 33611.

Mid-Iowa Woodworkers meet monthly. Contact R. Toppenberg, 713 E. 5th St. N., Newton, Iowa 50208.

Grants: Research or publication projects on Early American industries. Deadline Mar. 15. Contact Early American Industries Assoc., c/o Winterthur Museum, Winterthur, Del. 19735.

Make Christmas toys for needy children. Knox County Home Workshop. Contact Arthur Dameron, 1248 Becher Ave., Galesburg, Ill. 61401.

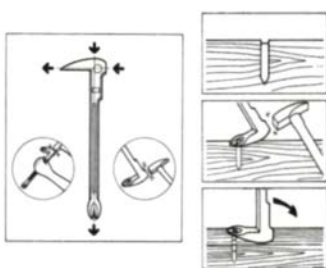
New guild forming in southern Oregon/northern California. Contact The Woodwright's Gallery, Box 7571, Klamath Falls, Ore. 97602.

Assistantships for workshops in Mar. Deadline Jan. 20. Arrowmont School, Box 567, Gatlinburg, Tenn. 37738. (615) 436-5860.

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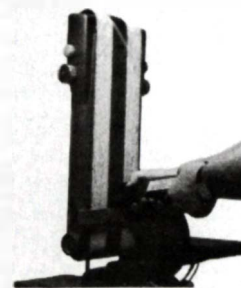
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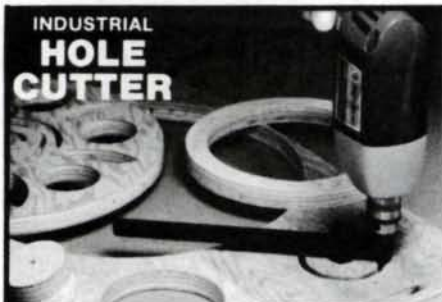
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WS72M 14"	Gen. Purpose	54	ATB	142.72	71.36
WS81M 10"	Gen. Purpose	40	TCG	90.20	45.10
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*ATB = Alternate Top Bevel

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I have to admit that my friend turned out to be more right than wrong. I probably should have borrowed the money from the bank, bought the tools and written the interest off my taxes, like a sensible businessman. But old habits die hard, and I still suspect that you can turn a woodworking hobby into a business on the cheap, a view shared by many, I'll bet. Were I to do it again, I'd set up my hobby-cum-commercial woodshop a little differently.

First, I'd decide not to decide on what tools I really needed. I've heard the arguments about what machines are indispensable. I've also poked around enough shops to realize that virtually any combination of two or three stationary power tools can be made to do just about anything. So the question is not so much what tools do I want, but what tools are available when I've got the money. I'd make my purchases over a period of months and, depending on what I found first, I'd look for these machines: a tablesaw, a jointer, a thickness planer, a bandsaw and a radial-arm saw.

I'd start looking not at my local Powermatic dealer, but in the machinery and tools section of the classified ads. Better still is your local all-classified shoppers' news. Wherever I've lived, I've found that weekly perusal always turns up a good buy or two. If I were in the market for my must-have list of machines, I'd follow the paper daily and get the shoppers' news hot off the press.

For a tablesaw, I'd look for a Rockwell Unisaw or a Powermatic 66. These don't often show up used, but when they do, they sell fast, so don't dally. I'd like to say I wouldn't settle for a Sears Best or any other Harry Homeowner model, but I recently saw an ad offering a Sears 10-in. saw for \$45. At that price, I'd buy it just to have as a second saw, permanently set up for some special operation, like dadoing.

Sometimes you can come across a real



Portly warrior hides drawers of red tape

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26 in. across and 20 in. deep. About 15,000 tiles of various woods, selected for their colors, are glued to the skin. Each tile is grooved and held in place with an epoxy paste. The tie is walnut, which Speaker says is a tribute to all the walnut-paneled offices where business is conducted. He estimates that construction took more than 2500 hours. Speaker is the same artist who made the Rhinodesk shown on the back cover of *FWW* #18.

gem. Once I spotted a bandsaw advertised for \$100. When I phoned to ask what kind it was, the guy said he would go out to the garage and have a look. It turned out to be a huge cast-iron Tannewitz wired to run on residential volts. The guy had just bought the house, the saw had come with it, but he wanted the monster out of his garage. Unfortunately, I had no way to move that machine nor a place to put it, so I let it pass.

The ads often turn up this sort of old industrial workhorse. Thousands of them have been smelted into Toyotas, but many still molder in barns, basements and garages. Running an ad in

the classifieds' "wanted" section can often pry them loose. For \$10 or so, you can ask the paper's thousands of readers to go look for whatever tool you're after. Once I ran an open-ended ad for a tablesaw, and in two weeks I must have been offered 40 lame dogs. I was about to give up when a man called asking if I'd like to buy a drill press. He had an old Walker-Turner bench model, which I bought for \$120 and still have. No steal, but a good tool at a fair price. The man's father had died the year before, leaving behind a shop full of mostly metalworking tools. The son had meant to sell them off, but had just never gotten around to it. My

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- Table Tilting 10\"/>
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- Height (floor to table) 43\"/>
- Height (table to guide) 6\"/>
- Blade to Frame 14\"/>
- Floor Space 19\"/>

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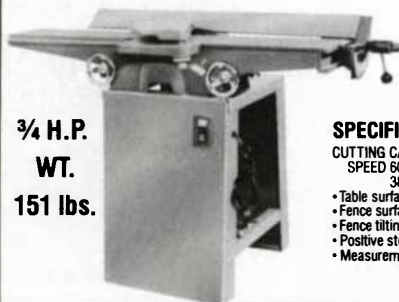
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\$495.00

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6\"/>

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SPECIFICATIONS

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- 3800 RPM 11,400 CUTS/MINUTE.
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There are other good sources of used tools. Local millwork shops and other woodworking businesses sometimes have serviceable machines stuck off in a shed somewhere, needing only bearings, a switch or perhaps a motor. New-tool dealers shouldn't be ruled out either. Many take trade-ins which they then recondition and sell. But sometimes the profit on a rebuild job is so small that they would just as soon not bother, instead selling the equipment in "as is" condition. A weekly call to such a dealer will keep you abreast of what's available. Just be sure you're up to performing the needed repairs.

The trick in extracting useful stuff from the used market is not so much in knowing what you want, but in knowing what you can use. A must-have list is fine, but if you're looking for a table-saw and run across a double-end tenoner for \$200, and you have a place to put it, why not buy it? Maybe you can't use it now, but it could prove indispensable later. And if it turns into a half-ton white elephant, you can always put an ad in the classifieds.

—Paul Bertorelli

Sure does pay to shop around

Tool merchants often sell exactly the same items as their competitors, so you might not expect much variation in retail prices. But there is. Window-shopping through last fall's crop of tool catalogs, we were amused to find the highest prices not at some fancy woodworking specialist, but at Sears, which just last year added a line of cabinet-making tools to its big wish-book.

The Primus 24-in. jointer plane with wooden body, metal blade mechanism and *lignum vitae* sole, is made in West Germany and enters the U.S. market at a wholesale price of about \$87. We noted retail prices ranging from a low of \$112.65 (Garrett Wade) all the way up to \$159.99 at Sears. The Stanley #92 rabbet plane, wholesale \$33, sells from \$46 to \$79.99, the high price again at Sears.

Equivalent price swings prevail in the stationary and portable power tool market, particularly for machines imported from Japan. In our test of jointer-planer combination machines (*FWW* #43), we reported a price of \$1350 for the Makita 2030 and \$1500 for the Hitachi F-1000A, discount figures that are well below the \$1980 and \$1999 manufacturers' suggested retail. A skim of current advertisements turns up a whole range of prices below manufacturers' list. None of the dealers consistently underprices its competition on every machine, however, so when you're ready to buy, it'll pay to shop around. But before you buy, find out how much extra you'll have to pay for shipping and handling. The bargain might not, in the end, be such a steal.

—Ed.



Albuquerque apricot

"Hotei," a 12½-in. apricot-and-walnut carving by Charles Jaeger, was a featured work in the Woodworks '83 show sponsored by the Albuquerque, N.Mex., United Artists organization. The December show included furniture, crafts, sculpture, carving and jewelry by 20 Albuquerque-area woodworkers.

Adventure: The hard way to learn

As a boy, I learned the rudiments of woodworking the hard way—by necessity. In 1923, I was 14 and my brothers were 12 and 10. We lived in the country outside of Boston. My father, a busy doctor, was normally a mild man, but when angered he'd put the fear of God into us.

My initiation into woodworking occurred on a beautiful weekend in September. My father and mother left Saturday morning for an overnight trip. We boys began casting about for some enjoyable mischief.

The pear trees on our property were laden with fruit, so we decided to make pear juice, even though most of the pears were as hard as rocks. My father's

most prized possession was a grape press he used to make wine. Just the thing. We dumped the pears into the vat and began to turn the threaded steel shaft that pressed the cover down. It was tough going. Not a drop of juice was coming out. We needed leverage. We stuck a long crowbar into the eye of the shaft, leaned on it, and slowly it began to move. Suddenly there was a crack like a pistol shot as the wood crossmember holding the shaft buckled upward.

We silently looked at each other, imagining our father's razor strop hitting our bare backsides. We were going to have to make a new crossmember, and hope nobody would notice.

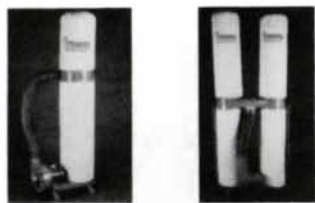
In the cellar near the wine press was an old workbench with a few basic tools: an ax, saw, hammer, plane, bit

and brace, and chisel. I suppose I knew in general how to use those tools from having watched my father, but none of us boys had ever tackled a project like this. We found an oak log in the firewood pile and began muscling it down. As the eldest, I had not only to plan the work, but also to do the lion's share of the labor. Bit by bit we whittled that log down to size. Our arms ached and our hands were covered with blisters. But we dared not stop. The mortises in the uprights, fortunately, were undamaged. With the last of our strength, we cut tenons on the new crossmember. It was late on Saturday when we fell into bed, exhausted.

Sunday morning we were back at work, trying to bore a vertical hole in the new crossmember to hold the

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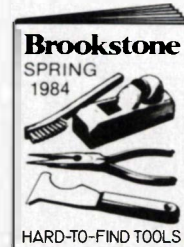
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threaded steel insert for the shaft. I devised a rough jig to keep the brace and bit approximately vertical while we struggled to turn it. The bit inscribed a neat circle, then stalled in the tough oak. I bent over the brace with my youngest brother balanced on my back for additional weight while my other brother heaved the handle around. Finally the bit broke through. It was already noon and we felt as if we were in a race for our lives. We mortised the steel insert into the underside of the new piece. But before we could test our work, we heard our parents arriving home. We rubbed a few handfuls of dust into the new wood, ran out into the backyard and pretended to be playing.

At supper, my mother asked about the blistered hands. I muttered something about mowing the lawn. My father said it looked as if I had had a long session with some hand tools. "In fact," he continued, "I'm thinking of recommending you to the man who made my wine press. I think you'd make an admirable addition to his woodworking crew." He paused. I felt sheepish. "I wouldn't have known that anything had happened if you hadn't left the broken piece lying on the cellar floor. But you did an excellent repair job, and any punishment I could administer would be insignificant compared what you've already inflicted on yourself."

And that was the end of it. Except sometimes I wonder why, with that as my first experience, I still enjoy woodworking. I suppose it's because all my woodworking since has been voluntary—not compulsory. —Richard Friedman

Trolls under plywood

Lumberyards are dangerous and hostile places, inhabited by suspicious men who wear bib overalls and spit a lot and duck behind piles of boards as soon as they see a homeowner coming. These men have lived in a lumberyard since childhood. At night, they just pull up sheets of plywood over themselves and go to sleep. They don't like intruders, especially woodworkers who are buying wood for some idiot home project, and they will try any crafty ruse to drive you away. For example, all their wood measurements are lies. A so-called two-by-four is *not* two anythings by four anythings, and so on. There is no way you can possibly know what size of wood you're getting.

Another common trick among the lumbermen is to call things by silly names, such as "soffit." They dream up these names at night while they're lying under their sheets of plywood, and they use them to make you feel stupid.

You: "Hi. I'd like two eight-foot two-by-fours, please."

Lumberman: "What are they for?"

You: "What?"

Lumberman: "Are they for joists? Headers? Beams? Rafters? Sills? Footers? Framing? Tenons? Partitions? Templates? Easements? Debentures? Just what is it you want, mister?"

You: "Uh, well, ah, maybe I better go home and check my measurements."

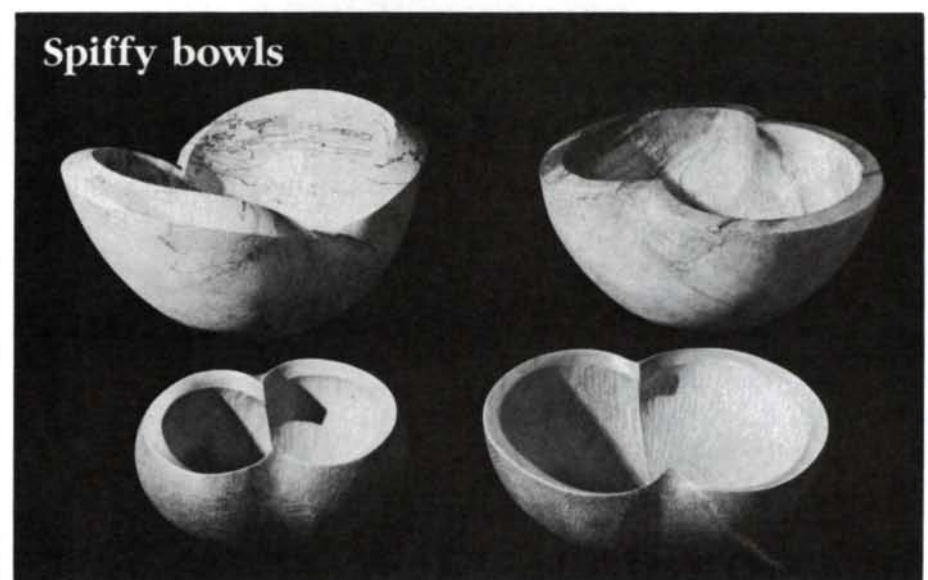
Reprinted from The Taming of the Screw, ©1983 by Dave Barry, with permission of Rodale Press, Inc., Emmaus, Pa.

More about quality and Japanese tools

I found Henry Lanz's comments in *FWW* #42, p. 100, on the confusion over the quality of Japanese tools interesting because the confusion for once is coming from the salesman's side of the display case. This brings up a number of significant points about Japanese tools and the current interest in them.

Because I have studied in Japan, many people ask me whether Japanese tools are any good. Besides checking the tools for obvious signs of poor quality, Lanz is correct: there really is no way to assess tools without actually using them, unless you know the specifics about where and by whom a tool was made. When I purchased my own tools in Japan, I was given the same answer. Thus, all I can say about buying Japanese tools in the United States is, buy from a reputable dealer who knows about the tools his company sells. If a dealer is reputable and knowledgeable, then generally the higher the price, the higher the quality. I realize that this is definitely not a "pro-consumer" approach to buying tools, but it is the best we can do right now.

This places a substantial responsibility on the shoulders of people like Henry Lanz who are importing these tools for the rest of us. In the Bay Area, where I live, a number of tool dealers have taken this responsibility seriously and they do carry a fine range of quality tools. I have also found that, in some cases, the dealer can return damaged or



Welsh artisan David Griffith combines formal training in fine arts and an interest in sculpture to produce handcarved wooden bowls. The four pictured here

are of lime, cherry, pine and elm, and they were part of an exhibit last summer at Cotman Gallery in Nantwich, Cheshire, England.

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E. Total distribution.....	236,995	237,331
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2. Return from news agents.....	8,393	8,722
G. Total (sum of E, F1 and 2).....	259,113	255,156

11. I certify that the statements made by me above are correct and complete. Signature: Paul Roman, Publisher.

deficient tools to the manufacturer.

My second comment is the observation that advertisements for Japanese tools have tried to market a mystical level of quality that just doesn't exist in Western tools. Those people with finely tuned Western tools can't believe it, and I don't blame them. The fact remains, the user will make the tools work, or not. We all have our preferences: Toshio Odate blends his skills with Japanese tools; James Krenov takes feathery shavings with his finely tuned Western-style planes. Where is the quality? In the tools, perhaps, but more likely in the hearts and hands of the woodworkers using them.

This hopped-up advertising blitz can backfire, leaving the tool buyer confused and alienated, unwilling to consider Japanese tools. But wait, how many Western tool companies rave about their high-quality products? They all do. So what do woodworkers do? They buy from reputable dealers who seem to know something about the products they sell, they rely on price to judge "amount of quality," and they use their own skills, tastes and feelings to determine whether or not they've received value.

Perhaps the most important contribution Japanese tools have made has been to elevate everyone's understanding of woodworking tools in general.

Here are a few more suggestions regarding buying Japanese tools:

—The saws cut on the pull stroke. If you have never used a *ryoba*, buy a cheap one (\$12 to \$20). Its thicker blade will be less likely to bend if forced on the push stroke. If trying a *dozuki* saw, buy one that has replaceable blades.

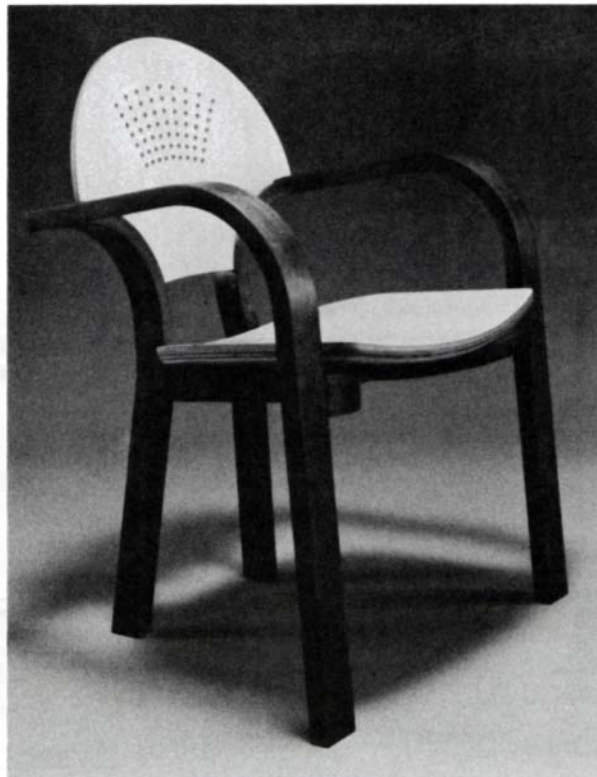
—Start with a small plane in the \$20 to \$30 range, on which to practice preparation and maintenance. Also get a scraper plane to maintain the plane sole.

—Buy one good chisel (\$20 to \$30) and compare its qualities to your other chisels before you buy a set.

—Generally, King Brand 1000-, 1200-, 6000- and 8000-grit sharpening stones are of good quality.

Perhaps frustration influenced Henry Lanz's comments regarding Japanese tools. He leads us to believe that, unless we are Japanese professionals, we will spend too much for a quality too subtle. Maybe this warning is beneficial for some people. But there are many woodworkers who have the patience and time to prepare and maintain their Western tools to make them perform well, and they can equally reap the subtle benefits which Japanese tools afford.

—*Ted Chase, Concord, Calif.*

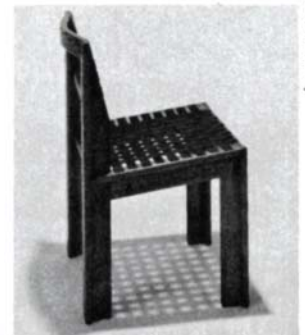


M. Mitchell

Chairs in Toronto

What began as one woman's search for living room furniture resulted in a major exhibition by four woodworkers last fall at a government gallery in downtown Toronto. Despite her frustration with store offerings, Shirley Morris, curator of the Brampton Public Library and Gallery, was excited by the designs and workmanship she had seen in a Toronto crafts gallery and at a local school show. And when provincial officials asked her for help to improve exhibitions at Toronto's MacDonald Gallery, she nominated four furniture makers: Paul Epp, Michael Fortune, Stephen Harris and Donald McKinley.

Each of the four has a distinctive style, but a common bond—McKinley



D. McKinley



D. Allen



P. Patterson

taught Epp and Fortune, and subsequently taught *with* all of them. Traces of this link may appear in their chairs: Epp's bubinga and holly sidechair is shown at left above; McKinley's walnut dining chair with nylon webbing, top; Fortune's steambent cherry and Australian lacewood dining chair, middle; and Harris' upholstered imbuya dining chair, bottom.

—*Marilyn Scott, Cambridge, Ont.*

Trade-show shuffling

For a while last fall, two groups of trade-show promoters were competing for the attention of the San Francisco woodworking public (*FWW* #43, p. 108). Now one group—the Woodworkers Foundation and Thorsch Productions—has bailed out, cancelling the Working With Wood show scheduled for February at the San Mateo fairgrounds. This show was to have been the site of the third annual furniture exhibition by the Northern California Woodworkers Association, also cancelled.

The other Bay Area event is still on.

It's billed as the National Working With Wood show and is scheduled for April 6-8 at the Showplace Square in downtown San Francisco. Its promoters can be contacted at 234 Marshall St., Redwood City, Calif. 94063.

Meanwhile, in Los Angeles, the promoters of an annual wood industry show have decided to take their own shot at the consumer market. They've scheduled an event called The Woodworking Show for Craftsmen and Hobbyists for April 13-15 at the Pasadena Convention Center. For more information, write 1516 South Pontius Ave., Los Angeles, Calif. 90025. □

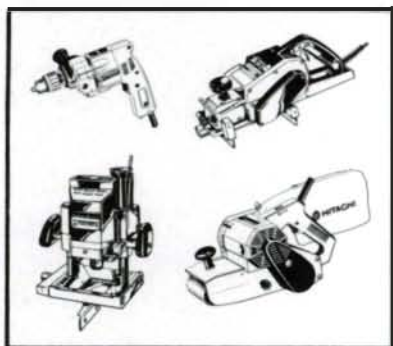
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9900B	3 x 21 belt sander	\$126
9924DB	3 x 24 belt sander	\$135
9401	4 x 24 belt sander	\$173
5007B	7 1/4" circular saw	\$ 94
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LS1400	14" miter saw	\$419
DP4700	1/2" var/rev. drill	\$ 99

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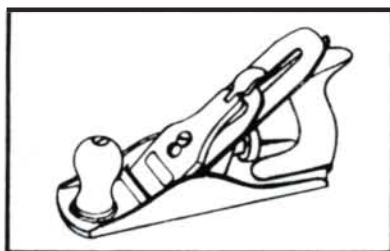
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Finding chairs inside an elm log

In these furniture-ish sculptures of elm, Heather Hilton lays the flowing lines of waves and seashells on the shapes that grew in the wood. Yet her forms and the tree's forms harmonize, not clash.

You can sit in these pieces, though not conventionally. You can treat them as sculpture to look at, though because of their furniture aspect each does seem to have one or more "best" views. They beckon to be touched, and are meant for people who want to touch the gleaming wood.

Hilton carves by roughing out the forms with a chainsaw, then she seeks the final surface with hand-adze and gouges. Once the green wood has been sanded, she stabilizes it with polyethylene glycol, though not by soaking it for a long time in a vat of the stuff. Instead, she scrubs the waxy liquid into the wood, then wraps the piece in plastic for six weeks, sloshing on more PEG every few days. She fills checks with an epoxy mixture, sands smooth, and finishes with penetrating oil.

Hilton, 38, teaches sculpture at Spellman College in Atlanta, Ga.

