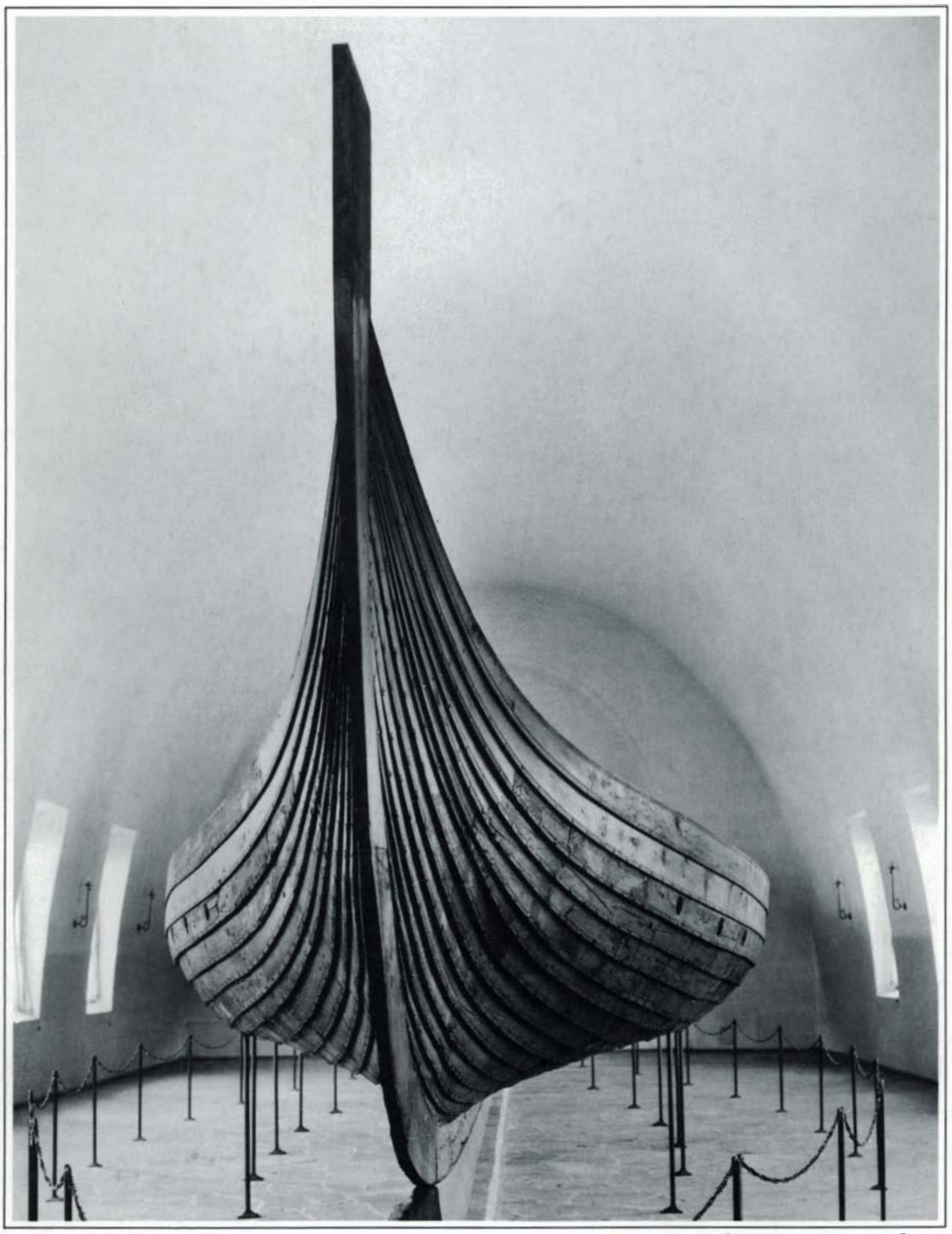
Fine WoodWorking

SEPTEMBER/OCTOBER 1982, NO. 36, $3.00



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Fine WoodWorking®

SEPTEMBER/OCTOBER 1982, NUMBER 36

Cover: The sweeping, overlapped planks of this ancient Viking ship are an elegant, unmistakable characteristic of lapstrake boatbuilding—a technique at least ten centuries old. Lapstrake boats are made with relatively thin planks riveted together into strong, light hulls. Much of what we know about this art has been learned from the Gokstad ship, shown on the cover, and from the Oseberg ship, whose richly carved bow is pictured above. For more on Viking boats and lapstrake boatbuilding, see p. 54. Photos: ©University of National Antiquities, Oslo, Norway.

DEPARTMENTS

ARTICLES

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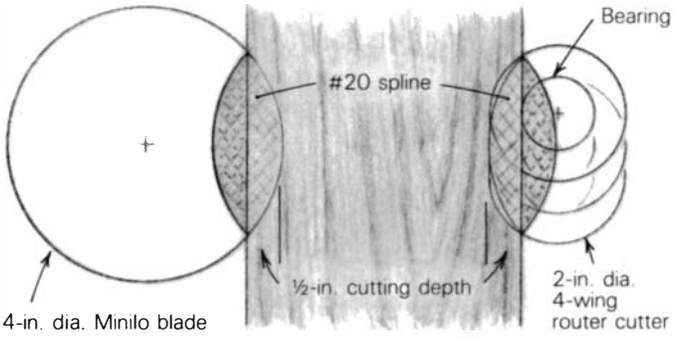
Letters

As reviewed in *FWW* #34, plate joinery is a rapid and accurate method of aligning boards. Several years ago I began using the #20 Lamello plates or splines for various projects. As a hobbyist, I couldn't justify the more than $500 price of the Minilo machine, and the less expensive Elu had not come out yet. The Minilo machine uses a 100mm (4-in.) diameter blade that cuts a slot 4mm (5/32 in.) wide and 12.5mm (½ in.) deep. As an alternative, I purchased a 5/32-in. slotting cutter for use in a router. It does the job quite nicely, with the only difference being that the slotting cutter is 2 in. in diameter instead of 4 in. Therefore the slot, which is cut by moving the blade along, is slightly deeper at the ends of the spline than necessary. This has posed no problems for my purpose. With



a 0.945-in. diameter bearing, the slot is about ½ in. deep, which matches the cutting depth of the 4-in. blade. A custom-ground, carbide-toothed slotting cutter can be purchased from Winchester Carbide Saw, 2633 Paper Mill Rd., Winchester, Va. 22601. A 4-wing assembly (includes cutter, arbor and bearing) costs less than $35 with postage. Request a B-13 bearing with the assembly, and specify whether you want a ¼-in. or ½-in. arbor. You can also purchase a less expensive 2-wing assembly, or just the cutter by itself if you already have an arbor and bearing.

—David D. Dolton, Bowie, Md.

I must call your attention to serious safety problems depicted in John Kolkman's Method for sharpening planer knives (*FWW* #34, p. 14). The first error is grinding on the side of a type 1 grinding wheel. Type 1 wheels are made to be used on the periphery only; they are not made to be stressed from the side. In addition, any wearing of the side only further weakens the wheel. Wheels designed for side grinding are steel-backed, with the abrasive cemented to the back.

The drawing also shows a wheel flange on one side but none on the other. This is also very dangerous. The pressure of the flanges must come at opposite points on the side of the grinding wheel. The combination of a larger flange and a smaller nut will create a sort of punch press that can cause the wheel to explode. *—Oliver Quist, Stoddard, N.H.*

In Kolkman's application, may I suggest a type 6 straight cup wheel or a type 11 flaring cup wheel? Not only does the user reduce the risk of injury, but these are standard "tool room" wheels that most industrial suppliers will have on the shelf in a wide range of grades. *—Tim Neun, Portland, Ore.*

Robert Mussey's article "Early Varnishes" (*FWW* #35, July '82) was very interesting and obviously thoroughly researched. Unfortunately, I must fault him in a small way for the careless use of botanical names. Of the seven in the article, there are three misspellings and two instances of entirely incorrect names. This is not surprising: supposedly "correct" botanical names are replaced from time to time as inconsistencies with the international rules of botanical nomenclature become apparent. Also, there is sometimes room for argument as to which genus a species properly belongs. For example, the question of whether incense-cedar is *Calocedrus decurrens* or *Libocedrus decurrens* falls into this category. However, the use of names that were unequivocally replaced decades ago is just plain inexcusable. Mussey's "*Abies excelsa*" was a real puzzler, because that name had been variously used for no less than three distinct species during the 19th century. I finally determined that he was referring to what is now known as *Abies alba,* usually known in English as European silver fir and rarely as "German fir."

I *do* encourage you to continue using botanical names. I'm sure they are helpful to your foreign readers who may not be familiar with American common names, and they can be a definite help to anyone who works with tropical woods. Perhaps you may also save some 21st-century scholar/woodworker the frustration that I'm sure Mussey experienced in deciphering those old recipes.

For your reference: *Callitris quadrivalvis* (misspelled as *Calitris*) is *Tetraclinis articulata, Rhus copallinum* is *Rhus copallina,* and *Rhus vernicifera* is *Rhus verniciflua.*

—Kim C. Steiner, Associate Professor of Forest Genetics, Pennsylvania State University

ROBERT MUSSEY REPLIES: I appreciate these corrections. Professor Steiner properly points to the confusion in trying to interpret historical material. I have discovered another error in the article as published. The sentence at the bottom of the first column of p. 57 parenthetically describes true "English polishes" as "oil varnishes made with copal and shellac resins." These are *spirit* varnishes made with copal and shellac resins; shellac is not soluble in oil.

I have also come across another source of supply for varnishes and varnish resins. It is Wood Finishing Enterprises, Box 10117, Milwaukee, Wis. 53210.

Ms. Holzapfel's reflections on handicapped persons gaining access to wood turning through the use of a machine lathe (*FWW* #34, p. 98) are indeed fact. At the Veterans Administration's Blind Rehabilitation Clinic in Northampton, Mass., we have been using a machine lathe as well as a compound rest attachment on our wood lathe as an integral part of the training of blind and visually impaired veterans for over ten years. We use these more mechanical methods as a confidence-building introduction to turning, or to make precise turned pieces. Except in cases of severe physical impairment, we also encourage our clients to attempt freehand turning as an exercise in coordination, creativity and "feel."

A device that has been very effective in allowing visually or physically impaired persons to do freehand turning is a tool rest made from a ¼-in. thick steel plate mounted flat on the tool-rest post. You set its height to fix the plane of cut for a scraping tool, and it provides support along the length of the tool. This lessens the chance of accidentally raising or lowering the point of cut and gouging the project. We make the plate triangular in plan, to fit into bowls.

Using these devices in conjunction with most other normal procedures, we have been able to introduce over 200 handicapped individuals to a more independent lifestyle through woodworking. *—Peter A. Kukish, Evan G. Bandouveres, V.A. Medical Center, Northampton, Mass.*

Many of us do a lot of turning, and have found that, to our horror, checks and defects mar the finished product. Instead of trying to hide these defects, I have made them work for me by making them more pronounced. The defects are filled with a mixture of fine sawdust or water putty, carpenters' glue, and acrylic color (the brighter the better). Mix to a thick

INDEX TO ADVERTISERS

paste and fill the cracks, building it up to allow for shrinkage. When it's dry, sand smooth. Bright red seems to lend itself the best to dark woods, yellow is also an eye-catcher.

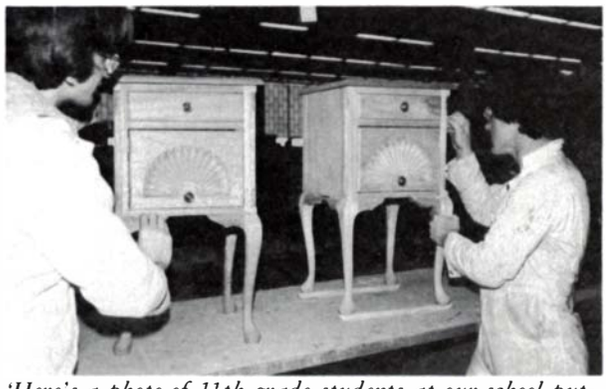
—Ernest O. Nahapiet, San Jose, Calif.

There you are—a lovely piece of wood, superb grain, just the right place for it—and it has a loose knot smack in the middle. Knots in themselves may be attractive and may not interfere with the strength of the piece, but a loose or rotten knot cannot be incorporated easily. The solution is simple—remove the knot or bore out the hole, whittle a plug from a darker piece of wood, and then glue it in. When it's dry, machine it flush and finish. The resultant "tight knot" will give no more trouble and will be attractive.

—Buster Welch, Winnipeg, Man.

I've noticed several letters in your magazine from readers inquiring about the prevention of rust on fine tools. An easy solution is to keep the tools in an airtight container when they are not in use. Include camphor blocks to displace the oxygen that forms rust. These blocks can be found at industrial supply houses, and are sold for just this purpose. The blocks are also sold in supermarkets as diaper-pail deodorizers.

—R. Cordle, East Peoria, Ill.



'Here's a photo of 11th-grade students at our school putting the finishing touches on Queen Anne night tables. Our students read your magazine and thought you'd be interested in what they're doing.'

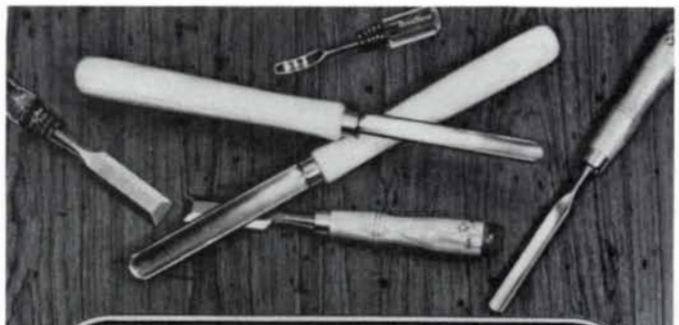
—Robert C. Landry, Cabinetmaking Instructor, Northeast Vocational School, Wakefield, Mass.

I have tried practically everything I know of or have heard about to treat tablesaw tables, drill-press columns, jointer beds, etc., to permit free movement of wood or metal against metal, and also to protect the metals against rust. I have finally found the answer. Spray PAM over the saw table and blades, and then wipe off the surplus. This leaves a film that surpasses anything I have used. PAM is a vegetable-oil spray, sold in grocery stores, which you coat pots and pans with to keep food from sticking. I even spray all my handsaws after use.

—D.G. Sattler, Kalona, Iowa

I have only recently become a devotee of your magazine and find it most instructive and interesting, although I do not agree with everything the so-called experts say. The reply of Oscar MacQuiddy to David Dike's problem in the March '82 issue is a case in point.

Alcohol-based stains are a trap for the unwary; once on, they cannot be simply removed. I therefore offer the following advice, which I got from an old Scottish craftsman. Stain your wood with a suitable mixture of artists' oil colors, which can



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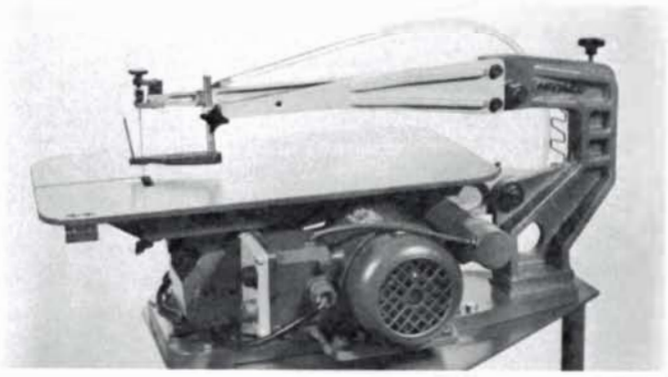

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be applied with a turpentine-soaked rag or, alternatively, can be made up in a can or jar with turps and perhaps a smidgen of boiled linseed oil, and then applied with a brush. The remainder can be stored for later projects.

A basic palette comprises raw and burnt sienna, raw and burnt umber, black and a suitable brown (I prefer Vandyke brown). If you use a rag to apply dabs of the colors mixed on a plastic lid, you can emphasis the grain. If you don't like the color you have applied, even though it looked good on the test piece, wipe it off with a turps-soaked rag and start over. If the color is too dark, it can be lightened after it has dried for 30 minutes or so, by rubbing with a clean dry rag, or lighter still with a turps-dampened rag.

When you are through, remember to lightly rub the work with a soft dry rag to remove the excess dry stain before sealing with shellac for French polishing or copal varnish. Or spray the piece with polyurethane before finishing with that type of varnish. Try it, you'll like it. It really works.

—John A. Sykes, Arcadia, Calif.

'The drafting table is walnut and cherry, with a ¾-in. birch plywood drawing surface. The top has a hinged bottom that swings down to allow for paper storage.' —Ben Erickson, Eutaw, Ala.

In response to Q&A—Removing gray color from oak (*FWW* #34, p. 30), I must disagree with George Frank's solution. I don't believe in putting anything on antique furniture that will raise the grain. I never have any of my pieces professionally dip-stripped for this reason. The only solution to the raised grain is sanding. In sanding, the loss of detail on turnings and embossed designs on antique oak furniture is, I think, unforgivable.

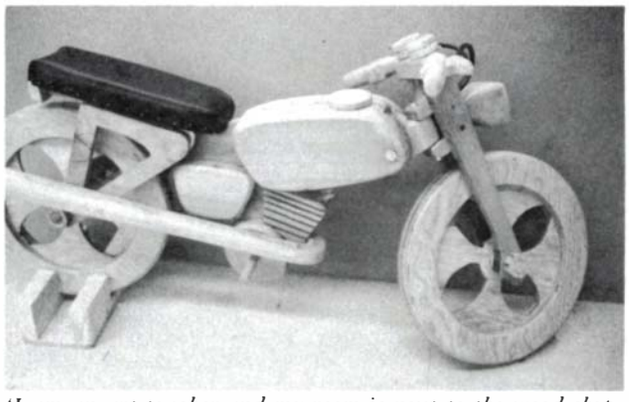
My solution: see if the grayish color is really going to be a problem in the long run. What you are really interested in is the final color of the finished piece. To find this out, brush on pure turpentine. I find that the grayish color produces a beautiful dark antique oak color upon the application of golden oak stain and the finish.

—Douglas Novak, Macomb, Ill.

In regard to Gene O'Neill's letter (*FWW* #34, p. 4) about the Hammond Glider, I was concerned about the same problem of welding the arbor. I've discovered that the arbor can be left in much the original form. The only changes I will make are the addition of the ⅝-11NC LH threaded shaft and the taper at the other end. The machinist doing the work feels that a crosspin will be sufficient to secure the two additions. He also advises against welding, as it may weaken and possibly warp the shaft. By the way, I was more

fortunate than Mr. O'Neill—my Glider cost $275.
—Robert Ricker, Chicago, Ill.

Re the article in the May/June issue (#34) by Ian J. Kirby, "Choosing a blade," circular sawblades for woodcutting are not made from high-speed steel. The steel used is generally high-carbon, alloyed with nickel and chrome. High-speed steel is used in metal-cutting circular sawblades, which are hollow-ground for clearance (instead of being set). These metal-cutting blades are heat-treated to a hardness considerably above that for alloy steel woodcutting blades.
—Thomas Shields, Hillsborough, N.C.



'I am an art teacher and my room is next to the wood shop. Scrap wood is very easy to come by, so I put together this wooden motorcycle. I adjusted the height so my son could ride it.'
—Ken Youra, Pardeeville, Wis.

In regard to Jim McGill's Method in issue #35 for refurbishing Bailey & Sargent wooden-soled planes, anyone needing a 2⅛-in. plane blade should check with some older industrial supply houses. One here in Grand Rapids has not only a dozen 2⅛-in. blades, but also a small supply of 1-in. blades for the Stanley #1. Unfortunately, they don't have planes to fit either, and aren't interested in going into the mail-order business.
—J. Crowley, Grand Rapids, Mich.

John Kassay's bending jig for making the Shaker carrier handle in *FWW* #32 uses four layers of 24-ga. galvanized sheet metal with a block of hardwood bolted at each end. I find that the banding strap used on crates does a better job. Banding strap is made in various widths, thicknesses, strengths and finishes. The 0.032-in. by 1¼-in., high-strength, coated banding steel has the strength and spring to work well as a restraining strap in steambending. The clincher is that short lengths of it are available for free from the trash bin of lumberyards and steel warehouses. *—J. Wilson, Charlotte, Mich.*

I read your informative article on powderpost beetles (*FWW* #34) and thought I'd pass along this story. I have, at times, purchased ponderosa pine from a mill in this area for use in various projects. I had milled some of it on the tablesaw for a door project. I was then cutting it to length on a Rockwell motorized miter box. After one particular cut, I noticed a small movement on the cut-off piece. I picked up the piece, and to my surprise out crawled an anobiid beetle. He was somewhat shaken, for I had cleanly cut off the major portion of his three little legs on one side of his body. So he was left lopsided and disoriented. I had to marvel that the little bugger's legs had been so cleanly amputated.
—Tom Andersen, Prescott, Ariz.

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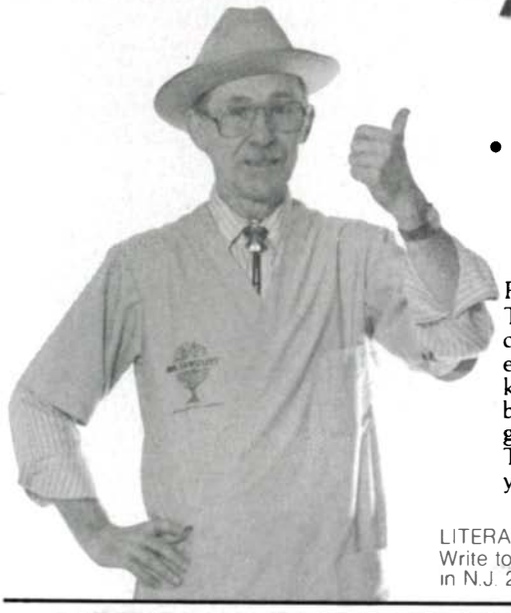

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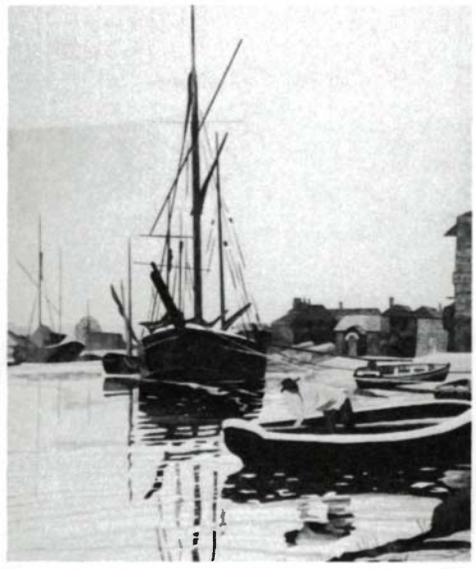
BRITISH MARQUETRY SOCIETY

The 1982 British National Marquetry Exhibition, staged by the Marquetry Society last spring at Ipswich, England, attracted 400 entries. Pictured here are two of the winners. Comments and photographs are by Ernie Ives, who edits the Society's technical newsletter, *The Marquetarian*. For more on the British Marquetry Society, write to 63 Church Lane, Sproughton, Ipswich, Suffolk, England 1P8 3AY.



Richard Shellard won the Rosebowl, the championship cup for the best exhibit, with 'Long-Tailed Tit' (above left and detail at left), a picture measuring only 7½ in. by 10 in., yet filled with fine detail. When asked how he assembled all those pieces for the feathers, Shellard replied: 'It's nothing really. Just cut out the window in the usual way, stick cellophane tape underneath the opening and pack the slivers (which are all odd lengths) side by side onto the tape until the opening is filled. Then just smear glue over it to hold the pieces in place. It's so simple.' Tony Rheindorp entered 'Rye Harbour' (above right) in the intermediate class and garnered first prize for the best picture by an out-of-chapter member. The judge particularly liked the sense of depth and atmosphere of this picture. Obviously the maker found just the right piece of olive ash for the water—it really does look wet.

Fine WoodWorking Design Book Three

Call for entries – Deadline January 3, 1983

This is an open invitation to woodworkers to show photographs of anything and everything made of wood, the very best work you have done during the past four years. Several hundred of the best photographs will be selected by the editors of *Fine Woodworking* magazine for publication in *Design Book Three.* As in our first *Biennial Design Book* (1977) and in *Design Book Two* (1979), the emphasis will be on excellent design and craftsmanship. Our intention is to document the current state of the woodworker's art, as a source of inspiration for today, and a record for tomorrow.

Design Book Three* will also include a comprehensive, state-by-state *Directory of Woodworkers.

Although we would like to publish everybody's photographs, a book can do no more than sample the depth and breadth of contemporary work in wood. Whereas only a fraction of those who enter this competition will see their photos in print, all who enter are eligible for a free directory listing. Since the directory will be arranged by state, readers of *Design Book Three* will be able to locate and commission local artisans. However, the only way to list your shop in the *Directory of Woodworkers* is to enter your photographs in the competition for *Design Book Three.*

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Title and/or function of entry _____

Woods used _____

Other materials _____

Dimensions (height, width, depth) _____ Price (optional) _____

Principal woodworking techniques used _____

Remarks (on design, construction, art, craft, life... we may excerpt what you write here for publication with your photos) _____

Number of photos submitted _____ Is each accompanied by a description? Yes ☐

Do you want your photos returned? No ☐ Yes ☐ (enclose SASE)

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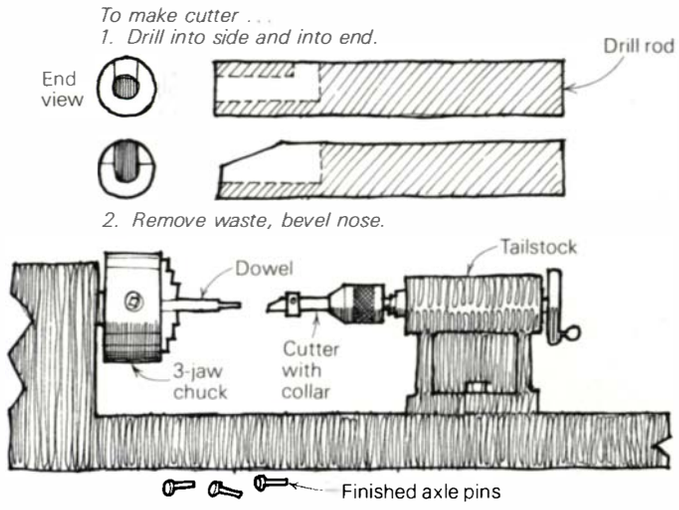
Send your entries to: *Design Book Three*, The Taunton Press, 52 Church Hill Road, Box 355, Newtown, CT 06470.

Rules

- An entry in the competition for *Design Book Three* consists of a maximum of six black-and-white photographs of things designed and made by an individual woodworker or a woodworking partnership, plus an entry blank. The entry blank printed here may be photocopied or hand-copied.
- The work shown in an entry must be of original design, the primary material must be wood, and the work must have been done since 1978. There are no restrictions on tools, techniques, function (or the lack of it), style or scale. If it's wood and you made it, you can enter it.
- An entry may focus on a single object (overall views plus detail close-ups) or on several objects. The entry blank has spaces for describing one object. If you enter photos of more than one thing, please enclose additional descriptions.
- Photographs should be sharp black-and-white prints with good contrast, at least 5x7 in size, made from 35mm or larger negatives. The background should be featureless so it doesn't interfere with the work itself. To help us compose the book, please leave space around the object within the picture area for cropping. (For more about how to photograph your work, see pp. 92-97.)
- Print your name on the back of every photo. Be careful that ballpoint pens don't emboss the image, and that wet ink doesn't smear from the back of one print onto the face of the next.
- Snapshots, Polaroids, color slides, color prints and blurry photographs cannot be published and so will not be judged.
- All entrants are eligible for a free listing in *Design Book Three's Directory of Woodworkers.*
- Entrants whose photographs are published will receive one free copy of *Design Book Three.* Each entrant, whether published or not, may purchase up to ten copies at 25% off cover price.
- Deadline for entries is Jan. 3, 1983.
- If you want your photos returned, please enclose a self-addressed stamped envelope. All photos will be kept until *Design Book Three* is published, in late summer of 1983.
- The decision of the editors is final.

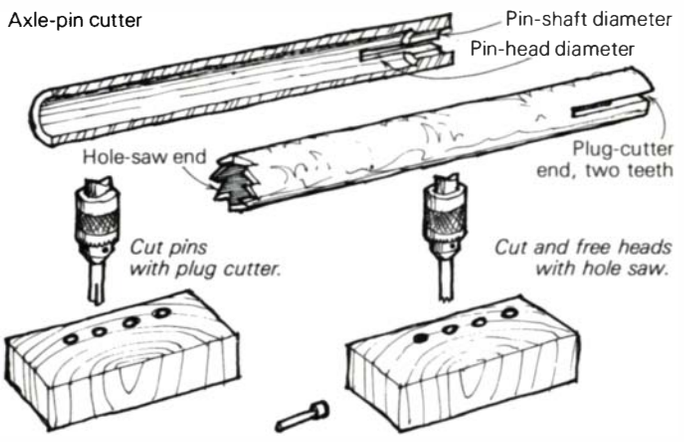
Making wooden toy axles–two methods

When I couldn't find axle pins in the size and length I needed for the wooden toys I make, I devised this lathe tool to make my own. Start with a short length of ½-in. drill rod. Drill a ¼-in. blind hole in the side of the drill rod ⅞ in. from one end. Then drill a ¼-in. hole through the center. Hacksaw out the center portion to produce a ¼-in. slot in the end of the rod. File the sides of the slot smooth, then file the bevels on the leading edge of the cutter as shown in the sketch. Put a ½-in. setscrew collar over the cutter and tighten it up. Without the collar the cutter would open up in use.



I chuck the cutter in the tailstock and adjust the tailstock clamp so it will slide smoothly on the lathe bed. I use 7/16-in. dowel stock for the axle pins which I feed through the headstock and hold with a three-jaw chuck. To cut the pin I push the tailstock cutter against the dowel until I have the length pin I need. I then cut off the pin, starting with a fine-tooth saw, rounding off the face with a file and then completing the cut-off with the saw. *—Stanford LeGath, Clifton, N.J.*

A few days before my daughter's birthday, I discovered I was out of the little axle pins necessary to fasten wheels to the toy train I was building for her. Then I hit on a simple tool that produces pins in abundance. It took only a couple of hours to make, and it freed me from the two-week mail-order delay.

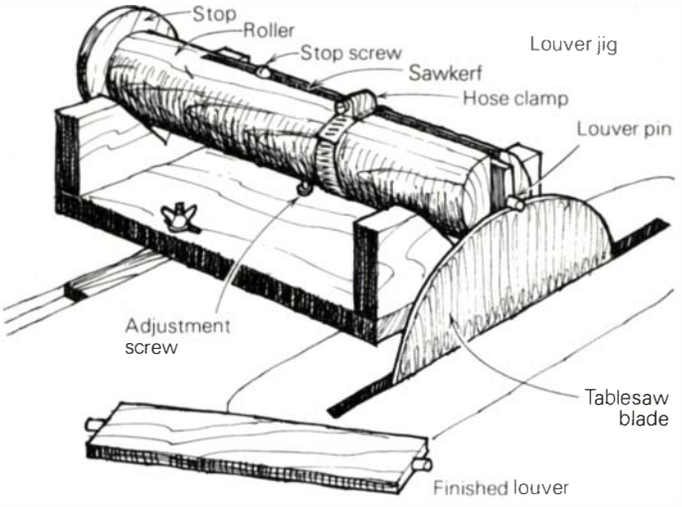


The tool is a short steel bar that's a plug cutter on one end and a hole saw on the other. Each end is used in turn—first the plug cutter to make the shaft of the pin and then the saw end to free the pin head. To make the tool, start with a 3-in. long section of ½-in. drill rod or round tool steel. Drill a ¼-in. hole through the length, making a tube. Next, enlarge the hole to ⅜ in., stopping about ¼ in. from one end. To make the hole-saw end, file eight deep teeth into the wide end of the tube with a triangular file. To make the plug-cutter end, simply saw a ⅛-in. slot 1 in. into the narrow end of the tube. The slot will allow sawdust to escape. Cut two teeth into this end of the cutter, one on each slot. To finish the tool, dress and sharpen all the teeth, then harden and temper the steel.

To make axle pins, first cut an end-grain block of hardwood a little longer than the pins need to be, 1/16 in. or so. Chuck the tool in the drill press, and using the plug-cutter end, cut all pin shafts in the block. You will likely have to back the cutter out of the hole occasionally to clear chips. When done, reverse the tool and cut the pin heads following each hole. Dress each pin head by chucking the pin in the drill press and filing the head to the desired shape.

—Robert F. Vernon, Keuka Park, N.Y.

Making louvers



This simple jig cuts the pins on the ends of the individual louvers in homemade louvered doors. It consists of a V-notched base, which slides in the tablesaw's miter-gauge track, and a cylindrical louver holder. A slot in the cylinder holds the louvers in the correct cutting position, using adjustment and stop screws as shown in the sketch. To use the jig, load a louver blank into the cylinder, then tighten a hose clamp around the cylinder to lock the louver in place. Place the cylinder in the base, push the jig into the blade and rotate the cylinder to cut a pin on one end of the louver. Remove the louver, reverse it in the cylinder and repeat to cut the other end's pin. *—R.F. Paakkonen, Stafford Springs, Conn.*

Shading marquetry veneer

Sand-scorching has been used in marquetry for years to achieve the subtle shades needed to show shadows, curvature and depth. The standard procedure calls for either dipping the veneer into a hot sand bath or spooning the hot sand onto the veneer in repeated steps to gradually shade the area. Recently I discovered a direct-scorching technique that proved quite successful. I used a miniature 5-in. butane torch (available from Microflame, Inc., 3724 Oregon Ave., Minneapolis, Minn. 55246). The secret is to use unheated sand to mask the area to be scorched. I carefully line each shadow area with a layer of sand, leaving no area that I want to remain light-toned uncovered. I slowly warm and shade the exposed areas with the torch to create the appearance of gentle curves or dimples. The sand acts as a deflection shield to repel heat in

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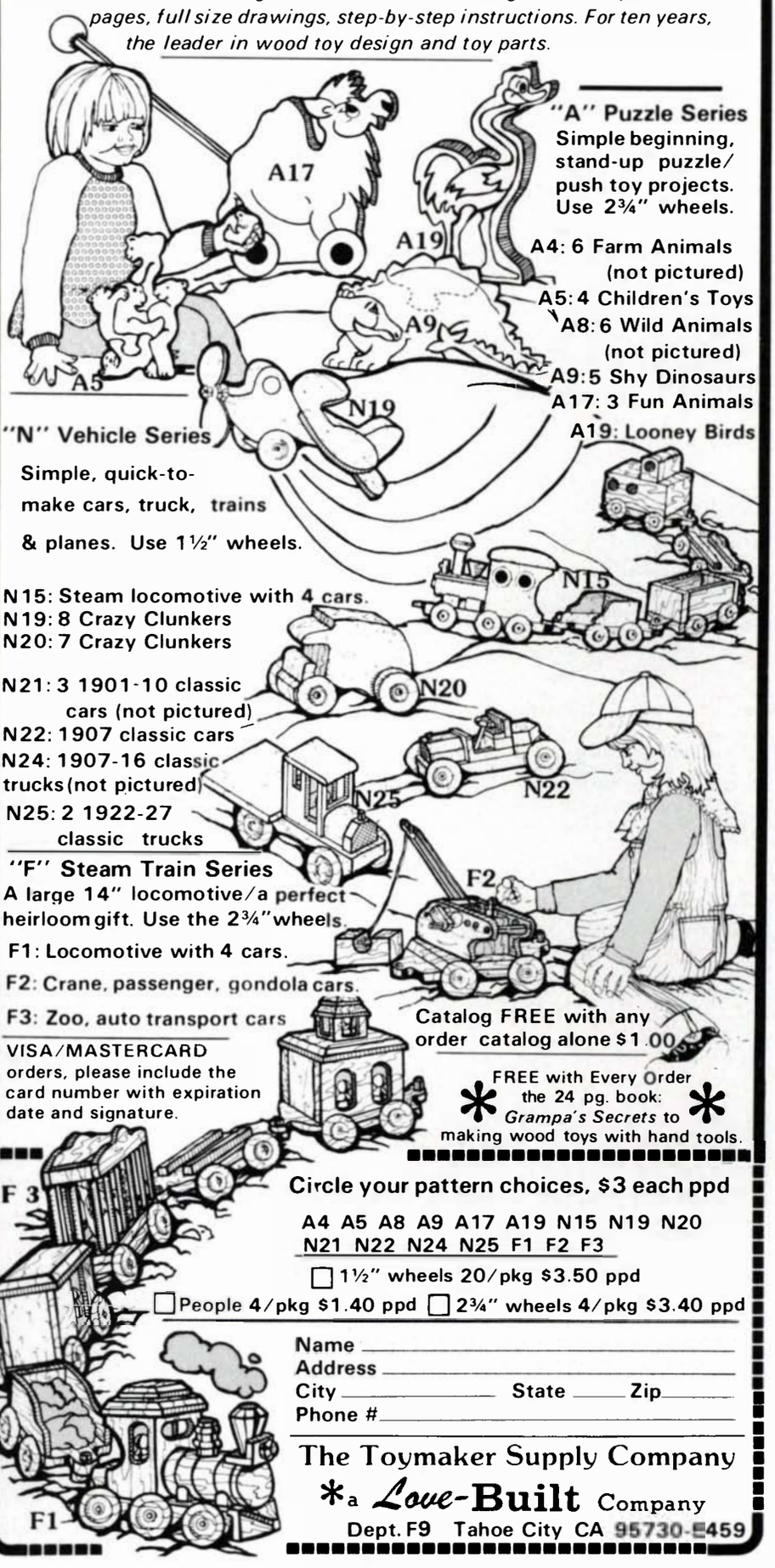

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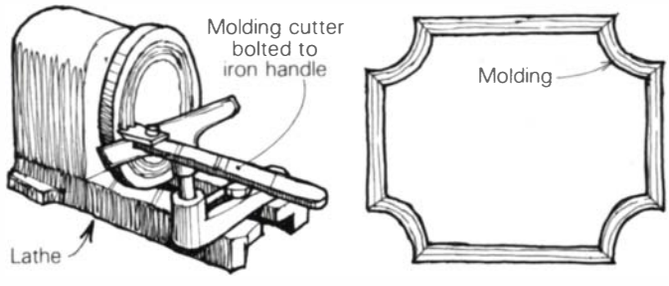
proportion to the amount of sand piled up on the unexposed area. When I need to show a sharp hard-edged shadow, I cut into the veneer along the edge of the shadow, dip a thin metal heat shield into the cut and scorch the exposed veneer. Great care must be taken with open-edged pieces because they burn readily, and shrinkage is a certainty. To expand shrunken pieces I wipe on a solution of equal parts water, white glue and glycerine. This solution usually returns the piece to its original size.

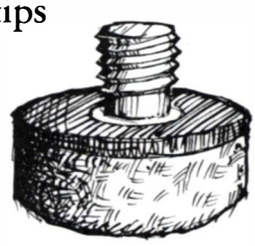
—Martin R. Zschoche, Vista, Calif.

Making sectional molding

Sectional molding for cabinet doors is easy to make on the tablesaw and lathe. Cut the straight sections on the tablesaw with a molding head. To make the semicircular section at each corner, remove the cutter from the molding head and bolt it to a heavy strap-iron handle. This provides a scraping tool for shaping a circle on the lathe's faceplate. Separate the molding from the waste wood with a parting chisel. Then cut each of the four corner sections from the circle at the proper miter angle. *—Duane Waskow, Cedar Rapids, Iowa*



Door bumpers from cue tips



Replacement leather tips for pool cues make excellent bumpers for sliding and swinging doors on projects. They do a fine job of quieting and cushioning the doors when they are slammed, and they are certainly better looking than the black rubber bumpers that are commonly available. The tips, which can be bought at sporting goods suppliers, have a threaded brass shank for fastening to the cue. To install the tips on a project, drill a slightly undersize hole and use a hammer to tap the threaded shank into the hole. The threads hold like ring nails, and all that shows is leather.

—C.W. Moran, Larchmont, N.Y.

Homemade scraper plane

The cabinet scraper sets the standard of excellence for smoothing wood, but it has some drawbacks: tired, blistered fingers (these things get hot!) and uneven surfaces. Scraper planes are available, but the most common one (which resembles a large iron spokeshave) has such a short sole that it is difficult to control and often chatters.

With these thoughts in mind I decided to make a simple wooden scraper plane. It went together in only a couple of hours and proved to be quite successful.

The body of the plane is laminated from three pieces of wood as shown in the illustration [p. 20]. The block against which the blade bears must be dished slightly to spring the blade into a curve. The back of the wedge must be correspondingly convex. This curve should be roughly $\frac{1}{32}$ in. across

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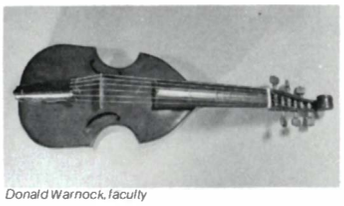

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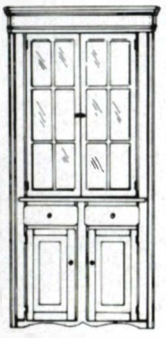

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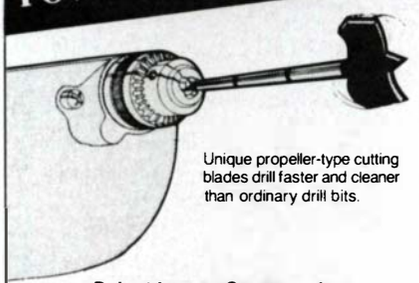

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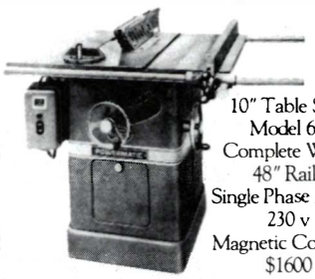

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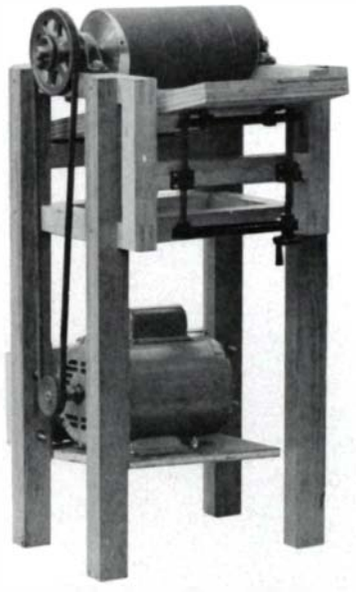

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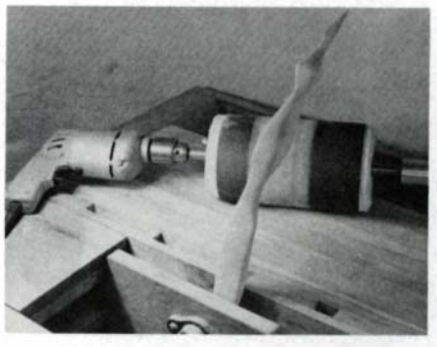

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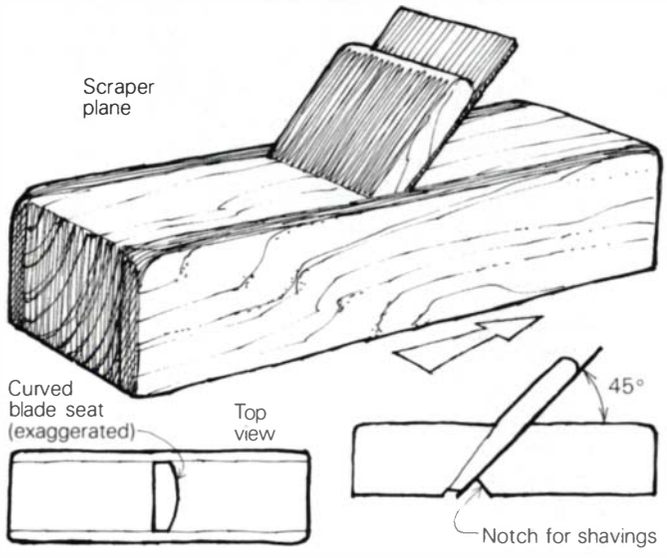
a 2½-in. wide throat. The wedge must fit accurately and should extend through the body nearly to the sole. The support provided by the wedge, the curve of the blade and the length of the plane combine to prevent chattering.

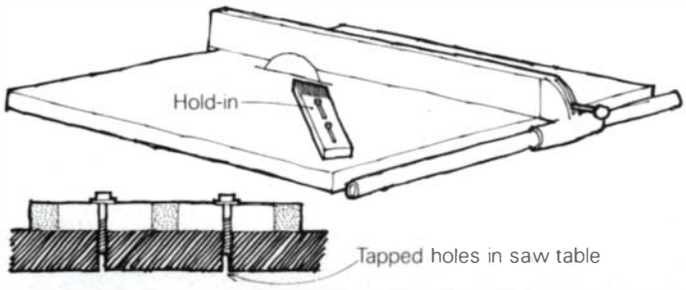
A scraper plane is useless unless the blade is properly sharpened. To sharpen, joint the edge with a file, then bevel the edge on a stone to a 45° angle. Hone the edge just as you would a plane iron. Then with a burnisher or hard steel rod, rub back and forth. At first hold the burnisher parallel to the bevel, then gradually tilt it until it is perpendicular to the blade. This technique produces a razor-sharp curl every time.

—Bradley C. Blake, Redwood, Miss.



Hold-in improvement #1

Fingerboards perform much more effectively if you screw them to tapped holes in the saw table rather than clamping them. Clamped fingerboards don't lie flat, and they can slip and lose pressure against the work.



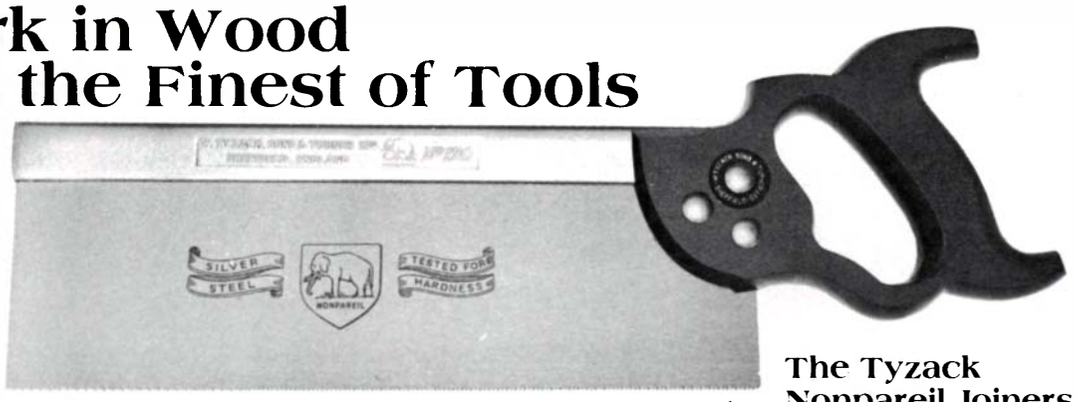
To make the fingerboard, saw kerfs ⅛ in. or so apart in the end of an angled 1x3. Rout two ¼-in. slots down the centerline of the fingerboard—one at the head, one at the tail. Now set the fingerboard in position on the saw, so it will exert pressure just ahead of the blade, and mark the center of each slot on the saw table with a punch. Drill and tap holes into the table at these points. Lock the unit in place with cap screws or bolts threaded into the tapped holes.

—Ben Erickson, Eutaw, Ala.

Hold-in improvement #2

The molding head for the tablesaw is a valuable tool. But without the proper hold-ins it is practically impossible to shape thin stock without chattering. The hold-in fixtures I use to overcome this handicap consist of an auxiliary fence and a

Handwork in Wood Requires the Finest of Tools



The joiner's choice is Tyzack Nonpareil

The 4 Things to Look for in a Quality Handsaw

STEEL

When judging saw steel examine 3 points. The alloy used, the grinding, and the tensioning. In England, the finest steels are said to be Sheffield steels. Tyzack Nonpareil saws are made of vacuum-melted nickel chrome alloy, a Sheffield steel that is extremely hard and known for its ability to hold a fine edge. Next study the way the saw was ground. On a panel saw the blade should be full thickness at the teeth and taper to the back. After grinding, the finest saws are hardened, tempered, tensioned. The resulting blade will be flexible but will always return to true.

BALANCE

"Balance" refers to the way a saw feels as it cuts. I'm sure you've had the experience of trying to use a saw that seems to fight you rather than work with you. Often, this is a reflection of a poorly balanced saw. When using a fine quality saw, the weight of the saw does most of the work. To achieve this "balance" the sawsmiths at Tyzack use a heavy spine of solid brass, placing weight and stiffness directly over the cut. A steel spine would be cheaper, but brass is heavier, and when highly polished as on the Tyzack Nonpareil, a thing of beauty.

COMFORT

The nature of handsawing requires that human energy be transmitted through the handle. If a handle is poorly shaped or finished, sawing with precision becomes all the more difficult. The Tyzack Nonpareil saw handle is very comfortable, made of the classic English Red Beech, and beautifully finished in a clear lacquer. Saw handles are attached to the blade in several different ways, the least desirable being wood screws, the best being the elegant brass saw screws as used on the Nonpareils.

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While the carpenter can use almost any tool, the furniture-maker must always strive to work to the ultimate in precision. For this reason, his tools must be the finest of their respective kinds. We know of no finer saw than the Tyzack Nonpareil. Since 1812, Tyzack has built saws for joiners who were as demanding of their tools as the quality of their work. To own a Tyzack Nonpareil is to own the finest saw in the world.

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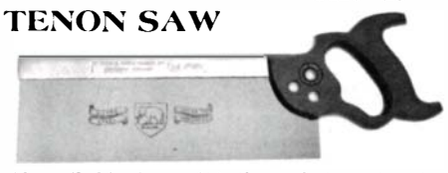
TENON SAW



Also called back saw, it is the perfect saw to cut tenons, laps and other joints. The Tyzack 12" x 15 pt. back saw belongs in every woodworker's shop, both for it's precision and its sheer beauty. An excellent saw for most work.

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DOVETAIL SAW

To cut dovetails, perhaps the most demanding of all joinery, you will want to use your dovetail saw. The brass backed Nonpareil Dovetail saw has a blade 8" long with extremely fine 20 pt. teeth. It cuts so finely there is always the temptation to use this saw indiscriminately, but it should be kept exclusively for dovetails and fine miters.

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GENTS SAW

Originally called the "joiners fancy", the Tyzack Gents saw has 15 pt. teeth and a very fine set. The Sheffield steel blade is stiffened with brass spine and joined to a turned handle. This is the saw to use for all the numerous small jobs such as cutting dowels.

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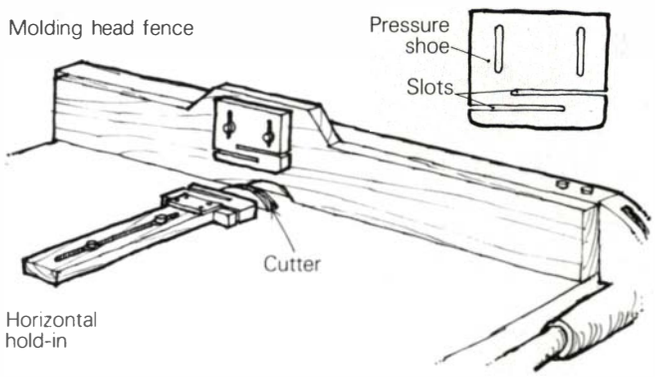
horizontal hold-in. The auxiliary fence is a maple 1x3 that screws to the saw's rip fence. Since this fence may cover part of the rotating cutterhead, it's a good idea to cut a recess into the fence beforehand by raising the cutterhead into the fence. The top of the fence is fitted with an adjustable pressure shoe that holds the work to the saw table.

Make the pressure shoe from a stick of maple by sawing two (or more) sawkerfs from opposite ends. This gives the shoe some spring, allowing it to adjust to minor variations in thickness and to damp out any chattering.

The horizontal hold-in is simply a slotted arm fitted with another pressure shoe. It holds the work firmly against the fence. The arm locks in place with cap screws that fit tapped holes in the table.

Design the fence and hold-in so you can reverse them and use them on either side of the saw's rip fence. This will allow you to take full advantage of both left-hand and right-hand cutter designs. *—Walter O. Menning, LaSalle, Ill.*

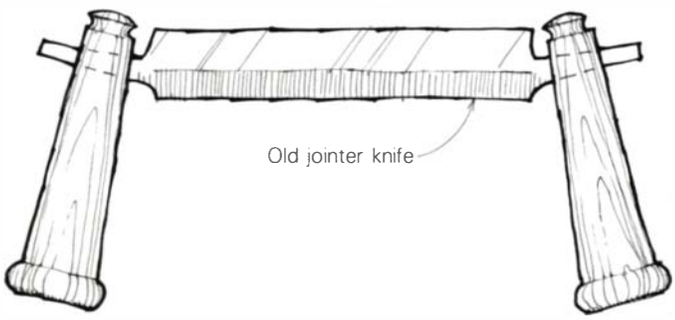


Mini-drawknife

This mini-drawknife is as small and handy as a spokeshave but can slice away a good deal of wood on each draw. It is great for getting in close to the bench and for use in tight quarters where neither of its brothers could perform.

To make the tool, start with an old 6-in. jointer knife and slowly grind the handle tangs as shown in the illustration. Grind the tangs at a slight angle back from the cutting edge so that the handles wedge on the tangs and stay tight when the tool is pulled. Turn the handles to any comfortable shape, and fit the tangs. For a perfect fit, glue up the handle blanks with paper between. Turn, split apart, and groove each half to fit the tang. Then glue the halves together.

—Jim Clark Jr., Bridgeville, Penn.



Solution to tear-out problems

If your planer or jointer tears out crossgrained wood, sponge on a light coat of water. The water swells and softens the fibers, packing them tight together to give the cutting edge a little more to push against. Where the grain is steep, more

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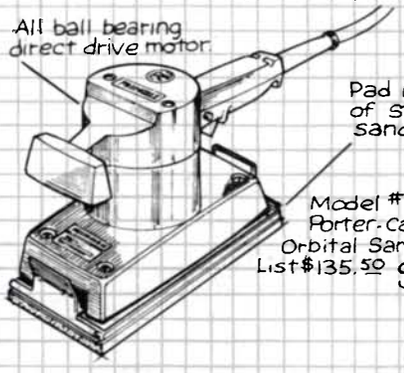
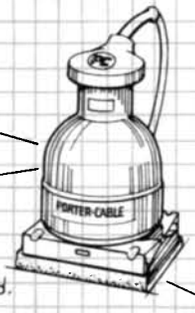


Model #505 Porter-Cable High Speed Orbital Sander (10,000 opm). List $135.50 Sale $99.50 ppd.



Model #330 Porter-Cable High Speed Orbital Finish Sander (12,000 opm). List $85.50 Sale $64.50 ppd.

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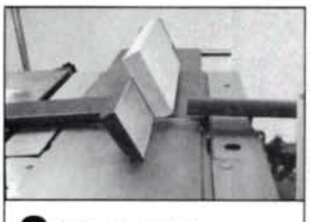

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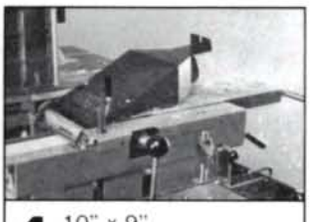

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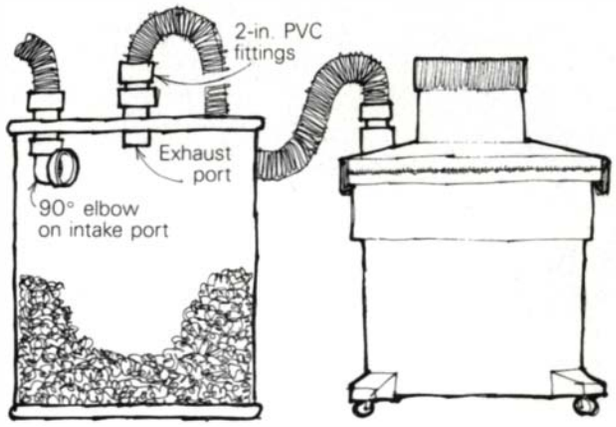
water is absorbed—just where you need it. After applying a light coat of water, wait a minute and take a light cut. If the grain tears out, add more water and let it soak in longer. Since most of the wet wood is planed away, there is little chance of warping the wood.

This trick works best with hardwoods but is occasionally successful with softer woods. Tear-out problems in hand-planing also respond to this treatment, but you must wait until the surface is completely dry before scraping.

—John Leeke, Sandford, Maine

Auxiliary shop-vac tank

For sawdust collection I use a couple of Sears shop-vacs that I connect to my tools through normal methods. But by using auxiliary dust-collection tanks, I'm able to stretch the filter-cleaning cycle considerably. To make the tank, start with a 55-gal. drum or a fiber barrel (the kind with the removable clamp-on lid works well), and install 2-in. PVC pipe intake and exhaust ports as shown in the sketch. The 90° elbow on the intake port sets up a cyclone action that drops dust and chips at the perimeter and bottom of the tank. You can fill the auxiliary tank to the elbow and still have the vacuum filter open and breathing.



The 2-in. PVC pipe fittings fit the standard flexible hose ends commonly used on shop-vacs, increasing their versatility and hook-up options. *—D.J. Greenwald, Hudson, Wis.*

Spreading glue with a pad painter

The pad painters sold for painting trim are excellent glue spreaders. Their short fibers and stiff backing let you apply a smooth coat of glue faster than with a brush. Dip the pad into a shallow pan of glue or just use the pad to spread glue straight from the bottle. *—Chuck Lakin, Waterville, Maine*

EDITOR'S NOTE: Contributing editor Tage Frid has offered a couple of observations about Robert Thomason's wooden bending blanket method (*FWW* #32, Jan. 1982, p. 20). Whereas Thomason used tapered keys to align the top and bottom parts of his laminating form, Frid suggests using straight keys. With straight keys the top and bottom are in alignment from the moment the form starts together. Frid also points out the importance of using sticks in the bending blanket that are all exactly the same thickness. Thickness-plane the stock first, then rip the sticks. Use the thicknessed dimension for the top and bottom of the blanket. *—Jim Richey*

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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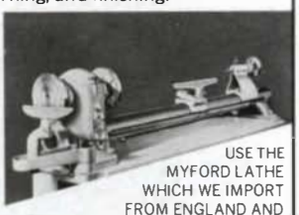

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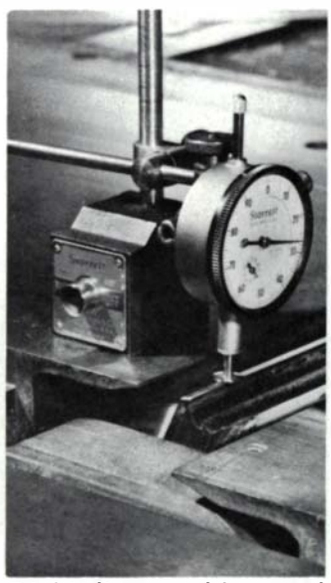
Troubleshooting the jointer—*We have a vintage Faye and Egan jointer in our shop and we can't get this machine to cut a true edge without setting it up in a way that seems cockeyed to me. The outfeed table has a lever that allows its plane to be varied from that of the infeed table. To get a straight cut, we have to angle the outfeed downhill, away from the infeed side. If we don't do this, we get boards that have convex edges. We've tried everything. Can you help?* —*Patrick Hughes, Oxford, Iowa*

I've got a Sears jointer with a non-adjustable outfeed table, so I've carefully set the arc of the knives flush with the table and I apply pressure to the board on the outfeed side only. But no matter what I do, I end up with boards tapered in width. The only way I can get close to a true edge is by alternating the board end for end. From what I've read, jointer operation shouldn't be so difficult.

—*Joseph Majewski, Rindge, N.H.*

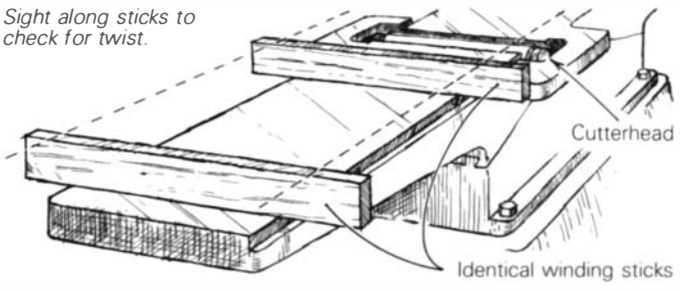
RICH PREISS REPLIES: When the jointer won't cut straight, setting it right can be a frustrating experience, particularly when you consider that its few moving parts make the jointer one of the simplest machines in the shop. Maladjustments usually cause jointers to misbehave, but the problem can be subtle. Adjust the fence so that the jointed edge is square, then check for straightness by sighting along the jointed edge. Concavity and snipe (a slight increase in depth of cut in the final inch or two) are caused by an outfeed table that is too low in relation to the knives. A convex or tapered edge indicates that the outfeed is too high. You can check for taper by using a marking gauge to scribe a line parallel to a known true edge and perhaps ¼ in. from the test edge of the board. Then join down to this line and see if the cut still remains parallel. Four or five passes may be needed for this test.

If these basic adjustments don't help, the machine should get a thorough going-over. Before you start, make sure the jointer is level and not rocking on its base. Begin by freeing up the locks that hold the tables in position—if they are too tight, they can distort the machine's castings. When you reset them, they should be just tight enough to lock the table in place and no tighter. Also, check the feed screws which raise and lower the tables. If they bind, the tables can distort. If a dial indicator and base is available, use it to check that the horizontal axis of the cutterhead is parallel to the plane of the outfeed table by resting the indicator's foot on the cutterhead cylinder. A runout of less than 0.003 in. is acceptable; if it's more, the outfeed ways may have to be shimmed with machinists' shim stock. The infeed table should also be checked. Similarly, the indicator can be used to set the knives, as in the photo at right, by resting the foot on the knives instead of on the cylinder. You need a good straightedge for setting up a jointer. If you don't have one, a scrap from a metalworking shop cutting



Dial indicator and base, used to set jointer-knife height.

shear will work fine. Use the straightedge to test each table for hollows and warps. With the straightedge lengthwise along both tables, check to see if they are in the same plane. Make up a pair of wooden winding sticks as in the drawing below to check the tables for twist.



If you find a warp or twist, you may be able to use shim stock in the ways to distort the casting into alignment. If not, the only alternative may be to have the table ground flat by a well-equipped machine shop.

Use the straightedge to test the fence for straightness and flatness. If the casting is bent, it can sometimes be straightened by supporting it, crown up, off the floor between two blocks. Apply weight by standing on it until the metal just gives, pushing the fence to where it should be. If it's twisted, clamp one end in a vise and apply pressure in the right direction until you feel it give. Don't force it further and don't hammer on it, or you could break the casting.

For accurate cutting, the arc of the jointer knives must align with or be slightly above the plane of the outfeed table—many manufacturers recommend setting the knives 0.002 in. above the outfeed. Use a 12-in. straightedge or a dial indicator placed on the outfeed table for this setting. Unplug the machine and rotate the cutterhead by hand with the knives snugged but not tightened in place. When properly set, they should just touch the straightedge tangentially as they are rotated through the arc. Contact between knife and straightedge should be consistent on both edges of the outfeed table. This setting is particularly critical on jointers without adjustable outfeed tables because if you don't get it right, you have no other recourse.

If the jointer checks out on all these points, make sure the knives are sharp. Dull knives can cause hardwoods to ride up during jointing and a taper will result. Finally, check the cutterhead bearings and shaft; these could be worn or out of alignment, particularly in older machines which have babbitt bearings. Rebabbitting or new bearings and/or a new cutterhead may then be the only solution. [Rich Preiss runs the woodworking shop at the University of North Carolina at Charlotte. For more on jointers see *FWW* #13, p. 50; #19, p. 92; #23, p. 19; and #30, p. 72.]

Making torsion-box doors—*I enjoyed Ian Kirby's article on torsion boxes* (FWW *#32) and plan to use this method to make four curved doors for a Sheraton sideboard. Should I use pine for the torsion box cores or a hardwood? I want to skin the boxes with* $\frac{1}{16}$*-in. basswood plywood and then veneer that with mahogany.*

—Vincent J. Picarello, Mount Vernon, N.Y.

IAN J. KIRBY REPLIES: Use a mild-working hardwood such as Honduras mahogany, basswood or butternut for the core, and keep the core members rather thin in section, say, ½ in. maxi-

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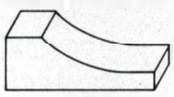

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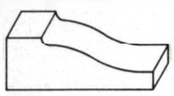

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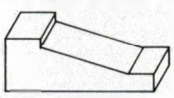

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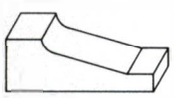

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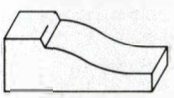

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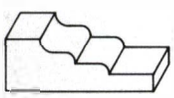

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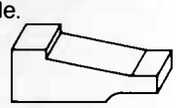

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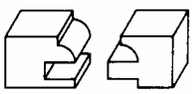

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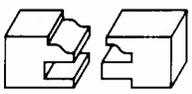

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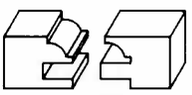

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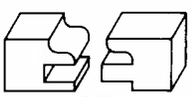

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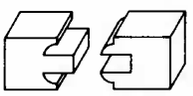

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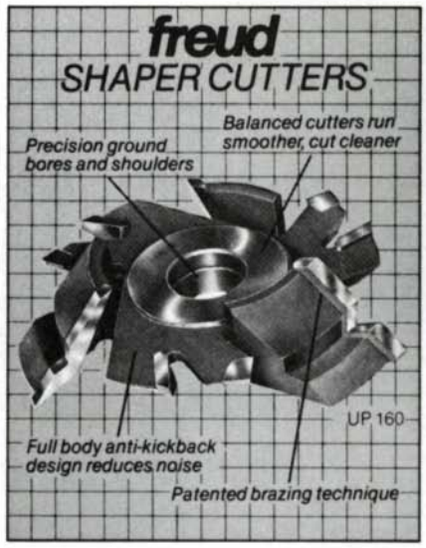

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mum. For a 1/16-in. thick skin, the voids in the core should be no larger than 3 in. on centers. Veneer the basswood plywood before you skin the core, as it will be easier to apply when the plywood is flat. [Ian J. Kirby is a cabinetmaker and teacher in North Bennington, Vt.]

Matching old stains and finishes—*In* FWW *#33, Robert Mussey wrote about old finishes and how they were made. When I make furniture repairs, I match the old wood in color, grain and texture, but I find it difficult to stain this new wood to match because some of the old finish around the patch gets disturbed. When you are matching stain, how do you confine the stain to the patch?*

—Rick Ludwick, Libertytown, Md.

ROBERT MUSSEY REPLIES: Touching up stain in repairs is an art, and there can be many solutions to one problem. The biggest trick in stain-matching is starting out with a stain as light as the lightest color present in the original wood. Then use artists' brushes to add the necessary detail and shading to make your repair match the old finish. Frequently, you don't have to disturb the finish around a new patch. Put several coats of wax on the old finish around the patch, let in the patch and trim it flush with a sharp plane or chisel. Sometimes you can even stain or dye the repair before you put it in. After the stain is dry, wet the patch with naptha or paint thinner to get an idea of how it will look when finish is applied. Play around with samples first before you glue the patch in. Stains and finishes can also be applied with great control using an artists' airbrush. The finish should be thinned, and the tip and nozzle of the brush adjusted very fine. Keep the brush moving so you don't get blotches. When the stain is dry, check your match by wetting with naptha.

Sometimes blending the repair into a larger area makes protecting the old finish less critical. Shading lacquers or tinted shellac can be sprayed along a line extending through the patch. Final selective sanding or rubbing with steel wool will help match the sheen of the new finish to that of the old. Easy does it—you don't want to sand through the repaired finish. The flatter the sheen of the overall finish, the easier it is to make a patch blend in.

There are no hard and fast rules; just practice and don't be afraid to try everything under the sun. [Robert Mussey heads the furniture conservation shop at the Society for Preservation of New England Antiquities in Boston.]

Veneering with crotch mahogany—*I have ten sheets of bookmatched crotch mahogany veneer—just enough to do a job I have in mind. The dark part of this veneer is extremely porous, and when you hold it up to the light, you can see right through it. I plan to use plastic resin glue to attach this veneer to a plywood core, but I'm worried that the glue will seep through the pores, causing finishing and staining problems later on. Could I avoid this problem by using contact cement? Also, should I apply glue to the core only or to both core and veneer?*

—N.J. Gillespie, Toronto, Ont.

TAGE FRID REPLIES: The dark part of the veneer is end grain, and if you use plastic resin glue or any urea-formaldehyde adhesive, it should have no effect on the finish. Apply glue only to the core; if you put it on the veneer, it will roll up like a scroll before you can get it set up in the press. Crotch veneer will eventually crack, but you can postpone that by applying

size—a very thin coat of glue—after the veneer has been glued to the core. The right mixture for size calls for experimentation, but start with one part hide or animal glue to two parts hot water. Scrape or sand the veneer and then rub in the size with the palm of your hand, removing any excess glue. After the glue dries, lightly scrape or sand it again.

I don't recommend contact cement for veneering. It fails, and when it does it's difficult or impossible to repair. [Tage Frid is a retired cabinetmaker and teacher.]

Revitalizing dried-out walnut furniture—*I have a fine set of walnut dining furniture, but much to my dismay it has aged considerably in the 3½ years I've owned it. The wood, which I treat with lemon oil, appears dried out and lighter than it did when it was new. How can I return it to its original color?*

—Susan Melwing, Bourbonnais, Ill.

OTTO HEUER REPLIES: I suggest that you remove some of the finish in an out-of-the-way place, such as inside a chair leg, with fine steel wool. Then apply an antique or Danish oil such as Watco, which can be colored to your liking with oil-based tints sold in tubes at paint stores. If this method restores the color, you may wish to treat the entire surface after removing the old finish or having it commercially removed. Incidentally, lemon oil polishes are somewhat like the famous pork and beans, that is, mostly beans and little pork. Typically, these products are very light mineral oil in a petroleum base with 0.4% to 2% synthetic lemon oil. The lemon oil is there only as a perfume, and it has little beneficial effect on the finish. [Otto Heuer is a chemist and consultant specializing in wood finishes.]

What to do with moldy wood—*I put some red oak and white ash split logs in a tank of water over the summer for use in making green wood chairs during the winter. When I uncovered the logs in the fall, the tank was a gelatinous mass of mold smelling like ripe cheese. My guess is that this mold feeds on the sugars of the inner bark, but can it destroy the strength of the wood fibers? The wood has naturally absorbed a lot of water, but apart from the odor, is there any reason to discard it?*

—Douglas Reed, Argyle, N.Y.

R. BRUCE HOADLEY REPLIES: I suspect you will find some severe surface discoloration and staining, but I wouldn't predict how deep it has penetrated. I'd simply carve or split a few pieces to find out. If the discoloration is only superficial, chances are the rest of the wood is okay. But any deep internal discoloration may indicate the early stages of decay which can significantly affect toughness and impact strength, important factors in selecting wood for chairs.

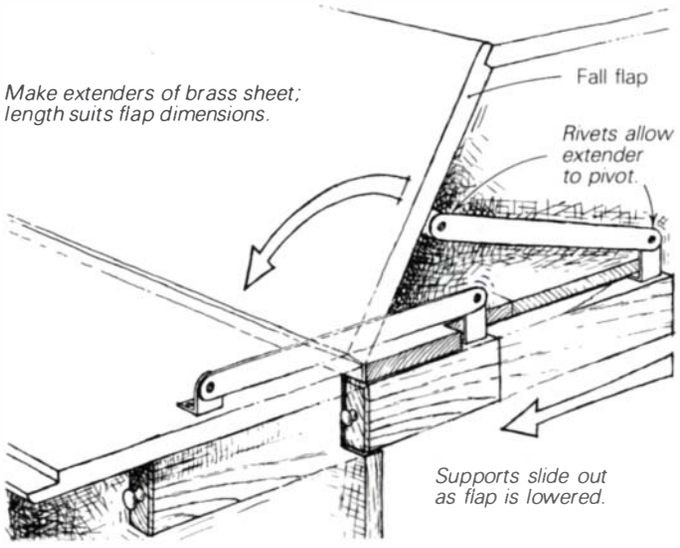
How well fungi grow in submerged wood is dependent on the interrelationship between oxygen and moisture. If the wood is dead green when immersed, there may be too little oxygen for much development, especially in oak. But ash is more likely to have a low moisture content and thus more air to support fungal growth. In addition to fungi, various bacterial discolorations may also occur under deadwater conditions. Red oak and white ash have little in the way of fungi-resisting extractives, so the wood, especially the sapwood, is a very suitable food supply, and summer temperatures are ideal for rapid fungal growth. Commercial fungicides are available from logging and sawmill supply houses, and though they will prevent fungus formation, they usually aren't sold in

small enough quantities to be useful to woodworkers. [R. Bruce Hoadley is a wood technologist at the University of Massachusetts at Amherst.]

Follow-up:

Re Steve Zanki's request for automatic fall flap supports that extend when the flap is lowered (*FWW* #33, p. 30). I've seen this method (drawing below) used on a number of pieces that I have repaired in my shop. I don't know of a supply source for these, but they can easily be made of sheet brass or steel, fastened with rivets.

—W.J. Given, Foley, Ala.



Readers Want to Know:

. . . I'd like to correspond with readers who make their own hardware, such as hinges, locks and pulls, particularly out of brass. *—Rick Levine, Binghamton, N.Y.*

. . . I'd like to know about building wooden caskets, plain and fine. Does anyone know of any books or articles on the subject? *—Duane R. Doane, McAlester, Okla.*

. . . Installing jointer knives usually takes me half a day or more. I'd appreciate any quick tips your readers may have. *—Paul L. Jones, San Diego, Calif.*

. . . Does anyone know the origin of the popular name for shedua (*Guibourtia ehie*), a hardwood exported from the Ivory Coast of Africa? *—R. Bruce Hoadley, Amherst, Mass.*

Readers Can't Find:

. . . a product called French red liquid for finishing gun stocks and walnut furniture. *—Robert Parkin, Huntington, N.Y.*

. . . a cutterhead to mount shaper knives made by Jet Tool Co. of Lemon Grove, Calif. *—Henry J. Schatmeier, Clearlake Oaks, Calif.*

Sources of Supply:

—A good selection of specialty furniture hardware and moldings is available from Faneuil Furniture Hardware, 94 Peterboro St., Boston, Mass. 02215. *—W.J. Given, Foley, Ala.*

—Custom-made carbide-tipped router bits of various shapes and sizes can be bought from Fred M. Velepec, 71-72 70th St., Glendale, N.Y. 11385.

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

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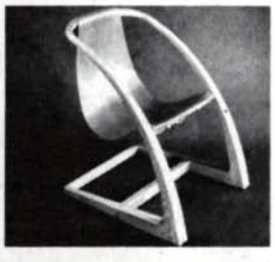

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Ian Kirby, Furniture designer and maker, author and educator. Consulting Editor to *Fine Woodworking*, Director of Kirby Studios, a woodworking studio and school of furniture design and furniture making, North Bennington, Vermont.

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Books

The Furniture of Gustav Stickley by Joseph J. Bavaro and Thomas L. Mossman. *Van Nostrand Reinhold Company, 135 West 50th St., New York, N.Y. 10020, 1982. $18.95, cloth; 175 pp.*

The Craftsman furniture made by Gustav Stickley in the early years of this century is an ideal source of models for home craftsmen looking to practice basic woodworking. Characterized by simple lines in solid wood, most of it decorated only with exposed joinery, this is remarkably contemporary furniture, easy to live with and straightforward to build. And this was Stickley's aim. More than to sell Craftsman furniture, Stickley wanted to promote a Craftsman style of life, in which people would find immutable value in homes and furniture that they built themselves. "When we come to make things ourselves and because they are needed," he wrote, "instead of depending upon the department store to furnish them, we shall not only find more pleasure in making them, but we shall also take more pleasure in possessing them."

This book reflects that philosophy. First there is a short history of the cultural context that influenced Stickley and that he in turn helped shape, a profile of Stickley's life, and a critical description of the Craftsman style. There follows a gallery of Stickley furniture, well photographed and suitably inspiring. Third is a chapter entitled "Materials and Methods," which in thirty pages is good, basic, technical talk, providing general instruction for making furniture in Stickley's style. Stickley himself is quoted at length in this section, explaining his preference for quartersawn oak and his recipe for fuming it. The fourth section of the book details nine projects, complete with measured drawings, materials lists, sequential instructions and photographs of the pieces, both in progress and completed. It's a good selection of practical and attractive furniture, projects right for weekend woodworking. If you're uninspired by all the 18th-century plans on the market, give this stuff a try. *—Rick Mastelli*

America's Wooden Age: Aspects of Its Early Technology edited by Brooke Hindle. *Sleepy Hollow Restorations, Tarrytown, N.Y. 10591, 1975. $15.00, cloth; 218 pp.*

Material Culture of the Wooden Age edited by Brooke Hindle. *Sleepy Hollow Press, Tarrytown, N.Y. 10591, 1981. $22.50, cloth; 394 pp.*

Technologies that develop during periods of rapid change are apt to be poorly documented. How many woodworkers know anything about American lumbering, building and industrial practices during the years between the landing of the Pilgrims and the Civil War—the final flowering of the centuries-old Wooden Age? *America's Wooden Age* and *Material Culture of the Wooden Age* go a long way toward filling this void. These two books are anthologies of historical essays—products of the recent upsurge of interest in industrial archaeology, vernacular architecture and the history of technology. Together they provide an excellent introduction to a long-neglected subject: the primacy of wood and woodworkers in pre-industrial and early industrial America.

The stage is set in *America's Wooden Age* by an account of "The Forest Society of New England" in the 17th century, and with an informative, amusing pictorial essay about early lumbering. Background in *Material Culture* is provided by

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Model: 8419-B2

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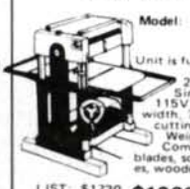
9924DB/9381 LIST: $206 **$149.99 ppd.**

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.

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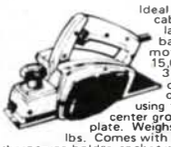

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Model: F-1000A

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.

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Model: P-100

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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.

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Model: TR-12

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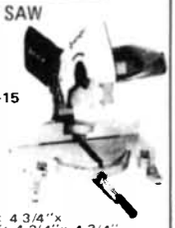

Model: TSB-15

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.

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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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JHV 60 Compact, light weight. Wt. 5.2 lbs. **$129.99 ppd.**

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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.

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Model: JSE-35

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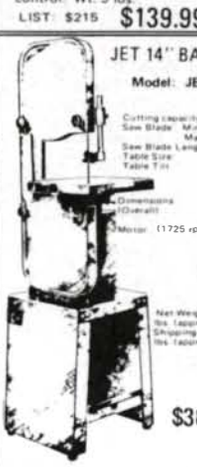

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an essay called "Wood on the Farm." Then there are comprehensive treatments of such familiar subjects as wooden watermills and the evolution of woodworking machinery (in the first volume), and shipbuilding and timber framing of houses and early factories (in the sequel).

Both volumes are rounded out with stories of a variety of forgotten wood crafts and craftsmen. In *Wooden Age* we learn about the makers of mathematical instruments—precision wooden tools for navigation, surveying, astronomy and the sciences. *Material Culture* tells how the transportation industries relied upon wood as a material as well as a fuel. The early woodburning locomotives had wooden frames and even wooden brake shoes. They pulled wooden cars over a roadbed itself made almost entirely of wood: ½-in. thick iron straps capped wooden rails wedged into gains in wooden ties, which in turn rested on wooden mud-sills, trestles and bridges. Early engineers and bridge-builders are brought to life in an account of the most famous of covered bridges, the "Colossus of Philadelphia," a 340-ft. single-arch span over the Schuylkill River that was completed in 1812. For overland travel, wooden roads provided an inexpensive though shortlived alternative to paving.

Another forgotten use of wood is in the by-products industry, dealt with in *Material Culture* by way of accounts of the potash trade, which provided the alkali necessary for the manufacture of soap, glass and gunpowder, and of the naval stores industry, producers of pitch, tar, gum, rosin and turpentine for maritime interests and for the growing paint and chemical businesses.

Finally, there are the stories of the survivors—tales of the persistence of wood-based technologies well into the Machine Age, exemplified by "Waterpower in the Century of the Steam Engine" in *Wooden Age,* and in *Material Culture* by an amazing account of the charcoal-fired blast furnaces which competed with fossil-fuel smelters until the beginning of the 20th century. Done in by cheap and reliable open-hearth steel, they rose phoenixlike in the guise of the wood chemicals industry, continuing to produce acetone, creosote, methanol, and pig iron until the end of the Second World War.

Introductions by the editor tie all these threads together in each volume, highlighting social, cultural and geographic circumstances to complement the material and economic emphases in the individual essays.

Each reader will find favorites among the essays. In *Wooden Age* I am partial to Nathan Rosenberg's account of America's pioneering development of woodworking machinery, ranging from the first sawmills, planers and power saws, right through such highly evolved wooden machines as Thomas Blanchard's lathe for turning gunstocks, shoe lasts, oars and all manner of irregular shapes. As a housewright, I went right to Dell Upton's essay in *Material Culture* on the history of traditional timber-framing, and found it the best short treatment I have read of the ancient carpenters' art, especially praiseworthy for its description of the ethnic basis of regional framing styles.

While the authors are almost all academics, their writing hasn't suffered too much for it. The essays are well constructed and easy to read, albeit dry here and there. Footnotes are extensive and illustrations are plentiful. These authors represent a new breed of scholar who spends time in the field and shop as well as in the library. Some, I suspect, even have calluses on their hands. *—Ed Levin*

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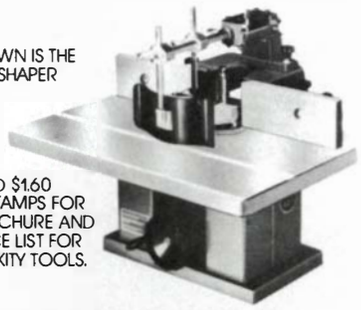

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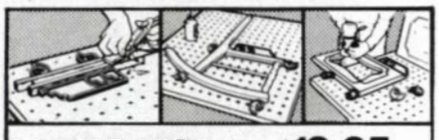

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THE GREAT HOT TUB ESCAPE

BY CHRIS PETERSON

It was late last summer and it had been one of those days in the shop. Not only had I broken three jigsaw blades and two drill bits, but the bearing in my belt sander was squawking. Fortunately, I had just finished the hot tub.

I've been making hot tubs for about five years. When I first started selling the tubs at the weekend craft market, people had no idea what to do with them. Amid looks of puzzlement and general awe, I explained all there was to appreciate about these marvelous contraptions—that the tubs are made from clear 2x6 Western red cedar, that the side boards are called staves and are beveled to form a circle, and that the staves, along with the floor boards, are all splined together. The whole mess is then banded together with iron hoops. When the lucky owner finally fills the tub with hot water (to parboil various bodies into a state of mindless ecstasy), the wood swells and closes any leaks. Simple.

The tub I had just finished was the most popular size, 5 ft. in diameter and 4 ft. deep. With five benches, it was big enough for a good party. As I rolled the tub into the Blue Whale (my pickup truck), I thought how good that cold beer was going to taste after I had delivered the tub to its proud new owner. Up went the tailgate, the tub was securely wedged in place, and off I drove.

It took a while to cross busy Willamette St. Then I headed up the hill of 19th St. Halfway up the hill I heard a sound that made my heart skip. The tailgate—which I was sure I had slammed shut—had come open. In the rearview mirror I could see the tub gently rocking on the edge. With excruciating care I coasted toward the curb. But slowly, very slowly, as I watched in the mirror, the tub went out the back, bounced, and started down the hill.

I slammed on the parking brake, jumped out the door and started running after the tub. It was gaining more momentum every second. As I picked up speed myself, a peculiar thought came to me. Would my builder's insurance or my auto insurance cover the costs if the tub were to smash a car on Willamette St.? Fortunately, I caught up with the escaped tub and ran in front of it, fully expecting to bring it to a halt by extending my arms. It didn't take long for me to realize that I'd be squashed flat before I stopped anything. Prudently, I jumped out of the way. As the tub rumbled past, I put my shoulder to it, and deflected its movement toward the curb. The tub ascended the curb, hesitated on one edge and flopped over, right side up. It stopped. I couldn't believe it. Neither could the owner of the lawn it ended up on.

I was invited over to take a long, leisurely soak in that tub the other day. It's doing just fine. After I healed its wounds with a bit of sandpaper, the tub was as good as new. And I was right, that beer was the best I ever had. □

Chris Peterson runs Great Western Woodworks in Eugene, Ore. 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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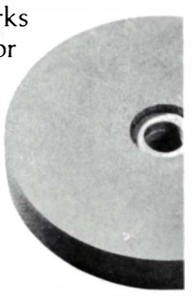

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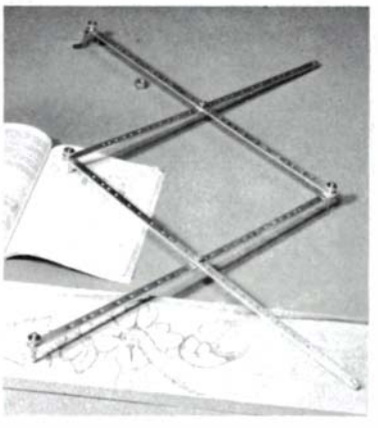

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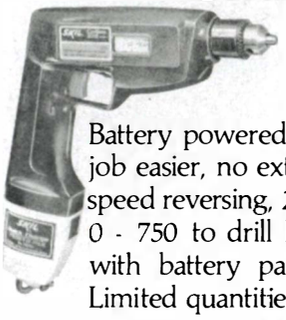

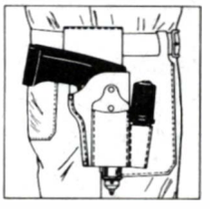

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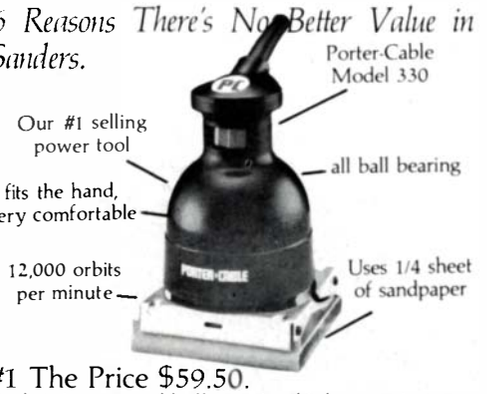

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"Work in Progress" in Sonoma

BY MICHAEL PEARCE

From toothpicks to furniture. . .we all live with wood. Yet most people don't know what goes into working it. The "Work in Progress" show last Memorial Day weekend at Artisan Woodworkers in Sonoma, Calif., was a well-received attempt to bring the general public behind-the-scenes of everyday woodworking. The show gave professionals and non-professionals a chance to see—and to try their hand at—some unusual woodworking techniques. Exhibits ranged from a display showing the stages in the manufacture of clothespins and pencils, to the plywood skeleton of an aerobatic biplane.

Ted Chase, right, talks shoji.

The most engaging exhibits were those with woodworkers demonstrating their skills and fielding questions. Ted Chase, of Concord, Calif., showed how he makes Japanese shoji, and explained his ideas about their application to Western architecture. John Coonen sat at a shaving horse and stripped the crooked branches that go into his rustic furniture. Coonen also demonstrated the use of a hollow auger and brace, with which he cuts the tenons for chair legs and stretchers.

Probably the most popular exhibit was Cong Huy Vo's demonstration of Vietnamese planecraft (*FWW* #33, p. 96). Making a small oak table, Cong would alternate between shaping an apron with one of his molding planes, or cutting a miter joint with a hidden tenon, and supervising those who cared to try out one of his planes on a spare stick of mahogany. "Cong had three kids standing up there a while ago, each one with a plane," John Ward told me. "He doesn't seem to be too nervous about his tools."

Ward, who started Artisan Woodworkers two years ago (*FWW* #32, p. 84), began the tradition of an annual exhibition last year with a show of finished pieces, "Designs Among Friends." Though he managed this year to hustle some contributions from his suppliers, the show cost him $5000, a loss he figures he recovers in publicity, good will and his own satisfaction in putting it together.

The Artisan Woodworkers shop itself provided the most complete exhibition of "everyday" woodworking. Besides the machines, benches, jigs and tools, there were several works in progress around the shop. These included a 4½-ft. high pecan stand that Ward is building to hold the ceremonial drum at a local zen center, and a large set of custom cabinets, with working drawings on the wall behind.

The message of the show—that woodworking is not merely a finished product, but people, skills and materials that are accessible to anyone—was conveyed very well. As woodworkers, we would do well to provide more opportunities like this to bring the doings of our trade to those who usually see only the results. □

Michael Pearce builds furniture in San Francisco.

Events

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

ARIZONA: **Workshop**—Carved doors, ornamental carving, Wayne Hawthorne, Sept. 6-Oct. 15; joints & joinery, Kerry Gordon, Oct. 25-Dec. 6. Write Registrar, Cosanti Foundation, 6433 Doubletree Rd., Scottsdale, 85253.

ARKANSAS: **Exhibitions**—Decorative arts, functional and sculpture, Sept. 17-Nov. 14; toys designed by artists, Dec. 3-Jan. 2. Entry deadline, Nov. 5. Townsend Wolfe, Arkansas Art Center, Box 2137, Little Rock, 72203.

CALIFORNIA: **Wood Show**—Western States Invit., Sept. 18-Oct. 31. Gallery Fair, Kasten & Ukiah St., Mendocino.
Show—Sculptural expressions in contemporary furnishings, Aug. 4-Sept. 3. Flood Gallery, 3921 California St., San Francisco, 94118.
Workshop—1st Western Turning Conference, Leo Doyle, David Ellsworth, Bruce Mitchell, Jerry Glaser, Del Stubbs, Merryll Saylan, Sept. 24-26. California College of Arts and Crafts, 5212 Broadway, Oakland, 94618. Contact Ellen Jouret, (415) 653-8118.
Workshop—Design and operation of circular and bandsaws, Sept. 20-24; Seventh Internat'l Wood Machining Seminar, Oct. 18-20. Univ. of Cal. extension, 47th & Hoffman Blvd., Richmond, 94804. To enroll call Dr. R. Szymani, (415) 231-9582.
Exhibition—Far Eastern lacquers. Permanent installation, Oct. 14; expressionist sculpture, through Sept. 18. Los Angeles County Museum of Art, 5905 Wilshire Blvd., Los Angeles, 90036. (213) 937-4250.

Lecture—James Krenov, Oct. 15; workshop, Oct. 16. Contact San Diego Fine Woodworking Assoc., Box 99656, San Diego, 92109.
Seminars—Traditional Japanese craftsman and his tools, Toshio Odate, Sept. 24-26 (Los Angeles), Nov. 5-7 (San Diego), Nov. 19-21 (Berkeley); chairmaking, John and Carolyn Grew-Sheridan, Oct. 23-24 (Berkeley), limited enrollment, reservations required; joinery, James Krenov, Oct. 29-30, (Berkeley), Nov. 19-20 (Los Angeles). The Cutting Edge. Berkeley: (415) 548-6011; Los Angeles: (213) 390-9723; San Diego: (714) 695-3990.

CONNECTICUT: **Workshops**—Simon Watts, Sept. 18-19; Alphonse Mattia, Oct. 2-3; Bob March, Oct. 16-17; Albert LeCoff & Giles Gilson, Nov. 6-7; John Marcoux, Nov. 13-14. Brookfield Craft Center, Box 122, Brookfield, 06804. (203) 775-4526.

WASHINGTON, D.C.: **Juried Exhibition**—Washington craft show and sale, May 5-8, 1983. Deadline for slides Oct. 15, 1982. Write Women's Committee of the Smithsonian Assoc., Room 3101, Arts and Industries Bldg., Smithsonian Institution, Washington, D.C. 20560. (202) 357-4000.

ILLINOIS: **Trade show**—Excellence in Woodworking/East—Woodworking tools, machines, equipment, Hyatt Regency, Chicago, Nov. 12-14. Write Marvin Park Assoc., 600 Talcott Rd., Park Ridge, 60068.

IOWA: **Crafts Exposition**—Pioneer Exposition of Arts and Crafts, Sept. 2-5, 106 Navajo, Council Bluffs, 51501.

MARYLAND: **Exhibition**—Wildfowl carving, Oct. 8-10, Wicomico Civic Center. Contact K. Bartrug, 707 E. Shore Dr., Salisbury, 21801.

MASSACHUSETTS: **Workshop**—Harvesting wood, Robert Sperber, Oct. 8. Worcester Craft Center, 25 Sagamore Rd., Worcester, 01605.
Craft fair—Old Sturbridge Village, Nov. 6-7.
Exhibition—Work by Seth Stem, Gary Wright, others. Sept. 1-Oct. 10, Society of Arts and Crafts, 175 Newbury St., Boston, 02116.
Show—Bowls, tables, ceramics, jewelry, clothing by Michelle and David Holzapfel; November. Ten Arrow, Cambridge. (617) 876-1117.

MISSOURI: **Seminar**—Preparation of stock and joinery, Ian Kirby, Nov. 5-7. Contact Cheryl Hays, Fine Tool and Wood Store. (405) 842-6828 or (800) 255-9800.
Exhibition—Multimedia baskets, Sept. 5-Nov. 3. Craft Alliance, 6640 Delmar Blvd., St. Louis, 63130. (314) 725-1151.

NEW HAMPSHIRE: **Workshops**—Japanese planes, Sept. 18; sharpening, Sept. 25; Japanese woodworking tools, Oct. 2-3, with Robert Major. Mahogany Masterpieces, RFD 1, Wing Rd., Suncook, 03275. (603) 736-8227.
Seminar—Applications available Sept. 1 for Seminar '83, Jan. 11-13. League of New Hampshire Craftsmen, 205 N. Main St., Concord, 03301. (603) 224-3375.

NEW JERSEY: **Seminar**—Originals, reproductions and restoration, with Robert Whitley, Oct. 13. Hunterdon Central HS, Flemington. Contact Ed Ciurczak, (201) 236-2708.
Workshops—A number of crafts workshops, including Wendell Castle, Oct. 2; How to do woodworking with kids, Rich Starr, Oct. 9; traditional chairmaking, Peter Touhey, Oct. 16. Contact Sherrie Posternak, Peters Valley, Layton, 07851. (201) 948-5200.

NEW MEXICO: **Show**—Once a Tree, Sept. 3-8, La Fonda Hotel, Santa Fe.

NEW YORK: **Crafts fair**—Demonstrations of timber frame joinery, green woodworking, furnituremaking, Japanese tools. Ed Levin, Peter Touhey, Robert Meadow, others. Sept. 3-6. Ulster County Fairgrounds, New Paltz.
Trade Show—Excellence in Woodworking/East—Woodworking tools, machines, equipment, Oct. 15-17, Madison Sq. Garden, NYC. Write Marvin Park Assoc., 600 Talcott Rd., Park Ridge, Ill., 60068.
Workshop—Japanese tools, subscription series: Sept. 25-26, Oct. 23-24, Nov. 20-21; veneer sawing and application, Oct. 2-3. Contact Robert Meadow at the Luthierie, 2449 W. Saugerties Rd., Saugerties. (914) 246-5207.
Courses—all levels, by Maurice Fraser. Begin week of Sept. 13, 15 sessions each; demonstration: traditional mortise-and-tenon making, Sept. 14, free. Craft Student's League of YWCA, 610 Lexington Ave. at 53rd, New York, 10022. (212) 755-2700.

NORTH CAROLINA: **Workshop**—Timber frame construction, Ed Levin, Nov. 2-6. Contact Bill Asherp, Box 955, Black Mountain, 28711. (704) 669-5214 on weekends.
Courses—Blacksmithing, Mark Bokenkamp, Sept. 5-11; Peter Ross, Sept. 12-18; woodcarving, Helen Gibson, and refinishing and restoring furniture, James Kroeplin, Sept. 5-18. Write The John C. Campbell Folk School, Brasstown, 28902.

OHIO: **Demonstration**—Timber frame raising, Sept. 11, Yankee Peddler Festival, Clay's Park Resort, Canal Fulton. For information, contact Betty Cajka, 4046 State Rd., Medina, 44256. (216) 239-2554.
Exhibition—Marietta College Crafts and Sculpture, Oct. 30-Nov. 28. Slides due Sept. 11. Write MCCN '82, Arthur Howard Winer, Marietta College, 45750.
Exhibition/Sale—Artistry-in-Wood, Sept. 11-12, Dayton Convention Center. Contact Betsy Williams, 2731 Springmont Ave., Dayton, 45420. (513) 256-4295.

OKLAHOMA: **Seminar**—Carcase and drawermaking, Ian Kirby, Oct. 1-3, Fine Tool and Wood Store, 7923 North May Ave., Oklahoma City, 73120. Contact Cheryl Hays, (405) 842-6828.

OREGON: **Show**—Curtis Erpelding, Oct. 21-Nov. 23, Hoffman Gallery, Ore. School of Arts and Crafts, 8245 S.W. Barnes Rd., Portland.
Exhibition—Northwest Furniture Makers, Oct. 15-17. Western Forestry Center, 4033 S.W. Canyon Rd., Portland, 97221. (503) 228-1367.

PENNSYLVANIA: **Arts and Crafts Expo**—Pittsburgh Convention Center, Nov. 26-28. Slide deadline Sept. 8. Scott Rubinstein, Quail Hollow Events, Box 437B, Woodstock, NY 12498. (914) 679-8087.
Show—Yorkarvers woodcarving and decoys. Oct. 2-3, York College. York, 17402.
Courses/Seminars— Amaranth Gallery and Workshop, beginning Sept. Musical instruments, Nov. 13-14. Write John Basinski, 4101 Lauriston St., Phila., 19128. (215) 483-5400.
Workshop—Silas Kopf, marquetry, veneer and inlay, Sept. 25-26. Slide lecture, historical and contemporary use of marquetry, Sept. 24, Society of Philadelphia woodworkers. Contact Larimore/Ingram Workshop, 1102 E. Columbia, Phila., 19125. (215) 739-7253.

TENNESSEE: **Conferences**—Wood, paper, fiber, clay, metal, more, Oct. 6-9. Write Arrowmont School, Box 567, Gatlinburg, 37738.
Craft Fairs—About fifty arts and crafts fairs, (some local, some statewide) at various locations and times, through Dec. For entry information, contact Tennessee Arts Commission, 505 Deaderick, Suite 1700, Nashville, 37219. (615) 741-1701.

WASHINGTON: **Program**—Boatbuilding, beginning Oct. '82. Write The Northwest School of Wooden Boatbuilding, 330 Tenth St., Port Townsend, 98388. (203) 385-4948.

WISCONSIN: **Craft Festival**—Workers in Wood, Sept. 3-5, Country Sunshine Campgrounds, Hwy. 42, Carlsville.

NOVA SCOTIA: **Courses**—Woodworking, with Jeff Amos, Leo McNeil, Rick Lair, Richard Tyner; drawing and design with Tom Klenck, begins last week of Sept. Contact Richard Tyner, 32 Edmonds Grounds, Halifax, B3N 1M6. (902) 477-3008.
Conference—Finishing, Oct. 22-24, Atlantic Woodworkers Assoc. Contact Larry Graham, 149 Nestor Crescent, Dartmouth B2W 4V6.
Seminar—Jointmaking and joinery, Ian Kirby, Oct. 29-31. Contact Nancy Taflin, Woodcraft Manufacturing Co., RR2 Armdale, Halifax County, B3L 4J2. (902) 434-6306.

ONTARIO: **Show**—"Do It Yourself," Oct. 14-17. Automotive Bldg., Exhibition Place, Toronto. Contact Ontario Marketing Productions Ltd., Suite 301, 69 Yorkville Ave., Toronto, Ontario M5R 1B7.
Show—"Four Workers in Wood," Art Shaw, Doug Oliver, John Kraai, and Chris Laffin, furniture. Aug. 28-Oct. 20. Upper Edge Gallery, 219 Princess St., Kingston.
Exhibition—6th Canadian Agricultural International Wood Carving Exhibition, Aug. 18-Sept. 6. Exhibition Place, Toronto.
Show—Winter's End (April '83), deadline for entry Aug. 31. Craft Show, 458 St. Clements Ave., Toronto M5N 1M1.

POWER TOOL SALE

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, dust hood, magnetic blade setting. Weight: 320 lbs.
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P-100 12⅛"" Planer, 3 hp, 15 amps, 110 volts, 10,400 rpm motor. All gear & chain drive (no belts), ⅛" depth of cut, 3/16" thru 6⅝" cutting height, 4 column support, chip blower, dust hood, magnetic blade setting system. Weight: 265 lbs. **Sale $1150 delivered.**

SB-110 Dustless Belt Sander, 4" x 24", 2 speed, 8.7 amps, 115 volts, 25 belts, **$205 ppd**

SB-75 Dustless Belt Sander, 3" x 21". 2 speed, 8.7 amps, 115 volts, 25 belts, **$140 ppd**

Router Trimmer TR6 1 hp, 30,000 rpm motor, 4 amps, 115 volts, ¼" collet **$95 ppd**

Router TR8 Plunge cutting, 1½ hp, 115 volts, 6.9 amps, 24,000 rpm, ¼ collet, **$130 ppd**

Router TR12 Plunge cutting, over 3.25 hp, 22,000 rpm. 115 volts, 12.2 amp., **$210 ppd**

SO-110 Finishing Sander 115 volts. 3.2 amps, 10,000 rpm motor, **$103 ppd.**

Planer F-20 A (hand planer) $95 ppd.

Super Drill DR-10 variable speed, reversible ⅜" key chuck side handle, speed control **$125 p**

Jig saw JHV-60 variable speed 0-3,200, stroke 1", 3.5 amp, 115 volt, capacity: **$125 ppd**

Circular Saws PSM-7 7½", maximum cutting depth 2-9/16" at 90°, 2" at 45°, 11 amp **$122 ppd**

B-600A 16"" Band Saw 3 hp, 1 or 3 phase 15 amp, 110/220 volts, 1050 rpm, 3" wide blade, will accept down to 1/16" blade, double trunion, safety hand break, rack & pinion fence, helper guide, improved blade guide with auxiliary four ball bearing guide system for perfect scroll work. Resaw to 12⅛", tilt 0 to 45°, weight: 340 lbs.
Sale $1450 ppd. $1699 ppd.

Freud SAW BLADES

Model	Diam.	Teeth	Arbor	Use	PPD. List/Sale
72 ME	10"	40	⅝"	All Purp.	$66/$44
73 MD	10"	60	⅝"	Cut Off	$76/$50
84 MD	10"	50	⅝"	Rip/Cross	$72/$50
71 MA	10"	18	⅝"	Rip	$61/$41
DADO 3	8"	18	⅝"	¼-13/16	$162/$122

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Greenlee brad point drills; have precision ground flutes that shave the inside of the hole smooth, a sharp brad point that prevents skating and two razor sharp cutting spurs keep holes extra clean. Made from the finest grade of high carbon steel, tempered for long life, designed for use in drill press or ⅜" portable drills. The set includes ⅛", 3/16", ¼", 5/16", ⅜", 7/16", ½" bits, all stop collars and protective pouch. **Sale $24**
Sizes 9/16", ⅝", ¾", ⅞" & 1" all have ⅜" shanks and are loose packed, cost **$44** both sets together **$55PPD.** **WHILE SUPPLY LASTS! ***

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Shank Diam.	Cutting Diam.	Cutting Length	Overall Length	Bit #	Price Ppd	
¼"	¼"	¾"	2¼"	1	$ 7	
¼"	¼"	1"	2½"	2	$ 8	
¼"	⅜"	¾"	1¾"	3	$ 8	
¼"	½"	¾"	1¾"	4	$ 8	
¼"	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.
½"	1" radius	1¼"	3¼"	17	$70	ROUND OVER BIT WITH B.B.
½"	½" radius	1"	2¾"	18	$37	ROUND OVER BIT WITH B.B.

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Makita

15⅝" Planer 2040 2hp 115 volt 6500 rpm motor; full cutting range: ¼" thru 7⅝"; 2 quick set knives; speed reducing kit; dust collector hood.
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Connections

In Connections, we'll publish membership calls for guild-style organizations, letters from authors compiling directories in which craftsmen might like to be listed, and appeals from readers with special interests looking for others who share them.

Woodworking schools: Early next year, *FWW* will list changes and additions to the school survey we printed in issue #26. The survey was compiled from questionnaires we sent to more than 600 schools across North America. If you were listed in that survey and there have been changes which people should know about, please let us know. If you were not listed and would like to be included in the update, contact us at The Taunton Press, Box 355, Newtown, Ct. 06470. We will send you a survey form that asks for the specific information we need.

Kentucky Woodworkers Guild is forming. Meeting will be held 3 p.m. on Sept. 11 at Unfinished Universe, 505 E. High St., Lexington 40508. (606) 252-3289.

Accepting applications for a series of mail-order crafts catalogs to be published the summer of '83. Juried by photos in 4 categories of handmade items: for children, for the home, to wear, and gifts under $50. Entry open to craftspeople in U.S. and Canada. Send legal-sized SASE to: Goodfellow Catalog Press, Box 4520, Berkeley, Calif. 94704, or call Christopher Weills, (415) 845-7645.

Retired piano workers: I'd like to interview piano workers (or relatives of) who were employed in piano factories before 1960, for a forthcoming book. Contact Richard K. Lieberman or Bruce Basking, (212) 626-8706, or write Community History Program, Fiorello H. LaGuardia Community College, 31-10 Thomson Ave., Long Island City, N.Y. 11101.

Old photos sought: I collect old photographs of men working around or with old woodworking equipment for my own personal enjoyment. Woodworking enthusiasts who share my pursuit, please contact Steve Schurman, Custom Furniture and Cabinetry, 8577 Copley Ct., Fair Oaks, Calif. 95628.

Directory of American Tool Makers: The Early American Industries Assoc. is gathering data to publish a listing of hand-tool makers from early colonial days to the present. You can obtain forms to list information about the makers marked on your tools from William Downes, 987 River Rd., Mystic, Conn. 06355. Any documentary information you can provide about where the makers lived, and when they made tools, will be useful too.

Column makers: I am looking for information about historic and contemporary methods of column construction (especially hollow-bored and hollow stave-built). I am writing an article, and would also like to list small shops as well as the large manufacturers. Write John Leeke, RR1, Box 847 Sanford, Maine 04073.

Job opportunities: As master cabinetmaker at Colonial Williamsburg, I meet many woodworkers looking for positions, but apprenticeships at the Anthony Hay Shop can't accommodate them all. Occasionally, I hear of a shop that needs a good man, and I'm able to match things up. It seems to me that more of this should be done, so I'm willing to compile and make available a list to help pair interested, qualified woodworkers with serious employment opportunities. Please write to me if you fit either category, and I'll do what I can. Wright Horne, Master Cabinetmaker, Colonial Williamsburg Foundation, Williamsburg, Va. 23185.

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WANTED—CABINETMAKER. Mature individual for small plant reproducing fine Early American furniture. To work, teach, make models and prototypes. Excellent opportunity. Plant located south central Pennsylvania. Forward resume to Box 66, Legacy Lane, Aspers, PA 17304.

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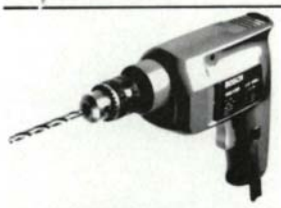

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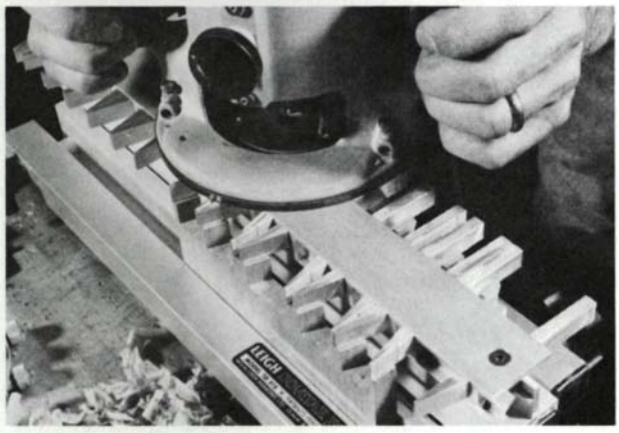

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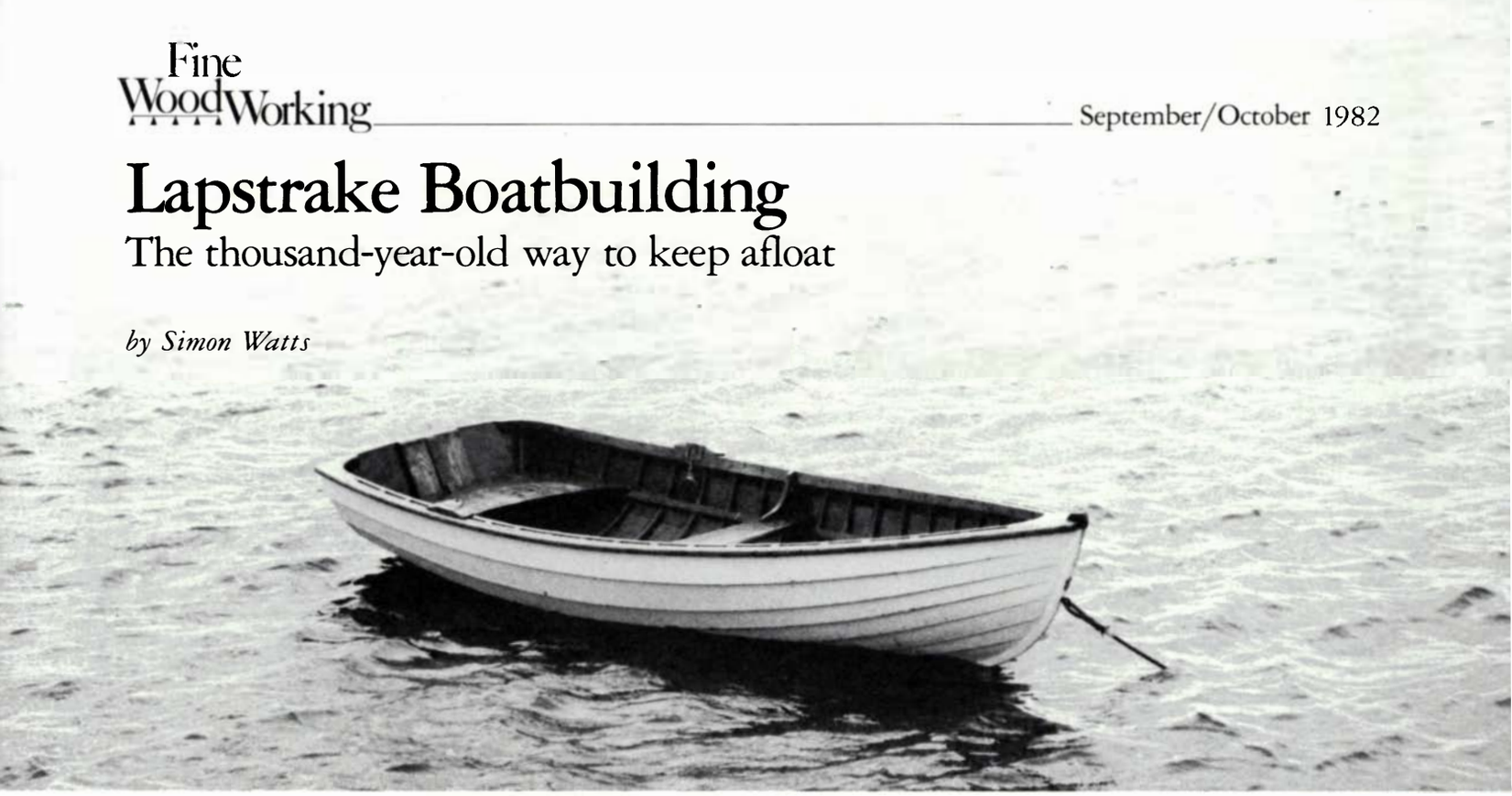
Fine WoodWorking September/October 1982

Lapstrake Boatbuilding

The thousand-year-old way to keep afloat

by Simon Watts

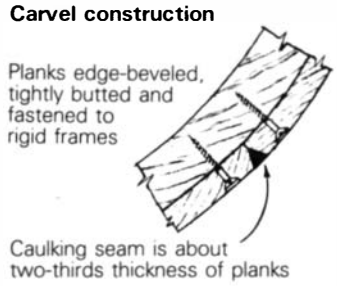


Although she came off no drawing board, centuries of boatbuilding experience went into the design of Sea Urchin, above, a 10-ft. rowing boat made by Nova Scotian Jim Smith in 1963. As did generations of builders before him, Smith knew that lapstrake makes strong, light hulls that withstand the rigors of time and sea. Pictured below is Slippen, an English lapstrake pilot gig built in 1837 and still in daily use out of England's Scilly Isles. Lapstrake's ease of construction makes it ideal for a first boat, and in a subsequent article Simon Watts will explain how to build the little Sea Urchin.

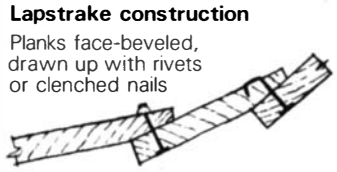
The objective of much woodworking is to wrap wood around a hollow space. If the space is angular, the job is straightforward enough. We simply plane the edges of straight boards, glue them up until they are big enough and join them at the corners. But suppose the volume to be enclosed is curved? As boatbuilders and coopers know, the job then becomes a tricky exercise in cutting and planing constantly changing bevels and curves. And if the joints are to be watertight, as they must be on boats and barrels, the bevels must match perfectly.

Over the centuries, two basic approaches to boatbuilding have evolved. One is to construct a skeleton first and then cover it with a skin of planks, plywood or steel plates. The other is to make a shell of wood, fiberglass or concrete, and then stiffen it with an internal structure. The first method—called carvel—is roughly analogous to the cabinetmaker edge-joining boards. Carvel boats are smooth inside and out, their planks lie tightly edge to edge, and they are fastened to a rigid framework within, so the shape of the boat is determined before any planks are hung. With the second method, known as lapstrake or clinker, it's the other way around. First the planks are bent into place around molds, then ribs are added to stiffen the structure. Each of the planks overlaps the one below it, making the boat look like a clapboard house. The lapstrake shell is light but remarkably strong—a quality that would make this method of construction useful for other types of woodwork, including furniture or architecture.

Carvel construction



Lapstrake construction



Lapstrake's advantages were evident to early boatbuilders. Viking ships unearthed in Norway show us that the method has been used for more than ten centuries. Some of the most refined and practical workboats ever built, such as the English pilot gigs and American Adirondack guide-boats, use this method. In this article, I'll describe these craft and outline the principles of lapstrake construction. In a subsequent article, I'll describe how to build a traditional 10-ft. lapstrake rowing boat—a type that developed in Nova Scotia over the past century. Such a basic lapstrake boat can be built by anyone with average woodworking skills, using locally available materials and simple tools. Small lapstrakes make elegant and practical little boats, safe, seaworthy and fun to row.

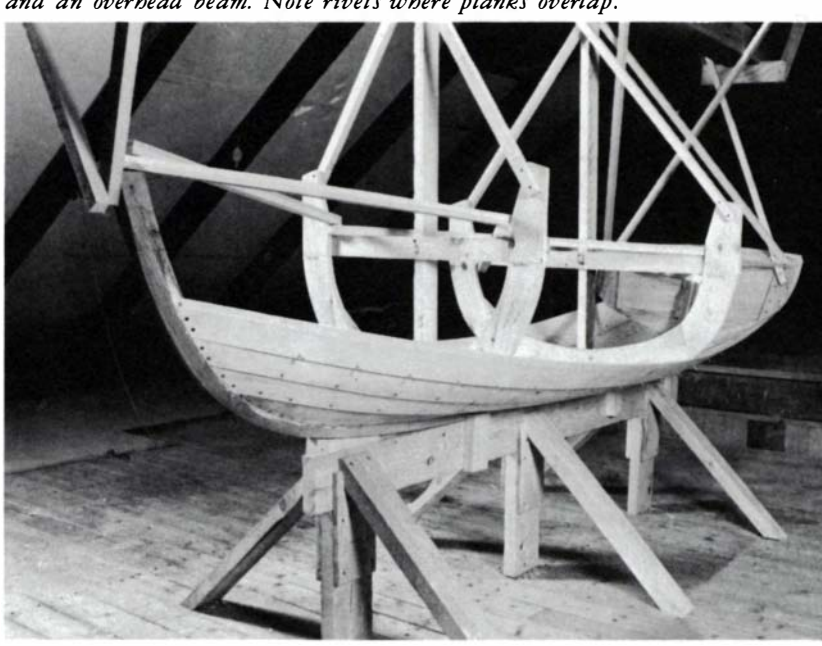
Basic lapstrake—Lapstrake construction meets a primary requirement of small boats—flexible strength combined with light weight. Where the planks overlap, the double thicknesses of planking act as stringers that strengthen and reinforce the hull. This makes for thinner planking than is possible with carvel, and thus a lighter boat. There is another reason why lapstrake planking can be thinner than carvel planking: planks butted edge to edge don't make a watertight joint. To keep out water on a carvel boat, a caulking of unspun cotton or oakum is driven into a small, vee-shaped groove (called a caulking seam) between adjacent planks. This means there is a limit to the thinness of carvel planking—anything less than ½ in. and the caulking is liable to be driven right through. There is no such limit with lapstrake because there is no caulking between the planks. The overlapping planks are beveled for a close fit and then tightly fastened together with rivets or clenched nails driven through the laps.

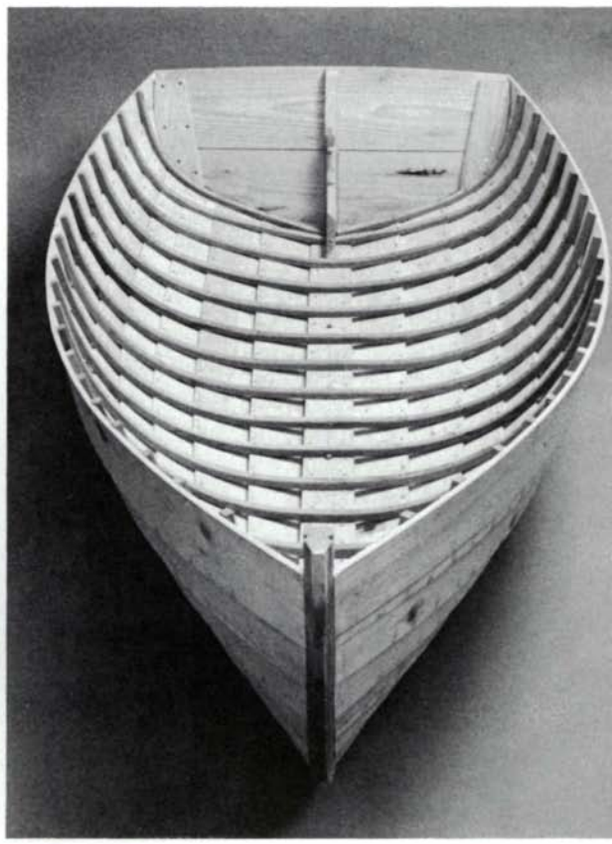
Forms or molds are often used in building a lapstrake boat, but only as temporary guides. The actual volume and shape of the boat are obtained by twisting and bowing the planks until they take on a form pleasing to the builder's eye. Traditionally, lapstrakes are built right side up on a strongback, a stout beam attached firmly to the shop floor. The keel, transom (back) and stem (front) of the boat are temporarily fastened to the strongback along with the molds. Then the whole assembly is securely braced before planking is begun. In carvel construction, the thicker planks can be wedged sideways and clamped to rigid frames for fastening. But trying to force the thinner planking of lapstrake into place will only cause it to buckle and spring away from the molds. The lapstrake builder must always work with the planking, not against it. Experienced builders often use only one mold giving the shape of the boat at its midsection. The rest of the boat's shape is made by twisting and bowing the plank until it looks right. Traditional Norwegian small craft are built by eye, entirely without molds, and so reflect the builders' idiosyncrasies more than a boat built around molds does.

While the planking lines on the smooth, painted hull of a carvel boat are barely noticeable, they are the most conspicuous feature of a lapstrake. Any errors in the way the planks are laid out are obvious—even to the untrained eye. This is a case where whatever looks right is right. Abrupt changes in width between adjacent planks appear awkward, as does excessive taper—it also may not leave enough room at the ends for fastenings. "Shapely" boats (a euphemism for tubby) are harder to plank than slender ones.

As each plank is bent into place, it must be fastened to its neighbor. There are several methods that can be used to pull the laps tightly together. Most often, copper nails are driven through the laps from the outside, a copper washer is forced

Lapstrake boats are built on a strongback attached to the floor. This is a Sea Urchin copy being planked up around molds. Keel, transom and stem are in place and firmly braced to one another and an overhead beam. Note rivets where planks overlap.



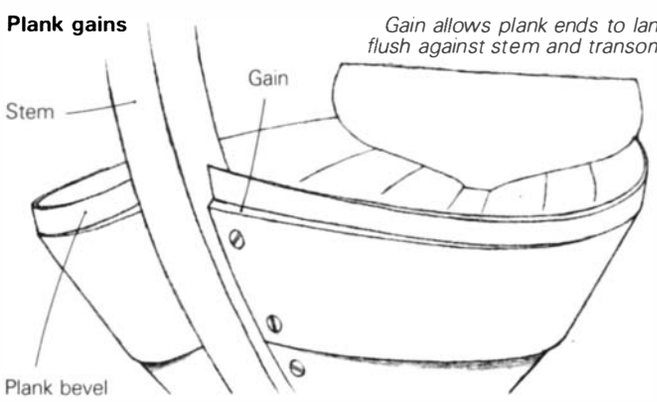


Planking lines can make or mar a lapstrake boat. You don't need to be an expert to spot the ugly duckling, above. The shape and volume of lapstrake boats are determined by molds, but the lines are set by eye. The planking job on this British-designed boat is poor, yet the boat has given excellent service. At right is a copy of Sea Urchin with planking and timbering complete but minus her trim and seats.

down over the point, then the nail is clipped off short. The cut end is then peened over, forming a rivet. Another way is to turn the point of the nail back so it reenters the wood. To make a watertight seal, the upper, outside surface of each plank is usually beveled so the plank above lies flat against it. This bevel varies along the length of the boat—the more curvature the boat has, the steeper the bevel must be. If the overlap were continued into the bow and stern it would look clumsy and let in water. A tapered rabbet, called a gain, is therefore planed into the ends of the plank so they lie more or less flush at stem and stern, as shown in the drawing below. This explains why the lines of planking seem to disappear into the stem at the bow of the boat. Bare, wood-to-wood joints, carefully fitted, should need no filler to be watertight. When first put in the water, or after winter storage, a lapstrake boat usually leaks a little, but as soon as the planks have had a chance to swell, they tighten. Many boatbuilders now use a bead of sealer such as polysulfide between the laps to act as a gasket.

After the boat has been planked, reinforcing ribs called timbers are installed. Usually, these are of white oak, steamed, bent, and clench-nailed or riveted to the planking.

Plank gains



Lapstrake building is surprisingly fast. Carvel boatbuilders must "spile" to get the shape of their planks. This means bending a thin batten around the boat, marking on it the shape of the plank already in place and transferring that shape to the new plank. A carvel builder must work fast to accomplish more than one round of planking in a day. For a small lapstrake boat, the stock is limber enough to be wrapped around the boat and scribed directly, thus eliminating spiling. If the builder has continuous lengths of stock to work with and if he knows the boat, an 18-footer can be lapstrake-planked in three days. The method is also more forgiving—if the overlap varies slightly along the length of the plank, it's not critical.

In the water, lapstrake boats behave differently from smooth-skinned ones. They don't roll as readily because the laps "grab" the water and have more resistance to being pushed sideways. Norwegian fishermen, who have centuries of experience with lapstrake boats, talk of "packing" a layer of air bubbles in the laps as the boat moves through the water. This foamy water passing under the hull is thought to reduce drag and increase speed. Lapstrake hulls are supple and the larger ones flex noticeably in rough water. This quality makes lapstrake unsuitable for large cargo-carrying vessels; flexing can loosen rivets, opening the laps, causing the boat to leak. But lapstrake's combination of lightness and strength, not to mention good looks, makes it a sensible choice for small and intermediate-size boats.

Simon Watts is a cabinetmaker, boatbuilder and contributing editor to this magazine. For more on boatbuilding, see FWW *#29, p. 82, and #35, p. 72. Photos by the author except where noted.*

Viking ships

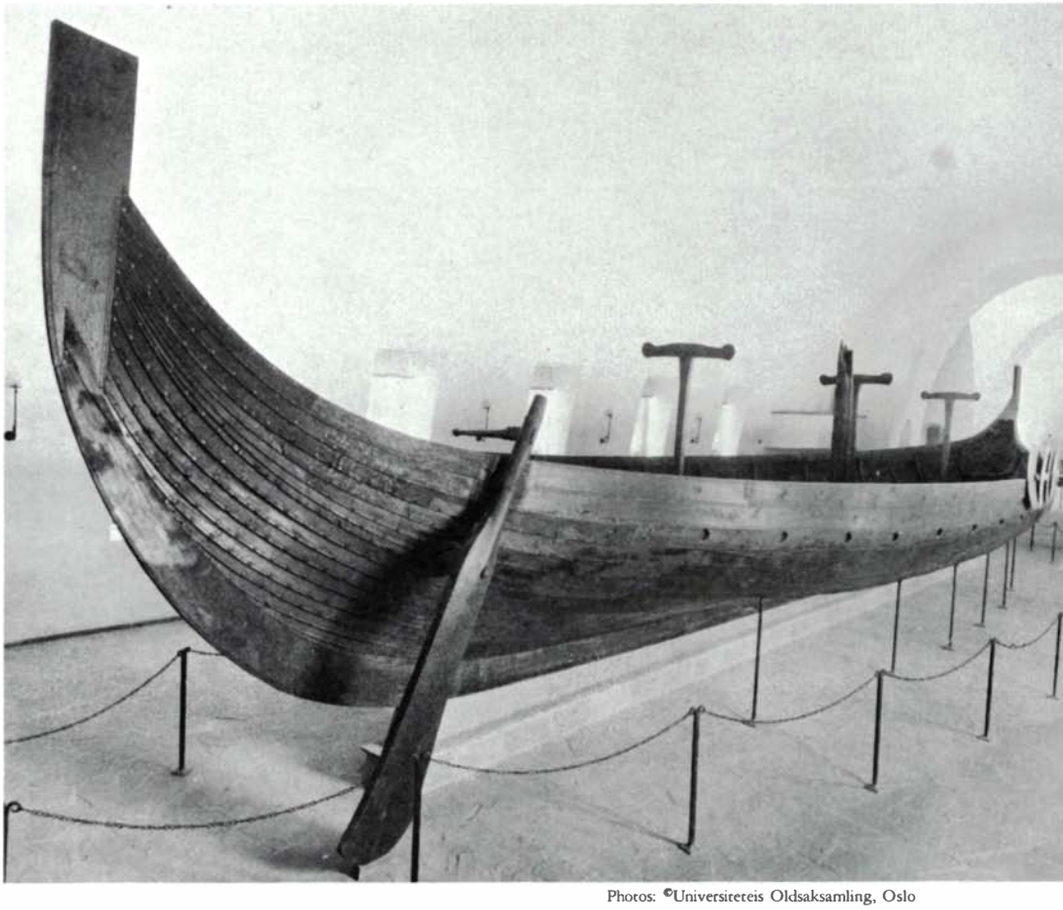
Norse boatbuilding survives yet today. The Oselver boat, above, built by Alfred Sovik, is a descendent of early Viking lapstrake craft discovered in ancient burial mounds.

Norway has an unbroken boatbuilding tradition going back several thousand years, but the popular image of sleek, dragon-headed Viking ships is only part of the picture. Using lapstrake construction, the Vikings built a wide range of boats, from delicate *faerings* ("four oars") to large seagoing vessels for raiding and colonizing. The largest of these, the Long Serpent, which was built around 1000 AD, is thought to have been 160 ft. long. Viking leaders prized these ships so highly that they were often buried in them.

Much of what we know about these boats comes from the discovery and excavation of Viking ships in burial mounds in Norway. The largest and best preserved of these, the 76-ft. Gokstad ship, had remained buried for close to a thousand years. Although quite flattened by the weight of the mound, she was removed in fragments and reassembled in a specially designed museum near Oslo. Except for a pine deck and mast, the Gokstad ship is built entirely of oak. The 60-ft. keel was hewn from a single log and resembles a "T" in cross section. Instead of light, bent ribs or timbers, all Viking ships had sturdy "grown frames." These were selected from pieces of oak that naturally conformed to the required shape. Lacking sawmills, the Viking shipbuilders split their planks out of round logs. The resulting wedge-shaped boards were stronger than sawn wood, though, because the grain fibers inevitably followed the plane of the plank.

Each side of the Gokstad ship has sixteen of these overlapping planks fastened to each other with iron rivets. Below the waterline, the planks are not nailed to the frames but are lashed with thin spruce roots. A pair of cleats was hewn into each plank to serve as eyelets, so the lashings wouldn't pass through the hull. Above the waterline, planks are fastened to frames with an ancient device called a treenail—wooden pegs driven right through, then split and wedged at both ends.

As early as the 10th century, the Vikings had developed lapstrake to a high art, and the boats pictured here are striking illustrations of their skill. The most complete example of the Norse boatbuilding technique is the Gokstad ship, below right and front cover. This large, seagoing vessel was owned by a Viking chieftan, and it became his tomb. So valued were these boats that they were frequently lavished with ornate carving, as shown in the stern view of the unearthed Oseberg ship, below left.



Photos: ©Universitetets Oldsaksamling, Oslo

Pilot gigs

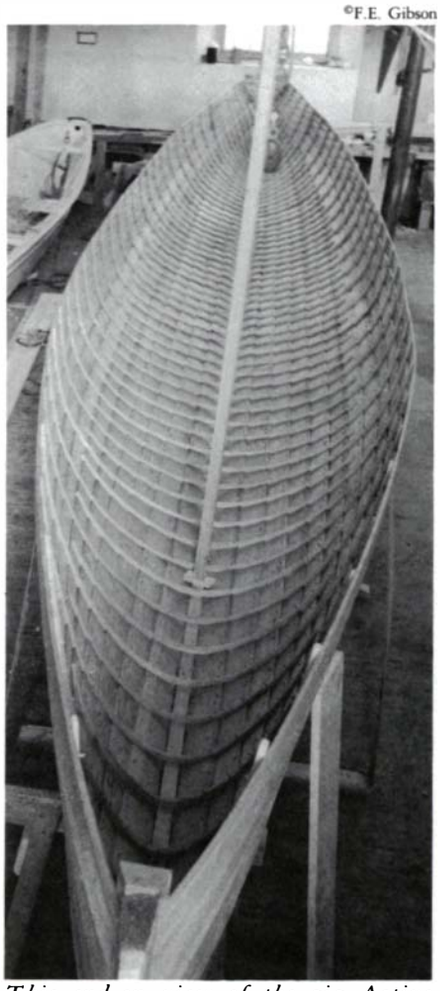
The Scilly Isles lie some 40 miles off the coast of Cornwall at the junction of two great shipping lanes—the English and Bristol channels. Incoming ships traditionally stopped here to pick up a pilot, fresh provisions and instructions from their owners. As soon as a vessel was sighted, pilots were rowed out in small boats to meet it and often this developed into a race, since the first boat out got the job, and the losers only a long pull home. The result of this constant competition was the creation and rapid evolution of a remarkable boat—the pilot gig.

A typical gig of the 1830s was 28 ft. to 32 ft. long and had a full bow with a high, narrow transom that effectively made it double-ended at the waterline. Gigs were built for seaworthiness and speed, but since the gig also had to be light enough to be picked up and launched by its crew, lapstrake was the best construction. The planking, which was always Cornish elm, was only ¼ in. thick, fastened with copper rivets and reinforced with slender oak timbers.

Gigs were the local equivalent of pickup trucks, ferrying cricket teams and wedding parties and delivering local produce to market. When a vessel went astray in fog or storm, the gigs went out for rescue and salvage. The speedy gigs were well suited for smuggling. Rowed by hardy, determined men, an eight-oared gig was more than a match for any revenue cutter of the day, and crews traded fresh produce for contraband, or rowed more than 100 miles across to France for spirits and tobacco.

Apart from the elegance of their construction, the most remarkable aspect of the gigs is their longevity. Workboats seldom last more than half a century, but several gigs—including the venerable Newquay, built in 1812 by Cornishman William Peters—are actually still in use. I asked the last boatbuilding member of the Peters family, Frank, about this. "The secret," he said, "was in the seasoning. Fresh water rots wood, but salt preserves it. The old boys selected their own trees—never took one more than half grown 'cause the nature was gone out of it." The boatbuilders would then chain the logs in creek mud where saltwater tides could soak them until worms had eaten away the sapwood—about four years. "Then they'd haul 'em out, adze 'em off and saw 'em," Frank told me. After four years of salt pickling and another year of drying, planks were ready for use.

Cornish elm is too small to make one-piece keels, so these were made of oak or American elm. The keels were not given the salt treatment and in the surviving gigs they have had to be replaced. As piloting declined toward the end of the century, so did the gigs. During the 1950s, though, interest in them reawakened; new rowing clubs were formed and funds were collected for repairing the survivors. Gig racing has become so popular that eight new boats have been built.



This end-on view of the gig Active makes it easy to see why large lapstrake hulls flex noticeably in a rough sea. Active, copied from an existing gig, was built by Thomas Chudleigh in the Scillies. The Newquay, below, built by the Peters family in 1812, is the oldest pilot gig in existence. This six-oared boat has a full bow that rises to a sea rather than plowing through it. The almost vertical stem is characteristic of many British-designed lapstrake boats.

Ralph Bird

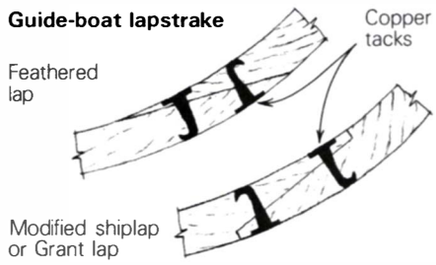
Adirondack guide-boats

About the time the English pilot gigs reached their final form, a very refined type of lapstrake boat appeared in America—the Adirondack guide-boat. Like the gigs, the guide-boats were working craft built for a special need. The Adirondack region in Upstate New York had few roads but many lakes and streams. The first settlers, hunters and trappers mostly, needed a lightweight, portable boat. Indian canoes were used at first, but as these wore out, plank boats gradually replaced them.

Guide-boats began as conventional lapstrakes but were too heavy to be carried by one man and were noisy in the water. Lighter, quieter boats were made by beveling the white oak planks at the joints instead of overlapping them. A smooth, uninterrupted skin was the result. Too fragile for nails or rivets, the joints were instead fastened with two staggered rows of copper tacks. Each row was driven from opposite directions and the points turned back into the wood. On the best boats, the laps are so perfectly fitted that they can barely be felt and are invisible when painted.

Construction procedures also differed from those for conventional lapstrake boats. Instead of timbers being bent into place after the shell had been completed, the boat was planked around a cage of L-shaped spruce crooks which extended and overlapped across the bottom plank. Finding and extracting suitable stumps to make these crooks was a considerable chore.

Two types of lap were used: a feather edge and a modified shiplap. The latter made a better joint but was harder to do well. Neither was as strong as conventional lapstrake because it didn't have the double thickness of riveted planks.

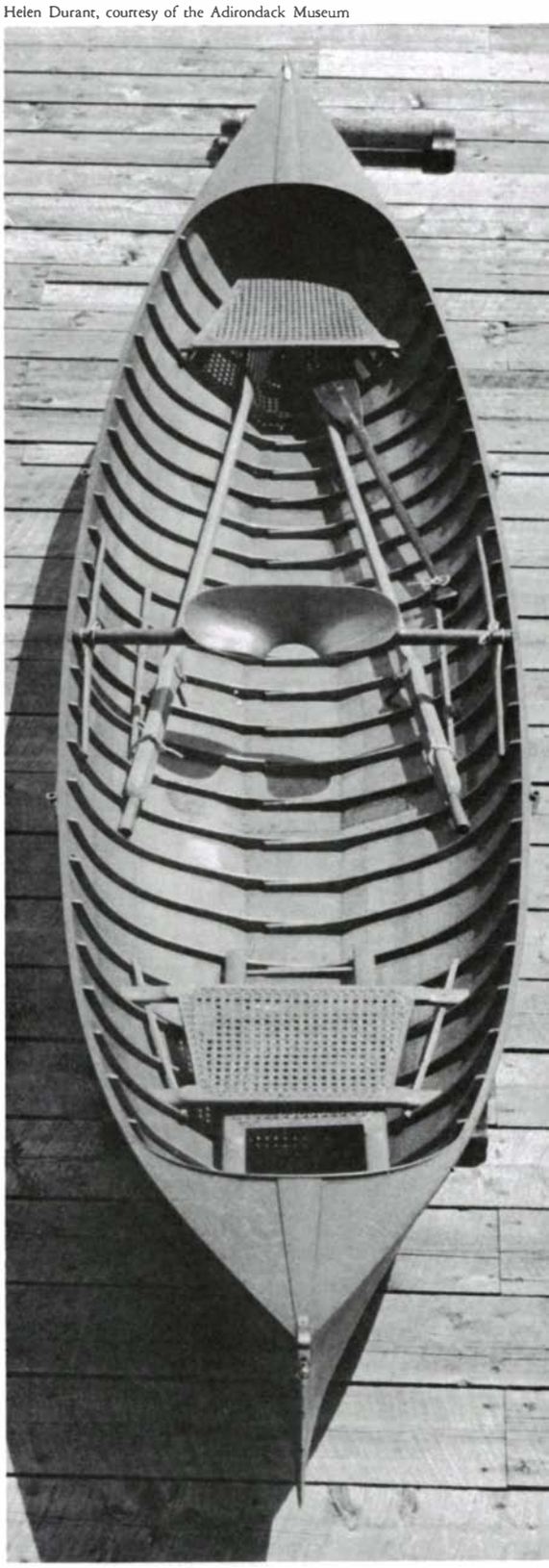


Lightness was so important in guide-boats that builders reduced the thickness of the pine planking to ¼ in. and replaced solid wood seats with caning. This constant refinement produced a boat akin to a fine musical instrument. "Resonance," write Kenneth and Helen Durant in *The Adirondack Guide-Boat* (International Marine Publishing Co., Camden, Maine), "was evidence of a boat in good condition. A guide-boat without resonance was a sodden hull passing into decay."

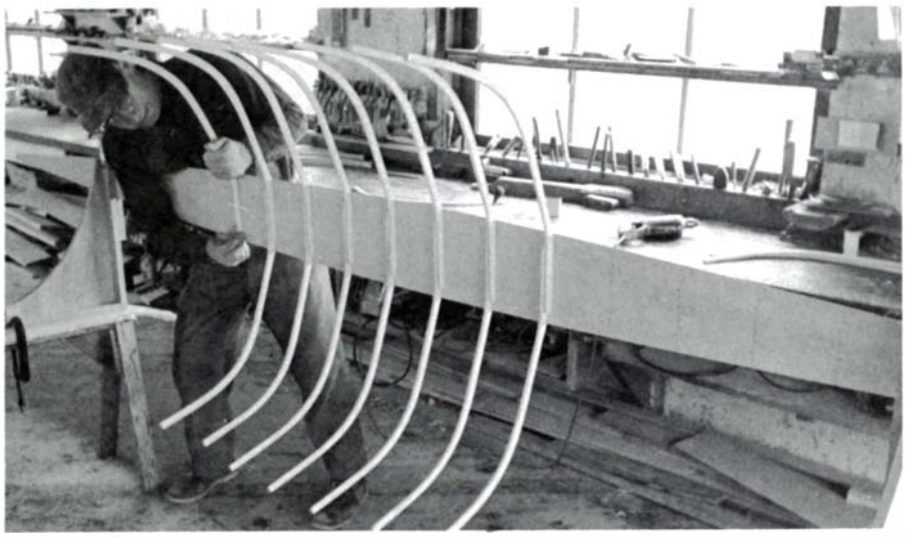
These boats were often built on a strongback that could be lowered and tilted as planking proceeded. They had no keel but started with an elliptical bottom board. The two stems were attached to this board and then the intermediate ribs. A 16-ft. boat typically had 36 ribs sawn from 13 different patterns. These largely determined the shape of the boat, instead of the molds used in conventional lapstrake.

For more than 60 years, the guide-boats served to carry the guide and his "sports" and their gear across choppy lake waters. As the Adirondacks became more accessible, such refined boats were no longer needed and they passed out of use. Fortunately, some of the finest examples have survived in private camps and at the Adirondack Museum at Blue Mountain Lake, N.Y. □

Helen Durant, courtesy of the Adirondack Museum



Light weight was an essential quality of a guide-boat. Planking was reduced to ¼ in. and seats were caned for lightness, as in the photo above. The smooth hulls, which weighed as little as 65 lb., made for quiet movement through the water—vital to hunters and trappers. Guide-boats could be rowed or paddled. But unlike conventional lapstrake craft, the shape of a guide-boat was determined by pairs of ribs fastened to a bottom board, as in the photo at left, instead of molds on a strongback. Ribs were not steam-bent but cut from natural crooks in spruce stumps.



Adirondack Museum

Chainsaw Lumbermaking

Good-bye to vibration and fumes

by Will Malloff

Anyone can make lumber. All you need is a chainsaw attached to a mill, a straight board, a hammer and three nails. The board, positioned and nailed to a log, is a guide for the mill, which is adjusted to the depth of cut plus board thickness. The mill is pushed along the board and the sawbar pivoted out of the log at the end of the cut. That's all there is to it. But for efficient lumbermaking and the best results, there are a number of other considerations. Over the years I've developed and refined milling equipment and techniques, and now I feel I have the most effective, simplest system for ecological lumber production. To my surprise, a lot of people agree with me.

With a chainsaw, the logger decides what to harvest—trees that are mature, damaged or crowding other trees. A tree is felled and milled where it falls. Only usable lumber is removed, leaving the by-products to feed the land. Once you start to make your own lumber, you begin to notice usable wood everywhere you go. You're not restricted to milling only standing trees and you're not limited to working with the sizes and species available at the lumberyard.

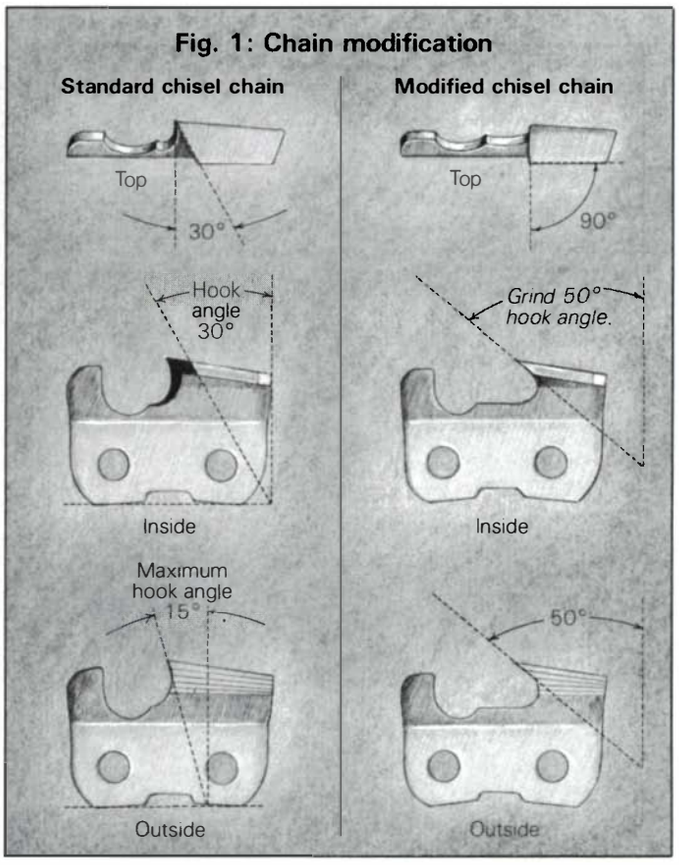
EDITOR'S NOTE: This article is adapted from Will Malloff's *Chainsaw Lumbermaking*, The Taunton Press Inc., Newtown, Conn. (Hardcover, 224 pp., $23.00.) Malloff, of Alert Bay, B.C., is a professional logger and lumbermaker. Besides describing and illustrating the milling process in great detail, Malloff's book explains how to choose and modify ripping chains and mills, and how to make milling gear for timber joinery, natural boat knees, and more.

Ripping chain—The most important factor in successful lumbermaking is properly prepared and maintained saw chain. Although you can use standard crosscutting chain, this will result in inefficient milling. You really need ripping chain, which you can make by modifying crosscut chain, using either a grinder or a hand file (figure 1). It's better to modify regular chain than skip-tooth chain or safety chain. I use a Stihl 090 saw for most of my milling, and I usually start with Oregon square-edge chisel chain (model 52L) made by Omark (Oregon Saw Chain Division, 9701 S.E. McLoughlin Blvd., Portland, Ore. 97222).

You'll find that a good disc-wheel chain grinder will soon pay for itself by its accuracy and speed in modifying and sharpening ripping chain. And one properly shaped grinding stone will do the work of several dozen hand files.

Chain modification—I grind my ripping chain cutters straight across the fronts with the round-edged grinding stone

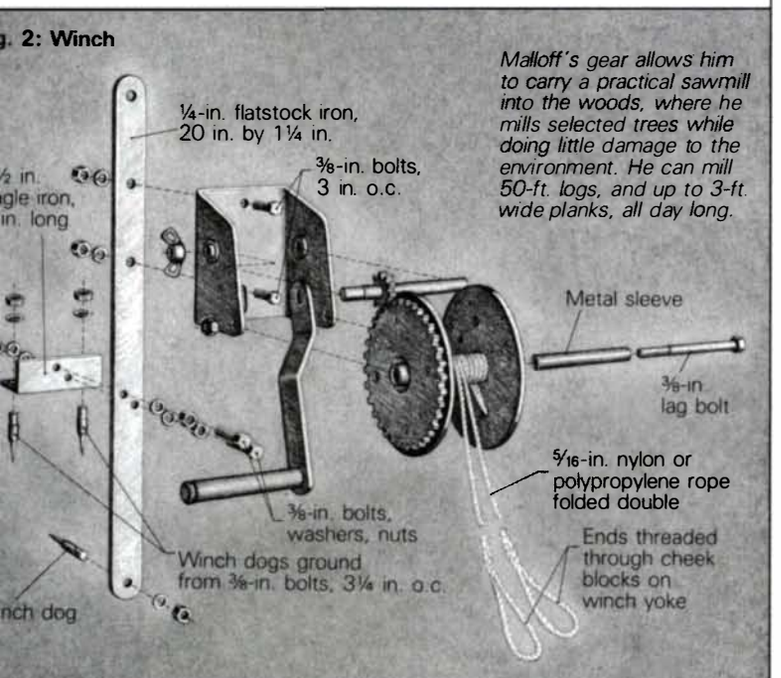
Minimum milling: a chainsaw mill, a plank to guide the first cut, and a few nails to hold the plank on the log. Malloff, a chainsaw logger by profession, has improved every aspect of this setup, developing the rig shown on the following pages.



Photos: Beth Erickson; drawings: Lee Hov

The winch ropes, fig. 2, pass through the cheek blocks on the yoke, fig. 3. One rope hooks to the nosebar end of the mill, the other to a short bridle rope, attached between the saw itself and the surgical tubing on the throttle attachment, fig. 4. As the winch ropes tighten, the attachment pivots, and the ¼-in. bolt on the end of the lever depresses the chainsaw's trigger switch to bring the saw to full throttle before forward pull is applied to the mill. A quick turn back on the winch returns the saw to idle.

g. 2: Winch



. 3: Winch yoke

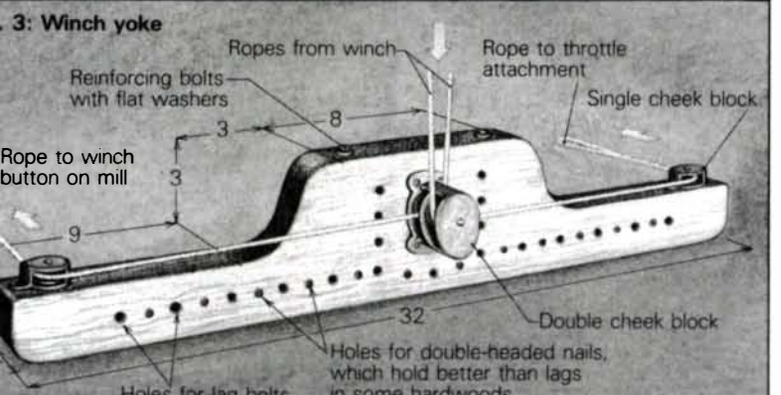
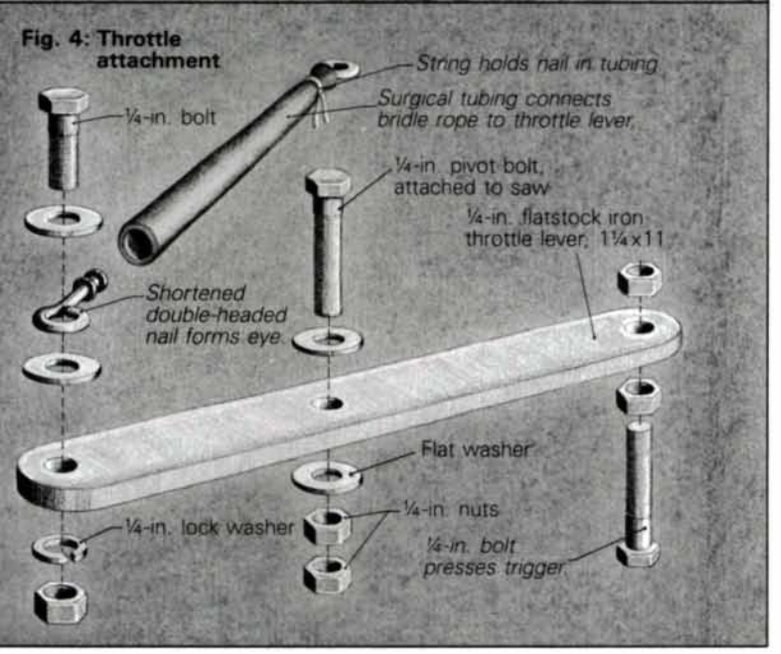


Fig. 4: Throttle attachment



adjusted 50° from vertical (40° from horizontal). Commercial sawmills grind their blades for circular saws, gangsaws and bandsaws this way for a smooth, fast cut. Adjust the grinder so the stone is 90° to the chain, then tilt the stone to a 50° hook angle. Mount your chain in the chain track and adjust the stone to grind off the entire angled edge of the cutter—no more and no less. It is critical that the teeth be the same length and that the depth gauges be filed evenly.

Hand-filing—Chain modification with a file guide and round file is essentially the same as with a grinder; but file a 45° hook angle on each cutter instead of a 50° hook. The round file leaves a hollow-ground edge; if the hook were filed to 50°, the cutting edge would be weakened. Because guides are normally set by the factory to cut a 5° hook angle, you have to shim the file under both clamps to lower it so it will make the 45° hook. Start off with the file diameter recommended for your chain, but switch to the next smaller size (1/32 in. less) when the chain's cutters are about half-worn.

Keep filing until the hook angle on the side of the cutter is 45° and the top plate is 90° across. The bottom of the cutter gullet should be just above the top of the drive link. At least two files will usually be necessary to modify one chain.

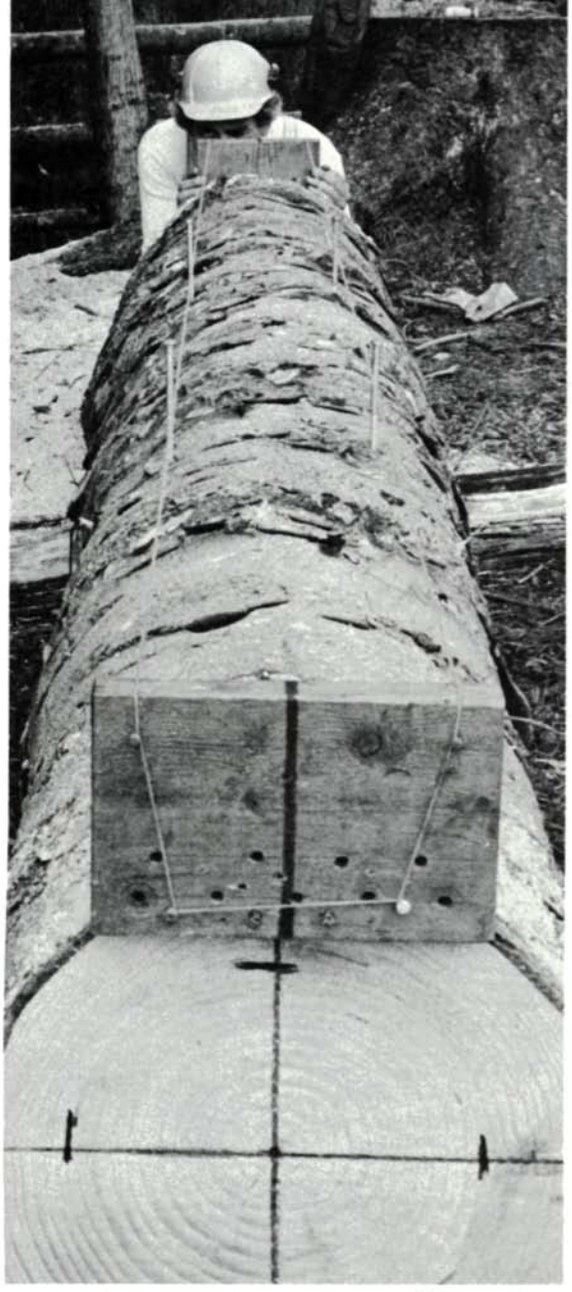
The winch and yoke—In lumbermaking, you normally have to push the mill and roaring chainsaw through a cut, breathing exhaust fumes and spitting out sawdust all the while. But with my setup (photo, next page), you can stand back from the noise and vibration, and move the saw through the cut with minimum labor—all you have to do is crank a winch handle. Besides the winch, you'll need a remote throttle attachment for your saw, winch buttons to hold the ropes, and a winch yoke to pull the mill straight. The yoke also helps keep the guide rails of the mill level on the top plank.

I use a small boat-trailer winch as the base mechanism (figure 2). Make winch dogs (spikes that attach the winch unit to the log) by tapering ⅜-in. bolts. Hold each bolt in the chuck of an electric hand drill and, with the drill switched on, grind the taper on a bench grinder.

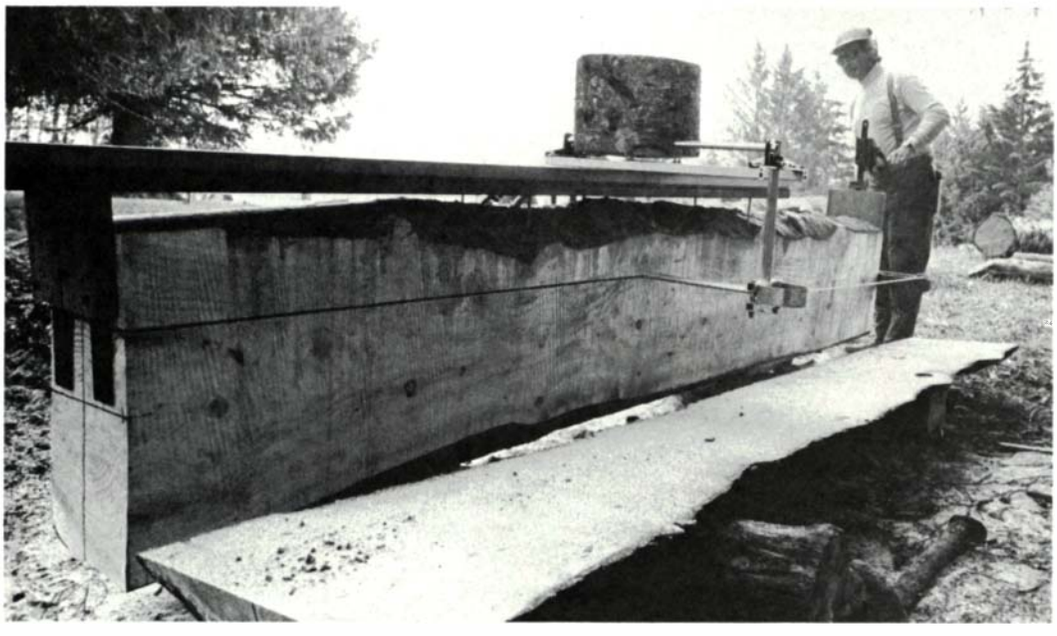
Assemble the winch and mount the winch rope. Cut a length of ¼-in. or 5/16-in. nylon or polypropylene rope a little longer than double the length of the log you'll be milling, then splice or tie an eye to each end. Fold the rope in half and attach the fold to the winch drum. Later you'll thread the rope ends through the cheek blocks on the winch yoke (figure 3).

Throttle attachment—Because the operator is at one end of the log and the saw at the other when milling with my system, you need to build a remote throttle attachment to work the saw trigger (figure 4). This one is designed for a Stihl 090, so if you're using a different engine, you might have to adapt a little. The surgical tubing should be long enough (about 6 in. to 8 in.) to provide proper tension in both the open-throttle and closed-throttle positions. Through the saw handle, drill and tap a ¼-in. thread and mount the attachment by screwing the bolt into the hole and locking it with a nut and washer. I'll explain how to use this remote throttle attachment when we get to setting up.

Saw bridle button—I use a modified Granberg Mark III mill, but any mill should work. The winching rope is attached at one end to the mill and at the other end to the



Careful layout is the route to precision milling. Above, Malloff checks the height of the lag bolts that will support the guide plank. The end boards have been carefully aligned with vertical and horizontal layout lines drawn on both ends of the log. In this case, he's milling directly through the heart center of the log. If the heart were off center, he might mill to the average center instead.



A yoke, fastened just below the line of cut, keeps the cut straight as Malloff cranks the winch, above. One rope is attached to the modified Granberg mill; the other rope is connected, by means of an adjustable bridle rope, to the saw itself and to a lever that controls its throttle. The mill, with its log-section counterweight, will be pulled to the end of the guide plank. Then the plank will be slid forward on the supporting lag bolts until it rests on the end board. The winch is attached to the plank itself, and the cut continues. Subsequent cuts don't require the plank and lags because the mill can ride directly on the flat-cut surface of the log. At left, with steel end dogs in place to control twisting, milling is well under way.

middle of a length of rope I call the bridle rope. One end of the bridle rope goes to the remote throttle attachment; the other end must attach to the saw. But since there's no place on the saw to accept a rope, you have to make a holding button. I call this the bridle button. On the Stihl 090, I substitute a 5/16-in. by 1½-in. bolt for the original shorter metric bolt in the handle to make this bridle button. This is the logical place for it, as the bolt is in a strong position on the saw and in the line of pull when winching through a cut.

End dogs—The inner tensions that have grown into a tree often make boards twist or bend while they're being sawn. This distortion can throw off a properly aligned milling system. So I've designed end dogs to help keep boards straight until the cut is complete—the dogs tack the board and log together, so the board can't deform during the cut (bottom photo, facing page).

The best end dogs can be forged from short pieces of automobile leaf spring, though other hardened steel would probably do as well. To make them, first round the ends of the spring stock. Then heat and bend the ends so that they are at right angles to the flat stock. Reheat the dog to a dull red, and allow it to cool slowly in the air. Grind the upturned ends from the outside to a sharp edge and then grind the edge straight across so that it is about 1/32 in. to 1/16 in. wide. End dogs with edges that are too sharp eventually deform and become difficult to drive.

I insert wooden kerf wedges every few feet in the cut. The wedges support the piece being milled and keep the kerf open, allowing the bar to travel freely. I also insert wedges behind the saw just before the end of the cut. This allows the mill to exit easily and eliminates end run-off. Six or eight wedges are enough for most jobs.

Setting up—Before you can begin to mill any lumber, you must establish a level surface on each log to guide the first cut. My system consists of a straight guide plank resting on end boards and pairs of leveled lag bolts placed along the length of the log. The wider the plank, the more support for the mill. The plank should also be thick enough to support the weight of the mill with minimum help from the lag bolts. The guide plank needn't be as long as the log, because you can mill in stages by sliding the plank off the end board and along the lag bolts as you go.

To stiffen the plank and help keep it straight, and to allow the plank to slide along the lag bolts without damage, attach two 3/16-in., 1½-in. by 1½-in. angle irons to the plank edges, using countersunk screws about every 12 in.

The guide plank is supported at both ends of the log by end boards nailed or lag-bolted into the log end. The top edges of the end boards must be the same distance above horizontal index lines, reference points drawn on the ends of the logs, from which you calculate your milling patterns (upper left photo, facing page). I usually make pairs of end boards from common, 2-in. thick, dressed lumber. Heights of 4 in., 6 in., 8 in. and 10 in., cut to the width of the guide plank being used, cover most milling situations.

Measure and mark the log for the supporting lag bolts. When using a 10-ft. guide plank, I usually place a pair of lags every 4 ft. Remember to make sure the lags don't go so deep that they're in the path of the cut.

Position the guide plank, looking under it to make sure the angle irons rest securely on the lags and end boards. You'll need an overhang of at least 12 in. to support the mill as it begins the cut, so pull the plank out that far.

If you're milling with a winch, you'll need a weight to counterbalance the saw engine and to hold the guide rails of the mill flat on the plank. Make this from a block of log that is slightly larger in diameter than the space between the mill guide rails. Notch the log to fit over the mill handle.

The first cut—Determine how high to set the mill for the first cut by measuring on a vertical index line drawn on the end of the log. Mount the mill on the guide plank. Keep the thrust skid against the log and begin the cut with the nose end of the sawbar. Come to full throttle and cut until the back guide rail of the mill just passes the end board. Pause, and drive in both end dogs, spacing them as far apart as possible without splitting the slab.

Now position the winch yoke. Center it on the butt end of the log so that the outside pulleys are 1 in. or 2 in. below the mark on the vertical index line, and thread the winch ropes through the cheek blocks. Now slip one end of the bridle rope over the bridle button on the saw engine, and hook the other end of the bridle rope to the eye on the remote throttle attachment's surgical tubing. Gently take up the slack in the winch rope, and thread it through the bridle rope so that it will pull the throttle wide open before it begins to pull the mill forward.

When the winch is set up, start the saw engine and position the counterweight. As you start cranking the winch, the engine should open up to full throttle. To stop milling, or if the saw sticks in the cut, quickly crank the winch handle several turns backward. This will stop the pull and allow the engine to return to idle. Keep an eye on the guide rails of the mill to be sure they remain flat on the guide plank, and mill up to the last set of lag bolts. Crank the winch backward quickly to stop milling, allow the engine to idle and then turn the engine off. Leave the mill in the cut.

Pull the guide plank forward to the next cutting position. In the last position, the plank will just cover the end board. So set the winch dogs into the end of the guide plank and continue milling, adding kerf wedges as necessary. When the mill comes close to the end of the cut, remove the counterweight, winch ropes and yoke. Pull the guide plank forward so it projects beyond the end board to support the mill as it finishes the cut. Complete the cut by hand, keeping a firm downward as well as forward pressure on the mill.

You can mill a board or two off the top slab if you invert it in place on top of the log. Estimate the center of weight of the slab and drive a wedge on either side to provide a pivot. Absolute balance is not necessary, but the closer you guess, the easier it will be to move the slab. Swing the slab with a peavey, so that it crosses the log. Use a peavey or jack to flip the slab over. Swing the slab back into place, then lift it to near level and block it with wedges.

I don't normally use the winch yoke on shallow cuts. I attach the winch rope to the bridle rope at the engine end as when using the yoke, but attach the nose-end rope by slipping the loop over the mill's riser post. Once the counterweight is in position, you can start milling. The winch system is more complicated than hand-milling, but certainly less tedious. I often hand-mill short and narrow cuts, but find a day's work much easier with a winch. □

More on lumbermaking

New machines turn logs to boards

If you have a woodlot or can buy sawlogs from someone who does, you might want to make your own lumber. In the past, there were two ways to do it: you could haul the logs to a sawmill, if you could find one willing to do the work, or you could buy a chainsaw mill and cut the logs where they fell. High lumber prices and a growing interest in owner-built homes have produced a third choice for the do-it-yourself sawyer—portable bandsaw lumbermills.

Two companies are making bandsaw mills that they claim will turn logs to lumber faster, more accurately and with less waste than a chainsaw mill. The rigs are larger and costlier than chainsaw mills, but simpler and cheaper than circular sawmills of comparable capacity. A third company plans to market its own smaller, less expensive bandmill. Both bandmills now on the market are simply gasoline-powered horizontal bandsaws that ride on tracks, cutting into the stationary logs. Both can be trailered or skidded through the woods.

Warren Ross of West Hempstead, N.H., makes the simpler of the two bandmills. His 1,230-lb. rig consists of a bandsaw mounted on a carriage which rides on a track of heavy channel iron. The saw is powered by a 5-HP industrial gasoline engine. To mill logs, the operator peaveys the timber onto the machine's 20-ft. track, dogs it down and pulls the bandsaw through the cut by hand, or—if the track is sloped slightly—lets it feed by gravity. The carriage is returned by hand and the log is raised for the next cut. Logs up to 17½ in. in diameter can be sawn on the Ross mill. It sells for $4,400.

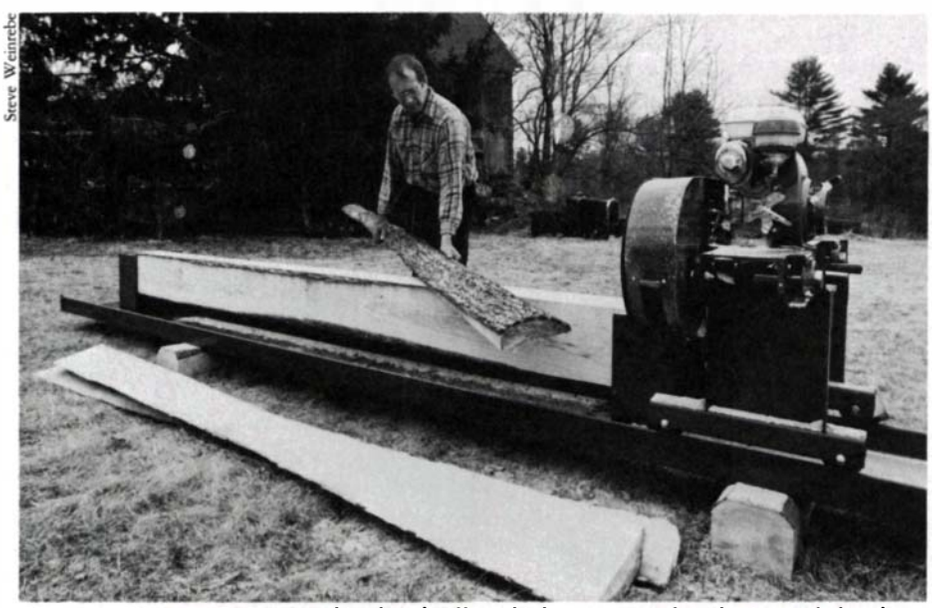
Dupli-Carver's Wood-Mizer lumbermill operates on the same principle as the Ross machine but the saw is cantilevered over the log and is fed by a chain-and-crank system instead of being pushed or pulled by hand. As the cutting progresses, the log stays put while the saw carriage is moved up and down with another chain-and-crank mechanism. The Wood-Mizer saw is powered by a 14-HP rope-start gasoline engine and costs $4,421. The optional trailer with winch runs an additional $1,016.

For the money, say Ross and Dupli-Carver president Don Laskowski, buyers of bandmills get more versatility than circular sawmills or chainsaw setups offer. With a 1/16-in. instead of a 3/8-in. kerf, bandmills produce more lumber from a given log and less waste. The narrower kerf and fine adjustments make slabs as thin as ¼ in. possible. Both machines can resaw.

Laskowski says his bandmill can realistically saw 1,000 bd. ft. in a day, depending on the species and size of the logs. Ross makes similar claims for his mill.

Both Ross and Laskowski say that their machines are built not for commercial lumbermaking but for property owners with timber holdings, for woodworkers and for people interested in building their own homes. Belsaw Machinery Co. (PO Box 593, Kansas City, Mo. 64141) sells a 40-in. circular sawmill for the same market, for about $3,000. It can saw logs up to 18 in. in diameter and 14 ft. long. After several years of development, by this fall Rockwell International plans to sell its own portable bandmill, for less than $2,000.

—Paul Bertorelli



Steve Weinrebe

Inventor Warren Ross says his bandmill, which consists of a horizontal bandsaw mounted on a carriage that rolls on a channel-iron track, can cut up to 1,000 bd. ft. of lumber a day.

Don Laskowski, president of Dupli-Carver, uses his bandmill to square a log for timber. The machine can mill boards from logs up to 16½ ft. long.

For more information on bandmills, contact W.K. Ross Inc., West Hempstead, N.H. 03841; Dupli-Carver, 4004 W. 10th St., Indianapolis, Ind. 46222; and Rockwell International, 400 N. Lexington Ave., Pittsburgh, Pa. 15208. Chris Becksvoort, a cabinetmaker and writer in New Gloucester, Maine, contributed to this report.

The Three-Legged Stool

Furniture turned on the lathe

by David W. Scott

The three-legged stool is the essence of casual furniture, good for a brief perch in the kitchen or shop or for a longer sit when the body is leaning forward and partly supported by a desk or counter. For a turner, the stool may serve as an introduction to joinery and a chance to go beyond the usual turned work.

The idea of individual turnings coming together to form a finished piece of furniture is fascinating. Building furniture and doing production lathe work in a small shop, I have long been intrigued with the structure of the three-legged stool—the variations on its simple theme seem endless. Free-form slab seats in the style of Wharton Esherick (*FWW* #19, pp. 50-57), seats that are turned and then carved, other rung configurations and legs at other angles, even different angles in the same stool, all open up new design possibilities.

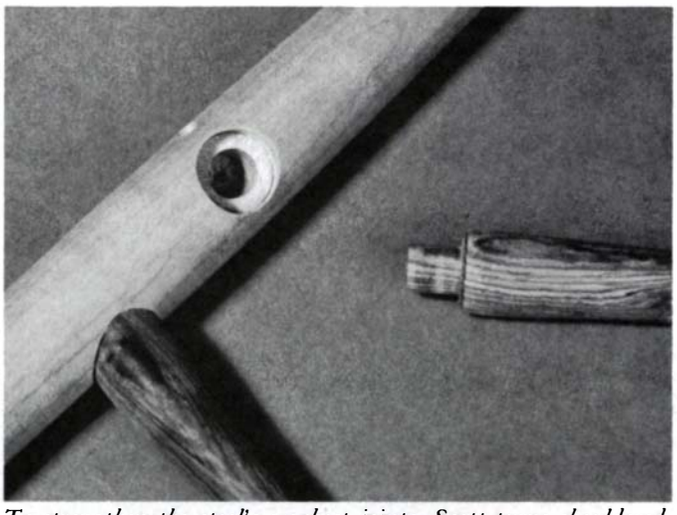
I make stools between 25 in. and 28 in. high, a good size for general use. A 25-in. stool with legs angled at 78° has feet about 17 in. apart—graceful and stable in appearance and in use. I determine the placement of the rungs according to appearance, intended use of the stool, and the user's leg length. If the rungs are too low, the stool looks clumsy; if too high, it begins to look storky. Two-rung stools, like one of those in the photo at right, have the rungs' mortises all at the same height from the floor. Three-rung stools have rungs staggered in height 1 in. to 1¾ in. so as not to weaken the legs. In order to be able to choose the rung heights and lengths for each stool individually, I turn the seat first and then the legs. The legs join the underside of the seat in 1-in. diameter holes about 4 in. to 5 in. from the seat center. I mark and drill the holes in the legs for the rungs, test-assemble the legs and seat without glue, and measure the lengths of the rungs. Then I turn and finish the rungs, take care of details and glue the pieces together.

Making the seat—Usually, I turn the seat from 6/4 or 8/4 stock, 12 in. to 14 in. in diameter, mounted inboard on a Glaser center-screw chuck on the lathe (*FWW* #25, pp. 84-85). I bought the chuck, which lets me mount and unmount the seat blank quickly and precisely, for $70 from Turnmaster Corp., 11665 Coley River Circle, Fountain Valley, Calif. 92708. My preference is seats made all from one board, but seats glued up to get that width look fine too. First I drill the hole for the center screw on the seat-blank underside, then, using a protractor, I mark three lines radiating out from the center at 120° intervals. Then I bandsaw the rough shape, mount the blank on the lathe, and pencil-mark a circle that sets the distance the legs will be from the center. This ensures that the legs will center up with the finished seat. The holes for the legs must be drilled before the seat is turned, because the top's final shape may not lie flat on the drill-press table without wobbling. I tilt the table to 78°, and drill 1-in. dia. holes in the bottom of the seat blank, making sure that the holes angle out from the center. Multi-spur bits make clean holes. You can make holes only 1 in. deep or so, if you don't want the legs to come up through the top of the seat.

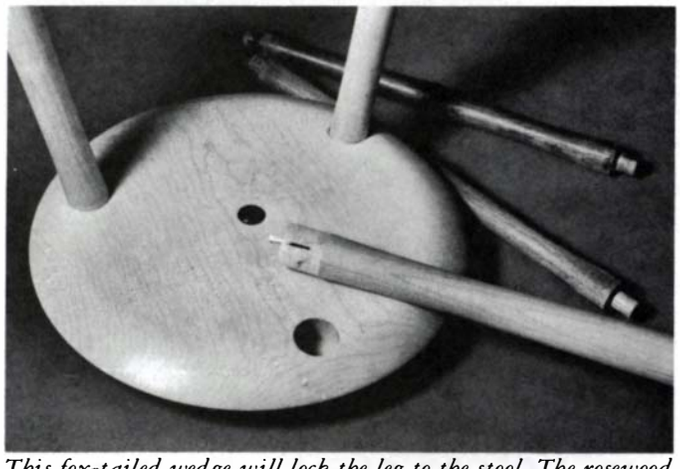
Two graceful and perky stools: turned furniture.

Legs—I turn legs from 8/4 stock. With my production stools, particularly sets, I use a router and a homemade duplicator, a long, open-ended box that fits over the lathe. It's similar to one I saw in *FWW* #25, on p. 22. The router rides on the flat top of the box, and a ½-in. dia., 2½-in. long, double-fluted straight carbide bit makes a shearing cut on the side of the spindle as it turns. The router collar rides against a template of ⅛-in. hardboard cut to the final leg shape, and mounted just above the stock. I rip the leg blanks octagonal on the tablesaw before turning, to minimize stress on the router and bit, and I take a number of end-to-end passes to work down to template size, working from the tailstock to the headstock on each pass. The final pass leaves a rough surface, which I clean up later with a gouge or skew, when I turn the details of the feet and the top tenons.

Rungs—Because most stools have rungs at different heights from the floor, the rungs will vary in length. I turn rungs from 4/4 stock. Conventionally, rungs taper to ½ in. or ⅝ in. at the ends, and this diameter enters a mortise in the leg. This is the weakest link in the stool's structure, however, since the rung is vulnerable to the concentrated weight of a careless



To strengthen the stool's weakest joints, Scott turns shouldered, round tenons that will be pinned in the legs.



This fox-tailed wedge will lock the leg to the stool. The rosewood plug in the center of the seat fills the single hole left by the chuck's center screw.

When easing a stool together dry, Scott makes sure the joints all draw up at the same time, or the last pieces will be difficult to get into place.

person. To beef up this area without removing too much material from the leg, I turn each rung with a double-diameter end—in effect, a shouldered, round tenon. The larger diameter, ⅞ in., penetrates only ¼ in. into the leg, while the ½-in. tenon goes a full 1 in. deep. Size the rung ends carefully and check them in a sample hole; they should fit snugly.

Assembly—The legs are now ready to be drilled for the rungs. The placement of these holes will determine the height of the rungs from the floor, the angle of the rungs to the legs (the same as the angle of the leg hole in the seat), and the relationship between adjacent rungs, which should be 60°.

Adjust the drill-press table to the same angle used for boring the leg holes in the underside of the seat. Then clamp a long V-block to the drill-press table. Fix an adjustable stop-block at the lower end, at the distance one of the rungs should be from the foot of the leg. With the stop thus set for the proper hole height, drill one shouldered, round mortise in two of the legs for the lowest rung. You need to drill two holes in the same place, the larger, shallower one first and then the smaller, deeper one. Dry-assemble these two legs and one rung (the longest) with the seat to ensure that the angles are going in the right directions. Now move the stop block 1 in. farther from the drill bit to set the height of the next rung, and drill a hole in the remaining leg. Leave this stop block in place on the drill press. The next steps will determine the proper relationship of the remaining three holes to these first ones.

Dry-assemble the legs and seat with the lowest rung in its holes in the back legs. Placing your forehead against the front leg opposite the hole you have drilled in it, sight with one eye to either side of the leg directly across to the leg adjacent. This will locate the center point of that leg for the fourth hole to be drilled. This point could also be located by using a piece of dowel with a pencil lead in one end, but the eye produces an accurate result. After marking the point, drill it using the same setup as for the third hole.

Finally, drill the holes for the third rung, using the same procedures as before, with the stop blocks moved to allow for the new distance from the floor.

Dry-assemble the entire stool to get the feel of how it must go together during glue-up—you must ease all the joints together simultaneously, or you won't be able to get the last pieces into place. You will have to flex the rungs into place in any case—and a rubber mallet will help drive them home—but be sensitive to their breaking points. While the stool is still dry-assembled, wax around all the joints to protect the wood against glue squeeze-out.

The wedges that hold the legs in the seat should be perpendicular to the grain line of the seat. For further security, the rungs should be wedged too, or else cross-pinned. If you use wedges in the ends of the rungs, orient them perpendicular to the leg grain. I cross-pin the rungs into the legs using a small finishing nail set in a shallow ¼-in. dia. counterbore. I then cut ¼-in. decorative plugs with a plug cutter, turn their ends while I hold them in a drill chuck on the lathe, and leave them proud to cover the pins. To cover the screw-chuck hole in the seat bottom, I turn a rosewood plug. □

David Scott is a full-time woodworker. He and his wife, Kathy, are also caretakers of the Museum of North Carolina Handicrafts, in Waynesville. Photos by the author.

Stools: A slightly different angle

by Jim Cummins

Ron Curtis doesn't "relate" to his tablesaw, a 16-in., 5-HP beauty, though he respects it. "You just can't slow it down," he says. He's an established woodworker in Bloomfield, Conn., with a one-man shop full of good equipment. Curtis has been building furniture and stools he describes as "free-form construction with sound joinery" since 1968, and these days he's able to make his living from his work.

But he's not a tablesaw type of woodworker, the kind he defines as thinking square and parallel all the time. Not that he doesn't build square himself, when that's his intention, but he usually feels a little looser than that. He'll use any jig that makes his work easier or better, but he'll eyeball everything he can.

Mostly with power sanding equipment, Curtis shapes the top of his stool seats freely. But he leaves at least the middle of the bottom flat, so it will bear against his leg-angle jig: a tapered piece of wood about 8 in. long made from a 2x4 that he clamps to the drill-press table. He drills clear through from the top at locations he works out with a compass—he'll wedge the tenons later. The jig for the stool in the photos is 17°, but he uses 15° as well.

Curtis takes leg blanks that he has pre-cut with a taper jig on the tablesaw, and makes the tenons with an adjustable hollow auger that he bought at a garage sale. With the three legs stuck in the seat, he stands the stool up on an assembly table and proceeds to his other jig: a plain board with drilled holes for the feet of the stool. With all three legs locked into the seat at the top, and two legs fixed at the bottom by the jig, he measures the height for the first rung, then eyeballs the direction for the holes.

With a Stanley ½-in. Powerbore bit, shortened so the electric drill can fit between the legs, Curtis drills from the outside until he feels the point of the bit coming through. Then he drills back through the hole from the other side, so as not to tear out chunks at the exit hole. He drills the second leg like the first. If the holes do not line up perfectly, he says it just puts a little tension on the rung and helps tie the stool together.

For stretchers, he makes up octagons (he likes the way they catch the light in the finished stool), gauges them by eye for length against the legs while they are still in the foot jig, and then uses the hollow auger to make long tenons. He bandsaws the rung to a taper that will meet the tenon smoothly, then removes the marks with a drum sander.

Curtis is quick to give Wharton Esherick credit for the inspiration behind his type of stool, and Sam Maloof credit for the finish: beeswax and oil over a sealer that's part polyurethane. But when it comes right down to it, Curtis's eye makes each stool. □

Ron Curtis eyeballs a mortise as his foot jig steadies the work, left. The stool has an elm top and legs, and is about to be fitted with ash rungs. Curtis prefers native woods and will go out of his way to get them, but admits, 'I usually cut up some South American stuff for the wedges.'

Instead of tilting the table, Curtis uses this angled block. He sets the seat blank on it when he drills the holes for the legs.

Pat Pollard

The stools sell for $195 at Pritam and Eames Gallery in East Hampton, N.Y.

Folding Stool With Tray

Knockdown design for a dual-purpose project

by Tage Frid

I was asked to design a folding stool that would be light, take up little space when folded, and serve as the base for a tray. In addition, any parts broken during service would have to be easily replaceable. When the stool was finished it weighed 4½ lb., and measured 1¾ in. folded. Nothing has broken yet, so I haven't had to take it apart, but I could if I wanted to and it would go back together good as new.

I made the stool from ash. If I had used a weaker wood, I would have added to the thicknesses and widths for strength. The seat can be either leather or canvas. The one shown is canvas, with a single row of stitches to make a hem at the edges and a double row to hold the 3-in. overlap.

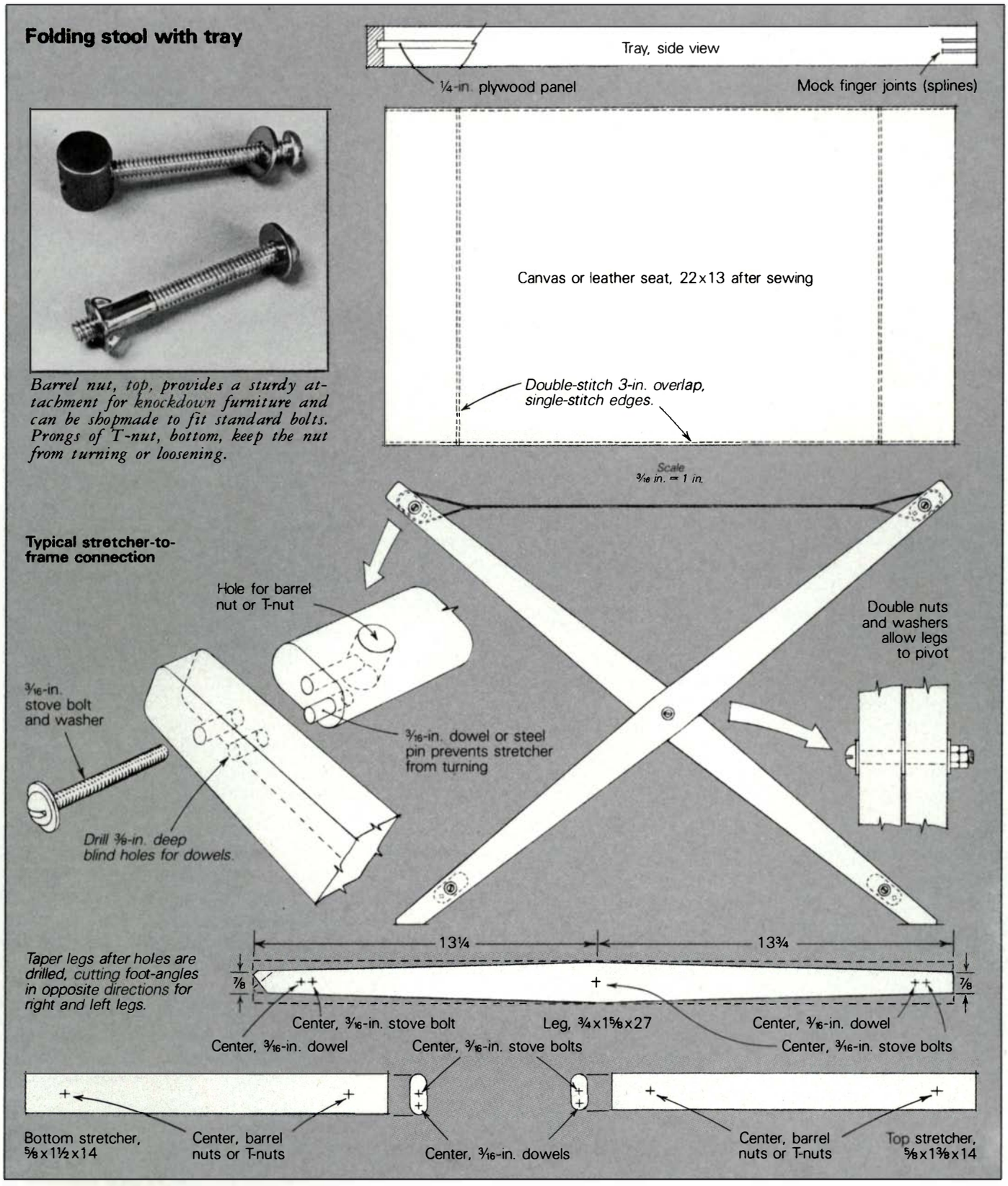
The stretchers can be held to the legs with either T-nuts or barrel nuts and 3/16-in. stove bolts. The stool shown here has T-nuts, which leave the holes in the stretchers open. Barrel nuts would have filled the holes and looked like metal plugs. Where the stretchers butt against the legs there's a hidden dowel (or a steel pin) that keeps the stretchers from turning. A washer between the legs where they cross allows the stool to fold easily, and double nuts are locked together so they don't have to be drawn too tight. If a tight single nut were used, the stool wouldn't fold. Washers under the bolt heads protect the wood.

The legs are identical except for the angle on the foot—the angle makes it a right leg or a left, to keep the dowel holes inside. Mill the leg blanks, square them and cut them to exact length. Set up the drill press with stops to locate the holes, and then drill them all. Notice that the holes for the dowels or steel pins don't go through—make these holes ⅜ in. deep. After you've drilled the holes, taper the legs with a taper jig on the tablesaw or on the bandsaw. Cut a little wide so you can run the edges over the jointer to remove the saw marks, and then cut the foot angle.

The stretchers are all the same length. I made the bottom stretchers ⅛ in. wider than the top because people have a tendency to put their feet on them when they sit on a stool, but the stretchers could be all the same size. Mill them out and cut them to length, then use a stop on the drill press to make the holes for the T-nuts or barrel nuts. For T-nuts, make ⅝-in. holes; for barrel nuts, use ½-in. holes. Of course, regular nuts could be used if the others aren't available, but barrel nuts are easy to make. My students and I use them a lot—they make an attractive and strong joint if a piece has to be disassembled. They can be of ½-in. cold-rolled steel, aluminum, brass, or other rod stock. Cut the nuts to length, so they will be flush with the surface if you want them to show, or shorter if you want to use them in a blind hole. File and sand the ends, then drill and thread holes for the bolts. Use a V-block jig in the drill press to bore the hole. Remember to countersink these holes so the bolt will start easily—when it comes time for assembly, you can wiggle the nut until you feel the bolt start to engage. If you use barrel nuts or regular nuts for the stool, use a 3/16-in. stove bolt, 2½ in. long. For T-nuts, use a 2-in. long bolt. Tilt the drill-press table to 90° and clamp a jig to hold the stretchers while you drill the holes

The taper in the legs of this stool cuts down weight, leaves the wood where it's needed, and allows the stool to close up to a snug 1¾ in. T-nuts in the stretchers allow disassembly. You don't have to store this stool in the closet when you're not sitting on it—make a tray that converts it into an occasional table or server, as shown above.

Photos: Roger Birn



for the bolts and dowels. The stool is now ready to be assembled, but first chamfer all the edges with a router or a plane, then sand and finish the pieces.

Don't make the tray before you have assembled the stool and measured it to be sure that the tray will fit. This one is an ash frame with a panel of ¼-in. walnut plywood in a groove. I didn't use solid wood for the panel because, to remain stable, it would have had to be ⅜ in. thick, and that would have made the tray too heavy to carry around. There's no trick to making the tray—I cut the corners to 45°, rubbed them together with hot glue, then strengthened them with a mock finger joint, which I learned from that wonderful book by Tage Frid. □

Tage Frid is professor emeritus of furniture design at Rhode Island School of Design, and the author of Joinery: Tools and Techniques *and* Shaping, Veneering, Finishing, *both of which are available from The Taunton Press.*

The Taming of the Skew

Subtlety, not force, wins favor

by Mike Darlow

For each piece of wood, an efficient turner employs the minimum number of tools, each, if possible, only once. This means being able to use each tool for a variety of cuts. No tool in a turner's kit has greater potential for this than the skew chisel—it planes surfaces smooth, cuts balls and beads, defines fillets and even makes coves, working all the while with a precise, responsive touch—yet the skew has a reputation for being the most unforgiving and unpredictable turning tool. It requires large, confident movements to slice its thin shavings, but a single small movement in the wrong direction can cause the tool to dig in and ruin the work. Indeed, the *Fine Woodworking Design Books* confirm, to my eye, that many turners deliberately avoid cuts requiring the skew, compromising on the preferred design in order to be able to use a gouge or scraper. If you slice with a skew instead of scraping, you will cut cleaner and produce finished work faster. We can create confidence in the skew by understanding the tool's geometry and practicing the various cuts.

Tool geometry—The skew is a long, straight-bladed chisel with its cutting edge ground at an angle to produce two very different points—an acute one called the long point, and an obtuse one called the short point (figure 1). There are two bevels, usually equal, ground on the sides of the tool to form the cutting edge. Perpendicular to the sides are two edges: one leading to the long point, called the long edge, and one leading to the short point, called the short edge.

For consistency, it is essential that the skew's sides are truly parallel, so that the cutting edge can be parallel to both of them, and that the long and short edges are at 90° to the sides. The width of the sides defines the nominal size of the skew, and sizes vary between ¼ in. and 2 in. Most general turning is done using a ¾-in. or 1-in. skew. This is a compromise between a long cutting edge (an advantage in planing) and narrow sides (which allow work in tight places). If a constricted space dictates using a smaller tool for part of the work, a production turner must decide whether to use a small skew for the whole job, or to pick up two or more different skews. If there is a large proportion of planing in the work, the turner will probably use two. Where a skew with sides narrower than ¼ in. is required, it is preferable to grind the long edge down at the end to make a shorter cutting edge in order to preserve reasonable stiffness. The minimum thickness of a skew should be ¼ in., or else the tool will be flexible and hence dangerous.

An important advantage of the skewed cutting edge is that this skewness provides a clearance angle for making certain cuts. When the tool is correctly shaped and sharpened, you can make the finishing cut on a shoulder, for instance, without the skew digging in. Set the skew's long edge flat on the

Fig. 1: The geometry of a skew chisel

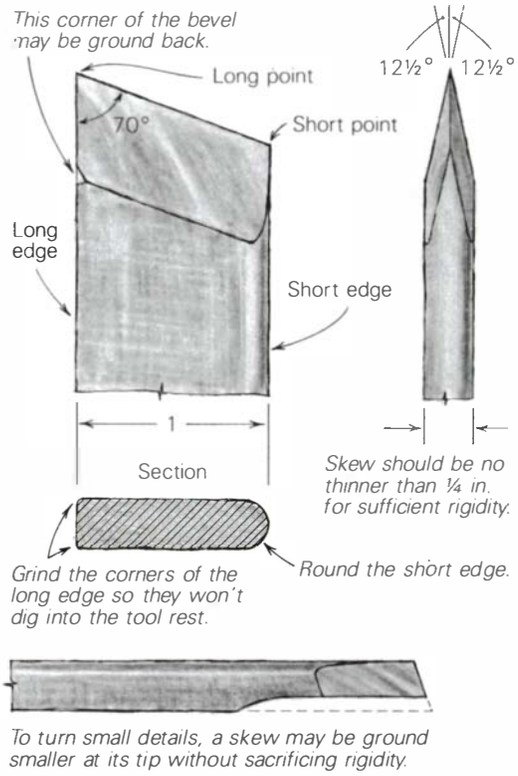


Fig. 2: Squaring a shoulder using the long point

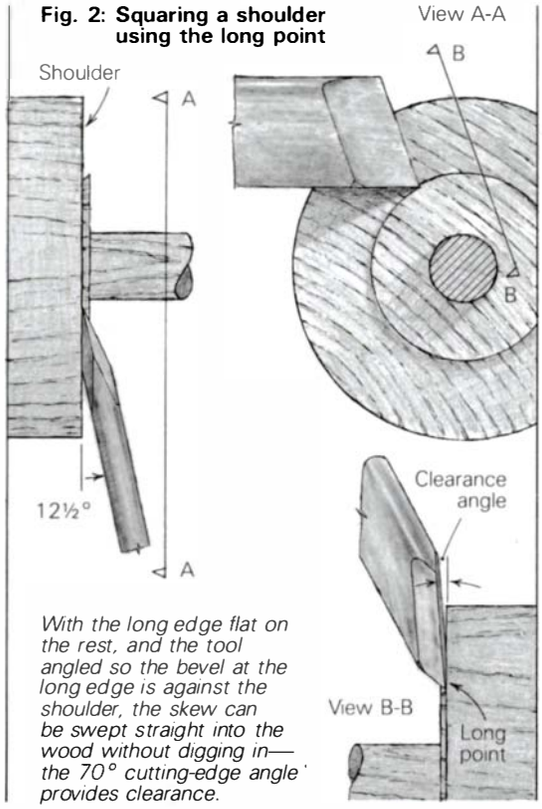
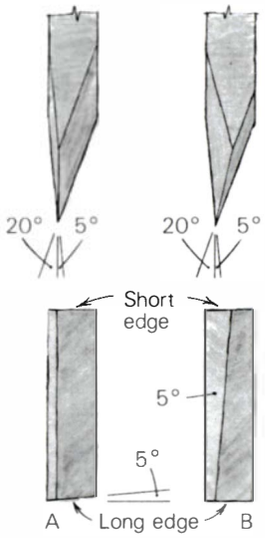


Fig. 3: Offset skew

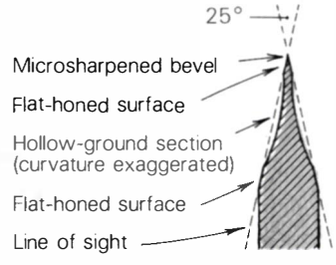


tool rest with the left-hand bevel at right angles to the lathe axis (figure 2), and push the skew straight in—the clearance angle makes the cut both easy and safe. Good turning is based upon confidence which is, in turn, based upon your tool's being predictable. The clearance angle is only about 5°, and hence if the tool is incorrectly shaped or sharpened the clearance angle may be larger on one side and smaller on the other, and predictability is lost.

In use, a side or an edge of the skew must always be in contact with the tool rest. To facilitate smooth movements over the rest, it helps to grind the short edge of the skew slightly convex, and to round the corners of the long edge. The tool rest and the sides of the tool should be smooth.

Sharpening—An angle of skewness of about 70° is the optimum compromise between retaining a strong long point and providing an adequate clearance angle. When grinding, hold the cutting edge parallel to the grinding wheel axis, the bevel flat on the wheel, and aim for an angle on each bevel of about 12½°, as shown in figure 1. I find that this sharpening angle works well on all woods, even our native Australian hardwoods (some of which are very hard indeed). The optimum diameter of the grindstone is 8 in. to 10 in. If smaller, excessive hollow grinding weakens the cutting edge; if larger, the bevel will be rather flat, which makes both grinding and honing more difficult. The grit and composition of the wheel depend on the type of steel. For my high-speed steel tools, I use a Norton 19A 60KVBE. Take care to keep the two bevels the same length, so that the cutting edge, when looked at head-on, is centered and parallel to the sides. Then the clearance angle will be the same on both sides.

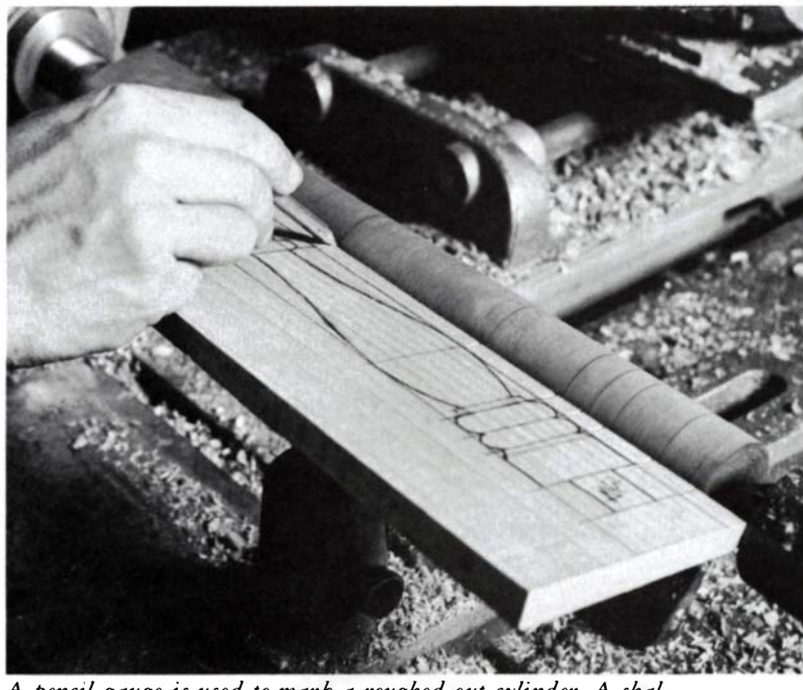
There are two misconceptions about sharpening: that the bevel need not be hollow-ground, and that honing is not required after grinding. The bevels need to be hollow-ground so that there is a straight line of sight along the bevel. The turner can then sight along the true cutting edge, the microsharpened bevel, when making cuts with the long point. Although gouges are more easily honed by moving the stone over the tool, I prefer to use a fixed stone for the skew. Try a shallow tray holding a fine-grade 6-in. by 2-in. oilstone immersed in kerosene, plus the slips for the gouges, mounted adjacent to the lathe and covered with a lid. Hone the skew with short to-and-fro strokes, and with both the heel and the toe of the bevel bearing on the stone. After both bevels have been honed, any burr can be stropped off.



Some turners do not hone, perhaps because the ragged edge straight from the grindstone gives an illusion of sharpness. An unhoned edge, however, scratches the wood surface and does not last. In addition, it is far quicker to rehone than to regrind, and your tools will last much longer.

A convex bevel is occasionally recommended in the belief that it polishes the cut surface. Actually, the texture of the wood contacted by the bevel is little affected by bevel shape, and the loss of the clear line of sight is a disadvantage.

Steel—Almost all ready-made turning tools are carbon tool steel, as it is easier for the manufacturers to fabricate. Here, in Australia, professionals usually use high-speed steel—it takes a finer edge, is more resistant to abrasion and does not lose its temper as readily as carbon tool steel does. It is especially recommended for the skew chisel with its exposed long point, which overheats easily. The amateur can change to high-speed steel by making his own long-and-strong skews. Hardened and tempered rectangular tool bits about 1 ft. long need only to have the bevels and tang ground by the turner himself. Of the vast range of tool steels available, American Iron & Steel Institute classifications T1 and M1 are best, being the least brittle of the true high-speed steels. Sears sells high-speed steel turning tools at a reasonable price, but the blades are shorter than I like.



A pencil gauge is used to mark a roughed-out cylinder. A shallow groove in the plywood supports the pencil point, allowing the turner to precisely transfer marks to the spinning work.

Handles—The skew should be worked with a sensitive touch, not brute force. On spindle turning the skew will usually be used for most of the turning time, and it will go through many complex movements. For good balance and leverage, the overall length should be about 18 in., and the handle should be light and fairly short rather than long and heavy. It's less tiring and gives better balance when you use the tool one-handed. My 12-in. tool blanks allow me to make long-and-strong tools with a 9-in. blade showing and a 9-in. handle. Although a rack of tools with matched handles looks very smart, having them all different, both in shape and wood, helps you find one fast when you want it.

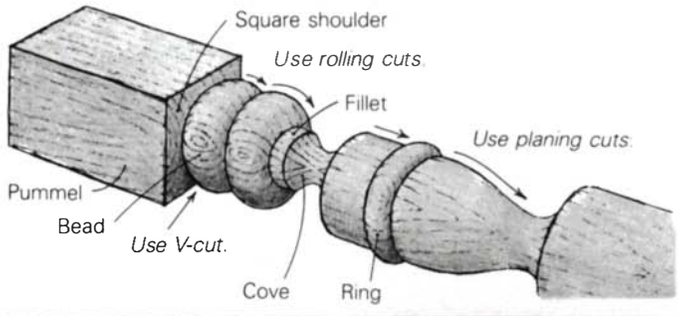
Laying out the cuts—Where a few identical items are to be turned, I begin each with a roughing gouge (*FWW* #12, pp. 60-64) to remove the bulk of the wood. A truly sharp one will leave the surface ready for marking out and detailed turning. Then I use a pencil gauge, as in the photo above. The gauge is ¼ in. to ½ in. thick, about 3 in. wide, and usually about 1 in. longer than the work. Draw the pattern full-size on the gauge, and project the main reference points to the edge. File short grooves where the lines meet the edge of the gauge. To mark out, rest the gauge on the tool rest

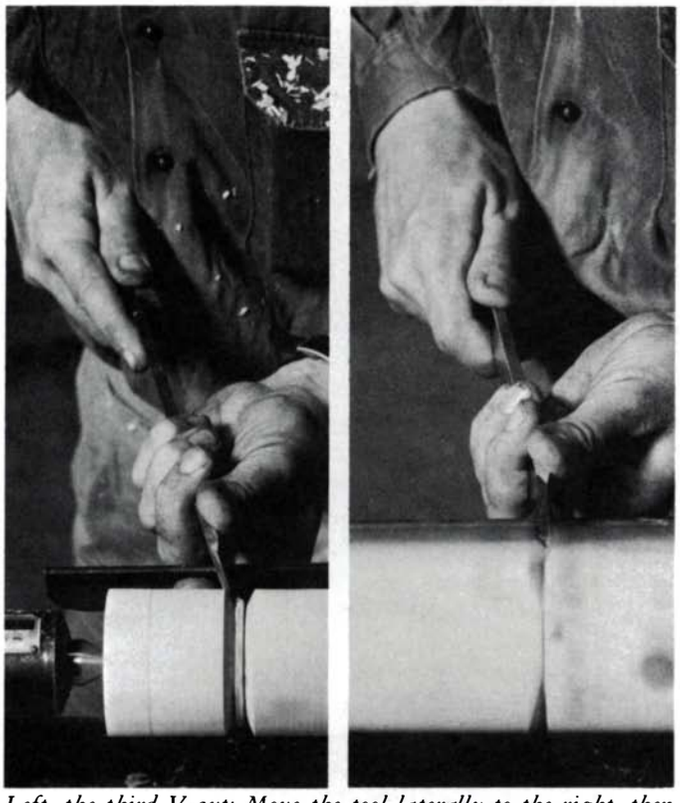
with its top edge lightly touching the rotating wood, and hold a pencil point against the turning at the grooves.

A conventional turning has several features, as shown in figure 4. A bead, an approximately semicircular convex curve, frequently ends at a short fillet forming a break between the bottom of the bead and a cove. A bead turned on a long curve is called a ring. Some spindle turning requires only a roughing gouge, a skew and a detail gouge, each being used only once during the process. Here are some of the cuts that can be made with the skew, roughly in the order in which they might be used.

V-cuts—To turn a bead, there must be clearance for the skew to move into and for the shavings to escape. The V-cut, with the skew resting on its long edge, is the first clearing cut. It spears into the wood, leading with the long point. To begin cutting a bead, three V-cuts are usually necessary. For the first, hold the tool at right angles to the lathe axis, with its long edge on the tool rest, and position the long point above the mark for the outer edge of the bead. Raise the handle so the point sweeps down into the wood. This initial cut is admittedly crude—the skew's tip crushes the wood on each side of the bevel, resulting in considerable friction and heat. There is little metal at the long point, so heat is only slowly conducted away into the body of the blade. Too heavy and sustained a pressure will create temperatures at the tool tip that are high enough to soften carbon steel. The two succeeding V-cuts widen and, where necessary, deepen the groove. Move the skew a little to the side of the first cut. Swing and rotate the handle so that the cutting edge points at the bottom of the first cut. Then raise the handle so that the long point sweeps down in an arc until it reaches the bottom of the first cut, as shown in the photo, bottom left. The process can be repeated, deepening and widening the V until sufficient depth is reached.

Fig. 4: A typical turning





Left, the third V-cut: Move the tool laterally to the right, then swing and rotate the handle so the cutting edge points along the intended line of cut. Sweep the point down to make the cut. To leave a pummel (right), cut the shoulder before the stock is roughed out. Make a series of V-cuts to achieve enough depth, then align the bevel at the skew's long point with the shoulder. With the long edge flat on the rest, arc the skew into the work, taking a light cut. The skew's built-in clearance angle makes the cut safe and easy.

To leave a square, or pummel, on a turned piece, the procedure is similar, although the V-cutting precedes roughing. Obviously, because of the greater depth of wood at the corners, more than three V-cuts are usually required. Make alternate perpendicular and sloping cuts until the shoulder is deep enough. These initial V-cuts leave a rough surface, so a final, light V-cut should be taken down the face of the square to the full finished depth. At the long point itself, the bevel facing the square should be at right angles to the lathe axis, which requires that you swing the handle slightly, as shown in the photo, bottom right. As long as the long edge is flat on the tool rest, you will come to no harm.

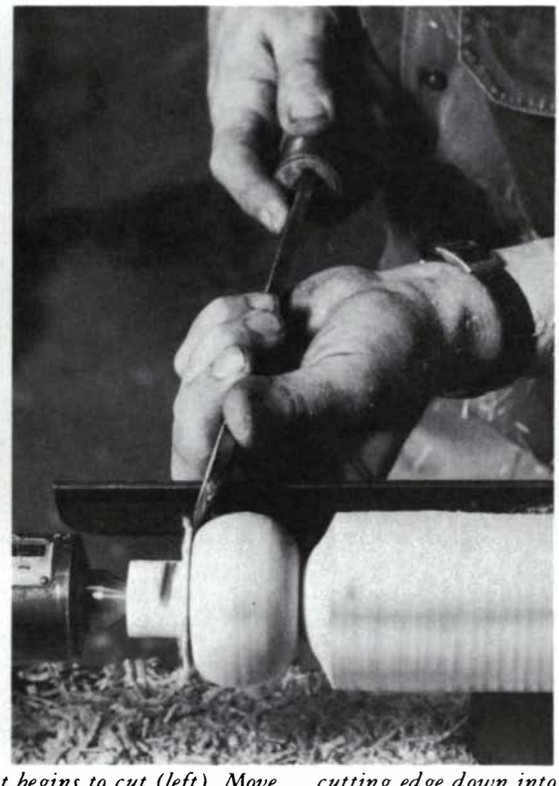
In cutting a bead, V-cuts define both the bead's lateral extent and, more important, its depth. After the V-cuts have angled in to clear room, the short point can make a series of rolling cuts to shape the curve. On stock of the size in the photos on the facing page, cutting each side of a bead usually requires three V-cuts followed by at least two rolling cuts.

Rolling cuts—In bead-cutting, use the very end of the cutting edge at the short point. The cut starts with the skew almost flat on its side. Hence to start a rolling cut, the handle must be rotated to tilt the cutting edge slightly so only the short point cuts. Also, the handle must be angled slightly behind the cut so that the cutting edge, not the short edge, is presented to the wood, as shown in the top photo and the bottom left photo on the facing page. Then, as shown in the middle photo, simultaneously rotate the short point to take a deeper cut, and—to keep the cutting edge in the work—move it around the side of the bead and vertically downward. It is often necessary to slide the blade along the rest. This involves quite large movements of the handle, swinging through a wide lateral arc and rising steadily, in order to keep the bevel rubbing and the short point cutting.

The underhand turning grip, visible in the photo at the top of the next page, makes control easier than conventional overhand grips. In this grip, which is widely used in Australia, the forefinger of the left hand extends under the tool rest and is used to steady the hand and power the tool. Left hand, tool and tool rest are tied together and can act as a unit. Provided that there is a gap of at least ½ in. between the work and the tool rest, the finger is safe.

To achieve a full semicircular bead at the end of the rolling cut, the skew has to cut perpendicularly to the lathe axis. Unfortunately, the clearance angle—of such assistance when

To begin a full rolling cut with the short point, start at the top of the bead with the skew almost on its side. Angle the handle slightly behind the cut to keep the cutting edge, not the short edge, in contact with the wood. When making rolling cuts, Darlow uses the Australian underhand grip, his forefinger gripping the back of the tool rest for better control.



Almost flat on its side, the short point begins to cut (left). Move the skew laterally along the tool rest to continue (center), rotating the handle to keep the overhanging cutting edge clear. Keep your elbows near your body for better control, swinging your body to pivot the skew on the tool rest. Raise the handle and move the cutting edge down into the work to keep the short point cutting. At the completion of the cut (right), the handle is rising and moving forward—Darlow has swung it far to the right with his body and rotated it so that the cutting edge, beyond the vertical, can form the side of the bead perpendicular to the work.

you are using the long point—becomes an interference angle when you are using the short point. Therefore, at the end of the cut the handle must be rotated so the blade tilts about 5° away from the cut, as shown in the photo at far right. This is why it helps to round the short edge of the skew, so that there is no sudden change in the cutting edge's relationship to the work when you transfer from one fulcrum to the other.

There are three main problems when making rolling cuts. First, if you fail to rotate the handle enough as you move around the bead, the overhanging part of the cutting edge will bite into the part of the bead you have just cut. This causes the working length of the cutting edge to increase suddenly from virtually nil to up to perhaps ¼ in. The cutting force increases almost instantaneously. Human reaction time is too slow to keep control of the tool, and it is shoved back, riding up and out of the bead. Second, if you inadvertently take too thick a shaving—by raising the handle too far, swinging it too soon around the bead or rotating it excessively—the strong shaving formed outside the short point will force the cutting tip farther into the side of the bead, ruining the shape. Third, if you persist in using a dull tool, it will not be able to penetrate the wood at the correct working angle—the tool will ride on top, compressing and glazing the surface, and making penetration even more difficult. When you try to get below the burnished surface, the tool will dig in. There is no cure except to sharpen your skew.

Rolling cuts are the main cause for the skew's notoriety. They require simultaneous lateral, vertical and rotational movements of the cutting point, plus lateral movement of the blade along the rest to make smooth curves without digging in. Needless to say, they need to be taken slowly, and they require considerable practice so that they become almost automatic. A bead of about ½-in. diameter is a good size to practice. It rolls naturally without the necessity of moving the skew laterally along the rest, although the handle still rises and swings through its broad arc, and the tool must be guid-

The planing cut, with the bevel rubbing the work to support the cutting edge, leaves a smooth, polished surface. Darlow guides the skew with his thumb while his left hand dampens vibration in slender stock, above. Generally, as shown at top right, neither the short point nor the long point should contact the work. The bottom right photo shows a modification: the slide cut, a planing cut that gradually leads up to using the extreme short point to cut the end of a curve without marring the side of a bead. As in all turning where most of the tool movement is horizontal, the conventional overhand grip is used.

ed forward over its pivot point on the rest. Larger sizes, with full rolling cuts, are less automatic and more difficult to learn. Many turners favor several short, overlapping rolling cuts, with the sideways movements in between.

When practicing, do not attempt too much at once and do not practice when you are tired or when things begin to go badly. Take a rest to restore your concentration. Don't use too large a square at first, 2 in. to 3 in. is about right. Use a gouge to clean up any scars on the work before proceeding or you may dig in again in the same place.

In the series of rolling cuts necessary to complete a bead, you are aiming for a constant shaving thickness. The cuts should be taken slowly and purposefully so that all the varying movements can be coordinated. There is also the problem of whether to watch the skew's cutting tip or the evolving bead profile. Obviously it is best to watch both simultaneously, but for those without Eddie Cantor's optical facility, watch the tip initially, and once the cut is started, switch to the profile. When you are comfortable making full rolling cuts with the short point, you will have few problems with the rest of the skew's repertoire. Here are some tips on the other cuts.

Long-point cuts—Most beads can be cut with either the long or the short point. The short point works better. It cuts down into the wood, thus burnishing the surface, whereas the long point lifts the ends of the wood fibers, so an inferior, almost porous surface is left. In addition, because the micro-sharpened bevel at the short point is supported by the work, there is less tendency for a jerky rolling action than when you are using the relatively unsupported long point. But do use the long point for very small beads, where the greater visibility helps. Ideally, you should execute the cut the same as you would with the short point, starting with the skew on its side and rotating the cutting edge through a full 90° until the blade rests on its long edge.

Where you cannot lay the blade on its side to start the rolling cut—as on the far side of a bead adjacent to a square section, where the corners of the square would hit the skew—you can use the long point, held more vertically, to make a series of rounded V-cuts to define the bead. Alternatively, and this means a time-consuming tool change, a very small skew or a nosed gouge could be used for a better surface.

When similar beads are adjacent, it is not possible to rotate the skew far enough to make the bead bottoms truly vertical. Cut as close to vertical as you can, until the skew begins to bind, then reach in with the long point to cut out any rags left in the cusp.

Cutting fillets—After completing the shape of the bead, and clearing some room, cut the fillet using the short point. As with the start of a rolling cut, angle the handle away slightly to present the short point of the cutting edge to the wood. It is easiest to keep the tool at one point on the tool rest, and to swing the handle so the cutting point levels the fillet. Don't contact, and hence spoil, the side of the bead above the fillet. Normally, fillets are cut parallel to the lathe's axis, although where room is constricted they are often sloped to avoid having to switch to a narrow skew.

Planing cuts—The planing cut, shown in the photos above, is a finishing cut that leaves curved and straight sections smooth and even. It consists of mostly lateral motion of the

skew along the tool rest. The planing cut is made with the short point leading, the supporting bevel almost tangential to the surface, and the cut always moving level or downhill. The cutting edge usually works at about 45° to the lathe axis, giving both a cutting and a riving action. The full length of the cutting edge can be used, with the exception of the long and short points themselves. The larger the diameter of the work, the larger the skew that should be used, in order to keep the points safely away from the work. If the long point becomes buried, the shaving is cut only on its near side. The shaving thus offers more resistance, and pushes the long point down into the wood, resulting in a deep tear. If only the short point is cutting, the action becomes purely riving, and splinters, not shavings, will result.

Sensitive control, which is one of the joys of using the skew, is accomplished by slightly varying the presentation of the tool to the work. The movements, in various combinations, become so ingrained that they seem instinctive: To take a deeper cut, merely raise the handle. To increase the downhill gradient of the cut, slightly steepen the angle of the cutting edge by rotating the handle. Raising the tool rest for the planing cut is unnecessary and time-consuming. Simply lower the handle so that the tool is presented with the bevel supporting the cutting edge.

If you are planing thin work and encounter vibration that causes your skew to chatter, it is perfectly safe to support the work with your left hand as it turns. The photo at the left on the facing page shows me steadying a turning while I guide the skew along the cylinder with my thumb. Your left hand can also feel how successful the steadying is—if you've got it right, the turning will feel smooth.

The riving component of the cutting action causes tear-out on interlocked or non-axially grained wood unless the cuts happen to be fairly steeply downward. To minimize tearing out, angle the handle back behind the direction of travel so that the cutting edge is more nearly square—say, about 70°—to the lathe axis.

If you are doing work where the corner of the bevel at the long edge digs into the finished surface, you can grind the offending corner away, as shown in figure 1, or tilt the skew more steeply so the corner clears the work.

Where a long curve meets a ring or similar projection, modify the planing cut into what could be christened the slide cut. As you approach the projection with the skew planing, gradually slide the tool forward so that the short point itself cuts, as in the lower right photo on the facing page.

Planing cuts can define convex and concave profiles, as well as straight ones. Hollows with a surprisingly small radius can be cut with a skew, using a modified planing cut and firm control. The lower middle section of the cutting edge is used and the angle of the tool is somewhat steeper than the tangent at the point on the hollow being cut. With large work, control is difficult because the bevel is not supported, but with practice the technique will be found risk-free and safe. Use a small skew on work less than 1 in. in diameter. Always cut down toward the bottom of the cove from both sides—don't try to cut uphill.

Parting cuts—You can make V-cuts one-handed with the long point for parting off, which frees your other hand to steady and catch the finished turning. Slacken the tailstock a little toward the end of the cut so that the work will come away freely. Don't part off work too large to control or turnings with square sections at the left-hand end.

The skew can quickly remove waste. Keep the bevel rubbing, and the edge moving forward, as the diameter goes down. A firm grip is necessary.

If you do much parting off from a chuck, you will want to be able to part off close to its face, which should be covered by a guard. The offset skew (figure 3) allows this, with its 5° right-hand bevel.

The skew can also set diameters and remove waste. Hold the cutting edge parallel to the lathe axis with the lower bevel rubbing, as in the photo above. The action is identical to that of the conventional parting tool—which should slice rather than scrape—except that the skew will tend to move sideways in the direction of its long point. You cannot make this cut, of course, unless there is clearance for the short edge of the tool. If holding the skew with only the right hand (the left hand holding the caliper), brace the handle beneath your forearm, extend your forefinger down the tool for firmness, and don't use a skew wider than ½ in.

Steering the skew—The right hand provides most of the power and steering. When doing a series of cuts with a particular tool, it is natural to regrip for each cut so that the right hand is comfortable during that cut. For rolling cuts, however, it is best to grip the tool so that the right hand reaches the natural, comfortable position at the completion of the cut. This makes the cut almost automatic because the right hand wants to return to an unstrained position.

Extending the forefinger, as I usually do, is a way of getting a more precise feel of the tool, as well as of adding firmness when needed. For control and balance, keep your right arm close to your side.

With any human activity, practice of the correct techniques, while perhaps not making perfect, at least makes much better. Unfortunately, new techniques tend to feel unnatural, so keep on turning and be prepared for things to get worse before they get better. □

Mike Darlow, 38, keeps four lathes busy turning lace bobbins, restorations, production work, bowls and gallery pieces in Chippendale, N.S.W., Australia. Photos by Peter Johnson, Sydney.

Wood Identification at FPL

Sharp eyes and lots of experience get it right

by Paul Bertorelli

As a material, wood has a lot of things going for it—not the least being its enormous variety. There are more than 20,000 different kinds of trees growing in the forests of the world. So many of these woods are favored by man for his shelter, furniture and objects that just telling them apart is nearly a full-time job for a handful of laboratories in the U.S. and abroad.

One of these places is the U.S. Department of Agriculture's Forest Products Laboratory, located in Madison, Wis. There, a staff of three wood scientists divide their time studying wood anatomy and identifying thousands of samples sent in each year. To aid their research and to compare knowns with unknowns, the FPL scientists have the world's largest wood research collection—some 100,000 cigarette-pack-size blocks stored in banks of indexed drawers. The collection grows by 200 to 300 specimens each year.

About half of the lab's identification work is done for the wood industry. The rest of the samples to be tested come from the general public or various government agencies and museums, and more than a few bar bets have been settled by the lab, according to Regis Miller, who supervises it. Miller says the lab likes to guarantee satisfaction but can promise only to identify a particular wood's family and genus—picking the species is usually not possible.

Miller begins the task of identifying a strange wood by slicing a small chunk off the specimen's end grain. Next he wets the cut surface so the wood's characteristics can be scrutinized through a 14-power hand lens. If the wood happens to be a distinctive domestic species, Miller can usually identify it just by looking through the lens. At this stage, he can sometimes use color, odor and density for a quick identification.

More frequently, though, he must take thin slices off the sample, making sure to get radial and tangential sections. These match-head-size shavings are then placed on a glass slide with a solution of half glycerine and half alcohol, and boiled on a hotplate. This process drives out air bubbles that can obscure the wood's inner structure.

Peering through a lighted microscope at the thin slices, Miller begins what can be a complicated mental juggling act by asking himself if he has seen this cellular pattern before. "There's no substitute for experience. . . you've got to know what you're looking for, and the only way to know is to have seen it before," he says. With more of the wood's inner structure revealed, Miller can sometimes call up the proper mental image to identify the wood, or he can at least get close enough to root out a sample with which to compare it.

If the wood's identity still isn't apparent, the real work begins. Miller falls back on his knowledge of wood anatomy to pick out the sample's dozens of individual characteristics. He then pages through hefty books called dichotomous keys, which list thousands of wood samples by anatomical detail, an arrangement that permits a methodical narrowing of possibilities. Notes kept on index cards help Miller supplement information printed in the keys. Eventually, this process of elimination points to a small number of wood families.

Wood anatomists at the U.S. Forest Products Laboratory in Madison, Wis., have nearly 100,000 specimens of wood for research and identification. Here, Regis Miller, the lab's supervisor, searches for a sample.

Woods from temperate climates, particularly North America, are the easiest to identify because they are few in kind, and Miller has seen many of them before. There are, however, thousands of tropical species, some of which have never been identified at all. And tropical woods have a way of passing in and out of commercial importance, a fact that diverts a fairly steady stream of tough-to-pick unknowns into the lab. Computers can make wood identification faster, and FPL researchers are designing computer-assisted identification systems for domestic and tropical species.

Miller estimates that only 1% of all the samples examined can't be identified, either because they don't appear in the keys or his notes, or because he can't find a sample in the collection with which to compare them. "You get to a point where you've worked on a sample for two or three days and you've gotten nowhere. We have other work and we just have to move on," Miller says.

Because of limited time and staff, the lab requests that samples be sent only by people with a clear need for identification, and in limited numbers. Samples should be at least 1 in. by 3 in. by 6 in., though smaller pieces can also be identified. Place of origin and local popular name, if they are known, will help. Specimens should be sent to the Center for Wood Anatomy Research, U.S. Forest Products Laboratory, PO Box 5130, Madison, Wis. 53705. There is no charge for the identification service. □

Paul Bertorelli visited FPL this past spring. For more information on the world's huge variety of woods, contact the International Wood Collectors Society, c/o Bruce Forness, Drawer B, Main St., Chaumont, N.Y. 13622. The IWCS, formed in 1947, is dedicated to the advancement of knowledge about wood. The Society sponsors wood identification workshops, regional and national conventions and an annual wood auction, and it publishes a monthly newsletter. Its members frequently swap wood samples. IWCS membership costs $10.50 in the U.S. and $12.50 in Canada.

Gilding With Metal Leaf

Fit for a frame or a fleur-de-lis

by Erwin O. Deimel

While there is no doubt that genuine burnished gold leaf is the ultimate in gilded finishes for frames, furniture and ornaments, there is a much less costly alternative. Schlagmetal, thinly beaten metal alloy, is the material used on most picture frame moldings and other gold-leafed articles. The result is meant to look like the burnished-gold leafing that was extensively practiced during the Renaissance, but which, due to cost, is seldom done today. Schlagmetal is much easier to handle than real gold, which is beaten so thin that it is transparent when held up to the light—you can touch schlagmetal without having it disintegrate.

As a picture framer who finishes most of his own moldings, I use a process not much different from that used by commercial molding companies, who gild thousands of feet a day. This process, however, can be adapted to small scale, using brushes instead of air guns, and not requiring such elaborations as spray booths; in short, adapted to the home workshop or retail establishment.

In the original process, water gilding, genuine gold leaf is applied to a colored ground of gilding clay mixed with animal glue. The clay has a high iron-oxide content, which gives it a barn-red color. The glue is the binder for the coating, and can be burnished to a high gloss and reactivated with moisture to hold the leaf to the clay. Because leaf is an uninterrupted sheet of reflective metal—not ground-up particles in a dulling binder—it has a luster that paint cannot match. Renaissance frames were probably left very bright, to look like solid gold. But during generations of being dusted and cleaned, the gold wore off the high places, dirt accumulated in the low spots, and the frame acquired a soft patina that pleases us more today. Contemporary gilders simulate this patina by sanding or scratching the leaf to expose the color underneath, applying imitation flyspecks (meant to be the work of generations of flies), and using a thin wash of paint instead of waiting centuries for dust to build up.

I buy unfinished molding instead of milling it myself. A splendid array of shapes and sizes, in a variety of woods (mostly bass, poplar and virola), can be bought wholesale from distributors, or one-frame's-worth at a time from frame shops. Old frames can be salvaged and refinished, too. While you can work on a frame after it has been assembled, it is easier to gild the lengths separately because you won't have to fold the leaf into tight corners. Cut the sides of the frame a little longer than necessary—you will make fresh miters after the leafing and antiquing have been completed.

Whether you are gilding a frame, a box or a piece of furniture, begin by priming the wood with orange shellac (4-lb.-cut, diluted with about five parts alcohol) to seal it and set up the fibers for sanding off with 150-grit paper. Remove the fuzz, then paint on two or more coats of acrylic paint. This base coat softens the molding shape and provides tone, just as clay originally did. Commercial molding companies often use a brilliant crimson under the leaf. A muted red, like burnt sienna, looks more like the real thing. For silver leaf, a blue clay was frequently used. When I gild with aluminum leaf, to simulate old silver, I prefer a black ground.

You can get acrylic paint in tubes from an art supply store. Mix it roughly half-and-half with acrylic medium, thin enough to brush smoothly but with enough body to fill small irregularities. Acrylic paint is a polymer, but if you catch it before it cures, you can clean up with soap and water. Two coats can be applied in an hour or so, and the ground will be ready for sanding after it has dried overnight.

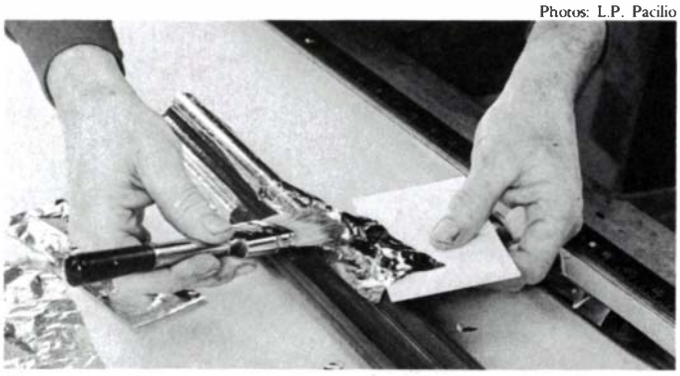
Sand the ground coat smooth, then apply one or two coats of undiluted 4-lb.-cut orange shellac, sanding lightly between coats. This step is important. If the surface isn't completely sealed, the adhesive that holds the leaf will dry too quickly in patches, and the leaf won't stick there.

Since we don't have animal glue in our ground, we must apply a layer of gold size (adhesive) to hold the leaf. The size is an oil-based varnish specially developed for gilding. It comes in two varieties—slow and quick. Quick size dries in about an hour or so, but I've found it too irregular for good results. I use the slow size, which reaches the proper tack in about 12 hours and is workable for 12 hours after that. Whichever you use, the object is to have as thin a coating as possible, with just enough tack to hold the leaf. If size is applied too heavily, or accumulates in low places, it will skin over but remain liquid underneath. This will turn to goo and spoil the job when you rub the leaf down. Gold-leaf size will polymerize if there is any air in the can, so when I open a new liter I immediately put it into 2-oz. medicine bottles and seal them tightly. In my shop, where I leaf 20 ft. to 30 ft. of molding a week, an ounce of size lasts a month or more.

I apply the size using a velveteen pad about 2 in. square. On frames without carving this pad gives me better control than a brush would, and when I'm finished I can just throw the pad away. Slow size comes either clear or with yellow pigment added for visibility. I use the yellow, and apply just enough to be able to see a faint yellow color over the ground. Apply size in the late afternoon. By the following morning it will be ready to gild, and it will keep its tack through most of the day—you don't have to rush. A properly prepared frame will seem to have dried too much—the size will not feel tacky, but smooth and hard, with a squeaky clean kind of feeling. A fingerprint may prevent the leaf's adhesion, so try to do your

Erwin Oskar Deimel, a retired aerospace engineer, owns Oskar's Picture Framing in New Hartford, N.Y.

Photos: L.P. Pacilio



To apply the metal leaf, first prepare the wood surface with shellac and acrylic paint. Then apply a special oil-based varnish. When the varnish is tacky, transfer the leaf to the molding using a paintbrush. Cover the high spots first to avoid tearing the leaf, which won't stretch into the valleys.

Buffing the leaf with cotton forces it to conform to the base coat's polished surface. Excess leaf is dusted off.

testing, if you must, on some inconspicuous part of the frame.

Leaf is available in several forms: most commonly in books of 25 sheets, about 5½ in. square, separated by paper sheets, or in bulk packs of 50 sheets stacked together, 10 packs to a box, about 7 in. square. I use bulk leaf, picking it up from the box with a 1½-in. paintbrush, and laying it on a flat surface so it can be cut. With scissors, cut strips of the desired width. Slip one strip of leaf, with the help of the paintbrush, onto a piece of cardboard a little longer than the leaf, and slide it onto the sized surface of the frame. Aim for the right place. Once the leaf touches the size, you will only tear it if you try to move it. But if you have placed it a little crooked, no matter. Lay it down as it lands and overlap the next piece to fill the gap. The leaf will stick only to the size, not to itself, and the extra will be dusted away later.

Leaf doesn't stretch. On many moldings, it will stick to the high spots and tear raggedly when you try to force it into the low spots. The solution is to gild the high sections first with narrow strips of leaf, coming back to coves and valleys later.

After the entire length is covered with leaf, take two or three cotton balls and rub the surface smoothly but firmly to ensure that all the leaf contacts the size. Rub in the direction that will press the overlaps down, not tear them up. Give an extra rub parallel to each joint. If there is a holiday (bare spot) in the job, place a piece of leaf over the spot and press it into place with cotton, then rub the patch smooth. The hairline joints between leaves are called spiderwebbing and will become part of the antiquing.

If your size was too heavy or not dry enough, wrinkles in the leaf will set into the finish when you rub it down. Puddles of undried size can smear over the surface, irreparably dulling it. In this case, it is best to let the size dry thoroughly, then sand the leaf smooth and gild again. Usually, though, the problem is poor or spotty adhesion. If the problem is extensive, sand and reprime. Small blemishes, however, can be corrected by adhering fresh leaf with shellac. Dab on a thin layer with your fingertip, feathering the edges so a ridge doesn't form. Within a few seconds, the shellac will have the correct tack for the leaf to be applied.

Unlike real gold, schlagmetal is subject to corrosion, so to prevent it from tarnishing, seal the surface with the same dilute alcohol-shellac mixture used to prime the wood. This will reduce the glare of the leaf slightly, but the molding is quite garish at this stage, looking like a chocolate candy wrapped in gold foil. It will need even more antiquing to tone it down.

To obtain a typical finish, first apply the thin sealer coat, then give the molding a coat of undiluted orange shellac to make the gold a little deeper in color, a little redder or warmer. In fact, even aluminum leaf can usually do with some warming up. Next paint the molding with an antiquing coat of acrylic paint, a mixture of burnt umber with a little black added, then wipe it off lightly with a paper towel to leave some color in the low areas and a light, streaky finish in the high spots. When this is dry, use a toothbrush and some dark paint to imitate flyspecks. Point the toothbrush at the frame, then stroke the bristles toward you. Tiny drops of paint will spatter the frame. New flyspecks are raw umber, ancient ones are black. They are put on not so much to immortalize the housefly, but to give depth to the finish. From a few feet away, they will not be noticeable. Remember what we are aiming for: years of considerate care that have nevertheless left their mark, not what looks like half-a-day's vandalism.

To age your molding, scrub off some gold. Sandpaper rubbed with the grain imitates the effect wood movement has on clay. Fine steel wool can rub the gold from the high spots to expose the ground color. You can stipple the wash coat instead of wiping it, and you can increase contrast by wiping the wash coat away from the high spots with a damp paper towel. Instead of the dark wash coat, you can try raw umber and white, which makes a warm gray. After the frame has been mitered and joined, you can touch up the joints with a little antiquing color to cover up any hairline of raw wood. Experimentation will show you a boundless variety of finishes. I once tinted the shellac with aniline dyes to yield a molding of warm brown-gold with a stripe of brilliant green—the colors of a Japanese beetle.

A final coat of clear acrylic medium will yield a remarkably durable, low-luster finish. In ten years, I have never had a job come back because the finish failed. I have scrap pieces that have been kicking around my outdoor kindling shed for years, exposed to heat, humidity and drifting snow. They still look as good as gold. □

EDITOR'S NOTE: Gilding supplies are available in small quantities from Dick Blick Co., Box 1267, Galesburg, Ill. 61401. H. Behlen Bros. sells supplies for both oil and water gilding through a network of distributors; for more information, write to them at Rt. 30 N., Amsterdam, N.Y. 12010, or phone (518) 843-1380. Other sources worth checking out are Art Essentials, Drawer 260, Monsey, N.Y. 10952, and The Durham Co., Box 1548 GMF, Boston, Mass. 02205.

For further reading, get a copy of *Gold Leaf Techniques,* by R.J. LeBlanc, revised by Arthur O. Sarti, 1980, available for $13.95 from Signs of the Times Publishing Co., 407 Gilbert Ave., Cincinnati, Ohio 45202.

Gilding: On the trail of Cennino

by Henry E. Sostman

Clocks tell time, but time also tells on clocks. The clock at right is one of two that were built in Holland in 1722, with hand-cut clockworks by Jonathan Marsh. Clockmakers in the early 18th century made only the movements, and Marsh's were put into twin cases by some unknown woodworking shop. My wife's ancestors bought this one new.

It is only recently that my wife, Theodora, and I have lived in a house whose ceiling can accommodate the clock's 9½-ft. height. We had the works restored, and the movement keeps excellent time now. All the delightful figures—the boy who pulls a fish out of the river once a minute, and the windmill that turns when the hour and half-hour strike—work again. I restored the case myself, because I wanted to have a hand in its future.

Moisture and age had reduced the crowning figures to bare wood. The angels had lost their trumpets and wings. Atlas, in the center, looked like he was losing his battle to hold up the world. A photograph of the twin clock provided a design for the missing parts and confirmed that the figures had been covered with gold. I was anxious to learn about the techniques used by the original maker, but information was scanty. Medieval painters, excellent gilders, kept their methods secret. During the Renaissance, however, one artist broke security. He was Cennino d'Andrea Cennini, and his book tells almost all we know about tempera painting and its integral component, gold. In a translation by Daniel Thompson, *The Craftsman's Handbook,* I found the source for a process that has remained virtually unchanged for at least 500 years. Although I substituted modern materials, I tried to recondition my angels in the spirit in which they had been made.

One chapter of Cennino's book takes the reader through the gilding process. In the 15th century, the first step was to choose a gold coin and deliver it to the local gold beater, who methodically pounded it between sheets of leather until it became flattened into many leaves. Cennino even tells us that the beater "ought not to get more than a hundred leaves out of a ducat."

The wood was prepared with many coats of gesso and clay, smoothed and polished with stones. Cennino used powdered chalk for gesso, and Armenian bole for clay, both mixed with a

An angel restored and gold-leafed.

binder made by boiling animal skins. Fine carving could be incised into the surface before the gold was put on, and the surface burnished to look like solid, polished gold. Cennino used a dog's tooth to burnish the gold. Today, gilders use a tooth-shaped agate.

I used plaster and gelatine for the gesso, and Hastings clay instead of Armenian bole. To adhere the leaf, I substituted slow-drying size for Cennino's boiled parchment glue. I used as much care and time to prepare the surface as Cennino said was necessary. After so much work, it seemed a foolish economy to substitute brass leaf. Brass would have to be sealed with a lacquer or shellac that would deteriorate in a few decades, while pure gold would never tarnish, and its thinness would allow it to follow every detail of the carving without hairline wrinkles. It seemed to have every advantage, so I took Cennino's advice, and for gold I used gold. □

Henry E. Sostman is vice president of the Yellow Springs Instrument Co., Inc., in Yellow Springs, Ohio. He is a registered Professional Engineer whose activities include temperature physics and Federal regulatory law. Photos by the author. Cennino's book, translated by Daniel Thompson and published by Yale University Press in 1933 as The Craftsman's Handbook, *is available from Dover Books, 180 Varick St., New York, N.Y. 10014, for $3.00.*

The stately clock with its golden crown.

Curved Moldings on the Radial-Arm Saw

Shaper setup can cut a swan-neck

by Wallace M. Kunkel

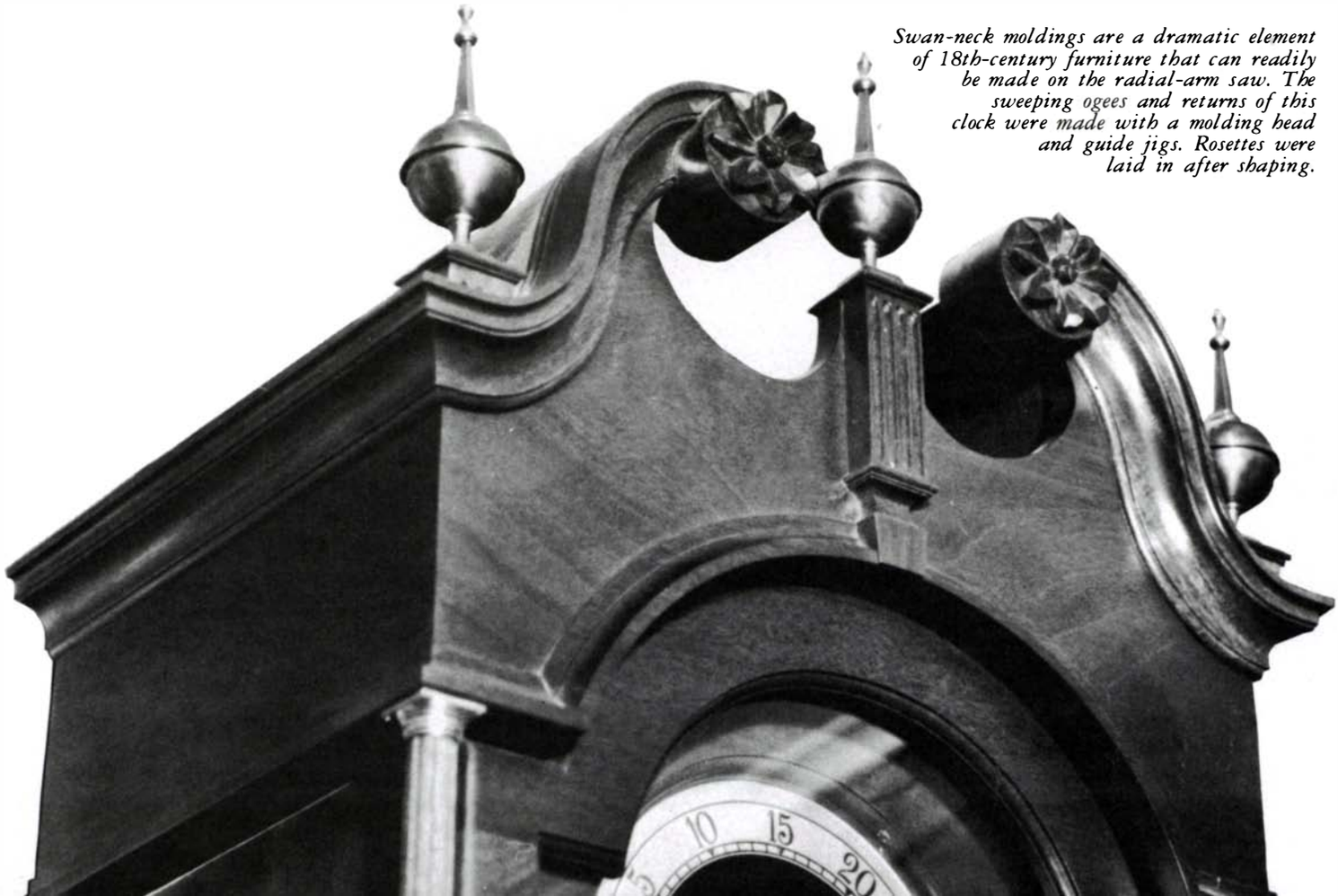
My particular interest is copying 18th-century furniture, and nothing delights me more than bonnet-tops for highboys and tall clocks. Many woodworkers are capable of all the necessary joinery for such pieces yet are stymied by the swan-neck or sweeping ogee moldings. I make many joints by hand, but my moldings are a product of my DeWalt 10-in. radial-arm saw.

The swan-neck molding is a series of parallel profiles describing an ogee curve. On clocks and highboys, it is returned with a straight molding of the same profile along the sides of the case. This type of shaping is often done on the spindle shaper, but the radial-arm saw can make the series of cuts with a molding head, guided by a template screwed to the board being molded.

I usually make all four pieces of the molding—the right-hand swan-neck and the mirror-image left-hand swan-neck, each with its accompanying straight section—at the same time, on opposite edges of a single board. You can also use two shorter boards, as in figure 1. If you do, just flip the template for the mirror-image molding. Start by laying out the innermost curve of the molding on one edge of each board. You can enlarge the curve from figure 1, which is taken from Lester Margon's *Construction of Early American Furniture Treasures,* or you can design your own profile. For the molding shown here, I started with a straight-grained cherry board 26 in. long, 8 in. wide, and 1⅞ in. thick. The molding stock should be screwed, down the center, to a piece of ¾-in. particleboard that is the same width as the molding stock but 6 in. longer on each end. The particleboard will serve as a template and it will elevate the molding stock to give the arbor nut room under the molding head. The particleboard's extra length makes entering and exiting the shaping operation safer. With the molding stock attached to the particleboard template, transfer the curve to this assembly and bandsaw the shape. Hand-sand or use a drum sander to smooth the curve, particularly on the template since it determines the smoothness of the final cut.

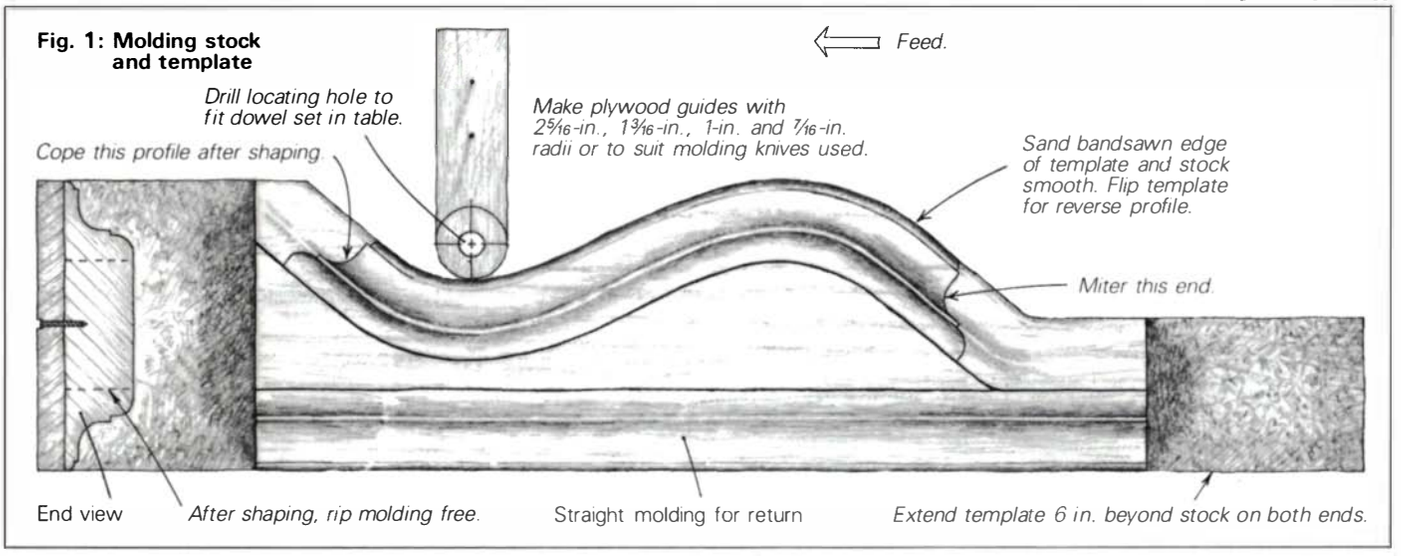
I use a Rockwell 4-in. molding head with interchangeable knives. This 3-knife head describes a 5½-in. diameter circle with knives in place. If you are making moldings requiring a tighter inside radius, Rockwell sells a smaller head that works inside a 2¾-in. diameter, using the same knives.

To set up, make a new back table for your saw. Since you won't be using the fence for this operation, make the new table ¾ in. wider than the old one. Use a flat piece of particleboard or plywood, and make sure the joint between the front and back table surfaces is flush. With the new back table temporarily locked in place, remove the sawblade,



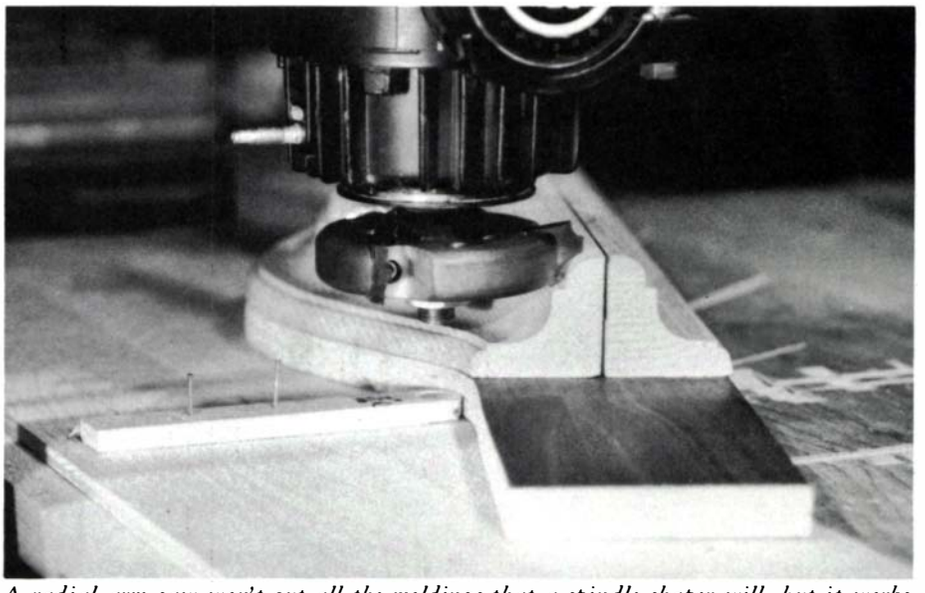
Swan-neck moldings are a dramatic element of 18th-century furniture that can readily be made on the radial-arm saw. The sweeping ogees and returns of this clock were made with a molding head and guide jigs. Rosettes were laid in after shaping.

Drawings: Christopher Clapp



collar and guard, and swing the arbor to the vertical position. Then move the arbor about 3 in. behind the table joint and mark the arbor center on the back table. Remove the back table and drill an arbor-size blind hole (usually $\frac{5}{8}$ in.) in the tabletop, almost but not quite through the thickness of the table. Put the back table in position, and move it and the motor until the arbor drops into the hole as you lower the arm. Lock the back table in this position. Then lock the roller head in the arm and leave it locked throughout the entire shaping operation. To add extra rigidity, I next adjust the roller-head bearings so they bind in their track—that way the roller head won't wobble. Keeping the motor rigid is important, otherwise the cutter may chatter during shaping. Elevate the arbor out of the hole. The arbor-size hole you drilled will be filled with a dowel that sticks $\frac{1}{4}$ in. above the table surface. This dowel serves as a positioner for the guides.

Next make the guides—various-size $\frac{1}{4}$-in. plywood jigs tacked to the saw table that control the distance the template is held from the center of the arbor, and hence the depth of the cut. Making them is no problem if you understand the relationship between molding head diameters and the cuts they make. The Rockwell cutterhead with knives installed describes a $2\frac{3}{4}$-in. radius at the outermost portion of the knife. The simplest profile, that made by the Rockwell #104 straight knives, will have a radius of $2\frac{3}{4}$ in. at all points. If the knife describes a $2\frac{3}{4}$-in. radius and you wish to make a cut 1 in. into the material, for example, you need to make a guide that has a radius of $1\frac{3}{4}$ in.



A radial-arm saw won't cut all the moldings that a spindle shaper will, but it works well for swan-necks. The stock to be molded, here ripped into two pieces for clarity, is screwed to a particleboard template. The saw's fence is then removed and replaced by a radiused-end plywood guide that bears against the template as the stock is fed into the cutter. Make the template 6 in. longer on each end so you'll have a bearing surface to start and finish the cut.

Any kind of molding head can be used, but make sure you check its radius before making the guides.

The sizes I use are shown in figure 1, but you can vary them to suit the radius of your molding head and knives. The length of the guide should be at least 6 in. The locating hole in the guide must be the same diameter as the dowel pin set in the table. Touch up the edges of the radius with sandpaper.

For my molding head, four guides are needed—from $\frac{7}{16}$-in. to $2\frac{5}{16}$-in. radius, as shown in figure 2 on the next page. Each guide is placed over the dowel, squared with the table and secured with two brads at the back. Changing knives and guides can be tricky. Without unlocking the motor in the arm, you can raise the arm and pivot the motor to the crosscut position to make it easier. Also, you can swing the arm to the side to give yourself room to hammer brads to attach guides.

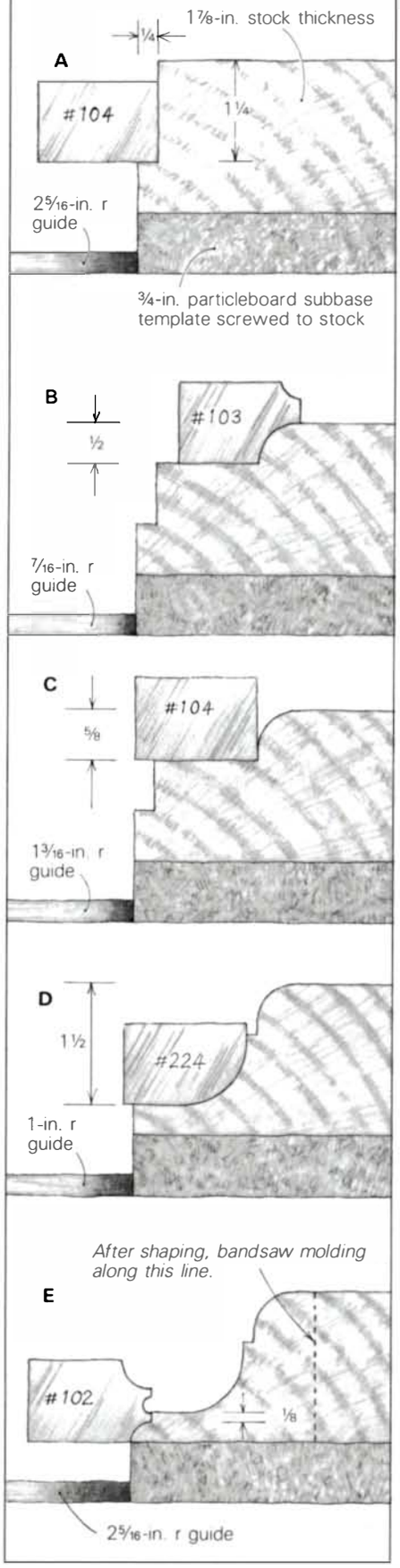
On deep cuts, the nut on the bottom of the arbor might rub against the wood, marring it. To prevent this, the first cut is made with the straight knives and it removes enough wood to allow the second cut to be made without the arbor nut rubbing. This "relief" cut won't be part of the finished profile, but it must follow the edge of the template.

With the setting up done, the actual shaping is a matter of feel. Running the first or relief cut is good practice since the results are not critical. With the $2\frac{5}{16}$-in. guide, make the relief cut with the straight cutters $\frac{1}{4}$ in. into the stock and to a depth of $1\frac{1}{4}$ in. To start the

Fig. 2: Sequence of cuts

First pass is relief cut to provide clearance for the arbor nut in the second cut. When starting a new profile, increase depth in ⅛-in. to ¼-in. increments, then take a light finishing cut.

Numbers are Rockwell knife identification numbers



cut, lower the cutters with the motor off until they touch the top of your material. Move the stock away from the cutters and lower the arm exactly three turns—⅜ in. Turn the motor on, and with the extended portion of the particleboard template held against the guide, feed the stock slowly into the cutters. Despite the curves, feed the work as nearly parallel to the fence line as possible. The subbase template will guide you into and out of the cut easily, and the stock sort of wraps around the molding head as the radius of the curve nears the radius of the head. Continue with the first cut in increments of two or three turns of depth until you reach the full depth of 1¼ in. Continue shaping using incremental depth settings and the sequence of knives shown in figure 2.

As you begin each new profile, you can take cuts as deep as ¼ in. But after that, stay with ⅛ in. until you get the feel of the cut. Total depth measurements are shown for each profile, but you can vary them to suit your own needs. Remember that each turn of your elevating handle equals ⅛ in. in depth. Each pass must be made on both edges of your stock—the curved edge and the straight edge. Be patient, and as you approach the final depth of each profile, leave a quarter turn of the handle for a clean-up cut. Fine sandpaper will smooth any remaining irregularities.

For a clean, safe cut the molding knives require hand-honing. Work the flat face (bevel up) on a fine slip stone until the entire profile shows the result of the honing. The bottom edge of the knives is relieved (slightly beveled), so you also hone that bevel because most of these cuts reach deep into the material, and the bottom of the knives must do some planing. The knives described here are among the most useful. Whether you purchase them specifically for this molding or not, you'll need them sooner or later if you plan to do much shaping. They cost about $15 per profile plus $40 for the head. After you have made this molding, one of the most difficult, you'll be able to apply the same method to other radial-arm shaping jobs with ease. The key is understanding how the guides work and getting the feel of moving the stock into the cutters. □

Wallace M. Kunkel operates the Mr. Sawdust School of Professional Woodworking in Chester, N.J. Photos by Jeff Kunkel.

Clock tops and planing on the radial-arm saw

by Raymond H. Haserodt

I often hear people insist that a radial-arm saw is just too inaccurate to do really fine work, but I've found that with patience and a little thought, I'm able to use it to perform all the operations I need to do in my shop—from planing rough boards to shaping fancy, radiused moldings. A radial-arm saw's settings need more attention than a tablesaw's, but the reward is greater versatility. I've improved the performance of my saw—a Sears 10-in.—with these jigs, which you can make or have made inexpensively by a machine shop.

Locking the roller head: Getting the roller head to stay put is always a chore on a radial-arm saw, particularly when you want to nudge the saw this way or that to make fine adjustments for ripping. I made a pair of aluminum clamps that fit in the arm track, bearing firmly against both sides of the roller head (figure 1, at top of facing page). Adjusting screws allow me to move the roller head in increments of as little as a few

This is the radiused molding on one of the twelve clocks Haserodt made for his grandchildren. The molding is returned along the sides of the case.

Christopher Clapp

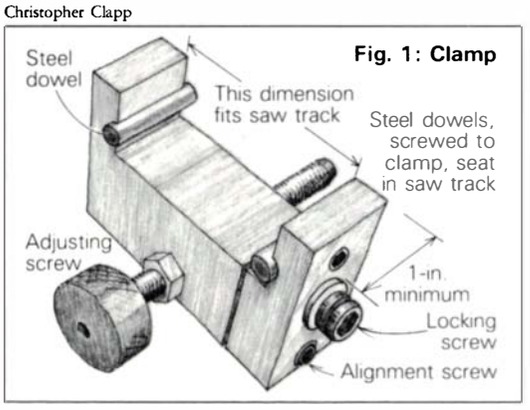
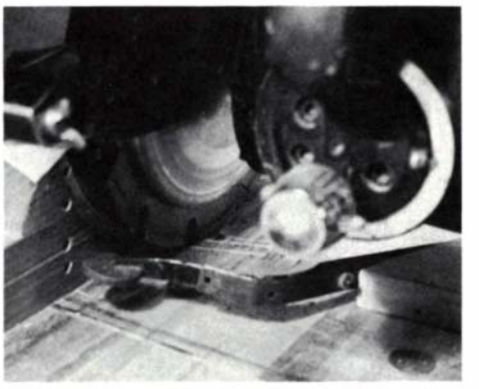


Fig. 1: Clamp



To set up his radial-arm saw for planing, below, Haserodt rotates it to the rip position with the blade closest to the extra-high fence. With the aluminum blade-stiffening disc installed (visible behind blade), he feeds the stock on edge between the blade and fence. A spring attachment, right, is clamped to the table to hold the stock against the fence on the out-feed side. Note the aluminum clamps (figure 1, left) holding the roller head in place. The clamp's adjusting screws must bear firmly on the roller-head frame.

thousandths of an inch—that's certainly more than accurate enough for woodworking applications.

The dimensions aren't critical, but the throat opening of the clamps must match the track of the saw on which the clamps will be used. On my radial-arm saw, the roller head rides in a cove-shaped track, so I screwed small steel dowels to the clamp. The dowels fit tightly into the cove, so the clamps seat snugly when tightened down.

Radial-arm planing: Since I don't have a planer, I've developed a method that lets me do the job on my saw. I rotate the roller head to the rip position, as in the photo at right, and run the stock vertically against the fence. I turned an aluminum disc (figure 2) which stiffens a 12-tooth raker blade I use for planing. The surface produced is surprisingly smooth and accurate. I've found that finer blades don't produce a better surface and do take more power to turn. Since I can't plane boards wider than 4 in., I rip boards in the rough, plane them and glue them up to the width I need.

Curved moldings: I use a molding head and the jig shown (photo, bottom right) for making radiused moldings for the clocks I build. I don't have a band-saw, so I glue up the stock in bricklay fashion in roughly the shape of the radius. Then I attach it to the jig from below with screws and mount the assembly on the saw table. Jig and molding stock pivot on a dowel located so that the molding-head cutter arc passes through the stock at the proper point. I cut the inside radius first, then I move the roller head and cut the outside radius. You can use any combination of knives to get the profile you want. □

Raymond H. Haserodt is a retired tool-and-die maker. He lives in Lyndhurst, Ohio.

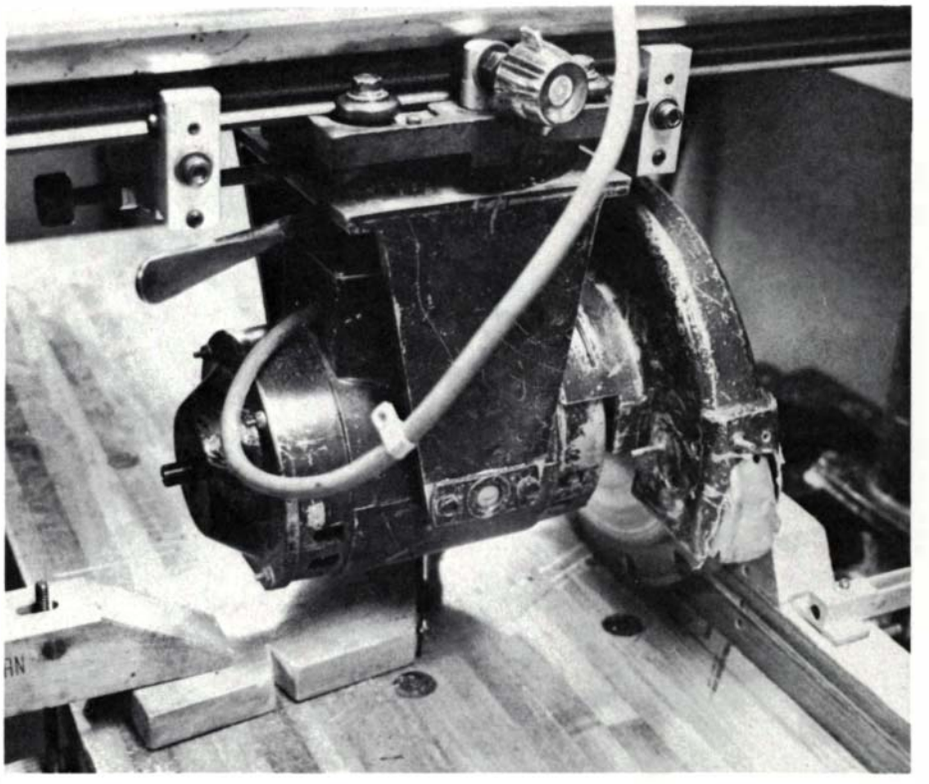
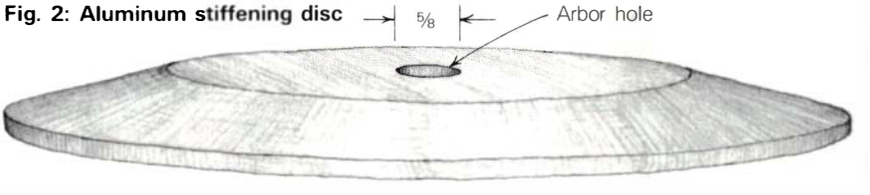
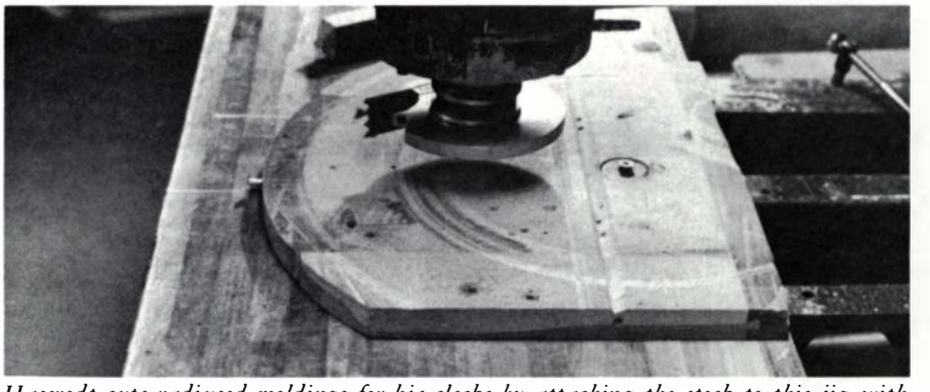


Fig. 2: Aluminum stiffening disc



The ½-in. thick disc should be about 8 in. in diameter overall, tapered to about 5 in. in diameter on the side facing the motor.



Haserodt cuts radiused moldings for his clocks by attaching the stock to this jig with screws. The jig itself pivots on a dowel screwed into the saw table, at right. An arm is attached to the jig to swivel it. Several passes, moving both roller head and depth controls, produce the desired profile.

Woodworking Injuries

A hand surgeon looks at how accidents happen

by Dr. E. Jeff Justis

Woodworkers relish the feel of a tenon sliding into its mortise, and the smooth texture of a newly finished piece of furniture. Our fingertips are so sensitive that we can feel blemishes and flaws in our woodwork that are too slight to be perceived by the eye. Where would we be without these sophisticated sensors? Human evolution is, in part, the result of our early manipulation of our environment with our hands, and this is perhaps at the root of the creative impulses that make woodworking so satisfying.

It's no wonder, then, that people who have severely injured a hand or lost a limb often have emotional difficulty adjusting to their impairment. In fact, sometimes psychiatric care must supplement physical therapy. As a woodworker and a hand surgeon who has seen too many injuries, I am vividly aware of the risk in using power tools. I've also come to realize that virtually all injuries are preventable.

I have treated many patients with hand injuries inflicted by woodworking tools. Surprisingly, about one-third of all accident victims seen in hospital emergency rooms have an injury to the arm or hand. A 1964 study in England found that woodworking tools are responsible for most industrial injuries. Even so, research has not been done on the question of which tools are the most dangerous; hospitals don't generally obtain such information, and medical personnel don't always know the differences among various tools. A medical report may attribute an injury to a handsaw when in fact the injured patient was using a portable circular saw. I've never been injured by my tablesaw or my portable circular saw, but my own experience as a surgeon clearly suggests that circular saws account for the majority of serious hand injuries among woodworkers. I routinely discuss the mechanism of injury with patients, and I have concluded that there are three major causes of serious injuries from a power tool: inattention through repetition, an unanticipated happening, and inexperience or overconfidence. Many accidents involve some combination of the three, not to mention bad judgment brought on by fatigue (see p. 87).

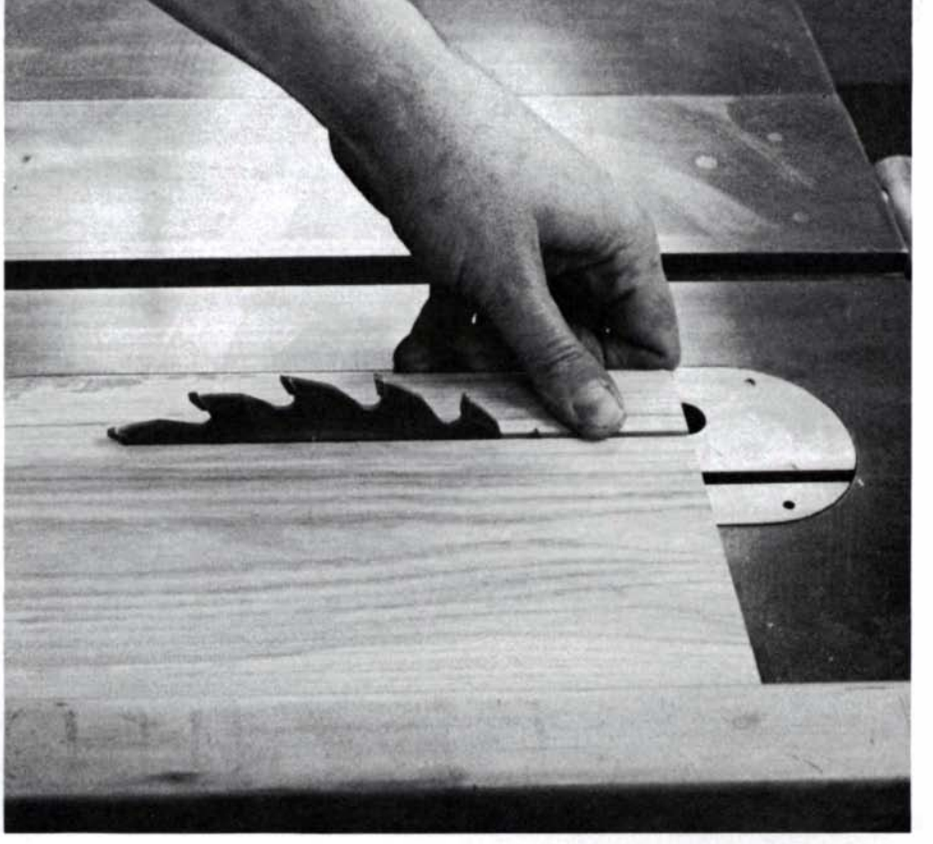
Inattention through repetition—A woodworker performing a number of repetitive cuts, such as a series of crosscuts to length, may become dangerously inattentive. The whine of the machine and the repetitious physical movement can lull the worker in an almost hypnotic way. A tragic example comes to mind: A cabinetmaker with 20 years of experience in a local shop was making repetitive cuts with a radial-arm saw, using his left hand to feed the stock and his right to pull the saw through. In an instant, his right hand moved too fast for his left, and the saw passed over his hand, severing all four fingers of his left hand just above the knuckles but sparing his thumb. Although his ability was permanently impaired, the man was able to resume woodworking by, as he put it, "doing the best I can under the circumstances, but I never realized how important my left hand was until this happened." Another patient, who severed his thumb just beyond the base joint in a similar accident, told me afterward that he had never been aware of how much he used his left thumb, especially when trying to hold work against the miter gauge of a tablesaw or the fence of a radial-arm saw.

Interestingly, a 1975 study of 1,071 hand-injury patients showed that although 90% of them were right-handed, their injuries were nearly evenly divided between right and left hands. In virtually every case, the fingers bore the brunt of the injury. Inattention through repetition seems most likely to occur in the production shop, but all woodworkers must avoid being complacent when working with machines. It pays to pause deliberately after every couple of repeat operations to refocus on the task and to carry on with full awareness—a habit that can be acquired.

An unanticipated happening—Power cutting tools operate at high speeds. When something goes afoul, it occurs quickly and surprisingly. Kickbacks caused by binding are a common unanticipated event that can quickly draw fingers into a blade. Putting the fingers too near the blade can result in unpleasant surprises. One patient of mine recently reached with his left hand beyond the sawblade to catch a waste strip. The strip began to slide backward, and as he attempted to catch it, he caught his thumb on the sawblade. Fortunately, the blade was set just above the level of the board and his thumb wasn't severed. But a tendon and two nerves were cut, and although he has regained motion, sensation in his thumb will never be the same. Many of us forget that the regenerative capacity of the human body is limited. Any cut into the sub-dermal layer, no matter how well healed and painless, leaves a scar that is not normal tissue. Thus, a hand that suffers a major injury cannot be fully restored. Even a small cut, on the wrist for example, can result in a nerve injury that is the functional equivalent of an amputation.

Many times an unanticipated event will occur through inexperience, poor planning or a lack of understanding of how tools and machines work. For example, it should be obvious that trying to shape a small piece without a guard or a jig can end in disaster. Jointers can mangle fingers when the operator attempts to machine a small piece. Similarly, failure to anticipate the "breaking through" of the bandsaw blade can result in an injured finger. As a youngster, I recall slicing through the pulp of my left thumb with a scroll saw when the blade passed quickly through a soft spot in the puzzle I was making. My attention was so focused on guiding the saw accurately that I failed to anticipate its moving through the wood so fast. The same can happen with hand tools, particularly sharp edge-cutting tools such as chisels and planes. A cut

E. Jeff Justis is a hand surgeon in Memphis, Tenn.



A quick way to lose fingers is by passing small pieces over the jointer, above left. Don't machine stock shorter than 12 in., use a push stick and leave the cutterhead guard in place. Some tablesaw operators hold their thumbs near the blade during a rip, as in the photo above. An unanticipated kickback can pull the thumb into the spinning blade. The drill press, left, seems like a benign tool. But when haste wins out over safety, it can do considerable damage in short order. Always clamp the stock being drilled. Bandsawing small pieces is risky enough, but in the photo at right the operator will be in for a painful surprise when the blade breaks through the stock and into his finger.

from a sharp chisel is less traumatic than a severed finger, but both are painful. Yet with attention and care, both injuries can be avoided.

Inexperience or overconfidence—Some general accident studies show that the greatest incidence of injury occurs at two extremes of experience: the rank novice and the highly expert. I've seen many young patients who had summer jobs requiring the use of radial-arm saws, jointers or tablesaws. Within days of beginning work, they sustained serious hand injuries. One young man was using a tablesaw under pressure from his supervisor to keep his speed up while ripping boards. When a board jammed between fence and blade, it pulled his hand into the blade. His index finger was so mangled that it had to be amputated. Fortunately, with reconstructive surgery, he regained acceptable use of his middle finger and hand. Not surprisingly, however, his enthusiasm for woodworking and tools was forever diminished. In his case, the combination of inexperience, repetitive motion and an unanticipated event had tragic results.

At the other end of the scale, a high school shop teacher with 20 years of experience had grown so accustomed to using his tablesaw that he thought nothing of making routine passes with his thumb just millimeters away from the blade. A sudden grabbing of the wood pulled his right thumb into the blade, instantly severing the tip of that digit. Experience, though a good teacher, can lead us to believe we know more than we do, and the subsequent risks we are willing to take can cost us dearly. Even seemingly harmless tools such as the drill press can do grievous damage if they are misused or treated with less respect than they deserve.

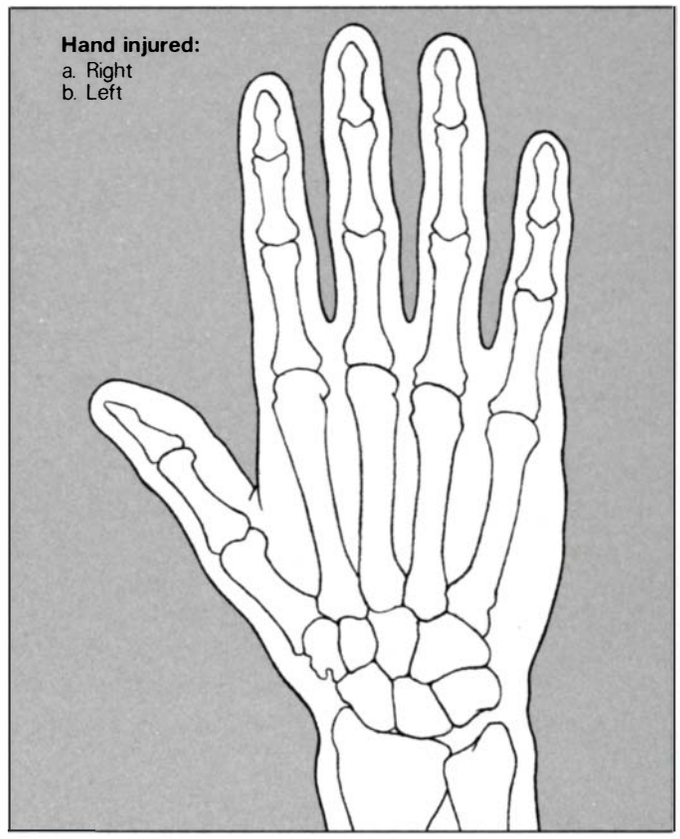
The experiences I've described here, no matter how grisly, can teach us important lessons about safety. You can't avoid repetitive operations when using machinery—particularly in production shops. But you can be alert to the hypnotic effect of this type of activity and you can teach yourself to be constantly vigilant. Keep fresh by breaking up a long routine of cutting or machining with another, less redundant operation. And never work around machines when you are tired or under the influence of alcohol or drugs that might make you drowsy.

By definition, the unanticipated happening can't be predicted. Using common sense and a bit of ingenuity, however, will ensure that your hands are out of the way when such events do occur. Build jigs and fixtures to keep the wood under control and your hands well away from cutters and blades. Don't alter or ignore the machinery's own built-in safety devices. And keep the workshop liberally supplied with push sticks—it's far better to have them or a project chewed up than to lose one of your fingers. Push sticks can be made by the dozens and projects can be started over, but damage to the hands may be irreparable, and lost function is an impairment to be carried forever. *(continued next page)*

SURVEY OF HAND INJURIES

Cuts, scrapes and scratches are an inevitable part of using tools. Fortunately, few woodworkers have suffered permanently impairing hand injuries, yet all too frequently we hear horror stories describing the most gruesome accidents and maimings involving power tools. Little is known about which tools pose the greatest risks and why. If we are able to answer those questions, which we hope to do with the survey printed below, we may learn where the greatest dangers exist and so be better able to avoid them.

We would like to hear from woodworkers who have had a serious injury involving the loss of fingers or parts of fingers, or hand wounds that required care at a hospital or doctor's office. To participate, tear out or photocopy this page, answer the questions and mail it to us in the postage-paid envelope that's bound into the back of this magazine. Please write "injury survey" in bold letters on the outside of the envelope. Results of the survey will be published in a future issue of *Fine Woodworking*. If our questions don't fit your case, please include the information on a separate sheet. □



1. Which tool caused the injury?

Stationary power tools	Portable power tools	Hand tools
a. Tablesaw	j. Circular saw	q. Hammer
b. Radial-arm saw	k. Saber saw	r. Hatchet
c. Bandsaw	l. Chainsaw	s. Saw
d. Jointer	m. Hand drill	t. Chisel
e. Planer	n. Router	u. Gouge
f. Shaper	o. Grinder	v. Plane
g. Sander	p. Other _____	w. Knife
h. Drill press		x. Other _____
i. Other _____		

2. Describe your injury and mark its location on diagram.

_____

_____

_____

3. Did the injury require surgery?

a. No b. Yes If so, by whom?
c. Physician f. Plastic surgeon
d. General surgeon g. Hand surgeon
e. Orthopedic surgeon h. Other _____

4. Did you need a hospital stay?

a. No b. Yes c. How long? _____

5. How long were you unable to do woodworking because of your injury?

a. Less than a week d. Four to six months
b. One to three weeks e. More than six months
c. One to three months f. Permanently disabled

6. What do you think was the likely reason for your injury?

a. Inattention due to repetition d. Unanticipated event
b. Inexperience with the tool e. Removal of safety device
c. Fault in the tool f. Other _____

7. Which tool do you consider the most dangerous and why? What might be done to make it less so? (Attach a separate sheet.)

8. What time of day did the injury occur?

a. 6 a.m. to noon d. 7 p.m. to midnight
b. Noon to 3 p.m. e. Midnight to 6 a.m.
c. 3 to 7 p.m.

9. How long had you been working when it occurred?

a. Under an hour d. Six to nine hours
b. One to two hours e. Ten hours or more
c. Three to five hours

10. At the time of your injury, how much woodworking experience did you have?

a. Under one year d. Ten to nineteen years
b. One to four years e. Twenty years or more
c. Five to nine years

11. What type of woodworking did you do most often?

a. Boatbuilding g. Millwork
b. Carpentry h. Woodturning
c. Cabinetmaking i. Carving
d. Musical instrument making j. Furnituremaking
e. Sculpture k. Miniatures
f. Furniture repair l. Other _____

12. Were you a professional (earning 50% or more of your income from woodworking) or an amateur woodworker?

a. Professional b. Amateur c. Other _____

13. What year did the accident occur? _____

14. How old were you at the time? _____

15. How old are you now? _____

16. Are you: a. right-handed b. left-handed c. both?

Name _____

Address _____

City _____ State _____ Zip _____

"It was over in a millisecond. . ."

by Paul Bertorelli

What Rame Nelson remembers most vividly about losing three fingers is how quickly it happened:

"It was over in a millisecond. . . I was ripping the piece and the next thing I knew my fingers were gone and one of them was lying there on the tablesaw. It's kind of funny, it wasn't all that painful. . . just a hell of a shock at seeing my fingers gone." When I visited him in the hospital last February, just a week after his accident, Nelson had still not quelled his disbelief, and he was only beginning to understand how his accident had happened.

Nelson was working late that night, pushing himself hard to finish a chest for display in the Michigan Woodworkers Guild show set to open two days later. While plunge-ripping a maple board on the tablesaw for the chest's base, Nelson missed his mark slightly. To line it up, he inched the board backward, with the rotation of the sawblade. "I was using my right hand to push it against the fence," he told me, "and I had my left hand on top of it. The thing caught the blade and pulled my hand right into it."

The damage was extensive. The sawblade raggedly severed at the knuckle the little and ring fingers on Nelson's left hand. He lost his middle finger nearly at its base. As such injuries go, Nelson was actually lucky. His father happened to be working with him at the time, and his shop in Walled Lake, Mich., is only 40 miles from Detroit's Harper-Grace Hospital, a leading center for the treatment of hand injuries.

In his 13 years of woodworking, Nelson has considered the prospect of injury, even having gone so far as to post the names and numbers of hand surgeons by his telephone. "My first reaction was that I would bleed to death. In my panic, I didn't think to call anyone. . . I just wrapped my hand in a rag and we headed for the hospital." In their hasty departure, the two men collected Nelson's severed middle finger but missed his ring finger—which had landed on the jointer five feet away. His mangled little finger had been hurled into the recesses of the shop.

Three hours later, Nelson was in surgery at Harper-Grace Hospital. His surgeon, Dr. Ronald Rusko, decided that only the middle finger could be saved. The other two fingers, retrieved later by Nelson's brother-in-law, were too chewed up to work with. Peering through a microscope and using sutures small enough to pass through a human hair, Dr. Rusko painstakingly spliced the severed digital tendons, nerves and blood vessels in Nelson's hand. A steel pin was used to join the shattered bone. By the time I visited Nelson in the hospital, signs of healing were already evident. Although the reattached finger was still completely bandaged, he could feel sensation returning to it. And with the healing came the "phantom limb" effect, the eerie attempt by the nervous system to convince the brain that the missing extremities were still there.

Dr. Rusko considers the operation a success, and when I talked to Nelson in June he reported steady but slow healing. "It's weird, though," Nelson said. "I can't believe how often I reach for something and come up short." Reattachment microsurgery has been practiced only since the mid-1970s, and though much progress has been made, it cannot work miracles. "In general terms, no reattached limb is ever going to be normal. The worse the injury, the worse the outcome is going to be functionally," Dr. Rusko told me. Patients can expect stiffness, weakness and extreme sensitivity to cold in salvaged fingers. Sometimes, reattachment isn't worth the effort; surgeons frequently counsel against single-finger reattachment because the patient can often regain more use from a limber, well-formed stump than from a stiff replant. Nelson's middle finger was reattached because the doctor figured he stood a good chance of gaining rather than hindering function. Most reattachments require more surgery later, to remove scar tissue around tendons and nerves which can make the replant stiff and useless. Not surprisingly, injuries that are clean-cut offer the best prospects for success.

With his practice located amidst hundreds of auto and manufacturing plants, Dr. Rusko sees his share of the bloodiest hand injuries, and Nelson's outcome is fairly typical. Others, however, can't count on being as fortunate. Time is important in reattachment, and since not every hospital is equipped to do this type of microsurgery, the closest help may be hours away. Depending on the circumstances, severed fingers can be replanted up to 12 hours or more after the injury, but the longer the wait, the fewer the surgeon's choices. Dr. Rusko says the injured person can help himself most by keeping his wits after the injury. You aren't likely to bleed to death even after losing several fingers. Sterile dressings kept in the shop can be used to wrap the injured hand for the trip to the hospital. Apply direct pressure to the wound (tourniquets are rarely necessary) and elevate the hand higher than the heart. As gruesome as it may be, you've got to pick up the lost fingers and carry them with you to the hospital in a container or a clean towel. Don't bother with any topical treatments like iodine or ointments. Nelson's list of hand surgeons near the phone is a good idea, but it's even better to know the location of the closest hospital equipped to do microsurgery.

Even the best surgeon and a quick trip to the hospital after the injury, however, fall far short of avoiding the accident in the first place. This point is not lost on Rame Nelson. "I'm embarrassed that I could do something so stupid. I've always had a second nature about safety and I'm still surprised this could happen to me."

Sitting in Nelson's hospital room, I couldn't help thinking about all the times I've worked late or done crazy things with machines while trying to finish a job in a hurry. I've taken false comfort in my lack of injury, but now I wonder if my intact hands are due more to dumb luck than to skill and good sense. The point isn't lost on me either. Next time I feel brain-fade from exhaustion, I'll turn out the shop lights and try again the next day. □

Workbench

An island with dogs and drawers

by Dwayne J. Intveld

I've accumulated quite a selection of tools over the years, but when I was setting up the basement workshop in my new home recently, I found my tools to be poorly organized and my bench—a knock-up affair of plywood and 2x4s—in dire need of replacement. I decided a bench should be my first project, so I set out to design one to suit my needs.

I've always admired European-style benches for their solidity, clamping flexibility, and beauty. But since my shop is small, my new bench would have to function as both work surface and storage cabinet. I needed a large surface for assembly, and I also wanted to be able to work on all four sides. The design I settled on is an island-type bench which has the bench dogs that make European benches so versatile.

Construction of the bench is straightforward. The base carcase consists of a framework of 2½-in.-sq. maple rails and stiles mortised and tenoned together. I used ¼-in. maple plywood for panels in the base, letting them into grooves in the various frame members. I installed three ¾-in. fir plywood dividers inside the carcase—this breaks it into four compartments. I used three of these compartments for drawer banks, and installed a door on the fourth to provide storage for tools too bulky to fit in drawers.

I dovetailed the drawers together, using maple for the fronts, pine for the sides and backs, and hardboard for the bottoms. I chose the size and number of drawers to suit what would be stored in them. Before the drawers were assembled, I cut a series of vertical dadoes ¼ in. wide by ¼ in. deep so I could adjust the dividers in the drawers later. I used metal drawer slides for all the drawers except the top ones, which are too shallow; these ride on wooden slides.

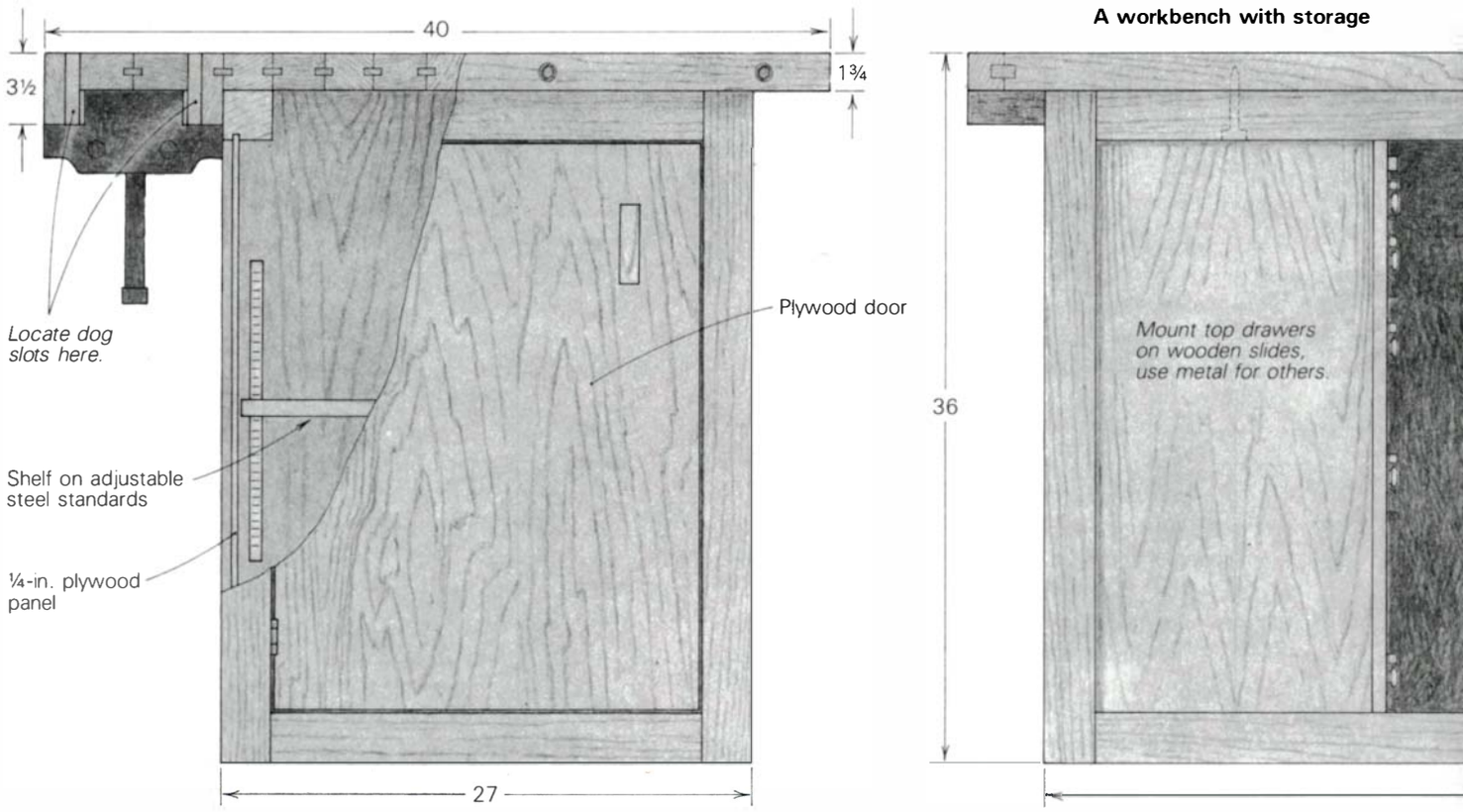
The fourth compartment, accessible through a door at the end of the bench, has a shelf set on adjustable metal standards let into the frame legs and divider panel. On the opposite end of the bench, I installed a pegboard that's useful for hanging miscellaneous tools.

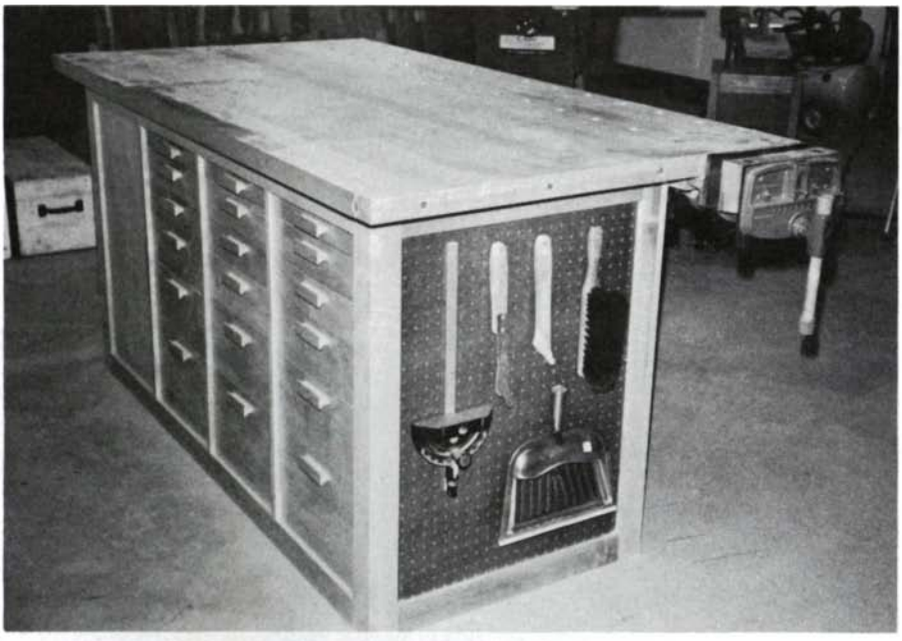
The bench top overhangs the base on the vise side so that dust and chips will fall through the two rows of bench-dog slots to the floor instead of into the drawers. I made the top of 1¾-in. hard maple ripped into strips 2½ in. wide and glued up, but a commercially-made maple block top could also be used, if you can find one the right size. To avoid a lot of tedious clean-up work, I glued up the top in three pieces, ran the sections through a surface planer and then glued them together, leaving only two glue lines to clean by hand. For bench-dog holes, I dadoed slots in two 3½-in. wide pieces of maple and glued these (edge up, and with a narrow section of bench top in between) to one long edge of the bench top. With the top glued up and trimmed to length, I routed grooves into the ends of the bench top and attached end caps with bolts.

My Sears vise isn't equipped with bench dogs, so I made an adapter block that screws to the vise jaw and accepts two dogs. Two inches of lost vise opening seemed like a small price to pay for the greater clamping range of the dogs. A sprayed lacquer finish protects the bench from moisture, dirt and spills. □

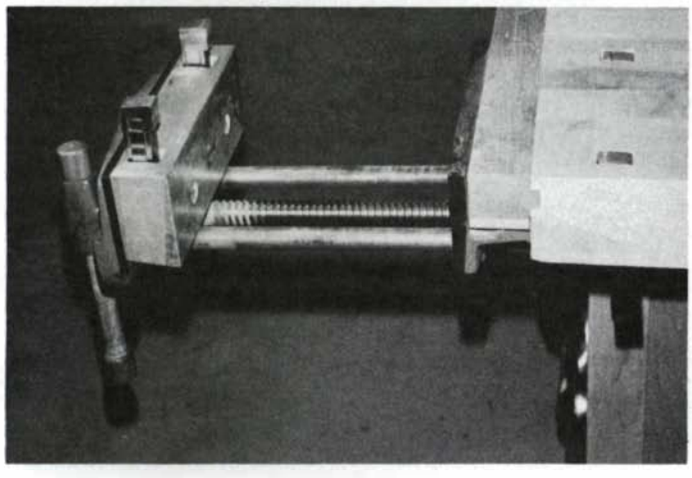
Dwayne J. Intveld, of Hazel Green, Wis., is a design engineer for a construction equipment manufacturer. Photos by the author.

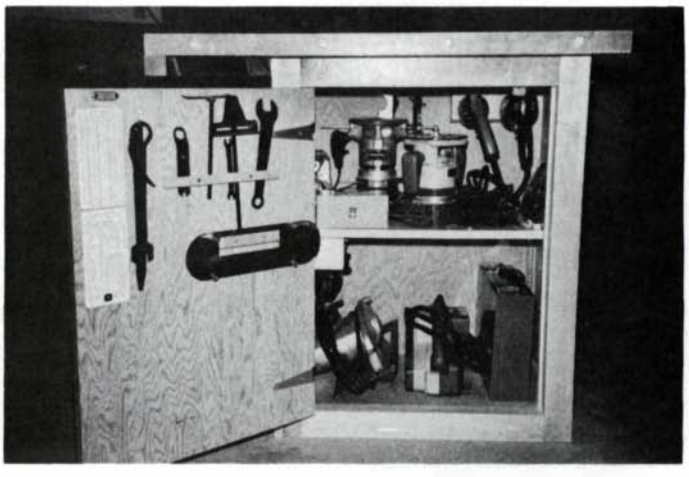
A workbench with storage

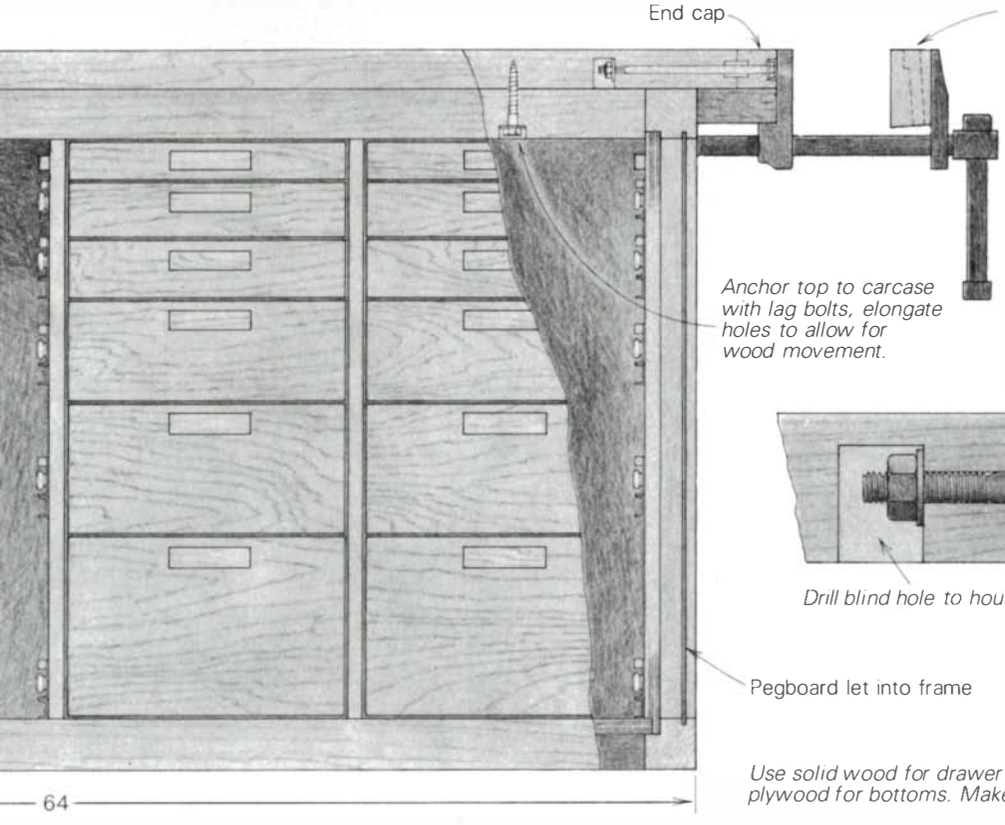




Workers with limited shopspace need to make use of every nook and cranny, and Intveld's island-style bench does just that. A large, maple-block work surface is mounted over a frame-and-panel cabinet that has 18 drawers—plenty of storage for tools and supplies. Carcase frame is made of 2½-in.-sq. members mortised together and paneled with ¼-in. plywood. Intveld modified his Sears vise, shown at lower left, by attaching a maple block that will mount two European-style steel bench dogs. Dog slots in the bench stop should be spaced no farther apart than the maximum throw of the vise. And they should be located beyond the edge of the bench so debris will fall to the floor instead of into the cabinet. The bench's end compartment, below, has a plywood door and adjustable steel standards for a shelf, but it could be fitted with drawers instead. A rack on the door stores easy-to-lose items like arbor wrenches, saw throats and other small tools.

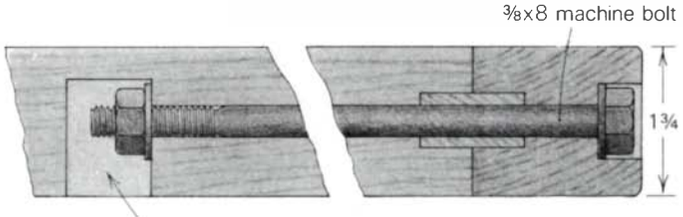






End caps

Attach each end cap with four ⅜x8 machine bolts or threaded rods.



Use solid wood for drawer fronts and sides, hardboard or plywood for bottoms. Make drawer dimensions to suit needs.

The Set-Up Table

An old door makes an adaptable, low work surface

by Henry T. Kramer

Someone starting out to equip a home workshop must be made of stern stuff if, after totaling the cost of all the needed tools, he doesn't give it up and turn to ocean racing or something else closer to his budget. The set-up table—which is nothing more than a well-placed, plainly dressed work surface—won't replace expensive power tools, but it can ease the pain by allowing you better use of hand tools.

The set-up table is a triple threat. It serves as an ordinary worktable, it's an aid to setting up and assembling, and it makes working with hand tools a positive joy. (It also offers a safe retreat for the dog when he comes to visit.) It's not intended to replace the typical workbench, but after you've used both for a while, don't be surprised if you favor the set-up table for its simplicity and ease of use.

The top of my present set-up table is a 1¾-in. solid-core door, 36 in. by 80 in., which was given to me by a friend. I finished it with a synthetic varnish (awful stuff, but tough as the back of a shooting gallery) and then waxed it. One can't avoid dropping glue on the table occasionally, but the surface is so smooth that a fingernail will get the glue right off.

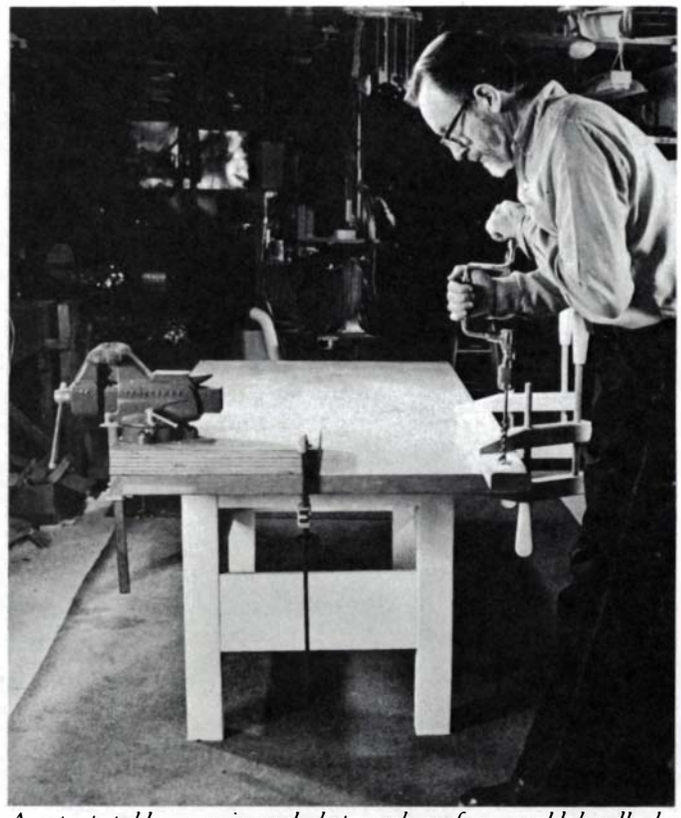
I made a base of rough 4x4s and pine lumber. I doweled the base together, even though I know that some good and true men are on record against dowels—in this table, they're strong enough and quick to make. The top rests on the tops of the legs and is fastened to the rails with blocks and screws.

I made my table 28½ in. high, but you can build yours to suit you. For best leverage when using hand tools, the set-up table should be lower than the typical workbench. Height ought to be a function of your height, specifically, about ¾ in. less than the height of your fingertips with your arms at your sides—give or take a fingernail. This is very close to the ideal sawhorse height, making the table suitable for handsawing, boring with a brace and bit, and use with other hand tools.

Depending on the size of your shop, a set-up table may be as long as you want, but 80 in. is enough for me. When deciding on width, remember that you'll often want to be able to reach comfortably beyond the midpoint. Thirty-six inches is right for me. If you've got arms like an ape, make it wider. The most important feature of the set-up table is that the top overhangs the base on all sides by at least 5 in. This overhang gives you plenty of room to clamp work and tools to the table—without the vises, bolt heads or drawers of the typical workbench getting in the way.

The set-up table ought to be located as centrally in the shop as possible, and you should be able to get around all four sides of it. Because the table is lower than the work surface of most major machine tools, it shouldn't interfere with long boards passed through them. Put the table on the off-feed side of the tablesaw and you can clamp a roller table to it when you're cutting long stock.

As a jack-of-all-trades work surface, the set-up table is hard to beat. You can clamp portable tools such as vises, grinders and miter boxes to the table, and then stow them away on a shelf underneath when they aren't needed. For assembling large jobs such as big frames and cases, the set-up table offers plenty of space for clamps, tools and glue bottles—all the stuff that always gets knocked off small benches during the heat of glue-up.



A set-up table, a universal shop work surface, could hardly be simpler. Here, Kramer uses a brace and bit with his work clamped to the table with a hand screw. Size can vary, but the height ought to be less than that of a conventional workbench.

But the nicest thing about the table, I find, is that it's just plain easier to use hand tools with the work clamped to the table. Everything doesn't have to be done on a big power tool just because it's there and it cost so much. Besides, it's more pleasant to see what you are doing and to do it right, because once you start a cut with a power tool, you are committed to finishing it whether it works out well or not.

It's surprising how many words it takes to describe how useful such a simple thing can be in the home workshop. It is this very simplicity and universality that appeals to the person who works wood for fun and doesn't take himself or his work too seriously. If you plan and build a set-up table, you'll be amazed at how it will change your work habits. □

Henry T. Kramer is a retired reinsurance specialist and an amateur woodworker in Sommerville, N.J.

A portable carving bench

by Everett Traylor

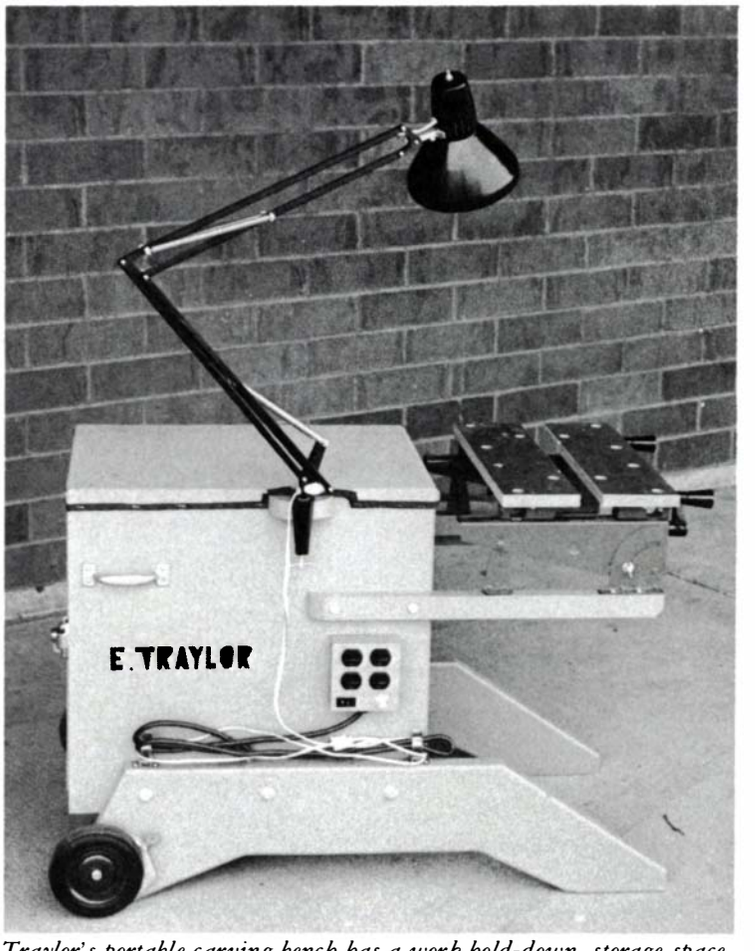
Except for the necks and scrolls of musical instruments, most of the carving I do is relief carving. For a number of years I'd planned to build a carving bench better suited to my needs than the one I regularly use. I wanted to be able to carve in my basement workshop and, in good weather, use the bench in the yard and at craft fairs. I came up with this portable bench design that includes electrical outlets for tools, a lamp, tool storage and a work-holding device. A side-mounted tool tray is removable when the bench is stored or moved.

I made the "box" part of this bench out of ¾-in. fir plywood butt-joined at the corners with screws and glue. The height is right for me, because I sit in a secretary's chair when I'm working at it, but it could be made to suit any seating arrangement. The bench legs are made from a fir 2x10, and the extensions for the vise supports are of rock maple. I added a drawer for tool storage and installed wheels at one end. To keep the bench from rolling when in use, I scavenged the wheel-retracting mechanism from an old lawn mower. It allows the bench to sit firmly on the ground or floor.

I mounted a work-holding device from Sears on two arms bolted to the box. Sears no longer sells the device, but Black and Decker has a similar tool that can be attached to a vertical surface, eliminating the need for arms. The vise can be angled, and I use it to hold a drawing board I made up for use with the bench.

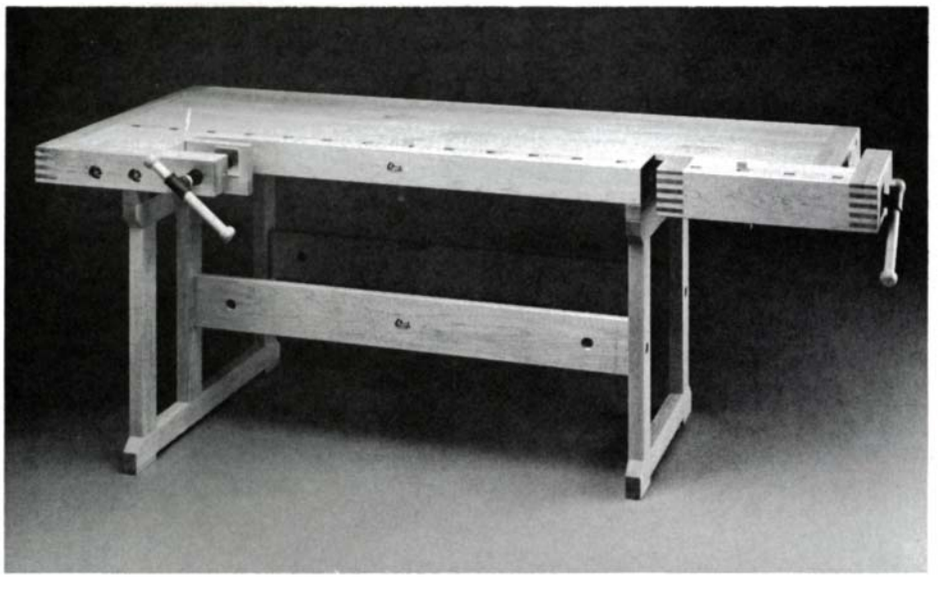
I gave the bench a coat of crinkle paint and upholstered the top with tough corduroy to keep work from being marred. A long extension cord lets me connect the bench to a power source outdoors or at craft shows. □

Everett Traylor teaches woodcarving in Bettendorf, Iowa. Photo by the author.



Traylor's portable carving bench has a work hold-down, storage space, a lamp and electrical outlets. Wheels, pirated from an old lawn mower, retract to keep the bench from rolling around when in use. Traylor added a drawer to the storage compartment and made the tool tray removable. The top is covered with tough corduroy to protect work from being marred.

The European bench—American-style



Many woodworkers make their own benches, but among those who buy them, a popular choice is the Scandinavian bench, most of which are imported from Europe. But at least one American-made bench of this type is now being sold, on a commission basis only. Its maker, D. Hunter Kariher of Pittsford, N.Y., looked at a number of imported benches and incorporated in his design the best features of all of them, including larger vise screws for smoother operation, one instead of two tail-vise guide rods, which is less cumbersome, and wooden bench dogs that won't mar the work as readily as steel ones do. Kariher's bench costs $950, from Liberty Hill Woodworks, 2310 Lehigh Station Rd., Pittsford, N.Y. 14534.

Photographing Your Work

Like woodcraft, the more care you take, the better the results

by Gary Zeff

As with most art, things made of wood have to be seen in their three-dimensional form to be fully appreciated. But if you're a professional woodworker, or a generous amateur, you don't keep your best pieces around as samples. So when a prospective client or an exhibition jury wants to see your work, photographs may be all you can show. The formula is simple: the picture of your last piece clinches the commission for your next. At times, then, the quality of your photographs is as important as the quality of your woodworking. For promoting and marketing your work, your camera is possibly the most important career-making tool. And the photos you take can also serve another purpose: they're a visual chronicle of your progress.

As professions and hobbies, photography and woodworking have many parallels. In both pursuits the more care you take, the more satisfying the results. A snapshot can give you a picture of your work but not show its quality. With the right camera, some inexpensive lights and a few accessories, you can take photographs whose quality does equal your woodwork. Once you have established a studio setup, you may want to give it permanent space in your shop so that everything you make is easily recorded before it goes out the door.

Camera—To obtain sufficient quality, you need a camera that uses 35mm or larger film. Some 35mm cameras—rangefinder types—have a viewing lens separate from the taking lens, and some are single-lens reflex. The main advantage of the SLR is that you focus and compose your picture by looking through the lens that will take the picture. You see exactly what the film will see. This feature is almost mandatory when you're taking pictures of small objects. Most 35mm SLRs made today have both manual and automatic modes of operation. To take advantage of the techniques described later, you may need to use your camera in the manual mode.

Lens—Lenses are described by their widest aperture and their focal length, both of which are marked on the front of the lens barrel. A "normal" lens, one that sees objects from the same perspective your eye does, neither enlarged nor reduced, has a focal length of about 50mm, and is suitable for most needs. It has limitations when photographing small objects, details of large objects, and large objects in small surroundings. Most normal lenses, for instance, cannot focus closer than 18 in. from the object, and objects smaller than 8 in. will not fill the frame at that distance.

To photograph small objects or details, you can buy a macro lens, which can focus close to the object and fill the frame. Macro lenses are expensive. A cheaper alternative is a set of close-up lens attachments which screw onto the front of your normal lens. Used individually or in combination, these attachments will allow you to fill the frame when photographing objects as small as 2 in.

Another shortcoming of a normal lens is its tendency to distort the perspective of a subject close to the lens: near parts appear disproportionately larger than parts farther away. The alternative is to use a lens of longer-than-normal focal length, say, 105mm or larger. Such a telephoto lens can fill the frame with a small object or detail, while allowing more room between camera and object in which to maneuver lights. Long lenses, however, distort perspective in the opposite way, flattening the depth of the object. Where space is tight and your subject large, as with installations, you may need a shorter-than-normal (wide-angle) lens, for instance 35mm, to fit the whole subject in your viewfinder. Perspective distortion is the trade-off, although sometimes these distortions can be dramatically effective. For varied needs, you may appreciate the versatility of a zoom lens; 35mm-105mm would be a good choice. But a zoom lens cannot match the optical quality of fixed-focal-length lenses. With all lenses, use a lens shade to exclude stray light.

Camera support—The camera must be held steady during the exposure and while you're arranging the object and lights. An adjustable tripod with a tilting head is a must. A cable release, which allows you to trip the shutter without directly touching the camera, will further reduce the chance of movement and blurry pictures.

Lights—There are basically two types of lighting equipment: photolamps, which are large tungsten light bulbs, and electronic flash. Though cumbersome, photolamps are better because you see their effects while composing your picture. Photos lit with flash are often spoiled by unexpectedly harsh highlights and shadows.

Photolamps balanced for 3200°K color film are EDT (500 watts) and ECA (250 watts). You will need 10-in. to 12-in. reflectors for your photolamps, with sockets that are safe for 500 watts. For many setups, you will want to soften the light, either by bouncing it off some reflective surface or by diffusing it. Umbrellas for bounce-lighting are expensive, but white cardboard can do the same job. You can buy diffusers that clip onto the front of the reflector bell, or you can fashion your own from a sheet of matte acetate. Since photolamps produce light of a different color than daylight, do not allow daylight into the room when shooting color film.

The natural lighting which people are most familiar with is the combination of sunlight and skylight. The sun is the main or "key" light source, which illuminates and casts a shadow. Skylight is a "fill" source, which lightens the shadow without casting a second shadow. Indoors, we can duplicate this dual lighting effect with a main light, high and to one side of the camera, and a fill light near to and on the other side of the camera. The fill light will be of a lower intensity, diffused, reflected, and/or farther away from the object, so that it

won't cast a noticeable shadow. An object with two shadows looks unnatural.

Film—Because you will be working with a tripod and lights, you can use slow- to medium-speed films, which have the advantage of being fine-grained. If your photos are for a black-and-white publication (magazine, brochure, etc.), use a medium-speed black-and-white negative film. For color pictures you can use color negative film (for prints) or color slide film balanced for 3200°K. Slides have an increased brightness range, which shows more detail, but exposures are more critical because slide film has less latitude than negative film. In addition, you'll need to carry a viewing system to show your slides. Color prints can be made from color slides, and color slides can be made from color negatives, and black-and-white prints from either, but the quality of the image suffers. Therefore, you should know what you intend to use your photos for before choosing your film.

This small turned container by Stuart Bicknell was photographed by the author using a 50mm lens with a 2x close-up lens attachment. Two 500-watt photolamps were used, the one on the right of the camera with a diffuser—hence only one shadow. The two rings included in the photo not only indicate a use for the object but also illustrate its relative size. Exposure was ⅛ sec. at f/16 using Kodak Plus-X pan film.

Filters—A filter is a piece of glass or plastic which is attached to the front of the lens, to change some quality of the light reaching the film. Besides conversion filters, used to modify the color of outdoor light for indoor films, and vice versa, there are filters that can be used in black-and-white photography, but for a different reason. Objects that photograph well in color may lose their tonal separation with black-and-white films: reds, oranges and browns in the wood all may photograph as black. Colored filters can correct this problem. A filter will lighten objects that are the same color as the filter and darken objects that are the complementary (opposite) color of the filter. A general rule would be to try a yellow filter (such as a No. 8) for yellowish woods such as maple or oak, and a red filter (such as a No. 25) for reddish woods such as cherry or padauk. Try a test roll, photographing various woods using various filters, and see what looks best.

Location—The best background is the simplest, because it allows the viewer to concentrate on the work. You can shoot outside, on grass or sand or some such regularly textured background. Pick a day when the sunlight is diffused—you don't want harsh shadows. Or shoot in the open shade. The disadvantage of shooting outdoors is that you have little control: light can change in the middle of your photo session, as can the weather.

A better location is a room or section of a room with light-colored walls, a high ceiling, and no daylight. To keep your photographs free of clutter and to eliminate distracting horizon lines caused by table edges or wall corners, buy a roll of seamless background paper, which comes as wide as 12 ft. You can support the roll above and behind your object with a commercial or a homemade background stand: wire a pipe to eye-bolts in the ceiling. Don't wrinkle the paper, and don't walk on it, except wearing clean socks. Unroll enough paper to form a smooth transition between vertical and horizontal, then place your object far enough forward to keep shadows off the vertical area. When you're photographing a small object, it's easier to position the camera and lights if you place the object on a table draped with background paper.

For your first roll of paper, try light gray. But because light-colored woods usually photograph better on darker backgrounds, and vice versa, you may want more than one roll. Wide double-knit cloth can also be a useful background, but avoid bedsheets, which wrinkle into ugly shadows.

Composition—To compose your photo decide first which view best shows your object. Some things will require more than one shot—an overall view and a detail, for instance, or one photo of the piece closed and one open. For a group of objects, you might combine a detail with a full view in one picture. Usually, the camera is positioned above the object and tilted downward, from a little less than standing height, but experiment with different camera angles and positions. Try to fill the viewfinder with the object, without having it touch the frame. A comfortable margin makes for a more attractive—and publishable—print.

As you fine-tune the camera's position, watch for awkward contact points between parts of your object—a chair leg, for instance, that sweeps down and seems to touch the side of another leg, instead of cleanly meeting the floor. The visual rhythm among parts of an object and the spaces between them can appear odd or harmonious, depending on the angle of view.

Keep in mind all of the characteristics of the object you want to show: shape, color, texture, detail, size. The best pictures focus on the object's best characteristic—decide what it is and from where to see it. For some objects, size will be indefinite, unless you provide some familiar context or a prop for comparison. You could, for example, place aspirin next to a pill box, an orange near a bowl, or a magazine on a coffee table. Furniture such as chairs or dining tables is of common

enough size to require no context or prop, and may show better without one.

Camera settings—With the object and camera placed, you can focus the lens. For objects that are large from front to back and for small objects close to the lens, you need maximum depth of field. Depth of field is the area in focus, and it varies with the size of the lens aperture. For large lens apertures (low numbers like f/2.8), depth of field is shallow. To get maximum depth of field, shoot at small apertures (f/11 to f/16) and focus about one-third the way back from the object's forward-most point. The catch is that for a given amount of light, small apertures require slow shutter speeds. Inanimate subjects shot from a tripod pose no problem.

With the camera focused and the lights set, take an exposure reading to figure combinations of lens aperture and shutter speed. Because a camera's built-in exposure meter can be fooled by light woods on dark backgrounds and vice versa, use a neutral test card. This is a piece of gray cardboard, standard in photography, that you place where it will receive the same lighting as the object. Take the camera off the tripod and point it at the card, moving in until the card fills the frame. The meter will show the proper exposure. Be sure, however, that the meter does not read glare. Put the camera back on the tripod and look through the viewfinder, using your camera's depth-of-field preview button at the various f/stops your exposure will allow while focusing. This will show you various depths of field, and you can see when all of your object is in focus. If the image is too dark, tape pieces of newspaper on the nearest and farthest parts of your object to aid in focusing.

To ensure getting a good photo, even if your reading is wrong, bracket your exposures. Make one exposure at the combination of lens aperture and shutter speed that you determined with the meter and test card. Then take another picture at settings that allow more light to reach the film, and another that allows less light to reach the film. If your calculated exposure is $\frac{1}{15}$ sec. at f/16, for example, your bracketed series would be $\frac{1}{8}$ at f/16, $\frac{1}{15}$ at f/16, and $\frac{1}{30}$ at f/16. You can also bracket by keeping shutter speed constant and changing lens aperture. Bracketing is especially important with color slide films, which have less latitude than negative films. Keep a record of the exposures so you can analyze your prints or slides and decide what to try next.

Once you've had them processed, keep your photos and negatives organized. Attach a contact sheet to each set of negatives, so you can identify the shots without handling the negatives themselves. Store slides in trays for projection viewing or in clear plastic pocket sheets for viewing on a light table. Write your name, address and information about the piece on the cardboard slide mount. But stick a label on the back of prints, since the pressure of writing can damage the image.

In photography, as in woodworking, the more you do, the more proficient you will become. Although there may be times when you will need the services of a professional photographer, your best teacher will be the results of your own photo sessions. Once you find a setup that works well for the woods you use and the things you make, picture-taking will be the final step of your creative process. □

Gary Zeff, of San Diego, Calif., is an avid woodworker and a technical representative for Eastman Kodak Co.

Lighting Wood

How to improve your image

by Ross Lowell

With enough practice, woodworkers often become good photographers, since considerations such as line, shape, proportion, balance, and texture are important to both. As a bonus, careful scrutiny of your work through the unforgiving camera lens can help refine your designs.

You may already have some proficiency in photography but may still be plagued by lighting that is too flat or too hard, by shadows or backgrounds that distract, or by any number of difficulties that prevent your two-dimensional images from doing justice to your three-dimensional originals. Here are some basic suggestions for photographing your woodwork, with special regard to lighting against seamless background paper.

Don't light by formula: Place the key (main source) where it provides the best revelation of form, character and texture, the best definition of subject surfaces, the best separation of subject from background, and the best shadows. Look at the results critically and try various key positions. Experiment, no matter how much you like one lighting scheme. Hone your tastes by looking more carefully and analytically at photographs and paintings, and learn to trust your eye.

Each plane should have a different brightness: Cabinets, tables, boxes will be more attractive and seem to have a third dimension if the top, front and side are not equally bright. Try lighting from above and slightly behind the object, so the top surface and/or side plane is brighter than the front.

When in doubt, use soft light: Hard light (spotlights or small sources) can be dramatic, but the resulting dark shadows interfere with the recognition of shape and detail. A professional, soft light source or light bounced off white surfaces or aluminized umbrellas can provide soft, "round" highlights and shadows, ideal for wood surfaces and complex shapes.

Soft light does not have to be flat light: A light source, whether hard or soft, placed close to the lens will result in flat, characterless lighting. A soft source positioned 45° or more off the lens axis (to the side or above) will provide a soft-light look that is not flat.

Keep the lighting simple: Don't use more lights than you really need. Each new light may introduce new problems, such as more shadows. Often a large white card placed near your subject can provide enough fill to lighten dark areas without creating new shadows.

Use glare: Glare results from light that strikes a surface at the equal-but-opposite angle from the camera. A little glare helps delineate surface curvature, texture and carving relief. Too much will hide grain and figure and detract from form. To control glare, change the angle of the light or subject, use dulling spray on the object (ask your photo dealer), or attach a polarizing filter to the lens.

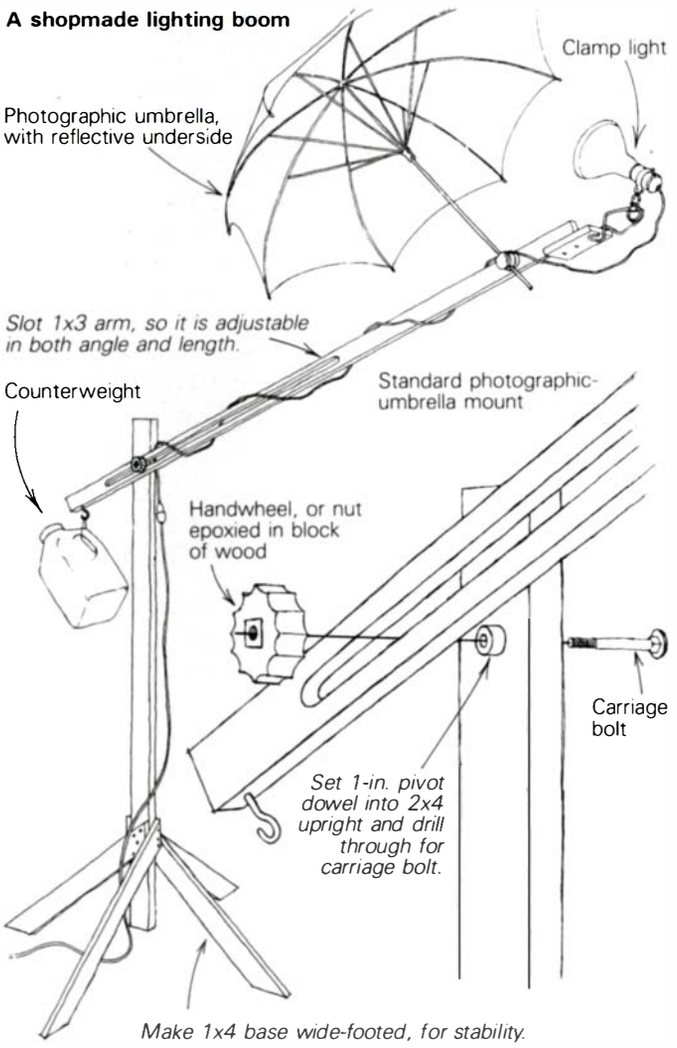
Use an assistant: It's difficult and time-consuming to keep moving from lights to camera to check the effects of light changes. A helper who can adjust things while you look through the lens can actually improve your photographs. If you have to work alone, position a large mirror behind the camera, to see how the subject looks from there.

Contrast should suit the end use: More contrast (less fill) may enhance slides that are meant for viewing or projection only. However, if the shots (color or black-and-white) are intended for prints or publication, less contrast is necessary because reproduction tends to increase contrast.

Judging contrast: It is difficult to anticipate contrast in the final shot because film does not "see" as great a range of light as the human eye. It helps to keep notes on what you did. Try squinting, or analyze the lighting with the lens stopped down (use the preview button). You can use a spot meter or move in close with your camera to take a reading from the lightest significant area and from the darkest significant area in your scene. Generally speaking, a difference of one or two f/stops can be judged low-contrast; more than three or four f/stops is high-contrast.

Light the background separately: Place your subject well away from the vertical part of the seamless, so that if you want the background bright, you can light it with a separate source, from the side or overhead, being careful to keep this light off the subject. This will solve a lot of common problems, such as peculiar shadows that run up the curve of the seamless background paper.

A shopmade lighting boom



You can make some useful photographic devices: Why not make a set of wooden brackets to support pipes or poles to hold one or two rolls of seamless paper high up on a wall? Or how about panels of lightweight composition board painted flat white on one side, black on the other? They should be mounted on braced 2x6 crosspieces with casters so they can be wheeled into position to provide large, soft fill light (white side) or to block reflections (black side). Ideally, they can also be dismantled quickly and stored compactly.

Lighting booms can also be made in the shop. Although most are made out of metal, a reasonably useful boom (drawing, below left) can be constructed with 1x3 lumber mounted on a substantial stand or wooden base with wheels. Such a boom could hold an umbrella light to reach out over or behind the subject, to provide soft top or back light.

Useful stuff to keep handy: Plenty of wooden clothespins, spring clamps, various kinds of tape, small wedges, malleable wax, aluminum foil, large white cards, dulling spray, small mirrors or reflectors, non-flammable frost gel, spare stands on which to attach white cards or reflectors, black cards to shade the lens from direct light that can cause flare.

Outdoors, keep background simple: Maximum depth of field isn't always beneficial. You want your object in focus, but in outdoor scenes it distracts from the subject to see every leaf on every tree in the background. To keep your background focus soft, use a telephoto lens, and/or open the lens diaphragm fairly wide, and/or put considerable distance between subject and background. The preview button will help you judge the degree of sharpness of the various planes.

Sculpture may need special treatment: Lighting and composing sculpture, free-form wooden objects or musical instruments with curved surfaces and openings offer creative challenges. It's difficult to choose the most representative angle, but a well-placed shadow or reflection of the piece will reveal another facet of the same object. Sculpture often looks more appropriate outdoors than furniture does.

Safety: Photography has its potential dangers. The small, tungsten-halogen bulbs used in up-to-date, efficient light fixtures get extremely hot, almost instantly. Always unplug the lights before inserting bulbs. Handle the fixtures only by their plastic knobs or with gloves. Considerable heat can be concentrated on the subject at close distances—enough to ruin finishes, scorch wood, conceivably start a fire. If you can hold your hand on the object, the lights are not too hot. Do not place lights extremely close to people; prolonged exposure to the small amounts of the ultra-violet light these lamps emit can cause eye damage.

All of the usual considerations and cautions should be exercised in relation to electricity. Lights that are extended too high on unstable stands or that are improperly mounted can damage your subject—be it animated or wooden. □

Ross Lowell is a director, cameraman, and inventor and manufacturer of on-location lighting systems, for which he has won an Academy Award. A catalog of products is available from Lowel-Light, 475 Tenth Ave., New York, N.Y. 10018. Lowell is also an amateur woodworker.

More on photographing work

Watching a professional shoot a chair

The usual way to work with professional photographers is to tell them what's wanted, then leave them alone. It takes them forever to set up. Then they fiddle inscrutably and interminably with their lights, their camera and the position of their subject. Or so it seems, when you don't know all they're up to.

To take some of the mystery out of the photographer's craft, we decided instead to watch closely, and to ask the photographer to explain what he was doing while he was doing it. We hired New York freelancer Doug Long to shoot a strikingly well-poised armchair that was being shown last spring at Workbench Gallery, in an exhibit by Rochester Institute of Technology students and alumni. The chair, in Honduras mahogany upholstered with burgundy velvet, was made by second-year furniture student Robert Harper, and was priced at $2,200. So that we could show what a difference Long's techniques would make, we first spent an hour flubbing a few shots ourselves. Those results appear below.

When Long arrived, the first thing he did was look, for several minutes, at the chair. We'd already gotten it onto white seamless background paper, which he appreciated. Then he began digging into his on-location kit, which consisted only of a camera bag and a cavernous duffel. He pulled out a venerable 35mm Nikon F camera, which he placed on a tripod, about 15 ft. from the chair. He loaded with slow film, Kodak Panatomic-X at ASA 25, because of its finer grain and inherent high contrast. This, he said, would help distinguish the relatively consistent hues of the wood and fabric. A subject with more contrast—say, light and dark woods in the same piece—would be best shot with the faster Plus-X (ASA 125), which can better handle tonal extremes with its wider contrast range.

Long didn't fuss with the position of the chair yet. He just planted it a few feet out from the cove of the seamless, and turned it for a three-quarter frontal view from the camera. This view, he said, could be depended upon for a classic, informative, aesthetically pleasing picture. For the next hour, Long methodically unpacked and set up his lights—four 500-watt photolamps (each bulb packed in a heavy woolen sock) with bell reflectors and standard adjustable stands. The duffel bag also produced some wrinkled aluminum foil, tracing paper, construction paper, gaffer's tape and numerous spring clamps.

He set the first two lights behind the chair on either side, one 4 ft. high and the other 5 ft., but pointed at the background. Their purpose was to light the seamless paper, so the chair would stand out from it. To keep light off the chair, and thus avoid producing shadows, he taped a sheet of black construction paper, shaped like a hood, onto each reflector. By modeling the mouth of the hood, he could adjust the gradation of light against the background.

Long then began to light the chair itself. He put a light on either side, but a few feet in front, the left one about 3 ft. high and the right about 6 ft. The principal concern here, Long said, was to light all four corners of the piece, for a balance of light overall. Next he taped a piece of tracing paper to the front of each reflector to diffuse the light and soften the shadows. The paper was taped only at the top, so it hung free of the reflector, allowing strong, undiffused light to flood the scene's foreground.

Long looked and wanted one more thing: a highlight. So he borrowed one of our lights and set it up off to the left side, with a long snout of foil aimed at the top rail of the chair. Placing this light off to the side, he said, would throw the hard shadow out of the scene.

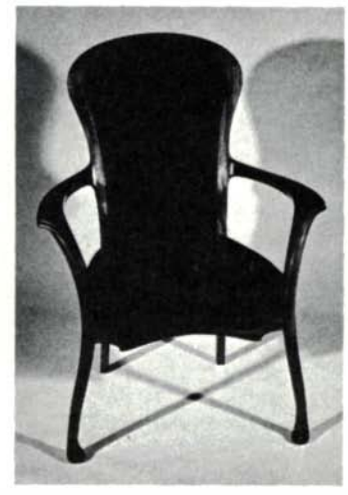
At last, Long went to the camera. He attached an 85mm lens, to give a flatter field, a truer perspective than a 50mm lens would yield. To fill the frame with the chair using a 50mm lens, he explained, would have necessitated bring-

A

B

C

D



Some common photographic flubs: In photo A, *the busy background competes with the chair. A wrinkled sheet, as in photo* B, *is no better. The composition here is also wrong because it shows only three of the chair's shapely legs, and the leg in the foreground is too close to the edge of the frame. In photo* C, *seamless background paper is better than the bedsheet, but the chair is too close to the back of the paper, making the shadow appear behind it rather than below it, and the lighting is bad. It's an electronic flash mounted on the camera, and the resulting hard shadow makes another shape haunting the chair's. Single-flash lighting also causes the harsh glare, the flattened third dimension, and the shallow focal plane. In photo* D, *the chair has been pulled forward a bit and the lighting is softer, but the crisscrossing shadow comes from two equally strong, equivalently positioned lights, instead of a more natural main/fill arrangement. The light meter was used wrong too—held too far from the chair, it measured the light background and indicated an exposure that would yield medium gray there, leaving the chair underexposed.*

ing the camera in too close, distorting the chair and making it look gawky.

"Now the composition," said Long, as he began about a half hour of fine-tuning. "Since I'm shooting only one view, I'm not going to shoot straight on from the front, side or back," he told us, "so I know it's somewhere in between." As he shifted the camera—not the chair, for that would have changed the lighting—he reported what he was seeing: "I know I don't want too high an angle, because I want to show space under both arms. But I don't want it too low, because I get too much negative space." The ideal spot, he decided, was a little lower than eye level, from a shallow three-quarter frontal view.

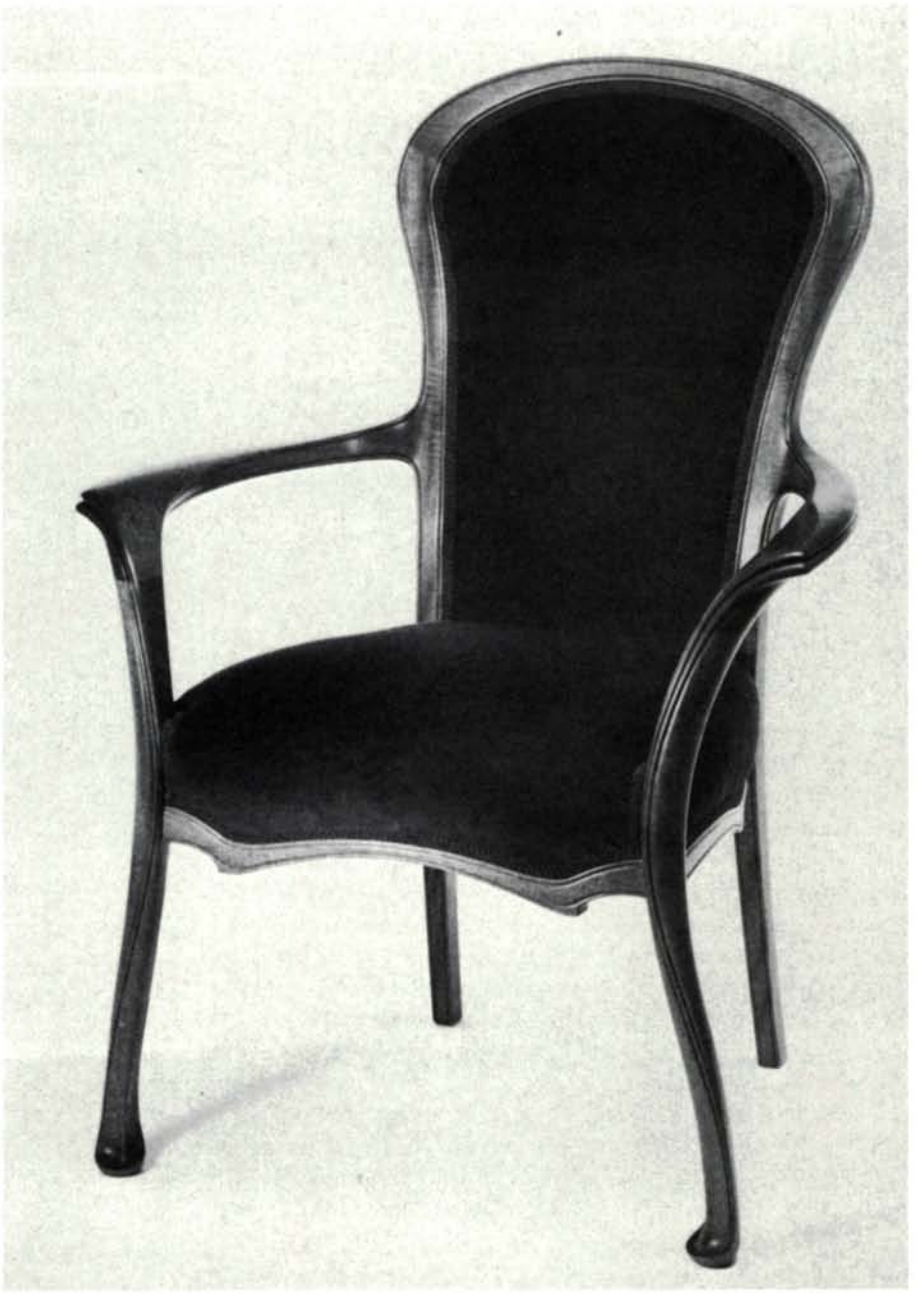
With the composition thus subtly adjusted, Long then zeroed in on the chair's edges, looking for glare that would melt into the white of the background. "You want some glare," he said, "but you have to make sure the edges separate from the background. And that means making an inch-by-inch survey of the chair. . . it's the only way I know to anticipate what will be obvious on the print in the darkroom." When he spotted a troublesome reflection, he'd identify the offending light and slightly shift it, or the chair, or the camera.

Long put the finishing touches on the lighting with a large piece of white paper taped to the lower half of the front left stand, to boost the light on the front of the chair. It filled in, without casting shadows or introducing new glares. In his studio Long keeps free-standing white partitions that he can park all around an object, to provide soft, even light.

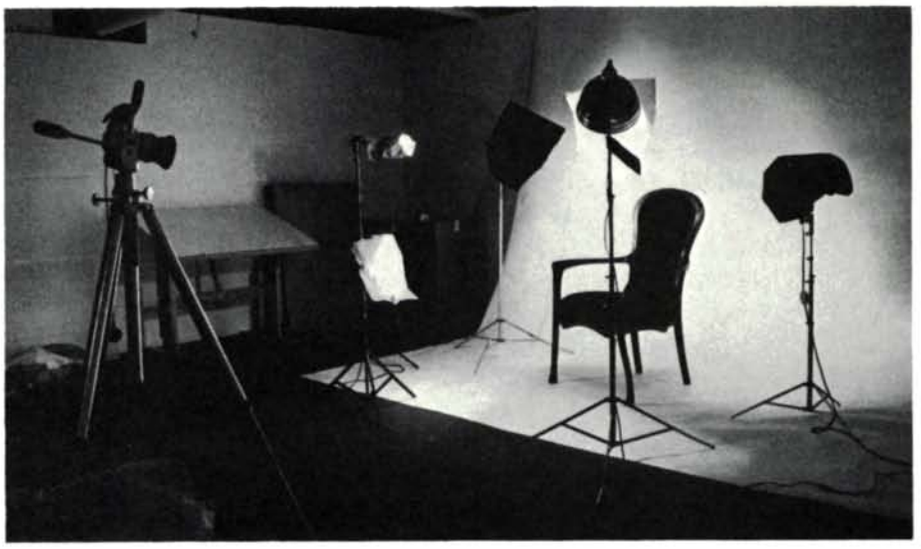
The scene was now fairly incongruous. Within a tight rectangle, the chair glowed perfectly. Everywhere else was a craziness of stands, wires, paper, foil and tape. Almost 2½ hours into the shoot, it was time to take an exposure reading. Long used an incident-light meter, not the reflected-light meter that 35mm cameras contain—because reflected-light meters get thrown off by very light or dark backgrounds. He held his meter near the seat of the chair and read f/22 at 1 second. Finally, Long took a picture. Then he bracketed this exposure, varying the shutter speed from 2 seconds to ½ second, while keeping the aperture stopped down for maximum depth of field. He took two frames at each setting—this was his insurance against the possibility of a scratched or water-marked negative.

The actual snappings of the shutter took only a few minutes. The hours of preparation had been like the making and setting up of a jig. The shoot went like a clean cut.

—Rick Mastelli, Deborah Fillion



A professional's touch: Photographer Doug Long's shot was f/22 for 1 second, using an 85mm lens and Panatomic-X film. Chair of Honduras mahogany was made by Robert Harper. Long's setup (below) included two lights for the background (with black construction-paper hoods), two lights for the chair (one high, one low, with tracing paper diffusers), and one for highlighting the top rail (with aluminum foil snout). Most of his accessories are not sophisticated, but cobbled up from whatever's handy.



Linenfold Carving

Planes and gouges shape folds

by Rick Bütz

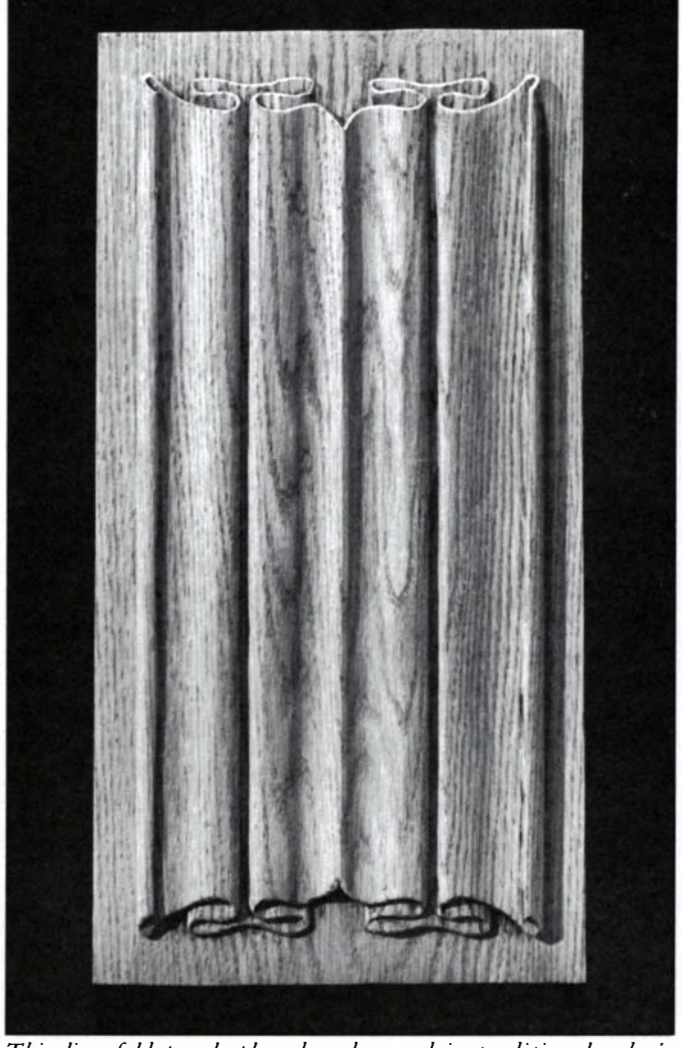
Linenfold carving creates in wood the effect of creases and undulating folds of cloth or parchment. The design seems to have originated with French and Dutch woodworkers around the year 1450, and was probably inspired by the shapes and patterns of draped altar cloths. Several surviving pieces show intricately carved borders reminiscent of the rich embroidery found on ecclesiastical appointments. During the late 15th century, linenfold was introduced into England, where it quickly caught on among the tradesman woodcarvers. The style became so popular that it is now the hallmark of Tudor-Gothic design.

Linenfold was usually carved on a rectangular panel, which was then fitted into a grooved framework. The design could easily be altered in length, and today can be seen as paneling in houses, public buildings and churches, including Westminster Abbey. Linenfold was also popular for paneled doors, chests, beds and other household furnishings of the 15th and 16th centuries. Although many of the early examples were realistic interpretations of cloth folds, the design eventually became quite stylized, and it is even found sideways at times, as if the idea of a hanging drapery had become quite forgotten. As tastes changed toward the end of the 16th century, linenfold carving was replaced by the elaborate floral themes of the early Renaissance.

There are many traditional designs to choose from. I've included drawings of a few to give you an idea of the range. The old woodcarvers varied each panel slightly, achieving a vitality that let them cover an entire room or hallway with linenfold without it seeming monotonous or repetitious. This variety sets the original Gothic woodcarvings apart from later imitations. So don't be afraid to modify the design, but keep in mind that it will be difficult to visualize the end result. Make precise drawings: a full-scale cross section and a clearly defined sketch of the end folds, as shown at right.

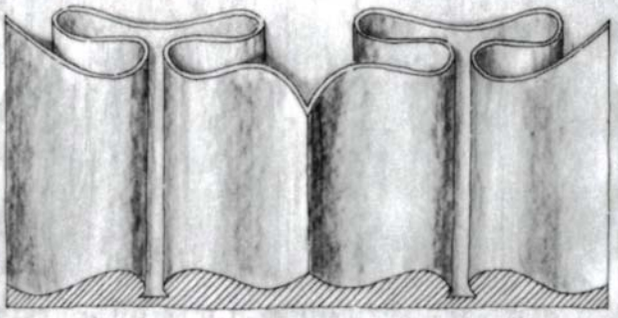
The carving of linenfold is basically a two-step procedure. The long folds and undulations are planed out, then the ends are shaped with various carving tools. One aspect that makes carving a linenfold panel so enjoyable and interesting is the variety of tools that are used. While you could use routers and circular saws, it's just as quick and more satisfying to do it with traditional hand tools. For cutting down the background and shaping the contours of the long folds and creases, use a rabbet plane, a plow plane, one or two round planes, and a small block plane (photo A, top of facing page). For carving the end folds, you will need one or two fishtail gouges of medium sweep and a back-bent gouge. If you don't own all of these tools, you can modify the design to suit the ones you have.

Rick Bütz, 34, makes his living by carving wildlife in Blue Mountain Lake, N.Y. Photos by Ellen Bütz, except where noted.

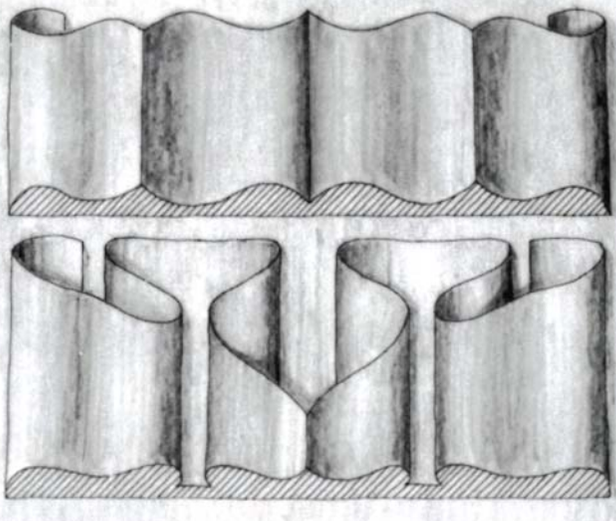


This linenfold panel, planed and carved in traditional oak, is ready to be let into a frame.

Typical linenfold designs



The linenfold design forms the raised part of a panel. These patterns, adapted from 15th- and 16th-century examples, provide a starting point for decorative carving in the Tudor style. Oak was a favorite wood for the panels of chests, beds, hallways, doors and window shutters.



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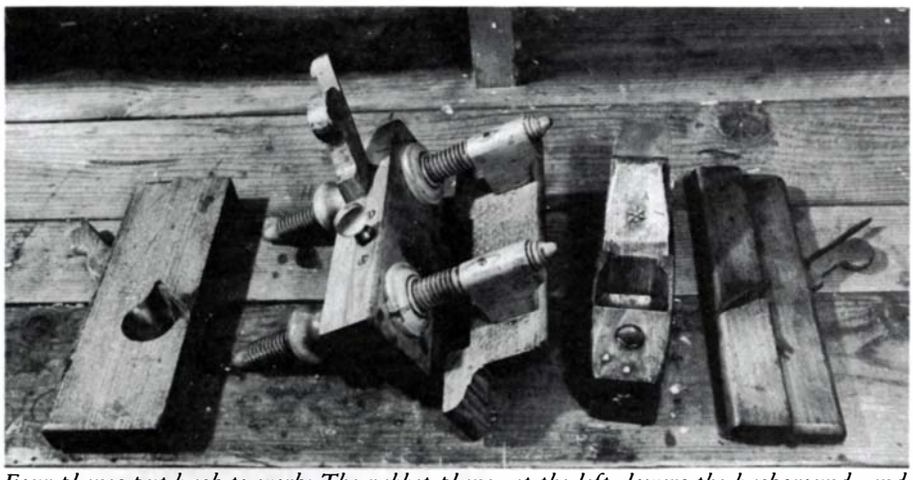
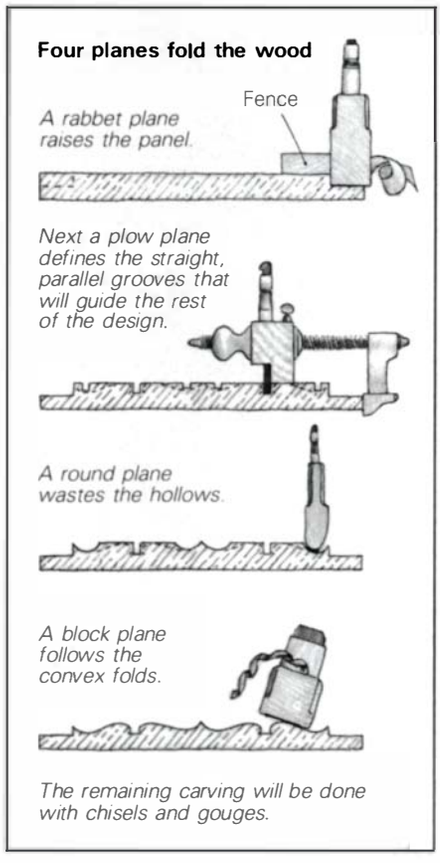


Four planes put back to work: The rabbet plane, at the left, lowers the background, and the plow plane grooves the guidelines; then the block plane and the round plane shape the curves.

Begin the linenfold by marking out the border with a marking gauge. Be sure to allow some extra material for a tongue, to fit the panel into a door or a furniture carcase. Next cut down the background along the edges with a rabbet plane (below). The most accurate way to set up the rabbeting is to clamp a fence, a smooth 1-in. by 2-in. board along the face of the panel, to guide the plane and keep the edges straight. As a general rule, the background should not be taken down any more than one-half the thickness of your panel. If you exaggerate the vertical scale of the drawing too much and go for a deeper relief, the end folds will become fragile, which is a real problem in oak, the traditional Gothic wood.



When the background has been cut down and smoothed, mark out the ends of the panel by tracing a cross-section template from your plan. Make sure that your markings are symmetrical and that they line up on both ends of your board. I use a plow plane with a $\frac{1}{8}$-in. iron to cut a series of grooves that exactly match the deepest parts of the cross section. The grooves will serve as a guide for hollowing out the undulations with a round plane, keeping the edges parallel and preventing the shaping from going too deep. This is important for a clean, crisp job.

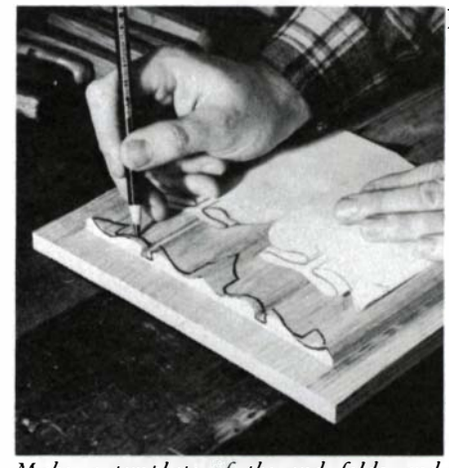
Use a $\frac{3}{4}$-in. round plane, or something similar, and carefully hollow out the concave folds. The plane iron should be absolutely sharp and the sole of the plane should be waxed with either paraffin or a hard, cross-country ski wax. Ski waxes come in different colors to indicate their relative hardness and the kinds of snow they should be used on. I find that harder waxes, such as blue or green glider, make planing easy and keep the cuts true and clean.

Next smooth off the convex surfaces of the folds with a block plane, and then use a shallow carving gouge to eliminate any remaining ridges. A #5 sweep in a 12mm to 16mm width and a small flat chisel work quite well for this job. The rest of the shaping will be done with carving gouges and the lightest of finish-sanding.

Now make another tracing and template showing the shape and outlines of the outer end folds. Transfer this to the ends of the panel (photo B), and begin "setting in" with a mallet and gouges. "Setting in" means to drive the tool down vertically with a mallet (photo C). Then make a horizontal cut to meet the curves. The sweep of the gouges should correspond to the curves of the lines. For this panel, I used an 8mm #5 and a 4mm #7 to set in all of the lines. Don't drive gouges too deep—they can break. When you set in, stop about $\frac{1}{16}$ in. short of the background depth. This is important because the outlines will eventually be undercut in order to give the final piece a feeling of depth and separation from the background. If you drive the gouge down too far at this stage, the cuts will show after you undercut, leaving the work rough.

Using a 14mm #7 gouge, ease off the edge you have just set in. This is done by carefully carving a smooth bevel that extends from the inner fold line down to the outer fold line, leaving no

B

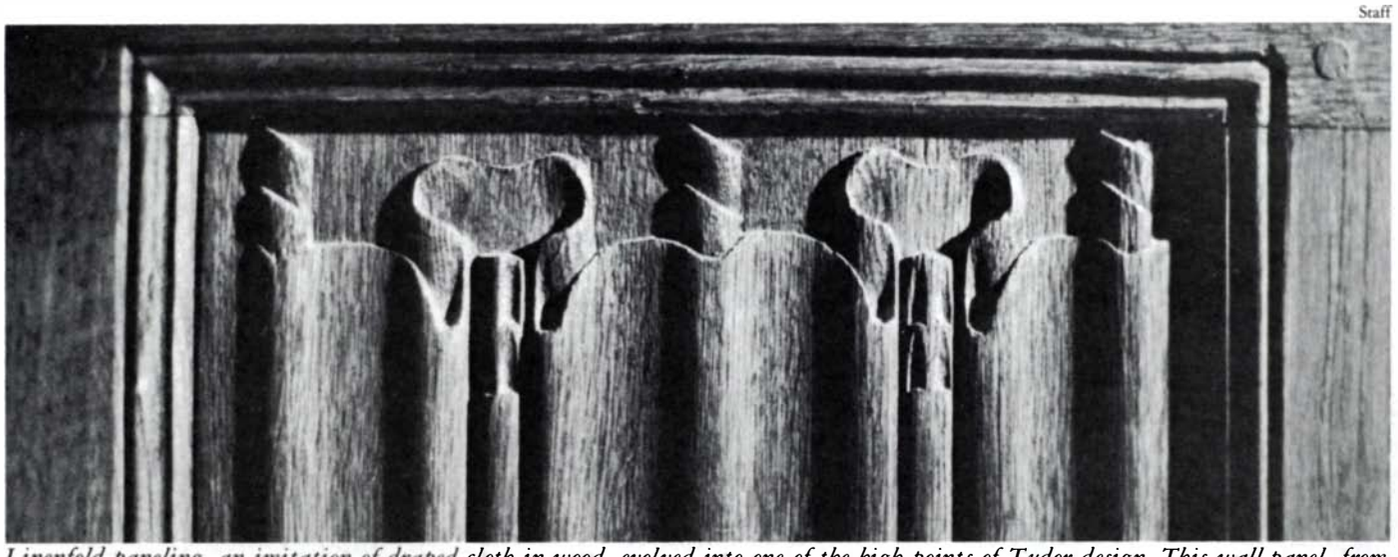


Make a template of the end folds and trace it on the work.

C

Set in by driving vertical cuts to within $\frac{1}{16}$ in. of the background.

Staff



Linenfold paneling, an imitation of draped cloth in wood, evolved into one of the high points of Tudor design. This wall panel, from the Parnham House in Beaminster, England, is typical of much architectural woodwork of the 15th and 16th centuries.

D

Bevel between the lines with a gouge, leaving bottom edge of 'cloth.'

E

Outline the edges with a V-tool, cutting with the grain as much as possible.

less than $\frac{1}{16}$ in. of that contoured line (photo **D**). To begin setting in the inner folds, sketch in the line of the folds, then outline these edges with a 6mm V-tool (photo **E**). To prevent splintering when working across the grain, start each cut from the outer edges of the fold and work toward the center.

Make your horizontal cuts in from the end with a 5mm #3 gouge to clear away the waste, and use an 8mm #5 back-bent gouge to even up the outline (photo **F**). Undercut them slightly. A back-bent gouge is perfect for finishing up linenfold, but it can feel awkward if you are not used to it—the action is the reverse of the more familiar spoon gouge's. A straight gouge can also be used for undercutting, but be careful—the angle of cut may split the wood.

Use the small #3 gouge to clear away any waste, and smooth out the surfaces of the end folds. Use the back-bent gouge to undercut the original set-in line, and then clear away any background material that was left earlier.

As a last step, here's one of woodcarving's fine points: Take a small carving chisel, or shallow gouge, and cut a small bevel along the entire edge of the end fold lines, to reflect light so that the edge will shine (photo **G**). If this line were left sharp, it would disappear in most light and spoil the illusion of cloth folds captured in wood. Finally, lightly touch up any rough spots with fine sandpaper. Just be careful not to smooth over or obscure any edges that should be left crisp, and try to leave the tool-mark facets prominent. Gothic woodcarvings, particularly linenfold, should be boldly simple. Those old craftsmen cut right to the line. □

F

Undercut the folds slightly with a back-bent gouge.

G

Bevel the edges to catch the light, further defining the carving.

Current Work

Rocky Mountain invitational

by James Rannefeld

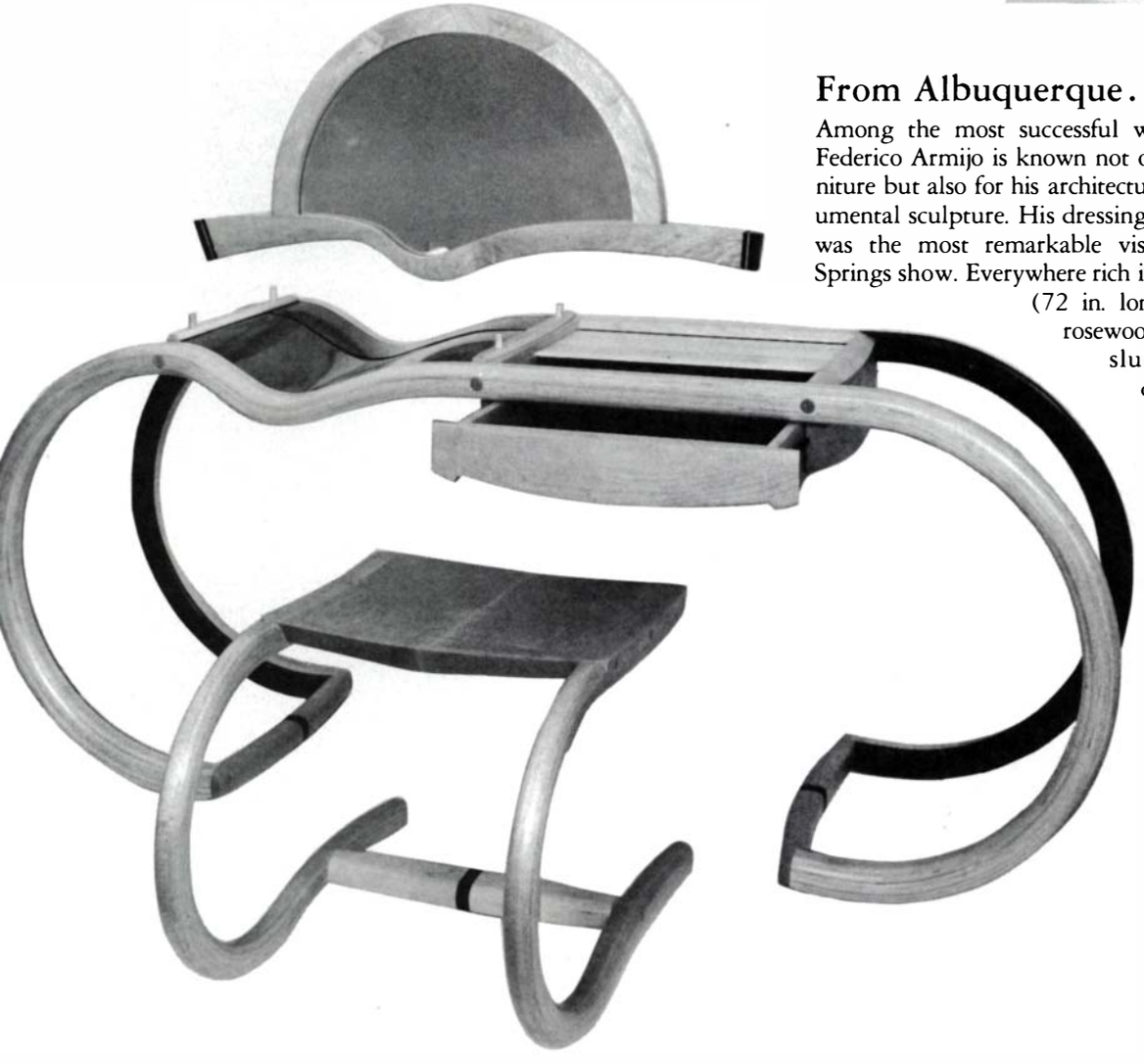
"Woodworking in the Rockies," an invitational exhibit at the Colorado Springs Fine Arts Center during May and June, was a signal show. Twenty-two woodworkers from Colorado, New Mexico, Arizona, Nevada, Utah, Idaho, Montana and Wyoming were invited to show their best work. Curator Charles Guerin, a woodworker himself, sought to inform the public about the contemporary renaissance in the woodworking arts, and to introduce these designer-craftsmen as an important part of that national movement. An excellent catalog of the show is available for $6.00 from the arts center at 30 W. Dale, Colorado Springs, Colo. 80903.

James Rannefeld (JAWAR), a furnituremaker in Taos, N.M., also showed work at Colorado Springs.

From Las Vegas...

John LaBounty designed this dressing table two years ago, and the chair two months before the show. He was at first surprised to see them displayed as a suite, then pleased by how well they work together. They show a continuing evolution of his personal style. The dainty pirouette of rhythm and line is as beautiful as any I've seen. The table is 42 in. high by 36 in. long, the chair is 34 in. high. Both pieces are of cherry and walnut; joinery is mortise-and-tenon, dowel and dovetail.

James Rannefeld

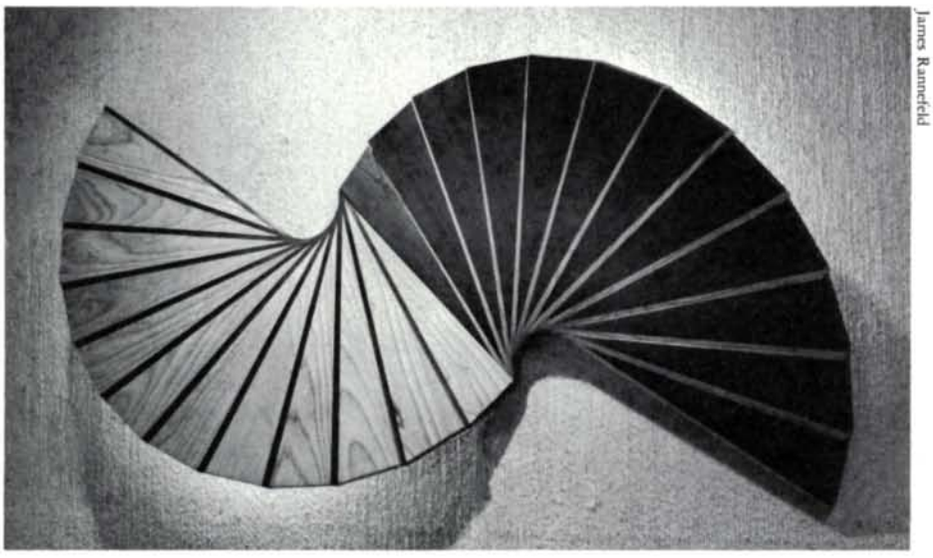


From Albuquerque...

Among the most successful woodworkers in the region, Federico Armijo is known not only for his imaginative furniture but also for his architectural woodworking and monumental sculpture. His dressing table with stool and mirror was the most remarkable visual treat in the Colorado Springs show. Everywhere rich in sculptural detail, the table (72 in. long) is made of maple with rosewood and ebony accents, and a slumped glass top. As the drawer is opened, a horizontal tambour withdraws across the top, to reveal a suede-lined cosmetics compartment.

Photos, except where noted: Bill Bowers

From Pocatello, Idaho . . .

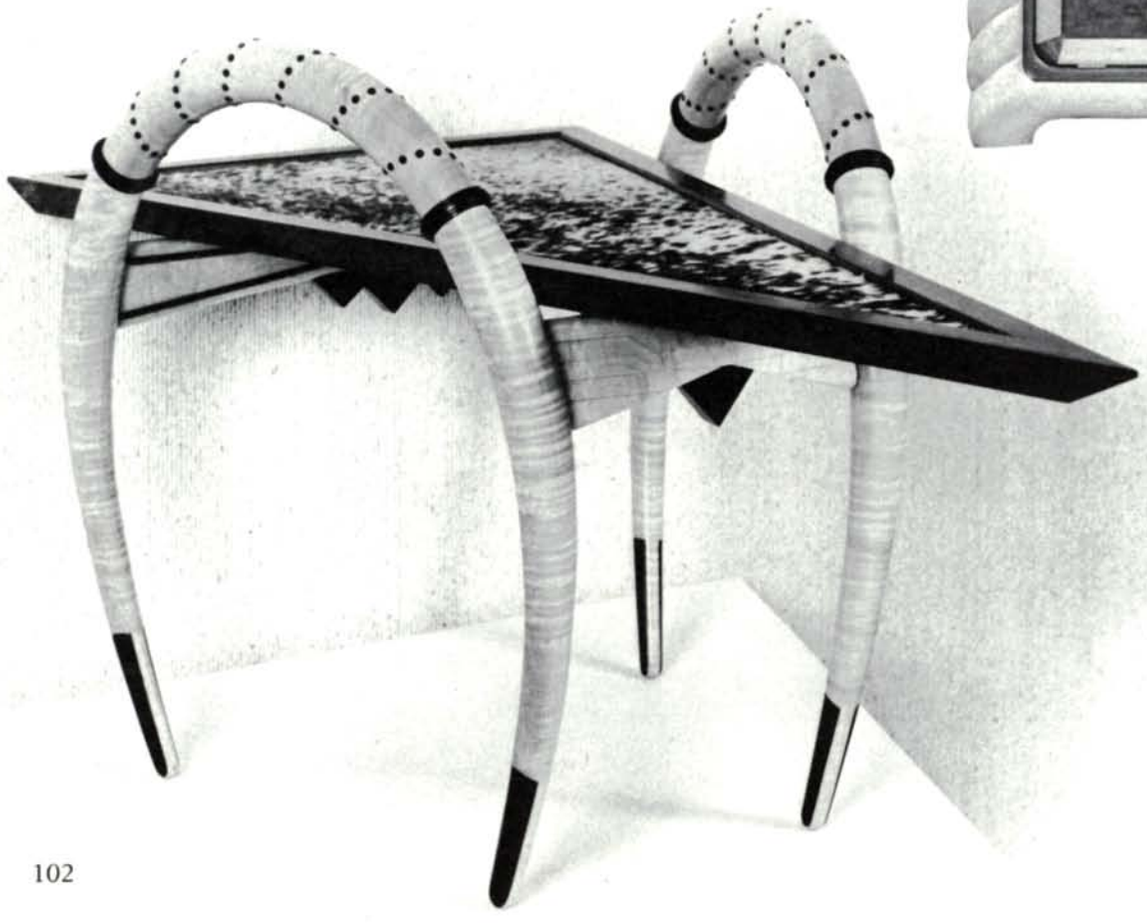


James Rannefeld

Timothy Zikratch is searching for a style with the experimental pieces he's able to fit into his general woodworking business. His cherry and ash wall-hung light fixture (above, 55 in. long, 36 in. high, 10 in. deep), spline-joined, made from the cut-off pieces left over from a coffee table job, splashes light across the wall on which it's hung. His art deco stereo cabinet, right, is an obvious play on the outlandish juke boxes of a generation ago. Impressive in size (80 in. high, 27 in. wide and 20 in. deep), it's meticulously constructed of cherry, bird's-eye maple and walnut, with a back-lit stained glass panel. Zikratch also made the nifty brass hinges.

From Albuquerque . . .

Steve Madsen has built his reputation as an artist by making imaginative, richly detailed boxes and diminutive chests-of-drawers. "Night Stalker," an experimental table, is a haunting, evocative arabesque in maple and ebony with a speckled cowhide top. Although small (36 in. long), it's larger than Madsen usually works and it continues his explorations of decorative detail and startling imagery. I was intrigued each time I returned to it, as it revealed new subtleties and complexities.



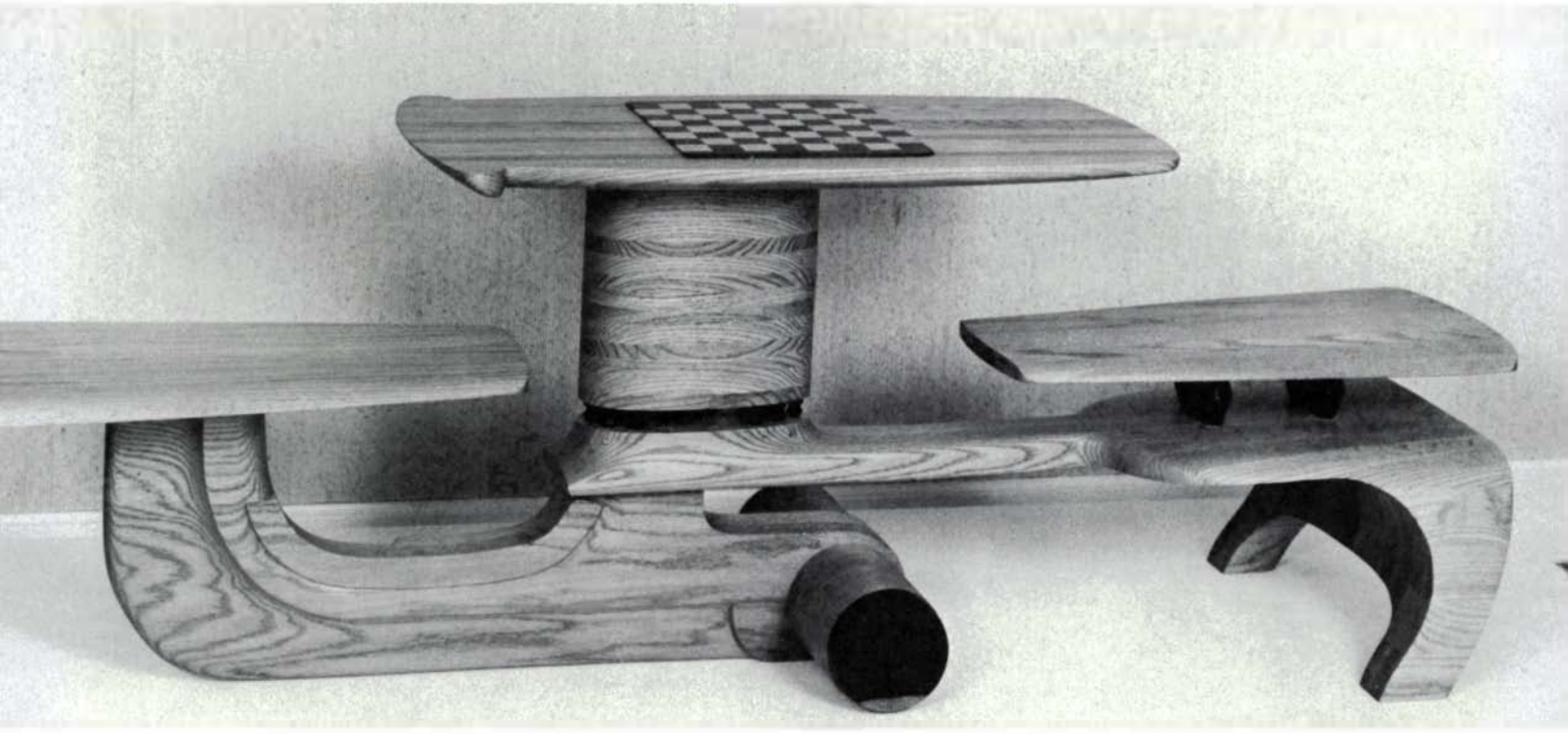
From Scottsdale, Ariz. . . .

Al Abrams

Warren Fenzi's "Avalon" club chair (43 in. high) in pickled ash is slung with leather, and sports an impressive if impractical copper footrest. The best chair in the exhibition, it seems to belong at the yacht club or the croquet court. His "Marfen" desk (71 in. long, 30 in. wide, 29 in. high), above, with its penetrating plum lacquer finish (over poplar), brass inlay and bronze-mirror writing surface, was, to a cabinetmaker, the most enigmatic piece on display at Colorado Springs—the only visible clue to its joinery is an exposed ash spline under the maple legs.

From Albuquerque . . .

Federico Armijo (p. 101) frequently makes chess tables, which he calls "an intimate way to get two people together." This version (84 in. long) is a bold sculptural statement of stack-laminated oak with details of ebony, rosewood and brass.



In Concord, Mass. . . .

by Paul Bertorelli

Creative self-expression in wood doesn't usually call to mind traditional furniture. The tested forms of the past seem stale or stilted to woodworkers who want to voice their imaginations in terms of today's techniques, materials and design challenges. Nevertheless, a lively market for period furniture persists, and the designs have vitality for those who don't see creativity as starting from zero. In the Northeast, more than a handful of cabinetmakers keep busy by working exclusively in the traditional idiom.

Last spring, I visited a show devoted entirely to high-style traditional furniture. Held by the Concord Art Association in Concord, Mass., to complement a retrospective of paintings by a local artist, it featured the work of nine Boston-area cabinetmakers. Their furniture and wooden objects represented a wide range of popular period tastes. These makers don't consider their work reproductions, preferring instead to describe it as "designed in the style of" some particular historical period. Thus, a piece may evoke the line and form of a 17th- or 18th-century predecessor, yet still be an entirely new creation whose originality resides in the execution of detail and the variations that reflect a client's particular needs or the builder's idiosyncrasies.

"I'm unsure of my own sense of design," says Joseph Twichell of Stowe, Mass., who exhibited a Queen Anne desk-on-frame and several other pieces. "But I recognize what I like when I see it, and I feel plenty of room to be creative." Like other modern-day period stylists, Twichell starts with classic forms which he acquires from books, measured drawings or actual pieces. He then subtly manipulates proportions, materials and details to arrive at a pleasing whole.

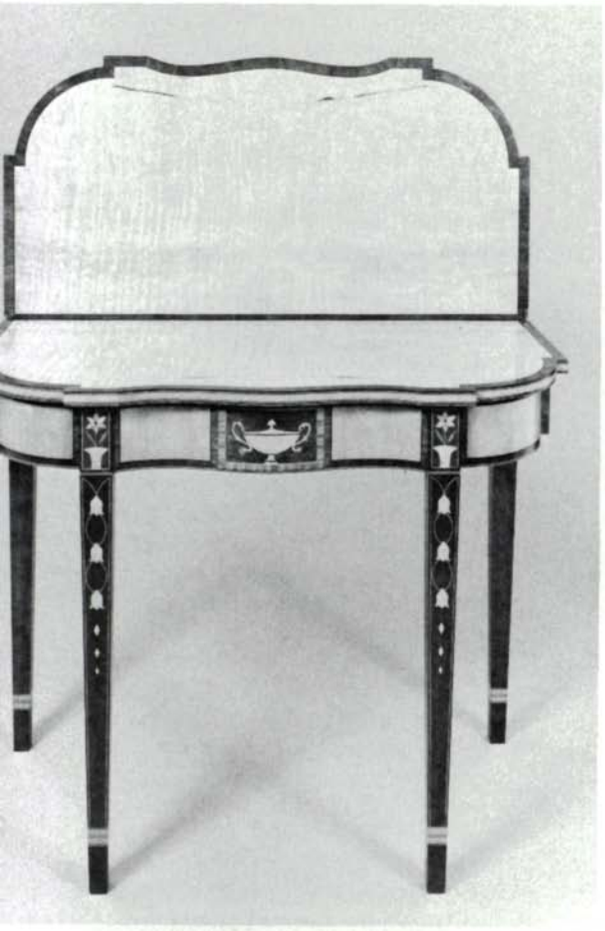
Technically, period furniture makers must exercise strong discipline in learning traditional joinery. They are rarely able to design around joints that they haven't yet figured out how to make; there is no shortcut to a carved crest rail and no router jig for making a crisp, well-formed ball-and-claw foot. "I'm interested in improving my technique. But it's going to take me twenty years to learn all of the things I want to know, and even then I don't see an end to it," says Lance Patterson, who shares a shop on Boston's Congress Street with four other period woodworkers, including Alex Krutsky, another cabinetmaker who showed at Concord.

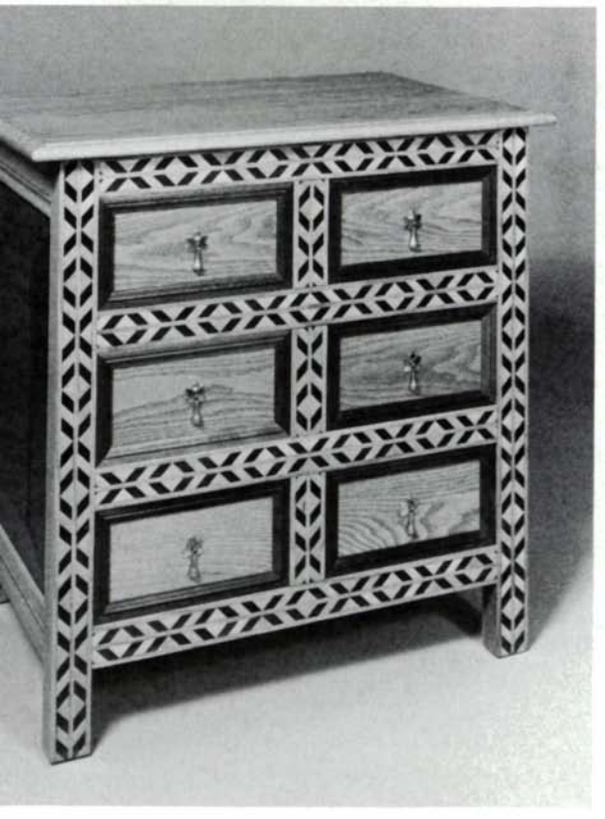
Patterson and most of the others in the show are graduates of the North Bennet Street Industrial School in Boston, a unique trade school that specializes in teaching the design and construction of traditional furniture (*FWW* #28, p. 66). The practicing graduates of North Bennet have varied tastes and philosophies within the period realm, but they seem to share a less than passionate view of contemporary design. "I find contemporary furniture cold, boring in fact," says Patterson, now an instructor at the school. "Its oversimplicity is degrading to the complexity of the human mind." □

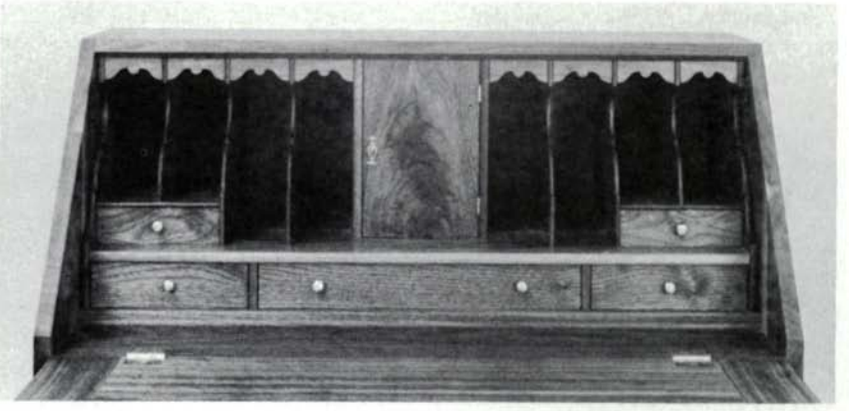
This velvet-lined walnut jewelry box with holly inlay, above, was made by Phil Lowe, an instructor at Boston's North Bennet Street School. To satisfy his creative urges, Alexander Krutsky embellished the knee carving and added bulk to the crest rails of his Queen Anne chairs, below. They were inspired by originals owned by the Boston Museum of Fine Arts.

Photos: Visual Proofs, Inc.

Joseph Twichell experimented with the rhythm of the gallery dividers in his walnut Queen Anne desk-on-frame, shown in two photos below, but retained traditional case-and-frame joinery throughout. William Thomas of Hillsboro, N.H., says his inlaid card table, top left, draws its form from the Baltimore style of the 1780s, and details from other periods are evident. It's made of mahogany and curly maple veneer finished with a French polish. Lance Patterson, also an instructor at North Bennet Street, got the idea for his 17th-century inlaid chest, bottom left, from measured drawings by Lester Margon. He changed dimensions and altered the inlay for a more symmetrical effect. The chest is made of red oak, with mahogany and maple inlay set off by teardrop pulls.







ARMIN ERB OF THE ALPS

Traditional mountain cheesemaking is a summer activity in the Swiss Alps. By fall the pastures are eaten down, snow falls sporadically and the cows move to farms in the lower valleys. Then the cheesemakers turn to other work, often carpentry or logging. Armin Erb is a mountain cheesemaker who sells a little firewood to supplement his income, but some villagers think he's lazy because he doesn't take a regular winter job. Instead, he works in a small dark shop that his father used as a pig house, working wood in the Swiss hand-tool tradition, but in a style that has become increasingly personal and contemporary.

My wife and I were introduced to Erb in 1972 by a local cooper. Erb has a reputation in the village for being a loner, yet we communicated readily, mostly through our work, and he invited us to stay "as long as we cared to." The visit lasted ten weeks.

Erb's cheesemaking room in the 300-year-old *Alpenhutte* in the mountains is almost identical to one I saw reconstructed in a Munich museum. Erb's other home in the village, however, where he was born in 1925, came as a surprise. It was built in the 1600s, and on the outside looks like a typical plastered timber-frame farmhouse. But inside, from the knotty floors to the paneling on the walls and ceilings, Erb has built or rebuilt almost everything, creating a uniquely personal environment that includes chairs, chests, carved bowls and many small *Alpenroot* sculptures made from found, weathered wood.

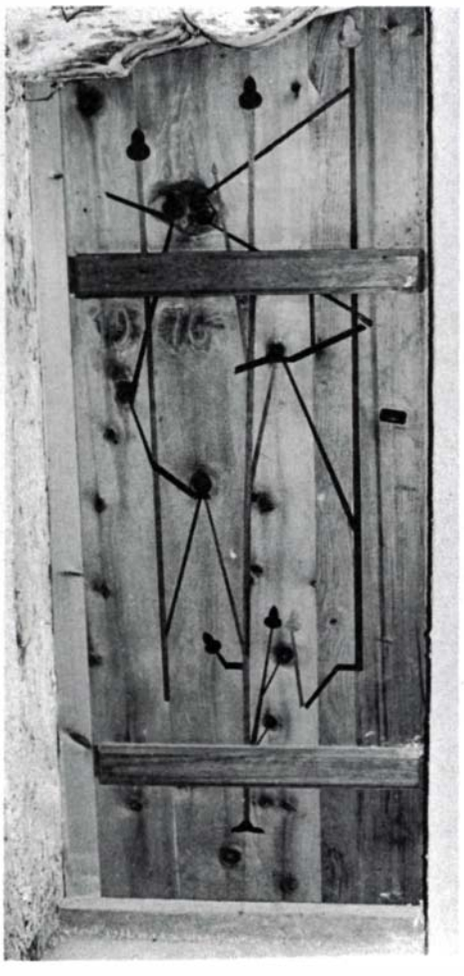
As a boy, Erb discovered what he calls a "woodworm" within himself, and he picked up the skills quickly. He is mostly self-taught, though at the age of 19 he spent the winter training with a furnituremaker, and later worked with a carpenter. Erb's earliest projects were in the Swiss country tradition, with elaborate chip-carving and inlay, but he now sees no need to reproduce pieces of the past—his latest work, suggesting dream imagery, is almost surreal.

His favorite wood, called arve, is a slow-growing, knotty (but very soft) pine that grows near the timberline. Erb generally has his logs sawn through and through, retaining the waney bark edges. The boards are carefully stickered in a shed. He has built a heat-closet kiln around the woodstove flue in his workshop, but many of his pieces are made from wood that is simply air-dried.

He uses hand tools mostly, though he does have a few basic power tools—a cheap circular saw, a jigsaw and an electric drill. In a covered passageway, there's a huge planer, powered by an antique hit-or-miss engine.

Erb uses hand tools with clarity and precision, and he prefers straightforward, visible joinery, such as through tenons and rather large dovetails. His work shows an interaction between the natural forces that created the wood and the person who made the object. Erb's wooden hinges and handcarved knobs are seldom perfectly symmetrical or matched in identical pairs. A great deal of attention, however, is given to making each element in a piece visually interesting and functional. He has done much of his work for himself. For a while in the 1960s, Erb inlaid constellations of knots into boards that weren't knotty enough. In some of his pieces he lets irregular edges run wild, or he'll use a board of knotty arve where you'd expect clear, straight-grained stock. He sometimes contrasts precise geometric designs with irregularly gouged surfaces.

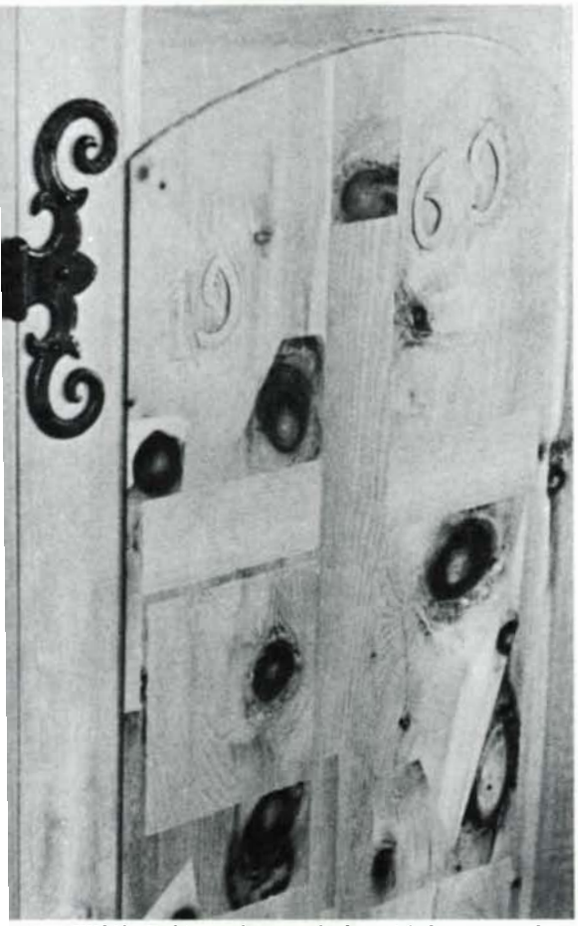
People have begun to discover Armin Erb, appreciating his woodworking and helping him with his farming. This recognition has freed his creativity, resulting in work that is continually more personal and searching. His work grows on you. When I visited him again in 1980, I liked it better than ever, especially the small, intimate *Alpenroot* sculptures. Erb is a man of few words. He once quoted me a brief poem by Hermann Hesse that describes his philosophy. In English, roughly, it says: "Seek happiness within yourself." □

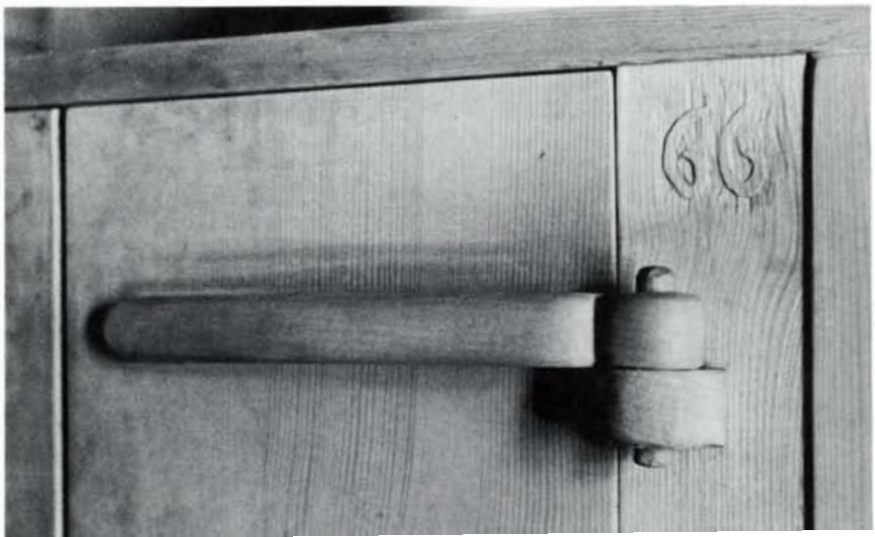


Armin Erb, above, in the doorway of his goats' winter barn in the village. Erb spends his summers in the Swiss mountains making cheese. He's a frugal person whose lifestyle has become his art. Erb's freestyle woodworking puzzles neighboring craftsmen, who favor patterns and templates little changed for generations. The inlay on the closet door shown at right, which at first appears random, is a meeting of tradition with the forces that make every tree or person unique, a theme that runs through all of Erb's work. The door's design combines traditional elements with inlaid knots and interconnected lines.

Drew Langsner and his wife, Louise, toured Europe in 1972, to seek out country craftspeople. He is the author of The Logbuilder's Handbook *(Rodale Press, 1982; $14.95 hardcover, $11.95 paperback) and the director of the Country Workshops in Marshall, N.C. Photos by the author.*

Armin Erb is fluent in many styles, ranging from the strictly traditional—like his reconstruction of this 18th-century chest, above—to the minimally modern, as shown in one of his Alpenroot *sculptures, below.*





While Erb's sculptures look as if they grew that way, he has no qualms about helping nature along in his other work—most of the knots in the cabinet door, above, were transplanted from other boards to become part of the design. The hinges were wrought by a local blacksmith. The chair, far right, seemingly a tangle of roots and branches, is joined so as to emphasize the apparent randomness. Pintel hinges, like the one at right, on a cabinet in Erb's home in the village, are common in Switzerland. The straps slot into tapered dovetails, allowing wood movement yet restraining the door from warping.

Stan Dann beside 'Broom with Dustpan' (38 in. by 38 in. by 3 in.), in his Oakland, Calif., studio. Right, a detail of the surface. At top, 'Pair of Scissors' (44 in. by 34 in.).

Bandsawn Bas-Relief

Trained as a graphic designer, Stan Dann turned to carving signs in 1964, and developed a lucrative business projecting the character of shops throughout the San Francisco Bay area. By 1980 he was sated with signs and, braving the commercial lull that usually accompanies the transition from making potboilers to exploring possibilities, he began carving bas-reliefs ranging from simple objects to elaborate scenes. His first panels were sculpted from a single board, but as texture became increasingly important to him, Dann's reliefs developed into assemblages, which allow a sharpness of detail unattainable in traditional reliefs.

Both of the reliefs here were made from numerous pieces of alder, bandsawn and then shaped with rasps, rifflers and die grinders before being glued to 1-in. thick redwood panels. Dann finishes with sealer, followed by a wash coat of acrylic paint wiped with lacquer thinner to even the wood's varied tones.