Fine WoodWorking

JULY/AUGUST 1982, NO. 35, $3.00

Picture Framing

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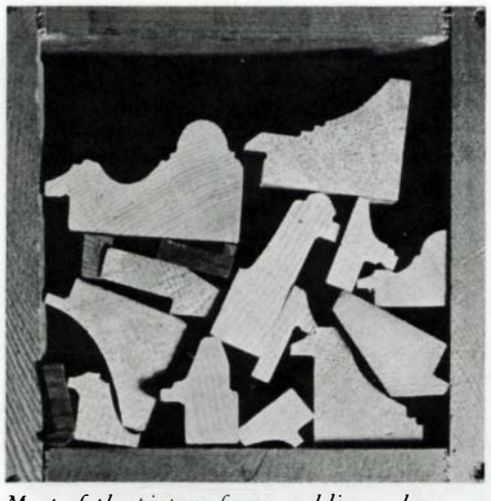

Most of the picture-frame moldings above, as well as the one on the cover, were made on the tablesaw using nothing more complicated than a 10-in. carbide blade and a shopmade, adjustable-angle fence. For more about the framer's craft, including such fine points as how to choose a frame, how to make the molding, and how to cut it and join it, see p. 61. Cover photo: D. Fillion.

Fine WoodWorking®

JULY/AUGUST 1982, NUMBER 35

DEPARTMENTS

ARTICLES

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Letters

I found Ian Kirby's article "Using the Tablesaw" (*FWW* #34, May '82) a fine refresher on the basics of using this machine. The push stick that you depicted is the one shown by most industrial arts books; however, I feel it is not the safest or most accurate to use. I have been taught to make a push stick in the shape of a shoe. For general work I make the shoe about 12 in. long and 6 in. high. The heel must be a little shorter than the thickness of the wood being ripped. Therefore I always keep several shoes with heels from a scant $\frac{1}{8}$ in. to more than 2 in. high to accommodate different thicknesses of wood. I prefer to use birch plywood to make the shoe . . . and often laminate several pieces when I feel a wider push is needed. The extra expense of birch is well worth it when safety is a factor.

The main advantage of the shoe is the extra stability given by its sole. This is most helpful when ripping wood that has knots, is very hard or is cupped. The sole also helps hold short pieces. *—John Roccanova, Bronx, N.Y.*

Kirby's article on the tablesaw was informative, yet I don't believe it went far enough on safety equipment. What safety devices are available and how do they compare? Where are they sold? For example, I use a Rockwell 12-in. contractor's tablesaw. The original blade guard and anti-kickback device are almost unusable. The blade is all but invisible with the blade guard in place. What else could be used with that saw? The fact that one sees most saws stripped of their safety gear indicates that many other people have the same problem that I do. *—William Loehr, Franktown, Colo.*

. . . I couldn't agree with Kirby more about the hazards of kickback on a tablesaw. By far, the worst injuries I've seen associated with the tablesaw have come from kickback. A note I'd like to add is to mount a push-button on-off switch flush with the edge of the table and at knee height, facing the operator. For a right-handed operator, the switch should be on the left-hand side of the blade. This can help avoid standing in front of the saw with a dangerous situation that needs two hands to keep from being potentially fatal, and waiting for the motor to overheat so the saw will shut off.

—Gary Root, E. Calais, Vt.

The reason for this letter is NASA's "space age saw-guard" (Methods, March '82). That design is as old as the Industrial Revolution. If that is space age, then the space shuttle's fuselage was hollowed out with a gutter adze.

There are many small lumberyards which I've been in that employ that type of saw guard. Some are still maintaining lineshafts and flatbelts. One lumberyard very near us has a 16-in. tablesaw with that apparatus mounted to the ceiling so it doesn't interfere with large cuts or fence movements.

—Ric Puls, Elkhart Lake, Wis.

I would like to answer reader F. Eldon Heighway's letter (*FWW* #34). He wonders if some advertisers actually make more money from selling their advertising literature than from selling their product.

I cannot answer for other advertisers but here are some facts regarding our catalog, which we "sell" for $1.50. Catalog costs 45¢, envelope 4¢, label 3¢, order form 2¢, price list 2¢, first-class postage 88¢, labor (typing, packing, etc.) 30¢. The total is $1.74 for something we sell for $1.50. From this

Photo: Bruce Blank

Craig Arbaugh of Norristown, Pa., built this cherry desk for "a gent of large outdoor stature with the sentimental desire to have furniture from his own trees."

Jeff Stewart brought his walnut beaver from Mt. Hood to the sculpture show held in February at the Western Forestry Center in Portland, Ore.

Photo: David L. Ryan

"A marquetry picture of a bookshelf intrigued me, and inspired the door of this cabinet . . . a new realm for me."
—Silas Kopf, Northampton, Mass.

it would seem that we should stop advertising, because the more we advertise, the more we lose. But of course it does not work out that way, as some folks receiving our catalog become customers. Incidentally, the above figures do not include the cost of the ad, which can run from $200 to $600 per inch per issue.

—John Capotosto, Armor Products, Deer Park, N.Y.

I have found that plastic cards such as credit cards make good glue spreaders. Trim them so the corners are square. Their stiff but flexible construction gives you a lot of control, and the smooth surface of the card will spread the glue thinly and evenly. Of course safety is always an important consideration. My research indicates that this may be the only safe way to use a credit card.

Scraps of Formica are also good. Cut them to whatever shape best fits the joint you are gluing and feather out the edge with a belt sander. *—Steve Lukaczer, Leadville, Colo.*

I was considering buying a glue applicator. The price through the catalog was $9.95. Then one day while eating a hot dog I realized that the 16-oz. plastic mustard container could be used as the glue applicator I needed. It works quite nicely. You can adjust the nozzle to control the flow. And it cost only 87¢.

—Larry A. Baum, Independence, Mo.

"Here's my teak dining chair in a Danish Oriental style . . ."
—Holger M. Laubmeier, Del Mar, Calif.

I was pleased to read January's anecdotal business discussion. All too often I have sensed some unspoken proscription among your writers against treating with any sort of detail the harsh financial realities of a small professional woodworking operation. Being somewhat suspicious by nature, I have often wondered just what proportion of the artist/craftsperson/designer population actually supports themselves by their work rather than by teaching, doing commercial millwork or cabinetry, doing other professional work (architecture, engineering), or being supported by a significant other.

—Scott Lowery, St. Paul, Minn.

I have four indispensable tools in my shop that may be of interest to your readers:

—A hand-operated plant sprayer filled with distilled water. I don't have running water in the shop, so the sprayer comes in handy for such tasks as mixing glue, wetting a cloth to wipe off excess glue, wetting wood to raise the grain, cleaning my hands, and for a million other times when a small amount of

water is needed. The sprayer will give a rather strong narrow stream, or a light mist, or one drop at a time.

—Many brands of beer and soft drinks come in cans which have a beautiful, nearly spherical indentation in the bottom. This makes an excellent receptacle for mixing small quantities of glue, finish or other liquids. It can be cleaned after use, or discarded, depending on how much beer you drink.

—A box of wooden toothpicks. They are nice for mixing and applying small amounts of glue, particularly epoxy. They're also handy for packing a screw hole, to tighten the screw or to move the hole a little.

—A package of pipe cleaners. They serve as inexpensive disposable brushes for putting oil finish on small pieces, as glue applicators, and for cleaning in tight places.

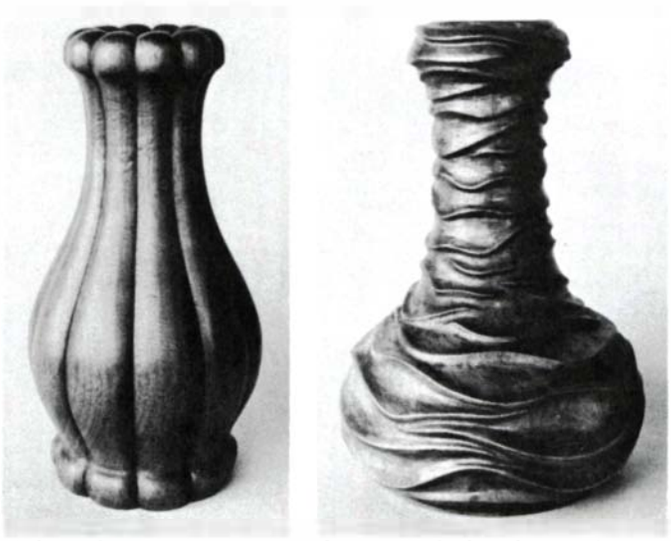
—H. Norman Capen, Granada Hills, Calif.

I write to comment on Richard Starr's recommendation of WD-40 for rust prevention (*FWW* #34, p. 26). As an active hunter, amateur gunsmith and owner of a shop in a damp basement, I have used it extensively. It has not performed well as a rust preventer.

It seems to consist of a low-viscosity penetrating oil in a volatile base. It performs well as first aid for wet iron and steel and as a penetrating oil for loosening rusted screws and bolts. However, after several months it seems to oxidize to a gummy film which is difficult to remove and which may leave behind a dark stain on polished steel surfaces. Also, casual periodic spraying of exposed steel on power tools in the damp basement has not prevented rust completely. . . .

For tools that require a dry surface, I prefer automobile paste wax for rust prevention. For tools that can be wiped off before each use, a grease called RIG, available from gunsmithing supply houses, has been 100% effective without leaving an oxidized residue.

—Frank L. Murphy Jr., Devon, Pa.



"The walnut vases were turned out on a lathe, then worked out with carving tools. They have a glass tube for flowers. I am a retired artist." —Frank Hesh, Naperville, Ill.

. . . In the March issue, reader George Adams wanted to know how to keep his carving set from rusting. If he will keep a cake of carpenter's line chalk along with his fine tools,

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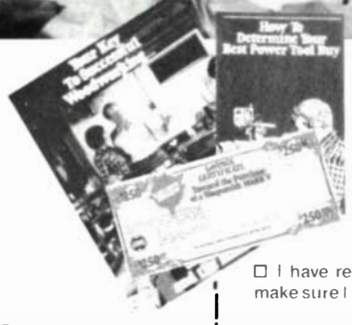

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he won't be bothered with rust.

On another subject. . . I built a solid oak drop-leaf kitchen table, and after much thought on how to finish it, as I wanted the grain to show, I gave it a coat of Watco, allowing it to dry for a week. Then I gave the table five coats of Deft lacquer, lightly sanding between coats, and steel-wooling lightly after the last coat. The table turned out to be a thing of beauty, and so easy to wipe clean. *—Harry J. Steiner, Bellaire, Mich.*

"This is my armless chair of oak. There's hardly anybody doing similar work here in Israel, so I hope to spend a year in the U.S." —Jacob Finn, Jerusalem

I was astounded to learn that brass is "impossible to weld" in Simon Watts' article on period furniture hardware (*FWW* #34, p. 89). I have been welding brass for about 40 years. All that is required is the oxy-acetylene torch, brass filler rod, and a suitable flux. The process is easier if a filler rod which flows at a lower temperature than the parent metal is used. This is commonly known as eutectic brazing rod, meaning the alloy contains the proportions of copper and zinc that melts at the lowest temperature.

—E. McCafferty, Naches, Wash.

SIMON WATTS REPLIES: That should have read, ". . . and practically impossible to weld during the 18th century."

In reference to your article "Air Drying Lumber" (March): Since I too was concerned with water damaging the outside edges of the boards, I lined the sides with some old window shutters so there would be good cross ventilation. The ends and top of the pile were covered with polyethylene and further weighted down with chunks of wood. By positioning the shutters to the prevailing breezes, one can very effectively dry out the stack.

—John E. Cox, Oxon Hill, Md.

Not so fast there! Your answer to A.J. Cruz (Letters, *FWW* #34), on bandsawn drawer bottoms, is incorrect. A thinner drawer, a thicker bottom or a wider sawkerf will conspire to cause a larger radius differential from drawer top to bottom. Only a circular cutout will fit perfectly. A rectangular shape will show a slight though acceptable error at the corners (worse for tighter radii), whereas an L-shape will show double the error at the reverse corner. Using a ⅛-in. blade with 24 tpi, I can achieve an almost perfect fit with outside radii. The few pieces I've tried with reverse curves have ended up as scrap, although I suppose filling the gaps would work. *—J.A. Hiltebeitel, S. Burlington, Vt.*

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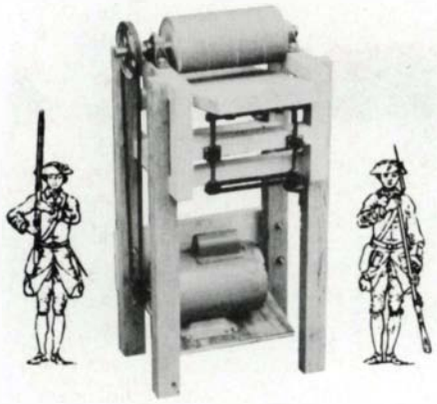

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9401	4"x24" Dustless Belt Sander	273	176
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B04520	Finish Sander	77	51
3608B	1 H.P. Router	118	77
3601B	1 1/4 H.P. Router	196	126
3600B	2 3/4 H.P. Plunge Router	299	190
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COMMISSION SHOW

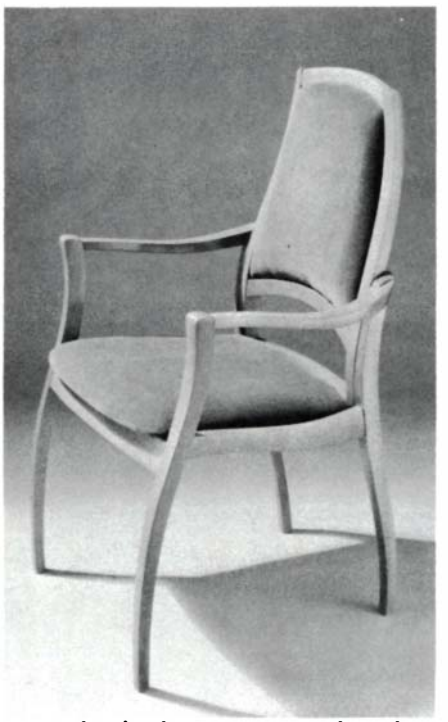
"How to Commission Handmade Furniture," a recent exhibition at New York's Workbench Gallery last spring, included Daniel Bailey's pearwood armchair, right. Bailey and five other woodworkers from the Northeast showed their work while the gallery explained the commissioning process with displays and information sheets.

They offered some good advice. The customer should know whether a maker is a specialist, or a creator of all diverse kinds of furniture. He should ask what materials and techniques will be used, and he should take a close look at some completed pieces. The craftsman should be clear about delivery dates and payments. Workbench provided a sample contract, divided into design and execution phases. Designs take time and effort which someone, client or maker, pays for--one way or another. The contract should specify clearly who is paying, and for what.

When the designs have been accepted, a commission agreement should stipulate essentials such as size, materials, price and delivery dates. It should also cover those things which we would rather not think about. What if the customer wants to back out of the deal, or the maker has an accident and can't finish the piece? Contracts may seem too formal; we all value the personal contact of a small shop. But because friendly agreements can turn unfriendly, it is best to settle possible bones of contention beforehand, in writing.

Small workshops can make that special piece, the one that does just what the customer wants, and the Workbench show demonstrated what galleries can do to get a client together with the right designer-craftsman. A gallery is a showcase of possibilities as well as of what is on its floor. People who like what they see and want to know more can be referred to the maker. Although Workbench is non-profit, other galleries take a percentage of the resulting job to make referrals worth their while. Commissions are bread and butter in a lot of small shops--exhibitions like the one at Workbench can help to set a table at which gallery owner and woodworker can both eat.

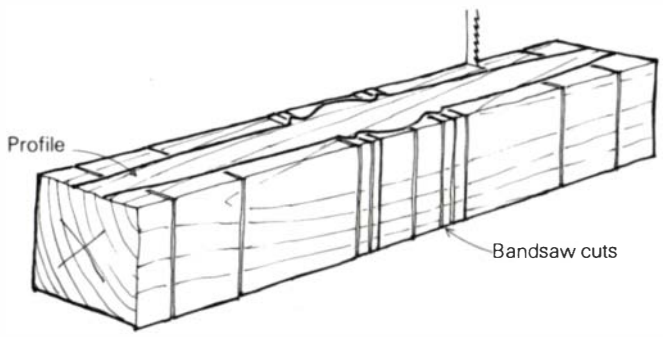
—Roger Holmes



Rose-colored velveteen on Daniel Bailey's armchair picks up the pink in the pearwood. Doubling up the legs with the back stiles strengthens the delicate structure.

Two methods for turning duplicates

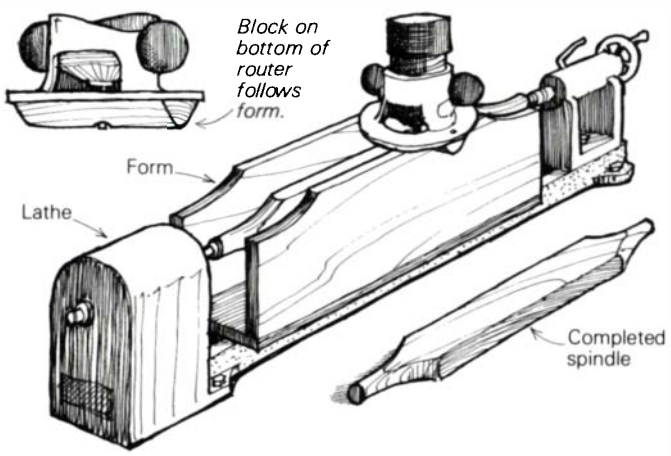
Turning copies of a spindle on a hand lathe can be tedious work. Templates, gauges and other gadgets help but don't substantially increase speed and accuracy. In contrast, this method, which uses the bandsaw, is the best turning aid I've found yet. On one face of the square stock, mark out with a template the desired profile and make bandsaw cuts to within 1/16 in. of the profile at convenient reference points. Bevel the square's corners as you usually do, mount the stock on the



lathe and begin turning. The cut lines will be easy to see and will allow quick and accurate shaping without so many stops for caliper checks. The secret to this method is accurate layout and careful sawing. *—Robert M. Vaughan, Roanoke, Va.*

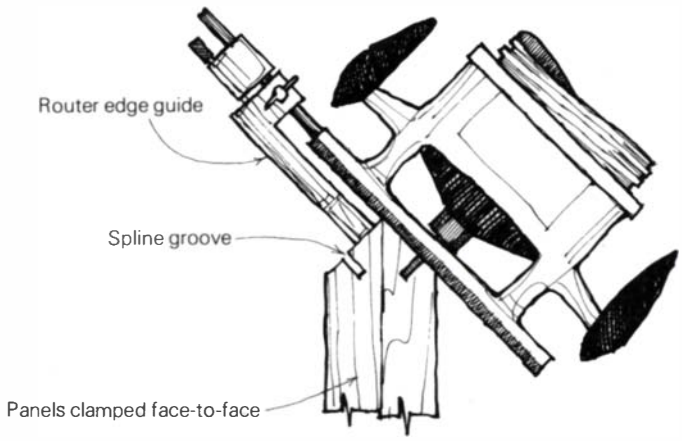
Lee Watkin's method for making dowels using a router and lathe (*FWW* #25, p. 22) arrived just before I put the finishing touches on the deck I was adding to my house. Here's how I adapted his method to make the deck railing a cut above the usual. Starting with the straight U-shaped fixture used to make dowels, I sawed off a curved section from each end. I screwed a V-shaped block to the bottom of the router base. This allowed the router to follow the profile of the top of the fixture and to transfer the shape to the spinning blank below. The shape I wanted in the railing spindles was similar to the backrest supports in a chair. The fixture helped me produce 85 identical spindles quite nicely.

—Donald B. Sherman, Merrimack, N.H.



Routing splined miter joints

This router-based method for cutting the slots in splined miter joints is easy to set up and guarantees an accurate fit. First miter the panels in the normal fashion on the tablesaw and clamp them face-to-face as shown in the drawing, top right. Wide or bowed panels may require the addition of a stiffener clamped below the miters. Now chuck a spline-sized bit (1/8-in. or 3/16-in. for 3/4-in. stock) into the router and set the depth of cut (1/4 in. to 3/8 in.). Adjust the router guide to be

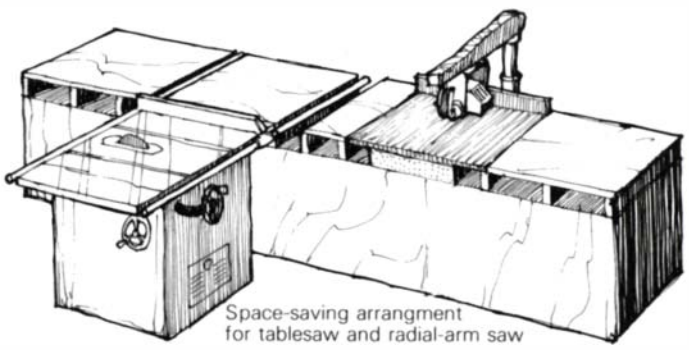


about 3/4 in. from the bit. Absolute accuracy in depth and guide settings is irrelevant. Rest the base of the router on the peak formed by two panels and rout a spline slot in each panel. To cut a stopped spline slot, just plunge the router.

Although the whole process can be accomplished with little more than eyeball measurement, the right angle formed by the two miters and the constant offset of the cut all but guarantee success. *—Warren H. Shaw, San Francisco, Calif.*

Space-saving saw setup

Here's one solution to the problem of squeezing both a tablesaw with long extension rails and a radial-arm saw with long extension tables into a narrow shop. My shop is 10 ft. by 25 ft. and until recently these machines took up most of my



floor space. But by setting the tablesaw at right angles to the radial-arm saw and combining the extension table space of the two machines I was able to recover much of this lost area.

To combine the machines the two tables must be the same height. I chose to block up my radial-arm saw to the height of my tablesaw. Cut two troughs in the radial-arm table to accommodate the tablesaw's rails. Cut the front trough wide enough for the rip-fence lock. Position the rails so that the rip fence rides just a fraction of an inch above the radial-arm saw's table. *—Andrew A. Ruotsala, Seattle, Wash.*

Stones and strops from the attic

There have been several good articles on sharpening and honing devices lately, but I haven't seen anybody comment on the old-time water stones that folks used to sharpen their straight razors on. You can sharpen up smaller edged tools with one right smart. They're cheap and available at flea markets, etc., or better yet from older family members or friends. Get ahold of a razor strop too; they work well.

—David Blackley, Matthews, N.C.

Adjustable slot-mortising table

Recently I rescued an old American 16-in. tablesaw from the junkyard. The machine had a slot-mortising chuck on the end

THE BEST BUY IN CARBIDE SAW BLADES

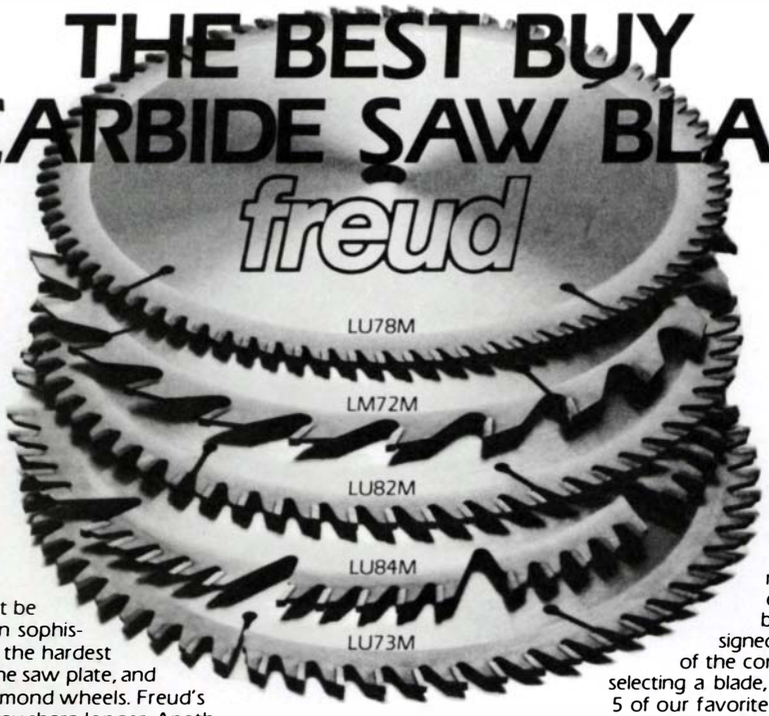


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Plate. The body of a premium blade is made from milled tool steel, cheaper blades are made from stamped cold-rolled steel. After a premium Freud blade is machined, it is heat treated twice and then surface ground on both sides. Finally, each premium Freud blade is hammered on automatic equipment to tension the blade and checked by hand for trueness. A properly tensioned blade, with its stresses relieved, will stretch evenly at high running speeds while a cheaper blade will distort and vibrate.

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	Rip Solid Wood	Rip Plywood	Cross Cut Wood	Cross Cut Plywood	Particle Board	Plastic Laminates	General Purpose	Diameter	Teeth	List	Sale
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								9"	54	75.86	**60.00**
	NR	G+	G+	G+	G+	NR	F	10"	60	75.86	**60.00**
								12"	72	107.95	**86.00**
General Cross Cutting Excellent Value								14"	84	131.59	**105.00**
LU82M								8"	48	74.61	**59.00**
								9"	54	82.29	**65.00**
Precision Cross Cutting Wood & Veneers	NR	G	E	E	E	NR	NR	10"	60	82.29	**65.00**
								12"	72	117.49	**94.00**
LU78M								10"	80	111.45	**89.00**
Chip Free Cutting Plastic Laminates	NR	G	F	G	G	E	NR	12"	96	134.16	**107.00**
LU84M								8"	40	68.12	**54.00**
								9"	40	67.61	**54.00**
Combination Blade 4 ATB Teeth & 1 Square Tooth	G	G	G	G	G	F	E	10"	40	67.61	**54.00**
								10"	50	70.96	**56.00**
								12"	60	107.24	**86.00**
LM72M								8"	24	54.27	**43.00**
Straight Line Rip Hard & Soft Woods	E	G	NR	NR	F	NR	NR	10"	24	61.76	**49.00**
Three Blade Set: LU73M-10x60, LU84M-10x50, LM72M-10x24								10"		208.58	**149.00**

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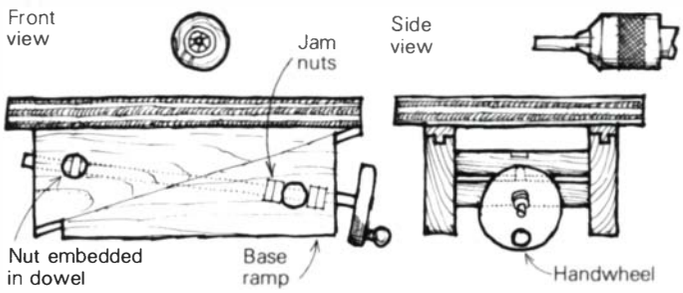
of the arbor and provisions for bolting on a mortising table, which, unfortunately, was missing. So I made a new mortising table using the design principle sketched below. I could



have used a hinged table as featured on several devices in *FWW* recently, but a slanted table just felt clumsy to me.

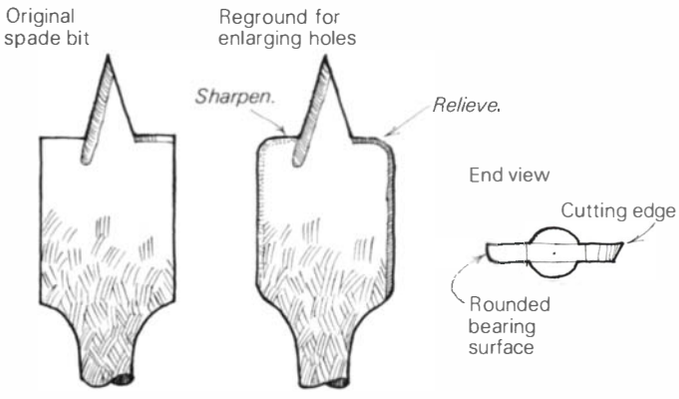
Here's how the table adjustment works. The threaded rod passes through a hole in the dowel in the base ramp, and is held in place by nuts. As the handwheel is turned, the threaded rod screws into a nut embedded in the dowel in the sliding table, thus ramping the table up on the base. The ramp pieces should be aligned using flanges or a slot-and-rail arrangement. *—Bart Brush, Cherry Valley, N.Y.*

Enlarging flute bores

Recently I used a spade bit in a bit extender to enlarge the bore of a wooden flute I was making from ¾ in. to ⅞ in. The method worked so fast and left the bore so smooth I'll use it from now on, even to work the hole size up from the ⅜-in. shell auger I start with. A major advantage of the thin shank is that you don't have to stop so often to remove chips. The secret is to regrind the cutting edge of the spade bit so it will enlarge and follow a pre-drilled hole.

Grind away and taper the corners of the bit so it can enter the smaller hole. Then sharpen one edge (I used a polishing belt on a Dremel sander, followed by a hard Arkansas stone) and relieve the other edge of the bit so that the sharpened edge can cut. The more you relieve it, the deeper the bit will bite. To avoid scoring the inside of the bore as you remove the bit, round the back corners.

—Vasco Pini, Woodstock, N.Y.



Refurbishing wooden-soled planes

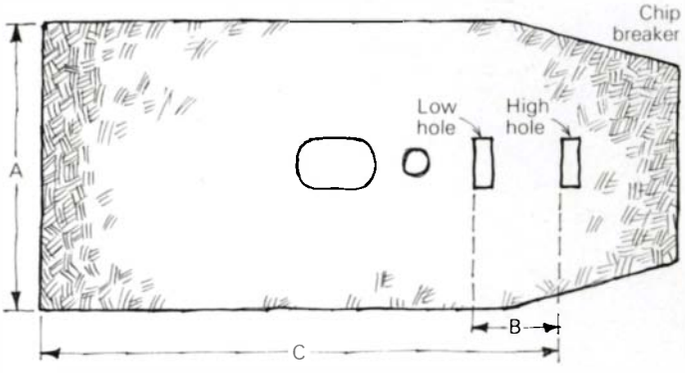
There are hundreds of old wooden-soled Bailey and Sargent planes that, because they're missing blades, chip breakers or cap irons, can be bought for next to nothing. These planes are excellent tools that can be refurbished for a fraction of the

price of a new plane, if one doesn't mind a bit of puttering. The planes come in four widths: 1¾ in., 2⅛ in., 2⅜ in., and 2⅝ in. Replacing the blades and cap irons for the 1¾-in. and the 2⅜-in. planes is no problem as both sizes are still made by Stanley and Record. Blades and cap irons for the 2⅝-in. plane are made only by Record now, but some Stanley blades and caps in this size are available from the Tool Works (111 8th St., New York, N.Y. 10011). The 2⅛-in. blade is a problem because no one makes them anymore. Your best bet is to grind the edges off a 2⅜-in. blade. A 2-in. cap iron works fine on the 2⅛-in. plane.

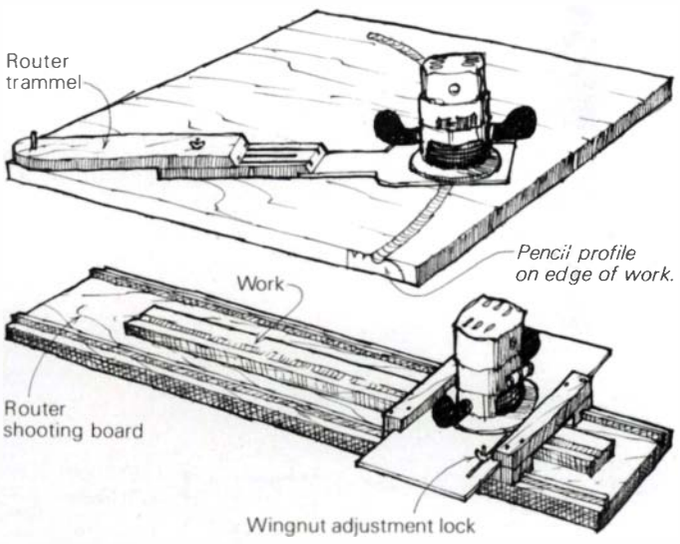
The major problem, however, is the chip breaker. Both Bailey and Sargent use a "high-hole" breaker, but modern iron planes use a "low-hole" breaker. The two types won't interchange. The answer is to cut a new ½-in. by 3/16-in. slot in a modern "low-hole" breaker to fit the "high-hole" mechanism. The accompanying table shows where to cut the slot.

—Jim McGill, Seattle, Wash.

Blade width A	High-hole placement B	C	Cap-iron size
1¾	⅜	4	1¾
2⅛	½	4¼	2
2⅜	⅝	4½	2⅜
2⅝	¾	4⅝	2⅝

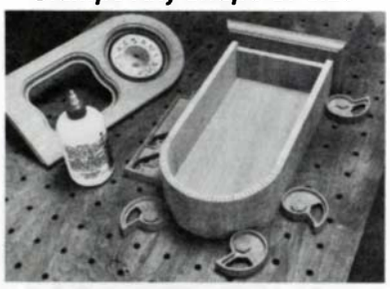


Router jigs for making molding



The sketches above show two jigs which, when used with a portable router, can produce both semicircular and straight molding in patterns difficult to produce with a shaper. The first jig is an adjustable router trammel used to make curved

Clamps Any Shape Or Size



This ingenious patented clamping system solves holding problems for nearly every workbench operation. The vise clamps any size or shape workpiece firmly to your bench for planing, sawing, sabresawing, routing, drilling, jigging, dowelling, gluing and assembly.

Each vise contains four cams, a special fence with pins and a template. By drilling ⅜" holes 2" on centers a clamping bed of any size can be made on your work surface. It performs on any bench, sawhorse, or hobby board, and adds capability to portable benches. Requiring hand pressure only, and no bolts or screws, it can be mounted and removed in seconds.

This versatile tool functions 360° on your workbench eliminating "C"-clamps and nailing down. It clamps both workpiece and pattern for routing and is perfect for gang operations. Since components project less than ¾" above the bench surface ¾" stock can be worked with tool clearance.

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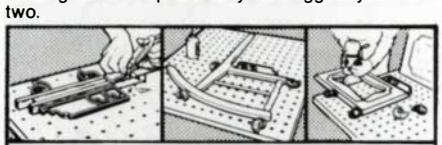

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molding. The jig's two-part base adjusts by means of a slot-and-track arrangement and locks with a bolt and wingnut. The router is screwed to a ¼-in. hardboard foot which is, in turn, screwed to the base.

The second jig consists of a sliding adjustable router holder and a "shooting board" which has two parallel tracks. The slotted hardboard in the holder allows the router to be adjusted laterally.

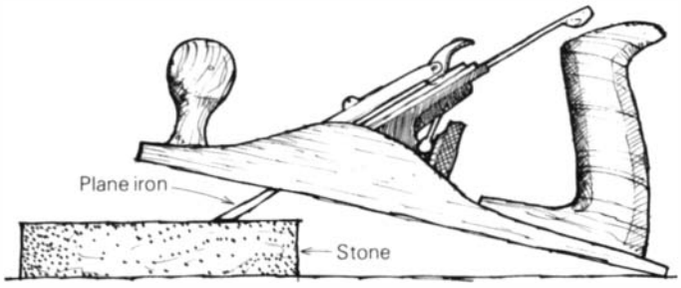
To use these jigs, first pencil the molding profile on the edge of the workpiece. Position the work and the jig so the router is right over the molding. Take repeated cuts adjusting the bit depth, changing bits and adjusting the router's lateral position as needed. When all the routing is complete, separate the curved molding from the waste stock with a bandsaw. Some sanding is necessary to finish the molding.

—S. Gaines Stubbins, Birmingham, Ala.

Constant-angle honing

Most of us know an old-timer who has demonstrated a method of work so effective and simple you wonder why it never occurred to you before. This happened to me recently while honing my plane iron. I was struggling to maintain a constant angle against the stone, lamenting that I did not have one of those fancy roller tools that locks the plane iron at a constant angle while rolling it across the abrasive. Here's the simple solution presented to me.

Slide the chip breaker back from the cutting edge about ¾ in. Then lock the double iron in the plane with the blade extending through the throat about ½ in. Now with the heel on the bench top and the plane iron on the stone, slide the plane back and forth. The setup holds the iron at a constant



angle to the stone to grind a perfect secondary bevel.

You may have to adjust the setup slightly to fit different-size plane bodies, stones and bevel angles, but the basic idea seems to work with any plane.

—James Vasi, Cheektowaga, N.Y.

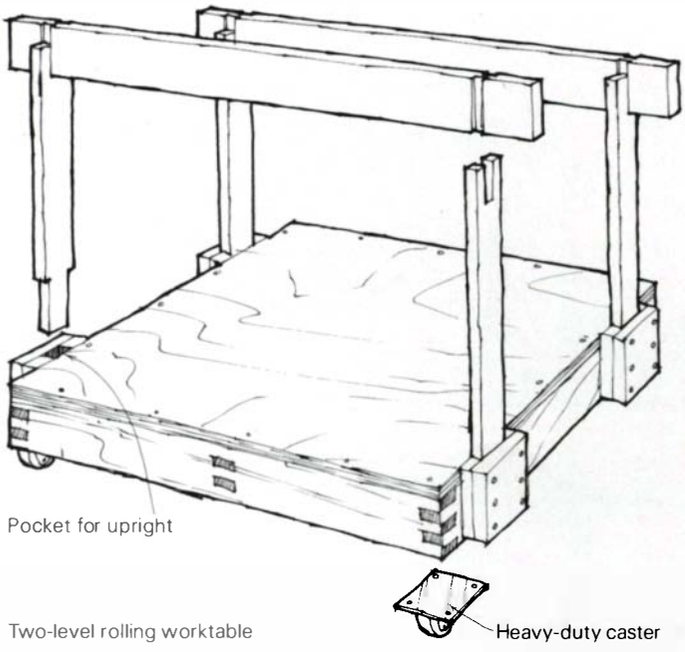
Two-level rolling worktable

I made this rolling worktable to ease the logistics of constructing a full set of kitchen cabinets in my small (18-ft. by 18-ft.) workshop. Since then I have found it to be the ideal companion to the traditional cabinetmaker's workbench when space is limited. Built square, level and strong it provides an excellent base for moving cabinets and furniture into or out of the work stream. Or, with the crossbars in place, the worktable can be used at waist height for moving production pieces from machine to machine. As a bonus, it stores away without taking up much room.

Four 360° heavy-duty casters support a 40-in. by 40-in. finger-joined or dovetailed frame of 2x3 hardwood, gusseted with ¾-in. plywood at each corner. Add a couple of 1x3 crossbraces if needed. Screw and glue the ¾-in. plywood top

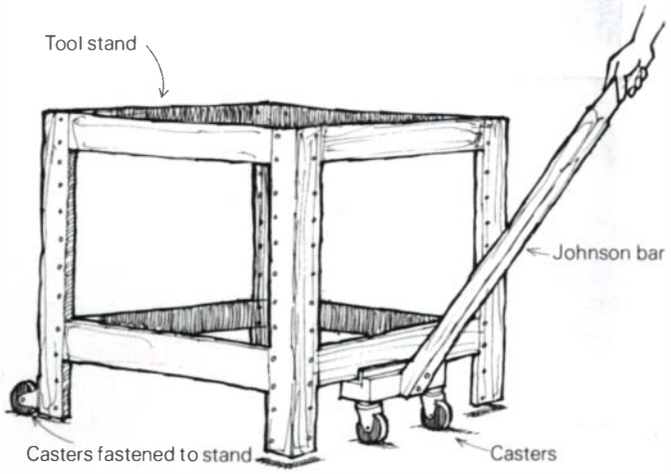
to the frame, then paint and wax it to make it easy to clean up spilled glue and finishes. Next add two pockets on each of two opposite sides, as shown, to accept the ends of the four hardwood 1x3 uprights. Slot the top of each upright to slip into the two appropriately notched crossbars. These four uprights and two crossbars can be assembled in about 30 seconds to produce a table-height workhorse.

—Norman Odell, Quathiaski Cove, B.C.



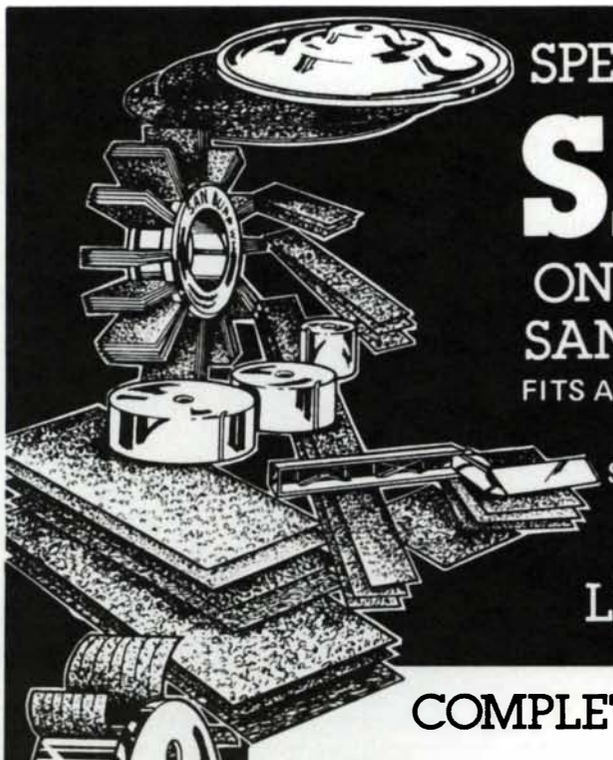
Two-level rolling worktable

Making stationary tools portable



I do my woodworking in the garage, so when I'm through for the day the tools must be moved to make room for the car. For this I use a homemade Johnson bar—a small two-wheel trolley. I made the Johnson bar from heavy-duty casters, a short length of angle iron and a couple of pieces of scrap wood. I insert the trolley under the tool stand, and lever the handle down to jack up the tool stand on its own set of two fixed casters. I can then push or pull the tool to any location I wish. *—Jerome A. Jahnke, Milwaukee, Wis.*

Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *Box 355, Newtown, Conn. 06470.*



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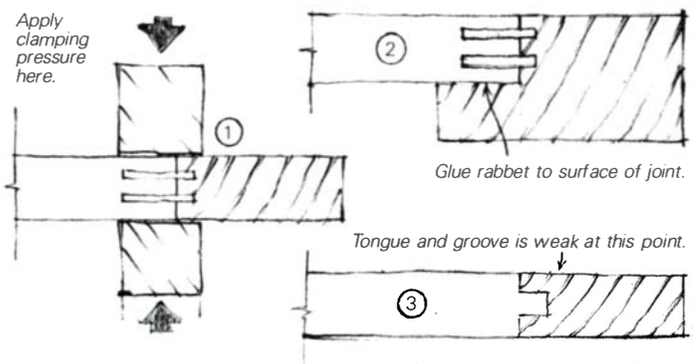
Breadboarding, yet another way—*I am confused about the practice of gluing bands of solid wood to the ends of a solid, glued-up panel to prevent warping. Some say cross-grain movement will cause splitting of the glueline, but others make no mention of this problem when specifying this type of construction. Is there a limit to the width of a panel beyond which cross-grain construction will be destructive? Are there special methods to circumvent the problem and can finishes seal the wood against the humidity that causes movement?* —*Tom Nelson, Lansing, Mich.*

IAN J. KIRBY REPLIES: Breadboarding must certainly be a practice developed by persons unversed in the hygroscopic nature of wood. It has persisted because of its obvious aesthetic appeal; end grain is not considered attractive and covering it with a breadboard or end cap is like putting a period at the end of a sentence. But even the smallest end-grain constructions will have problems as stress builds at the glueline during seasonal movements. The wider the panel, the greater the problem is likely to be. Cracking of the panel and degradation of the glueline are the most apparent symptoms. Finishes do slow the moisture exchange that causes movement, but nothing short of encasing the wood in impervious plastic will entirely prevent it.

The solution, then, is to use a construction that stands up to the movement. If you must use a breadboard, attach it with two thin splines, as in figure 1 below. Mill the splines deeper into the end grain of the panel than you do into the side grain of the breadboard. Removing material from the panel in two grooves lessens the volume of wood tissue available to absorb moisture. The wood still moves, but since there is less of it, it puts less strain on the joint. When gluing up this assembly, it's a good idea to apply clamping pressure perpendicular to the splines to assure a good glueline. Use waxed paper between the cauls and the joint, otherwise the cauls may become an unwanted detail in your design.



To further strengthen this assembly, you can extend the breadboard around the outside of the joint, as in figure 2. The splines are still used and the rabbet outside the joint is glued to the outside surface of the joint. Frequently, a tongue and groove is used to attach a breadboard, as in figure 3, but I see this as bad practice. The joint is inherently weak because it removes so much material from the breadboard's long grain but very little from the panel's end grain where all the movement is likely to occur. [Ian J. Kirby is a cabinetmaker, designer and educator.]

Staining poplar—*I'm making kitchen cabinets for my parents' home using poplar that has a fair amount of green color to it, which stains darker than the surrounding wood. How can I create an even color? What kind of a finish would be durable enough for a counter made of the same wood?* —*Dan Snellenberger, Cloverdale, Ind.*

OTTO HEUER REPLIES: Poplar has light-colored sapwood and a darker, green-tinged heartwood that can present problems in staining. But by bleaching the wood, you can even out the undesirable streakiness staining often produces. I would suggest an application of type A and B wood bleaches (available from the Klean-Strip division of W.M. Barr Inc., PO Box 1879, Memphis, Tenn. 38101). Follow the recommended instructions for the bleach, use rubber gloves and apply it with a fiber brush. A cheaper alternative is ordinary household bleach straight from the bottle. Be sure to wash the wood well before attempting to stain it.

Before staining, you may want to use a washcoat of one part 4-lb. cut white shellac to 7 or 8 parts alcohol. When this has dried, sand lightly and apply a coat of linseed oil to the end grain of the doors to prevent excessive stain absorption. I recommend a pigment wiping stain that does not contain any aniline dyes. As a top coat, you can use a Danish oil or perhaps a urethane varnish or any other surface finish that meets your requirements for gloss and protection.

I'm sorry to say that poplar is not a good choice for a countertop because it is so soft and dents and damages easily. A better choice would be a plastic laminate counter or a harder wood. But if you must use poplar, a tough two-part urethane varnish will help protect the wood. [Otto Heuer is a chemist specializing in wood finishes.]

Glue open-assembly time—*When gluing up joints with several surfaces, I find spreading the glue is fairly time-consuming. I try to be well organized but sometimes 5 to 10 minutes go by before I get the joints together. The glue appears to get tacky during this time. Does this weaken the glue's strength? I'm using Franklin Titebond glue.* —*Steve Lukaczer, Leadville, Colo.*

ROBERT GILLESPIE REPLIES: Quite often, a little patience pays off when gluing. Aliphatic resin glues like Titebond have open-assembly times (the time between when the glue is spread and when the joint is assembled) that vary according to the age of the glue, temperature and humidity. Letting the glue sit exposed to the air for a while is actually an advantage because it gains viscosity, allowing it to fill gaps more effectively and preventing it from being squeezed out under clamping pressure. Five or ten minutes is usually fine. If you wait too long, the spread glue may appear dried out, skinned over or glossy. You can sometimes salvage the situation with a fresh application of glue, but the surest way is to clean off the mess and start over again. Generally speaking, higher temperatures and lower humidity shorten glue open-assembly times. Also, it is a good idea to spread glue on both parts being assembled. White glues (polyvinyl acetates) have similar open-assembly time properties. [Robert Gillespie is head of adhesives research at the Forest Products Laboratory in Madison, Wis.]

Sharpening Forstner bits—*I have a set of Forstner bits which I use with the utmost care, but even so, the cutting edges have become dull. How does one sharpen these bits?* —*George Downey, Westford, Mass.*

ED LEVIN REPLIES: Sharpen the cutters of a Forstner bit just as you would a twist auger, by filing or whetting the tops of the cutting edges with a bit file or stone. Take care to remove material equally from both cutters. The rim (the equivalent of the spurs on a Jennings auger) is honed only on its inner surface, with a small round file or slip. This edge may be renewed with a burnisher until additional honing is necessary. The bottoms of the cutters can be polished up to give a really keen edge, but the outside of the rim should not be touched, except very lightly to remove the burr left by sharpening. [Ed

Levin, of North Canaan, N.H., is a professional housewright. For more on sharpening Forstner bits, refer to pages 42 and 79 of the Taunton Press book *Make a Chair From a Tree,* by John D. Alexander.]

Contending with darkening wood—*About a year ago, I finished work on a jewelry box made of padouk. I left the inside unfinished to preserve the wood's aroma and I applied two coats of linseed oil to the outside. Lately, the padouk is turning to a muddy reddish color and I am wondering what the cause is and how to prevent it.*

—Jeff Colla, Minneapolis, Minn.

R. BRUCE HOADLEY REPLIES: Unfortunately, color changes in wood are unavoidable, and the gradual fading of the brilliant colors of freshly machined wood has always been a problem for woodworkers. The color changes are apparently caused by a combination of air and light reactive processes, but the ultraviolet portion of sunlight is probably the biggest factor. Finishes change the light reflective and absorptive characteristics of a wood surface and they usually have an immediate effect on color. Oil finishes, such as Watco, tend to darken the most, while urethane varnishes seem to impart a yellowing effect. I've noticed the least color changes with clear paste wax and with "water-white" lacquers. Varnishes are available with ultraviolet inhibitors that may slow down sunlight darkening of some woods, but there is probably no way to stop the process entirely. [R. Bruce Hoadley teaches wood technology at the University of Massachusetts at Amherst.]

Softening old glue—*I am trying to repair a misassembled chair that was apparently put together with hot glue. I've tried water to soften the glue but it hasn't worked. Any ideas?* *—Steve Troutman, Fallon, Nev.*

ALLEN COCHRAN REPLIES: Reversing glue is not an easy task, it takes patience and ingenuity. Hide glue is reversible with water or steam. The best way to get moisture into the joint is with a steam generator, if you have access to one. Drill a very small hole into the joint from the underside, where it won't show, and force steam into the hole through a small nozzle. If steam isn't available, use a hypodermic syringe or glue injector to squirt hot water into the joint. It may take a number of injections over an entire day to loosen the joint, but take your time and it will eventually come apart. Household ammonia can also be used in this manner.

White and yellow glues will also loosen with steam and hot water, but yellow glue may take longer. Injections of acetone or ethyl alcohol will also loosen white and yellow glues. These methods are almost certain to damage finishes, but they can be repaired later.

Plastic resin glues are not reversible with the injection methods and we've found that vibration is the only way to get these joints apart. Place one of the parts to be separated in a vise and strike the other a sharp hammer blow. Protect the part with a soft block of wood before striking it. It usually takes two people to do this job, one to hold the parts and one to jar the joint. Reverse clamps are handy in getting joints apart—they produce a steady, controllable push that makes damage less likely. [Allen Cochran is a cabinetmaker and a furniture conservator for the National Park Service in Harpers Ferry, W. Va.]

Bubbled veneer—*Shortly after I covered the top of an*

antique dresser with maple veneer, it bubbled up in places. The next day, however, the veneer was unbubbled and as flat as one could hope for. A couple of weeks later I happened to leave the top in my car in bright sunshine for about 20 minutes, during which time it checked horribly—and I mean horribly. What's going on? Why did it bubble and check and how can I avoid a repeat of this problem? I used contact cement and applied the veneer directly to the maple top, with no cross-band.

—John A. Nelson, Bagwell, Tex.

SIMON WATTS REPLIES: It's difficult to say what the problem is, but I assume that your solid wood substrate is on the move due to moisture changes, and the bubbling was caused by it shrinking, lifting the veneer as a result. The substrate may have expanded a little later, giving the appearance that all was well. When the top was placed in the sun, the veneer dried rapidly and tried to shrink. But since it had nowhere to go, it checked and cracked instead. Cross-banding, a sheet of veneer placed with its grain perpendicular to the substrate grain, probably would have helped. So would the right adhesive. Contact cements aren't suited for veneer but are best for gluing rigid or semi-rigid materials like plastic laminates. A better adhesive for veneering is urea formaldehyde for large surfaces or yellow glue for small areas. URAC 185 is an adhesive designed for veneering, it's made by American Cyanamid, Wayne, N.J. 07470. [Simon Watts is a cabinetmaker and boatbuilder.]

An alcohol-resistant bartop finish—*I'm finishing a restaurant bartop with an oil finish and can't seem to come up with one that is alcohol-resistant. I've tried linseed oil and turpentine and tung oil, to no avail. The customer insists on an oil finish. Any suggestions?*

—Alexius R. Robben, San Antonio, Tex.

GEORGE FRANK REPLIES: Bartops can be finished with oil, but the finish is not alcohol-proof and it will need frequent renewal if you want a decent-looking job and some degree of protection from alcohol and moisture. I'd suggest a good alcohol-proof lacquer or varnish that can be dulled to an oil flatness with steel wool. Contrary to what many believe, you don't have to build up many coats to protect the wood, two coats of lacquer or varnish should offer excellent protection, in most cases. [George Frank is a woodfinisher, with more than 50 years experience.]

OTTO HEUER REPLIES: If the customer insists on an oil finish, I would apply a mixture of equal parts of tung oil, japan drier and mineral spirits, and let this dry 32 to 48 hours. Sand lightly and apply a second coat, allowing it to dry about 36 hours. Dispose of any rags used with this mixture, as it may produce spontaneous combustion, or store them in a fireproof container. Alcohol-resistance can come from a product such as Varathane, made by Flecto International, 1000-02 45th St., Oakland, Calif. 94608. Thin this finish with two parts of the proper reducer to one part of varnish, and brush on a thin coat. A mixture of two parts tung oil, two parts mineral spirts and one part phenolic spar varnish might work as well. Apply two coats at 36-hr. intervals, sanding lightly between coats.

Follow-up:

We've received lots of replies to V. Liden's request for help on making the wooden puzzle described on page 32 of

FWW #34. Liden, of LaGrange, Ill., asked how a ball bearing floated in a groove in the puzzle, locking it when in one position but unlocking when the puzzle was rotated. Many readers sent in photocopies of page 54 from *Puzzles in Wood,* by Edwin M. Wyatt. This book, which is available from Woodcraft Supply Corp., includes designs for many wooden toys and novelties.

Donald A. Cowles, of Owasso, Okla., suggested that a small notch the length and depth of the bearing be cut near the pivot point. This notch gives the bearing a parking place, thus clearing the groove and allowing the puzzle to be opened. Turning the puzzle would roll the bearing out of the notch and back into the groove, locking the puzzle closed.

Chip Worrell, of Hendersonville, N.C., writes that his Uncle Fred made a puzzle for him using the same principle but a ⅛-in. brass rod instead of a bearing. Like the bearing, the rod rides in a groove and slides out of the way to unlock the puzzle. Worrell says his puzzle has a clearance notch cut into the groove so the puzzle pivot part can pass over the rod when it's opened.

. . .The method you printed of using 60-grit sandpaper for finishing a walnut grandfather clock (*FWW* #33, p. 28) seems more suited to floors than furniture. A cabinet scraper might work better to remove blemishes before finishing.

—Grey Doffin, Fargo, N.D.

Readers Want to Know:

. . .I'd like to hear from anyone knowledgeable about using a four-head molding machine.

—Frank S. Bowman III, Boonsboro, Md.

. . .I have a Power King Wood Lathe but have been unable to figure out how to change the drive belt.

—Jim Miller, Saratoga, Calif.

Readers Can't Find:

. . .I'd like someone to correspond with about making a ventriloquist figure. *—Richard D. Rollf, Salem, Ore.*

. . .I am looking for books, articles or other information on making bagpipes. *—Joseph M. Herrmann, Jefferson, Ohio*

. . .a source for Queen Anne legs. I used to get them from Rollingswood but they are out of business.

—Clair W. Streng, New Lothrop, Mich.

. . .a source for Danish Ball locks.

—E.E. Woodman, St. Joseph, Mo.

. . .a source for hinges for Murphy or fold-away beds.

—Susan Los Calzo, New Orleans, La.

Sources of Supply:

—Italian poplar plywood, suitable for the bending mentioned in the Taunton Press book *Tage Frid Teaches Woodworking,* is available from Allied Plywood, 1635 Poplar St., New York, N.Y. 10461.

—Owners of Hitachi 3-HP routers who have experienced chronic bearing problems with their tools may get better results if they use ABEC grade 5 replacement bearings. These bearings are available from bearing suppliers and are sold under the same part number as the original.

—Mendocino Woodworkers Assoc., Mendocino, Calif.

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

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FINISHING SANDER
Model: BO 4510

Good for heavy duty applications of cabinet shops, auto body shops etc. Light weight: 2.4 lbs. Powerful 1.8 amp. motor turns 12,000 rpm. Orbital action. All ball bearing construction. LIST: $75.

$47.99 ppd.

2 3/4 H.P. ROUTER
Model: 3600B

Makita's best. Super duty plunge type production router. Powerful 12 amp motor turns at 22,000 rpm all percision ball bearing. Quick change of cutting depth between 0 - 5/8". Accepts ½", 3/8", ¼" shank bits. Comes with ½", 3/8", ¼" collets, wrenches. Guides are optional. (All three pc. set add $18.50)

LIST: $299. **$199.50 ppd.**

3/4" HAMMER DRILL
2 Speed

Model: 8419-B2

Designed for heavy duty and industry jobs. 2 speed gearing of 18,000 bpm and 46,000 bpm. Quick change from drilling to hammer drilling. All ball bearing, 6 amp. motor. Side handle swivels 360.

LIST: $186. **$129.50 ppd.**

PLANER-JOINER
Model: 2030

Compact design. 2 H.P. single phase 110 V. mutor. 12" width, 6⅛" depth planer, 6¾" joiner. Fully assembled, ready to run. Comes with blades, sharpening holder, spanner wrench. Weighs 275 lbs.

LIST: $1936. **$1449.50 ppd.**

3/8" Cordless Drill, Reversible Screwdriver Kit
Model: 6010DW

One hour fast charge with removable battery. Most powerful cordless available. Comes with battery charger, phillips bit. Weighs only 2.4 lb

LIST: $129. **$89.50 ppd.**

4-3/8" CIRCULAR SAW
4200N/9333 LIST: $131 **$89.50 ppd.**

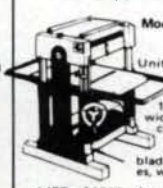
16" CIRCULAR SAW
5402A/9387 LIST: $404 **$299.50 ppd.**

2-Speed Reciprocating Saw
JR3000w/case LIST: $151. **$106.99 ppd.**

3"x24" BELT SANDER
9924D B/9381 LIST: $206 **$149.99 ppd.**

BAND SAW
2116 LIST: $1936. **$1399.99 ppd.**

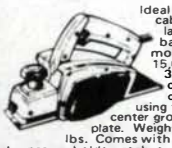
15 5/8" PLANER
Model: 2040



Unit is fully assembled with 2 H.P. motor. Single phase 115V. 15 5/8" width, 7 5/8" deep cutting capacity. Weighs 254 lbs. Comes with blades, socket wrenches, wooden leveler.

LIST: $1730 **$1369.99 ppd.**

3 1/4" PLANER
Model: 1900B



Ideal for door and cabinet installations. 4 amp. ball bearing motor turns at 15,000 rpm. 3¼" blade capable of chamfer cuts using the unique center groove in sole plate. Weighs only 5.5 lbs. Comes with blade guage, sharpening holdar, socket wrench, guide rule, blades. (Carbide blades add $37.)

LIST: $139. **$95.99 ppd.**

PLANER BLADE SHARPENER
9820-2 Sharpens planer and jointer knives up to 15⅝" wide. Med. grit stone and wrenches and blade holder.

$149.50 ppd.

10" MITER SAWS
Model: 2400B

Best power miter saws on market. Powerful 10 amp. motors. Cuts 2 7/8" x 4 1/4" at 90°, 2 7/8" x 3 1/2" at 45°. Electric brake for instant stop. Accepts vise and holder assemblies. Comes with dust bag and wrench. LIST: $333.

$279.99 ppd.

Model: 2401B

Same as 2400B, it doesn't accept vise and holder assembly. But it has positive stops at 90° and 45°. Turn table is made of cast iron. Comes with wrench.

LIST: $306. **$249.99 ppd.**

14" Miter Saw
LS 1400 LIST: $503 **$389.99**

4" X 24" BELT SANDER
Model: 9401

8.5 amp powerful motor. 1148 ft/min. Perfect for flush-along-side sanding. High efficiency dust collector.

LIST: $273. **$199.50 ppd.**

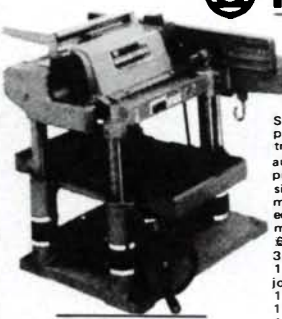
1/2" Variable Reversible Speed Drill
Model: DP 4700
Cat. No.: 9336

Heavy duty 4.8 amp. motor turns 0-550 rpm. Ball and bearing construction. Light weight 4.4 lbs. Motor hip-clip.

LIST: $134. **$89.99 ppd.**

Hitachi

PLANER/JOINTER
Model: F-1000A



Small size and light weight; easily Portable by two people and easily transported by light vehicle. 12 1/8" automatic planer edge-wedth permits processing of one-food workpiece in single operation. Spring system method allows simple adjustment of edge height, both automatic and manual. Max. cutting height: 6 5/8". Max. cutting thickness: 3/16". Max. cutting width of planer: 12 1/8". Max. cutting width of jointer: 6 5/8". Accessories include 1 blade sharpening Ass'y, 1 tool box, 1 driver, 1 wrench, 1 box wrench, 1 blade height adjusting ruler. Weighs 319.4 lbs.

$1499.00 ppd

12-1/8" PLANER
Model: P-100

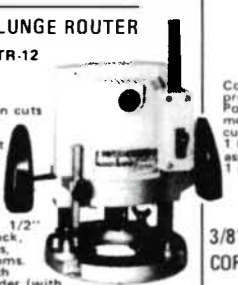
3 h., 15 amps, 10,400 rpm motor. All gear and chain drive. 4 column support, chip blower, speed reducing kit, magnetic blade setting system. Weight 265 lbs. setting system. Wt. 265 lbs. **$1150 ppd.**

3-1/4" PLANER
Model: F-20A

Compact lightweight design, high-precision ball bearing operation. Powerful 3.4 amp. 15,000 rpm motor. Cutting width 3¼", max. cutting depth 1/32". Comes with 1 box wrench, 1 blade sharpening ass'y, 1 blade setting gauge and 1 guide. Weight 6.1 lbs.

$97.00 ppd

1/2" PLUNGE ROUTER
Model: TR-12



Fast, clean cuts enabled by powerful built in motor. Three stages of cutting depth easily selectable. 1/2" collet chuck, 12.2 amps, 22,000 rpms. Come with 1 bar holder (with wing bolt and feed screw), 1 template guide, 2 wrenches, 1 straight bit, 1 trimmer guide, 2 chuck sleeves, 1 straight guide. Weighs 12.3 lbs.

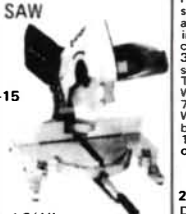
LIST: $ **$219.99 ppd**

3/8" 2-Speed Reversible CORDLESS SUPER DRILL
Model: DRC-10

Removable, 60-minutes rechargeable battery pack system. Exclusive, adjustable-clutch, for screw drilling. Auto cut off 60 minute charger. Capacity in steel 3/8", wood 19/32", wood screw (DxL) 3/16"x1-3/8". Torque range 6.9-34.7 in lb. Weight 3.3 lbs. Battery pack voltage 7.2V. 6 Pcs. nickel cadmium cells. Weight 1.98 lbs. Comes with 1 battery pack (B2), 1 charger, 1 chuck wrench, 1 plus bit. Case optional.

$97.00 ppd

15" MITER SAW



Model: TSB-15

Cuts wood, plastic and aluminum. 0-45 degree bevel cut capability, right or left. Safety lock switch. Max. cutting at 90: 4-3/4"x 6-3/8". At 45: 4-3/4"x 4-3/4" 13 amp, 3,400 rpm powerful motor. Weight 55 lbs. Comes with 1 combination blade and dust bag. Optional are extension bar, vice, vice holder, stopper, and tipped saw.

$379.00 ppd

10" MITER SAW
Model: TSB-10

Same features as Model TSB-15. Max. cutting at 90: 3-1/8"x4-5/16" At 45: 3-1/8"x3-1/8". Powerful 13 amp, 5,000 rpm motor. Weight 44 lbs. comes with combination blade, and dust bag.

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W6VA Positive depth adjustment. Wt. 3.4 lbs. **$97.50 ppd.**

2-Speed Reversible Cordless Drill
DTC-10 60 minute rechargable. Wt2.64 lbs. **$89.50 ppd.**

1/4" PLUNGE ROUTER
TR-8 Wt. 6.4 lbs. **$139.00 ppd**

3 x 21" BELT SANDER with Dust Collector 2-Speed
SB-75 Wt. 10.8 lbs. **$149.50 ppd.**

14" METAL CUT-OFF Machine
0-45 degree bevel
HU-14 Wt. 36-1/3 lbs. **$199.50 ppd.**

VARIABLE SPEED JIG SAW
JHV-60 Compact, light-weight. Wt. 5.2 lbs. **$129.99 ppd.**

BAND SAW
B-600A Wt. 339.2 lbs. **$1499.00 ppd**

ORBITAL SANDER with Dust Collector
SOD-110 Powerful Wt. 5.9 lbs. **$105.99 ppd.**

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POWERCUT 7 1/4" Circular Saw
Model: PC 70

Professional quality, rugged performance. Excells on crosscuts, rip cuts and angle cuts. Powerful 12 amp. motor 5800 rpm. Max. depth of cut 2-1/2" at 90, 1-7/8" at 45. Comes with blade wrench and 18-tooth carbide-tipped blade. Wt. 13.4 lbs.

LIST: $157. **$119.99 ppd.**

Electronic Variable-Speed JIG SAW
Model: JSE-35

Handles straight curved and plunge cutting. Powerful 3.7 amp motor with variable 300-2700 spm. Capacity 1/8" in steel, 1-3/4" in wood. Electronic control and speed selection. Heavy duty shoe tilts 45 left and right. U-shaped shoe allows view cutting line. Comes with 2 hex wrenches and assortment of five blades. Wt. 4 lbs.

LIST: $105. **$79.50 ppd.**

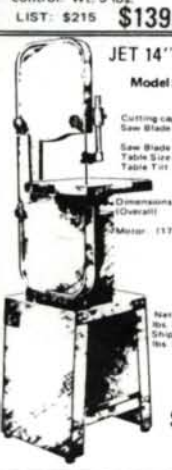
BOSCH

Orbital Action Jig Saw-VARIABLE SPEED
Model: 1578

Industrial duty. Unique blade motion with variable speeds from 1000-3400 strokes per minute. Barrel grip allows for precise handling on intricate patterns. Rotating "mushroom" handle for extra control. Wt. 5 lbs.

LIST: $215 **$139.99 ppd.**

JET 14" BANDSAW
Model: JBS 14



Cutting capacity	6"
Saw Blade Min	1/8"
Max.	3/4"
Saw Blade Length	93½"
Table Size	14"x14"
Table Tilt	45 xR 10 xL
Dimensions (Overall)	65½" H 24½" W 19½" D
Motor (1725 rpm)	½ H.P. Sgl. Ph. 1156230 (Pre-wired 115 V)
Net Weight lbs. (approx.)	201
Shipping Weight lbs. (approx.)	208

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Books

The Woodworker's Pocket Book edited by Charles H. Hayward, revised by Robert Lento. *Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632, 1982. $5.95, paper; 167 pp.*

Handbook of Carpentry and Joinery by A.B. Emary. *Sterling Publishing Co., Inc., Two Park Avenue, New York, N.Y. 10016, 1981. $8.95, paper; 352 pp.*

The Theory and Practice of Woodwork, 4th edition, by George Love. *Longman Group, Ltd., Burnt Mill, Harlow, Essex, CM20 2JE, England, 1981. £3.05, paper; 156 pp.*

The British don't speak English; just ask any American ploughing through a British woodworking book for the first time. I was puzzled for months when told by a British book to clean my clogged sharpening stones with paraffin. In England, I finally learned, paraffin isn't candlewax but kerosene. Likewise, an Englishman shoots the edge of a board with his plane, he buys timber rather than lumber, and he measures it in cubic feet or cubic meters, not board feet.

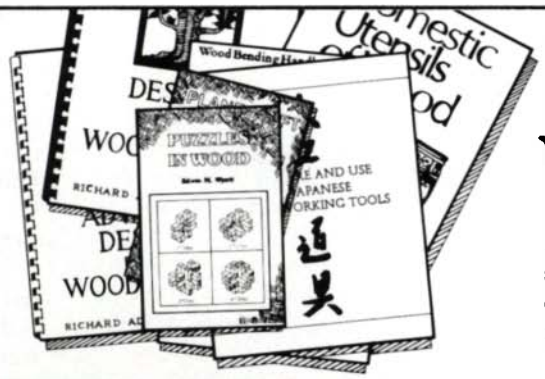
Translating English into American should make a British book much more useful on this side of the ocean. Unfortunately, Prentice-Hall has done a careless job with Hayward's *Woodworker's Pocket Book.* The first section, entitled "Timber," is about lumber, and it also confuses meters and feet: above the label "One board foot" is a drawing showing a cubic meter. The section on glues lists both American and British brands, but doesn't tell which is which; you can probably buy them all here, but only from special suppliers.

Still, like all Hayward's books, this one is useful. It is a good beginner's dictionary to rudimentary woodworking terms, tools and techniques. He gives definitions, not much instruction, and is at his best with joints and hand tools. The drawings are clear without being tight. Get a British edition if you can—you'll have to translate it yourself, but it will fit nicely into a shirt or pants pocket; the American edition is too large for that.

A.B. Emary's *Handbook of Carpentry and Joinery* is another British import, and its national flavor—the British still do many things in the old ways—increases its interest for the American reader. Emary has included "many of the finer parts of the crafts of carpentry and joinery (that) seem to be disappearing today . . ." Just the sort of information the amateur or specialist woodworker often has trouble finding.

Inside the house, Emary moves from simple paneled doors to complex staircases; outside, from rudimentary concrete formwork to roof trusses to eyebrow windows and turrets that go on the roof. I especially enjoyed his drawings of staircases—straight-flight, landings, various geometrical flights and, finally, dancing stairs, the tapered stairs that turn a straight-flight around a corner without a landing. This book is a handbook, condensed from two longer texts, so Emary does not provide step-by-step procedures. But the clear, concise drawings and text explain what everything is, and head you in the right direction to do it. Even if you don't make what Emary shows, the book is worth its price for keeping some of those finer parts of the crafts of carpentry and joinery from disappearing.

Love's *The Theory and Practice of Woodwork* is a concise textbook for British schools. It covers the whole range of woodworker's concerns, from drawing, through materials and tools, to veneering, turning and finishing. But its reach ex-



The Woodcraft Library

...Revives many of the lost, traditional woodworking techniques sought by today's craftsmen. These woodworking classics, long out of print or commissioned exclusively for Woodcraft®, are a must for every woodworker.

DESIGNS FOR THE WOODCARVER, by Richard Dabrowski. Fifty patterns for carving as plaques, in varying degrees of bas-relief or even in the round: dolphins, roosters, stallions, clipper ships, African and New Zealand masks, ritual heads, 14 variations of the American bald eagle, and more. Spiralbound, 64 pages.
10W21-D $9.50 ppd.

THE CARE AND USE OF JAPANESE WOODWORKING TOOLS, by Kip Mesirow. Unlike western tools, Japanese saws, planes, and drawshaves are meant to be drawn rather than pushed. This English-language text explains techniques, sharpening, honing hollow-ground chisels, and more. Softbound, 95 pages.
10S51-D $8.95 ppd.

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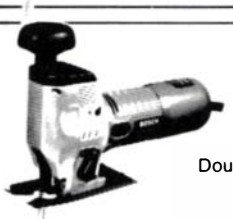

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ceeds its grasp—the book is spread too thin. What can be said about the history of design, for example, in a few pages is hardly worth saying. But Love is good on basic techniques and constructions—buy the book for that. *—Roger Holmes*

Woodwork Aids and Devices by Robert Wearing. *Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632, 1981. $6.95, paper; 208 pp.*

The function of a jig, it seems to me, should be to make repetitious work bearable and to expand a woodworker's potential, not merely to make every cut foolproof. The main problem with Wearing's book is that you would get more out of making many of these jigs than you would from using them. It's not that the book doesn't have lots of good ideas: There's a method for making push-broom-bristle holes that just begs for wider application. And there are many familiar clamping systems that work fine. As a bonus, there's an exhaustive list of plans for making planes. But the good ideas are lost in page after page of jigs that stretch credibility. Would anyone actually use a sliding clamping system for relatively simple crosscuts on the tablesaw? It would take more setup time than the cut itself. The author comes close to saying it himself: "An alternative method using two roller bearings as shown at D makes either an improvement or an unnecessary complication, according to preference."

In reading a book full of so many jigs that don't seem necessary you can lose concentration and miss the ones that are really fun. The book is strained—not inspired—that's its trouble. It leaves me feeling bogged down and impatient. I'm off to make one of those push-brooms. *—Jim Cummins*

DESIGN BOOK THREE

We're often asked when *Fine Woodworking* might publish another book of photographs of the wooden things our readers have made. The answer is that *Design Book Three* will be published next year.

Back in 1976, we invited readers to send us photographs of their best work in wood. To our surprise, we were awash in thousands of photographs, which we sifted and sorted into *FWW*'s *Biennial Design Book.* The project was so much fun that two years later we asked for more photographs. Again the deluge. But for *Design Book Two,* we decided to go for breadth and to print as many of the photographs as we could squeeze between covers—1,150 of them. The two books together, we figured, described the state of the woodworker's art during the late 1970s. And to date they have sold about 150,000 copies.

Now it's time to do the same for the 1980s and publish *Design Book Three.* But instead of the breadth that results from thousands of pictures, we'd like to try for depth. We want to publish fewer, bigger photos of the very best work by a few hundred woodworkers.

This notice is a preliminary announcement. Full details of the competition for *Design Book Three* will be printed in our next issue (Sept./Oct. '82, No. 36), along with an entry blank. That issue will also feature a technical article about taking quality black-and-white photographs of wooden objects. Please do not send us any photographs yet; wait until you have the entry blank and the full rules of the competition. Deadline for entries will be Dec. 31, 1982. □

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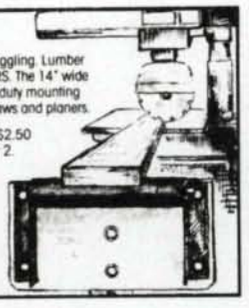

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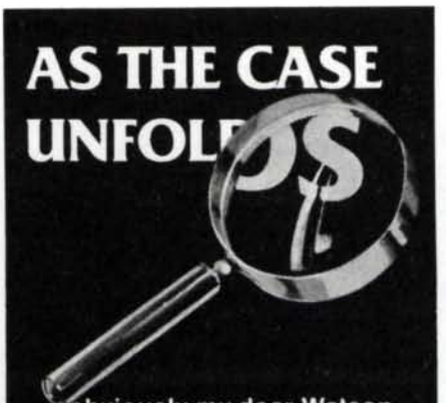

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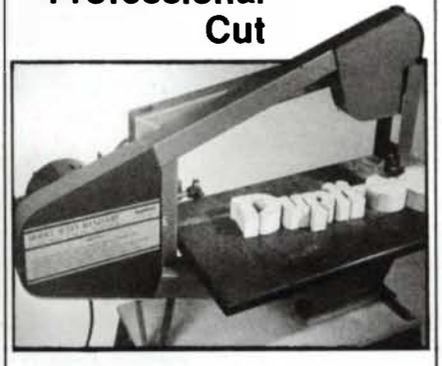

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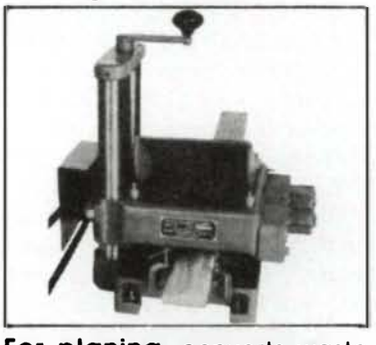

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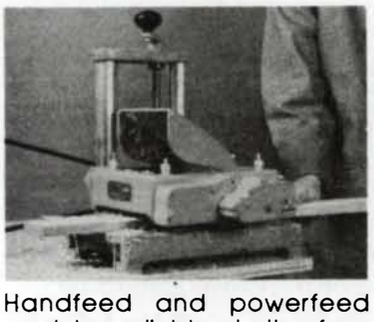

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FIRST ROSEWOOD

BY ROBERT F. VERNON

I have been an ardent maker of recorders and flageolets for several years now. Nothing provides an easier retreat from inflation, nuclear poisoning, third-world mayhem, or other 20th-century delights as much as slipping down into the workshop or pondering an ancient manuscript and joining the Renaissance world. Ah, those golden centuries past of plague, Inquisition and the Hundred Years War. It is somewhat reassuring to know that I am already ten years beyond what the average lifespan was back then.

Part of the fun in crafting these musical instruments is the practical and archival research and speculation. Recorder-making, like the instrument itself, is beguilingly simple to learn and elusively difficult to master. I began by reading Trevor Robinson's book *The Amateur Wind-Instrument Maker* (University of Massachusetts Press, 1980) and by measuring modern instruments I had on hand. I continued researching and began to make a few models in order to understand approaches and techniques. Each understanding led to a new puzzle and challenge. I still have much to discover.

Another part of the fun is the making of the necessary tools. Through frustration I developed a special rasp for cutting the windway, and later uncovered a 16th-century woodcut of a craftsman using an identical tool. As a social scientist I enjoy speculating on how a Renaissance shop was organized. Did the masters do the final voicing, leaving the journeymen to turn away, as the British recorder-making firm Dolmetsch Ltd. does today? How many recorders per employee per day did a shop have to produce to stay in business? What secrets were guarded and what techniques were common?

Most of the fun is in the making and the playing. After about three years of serious fooling around, I began to produce acceptable sopranos in maple. That was two years ago and I am just now starting to make altos. Perhaps I will make the great bass, an 8-ft. monster, before my retirement.

By the time I'd gotten the basic hang of it I'd given away several nice specimens to friends and relatives. My trashcan, the best tool in the workshop, had swallowed countless earlier attempts. On the shelf above the lathe was a lovely piece of rosewood I'd ordered from Constantine's two years before. It had sat there adjusting to the shop all that time, waiting to become my own instrument. Its time had come.

The wood was considerably heavier than the maple I was used to. In fact I wondered how wise it was to try it because I'd never turned rosewood before. I cut the square into a rough cylinder. Ah, rosewood. When I shot the pilot bore with a small-diameter auger, the tip fell just a millimeter from the headstock spur. The alignment was dead-on. First, second, third, and final reams. No chattering. The bore was glossy without sanding. Enchanted by the rosewood, I continued and mounted the blank onto a mandrel to turn the final shape. The rosewood peeled away. I made a mental note to place a large order with Constantine. Turning done, the marks erased easily with a scraper. The simple lines pleased me. The rosewood glowed under a light coat of beeswax.

The rest, rough-cutting the holes, working the final windway and making the fipple, was a delight. The rosewood did everything asked of it. No checks, no splintering—remarkable wood. I made a mental note to order more than I could afford. I carefully taped the beak to protect it from moisture and began the patient task of tuning. Several evenings later, having tempered the instrument to taste, I removed the tape to rub in the final coat of beeswax. I sat down with some favorite music. The time had come to evaluate.

I jumped off into a Susato dance. Another. I was delighted. Praetorius. More Praetorius, followed by Schein. Even Henty VIII, another passionate amateur, would have been happy. (Henty, by the way, owned 76 recorders at the time of his death.) I continued with a few of his compositions. Then a few of my own. Very content, I put the recorder away. It was superb. That night I dreamed of rosewood trees growing in my backyard. Perhaps I'd retire in Brazil. . . .

By the next morning my lips were badly chapped. Blisters appeared by noon. Scabs formed by the next day. Far, far too late I'd discovered my allergy to rosewood. I called up a close friend who is a fellow woodworker and also a physician and told him of my problem. He was anything but optimistic. I gave him the rest of the rosewood. He eyed it suspiciously.

I still pick up the rosewood instrument from time to time. I could inlay the mouthpiece. Yet somehow it seems complete. I've got some pearwood stickered out back. I chewed a piece the other month, just to be sure. □

Robert F. Vernon teaches social science at Keuka College in New York. For more on woodwind instruments, see FWW *#8, p. 80, and #28, p. 34.* Fine Woodworking *buys readers' adventures. Suitable length is 1,500 words or less—up to six typed pages, double-spaced. Please include negatives with photographs.*

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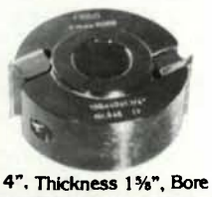

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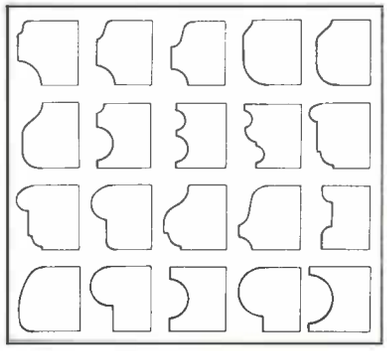

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Events

Listings are free but restricted to events of direct interest to woodworkers. The Sept. issue will list Aug. 15-Nov. 1: deadline July 7; the Nov. issue will list Oct. 15-Jan. 1: deadline Sept. 7.

ARKANSAS: Ozark Mountain Workshops—Basic Woodworking Joinery, Dennis Soden, Aug. 2-6; Furniture Restoration, Stephen Smith, Aug. 9-13; Woodworking Art & Philosophy, Aug. 16-20. Contact Timberworks Studio, Box 22332, Kansas City, Missouri 64113.

CALIFORNIA: Wood Show—Western States Invit., Sept. 18-Oct. 31. Contact Gallery Fair, Box 263, Mendocino, 95460, (707) 937-5121.
Fair—ACE, at Fort Mason Center, San Francisco. Trade, Aug. 12; public Aug. 13-15.
Juried Show—Sculptural Expressions in Contemporary Furnishings, Oct. 8-Nov. 27. Contact Flood Gallery, 3921 California St., San Francisco, 94118.
Workshop—1st Western Turning Conference, Sept. 24-26. Contact Ellen Jouret, Calif. College of Arts and Crafts, 5212 Broadway, Oakland, 94618.
Seminars/Workshops—Turning, Bob Stocksdale, free, Aug. 7 (Berkeley); lecture, Shaker Furniture, Dr. John Kassay, $7.50, Aug. 20 (San Diego), Aug. 27 (Los Angeles); Make a Shaker box, John Kassay, preregister, $25, Aug. 21 (San Diego), Aug. 28 (Los Angeles); Japanese Tools/Sharpening, Robert Gheleter, free, Aug. 28 (Berkeley). Contact The Cutting Edge. Berkeley: (415) 548-6011; Los Angeles: (213) 390-9723; San Diego: (714) 695-3990.
Workshop—Circular and bandsaws, Sept. 20-24; Seventh Internat'l Wood Machining Seminar, Oct. 18-20. Univ. of Cal. extension, 47th & Hoffman Blvd., Richmond. To enroll call Dr. R. Szymani (415) 231-9582.

COLORADO: Workshops—John Nyquist, July 26-Aug. 6; Sam Maloof, Aug. 21-22. Turning: David Ellsworth, July 5-9. Basic Woodworking: Richie Marks, July 12-16. The Fine Art of Woodworking: Wendell Castle, July 19-23. Chairmaking: John & Carolyn Grew-Sheridan, Aug. 9-20. Shaker Furniture: Walker Weed, Aug. 23-27. Anderson Ranch Arts Center, Box 2410, Aspen, 81612. (303) 923-3181.

CONNECTICUT: Workshop—Wooden boat construction and repair, Simon Watts, Aug. 16-22; lamination, Seth Stem, Aug. 7-8; woodworking techniques, James Schriber, June 30-Aug. 4; scrapwood projects, shorebird decoys, Bud Kronenberg, July 10-11; joinery and design, Tom Hucker, Aug. 14-15; marketing, Nina Holland, Aug. 14. Brookfield Craft Center, Box 122, Brookfield, 06804. (203) 775-4526.

GEORGIA: Workshop—Crafts Marketing, July 24, $35. Georgia State U. (404) 658-3456.
Seminars—Carcase and drawermaking, July 17-18; Cabinetmaker's planemaking, Aug. 14, 21, 22. McGee, 218 S. Boulevard, Carrollton, 30117. (404) 834-7373.

ILLINOIS: Workshop—Furniture conservation, Wallace Gusler, Aug. 2-5. Campbell Ctr., Box 66, Mt. Carroll, 61053.

IOWA: International Wood Carvers Congress and Exhibition—July 30-Aug. 8. Great Mississippi Valley Fairgrounds, Davenport.
Carving—Int., July 10-Aug. 7; adv., Aug. 21-Sept. 18. Contact W. Schnute, RR #6, The Woods, Iowa City, 52240. (319) 351-0014.

KENTUCKY: Joinery and Woodturning—July 1-3. Berea College, CPO 758, Berea, 40404, (606) 986-9341.

MASSACHUSETTS: Exhibition—July 15-Sept. 11, Furniture by McKie, Brooks, Hurwitz, Castle, Keyser, Newman, Kopf, Coffey, more. Craft Center, 25 Sagamore Rd., Worcester.

MINNESOTA: Course—Aug. 2-7, at Sugar Hills Carving School, Grand Rapids. $50 fee by July 1. Contact Will Bondhus, 10309 Thomas Ave. S., Bloomington, 55431. (612) 881-7357.

MONTANA: Classes—Handtool joinery, July 5, Aug. 16. Primrose Center, 401 W. Railroad St., Missoula, 59802. (406) 728-5911.

NEW HAMPSHIRE: Seminars—Robert Major: Selling, July 31, Aug. 28; Japanese planes, July 24. Mahogany Masterpieces, RFD 1, Wing Rd., Suncook, 03275. (603) 736-8227.
Show—Furniture by David Lamb, June 8-Aug. 20. Gordon-Nash Library, New Hampton.

NEW JERSEY: Seminars—Radial-arm saw & router table, W. Kunkel, Aug. 7-8; Old ways of working wood, B. Kunkel, Aug. 14; Bench carving, chainsaw sculpture, M. Kunkel & D. Gibbons, Aug. 21. Mr. Sawdust School, Box 4, Schooley's Mountain, 07870. (201) 879-5899.

NEW MEXICO: Show—Once a Tree, Sept. 3-7. La Fonda Hotel, Santa Fe.

NEW YORK: Classes—YWCA, 610 Lex. Ave., at 51 St. (212) 755-2700.
Exhibits—Furniture, June-July; Turned Work, August. Pritam & Eames, 29 Race Lane, East Hampton, 11937. (516) 324-7111.
Workshop—Japanese Style Woodworking, Robert Meadow, Aug. 16-20 at The Lutherie, 2449 W. Saugerties Rd., Saugerties, 12477.
Course—Design, July 18-31 at Parsons School of Design, Lake Placid. (416) 977-3801.
Fair—Sept. 3-6. Woodstock.

NORTH CAROLINA: Courses—Carving, July 4-17; woodworking, July 18-31. The John C. Campbell Folk School, Brasstown, 28902.

OKLAHOMA: Woodcarving Show—July 8-11, Woodland Hills Mall, Tulsa.
Seminar—Carcase & Drawermaking, Ian Kirby. Oct. 1-3 at Fine Tool and Wood Store, 724 W. Britton Rd., Oklahoma City, 73114. Contact Cheryl Hays, (405) 842-6828.

OREGON: Workshop/Lectures—Sculptural approach to functional objects, Terry Al Smith, Aug. 2-7; bowlturning, John Whitehead, Aug. 23-28; business, Libby Platus, Aug. 9-11; selling, Wed. eves. July 21-Aug. 18. Oregon School of Arts and Crafts, 8245 S.W. Barnes Rd., Portland, 97225.
Exhibition—Furniture, Gary Rogowski, Aug. 9-27. Reed College Vollum Ctr., Portland.

RHODE ISLAND: Fair—ACE, Newport Yachting Center, July 23-25.

TENNESSEE: Courses—Woodworking, beg., James Schriber, July 5-16; int.-adv., Michael Hurwitz, July 19-30; furniture design, Judy McKie, Aug. 2-13; canoe building, Tommy Hill, Aug. 16-27. Appalachian Ctr. for Crafts, Rt. 3, Smithville, 37166. (615) 597-6801.
Workshops—Woodturning, Mark & Melvin Lindquist, July 12-19. Arrowmont School, Box 567, Gatlinburg, 37738. (615) 436-5860.

VERMONT: Workshops—Woodworking, July 19-24; Drawing, July 19-24; Carcase and drawermaking, Aug. 2-7; Design, July 26-31; Frame and panel, June 28-Aug. 3; Furniture, July 26-31; Seating, Aug. 9-14. Kirby Studios, North Bennington, 05257. (802) 442-3119.

WASHINGTON: Workshop—James Krenov, July 17-18. Northwest Gallery of Fine Woodworking, 202 1st Ave. S., Seattle, 98104.

WEST VIRGINIA: Exhibition—Woodworking, June 20-July 31, Stifel Fine Arts Center, 1330 National Road, Wheeling.
Workshops—Turning, Palmer Sharpless, July 12-16; Traditional Furniture, Mack Headley, July 26-30. Cedar Lakes Craft Center, Ripley, 25271, (304) 372-6263.
Classes—Treenware, July 11-17; Hammered Dulcimer Const., July 18-Aug. 7; Coopering, Aug. 1-7; White Oak Basketry and Toymaking, Aug. 8-13. Augusta Heritage Arts Workshop, Davis & Elkins College, Elkins, 26241.

WISCONSIN: Craft Festival—Workers in Wood, Traditional Craft Festival, Sept. 3-5 at Country Sunshine Campgrounds, Hwy. 42, Carlsville. Juried, deadline Aug. 1. Box 201, Menasha, 54952.

NOVA SCOTIA: Courses—Woodworking, with Jeff Amos, Leo McNeil, Rick Lair, Richard Tyner. Contact Richard Tyner, 32 Edmonds Grounds, Halifax, B3N 1M6, (902) 477-3008.

ONTARIO: Courses—Decoy Carving, July 12-16, Woodturning, Aug. 2-6. Write Haliburton School of Fine Arts, Box 339, Haliburton, Ont. K0M 1S0, (705) 457-1680.
Show—Art Shaw, Doug Oliver, John Kraai, and Chris Laffin. Aug. 28-Oct. 20. Upper Edge Gallery, 219 Princess St., Kingston.
International Wood Carving Exhibition—Aug. 18-Sept. 6. National Exhibition, Toronto.

SASKATCHEWAN: Turning Conference—Aug. 13-15, with David Ellsworth, Rude Osolnik, Del Stubbs, Gilles Blais, Jim Beebe. Contact Michael Hosaluk, RR#2, Saskatoon, S7K 3J5, (306) 382-2380.

Photo: Cornis McHugh

Britain's Prince Charles hoists aloft the child's chair—split and shaved of English oak by Richard La Trobe-Bateman of Batcomb—given to him when he opened the Craft Council's new gallery and library in London. As you may have heard, Charles and Princess Di expect to need such a chair any day now.

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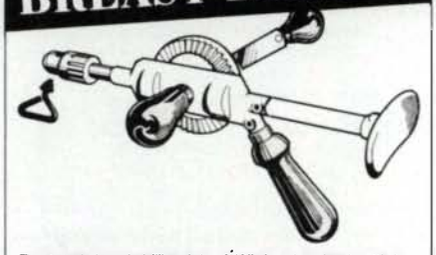

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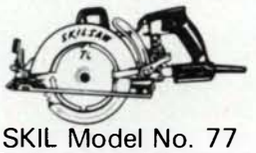

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Blade Depth	Hitachi Makita Teeth/Inch	Powermatic Rockwell 14" Teeth/Inch	Blade # Letter	Price PPD.
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⅛"	24	24	B	$11
¼"	10	10	C	$9
⅜"	10	10	D	$9
½"	10	10	E	$10
¾"	10	10	F	$12
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Padouk	1" 1¼" 2" 4"	$6	15
Bubinga	1" 1¼" 2" 4"	$6	15

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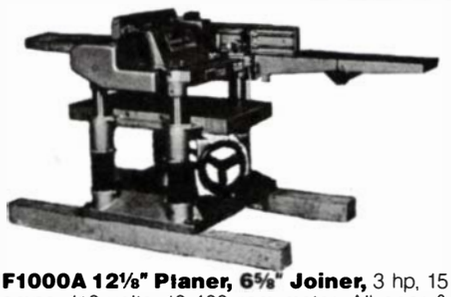

F1000A 12⅛" Planer, 6⅝" Joiner, 3 hp, 15 amps, 110 volts, 10,400 rpm motor. All gear & chain drive planer (no belts), ⅛" depth of cut, 3/16" thru 6⅝" cutting height, jointer bed 63", 4 column support, chip blower, speed reducing kit, magnetic blade setting system. Weight: 320 lbs.

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¼"	½"	¾"	1¾"	4	$ 8	
½"	⅜"	1"	2"	5	$ 9	
¼"	¾"	¾"	2"	6	$10.50	
½"	⅜"	1"	2¾"	7	$ 8.50	
½"	½"	1¼"	2⅞"	8	$ 9	
½"	¾"	1"	2⅝"	9	$11.50	
¼"	½"	1"	2⅝"	10	$10	FLUSH TRIM BIT WITH B.B.
½"	½"	1"	2⅝"	11	$11	FLUSH TRIM BIT WITH B.B.
¼"	¼" radius	1"	2⅝"	12	$25	ROMAN OGEE WITH B.B.
¼"	⅜" radius	1"	2⅛"	13	$19	ROUND OVER BIT WITH B.B.
¼"	¼" radius	¾"	2½"	14	$17	ROUND OVER BIT WITH B.B.
¼"	½" radius	¾"	2⅛"	15	$21	ROUND OVER BIT WITH B.B.
½"	¾" radius	1"	3"	16	$38	ROUND OVER BIT WITH B.B.
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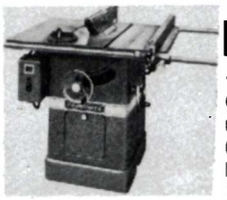

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84 MD	10"	50	⅝"	Rip/Cross	$72/$50
71 MA	10"	18	⅝"	Rip	$61/$41
PS203	7¼"	24	⅝"	Construction	$25/$20
PS303	7¼"	40	⅝"	Construction	$30/$24
PS204	8"	24	⅝"	Construction	$26/$21
PS304	8"	40	⅝"	Construction	$32/$26
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74 ME	10"	80	⅝"	Thin Kert	$96/$64
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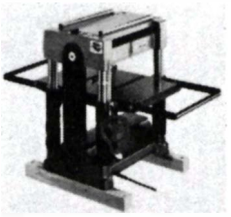

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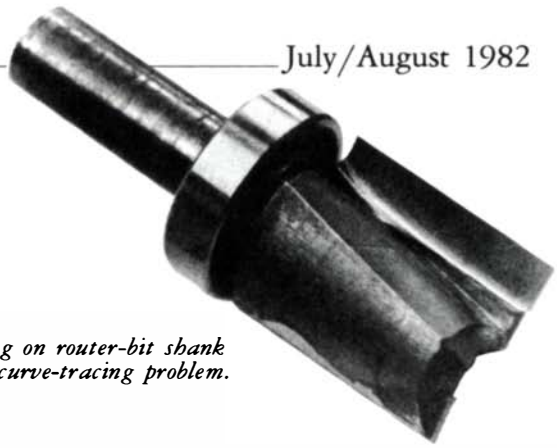
Joinery Along Curved Lines

A general method for template routing



Bearing on router-bit shank solves curve-tracing problem.

by Jim Sweeney

We woodworkers are fascinated by joinery. Often we'll examine a piece of furniture to see how it's put together, even before we consider how it looks or functions. Exposed joinery is particularly satisfying. Through its visible joinery, a piece speaks of the fact that it is wood, and of all the possibilities and limitations of assembly which that implies. In this article I'll discuss a general method for extending exposed joinery from the ordinary linear joint to joints that follow almost any arbitrary curve. Using only a router and a few combinations of straight cutters and bearings, complex but precise curved joints become available to anyone willing to apply some ingenuity.

In making furniture with non-traditional shapes, it's particularly valuable to have a vocabulary of curved, exposed joints that are analogous to the lap, bridle and dovetail of rectilinear joinery. The principal lines in contemporary furniture often are not straight; the maker tries for a coherent whole using the rhythms and tensions of curved lines and planes. But in a non-traditional shape, as in an unrhymed poem, the sense of rightness is elusive. The eye is less forgiving, less able to fill in, when it is faced with the unfamiliar. The designer of unfamiliar shapes struggles against the pull of the amorphous, the chaotic, or the simply awkward. In this context, traditional joint shapes can be especially inappropriate, unless used in irony or in contrast—they are words from another language. Of course, these problems can be avoided by using concealed joinery (mortise and tenon, dowel, etc.) or non-joinery (stack lamination), but such choices just eliminate one more option in resolving the design.

Bridle joint with curved shoulder.

It's not surprising that the tool used to cut curving joints is the router. The other joinery tools that have evolved—saw, chisel, plane, and their machine counterparts—cut flat planes. The router, unlike these older tools, does not need to refer to where it has just been to determine where it is going. At any instant it is free to move exactly where we guide it. The problem of curved joinery thus becomes how to guide the router to cut the precisely matching negative and positive curves that will unite to form some particular joint.

The main tactic for doing this is to shape templates of some durable material (plywood, Masonite, aluminum) and to transfer the shape to the work, by using a straight two-flute router bit with a ball-bearing mounted above its flutes. There are thus three parts to the problem of cutting curvilinear joints: first, how to make precisely matching negative and positive templates of a chosen shape; second, how to transfer these shapes into the workpiece; and third, how to make this transfer occur exactly where we want it in the finished work. Though this third aspect of the problem may at first seem trivial, it often calls for the biggest bag of tricks, and is the least susceptible to any kind of general solution.

Let's first consider the second problem, that of transferring the curve from a template to the work, because it best introduces the use of bearing-cutter assemblies. My technique descends directly from two common techniques, so I'll start by describing them and their disadvantages.

In one standard technique the router is guided, as it is fed through the cut, by its subbase being pressed against a template or fence that is clamped to the work. In a more flexible version of this method, a template guide-collar is attached to the subbase of the router and run against the template, while the router subbase rides atop the template. The cut may go completely through the work, or only partly into it. But in either case there is one problem: concentricity, or rather, the lack of it. The router bit is reasonably concentric with the motor, the motor is somewhat loosely housed in the base, the subbase is aligned with the base by some hopeful screws, and finally, the guide collar fits into a hole in the subbase. All of these attachments are governed by the initial imprecision of manufacturing as well as by subsequent wear. We should not be surprised when this chain of vagueness does not yield pre-

cise concentricity. The cutter changes position whenever the router is rotated relative to the template. So the worker must try to keep the same point of the subbase, or guide collar, against the template throughout the cut—a hopeless task when so much else compels his attention.

In a second standard method, the guiding surface is built into the cutter, so that concentricity is guaranteed and overall accuracy is limited only by the precision of the cutter assembly itself. This technique employs a flush trimmer bit—commonly, a ½-in. straight cutter with a ½-in. ball-bearing at its end—with the bearing rolling against a template that is attached to the work on the face opposite the router. This method is limited mainly by the position of the bearing: we can trace through work only as thick as the cutting flutes are long, and we must always cut completely through the work. The first limitation is not serious because you can find trimmer bits as long as 2 in., though they are fragile. The second limitation, always cutting through the work, is very restrictive—a mortise cut this way, for example, must always be a through mortise. You cannot use a trimmer bit to cut the negative part of a half-lap or a bridle joint.

Furthermore, trimmer bits themselves contain a subtle source of error. Because they are designed so that the bearing can roll against a vertical, Formica-covered surface while the cutter trims the adjacent horizontal surface, the diameter of the cutting circle is usually 0.005 in. to 0.010 in. smaller than the bearing. This minute difference can become significant when you make a template from a series of intermediate templates, because the errors accumulate. You can sometimes compensate with a layer of tape on the template.

There is another technique for transferring a curve from template to workpiece, but it requires a pin router. A template fixed to the underside of the workpiece can run against a pin the same diameter as, and directly below, a bit entering the workpiece from above. For more about pin routers, see *FWW* #29, p. 63, and #33, p. 59.

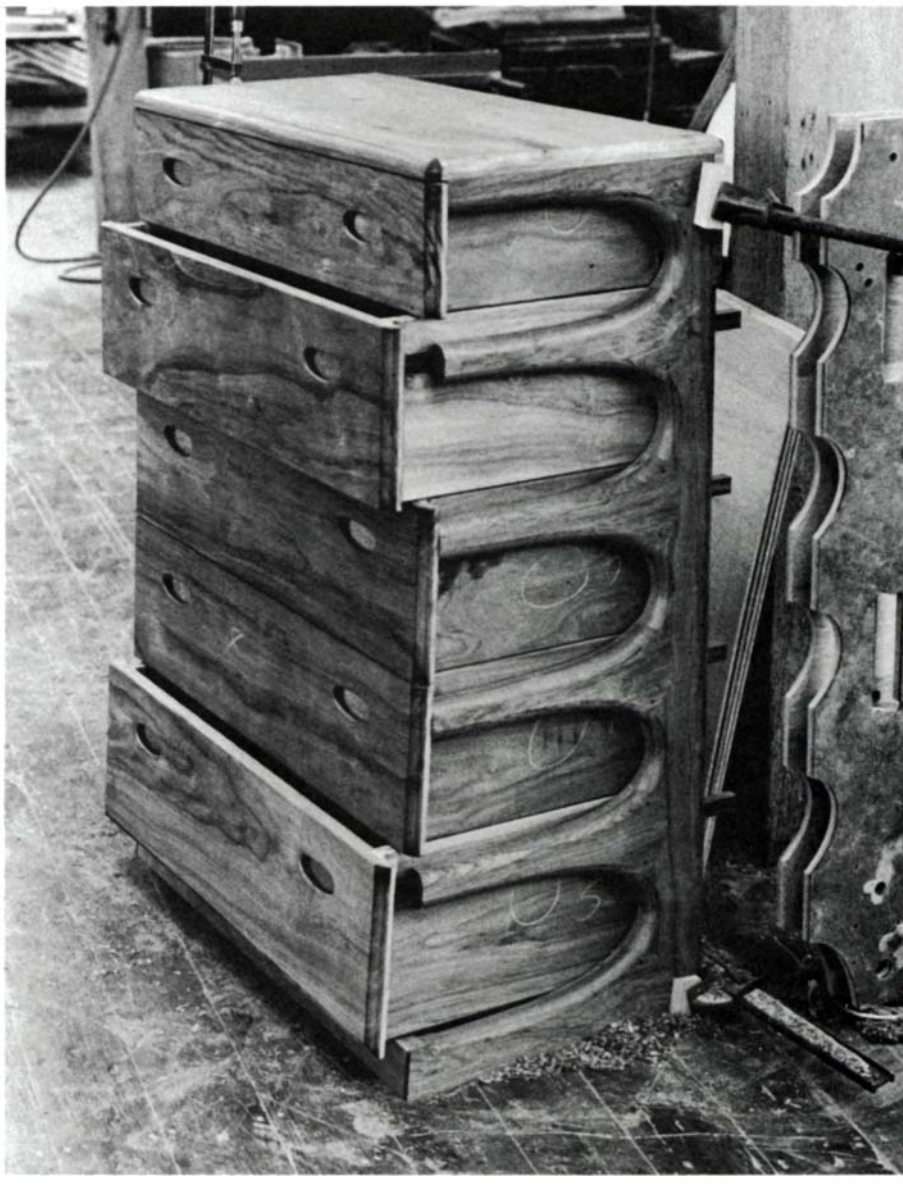
The system I consider optimum combines the best features of both standard techniques: a bearing on the bit for concentricity, but placed on the router side of the cutter, on the shank above, rather than below, the cutting flutes. This bearing will follow a template exactly, yet the cut can stop at any desired depth. The outside diameter of the bearing is ordinarily the same as the cutting diameter, but it can also be larger. This simple idea, it turns out, unlocks a host of joint designs that can be as simple or as complex as the craftsman wishes. Any pair of fitted shapes that you can make in ¼-in. hardboard can be transferred into solid wood, either completely through the workpiece or to any depth, although it is sometimes necessary to juggle template thickness and cutter length.

Router bits with bearings mounted on their shanks, unfortunately, are not stock items. And although router bits are made in a wide range of sizes, ball-bearings are not. The woodworker must devise bearing/bit combinations that will do the work at hand, and find a mill supply house or industrial hardware dealer who stocks or can get the parts. For most of my work, and in the examples that follow, I use either of two bit/bearing combinations: a ¾-in. diameter cutter with ⅜-in. diameter shank plus a bearing of ⅜-in. ID and ¾-in. OD (for example, New Departures' #77R6AB), or a 1⅛-in. diameter cutter with ½-in. shaft plus a bearing of ½-in. ID and 1⅛-in. OD (for example, TRW's MRC R8ZZ).

The only limitation here is that the smallest radius of curvature in the joint must equal or exceed the radius of the smallest bearing. With my ¾-in. combination, a ¾-in. diameter washer must be able to roll along the curve and touch every point of it. You can get around even this limitation by using unmatched bearing/bit combinations, ¾-in. to ⅜-in. for example, with appropriate offset in the template.

Usually the bearings simply slide onto the bit shank until they are stopped by the metal of the cutting flutes. If there is any resistance, apply force to only the inner race of the bearing. In extreme cases, expanding the bearing with heat and

Author's open-sided chest-of-drawers relies upon curved bridle joint for visual continuity. Chest is under construction in photo below, and finished in detail photo on facing page. Scalloped template (shown standing at right) straddles the chest's vertical spine to rout the curved shoulders of the bridle joint. A mating template attaches to the horizontal arms that hold the drawers, and the ends of the arms are routed to fit the spine. Inset drawer pulls are shaped with the same template techniques; a similar handle is explained in detail on page 52.



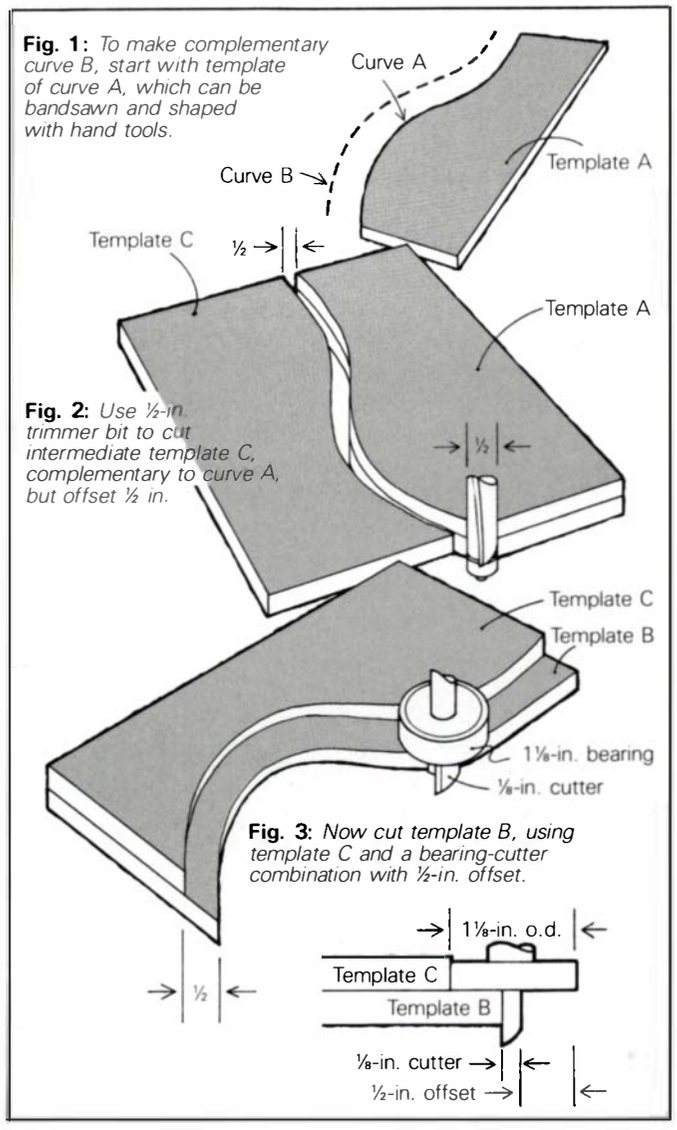


Fig. 1: *To make complementary curve B, start with template of curve A, which can be bandsawn and shaped with hand tools.*

Fig. 2: *Use ½-in. trimmer bit to cut intermediate template C, complementary to curve A, but offset ½ in.*

Fig. 3: *Now cut template B, using template C and a bearing-cutter combination with ½-in. offset.*

contracting the shaft by freezing will help. On the router end, the collet itself stops the bearing from sliding up on the bit shank. A drop of Loctite will hold it fast.

Of my two bearing/cutter combinations, the smaller is best for inside cuts (that is, when the bit is surrounded by wood), where control and power are most important. The larger is for outside cuts, where good surface finish and freedom from tear-out are necessary. Bear in mind, though, that even a powerful router is an ineffective hogging tool, because the counterforces developed in a heavy cut make precise control difficult. Whenever possible, it's best to use the router as a trimming tool, with some other tool—drill press, gouge, dado blade, or bandsaw—removing the bulk of the waste.

Now that we have a way to trace a template curve down into the workpiece, let's return to the original problem of fitting two pieces of wood together along some curve—that is, how to create two matching templates, one negative, the other positive. Let's assume we already have an arbitrary curve A and we wish to create the matching curve B (figure 1).

Clamp or tack a piece of template material on top of template A, leaving plenty of this template material on the off side of the curve. We will cut an intermediate curve, C, which will be exactly like the desired curve B except offset ½ in.—too small or too large, depending on whether it is concave or convex. We can do this by tracing along curve A with an accurate ½-in. trimmer bit, as though creating a copy of A. What we want, however, is the fall-off (figure 2).

This is the only stage in the process where we are at risk, because any deviation by the bearing from perfect contact with A will result in a defect in curve C, which will be inherited by curve B. You might need several tries to get it right, but the price of failure is low—a wasted piece of hardboard.

Now, to obtain curve B it's necessary to cut a curve parallel to C but offset ½ in. in the other direction. Tack C onto a piece of template material, and cut out B by rolling along C with an unmatched bearing/cutter combination, one with a bearing 1 in. larger in diameter than the cutter. One such combination would be a 1⅛-in. diameter bearing on a bit with a ½-in. shank and ⅛-in. cutting diameter (figure 3).

Although in theory this would work perfectly, in practice ⅛-in. diameter cutters are fragile and easily broken. I therefore had a machinist turn a bushing with a 1⅛-in. ID and 1¼-in. OD, and press it onto a ½-in. ID by 1⅛-in. OD bearing. This maneuver created a 1¼-in. bearing that I could mount on a ¼-in. cutter. The difference in radii is the desired ½ in. Another way to achieve the transition from C to B is to make two setups with a 1⅛-in. bearing on a ⅝-in. cutter, first using C to cut an intermediate curve, D, and then using D to create B. This tactic achieves a ½-in. displacement by adding two ¼-in. displacements. A number of other combinations will also work as well.

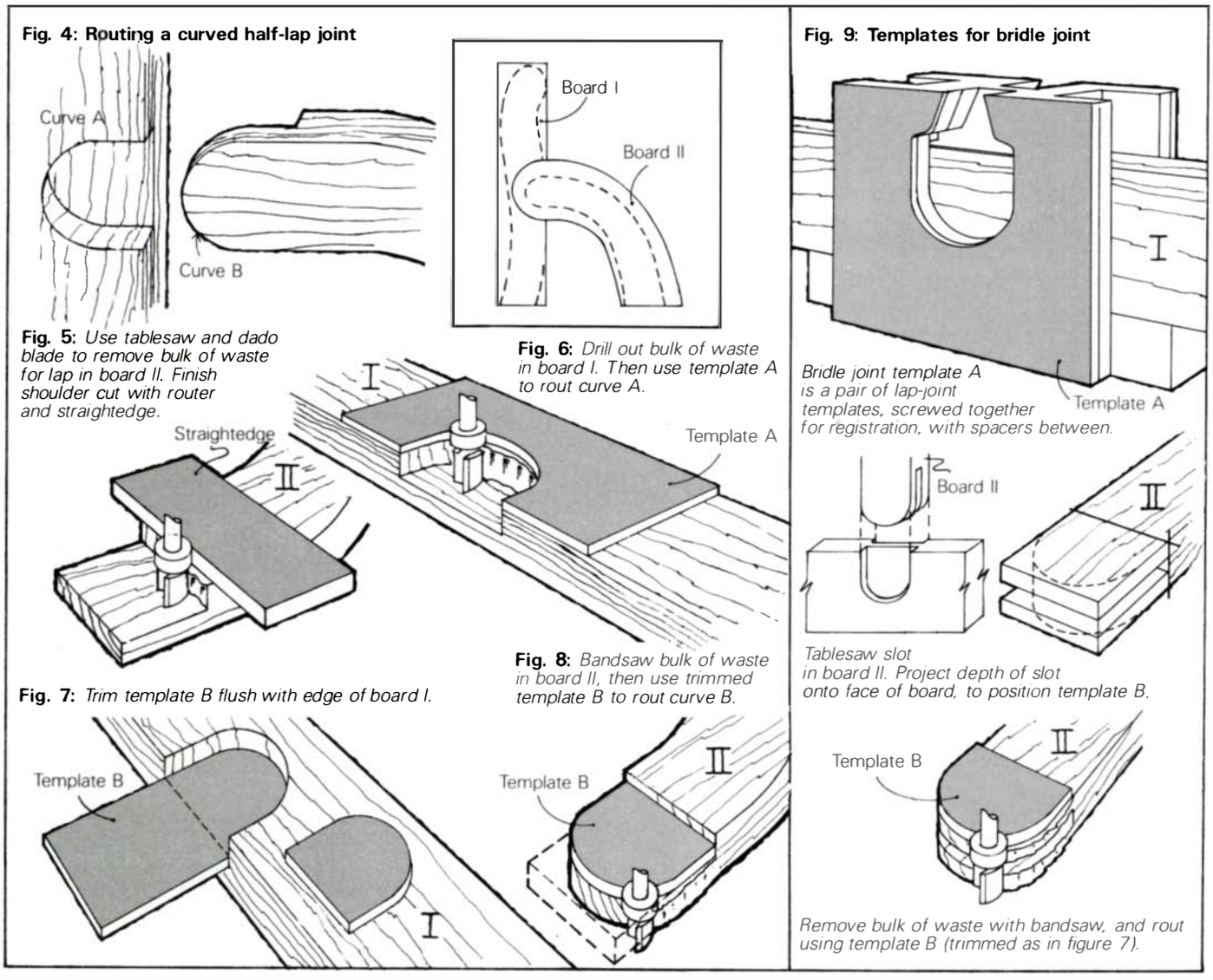
Curve B should fit precisely into curve A—unless, of course, something went amiss, which it frequently does. One source of error is any difference between the diameter of the cutter and the diameter of its bearing, likely if the bit has ever been sharpened. A discrepancy can be corrected by applying tape along curve A, as close as possible in thickness to half of the difference between cutter diameter and bearing diameter. Masking tape, packing tape, duct tape, and ordinary Scotch tape all have usefully different thicknesses.

Before going on to consider the third part of the curve-fitting problem, that of using these templates to rout our matching curves exactly where we want them, I should mention a few ways to generate curve A. Bandsawing and hand-sanding work, though it's difficult to maintain a perpendicular edge. If the edge isn't perpendicular to the face of the template, you have not one but several curves, all vaguely close to A, depending upon which cross-section the bearing rides. A drill press with sanding drum, or better still a spindle sander, is more effective. A good way of generating curve A in the first place is to combine several sub-curves already on hand, for example circles of various diameters (cut with lathe or drill press), straight lines, or french curves, tracing out the various components one at a time with a bearing and bit, all the while maintaining fairness where they merge and overlap.

To the third problem, that of positioning the matching curves in the work, I can give no general solution. Each joint requires its own tricks. Perhaps it will be useful to discuss a joint, the trick for which occurred to me suddenly as I was riding on top of a crowded bus to a dive in Moorea, dodging coconut fronds, and certainly not thinking about woodworking. Suppose we have templates A and B, with which to cut boards I and II, so that they may be joined in a lap joint, as shown in figure 4.

A template can be aligned on board I by making the respective edges flush and by making some point on the curve coincide with some point on the edge. But board II has no

Drawings: Jennifer Kallgren



straight edges, and it will be difficult to position the template to cut a half lap so that curve B has the same relationship to the lap's shoulder as curve A has to board I's edge. Do we cut the lap first, or curve B first? Proper cutting sequence is crucial in curved joinery, because each curve cut eliminates one more straight line from which to index.

In this case, it makes sense to cut the lap shoulder first. Start by scribing a line on board II for the lap shoulder. This doesn't have to be exact, as there is some allowance for waste, but the closer it is, the less waste there need be. Rough out as much wood as possible with tablesaw and dado blade, cutting to the finished depth but not to the lap shoulder line. Because of the curvature of board II, it would be awkward, though not impossible, to cut this shoulder on the saw. Instead we turn the work over and use a router with a straight-edge template to finish the shoulder (figure 5).

Now mark out curve A on board I, and drill out most of the waste. Clamp template A to board I, lining up the edges, and cut curve A into board I with the router (figure 6).

Now, and this is the crucial trick, slide template B into the A-shaped cutout you just made in board I, and tack it tightly. Then trim template B flush with the edge of board I (that is, the edge that ultimately will butt against the lap shoulder in board II). Use either an accurate trimmer bit, with the router base riding on the cut-out face of board I, or a bit-with-bearing-above-cutter, with the router base riding on the face opposite the cutout (figure 7).

Tack this truncated version of template B tightly against the lap shoulder in board II. The lap shoulder of board II will fit against the edge of board I exactly as tightly or as loosely as template B fits against the shoulder. Cut template B's shape into board II using a cutter with same-size bearing above its flutes (figure 8).

In the very corners, the bearing will bump into the lap shoulder, leaving an area where B is not traced down. A few minutes with bandsaw and file, or chisel, or spindle sander, cleans this up for a perfect fit.

Though procedures like these may become convoluted, care will always yield a perfect fit. Sometimes, of course, I choose to work at risk, not to seek the tedious but foolproof solution. But at other times, when my ultimate concern is the accuracy and strength of the finished joint, I use techniques like the ones I've described here, ignoring the automatic censor that won't allow things of great difficulty to suggest themselves. New joints can emerge from design processes that are integral with and complementary to the lines of the piece as a whole. Such an exposed, routed joint can be the whole focus of an otherwise simple piece of furniture. □

Jim Sweeney makes furniture in San Francisco.

Relying on the Router

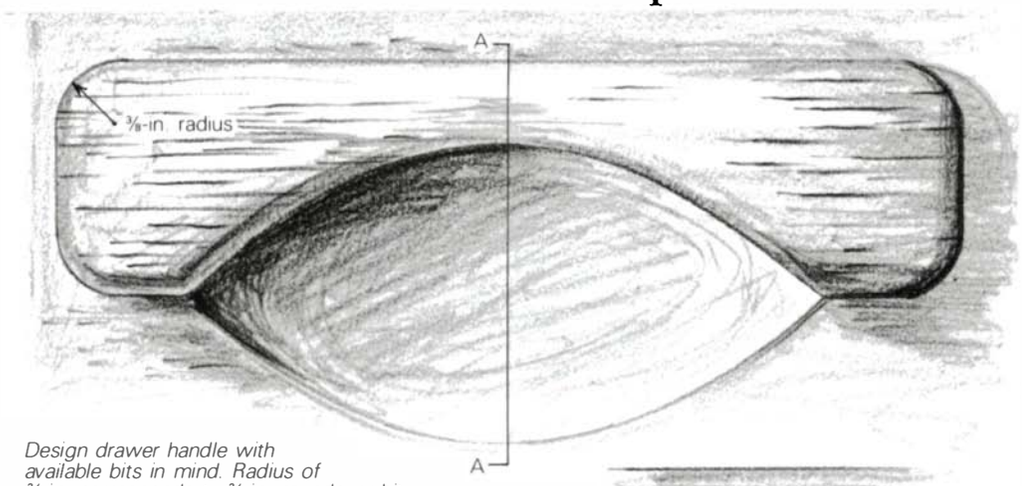
Three tricks from San Rafael

Unlike woodworkers in the European tradition and, to a lesser degree, those on the East Coast, many woodworkers on the West Coast came to their profession with a minimum of formal training. Thus there has developed among us a heavy reliance on the electric router for doing quite a few jobs that the old school would have done with other tools in other ways. Never mind that a sharp chisel could do a job well, we're more fluent with the router. A lot of us have spent the better part of a day—or even a week—perfecting a jig or a template that will harness the router to the task at hand.

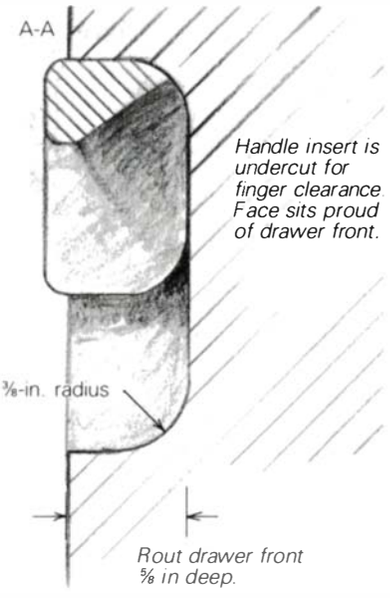
Often this router technology is enormously efficient, allowing us to repeat processes quickly and accurately. At other times the router work is mundane, just another way of doing an ordinary woodworking job that could be done by other tools. But not surprisingly, the router is also capable of making many cuts and shapes that no other tool can accomplish. Those of us who rely on the router in our everyday work are the ones who are likely to discover the creative things it can do. Many times it seems that the router jig itself is our final product, rather than the piece of furniture. Sometimes we miss out on the sound of a sharp blade slicing into the wood; instead we put on ear protectors to mute the whine of the three-horse Stanley. Nevertheless, the router technology we've evolved allows an economical efficiency that the professional woodworker cannot overlook in his struggle to make a living. I share shop space with two other craftsmen, Dale Holub and Bruce McQuilkin. The following pages demonstrate what I mean about the router by explaining three of the things that have evolved here in San Rafael: an inlaid wooden handle that Holub routs into his drawer fronts, the quick mortising method that I use, and a nifty wooden hinge that McQuilkin uses for desks and cabinets.

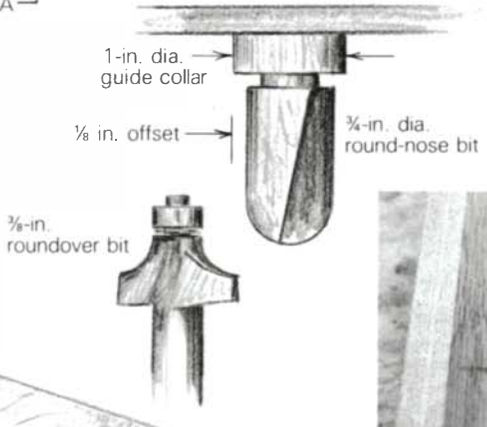
—Grif Okie

Holub's inlaid wooden drawer pull

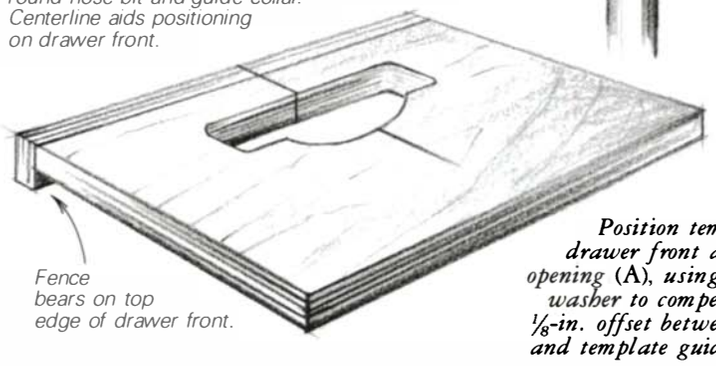


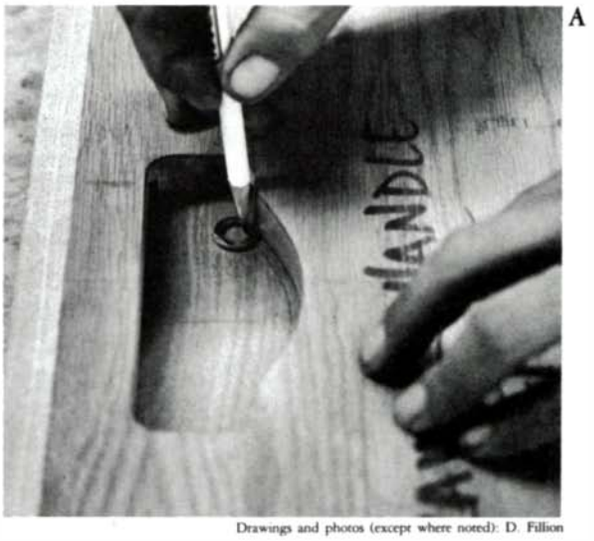
Design drawer handle with available bits in mind. Radius of ⅜ in. corresponds to ⅜-in. roundover bit, and ¾-in. round-nose bit. Drawer front is routed out to accept handle blank and to provide finger clearance.





Cut out template for drawer front, adding ⅛ in. all around to allow for offset between round-nose bit and guide collar. Centerline aids positioning on drawer front.



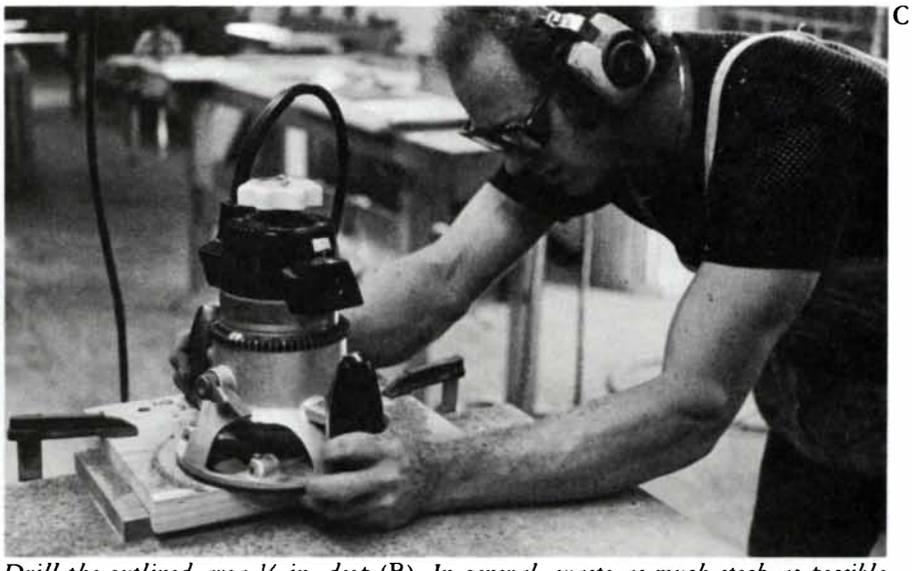


Position template on drawer front and trace opening** (A), **using suitable washer to compensate for ⅛-in. offset between cutter and template guide collar.

Drawings and photos (except where noted): D. Fillion

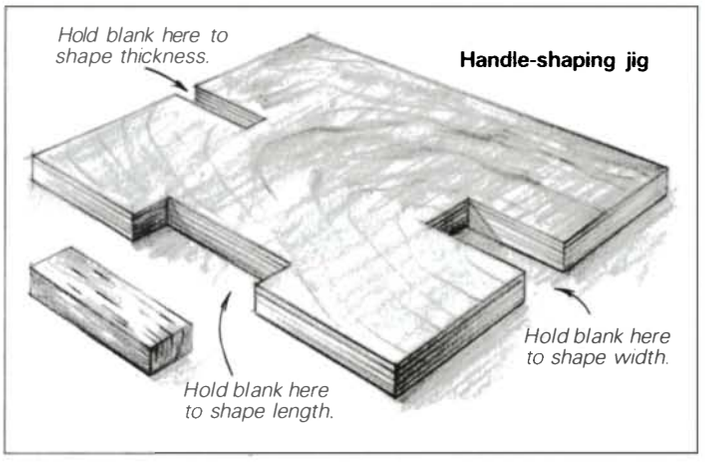
B

C



Drill the outlined area ½ in. deep (B). *In general, waste as much stock as possible with other tools before routing to the line. Clamp template to drawer front. With a ¾-in. round-nose or corebox bit set to cut ⅝ in. deep, begin routing in a circular motion from the center of the opening* (C). *With a clear area in the middle, check the depth of cut, adjust if necessary, then rout out the entire area. Clean up with a gouge, and sand the top edge.*

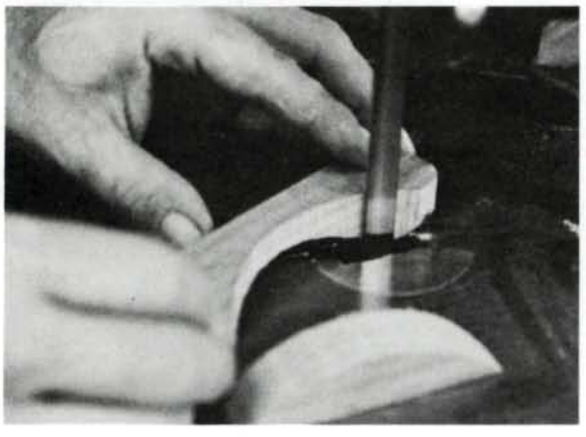
D



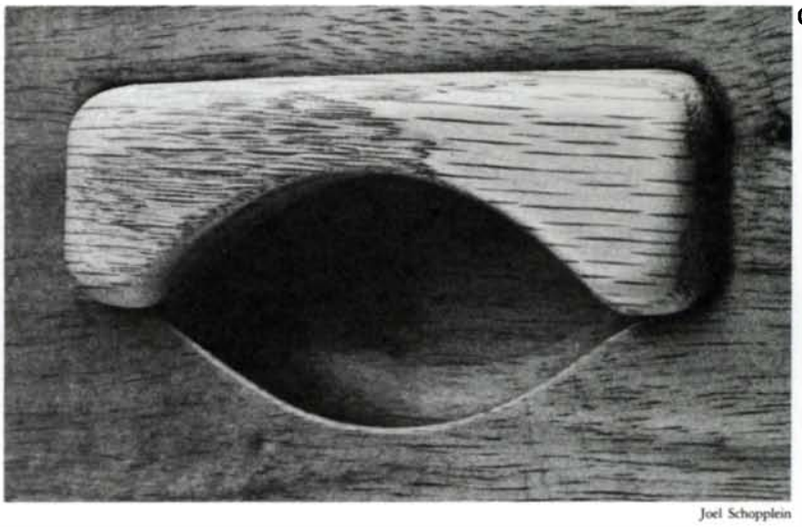
E

Plane, rip and crosscut handle stock to size. Shape the underside of the blank on the router table, using a ⅜-in. roundover bit with guide bearing (D), *and a jig for holding the work (drawing). Alternatively, if you are making a number of handles, you can rip and shape a suitable length of stock to width and thickness, then crosscut individual blanks to length for further shaping. A routed handle blank is shown at left* (E). *Clean up edges with a drum sander, and try the fit. Transfer the curve of the finger allowance to the face of the handle. Bandsaw the curve of the handle and undercut the finger space* (F). *Sand the edges. Chamfer or round over the show edges, then glue the handle in place* (G). *The finished drawer pull is oak inlaid into a koa drawer front.*

F



G

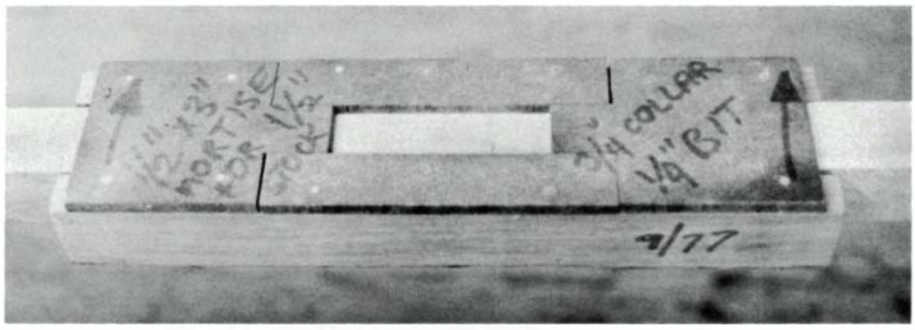


Joel Schopplein

Okie's quick jig for routing mortises

This jig for routing mortises is simple to build, and it produces an accurate joint that's easily repeated. It does, however, make a round-cornered mortise. The corners can be squared off with a chisel, or the tenon can be rounded over to match. But you can also rout equal mortises in both pieces of wood and then insert a separate, spline-type tenon. Tenons can be ripped by the running foot, then routed with a roundover bit of the appropriate radius to fit into the round-cornered mortise.

The jig consists of two shoulder blocks clamped onto the wood, with four pieces of hardboard tacked onto them to confine the travel of the router's template collar. The template can be a rectangular hole cut into a single piece of hardboard; I find it easier, however, to make each jig anew to fit the thickness of the stock I'm using, by assembling the jig right on the stock. First decide on the length, width and depth of the mortise you want, according to the strength needed as well as the bits and template guide collars you have. The best mortising bits are either spiral end-mills or straight, two-flute cutters, carbide or steel. Lay out the mortise on the stock, then clamp the shoulder blocks to the adjacent faces. Make sure that the shoulder blocks are wide enough, of sufficient length, and flush with the surface to be mortised. Now tack or glue the hardboard strips to the shoulder blocks, far enough away from the layout lines to account for the difference in radius between your router bit and its guide collar. With the jig in place, tip the router into the cut and run its guide collar around the inside of the opening you've made, proceeding in suitable increments to the full depth.



Okie's mortising jig, for use with router and guide collar, is expeditious. First lay out mortise, then clamp shoulder blocks to faces of stock, and tack hardboard template parts to blocks. Size of opening depends on offset between cutter and guide collar.

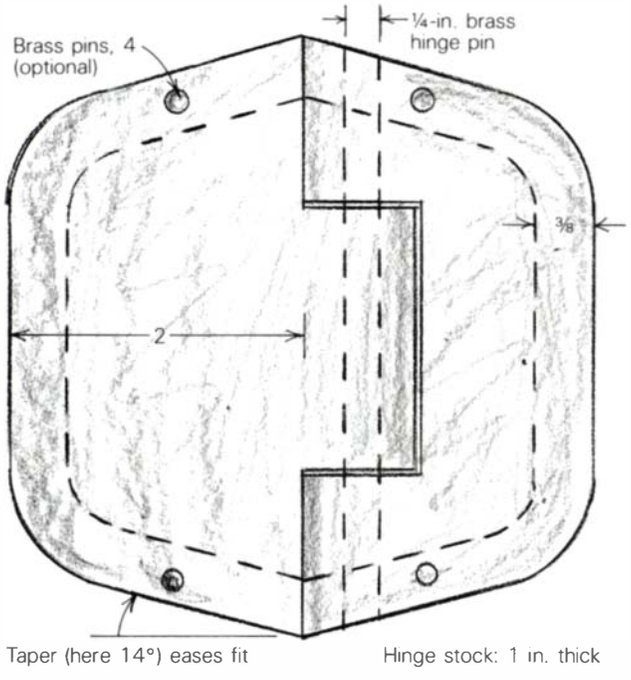
Two things make this type of cut easier: a template opening that's wider than the guide collar, and template hardboard that's thick enough to contact and align the guide collar before the bit gets into the wood. A plunge router (*FWW* #30, p. 90) is ideal. Walk the router clockwise around the mortise, in the bit's direction of rotation.

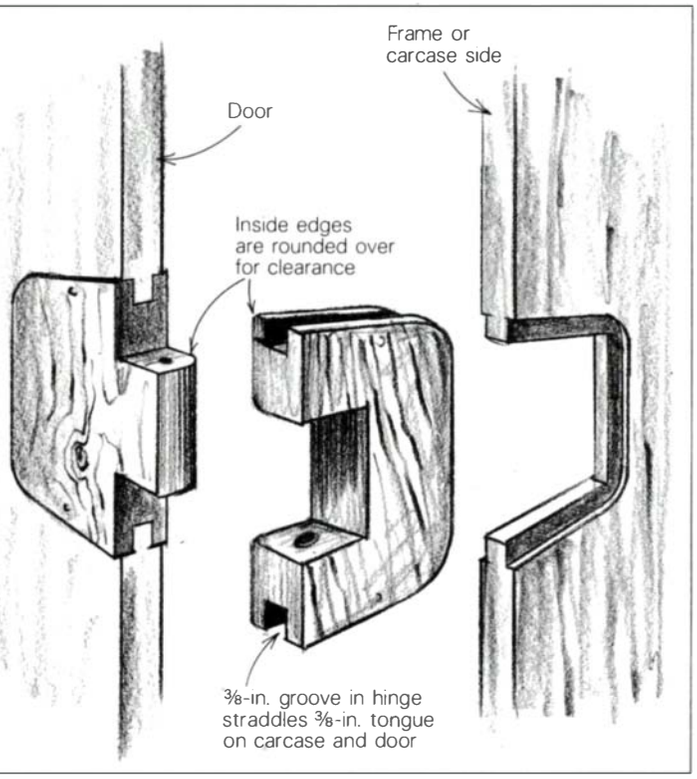
I use this method enough to have settled on the mortise widths and tenon thicknesses appropriate for my work and my tooling. For each width of mortise, I make up a bunch of hardboard template end-plates with tongues, as shown. Then making a new jig for each new mortising situation is only a matter of cutting the side plates to length, and nailing them to shoulder blocks.

McQuilkin's inlaid wooden cabinet hinge

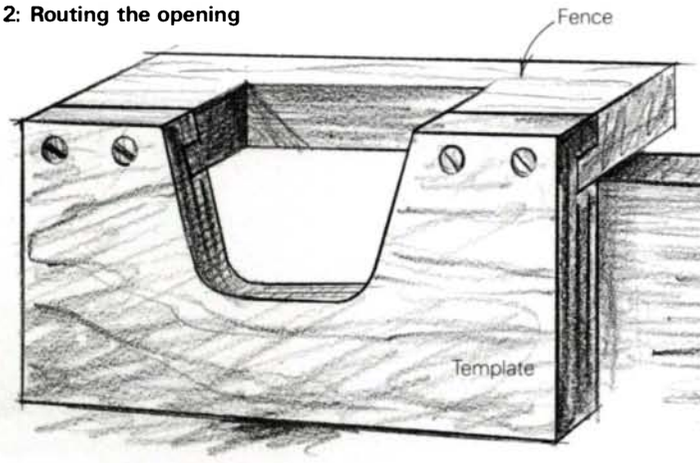
1: Designing the hinge

Use hard, exotic wood such as cocobolo, bocate, rosewood.

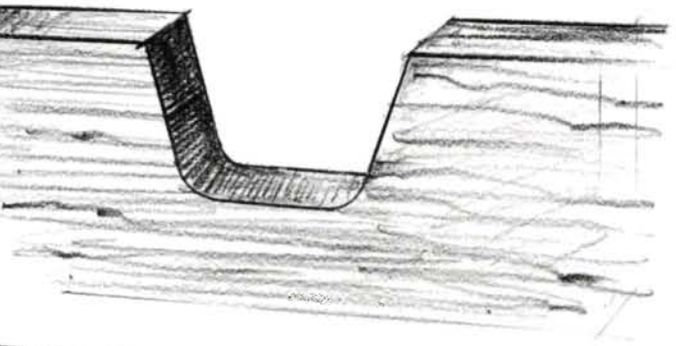




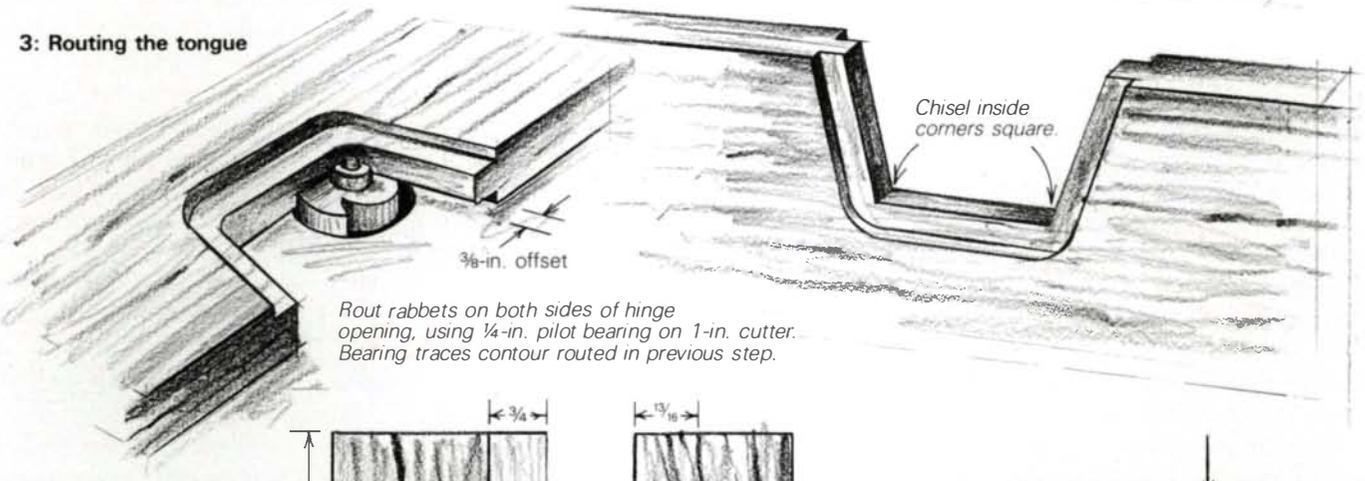
2: Routing the opening



Make template the exact size of hinge opening–inside the tongue, not to its shoulder. Lay out opening, then bandsaw most of waste. Clamp template in place–fence bears on edge of carcase or door. Rout opening to finished size using straight bit with same-size ball-bearing above cutting flutes.



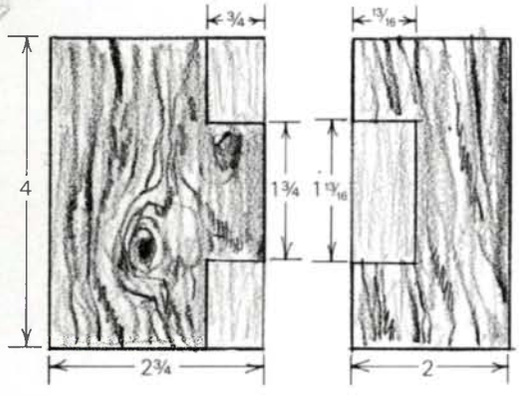
3: Routing the tongue



Rout rabbets on both sides of hinge opening, using ¼-in. pilot bearing on 1-in. cutter. Bearing traces contour routed in previous step.

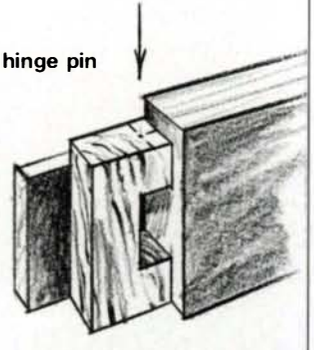
4: Making the hinge

Tablesaw blanks to size and shape. Hinge stock can be same thickness as carcase side and door, or thicker, to sit proud, as shown. For clearance, notch in female part is a bare 1/16 in. wider and deeper than matching tongue on male part.



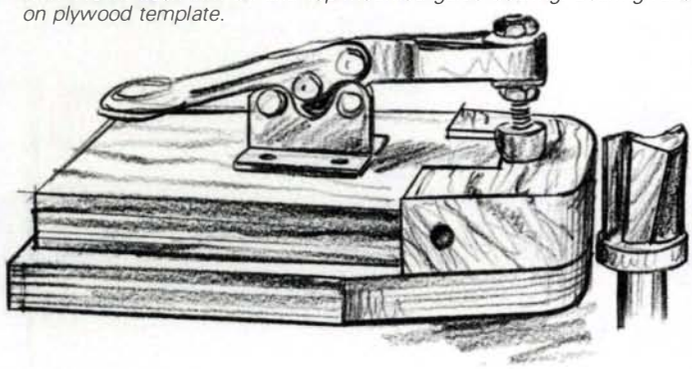
5: Boring for the brass hinge pin

Set up two drill-press fences to bore equidistant from three edges of the blank. For a ¼-in. hinge pin, bore 17/64 in. through male tongue and through top half of female part. Bore ¼ in. through bottom half of female part.



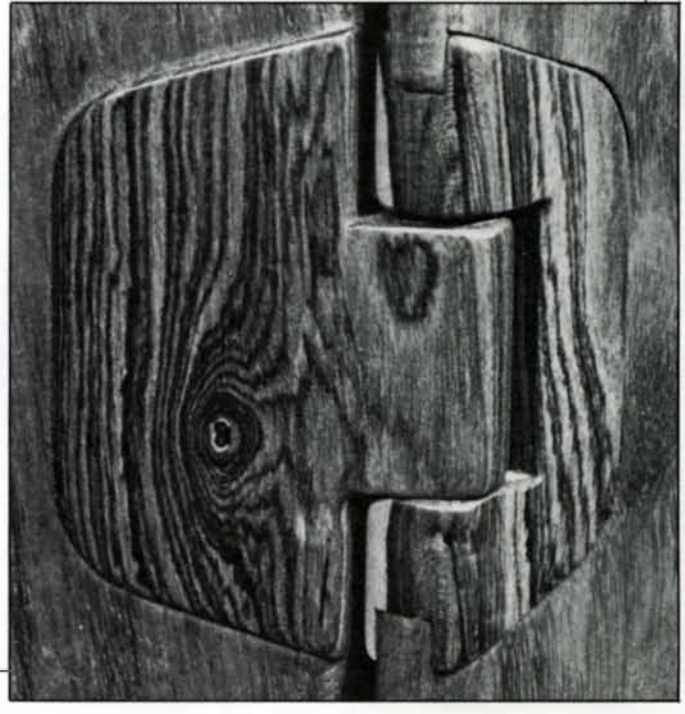
6: Shaping the hinge parts

Make a plywood template (positive) that exactly fits rabbets routed in carcase and door. Attach a hold-down mechanism (DeStaco clamps, for example) to position the hinge blanks for shaping on the router table, with 1⅛-in. flush-trim bit and top-mounted guide bearing. Bearing runs on plywood template.



7: Final shaping

Tablesaw ⅜-in. groove around hinge blocks. For safety, dado cutter should tightly fit slot in saw's throatplate. Use ⅜-in. roundover bit to shape inside edges of hinge and carcase for clearance. Glue hinge in place. The finished hinge at right is bocate, let into a rosewood door.



Drawings: D. Fillion

Early Varnishes

The 18th century's search for the perfect film finish

by Robert D. Mussey

The 18th-century finisher looking for a durable, high-gloss surface had only a few choices. He could, and usually did, finish with a wax or an oil (*FWW* #33, p. 71). Varnish, however, offered greater protection from moisture and wear, and produced a more lustrous shine than all but the most elaborate oil or wax preparations. Today, when we want to use varnish, we can go to any paint store and select from numerous scientifically formulated brands. But in the 18th century, varnishmaking was an imperfect science at best. Achieving a smooth, glossy surface demanded great skill and patience from the finisher.

Varnishes are solvent solutions of resins and gums that dry to form a thin, tough and glossy film on the surface of the wood. In the 18th and early 19th centuries, alcohol and various vegetable oils were the common solvents. Natural gums, which are soft, water-soluble plant fluids, were used only in small quantities as plasticizers. Natural resins, exuded by a vast range of living plants and several kinds of insects, or mined from fossilized vegetable remains, were the most important varnish constituents. They are soluble in oil, alcohol or other organic solvents and vary in hardness. Today most of these natural resins have been replaced in varnishes by chemically synthesized resins or modified natural resins.

Resins, essential to America's growing shipbuilding industry, were readily available to the varnishmaker, more so in urban than in rural areas. When varnishes had a high concentration of hard resin to solvent, they produced a hard, brittle film that could be abraded glass-smooth and polished to a mirror shine. A high proportion of drying oil to certain resins produced an elastic, durable, virtually waterproof film. Each resin had its own advantages. Sandarac was almost perfectly clear and transparent, easy to dissolve. Copal was very tough. Colophony (a type of rosin) gave a high gloss. Tremendous research focused on the varnishmaking industry, hampered by the imperfect understanding of chemical principles and the relatively small number of appropriate resins. During the 150 years prior to 1800, the same 15 or so resins appear in endless combinations in varnish formulas—in the search for a magic elixir that would possess all the advantages, but none of the disadvantages, of the individual resins.

This complex, kitchen-recipe approach to varnishmaking was opposed, however, by a famous Parisian varnishmaker named Watin. He held that, "The real secret of the artist is the simplicity of his procedures. . . . The art should be like Nature when possible, to do the greatest with the least, without complication, without effort." And so, after 40 years of effort, Watin announced in 1776 that he had developed the "perfect" varnish. Of course, he kept its exact formula secret.

These two approaches, the complex and the simple, and a spectrum in between, can be found in the thousands of varnish recipes of the 18th and 19th centuries. It is difficult to form simple conclusions about these recipes. I have looked at

18th-century varnish resins

Here is a list of common alcohol-soluble resins used in 18th- and 19th-century varnishes. It is possible to buy some of these in small quantities, although resins other than shellac can be expensive. H. Behlen and Bros., Rt. 30 N., Amsterdam, N.Y. 12010, carries copal and a range of shellacs. A.F. Suter and Co. Ltd., Swan Wharf, 60 Dace Rd., Bow, London E3, England, stocks most of these resins.

Benzoin: Often called "benjamin," benzoin is derived from the tree *Styrax benzoin,* of Borneo and Sumatra. Used in many 16th- and 17th-century spirit varnishes it was later added as a plasticizer, or for its pleasant smell. Today it is used as a final glaze over French polish to impart gloss.

Turpentine: Called "rosin" in Colonial America, turpentine is the resin obtained from the gum (sap) of fir, balsam, pine, larch, spruce, or other conifers. It was used in inferior spirit varnishes in several forms, including chio turpentine from Mediterranean pines, Strasburgh turpentine from the German fir tree *Abies excelsa,* venice turpentine from the European larch tree, and rosin (also called colophony), the resin of various species of American pine tree.

Sandarac: From the North African conifer *Calitris quadrivalvis,* this brittle resin was often called gum juniper.

Elemi: Also called allemy, any of a large number of resins from the *Burseraceae* family of trees. A softer resin, it was added to varnishes for toughness and flexibility.

Mastic: This soft resin makes a perfectly clear varnish. It is exuded by the Mediterranean tree *Pistacia lentiscus.*

Copal: A tremendous variety of resins, some hard, some soft, are called copal. The hard copals, African, and probably of fossil origin, were highly valued, and insoluble in alcohol. A widely used soft copal, largely soluble in alcohol, was derived from the common American sumac *Rhus copallinum.*

Anime: No one seems to know what resin this actually was. Possibly it was a spirit-soluble soft copal and may have come from the Zanzibar tree *Trachylobium mossambicense.*

Shellac: The best known of the three resins exuded by insects, shellac is deposited on branches and twigs by the insect *Coccus lacca,* which feeds on the sap of the tree. The natural grades are reddish, the finer grades are bleached white and used to produce a hard but flexible spirit varnish. —*R.D.M.*

many, in six European languages; each language has its own tangled, inconsistent set of terms and nomenclature. Writers had considerable difficulty differentiating resins. When a recipe called for copal, it could have meant any of 40 different materials, depending on the country of origin, the country of use and the date. Moreover, varnishmaking and finishing practices in Europe and America differed, as did those between urban and rural areas within America. And early varnishmakers may well have deviated from the published recipes. Varnishmakers were competitive and secretive; many of the finest formulas probably never were published. "Almost every varnisher," observed one 18th-century writer, "has at least one or two compositions peculiar to himself, the superior value of which rests chiefly in his own opinion."

Even when the varnishmaker worked his best magic, many obstacles loomed between the finisher and the perfect finish—temperature, dust, moisture, and numerous complicated surface preparations and polishing techniques. The best of the 18th- and 19th-century finishers, driven by necessity and fashion, mastered all these problems. The evidence of their skill remains today in carefully preserved museum pieces.

There are three broad groupings of 18th- and 19th-century varnishes: spirit, essential-oil and fixed-oil. Each is named for the vehicle used to dissolve its resins and gums. Spirit varnishes have alcohol or other volatile vehicles that evaporate, leaving a film of dried resin. Essential-oil varnishes use fluids distilled from one of several natural resins or oils; today we would consider them another type of spirit varnish. Fixed-oil varnishes are solutions of resins and gums in a drying oil, such as linseed, poppyseed or walnut. These varnishes dry by chemical change as well as by solvent evaporation, and they leave a more complex film, a combination of resins and oxidized oils. Resins dissolved partly in a drying oil and partly in alcohol constitute varnishes of a fourth and minor class that was used infrequently and will not be discussed.

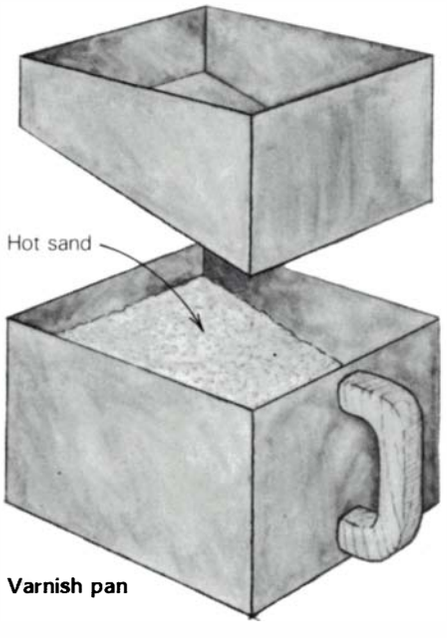
Spirit varnishes—The cheapest and easiest varnish to make is the spirit-solvent variety. Because spirit solvents evaporate rapidly, a considerable body of varnish in numerous thin coats could be built up in a short time. And they could have great clarity, or "whiteness," because the dissolution usually did not require heat, and so avoided darkening the resins. On the other hand, spirit varnishes were brittle, cracked easily, were readily spoiled by alcohol or water spills, and were not as easy to polish as drying-oil resin varnishes. They required careful formulation and skillful polishing to get a high gloss.

"Spirits of wine," as alcohol was then called, was the usual solvent for 18th-century spirit varnishes. The production and trading of rum, brandy and other alcohols was an essential part of the New England economy. Cabinetmakers' account books are littered with records of "spririts" purchases, though it is unclear how much of it was used in varnish.

Most 18th-century solvent alcohol was quite impure, as much as half water. It was usually distilled from wine, and frequently from brandy. Some recipes even recommend extremely strong brandy itself as the solvent. Several methods were used to purify these spirits. Repeated distillation in a glass double-boiler called a *bain-marie* was the usual method. This process, also called rectification, could produce a very pure alcohol. Adding potassium carbonate (salts of tartar) or potash to alcohol, a process called tartarization, also absorbed some of the water and strengthened the solvent.

Several tests to "prove the truth" of the spirits were recommended by various guidebooks. One book suggests half-filling a spoon with gunpowder, covering it with the alcohol, then lighting it afire. Pure alcohol would burn off and the powder would ignite; if the powder had absorbed too much water from the alcohol, it would not. The fanciest, and safest, method was the hydrometer—I've found them advertised in several Philadelphia papers of the late 18th century.

Making spirit varnishes—Only the very lightest, clearest, "whitest" resin lumps, free from dross, sticks and impurities, were recommended. Inferior resin must have been common, and the formularies cite many methods for telling real from false. Of all the resins, sandarac was the most common and most highly regarded. Once the best resin pieces were selected, they were powdered or granulated in a mortar, or pounded in a cloth bag, then submerged in a glass bottle or jar of alcohol. The resins dissolved easily in cold alcohol if the jar was agitated occasionally or placed in sunlight. When the liquid had settled, its top layers were poured off and filtered—this filtrate was the final spirit varnish.



Varnish pan

From the second edition (1851) of *The Painter, Gilder, and Varnisher's Companion* comes this description of a varnish pan (drawing is speculative) used by finishers throughout the 18th and 19th centuries: "The best vessel for holding your varnish while using it, is a varnish pan....It is made of tin, with a false bottom; the interval between the two bottoms is filled with sand, which, being heated over the fire, keeps the varnish fluid, and makes it flow more readily from the brush....a false bottom comes sloping from one end to the other, which causes the varnish to run to one end."

Instead of being filtered, to achieve dissolution the spirit-resin mixture could also be warmed. This was done in a sandbath varnish pan, a sort of tin double-boiler. The sand below the bath's false bottom kept the bottle from direct contact with the fire. It was a dangerous process, and explosion and fire were the varnishmaker's greatest enemies. If the resins were heated too much, the varnish darkened. The lightest, most transparent varnishes were the ultimate goal.

Shellac—Restorers and furniture historians have long assumed that shellac was the main resin used in varnishes of 18th-century America. All the evidence from my research directly contradicts this assumption. For centuries shellac had been the primary source of the valuable red coloring matter called lac dye. It was rarely used in 18th-century America. It was relatively expensive, and the resultant dark varnish obscured all but the darkest woods. The reddish dye could be only partially extracted from the resin, and it was not until the late 18th century that chemical bleaches enabled the pro-

Drawing: Roland Wolf

duction of colorless shellac resin. Modern shellac is actually a spirit varnish consisting of shellac resin dissolved in alcohol.

Until about 1820, spirit varnishes were applied only with a brush, and were usually thinned considerably and warmed to make them flow out and dry rapidly. The method of rubbing on spirit varnishes that is called French polishing was first mentioned, as far as I know, in the 1818 London edition of *The Cabinetmaker's Guide,* where it was compared favorably with beeswax. The *Guide* gives seven formulas for spirit varnishes that may be French polished, none of which calls exclusively for shellac resin. One of them, called "The True French Polish," includes one pint of spirits of wine, a quarter-ounce of gum copal, a quarter-ounce of gum arabic, and one ounce of shellac. This influential recipe is repeated exactly in over 30 formularies dating up to the 1920s, and several museum restorers have recently begun to use a French polish based on it. The method the *Guide* describes for applying this French polish is nearly identical to that used today (see *FWW* #20, p. 66). Open-grained woods were sized with glue and lightly sanded. The polisher, a wad of coarse flannel wrapped in a fine, soft linen rag, was dampened with the polish and rubbed onto the work with a circular motion, covering about one square-foot at a time. The whole surface was rubbed until the rag appeared dry, then the process was repeated three or four times, producing, the *Guide* says, "a very beautiful and lasting polish." A final polish of half a pint of best rectified spirits of wine, two drams of shellac and two drams of gum benzoin was recommended.

GENUINE RECEIPT
FOR MAKING THE FAMOUS
VERNIS MARTIN

After the melting pot is warmed, we pour into it four ounces of chio or cyprus turpentine; we let it dissolve till it is fluid, then pour to that eight ounces of amber finely bruised and sifted; mixing it well with the fluid turpentine, and then we set it on the fire for a quarter of an hour. After that time, we take off the pot, and gently pour into it a pound of copal bruised fine, but not to a powder; these we stir well together, and to these we add four ounces more of the chio turpentine just mentioned, and a gill [4 fl. oz.] of warm turpentine oil; set it again on the fire, blowing it rather more briskly.

When it hath stood on the fire about half an hour, we take it off, uncover the pot, and stir the whole well together, adding as we stir, two ounces of the finest and whitest colophony. We then set it again on the fire, blowing more briskly than before, and let it remain till the whole is dissolved and fluid as water. This done we take off the pot, remove it...and let it stand a few minutes....Having now twenty-four ounces of poppy, nut or linseed oil, made drying, ready at hand, we pour it into the dissolved gums, by degrees, boiling hot...and stir the whole well together with a long stick....When we have thoroughly incorporated the fluid gum and oil, we set them over the fire a few minutes till the whole boils once up, then we take it off, carry it to some distance, and pour into it a quart of turpentine made hot over the second fire. All these we stir well together, and give them one boil up, then take it off again, and again pour into it a pint more of turpentine made hot....

If the gums are thoroughly melted, and have incorporated well, the varnish is made.

This recipe, like others of the period, uses the terms gum and resin almost interchangeably. No true gums are used here, and they appear only in small quantities, as plasticizers, in other recipes. It goes almost without saying that the process as described here was extremely dangerous.

Fixed-oil varnishes—With the English publication in 1776 of the "Genuine Receipt for Making the Famous Vernis Martin," British and, eventually, American workers finally possessed the recipe for the most famous Continental varnish (see box at left). For 150 years Europeans had sought to imitate the finest examples of Oriental lacquerware. Craftsmen of each country touted their "Chinese" or "Japanese" or "Turkish" varnishes, raving about the brilliant colors, high gloss and durability. Although Europeans could not get the actual resin of Oriental lacquer (which was obtained from the shrub *Rhus vernicifera*), that didn't stop them from trying every available alternative. The Martin family of Paris, eight makers of lacquer and varnish spanning two generations, produced varnishes that were said to achieve unparalleled brilliance, clarity and durability, in addition to being waterproof and crack-free. The Martins had overcome, or so it was claimed, all the disadvantages of oil, wax and spirit-varnish finishes. The Martins' ingredients and laborious procedures represented the peak of the varnishmakers' art, but they became typical of most such hard-resin, fixed-oil varnishes of the 18th century.

Fixed-oil varnishes employed a drying oil (linseed, poppyseed or walnut) in which one or more oil-soluble resins were dissolved. Suitable resins included copal, amber, rosin, dammar and anime. Copal and amber, vegetable resins of both fossil and recent origin, were the hardest resins known, and also the most difficult to dissolve. By liquefying, "running," the resins at high temperatures (300°F to 400°F), they would, on cooling, become soluble in hot oil. This process is described in the recipe for the Martin copal varnish. A second method employed tartarization or a similar process. Here, various strong alkalis (tartar salts, lye, potash or ammonia solutions) broke down the resin chemically, by alkaline hydrolysis, then it was dissolved in hot oil. A third method, involving infusions of water, alcohol or ether, extracted some of the resin constituents that were insoluble in oil.

Ironically, both heating and tartarization probably contributed significantly to the rather rapid deterioration of these hard-resin varnishes. Both the extreme heat needed to run the oil and the chemistry of tartarization accelerated destructive oxidation. The widespread use of both processes makes it unlikely that any of these hard-resin amber-copal varnishes remain on antique woodwork today.

Copal and amber varnishes were valued for four reasons. They were extremely clear and colorless when first applied. They far surpassed the spirit varnishes in hardness and durability. They could be rubbed to a very high polish. And they were waterproof—made with a large proportion of drying oil, they would hold up outdoors better than any other varnish then known. Because of the difficulty and expense of making

such varnishes, even the finest finishers often bought them ready-made. Copal varnish was probably the most common hard-resin, fixed-oil varnish in 18th-century America.

A number of softer resins could be dissolved in drying oils to make a second type of fixed-oil varnish, called "common brown varnish." Boiled linseed oil was the usual vehicle and solvent, and rosin in one of its various forms was the common resin. Colophony, venice turpentine, Strasburgh turpentine or plain turpentine was mixed in the drying oil at a low temperature. Various resins were then combined in the mixture, in an attempt to borrow the best quality of each. It was not durable, did not stand up to water, and had a dark color. But it was cheap, easy to get and simple to make. Despite the widespread use, it is unlikely that many original soft-resin varnish finishes remain.

Essential-oil varnishes—In the 18th century it was believed that oils or fluids derived by distilling resins were the essential volatile oils of those resins. Oil of rosemary and "spirits of turpentine" (derived by distilling conifer sap) were in this category. Today we know that the latter is a complex organic solvent with some resin impurities, and we would classify varnishes made with it as spirit varnishes. These solvents dry strictly by evaporation, not by the complex oxidation reaction of resin and drying oil or by polymerization and cross-linking of resin molecules into molecular networks.

Essential-oil varnishes were soft and not durable, and were recommended only when the varnish had to be periodically removed, as on fine paintings. Inferior furniture might have been finished with these varnishes. I have found a number of references in account books to "turpentining" a table or a wheel. Turpentining probably refers to the application of raw conifer sap as a preservative, but it may also mean a cheap varnish made with spirits of turpentine as the solvent and rosin as the resin. It is unlikely that any of these varnishes remain on surviving furniture.

Varnish polishing—The "Genuine Receipt for Making the Famous Vernis Martin" describes how to apply and polish it. The process is laborious and the explanation takes three full pages. In summary, the procedure starts with the laying on of six coats of varnish, each allowed to dry in a warm room-size chamber heated with stoves. Then the panel is rubbed smooth with a coarse wet rag dipped in pulverized, sifted pumice stone. After the surfaces have been washed, another ten or twelve coats of varnish are laid on, each coat again "stoved." The varnish was probably quite thin, which might explain the many coats required. This built-up finish is then rubbed down with the same pumice-stone process as before. A rubbing with fine emery powder follows, "till our pannel bears a surface smooth and even as glass." The emery is dried and wiped off, and the process continues with fine rottenstone. The final polish is achieved with a rubbing of "sweet oil" (olive oil), the excess oil cleared with fine powder or flour. Last, the panel is burnished to a high shine with fine flannel dipped in flour, giving it "a lustre as though the [panel] were under a glass. . ."

This process is fairly typical, although the most extended I have found. Many abrasive materials were used, including sandleathers (soft, wet leather impregnated with sand or tripoli), shave grass, soft rushes, sealskin and sharkskin.

True "English polishes" (oil varnishes made with copal and shellac resins) of about 1815 were rubbed to a high polish, after the varnish had dried, with a cotton cloth wrapped around a wool cloth and saturated with pumice powder and linseed oil. Hartshorn (powdered animal horn) removed the oil residue. This polish was said to give the same beauty as the finest rubbed amber and copal varnishes, even if it wasn't as hard or durable.

Until the first quarter of the 19th century and the advent of French polishing, final polishing with a rag or pad moistened only in alcohol or other spirits was never mentioned in the guidebooks. Nor have I seen any reference to backing up polishing leathers, cloths or pads with any sort of flat rubbing block (cork or wood), as is the common practice today. Perhaps the extraordinarily careful preparation and smoothing of wood grounds made this less necessary than it is today.

Despite the variety of varnish-polishing techniques and materials, writers of the period agreed on one thing: the final polished surface should be "brilliant, delightful and shining and glossy as glass." None of the formulations contains anything that could be considered a flatting agent like the metallic soaps (stearates) used today. Flat, semigloss, or rubbed-effect finishes were simply not wanted in the 18th century. They suit today's taste and they can hide manufacturing defects. But, in an age when people were surrounded by rough-hewn, worn surfaces, a perfectly flat, highly lustrous surface was a mark of consummate workmanship, eagerly sought by those patrons who could afford it. □

Robert D. Mussey is head of the furniture conservation workshop at the Society for the Preservation of New England Antiquities in Boston. For more about period varnishes, consult the published Proceedings of the Furniture and Wooden Object Symposium, *which was held in 1980, available from the Canadian Conservation Institute, 1030 Innes Road, Ottawa, Ont.*

Roubo's spirit varnish

Of all spirit-varnish recipes of the 18th century, those using sandarac (from the North African alerce tree *Calitris quadrivalvis*) were the most common and the most highly regarded.

In *The Art of the Woodworker* (Paris: 1769-74), Andre Jacques Roubo offers a recipe for white (clear) varnish to be used on fine woods such as rosewood or holly, to alter their color minimally. The varnish is "composed of a pint or two pounds spirits of wine, five ounces of the palest sandarac possible, two ounces of mastic tears, one ounce of gum elemi, and one ounce oil of aspic [oil of lavender], the whole dissolved in a *bain-marie,* not allowing the alcohol to boil; when the varnish is cooled, one filters it with a width of cotton, so that it is free of any kind of dirt or filth." Roubo recommends building up a surface with up to eight thin coats.

I have reformulated several of the old recipes and found it virtually impossible to get satisfactory results when mixing up only small quantities of the ingredients. Also, making fixed-oil varnishes is dangerous. You can buy ready-made varnishes that use traditional resins from artists' supply stores. Windsor and Newton produce sandarac, elemi, mastic and copal varnishes, and possibly more. These come in small quantities, and are very expensive. —*R.D.M.*

The Harpers Ferry Conservation Shop

Where White House furniture gets refurbished

by Paul Bertorelli

From first glance, you can tell this shop is different. It has the usual complement of machine tools, rows of clamps stowed on the walls and a well-stocked lumber rack off in one corner. Absent, however, are the little mountains of sawdust and shavings typical of a shopspace that sees heavy daily use. You have to look hard to find even a scrap of the usual woodworking offal in the U.S. National Park Service's furniture conservation shop at Harpers Ferry, W. Va. The place is clean for a purpose: it is here that many of the nation's most valuable pieces of historic furniture and wooden objects are operated on every day.

Three furniture conservators—Allen Cochran, Ron Sheetz and Dale Boyce, the first two with more than 20 years' experience each as cabinetmakers—are charged with the often awesome task of putting back together what time, man and variations in humidity have undone. Their work is a steady diet of loose joints, missing bits of veneer, cloudy finishes and everything else that goes wrong with old furniture.

The Park Service cares for 15 million historic objects, a fair number of them furniture and wooden items. A growing sensitivity to the historic and cultural value of artifacts has led the Park Service to acquire them faster than the labs at Harpers Ferry can tend to them.

The furniture shop has treated thousands of objects, from the mundane—a production oak roll-top desk, circa 1900—to the spectacular—fine dining tables and chairs from the Lincoln White House. Regardless of its source, furniture delivered to the lab for work is carefully inspected and documented. Photographs are taken and a detailed report describes the condition of the piece and its historical importance. Then all the work the lab does is also documented.

The idea here is decidedly not to make old stuff look new. "This happens all too often at the local Dip 'N Strip," says Tom Vaughan, director of the conservation lab. He oversees nine different labs at Harpers Ferry, treating objects that range from old firearms and metalware to paper, textile and leather artifacts. All are housed in an aging building that once served as this historic town's elementary school. Vaughan says the conservators' main job is to stabilize and preserve furniture and other objects in Park Service care. Cosmetic improvements are made so as not to disturb the nicks and blemishes that are the essence of old objects.

"We try to make things look like they would have looked when they were in use," says Cochran, who at 61 is the most experienced hand in the furniture lab. The work is more common sense and sound woodworking technique than secret formulas or mysterious swabs and daubs. "After 30 years, your common sense gets to be pretty good," Cochran says. "The three of us talk about what we're going to do before we start." This consensual approach is important because although few people consistently agree on something as subjective as how a 200-year-old piece of furniture should look,

Lincoln gondola chair, left, before restoration. Back splat was broken, veneer was missing and upholstery was tattered. Part of a set, the chair had been on tour in the care of private owners for many years after Lincoln's presidency. The restored chairs, above, are now back in Lincoln's Springfield, Ill., home.

Photos this page: U.S. National Park Service

there is no lack of second-guessing when it doesn't look right. As a rule, though, the conservators do only what's necessary to stabilize a piece. They constantly tread the blurred line between conservation and restoration.

In piecing together old furniture, popped joints are everyday fare. Likely as not, someone else has already tried to fix the problem. "A lot of our work is repairing what other people have screwed up," says Sheetz, a lifetime cabinetmaker who still makes furniture on his own. He recalls digging some 200 nails out of a solid walnut wardrobe used by Abraham Lincoln. The fasteners had been driven in to shore up the carcase years after the piece was built. As if that weren't enough, fence staples and a crude wire brace had been added, evidently for diagonal stiffness. "They had that thing tightened up like you would an old fence post," recalls Cochran, in a bemused Virginia drawl. Sheetz and Cochran removed the nails and wire, and carefully patched and restored the finish of the wardrobe. It was then shipped back to the Lincoln home in Springfield, Ill.

Furniture fortunate enough to survive amateur repairs holds up remarkably well if given even minimal care. The advent of central heating has probably caused the worst damage. When houses were heated by fireplaces, the seasonal variations in relative humidity were less extreme. Now, central heating warms and dries out homes and furniture, and brings on the kind of harsh wood movement that breaks furniture apart. Still, well-made work can survive. Century-old pieces are common in the lab, and even older work frequently shows up in good condition.

But the work of master craftsmen of yore still presents its problems. Cross-grain constructions, for example, are always troublesome. In 1977, the furniture lab tackled the difficult problem of repairing the leather top of President Carter's Oval Office desk. The piece dates from the late 1870s (*FWW* #17, p. 83), and seasonal movement had caused cross-grain bracing to crack the oak subbase over which the leather was stretched. As the subbase shrank, the leather puckered, rendering the top nearly useless. At Harpers Ferry, Cochran lifted a corner of the leather loose and then used blunt spatulas to gently and laboriously remove the covering. With the subbase exposed, the conservators were able to rout out the cracks and insert splines. The subbase and leather were cleaned and the leather was reapplied to the desk top, using white glue and rollers to flatten out the wrinkles and pockets. Where the leather had stretched a bit during removal, it was trimmed flush to the edge of the subbase. The refurbished desk is now back in the White House for President Reagan's use.

Usually, straightforward woodworking and finishing techniques dictate the decisions made by conservators in treating a particular piece. The conservators are more interested in the results of their work than in the old processes themselves, so modern methods are generally preferred to the hand-tool techniques of the original construction. In refinishing, for instance, they don't hesitate to spray materials that originally may have been brushed or rubbed on.

Occasionally, a little sleuthing is in order. While inspecting a cherry tavern table believed to have been used by Gen. George Meade at the Civil War Battle of Gettysburg, Boyce and Sheetz noticed some markings on the table's underside. "You could see the writing, but you couldn't make out what it was," says Boyce. Examination under infra-red light—a

Dale Boyce fits a new leg into a Windsor chair from George Washington's military headquarters at Morristown, N.J.

Above, Allen Cochran replaces a molding on a White House console table, dating from the Andrew Johnson administration. Below, Ron Sheetz applies finish to a Chippendale writing desk, circa 1750, from the William Floyd estate on Fire Island, N.Y.

standard test when important markings are thought to exist—revealed names and military unit designations scrawled in pencil. Research at the National Archives confirmed that the soldiers named were indeed in Meade's army of the Potomac, adding credence to the claim that Meade had used the table. A sheet of Mylar was taped over the writing to protect it from further fading.

Once, an offhand diary reference to painted furniture led the conservators to carefully remove four layers of paint—one coat at a time—from a set of cottage furniture that had been brought to the lab. When they finished, they had discovered the bedroom furniture used by Andrew Johnson at his boyhood home in Greenville, Tenn. Some of the original paint was in excellent condition.

With a fully equipped shop, Cochran, Sheetz and Boyce are more than capable of reproducing missing or damaged parts. But given the choice, they will try to repair what is left of the original. They keep a stock of aged wood scraps and veneers for just that purpose. Modern materials like plastic and fiberglass aren't off limits in the furniture lab, and plastic wood fillers are frequently used for repairing minute defects. Some modern glues, though, are verboten, particularly epoxies. "We like to make everything we do reversible, so we usually use hide glue," says Sheetz. Loose joints that will come apart are cleaned up and reglued, finishes and stains are matched, and major new repairs are inconspicuously dated so future historians won't confuse them with the original work. Much of a typical day in the lab might be spent at the bandsaw working out specially shaped clamping cauls and fixtures to fit odd-shaped parts. Once the structural repairs and patches are complete, the work is stained and finished to match the original. If absolutely necessary, a repair might be distressed to knock off the newness and blend it in.

When the work is complete, the pieces are shipped back to where they belong in a humidity-controlled Park Service van that makes periodic rounds throughout the country. Some of that furniture will be properly stored and displayed, and will never need work again, but other pieces may have to make the trip back to Harpers Ferry for periodic attention. That, coupled with the fact that the government is constantly discovering new artifacts worth preserving, ensures that Cochran, Sheetz and Boyce never lack work. □

Paul Bertorelli is assistant editor of this magazine.

Tips on conserving furniture

Poor storage, bad housekeeping, humidity, and simple neglect are the enemies of wooden objects, and by virtue of age, old furniture suffers more than its share of each. Park Service conservators, hoping to reduce the burgeoning number of historic objects sent to their labs for work, have in recent years offered training sessions in preventive care. It's simple stuff, really, but the sheer volume and nature of the conservators' work suggests that many people who own old furniture don't know how to care for it properly. Here are some of the ways you can protect valuable furniture and wooden objects:

Storage and exhibition: Furniture should be located in rooms where the relative humidity can be controlled at a constant 50%, adjusted slightly upward or downward to suit local conditions. Unless expensive control equipment is used, variations are bound to occur, but when possible the seasonal changes should be allowed to occur gradually. Moisture levels at or slightly below 50% prevent wood shrinkage and the growth of molds and fungi. Locate furniture out of a room's traffic pattern so surfaces will be less likely to get kicked and scuffed. Avoid direct sunlight, it will bleach finishes; ultraviolet screens for windows will help. One source of screens is Van Leer Co., 64 Industrial Parkway, Woburn, Mass. 01888. Ideally, artificial lighting should be limited to 5 foot-candles per sq. ft.—as bright as a movie theatre during intermission—but light levels up to 15 foot-candles are practical.

Furniture not in use should be stored in a humidity-controlled environment, preferably with no light at all. To protect against dust, cover the furniture with muslin. Plastic can be used over the muslin, but allow a few inches of space at the bottom for air circulation. Where the floor may be damp, shield the furniture by putting plastic under it, or put it up on blocks.

Housekeeping and care: Furniture should be dusted frequently, but not with waxes or silicon-based polishes. Park Service conservators suggest a product like Endust. It's available in grocery stores and should be sprayed on a clean, soft cotton cloth. Vacuuming should be done, when possible, with an adjustable-suction vacuum cleaner. A nylon mesh screen can be placed over the object to be vacuumed—this will prevent loose veneer and upholstery fibers from being sucked into the machine. Any parts that are knocked loose should be stored in a plastic or cloth bag in or near the damaged furniture. Furniture should also be inspected for signs of insect or other damage (*FWW* #34, p. 59). After dusting, the conservators suggest a light coat of Staples wax (available from H.F. Staples and Co., Meumack, N.H. 03054) or Butchers wax. An application of wax every one to two years with a soft cloth should be plenty. When it builds up, the wax can be removed with mineral spirits or VM&P naphtha. Brasses and hardware can be cleaned and polished with a mild abrasive paste called Nox-on. It is sold by Boyle-Midway Inc., 686 Third Ave., New York, N.Y. 10017. If possible, remove the hardware before polishing it, or loosen it slightly and pull it away from the surface so you can insert a sheet of plastic behind it to protect the wood finish. If the hardware can't be removed or loosened, don't try to polish it in place; you could damage the finish. When waxing the piece, wax right over the brasses to protect them.

Moving furniture: Before moving any valuable or old furniture, clear the space where it will go and make sure it will fit through the doors and openings. Chairs should be lifted by the seat rails, never by the legs, backs or arms. Similarly, lift tables by grasping their apron rails and not their tops or legs.

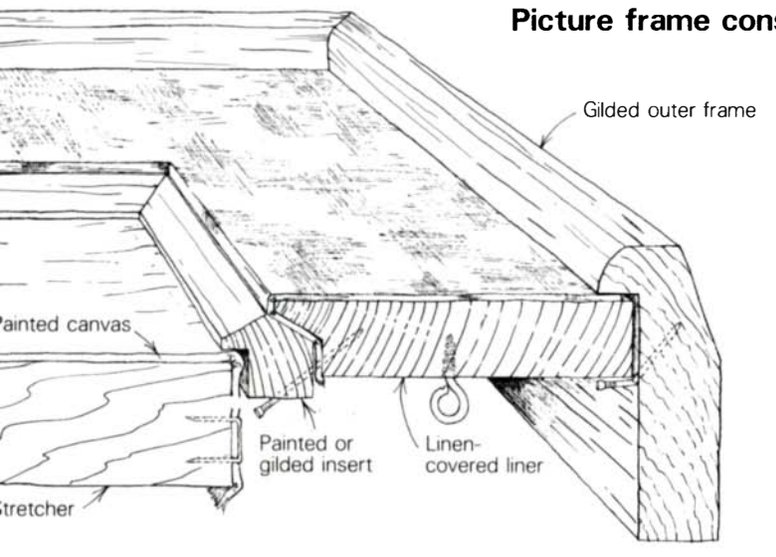
When moving casework, particularly large pieces, disassemble as much of the case as possible, remove the drawers (numbering their position) and tie the doors shut. Lift the furniture by its bottom rails, or use a dolly under all four corners of the piece if possible. Before moving the piece, cover it with furniture blankets to pad it against damage during the move. —*P.B.*

Framing Pictures

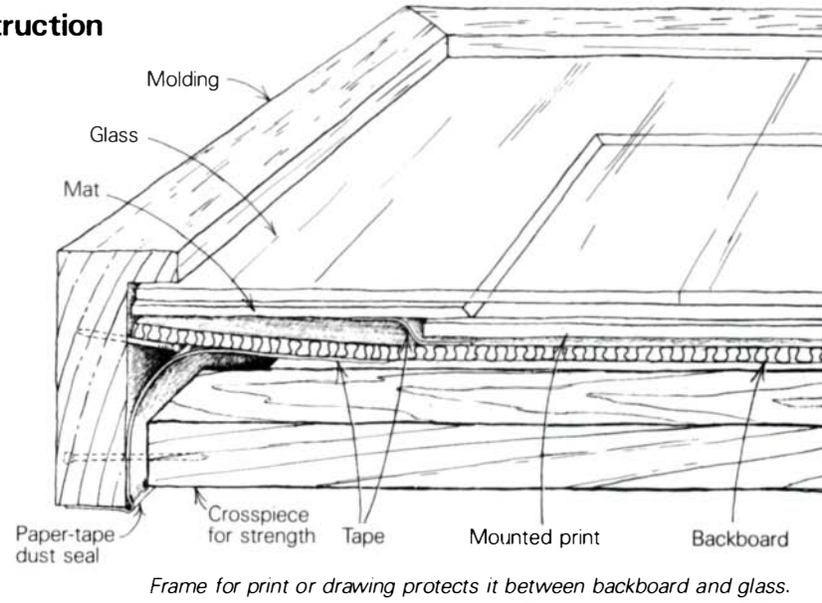
Choosing and making suitable moldings

by Jim Cummins

Picture frame construction



rame for modern oil can be made in sections, with different finishes on each.



Frame for print or drawing protects it between backboard and glass.

Illustrations: E. Marino III

Department-store frames, mass-produced, rarely succeed at matching up with works of art that are made one at a time, nor do they readily suit rooms and tastes that are personal and distinctive. Custom-made frames, on the other hand, seem extravagantly priced, and there's no guarantee of satisfaction there, either. You and the framer can pick a molding that suits the picture just fine, but in your home it may not look quite right. The next time you need a frame, you might try making your own. You can end up with something you're satisfied with, save money, and perhaps develop an interesting sideline. After all, none of the separate operations involved in framing a picture is very difficult.

Frames are commonplace because they're necessary. Once we realize what's required of a frame, we are on the way to making one, because a frame's functions determine both its construction and its visual design.

Function and design—Design in framing is related to function—not only physical function, but also the visual and emotional function the frame plays as it affects the picture, the room, and the viewer. Consider four functions as you choose a frame: protection, enrichment, focus and transition.

Protection: A watercolor cannot be cleaned, so it is sealed up behind glass in its frame. Pastels need protection not only from dirt, but also from physical contact, because they smudge easily. Needlepoints can go either way; while cleaning them may mean restretching them, glass does interfere with the appreciation of their texture. An oil painting should be cleaned every 20 or 30 years and is protected by its removable coat of varnish. Glass in this case is not only unnecessary, its hardness and reflection would diminish the texture and lucidity of the painting. Hence oils are left unglazed. The frame may still protect an oil by preventing the wooden stretcher the canvas is mounted on from warping or by actually holding together multiple panels (as in the case of some Renaissance paintings). In the same way, the frame protects a flimsy piece of paper by providing a stiff mat to which the paper is attached. The strength and size of the frame depend somewhat on the weight of the picture, although in the case of a large poster—in its pure form a piece of artwork originally meant to be pasted to a wall without a frame at all—the frame may be made with hidden supports that allow its visible part to be minimal.

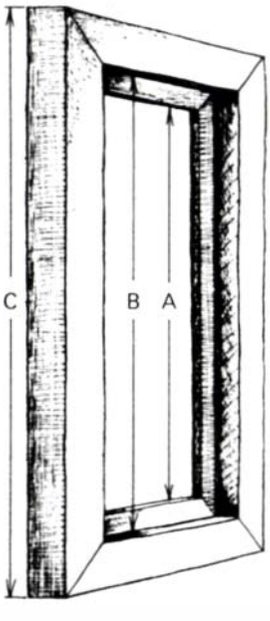
Enrichment: Stone-age cave paintings have no formal edge, the cave itself is the frame for the art. Egyptian or Greek murals were framed by the rooms in which they were done. Picture frames, as we think of them today, began in the Renaissance: the artist scooped out a board to paint on, leaving the edge full for stiffness—frame and painting were one piece. Painting was then regarded as more of a craft or a science than an art, and the frame was within the artist's sphere of work. The workmanship in the gilding, inlay, carving and design of the frame reflected his general competence, and encouraged a good price for the art. Eventually, artists left the framing to others; by the time of the High Renaissance, it wasn't unusual for the frame carver and gilder to make as much money as the painter himself. The artist, however, probably designed the frame. Money aside, a frame still reflects on the art in it. Paintings rich in color and subject matter, suggesting opulent times, require complementary frames;

rustic frames suit rustic subjects. Most drawings look best with a mat and narrow frame, but a Picasso line drawing, just a few strokes, can have all the richness of an oil, and be able to balance an ornate gold frame without losing its character.

Focus: Since the style of a painting, its color, texture and period, should be balanced by the frame's design, the frame, in effect, makes the painting into a larger object. The frame's continuity provides a visual field that defines the subject matter and directs the eye into it. The regularity of the frame first draws the eye to it, then sends it into the picture. A frame therefore should attract the eye—with gold leaf or fancy carving, for example, or a mat under glass. The proportions are important. Visual effects that are too much the same, such as a 2-in. frame with a 2-in. mat, trap the eye. Too colorful a mat or too bright a finish will do the same, which is why some frames are made to look faded and old. Many modern works of art are designed to catch the eye without much of a frame. A broad, uninterrupted wall may be all that a strong oil painting needs to be seen at its best. The frame merely covers unsightly staples, tacks and ragged canvas at the picture's edges. Lack of focus is the reason that lumberyard moldings don't work well for frames. They are designed to shoot the eye along, to make it wing outward in order to enlarge rooms and break up flat, blank walls. This is the opposite of what a frame should do.

Transition: While a painting is an object with merit of its own, a framed painting doesn't do well without reference to the room in which it hangs. This is why paintings in museums often look absurdly overframed. Their period frames need period rooms. The frame's color, reflection, richness or simplicity, even its width, must relate to and be seen along with its surroundings. A room without a framed painting is no worse off than a framed painting without its room.

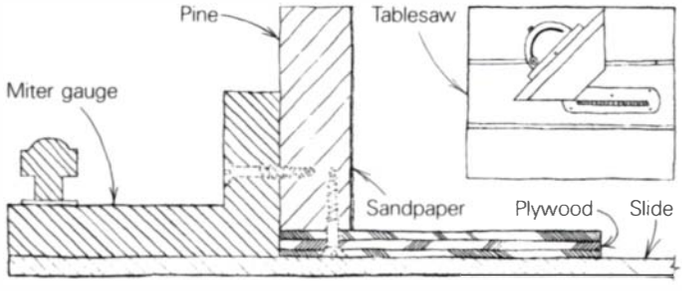
Measurements—If we look at a basic frame we can start to tie the abstract and the practical together. Look at a frame from the back, and note the different ways it can be measured. A is "sight size," what you'd see from the front. B is "glass size" or "rabbet size," the size to which the mat, glass and backing are cut. We normally call a frame by its rabbet size, although the rabbet is cut $\frac{1}{16}$ in. or so larger than the mat and glass, to allow a comfortable fit for standard-size glass. If the frame is too tight, the mat and backing will soon buckle, and the glass may break or force open the corners of the frame. Frames for oil paintings are usually made $\frac{1}{4}$ in. oversize, room for pegging out the stretcher that keeps the canvas free from ripples and sags. C is "overall size," but the term can be misleading because the length of the molding needed for a frame is the sight size plus double the width of the molding. An 8x10 frame (rabbet size) made from a 2-in. wide molding needs sides that measure about 12 in. and 14 in., so instead of 3 ft. of molding, you actually need almost $4\frac{1}{2}$ ft. because of the waste at the miters.



Cutting miters—Professional framers have specialized machines for making miters. These include guillotine choppers that cut a 90° notch, making two miters at once, Lion trimmers that neatly slice one miter at a time, 45° cutoff saws, radial-arm saws, and industrial pneumatic and hydraulic monsters weighing tons. But you can cut a perfect miter on a tablesaw, if you forgo speed and automatic accuracy.

First, check that the sawblade is parallel to the miter-gauge groove in the table. A blade that is not parallel will seem to work fine when the gauge is on one side, but on the other side it will force the molding away during the cut, changing the angle. And vice versa. This is one reason for making sample cuts and checking that two pieces meet to form a 90° angle. If the molding is forced away from a nominal 45° on one side, then the other side (the side that will cut the true angle) must be fudged to compensate. Worse, moldings of different widths and profiles will be pushed different amounts along the gauge fence, so no single gauge setting will work for all shapes if the blade itself isn't parallel to the table grooves. Carbide blades, with their wide teeth, allow a little latitude if the cut can be completed before the molding contacts the side of the blade. Set the blade high, and push the molding only as far as necessary to complete the cut.

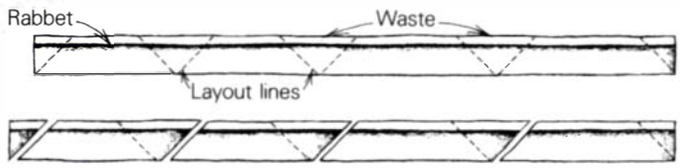
Check that the miter gauge is a good fit in the groove. Sometimes the grooves themselves are different sizes. I've had to peen the slide to fit one groove, and file the other groove wider. If the gauge wobbles, you can't expect an accurate cut. If the gauge binds, even a little bit, you can't tell if the work is binding—a potential disaster. Once your gauge runs smoothly, you can improve it further by adding a backup fence that's L-shaped in cross-section. It will support both the back and the bottom of the molding as it is being cut. Make the backup fence long, then cut off its ends at 45°, with the gauge sliding in its grooves. The fence ends now mark the



line of cut. Glue fine sandpaper or non-slip tape to the fence so the molding won't slide while you're cutting it.

Never trust the angle indicator on the gauge, since any error will be multiplied by the number of cuts in the frame. Instead, make a template for setting the gauge. Either scribe lines right on the saw table (*FWW* #26, p. 80), or take a piece of 8-in. wide plywood that's long enough to contact the full miter-gauge fence, and lay out a square and its diagonal on one end. With the gauge set to its nominal 45°, nibble toward the diagonal line, adjusting the gauge until the cut is exactly on the line. This is a perfect 45° cut—from now on you can use it to set the miter gauge. With the saw turned off, raise the blade as far as it will go. Place the template against the miter fence and slide it over to the sawblade. Rotate the miter gauge until the diagonal evenly meets both the front and the back of the blade, then lock it. Flip the template over to reset the gauge for the opposite cut.

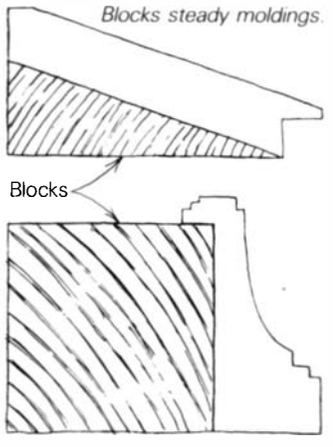
Instead of resetting the miter gauge every time you make a



Make these cuts first.

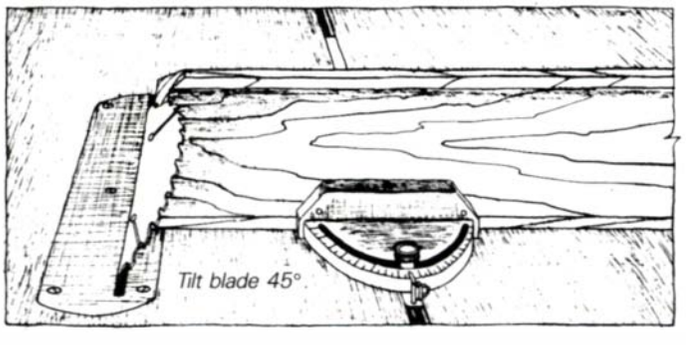
corner, saw all the right-hand miters at once. If you are taking more than one piece from a length of molding, mark it to make sure the miters go in the right direction and that you are leaving enough for waste. It's easy to come up short, and embarrassingly easy to cut a miter that goes the wrong way. Remember that every cut will leave the piece larger on the side away from the rabbet. Locate and draw the first miter on the back of the molding, and make a clear mark inside the rabbet where the miter line meets it. Then write the rabbet size to be cut on the back of the wood. This helps avoid cutting three 24-in. pieces and one 30-in. piece for a 24x30 frame—another familiar pitfall. Carefully lay out the rest of the rabbet marks and sketch in the miter marks as you go. When you saw the molding, cut on the marks in the rabbet—the drawn miter lines are just reminders.

Some moldings won't sit flat on the saw table, and special pains must be taken to keep them from rocking during the cut. Make blocks and wedges as needed. Extra-deep moldings (like some shown in the box on page 67) may be too high for your saw. Cut these flat on the table, with the blade tilted to 45°, and the miter gauge set to 90°, as shown in the drawing below. Always use a sharp, fine-tooth blade. Dull blades will only force the molding away, while coarse ones won't leave a good gluing surface.

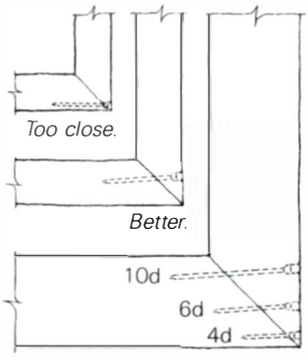


Joining frames—In spite of perhaps a dozen other methods that can be used, nearly all picture frames are joined with glue and nails. You start by making two Ls, and then join the Ls. In our shop, the process goes like this:

We put one side in a machinists' vise (padded), and hand-hold the other side in position to drill holes for the nails. This allows the corner to tighten to the maximum when we set the nails. We don't use those 90° vises that hold two sides together for gluing and nailing, because the corners will never be tighter than you can set them in the vise. If you make it a habit always to put the long side in the vise and glue the short side to it, you can avoid joining the sides in the wrong order, which results in a diamond shape instead of a rectangle—if you can get the miter together at all. Put glue on both miters to be joined. We use ordinary yellow glue. If you prefer to use white glue, let it thicken first; as it comes from the store it's too thin for miter joints. Apply enough glue so that it squeezes out along the entire glueline when the joint is nailed, then wipe off the excess with a wet rag.



If you are right-handed, support the short side with your left hand, and pick up an electric drill with your right. Drill holes for the nails or brads, not allowing the corner to shift. We use 1x18 brads for small frames, 4d finishing nails for larger frames, and up to 10d where extra length is needed. In soft woods such as pine, use a #56 drill bit for the brads, and a #50 bit for all finishing nails. Angle the holes a little to get the most purchase. A common mistake is to start the nails too close to the corner, which results in no gripping power at the head. Use your three-dimensional imagination to keep wood around the nail. If a 4d nail seems a little short, and a 6d nail might split the wood, just set the 4d nail deeper. On very wide frames, where even a 10d nail is too short, you can hold the inside of the miter tight while the glue dries by stapling it from the back in addition to the nails.



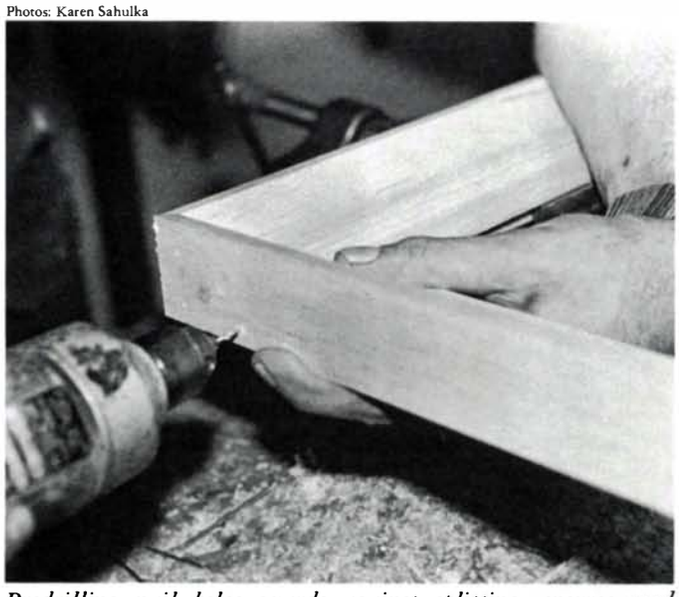
Support the weight of the loose side while it's in the vise. At no time should the free side hang by the nails. We rarely nail across corners from both sides, because it's the glue that keeps the corner together, not the nails. If a corner pulls up tight when the first nails go in, that's all that's necessary. Cross-nailing, or using elaborate metal fasteners, can weaken a corner by imposing additional strain and shock. Force applied to pull up a corner just builds stress into the joint, and sooner or later it will crack.

Repeat the process with the other two sides, and then join the two Ls. If the frame is not too heavy, just support the free L as you did the free side. Handle the Ls carefully—you have a good, tight corner when you set the nails, but until the whole frame is joined any shock or twist will open it. We have a tilting vise that lets us support heavy Ls on the table. You can block up the free end; but it's usually easier to hold things than to set up blocks or to tilt the vise. Helpers are rarely any help.

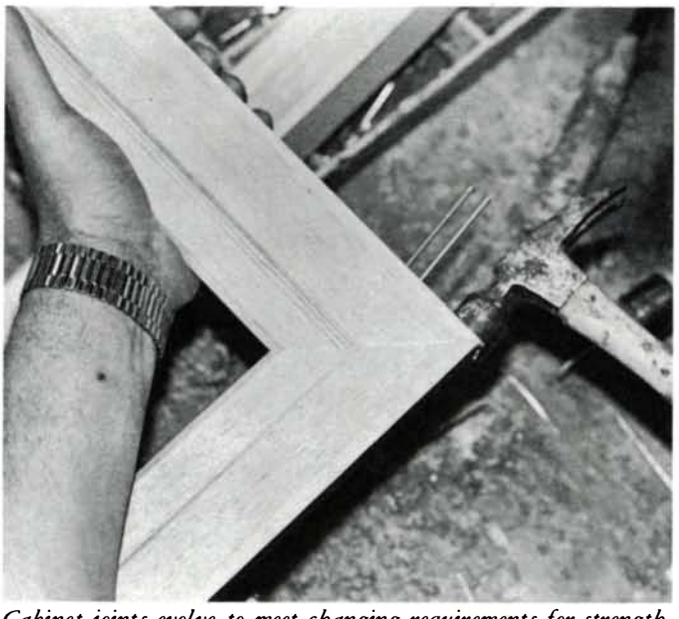
Join a complete frame at once, don't let the Ls sit around and take the wrong set. If you finish joining the frame before any of the glue has dried, the stresses will even out, the frame will be stronger, and it will dry square. Clean the glue from the rabbet, or it may break the glass when the picture is being fitted into the frame.

Glass—Glass comes in several varieties. Ordinary window glass weighs about 19 oz. per sq. ft. Picture glass is 15 oz. to 17 oz. per sq. ft.—more expensive, slightly clearer, and usually available only in frame shops. The trend is to use window glass for most frame jobs. Non-glare glass has been surface-treated to reduce reflection, and is best used in direct contact with the art—any separation, as caused for instance by a double mat, will blur the image. Allowing glass to contact artwork is chancy because moisture condensation can cause

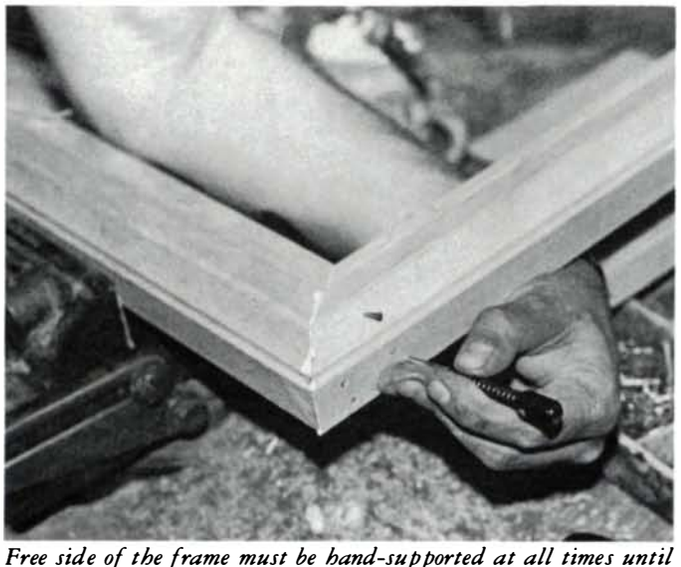
Photos: Karen Sahulka



Predrilling nail holes guards against splitting, ensures good starts in the right direction for maximum purchase. One side of the frame is held in a machinists' vise, the other is steadied from underneath by hand, the forearm resting on something solid.



Cabinet joints evolve to meet changing requirements for strength. In picture framing, the nailed miter continues to hold its own.



Free side of the frame must be hand-supported at all times until the corner comes out of the vise. Nails pull the miter as tight as it will go—tighter than a corner vise can be set.

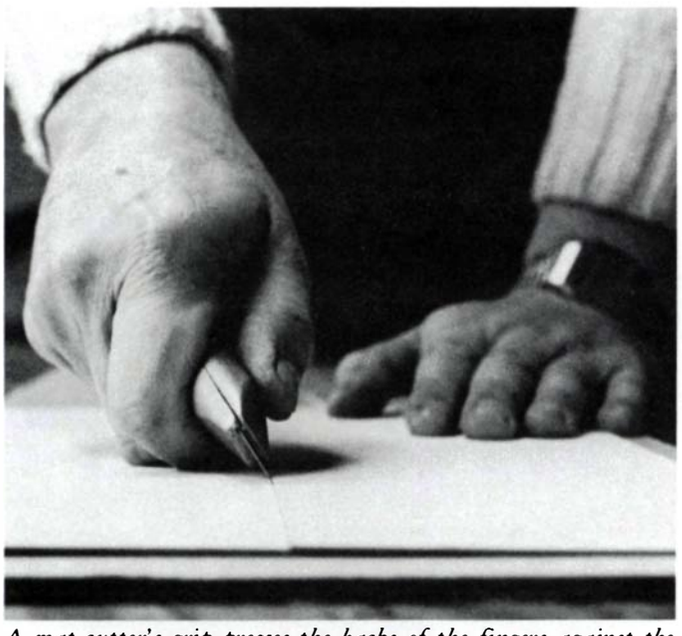
damage. Non-glare glass, incidentally, won't perform miracles in really bad situations—it has an overall "bloom" which you can't see through at all. Try changing the height of the picture or letting it tilt out from the wall. If your frame is very large, your local hardware store may stock the size only in double-strength window glass—too heavy for framing. You would be better off using Plexiglas.

Matting—Artists' supply stores sell matboard, differentiated from cheaper illustration board by its surface finish and light-colored paper core. Standard matboard sizes are 30 in. or 32 in. by 40 in., and 40 in. by 60 in., with a smaller color range in the larger size. Until recently, colored matboard was made by gluing cover sheets to a pulp center that contained acids left over from the paper-making process. These acids would gradually seep out through the cut bevel, and nearby portions of the art would turn brown. Museums and collectors don't like that at all. Instead, they use board made from 100% cotton fiber (rag), and processed without acid residues. A new type of matboard, called Alpha-mat, is chemically buffered to have a long, acid-free life, and comes in over fifty colors.

Sometimes artwork is simply laid on top of a matboard (to show the edges of the paper), but usually, after a color has been chosen to suit the artwork and its surroundings, an opening with a beveled edge is cut in the board. This bevel can be cut by hand or by machine. In our shop, we use utility knives (with a new blade for each mat) and a metal straight-edge. Lay out and cut matboard from the back. Make neat corners by overshooting the mark—a slight overcut won't be obvious. The mat border is usually from 1 in. to 4 in. wide. A stiff backboard (usually corrugated cardboard or acid-free Fome-Cor) protects the back of the art and keeps it flat in the frame. The art can be attached to it using small hinges or straps of acid-free paper and paste at the top edge, so it hangs and can expand or contract in the frame. Don't use masking tape—it will soon dry out, turn brown and stain through to the front of the paper.

Mounting—Posters, eye-catching outdoor advertising, were designed to be pasted to walls without frames at all, so they don't require fancy mats. But posters are typical of many lightweight papers that need mounting (pasting to a heavier board) to keep them from wrinkling badly. Valuable works of art should never be mounted—collectors and museums insist on maintaining the paper in its original condition. But for most of us, wrinkles interfere with our enjoyment of what we hang on our walls. There are many modern mounting systems using special-purpose adhesives and boards that will stiffen artwork without damaging it. A frameshop can advise you whether or not to try a particular mounting job yourself. If you want to try, it's a lot like veneering and just as difficult to fix when something goes wrong. Use wheat paste, dampen the print, countermount a similar paper on the back of the board to equalize tensions, weight the art down while it dries, and make sure it's really dry before removing the weights.

Stretching—Often, instead of gluing something down, you can stretch it. Oil paintings on canvas are usually stapled to stretcher bars. If you are stretching an oil, make sure the stretcher is square, then staple pieces of cardboard to the back corners to keep it square while you work. It is more important to keep the tension even than to try to get the painting



A mat cutter's grip presses the backs of the fingers against the surface to hold the bevel angle. Practice canting the knife until the blade travels straight, pulled by the entire body, not the arm. Once the grip is mastered, a straightedge can be used for peace of mind. Blades are cheap—use a new one for every mat.

super-tight. Stretch needlepoints and crewels around heavy cardboard or ¼-in. plywood. If you stretch a crewel over artists' stretchers, put matboard behind the fabric, otherwise the wood may show through the stretched-open weave.

Fitting and hanging—Putting the picture into its frame is called fitting. The sandwich of glass, mat and backboard is usually held in by the pressure of small brads in the rabbet. Oils can be toenailed into their frames. Weight adds up—if regular screw eyes don't seem strong enough, try mirror hangers, or fasten a sturdy crosspiece behind the frame. Double the picture wire if you can't find any heavy enough. Most pictures that fall off walls do so either because the hanger failed in the wall or because the frame was split when the screw eyes were being installed. Drill a hole before you force the screw eye—splits only get worse.

Set the screw eyes about a quarter of the way down from the top of the frame. The lower they are, the more the picture will tilt from the wall. Wind the wire twice through the screw eye (so it won't slip), and don't make the wire too tight—a tight wire has only about half the strength of a loose one.

Wherever you hang the picture you have framed, make sure that there is enough light to see it, and enough room to stand back and enjoy it. Having done all this work on the frame, I'm afraid that you will never be able to see it the way others will. To them it should be almost invisible. "Is that a new painting?" is the best thing visitors can say about your framing. "What an interesting frame. . ." means that you haven't quite got it right. □

Jim Cummins, an assistant editor at FWW, *has owned the Vasco Pini Frame Shop in Woodstock, N.Y., for 15 years.*

A tablesawn molding

The tablesaw is a versatile machine, even if you don't want to invest in a molding-head cutter. You can make most of the moldings shown in the box on p. 67 with a regular 10-in. blade. You can also make good copies of many other designs that strike your fancy. One customer recently brought in a painting from the 1920s, still in the frame in which it had won a national award. I copied the frame as shown in the photos on the next page.

I used sugar pine because it machines and finishes well. Harder woods can be used, but work should go slower, especially when making coves. Wood must be dry, or you're wasting your time—miter joints open up quickly if the wood moves much, often within a week of when the heat comes on in the fall. A 60-tooth carbide combination blade leaves a surface I hardly need to sand. This blade can't be hurried, but you shouldn't let it burn the work either. Ripping with a coarser blade would be much faster, but I'd rather make the cuts right than sand and fuss with the molding later.

I don't like to do careful ripping like this on pieces that are more than 6 ft. long. There isn't enough control. In making this frame, one long side and one short side added up to about 4 ft. in length, so I worked with two 4½-ft. pieces. For a large frame, I make all the sides separately. I joint the stock square on two sides and then cut it to width and depth on the tablesaw. I make one extra piece, to see the results of each saw setting before risking the frame itself. This piece can be saved and used as a template for saw settings when you want to duplicate the molding. I make the piece about 2 ft. long to start, even though the final template can be as short as an inch or two. For the time being, the extra length allows you to cut off the ends as you go along if you don't like the way a test cut starts. Instead of measuring angles and doing a lot of mathematics, I usually sketch the profile on the end of the test piece and then set the blade and the fence to cut just shy of the line.

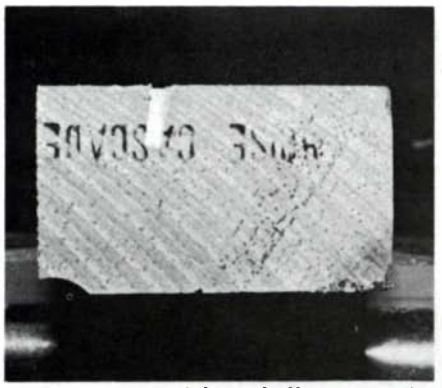
I make cove cuts with a shopmade adjustable-angle fence, which is shown at the bottom right on the following page. To get the idea of how it works, lay a board at an angle across the saw table, with the blade up about an inch and the saw turned off. Imagine that this board is the fence; sight along it and change the angle. Notice how the blade's profile changes from a circular cross-section (with the board at right angles to the blade) to a deep, narrow elliptical shape when the blade and board are almost parallel. If you run the work across the blade at any one of these angles, the shape you see is the shape of the cove you get. A smaller blade will give you a tighter curve, and tilting the arbor will make one side of the curve steeper. You can make molding without making the adjustable fence, by clamping the board to the table, but adjustments are tedious and difficult to duplicate.

Start with the cove on the outside edge. A cove cannot be made taking a heavy cut. Once you have adjusted the blade height and locked the fence angle to conform to the drawing on your test piece, you must lower the blade until it barely clears the table. Then take away only about ⅛ in. or less on each pass until the cove reaches the depth you want. The test piece will quickly tell you if you are trying to do too much at once: if the stock rides up, or won't feed without pressure, or

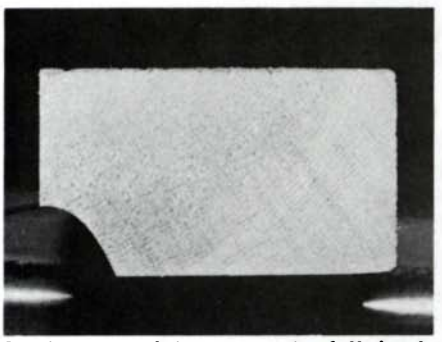
if the blade is being forced to bend, you must retreat, lower the blade, and try again. Your last cut should be especially slow and fine, to minimize sanding.

The straight cuts are all made with the regular rip fence. Notice that we leave good bearing surfaces for later cuts as we go along. This makes the work safer and more accurate. Watch out that you don't trap narrow cutoffs between the blade and the fence—I've had them shoot out of the saw and stick into the wall behind me.

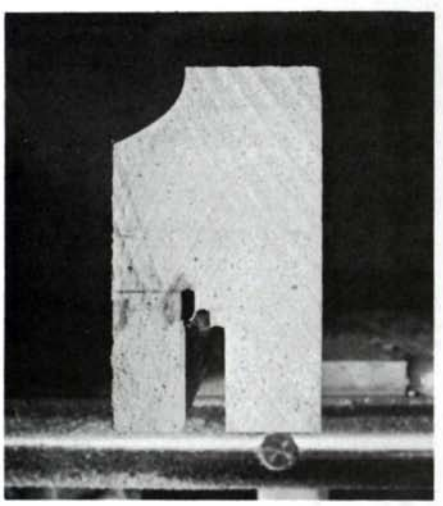
Save your scraps, you can build up other molding shapes from them later. Cut the rabbet last, then watch how a light sanding brings the profile to the line.



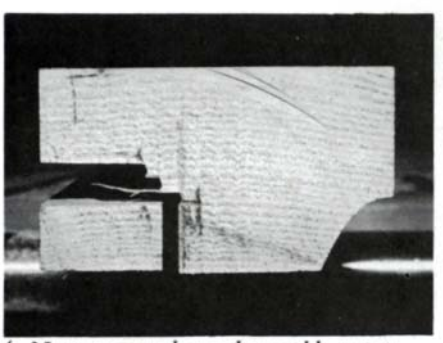
1. *Cove starts with a shallow cut using the angled fence shown at bottom right.*



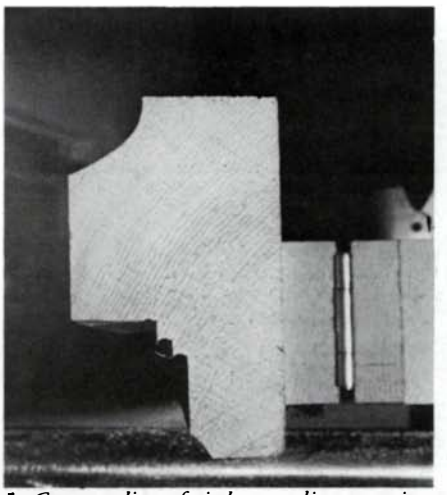
2. *Five passes bring cove to its full depth.*



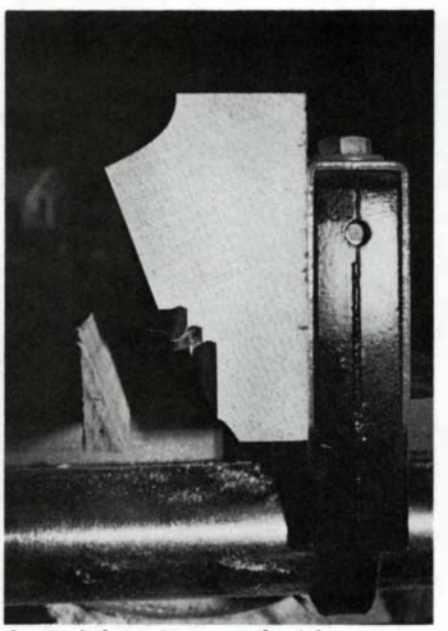
3. *Three straight passes begin to define the decorative rises.*



4. *Next pass takes salvageable waste.*

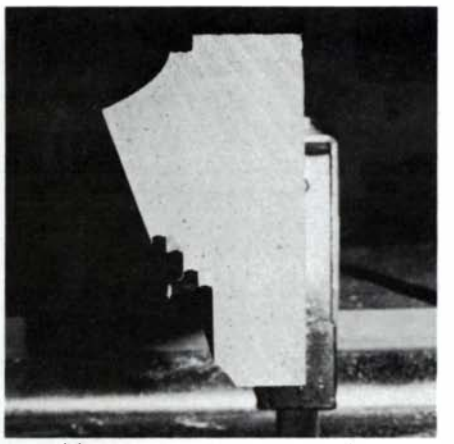


5. *Cove on lip, of tighter radius, requires two passes over a 6½-in. blade.*

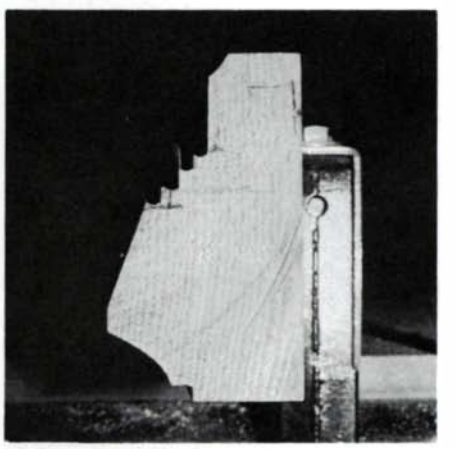


6. *Angled top is removed with one cut.*

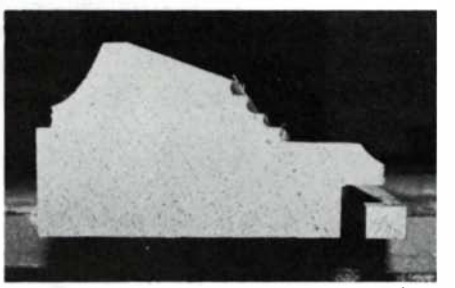
7. *Starting a decorative step on the outside. A second pass will deepen it.*



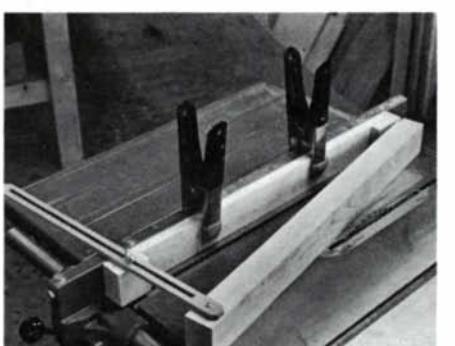
8. *Adding one more rise to the face.*



9. *Removing sharp point with a light cut.*



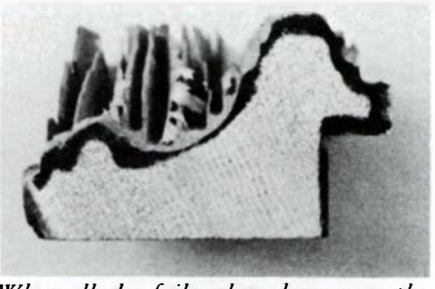
10. *Two cuts clear the rabbet—molding needs only light sanding to soften rises.*



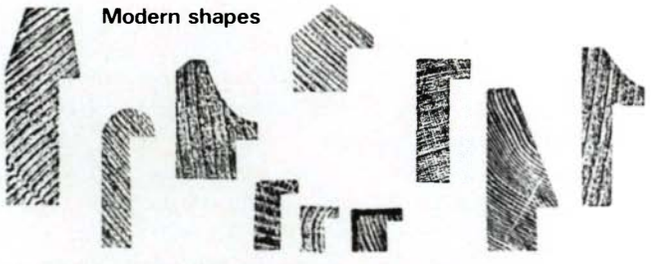
Adjustable-angle fence allows a range of coves to be easily set and duplicated on the tablesaw using regular sawblades.

Moldings you can make

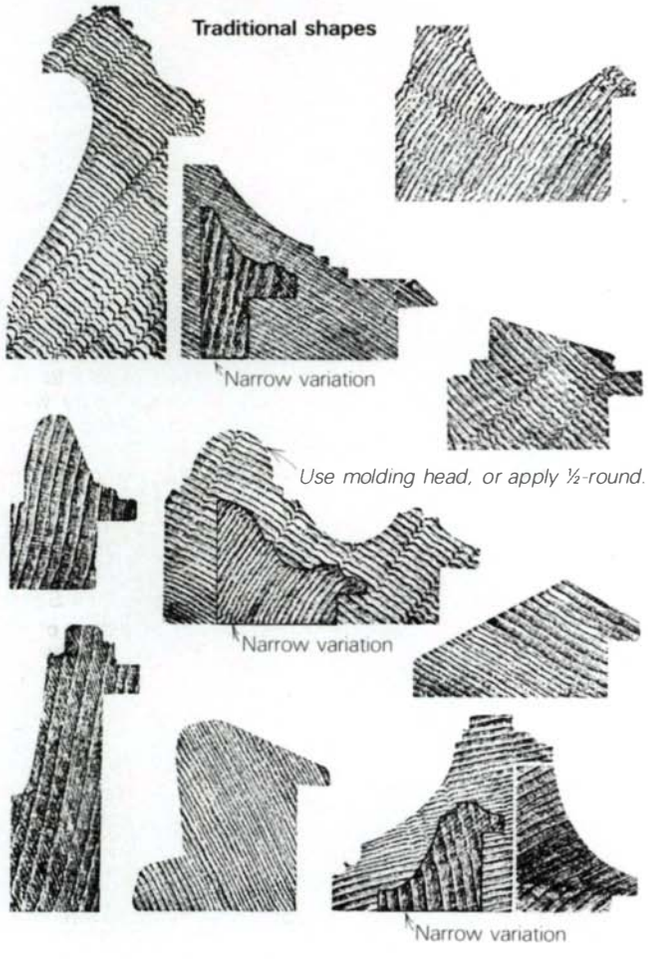
Many moldings can be copied on the tablesaw in a straightforward way. For those that can't, even intricate curves can be achieved without a molding-head cutter by chewing close with lots of linear cuts, and then fine-shaping with gouges and sandpaper. One advantage of making your own molding is that you can adjust the size to suit the job. You could frame anything, from a wedding announcement to the shotgun that inspired the marriage, by varying the proportions of these basic molding shapes, combining them and rearranging them. Wider moldings are frequently carved, finished with stain or gold-leafed. Interiors of boxes, and many liners, can be covered with fabric. —*J.C.*



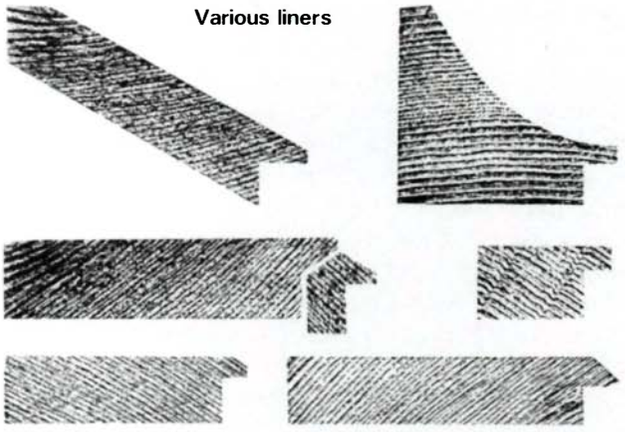
When all else fails, chew down near the line, finish with ingenuity.



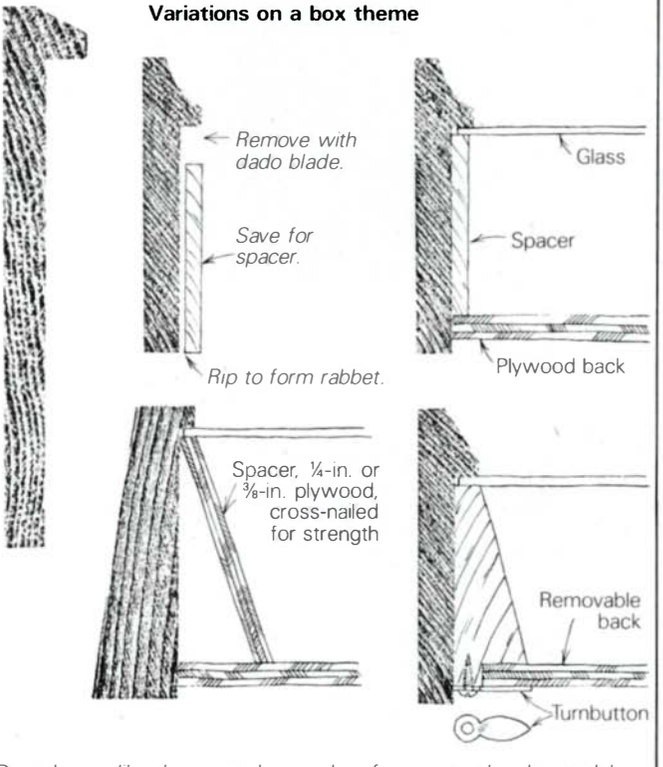
Simple shapes suit modern pictures. These moldings can be scaled up or down, as the size of the picture dictates. Finished with stains, leafed, or just oiled, they can be used with mats and glass, or as outer frames for the liners at right when framing oils.



These profiles are typical of traditional frames for oils. Scaled down, they suit traditional prints. Sizes can vary from 1 in. to 4 in.; the angles steepen and the shapes simplify as the size becomes smaller.



Liners vary in width, are usually fabric-covered, and can take the place of mats for oil paintings. Use narrow liners (¾ in. or 1 in.) with wide frames as a visual separator; use liners up to 3½ in. wide with narrow frames. Liner and frame should not be the same width—it's a visual trap that distracts from the picture.



Deep boxes like these can be used to frame arrowheads, medals, memorabilia. Boxes are enriching—a plate on a stand looks pretty good; framed in an octagonal box it looks like a treasure.

All moldings shown approximately half size

Three Decorative Joints

Emphasize the outlines with contrasting veneers and splines

by Tage Frid

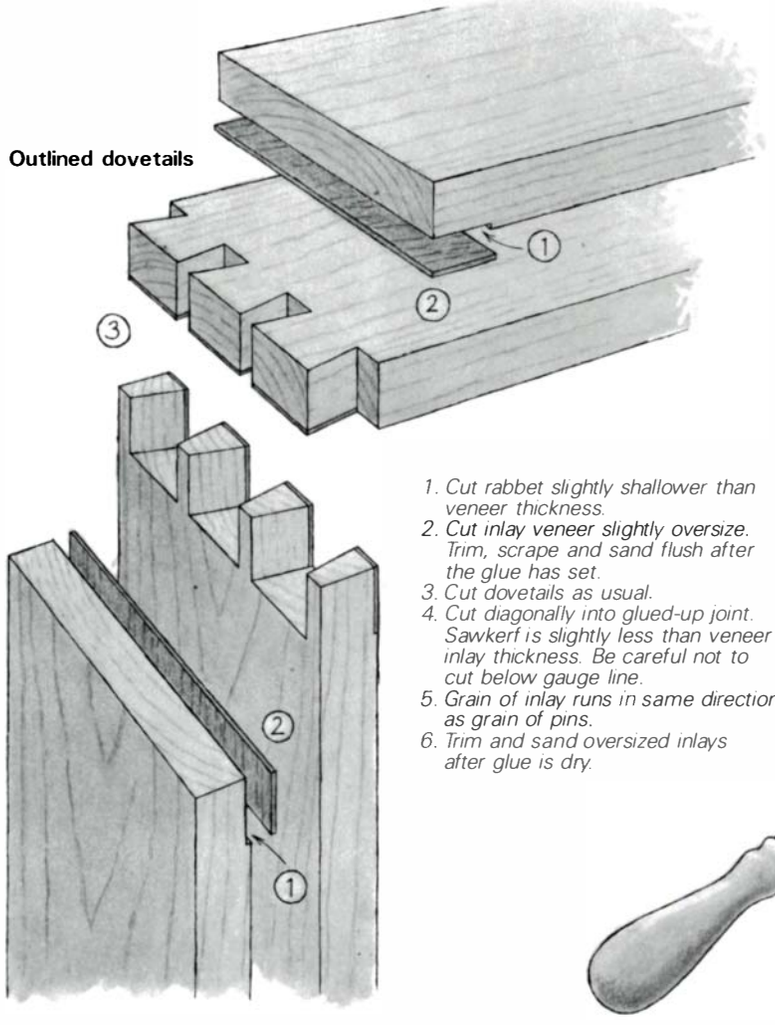
I've been a craftsman and designer for 53 years and a teacher for more than 30, but I'm still learning. My students keep me on the ball by always asking questions. I experiment to come up with new ideas and simpler or better ways to do things. Students usually don't ask for help until they are in trouble. By then they have a big investment in time and materials, and we have to figure out some way to fix the mistake so it does not stick out like a sore thumb.

Dovetails are difficult for the beginner, and I have many times shown how to fix a badly fitting dovetail by inserting a piece of veneer. When I thought more about this trick, I realized you could outline the whole joint with veneer of a different color for a nice decorative effect. The technique also works on other joints, such as the mortise-and-tenon slipjoint. Another kind of decorative joint is a three-way miter where the strengthening splines are also emphasized in a contrasting wood. This is an attractive joint for framed cabinets, tables and stools. Here is how to make these three joints.

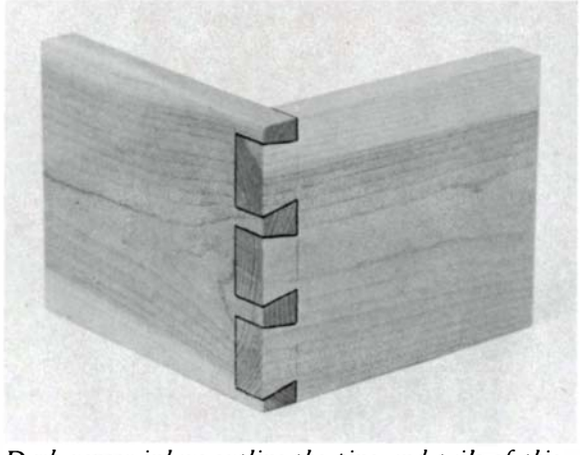
Outlined dovetails—The joint is laid out, cut and fit in the same way as a regular through dovetail. The veneer inlay that will outline the base of the pins and tails is glued onto the inside face of the mating pieces before the joint is cut. The rest of the outlining is done after the joint is glued together. Gauge the usual depth-lines around the ends of both pieces. To house the inlay, cut shallow rabbets up to the gauge line on the inside face of each piece. If you cut the rabbet on the tablesaw, set the blade as high as the gauge line (the thickness of the dovetailed pieces). Then set the fence to cut the rabbet slightly shallower than the thickness of the veneer.

The grain of the veneers should run in the same direction as the grain in the pieces to be dovetailed. It's easier to trim the inlay flush after the glue has set than to fit it perfectly before. So cut the veneer slightly oversize. Be sure the joint is perfectly tight where the end grain of the veneer meets the solid wood, especially on the pins piece because the veneer will be visible on both edges. Glue and tape the inlay in place

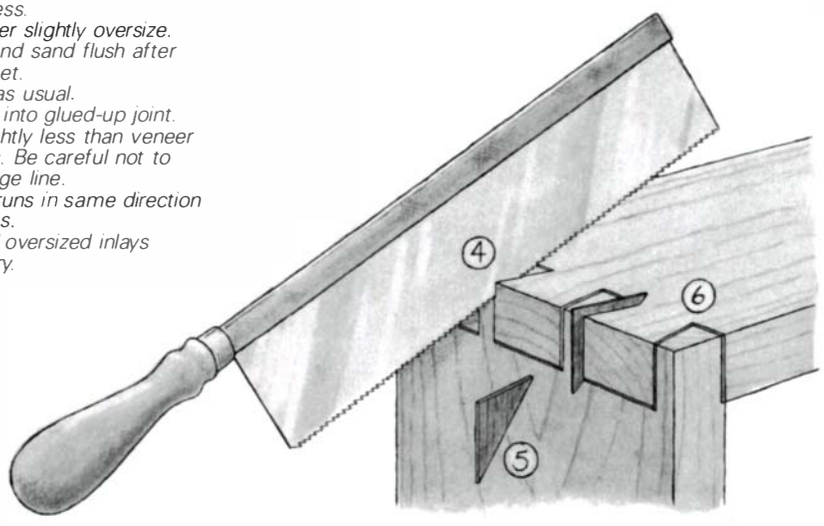
Outlined dovetails



1. *Cut rabbet slightly shallower than veneer thickness.*
2. *Cut inlay veneer slightly oversize. Trim, scrape and sand flush after the glue has set.*
3. *Cut dovetails as usual.*
4. *Cut diagonally into glued-up joint. Sawkerf is slightly less than veneer inlay thickness. Be careful not to cut below gauge line.*
5. *Grain of inlay runs in same direction as grain of pins.*
6. *Trim and sand oversized inlays after glue is dry.*



Dark veneer inlays outline the pins and tails of this decorative joint.



Drawings: Roland Wolf

and clamp it tight. When the glue has dried, lightly scrape and sand the inlay flush.

Now cut and glue up the dovetails. The veneer will line the base of the pins and tails. To add the veneer that will complete the outlining of the joints, saw diagonally along the line of the joint between tails and pins. Use a saw that cuts a little thinner than the thickness of the veneer inlays, and be sure the sawcut doesn't go below the gauge lines. Cut triangular pieces of veneer for the inlays. Orient the cuts so that when the pieces are glued in, their grain will run in the same direction as that of the pins. To fit the inlay pieces in the thinner sawkerf, you need to compress them a little by hammering them or by squeezing them in a steel vise.

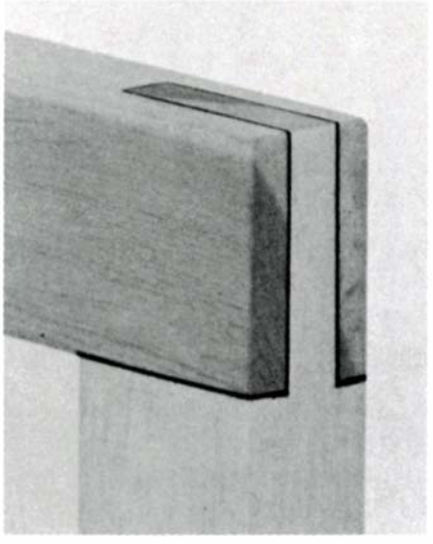
Now put some glue in the kerf—not on the veneer. Rub it into the sawcut, using your finger to force it in deep. Slide the veneer into the kerf. It will pick up moisture from the glue and swell for a perfect fit. When all the inlays have been inserted and the glue has dried, cut off the veneer with a sharp chisel and finish-sand.

Outlined mortise-and-tenon slipjoint—This joint can also be decorated with inlay, in the same way as dovetails are. Before you cut the joint, rabbet the inside edges of each piece for veneer. If you cut the rabbet on the tablesaw, use a backing block for more bearing surface against the fence. Flush off the glued-on veneer, then cut and glue up the joint as usual. To complete the veneer outline, saw diagonally down the line between tenon and mortise. Cut veneer triangles slightly larger than finished size, and compress them to fit the kerf. Rub in glue as for the dovetail; you can use a mechanics' feeler gauge to get the glue all the way in. Slide the veneer in, trim it and finish-sand the joint when the glue is dry.

A surer, easier way to make this joint is to glue the veneers on the two cheeks of the tenon before the joint is put together. Rabbet and veneer the inside edges of the two pieces as before. Then cut the tenon and glue the veneer onto its cheeks. Allow for the veneer thickness when laying out the tenon thickness. Cut the mortise to fit the veneered tenon and glue up the joint as usual. For dovetailed or slipjointed pieces made of thicker wood, the inlay could be thicker too.

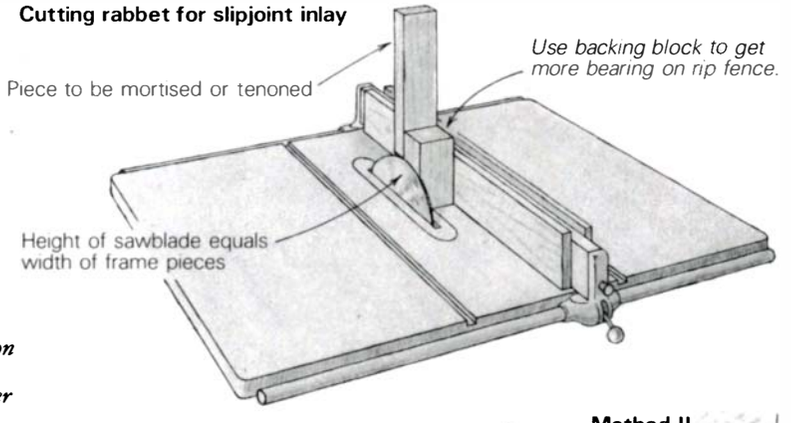
Decorative splined miters—There are other ways besides a veneer outline to emphasize joints. A strong, decorative and quite simple joint to make is the splined miter frame, as shown on the next page. I made this three-way miter frame joint with wood that is square in section. For demonstration, I made only one corner joint—in a table you might have four, in a cabinet, eight (one at each corner of a cube). Glue together the joints of the mitered frames. I use hot hide glue because it sets fast. Next, cut the grooves for the decorative splines. If you cut the grooves for the splines on a tablesaw, use a cradle to hold the piece at a 45° angle to the table. I cut a notch in a 2x4 to make a cradle. For strength and decoration I put in several splines.

Clean up the surfaces after the glue has dried, then bevel or miter one side of each frame along its length so they will



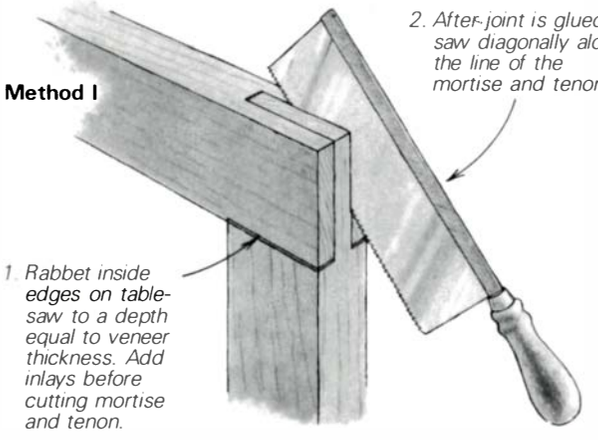
Mortise-and-tenon slipjoint can be outlined in veneer in either way shown below.

Cutting rabbet for slipjoint inlay

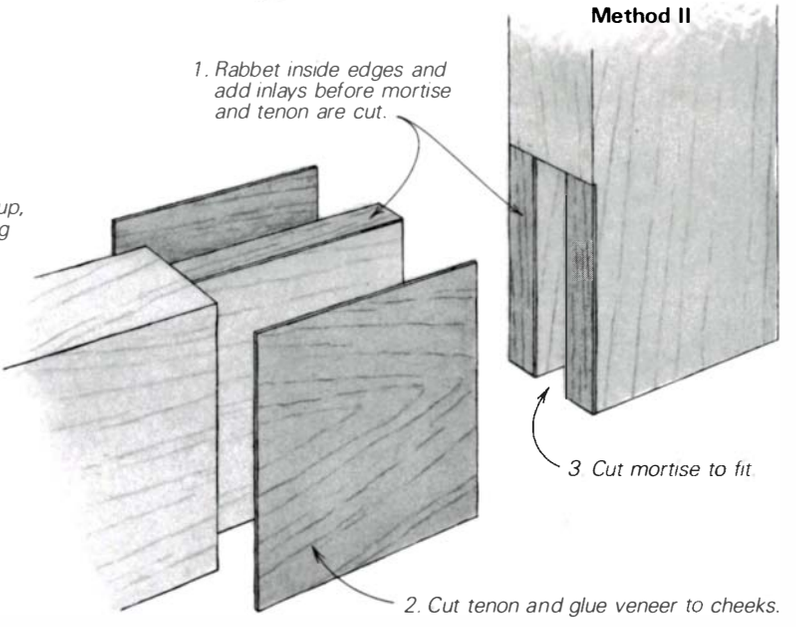


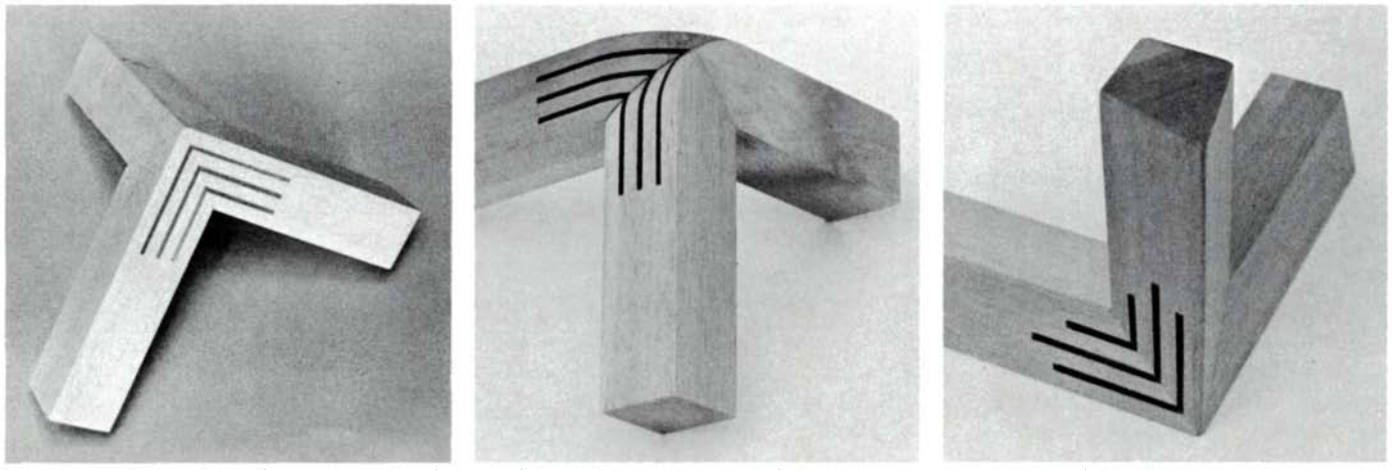
Outlined mortise-and-tenon slipjoint

Method I

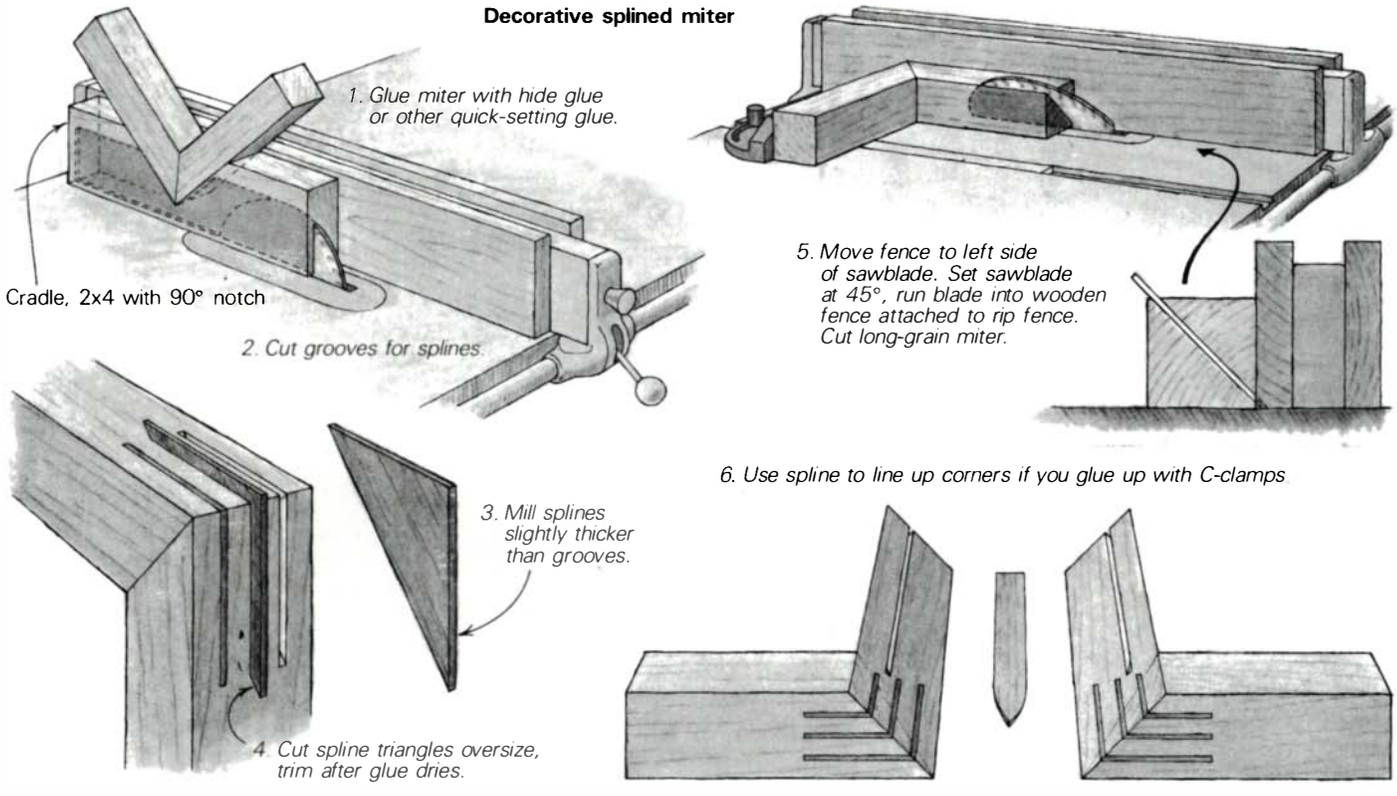


Method II





Three variations of the decorative splined mitered joint. Piece with angled faces, at right, is the most difficult of the three to make.



fit together. You can do this with a hand plane or with the tablesaw. With the tablesaw, mount a piece of wood on the rip fence, tilt the blade to 45° and run the blade slightly into the wooden fence. Use trial and error to find the right setting of blade and fence. You can leave a $\frac{1}{32}$-in. shoulder on the mitered piece, to bear against the fence beyond the sawcut. Plane this shoulder off before gluing up, or lose it later by rounding the edge. Don't stand directly behind the blade when you make this cut—the waste can be thrown backward.

Next make a groove in the mitered side for a hidden or blind spline, using the tablesaw or an electric router. The joint is long-grain to long-grain, so this spline is not for strength but for getting the corners to align if you glue up using clamps. If instead you wrap strips of inner-tube around the joined pieces, stretching it as you go, the corners will align and the spline won't be necessary. I have also used $\frac{1}{2}$-in. surgical tube; it's inexpensive and works better.

You can round off the corners, as in the photo, top center, before gluing up. I shaped the curves on a disc sander and dry-fit them to make sure they lined up at the joint.

For an interesting effect, you can put an angle of about 15° on the faces of the frames, as in the photo, top right. This joint is more difficult to make. Before gluing the frames together I ripped one face of each piece at a 15° angle. These bevels all should be on the front faces (in the same plane). You can use the same kind of tablesaw setup as for ripping the miters. These cuts must be very accurate. Finish-sand these faces before mitering and gluing up each frame. Then cut the sawkerfs and glue in the splines.

Next miter a long-grain side of each frame and cut the groove for the positioning spline if you are gluing up with clamps. Then rip the outside faces of each frame (that is, where the decorative splines appear) at 15° and finish-sand them. Finally, glue the two frames to each other. I like this joint and am going to use it in a frame-and-panel cabinet—when I get the time. □

Tage Frid is a contributing editor to this magazine, and the author of Joinery: Tools and Techniques *and* Shaping, Veneering, Finishing, *available from The Taunton Press.*

Bermudan dovetailing

by James Bump

Bermuda is a lovely semitropical island about 600 miles off the Georgia coast. Today it is a center for tourism, international banking and a couple of "country club" military bases. I was surprised to find, on this 20-square-mile paradise, a distinctive tradition of cabinetmaking. From the 17th century, Bermudan craftsmen carried on an individual sryle of decorative, cogged dovetail uncommon in either Britain or America.

Settled in 1609 by shipwrecked British sailors, Bermuda has been a British colony ever since. Early accounts cite plentiful supplies of timber as the island's only natural resource. Its cedar trees were used in furniture, in musical instruments, and in the Bermuda sloop, this seafaring community's lasting contribution to shipbuilding.

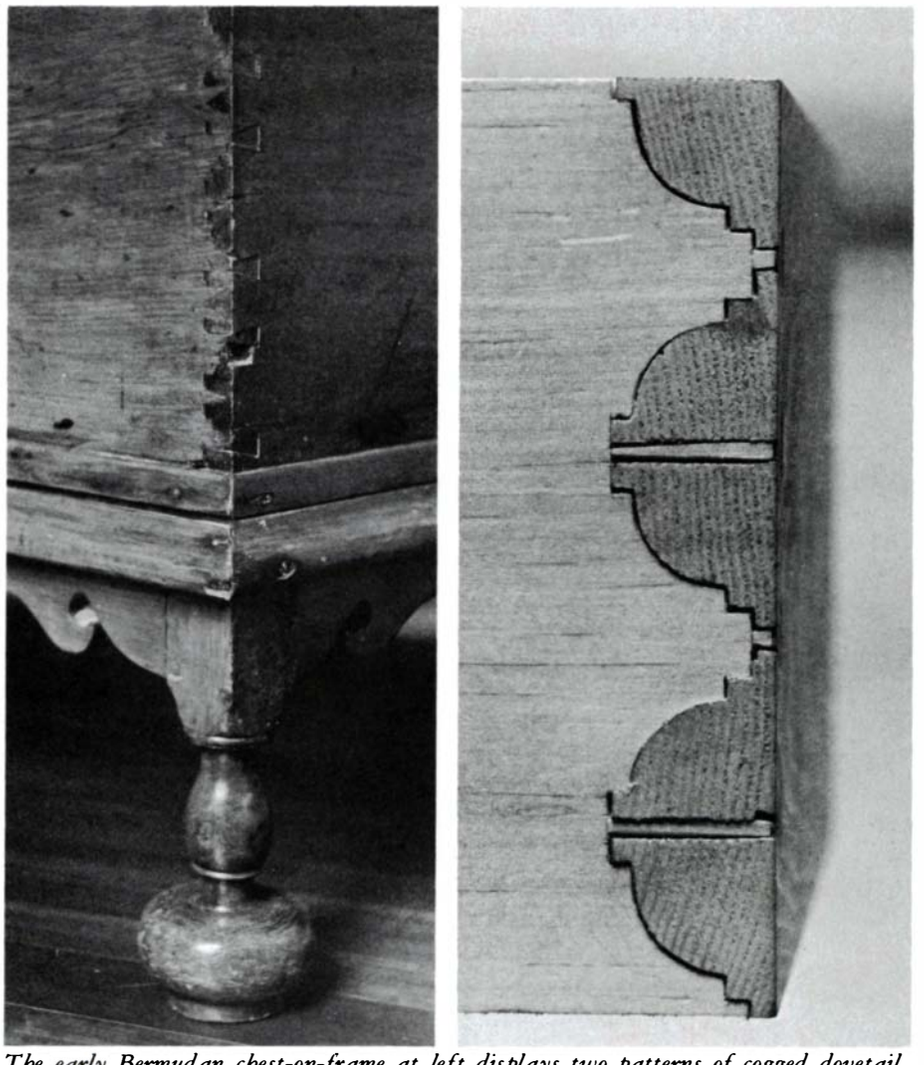
Bermudan ornamental dovetailing evidently had its origins in medieval Moorish workshops. It then spread to Spain and finally to Bermuda. To my knowledge, fancy dovetailing was used in Bermuda only for chests-on-frame. Early island cabinetmakers used Bermuda cedar *(Juniperus bermudiana),* now blighted and struggling against near-extinction. Today, Bermudan craftsmen import what they call Virginia cedar. Both cedars are aromatic, close-grained and knotty, and they finish to a gorgeous red-brown color.

Each cabinetmaker in Bermuda probably had his own individual designs for dovetailing. I made my own and found that templates were necessary. I cut the joint like a lap dovetail, the tails cut through, the pins blind. This leaves material for decoration on both pieces, which I shaped with a fretsaw, chisels and files. Test-fitting the joint is nearly impossible. The two boards have to be cut accurately before they will fit together at all.

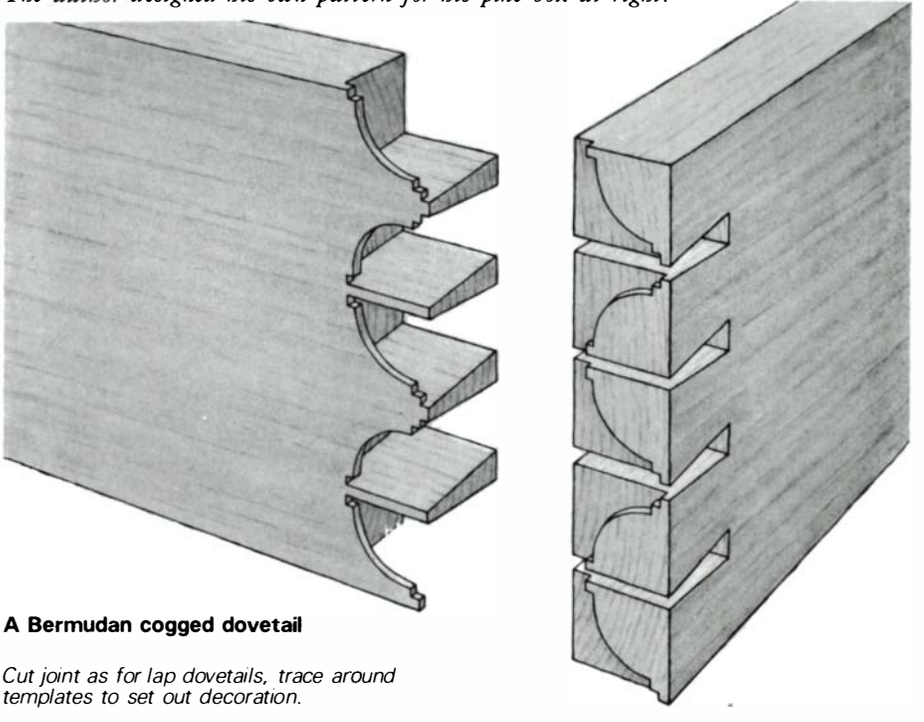
Since there is so much room for error in the first attempts, I used pine to make my dovetails. I am a lutemaker, not a cabinetmaker, and I struggled a bit with the joint. Someone handy with dovetails should have no difficulty.

Bryden Bordley Hyde's fine book on Bermudan fumiture, *Bermuda's Antique Furniture and Silver,* published by the Bermuda National Trust, shows examples of this sort of work. You can get it from the Maryland Historical Society, 201 West Monument Street, Baltimore, Md. 21201. □

James Bump lives in Hampden, Mass.



The early Bermudan chest-on-frame at left displays two patterns of cogged dovetail. The author designed his own pattern for his pine box at right.



A Bermudan cogged dovetail

Cut joint as for lap dovetails, trace around templates to set out decoration.

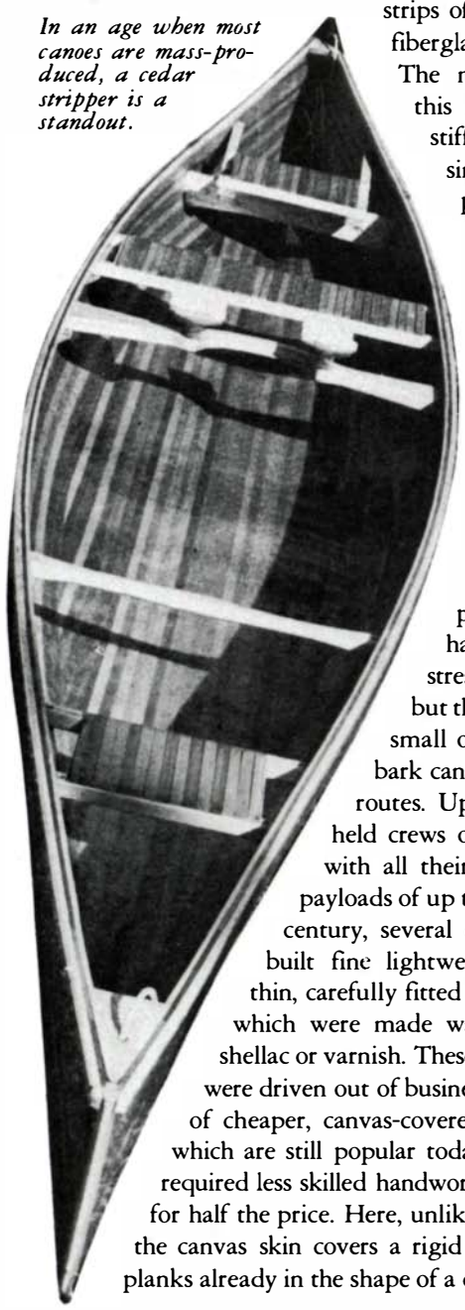
Photos: J. Bump, Don Eaton; drawing: Roland Wolf

Building a Stripper Canoe

Cedar and fiberglass combine to make a strong, lightweight shell

by Bruce Winterbon

A handsome boat is arguably man's most beautiful artifact, and a canoe with good lines is strikingly handsome. For centuries, canoes were made mostly of wood. American Indians perfected the birchbark canoe, a stressed bark skin over bent wooden ribs. In the 19th century, some makers replaced birchbark with canvas, others developed all-wood and cheaper canvas-covered wood canoes. Today, most canoes are mass-produced or batch-produced of aluminum, fiberglass, ABS composites or a host of molded plastics. But if you want to make a canoe at home, your best bet is wood and fiberglass. I made the stripper, a lightweight ribless canoe of thin strips of cedar reinforced with fiberglass, in my basement. The method of fabricating this light and exceedingly stiff shell is comparatively simple and could be applied, for example, to free-form cabinetry or to moderately large wood sculpture. The stripper canoe looks a lot like other canoes, but can be distinguished from its traditional predecessors by its construction. Birchbark canoes consist of a flexible framework of planking and ribs that has no shape without the stressed skin of the bark, but these canoes need not be small or flimsy. Large birchbark canoes plied the fur-trade routes. Up to 36 ft. long, they held crews of 7 to 15 men, along with all their provisions, gear and payloads of up to 3½ tons. In the 19th century, several companies in Ontario built fine lightweight canoes of wide, thin, carefully fitted cedar planks and ribs, which were made waterproof by coats of shellac or varnish. These companies, however, were driven out of business by the introduction of cheaper, canvas-covered, cedar-strip canoes, which are still popular today. This type of canoe required less skilled handwork to make, and it sold for half the price. Here, unlike the birchbark canoe, the canvas skin covers a rigid assembly of ribs and planks already in the shape of a canoe.



In an age when most canoes are mass-produced, a cedar stripper is a standout.

The stripper's fiberglass skin covers both sides of a wooden shell glued up of thin, narrow cedar strips—hence its name. The fiberglass and wood combination has the same properties as an I-beam: the two layers of fiberglass are the plates and the wood is the web. The structure is exceedingly stiff but brittle, and a stripper may not be flexible enough for whitewater canoeing.

Some woodworkers may dislike fiberglass because it's plastic, not wood. If so, they can use it to reinforce only the back or hidden side of a structure, although this surrenders an enormous amount of rigidity. Some may also appease their conscience by considering the fiberglass layer to be just an elaborate, transparent finish. The polyester resin used in fiberglass is about as dark as varnish, and when the resin wets it the fiberglass cloth seems to disappear. In the following I will outline the method I used to construct a stripper hull, and suggest variations appropriate for other projects.

The plans—Designing a canoe is complicated, beyond the inexperienced maker, so I bought plans from the U.S. Canoe Association for their "cruiser" canoe, and consulted their manual, *Construction Techniques for Wood Strip Canoes,* and David Hazen's book, *The Stripper's Guide to Canoe Building.* The USCA book and plans can be ordered from Larry Hempel, USCA Treas., 15 S. 12th St., St. Charles, Ill. 60174. David Hazen's book is published by Tamal Vista Publications, 222 Madrone Ave., Larkspur, Calif. 94939.

These books and the plans tell you how to build the boat's hull, its thwarts, seats, gunwales, decks and accessories. I will concentrate here only on the hull—although the fittings may take longer to make than the hull does. I soon learned that there is no single, right way to proceed, yet the broad outlines are fairly definite. I tried to improve on the manuals' techniques by making tighter, stronger glue joints.

The stripper is built over forms, called stations, attached to a rigid beam, or strongback. The shape of the canoe is determined by the shape and spacing of the stations; the strongback provides rigid support for the stations. The ¼-in. thick cedar strips are bent, held tight to the forms with staples (which eventually have to be removed) and glued to each other. The completed shell is smoothed on the outside and fiberglassed over. Then it is removed from the forms and smoothed and glassed on the inside. Last, the resin on the outside is sanded smooth.

Strongback—The strongback is a rigid beam that runs down the center of the length of the canoe, which is built upside down on top of it. My strongback was three 2x4s bolted together, but two 2x6s, or even a U- or box-beam of plywood or particleboard will do. Because the canoe tapers at each end, the last foot or so of the strongback should be narrower than the rest. If you make a lumber strongback, let

it sit and stabilize in the workplace for a week or so after assembling it. Mine warped a little during this period, and I had to put another 2x4 on edge under the strongback to flatten it. Fasten it to a pair of sawhorses raised to workbench height and leave room on the sawhorses to fasten a simple planing jig, running parallel to the strongback. Fasten a taut line along, but not touching, one side of the strongback and adjust the sawhorses to level this line. All further measurements should be to this line.

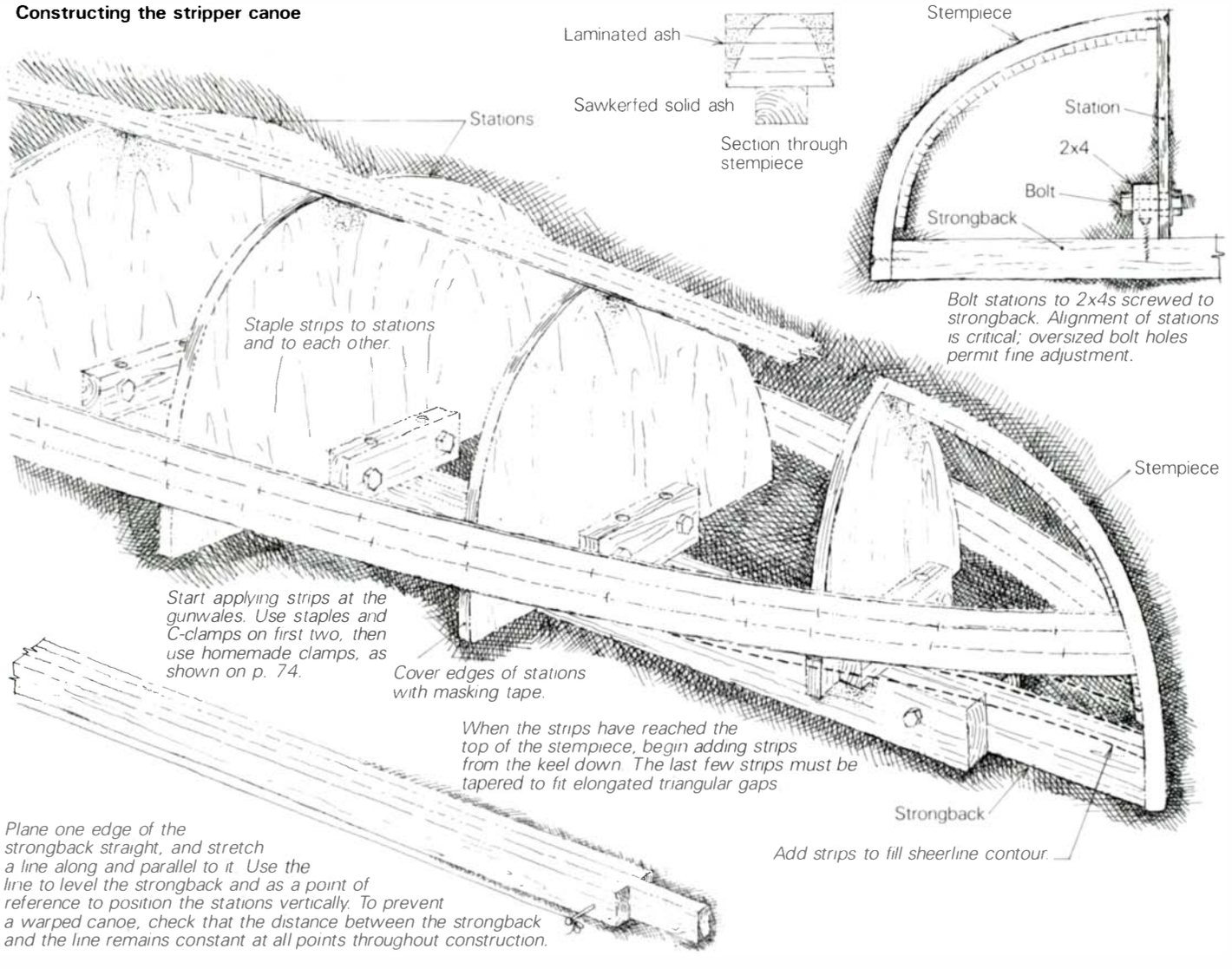
Stations—My stations were made of plywood, fixed at right angles to the strongback, centered on it, and spaced about a foot apart. A canoe has long, gentle curves, so if your project is flatter than a canoe and its planking is thicker than ¼ in., you could spread the stations out a bit; for thinner planking and tighter curves, move them closer together. I traced the outlines from the plans, bandsawed the rough shape, and sanded to the pencil line against a rigid sanding disc. If you don't have a stationary disc sander, coarse garnet paper glued to a plywood disc mounted on the radial-arm saw or tablesaw arbor works well. There is no need to bevel the forms.

Lay out the station positions on the strongback. I bolted the plywood to short 2x4s that were screwed to the strongback. Oversized bolt holes in the plywood permit fine adjustment. The station centerlines should be plumb and in line with the centerline of the strongback and each other. Their horizontal cross lines should be the same distance from the stretched reference line, and level. Check and adjust the alignment the next day, and again the following day. Making a canoe is a long job and it's too easy to relax the tolerances along the way. I found that some of the 2x4 blocks had rotated on their screw mounts, so the stations weren't perpendicular to the taut line and the strongback. A temporary strip stapled to the strongback held them square. Put masking tape on the edges of the stations so you don't glue the cedar strips to the plywood.

Stempieces—I made two-part stempieces, an outer part of form-laminated ash and a narrower inner one of solid ash sawkerfed to take the bend. The thin strips butt against the joint between the two. To laminate the stempiece I used resorcinol glue, because it is strong and waterproof and allows a long setup time, though the dark red glue lines might be unacceptable on other projects. The stempiece laminates were cut overlong, glued up on a plywood form, then cut to length. One end was butted and screwed to the top of the first station and to the end of the strongback. These screws must be removed later, after the canoe begins to take shape, but before there are too many cedar strips in the way.

Planking—Making the strips for the canoe's hull is next, and the wood of choice is red cedar. It is lightweight, rot-resistant

Constructing the stripper canoe



and easy to work, and thin strips of it bend without breaking. Since the surface of the wood will be covered by fiberglass and resin, the wood need not be particularly smooth or hard.

Because the two layers of fiberglass cloth and the wood act like an I-beam, the thicker the strips (the web of the beam), the stiffer the structure. Stiffness increases exponentially as a function of the depth of the web, so you mustn't let thicknesses vary much, or the hull's strength won't be uniform. For my 18½-ft. long canoe, I used ¼-in. thick strips, ripped from 20-ft. boards, nominally 1 in. thick. I anchored an upright to the floor 10 ft. ahead of the saw to help me line each board up with the fence. With a support for the long boards as they come off the saw table, one person can push-feed the stock while another holds it against the fence at the blade.

I checked the strips with a micrometer locked with masking tape at 3/16 in. and broke them where they passed through it. If this occurred near the middle of a strip, I scarfed the pieces together after cutting out the thin spot.

Clamps—You need to make special clamps. Cut some hardwood blocks to fit between the stations and groove them down their length wide enough to fit over the edge of the cedar strips. These blocks are held in place by wedges fitted against U-clamps, made of plywood or hardwood, that clamp to the stations. I used wood scraps from the stations for spacers, and shim shingles for wedges.

Planing—The appearance of the job depends on the care with which the strips are fitted, and how well they match for color and figure. You will need a planing jig to help you bevel and taper each piece neatly against its neighbor on the form. In the edge of a 2x4, cut a groove about half as deep as a strip is wide and wide enough to hold a strip on edge. Fasten the 2x4 to the sawhorses, alongside the canoe form, and put a stop at one end. After fitting the strip to its neighbor by trial and error along its whole length, trim one end to fit against the stempiece. The second end is trimmed at the last moment as you glue up. The strip's exact length depends on its curve and is difficult to get right without going through the entire clamping procedure before gluing.

Glue—Fiberglass will hold everything together, so the manuals suggest white glue. Instead, I used Aerolite, a waterproof, urea-formaldehyde glue that is colorless, doesn't creep and will fill some gaps. It's available from Leavens Bros., Ltd., 2555 Derry Rd. E, Mississauga, Ontario L4T 1A1, Canada, or from Woodcraft Supply.

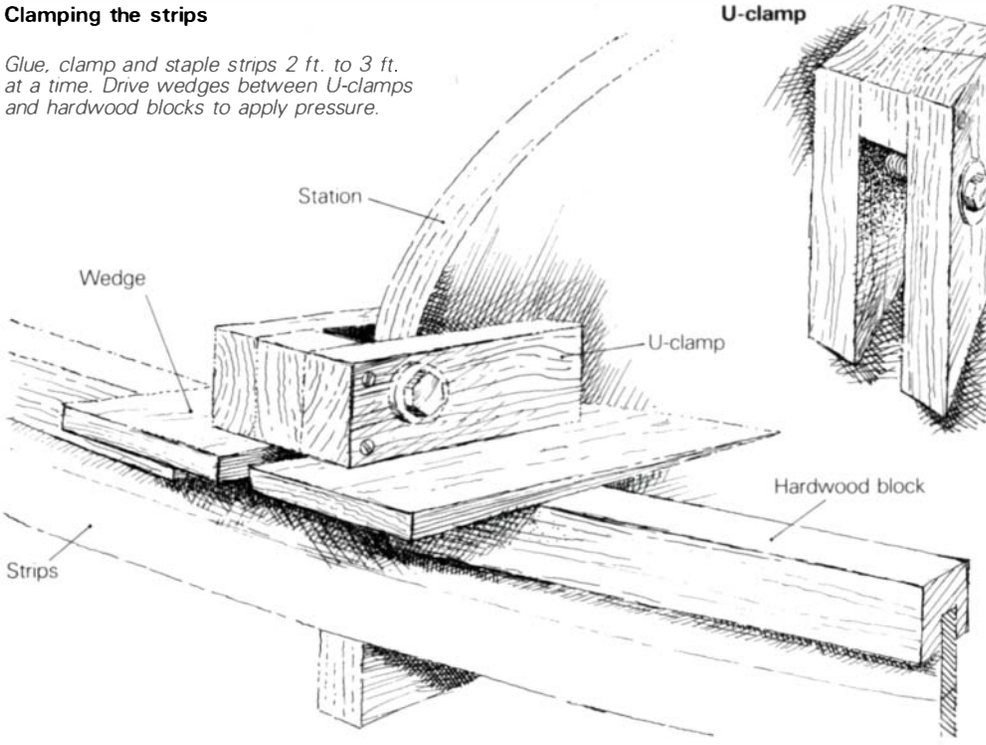
Assembly—Start attaching the strips at the gunwales and work upward toward the keel. Glue and C-clamp the first two strips on each side to each other and staple them to the stations. You can't use the wedge clamps until these first strips are set unless there is room on the stations to clamp from both sides. I ran the strips fairly straight and didn't attempt to follow the sheerline contour of the gunwales that would rise at each end of the finished canoe. Instead, I added short pieces to the ends later to make up the desired rise.

As the strips rise up the form, position each new one on the form, then tighten the U-clamps over the stations, leaving a bit of space between the clamps and the long blocks placed over the strip. Spread glue along mating surfaces for 2 ft. or 3 ft., then drive wedges between the long blocks and the U-clamps to put pressure on the glue joint. Staple the strips to the stations, one leg in each strip. If the strips don't line up between stations, staple them together there, too. (I used about 1500 staples.) Then move to the next section. Do one strip on each side, then wait for the glue to set. Keep the number of strips on each side about equal, to balance the stresses on the stations. And remember to remove the inside screws holding the stempieces to the end stations before the strips get in the way.

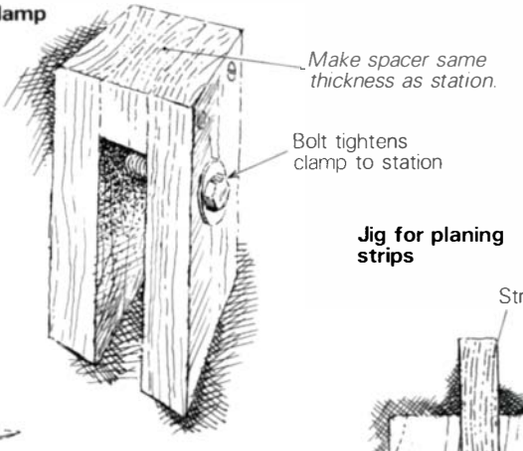
When the strips rise to the ends of the stempieces, it takes more effort to bend the strips into place. Start working from the keel line down. As you approach the previously glued

Clamping the strips

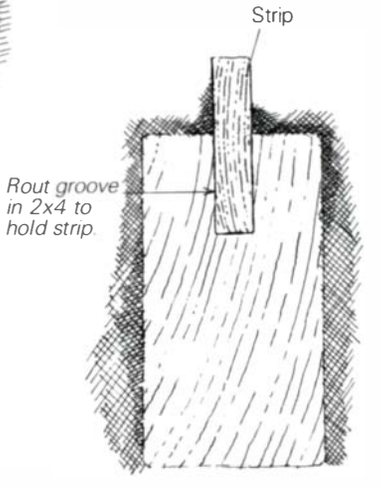
Glue, clamp and staple strips 2 ft. to 3 ft. at a time. Drive wedges between U-clamps and hardwood blocks to apply pressure.

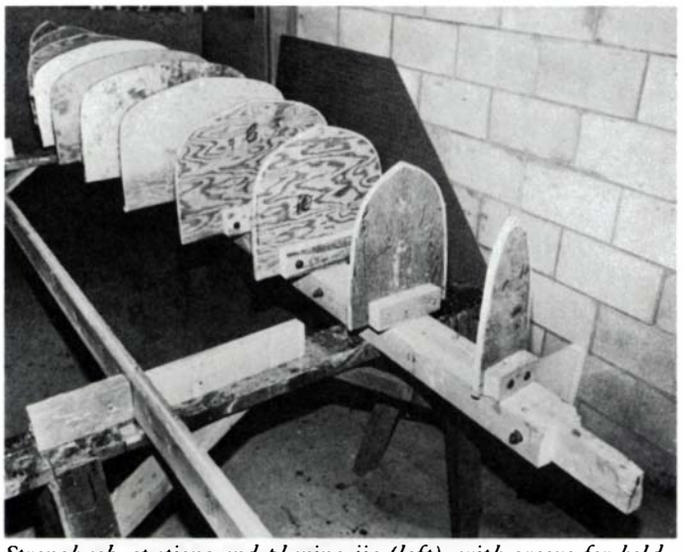


U-clamp



Jig for planing strips





Strongback, stations and planing jig (left), with groove for holding strips on edge, ready for fitting stempieces and first strips.

strips, put in tapered pieces to fill in the last irregular spaces.

The manuals say that the staple holes won't show in the finished canoe, but this isn't true. However, assembling the hull without putting 3000 staple holes in it would be much trickier. You need to hold the strips tight to the stations and, between stations, flush with each other. You would have to start by nailing on an extra strip along the gunwales and clamping the first strip against it. Then you could use external forms, dogs fitted to the U-clamps, or elastic bands or belts to hold the strips tight against the stations. The clamping force exerted by a belt or band is proportional to the curvature of the band. Hence, on a flat portion you'd need lots of wedging, so you'd have to make a trial run, dry-clamping carefully. Or, you could replace the staples between stations with waxed wooden-faced C-clamps.

Smoothing the hull—When the hull is completed, pull the staples (my sheath knife, blade flat against the wood, worked well here and it took me only about 30 minutes). Next, smooth the surface. I used a plane, spokeshave and paring chisel, and finished with an oscillating sander. Smoothing was the most enjoyable part of the whole project: from the initial mess of roughsawn boards, so rough that even the ultimate shape had been somewhat obscure, the shape and grain gradually appeared.

Fiberglassing—The outside of the canoe is fiberglassed after it has been smoothed but before it is removed from the form. The materials are nasty, toxic and possibly carcinogenic. All the fluids are flammable, and their vapors are explosive. If you don't know something about using fiberglass cloth and resin, get someone who does to help you. (A good book on working with fiber-reinforced plastics is the *Boat Builder's Manual,* by C. Walbridge, published by Wildwater Design Kits, 230 Penllyn Pike, Penllyn, Pa. 19422.)

Six-ounce (per square yard) boat cloth is the usual fiberglass covering for stripper canoes. The cloth should be bought in a width sufficient to cover three-quarters of the canoe's hull circumference. Four pieces, each the length of the canoe, will cover the canoe, with some overlap inside and out. Build up the ends to about four layers, cutting the extra pieces on the bias so they will stretch to conform to the extreme curvature around the ends. Fit all the cloth dry, and get it to lie smoothly before applying the resin.

Red cedar can contain oils that inhibit the setting of polyester resins, so I sealed the hull with two coats of clear, nitrocellulose brushing lacquer. Use a fiberglass resin formulated for boatbuilding; general-purpose resins are too brittle. I used about 2½ gallons on my canoe. Buy a resin without added wax—such resins won't set up hard and will allow the base coats to bond together well. For the final coat, add about as much wax as hardener—paraffin wax dissolved in styrene monomer—to the last resin batch. The dissolved wax will float to the surface, making a protective covering that keeps out oxygen and water vapor so the resin can fully harden. The wax coating is later sanded off.

It takes two to four people to apply the fiberglass and resin. Everyone should have rubber gloves, and you will need a beaker for measuring resin, a dispenser or syringe for measuring out hardener, paintbrushes, rollers and plastic squeegees. Acetone keeps things clean—set out one pot for dirty brushes and such messes, and another for final rinsing. We used Lestoil, a heavy-duty household cleaner containing pine oil, to clean up aftetward.

To apply the fiberglass, smooth the first piece of cloth into place dry and work the resin well into it, adding the other piece as soon as the first is well wetted. For a smooth finish, keep painting on more small batches of resin as soon as the last ones become tacky, until you can look obliquely at the surface and no longer see the weave of the cloth. Then apply the last, wax-impregnated batch of resin. Let this sit overnight. The surface will be highly pebbled, but don't sand it yet—you'll just mark it up later when you glass the inside.

Now the canoe can be pulled off the frame. It has little strength with only one side fiberglassed, so gently work it loose from the masking tape on the stations, move it carefully and support it well. Though it's easy to work on the convex outside of the canoe, cleaning up the concave inside is more difficult. I made a little plane with a rounded sole, using a piece of an old file for the iron, to plane the inside. An offset-blade paring chisel would have been useful, too. I used a flexible disc sander chucked in an electric drill in some of the more awkward places, then fiberglassed the inside. The inside surface gets much less resin than the outside because it should be a bit rough, otherwise the least bit of water will make it as slippery as an ice rink.

After the resin on the inside has dried thoroughly, sand down the outside with wet-or-dry paper. In contrast to the inside, the outside should be smooth to cut down on friction as the canoe moves through the water.

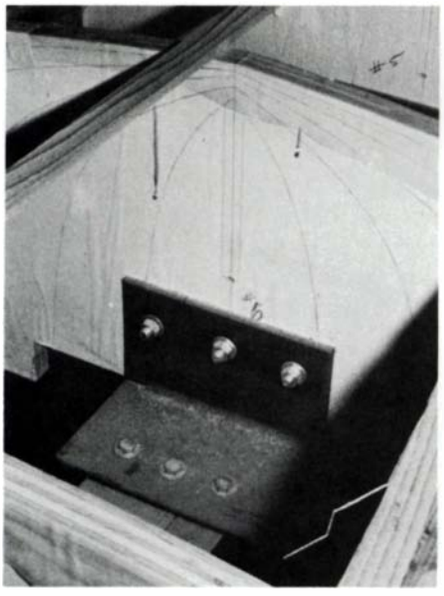
Sanding the resin will give a fine satin finish, but try not to sand into the fiberglass cloth, as it will scratch permanently and become opaque. I started with 40-grit and went up to 320-grit. Despite the wet-or-dry paper, there will be plenty of dust. Wear a particle mask, or you risk impairing your health. Keep rinsing the slurry off, keep the paper wet, and change paper frequently to get the maximum cutting action. I used the oscillating sander for most of this job. Add gunwales, thwarts and seats, and your canoe is finished. Mine turned out to be light enough to carry easily: it weighs a little under 65 lb.—wet, of course. □

Bruce Winterbon, of Deep River, Ontario, is a physicist and devoted amateur woodworker. Photos by Lorna Bourns.

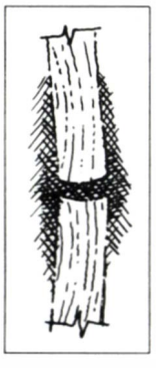
Another approach to the stripper

by Richard Swanson

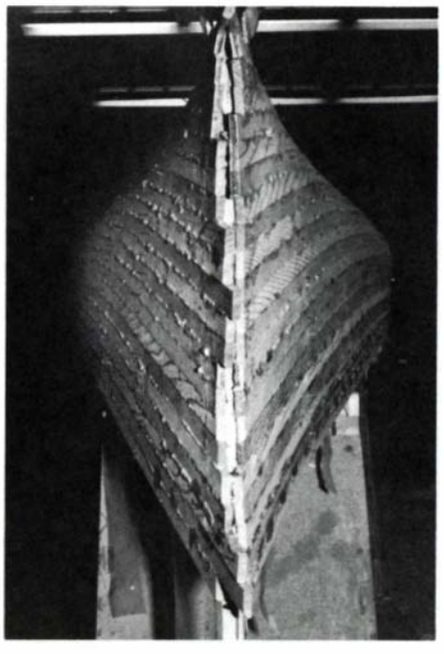
My colleagues Terry Hesse and Boyd Whitt, metalworking and woodworking teachers at the Madison Area Technical College in Wisconsin, built their strippers as school projects. Their "voyager" canoes are a fuller shape than Winterbon's cruiser canoe (see pp. 72-75)—and they weigh only 55 lb., 10 lb. lighter. The men also found the U.S. Canoe Association's manual helpful, though their methods of construction do differ from Winterbon's. For example, they glued up the strips with a casein glue and cured it instantly with the school's high-frequency Wood Welder, so they didn't need clamps. Even so, they put well over 300 hours into each canoe. The result of all that time and attention, Hesse claims, is a canoe that will outperform an aluminum canoe any time. Whitt agrees, "It will take a lot of punishment, but anyone who has made a cedar-strip canoe remembers all the hundreds of hours of knifing, fitting and nudging cedar strips into place. The first time I scraped bottom made me feel like I'd dropped a chisel on a French-polished tabletop."



Whitt and Hesse fastened their stations to the strongback with heavy angle-iron. Both men stress the importance of carefully cutting the stations and accurately aligning them on the strongback. A twisted canoe will snake through the water, no matter how expert the canoeist may be. They used ¼-in. by ¾-in. cedar strips to form the shell. To make the strips self-aligning, Whitt shaped the edges with standard Rockwell ½-in. flute and bead three-wing shaper cutters on an overarm router. As each individual strip was added to the form, the cutters were also used as hand scrapers to fit the mating edges perfectly. The cedar strips were then nailed to the stations. Curing the glue instantly by using high-frequency radio waves eliminated the need for clamps, and the wait, as each glue joint dried.



Whitt and Hesse formed the contoured sheerline of the gunwales by bending the first strips to the form, rather than by adding tapered strips later. Then they worked directly up the form until they reached the keel. This creates a different pattern than Winterbon's method does, and some tricky fitting on the bottom of the canoe. After the strips rise to the level of the stempiece, the ends of the remaining strips must be trimmed to fit the taper at bow and stern. To do this accurately, the pieces were roughly shaped, then wriggled into carbon paper placed in the gap. The ink showed high points that needed final trimming, which was done using the round and hollow shaper cutters as scrapers.

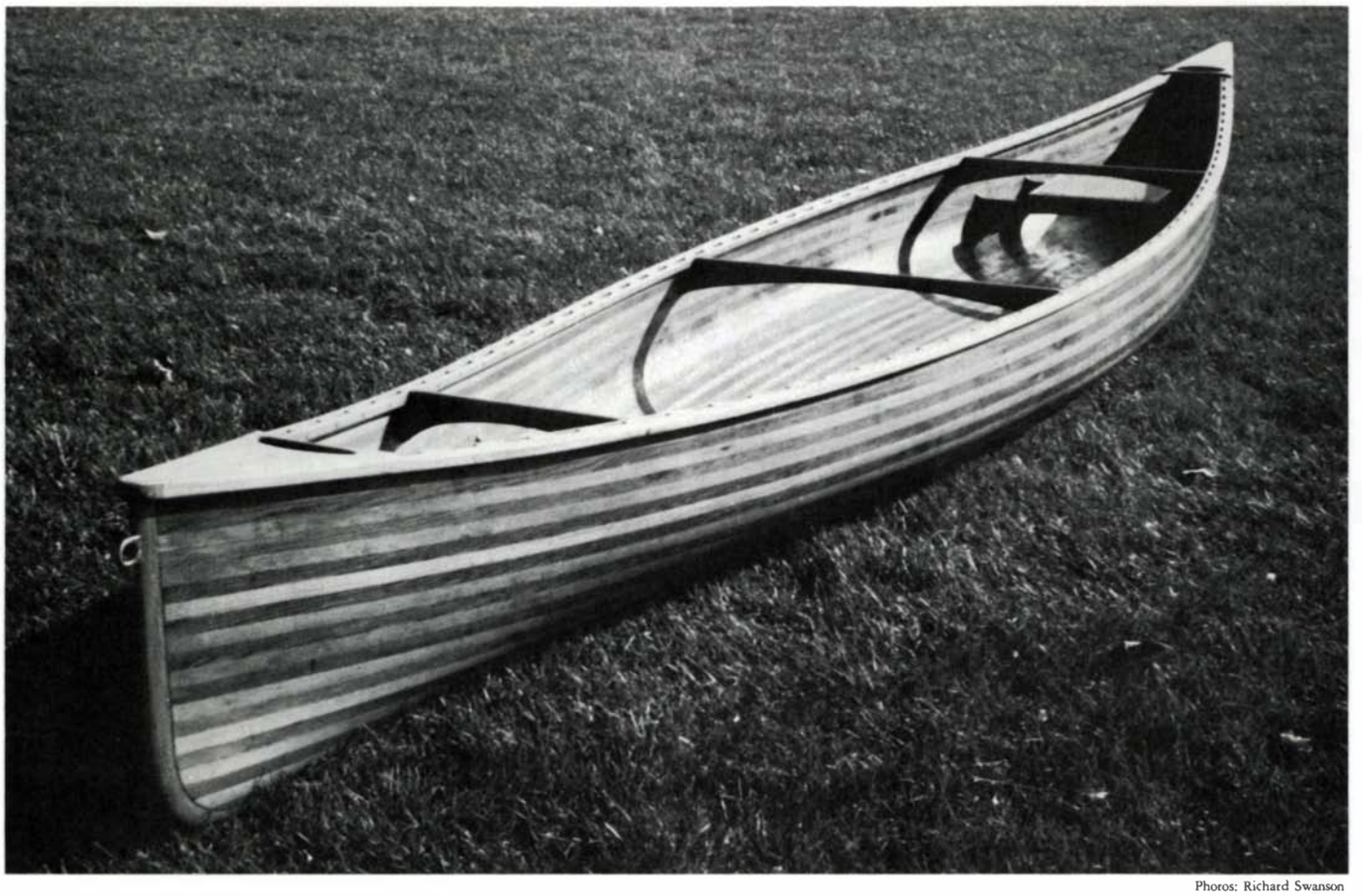


The men ran their strips past interior stempieces attached to the strongback and first stations. The laminated ash stempieces are trapezoidal in section and about ½ in. thick. After the outside of the hull was sanded, the ends of the strips were squared with the stempieces, leaving a ¾-in. surface to which was glued an outer, laminated ash stempiece, triangular in section.

The outsides of the completed hulls were smoothed with rasps and sandpaper. Whitt hand-sanded, starting with 60-grit, finishing with 320-grit. Belt sanders can easily gouge the soft cedar, and orbital sanders create a lot of dust and a terrific racket—the canoe acts as a sounding board. Whitt and Hesse recommend a thin fiberglass cloth, about 4-oz., and a standard resin. To keep weight down, they applied only one coat of fiberglass to the hull, doubling up for strength at the bow and stern. They allowed two days for the resin to cure—if you sand too early, the resin will turn into a gummy mess.

Whitt power-sanded the inside of his stripper—less noise—and both men used the shop's air-powered flexible disc sander. The inside surface of the canoe should be rough: if it's too smooth, a little water in the bottom will have you sliding around. Using only enough resin to cover the fiberglass cloth leaves a suitably pebbly surface.

The slots running the length of the gunwales in the finished canoe let water drain when the canoe is turned over to dry, and they cut down on weight. Both men took great care fitting the gunwales, thwarts, seats and decks. Hesse made his of walnut and ash, Whitt of teak. The boats (Whitt's is shown at bottom of page) are fitted with the precision of a piece of fine furniture. □



Photos: Richard Swanson

Getting the Right Feel

Don McClain's formula for good furniture and good business

by Charles Parish

For more than 25 years, Don McClain has been a custom cabinetmaker. Neither of his shops, the one in Savannah, Ga., which he's just moved into, nor the one in Columbus, Ohio, where he spent many years, has been large or has ever produced a high volume of work. But if you're an architect or designer seeking something special for a client, if you're an antique collector who needs a difficult restoration, if the museum won't part with the Louis XV chaise longue you can't live without, McClain's shop is where you could go.

Meticulous workmanship is one ingredient in McClain's success, but probably not the most important one. The real challenge, he believes, is putting emotion into the work, achieving that intangible "feel" that makes the customer say, "Ah, that's exactly what I had in mind."

That "feel" is crucial to McClain. Most copies of period furniture, even if correct in the design and technical details, lack this intangible quality. McClain learned to recognize and impart it to his own work by close study of the originals, imagining the conditions of the period and picturing the piece in the setting and use for which it was designed. If a cabinetmaker cannot do this, he explains, if he cannot get outside his own time and place, he will be comfortable only with the furniture with which he grew up. His reproductions may be technically correct, but they won't feel right. And he will be less able to design satisfying original pieces either.

McClain is a native of Georgetown, S.C. In 1927, when he was eight, an uncle gave him his first tool kit. Later, in a high school that didn't offer a shop class, McClain began studying furniture and figuring things out for himself. After World War II, McClain found himself in California, working as an apprentice in a small custom furniture and refinishing shop. In 1955, on the strength of a commission to build a houseful of furniture in Ohio, and his seven years of apprenticeship, McClain and his wife sold their house, moved to Columbus, and opened a shop. Over the years his clientele came to read like a *Who's Who* of central Ohio, and the obvious question is, how did he get to be so well known?

"I've done 7,662 jobs. If clients like the work, they talk about it and show it off. This leads to more jobs," McClain explained. "Every client is important in spreading the word, but some will be more influential than others. The problem is, you can't tell which is which until long after the job is done. This means you have to do every job right, and treat every customer well."

McClain says the most important thing is to be a friend to your customers, and never to make an enemy. Listen to what a client says, try to find out what he really wants. If a customer wants something out of the ordinary, McClain never refuses. Instead, he works with the customer to define exactly what's wanted, then he builds just that thing.

If McClain must advise a customer against something, he tries to do it in such a way that the customer is enlightened, not made to feel foolish. For example, a couple brought him a small inlaid table with most of the veneer in bad condition. McClain explained that he could replace the veneer, as they wanted, but he advised against it because the core of the table was not sound. New veneer would soon come loose again. He took extra time to point out worm and age damage, and how to recognize it in the future. The couple left, but soon returned to commission a duplicate of the table.

With frustrating customers, McClain continues to be accommodating. Once, he advised against square corners on a dining table for a family with young children. The customer insisted. Later, when a child banged his head into a corner of the table, McClain rounded off the corners at no charge.

McClain points out that the owner of a small shop is a businessman as much as a cabinetmaker. McClain's business practices are low-keyed. He advertises only in the Yellow Pages and by an occasional announcement in the *Christian Science Monitor*. His most productive business-building activity was to call on every decorator and upholsterer in Columbus, offering to work with them on a percentage basis, or directly with clients they referred.

McClain does not enter his work in shows and exhibitions. Attending the event would take him away from his shop, and he feels that work prepared for judging must emphasize unusual design and clever technique, rather than the emotional and aesthetic satisfaction of the user.

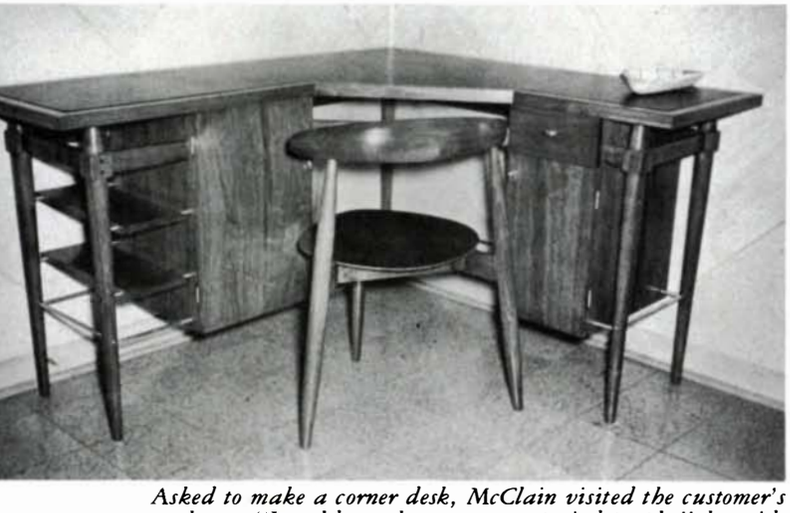
His pricing policy is unusual. The basic formula is five times the cost of materials. However, he might price according to his feelings, telling a client, "I feel good about the job and I feel good about you. Why don't we just make it and see how it turns out?" Or, he'll say, "The job interests me. I'll make it and you pay me what you think it's worth." Some people have received terrific bargains this way, and McClain has also had the chance to build challenging pieces he couldn't have tackled under other circumstances.

So what's McClain's advice to the amateur woodworker who wants to quit his job and become a full-time cabinetmaker? "Keep that other job, at least for a while." A professional woodworker, he explained, must be driven to build things and shouldn't use woodworking as an escape from an unhappy job. The new cabinetmaker must be committed, prepared to work exceedingly long hours for low pay and to stick with it. The best way to start, McClain suggests, is to apprentice in a first-class shop, where the novice's ideas about design, construction and business can mature over several years' time. And finally, the woodworker should develop some useful specialty, such as refinishing, to help pay the bills in between those jobs that satisfy the soul. □

Charles Parish lives in Columbus, Ohio, and owns two restaurants. A woodworker for 20 years, he makes reproductions of Shaker, Colonial and Irish country furniture.

Photos: © 1981 Anne Schultstrom

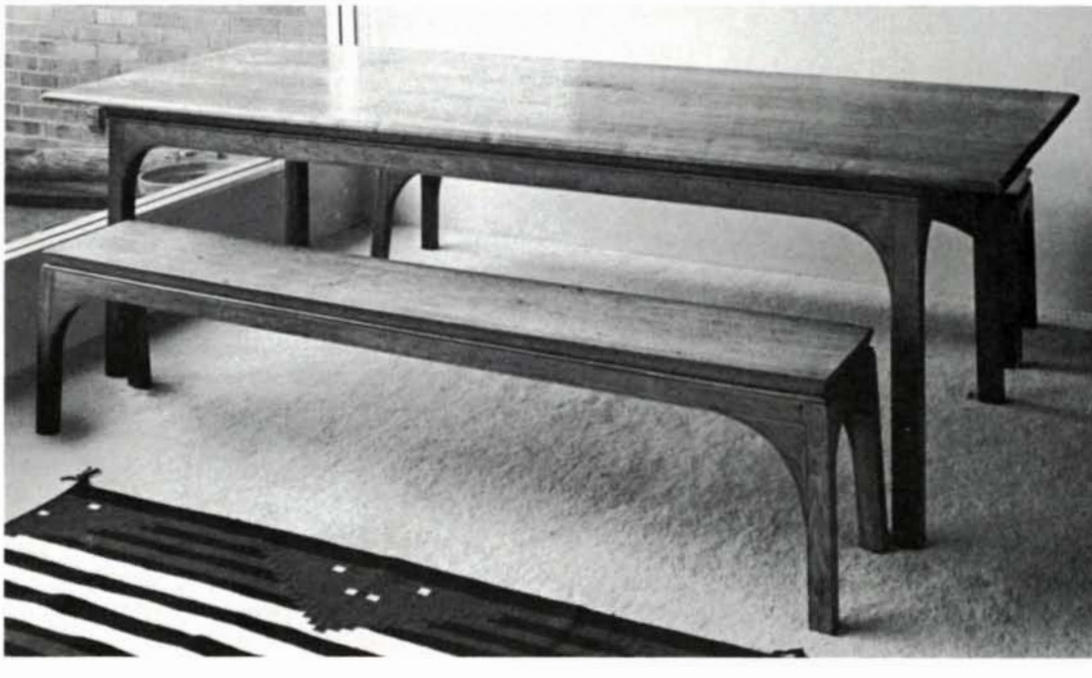
McClain was asked to match this sideboard to existing pieces. He distressed it to make it look like a period survival.



Asked to make a corner desk, McClain visited the customer's home. "I could see these were not period people," he said. "The hardest part was convincing them the drawing would be a nice-looking piece of furniture—drawings don't do it justice."

McClain takes on a variety of work—repair as well as fine cabinetmaking and marquetry. Flexible pricing allows him to take on interesting jobs that might otherwise be too expensive.

McClain enjoys making quarter-size reproductions (like the one above). They are like Social Security, he says, because collectors like them and they are easy to sell whenever he needs the money. McClain was commissioned to build some pieces of Egyptian furniture (right) based on drawings owned by the customer. He absorbed the feel, then designed and constructed these pieces accordingly.



Dough Trays

The Southern tradition of handmade wooden bowls

by Delbert Greear

Though the handmade wooden bowl has an ancient and honorable past, it has become rare in modern times as people have turned to mass-produced substitutes. One form of wooden bowl, however, is still in demand—at least here in the South. This is the so-called dough tray—a large wooden bowl, sometimes round but more commonly oblong, that is traditionally used for the mixing, kneading and "rising" of bread dough. The dough tray has appeal for its charm, and it remains practical for making bread. The form, however, is not limited to this use. It can be large or small, and it can function as a salad bowl, a serving tray, a nut bowl, and so on. I have been making wooden bowls for several years, and here are some of the things I've learned.

The dough tray was an everyday item in the lives of our ancestors. Much of the tradition for it and other forms of wooden bowl came from Europe with the early settlers, but the tradition also owes much to the American Indian, who shared his knowledge of many crafts with his immigrant neighbors. Before the Europeans arrived, the first Americans used fire to help craft their bowls and worked with tools of stone and bone. Beavers' teeth were used for gouges. After trade with the settlers was established, metal tools were available to the Indians, and bowls became an important item of barter. The Cherokees of North Carolina still carve and trade very fine wooden bowls.

Choosing the wood—In the Southern Highlands forest and in the East, the choice of wood for bowls is large. Tulip poplar, river birch, wild cherry, black walnut, maple, basswood, buckeye and apple are all commonly used. Out West I made bowls from quaking aspen, and in the far north on the Yukon River, I used paper birch and northern poplar (cottonwood). Many other woods might also be chosen, so long as a few points are kept in mind. The grain should be smooth and closed. The wood should split straight and smell sweet, or at least not impart strong or bad flavors to food. And to make bowls, you need sound, whole logs several inches larger in diameter than the bowl you want to make, and of sufficient length to allow for cutting off checked ends.

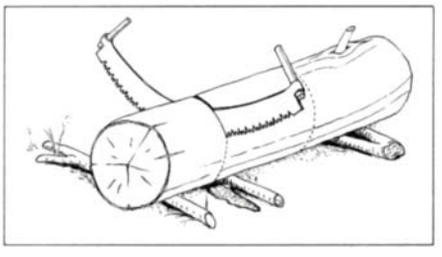
There are several reasons I prefer to make bowls from green wood or from wood left as a whole log until I'm ready to carve. Green wood is much easier to carve than dry wood, and it splits cleanly into bolts of suitable size. When a bowl is properly made and finished from green wood, it will season nicely, retaining colors that kiln-drying destroys. If the grain is straight and free of large knots, warping (which can be a problem when using green wood) will be minimal. The hollow of the bowl lets the wood shrink and change shape slightly without cracking as it dries.

You can make a bowl from dry wood: it will be more uniform in texture and color than one made from green wood, and more stable. But it will also be much harder to carve. If you must postpone carving the green wood, or prefer to carve it dry, it is wise to season a piece quite a bit larger than the final blank desired. Crosscut the log about 6 in. or 8 in. longer at each end, to allow for checking. Then split the log in half with wedges or maul, and coat the ends with paraffin or beeswax, to minimize checking. To insure that the ends of the rim will be strong, cut away the pith of the wood and the first four or five growth rings. Then remove the bark. Some longitudinal cracking in the sapwood of the blank is to be expected. This can be minimized by cutting off some of the sapwood where the bottom of the bowl will be, thereby relieving pressure on the sides.

Doty or spalted wood is often used for contemporary bowls because of the beauty it reveals when carved. If you choose to carve spalted wood, be sure your tools are extra sharp, as the wood tends to flake and is difficult to finish smoothly. I would not recommend it for very thin bowls, but it's fine for large, thick, decorative bowls, though you sacrifice some strength and durability with it as compared to green or properly seasoned wood.

A slight bulge in the side of a log can hide a flaw—a dead limb, for example, overgrown by sound wood. This can mean a hole in the wall of your bowl; on the other hand it can mean a handsome burl figure. Twisted grain or an offset heart with crowded growth rings to one side of the log means the finished product will twist as it dries. If you like freeform bowls, this can be an advantage. I like symmetrical bowls, and thus prefer a straight round log with the heartwood well centered.

Whatever your choice of wood, be sure to cut off all end-checks before starting to carve your bowl, and cut out

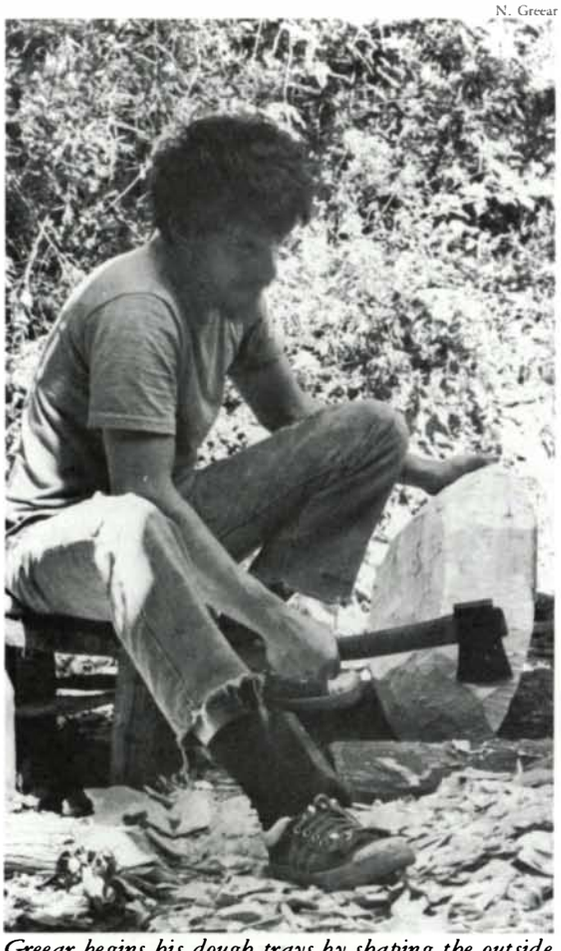


all radial cracks in the heart of the wood. Don't forget that a check extends a little beyond the point where you can see it. If you leave any part of a check in your bowl, it will spread when the bowl dries. For a full-size bread bowl—big enough for making four or five loaves of bread—you need a piece of wood that is free of defects, 20 in. to 24 in. long, 18 in. to 20 in. wide, and thick enough to allow 3 in. or 6 in. of depth in the finished product.

Roughing out the bowl—When you are starting with a fresh cut from a log, you first have to peel the bark (a step already taken with seasoned wood). Next split the log in half. Some judg-

Delbert Greear lives in Sautee, Ga., employing himself in country woodcraft. Drawings by Clay Johnston.

N. Greear

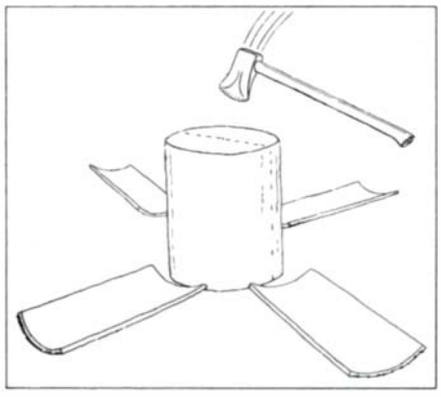


D. Greear

Greear begins his dough trays by shaping the outside of the blank with a hatchet, above. Then he hollows the inside with a bent sweep gouge, supporting the blank in a cradle, as shown at right. With the inside excavated, he returns to the outside for a second cut, this time with a gouge, below, leaving a foot at the bottom and flares at the rim, which serve as handles. After more smoothing and sanding, the bowl is finished. Below right, bowls in foreground and in background were carved with heartwood down, contrary to the shape of the split log. The rest of the bowls were carved with heartwood up.

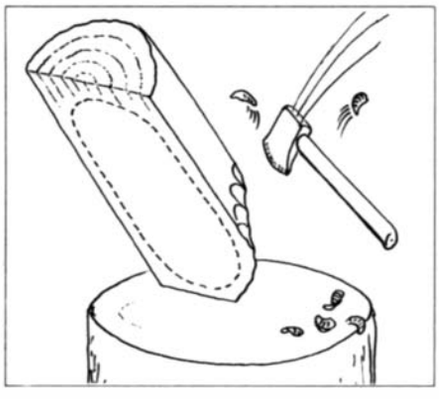
D. Greear

Fred Weis



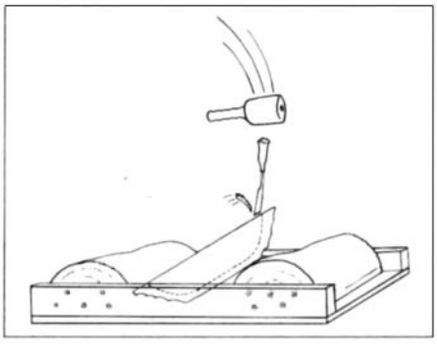
ment is necessary to choose the diameter for your split, as seldom is a log perfectly round. Good clean wood can be split with a solid stroke of an ax. Sometimes a maul and wedges are needed. If you lack confidence in your aim with an ax, you can use a froe to start the split square across the log. For twisted and knotty wood, you might need to saw the wood lengthwise with a chainsaw or a crosscut saw. However you go about it, your purpose is to halve the wood. Usually each half will make a bowl.

Once I have chosen and split a blank of wood, I stand it on a good solid chopping block and proceed to hew down the outside of the bowl. My tool for this job is a small hatchet with a gently rounded bevel on both faces. A hatchet beveled on only one face is right for hewing flat surfaces, but makes carving a round shape difficult. Ingenuity, balance and rhythm play a part in this operation, which with a large bowl may take several hours to accomplish. The ends must be rounded down to roughly the curve you want, and the bottom flattened so that the top is made level. Now and then you want to rest your bowl on something flat and stand back and look to see if it is coming out evenly. If you are striving for symmetry, you want to work from end to end, side to side, and around and around, taking off a little here and a little there to balance your bowl.



The shape you are working toward is a matter of design and personal taste. I like to leave a well-defined, undercut foot on the bottom of my bowls. This not only looks nice, it also allows the sides of the bowl to be cut to a more uniform thickness without sacrificing the strength and surface area of the bottom. A broad, flat bottom is traditional and makes for strength and stability. A shallow undercut, however, eliminates high spots upon which dough bowls are wont to rock and shift. For handles, I usually just flare the ends. Some people prefer protruding handles, and others, finger grooves for gripping the bowl.

Once the outside is roughed out, I proceed immediately to the inside. I use a long, bent sweep gouge and a wooden maul for this work; others use an adze. The trickiest problem is holding the bowl still while you work on it. The best solution I have found is a cradle made of two halves of a log just far enough apart to cradle the bowl, and fastened to a large thick board. It's quick to make, and gets more versatile



with use; and if you find that it doesn't accommodate itself to the size blank you want to work, it's easy to make another holder. With this rig I sit on a low stool in front of the cradle, and the blows of the maul force the bowl securely down into the cradle against the opposing log rather than propelling it all over the yard.

There is an alternative: you could carve the inside first. Dirk Rosse, who carves bowls for a living (*FWW* #32), roughs out the inside of a sawn blank first, which has the advantage of leaving the outside a regular rectangular shape that is easy to hold steady against an L-shaped stop on his workstump. I prefer carving the outside first, however. The flaws in the wood are more easily discovered and taken care of; the work goes quickly and the final shape is easier to visualize, making symmetry simpler to achieve. The solid block of wood, roughed down on the outside, is a stronger structure to work on and seems less liable to check than the hollowed log you have if you shape the inside first. Once the outside is roughed to the desired shape and you have determined that the wood is sound, you can position the bowl right side up while carving the sides to the desired thickness—it's easy to run a hand along the rim of the work and feel its thickness. A quick glance tells you the relation of the outside to the inside. If the bowl is upside down, it must be turned over often, and you just can't tell thick and thin spots as readily.

Perhaps some of the advantages I find in this order of work have to do with the tools I prefer. Hollowing out a large bowl takes time, and though there is the temptation to think of shortcuts, I work entirely with handtools. Some people use a chainsaw and make a series of lateral cuts with the end of the blade in what is to be the inside of the bowl. The resulting blocks are easily knocked out with a hatchet, an adze or a gouge. I find this solution unpleasantly noisy, and the possibility for major error is great. Yet some people are real artists with a chainsaw, and you can't argue with success. I prefer the hand work because it keeps me in touch with the wood, and the shape evolves more pleasantly to the eye and mind.

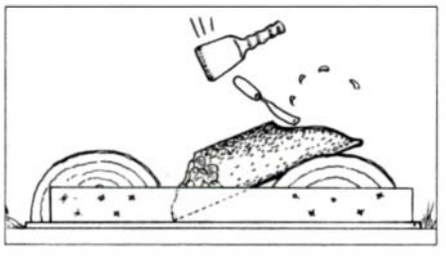
Taking the slow approach, however, is tiring, especially for the arms and back. But anyone who has carved green wood can tell you what will happen if you stop very long while there is still too much wood on the inside of your bowl, or even on the outside. Cracking in the heart, checking on the ends and longitudinal cracks in the sapwood are likely if you don't get your blank well roughed out before leaving it for more than a few hours. When you do have your bowl roughed out, leave it in a shady, cool place, perhaps under a tarp, or sealed in a plastic bag.

Finishing the bowl—Once your bowl has been roughed out to the desired shape and to a fairly even thickness overall, you are ready for the finishing work. I use a long, bent, Swiss No. 7 sweep gouge for most of this process. A long, bent sweep of shallower profile—about a No. 2—is handy for smoothing out the deep cuts made by the No. 7 gouge. I also use the shallow gouge for all my final cuts, as it more nearly matches the curve of the bowl. I find

that a small carving knife comes in handy for the bowl's top edge.

As a general rule, the outside is refined first, allowing more control over the final shape of the bowl. The thickness of the sides is determined by the final cuts on the inside. Of course, as you put the finishing touches on your bowl, you will be going around and around it inside and out, chipping away a little here and a little there until you finally decide you have done enough.

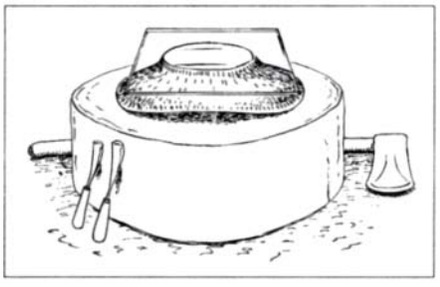
To shape the outside I start with the foot and cut smoothly toward the top. I leave a ridge of wood at the rim of the bowl; from this I make either handles or



a graceful flare for gripping. It is important to work toward even thickness in the bowl sides; this will minimize the chance of warping and checking in the finished product.

For the final cuts on the inside, I hold the bowl in my lap and work the gouge in a rocking motion toward my body, using the maul only when necessary to remove thick high spots. The maul-driven gouge leaves a ridged surface; to smooth these ridges, you pull the gouge by hand. I start the inside finishing cuts at the rim, working around and then down to the bottom of the bowl, keeping a smooth working face, as on the outside. During this finishing work, you should stand back often and look carefully at your work. The true measure of your craftsmanship will be revealed at the inside bottom of the bowl. From both ends, both sides and all four "cheeks," your gouge cuts must come out smoothly and evenly to the same level. The final cuts need to be made across the grain, to avoid riving or tearing the long grain. This calls for a keen edge and steady hand. The best gouge for this work has a shallow sweep in its end profile and a bend along its length, so that the handle will not bump into the rim of the bowl as you work. A bevel on the outside of the gouge and a little extra upturn at its end is best, so that the tool draws itself back out of the wood. Most spoon gouges are simply too steeply bent to be useful here.

Final touches and care—Wait a few days before leveling the foot, for as the bowl dries it will twist and change shape slightly. If the relative humidity is low, you can wrap the bowl in cloth or paper to slow drying, but allow it some air, or mildew may result. After a few days, most wood has stabilized enough to proceed. In leveling the bottom of the bowl, a piece of lightly greased, flat



glass can be rubbed over it to show the high spots. A small plane is useful in this final leveling, though I often simply use a shallow gouge.

Sometimes, in spite of all your efforts, you will end up with a few seasoning checks or small radial cracks in the heart at the ends of the bowl; sometimes a hidden knothole will be revealed in the surface of the bowl. These are to be tolerated good-naturedly, though a little epoxy or glue mixed with sawdust will sometimes help.

The sap will continue to bleed out of green wood as it dries, and this will temporarily darken the wood and obscure the figure. After drying a few days, the bowl will be ready to sand, which will remove the stain left by the oxidation of the sap. I like to sand my bowls smooth enough so that the grain and figure of the wood show rather than the gouge marks. This smooth finish makes cleaning the bowl easy, and it takes oil well. A fairly fine sandpaper, 120-grit or finer, cuts green hardwood as well as a coarser grit would, without scratching the wood so badly.

I have found oil—animal or vegetable, applied when the sanding is finished—to be the best finish for dough bowls. Animal fat, properly rendered, makes an excellent finish that will penetrate better and last longer than vegetable oil. I've used groundhog, beaver and bear grease to good effect, as these are liquid at room temperature. Hog lard and beef suet are not as good, for they solidify and tend to get rancid. Of course, vegetable oils are more generally available to the modern craftsman and housekeeper than animal fat. I recommend olive or safflower oil, as these penetrate better than corn, peanut or soybean oil. The bowl should be oiled often, especially after it is washed. For best results the oil should be rubbed in thoroughly with bare hands or a soft cloth. The heat from the hands and the friction from rubbing helps the oil penetrate the wood. Excess oil should be wiped off with a cloth.

I've heard from several sources that past generations used a small cloth bag containing salt to apply the oil. Perhaps the salt was believed to draw moisture from the wood, though I really don't know the reason for this interesting practice. At any rate, I have seen many old dough trays in antique stores and at auctions, and I believe a well-made one, if oiled and cared for, should easily last a generation, even with constant use.

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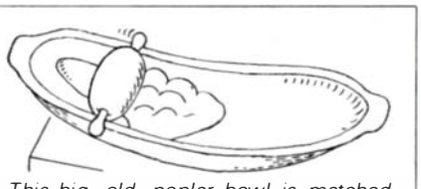
The dough tray was once an important household item, likely to be installed in the kitchen when a couple first set up housekeeping, along with the cookstove, frying pan and cooking pot. It was a piece of family history—maybe



This big, old, poplar bowl is matched with a special rolling pin whose handles ride on the sides of the bowl. The rolling pin is pushed down the length of the bowl, flattening the bread dough along the bowl bottom. The dough is then folded over into a pile in the middle of the bowl and the rolling pin flattens it.

an uncle crafted it for his niece, a grandmother passed it to a granddaughter, or a newlywed husband carved it for his wife. Today the wooden dough tray has become a luxury instead of the household necessity it once was. Plastic, steel and mass-produced crockery bowls have replaced it. Bread is not made in the average home in the quantities it once was; and when it is made, the bread-maker will use an inexpensive enamel dishpan for mixing it and will knead it on a Formica counter. Yet this has not spelled the end of the dough tray. What is there that can grace the table so beautifully at Thanksgiving as a great wooden bowl full of bread, fruit or salad? Nostalgia is a strong force, and the wooden bowl represents a heritage and a fine old tradition. Whenever people recognize this, that tradition lives on. □

Using Bench Planes

These basic tools still do what machines can't

by Ian J. Kirby

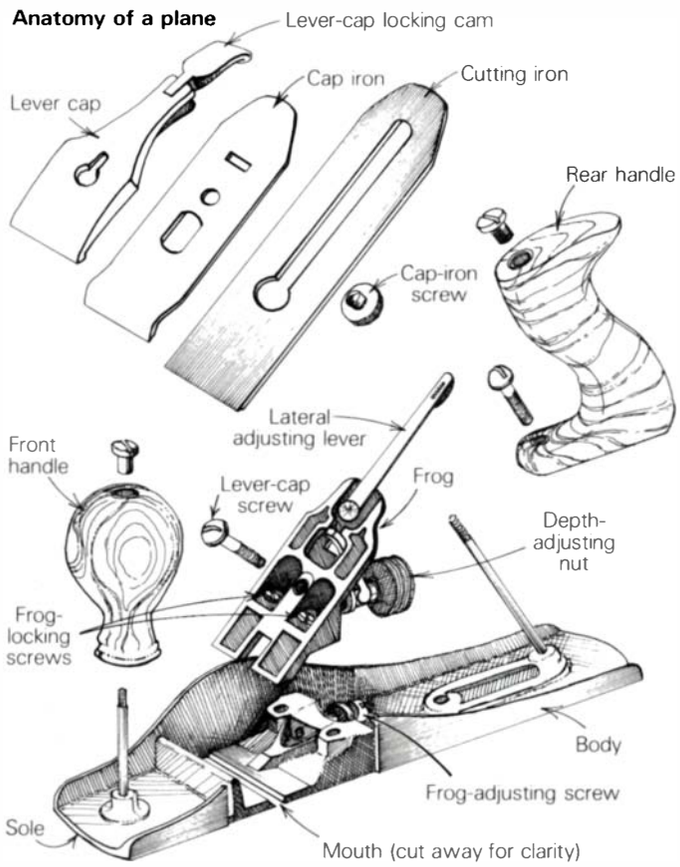
In woodworking, there is no sound quite as delightful as the clear hiss of a sharp plane taking off a thin shaving. Nor can any other tool so precisely remove a modicum of wood tissue while leaving a perfectly flat and smooth surface. Of the three basic woodworking tools—saw, plane and chisel—the plane alone projects such a false sense of complexity that much modern woodworking is done without it. To be sure, many of its operations can now be done faster by machine. Where the cabinetmaker once had bench, plow and molding planes, he now has power jointer, router and spindle shaper.

For those woodworkers intent on a more developed level of workmanship, however, the hand plane still has an assured place in the shop. No machine, no matter how cleverly contrived, can match the plane's virtuosity in fitting drawers and doors, aligning twisted frame assemblies or leveling surfaces. The plane is unique in its ability to deliver a smooth, clear surface unattainable in any other manner.

Woodworkers of yesterday had dozens of planes to pick from. Though many are still available today, you need to own only one or two to perform most planing work.

In this article, I'll explain the various types and parts of modern metal planes, how to select and adjust them and, most important, how to use them. These principles apply to wooden planes also.

Anatomy of a plane

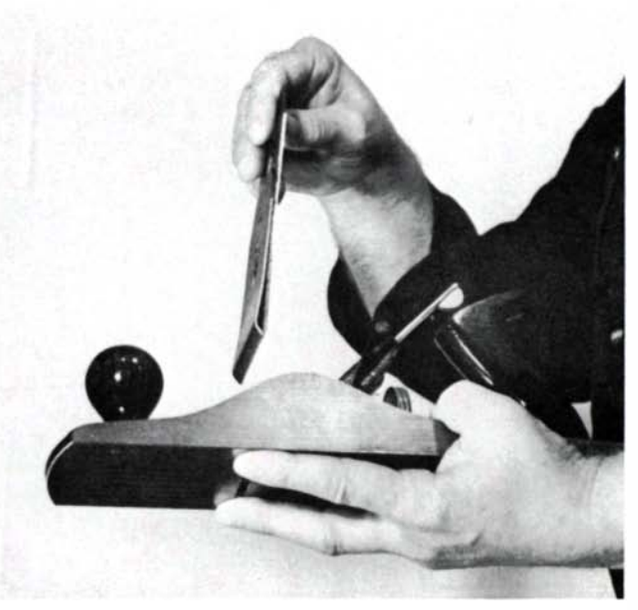


Why planes?—The woodworker's plane has been around for centuries. Unearthed tomb paintings depict Egyptian carpenters using planes to square up timbers. This remarkable history stems from the plane's basic usefulness; except for the adze and drawknife, no other primitive tool can prepare cleft or roughsawn wood to final dimensions. In its basic function and form, the plane has changed little: all planes consist of a blade or iron firmly mounted on a bed in the body of the tool. The blade must be adjustable and easily removable for sharpening. The bottom, or sole, of the plane must be kept flat and out of winding. The whole assembly, blade and body, must accommodate the hands or have handles so the operator can control the tool.

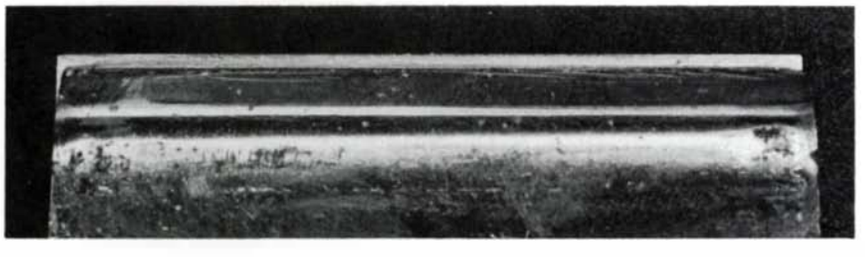
These requirements can be met with different designs and materials. Japanese planes, for example, are made of wood and are pulled. Western bench planes, whether metal or wood, are pushed. The result is the same: a smooth, accurate surface. Often the question is asked, which is better, metal or wood, and one can only reply that the answer lies with personal preference. Wooden planes are more difficult for the beginner to adjust and sharpen. A metal plane also delivers a clearer tactile sensation of the shaving being removed than does a wooden plane. Wooden planes can be made in the shop, and their soles can be flattened with another plane rather than with a grinding machine. A century ago, wooden planes evolved in such great variety because they suited the manufacturing technology then available. Each tradesman—joiner, cabinetmaker, cooper, coachmaker, and so on—had his own array of planes suited to his own particular work. Some, an ogee molding plane for example, were designed for a single job and were thus used only occasionally. But the bench plane, because it could do many jobs well, was used constantly. The working specialty planes have vanished along with the trades to which they belonged, or else their functions are now better done with machines. The electric router, for instance, makes grooves much better and more quickly than plow planes can. Woodworkers today still need the utilitarian planing tools that the early tradesmen found so indispensable, and thus the bench plane has survived in very much its original configuration.

Three types of bench planes are commonly sold today, and these are distinguished by their lengths. The longest, about 22 in., is called a jointer. Of the lot, it is the most versatile; its length is designed for spanning and accurately flattening irregularities when making finished boards from roughsawn lumber. The smoothing plane is the shortest and has a body about 9 in. long. Its short sole cannot bridge irregularities in a board, so it's not the tool for making an accurately flat surface or edge. The smoothing plane is best for producing finished surfaces of high quality, when flatness is not impor-

Drawing: Rosalind Kirby



Kirby uses the lever cap's tapered end as a screwdriver to disassemble and assemble the cutting iron. If you use a screwdriver, make sure it is large enough to avoid damaging the screw. When reassembling, the cutting and cap irons should initially be put together at right angles, above left. The screw is then finger-tightened and the cap iron is rotated into place. The cap iron should be placed about 1/16 in. from the back or non-beveled edge of the cutting iron, as shown below. For best performance, this distance is critical; if too small, shavings will jam and if too large, the iron may chatter. To put the cutting iron back in the plane, grasp the tool as shown in the photo, above right. Then, holding the cutting-iron assembly between the thumb and forefinger, drop it into the plane and make certain it seats against the bed and engages the depth-adjusting mechanism. At right, the frog-locking screws are loosened to move the frog forward and backward. Use your forefinger to feel how far the lower edge of the frog projects into the mouth.



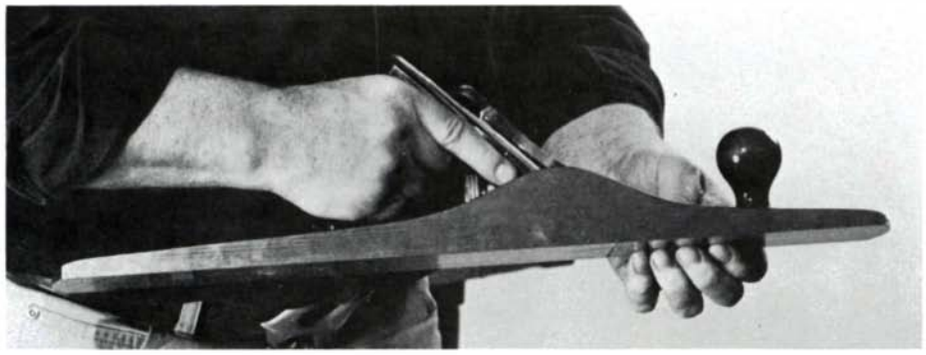
tant. In the middle, at about 14 in. long, is the jack plane, supposedly named because its medium length makes it a "jack-of-all-trades." I've always found this plane to be of limited use—it has neither the jointer's accuracy nor the smoothing plane's handiness. If I were to buy but one plane, I would get the jointer. It will do its job as a preparation plane and can also be used for truing subassemblies and for finishing and smoothing work. I find little use for the jack except in instances where the jointer is uncomfortably heavy.

Adjusting the plane—Before it can be used, the plane must be tuned up or "fettled" (see box, p. 87), its cutting iron must be sharpened and its various parts must be put in proper adjustment. Begin by removing the cutter and cap iron. With the plane on the bench, place your forefinger firmly on the lever cap and, using your thumb and middle finger, release the locking cam. Bear down with your forefinger to keep the lever cap from bouncing about. After you have removed the cutting-iron assembly, disassemble the cap iron from the cutting iron and sharpen the cutting iron (sharpening is discussed in *FWW* #29, p. 66). Holding the cutting iron in the palm of your hand, loosen the screw just enough to slide the cap iron free.

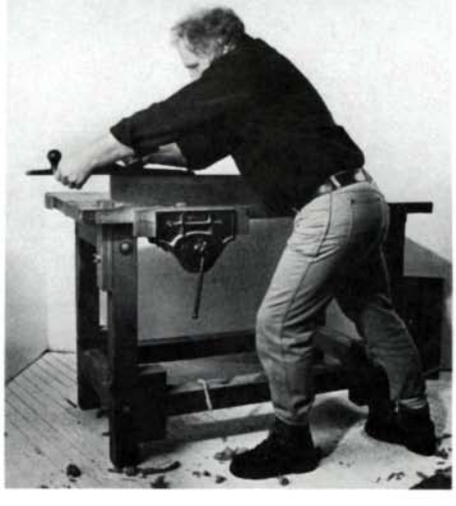
After sharpening the iron, reassemble the cap and cutting iron, making sure the cap iron doesn't slide across or bump the sharpened edge. Tighten the screw and slide the cap iron to within 1/16 in. of the cutting iron's edge. This setting is critical and getting it right may take some trying—too small, and shavings will jam; too large, and the iron will chatter.

To put the iron assembly back into the plane, grasp the body in the palm of your hand with fore and middle fingers at opposite ends of the mouth. Hold the assembly between your thumb and forefinger, and lower it into place onto your fingers. As the iron seats itself, you will feel it slide through the mouth to contact your fingers evenly on each side. Sight alongside the iron to make sure that it has firmly seated on the frog—the cast-iron assembly that beds the cutting iron in the plane body—and that the depth-adjusting mechanism has engaged the window in the cap iron. Place the lever cap over its screw and lock it down with the locking cam.

Adjusting the frog varies the space between the cutting edge and the front of the plane's mouth. This space should be made about 1/32 in. if delicate shavings are to be made, although for hogging off roughsawn stock it might be 1/16 in. or wider. The frog is held in place by recessed screws, and to get at them you'll have to remove the cutting-iron assembly



Grip the plane with your index finger extended (above). This triangulates the grip and gives you more control than wrapping all four fingers around the handle. When edge-planing, curl the fingers of your other hand up under the sole so your fingernails ride against the face of the board. Stand close enough to the work so that your shoulder is aligned with the cut (right). Standing too far away will cause you to tilt the plane, producing an out-of-square cut. Start the edge-planing cut with the toe held against the work (below left). Stand with one foot well below the work and the other spread about a walking pace back. The back leg should be straight, the front leg slightly bent (below center). Remember, this is a lower body action, not an arm movement. As you make the cut, uncurl your body and crouch into the work. Follow through by leaning well over the board (below right), extending your arms if you start to become unbalanced.



again. With the locking screws loose, a screw under the adjusting nut moves the frog forward and backward.

Unfortunately, the frog does not ride on a track; it can slew from side to side as it is moved. Its alignment can be gauged only with the cutter assembly in place, so the adjustment is a matter of trial and error. A likely starting place is with the leading edge of the frog just overlapping the mouth. Lock the cutting iron back in place, then turn the plane over. With the lateral adjusting lever centered, you want the cutting edge to be only $\frac{1}{32}$ in. from the front of the mouth. The edge should be parallel to the mouth opening. Adjust the frog to make it so, and recheck the adjustment with the cutting iron in place. When you've got it right, tighten the locking screws. Then apply a light film of machine oil to the frog, the cutting iron and the cap iron, and put the cutting-iron assembly back in place.

To adjust the cutting iron, back off the depth-adjusting nut until the cutting edge is inside the mouth. Then turn the plane over and sight down the sole. Turn the depth-adjusting nut clockwise until the edge of the iron appears as a black hairline projecting from the mouth. The edge of the iron should be parallel to the surface of the sole; if it isn't, adjust it with the lateral adjusting lever. When setting the depth of cut, never adjust the plane to take a thick shaving with the intention of backing the iron off for a thinner cut. Start from zero and make small adjustments downward to get the shaving you want. Once you've got it, back the adjuster off in the counterclockwise direction until it just stops turning freely—this will take up the slack in the mechanism and keep the cutter from creeping downward and taking too large a cut. Smear paraffin or candle wax on the sole for lubrication, and you're ready to make a test shaving.

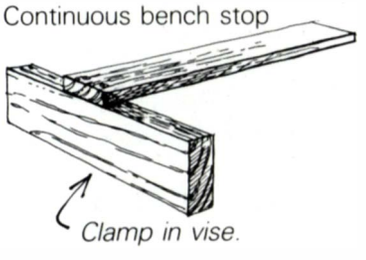
Select a board with an already planed edge, preferably not one done on a machine jointer. With the plane set for a fine cut, make a single pass and inspect the shaving. If it is uniformly thick and curls neatly against the cap iron, the plane is set correctly. If only crumbs appear in the mouth, advance the depth adjustment until a shaving can be made.

Using the plane—As with any tool, grip and stance are vital when using the plane. Other than working with a dull cutting iron, I find that ignoring these two points is the most

common planing fault. Begin by learning to grip the plane: grasp the rear handle with three fingers and your thumb, and place the forefinger on the frog casting, almost touching the depth-adjusting nut. Resist the impulse to cram your forefinger around the handle. It will be uncomfortable and you will lose the triangulation afforded by the proper grip. For edge-planing, grasp the toe of the plane in your other hand, with your fingers curled up under the sole so your fingernails can ride lightly against the face of the board as a fence. If you are surface-planing, grip the plane's front knob in whatever manner seems most comfortable.

In learning stance, it's helpful to remember that planing is a push from the lower body, not an arm movement. Stand close enough to the work so that the shoulder pushing against the back handle of the plane is directly over the direction of the cut. Stand with your front foot well under the work and your leg bent; your rear foot should be spread about a walking pace back, and your leg should be kept straight or flexed slightly. As you push the plane over the wood, uncurl your body and crouch into the action.

Start the cut by placing the plane's toe firmly on the board. Maintain an even downward pressure on both handles as you follow through. Skewing the plane in relation to the direction of the cut will ease the work, but keep the entire length of the sole on the work. Boards to be edge-planed can be held on the bench in a vise, with dogs or against a bench stop. I prefer the stop because there is no chance of the work becoming distorted by undue holding pressure, and it forces you to learn to keep the plane flat against the edge. If you are doing it wrong, the board will just flop over. Boards to be surface-planed can be held against the stop, or else the continuous bench stop shown at left can be made up of hardwood and clamped in the vise for wider support.



Contrary to the opinion that a block plane is the tool for planing end grain, I find that full-size bench planes are better for squaring and smoothing the ends of a board. All you need do is knife a line around the board to be squared and then plane down to the line, taking as light a cut as possible. To avoid tear-out, plane in from each edge toward the center, clamp blocks on the edge of the board, or plane a small chamfer on the edges.

All of the skills I've described in this article can be mastered with a perseverance that can be enjoyable. The plane is the ideal tool for many woodworking operations that are frequently done with power tools and sanders. Once you've tuned up and learned to control this tool, you will wonder how you ever got along without it. □

Ian J. Kirby teaches design and woodworking at Kirby Studios in North Bennington, Vt. For more information on choosing planes, see FWW *#3, p. 28. Tuning up planes can be read about in #1, p. 22; #2; and #14, p. 52. Japanese planes are discussed in #19, p. 91; #20, p. 60; and #29, p. 71. Another article on using planes appears in #13, p. 52. A book,* Planecraft, *published by C. and J. Hampton Ltd., is available from Woodcraft Supply Corp., 313 Montvale Ave., Woburn, Mass. 01802.*

How to tune up a plane

As a production item, the metal plane emerges from the factory as a nearly perfect tool. All the necessary parts are there, and made of materials suited to the job at hand. But if the plane is to be used to its maximum potential, it must be tuned up or "fettled." This means taking up where the factory left off by cleaning and adjusting the various parts. For a really superb job, enlist a machine shop to grind the plane's sole perfectly flat. Even planes with years of use behind them can benefit from this attention.

I begin fettling a plane by filing the cam that locks the lever cap and iron assembly to the frog. The cam works against a spring, and on new planes it is sometimes a bit rough and burred from casting. As a result it binds against the lever cap spring. Use a fine-cut file to dress the cam until it operates smoothly.

Next, true the end of the cap iron where it will bear against the cutting iron. It must rest perfectly flat against the cutting iron, or else shavings can jam up and break off in the mouth of the plane instead of curling smoothly away. You can do this on a bench stone. Keep the ground edge of the cap iron at right angles to its sides, so it will be parallel to the cutting iron's edge.

Use a straightedge to inspect the cutting iron for flatness in length and width. If the iron is bent along its length, straighten it by placing it over a block of softwood and bending it in the proper direction. Put the convex side up, and strike the iron sharply one or two times with a steel hammer. Final flatness is achieved by backing off on the sharpening stone. Next, tend to the brass adjusting nut. This nut should travel smoothly throughout. Usually, brass running on steel needs no lubrication. If you find, however, that a few drops of light machine oil won't correct a stiff nut on a new plane, send it back for replacement.

The most important, and difficult, part of fettling is getting the sole perfectly flat. I've tried several hand methods, with only marginal results. Now I send planes to a machine shop. The machinist makes up a cradle to hold the plane, so that a few passes of a precision grinder will flatten the sole. Leave the frog in place during grinding, or else the sole will be distorted when you torque the screws to reinstall it.

Planes come from the factory supposedly ground to tolerances of about 0.003 in., which seems quite fine by woodworking standards. Yet I've seen as much as $\frac{1}{32}$ in. of metal removed to achieve flatness. Grinding the sole is expensive and you have to decide whether it's worth the money. I find the difference quite noticeable; a well-fettled plane can take consistently finer cuts than one that has not been tuned. Before grinding, the edges at the heel and toe of the sole should be chamfered slightly with a file, to prevent burrs from forming if the tool is inadvertently struck against a hard surface. Lightly file off any burrs or paint on the inside of the mouth opening and on the working surfaces of the frog. Either of the handles can be shaped to improve comfort and grip: scoop out the rear handle near its base to fit your own hand. —*I.J.K.*

Current Work

Fresh approaches to marketing

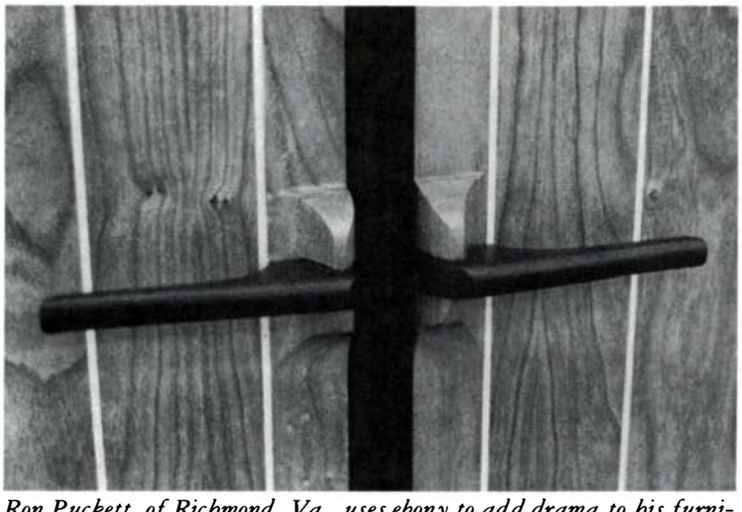
by Paul Bertorelli

Marketing one-of-a-kind furniture is uncertain during the best of times; an economic recession makes things that much riskier. Shows have become a favorite way of connecting work for sale with customers. After visiting three last February, I found that interest in craft fairs continues to grow. And I was pleased to see how enterprising groups of woodworkers can combine their resources with local businesses for mutual benefit.

The members of the Michigan Woodworkers Guild, facing the prospect of selling work in Detroit's eroded economy, staged their show in fashionable Somerset Mall, patronized by the monied survivors of the auto recession. Twenty-seven guild members displayed a pleasing range of wooden objects which tended toward the utilitarian. The show drew thousands, much to the pleasure not only of the woodworkers but of the mall merchants as well. Many of the guild members I talked with seemed confident that contacts they made at the show would turn into commissions.

Big-city craft shows always draw crowds, but residents of Staunton, Va., showed that small towns can support craftsmen as well. Two lumber companies and a furniture firm chipped in to sponsor an all-wood show of eight local craftsmen at the Staunton Fine Arts Association gallery.

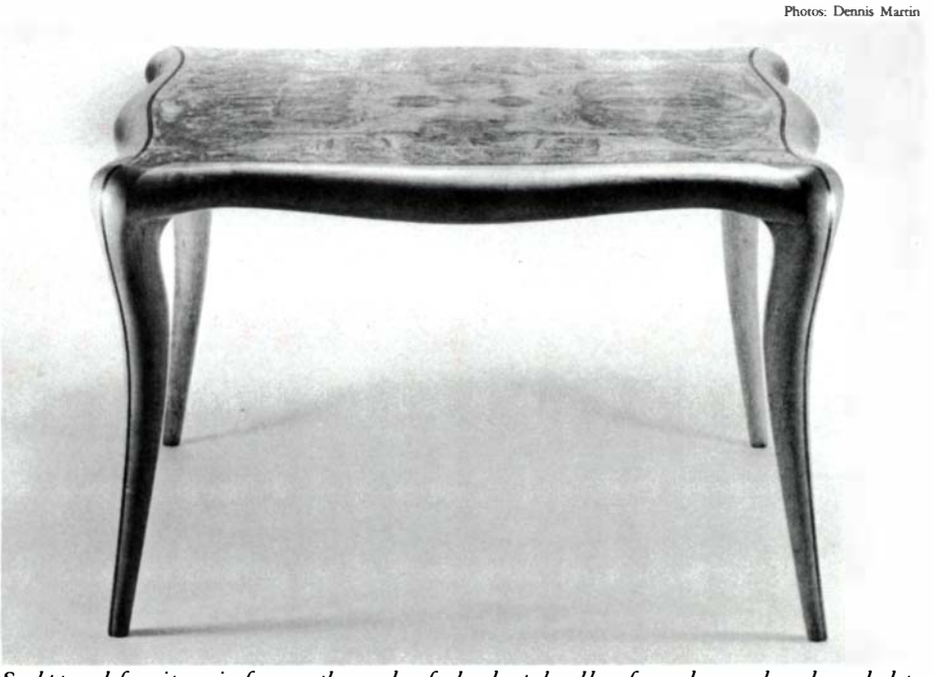
The American Craft Enterprises' Winter Market show in Baltimore is a more traditional outlet for designer-craftsmen, which may explain why it seemed less affected by the economic flu. Overall attendance and sales were up for the sixth year of the show and, as expected, the 66 woodworkers who attended did better at wholesale than retail sales. □



Ron Puckett, of Richmond, Va., uses ebony to add drama to his furniture. In this starkly detailed liquor cabinet predominantly of cherry and maple, Puckett used the dense wood for L-shaped door pulls. I thought the base too had been made of ebony, a lavish and expensive touch. Puckett later told me the base was walnut, stained with vinegar darkened by a handful of nails. He showed the piece at the Staunton Fine Arts show.

Photo: Ron Puckett

Photos: Dennis Martin



Sculptural furniture is frequently made of glued-up baulks of wood carved and sanded to shape. In this maple table, Charles Becker, of Philadelphia, combined that technique with veneering. The tabletop is maple burl veneer over particleboard. The legs are inlaid with sandwiched purpleheart and maple. Becker made the table specifically for showing at the Baltimore Winter Market.

In Alabama . . .

Southern wood show

by Craig Butterworth

Birmingham, Alabama, is known more for its steel mills than for its woodworking. Nonetheless, craftsmen from seven states sent their creations to Birmingham's Haand Gallery during January for a little Southern exposure at the gallery's "Ways With Wood" show.

Good planning and searching by gallery owners Ward and Martha Haarbauer produced a variery show rich in form and design. From graphic marquetry pieces to traditional Appalachian furniture, from bowlturner to duckcarver to toymaker, "Ways With Wood" was an education, a cultural exchange and a proving ground for Southern gallery owners, craftsmen and collectors. The only disappointments in the Haand show were pieces damaged in transit, a reminder to exhibitors to take care with packing, crating and insurance.

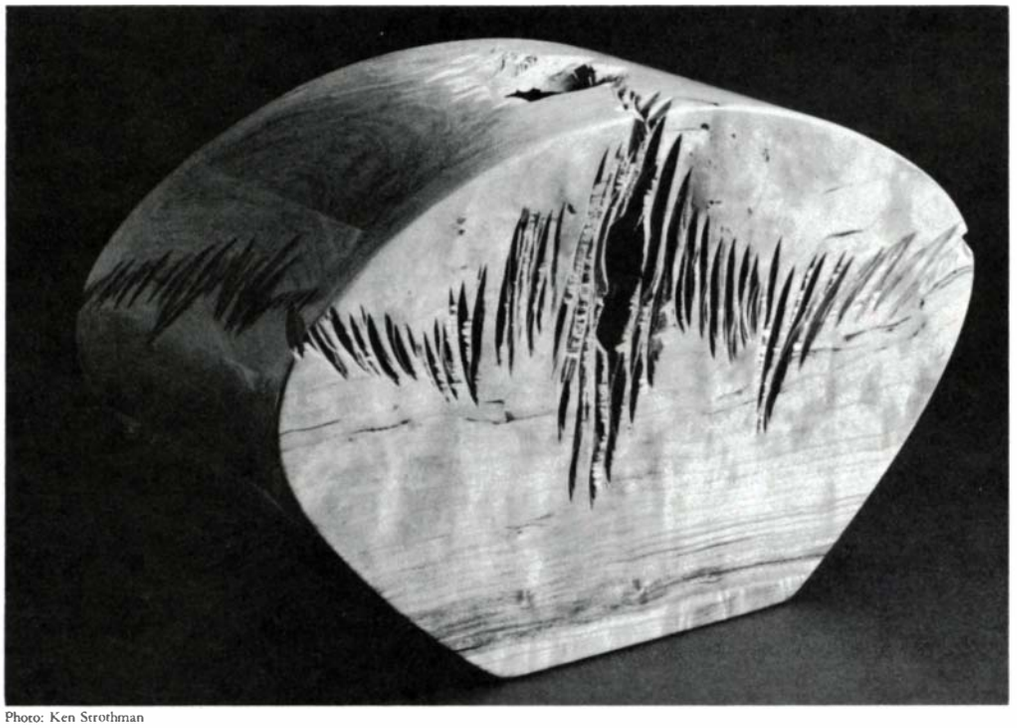


Photo: Ken Strothman

One delightful departure from many of the Haand Gallery's more sober pieces was this chainsaw-etched vase of laminated cherry, made by Rich Landergren, of Bloomington, Ind. "The chainsaw work is an attempt to do something spontaneous in wood and to play with contrasting textures," says Landergren. "It is an escape from the calculated atmosphere of the production shop."

Photos: Richard Brown

Dan Atwood manages an architectural woodworking business in Asheville, N.C., and lives in a small house. He needed a two-person dining table that would open out for guests. So, he built this quartersawn cherry drop-leaf table, above and right, which he displayed priced at $1800, to fetch commissions. The knuckle joint is pinned by a ¼-in. steel rod, which was concealed at glue-up. A smaller version of this table has been commissioned by the State of North Carolina to be on display in one of the state's interstate welcome centers.

Photo: Craig Nutt

Craig Nutt has at times busied himself in his Northport, Ala., one-man shop restoring antiques, and the experience has opened his eyes to the early woodwork in his region. The huntboard is indigenous to Alabama, where it was used as a backporch gathering place for huntsmen to talk and drink after the hunt. It was commonly made of yellow pine and painted. Fancier inlaid versions were often made of walnut, and served as sideboards in the home. Nutt's use of salvaged yellow pine for drawer sides in his own walnut huntboard, left, ties the piece with the past. Instead of the traditional birch or maple inlay, however, Nutt used satinwood for a translucent bees-wing effect.

"The huntboard is an expression of my interest in long-neglected regional forms," says Nutt. "The cabinetmakers working in this area around 1800 took high-style Sheraton and Hepplewhite furniture and stripped it down to its essential form. Whether this was intentional, or due to lack of skill, I can't say. I use their forms as a point of departure, to refine the design and construction. The result is a piece that is both traditional and contemporary."

Nutt, who has priced this piece at $3400, prefers to build furniture, but recently has tried sculpture, bowlturning and whirligigs. □

From California to New York . . .

Showing furniture across the continent

by George Breck and Roger Bell

Many furnituremakers take the "pay your dues" approach: working long hours at little or no pay for many years, slowly developing a local clientele, showing locally, waiting to be discovered and perhaps working up to big American Craft Enterprises shows as a goal at the end of the process. But local shows are about as far as most furnituremakers go, and a lot of people burn out emotionally or financially before achieving even local recognition, no matter how talented they are.

When we formed our partnership, Dasein Studios, we decided that we had already paid our dues, each of us having been an overworked, underpaid local craftsman for almost a decade. We wanted to break away from the usual tedious, unprofitable and heartbreakingly naive approach to marketing. We chose the country's most prestigious crafts market—the annual Rhinebeck, N.Y., fair in late June—and took with us four pieces of furniture (an investment of about $13,500), a booth designed specifically to show that furniture ($2000), a color brochure ($2000) and ourselves ($1000 transportation). It was a tremendous risk, but you get what you pay for. Doing things cheaply and meekly promotes failure—the frame of mind is already there.

The reaction to our work has been satisfying. At Rhinebeck we sold some pieces and lined up some shows, including one at the Holsten Gallery in Miami, Fla., and Gallery 10 in New York City. Nine months after Rhinebeck, we are still getting calls from prospective clients who saw us there.

When we got back to the West Coast, business continued to be good. People out here are impressed that we have been back there with our furniture; people back there are impressed that we live and work out here. East Coast dwellers are curious to see California crafts in their midst. The mere fact that a large piece of furniture has traveled across the country lends it validity. New Yorkers also seem to be more receptive to unconventional design than are people in our immediate area.

Dasein Studios' desk of wenge, maple, black glass, antique glass, cast glass jewels and stainless steel was priced at $5000 in New York's Gallery 10 last winter.

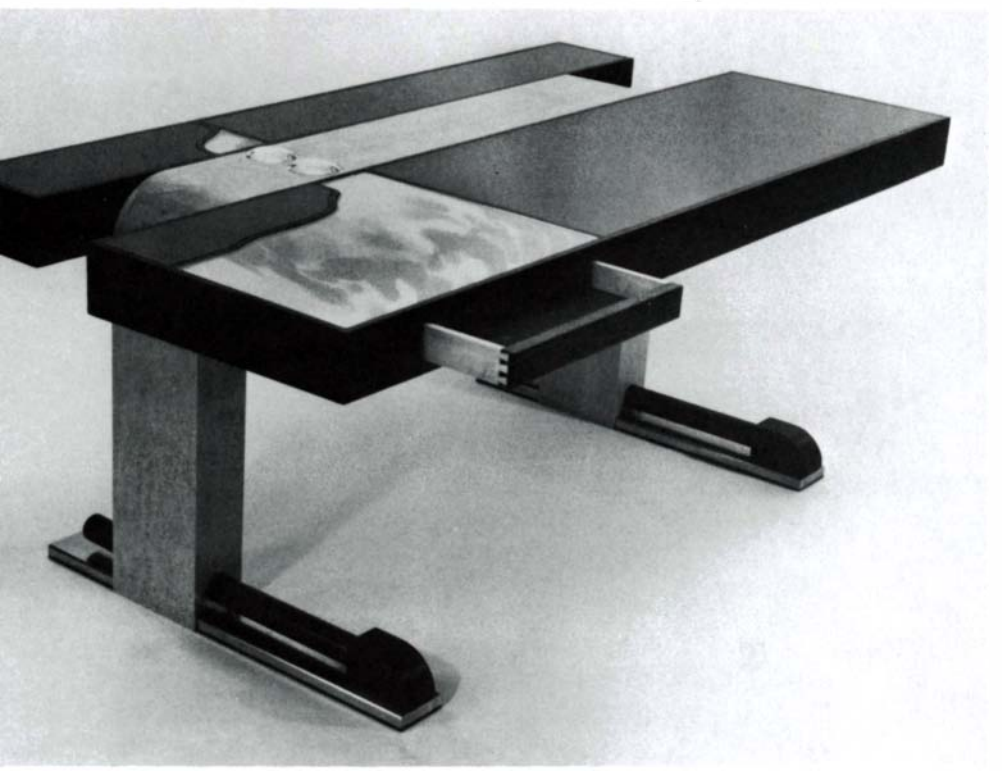


Photo: Roger Bell

The bottom line is that every prospective commission that has come from our cross-continental excursion has materialized. An interested person is given one free conference, outlining what, when and how much. Then, payment of a design fee (variable, nonreturnable) gets the client a design, drawings (not sketches), a firm price, a delivery date and another conference. Once all this has been settled, a deposit of at least 30% gets things moving.

As to how the furniture travels, everything we build knocks down. All our pieces are assembled with readily available nuts and bolts. We build our own crates and pack very carefully. We charge for crating and shipping. So far, whether because of luck or care, we have had no damaged pieces. The advantages of this system are evident: The stuff is easy to move, easy to crate; we assure ourselves of the adequacy of the packing. We get the best shipping rates (knockdown furniture goes very cheaply), and truckers love us for our crates. Should something get broken, we then would have to repair or replace only the damaged component. It recently cost a friend of ours $600 to ship a 5-ft. desk to the Midwest, and the desk was broken when it arrived. We shipped our 6-ft. desk, left, to New York for half that amount, including the cost of crating, and it arrived intact.

Knockdown furniture need not be inferior furniture. There are advantages to not using wide expanses of wood and to making larger forms out of smaller components, especially in furniture that has to live in different climates. We use relatively stable woods, wenge and maple for instance, and we keep the humidity in our shop low. We've had a little trouble with wood movement, mainly cosmetic flaws—some end-grain checks in the maple. The desk remains structurally sound for all its thousands of miles of travel, and the drawers work well on either side of the continental divide. □

George Breck and Roger Bell live and work in Sebastopol, Calif.

A Time and Motion Study

Photos: Michael Germer

The show's catalog calls Jere Osgood's new desk "light and graceful, with an anthropomorphic spring that defies weight." Osgood himself calls it a pedestal table with the pedestal shoved off to one side. Kept away from his bench for 18 months by his job as acting director of Boston University's Program in Artisanry, Osgood practically leapt into his shop when he returned to full-time teaching last spring. Out popped this desk, which is headed for a lawyer's office in Boston—it sold during the recent PIA faculty show. Osgood says the design is a step in a definite direction, one of a series built with the bent tapered lamination techniques he explained in *FWW* #6 and #14. To support the solid teak top, he bent and glued thin, tapered layers of ash and walnut around particleboard forms, using as many as 40 clamps on each leg. To determine the commercial feasibility of the design and the techniques, Osgood made its production a time and motion study—a desk like this, built in limited runs by a small shop, could retail for about $5000.