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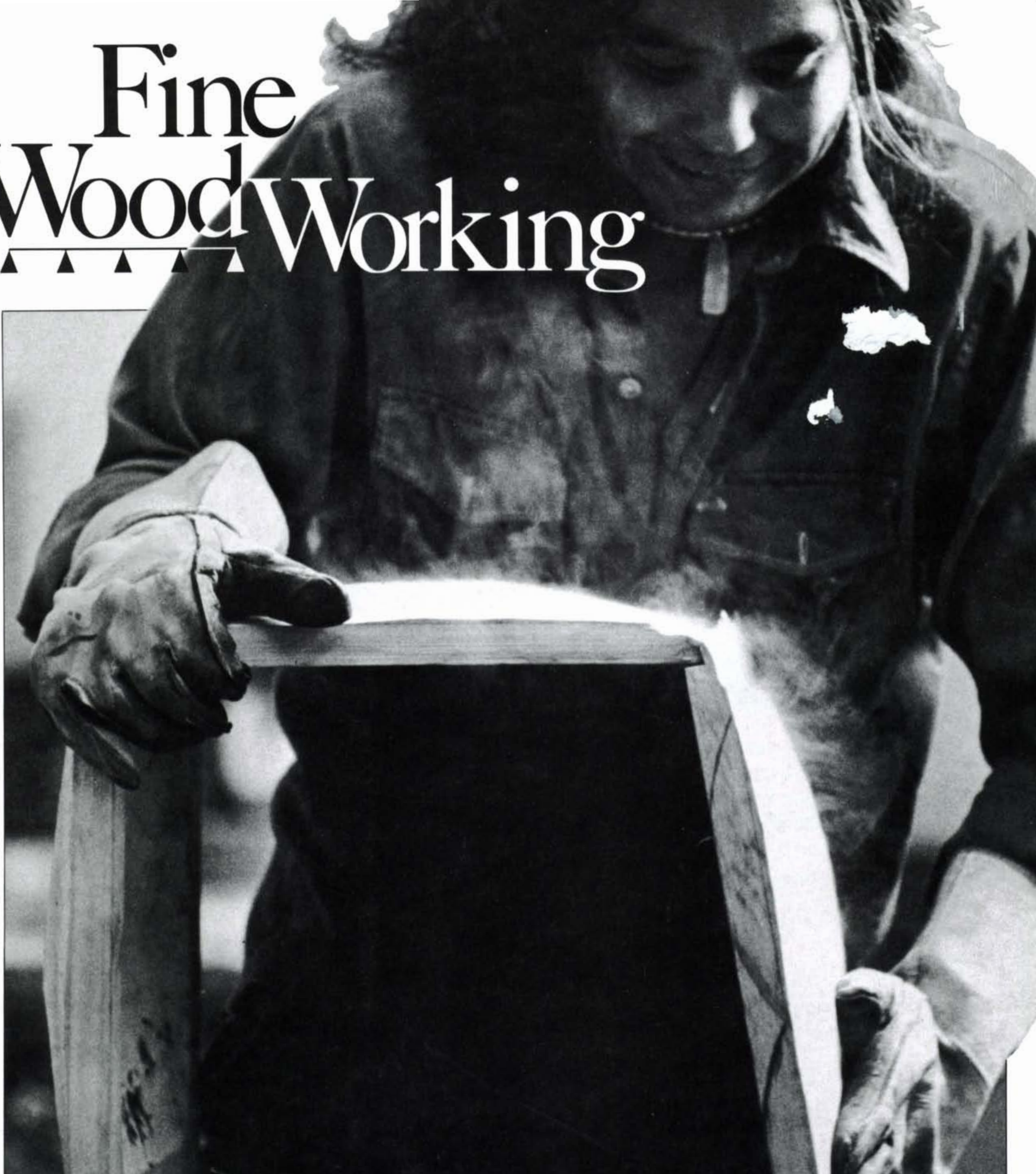

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Fine WoodWorking®

MAY/JUNE 1980, NUMBER 22

DEPARTMENTS

ARTICLES

Kwakiutl Roy Hanuse recesses the fourth corner of a steamed and kerf-bent box with a specially designed hooked knife. The kerf-bending tools and traditional techniques of the Indians of the Northwest Coast are described on pp. 36-43; how Hanuse made this box, also shown on the cover, is detailed in a photo-essay, pp. 44-45. Photo: Ulli Steltzer.

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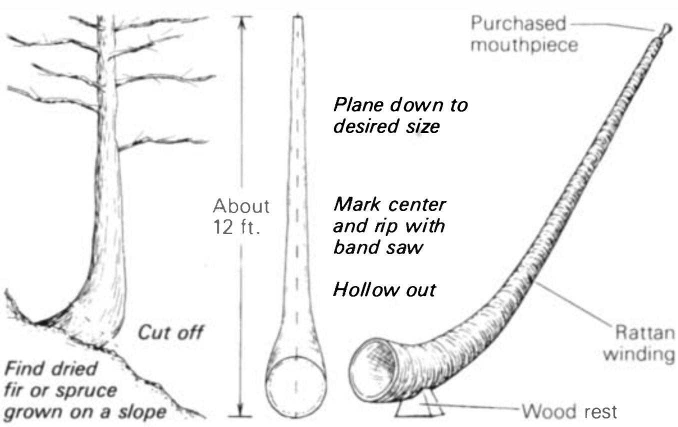
Letters

In a recent issue of *Fine Woodworking*, a reader wanted to know how one builds a Swiss alphorn. Here is a description by Ernst Balli, a Swiss cousin of mine who builds them in his spare time:

First, find a small fir or a spruce (apparently it makes no difference) that grew on a slope, died and dried out completely on the spot without, however, having started to rot (the harsh winters and wind conditions in the Alps help the process). A length of about 12 ft., yields a so-called *C*-horn. Once you've brought it home, plane it down conically. After planing, rip the length into two halves on the band saw. Hollow the halves with a gouge. The remaining wall thickness should be about 3⁄16 in. Glue the two halves together again with carpenter's glue, making sure that no glue seeps inward. After it dries, cover the whole horn with glue and wrap it like a mummy with strips of linen about 1⁄4 in. wide. Start at the bottom. This last step ensures tightness and stability. Thereafter, wrap the horn in tight layers of rattan, again starting at the bottom. When gouging out the top, make sure that the purchased mouthpiece fits snugly. I think it's a piece like for a trombone. —*Henry Ratz, Del Mar, Calif.*



As a longtime user of satin polyurethane varnishes, I have frequently complained to my supplier about the short shelf-life of half-filled cans. I have used several varieties and they all gel quickly. No answers to the problems have surfaced except using collapsible photochemical containers. My only solution has been to buy the smallest size containers and consign the remains to the rubbish barrel.

I kept thinking about how to remove air from the open container, which is the cause of gelling. Finally the effort paid off—I think. Why not flood the can with propane gas, displacing the air? Most of us have small propane cylinders in our shop for soldering. The gas is inert and should have no effect on the varnish.

Some months ago I gassed several partially filled cans of varnish, and thus far this plan works beautifully. The procedure I use is to flood the can with gas and then restrict the opening by sliding the cover halfway into place before turning the gas off. This should prevent any eddying, which might draw air back into the can. The same system should work for other oxygen-sensitive products such as tung oil and paint. —*William A. Woodcock, Huntington, N.Y.*

This morning I plugged in my version of the PEG soaking vat as described by Bruce Hoadley in your Nov. '79 issue. The problem I ran into, and you may want to warn readers about

this, is the fact that the heat generated is sufficient to melt a plastic reflector around the light bulb, and the plastic pail. If the insulation has a paper backing, you might start a fire. . . . I used a 150-watt bulb, which may have been asking for it. Glad I did though, because a 100-watt bulb would just have taken longer to do the same damage and I might have been asleep by then. . . . With the reflector hood just a pile of white goo, the light would probably have ended up in the water where probably it would have created a short circuit and tripped the circuit breaker. I may now try the immersion heater/thermostat route, which is more expensive, but hopefully safer. —*Randy Evans, Newport Beach, Calif.*

I wholeheartedly disagree with Tage Frid's comments (Jan. '80) about the best way to cut miters. He said no miter box was accurate enough to cut a smooth joint and advised investing in a 10-in. table saw and using a miter jig with it.

For cutting miters, the Lion miter trimmer (which I manufacture and sell) gives clearly superior performance to any miter box and any sawblade, anywhere. Its cuts on hard or soft wood are glass-smooth and dead accurate on 45°, and it does its work rapidly and easily. . . .

—*L.A. Nothnagle, Pootatuck Corp., RR 2, Box 12A, Windsor, Vt. 05089*

. . . In my opinion, to fit a tight miter joint in lieu of a trimmer, a shooting board and a jointing plane is the best way. A sawn cut just will not close up like a planed joint. Often the miter joint isn't exactly 90°. With a shooting board, a shaving can be placed under the proper edge of the stock to correct the miter as necessary for a tight joint. . . .

—*Richard R. Pruitt, Austin, Tex.*

Earl Beck seems to be very knowledgeable concerning shapers, routers, cutting angles, guides, etc. I enjoyed his article (Jan. '80) and particularly the detailed drawing on p. 71, which shows the casehardening caused by improper clearance angles.

However, on p. 70, he tells about two different systems that he uses to shape wood on his ½-in. spindle shaper. Since we have been in the business of making shaper cutters, collars and cutterheads since 1926, I must totally disagree with the safety of his method on his system *A*, where he used one knife and a post for balance. Also, to a lesser degree, his system *B*, where he uses a small knife in a disc. The knife is held firm by an allen screw.

On most shapers today, the spindle rotates between 8,000 and 12,000 RPM. I cannot understand how one knife can be balanced safely at that speed. It does not take very much weight to cause an out-of-balance effect at 8,000 RPM. An out-of-balance knife would cause the machine to vibrate, and the knife might be thrown from the cutterhead, which could cause a serious accident.

All manufacturers today must be extremely careful to grind knives to very close tolerances to prevent accidents. Most collars sold today are OSHA approved in either two or three-knife, safety-type, lock-edged collars, in which the knives are all balanced within one-eighth of an ounce, and are locked into the collars so that there is very little, or no, out of balance on knives. Also, many knives made today are machine-ground in the collars in which they will be used, to ensure that all the cutting edges on all the knives in one pair of collars will cut. . . .

I am speaking from a manufacturer's viewpoint, but whether the shaper is operated by a serious amateur or a worker in a large furniture manufacturing company, the pri-

Bill C.
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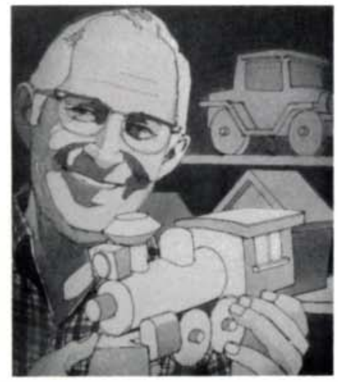

Jack B.
He does it for fun like Bill C. But he *sells* his work at fairs and street markets — at fancy prices.

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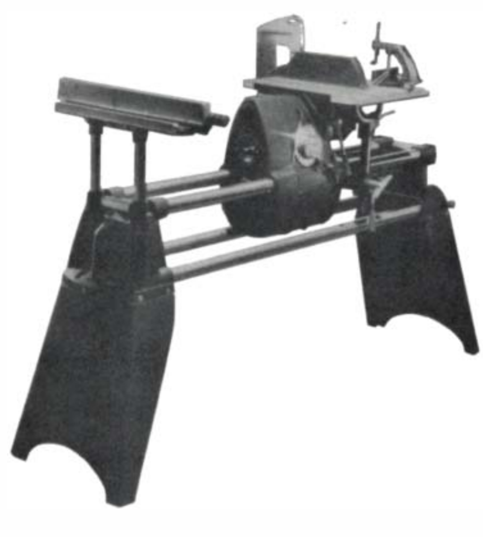

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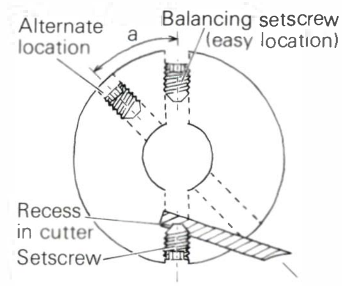
mary concern is safety. I believe it is very difficult, if not impossible, to balance one knife in a cutterhead that rotates 8,000 RPM. It does not cost that much more to buy a good brand-name pair of safety collars and steel, and have the assurance that your shaping job will be done safely, smoothly, and quickly.

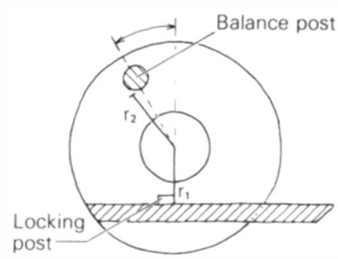
—Richard E. Paul, Charles G.G. Schmidt Co., 301 W. Grand Ave., Montvale, N.J.

EARL BECK REPLIES: Richard Paul correctly identifies an important area of concern, balance in high-speed machinery. He is incorrect in thinking that neither of my two systems for supporting a single shaper cutter can easily and carefully be balanced. Generally, I have found it unnecessary to balance system *B*, with its small projection and the very light weight of the tool-steel cutters used. Most of their mass is offset by the milled cut into which they fit and the unfilled portion of the hole for the setscrew. I have fitted some of mine with a hole drilled all the way through in line with the shaft hole. In one end of this fits the allen screw; on the opposite side is placed a similar but longer allen screw with a nylon locking insert. In use, fine adjustment is made by placing the assembly on a pair of level (in my case, metal lathe) ways and running the balancing screw in and out until a nominally perfect static balance is achieved. This takes two minutes or less, with a little practice.



Offsetting the balancing setscrew's hole by angle a brings the setscrew in line with the cutter extension, a slightly better setup.

Balancing the more complicated system *A* would be just as simple and direct, but for the variability in cutter sizes, overhangs, etc. In any case, the balancing post combined with other approaches such as drilled holes, and an approach such as that discussed by system *B*, would allow very close balancing. To avoid the nuisance of this, I place and size my balancing post slightly off a line normal to the cutter. Drilling a hole in the cutter to reduce its mass provides a simple way to avoid all the fuss.

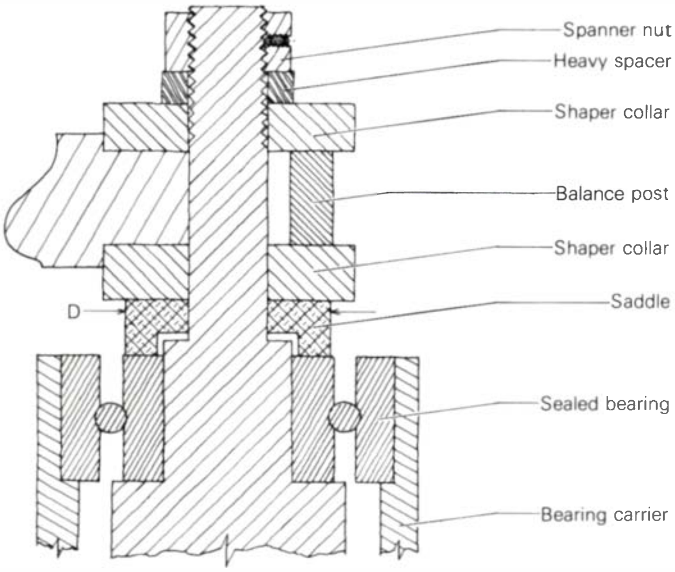


As for Paul's value of one-eighth of an ounce, this seems arbitrary, as the unbalancing causes centrifugal forces which must be successfully opposed by a centripetal force within the machine. Unbalanced force $= C N^2 r$, where C is an appropriate constant, N is the RPM and r the radius of unbalance. Based on my experience, I think my system, which I usually operate about 7,000 RPM or less, and for which r would be about 1 in., an unbalance of an eighth of an ounce would be noisy but probably not dangerous. I would neither recommend the use of such an unbalanced machine, even for a short time, nor use it myself. If I did not want to balance the cutter because it was a temporary grind for a single job, not likely to be repeated, I'd slow my machine down temporarily. If the basic spindle assembly is well designed, then bearing noise will be objectionable at unbalance conditions for below those that might cause shaft failure.

There are at least two low-cost shapers on the market with a large overhang; they may be identified as having adjustment by nuts and washers, one of which is kept from rotating by a milled slot in the shaft. The same slot also allows reversal of the spindle, which I can visualize as desirable for some uses, but not critical. One reason that I built my machine was to obtain maximum rigidity with the ½-in. spindle. I adhered to that to use a number of three-wing milled cutters I have had for a long time. If I were making a new machine today, I'd probably make the shaft ⅝ in. or even ¾ in. There's no point in cutting away good metal.

In the drawing on page 10 I show an approximate cross section through my spindle assembly's upper end. The two-step pulley at the lower end is threaded on and machined on the shaft. The shaft is

Section through shaper spindle



Maximizing D to make the saddle as large as the exposed part of the inner bearing race yields a very stiff shaper spindle.

very heavy—unnecessarily so, except that the flexibility for such a long shaft is such that even small unbalance in the portion between the bearings would cause whirl, damaging to both bearings and ears. The bearings, especially dimension *D*, are large by comparison with most small spindle shapers. The bearings are far larger than needed precisely so that the inherent stiffness of the shaft between the bearings and the shaper collar/cutter assembly can be coupled when the nut is tightened. A very stiff assembly results, far stiffer than would occur with a slender, overhung ½-in. shaft.

Let me add a final opinion. If I were for whatever reason driven to buying and using a ground two-blade collar/cutter assembly, I would do what at least three small operators I know have done. The first time they wanted a special shape, they reground one cutter freehand. They then used a dummy blade to balance setups with both the original and the new shape.

Because I had been in the market for a drill press for some time, the splashy advertisement by the C.O.M.B. Co. of Minneapolis in the Nov. '79 issue of *Fine Woodworking* caught my eye: $198 for a heavy-duty drill press; "Reg. Retail, $695," it looked like the ultimate bargain. Optimistic about the "2-4 weeks" delivery time, I ordered one. After four weeks I received a bill. Five weeks after that, I was notified by a trucking agency that I could pick up my machine.

The battered cardboard carton was boldly marked "Made in Taiwan, R.O.C." This was a discouraging revelation, for the advertised name of "Milwaukee Pneumatic®" hardly hinted it was an import. The rest of the ad implied it was a warehouse or factory liquidation of an American-made machine, although it never quite said as much. By coincidence, a friend had also bought one, so we could compare notes.

Unpacking the drill press I was immediately impressed by the ruggedness of the base, column, head and table. But it was also apparent that fine workmanship is not the hallmark of this machine. The castings are crude, there are burrs and rough edges everywhere and most milled surfaces are scored with irregular milling marks. Factory assembly also was pretty sloppy. One motor-mount screw was loose in the carton. The motor base had to be completely realigned, and one of its holes filed out, so that the loose screw could be installed. The screws in the belt housing were all loose. My wrenches slipped on most of the hex-head nuts and bolts and allen-type setscrews, so I assumed at first that the fasteners were metric. Eventually I found that the threads were standard national coarse sizes; only the heads were mongrel sizes.

During this preliminary check-out I was nevertheless favorably impressed. The quick belt-release and tensioning lever enable the speed ratios to be quickly changed and the belts retensioned. The depth stop is easy to set and there is a built-in lamp. The head can be swung 180° to the rear for end-drilling long stock. The table locks firmly to the column, and mine cranked up and down smoothly. On my friend's machine the table has to be "helped" with the other hand. I've also since discovered that my table is about 0.3° out of square with the column, and the circular table does not center under the quill. By comparison to the Jacobs chucks I have always used, the "Victor 16 mm" chuck that comes with the machine felt gritty and at several points it bound up. The jaws didn't come together evenly and the chuck key pinion didn't mesh smoothly.

But after all, the real purpose of a drill press is to bore holes. So when all components were checked and tightened, I eagerly chucked a ⅜-in. drill bit and hit the ON switch. Immediately I could see the horrible amount of wobble in the bit. A trial drilling through a piece of ¾-in. red oak confirmed the seriousness of the problem: The wood shimmied around on the table like the head on an orbital sander.

To assess the trouble, I checked it out with a dial indicator. At the rim of the quill spindle, there was only about 0.0005-in. runout. But just below, on the shank of the Morse taper holding the chuck, I picked up over 0.005-in. runout, suggesting that the taper was not concentric to the quill. At the middle of the chuck the runout registered 0.012 in.; on the upper shank of the bit, 0.018 in. At the point of long bits the runout is almost 1/16 in. My friend's drill press was as bad.

When I used a 1-in. multispur bit to drill holes in hollow catalpa logs to make bird houses, it worked just great, except the chuck fell off the quill after each hole. I drilled 1-in. holes across the grain into a 3-in. diameter stick of air-dried red maple to make a bird feeder. The belt slipped, and when I tightened it, the bearings and/or motor uttered a real growl. (My friend's machine growls loudly all the time.)

The exploded-view parts list that came with the machine is a further discouragement. Other than drawings and part numbers, the sheet is blank—no name or address of manufacturer or supplier of parts. Correspondence with the C.O.M.B. Co. about ordering parts has gone unanswered.

In conclusion, I suppose I got what I paid for.

—R. Bruce Hoadley, Amherst, Mass.

. . . I must take issue with a point of tool handling described by Martha Wetherbee. . . The ax is not a pounding tool. It has one function only, that is, to cut. To use the ax as she described is dangerous and damages the tool. . . .

—Frank E. Hebb, Lewisville, Tex.

I enjoyed Martha Wetherbee's article "Making a Basket from a Tree," in the Jan. '80 issue, but if we're going to go out and harvest our own black ash, you should provide more help in identifying the tree. Black ash is one of several native trees (among them maple, flowering dogwood, buckeye, horse-chestnut, catalpa, paulownia and the other ashes) that has opposite leaves. This identification is helpful in the winter and early spring because the leaf scars, buds, twigs and small branches are opposite, too. But in the photo you refer to as showing pinnate *leaves*, there is only one leaf, with nine *leaflets*. Indeed, not only are the leaves opposite, so are the leaflets. But so are the leaflets of many other trees. The distinguishing characteristic of black ash is that its leaflets have practically no stem, as your photo clearly shows. The leaflets of other ashes almost always have short stems; white ash leaflets have the longest stems.

—*John D. Alexander, Jr., Baltimore, Md.*

. . .I make pack baskets for canoes the same way as Martha Wetherbee and have these suggestions. After removing one layer or annulus from the log, scrape the surface with a sharp paint scraper; it is much easier to scrape the spring wood from the log than from the splint afterward. In some parts of the range of black ash (New Brunswick, western Ontario), the annulus is thin and splitting the splints is not practical. I find a log 10 in. to 12 in. in diameter easier to work with because the outer few inches have straighter, knot-free grain than the core, which I discard. I use a 3-lb. short-handled sledge to pound. A sharp block plane works well when trimming and straightening splints prior to weaving. Splint basketry is discussed extensively in an excellent how-to book by Richard Schneider, *Crafts of the North American Indians* (Van Nostrand Reinhold, 1972). . . .

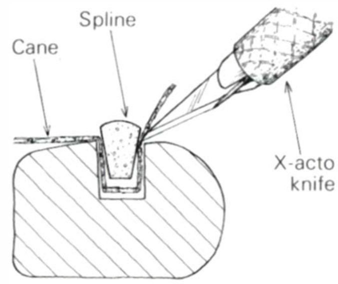
On faces for bar and pipe clamps: glue on leather. It is nonmarring and not bulky.

—*Harold "Buster" Welch, Winnipeg, Man.*

"French Polishing" by Clinton R. Howell (Jan. '80) is a well-explained article, elbow-grease and back-breaking indeed. I learned to French-polish in Europe in my teens and after a day of work in the cabinet shop I went to French-polish in another shop. It is not the best memory I have. I have to disagree—you say it is a durable finish, how beautiful it is. It has *no durability*. Even a glass of water marks it. If today a piece calls for French-polishing, I use Mohawk's Golden Rapid Pad. I use the same method, but it's a lot faster and the finish is durable. I use it over just about any finish. It produces only a high-gloss finish. I wish they would make some for satin or for flat finish.

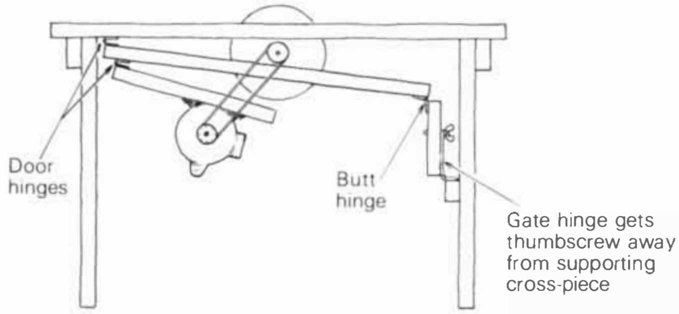
I also want to correct the Jan. '80 method of work suggesting round bench dogs. It is absolutely wrong and shows the author never worked on a good bench. The bench dog must be square. If it is round, the workpiece will roll out, for example, when planing a piece of wood cross-grain. Workbench holes are always bigger at the top and the dogs have a spring on them, so the dog will stop at any desired height. The bench dog has to have a checkered face, to permit down-clamping. That is, you simply tap down on the wood, then on the dog, and it is held tight. If you have finished work, you put a small block of pine in between to avoid marring. So if you have square dog holes in your bench, please keep them that way.

Also, I have recaned several hundred chairs. If you cut off the cane at the bottom of the groove, it will always come loose. The caning has to go all around the groove, so drive the spline in three-quarters of the way, then cut the cane against it with an X-acto knife. Finish driving the cane level with the wood surface.



—*F. Klausz, Bedminster, N.J.*

. . .William Taylor's wooden table saw (Jan. '80) reminded me of one I built 26 years ago out of scrap ¾-in. plywood and



2x4s. It hadn't the refinements of mortising and routing heads; I needed to do some carpentry, not cabinetmaking. But as it had to handle full sheets of plywood and other bulky lumber, and moreover, as I had not thought of tilting the tabletop to adjust blade height, I mounted my ball-bearing mandrel (also from Sears) on the top of a hunk of 1x6 and my washing-machine motor on the underside. The motor mount was hinged on the side farthest from the mandrel, so that the weight of the motor tightened the *V*-belt. This assembly was hinged to the underside of the table, or the frame, I forget which; a smaller scrap of lumber, hinged to the other end of the 1x6 and slotted to accommodate a thumbscrew, completed the height-adjustment mechanism. My fence was a well-seasoned 2x2, spaced from the blade by laborious measurement and *C*-clamped to the table. That saw paid its way through bookcases, window frames and countless other projects for several years until I felt flush enough to replace it with a radial arm. And for my purposes, it turned out to be the better tool! —*Louis B. Hall, Anaheim, Calif.*

I'm happy to see in the photographs in William Taylor's article about his ingenious home-built table saw (Jan. '80) that he still has all ten of is fingers in spite of the danger of his unguarded blade. He obviously understands the risks and is very careful, but a suggestion to any readers who want to duplicate his clever machine: for $25 a table-saw guard assembly can be obtained from Sears that includes a clear plastic cover, a spreader, and anti-kickback pawls to reduce the chance of wood being thrown back into the operator's stomach. Adapting the guard to the saw should be quite easy. Remember that one slip against a blade can last a lifetime.

—*T.G. Quattlebaum, Charleston, S.C.*

John Gallup (Letters, Mar. '80) comments on the poor fit of the round guide post in the hexagonal hole of the Rockwell 14-in. band saw. A length of ⅞-in. hexagonal bar stock bought from a local machine shop is compatible with all stock components and greatly improves the fit. . . .

—*Peter Cass, Nottingham, N.H.*

Re the question by C. Housego (Letters, Nov. '79) on anodized sheet-metal screws: These are available at most recreational vehicle and van shops. Van finishers also use a cup washer and snap cap, which cover the screw heads excellently.

—*Alan L. Gross, Lakewood, N.J.*

. . . Somebody has suggested blowing out sawdust and dirt with an air-compressor hose. This method puts the sawdust and dirt in places unseen, and delivers a blast of air loaded with moisture from the air line. I suggest a shop vacuum, and the hose can be replaced at the top of the vacuum to blow out if necessary, no moisture.

I also noticed an article on a table saw gummed up with sawdust caused by a lubricant on the control screws. This cleanup can be simplified by using Liquid Wrench as it contains very fine graphite, and leaves a dry lubricant, and a very easily operated machine.

You know, the average woodworker is taken for a sucker by the outrageous prices asked by some wood suppliers and by the outrageous prices on tools (especially foreign-made goods). I buy American made tools for quality and economy, and to keep Americans working. I refuse to buy foreign tools or machines.

Another pet gripe I have. . . is mounting a router under a table and trying to make a shaper out of it, also an electric saw mounted the same way. This is stupid and dangerous.

Here is a tool solution: Attend a public auction or flea market. I bought two boxes of tools (about 150 lb.) for less than $75. This included 20 wooden planes, two drawknives, a Stanley No. 45 plane and cutters, 12 chisels and more. . . .

—Donald E. Wetzler, Millerstown, Pa.

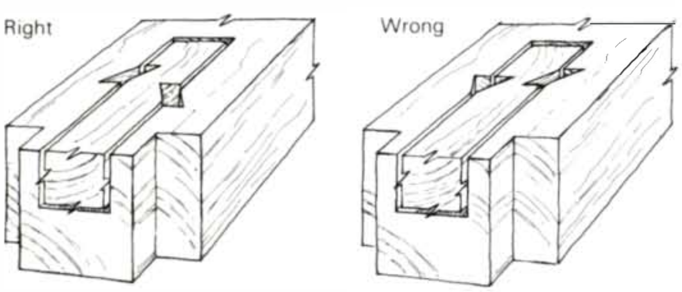
Addenda / Errata

—Hinges for the pigeonhole desk Simon Watts told how to make in our Jan. '80 issue are sold by Paco Distributors, 429 S. Bolmar St., West Chester, Pa. 19380.

—"Seedlac Varnish" (Jan. '80, p. 68) said Japanese lacquered furniture has seedlac as its base. Actually, Japanese lacquer is based on urushi, the sap of the tree *rhus vernicifera*.

—The wedge-lock lapped mortise-and-tenon scarf joint with half-blind stub tenon will not lock if it is made as drawn (Nov. '79, p. 90).

Wedge-locked, lapped mortise-and-tenon scarf joint with half-blind stub tenon



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. No commercial announcements, please.*

Sheridan College is preparing a show of work by past and present students of the furniture studio. If you were involved with the furniture program or know of a past student, please contact: Patterns of Growth, c/o Hogbin and Oliver, Sheridan College, 1460 S. Sheridan Way, Mississauga, Ont. L5H 1Z7.

Fifty-three people attended the first meeting of the Pittsburgh Woodworkers Club in late January. The new club plans to meet four times a year and hold an annual show to display and sell work by members. Interested craftsmen contact Bill Asher, c/o Cokesbury Bookstore, 901 Penn Ave., Pittsburgh 15222.

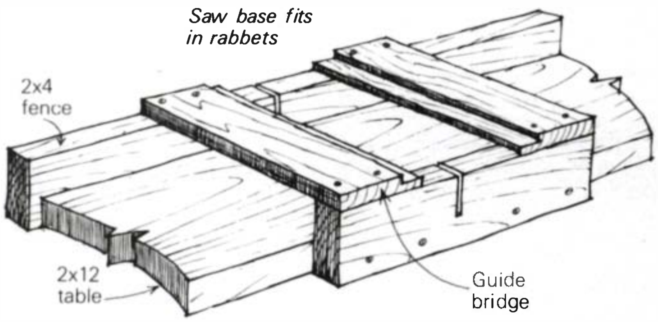
Sonoma County Woodworkers meets monthly, usually with a technical demonstration or lecture, at the shops of various members. For information contact Doug Shaker, Box 524, Occidental, Calif. 95465.

I received a Department of Energy grant to design and build two solar wood-drying kilns and then share my findings. I'd like to hear from other woodworkers who are experimenting with solar drying. Eventually I would like to put out a small-scale wood-drying handbook. Write: Thos. Bangert, Prairie Woodworks, Box 464, Eureka Springs, Ark. 72632.

Cutoff table

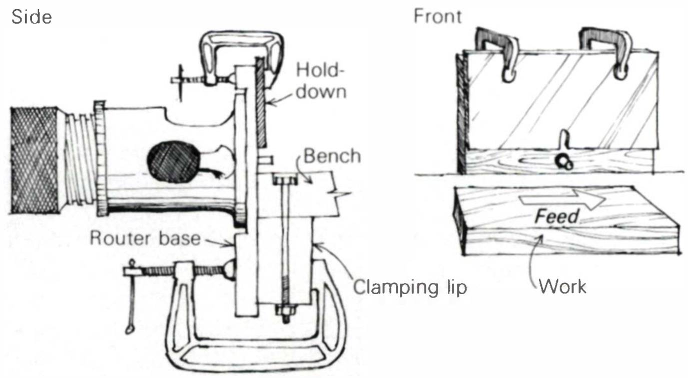
Back in the days before I had a radial arm saw in my shop, I worked out a cutoff table to use with my portable circular saw. The fixture consists of a 2x12 table, a 2x4 fence and a guide bridge. The rabbets on the two bridge pieces should face each other and be spaced just wide enough to fit the base of your portable circular saw. If desired, a stop block can be *C*-clamped to the fence for accurate duplicate cutoff work.

—C. G. Fader, Ketchikan, Alaska



Mortising fixture

The sides of a cradle I built recently were made of slats mortised into the frame. The router-based mortising fixture I built for the project helped me cut all those little mortises quickly and easily. The fixture has three simple pieces: a hardwood clamping lip, a birch-plywood router base and a Masonite hold-down. Bolt the 2x3 clamping lip under the workbench flush with the front edge. To permit deeper mortises, rout a ⅜-in. recess in the plywood base to fit the router. Mount the router in this recess using countersunk screws driven from the face.



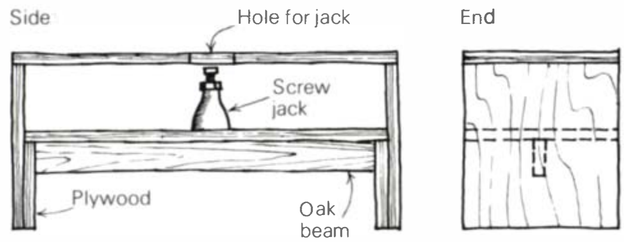
To use, clamp the base to the clamping lip, making sure the bit is the right height above the workbench. Then clamp the hold-down in place. Stand behind the router and, sighting from above, pull the workpiece into the router. A router cut or pencil lines on the hold-down are needed to show the left and right boundaries of the cut. Feed the work from right to left. The router produces mortises with rounded ends, which can be squared up with a chisel. But it's easier to round the tenons with a rasp or sandpaper.

—G. R. Livingston, New York, N.Y.

Cabinet-hanging prop

After years of struggling to hang upper cabinets, I built this simple prop. Now I can hang the upper units by myself, regardless of their size. Make the prop from ¾-in. plywood, except for the center support beam, which is oak. Dimensions depend on the height of the jack. For this application, I believe a screw jack works better than a hydraulic jack.

To use, first install the lower units and set the prop on top of one (protecting the countertop with plywood). With the upper cabinet balanced on the prop, screw the jack up until the upper unit contacts the ceiling. Leveling and plumbing can be done after the top band has been anchored to the wall (I use dry-wall screws). —*James E. Gier, Mesa, Ariz.*



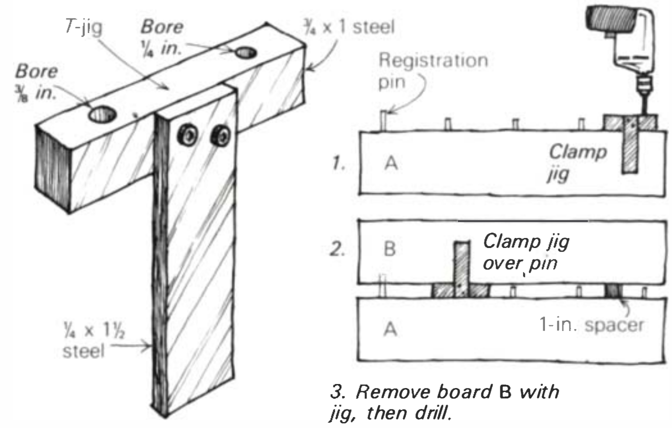
Doweling *T*-jig

A *T*-jig, used in doweling edge joints, ensures alignment of dowel pins and holes. Boards joined with the jig will mate better on the finish side, and sanding or planing misaligned joints is virtually eliminated. The jig's bar and leg are made of steel. High-carbon steel is best (anneal for machining, then harden later), but cold-rolled, mild steel will do. Wood will wear too fast. Drill common-dowel-size holes (¼ in. and ⅜ in.) in the center of the ¾-in. bar on each side of the leg. Two allen-head machine screws secure the leg to the bar.

In use, the *T*-jig serves as both a gauge (all the pin holes are equidistant from the face) and a copier (all the pin holes are mated from one edge to the other). First use the jig to drill all the pin holes in board *A*. Clamp the leg of the jig to the face of the board. No exact measurement of pin locations is needed—the holes in board *B* will be copied from the pins in board *A*. Install an extra-long registration pin in the first hole and regular-length pins in all the other holes.

Now clamp the jig to board *B* (leg to face) and drill the registration pin hole. Place the *T*-jig over one of the regular-length pins on board *A*, leg up, and fit the registration hole over the registration pin. Clamp the jig in place on board *B*, remove the board and drill. Repeat this operation for each pin in turn. Cut and use 1-in. spacer blocks to aid the pin-copying process.

After all the holes are drilled, trim the registration pin to



size, spread glue on the joint and press the boards together, keeping the ends even as the boards go together.

—*Wallace Smith, Newport Beach, Calif.*

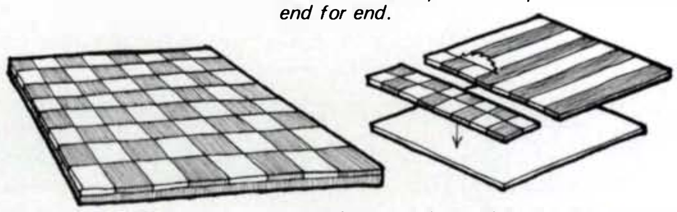
Checkerboard

Here's how I build a 16-in. checkerboard with a tenth of the work and time of the individual-square method.

First, saw and joint three strips of light wood and three strips of dark wood (like walnut and birch), each exactly 2 in. wide and 19 in. long. Now saw one strip dark and one strip light, 3 in. wide by 19 in. long, and joint one edge of these wider pieces. Edge-glue these eight strips together, alternating dark and light. Put the 3-in. strips on the outside, to build in a buffer strip for clamping.

When the glue has dried, square up one end, saw one wide (2½-in.) strip, then saw and joint six 2-in. strips. You should have one wider strip left over, making eight in all. Reverse four of the strips end for end and glue up. You will end up with an oversize 16-in. board that needs only to be sawn to size. This approach leaves the grain in all squares running the same direction. To build a board with alternating grain in adjacent squares, glue up a 19-in. wide, 10-in. long board of either the dark or light wood. Slice three 2-in. by 19-in. strips, and one 3-in. by 19-in. strip off the end grain. To avoid problems with end-grain butt joints, you could use thin (¼-in.) stock and laminate the completed board to ½-in. plywood.

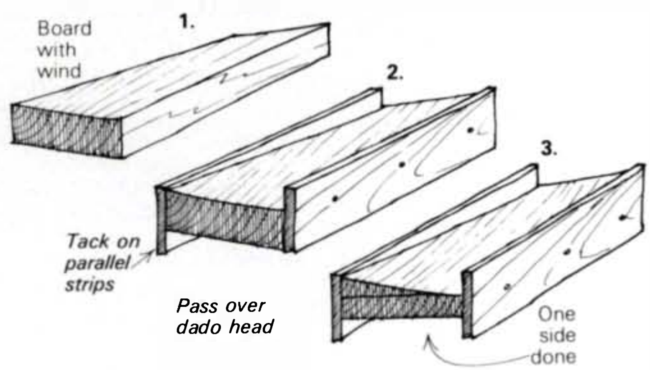
—*G. Vander Stoep, Pittsfield, Ill.*



Unwinding lumber

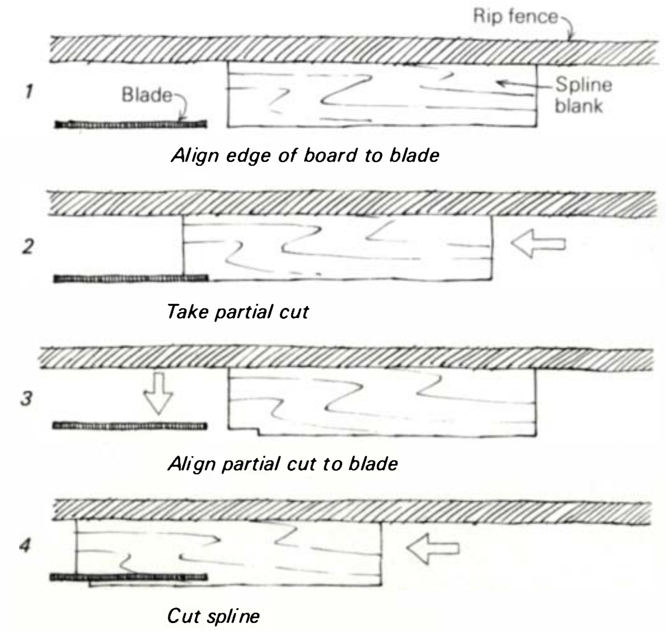
Here's a method for recovering short lengths of twisted lumber too wide for your jointer. First tack a strip (wider than the lumber is thick) to one edge. Lay the work on the saw table and tack an identical strip to the other side so that both strips lie flat on the saw table and are precisely parallel. Now run both sides of the work over a dado head (or flat, three-lipped cutter) to obtain a flat board.

—*Pendleton Tompkins, San Mateo, Calif.*



Cutting splines

This simple technique for cutting snug-fitting splines reduces the time and eliminates the frustration of the trial-and-error approach. First mount in the table saw a fine-tooth plywood



blade, to be used for the entire process. Cut the spline grooves, for a ¾-in. spline, just slightly deeper than ⅜ in.

To cut the splines, make a partial cut (½ in. or so), removing one full, exact saw kerf from the edge of the ¾-in. spline stock. Now readjust the rip fence so that the left side of the blade is aligned with the right side of the previous kerf cut. Pass the stock through the blade to produce a spline that is the exact size of the grooves.

—*Thomas S. North, Bloomfield, Conn.*

A replacement for rags

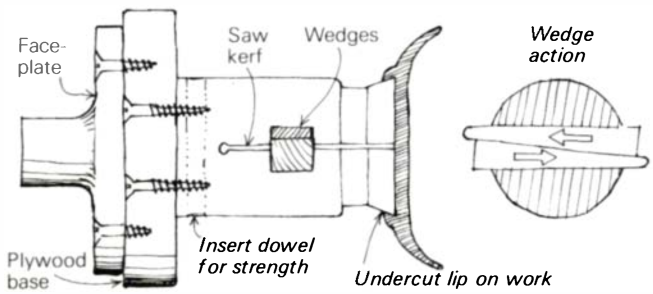
Before I discovered the bonded cellulose wipers I now use for oil and wax finishes, I used cloth rags. After I accumulated a pile of the dirty rags I cleaned them by first dunking in a solution of acetone and dry-cleaning fluid and then sneaking the batch through our washing machine. The cleaning solution was nasty and the whole process a headache.

Now I use Wyp-Alls, an industrial paper towel manufactured by Scott. I assume other paper companies market similar products. By the case, the 13x15 cloth-like wipers sell for a little over 4¢ each. The paper towels, which are designed for use with oil and solvents, work as well as, and perhaps better than, cloth. —*Bill Huggins, Issaquah, Wash.*

Another lathe chuck

This easy-to-make lathe chuck simplifies turning small bowls and other faceplate work. Mount a solid-wood block to a plywood base and turn a short cylinder with a flared lip as shown in the sketch. For flexibility, cut a saw kerf nearly through the cylinder. Then cut a mortise through the saw kerf and fit two wedges to the mortise. A dowel or bolt through the cylinder's base will add strength.

To use the chuck, bandsaw the blank to shape and mount



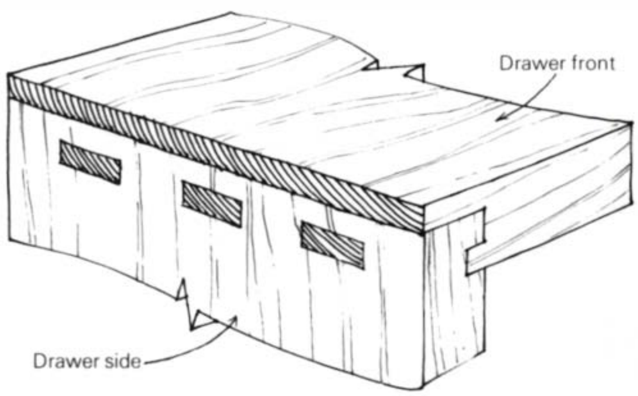
it on a screw center, screwing into what will be the waste from the concave part of the bowl. Shape the outside of the bowl, then carefully undercut a dovetail recess in the base to fit the lip on the chuck. Remove the stock from the screw center and the screw center from the lathe, attach the chuck, then slip the work over the chuck's lip, carefully orienting the grain to take the pressure. Drive home the two wedges to spread the lips and lock the work in place. For safety's sake, wrap a band of masking tape around the wedges to prevent their flying out.

—W. W. Kelly, Clinton, Tenn.

Drawer joint

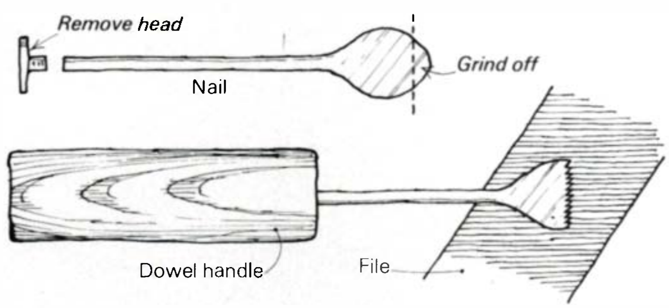
This rarely seen drawer joint is my favorite for fine furniture. Properly fitted, it is strong and attractive. The initial cuts, made on the table saw, are similar to those used for the familiar drawer joint. Then cut the tenons with a backsaw, chopping out the waste with a chisel. Tap the tenons into the side groove and mark the mortise locations. Complete the mortises with a small drill, coping saw and file.

—John W. Wood, Tyler, Tex.



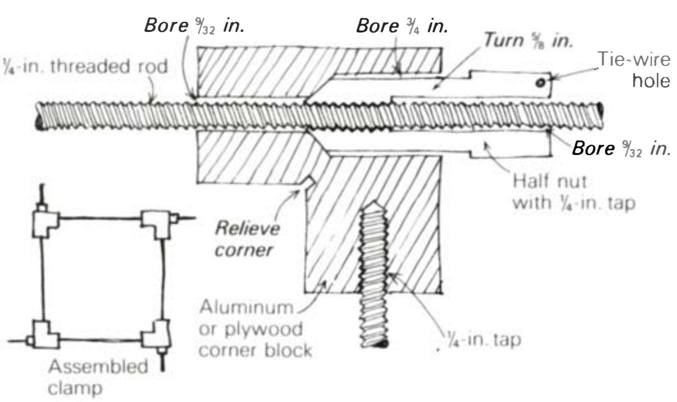
Cleaning file teeth

A blind sharpening-shop operator showed me this simple file-cleaning tool—it works better than a file brush. Hammer flat the pointed end of a 16d or 20d nail and grind the front edge straight. Remove the head of the nail and fit into a drilled dowel handle. Now push the straight edge of the tool along the grooves of file teeth. Soon tiny teeth will form in the edge of the tool which push metal, grease and rust out of the file. Turn the tool on edge to remove stubborn particles in one or two file grooves. *—John Foote, Clarksville, Tenn.*



Quick-adjust picture-frame clamp

The key to this quick-adjust picture-frame clamp is the split-nut tighteners, tapped cylinders, which can be opened to disengage from the threaded rod and slid close to the corner

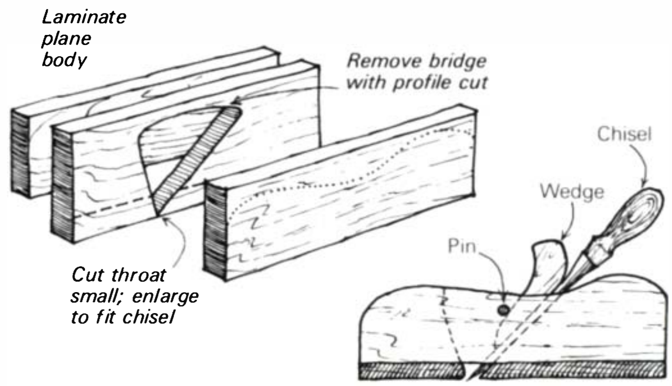


blocks. This allows the clamp to be tightened at any size with only a few turns. The corner blocks can be made from either plywood or aluminum (try the high-school metal shop for casting work). To make the split-nuts, center two pieces of ⅜-in. by ¾-in. by 2-in. cold-drawn steel in the four-jaw chuck of a metal lathe. All operations can be made from this initial setup, except boring the relief and the tie-wire holes. To keep the nut halves in mating pairs, pass a short piece of braided flexible cable (used on radio and *TV* drum drives) through each nut half and secure each wire end with a ball of solder.

—Brad Dimon, Swanton, Vt.

Chisel rabbet plane

The rabbet plane is not needed often in a modern electric shop. But when it is, nothing else will quite do the job. This design, using a standard ½-in. chisel for the plane iron, requires a minimum of both cash and intricate work. For the body, laminate three pieces of hardwood as shown in the sketch. A ⅞-in. step from the outside laminates to the middle one should be adequate to handle most rabbet depths. The middle lamination should be just slightly thicker than the chisel is wide, then dressed down with a rasp after assembly. Bandsaw the laminated blank to the desired shape, install a ¼-in. steel pin across the throat, then fit a wedge to hold the



chisel in place. Saw the initial throat opening small, then enlarge it a little at a time with a file until the clearance is right. If shavings clog in the throat, drill a 1-in. hole above the throat to give room to push the shavings out.

—Robert M. Vaughan, Roanoke, Va.

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.*

Q & A

Are there any non-toxic finishes that are tough and durable? In your November/December issue, you mentioned three non-toxic finishes. I have tried two of the three and found them unsatisfactory. The Craftsman finish, a lacquer type, is so soft it is scratched and made unsightly by crisp snacks such as Fritos and pretzels. The Woodcraft finish is no tougher, and it dries too slowly. The polyurethanes and moisture-cured urethanes are tough and quick-drying. Do you know if any are suitable for contact with food?

—Thomas A. Laser, Springfield, Va.

Sorry the woodbowl finishes didn't work for you. The recommendation was based on freedom from toxicity rather than on working properties. Though I haven't used either the Craftsman or the Woodcraft finish on bowls, I'm surprised to learn that they are too soft for dry snacks. I would try either a standard polyurethane or a moisture-cured urethane. No manufacturer I've contacted will recommend his finish for use with food or toys because of liability problems—this is understandable.

The question of toxicity arises mostly where a finish is exposed to liquids long enough or often enough to leach metallic compounds out of the finish and into the food. For only occasional use, even with liquid food, I would anticipate no problems with polyurethanes. They are very chemical-resistant, once they are thoroughly dry. Watco Danish Oil might also serve your purpose, as long as you let it cure for about 30 days to complete polymerization.

—Don Newell

Don Newell's discussion of oil/varnish finishes was on the whole instructive. However, I am still confused by the toxicity question (for toys and utensils). Are the metallic drier compounds added during manufacture or are they integral to the raw oil? If added, does that mean that "pure boiled linseed oil" is not as pure as I have believed?

—Scott Lowery, St. Paul, Minn.

Metallic drier compounds in drying oils are added during manufacture. This means your "pure" boiled linseed oil is pure only in the sense that it probably contains the things that commercial boiled linseed oil should contain and nothing more. Commercial boiled oil is supposed to have metallic driers in it to aid drying. Hence, your "pure" oil conforms to commercial specifications for purity. Commercial boiled linseed is not actually boiled, since boiling does not improve its drying properties appreciably. —*Don Newell*

I recommended using linseed oil with a 5% drier as a finish for salad bowls (*FWW* #18, Sept. '79, p. 27). In the Jan. '80 issue Dr. Michael McCann calls attention to the hazards of food poisoning such a finish might cause.

On Jan. 8, 1980, at 9:15 A.M., Mr. A. Brown was enjoying his breakfast in his home on the tenth floor of an elegant building in Sarasota, Fla. He was reading the *Wall Street Journal* when a huge construction crane, ill-maneuvered, made a wrong swing, crashed through the wall and grievously injured him.

Since the chances of a crane hurting me while I eat breakfast and read my paper are four times greater than my being poisoned by the finish I recommend, I wonder whether Dr. McCann would advise me to stop eating breakfast, stop reading the *Wall Street Journal* or make a detour whenever I see a large crane. —*George Frank*

I have a Sears router, bit and template, and I have problems getting the dovetails to fit right. They are either too loose or too tight. How do you adjust the router to get a good fit?

—*Jon Gullett, Washington, Ill.*

Depth of cut is critical to a proper fit in routed dovetails. Deepening the cut tightens the joint, while making a shallower cut loosens it. The precise distance from the toe of the cutter to the base of the router depends upon the thickness of the finger template you're using, and the setting recommended by the manufacturer must be taken as an approximation of the exact setting that you determine through experimentation. Raise and lower the bit in 1/64-in. increments until you achieve the desired fit, and then gauge the distance from the toe of the bit to the base of the router. Record this measurement or make a permanent mark on your steel rule. Depending on the wood you're working with, this setting will vary slightly, and it's a good idea to make test cuts in scrap.

If your Sears router is the kind with a rack-gear elevating mechanism, you'll probably have trouble adjusting it with the close precision that's required to cut good dovetails. This trouble is because the depth of cut changes when you tighten the thumbscrew that locks the router motor to its base. The solution is to measure the toe-to-base distance after tightening the thumbscrew, a trial-and-error method to be sure, but one that works well with practice.

I covered a birch-plywood tabletop with cherry veneer, using contact cement. For six months it felt tight, but now I can hear a crackling noise when I run my hand across the surface. Although it has not peeled up or begun to show any cracks, it seems as though it may pull up soon. How can I fix it?
—Alice Anderson, Loudon, Tenn.

For surface veneering don't use contact cement because it never dries hard. The glue stays flexible, which allows the veneer to move and causes the crackling noise. Eventually the veneer will crack. I am sorry to say that there is no way to fix it. For edge veneering and edge banding, I wouldn't use contact cement either because if the veneer works loose, there is no way to repair it. Also oil finishes, such as Watco, may dissolve contact cement.

Contact cement is good for bonding different materials, such as wood to metal. Because of the glue's flexibility, the wood will be able to move, while the metal doesn't. For veneering I use hot hide glue, Titebond (yellow aliphatic) or Cascamite (Elmer's plastic resin). *—Tage Frid*

I am refinishing an antique end table with an inlaid leather top, with gold leafing around the borders of the leather. Can I use paint or varnish remover directly on the leather to remove the old finish. If so, what sort of wash should be used after the finish is removed? Should I take any precautions to preserve the gold leafing?
—Paul Hoke, St. Clair Shores, Mich.

You should not use paint or varnish remover; either could damage the leather or lift the gold. First, determine what the old finish consists of by trying to remove patches with various solvents in an inconspicuous place. Most likely the finish is shellac. If it is, soak a pad of soft, lint-free cloth with denatured alcohol and gently wipe the surface of the leather with a circular, French-polisher's motion. Turn the cloth often, adding plenty of alcohol until the finish is removed. Allow it to dry and repeat. Be gentle over the gold to avoid rubbing it off. If the finish is varnish or lacquer, use a 50/50 mixture of alcohol and lacquer thinner. Should the leather be dirty, clean it with saddle soap and water, and if the leather has grain, use the saddle soap sparingly.

If the gold is real, no preserver is needed. To preserve and polish leather that's in good shape, all you need to do is slop on a generous amount of a mixture of 40% lanolin and 60% neat's-foot oil and let it soak in for three days. Then rub in the residue with your fingertips and remove the excess with an absorbent cloth. Polish lightly with a piece of flannel. For flaking leather, instead of using neat's-foot oil and lanolin, apply a coat of white shellac with a cotton ball and a deft touch. Use a circular motion and don't go back over a place that has already begun to dry. Use shellac as a last resort, when the leather is flaking and needs to be consolidated. —*Sandy Cohen*

In the Nov./Dec. issue, pp. 32-33, Lelon Traylor recommends that planer bedrolls be set 1/32 in. (about 0.03 in.) above the bed to eliminate dips and bumps in the surface of planed stock. I set the bedrolls on my 18-in. Rockwell planer between 0.01 in. and 0.015 in. above the bed, and I still get dips in my stock. Traylor also indicates that the dip is due to the chipbreaker and pressure bar forcing the wood down against the bed before it contacts the outfeed roll. It seems that this situation would result in a hump, rather than in a dip. This problem is costing me about one lineal foot of good stock on each run.
—*Curt Duever, Gorst, Wash.*

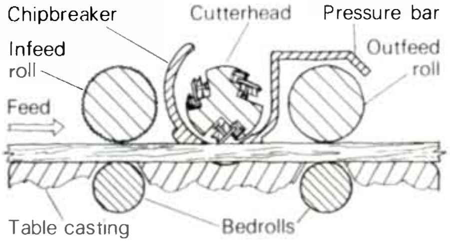
Your bedrolls are too high. For finish cuts in hardwood they should be 0.003 in. to 0.005 in. above the bed. Use a metal straightedge and feeler gauge to set them. Rockwell makes a device called Redi-Set. It lets you instantly raise or lower the bedrolls to give the right clearance for rough pine or finished hardwoods. To learn more write: Rockwell Manufacturing Co., 400 North Lexington Ave., Pittsburgh, Pa. 15215.

The dip (it's called a "snipe") can also be caused by your pressure bar being too high. The stock passing through the outfeed rolls is relieved of the pressure of the infeed rolls and rises slightly into the cutterhead. To correct this adjust the pressure bar. After setting the bedrolls, feed a long, narrow piece of stock through the planer, and while it is in motion lower the pressure bar until the stock jams. Then raise the pressure bar a fraction of an inch so that the stock will feed smoothly. Repeat this operation several times on both sides of the planer.

You have a good machine, and it is capable of first-class work.
—*Simon Watts*

Dips and ridges are nuisances and can be eliminated by proper adjustment and operation of a small planer. As the board goes through the planer and climbs up and over the outfeed bedroll, you get a dip in the board. As it leaves the planer and drops off the infeed bedroll, you get a ridge in the board. Sometimes on small planers, other situ-

Cutterhead-roller assembly



ations can cause troubles. One is insufficient pressure on the chipbreaker and the pressure bar. As the board leaves the planer and the end clears the infeed rolls, it will ride up if there isn't enough pressure on the chipbreaker and pressure bar. Adjust the spring tension to eliminate this condition. Caution—if you feed a long board through a small planer and don't support the ends on both the infeed and outfeed, it will bear up against the chipbreaker and pressure bar and ride up into the cutterhead, and cause a digging-in on each end. Study and analyze your particular situation. This sagging and riding-up isn't as bad on large planers because their tables are longer and the lumber is supported better.

—*Lelon Traylor*

I am interested in making a pair of cross-country skis. I plan on bending solid stock and need to know the best woods for this and whether the stock should be plainsawn or quartersawn.

—*Leonard Dedrickson, Rochelle, Ill.*

Solid-wood skis have traditionally been made in oak, ash and hickory. You will probably have to steam-bend the tips or at least soak them in hot water. You should over-bend them as they will straighten out somewhat. Quartersawn stock should bend more easily than plainsawn. You might consider laminating them on a frame, using ⅛-in. strips and a good glue. This would give you a lighter and stronger pair of skis.

—*Simon Watts*

Can you help me find a way to get the grain to show through on black walnut? I've stained several scraps of it, and I'm not pleased with any of the results. I've heard of water-base stains but don't know where to get them or how to use them. I once read about using chemicals to bring out the grain in crotches

and burls, but now I can't find the article. Can you help me?
—T. Bennett, Woodland Hills, Calif.

Your mistake is trying to stain it at all. There is no reason walnut needs stain, unless it is painted on in thin coats with a brush to even the tone of sapwood and blend it into the heartwood. Otherwise, its own color is truly beautiful without further manipulation.

EDITOR'S NOTE: In our January '80 issue, George Frank's reply to Bob Frohwerk describes a way to remove a stubborn blemish from a veneered tabletop. As a last resort, Mr. Frank advises using a wire brush with a "rotating motion." By this he meant the brush should be "rotated" in a sweeping motion with the grain of the veneered surface, as in the drawing below.

Follow-up

Re grain-accentuating stains for maple *(FWW #20, Jan. '80, p. 24)*: My interest in staining maple began with Kentucky rifles, which are known for their curly maple and rich, 200-year-old patinas. Trying to find a commercial stain was fruitless, while the many traditional staining techniques (potassium permanganate, chromium trioxide, nitric acid with dissolved iron) were either dangerous, hard to control or had undesirable side effects. By chance I found a supplier of pure-color liquid aniline dyes, which, after some experimentation, produced brillant colors of great and subtle variety with all of the grain brought out. The procedure is not quick, but if you like to experiment or if you're after a color that is just right, mixing your own aniline stain may be the answer.

You begin with concentrated liquid aniline solution (available from the Wallbrunn Paint Co., 1215 Washington St., Wilmette, Ill. 60091). It comes in red, yellow, brown, orange, green, blue, blue-black and jet black and costs about $8 a quart. The dyes are soluble in water, alcohol or in a special stain solvent. I dilute them with five or six parts water to one part stain.

I have two approaches to finding the color I want. The first is to begin mixing various quantities of the stains, testing them on a piece of wood or paper, until I get a pleasing color. The second is to have in hand a color to match. I start experimenting with small quantities in a tiny 50-ml beaker. Guessing at a formula I think will match the original color, I measure out a small amount with an eyedropper. After the colors are all mixed, I add enough water, again with an eyedropper, to dilute the colors by five or six to one. The procedure makes very small quantities and so dilute that four to six applications are needed to build up the color. I test it on a piece of waterproof paper, first writing the formula at the top. Then, using a Q-tip, put six or eight stripes of stain across the paper. After drying, stain all the stripes again, except the top two. After all six or eight applications, you can compare the test stripes to the original.

You usually find that your conception of how the original color was put together is wrong. So back to the formula for an adjustment and a mix of a new test stain. This may seem tedious but can be relatively fast. In the stain mentioned above, which I recently mixed, the total time needed was a few hours stretched over a four-day period with about twenty different stains mixed. Yet despite the fact that I made two false starts before finding the right formula, the final stain matches the original color. I was convinced the original had a touch of red in it, but indeed it did not. Once the stain is matched on the paper strip, I switch to a test piece of wood and finish it exactly like the project itself. With these procedures I have found many beautiful, unique stains, all exceptionally clear and grain-accentuating.

Final formulas may seem strange or overly complex. My recent stain has eight parts orange, two yellow, two jet black and one brown; it produces an exquisite honey-brown color. I study my final test-stain blocks in many lights: incandescent, fluorescent, direct sunlight, north light and subdued evening light to get the tones right. A two-stain process often heightens the figure in gunstock woods like curly maple. I apply a weak brown or black stain during the whiskering stage. A final sanding removes the stain from the hard curl and leaves it on the soft curl. Staining a second time adds the desired color to the hard curl and darkens the soft curl even more.

—Lynn Fichter, Harrisonburg, Va.

Re oil-shellac finish *(FWW, #20, Jan. '80, p. 21)*: Your mother-in-law is partly right. An oil-and-shellac finish gives fast and beautiful results if done right. I first used the finish about 30 years ago to repair the side of a cabinet that had gotten badly scratched as it was being unloaded from a truck. Since it would have taken me about three days to restore the original oil finish, I decided to take a chance on an untried method. Once I had scraped and sanded the damaged side, I applied some oil and followed it with an application of shellac. When the surface had dried thoroughly, I rubbed it down with steel wool, and it came out as beautiful as the rest of the furniture.

When I first demonstrated the method to my students, they named it the "four-F" finish (Frid's fast fine finish). Before trying the finish yourself, make sure to get the right ingredients—raw (not boiled) linseed oil or Watco, and orange (not white) shellac. Don't mix the oil with the shellac, but apply the oil evenly and sparingly to the prepared surface with a rag. Then immediately brush on a three-pound cut of orange shellac, leave it until it gets tacky and then rub the surface with a pad of 3/0 steel wool. Next wipe it clean with a clean, dry cloth, taking care to remove all of the oil and shellac from the surface. If any excess remains, the finish will turn grey. If necessary, another coat can be applied a short while later, but this time using less oil.

This finish is best for small pieces and things like chairs and table bases, because it is not waterproof. If water is left on it for a while and it spots, you can repair it easily. Put oil on the spot, steel-wool or sand until the spot disappears and wipe off all the excess.
—Tage Frid

Supplies:

—Hardware for high-chair trays and for drop-side cribs: Baby Toytown, 8930 Valley Blvd., Rosemead, Calif. 91770.
—Two-part, let-in locks for chest lids: Period Furniture Hardware Co., Inc., Box 314, Charles St. Station, 123 Charles St., Boston, Mass. 02114.
—Caning and chair-seat materials: The Caning Shop, 926 Gilman St., Berkeley, Calif. 94710.
—Manufacturers of multi-spindle, industrial-duty carving machines: Oliver Machinery Co., 445 Sixth St. N.W., Grand Rapids, Mich. 49501.

Readers can't find:

—An outboard faceplace threaded ¾-in. x 16 left-hand.
—A source for holly boards ¼ in. thick.
—A source for sheet phenolic.

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

Books

Wood Handbook: Wood as an Engineering Material by the U. S. Forest Products Laboratory, U.S.D.A. Forest Service (Agricultural Handbook 72, rev.). *U.S. Government Printing Office, Washington, D.C. 20402, 1974. $10.00, cloth; 446 pp.*

Properties of Imported Tropical Woods by B. Francis Kukachka. *U.S.D.A. Forest Service Research Paper FPL 125. U.S. Government Printing Office, Washington, D.C. 20402, 1970. $0.75, paper; 68 pp.*

Handbook of Hardwoods (2nd edition) Revised by R.H. Farmer. *Her Majesty's Stationery Office, London, 1972; available from Pendragon House, Box 255, Old Mystic, Conn. 06372. $18.00, cloth; 243 pp.*

World Timbers: Vol. 1, Europe and Africa; Vol. 2, North and South America; Vol. 3, Asia and Australia and New Zealand by B.J. Rendle. *University of Toronto Press, 5201 Dufferin St., Downsview, Ontario M3H 5T8. Vol. 1 is out of print; Vols. 2 and 3, $60, cloth; 191, 150 and 175 pp., respectively.*

Commercial Timbers of the World (3rd edition) by F.H. Titmuss. *The Technical Press, London, 1965; available from Stobart & Son, 67/73 Worship St., London EC2A 2EL England. £7.50, cloth; 277 pp.*

Know Your Woods by Albert Constantine, Jr., revised by Harry J. Hobbs. *Charles Scribner's Sons, 597 5th Ave., New York, N.Y. 10017, 1975, $12.95, cloth; 360 pp.*

Part of woodworking is the desire to try different woods. But becoming familiar with a new species by direct experience can be slow and costly, and researching likely woods first is a more logical way to begin. When considering an unfamiliar species, there are endless questions to ask: Color? Figure? Characteristic or troublesome structure, such as interlocked grain or tension wood? Seasoning problems? Dimensional stability and tendency to warp? Toxicity? Machining, gluing and finishing characteristics? Resistance to fungi? Availability and cost? There may be interesting sidelights about the wood, such as geographic range and use, historical vignettes or facts that might be just fun to know.

It would be great if a single publication could answer all questions for all woods, but this can hardly be the case because of the number of species on the world markets and the diverse information about them. The woodworker will probably find it worthwhile to collect a few resource books, and this review concentrates on publications I have found especially informative.

A good start is the *Wood Handbook*. This book draws upon more than a half-century of investigation at the U.S. Forest Products Laboratory. Its first third contains extensive technical information about 60 domestic and 50 imported species. Individual descriptions cover growth range, structure, characteristics affecting use and common products made from the woods. Unfortunately, there are no illustrations to show figure or other characteristics.

The *Wood Handbook* covers structure and physical properties of many individual species, via summary tables of color and figure, average moisture contents of green wood, shrinkage percentages, machining characteristics and decay resistance. The chapter "Mechanical Properties of Wood" gives perhaps the most extensive strength data for domestic woods of any single source. The remainder of *Wood Handbook* has valuable information on commercial lumber, its classification and grades, fastenings, adhesives and gluing, painting and finishing, plywood and related panel products, structural members, insulation and preservative treatment.

Although the *Wood Handbook* is frequently dull, and is probably directed more toward commercial-scale product manufacture and construction, its modest price and wealth of data make it very much worth having.

Another FPL publication, *Properties of Imported Tropical Woods*, gives individual descriptions (somewhat more complete than those in the *Wood Handbook*) for more than 100 tropical woods, with emphasis on properties that affect utilization or machining, like grain characteristics and reaction wood, as well as sources and availability. Woods are listed by botanical names and cross-indexed by common name. Unfortunately only the most common trade names are given, making it difficult to cross-reference with local names.

Appendix tables give strength values, shrinkage percentages and kiln schedules for individual woods. Although the publication contains no illustrations, its extensive information at the give-away price of 75¢ makes it a worthwhile com-

EDITOR'S NOTE: *The Encyclopedia of Wood*, Sterling Publishing, 2 Park Ave., New York, N.Y. 10016, is a 1980 paperback reprint of *Wood Handbook*, reviewed above. Sterling's version costs $12.95.

Books *(continued)*

panion to the *Wood Handbook*.

Handbook of Hardwoods, in some respects the British counterpart of our *Wood Handbook*, is based heavily on data collected by the Forest Products Research Laboratory at Princes-Risborough. Some 220 woods are described, listed by preferred common name and cross-indexed by scientific name. For some woods an abbreviated account is given, but more than half of the woods are fully described. The information is presented in concise outline form, with captions covering tree characteristics, visual features and physical and mechanical properties including numerical strength values, processing characteristics, resistance to biological degradation, and principal uses.

Appendix I has a summary chart of properties reduced to relative qualitative terms and arranged for quick reference and a comparison among species. For example, one could quickly locate all species of low density, or rapid drying rate, or one could easily compare all the properties of a particular wood, say ramin, to another, say rock maple. Appendices II and III contain detailed specifications for circular saws and kiln schedules. The crisp organization and easy retrieval of information and the rather complete coverage of worldwide hardwoods make *Handbook of Hardwoods* a popular and valuable reference.

While the books discussed above are packed with technical data, they suffer a certain drabness because they have few illustrations. In describing woods, words alone can never equal a photograph.

World Timbers is a striking three-volume atlas of color plates and write-ups of 212 geographically grouped woods, based on a series that originally appeared over a span of many years in the British journal *Wood*. Acknowledging the difficulty in portraying the typical figure of a given species with only one or two photos, *World Timbers* does the job well with generally high-quality photographs. Each species description summarizes the source of supply, the form (timber, veneer, etc.) available, seasoning and dimensional stability, strength and bending properties, durability and preservative treatment and typical uses. The descriptions are presented "in a form designed to appeal to those who are interested in timber but are not specialists in wood technology."

World Timbers covers many species I have not found in other references. Its overall attractiveness along with its usefulness make this three-volume set worth its premium price.

Commercial Timbers of the World

describes 244 worldwide woods in attractive, essentially nontechnical terms and appropriately covers information of interest to the woodworker: color and other gross features, density, working qualities, general uses, geographical sources, availability and miscellaneous notes. Many descriptions cover microscopic identification, and (for 34 woods) include a low-power photo of the wood in cross section. Unfortunately, many photos are marginal in quality and most are of species that are already familiar to most woodworkers. The fourth edition of the book was published in 1971.

Know Your Woods is a book I would not want to be without. In its pages one senses the vast legacy of experience in woodcraft and timber trade accumulated by generations of the Constantine family since the founding of their famous enterprise in 1812. Part I of *Know Your Woods* presents technically accurate and concise information about the nature of wood, scientific and common names, the conversion of trees to lumber and veneer, and physical characteristics. Additional lore, much of which is not to be found elsewhere, is suggested by the titles of some of this book's fascinating chapters: "Woods of the Bible," "Planting Trees Around the World," "State Trees," "Drugs from Trees," "Little-Known Behavior of Trees and Woods," "Collecting Wood of the World as a Hobby."

Part II, like some of the other books reviewed, systematically presents nontechnical write-ups about more than 300 woods. The descriptions, arranged by common names ("from abura to zebrano"), include the scientific names and their meaning (an especially enlightening feature) and all woods are cross-indexed by their common names. Also included are three characteristics and natural range, gross features and properties, seasoning and working characteristics and uses. The coverage varies considerably: For example, seven pages are devoted to mahogany, while nepora rates only a couple of sentences.

Wood is an endless subject, with a host of publications offering bits of information and versions of science, technology and experience. Any of the books reviewed, from the technical *Wood Handbook* and *Handbook of Hardwoods* to the narrative *Know Your Woods*, will give the woodworker a wealth of interesting and valuable assistance. —*R. Bruce Hoadley*

Bruce Hoadley's book, Understanding Wood, *will be published this fall by the Taunton Press.*

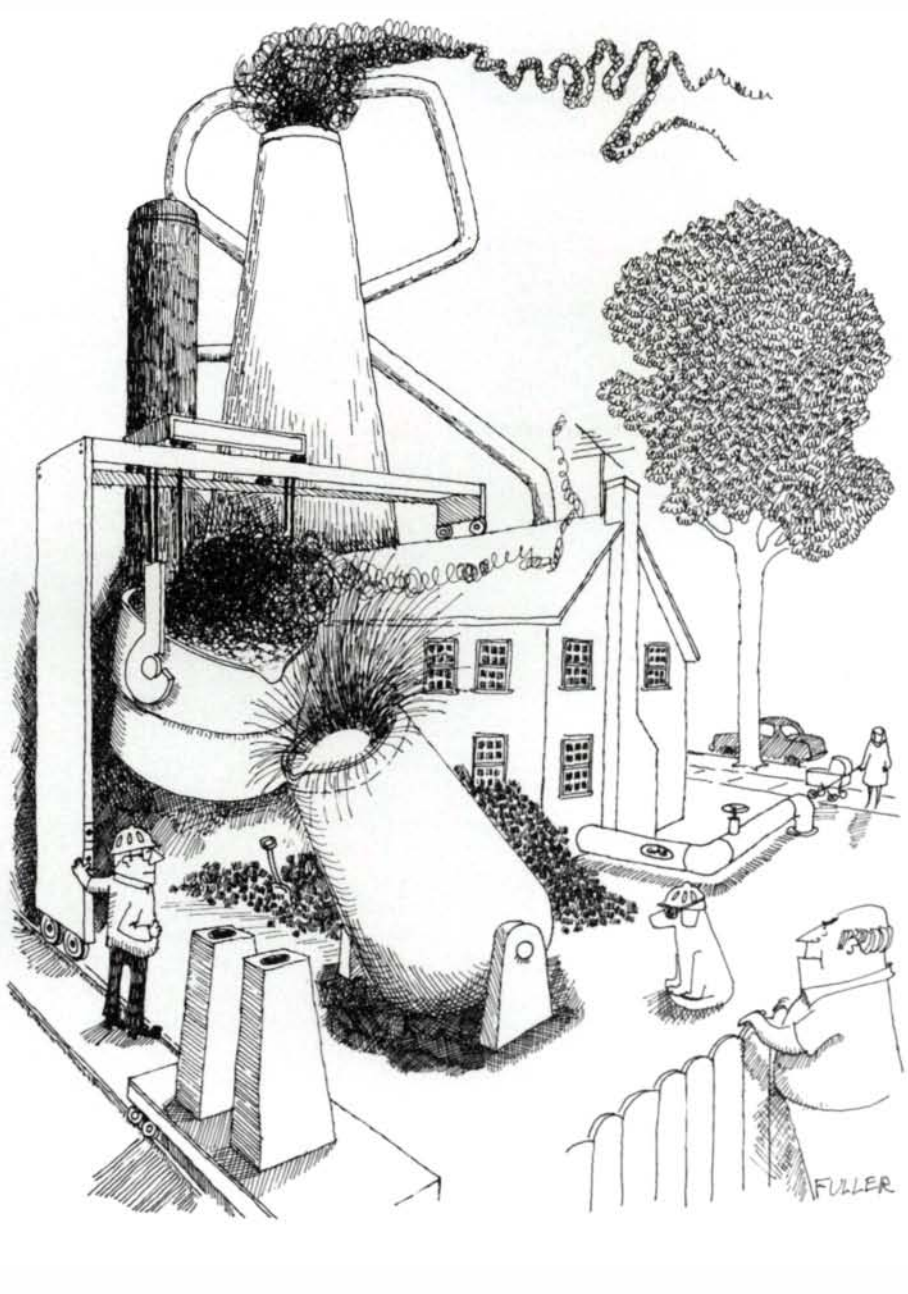
Steeling Away

BY JOHN GALLUP

Lately I've been dissatisfied with the quality of the steel in tools I get at the local True Value, so I decided to make my own. The process is quite simple, and with practice anyone can get good results. To get started, you'll need 20 or 30 tons of high-grade iron ore, 15 tons of low-sulfur coal, oxygen, and a dab of molybdenum.

The iron ore I use comes from the Mesabi range in northern Minnesota. Taconite, a low-grade pellet with less iron content, will work, but you'll need more of it. A coal yard should be able to fix you up with the coal, but if you prefer to use charcoal refer to Eric Sloane's *A Reverence for Wood* for instructions on how to make it. The oxygen is essential to the Bessemer process, which results in a better steel, and you can order as many tanks as you need from a welding supply house. You'll need the molybdenum only if you're going to make sawblades and the like; I get mine from the big Climax, Colo., facility near my home.

Okay, now we're ready. Load a few tons of coal into a coke oven battery and heat it for about three weeks. The natural-gas tap to your house may not be big enough, but you can dig it up out to the street and run a larger pipe



in from there. Check with the local utility company about getting a larger meter, and watch out for sparks. When the coal is cooked, it's called "coke," and makes the hot fire you'll need in the blast furnace. Using tongs and heavy potholders, transfer it there, and hurry so it doesn't cool off. Specially designed railroad cars are quicker.

Load the furnace with ore and start heating. When it's molten, the various impurities will cook off or be left as slag. Experiment will teach you just how much oxygen to inject and when. Pour the white-hot steel into molds for five-ton pigs, and hustle them over to your rolling mill. I built mine out of scrap, but be sure to use good-quality metal—the rollers are under quite a bit of stress when they squeeze that squarish 2,000° pig out into the bar stock you'll need to make plane irons and chisels. If the steel cools off before you're done working it, drop the pig into a firebrick-lined pit and cook it some more. You can't be too careful here. When those five-ton pigs are shooting back and forth between the rollers they sometimes get loose, and there go your insurance rates, right through the roof.

Now you've got about five tons of bar stock. Give it a few days to cool (if you do this in the winter it will really help the heating bill). A trip hammer is handy for cutting it to length. Don't forget to allow for tangs on your chisels. Take a piece over to the Rockwell hardness tester and check it. If it's below C60-64, you didn't add enough carbon back when the steel was molten. But don't worry. You can always melt it down and start again.

Once you get the fundamentals down, all kinds of possibilities open up. A few years' apprenticeship with a tool-and-die maker in a foundry will teach you all you need to know to cast your own plane bodies and saw tables. A drop forge is handy for making flat pieces, and will save you a lot of tedious anvil work. Once you start making your own steel, you will never again be frustrated with nicked chisels and broken router bits. □

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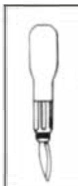

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Events

Events listings are free but restricted to workshops, fairs, lectures and exhibitions of direct interest to woodworkers. Deadline for the July/August issue is May 7, for events beginning June 15 through August 15.

Woodturning: Philosophy and Practice—symposium, June 27-29, the George School, Newtown, Pa. Rude Osolnik, Mark and Melvin Lindquist, Dale Nish and others. Tuition $125. Write A. LeCoff, 2500 N. Lawrence St., Philadelphia, 19133.

Ceramics, Metals, Textiles, Wood—work by the graduating class of Boston University's Program in Artisanry, May 19-30. Boston Architectural Center, 320 Newbury St.

Wood '80—show of the Saskatchewan Woodworking Guild, May 31 to June 8, Mendel Art Gallery, Saskatoon, Sask.

Woodworking Seminar with Sam Maloof—May 31 to June 1, Appalachian Center for Crafts, Tennessee Technological University, Box 5106, Cookeville, Tenn. 38501.

The Box: New Form, New Function—all media, juried exhibition for southeast artists sponsored by Arrowmont School of Arts and Crafts, Oct. 10 to Nov. 10. Deadline (slides) Aug. 1. Write Arrowmont, Box 567, Gatlinburg, Tenn. 37738.

Traditional Marionettes in French Belgium Today—50 costumed carved and painted puppets, each almost half the size of a person, to July 27. Renwick Gallery, Pennsylvania Ave. at 17th St., Washington, D.C.

In Praise of America, 1650-1825—exhibit of decorative arts and furniture, to July 6. National Gallery of Art, Washington, D.C.

African Furniture and Household Objects—exhibit to May 25. Indianapolis Museum of Art, 1200 W. 38th St., Indianapolis.

Ornamental and Engine Turning—conference, Aug. 7-9, Rochester Institute of Technology. Details from Kener Bond, College of Fine and Applied Arts, R.I.T., 1 Lomb Memorial Dr., Rochester, N.Y. 14623.

Wood—4th annual juried exhibition, deadline (slides) Aug. 1. Show Oct. 1-30. Westlake Gallery, 210 E. Post Rd., White Plains, N.Y. 10601.

Sitting in Style—exhibit of contemporary handcrafted furniture including pieces by Wendell Castle, Tage Frid, Sam Maloof, Judy McKie and George Nakashima, May 18 to June 30. Society of Arts and Crafts, 175 Newbury St., Boston, Mass.

Birds—paintings, drawings and woodcarvings by 47 artists, to May 6. National Collection of Fine Arts, 8th and G Sts. N.W., Washington, D.C.

Wood '80—conference, seminars, workshops, trade shows, July 25-27. Details from Ken Strickland, Visual Arts Dept., SUNY, Purchase, N.Y. 10577.

15th Annual Northeast Craft Fair—all media. Open to the trade, June 24-25; open to the public June 26-29. Dutchess County Fairgrounds, Rhinebeck, N.Y.

WOOD & TOOL EXCHANGE

For Sale

Stanley #55 four boxes (54) cutters, $125. Ralph Ament, Rt. 3, Cherokee, IA 51012. (712) 225-4032.

Stroke sander: 7½ HP, Oakley D, like new. Cost $5,500. Sacrifice to make room for new machinery, $1,900. (201) 764-6643 or 764-7983, Vernon, NJ.

Bernie Weisgerber, please get in touch. I have Stanley 750 chisels and books for sale. Chris Becksvoort, PO Box 12, New Gloucester, ME 04260.

Egan heavy-duty shaper, 30 in. by 36 in. cast-iron table surface, $250 or will trade for other equipment. Luther Lyle, S. Tugaloo St. Ext., Walhalla, SC 29691. (803) 638-6070.

16-in. De Walt Model GE radial arm saw, 3-HP motor, AMP 14/7, 220/440 volts, 60 cy., PH 3, $600. T.H. Holmquist, 320 Fourth St., Waukegan, IL 60085. (312) 662-1532.

Circa 1900 shipbuilder's woodworking machine: 16-in. band saw, table saw, jointer, lathe, shaper, 2-HP motor. Partially restored, $450. (203) 345-8943.

Hollow chisel mortiser on stand. Has foot pedal & table. Old machine, good cond., $125. Stanley #45, with cutters, in original box. Nice cond., $90. D. Williamson, La Rue, OH 43332. (614) 499-3244.

Five black walnut trees, green, standing, 6 in. to 16 in. in diameter. You come get them. Will accept best offer. Mark Sohn, Keene Village, Raccoon, KY 41557. (606) 437-6467.

Stanley #200 chisel and cutter grinder, $22. Chris Becksvoort, PO Box 12, New Gloucester, ME 04260.

Two Stanley #45s 1884 model, no screw adj. blade. 1st complete with 11 tempered craftsman-made cutters, $70. 2nd less complete, no blades, $40. A. Fate, 3893 W. Liberty, Ann Arbor, MI 48103. (313) 761-7994.

4/4 sassafrass. 4/4, 5/4, 8/4, 12/4 cherry, 80¢ to $2 bd. ft. 2 yrs. AD. Browne, Box 13, Sanger, TX 76266. (817) 458-7398.

600 bd. ft. black walnut, AD, 6 in. to 24 in. wide, 6 ft. long, 1 to 1¾ in. thick, $1,800. Also elm and ash. Gus Kotting, 118 Spruce, Cumberland MD 21502. (301) 759-2929.

Wadkin 9-in. jointer, Delta 20-in. band saw, Delta 6-in. belt sanding machine. T. Patridge, RR 4, Smiths Falls, Ont. Canada K7A 4S5. (613) 283-0970.

6-in. Powermatic jointer with motor, $550 firm. R. Cox, 9 Dublin Rd., Pennington, NJ 08534. (609) 737-9221.

Rockwell model #46-525 variable-speed wood lathe. Millbury tenon machine. Unisaw motors. Miscellaneous Delta parts. No Sunday calls please. Lee Backulich. (614) 471-7782.

Trade only: AD walnut and cherry for teak and Sitka spruce. McKee, RR 1, Decorah, IA 52101. (319) 532-9428.

2500 bd. ft. clear Idaho pine, 6/4 and 8/4, KD, $1.25 bd. ft.; 2500 bd. ft. poplar, FAS, 6/4 and 8/4, KD, $1.25 bd. ft. Both 4 in. to 20 in. wide, 6 ft. to 16 ft. long. Haber, 114 Spruce Pl., Cumberland, MD 21502.

Wanted to Buy

Delta Rockwell hardback publications: "Getting the Most Out of Your: Circular Saw/Jointer-Lathe". Price/condition to Steve Hessel, 910½ S. Locust #1, Champaign, IL 61820. (217) 367-9636.

Blade guides for old 18-in. Walker-Turner jigsaw and a set of blade guides for a medium-sized band saw. I want to adapt to fit 18-in. Gilliom. Tom Ricci, Box 17, Bradfordsville, KY 40009.

Skil 324 or Rockwell 500 belt sander. Dennis Taylor, 2128 S.E. 51st Ave., Portland OR 97215.

Worm gear and sliding bracket for older Walker-Turner table saw. Contact Mike Hicknell, 520 Mckellar St., Peterborough, Ont., Canada K9J 1R2. (705) 742-3139.

Need 4-in. by 24-in. to 84-in. crotch-cut cherry with nice figuring to build my high poster bed. Thomas Bennett, PO Box 43, Woodland Hills, CA 91365.

4-in. by 12-in. planer, Red Fox by Partington, Inc., Cincinnati, Ohio. B. Bunker, Box 295, Franconia, NH 03580.

Planer similar to Parks, Belsaw, W&H. Send price and info to G. Nielsen, 112 N. "M" St. #1, Lompoc, CA 93436.

12-in. thickness planer like a Parks No. 95 or equivalent in working order. Wayne Webber, 1721 Creek St., Rochester, NY 14625.

Woden X190 double-bushed doweling jig (ill. in *Ency. of Furn. Making* by Joyce, p. 191), Philip Gerstner, Rt. 1, Box 255, Trinidad, CA 95570.

Looking for Port Orford cedar of high quality or Mediterranean cypress. Need 12-in. or larger jointer and planer, also band saw. R. Cox, 9 Dublin Rd., Pennington, NJ 08534. (609) 737-9221.

Myford lathe and Rockwell 24-in. scroll saw. Send details. D. Cerretani, RD 1, Box 259, Vestal, NY 13850.

SITUATIONS WANTED

University of Wisconsin (Stout) May 1980 woodworking graduate seeking apprenticeship in a woodworking shop. Two summers custom work experience. Anywhere is U.S. Mark Falanga, 7 Dalewood Lane, Kings Park, NY 11754.

Professional woodcarver with extensive traditional and contemporary experience seeks position or commissions with challenge. Will relocate. J. Demar, 1755 Arrowhead, Fayetteville, AR 72701.

Carpenter with facade restoration and interior finish experience is relocating to Great Lakes states region. Seeks partnership/employment. Jack Kuester, 170 6th Ave., San Francisco, CA 94118.

Skilled/ambitious. Seek position with custom furniture or architectural woodworking firm. Will relocate. Jim McNulty, c/o The Dovetail Joiner, 300 Northside Dr., Bennington, VT 05201.

Reliable, motivated individual seeking association with high-quality craftsman/designer. Willing to relocate and make a commitment. Gary Fillmore, Box 327, Orchard St., RD 2, Califon, NJ 07830.

Apprentice furniture/cabinet maker seeks position with master. 2 yrs. woodworking school, 1 yr. organ shop experience. Will relocate. Strong desire, Bruce Carter, 53 Orchard St., Northampton, MA 01060.

Ambitious—29. Seeking employment in custom building or furniture shop. 5 yrs. self-taught. Want formal training. Have proper tool use. T. Pfeiffer, c/o Rainbow Beach, Box 755, Frederiksted, St. Croix 00840.

Fully equipped woodworking/ceramics shop, 2 hrs. NYC in exchange for limited maintenance responsibility at small college. Shop all yours 9-5. Further info: R. Questel, 245 E. 21st St., New York, NY 10010.

The CLASSIFIED rate is $3/word, minimum ad 15 words. Payment must accompany order. The WOOD & TOOL EXCHANGE and SITUATIONS WANTED rate is $2 per line, minimum three lines, maximum six lines, limit two insertions per year. Allow 30 letters or spaces per line, including name and address. The Wood & Tool Exchange and Situations are for private use by individuals only. Commercial accounts must use Classified. Please inquire for DISPLAY CLASSIFIED rate. Send to: The Taunton Press, Advertising Dept., Box 355, Newtown, CT 06470. Deadline for ads is the 25th of the third month preceding publication date.

From *Indian Artists at Work*, 1978, courtesy Douglas & McIntyre, Vancouver.

Kwakiutl storage chest kerf-bent in red cedar by Larry Rosso of Vancouver.

Kerf-Bent Boxes

Woodworking techniques and carving tools of the Northwest Coast

by Susan J. Davidson—Photographs by Ulli Steltzer

Although the art of the Pacific Northwest Coast Indians has long been recognized, little attention has been given to how they actually made things. Most people will think of their massive totem poles, dugout canoes and sculptural masks, but the kerf-bent wooden box is the more ingenious example of a woodworking technology developed through eons of practice. It consists of just two planks of cedar. One is the flat bottom, rabbeted all around to receive the sides. The other is a single plank that has been deeply kerfed in three places, plasticized by controlled steam and bent at right angles to form four sides. The last corner is sewn or pegged together. The result will hold water.

These richly decorated boxes range in size from a few inches to several feet. Some have flat sides, some bulge outward. Some have lids, some have sweeping curves cut into their top edges. They stored the food and possessions of everyday life as well as the ceremonial regalia of the winter dances, they were cooking pots and serving dishes, and finally they were coffins. But they were not merely containers as we think of containers, for their intricate motifs also represented the personal crests of the owner. These crests were displayed proudly, for they served to verify rank as well as spiritual power.

The Indian population probably never exceeded 100,000 on the whole coast of Alaska, British Columbia and Washington. They lived scattered in hundreds of villages separated by at least six different languages and dozens of dialects. (Major tribal groups and villages are shown on the map, facing page.) That this sparse population had the time to make great quantities of boxes testifies to the material richness of their seacoast and rain-forest habitat. As the Haida carver Bill Reid, whose totem pole is shown on the back cover, has written, "Even today, only a stupid man could starve on this coast, and today is not as it was." They could support a whole class of artisan specialists who, freed from the urgency of subsistence work, transformed the gifts of the forest into concrete expressions of their cultural values. The elite, in turn, would hoard the treasures they had commissioned and convert this wealth into status at the potlatch, by giving it all away, in the expectation of receiving even more in return.

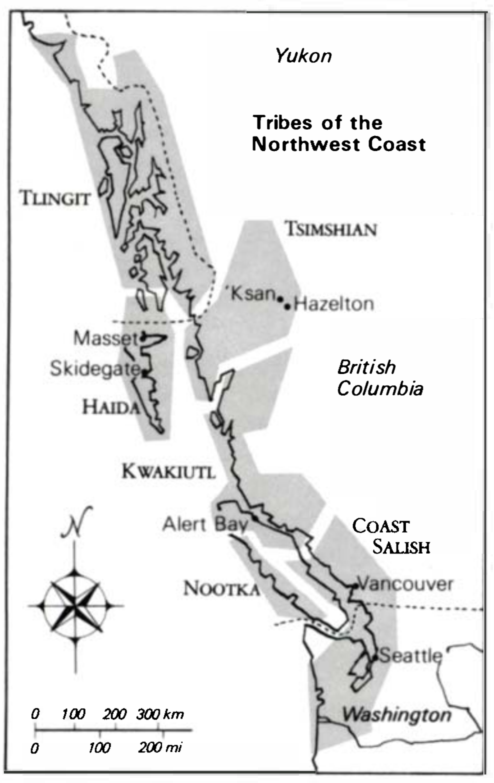
Although it used to be thought that the woodworking arts were quite unsophisticated until the introduction of iron tools by European explorers after 1770, recent archaeology shows otherwise. This culture and its art has been on a high level for several thousand years. Iron tools had been known on the coast for about two hundred years before direct European contact. When Europeans traded metal tools in quantity for furs and artifacts, the Indian culture reached a lavish sophistication previously not feasible. Yet this coast was still the remotest corner of the world, and remained essentially intact for almost another century. About 1850, gold was discovered inland. White settlers came to stay. There followed a century of terrible repression, while the Canadian authorities tried to "civilize" the heathens by outlawing their language, customs and ceremonies. Finally, as scholars began to recognize the value of what was being crushed, the political changes of our own era also stirred the Indian people.

The last 30 years have seen a genuine cultural renaissance. The elders have brought out their hidden wealth and memories, and young men and women have been struggling to reclaim their heritage. Historical techniques are being supplemented by modern methods. While power tools such as the router and band saw are used by native carvers for rough work, they prefer the old forms of hand tools, updated with metal blades, for finishing and detail cuts. To compile this article I have drawn heavily on ethnographic reports (see *further reading*, p. 42), but my best resource has been this new generation of craftsmen, and it is their work I wish to document.

In the old culture, a deep respect for the spirits of all living beings pervaded daily life and work. The spirit world was close at hand, especially in the grey winter. Before taking a salmon from the ocean, or bark from a tree, a person would ask permission from its spirit. Even today, after the Haida artist Robert Davidson had carved a 40-ft. Bear Mother totem pole for the village of Masset, the first part of the erection ceremony was for him to dance around the pole with all his tools tied to a rope draped over his shoulder. He chanted a raven's cry, which he later said was his victory song at having conquered the pole by completing it.

Cedar was, and remains, the material of choice—western red cedar and yellow cedar, known in the timber trade as Alaskan cedar. Some craftsmen today buy milled boards from the lumberyard, culling the piles for tight, clear, straight grain. Others use chain-saw mills to quartersaw planks from logs that wash up on the beach. Some still split out boards with wedges and mauls. The old way was to burrow two deep holes into the living trunk, one near the ground and the other as high up as the boards would be long. Planks could then be split off using a graduated set of seven yew-wood wedges and a stone maul, and the tree would live on. The trees were much bigger then, 10 ft. and more in diameter.

Aside from living memory and contemporary experience, information about the old ways of woodworking comes mainly from Franz Boas, the German-born anthropologist who studied the Northwest Coast tribes between 1885 and 1930. There is also a film (made by the University of California at Berkeley anthropology department) about steam-bending a wooden box, featuring the late Kwakiutl (pronounced *kwa-gyulh*) chief Mungo Martin, one of the last carvers to have had direct continuity with the traditional technology. By the time of Boas' observations, metal tools were readily available and the trees were usually felled. They were made to lie with their smooth, weather side upward. The seven graduated wedges were driven in along a line four finger-widths above the center of the log. When the tree began to open, a round crab-apple or yew-wood stick about 6 in. thick was inserted across the horizontal crack, and two men pounded on blunt wedges that were hollowed to fit around the "spreading stick." Planks were always split from the branch end down, to prevent the plane of fissure from



Haida chest, kerf-bent with bear design, 36 in. by 19 in. by 23 in., collected in 1870. Courtesy Museum of Anthropology, Univ. of British Columbia, accession no. A-7103.

turning outward, and to avoid producing a plank that was short and thin at one end.

The first plank removed was three finger-widths thick, because it never ran quite parallel to the splitting plane. Subsequent planks ran more nearly parallel and could be as thin as one finger-width—if the cedar was good. If the plane of separation dipped downward, the upper surface of the log was loaded with logs and stones. If it turned upward, the tree was turned over so the weight of the wood could change the inner stresses, dipping the plane downward again. Planks of 20 ft. and longer were split this way. Most boards were split tangentially, that is, the growth rings intersected the face of the board at a small angle. But the boards destined to become bent boxes were split radially, through the center of the tree, crossing the growth rings at right angles.

Twisted boards were piled in a level spot and weighted with heavy stones. A second method of straightening was to drive two pairs of stakes into the ground, a pair at each end of the plank, slanting away from each other. The plank was forced between the stakes and twisted to counteract the warp. After some time in traction, it usually would remain flat.

Boas, unfortunately, was not woodworker enough to note the moisture content of timber, although it is not likely that any amount of air-drying would bring it below about 15% in this damp climate. Green stock is easy to bend into a gentle curve, but green wood is liable to shatter when forced into tight bends like these, as a result of hydraulic pressure within the cells. Doug Cranmer of Alert Bay has made boxes of maple, yew, alder, yellow cedar and pine. He believes any seasoned wood can be bent if it is steamed long enough. But whatever wood is used, Cranmer says, "It must die first, dry right out and relax before it can be bent."

To smooth and thickness the board, a chisel with a bone or stone blade was used to shave off long splints. The final planing was done with a hand adze, working with the grain. The finished board might be only half a finger thick. Using an ingenious geometry dependent on cedar-bark strings and charcoal markings, the craftsman made a rectangular template from a large flat board. This pattern was traced onto the newly prepared board and the shape reproduced by adzing down the edges.

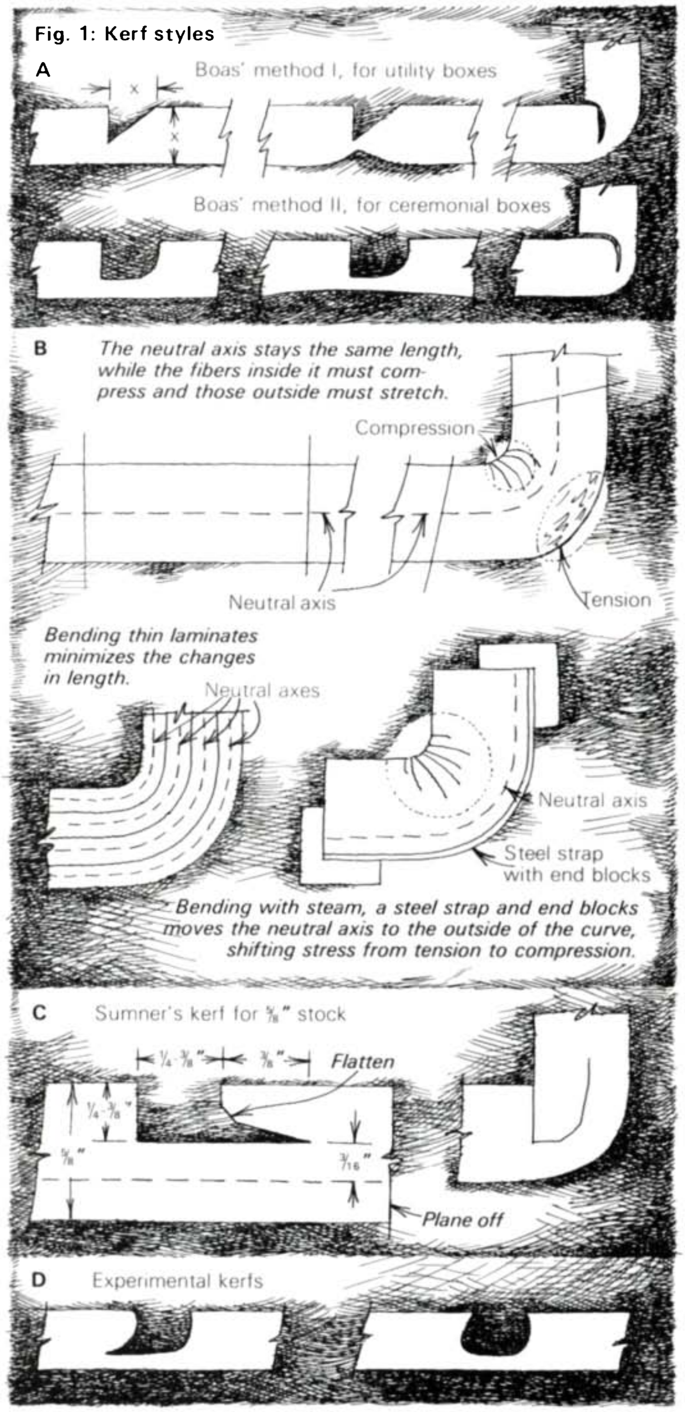


Fig. 1: Kerf styles

The next step was most critical, that of cutting the kerfs where the future corners would be. Boas describes two styles of kerfing (figure 1A). The simplest is a *V*-cut with one vertical side, about halfway through the board, as wide as the board is thick. The outside of the board would be shaved back on both sides of the *V*-cut. Museum specimens show that this method was reserved for utility boxes for gathering, storing and cooking food. The wood at the corners is quite thin and would have bent easily with a minimum of steaming, but the result is fragile—many surviving examples are cracked or broken. In the second method Boas recorded, the kerf looks like a dado with one rounded corner. It was made by incising a narrow vertical kerf, then working it wider with the knife along a curve reaching down to the original cut. The board was also thinned opposite the kerf. This method was reserved for decorated chests and serving dishes. It required more skill to make, but produced a more durable and aesthetically pleasing wrapped corner.

Kerf-bending can be explained by contemporary technology. As shown in figure 1B, when a piece of wood assumes a curve, the fibers on the inside of the curve must become shorter, and those on the outside must stretch. Only the fibers in the middle of the stock, along its so-called neutral axis, stay the same length. Laminating many thin layers minimizes the distance between the neutral axis and the surfaces in compression and tension, and therefore results in less stress *(FWW* #6, Spring '77, pp. 35-38). Wood, however, is considerably easier to compress without failure than it is to stretch. Thus another way to bend is to plasticize the fibers with steam and confine the length of the stock by means of end blocks fastened to a steel strap *(FWW* #8, Fall '77, pp. 40-45, and #20, Jan. '79, pp. 44-45). This effectively shifts the neutral axis to the outer surface of the bend, putting most of the fibers into compression rather than tension. Kerf-bending marries both approaches.

A study of 99 boxes at the National Museum of Man in Ottawa isolated 11 different kerfing styles. The deeply undercut kerf as used by Roy Hanuse shown below, right, and in the photo sequence on pp. 44-45 is the most common today; the version used by Richard Sumner of Alert Bay is shown in figure 1C. Sumner's dimensions apply to a plank 23¼ in. long by 3⅝ in. wide and ⅝ in. thick, the size he recommends to anyone experimenting with the technique. Like Hanuse, Sumner roughs out the kerf with a router, then finishes it with straight and curved knives. He also sands out the undercut. Instead of shaving a relief opposite the kerf, however, he runs the flat side through a planer to leave about $\frac{3}{16}$ in. of wood. Sumner and Cranmer agree that the key to perfect boxes is a uniform kerf, and Cranmer is experimenting with router bits to design one that will do the whole job, including undercut. Box-makers at the reconstructed village of 'Ksan (near Hazelton, B.C.) use other varieties of kerf (figure 1D).

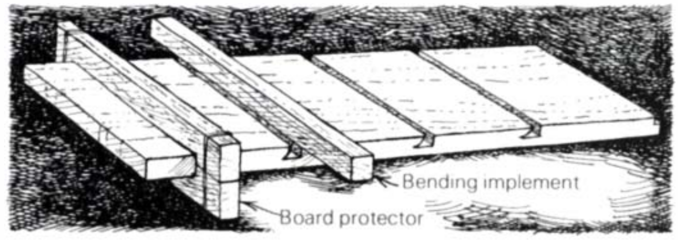
Larry Rosso of Vancouver, who has made many boxes including large chests (photo, p. 36), uses the undercut kerf, but he makes the wood even thinner toward the back side—no more than ⅛ in. Rosso recommends that the undercut start two-thirds of the way down the kerf and extend as far as possible into the wood. Rosso has bent alder, red cedar, yellow cedar, pine, spruce and fir. He finds that the softer woods, like cedar, spruce and pine, are easier to bend accurately, and that tight-grained woods are superior.

In old boxes, as today, the fitting at the fourth corner is a rabbet joint, the rabbet being as wide as the kerfed board is thick, and half as deep. The other end was and is left blunt to butt up against this tongue. Hanuse bends so that the undercut kerfs point away from the rabbet, whereas Rosso always sets up so that he is bending into the kerf, on grounds that this makes it easier to end up with a truly square box.

According to Boas, when the board was prepared—and this included as much shaping as possible in advance of bending—it was sandwiched between two level planks weighted with stones and left to soak overnight in hot water or steam. When all was ready, a big store of medium-sized stones was gathered from the beach and a large driftwood fire built to heat them. Seaweed and eelgrass were also collected. Three ditches four fingers wide, a short span deep and as long as the width of the board were excavated in the earth. Hot stones were transferred into each hole until it was nearly full. Seaweed was used to fill up the holes, and eelgrass was heaped on top. Then the board was laid on with a kerf directly over each miniature steam pit. Eeelgrass was piled thickly on top of the board, along the kerfs. The board was lifted up at one end, water poured into the three holes and the board lowered onto the steam. Red-hot stones were placed on top of the eelgrass last piled on and then more grass. More water was poured along the kerfs, and a final layer of eelgrass was used to cover the steaming plank.

These days, a hot plate or a camp stove is generally used to boil water in a tank, and the live steam is fed to the wood via a rubber hose. Some use a plywood box for steaming, while others, like Hanuse, simply put the wood inside a tent made from a plastic bag, the hose tied tightly at one end.

Contemporary craftsmen bend the steamed wood with the aid of asbestos gloves, belt clamps and strips of inner tube. The old way relied on two wooden implements and a length of cedar-bark rope. The two tools were what Boas called "a board protector" and "the implement for bending corners;"

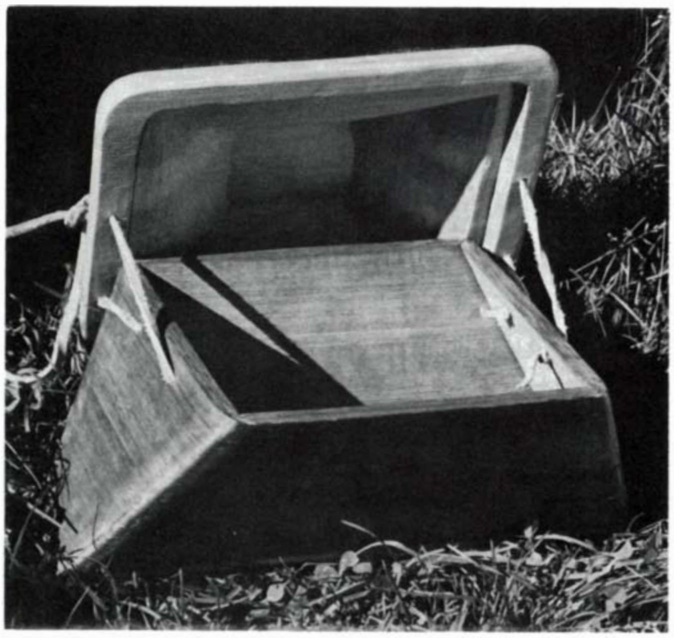


they are shown in the drawing above. The first was a piece of red pine the size of a 2x4 and several feet long, split in half and hollowed out to receive the steaming plank, then lashed together. The second was simply a square length of red pine, about a foot longer than the width of the steaming plank.

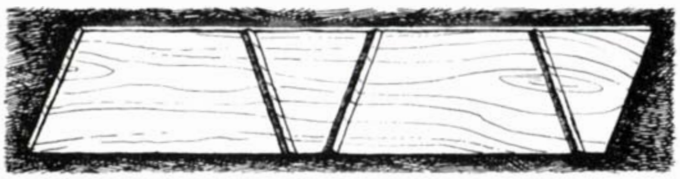
While the board steamed, the boxmaker split out many thin, tapered cedar pegs, each about four fingers long. These would be used later to peg the last corner together. When the board had steamed long enough, the eelgrass and hot stones were removed, the board protector slipped over one end of the plank, and the bending implement laid behind the vertical edge of the kerf. The craftsman stood astride the plank, one foot on each end of the bending implement, grasped the board protector in both hands, and pulled it up until the corner was bent slightly more than the required 90°. He repeated the procedure with the corner at the other end of the plank, and lastly with the middle corner. The rope was quickly wrapped around the bent form, the last corner fitted together, and the rope tightened up and wound several more times around so the box would not twist. To keep it square, four cedar sticks of equal length were wedged diagonally inside—two across the top and two across the bottom.

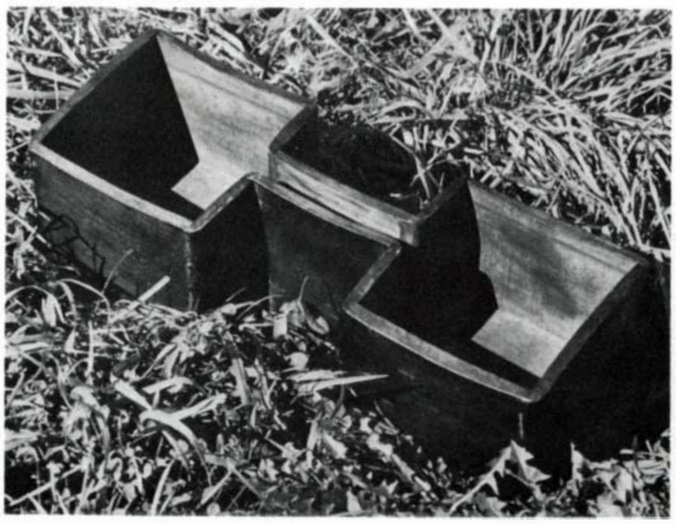
While the box was cooling, the open corner was pegged

Cedar box was made by Roy Hanuse of River's Inlet, B.C. How he steamed and bent it is documented in the photo-essay on pp. 44-45. The box is cubical, 12½ in. on a side. The carved design represents a person—the head, chest and hands on the left, the pelvis, legs and feet on the right. The same designs are repeated on the other two sides. This style of carving traditionally fills all the available space, by splitting and spreading out the elements of the figure depicted. The designs are usually bilaterally symmetrical and show anatomical details as if the artist had X-ray vision. Strong, thick 'formlines' define the patterns; variations of the ovoid and U-shape are also characteristic. A little creature, dubbed Mighty Mouse by one anthropologist, appears in the chest area on the left, his 'ears' suggesting lungs.



Tackle box by Doug Cranmer was bent as shown in sketch below.





Twelve-sided box by Larry Rosso, kerf-bent from one long board.

A medium-sized canoe, hollowed out but not yet filled with boiling water for spreading to final shape. Photo was taken in 1902 by C.F. Newcombe, courtesy British Columbia Provincial Museum, Victoria.

closed. Holes were drilled at angles alternately one above and one below the horizontal plane, three fingers apart, through the rabbet into end grain. The pegs were covered in saliva before they were hammered in. An alternate way of closing this corner was to "sew" it by lacing cedar withes through drilled holes. Shallow grooves were made to recess the lacing, protecting it from abrasion.

The bottom was shaped from a block of wood rabbeted down half a finger-width around the edge. It was made to fit up tightly into the box and then pegged securely to the sides. The lid was sculpted to fit tightly over the top.

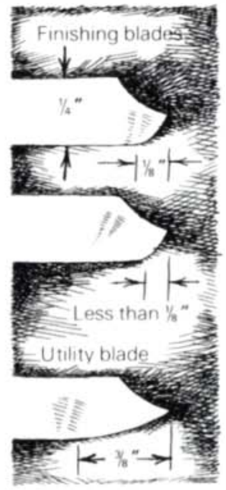
The corner joint, lid and bottom had to be fitted with precision if the box were to be water tight. This was accomplished by "spotting." Charcoal mixed with oil was rubbed along one of the adjoining edges. The two edges were pressed together. Black spots on the clean edge revealed the uneven places, which were then shaved off. Before the final fitting, the joints were rubbed with tallow and rotten pitch wood.

Although the board protector and bending implement were meant to create enough counterpressure to prevent the outer fibers from breaking, there was often some raggedness, or "sprizzling," along the bends. This was cleaned off as the last step in preparing a box to receive its decoration. The skin from dogfish, a member of the shark family, was used to sand wood to a smooth finish.

All the contemporary boxmakers emphasize that if a corner does not bend into place within a minute of coming out of the steam, the risk of fracture is very high. The wood should be re-steamed to avoid disaster. Sumner has isolated four common pitfalls. Cutting the undercut too far down, which leaves the wood too weak, and not using enough steam, are the main reasons a corner will crack. Inaccurate measurements and uneven undercutting cause the box to be off-square. Rosso evaluates a box by how evenly the corners are wrapped and how well the kerfs close. If there is a lid, it should fit in equally well in any direction.

Box-making was a highly evolved art, especially among the Kwakiutl, Tsimshian, Haida and Tlingit people. Unusual designs were developed for specific purposes—by varying the positions of the kerfs, for example, it was possible to make a box that would fit up into the bow of a canoe, for hooks, knives and other gear (photo and drawing, top left). Some unknown Haida artist once made a twelve-sided box, perhaps for a shaman, which Rosso has duplicated (photo, middle left).

Although the use of hot rocks for generating steam has largely disappeared, solar experimenters are rediscovering the heat-storage potential of a mass of rock. The Indians cooked in kerf-bent boxes by filling the box with water and food, and bringing to a boil by tossing in hot rocks. Great canoes up to 80 ft. long were made using the same techniques (photo, bottom left). A cedar log of appropriate size was felled, making sure it landed on its belly, the side with fewest branches. The outside was adzed to form and the inside was roughed out, sometimes using controlled fire for the preliminary hollowing. Holes of specified depths were drilled into the hull from the outside and plugged with twigs that had been charred at the tips. As the craftsman adzed out the interior he encountered charcoal smudges, indicating he had gone far enough. The sides were as thin as the breadth of one forefinger, while the bow, bottom and stern were two fingers thick. The cavity was filled with a mixture of one-third human urine and two-thirds water, and hot rocks were added



Traditional D-*adze, left, and adze with carving-gouge blade. Drawing, right, shows typical blade profiles.*

until the liquid boiled. A careful fire built under the canoe kept it boiling until the wood became pliable. When the sides could be spread the thwarts were pressed into place, the canoe allowed to cool, and the liquid poured out. The thwarts were then sewn into place by lacing spruce withes through predrilled holes. Extra pieces to extend the height of the prow and stern were pegged and sewn onto the main hull.

A carver's tools were so important to him that he often made them into beautiful works of art themselves. The handles became animal forms or were engraved with personal crest designs. The prehistoric materials for tools were animal bones, horns and teeth, shell, stone and wood. When European trade goods arrived, the superiority of iron blades was readily acknowledged but the traditional tool forms did not change.

The three distinctive tools still used by Indian carvers are the *D*-adze, the elbow adze and the curved knife. Traditional wedges, chisels, drills and mauls have largely been replaced by their modern counterparts, and power tools have found ready acceptance, in particular the electric router and the gasoline chain saw.

The *D*-adze, shown above, is named for the shape of its handle. It fits comfortably into a loosely closed hand, with the thumb extended over a knob on the front. The tool balances on the outer surface of the palm behind the little finger. The knob, which often becomes an animal's head, absorbs some of the impact from each chopping stroke and helps direct the next. *D*-adzes can be made for utility work—removing big chunks of wood at each stroke—or for finishing. A finishing adze is used in a very precise way to create a regular, dimpled surface as the final texture on large areas such as structural timbers, totem poles and canoes. Several variables can be adjusted, according to the tool's purpose.

The method of fastening the blade to the handle determines how the adze responds to impact. A utility adze should be rigid, and the blade is commonly bolted on. For a finishing adze, it helps to use a more flexible lashing. The rebound from each stroke helps establish the steady rhythm that will produce a uniform pattern. Old tools sometimes have quills or cedar wedges bound into the lashing, to increase elasticity.

When making a blade, consider four variables: its width, the curvature of the sharpened edge, the bevel on the bottom side, and the weight. An average *D*-adze blade is 1½ in. wide, 6 in. long and ¼ in. thick. A narrower blade will cut deeper. Blade metal often comes from car leaf springs, old files, or 3⁄16-in. mild tool steel. The business end is splayed by grinding away width on either side, and by rounding the tip. A flat curve is better for utility work, biting deeply and creating a chip that must be broken off. A rounder curve allows shallow scooping, freeing a shaving with each stroke.

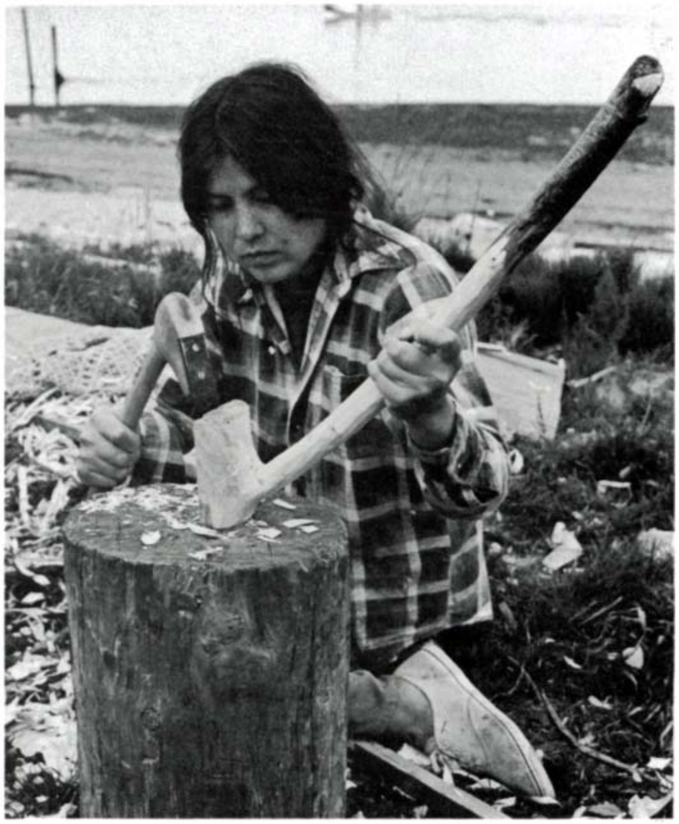
The top side of the blade (toward the handle) is beveled to the middle of the metal's thickness, which mostly helps to thin out the blade. The working edge is then created by grinding a second bevel on the bottom side. For a finishing adze, this bevel starts about ⅛ in. back and is rounded in cross section, as shown in the drawing above. If the bevel is made shorter, the tool bites deeper. The bevel for utility blades is long and flat, starting about ⅜ in. back from the edge.

Ultimately, experience and personal preference determine how a tool should be made. Carver Roy Hanuse uses a German #5 gouge lashed to a *D*-adze handle and weighted with an extra piece of steel. He made it for finishing, to create a deeper, more shadowed texture. This it does but it's also an excellent utility adze for roughing out concave forms, especially across the grain.

Mastering the adze requires endurance and patient practice. Utility work is less painstaking than finishing, but both depend on coordination and concentration. For finishing, the shoulder, elbow and wrist joints are locked. A controlled swing from the elbow and shoulder allows the tool to strike the surface repeatedly from a height of about three inches. The finishing texture is created by moving down the surface with the grain, in parallel rows that slightly overlap. Control is easier if the blade is angled 10° or 20° to the grain direction. To keep each cut uniform, the same section of the blade must make contact each time. Cross-grain texturing is done only on sculptured pieces.

The elbow adze is named for the shape of its haft. The branch of a tree becomes the handle, and a piece of the main stem becomes a platform for the blade (photo, next page). If a branch of the proper angle is not available, the haft can be steamed, bent and lashed in place, or a wedge can be placed on top of the blade. Traditionally the blade was lashed on with sinew, but bolts are more common now. Crab apple, willow, alder and cedar are all used for handles.

Elbow adzes are also used for both utility and finishing work. The angle between blade and haft is partly personal preference and partly functional: utility adzes around 30°; finishing adzes, 25°. A short grip is effective for utility work,



Isabel Adams Ronck, of Masset, makes the haft for an elbow adze.

while a longer grip puts more bounce in each stroke. Some utility adzes are large enough for a two-hand grip. The angle at which the blade contacts the wood determines the bite of each stroke. For utility work, 35° to 40° is about right. For shallow texturing, 15° is more like it.

When Hanuse demonstrated adzing out hollows for the sides of a box (p. 44), he unclamped the board and allowed it to respond to the blows. If we perceive that tools are simply specialized extensions of the hand, and the *D*-adze more so than most tools, we can understand his statement, "You can go on adzing for hours if you work at the same beat as your heart. Until you get something going for you, you're just hacking all over the place."

Different tribes preferred different tools. The northern groups used the elbow adze exclusively, while the southern peoples used both styles. According to the late Haida carver and boatbuilder, Robert Davidson, Sr., 25 or 30 different adzes were used for making canoes. When traveling, the carvers left their adze handles behind and made new ones as needed. To lash on a blade, the sinew or string was tied to a fixed object and the adze rotated into the string while the toolmaker kept it taut.

There are many varieties of curved knife (photos, next page), but the basic blade is about ½ in. wide and up to 3 in. long, sharpened on both edges and curving up toward the tip. It can be pulled or pushed and is extremely versatile, doing most of the work ordinarily given to spokeshaves, planes and carving gouges. Although its origins are uncertain, this style of knife definitely postdates European contact. It may derive from the farrier's knife used to trim horses' hooves, or from the canoe knife (crooked knife) used in the fur trade.

These knives are not available commercially, so carvers have become adept at making their own. The metal from a circular-saw blade makes a good knife, as does Keewatin mild tool steel in ⅛-in. bars. First a strip of metal the desired width is ground to make point and tang, then the bevel is shaped on both edges by grinding the top surface only. The metal is heated to the purple color just before cherry red, and the desired curve imparted by gently pressing on a piece of wood. Quenching the blade in oil and then water completes the tempering—a delicate business easily ruined, especially when using recycled steel. The edge is made keen with emery cloth and stropped on leather with Chromeglantz, an abrasive paste normally used for polishing pots. Cutting a clean, crisp outline in woods as soft as cedar requires a very sharp blade.

Knife handles can be straight, for two-handed use, or contoured, for one hand. The shape is carved in dry alder, then split in half. A niche is hollowed out to receive the tang, both sides of the handle and the tang are covered with epoxy, and the knife is clamped together to set.

A curved knife is usually gripped underhand, the thumb braced against the end of the handle opposite the blade for leverage and guidance. Power is gathered by the whole forearm and directed by the wrist. When pulling the knife toward the body, the wrist is firmly locked but carries through the stroke by twisting inward until the shaving falls free. When pushing, the wrist again follows through by swinging away from the body. The tip of the knife is vulnerable. If you drag it through the wood instead of forcing the edge to cut, the tip gets caught and can snap off.

To bring this article full circle, I wish to note the Indians' use of stale human urine in bending wood and preventing checking, which seems to be on the same track as current scientific research on bending wood with anhydrous ammonia. Wood that is immersed in liquid ammonia (NH_3) or in gaseous ammonia under pressure of 150 PSI becomes as

Further reading

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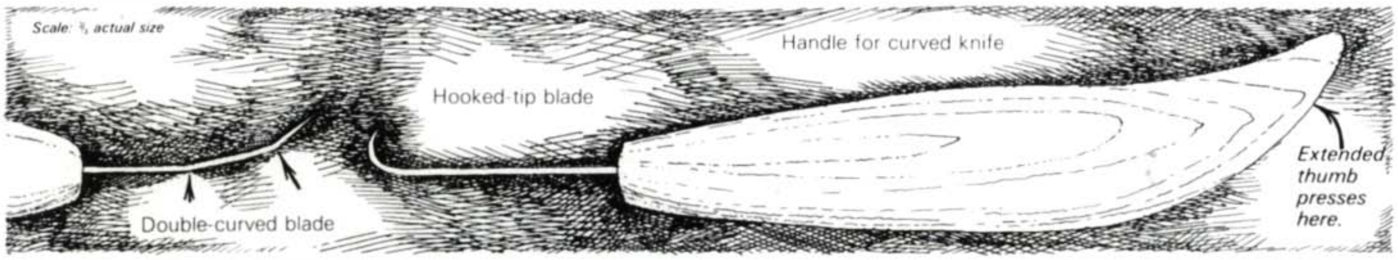
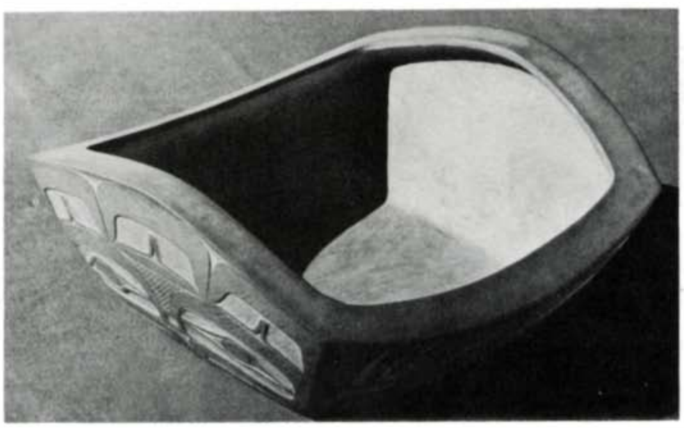
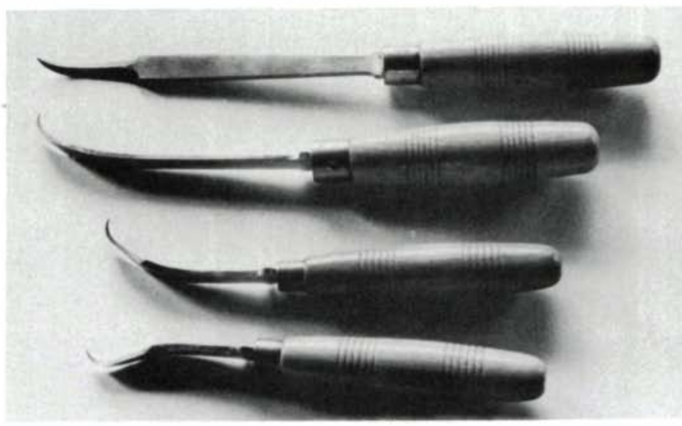
From left: double-curved knife, hooked blade, and slightly curved knife. Right, double-curved knife smooths an eye socket.







Eagle feast dish carved (not bent) by Haida artist Robert Davidson. The dish required four special knives (photo right, top to bottom): a straight knife with sharply hooked tip for carving out the bottom inside corners, a long-curved 'floor knife' for flattening the bottom, a delicate double-curve for shaping the interior of the sides, and a reverse-bent for undercutting the lip around the top.

pliable as spaghetti. This is not the same as household ammonia, a solution of ammonia in water, and the procedure is both difficult and dangerous.

Ethnographic accounts refer to the use of a stale urine mixture in spreading canoes as well as in steaming boxes, and Boas reports that canoes were less disposed to checking if steamed this way. The active component of stale urine is urea (NH_2-CO-NH_2), chemically similar to ammonia (NH_3). Both are powerful denaturing agents, although ammonia desorbs rapidly, leaving no active residue in the wood, while urea is a liquid at room temperature and likely to remain in the wood. This gives credence to Boas' report, as the urea residue could trap water in the cells and prevent the wood from drying out completely.

Cellulose fibers have a helical form, held relatively stable by cross-bonding among hydrogen atoms. The hydrogen in ammonia interferes with the hydrogen bonds in the cellulose, allowing its micromolecules to flow past one another. However, scientific attempts to increase the plasticity of wood by impregnation with a saturated solution of urea, then heating in an oven to 100°C, have not been successful.

All this has led researcher Robin Wright of the University of Washington in Seattle to make experimentally some 400 kerf-bent boxes by soaking the wood overnight in a 1:10 solution of industrial ammonia in water. She concluded that this preparation made the fibers more pliable, although it did not eliminate sprizzling along the corners. Robert Free of the Burke Museum in Seattle has continued this project, with the aim of making small boxes for sale rather than of settling the question. He soaks the wood in ammonia solution for up to two weeks. □

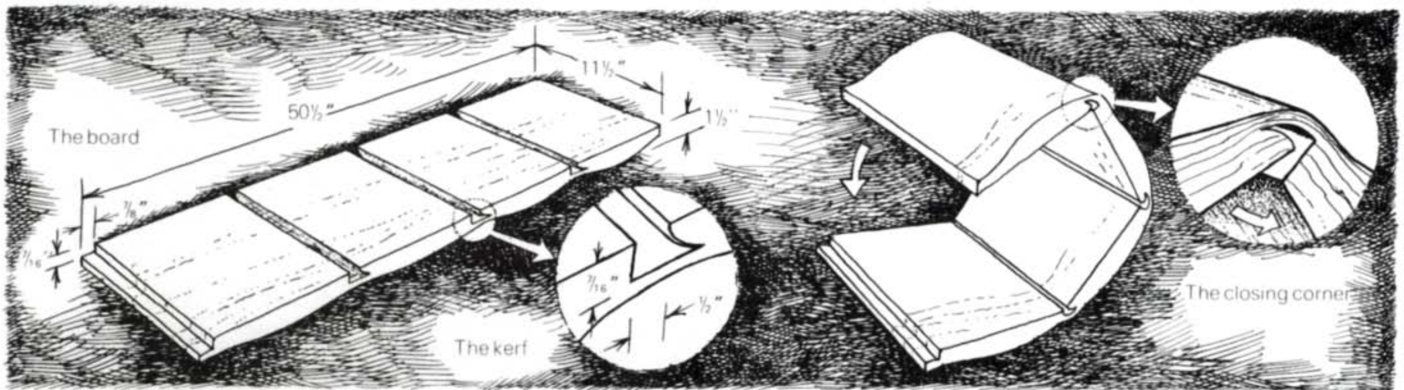
Susan Davidson, 35, of Vancouver, is an anthropological researcher and freelance writer whose principal interest is Indian art of the Pacific Northwest. Ulli Steltzer's books are Indian Artists at Work *(Douglas & MacIntyre, Vancouver) and* Coast of Many Faces *(Douglas & MacIntyre/University of Washington Press, Seattle).*

Kerfing and Bending a Box

Roy Hanuse, a Kwakiutl, is a carver who has only recently taken up box-making. He is also a carpenter and no foe of power tools, but he always returns to his traditional tools for the finishing touches.

(A) Hanuse begins by laying out the kerfs and side profiles along one edge of his stock, a select piece of clear, tight-grained yellow cedar. The box is to have bulging sides, hollowed on the inside, and the shaping is done before bending. First, though, he routs the rabbet for the fourth corner (7/16 in. deep by 7/8 in. wide). He turns the plank outside up and (using a 1/2-in. straight-flute bit) routs channels 7/8 in. deep above the center marks for each corner. These channels limit the undulations of the sides, bandsawn next. He shapes the curves with his elbow adze **(B)**, and cleans up the valleys with a curved knife. Now Hanuse turns the board inside up and roughs out the bending kerfs **(C)**, first with the 1/2-in. straight bit to a depth of 7/16 in., then with a modified dovetail bit **(D)**. The undercuts point toward the blunt end of the plank. He cleans up the kerf with a jackknife, and extends the undercut with a curved knife **(E)**.

Hanuse returns to the outside of the box and uses a *D*-adze to enlarge and shape the valley above each kerf **(F)**. Thinning the wood here is what allows it to bend. With elbow adze, curved knives and gouges, he finishes shaping the outside, then turns the plank again to rout and adze most of the waste from the inside.



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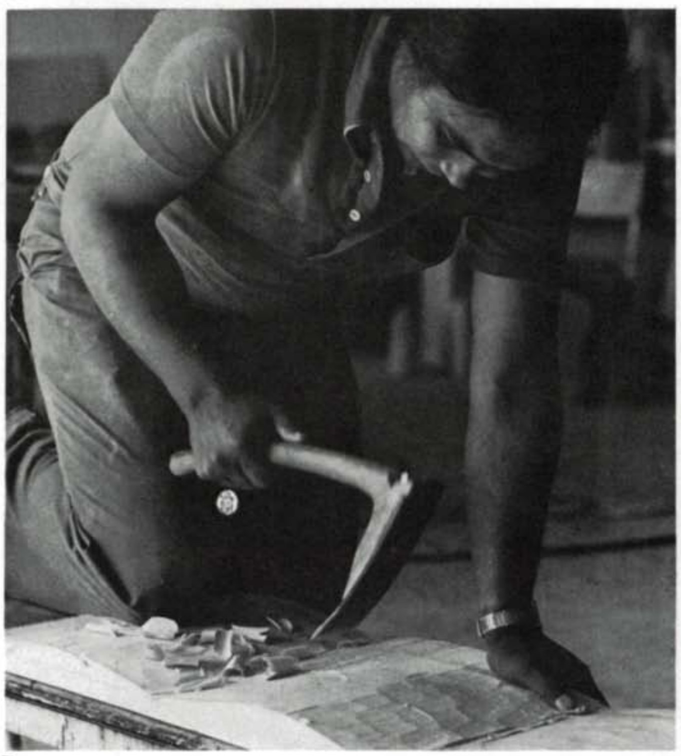

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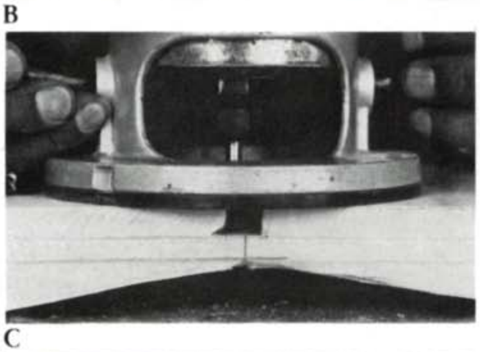

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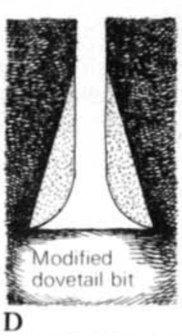

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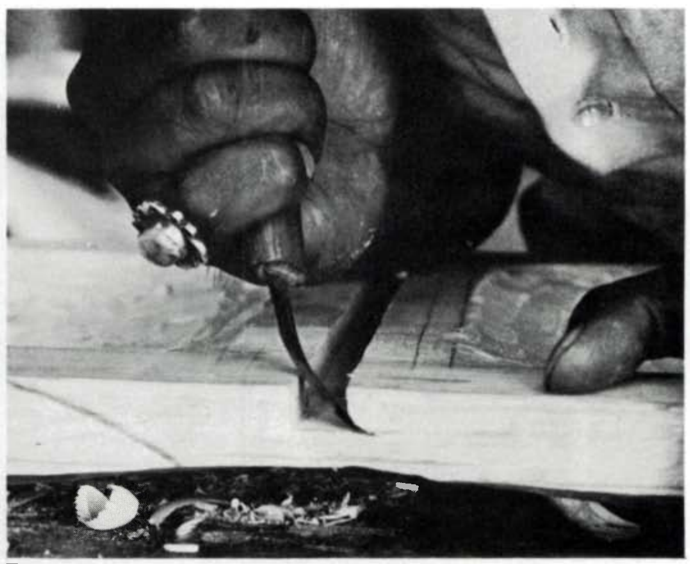


E

F

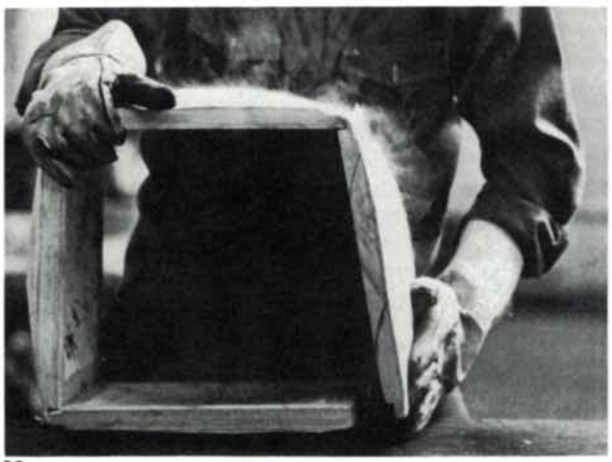
Hanuse's steam source is an old spray tank heated on a gas burner. A rubber hose delivers steam to a heavy plastic bag, in which the stock tests on nails hammered into a plank. He adjusts the bag to the job by wrapping the excess plastic around another plank.

Hanuse warms the stock in hot running water, pours a kettle of boiling water over the kerfs, then pops it into the steam (**G**). He keeps the tank three-fourths full of water, and occasionally flexes the joints through the bag to judge how it's going. It steams about an hour. Quickly out of the bag and bent (**H**), one corner at a time. Two belt clamps cinch the form; pipe clamps on the diagonal brace the open corner (**I**).

When the wood cools, Hanuse trims the open corner to a precise fit. Then he clamps up again, adding a pressure block to push the fourth corner tight for pegging. He's whittled about 15 conical pegs, from ⁵⁄₁₆-in. square sticks of kiln-dried yellow cedar. Using a ³⁄₁₆-in. bit, Hanuse drills five holes into the corner from the blunt side, at various angles, and ten angled holes in through the rabbet. He paints the mating surface and the peg holes with white Bondfast glue (polyvinyl acetate), hammers in the pegs (**J**), and shaves them flush.

The box dries for several days, the steamed wood shrinking around the pegs. Then the pegged corner is recessed with curved knives to match the other three. Hanuse then cleans up the exterior contours, trims broken fibers at the corners, sands the outside to 80 grit, and pares off a thin shaving all around to make a clean surface for carving. Finally, he completes hollowing and thinning the inside (**K**) and attaches the rabbeted bottom board with angled pegs and glue □

G



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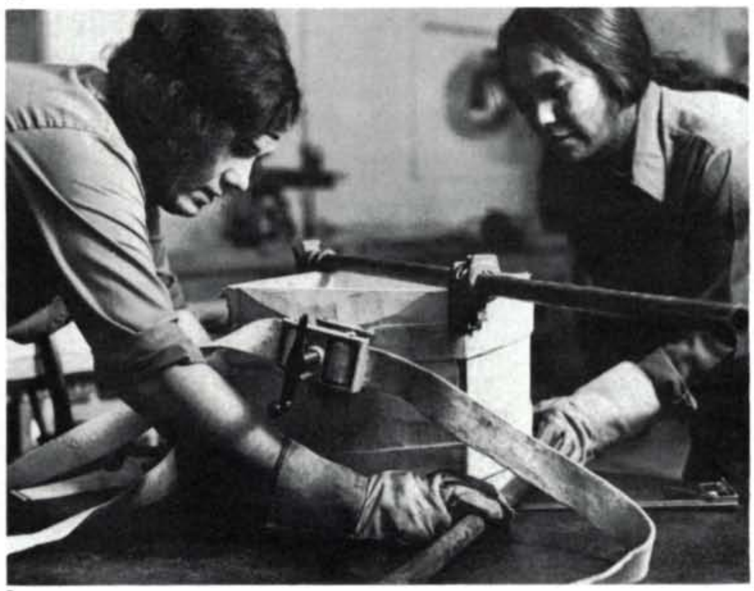

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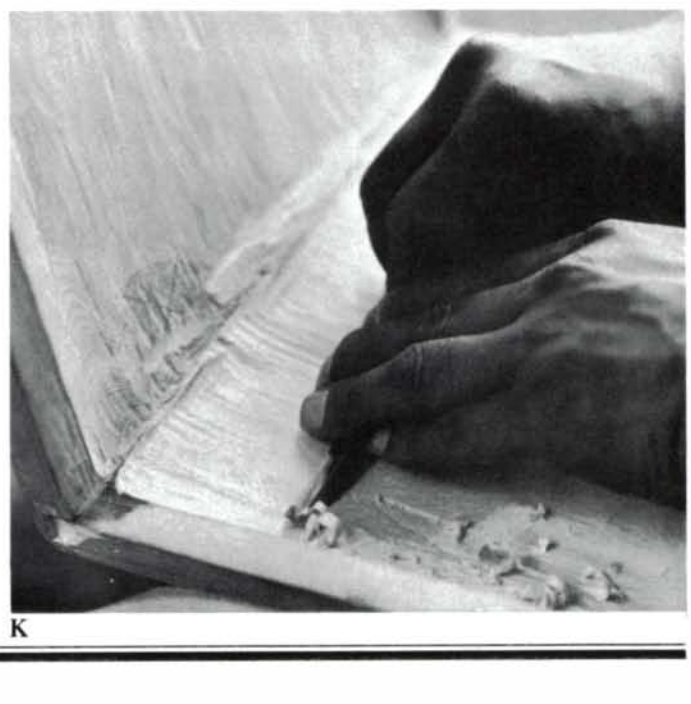


K

Balinese Masks

Carving cross-legged on the floor

by David Sonnenschein

Sonnenschein's hinged-jaw mask of the evil goddess Celeluk.

Bali, the Indonesian island of enchantment, has manifested a myriad of technically and creatively advanced art forms: music, dance, painting, silversmithing, and carving in bone, ivory, stone and wood. Of all the different types of Balinese woodworking, mask carvings are best known around the world, and most meaningful on the island. At temple festivals, weddings, holidays and tourist performances, masks are used to depict stories of the Hindu Ramayana, to display the perpetual battle between good and evil, and to provide comic relief mocking the seriousness of the morality dance/dramas. Some masks cover only part of the face, an enlarged nose, for example; others are elaborate full-head pieces with hinged jaw, fangs, large ears, ascending skull and waist-length hair. Godlike, regal and demonic characters often have bulging eyes with narrow slits underneath through which the dancer can see out.

My joyful experience studying Balinese mask carving began as an academic pursuit with an American anthropologist, Elizabeth Young. We set out to videotape the mask dances and to record the artists' analyses of their theater. Then I met Ida Bagus Anom, a master carver, dancer and musician. We found a wonderful rapport, and although I had not worked wood before, I was delighted when he invited me to study the creation and use of Balinese masks.

He taught by means of the symmetric nature of the face. He would work on one half, then hand the mask to me to match the other side. At the beginning my work took ten times as long, with short, choppy strokes instead of the beautiful, forceful cuts of Anom. Gradually, though, I took less instruction by copying and became able to respond to the verbal mode: "A little more off the nose." As I learned to handle the tools, I was able to devote attention to the character and expression of the face. My calluses thickened and so did my endurance for sitting cross-legged five or six hours a day.

Balinese-style masks made by the author for actors to wear in a film include Little Red Riding Hood in pine, the Wolf in redwood, and Grandmother in spalted pine.

Carving is done seated on bamboo mats, the carver holding the wood with his feet, leaving both hands free for chisel and mallet. Bracing the wood against a fixed, heavy chopping block affords quick and subtle angle changes. Carving a mask begins with choosing a dried piece of *bulu* wood (similar to jelutong), light and soft but moderately strong and able to hold fine detail. A section of the trunk between 8 in. and 10 in. high is split in half upon the chopping block.

The rough dimensions of temple, forehead and jaw are pounded out with an iron hatchet, which also begins hollowing the eye sockets by forming two horizontal *V*-notches. The nose is blocked out in a rough triangle by taking wood away from the cheek and mouth areas; the first strokes are parallel to the plane of the nose, the secondary strokes perpendicular. This avoids pulling off too much wood. While one hand holds the wood at the proper angle, the other guides the hatchet straight down. These cuts come to within ½ in. to 1 in. of the final form.

It is necessary to hollow out most of the interior before finishing any facial features, because heavy pounding on the back could dent the front of the mask. The gouges bring the thickness down to ¾ in., the carver checking continually for symmetry and avoiding irreversible thinness. Awareness of grain direction has to be maintained throughout, for a wrong move can break the mask in two. Such disasters are glued back together; the final painting hides the crack.

The carver begins to refine the facial features with a set of nine gouges and six chisels, hand-forged and without handles, driven by one of three different-sized ironwood mallets. The forehead is smoothed, the temples narrowed, the eye

Photos: Katherine Higgins

sockets deepened, the cheeks planed, the nose and mouth curves started and the jaw-line defined. The carver constantly changes tools to suit the curves. Because the metal is soft, the tools can easily acquire a very sharp edge, but they need frequent regrinding on curved stones.

Learning the nature of the cylindrical wood grain is the key to clean cuts with the hatchet, chisel and knives. The general rule is, always to move toward the center rings, using the inner layers to support the wood being cut. Changes in cutting direction usually occur around the nostrils and cheeks, where a line or curve flows toward the center and then away.

The knives used for detailing are of two basic shapes: the *pissau*, with flat sides and sharpened along a 1½-in. curved edge, and the *pungut*, a symmetrical, upward-curving blade coming to a point and sharpened on both edges. The *pissau* smooths and defines convexities—forehead, cheeks, nose—and produces sharp, incised lines by making parallel strokes at various angles to the face—nostrils, lips, wrinkles. The *pungut* creates and smooths concavities and recesses—eye sockets, under the lower lip, inside the mask. Both types and all sizes of knives are positioned with both hands. One hand grabs the wooden handle and iron stem, with thumb pointing toward the tip, while the other grips the mask in such a way that its thumb can press against the knife as a pivot. Thick calluses develop on both thumbs. The carver sits cross-legged and cradles the mask against his thighs. The knives are both pulled toward the body and pushed away—both strokes are necessary to cut toward the inner rings. Anom, my teacher, would peel off wood curls like skin from an apple.

The finished carving is then rough-sanded for the long process of traditional painting. Paint-making starts with fire-dried and pulverized pig bones, ground in water to a smooth paste. An imported Chinese glue, in the form of brittle, translucent rectangles, is blended in, along with pigment from a rock, lamp soot or commercial acrylic. When it is the right color, water is added and the heavier particles allowed to settle in the grinding plate. This pasty sediment is used to fill any holes or cracks. The thin paint is then applied and the mask set in the sun to dry. Between 20 and 40 coats are brushed on before the details of eyes, nose and mouth can be added. Finally, five coats of clear glue give a lacquered appearance and a protective finish.

The mask may be further embellished by the addition of goat hair for eyebrows and mustache, the hide held in place by small wood spikes. An elastic band through holes at eye level holds the mask on. Now it's ready for its ceremonial debut in the village festival, or for sale to a tourist.

Since studying with Anom, I have continued carving masks in Oregon, using seasoned driftwoods (pine, cedar and redwood). I am also a dancer, filmmaker and musician, and have created a Balinese-Oregon film version of Little Red Riding Hood. The characters' masks are carved in time-lapse photography. Actors don the masks and mime the story in the Oregon forest, each accompanied by a different woodwind instrument. For more information, write me at Box 711, Stinson Beach, Calif. 94970. □

Photo, top right: an array of Balinese woodcarving tools—nine gouges, three pungut *knives, two* pissau *knives and five straight chisels. The next photos show these tools as traditionally used. Mallet-driven flat chisel shapes forehead of Grandmother mask-to-be, while feet hold wood against chopping block. Fine features emerge as* pungut *hollows eye socket, and* pissau *incises wrinkles in forehead.*

Alpine Peasant Furniture

Carved designs embellish sturdy construction

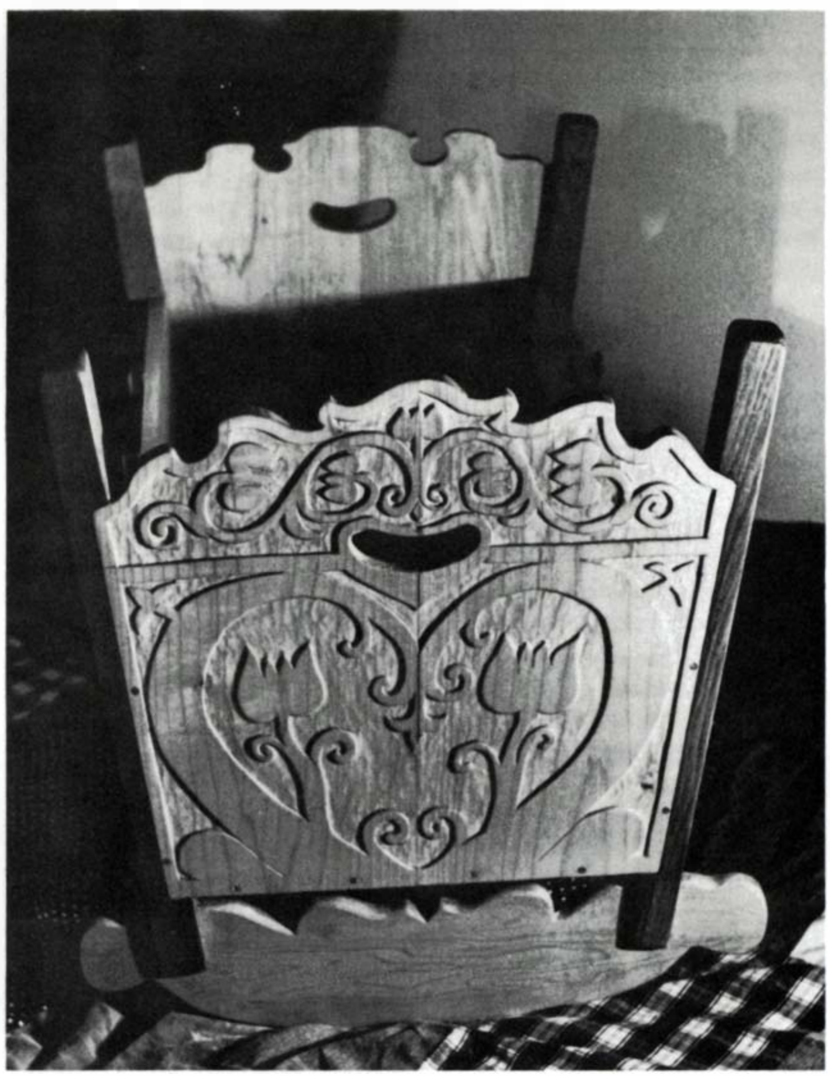
by Christoph Buchler

From the late Middle Ages to the 19th century, peasants in the remote Alpine regions of Europe fashioned themselves whatever furniture they needed—a simple table, a bench, one or two trunks for storage. Most villages, however, had carpenters, and there was no need for the peasants living there to build their own furniture. Peasants in the fertile plains were wealthier than those in the mountains and could afford to pay a carpenter. The term "peasant furniture" has come to mean furniture made both by peasants and for peasants. It generally refers to trunks, beds, wardrobes, tables, benches and chairs. Basic patterns recur, but their construction and style vary widely with regional fashions and tastes.

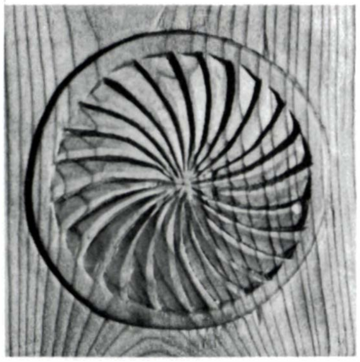
Ornamental designs — The most prominent characteristic of European peasant furniture is abundant and intricate decoration. Painted or carved geometric, floral, animal, religious and representational motifs abound. The most primitive form of carving was scratching the surface of the wood with some sort of pointed tool, such as a nail. It seems that this technique was also used to lay out the design and that, in some cases, the laid-out design was never carved.

Chip-carving (*FWW* #19, Nov. '79) is a more sophisticated technique, widely used for the early geometric designs, which originated in old Germanic pagan beliefs. The most common symbol was the sixstar. Its construction was simple, and all one needed was a compass, which could be a piece of string with a nail on either end. The sixstar was thought to be a symbol of life. It was originally a letter in the Runic alphabet, known as the hagalrune, and expressed the beginning of life. This symbol could also be elaborated into the sevenstar—a

Photos: Christoph Buchler



Carvings on wall cabinet, top left, include sevenstar on door and floral and Gothic-style hanging-curtain patterns on face frame. Peasant-style cradle made by Buchler, right and bottom left, sports free-flowing floral designs on ends and more abstract daisy and rose patterns on sides.



beautiful arrangement of seven sixstars.

A related symbol is the sunwheel, left, another simple compass construction. The sun played an important part in the peasants' life, and was thought of as a source of life. The signs used to represent the sun were all variations of the sunwheel.

Sunwheels and sixstars were thought to bring good luck. Other signs were thought to ban the entry of evil spirits. Many of these were in the shape of an endless knot, and the best known is probably the pentangle, a five-pointed star. Geometric signs and symbols were either arranged to form one big design or strewn over the surface of a piece of furniture. Often the peasants themselves carved the symbols, and they added on whenever they felt the need.

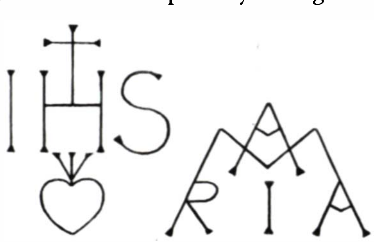
Reproducing floral patterns required a different technique—flat relief. To heighten the effect, the low areas were commonly blackened with a soot mixture. In the heyday of peasant furniture, in the late 18th to early 19th century, full relief carving embellished special representative pieces.

It appears that the discovery of floral design took the lid off the creators' imaginations—the restrictions and limitations of geometric designs were supplanted by the virtually endless flow of stems, leaves and blossoms. Craftsmen did not try to copy the natural model in all its delicate details. It was the symmetry and richness in nature's formations they were after. Grape and pumpkin vines were a favorite for decorating furniture frames.

Carving panels was different. The ornament had to be centered, and the center had to be low because otherwise the ornament looked top-heavy. Balance could be achieved simply by putting the plants into a flowerpot or vase. From this solid base a network of blossoms, leaves and stems could spread over the surface of the panel without seeming uncontrolled. Especially in these flower-pot arrangements, one can see how little attention these carvers paid to the logic and laws of nature. Out of the same stem they let three or more different flowers bloom. Sometimes one blossom "grows" out of the center of another blossom.

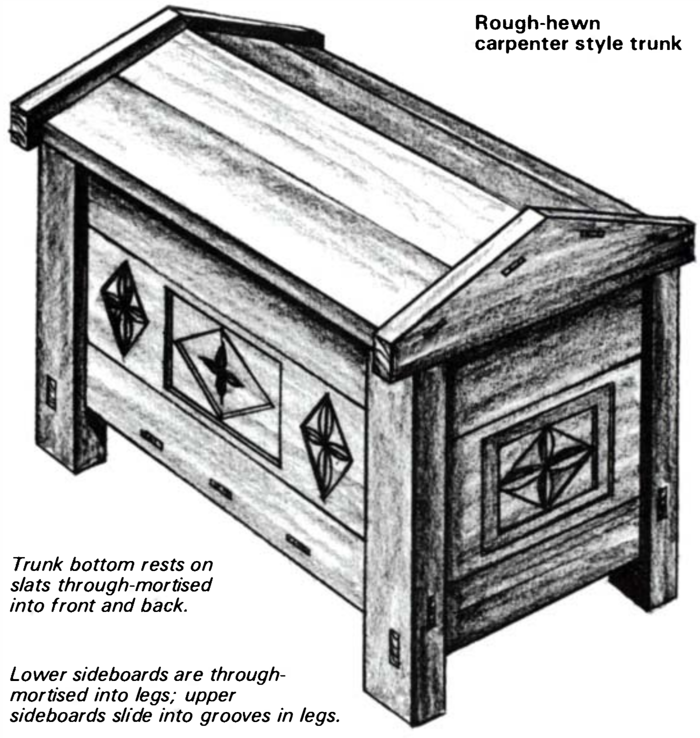
Along with floral designs we find animals. All the animals connected with the life of the peasants were represented. Without doubt, however, images of birds were most common, and the most commonly pictured bird was the eagle. On peasant furniture one finds both one-headed and two-headed eagles. Many abstract patterns can be traced back to the eagle image.

A fourth category of ornamentation encompasses themes connected with the life of Jesus Christ. Especially in regions that were strictly Catholic, such as Bavaria and Austria, the letters of the words Jesus and Maria were turned into symbolic images that resemble the early geometric signs. There one can see how the old pagan attitudes find



Jesus and Maria symbols resemble pagan geometric signs.

Rough-hewn carpenter style trunk



expression even through the mantle of the Christian creed.

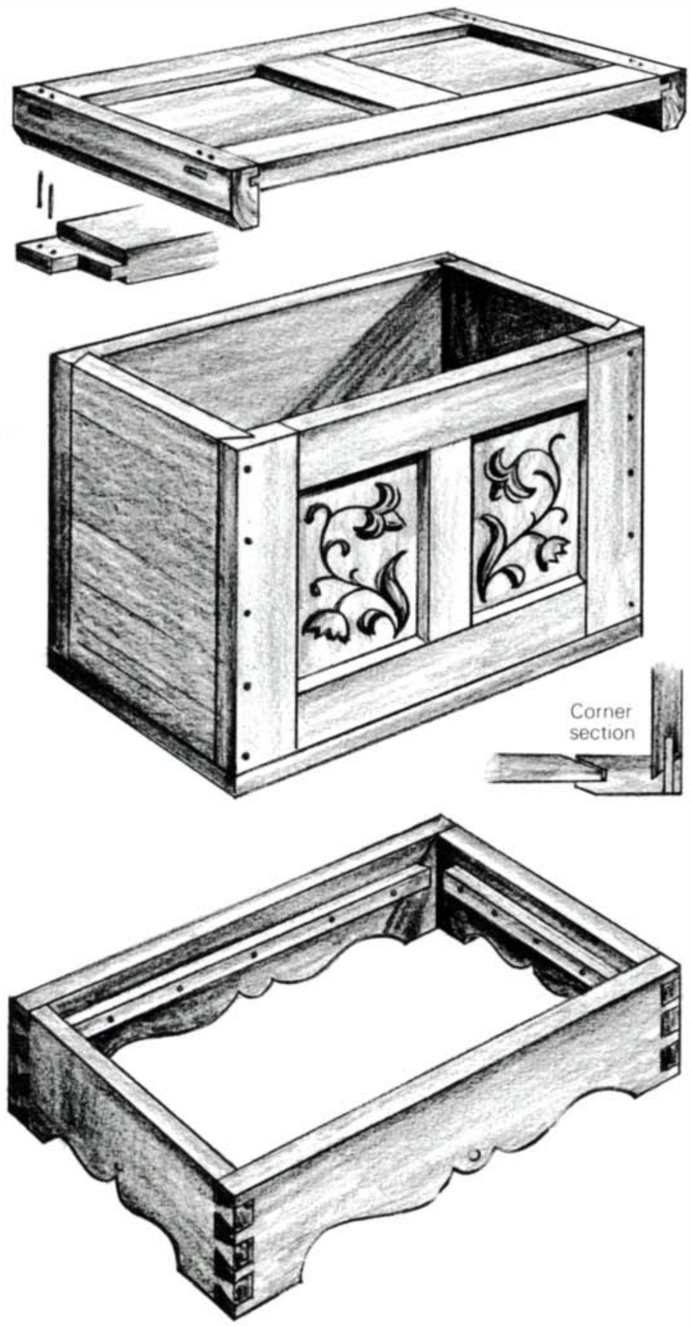
Another motif was the representation of the human figure. Here again peasant life is reflected in the subjects. One finds scenes of a plow team and the harvest—or tradesmen like the cobbler or the joiner. These themes required great carving skill and therefore were not as common as geometric, floral and animal designs.

Construction — A carpenter built furniture differently from a joiner, whose trade evolved later. The carpenter's techniques of construction were similar to those used in framing a house or paneling a room. This is evident in the most common piece of peasant furniture: the trunk. The carpenter started out with four pieces that formed the legs. About 8 in. off the ground he fitted the bottom sideboards into the legs with mortise and tenon joints. The rest of the side boards were then inserted in grooves in the legs. The bottom sat on a pair of slats mortised into the front and back. The lids were shaped like the roof of a house. Because these boards were split from the trunk of a tree and then hewn flat, the furniture was heavy and looked rather coarse.

Sawmills began to flourish around 1400 and so did the carpenter who specialized in furniture. The joiner's trade was established. Sawn boards brought advantages: They enabled the joiner to build much lighter furniture and opened new construction possibilities. The trunk, for example, evolved from the model described above to the *Seitenstollentruhe* (sideboard trunk). Here the sides extended to the ground and served as legs. Front and back were butt-joined and pinned onto the sides. The bottom was mortised into the sides and butt-joined to the front and the back. The wooden pins that reinforced all the joints were inserted at opposing angles, keeping the joints from coming apart.

A further development was frame-and-panel construction, which became the most common. The joiners could now build sturdy, durable and relatively lightweight furniture, which also gave the most opportunities for decoration.

Because trunks were used for a wide range of purposes,



Three-part frame-and-panel trunk construction

their size varies greatly. I have seen examples that measure from 8 in. high by 16 in. wide by 7½ in. deep to 40 in. high by 70 in. wide by 28 in. deep. All kinds of household items were kept in the smaller ones, and folded clothing was stored in the larger ones. The broad surfaces of such a trunk offered ample opportunity for richly carved decoration.

A typical frame-and-panel trunk is built in three parts. The largest part is the carcase, and the other two are the lid and the base. The carcase consists of four sides, joined with what may be called a half dovetail, as shown in the drawing above. Its effect is similar to a tongue in a groove. Wooden pins inserted at opposing angles secure the front and the back to the sides. The front is made of frames and panels—the number of panels depends on the size of the trunk. The rails and stiles are grooved on the inside to receive the panels, with room for the panel to expand and contract across the grain, which runs vertically. The panels are rabbeted on the face side and planed on the back to taper to a snug fit in the groove. The sides can be made the same way, but the back is generally made from solid wood. The sides are often made from solid wood, too. In that case, the grain of the wood runs horizontally to give the carcase strength. The bottom of the trunk is butt-joined to the carcase sides with glue and wooden pins. Cracked bottoms are common.

The construction of the lid is similar to that of the front. The lid usually consists of two panels (if the trunk is small, one panel is enough). Usually the frame support between the two panels is rather wide (about a quarter the width of a panel) to add strength. The side members of the frame extend down over the sides of the case. The thickness of these pieces prevents the lid from warping.

The purpose of the base is to keep the body off the floor and to prevent moisture from seeping in, which would start rot in the bottom and, even worse, would destroy the goods stored inside. The base consists of four boards joined with dovetails. The middle parts of the sides are cut out to permit air to circulate under the chest. A strip of wood about 2 in. wide is glued and pinned into the base about 2 in. below the top on the inside. The case rests on this ledge.

Another kind of construction typical in trunks made after 1600 is the common six-board, dovetailed chest, but with framing arches applied to the sides to create the effect of frame-and-panel construction. Carving, painting and applied pictures decorate the areas between the arches; the arches themselves were molded with architectural motifs.

If the trunk is to be decorated with carving on the panels and the framework, the carving has to be done before assembly. Although I work out the ornaments while I carve them (I do start out with a rough draft), it would be helpful for people who aren't familiar with this kind of ornamentation to work out the complete arrangement beforehand.

I work with hand tools. I feel that a sincerity towards the trade as well as towards the wood is necessary to build furniture true to the spirit of the material it is made of. This sincerity is rewarded in the end by a feeling of pride in one's work. To construct a trunk I use a bowsaw, a panel saw set for ripping and a backsaw. I also have a number of planes (plow, rabbet, smoothing) and a few chisels. Carving the traditional ornaments requires gouges, veiners, carving chisels and various molding planes.

The last step is finishing. I use only raw linseed oil and beeswax, except on pieces that come into contact with food. There I use mineral oil. The workers I draw my knowledge from and those who worked a hundred or more years ago used only linseed oil, and their furniture is still around and sometimes even still in use.

The growth of furniture factories in the 19th century halted the development of peasant furniture. The imagination of a single person no longer gave the ornaments individuality and liveliness. In the factories, pieces were designed by a person trained to do only that. Because most factories were located in large towns, the furniture they produced was designed for the tastes of the townspeople. With the rise of the bourgeoisie, peasant furniture was soon looked down upon. In the beginning of this century, and today, it is admired as the artistic expression of a bygone way of life. □

Christoph Buchler, of Talent, Ore., learned about hand tools and peasant furniture while living in the German-Austrian Alps nine years ago.

Two Easy Pieces
A frame chair and a sofa

by Simon Watts

This chair and sofa are two variations on one simple theme: a wood frame spanned by tensioned canvas that supports loose cushions. The canvas is kept taut by nylon lacing running through brass grommets. Both pieces are light, easy to make and economical.

I designed the chair as a practice project for apprentices in their first six weeks of training. It teaches the mortise and tenon as well as bridle joints, and it can be made from a drawing with minimum supervision. Since little material is involved, a poorly cut joint could be made over again without either the student or myself feeling badly about the waste.

Later I used the same basic design for a small sofa and then for a larger one. The former succeeded but the latter was a failure. Although amply strong to support three adults, it *looked* weak because the end frames were too far apart. The only structural difference between the sofa and the chair is in the thickness of stock—1⅜ in. instead of 1¼ in.—this is as much for the sake of proportion as for strength.

Sofas are bulky and awkward to move so I also made a knockdown version by substituting loose wedges for the glued mortise-and-tenon joints. This detail is shown at *B* in the drawing and can be used for either piece.

This design can be made in any straight-grained hardwood. Before deciding on the wood, consider how it will look against both the canvas and the fabric chosen for the cushion covers. I like a black canvas because it doesn't show dirt, goes with any wood (except walnut) and looks well with brass grommets and white lacing.

Construction — Starting with 6/4 stock, cut out the pieces for the end frames and rails. You will need two pieces 24 in. long, four pieces 22 in., six pieces 32 in., and three pieces for the long rails: 35 in. for the chair and 59 in. for the sofa. If you are making the knockdown version, be sure to add 3 in. extra to two of the long rails to make room for the mortises and wedges. Plane all these pieces down to 1⅜ in. if making the sofa, 1¼ in. for the chair.

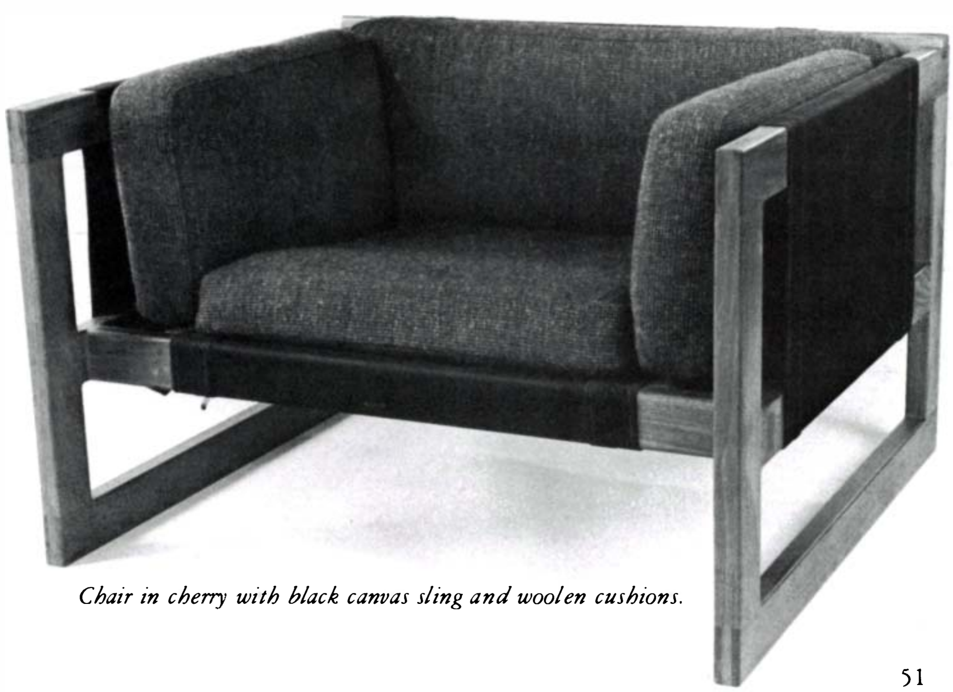
The next step is to join up the end frames by bridle joints at each corner. Bridle joints are best cut on the table saw; a carbide blade helps ensure accuracy and smoothness. If I were making this chair by hand, I would use a different joint, a mitered dovetail, because I don't like to do things by hand that are better done by machine and vice-versa. I'll describe how to make the bridle joint first, then the mitered dovetail.

After cutting the pieces to exact length, set a marking gauge to the width of the stock plus 1/16 in. Mark out one of the pairs to be joined on all four surfaces of each piece. If you are using a table saw, there is no need to mark more than one pair because saw and fence settings will take care of the rest. Usual practice is to make the tenon two-fifths of the thickness of the stock—about ½ in. for 5/4 stock.

Holding the stock vertically, saw the tenons first. For this operation I screw a wooden fence 8 in. high to the standard metal one. This gives more support and greater accuracy. The saw should be set a bare ⅛ in. lower than the gauge marks. Then, with a miter gauge accurately set at 90°, saw the shoulders. If you set the blade down so the waste is not quite sawn through, it will not come whistling back in your face. The remaining wood is easily cleaned up with a chisel or a shoulder rabbet plane. If you don't have a good enough blade for finish cuts, mark all the shoulders with a knife, saw 1/16 in. on the waste side and then chisel to the line. The shoulder must be left square, not undercut, because it shows.

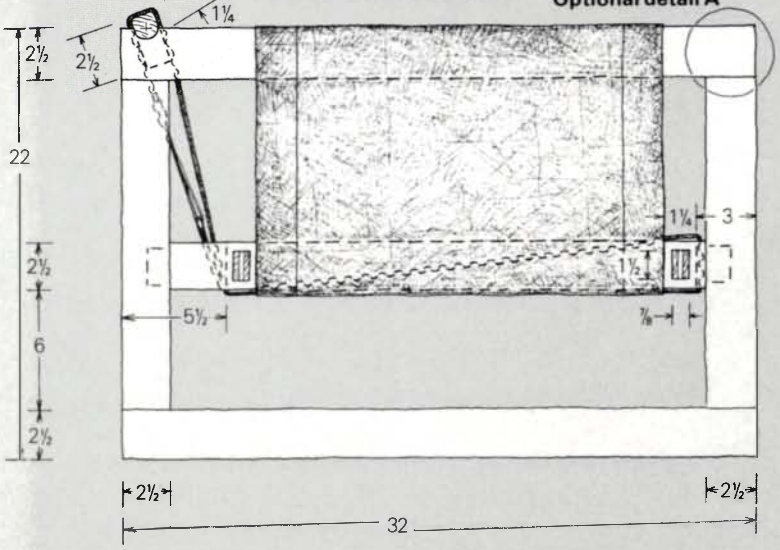
Next saw the mortises, vertically, in the same way. They should fit the tenons snugly without any forcing. Remove the waste by drilling a single hole (halfway from each side) or with a coping saw. With a chisel, clean up the end grain to the gauge mark on the inside of the mortise.

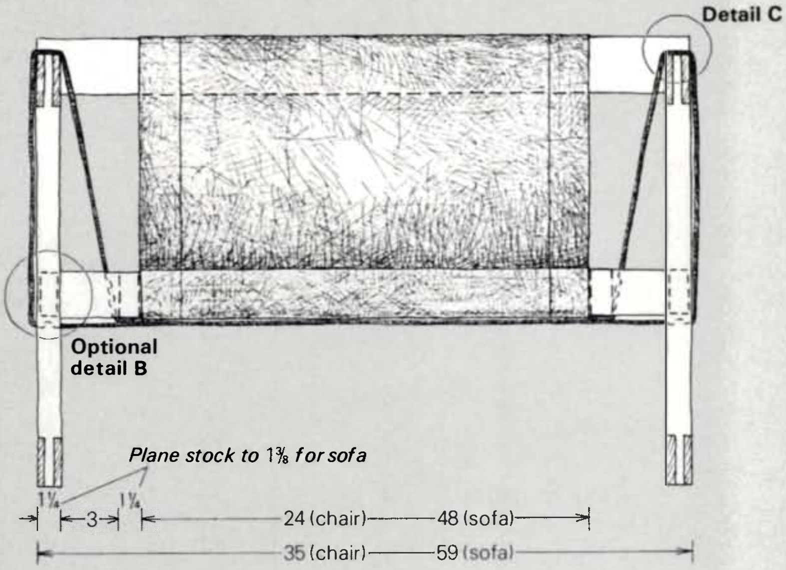
The mitered dovetail, the handmade alternative, is a one-pin affair that does the job of a bridle joint, only more elegantly. Begin by marking all four surfaces of each pair to be joined (dotted lines in the drawing at *A*). Mark out the miter lines on each side of both pieces with a knife, but do not saw them yet. Next, mark out the space for the tail on the horizontal piece *(a)* as shown. This can be sawn either on a table saw, with the blade angled, or by hand using a tenon saw. Cut out the waste with a coping saw and chisel to the line *y-y*



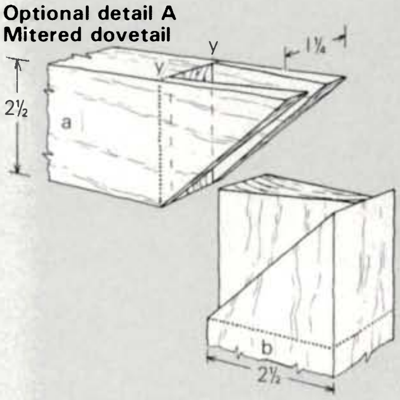
Chair in cherry with black canvas sling and woolen cushions.

Frame chair and sofa

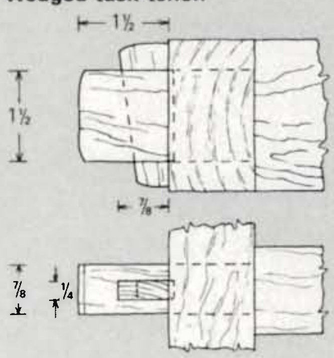


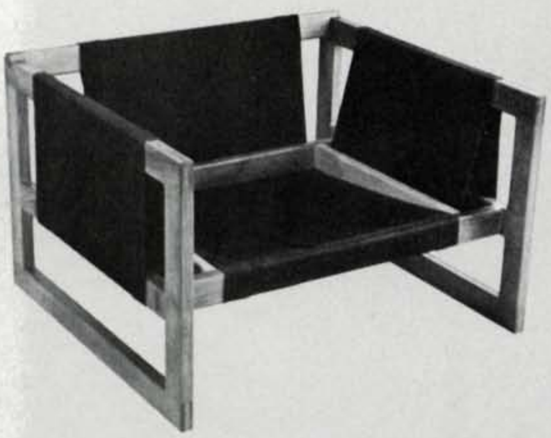


Optional detail A
Mitered dovetail

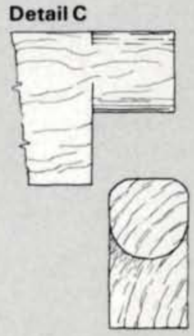


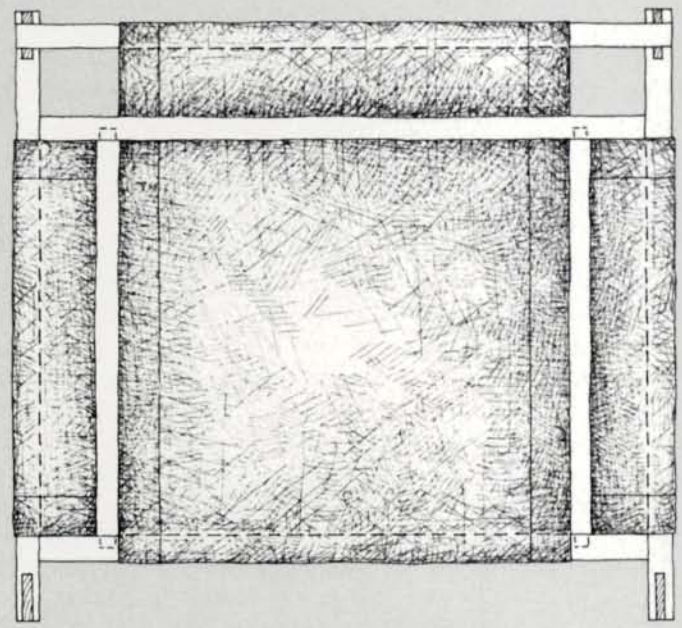
Optional detail B
Wedged tusk tenon



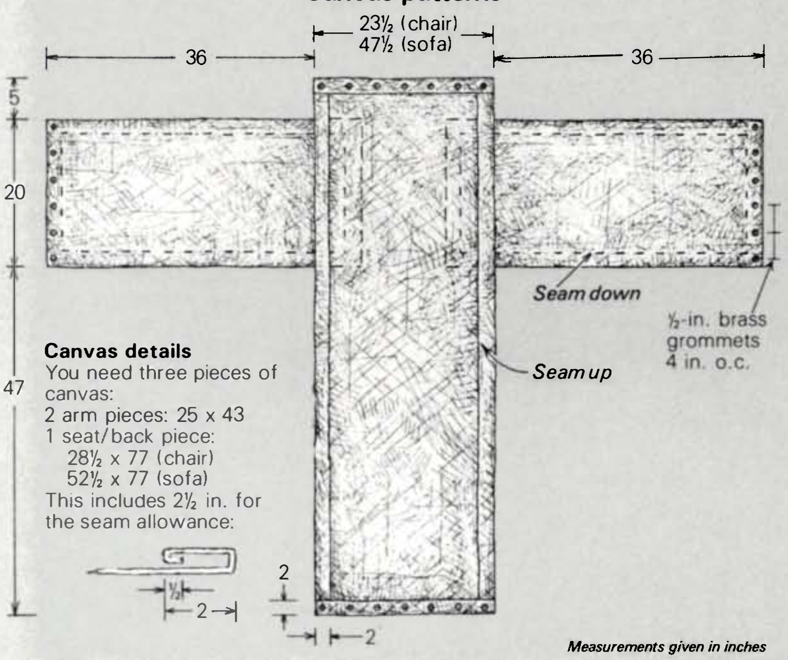


Detail C





Canvas patterns

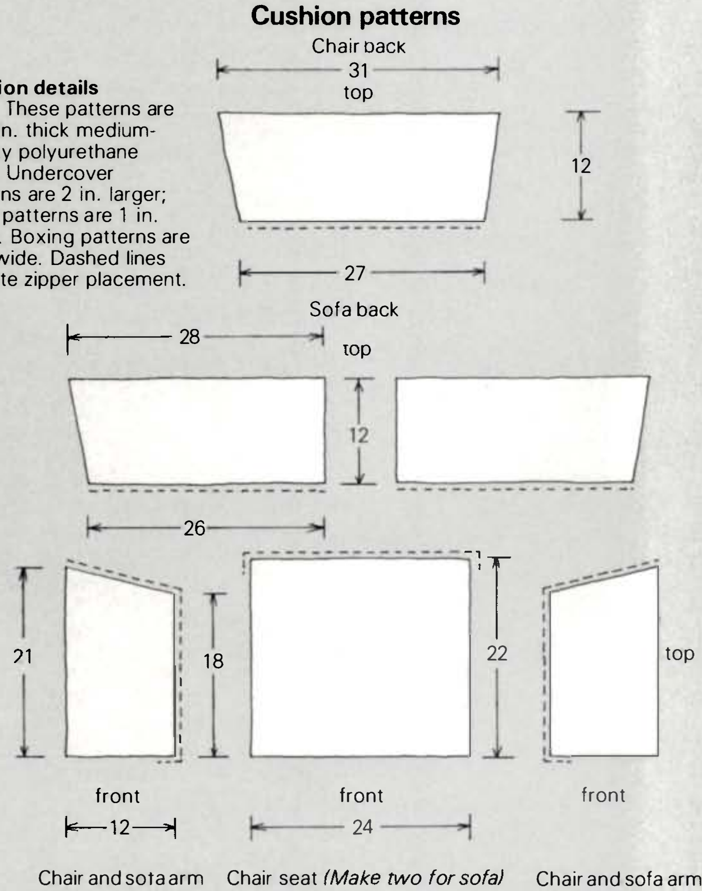


Canvas details
You need three pieces of canvas:
2 arm pieces: 25 x 43
1 seat/back piece:
28½ x 77 (chair)
52½ x 77 (sofa)
This includes 2½ in. for the seam allowance:

Measurements given in inches

Cushion patterns

Cushion details
Note: These patterns are for 4-in. thick medium-density polyurethane foam. Undercover patterns are 2 in. larger; cover patterns are 1 in. larger. Boxing patterns are 4 in. wide. Dashed lines indicate zipper placement.



working from both sides. Lay piece *a* firmly on the end of *b* and mark the pin with a scribe or thin-bladed knife. Mark out the other limits of the pin and saw the cheeks. Remember to stop the sawcut when close to the miter line.

The last step is to saw the miters on both pieces and trial-fit the joint. You should saw the miters a little to the waste side of the line, push the joint together and then run a fine saw into the joint, on both sides, until the miter closes.

With the joints in the side members cut, the middle rail is next mortised into the two verticals and then all five frame pieces can be assembled and glued up. When gluing a bridle joint, be sure to put clamping pressure (protecting the work with pads) on the sides of the joint until the glue has set. When gluing a mitered dovetail, put glue on the miters as well as on the pin and tail. Clamp lightly across the cheeks of the tail. Check with a square. After the glue has set (but before it is bone hard) flush off the surfaces with a sharp plane.

Next, cut the through mortises for the two long rails. Mark accurately on both sides with a knife, drill out the waste, then chisel to the knife mark. The semicircular cutouts are best done by clamping the top edges of the two frames together and drilling a single 1¼-in. hole. Remember to use a backing piece to prevent splintering.

The edges of the frames and rails must be rounded over. If they are left sharp, the canvas will eventually wear through on the corners. I use a router with a carbide rounding-over bit fitted with a ball-bearing pilot. It can also be done by hand, with a wood file and sandpaper. All the edges are treated in the same way except where two horizontal rail meet. Here they are left square.

Next, the four pieces of the underframe are cut and joined. The short pieces are stub-tenoned into the long rails because a through mortise would weaken the structure. This assembly is then attached to the end frames using either a glued-and-wedged mortise-and-tenon joint or, for the knockdown alternative, a through mortise and loose wedge. In both cases the wedge is vertical, at right angles to the grain.

When making a tapered mortise *(FWW #16, May '79, p. 46)*, it is best to make the wedges first. Lay a wedge on the outside of the tenon and mark the slope with a pencil. Then, with a mortise gauge and a knife, mark the two mortise openings top and bottom. Most of the waste can be drilled out (working from both ends) and the remainder cleaned out with a chisel. I always leave the wedges 1 in. overlong so when they are tapped home they can be marked, then removed for trimming. The top of the wedge should project slightly more than the bottom. In time they invariably get driven lower.

The top rail, at the back of the chair, is not fastened but is held in place by the tension of the canvas. It is rounded on the upper side and fits loosely into the half-rounds in each frame. Its two ends are best sawn out square and then shaped with a rasp or wood file.


Back and underside.

Canvas — The canvas is wrapped around the completed frame and laced across the back and under the seat. You will need 45 ft. of ¼-in. lacing, double for the sofa, which must be of nylon or the equivalent. Don't use clothesline or sash cord. I use an 18-oz. treated chair duck, which is a rather heavy material for a domestic sewing machine, and you may want to have the canvas made by a tent and awning manufacturer, a sailmaker or an upholsterer. The 2-in. seams are sewn with the edge turned under ½ in. They must be made exactly as in the drawings so only the smooth side of the seam shows. The brass eyelets, or grommets, are easy to put in yourself. You need about three dozen ½-in. grommets (five dozen for the sofa) and a ½-in. punch-and-die-set.

Cushions — To make the cushions you need a piece of medium-density polyurethane foam 4 in. thick, 1-in. Dacron wrapping, medium-weight unbleached muslin, a 26-in. zipper for each cushion, and fabric for the outside covers.

First make a full-size pattern of each different shape of cushion in heavy, brown wrapping paper. Transfer the patterns to the foam using a soft pencil or blue chalk. If you don't have a band saw, the easiest way to cut polyurethane is with a fine panel saw or hacksaw. An electric carving knife will work, too. Support the foam on the edge of a piece of plywood, saw with light strokes along the lines, and keep the plane of the saw vertical.

The Dacron batting gives the cushions some extra bulk and makes them less hard—both on the seat and on the eye. They are padded a little more on one side than on the other as follows: Using the same patterns, cut out with scissors one piece of batting for each cushion. Lay this on the side of the foam, which, when in place, will be ***toward*** a person sitting in the chair (away from the canvas). Next wrap each cushion, including the ends, once around with the batting. You may want to keep this in place with a spray glue (foam or fabric adhesive) while making the muslin undercovers. To cover the ends of the foam, either cut the batting over-wide and fold it over the ends, like wrapping a parcel, or cut separate pieces of batting and spray-glue them in place.

Undercovers — Muslin undercovers are essential. Without them it is practically impossible to remove and replace the outer, or slip, covers, for cleaning. Inner and outer covers are made in the same way: two panels joined by a strip (called *boxing)* that runs around the edge of the cushion.

Lay the original patterns on a piece of newspaper and then, with a felt pen, draw a line around them. Draw another line ½ in. outside the patterns and a third one ½ in. outside that. Cut around the outside line. Using these new patterns, cut out two pieces of muslin for each cushion. Next, cut the boxings, strips 4 in. wide and a little longer than the perimeter of the cushion. They don't have to be one piece.

If you are an old hand with a sewing machine, machine-stitch the covers directly, sewing ½ in. in from the edge of the material (the middle line of your pattern). This is best done by putting a piece of tape as a guide on your sewing machine ½ in. from the needle. Sewing the boxing to one panel all the way around and then, starting from one corner, sew the other panel. If you are a novice, pin or hand-stitch (baste) the covers before machining. Leaving one long edge unsewn, turn the covers inside out and insert the wrapped foam. The loose edge is turned under and blind-hemstitched by hand.

Fabric — As in choosing a wood, certain criteria apply when picking fabric for the outer covers. Leaving aside matters of color and pattern, you must choose a fabric that is strong enough. It must not stretch in use—which means a tight weave—or shrink when washed, or wear too quickly. Think of the climate, too. Wool is fine in Vermont, but it would be a poor choice for the heat and humidity of a Washington summer, where linen or heavy cotton would be preferable. Remember that light colors need cleaning more often, blues fade in bright sunlight, and some synthetics not only can melt but are flammable. The chair will require 5 yd. of 30-in. to 36-in. material, the sofa 8 yd. If you use 48-in. or 54-in. material, the chair will require 4 yd. of material, the sofa 6 yd. The undercovers will require roughly the same amount of muslin. Make sure the material is preshrunk. If it is not, you must wash it once to shrink it. Ironing makes the sewing easier.

Outer covers — Taking the same newspaper patterns that were used for the muslin covers, cut ½ in. off the perimeter (to the middle line) all the way around. Then pin the patterns to the fabric and cut out the panels as before, together with enough 4-in. strips for the boxing. The innermost line on the pattern is now the one to sew on.

The alert reader will notice that the muslin-covered cushions are ½ in. bigger than the outer covers. Like putting a sausage in its skin, this helps keep the outer covers tight and free from wrinkles. Wrinkles in the muslin will not show through—the muslin is too thin.

The inner and outer covers are made exactly the same way, the only complication being the zipper. This must be put where it won't show, and the best placement is indicated on the drawing. To install the zipper, take a piece of boxing 1 in. longer than the zipper and fold it in half lengthwise, making a crease. If it won't stay creased, iron it. Lay the zipper down on the crease so that the zipper teeth are just level with the folded edge of the boxing. Pin or tack it in place and then stitch it using the zipper foot of your sewing machine. Now take another piece of 4-in. boxing, crease it lengthwise, and stitch it to the other side of the zipper. You should now have a 4-in. strip of boxing, double thickness, with a zipper running neatly up the middle.

When sewing this piece of boxing to the side panels, remember to face the zipper *in*. Then, when the cover is turned inside out, it will be on the right side. A professional upholsterer covers the two ends of the zipper by overlapping the adjacent boxing. Or you can simply join it with a neat seam.

It is a good policy to sew the seams twice, once along a line ½ in. from the edge and again as near to the edge as you can manage. This prevents the material from unraveling at the seam if it is roughly laundered.

This chair and sofa have never been made in quantity but the design could easily be adapted for production by machine. This is because there is no hand-shaping, boards do not have to be selected for color and grain, and most of the joints can be cut by machine. The design could be further simplified by using only one thickness of stock (1⅜ in.), which would cut the number of separate parts in half. Bridle joints lend themselves to machine production but I would replace the mortise-and-tenon joints with stub mortises using allen-head machine screws and *T*-nuts. The whole piece could then be shipped knocked down and easily reassembled. The canvases could be made in quantity and enclosed with plenty of lacing and suitable instructions in several languages.

Perhaps someone would like to take this up? □

Cowhide for Chairs

One skin seats six or seven

by Jim Richey

In the old Texas tradition, R. W. Fiedler covers his chair seats with cowhide. Recently, he cleared a spot on the floor at the back of his feed and hardware store in Bon Wier, Texas, and demonstrated the craft he has been practicing for about 25 years. If he hadn't been interrupted to help an occasional customer or to light up an ever-present hand-rolled cigarette, he would have finished a seat every ten minutes or so.

Fiedler covers simple slat-back post-and-rung chairs that he buys unfinished from a small factory in Athens, Texas. "Strictly functional" is the best way to describe them. The chairs are made by installing dried rungs in green ash posts that gradually shrink, locking the chair into a solid, tight unit. Curved "ladderback" slats are pinned into mortises in the rear posts.

Cowhide is almost ideal for chair seats: inexpensive, easy to install, tough, and it "sits" better than wood. I will leave the question of its aesthetics to others. Properly cured cowhide is durable and outlasts rush and cane, the usual materials. In cattle country, it is also abundant: Green hides may be obtained from practically any slaughterhouse. The hide should be fresh and not salted, preserved or prepared in any way. Prices vary considerably, but $35 to $50 is typical. At a large slaughterhouse you can choose colors ranging from light grey to reddish-brown to black with mottled patterns of white. Winter hides have longer, thicker hair than summer hides.

Before cowhide can be used for chair seats, it must be cured. Cured cowhide dries into a sinewy, stiff leather called rawhide. The procedure is simple but, as Fiedler puts it, "messy and smelly." Cleaning the hide, which involves scraping away any remaining flesh and fat, is for the strong of stomach. Fiedler drapes the hide over a log or a fence rail and uses a curved skinning knife. The process takes about 30 minutes. He then uses Borax to cure the hide. He throws a couple of handfuls of the powder into a tub of water, immerses the hide for about 10 minutes and sloshes it around. After removing the hide, he lays it out flat and sprinkles a generous layer of Borax on the flesh side, rubbing it in. He then hangs the hide in a dry place to "work." After a couple of days the hide will have started to dry, but will still be limber. At this point it's ready for chair seats. A caution—don't let the hide dry out completely. If it can't be used, store it in a freezer, then thaw it out when ready. After the hide has been installed on the chair and is completely dry, you can remove excess Borax with a brush or vacuum. The Borax treatment only preserves the hide; it does not tan it. The hide won't end up soft and flexible like boot leather.

Before starting the seats, Fiedler cuts a length of lacing thong. First he trims away the jagged edges and sharp points of the hide, so it is relatively even. Then he slices a contin-

Jim Richey, of Ponca City, Okla., is Methods of Work editor of Fine Woodworking *magazine.*

uous ½-in. wide strip three times around the whole perimeter of the hide—enough lacing for the six or seven seats that can be made from a single hide.

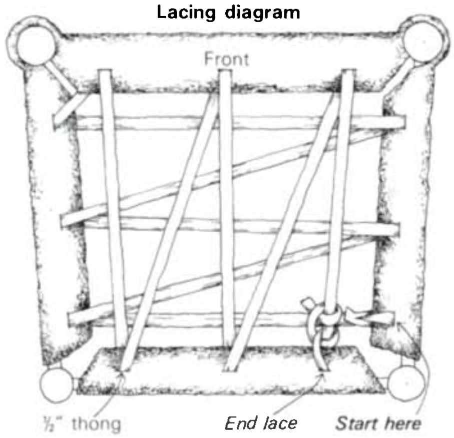
To fit the seat, Fiedler throws the hide over the chair seat, adjusting it until he has a pleasing pattern and at least a 4-in. overhang on all sides. Then he cuts small holes for the front posts, enlarging them little by little until the hide slides into position on the seat. He then cuts the seat away from the hide, leaving an overhang on the front and sides, and a larger overhang at the back. The hide shrinks as it dries, so a 3-in. to 4-in. overhang is a safe minimum. Fiedler leaves the hide intact around the front posts, in about an inch-wide strip. This simplifies the fitting by providing a reference point. He notches the hide to fit it around the back posts.

The hide is fastened to the chair seat by lacing it in place from the bottom with the thong. Fiedler uses three laces per side. He cuts lacing slots in the overhang about 1 in. from the edge of the hide. They are parallel to the edge and about ½ in. long. Fiedler cuts the front and side slots first, saving the back for later. The length of thong needed can be determined by wrapping the thong around the seat as many times as there are lacing holes on one side. Fiedler starts lacing by cutting a small slot near the end of the thong for a slip knot. He fastens the thong to one of the back side slots with a slip knot and then laces back and forth in opposing holes, like lacing shoes, until the sides are completed.

The back of the seat is then trimmed for the correct overhang, and lacing slots are cut. Passing the thong through the nearest slot in the front, Fiedler continues to lace until front and back are tight and completely laced. After taking up any slack in the thong, Fiedler ties it to the last lace slot with a loose double half-hitch. The whole process of fitting and lacing the hide goes faster than it takes to tell about it. A couple of weeks later, after the seat has completely dried, Fiedler unties the thong, takes up any slack and reties it permanently to the last lacing slot.

Rawhide must have many other uses besides chair seats, but I can't think of many for hide with the hair on. However, if the hide is cut into thin strips and rubbed against a nail to remove the hair, it makes excellent shoelaces. □

Lacing diagram



From cured hide to durable seat: a lacing thong is cut from the hide in a continuous half-inch strip (top center). The seat is positioned by fitting the hide around the front posts (top right), then it's laced from side to side (left) and trimmed around the back posts (above). Lacing continues from front to back until the seat is tight.

Alternative Wood-Drying Technologies

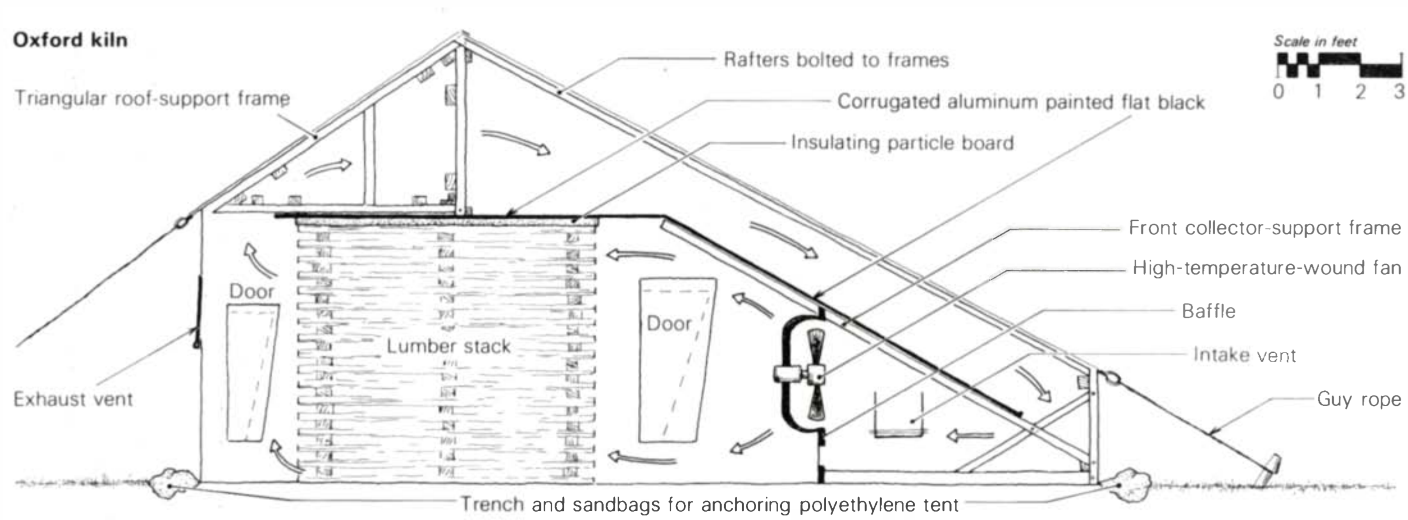
Solar energy and dehumidification

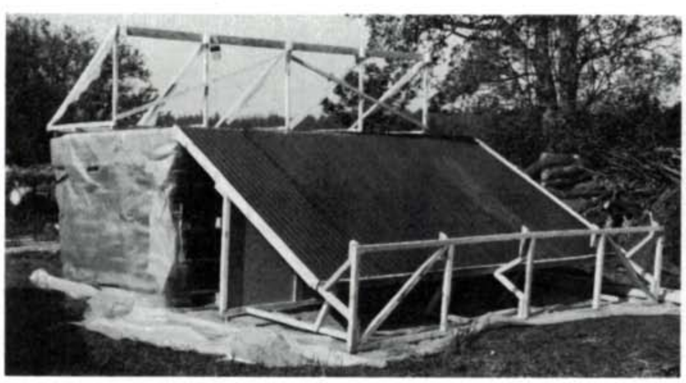
Two-thirds of the energy used to manufacture lumber goes into drying it. Burning mill residue supplies only part of the energy used by conventional kilns; most of it is fossil fuel and electrical energy. In the United States, we use more than 10^{13} BTUs of fuel each year to dry lumber. Energy-efficient solar and dehumidifier kilns are important alternatives both to industry and to the individual woodworker.

Drying green wood involves removing both free water and some bound water. Free water is water in the cell cavities, and it evaporates relatively quickly and easily. But at the fiber saturation point (30% for most species) bound water must be extracted from within the cell walls, and shrinkage begins. If a board is dried too quickly, the moisture gradient between the surface and the core becomes too steep. Excessive surface shrinkage precedes internal shrinkage, causing stresses that can result in surface checks, casehardening or internal collapse (honeycomb). Proper drying requires careful pacing and close control of both temperature and humidity throughout the process. (For more on water and wood, drying lumber and conventional kiln operation, see *FWW* #4, Fall '76; #5, Winter '76; and #6, Spring '77.)

Solar drying—Solar kilns are basically greenhouses that trap the sun's energy and circulate the heated air through stickered stacks of lumber. Most solar kilns consist of a rigid framework with one slanted side facing south for maximum solar exposure. Within the kiln, or mounted on the slanted side, are collectors—either metal plates or some other material painted flat black—to absorb energy. These collectors contact a transfer fluid, usually air. Water-transfer systems have higher heat capacities, but require expensive pipe-embedded plates and more demanding maintenance. Because of the relatively low temperatures required, because it is air that must ultimately be heated to effect the drying, and because of their simplicity and low cost, it is generally agreed that air-transfer systems are more appropriate for solar kilns.

The collectors must be covered with some transparent or translucent material that will allow solar energy to pass through to the collectors while inhibiting the escape of heat. The material should resist deterioration from ultraviolet light, weathering and heat. Glass is an obvious choice—low-iron, tempered glass is best, but more expensive than plain window glass. Glass requires substantial framing and expensive replacement when broken. A number of lighter, less expensive and, in some cases, more transparent materials have been developed specifically for solar-energy applications. They include Teflon and Tedlar solar films (Dupont, Wilmington, Del. 19898), a fiberglass material called Sun-Lite





The Oxford kiln with rafters and polyethylene tent yet to be mounted, left, and in operation, right, is light enough to be carried by two or three people from one stack to another. It was designed for use in energy-poor countries.

Illustrations: Christopher Clapp

(Kalwall Corp., Box 237, Manchester, N.H. 03105) and ultraviolet-resistant polyethylene and polyester (S.U.N., Box 306, Bascom, Ohio 44809). The polyethylene commonly available from building-supply houses deteriorates in ultraviolet light and cannot be expected to last more than a year.

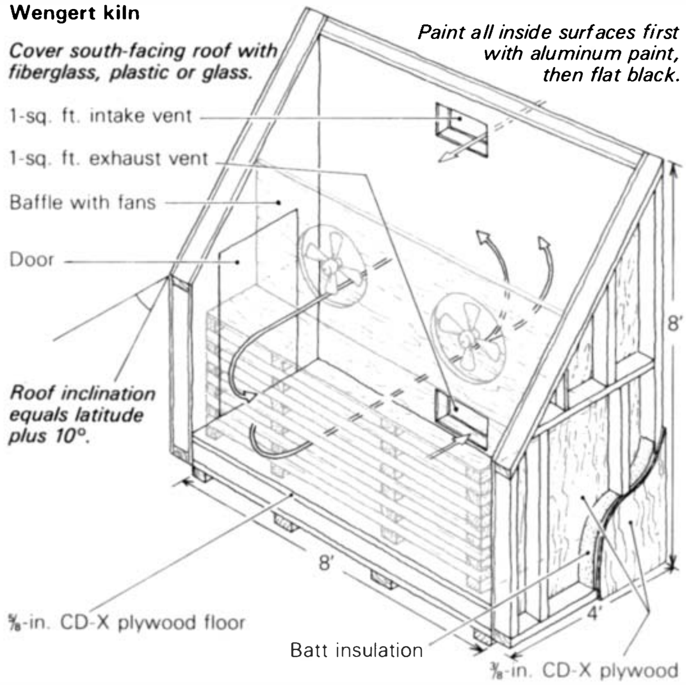
The other important components of most solar kilns are a fan and vents. Temperature within the kiln can rise above 150 °F, so fans with plastic components that may melt should be avoided. Proper air circulation ensures that the lumber will dry evenly and at the safest rate. A timer is generally used to turn the fans on during the day and off at night. It is important that the relative humidity within the kiln be allowed to rise at night, to slow down evaporation from the wood surface. As moisture from the core continues to migrate to the shell, stress is relieved and the moisture gradient is kept moderate. The most critical time is the first week; the kiln should be monitored daily (preferably in the afternoon when the kiln is hottest), lest too rapid drying cause checks. Vents are kept closed at first or opened only a little, to keep moisture exhaust to a minimum and the humidity high. Moisture content should be checked regularly with a commercial moisture meter or by weighing a sample board.

One small, permanent solar kiln has been described in *FWW* #7, Summer '77. A cheaper, simpler, easier-to-contruct kiln has been designed by R. A. Plumtree at Oxford University in England. It is portable enough for two or three people to move it from one stack of lumber to another. The design has been particularly effective in developing countries, where drying timber instead of exporting it unprocessed generates badly needed employment and revenue. It consists of two wooden frames, some sheets of corrugated aluminum painted matte black, a couple of fans and a roll of polyethylene that gets draped over the framework.

One of the frames is a triangular truss that sits atop the pile of stickered lumber, the pile having first been covered with an insulating layer of particle board, then with half the sheets of corrugated aluminum. The other frame forms a slanted surface on which the remainder of the aluminum sheets lie. This frame is positioned on the side of the lumber pile where it will receive the most solar exposure. It includes a plywood baffle that houses the fans. The polyethylene tent is draped over the frame and made taut with guy ropes from the top periphery and sand bags around the bottom.

Doors cut into the polyethylene—one between the stack and the baffle, another at the rear of the stack—give access to the lumber for moisture-content readings. The fans draw fresh air through two vents cut on either side of the kiln in

Wengert kiln



front of the baffle, and moist air escapes through a vent cut midway on the back side of the kiln. Velcro, a self-sticking material that can be bought in fabric stores, seals the doors and vents.

According to A. Frederick Prins, professor of forest science at Oxford, a kiln that can successfully dry 3,500 bd. ft. of 3-in. oak over the course of an English summer was built for around $1,600 in materials. Prins says the Oxford kiln can be scaled down, at a considerable reduction in cost, using only one fan, less polyethylene and fewer collectors.

Another solar kiln, developed and tested by Dr. Gene Wengert at Virginia Polytechnic Institute in Blacksburg, functions without metal collectors, an expensive component of most kilns. The plan calls for 2x4 stud walls covered inside and out with ⅜-in. exterior-grade (CD-X) plywood insulated with batt between the layers. The south-facing roof is covered with two layers of fiberglass, plastic or glass. Wengert suggests the angle of the roof be 10° steeper than the latitude of the kiln's location, which is between 30° and 50° in the continental U.S. Making it equal to the latitude gives best average exposure, but making it steeper improves winter performance, and summer performance is best moderated anyway. Multispeed, high-temperature-wound fans, mounted in a baffle that sits on a plywood covering atop the lumber stack, can be controlled with timers or thermostats. Instead of metal collectors, Wengert paints the baffle, plywood stack-cover and inside walls first with aluminum paint, then with flat black. The aluminum paint acts as a vapor barrier against the plywood, and the flat black absorbs enough heat to raise the temperature within the kiln, without a charge of lumber, up to 100 °F above the outside temperature. A vent at the top of the north wall allows fresh air in and a vent at the bottom exhausts moist air, but the flow of new air is kept to around 5%. As with most kilns, humidity is kept high in the initial days of drying by keeping the vents closed. Doors in the east and west walls provide convenient access to the stack for moisture readings.

Wengert says a kiln of this design, with a capacity of 1,000 bd. ft., can be built for as little as $500. Size is flexible, but

EDITOR'S NOTE: This article was prepared, with help from Roger Schroeder, from material published by the Forest Products Laboratory, Box 5130, Madison, Wis. 53705; the Forest Products Research Society, 2801 Marshall Court, Madison, Wis. 53705; and the Department of Energy, Washington, D.C. 20545. Contact these agencies for more information on wood drying and solar energy. Other publications serving as resources in solar technology include *Harvest the Sun* by Nick Nicholson (Ayer's Cliff Center for Solar Research, Box 344, Ayer's Cliff, Quebec, Canada J0B 1C0; 210 pp., $9.95), *The Solar Age Resource Book*, edited by Martin McPhillips (Everest House, 1133 6th Ave., New York, N.Y. 10036; 242 pp., $9.95), *Solar Age* magazine (Box 4934, Manchester, N.H. 03108; $20 for 12 issues), and *The People's Solar Handbook* (Solar Usage Now, Box 306, Bascom, Ohio 44809; 350 pp., $5.00). Solar kilns and dehumidification systems are undergoing continuing development. If you've had experience building and using them, write and tell us about it. —*R.M.*

there must be at least 1 ft. between the walls and the stack to allow air to circulate, and the proportion of roof area to capacity must remain at about 1 sq. ft. to 10 bd. ft. As with all solar kilns, performance depends on the time of year and the weather conditions, but in good drying weather Wengert has taken green oak down to 6% moisture content in 30 days.

Both the Wengert and the Oxford kilns are open-flow systems that cycle air into and out of the drying chamber. As much as 25% of the heat generated in a solar kiln can be lost in venting. A couple of kilns have been designed as closed systems, employing condensation rather than venting to eliminate moisture. Condensation naturally occurs in solar kilns as a result of daily temperature fluctuations. It reduces degrade by relieving the stresses that build up in lumber as it dries.

Timothy Lumley and Elvin Choong at Louisiana State University have designed and tested a closed-flow solar kiln that incorporates a modification of the traditional flatplate collector, as used in the Oxford kiln. Their collector resembles a large box cut diagonally through two opposite corners, providing four surfaces instead of one for absorption. The diagonal surface is glazed, and vents located in the bottom of the box allow heated air to pass into the drying chamber. The design more than doubles the absorption area of a flatplate collector with the same amount of glazing.

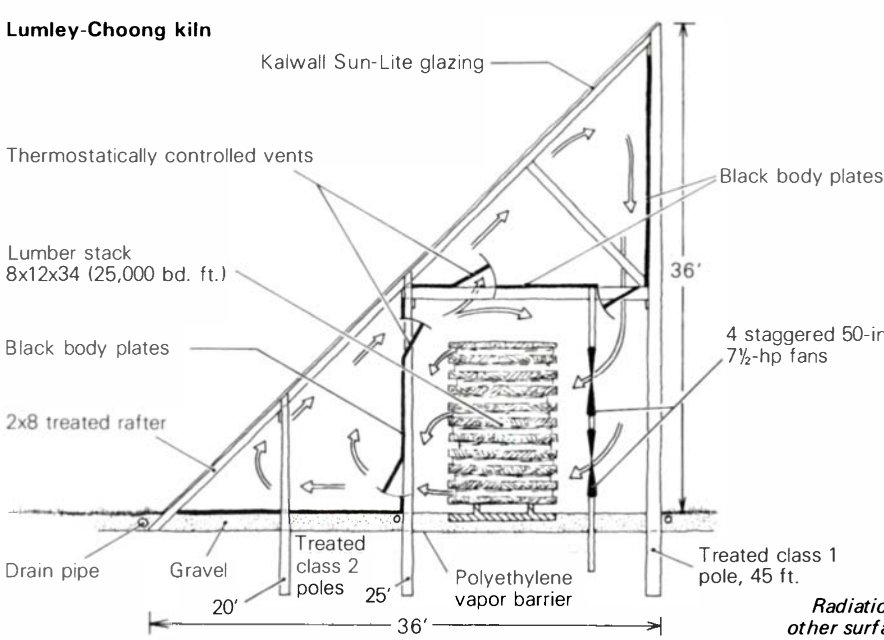
A further advantage of the box-type collector is that because each of its four surfaces is oriented differently, it will pick up solar radiation from different angles during different seasons or times of the day, and energy reflected off any one surface, instead of passing uselessly out through the glass, may be absorbed by another surface. The kiln tested in Louisiana has two box-type collectors, one above the stack and the other in front of it, and has a capacity of 25,000 bd. ft. It was constructed for half the cost of a similarly sized conventional kiln and successfully dried lumber in only twice the conventional-kiln time, and at a fraction of the operating costs. Lumley and Choong believe their design may be commercially competitive with conventional kilns, but that the greatest potential for solar kilns is to replace air-drying before finally kilning down to 6% moisture content. Performance is too dependent on solar conditions to match the control possible in conventional kilns.

Dehumidification—Both conventional and solar kilns dry wood by increasing the temperature of the drying air, which decreases its relative humidity, making it possible for it to take on more moisture as it is circulated through the lumber. The same principle can be inverted: The temperature of the drying air *after* it has circulated through the stack can be *decreased* until it reaches its dew point, when the water vapor evaporated from the wood condenses. Dehumidification is a closed-flow system that employs a heat pump to effect condensation and the drying process. A heat pump transfers thermal energy by compressing a volatile fluid in one section of its circuit (the condenser), then piping it to another section where it is allowed to evaporate. The evaporator section takes on heat from the atmosphere; the condenser gives heat off. In a wood-dehumidification system, both the lumber stack and heat pump are in an insulated chamber. Fans draw air through the stack and past the evaporator section of the heat pump. Here moisture that the air has absorbed from the wood condenses on the cooling coils and is drained away. Now cool and drier, the air passes through the condenser section, where it is reheated with the energy that was extracted from it in the evaporator section. The air is blown back through the stack warm and dry.

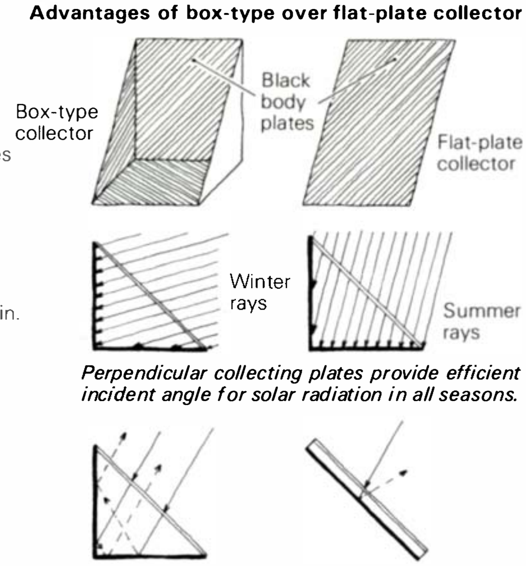
The dehumidifier requires only half the energy of a conventional kiln and reaches an operating temperature of around 120°F; each pound of water condensed produces 1,000 BTUs of energy. Still, this is a relatively low-temperature process and as such produces lumber with little degrade. The system is simpler to operate and maintain than a conventional steam kiln and can require less initial investment. Canadian-based Merkara, Inc. (7290 Torbram Rd., Mississauga, Ont.) distributes a dehumidification system called Westair that can dry 5,000 bd. ft. of green oak to 6% moisture content in 30 days. At $15,000 the system is about half the price of a comparable conventional kiln. Other manufacturers include Irvington-Moore (Box 40666, Jacksonville, Fla.) and Ebac Ltd. (Greenfield Industrial Estate, Bishop Auckland, Co. Durham, England). The latter sells a dehumidifier with a 1,000-bd.-ft. capacity for $800, excluding the drying chamber. Unfortunately this product is not yet distributed in the U.S.

But the fact that dehumidification uses half as much

Lumley-Choong kiln



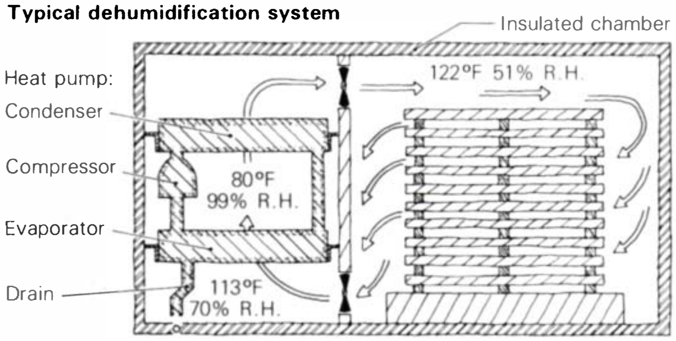
Advantages of box-type over flat-plate collector



Perpendicular collecting plates provide efficient incident angle for solar radiation in all seasons.

Radiation reflected in a box-type collector can be absorbed by other surfaces. Reflected radiation in a flat-plate collector is lost.

Typical dehumidification system



As moist air from the stacks is cooled in the evaporator section of the heat pump, water vapor condenses out and is drained away. The cool, dry air (the relative humidity is high only because it is cool) passes through the condenser section where it is heated with the energy absorbed from it in the evaporator section. This lowers the relative humidity, and it is blown back through the stack warm and dry.

energy as conventional kiln-drying must be weighed against the fact that it is electrical energy, which can be three to four times as expensive as fossil fuels. Also, for a heat-pump compressor to begin operating, the ambient temperature must be at least 70 °F, necessitating pre-heating outdoor facilities. Most systems must incorporate an electrical coil preheater.

Ultimately, comparing dehumidification with conventional kiln-drying comes to a question of cost effectiveness, and the energy costs at particular installations vary. Where electricity is cheap and for medium-sized lumber-drying businesses (1,000 to 1,000,000 bd. ft./year), dehumidification is worth considering. But on the properties of individual craftsmen and enterprising woodworkers faced with the rising cost of conventionally dried lumber, greenhouse-like structures will be the more common sight. □

Drying Lumber in a Vacuum

by John Kelsey

John Harra, who sells wood and tools, makes cabinets and teaches woodworking, telephones me one day to claim he can dry lumber from dead green to 6% in a couple of weeks. He yammers on while I struggle not to laugh at this nonsense, but in the end he persuades me it's worth taking a look. His shop is the 11th floor of a Manhattan warehouse, where Harra turns out to be a burly redhead who walks on the balls of his feet, bouncy like a boxer. He won't reveal the miracle yet, we have to go drink coffee and talk first. I sneak a peek anyway. It's two steel cylinders, both big but one more so, lying on their sides in one corner of the shop. There are cables, hoses, pipes and gauges all over the place.

Harra explains that he is using technology invented in Europe about 40 years ago, still almost unknown here. The trouble with conventional drying systems is the heat required to make water into vapor, and the damage that it can do to the wood. Also, it takes a month or two. Since in a vacuum water boils around 95 °F., why not pop the wood into a vacuum? That's those big cylinders. The walls are ½-in. steel and they hold a vacuum in the 98% to 99% range.

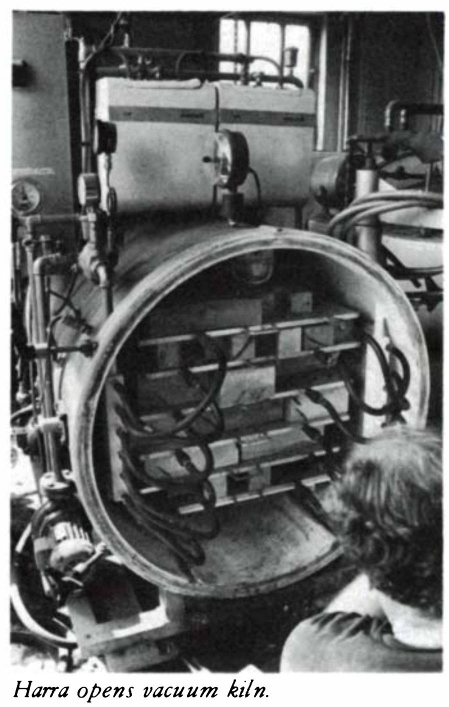
Even so, it still takes heat to vaporize water. The heat leaves the wood along with the vapor, just like when you sweat, and you have to replace the heat to keep the process going. So the wood is layered on aluminum panels ½ in. thick, honeycombed by a manifold to carry hot water from a nearby electric tank, the ordinary kind.

Now the water is happily vaporizing from the wood inside this vacuum chamber, just like it would in outer space, but the tank isn't all that spacious. It quickly becomes a vacuum saturated with water vapor. So running alongside the lumber-and-heater piles are two refrigerated plates, cooled by a conventional compressor mounted atop the tank. Some of the vapor is exhausted by the vacuum pump, and the rest condenses back into water on those cold plates. It runs down to the floor of the tank and leaves through a one-way valve. Thus the humidity in the chamber stays an even 100%. The exhaust water smells like potent stuff, full of heartwood extractives, so Harra watered a potted tree with it. The tree died.

Harra is pretty enthusiastic now, talking about how the high humidity prevents the usual drying degrade of surface checking, casehardening and honeycombing. Furthermore, the low heat doesn't shrink the wood as much as in an ordinary kiln. He talks of taking green 4/4 maple and cherry down to the 6% to 8% range in 14 days, and East Indian rosewood from 18% to 8% in just four days. I just have to see this, so we go back to the loft.

The big tank is 16 ft. long and 5 ft. high, holding almost 1,000 bd. ft. of lumber. An electronic control box on top—Harra's addition to the basic European design—monitors and controls temperature and pressure. The near end of the tank is a hatch with a tiny glass peephole. The hatch is dogged tight with the kind of faucet-handle clamps you see on portholes. I think about old submarine movies while Harra lets air hiss into the smaller cylinder and twists off the clamps. Watching lumber dry is even less exciting than watching trees grow—the big kiln just sits there, its pumps whirring now and then. Harra drops the hatch and warm, wet, odorous mist wafts over me. It's not unpleasant, just surprising. While my glasses defog, Harrra hauls out some 4-in. squares of hard maple and some 3-in. cherry planks. He fumbles with a moisture meter, jabs the electrodes into the wood and it reads 14%, down, he says, from green three weeks ago. Some bandsawn forks just lie there flat, showing none of the stresses you'd expect in wood dried so quickly. Later he shows me foot-wide planks of East Indian rosewood, absolutely check free. I am persuaded that the thing works.

Now here's the rub: this prototype kiln cost more than $60,000. He plans to build one for $100,000 that will handle about 12,000 bd. ft. at a time, near the maximum practical size, for the woods he imports. He dreams about having six or ten of these kilns hooked up in series and it starts sounding like madness again, until he points out the savings in time and energy: a vacuum kiln can dry lumber about five times faster than a conventional kiln. If a busy cabinet shop uses 1,000 feet of lumber a week, and conventional kiln-drying adds about a dollar to the cost of every board foot, a vacuum kiln could pay for itself in less than two years. □



Harra opens vacuum kiln.

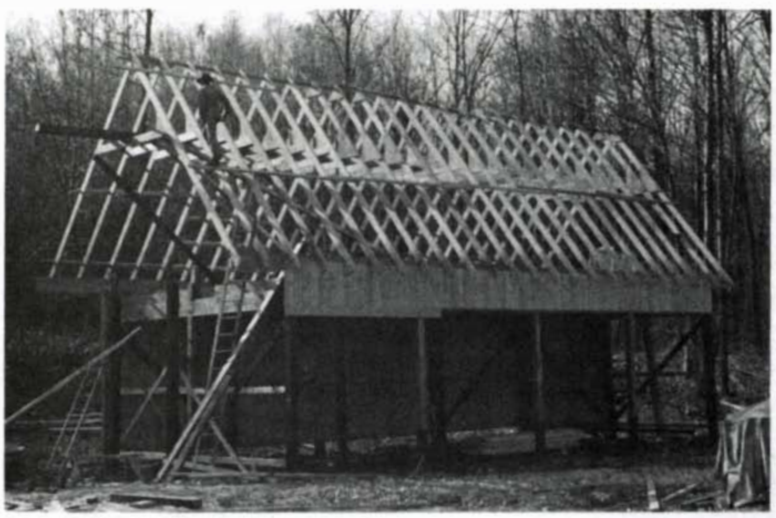
A Barn for Air-Drying Lumber

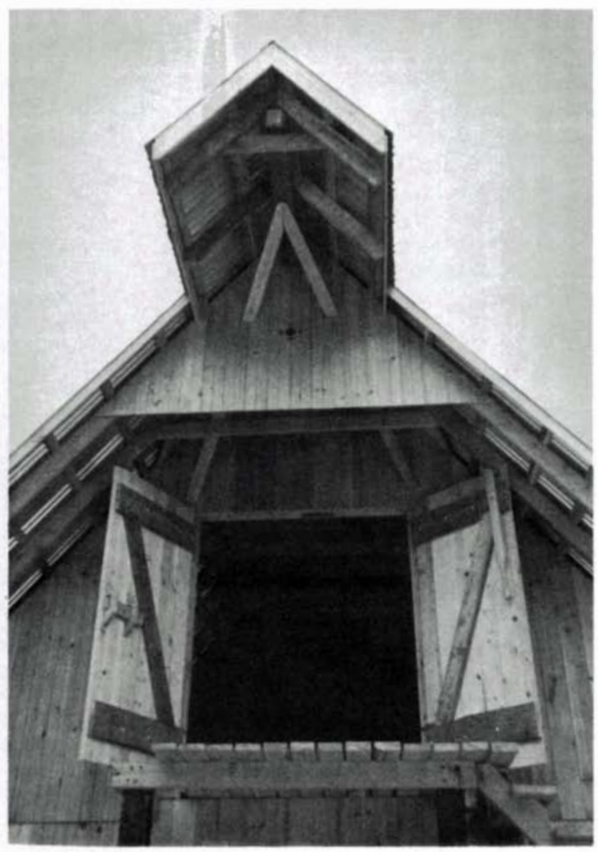
Pennsylvania Dutch tobacco sheds inspire design

by Sam Talarico

About ten years ago I came across a huge red oak burl left to rot by lumbermen who had no use for this natural rarity. It led to more than a career in woodworking. I now pursue burls, rootwood and highly figured flitches. I have gathered thousands of board feet, involving many hours of searching, felling, hauling and sawing. I came to be known as a source of hard-to-find, special pieces. I stacked these treasures carefully with stickers, waxed the ends and protected them from the weather with roofing tin. This worked until winter winds wreaked havoc. Too many times I found myself gathering the scattered tin to re-cover the stacks. Piling cement blocks on top caused another problem. Every time someone came for wood, I would have to uncover and unstack many piles to find just the piece or pieces to satisfy him. All of my lumber is bookmatched, so it took extra care to go through a stack. Numbering the pieces with marking crayon as they came off the sawmill helped. But I needed a shelter for air-drying that would provide easy access to the piles I was constantly shuffling through. It had to be spacious, sturdy and as maintenance-free as possible. I wanted an attractive building with a character to suit its purpose, one that would harmonize with the existing buildings on the property. And it had to be economical and easy to build.

Ideas for this barn came not from books or studies of convection and ventilation, but from everyday farmers, mostly of the Mennonite and Amish sects, whose livelihood depends on getting a good price for their money crop, tobacco. Their tobacco sheds, sound and handsome structures found throughout Pennsylvania and New England, are designed to generate and regulate air flow to eliminate fungus and mold, plagues also to the woodman trying to season green lumber. The pitch of the roof, for instance, not only beautifies the barn and

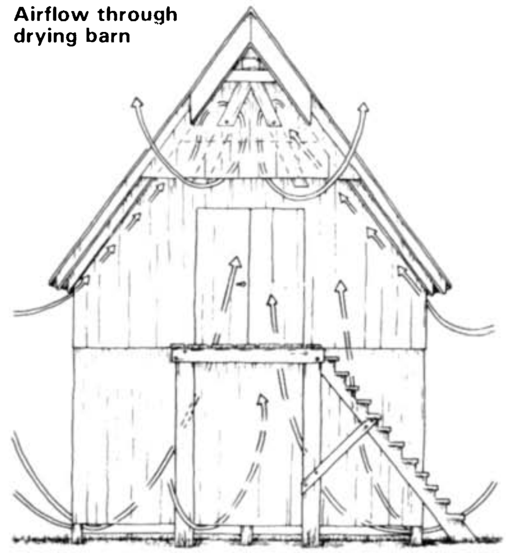




The drying barn under construction, top left. The floor will be poured concrete, leaving a 6-in. gap below the siding for air to flow in. Open-ended gables will vent air out. At left, the completed barn. Four sets of doors give easy access to lumber racks in the front and flitch piles throughout the lower level. Under front gable, above, stairs, deck and double doors provide access to upper level. Hoist beam extends halfway into length of building and is braced by 4x4s running obliquely into door framing. Swallow hole in gable serves no purpose, except 'for nice,' as the Mennonites put it.

Photos: Jim Penta; Illustration: Christopher Clapp

Gaps in flooring of upper level ensure airflow to dry burls and rootwood stored here.



allows headroom upstairs; it also moves air better than a lower roof would. The corrugated aluminum (traditionally tin) conducts the sun's heat, causing the air inside to rise. Fresh air is drawn in through a gap around the bottom of the barn and through spaces under the eaves. Openings under the gable ends serve as exhaust vents, and a 3x5 window in the top of the rear wall provides light upstairs. In a tobacco barn, long narrow doors, rather like louvers all around the building, can be opened and, in conjunction with the open-ended gables, provide maximum draft to inhibit mold and rot. For seasoning lumber, I didn't feel I needed as much draft. The eight wide doors on the side of the barn are mainly for access to the stacks, though in hot, humid weather, I open one or two sets for added ventilation. They also provide adequate light without windows on the lower level; direct sunlight bleaches some woods and its heat can cause surface checks and warp. A stairway on the front of the barn (easier to build than one inside, and it saved storage space), two doors and a hoist beam under the gable provide access to the second floor. The barn is 20 ft. by 40 ft., with the stairs added on to that; it is 23 ft. to the ridge.

I am experienced in the old methods of mortise-and-tenon contruction, held together with oak or locust pins, but these methods are too costly and time-consuming for today's economy. I compromised and used treated-pine pole construction with green oak framing, spiked and lag-bolted together. The lag bolts were old black steel, four 5-gal. buckets of them in various sizes I found for $5 a bucket. Beware of the new zinc-coated ones. I've had many bad experiences with their heads twisting off when you start to bear down on them. It's well worth hunting for the old black lag bolts.

The fifteen main posts, 10 ft. apart, and the two extra posts to frame the stairs and deck are 15-ft. 6x6s resting on concrete footers surfaced exactly the same depth using a transit. Before uprighting them, the posts are notched with saw and slick ("Working with Heavy Timbers," *FWW* #17, July '79) to receive the 2x12 rafter plate at the top and the 2x12 joist plate for the second floor 1 ft. below that. When the 4-in. thick concrete floor was poured, I still had almost 10 ft. of clearance below the second floor. The lower level has no sill, joists or wooden floor.

With the upper floor-joist plates bolted to the posts, braces are nailed flush with the outside of the posts to serve as nailers for the pine siding. At the top of the center posts a 6x8 girder runs the length of the barn. Two-by-eight joists cross the girder from plate to plate, and 1x8 green oak flooring gets nailed on to make the second floor. The gaps that shrinkage produces in this flooring provide good air flow from the lower level of the building through to the top.

The roof is composed of 23 2x6 trusses, laid out on a 15/12 pitch. They're put up on 24-in. centers with poplar lath and 1x6 pine diagonal wind bracing let into the rafters for support. The 6x6 hoist I added serves as part of the ridge pole. It extends 19 ft. into the building, braced into each truss and supported where it overhangs at the front by two 4x4s run diagonally back into 4x4 framing for the upper door.The aluminum roof is nailed on, and then the siding. Rather than paint this, I've chosen to let it weather. I've removed pine siding from barns well over 100 years old, and the boards were sound enough to be used in other constructions.

After the siding is on, hanging the doors is easy. Basically, you frame each 10-ft. opening between the posts with 2x10s notched horizontally into the posts and braced with two diagonals. Cover these with siding, fasten your hinges, cut right down the middle and open the doors. It's best to set your circular saw at an angle inward so the doors can open and close without binding.

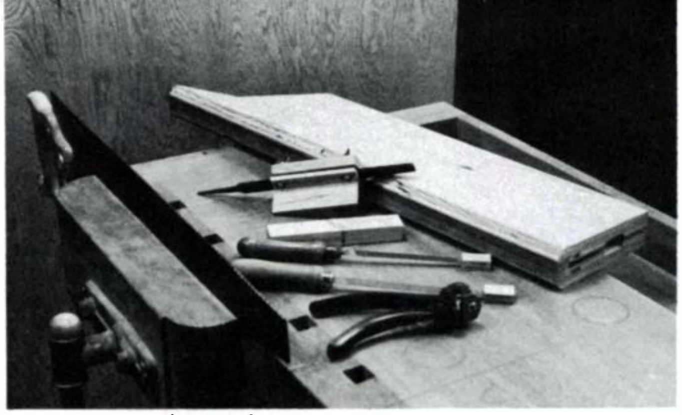
For lumber racks I framed out a 10-ft. by 10-ft. area in each front end of the barn to be used for easy access to dimensional lumber and smaller flitches. I lapped horizontal 2x6s into 4x4 uprights and into the 6x6 posts. I stack my large flitches on the floor throughout the rest of the barn on 4x4 blocks. All my shortest pieces, burls and rootwood I store upstairs. To add some extra storage I hung racks from the floor joists and posts in the back center. I've used all the space available and managed to keep things well enough in order to be able quickly to pull a particular flitch upon request.

I'm very happy with this barn; it's served me well, drying large and highly figured pieces with little degrade. It took me and my Mennonite neighbors just seven days to build, except for the concrete and lumber racks, which I did later. It cost me a little under $4,000 when we built it three years ago, and has required no maintenance to speak of since. □

Sam Talarico makes furniture from his prize flitches in Mohnton, Pa.

Sharpening Saws
Principles, procedures and gadgets

by Jules A. Paquin

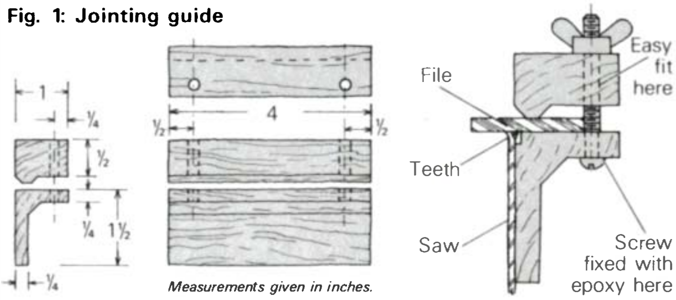

Crosscut saw with reconditioning apparatus.

A handsaw is a tool with a blade of tempered steel in which teeth have been cut. Different kinds of saws are made to perform different functions. The number of teeth to the inch and their shape vary according to the work the saw has to accomplish. The two basic woodworking saws are the crosscut saw, designed to cut across the grain of the wood, and the ripsaw, designed to cut with the grain. The crosscut-saw tooth cuts like a knife. The ripsaw tooth cuts like a chisel.

The teeth of a saw become blunt from regular use, particularly from sawing hardwood. New saws have been shaped, set and sharpened by precision machines at the factory, but many saws can be improved, and old saws reconditioned, by following the step-by-step instruction offered in this article. It is not always necessary to go through the complete sequence, but wherever you start, you should follow through the rest of the order.

For regular maintenance it is a good idea to file the teeth lightly as soon as they have lost their sharpness. One or two filings of this kind will not affect the set of the teeth. Generally it will take three or four filings before resetting is needed. At this stage you can check the shape of the teeth. If the previous filings were done with care and attention, and the saw has not been misused, only setting and filing will be needed. If the teeth have been damaged or made uneven by excessive filing, it will be necessary to go through the five restoring operations: jointing, shaping, setting, filing and honing.

Fig. 1: Jointing guide




To joint the teeth, place the saw in the bench vise and a smooth mill file in the jointing guide. Hold the guide flat against the side of the blade and run the file gently over the top of the teeth. The saw vise pictured on the bench is used in subsequent steps.

The only equipment you need is a saw set, an 8-in. smooth mill file and a fine-cut triangular file, slightly tapered and with 60° angles to match the angles between the teeth of most handsaws. The saw sharpening vise and various filing guides shown here you can easily make yourself.

Jointing — This operation consists of filing the points of the teeth with the mill file to make them even or in line along the saw. The jointing guide (figure 1) will keep the file flat on the tips of the teeth and square with the blade. Run the file gently along the top of the teeth, holding the guide flat on the side of the blade. This cuts a flat on the tip of the teeth, which varies in width according to how far out of line each tooth was. Jointing must touch all the teeth but cut none down more than is necessary to bring them in line. If the teeth are very uneven and a considerable amount of jointing is necessary, you should alternate jointing with the next operation, shaping, otherwise the shape of the teeth may be lost.

Shaping — This operation restores the teeth to their regular form. Place the saw in the sharpening vise (figure 2), the teeth close to the top so the thin metal will not vibrate when filed, and clamp the saw vise in the bench vise. Inserting the tip of a triangular file firmly on a tilting guide (figure 3), file straight across the saw, at right angles to the blade. Note that there are two tilting guides, one for ripsaws and one for crosscuts. Shape first the teeth that have been leveled most. The jointed flats or brights on the tips of the teeth will be taken off in two stages: The triangular file will wear half the flat on one tooth and half the flat on the next tooth. Take care that the top of the tilting guide remain horizontal while filing and that the stroke of the file be perpendicular to the blade. Don't file the gullet too deeply. To make the teeth equal and regular, often you will need to press more against the front of one tooth than against the back of the next tooth, or vice-versa. After shaping, all the gullets should be of equal depth, the front and back of the teeth at the proper angle and all the teeth the same size. Check by looking at the saw from the side. All the teeth will have been shaped from the same side of the saw and there will be no bevel toward the front or back of the teeth. Before setting, rub both sides of the saw with an oilstone to remove the burr left by the file, and brush away any oilstone residue left in the gullets.

Setting — The goal of setting is to make the kerf that the saw will cut wide enough so the blade will not bind. This is accomplished by bending outward the upper part of each tooth. To work properly, a saw should have no more set than is necessary. Only one-third of the height of the tooth should be bent, producing a saw kerf that is a little less than one and a half times the thickness of the blade, thus the set on each

Fig. 2: Sharpening vise

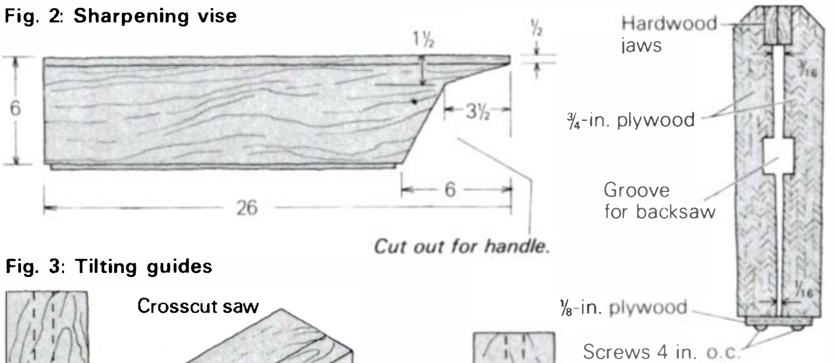
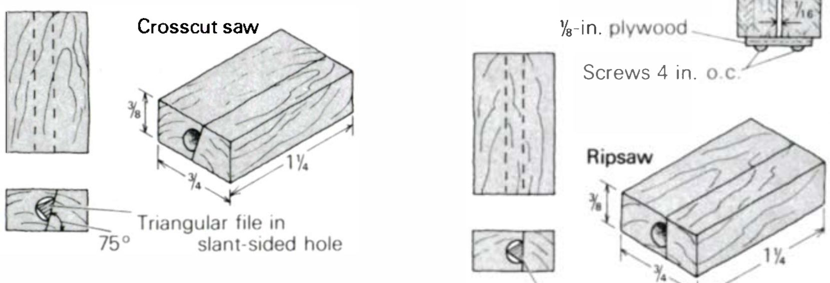
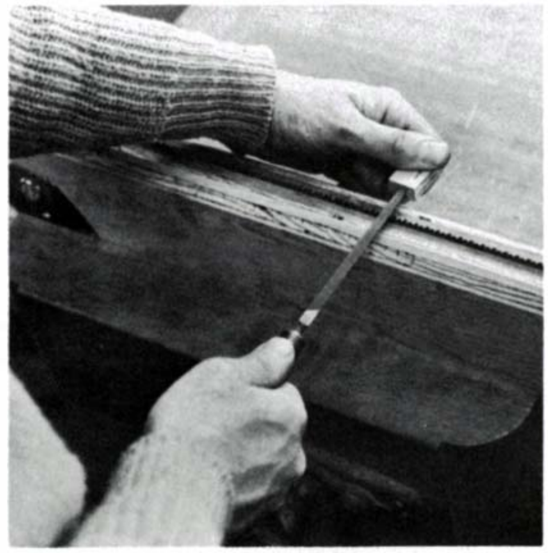


Fig. 3: Tilting guides

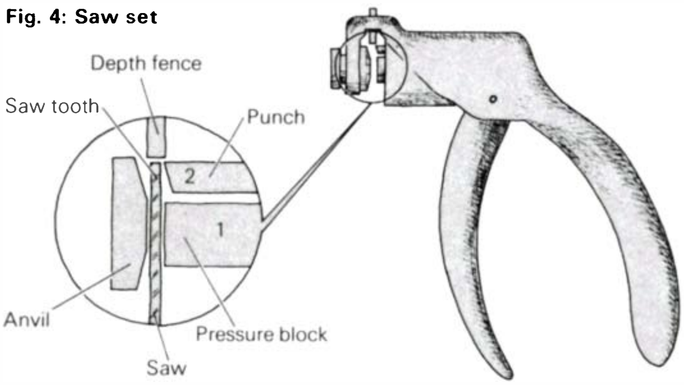


– Saw at 75° for crosscut saw; 90° for ripsaw.
– Make a groove at the center of one piece.
– Glue the two pieces back together.



Shaping is done with the saw in the saw vise and a tilting guide on the tip of a smooth-cut triangular file. The stroke should be level and at 90° to the sawblade.

Fig. 4: Saw set



side should be one-quarter the thickness of the blade. Trying to bend the teeth too much may break them off or cause a crack at the bottom of the gullets. Work in hardwood requires less set than work in softwood.

Setting is done with a special tool called a saw set, which operates with handles like those of a pliers. The principle is to press the tooth with a beveled punch against a little anvil. There are several styles of saw sets on the market. The most practical one (figure 4) does two operations simultaneously: A block presses and holds the sawblade on the anvil, and a beveled punch pushes the tooth onto the inclined part of the anvil. The saw-set anvil is usually an adjustable wheel with numbers around it. These numbers correspond approximately to the number of teeth to an inch of the saw. Bring the number to the appropriate index mark, and the anvil is in position to set all teeth to the same proper inclination. Set first the teeth that point away from you on one side, then turn the saw around and set the other teeth. Never reverse the set of a tooth. When you are finished check to see that you have not missed a tooth. The set must be the same from end to end of the blade, otherwise the saw will not cut straight, but snakey.

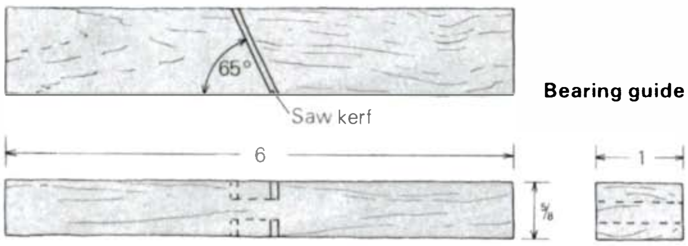
Filing — Filing sharpens the saw and is the most important operation in reconditioning. Depending on the point size of your saw, select a slim triangular file: for 11 to 18 points per inch, a 5-in. file; for 7 to 10 points, a 6-in. file, and for 4 to 6 points, a 7-in. file.

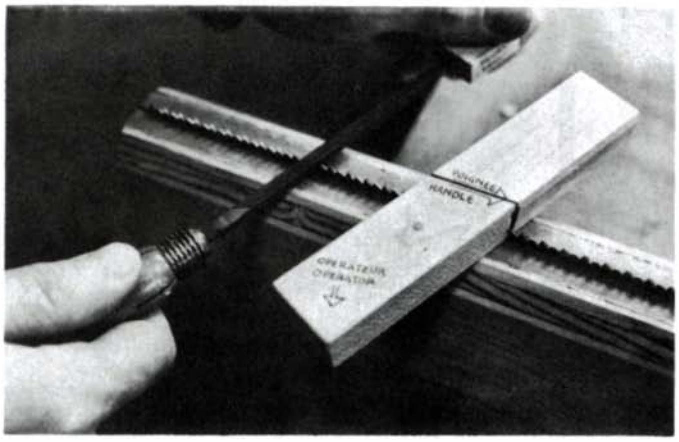
Except for differences in tilting and bearing angles, filing crosscut saws is the same as filing ripsaws. Mount the saw in the saw vise, the bottom of the tooth gullets ⅛ in. above the vise jaws and the handle of the saw to your right.

For a crosscut saw, place the bearing guide (figure 5, next page) on the top of the teeth, and the crosscut tilting guide (figure 3) on the tip of the file. The bearing guide may be placed to the right or to the left of the tooth being filed, but as close as possible to it without getting in the way. It is a device with which to line up the file by eye and is moved along the saw as needed. Start at the toe of the saw and place the file in the gullet to the left of the first tooth set toward you. The file should be parallel to the bearing guide, and the tilting guide should be horizontal. Push the file straight forward, holding it firmly at both ends. Exert slight pressure on the forward movement, but lift the file on the backward movement. The

Reconditioning a saw

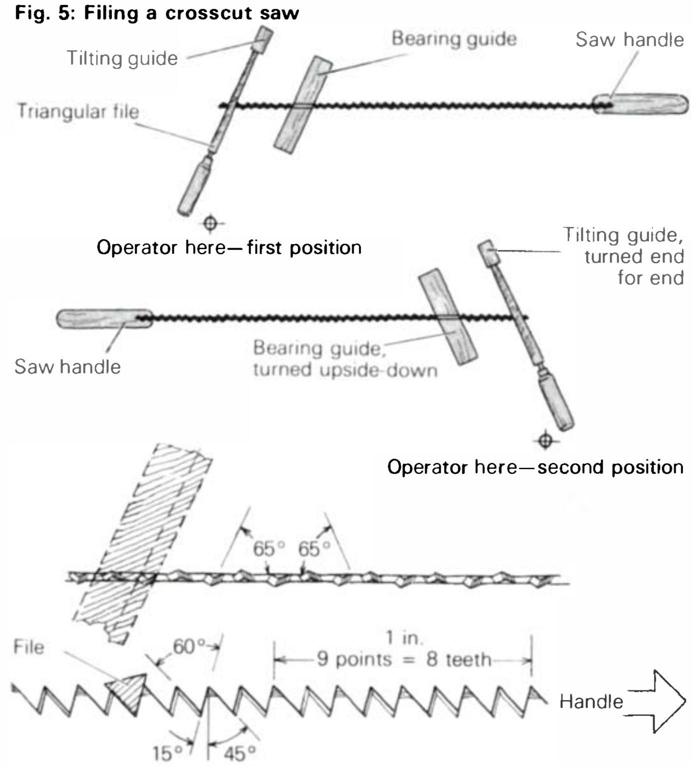
Process	Aim	Necessary	Recommended
1. Jointing	To make the teeth the same height.	If the teeth have been seriously damaged by careless handling of the saw.	After several filings to make the teeth the same height.
2. Shaping	To restore the shape of the teeth.	If the jointing has left a large flat top at the tip of some teeth.	If the flat on the teeth is not nearly the same.
3. Setting	To widen the kerf by bending alternate teeth in opposite direction.	If you have done processes 1 and 2.	After four or five filings not preceded by processes 1 or 2.
4. Filing	To sharpen the teeth.	Processes 1, 2 and 3 are always followed by filing.	When teeth become dull.
5. Honing	To remove the burr that appears on the sides of the teeth.		Highly recommended for delicate saw work.





Crosscut-saw filing is aided by a bearing guide on the saw and a tilting guide on the file. Maintain consistent pressure for an equal number of strokes in each gullet, with a tooth set toward you always closest to the saw handle.

Fig. 5: Filing a crosscut saw



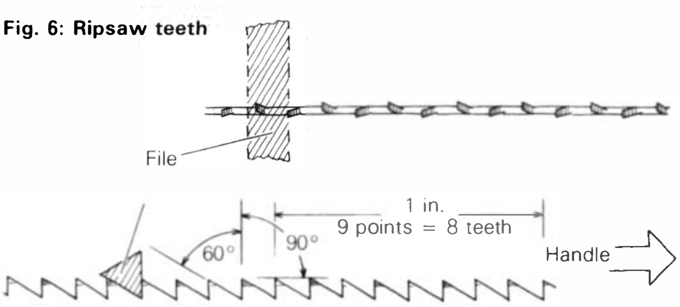
stroke should be always horizontal. This operation will wear both the front of the tooth set toward you and the back of the preceding tooth set away from you. Count the file strokes and note the pressure you exert because you will have to repeat the same number of strokes and the same pressure all the way along. After the first gullet go to the third gullet, skipping the second; then go to the fifth, skipping the fourth; and so on every second gullet up to the handle.

Turn the saw around so the handle is at your left. Turn the bearing guide upside-down and the tilting guide around, end for end. Work the other side of the saw in the same manner, starting at the toe and in the gullet to the right of the first tooth set toward you. After filing a few teeth on this side, check them. The filing should have brought the teeth to a fine point with a bevel to the front and to the back of each tooth. Do not remove any more metal than is necessary to make the bevels meet at the top of the tooth. Continue filing along the length of the saw.

A crosscut saw is filed well if you can slide a needle between the tips of the teeth without it falling.

For a ripsaw (figure 6), place the ripsaw tilting guide (figure 3) on your triangular file and file perpendicular to the face of the saw; rip teeth have no bevel. A well-trained eye and hand can easily keep the stroke perpendicular without the aid of a bearing guide. File the first gullet, the third, the fifth, etc. Turn the saw and file the other gullets so the filing will be uniform on each side; otherwise the saw.will cut on a slant. For ripsaw teeth, the alternation of the direction of the stroke and its evenness are the only differences between filing and the earlier operation of shaping.

Fig. 6: Ripsaw teeth



Honing — Filing leaves a burr or wire edge at the sides of the teeth. A burr won't make any difference in rough work, but for fine work it is best to get rid of it. To do this, put your saw flat on your bench and run a fine oilstone gently against the teeth on both sides. Honing will also correct small irregularities in setting.

The angles I use are good. I have adopted them with satisfaction. But there are other workable angles and they should not be ignored. For a crosscut saw some prefer a bearing angle of 55°, and others 60°. Some prefer the handle end of the file about 10° below the horizon. For a ripsaw some prefer a tilting angle of 8° instead of 0°. You can adopt the standards that best fit your needs, but when you have made your choice, be consistent. Remember, though, you will have to alter the guides shown in the figures accordingly.

Those who haven't tried it think that maintaining a handsaw requires a lot of time, but this is not the case. Here is the time it took me to recondition completely a 24-in. crosscut saw, with 12 teeth per inch. The work, which was performed without haste, took only 47 minutes. Jointing and shaping required 17 minutes; setting, 8 minutes; and filing and honing, 22 minutes. If the same saw were to require only filing to renew the cutting edge, it would take no more than 12 to 15 minutes.

Take good care of your handsaws. When not in use, keep them in a tool rack that will protect them from damage. Wipe the blade frequently with a lightly oiled cloth. □

Jules Paquin, 63, is a wood patternmaker and an amateur woodworker. He lives in Laval, Quebec.

Furniture Conservation

Historic objects can outlast us all

by Robert F. McGiffin

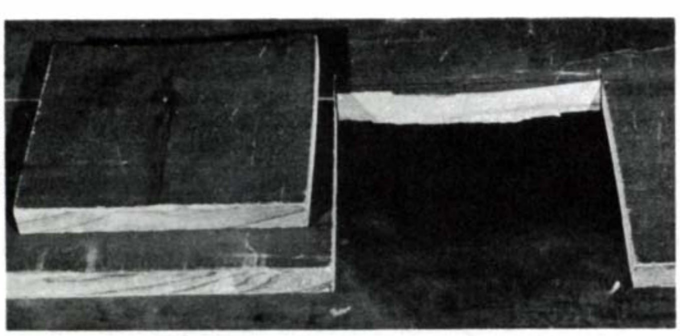
Hudson river valley kas, c. 1745.

Probably the greatest threat to furniture is man. Historical furniture is subjected to restoration abuse, misuse, damage and disfigurement by well-meaning individuals who are undoubtedly very proud of their work. Most of my work as a furniture conservator involves correcting theirs. I have seen many pieces of furniture damaged by modifications or inadequate repairs. It is all too easy to pick up a hammer or saw and go to work. I recently treated a Hudson river valley kas (large chest), c. 1745, whose shelves were originally large, single planks. At one point, probably within the last three decades, a section was cut out of one of the shelves to make room for a fire extinguisher, causing irreversible damage.

I feel that with luck, a piece of historical furniture will outlast all of us many times over, and we should do nothing to disturb it. Each of us should develop an attitude that we have no right to remove original material and evidence of an object's history, even if we own the object. This includes the aged finish. Unlike paintings, where darkened varnishes, scratches and later additions are considered disfiguring, historical furniture was designed to be functional, subjected to daily abuse and wear. Scratches, dents, stains and burns that may have occurred during its existence are part of its history.

Many times a beautiful and secure patina is dissolved in a stripping vat or is sanded and scraped away, because the owner, dealer or custodian of the piece is trying to "recapture the beauty of the wood" or to "return the piece to its original appearance." No one knows exactly how the piece appeared when new, although laboratory analysis may indicate what type of finish was used. We may even have some idea of the concentrations, but cannot tell for certain how the stain and/or the finish saturated the newly made object. We probably can't tell the degree of gloss or dullness that the finish originally had. Seasonal changes have made joints and moldings expand and contract, causing them to reach an equilibrium that is slightly different from when new. How about scratches, dents, abrasions and checks? Most can be minimized or camouflaged, but not all. Dents and scratches usually cause a traumatic shock to the wood fibers, obvious under a microscope. What would be gained by removing a burn from a tabletop, caused by a trivet or kettle placed there sometime in the 18th century? Wouldn't a part of history be removed if the table's finish, along with the burn, were sanded or stripped away? I am not saying that today's cigarette burn on a piece of antique furniture is adding to its history—a modern burn is disfigurement, because the piece should be preserved from daily wear and tear.

Photos: Robert F. McGiffin



Kas was irreversibly damaged when a section of one of its shelves was cut out to make room for a fire extinguisher.

Care of historical furniture — The treatment of the kas (photo, above) involved replacing the separated shelf portion, and a general cleaning. But this treatment won't work on all furniture. When you apply the following procedures to your own furniture, act with caution.

First, the surface of the kas was vacuumed with a soft brush attachment. Had there been cleaving veneer or upholstery, a piece of window screen, with all four edges covered with tape, would have been held between the object and the brush, to keep pieces of veneer or fabric from being pulled into the vacuum. To test the finish, a cotton-tipped applicator was dampened with distilled water and gently rolled over a small obscure area. The applicator picked up surface grime and didn't soften the finish. Whitening, which tells that the finish is reacting badly to water, did not occur after the area dried for a few minutes. Whitening may not be easily reversible—if it is visible, remove it, if possible, using the method described later, and continue cleaning not with water but with solvents.

A bucket was then filled with clean room-temperature distilled water, and the water applied with a clean, dampened (not dripping) sponge, by working in small areas and not rubbing too hard. The areas were dried with soft toweling to absorb any remaining moisture, then the entire process was repeated with clean water. The kas still had grimy area remaining, so we repeated the same steps with one teaspoon of

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Nails and screws where there were none originally can restrict wood movement, causing checks, or splits and disfiguring holes.

detergent stirred into a gallon of water. Use either a commercial woodwork detergent such as Soilax, or the anionic concentration, Orvus. Rinse away any detergent residue with a sponge dampened in clean water. We waxed the kas with a formula I will describe later. If you still have grime, further cleaning is possible with solvents. However, improper use of solvents can cause irreversible damage, and solvents are not safe for all finishes. The safer solvents are paint thinner (preferably odorless), turpentine and benzine (sometimes called petroleum benzine or VMP naphtha). Benzine is not benzene, which is toxic. Use these solvents in a well-ventilated area with no open flames or electrical sparks.

To test the solvent, dampen a cotton-tipped applicator with it, wring it out and roll it over a small portion of the grimy area. A lot of solvent on the surface can slow down evaporation and may soften the finish below the grime and wax, as well as surface wax, so be sparing. After removing some of the grime and wax from the test area, apply more solvent, making sure it is not softening the finish. Continue working in small areas with the cotton-tipped applicator and immediately dry the area with a soft, clean rag. At this point you have to decide if you are going to continue your grime removal to the point of removing old wax build-up from the entire piece of furniture.

Veneer cleavage — If there is veneer cleavage, you may be able to apply some glue under the veneer with a small brush. If you have a syringe, inject a little distilled water under the cleavage, clamp the area and wait a minute or so to let the original glue soften. Remove the clamp and wipe up any water that runs out on the finish. Dilute some hide glue 50% with distilled water and inject it under the veneer until it runs out. Wipe up the excess, then clamp. I prefer wooden cam-action clamps, such as the ones made by Klemmsia.

If you don't have proper clamps, hold the veneer down for about 24 hours with tape or a weight. Shield the veneer from the clamp surface with a small piece of Plexiglas, to keep the clamp from adhering to the wood and to prevent denting. Waxed paper will also shield the clamps from the glue. After the glue has dried, the Plexiglas may be stuck to the surface, but a gentle push from the side will pop it loose. Use hot hide glue or liquid hide glue, such as Franklin's. They are soluble in water, easily removed many years later and similar to the glue used when the furniture was made.

Don't be fooled by white polyvinyl acetate emulsion glues. Although they are soluble in water when they come from the bottle, they are less so after aging. On drying, they form a continuous film by fusion of the polymer droplets present in the emulsion. They also penetrate deeply and once in, are almost impossible to remove. If you repair using a white glue and are dissatisfied, or someone wants to reverse it later on, damage could result. If a treatment involves reconstruction and perhaps the replacement of a missing primary support, such as a leg, hot hide glue is strong enough, yet reversible.

Wood fillers, losses and separated elements — If you have losses, or holes, don't plug them with commercial wood fillers. They won't look like wood and may shrink or fall out during the seasonal dimensional changes of the wood. If someone tries to remove them, damage may result to the surrounding areas. Under no circumstances should a separated element be reattached with nails and screws where there were none originally. Not only are they hard to remove, but the restriction of the movement of wood results in checks or splits. They also leave disfiguring holes after they are removed.

For a small area, say a nail hole, I often use a pigmented wax stick that matches the wood. If the loss was caused by a screw head, you can cut your own plug from new wood of similar grain. Dowels or some commercially made tapered plugs won't camouflage the loss unless it is in end grain.

If the loss is more extensive, let in a patch. Obviously, this is time-consuming. I do not remove original material around the area to be filled unless it has jagged edges or splinters. I first find a piece of the same kind of wood with similar figure. Various methods, such as rubbings or measured drawings, are used to transfer the loss configuration to the new wood. The patch is then cut out and shaped.

At this point, I test stains and finishes on the waste portion of the new wood until I can duplicate exactly the original appearance. Sometimes I can finish the patch before pressing and gluing it into place. If the color is wrong, it is safer to find out before the patch is attached. Usually, the patch is fixed in place, the profile is leveled off, and then the new color and finish are applied to match the original surrounding area.

Finishes — After cleaning and repairing, you may want to apply a new finish over the old. Instead of applying varnish, shellac or lacquer over the original, I usually prefer to use wax. Wax protects, and is easy to apply. It can look like a shellac finish, is generally harmless and can be removed at any time. I formulate my own wax recipe and you can do the same. It contains two parts Cosmolloid 80H (a microcrystalline wax) and five parts odorless paint thinner: for example, 20 gm microcrystalline wax and 50 ml paint thinner.

Weigh the Cosmolloid and melt it in a double boiler, bringing the water to a boil on a hot plate, not over an open flame. Keep checking the water to make sure it hasn't all evaporated. Work in a well-ventilated room. The wax may take about 45 minutes to melt. When most has melted, pour the thinner into a glass jar large enough to hold both the wax and the thinner, and place the jar in boiling water to warm for a few minutes. By now all of the wax should be melted. The thinner is heated so that when the molten wax is added it won't gel and form a lumpy mixture. Quickly pour in the wax. Remove the jar from the heat and let it cool. Apply the wax once every year or two, but dust the object once a week. Store the wax jar in a warm area.

You may wish to use another recipe if you don't have a double boiler, or simply don't wish to play around with hot materials. Use two parts by weight of wax plus five parts solvent. Simply place the wax in a jar and add the solvent. Keep tightly covered until a homogeneous mixture has formed. This may take several days with periodic stirring by rotating the jar, and it may be necessary to add a little solvent from time to time to keep the wax soft.

To apply, put a small amount on a soft cloth and rub in. If it seems to go on a little hard (some objects can't take hard rubbing because the joints might be loosened), dip the cloth in a little odorless thinner. Rub in a circular motion, followed by strokes in the direction of the grain. Do not overload the cloth with wax, which can cause the surface to remain sticky. Let the solvent evaporate a few minutes after the wax has been applied to the furniture, then buff in the direction of the grain with a clean, soft, lintless rag. You may want to buff again after 24 hours, after more solvent evaporates.

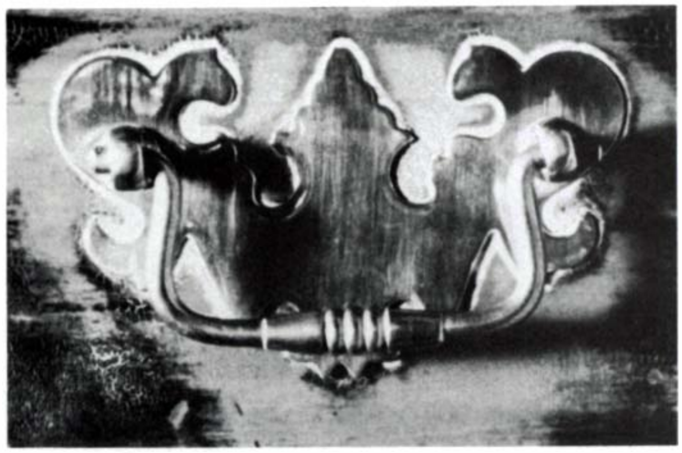
The wax formula may remain sticky for several days and therefore may not be appropriate for a piece of furniture that has daily handling. A useful product is Renaissance wax, which I recommend both because I know its ingredients and because it doesn't remain sticky. It's hard to buff on large areas, however, and will streak. Dampen the cloth in odorless thinner to overcome this. While polishing, watch for loose pieces of veneer, moldings or hardware that may be pulled loose, bent or broken by the cloth. In general, most conservators try to avoid commercial products because they can contain materials that, on aging, may undergo changes in color or transparency and become inseparable from the object to which they are applied. The Cosmolloid mixture and the Renaissance wax are not panaceas, and if there is wax build-up already on the surface, either may soften it and the surface could remain sticky. Wax build-up should be removed.

I would not use polyurethane varnishes on historical furniture. They are good moisture barriers, but never apply them over an original finish, because they are irreversible.

Avoid recipes for "feeding" the finish, a term from old wives' tales and 19th-century restorers' recipes. Feeding recipes, found in many books, often contain linseed oil, an irreversible drying oil that penetrates the surface, saturating the original finish or pigment particles. In a few years when the object becomes darker and darker, someone will try to remove it and may discover he must either leave it alone or destroy much of the original finish. Linseed oil changes chemically as it dries, forming a tough, hard film.

Some books suggest inpainting losses on painted furniture with oil paints, but never apply anything to painted surfaces. Oil paints discolor and are irreversible except by methods that may harm the original. Painted surfaces can be complex, and only someone with conservation experience should deal with them. Beware of "cure-alls." What may work for one treatment may be the opposite of what works for another. By not fully understanding the chemical and physical properties of a particular paint film, damage may result.

Furniture hardware — I don't use commercial emulsion-type brass polishes for hardware on historical furniture



Sloppy application of brass polish can damage a finish. White material around edges of pull is brass polish residue.

because repeated use can damage the hardware and, if you're not careful, the finish on the wood as well. I also stay away from copper brighteners or dip cleaners, the old home recipe of vinegar and salt, and steel wool or buffing wheels.

I use rubbing, isopropyl or ethyl alcohol to clean brass hardware, cleaning it on the object if the brasses appear original. If I can, I slip a piece of aluminum foil behind the brass to protect the wood, then wipe over the brass with a dampened cotton-tipped applicator to remove greasy fingerprints and allow a protective brown patina to form.

Whitening of finish — Water, condensation from a glass, or a fast-evaporating commercial cleaner can give the finish a milky-white appearance, but this is one area where we can rely on home remedies, moderately used. Try a little cooking oil mixed with cigar or cigarette ash. Rub on the whitish area with your fingertip for a short time, then wipe the area dry with a soft rag. If that doesn't work, try a little of the same oil and a small amount of whiting, pumice or rottenstone, or try wiping the area briefly with a little alcohol on a rag with your fingertip or cotton-tipped applicators. Be careful, because the alcohol may soften the finish, and can actually remove a French polish. If this happens, leave the area alone for a while to give the finish a chance to reharden. Any of these treatments may get rid of the white, but may make the area glossier than its surroundings. If this happens, rub a little 4/0 steel wool in the area. Pull off a small amount of fine steel wool from the pad and wrap it around a round wooden stick from a cotton-tipped applicator or toothpick. This can be followed by an overall waxing of the piece.

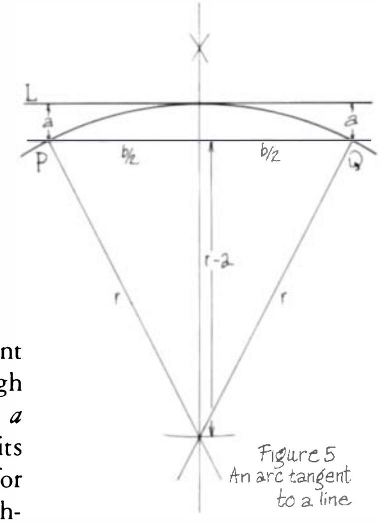
These treatments may also work on dark stains or burns, but make sure that the stain or burn is not relevant to the object's history. If the burn is recent, such as from a cigarette, use the same methods described for white rings. It may be a little deeper though and you might have to resort to 4/0 steel wool with a little turpentine or paint thinner. The finish will be destroyed in the area so you can tone with stains, or sometimes you can get by with acrylic emulsion paints or watercolors. Take a fine camel-hair brush and reapply a finish of shellac only in the damaged area. You may need to blend in the new shellac with 4/0 steel wool and wax. □

EDITOR'S NOTE: Orvus detergent, Cosmolloid 80H and Renaissance wax are available at Talas, 104 Fifth Ave., New York, N.Y. 10011. Pigmented wax sticks are available from Mohawk Finishing Products, Amsterdam, N.Y. 12010.

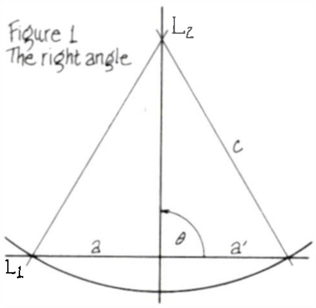
Shop Math

With a little help from Pythagoras

by C. Edward Moore



You can use shop geometry without knowing why it works, but you will be able to solve more real-world problems if you understand the basic principles. Our point of departure is the right-angled triangle and the theorem of Pythagoras. The terms "right," "square," and "90°" all mean the same thing.



The symbol θ, the Greek letter *theta,* designates any angle. In figure 1, we swing an arc of radius c whose center is on line L_2 so that it cuts through line L_1 in two places. This results in two triangles. By definition, whenever the two triangles are symmetrical $(a = a')$, the lines L_1 and L_2 form a right angle.

You use this understanding in reverse to construct a right angle, anywhere you want one (figure 2). First draw the baseline L_1 and mark the point x where you want the corner (vertex) of the right angle. Set a compass to any convenient radius *(a)*, put the point on x, and mark points a and a' equidistantly on either side of x. Now enlarge the compass setting, again by any convenient amount *(c)* and scribe intersecting arcs above L_1, from centers a and a'. Connect the point thus found with x.

The theorem of Pythagoras tells us that if θ is a right angle, then $a^2 + b^2 = c^2$ and conversely if $a^2 + b^2 = c^2$, then θ is a right angle. The best-known example of this is the 3-4-5 right triangle (figure 3), where $3^2 + 4^2 = 5^2$. Carpenters have used the 3-4-5 triangle, or the 6-8-10 triangle, to square frames for centuries. With a knotted or marked rope and stakes, it is the way to lay out the corners of a building.

The circle is a set of points that all lie the same distance from a fixed point, the center. We create this relationship simply by setting a compass or trammel. On a grid of squares, with horizontal coordinate x and vertical coordinate y, we have the equation $x^2 + y^2 = r^2$, because of Pythagoras. All the values of x and y that produce the same value for r lie on the same circle (figure 4).

Problem: Fit a circle tangent to a line and passing through points P and Q, which are a units from the line and b units apart (figure 5). This arises, for example, in designing an arch-top door, when the end-points and height of the arc are known, and it is necessary to find the center.

Solution: Any tangent to a circle is by definition perpendicular to a radius. Thus the center of the circle will lie on a line drawn at right angles through the midpoint of the line PQ. Pythagoras shows that

$$r^2 = \left(\frac{b}{2}\right)^2 + (r - a)^2 = \frac{b^2}{4} + r^2 - 2ar + a^2,$$

so

$$2ar = \frac{b^2}{4} + a^2 \quad \text{and} \quad r = \frac{b^2}{8a} + \frac{a}{2}.$$

This equation may be more useful in the form:

$$r = \frac{b^2 + 4a^2}{8a}$$

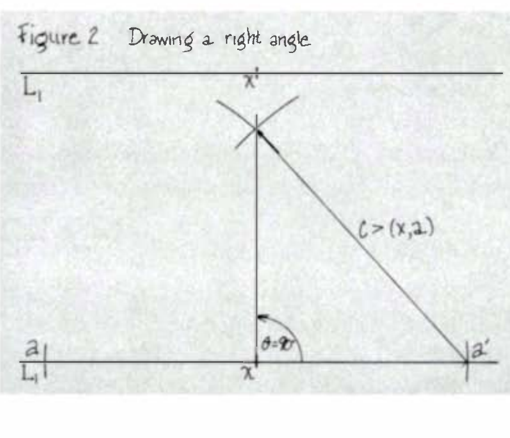
It can be transformed to find the third parameter of a circular arc when any two are known, that is, the width b can be found if you know the radius r and the height a, or the height a can be found if you know the radius r and the width b:

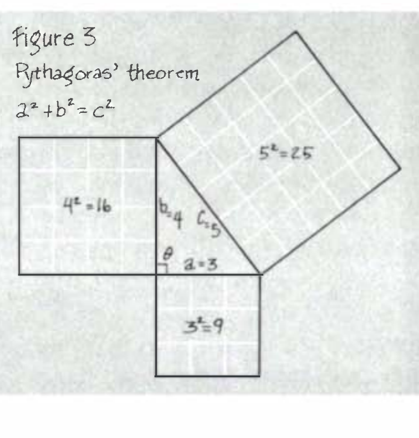
$$b = 2\sqrt{a(2r - a)} \qquad a = r - \sqrt{r^2 - (\tfrac{1}{2}b)^2}$$

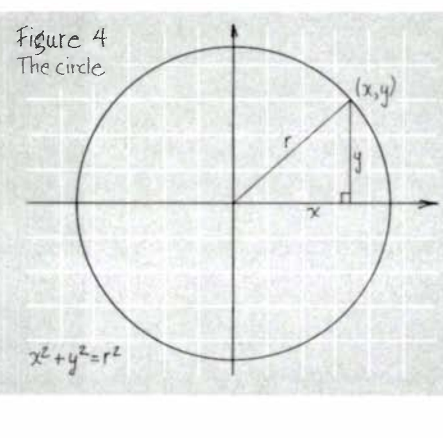
These relationships apply where a is less than half of b, the same as saying that line PQ is in the top half of the circle in figure 5. When the line moves below the circle's diameter, the last equation becomes

$$a = r + \sqrt{r^2 - (\tfrac{1}{2}b)^2}$$

When working equations like these on an electronic calculator, you must either become adept at moving results into







and out of the calculator memory, or else keep running notes with pencil and paper. In general, you start inside parentheses and work outward. For example, to solve for a, the height of an arc, when the radius r and width b are known, you would first find ½ of b, square it, and store the answer. Square r and subtract the previously stored result, then find the square root of this answer. Finally, subtract from r.

A useful property of the circle is the fact that if a triangle PQR is drawn with its long side on a diameter and its vertex touching the edge of the circle, that vertex will be a right angle. We can verify this by drawing the circle with its center at O on rectangular coordinates, and applying Pythagoras' theorem (figure 6), after showing that $(PQ)^2 - (PR)^2 = (QR)^2$. We know that wherever on a circle P is, the location of P can be described by coordinates x and y, and $x^2 + y^2 = r^2$. Since length $QR = 2r$, then $(QR)^2 = (2r)^2 = 4r^2$. We also know that $(PQ)^2 = (r-x)^2 + y^2$, and that $(PR)^2 = (r+x)^2 + y^2$. Thus $(PQ)^2 + (PR)^2 = (r-x)^2 + y^2 + (r+x)^2 + y^2$. If you do the algebra you'll find that $(PQ)^2 + (PR)^2 = 4r^2$, and we already found that to be the square of length QR. Thus the triangle PQR is right-angled ($\theta = 90°$): a diameter and any point P elsewhere on the circle always determine a right angle. Conversely, the legs of a right angle whose vertex is on the circle always cross the circle at the ends of a diameter.

Problem: Find the center of a circle or disc.

Solution: Place the right angle of a square or drafting triangle on the circle, and mark where the sides of the square cross the circle. Rotate the square about a quarter of a turn and again mark where it crosses the circle. Draw the two diameters you have thus located. They intersect at the center of the circle (figure 7).

This relationship can be used to verify whether a trough or semicircular cutout is in fact semicircular—just put the vertex of a framing square into it (figure 8). If the vertex and sides of the square all touch, the cutout is exactly half a circle. The relationship is also another way of constructing a right angle—draw a circle passing through the point where you want the right angle to be, draw in a diameter, and connect the ends of the diameter to the point.

Several recent *Fine Woodworking* articles have referred to proportional division by parallel lines. It is the way shaper-knife profiles are derived, and a way to divide boards for dovetailing. Suppose lines L_1, L_2 and L_3 are parallel and lines M_1 and M_2 intersect them as shown (figure 9). The resulting line segments are proportional, that is,

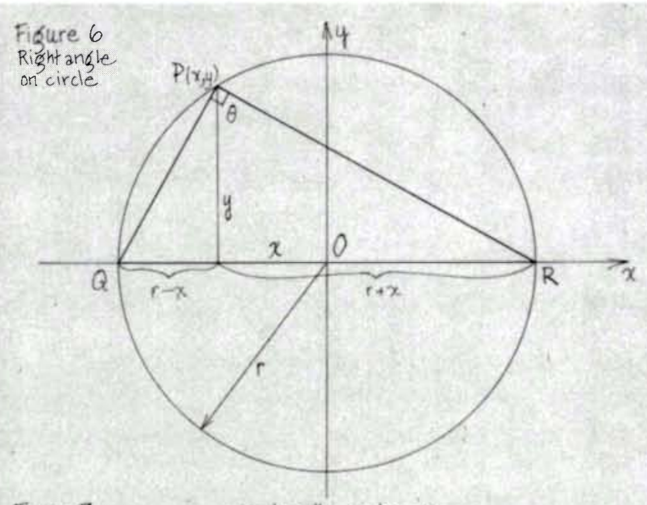
$$\frac{a_1}{a_2} = \frac{b_1}{b_2},\ \frac{a_1}{b_1} = \frac{a_2}{b_2},\ \text{and}\ \frac{a_1}{a_1 + b_1} = \frac{a_2}{a_2 + b_2}\ .$$

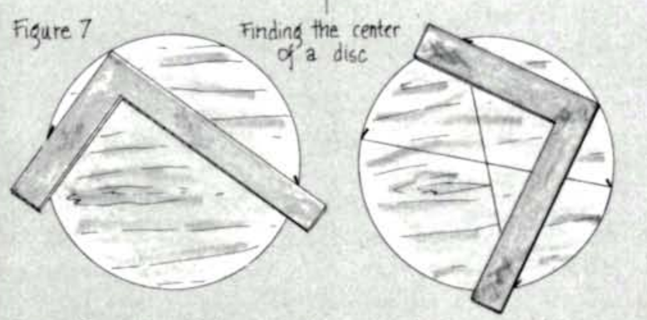
Problem: You have a line divided into two unequal parts. You want to divide another line of different length into the same proportions, that is, locate Q_2 below.

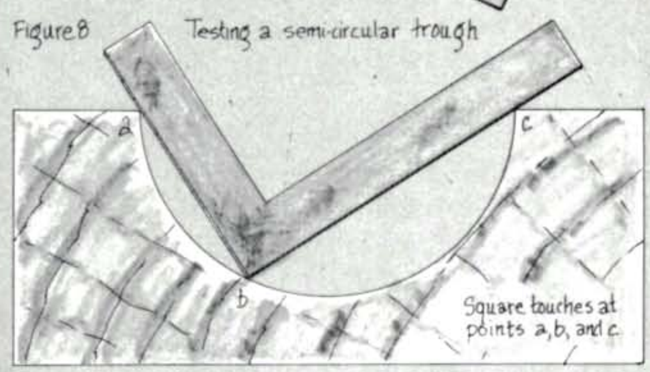
P_1 P_2 P_3 Q_1 Q_2? Q_3

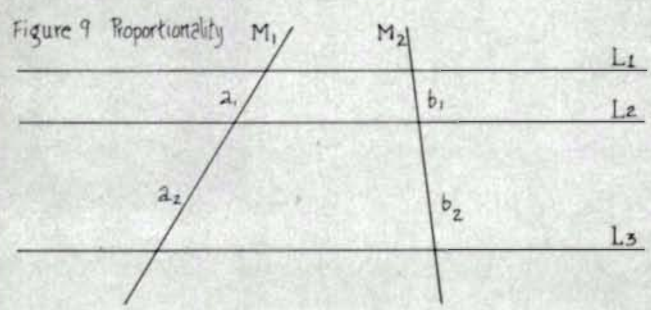
Solution: Draw an auxiliary line through Q_1 at any convenient angle and beginning at Q_1, mark on it lengths P_1P_2 and P_2P_3. Then place a straightedge and drafting triangle so that an edge of the triangle connects P_3 with Q_3. Hold the straightedge in place and slide the triangle along it to P_2. A line drawn here will be parallel to P_3Q_3, and thus locates Q_2 (figure 10).

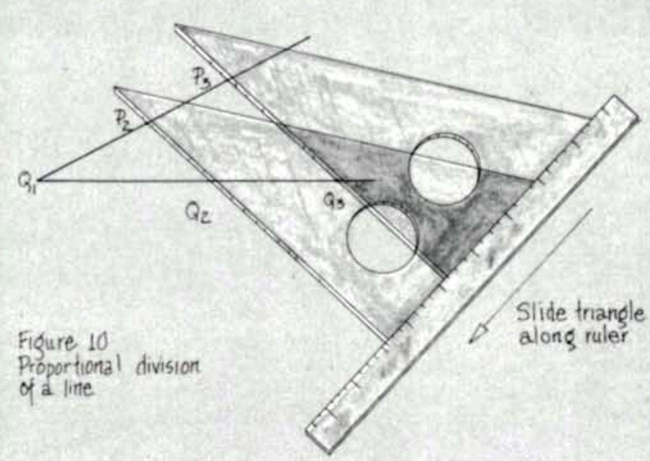
If you wanted to divide a line into five equal parts, you would use the same strategy: draw the auxiliary line, and

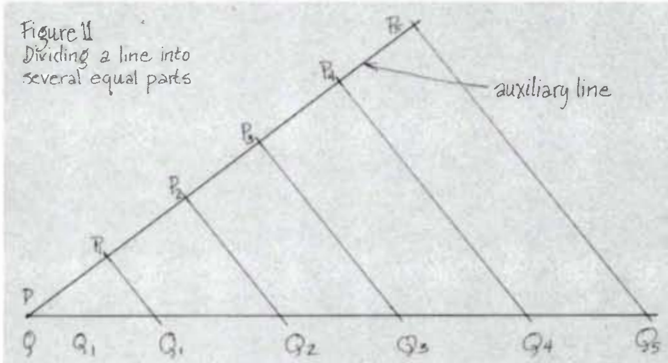


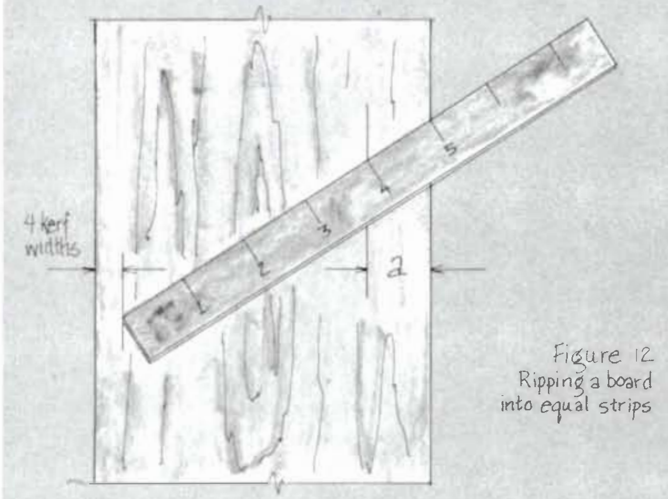


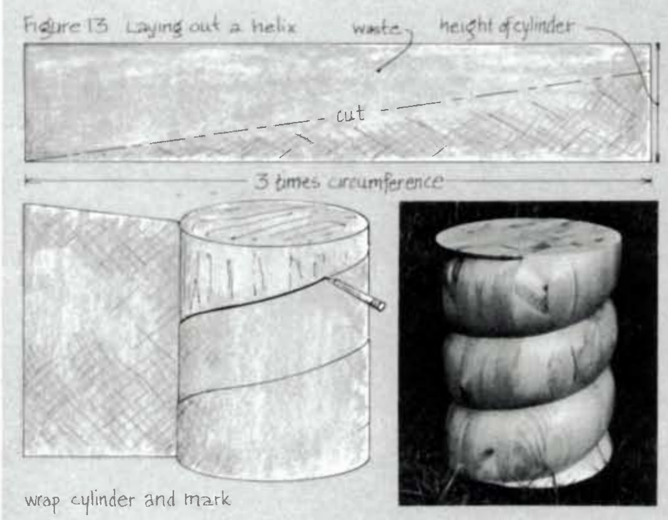


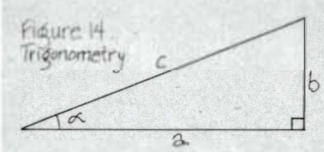


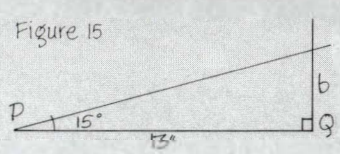


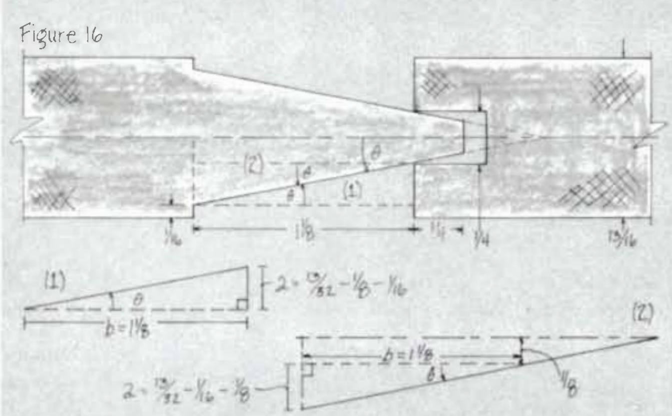












measure five equal, but convenient, intervals along it. Then use the square-and-ruler method to drop parallels from these points on the auxiliary line to the line you want to divide (figure 11).

Practical applications: You want to rip a board into *n* equal strips, for example, five strips. First make a test cut into scrap and measure the width of the kerf. Then mark off four kerf widths from one edge of the board. Start a ruler at this point and incline it until it crosses the other edge at some multiple of five. Mark at the fourth multiple, and measure squarely from there to the edge (*a* in figure 12). The width *a* is the distance from the rip fence to the inside of the sawblade.

A related problem is marking off threads on a cylinder, as for a twist carving. My version is the laminated pine table, shown in figure 13 without its round ½-in. glass top, carved from a cylinder 17 or 18 in. high and 14 or 15 in. in diameter. I wanted the thread to go around three times, so I wrapped a string around the cylinder three times, and cut it off there. Next I cut a piece of brown paper the same length as the string, and marked off the height of the cylinder on one edge. Then I cut along the line from the corner to this point, making a long triangle, which I wrapped around the cylinder, its bottom edge aligned with the bottom edge of the wood, and marked along the long side of the triangle as I went.

Here is a brief introduction to trigonometry, the study of relations between the sides and angles of triangles. Trigonometry is sometimes seen as a fearful creature, but with an electronic calculator and a note of the basic relationships, you can tame it for shop use.

Suppose you start with some angle α (the Greek letter *alpha*) and complete the triangle as shown (figure 14) so that side c is opposite a right angle. The side of the triangle opposite a right angle is called the hypotenuse. Now, no matter how large or small the triangle is drawn, the ratios a/c, b/c and b/a are fixed numbers. They are completely determined by the angle α. These ratios are given names: sine, cosine and tangent. We write

$$\sin\alpha = \frac{b}{c} = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos\alpha = \frac{a}{c} = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan\alpha = \frac{b}{a} = \frac{\text{opposite side}}{\text{adjacent side}} = \frac{\sin\alpha}{\cos\alpha}.$$

Pythagoras shows that $(\sin\alpha)^2 + (\cos\alpha)^2 = b^2/c^2 + a^2/c^2 = 1$, since $a^2 + b^2 = c^2$.

Problem: Suppose it is necessary to mark off an angle of 15° from the vertex P, where the length PQ is 13 in. That is, find length b in figure 15. We know that $\tan 15° = b/13$. From the calculator or from tables, we learn that $\tan 15° = .2679$. So, $b = 13 \times .2679 = 3.48$.

Practical application: What is the correct table-saw angle for cutting the taper on raised panels in a door?

First solution: Draw the cross section full-size or larger, and measure with a protractor.

Second solution: From the drawing, extract the relevant right-angled triangle and establish the length of two sides by subtracting known dimensions. Figure 16 shows two ways to do this, giving opposite side b of 7/32 in. and adjacent side a of 1⅛ in. $\tan\theta = \frac{7}{32}/1\frac{1}{8} = .09144$. You can use trig tables to identify θ or punch $\tan^{-1}(.01944)$ into the calculator and get 11°. On some calculators this operation is marked "arctan." □

Oblique Miters in Stock of Variable Thickness

by Jim Cavosie

In my job at a harpsichord shop, I had the task of mitering ¾-in. veneered plywood at oblique angles, so that both the inside and outside surfaces lined up flush. This caused me a lot of headaches because ¾-in. plywood comes from the factory plus or minus ⅓₂ in. The standard procedure was either to measure the thicknesses, make a drawing and measure the resulting angles with a protractor, or to rely on trial and error and experience. I found a faster and more accurate way using trigonometry and a pocket calculator. The derivation was difficult, so I'll just give the resulting equation.

To find the exact miter angles, you first need to find the length x of the line on which the two thicknesses can join flush. Measure the thickness of the two boards (a and b) and find the total angle of the miter joint (angle A plus angle B). Then find x by solving the following equation:

$$x^2 = \frac{a^2 + b^2 + 2ab\cos(A + B)}{\sin^2(A + B)}.$$

Once length x is known, finding the two miter angles is easy. Since $\sin A = a/x$ and $\sin B = b/x$,

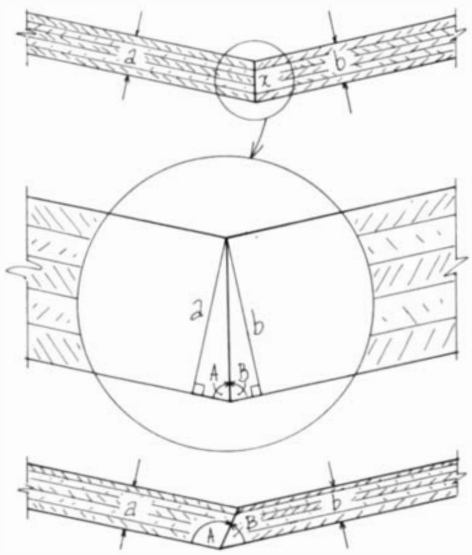
$$\text{angle } A = \sin^{-1}\left(\frac{a}{x}\right)$$

$$\text{angle } B = \sin^{-1}\left(\frac{b}{x}\right).$$

If $(A + B)$ approaches 180° and a is much greater than b, it is possible for angle A to be greater than 90°. If this is the case,

$$\text{angle } A = 180° - \sin^{-1}\left(\frac{a}{x}\right).$$

When many miter joints have to be cut at any given total angle, it makes sense to calculate a table of values for angles A and B over a range of values for a and b.



Jim Cavosie lives in Carrboro, N.C.

Boring Angled Holes

by Jacob N. Frederiksen

Here is a way to set up the drill press for boring angled holes, as in the seat of a Windsor chair. Most instructions call for tilting a bit brace back at some angle A, and to the side at another angle B. When using a drill press, it's easier to rotate the work through an angle of $R°$ in the horizontal plane, then, by means of an auxiliary table, to tilt the work to an angle T. The tilting table consists of two squares of plywood hinged along one edge and fixed to the drill-press table. The tilt is achieved by fitting blocks of wood under the back edge of the top piece of plywood.

The basic equations are:

$$\tan R = \frac{\tan A}{\tan B}$$

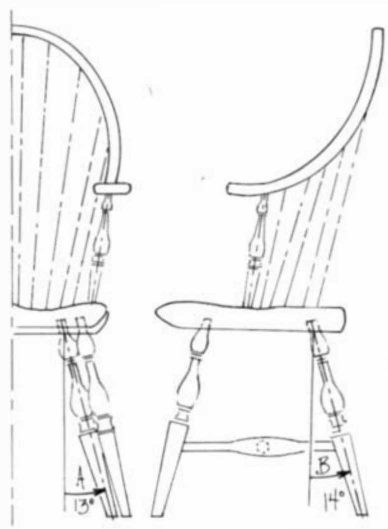
$$\tan^2 T = \tan^2 A + \tan^2 B.$$

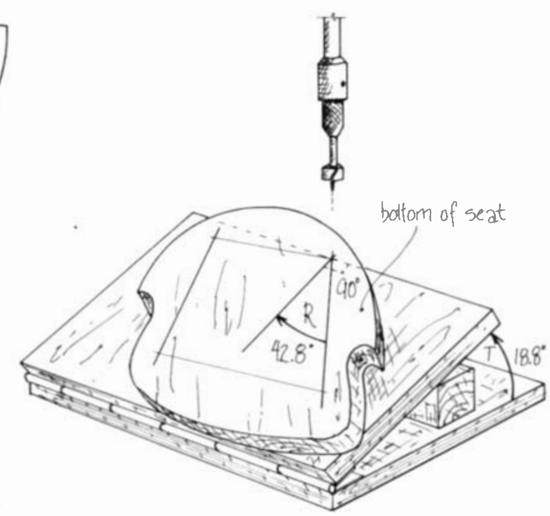
When the angles are given in terms of R and T, they can be converted back to angles A and B using the equations:

$$\tan A = \tan T \sin R$$

$$\tan B = \tan T \cos R.$$

Here is an example. I have been building a Windsor chair using Michael Dunbar's plans, purchased through Woodcraft Supply (313 Montvale Ave., Woburn, Mass. 01888). The rear legs of this chair tilt 13° outward (angle A) and 14° to the rear (angle B). The front legs tilt 15° outward and 9° to the front. These angles are measured from a line perpendicular to the bottom of the seat. For the rear legs, the work should be rotated on the table through an angle R:





$$\tan R = \frac{\tan 13°}{\tan 14°} = \frac{.230868}{.249328} = .925962$$

so angle $R = 42.8°$.

The table should then be tilted at an angle T:

$$\begin{aligned}\tan^2 T &= \tan^2 13° + \tan^2 14° \\ &= (.230868)^2 + (.249328)^2 \\ &= .115464,\end{aligned}$$

so $\tan T = .339799$, and angle $T = 18.8°$. For the front legs, where A is 15° and B is 9°, angle R is 59.4° and T is 17.3°.

Having done the calculations, I drew reference lines back-to-front on the bottom of the chair seat, through the points to be drilled, as shown in the drawing above. Then I added a second line through the hole centers, at angle R from the fore-to-aft reference line. I rotated the work so that this new pencil line was perpendicular to the back of the table, then tilted the table to angle T. The height of the spacer block to produce angle T can be found by trigonometry, or by trial with a protractor. The important thing is to rotate the work before it is tilted, else you will introduce error, and it is good practice to convert angles R and T back to angles A and B, to guard against mathematical mistakes. □

Jake Frederiksen, 53, of Chevy Chase, Md., builds reproduction furniture for his family.

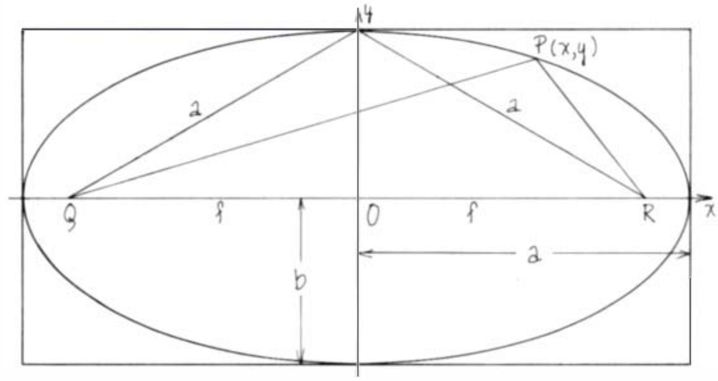
Drawing the Ellipse

Several ingenious methods

Everybody likes an ellipse. We use them for picture and mirror frames, tabletops, inlays and carved decoration. Everybody also seems to have trouble drawing an ellipse of the size and proportions he wants. First, a definition. An ellipse is a closed curve traced out by maintaining a constant sum of distances from two fixed points in a plane.

If points Q and R are $2f$ units apart and P is a point that is allowed to move so that length PQ + length $PR = 2a$ (a constant), then P will traverse an ellipse that fits into a box measuring $2a$ by $2b$, where $b = \sqrt{a^2 - f^2}$. If we place the center of this box on coordinate axes, then each point P on the ellipse with coordinates (x,y) satisfies the equation:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$



The major axis of the ellipse has length $2a$ and the minor axis has length $2b$. Points Q and R are called foci or focal points of the ellipse. The size and shape of the ellipse are wholly determined by our choice of a and b (half the length of the major and minor axes). These dimensions define the rectangle into which the ellipse will fit, and only one ellipse will fit any particular rectangle. If a is much greater than b, the ellipse will be long and thin. As a approaches b, the ellipse becomes more nearly circular, until $a = b$, whereupon the foci P and Q coincide at the center of a circle of radius a.

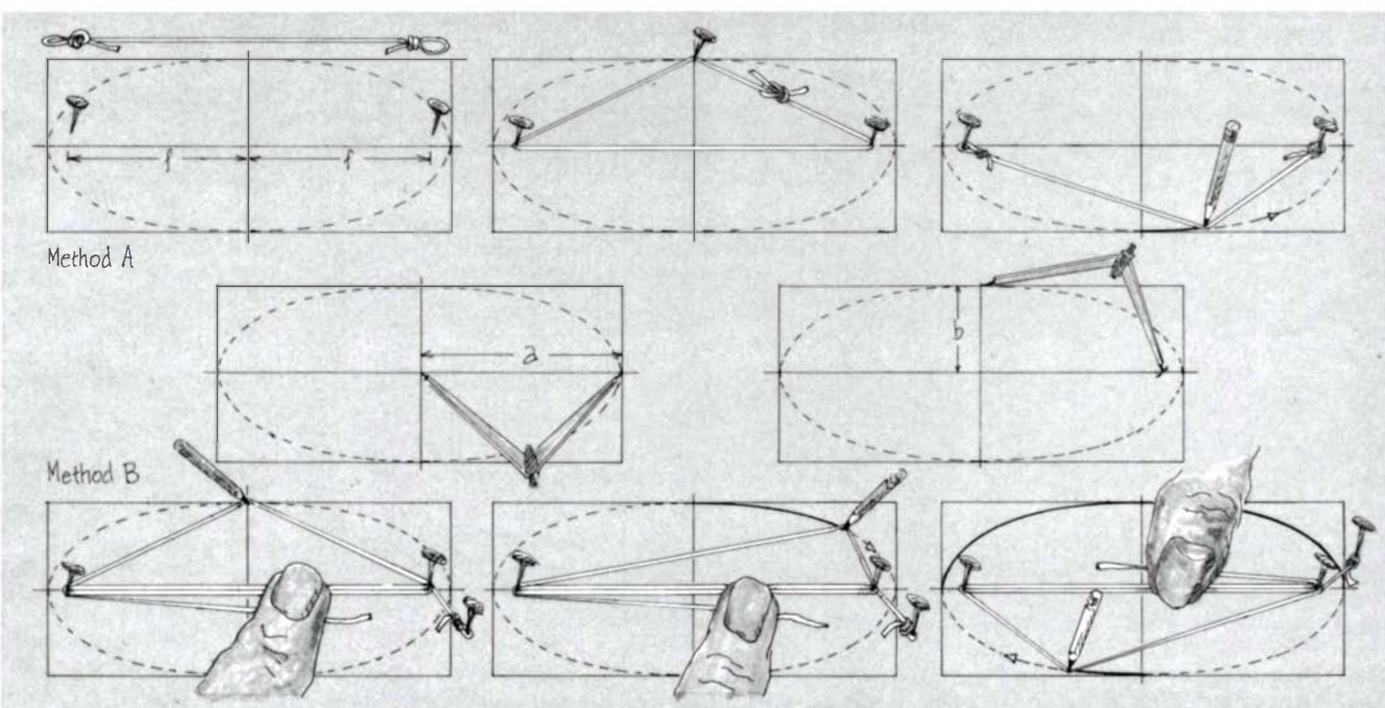
The usual shop problem is to draw an ellipse inside a rectangular box whose dimensions are given. There are a number of ways to do it.

The best-known solution (method *A* below), but not necessarily the easiest or best, is to draw the major and minor axes inside the rectangle, locate the two foci, drive two nails or push-pins there, and loop a string, monofilament line or braided fishline of length $2a$ around the pins. A pencil is pushed against the string and pulled around, keeping the string taut.

You can make the string come out to length $2a$ by driving a third pin at b on the vertical axis. Tie the string tightly around the three pins, then remove the third one. It doesn't matter whether you make loops at both ends of the string, or tie it into a loop around all three pins.

The distance f of each focal point from the center of the ellipse can be calculated from the formula $f = \sqrt{a^2 - b^2}$ or found geometrically. Set a compass to length a, put its point at b on the vertical axis, and scribe arcs to intersect the horizontal axis. These intersections are points Q and R, the foci of the ellipse.

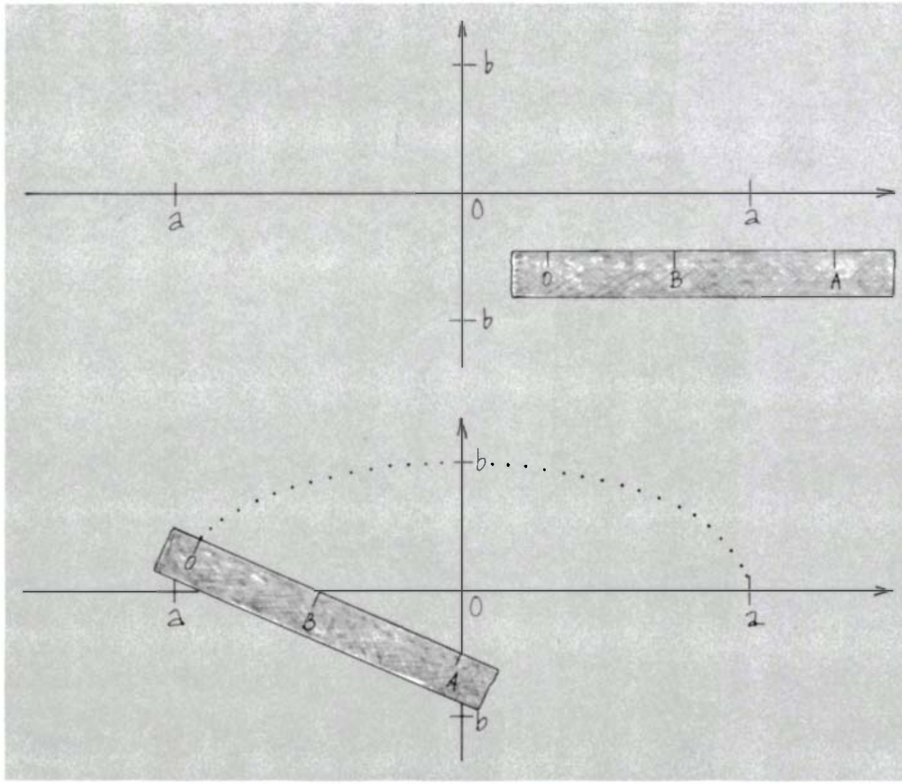
With method *A* it is difficult to make the looped string exactly the right length. A way to do it is shown in method *B*. Push-pins go at the foci, as before, but the third pin goes outside the ellipse and below the first two. Tie a loop in one end of a long string and drop it over the third pin. Run the string over the focal pins and around them twice, bringing its end over to the center of the ellipse. Then put your finger on the strings between the two pins. Pick up the last pass of string with the pencil, put just enough tension on it to keep from breaking the pencil point, and move the pencil up to the top center of the rectangle *(b)*. Keep the string taut, and sweep the pencil to the right to draw a quarter of the ellipse. Repeat the exercise three more times, moving the third pin above the center line after completing the top portion of the ellipse.



The trouble with the looped string methods is that it is quite difficult to maintain string tension and still keep the pencil at exactly the right tilt. The simplest and most accurate way to draw an ellipse is the so-called paper-strip method, which avoids focal points and string altogether.

Begin with coordinate axes and mark off length *a* to the left and right, and point *b* above and below, to define the rectangle in which the ellipse will fit, as shown in the drawing at right. On the edge of a separate strip of paper, tick a point and label it *O*. From point *O*, tick off length *a* and label it *A*. In the same direction from *O*, tick length *b* and mark it *B*.

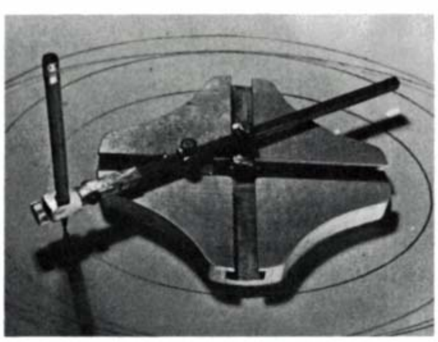
Now, whenever this edge is placed so that *A* falls on the vertical axis and *B* falls on the horizontal axis, *O* has found a point on the ellipse. Slide the strip along the axes, mark as many points as you find reasonable or necessary, and connect them to obtain the ellipse.



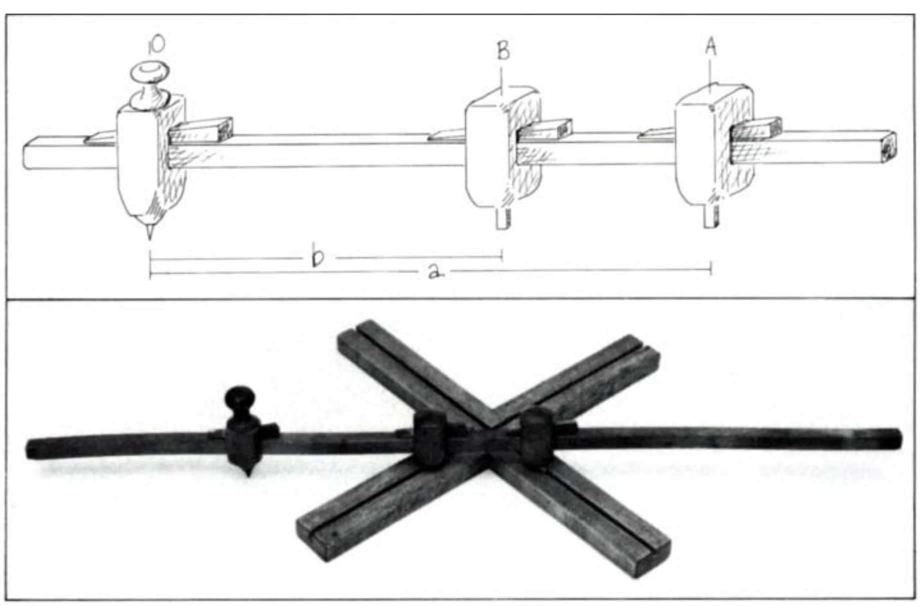
A simple device can be made for drawing ellipses by substituting for the strip of paper a trammel beam carrying two points and a pencil. You draw the axes as before, and set the trammel so that point *O* is the pencil, with lengths *a* and *b* held by the trammel points, as shown in the drawing below. If you can keep the points on the axes, the pencil will draw the ellipse. The Dominy family of woodworkers and watchmakers, who worked on Long Island from about 1760 to 1830, used an ingenious homemade trammel that ran in tracks, making it possible to draw ellipses blindfolded (photo). The track is simply two strips of wood, crossed at right angles and grooved to take the trammel points, which are not sharp but turned like a short dowel. The points slide along the beam and are fixed by wedges; thumbscrews would do as well. The Dominys probably tacked the track to the work and used an iron point to scribe the ellipse. A linkage like this might be arranged to guide a router directly into the stock, but we don't know anybody who has tried it.

One final note: to make two ellipses with parallel sides, as for a picture or mirror frame, two complete ellipses must be drawn because they will have different foci. The governing parameter for each is the box inside which it will fit, and the width of the resulting frame is the difference between the dimensions of the two boxes. □

This account was compiled from information sent by Ed Moore (definitions), Rufus Winsor and Fred Johnson (string methods), C.W. Beringhaus (paper method) and Steele Hinton (trammel method). Moore, a woodworker and associate professor of math at the U.S. Naval Academy, will field shop math problems in our Q/A column, Box 355, Newtown, Conn. 06470.



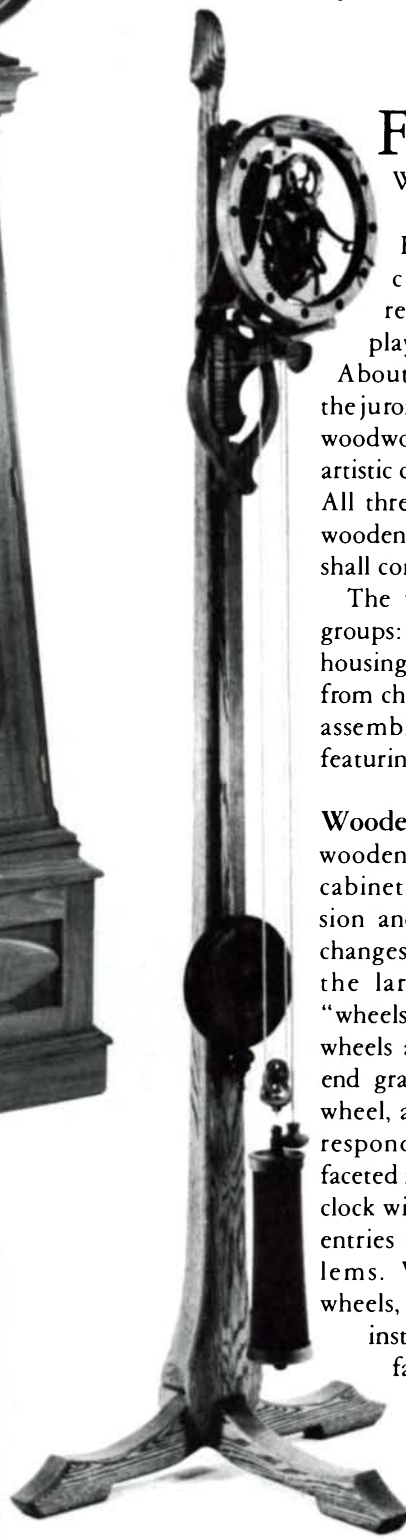
Ellipse trammel by Trevor Robinson of Amherst, Mass., has steel sliding blocks. The distance from pencil to farther pivot is half the major axis, and from pencil to nearer pivot is half the minor axis. Right, the Dominy trammel: birch beam is 39 in. long, sliding blocks are maple with satinwood wedges. Crossed tracks shown are a modern replacement. Photo from With Hammer in Hand *by Charles F. Hummel, courtesy the Henry Francis du Pont Winterthur Museum.*



It's About Time

A show of hands in Worcester, Mass.

by Rosanne Somerson



From February 2 to March 16, the large exhibition space at the Worcester Craft Center clicked, whizzed, chimed and tocked. Fifty-one hand-made clocks, clock mechanisms and time-related craft objects were displayed in a juried show called "It's About Time." From 160 entrants, the jurors chose work by 40, including 15 woodworkers. Entries were judged on artistic concept, fabrication and design. All three juror's awards were given to wooden grandfather-type clocks, and I shall comment mainly on them.

The wooden clocks fell into three groups: handmade wooden works, cases housing purchased works that ranged from cheap battery units to lavish brass assemblages, and kinetic sculptures featuring clockish mechanisms.

Wooden mechanisms—The maker of wooden clockworks, even more than the cabinetmaker, contends with expansion and contraction as the humidity changes. Clock-makers, by the way, call the large gears in the time train "wheels." The smaller cogs engaging wheels are "pinions." There is lots of end grain around the edge of a large wheel, and not much mass, so the wood responds promptly. If these multi-faceted relationships are not correct, the clock will run inaccurately or not at all. entries suffered from moisture problems. Works had warped wooden wheels, cases had open joints. In some instances poor construction was at fault; in others a drastic change in environment seemed to be the culprit, though the gallery is centrally humidified.

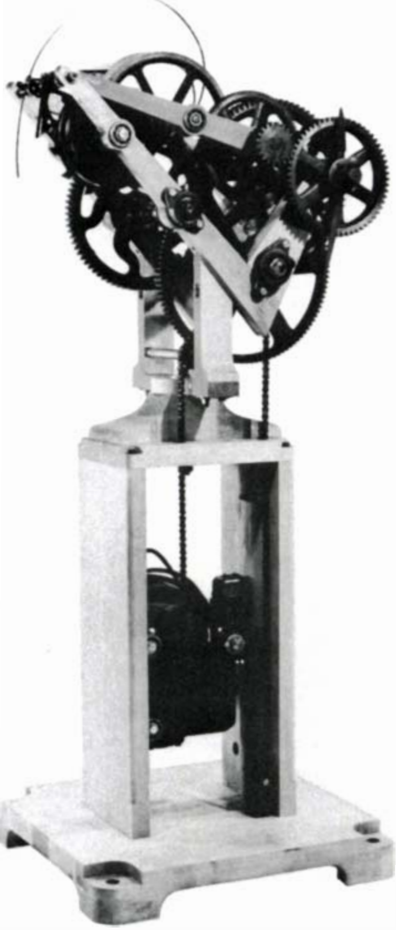
R. Jesse Morley of Westwood, Mass., showed two clocks with wooden works, one of walnut and one of oak. The weight-driven mechanisms were the same in both, and both ran like, well, clockwork. I found Morley's craftsmanship as impressive as his attention to detail. His lathe-turned knobs crest in delicate peaks, and he shapes edges as carefully as whole parts, gently easing off where one part seats into another. His lantern-style pinions ("Wooden Clockworks," *FWW* #10, Spring '78), use nylon rod instead of wooden dowel—perhaps a reason that they run so smoothly.

Morley's walnut clock, with its hand-painted face and refined surfaces, would better fit a traditional setting than would his oak clock. I preferred the more sculptural oak one, because he designed it with such congruous sensitivity to the individual elements of the works I felt more evidence of the spirit of the maker. The works of both run for 30 hours, which may seem limiting to some. My hunch, though, is that anyone owning a Morley clock would not resent having daily to raise the weight. Interacting with such a fine mechanism would be sheer pleasure.

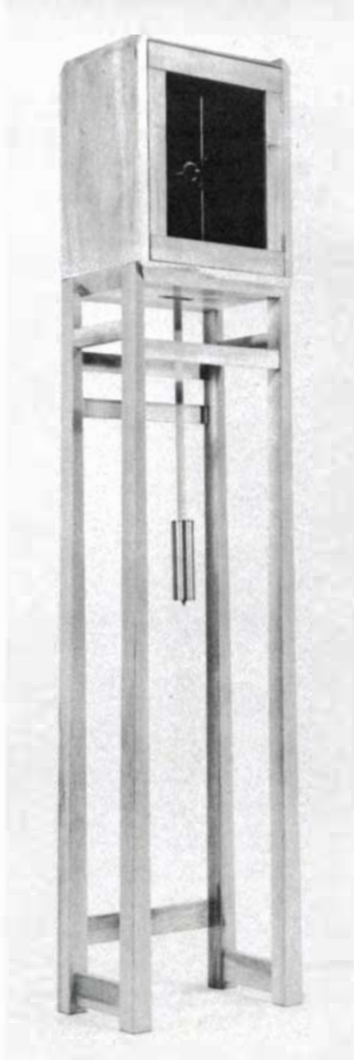
Morley's walnut clock received a juror's award, as did the elegant one made by John Economaki, although the latter did not run. Made of rosewood and teak, it consists of two simple wood frames encasing a beautifully shaped mechanism, pendulum and weights—little sculptures all integrated with each other and with the negative spaces around them. The clock's openness makes it interesting to view from any angle. Sadly, its wooden wheels warped terribly in being shipped from Oregon. They were made of two layers glued cross-grain, then pinned to brass rings in an attempt to add stability. I spoke to Economaki, and he agreed that the mistake was two cross-grain layers which expand differently, instead of three thin layers, the center one cross-grain, which would be stable like plywood. I also discussed the clock's design with him, because it is strikingly similar to one made by John Gaughan of Los Angeles. Gaughan's clock was shown in the Craft Multiples exhibition several years ago (*FWW* #1, Winter '75). I wonder if the jurors knew, when they made the award, of the existence of Gaughan's and other similar clocks.

Prize-winning walnut clock, top left, and oak clock, above, by R. Jesse Morley. The nylon rod he used for lantern pinions (detail) helps keep the wooden mechanism running smoothly. Each clock is about 6 ft. tall.

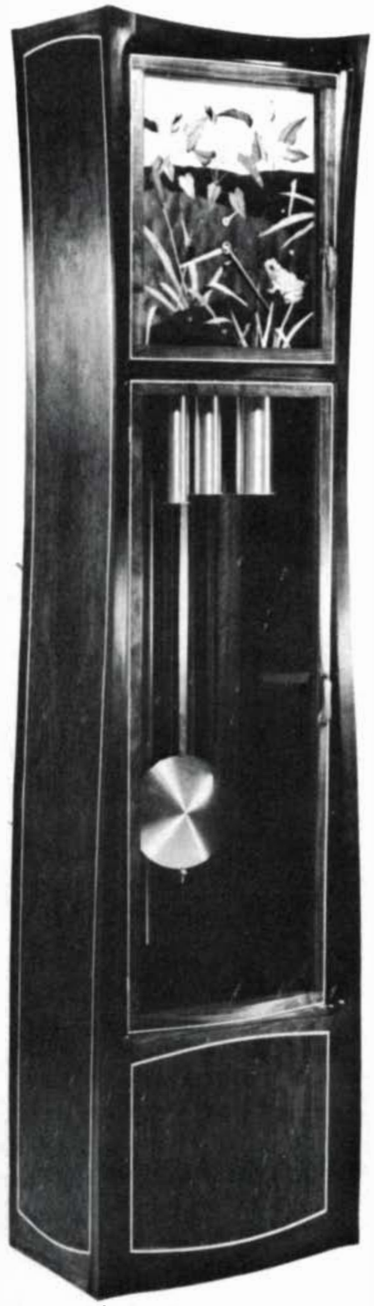
Portraits: John Russell; Details: Rosanne Somerson

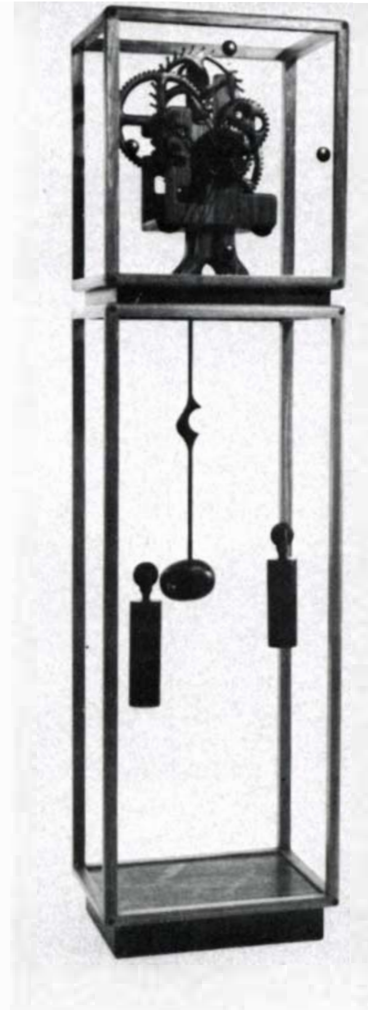


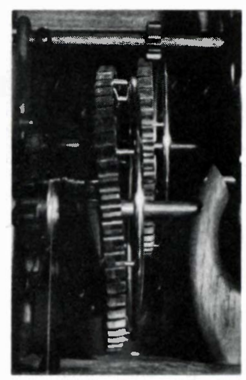
Clock #1, by William Bellows, is driven by the weight of its electric motor. It's 66 in. high.



Clean case detailing sets off Lawrence Bickford's maple and cocobolo clock, 66 in. high.







Silas Kopf's lavish marquetry clock is 84 in. tall (above). Warped wheels kept John Economaki's clock from running (right).

Wooden cases—Tall Clock II, made of maple by Lawrence Bickford of Berlin, N.H., is starkly simple yet handsome. The angled bottom of the clock box nestles onto a pedestal made with the complementary angle, a simple detail that adds visual interest. The piece feels inspired by the work of James Krenov. A simple vertical line gives the eye a reference for judging time, making it easy to imagine the perpendicular that would mark the quarter hours.

This simple clock contrasts sharply with Silas Kopf's marquetry prize-winner, embellished throughout. The case is framed in walnut with lauro preto panels, outlined in maple stringing. The face has a marquetry picture of a frog, cattails and water, made to look three-dimensional by hot-sand shading of the veneers. Brass dots mark the hours. This is an extravagant piece, yet its $4,500 price does not seem too high for the quality of the cabinetry, fine detailing, fancy brass works and impressive stature. The front of the case is slightly bowed and all the curves are softened, keeping this large clock from being overpowering. My only disappointment was that the folksy marquetry picture and the elegant case seem to be of different character.

Clockish sculpture—The most imaginative clock in the show was made by William Bellows of Jamaica Plain, Mass. He assembled metal gears, bearings, pillow blocks and assorted salvaged parts, all set into a wooden base shaped like a typical machine stand. The weight-driven mechanism uses a spring escapement rather than a pendulum, with a ¼-HP electric motor hung from bicycle chain serving as the weight. The motor slowly descends, then at the bottom hits its switch to turn itself on, and, guided by steel rollers in a grooved track, pulls itself back up the bicycle chain. At the top it turns itself off and starts the cycle over again—essentially a self-winding electric clock. The cycle takes about 20 minutes and the clock is not especially accurate, but it ticks very loudly and held the attention of large crowds throughout the show. □

Cabinetmaker Rosanne Somerson is Fine Woodworking's *Boston-based correspondent. A well-photographed show catalog costs $4.50 postage-paid from the Worcester Craft Center, 25 Sagamore Rd., Worcester, Mass. 01605.*

Marquetry with Flexible Veneers

Backed material can be cut with sharp knives

by Paul L. McClure

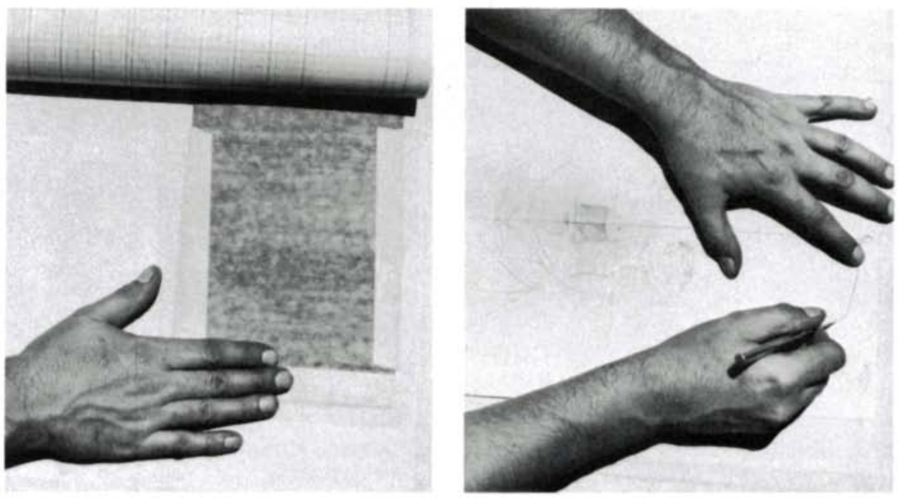
During the past five years, I have been producing marquetry with flexible veneers. This is a perfect medium for the amateur and novice craftsman. The veneers are very thin (1/64 in.) and have a nondirectional backing blown onto them, which eliminates warping and checking. They are all flitch-matched—off the same log and in sequence. Forty species are available in flat-cut veneer, and some are also available in quartered and rift.

Since these veneers are so thin, they are easy to cut with a knife. I use the knife method exclusively. This method is not new—an Italian marquetarian, Antonio Barili, made a marquetry self-portrait in the year 1502, using a shoulder knife. Veneers in those days were quite thick, up to 1/4 in., and he really had to lean on the knife. Today's flexible veneers are easy to cut with an X-acto knife.

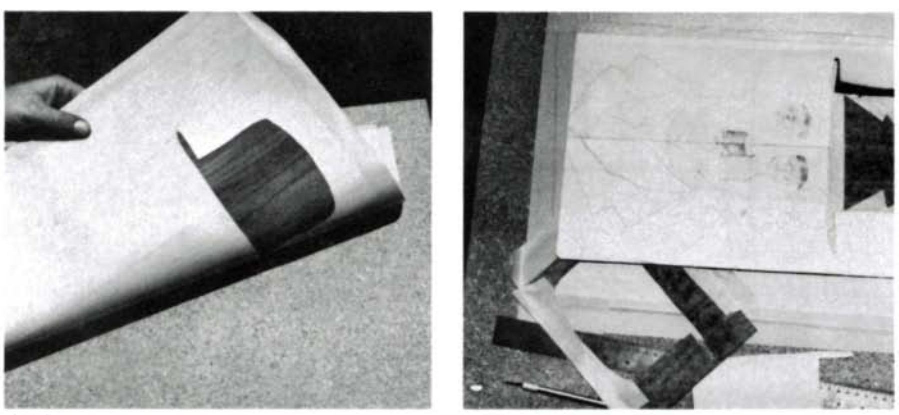
My tools are an X-acto knife with pointed blade (no. 11), a metal ruler with cork back (from the stationer; it won't slip), drafting tape (it is more transparent than masking tape, and has less gum, so it won't pull wood fibers out of the veneer), latex contact cement, a brush and a maple rolling pin.

I start by finding a picture that is as close as possible to a line drawing, such as a cartoon character. The first picture I made was of Mickey Mouse, taken from a coloring book. This type of picture is ideal because all the colors are definite and require no subtle shading. As you will have guessed, I am not expert at drawing, so I try to find most of my pictures already drawn. I enlarge them by redrawing with the grid method. My

AUTHOR'S NOTE: Many hardwood lumber and plywood outlets carry or can obtain flexible-backed veneers. Constantine (2050 Eastchester Rd., Bronx, N.Y. 10461) and Craftsman Wood Service (2727 South Mary St., Chicago, Ill. 60608) sell it by mail order; stores and yards in the MacBeath, Paxton and Plywood Plastics chains carry it.



Left, background veneer and paper pattern are taped to particle-board surface. Pattern is hinged back so object veneer can be taped in position. All veneers are taped face down, with flexible backing material up. Right, knife cuts through pattern and object veneer at same time, but second or third pass will be needed to cut background veneer.



Left, the hat veneer just fits the cutout in the background veneer. Right, with the hat taped in place from the back, the next area is ready for cutting and fitting. Scrap from the hat will make the eyebrows, hair and mustache.

Detail, 'The Little Tramp' (1977); bird's-eye maple, Brazilian rosewood, Indian rosewood, cherry, walnut, satinwood and poplar.

Photos: Ross McClure; Illustration: Christopher Clapp brother is an artist, and he helps me in this respect. Creating a picture in wood from a pattern or design drawn by someone else does not prevent it from being an original—it takes creativity to obtain the desired effect using only the colors, grain patterns and textures available in wood.

Choose a veneer of appropriate color, texture and figure for the majority of the background. This is the critical choice—all the other veneers have to work with it, or contrast against it. Now choose veneers for the rest of the color scheme. Number them and their respective areas on the picture, to keep track. Also, decide which areas to cut first and which last. Remember that as you cut the pattern, it will slowly be destroyed. Normally, I start at the center of the picture and work outward, but sometimes I have to alter this approach.

On a piece of particle board 6 in. larger than the picture, cut a rectangle of background veneer 1 in. oversize on all four sides. This margin allows you to glue the completed picture onto a backing board with room to trim. Tape the background veneer face down (flexible backing up) on your cutting surface. Tape one edge of the pattern down as well, so it can be raised up and down, like a hinged box lid.

Place a piece of veneer face down under the correct part of the pattern, with its grain going in the direction you want. Make sure it's right, then hold the veneer in place and lift the pattern back. Tape the object veneer to the background veneer. Put the pattern down again, and tape its free edges so it can't shift. Now cut through the pattern and the object veneer, and try to cut deep enough to at least score the background veneer, which will leave a white line. It usually takes two and sometimes three passes.

By now, the pattern will be almost destroyed and a mass of tape will have taken its place. Pull the tape off the edges of the background veneer and turn it over. The entire marquetry surface will be revealed, and you can inspect it. You may have to make some new pieces of veneer to fit. This is done by the window method. Place the vacant area in the background veneer over the object veneer and then tape the object veneer to the background veneer and cut it to fit.

Next, cover the entire front surface of the picture with strips of tape, to hold the pieces in place and make the assembly rigid enough for gluing. Remove all the tape from the back of the picture, making sure no small bits of veneer come away with the tape, and glue the picture onto the desired surface. I usually use a ½-in. or thicker particle board or birch plywood. When using plywood, make sure the majority of the grain in the picture is going at right angles to the grain of the top ply. I use latex (water-based) contact cement. In five years, none of my work has delaminated. This type of glue goes on smoothly, does not require heavy clamping and becomes stronger with age.

Once the marquetry has been glued down, roll the entire surface with a maple rolling pin to ensure proper adhesion. Pull the tape off the veneer and you will notice wet contact cement in the joints. Sand the entire surface with 600-grit wet/dry sandpaper. The sanding dust will adhere to the wet contact cement and create a natural filler for the fine gaps between the veneers. Finish in any way you desire—oil, lacquer, shellac or plastic. □

Paul McClure works for Frank Paxton Lumber in Denver, and also teaches at the Colorado Woodworking Institute. He describes another side of his work in the box at right.

Bubinga solves a weighty problem

"Can you make a teeterboard that will withstand the stomp of a five-and-one-half-ton elephant?" asked Gunther Gebel-Williams of Ringling Bros. Barnum & Bailey Circus.

My partners (Jim Woodruff and Fred Rish) and I asked a few questions, and accepted the challenge. A teeterboard is a seesaw 8 ft. long and 20 in. wide. Gebel-Williams stands on one end and Nelly, the elephant, stomps on the other. Gebel-Williams is catapulted into the air and onto the elephant's back.

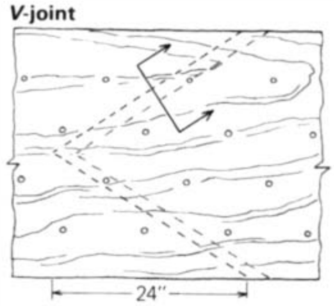
We needed a wood that had high shock resistance, elasticity, hardness and machinability, and also that would be available on the market. After perusing the *Wood Handbook* charts (reviewed on p. 28), and other charts, graphs and texts, we chose bubinga (African rosewood). The construction also took a lot of brainstorming. We decided to sandwich ½-in. Baltic birch, a nine-ply board made in Russia, between two pieces of 4/4 bubinga. We would add a 5-ft. plate of Baltic birch running from the elephant end to the fulcrum on the bottom, and a 3-ft. plate over the fulcrum on the top of the board.

Since our supplier sells Baltic birch only in sheets 60 in. by 60 in., we'd have to splice the middle layer either in the center or 2 ft. in from each end. We decided to splice in the center, but to use a *V*-joint spanning 2 ft. and to shiplap the mating edges, thereby having potential weakness neither over the fulcrum nor under the elephant. We also had to join the bubinga in width, so we made sure the glue lines were offset by using two boards for the top layer and three for the bottom. We crossed the glue lines with ¼-in. dowels on 8-in. centers.

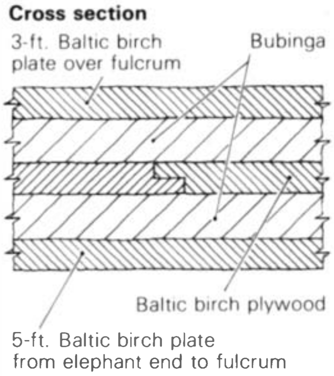
Now our clamps wouldn't span the sandwich, so we drilled a pattern of ¼-in. holes in staggered rows, 30 holes, and tightened down a ¼-in. bolt with washers through each hole. Our regular clamps took care of the edges. We used aliphatic (yellow) glue for the edge joints, and hide glue for the sandwich itself. When the glue had set we removed the bolts, rebored the holes to ⅜ in. and put in pegs. For edge and end caps, we had let the plywood protrude from the sandwich ⅜ in. all around, to fit a dado in solid bubinga. We added two offset rows of dowels through the edging into the bubinga.

We did the job in four days and delivered it to the circus. I was nervous as a cat when they brought in Nelly, the elephant. A few moments passed, which seemed like hours, then CRASH, the silence was broken but the board wasn't. Nelly stomped and even walked up it and the board didn't break. It was thrilling. You see, before our attempt, Nelly had broken 30 boards on the first stomp. —*P.L.M.*

V-joint



Cross section



One stomp on sturdy springboard launches Gebel-Williams.

Woodworkers and Copyright

Knowing the law is the best insurance

by Eugene S. Stephens

Copyright is simply the exclusive legal right to reproduce and sell your own work, and when you create an artistic object in wood, you also create a copyright under federal law. The copyright comes into being all by itself, as an automatic part of the act of creating. However, the copyright so easily obtained might later require some care to remain viable—in particular, the affixing of the © symbol, and perhaps registration with the government (see the box on the next page).

To create a copyright, woodwork must be artistic and original. Minor, visually insignificant variations of existing works lack originality and do not create a copyright, though works requiring artistic effort produce a copyright regardless of the level or quality of the art.

As a general rule, copyright protects work that is primarily to be viewed, not used. Marquetry pictures and patterns, sculptural carvings and pictorial carvings such as woodcuts are popularly recognized art forms that can be copyrighted. Protected sculptural and pictorial works can have abstract and suggestive shapes, and can be assembled or constructed as well as carved. Copyright applies even when the artistic portion of a work is small, such as a carved drawer-pull.

Functional forms and shapes, however, can not be copyrighted. This eliminates most furniture, cabinetry and utensils whose appearance, even though original, is more functional than visual. For example, scenes carved on cabinet doors would be protected by copyright because of their separate artistic impression, but the graceful lines and proportions of a cabinet's overall appearance would not be. On the other hand, sculptured wooden toys are protected by copyright because their appeal is predominantly visual, even though they are useful as playthings. Artistically shaped lamp and clock bodies also create copyright.

However, if you devise an aesthetic or ornamental look for a functional production piece, you might qualify for a design patent, which is different from a utility patent protecting how something works. A design patent requires a higher level of creativity than a copyright, and a patentable design must be so different from all previous designs that its form would not be obvious to an ordinary worker informed of all the existing design possibilities. A patent attorney will be able to evaluate and advise on patentable designs.

Original drawings and plans made for works in wood are protected by copyright, even though a piece built according to the drawings is not. Likewise, original photographs are protected. This means that the drawings or photographs may not be copied or published, even though nothing may prevent reproduction of the piece itself.

Copyright does not protect the underlying idea or concept involved in a work, but only its particular expression. For example, the first person to make wooden roller skates couldn't stop others from making versions of the same thing. Nor could anyone appropriate for his own the idea of a carved hand as a support for a bowl, even though others could not copy the particular hand.

Carvings and pictorial works that realistically represent animals, birds or other natural creatures and objects can be copyrighted, but the copyright has a narrow scope because others are free to create their own representations of the same creatures and objects. Copyright here protects only the particular shape, pose, arrangement and combination of features—the artistry with which nature is imitated and expressed.

It is important to be practical about copyrights because they apply to many works that never become valuable and are often of no consequence. Although the rights encompassed in a copyright are equally strong for all protected works, these rights are worth attention only for works that might be copied or become a source for derivative works, or whose public display or representation in photographs could be important.

What rights are covered? — The oldest and most significant copyright is the right to reproduce copies, though because of the time and skill required, reproduction copies in wood are usually not mass-produced. Nevertheless, the right to reproduce even a few copies can be valuable. The Nelson Rockefeller reproductions of artwork are an example. Rockefeller's contracts with the artists holding the original copyrights specify that the artist retains veto power over the quality of the reproduction and receives 5% of the retail sales price as a royalty. Wendell Castle's limited productions of his own carvings, made with the help of a machine that simultaneously carves several copies, are another example. Works in wood can sometimes be molded or cast in other materials, but the right to reproduce nonwooden copies also belongs to the copyright holder.

The right to distribute copies is separately stated under the copyright law, although it usually accompanies the right to make copies. It can be useful in stopping the distribution of infringing copies that are made out of reach, for example, in a foreign country.

Another copyright is the right to make derivative works. A photograph of a copyrighted work in wood is a derivative work, and copyright extends far enough to prevent copying or publishing photographs of the work, even if the photos were not taken by the woodworker. Besides photographs, derivative works include representations of the original work in other media, perhaps made larger, smaller or two-dimensional. Picture a copyrighted wooden work on a greeting card, a silver medallion or a dish. These would be derivative works requiring the creator's consent.

Another copyright that can be especially important to woodworkers is the exclusive right to display a work publicly. This gives the copyright holder control over how and where his work is exhibited. A good example of this is a chair that I own, carved by Jon Brooks from the stump and roots of an apple tree. Brooks has placed the chair on display in two shows, and because he retains the copyright and I only own the chair, I cannot show it publicly without his permission.

Transfer of rights — The rights to copy, distribute, display and create derivative works encompassed within a copyright are independent and can be separated from each other as well as from ownership of the original work. For example, the original work could be owned by the purchaser for private display, the public display rights could be retained by the copyright originator, the rights to make reproductions in wood could be sold or licensed to one party, and the right to make a derivative representation in another medium could be sold or licensed to someone else. Failing to specify these separate rights can lead to problems.

Simply selling a copyrighted piece to a purchaser gives the buyer none of the copyrights. Making a work on commission normally gives the buyer only the right to own the work, unless circumstances indicate that a transfer of copyright was intended. A work made for hire or a work made for an employer by an employee vests the copyright in the employer, along with ownership. If you employ artistic craftsmen or create artistic works for an employer, you should have a clear written understanding of who owns the copyright, especially if the employment is a loose arrangement.

The intentions of buyer and seller are the basis for deciding what rights are actually transferred. Unfortunately, these intentions often are not clear years later when a dispute arises. It is therefore good practice to note on sales slips, invoices, work orders or other papers whether copyright is being transferred or remains with the original holder. The copyright originator might also include a statement in the transfer documents reserving the right to borrow the piece back occasionally for public display. A permanent file containing a clear statement of the proprietorship of the copyrights for each piece that is transferred is good insurance against future problems. Also, deliberate transfers of copyright should be written out and recorded with the Register of Copyrights.

Generally, the craftsman should retain all the copyrights, unless they are specifically bargained for and sold. Then he should part with only sufficient rights to accomplish the immediate objective and not sign away the entire copyright just to achieve a limited publication of the work. Copyrights should not be lightly transferred.

Besides assigning or selling a copyright directly, a license can grant permission to use a copyright in a limited way. For example, a license could permit display of a work in a particular show or could allow publication of a photograph of the work in one specific way. Use of a copyright can be subjected to payment of royalties, approval of the copyright originator or the meeting of any specific condition. Any transfer of copyright should clearly state the rights and conditions involved.

Infringement of copyright — If you want to make direct or derivative copies of someone else's work without being liable for copyright infringement, you must either determine that no copyright exists or get permission or a license from the copyright holder. Copyright lasts for a long time. Since the January 1, 1978 date of the new Copyright Act, copyright applies automatically from the day a work is created and extends until 50 years after the death of the creator. The copyright of works made for hire by employees extends for 75 years from

How to Copyright

Notice—A notice is required on all copies of a copyrighted work that are distributed or offered for sale. The notice should contain the symbol ©, the copyright holder's name, and the year the copies are published. A generally known abbreviation or a business name can be used to identify the copyright owner. The original work does not need any notice, though you can place the symbol © next to your signature to notify the public of your copyright.

The copyright notice should be large enough to be read easily with the naked eye. It can be placed where it will not interfere aesthetically with the work, but you shouldn't have to open drawers or compartments or take the piece apart to find it. The general idea is to make the notice available to anyone who looks for it. The notice should be permanently attached, not separable like a removable tag. Carving, stamping or burning is best.

A copyright notice can also contain additional information and can omit the year of publication "where a pictorial, graphic or sculptural work...is reproduced in or on...jewelry, dolls, toys or any useful articles."

Registration—A copyright can be registered at any time. Though registration is not an absolute requirement, it is worthwhile for any valuable work that is likely to be copied, be the source of derivative works, or be involved in copyright licenses or assignments. Registration will help you enforce copyrights and collect damages for infringements.

The claim to copyright should be registered when copies of the work are made, if not before. To register pictorial or sculptural works in wood you'll need form *VA*, free from the United States Copyright Office, Library of Congress, Washington, D.C. 20559, (703) 557-8700. Registration requires a $10 fee and a deposit of the work. Since the Copyright Office does not accept three-dimensional deposits, works in wood should be photographed, and the photographs deposited. If you want to copyright original photographs and woodworking drawings or plans, send a copy of these to the Copyright Office along with form *VA*. The Copyright Office is generous in passing out information and has many pamphlets available on all aspects of copyright law. You can get them by writing or calling the Register of Copyrights. *—E.S.S.*

publication of the piece. Shorter time periods apply to works created and published before 1978, and works published in this country more than 75 years ago are public domain and freely copyable. If the copying you intend could be valuable and you are not certain whether a copyright exists, you should have a lawyer evaluate the situation.

If one of your copyrights is infringed, you have rights against the infringer, but what you do about it depends on the circumstances. Some infringements are so trivial that you can ignore them, and others are worth only a letter reminding the infringer of your rights. More serious infringements can result in litigation in federal court. You should consult a lawyer with copyright experience before you set out to enforce your copyrights because you could precipitate an expensive and undesirable lawsuit.

If you want help with infringements, transfers or other copyright problems, patent attorneys are more likely than general practitioners to be well-informed about copyright law. A complete list of all registered patent attorneys is available from the Commissioner of Patents and Trademarks, Washington, D.C. 20231. □

Gene Stephens is an attorney with Stonebraker, Shepard & Stephens in Rochester, N.Y.

EDITOR'S NOTEBOOK

On weekend conferences, shop fires and summer courses

by John Kelsey

The only way to know exactly what is in your lumber pile is to buy a moisture meter and learn how to use it. Keep close track of moisture conditions in the shop, and store dry lumber so it stays dry. Measure the moisture content of new lumber as soon as it arrives. If you paid for kiln-dried and it isn't between 6% and 10% (depending on the weather), scream and holler. It will be tough, but you have to persuade the dealer to take that lumber back—else you'll have to eat it when all the nice things you make to sell start moving unpredictably or falling apart.

That's the gist of the colorful message Dean Santner brought to a recent weekend gathering of 150 woodworkers at Berkeley, Calif. Santner owns a five-man shop in nearby Emeryville producing toys and boxes for the gift trade. The other speakers, most of them local talent, spoke and showed slides on such trends as the laser as a woodworking tool (on which I'll be writing soon), about chair design, on garnet abrasives, about current styles on our two coasts and in England, and on business practices for the small shop. Then Bob Stocksdale demonstrated bowl turning, Makoto Imai did Japanese joinery, David Kellar showed templates for routing large dovetails, and Doug Ayres carved with die grinders.

I've written a lot recently about get-togethers like this. I want to persuade you of their educational worth, especially to those of us who are self-taught craftsmen, not to mention the enjoyment of good company and new friends. I get lots of calls from readers asking how to find out about such events and why there aren't any wherever the caller lives. So I asked the Berkeley organizer, Willie Evans, boxmaker of Petaluma, what the secret was. Evans admitted it was pretty easy, no reason any woodworker couldn't organize a worthwhile get-together just about anywhere. There's some work, but most of it can be done in two bunches. First, about six months in advance, Evans decided what he wanted to learn and made a list of people who might speak or demonstrate their art. Rather than look for an organization or committee to verify his opinions, Evans simply assumed that others would share his interests, and he turned out to be right. He telephoned the people on his list to see who would be willing to appear, then he took his plan to the Berkeley university extension department. As it happened, they were looking for events to sponsor. They agreed to promote it, to handle the arrangements and to administer registration (each woodworker paid $45 for the weekend). The Berkeley people confirmed that most large universities are eager to get behind educational community events. Then a few weeks before the date, Evans got back on the phone to reconfirm the speakers and to devise a detailed schedule. After that he just had to be there on the weekend itself, wearing his best shirt, to introduce the speakers and say hello to new friends. He says he worried a lot but there were no hitches. He'll probably do it again next year.

• • •

One who is applying this simple formula is Dale Nish, woodturner and teacher of shop teachers. He grew weary of trekking east and west to meet craftsmen, so he is inviting them to Utah May 29-31. The price is $75 and the program features 25 distinguished speakers and demonstrators. Write Woodworking West, Brigham Young University, 242 HRCB, Provo, Utah 84602 for a brochure, or call (801) 378-4903.

• • •

Reader Charles Spear of Cincinnati writes to remind us about the terrible danger of spontaneous combustion in the woodshop. Spear was rubbing down varnish with steel wool and linseed oil. He carelessly forgot to take the oily pads and rags outside and, yes, they did burst into flames after he had gone to bed, but no, the house didn't burn down. Mrs. Spear awoke smelling smoke (their electronic smoke alarm made no peep), and she put the fire out.

Always put oil-soaked rags, steel wool and even shavings, in a tightly closed metal can, best kept outdoors. Or spread the rags outside to dry before throwing them away.

The fire regulations in San Francisco specified an overhead sprinkler system at John and Carolyn Grew-Sheridan's shop. But because they are a small, one-off furniture business, the fire marshall found another way. Grew-Sheridan bought several sets of three extinguishers (water, dry chemical and carbon dioxide) to mount strategically around the shop. Then he bought a common garden hose with trigger nozzle, long enough to reach every corner of the building. The hose is always hooked up and hangs neatly coiled on the wall. Nobody ever leans lumber or a bicycle against it. A week after he got the hose, a smoldering fire started in the shop next door, becoming a wall of flame by the time it burst through the partition. Because of that hose, both shops were saved.

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Summer allows many woodworkers, whether professional or amateur, time to take off and sharpen their skills at school. There are more good courses this year than last, with instruction and experience offered at more levels and in more locations. Some courses could be combined with a relaxed family vacation, while others promise an intensive, all-consuming experience crammed into just a few days.

Among this year's best opportunities are two concentrated sessions with James Krenov, the Swedish-American cabinetmaker and writer, in Mendocino on the northern California coast. Krenov will teach a four-week intensive seminar (June 16 to July 11) concentrating on tools including planemaking, joinery, and basic cabinetmaking techniques. He'll follow with a five-week advanced seminar (July 21 to Aug. 22) in which students will build major pieces of furniture.

Each session will accommodate between 10 and 20 people; prerequisites are experience with hand and machine tools and a desire to balance technique with the human and spiritual dimensions Krenov discusses in his three books. The organizers hope to develop these summer courses into a permanent, year-round school under Krenov's direction, if they can arrange start-up funds. Contact the Mendocino Woodworkers Association and Guild, Box 95, Caspar, Calif. 95420.

For those interested in sculptural furniture, Wendell Castle (who in past years has been a popular guest instructor at several other schools) will teach intensive classes in his own workshops near Rochester, N.Y. Castle has scheduled two week-long workshops (July 28 to Aug. 2 and Aug. 25-30) on the stack-lamination and bent-lamination techniques for which he is famous. He'll offer a third workshop Aug. 11-16 on basic joinery by hand and machine. Castle's staff of cabinetmakers will share the teaching load. In September, Castle plans to open a full-time, two-year school for about 20 students. For more information, write him at 18 Maple St., Scottsville, N.Y. 14546.

In Bennington, Vt., the English cabinetmaker Ian Kirby is repeating his intensive one-week seminars, eight of them running almost continuously from June 22 through Aug. 23. He plans to cover four topics—basic bench skills, basic woodworking techniques, frame-and-panel construction, carcase and drawer-making—twice each. Write Kirby Studios, BCIC Building, Water St., North Bennington, Vt. 05257.

Here are the other summer courses we had learned about by press time (March 1). Contact the schools directly for detailed information about schedules, fees and lodging.

California—California College of Arts and Crafts, 5012 Broadway, Oakland 94618. Wood bending, with E. E. Benson, May 12 to June 13; production woodworking with Peter Wright, June 16 to July 18; building a scale-model Japanese shrine and building a Japanese table with Kaehei Ichikawa, July 21 to Aug. 22.

California—The Cutting Edge, 1836 Fourth St., Berkeley 94710 and The Cutting Edge, 295 S. Robertson Blvd., Beverly Hills 90211. A wide selection of evening courses.

California—Evolution Art Institute, 6030 Roblar Rd., Petaluma 94952. Turning, carving & basic joinery with Bill Nereo, June -July.

Colorado—Anderson Ranch Arts Center, Box 2406, Aspen 81611. One-week courses in basic woodworking and furniture making with Sam Maloof, Art Carpenter, John Nyquist and Paul Nichols, June 11 to Aug. 15.

Maine—Maine School of Cabinetry, Box 12, Cobb's Bridge Rd., New Gloucester 04260. Beginning and advanced cabinetmaking with Thomas Moser and Bill Huston, July 16-28.

Massachusetts—Boston University Program in Artisanry, 620 Commonwealth Ave., Boston 02215. Wood Furniture Design I and II with Jere Osgood (May 20 to June 27) and Alphonse Mattia (July 1 to Aug. 8).

Massachusetts—Stringfellow Instruments, Windsor Mill, 121 Union St., North Adams 01247. Six-week course (beginning June 1) plus advanced work in making a flat-top acoustic guitar, with Bill Cumpiano. Open to five people.

Massachusetts—Truro Center for the Arts/Castle Hill, Inc., Castle Rd., Truro 02666. Bruce Hoadley will teach a course in decoy-making, Aug. 4-15.

Minnesota—Wood Carving School, 3956 Excelsior Blvd. Minneapolis 55416. Beginning woodcarving (May 19-23, June 2-6, and Aug. 18-22) and advanced (June 9-13) with Chris Effrem.

New Hampshire—Phoenix Workshops, 308 Sagamore St., Manchester 03104. Carving and sculpture with Jon Brooks, June 30 to July 11.

New Hampshire—University of New Hampshire Continuing Education Dept., 6 Garrison Ave., Durham 03824. Four one-week courses in making stringed instruments, including bow maintenance and acoustics for violinmakers. July 14 to Aug. 31.

New Jersey—American Carving School, No. 21 Pompton Plains Crossroads, Wayne 07470. Courses in basic, intermediate and advanced woodworking with Mike DeNike, July 9 to Aug. 17.

New Jersey—Peters Valley, Layton 07851. Weekend, one-week and two-week courses in sculptural woodcarving (June 23-27), sculptural furniture (July 1-3), joinery (July 7-11), non-traditional techniques (July 14-25), tables (July 30 to Aug. 1), and guitarmaking (Aug. 4-15). Instructors are Emil Milan, Michael Coffey, Robert Meadow, Ed Zucca, Edgar Anderson and Colin Butler.

New Mexico—Eastern New Mexico State University, Summer Woodworking Workshop, Station 11, Portales 88103. Two intensive courses: western carving with Tex Haase and Spanish colonial furniture with Marcus Romero, June 10-23.

New York—Art Life Craft Studios, 1384 3rd Ave., New York 10021. Sculptural wood carving, construction, carving, June through Aug.

New York—John Harra Wood and Supply Co., 39 W. 19th St., New York 10011. Cabinetmaking, May 15 to July 15.

New York—Woodsmith's Studio, 142 E. 32nd St., New York 10016. Cabinetmaking, carving, wood finishing, picture-frame making and wood turning, June 9 to Aug. 9.

North Carolina—Country Workshops, Route 3, Box 221, Marshall 28753. Week-long seminars in chairmaking (Aug. 18-22) with John D. Alexander, Jr., basketry (July 23-27 and Aug. 4-8) with Louise Langsner and traditional woodworking with Daniel O'Hagan (July 14-18) and Drew Langsner (July 28 to Aug. 1).

North Carolina—The John C. Campbell Folk School, Brasstown 28902. Three two-week courses (July 13-26, July 27 to Aug. 9, and Aug. 10-23) in multi-craft media, including woodworking and woodcarving to "combine three or more crafts in the production of a single piece."

Oklahoma—Northeastern Oklahoma State University, Industrial Education Dept., Tahlequah 74820. General Woods, Advanced cabinetmaking, design construction and furniture repair with Dunn Faires. Two terms, June 1 to Aug. 30.

Pennsylvania—Kutztown State College, School of Art, Kutztown 19530. Wood Design I and II, Wood Design Studio with John Stolz, July 14 to Aug. 14.

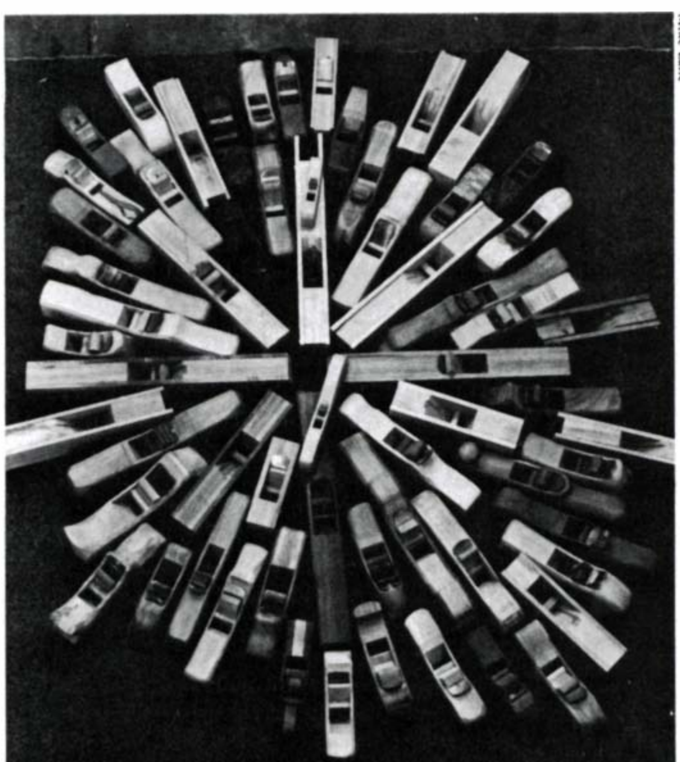
Rhode Island—Rhode Island School of Design, Box E-16, 2 College St., Providence 02903. Woodworking/Furniture Construction with John Dunnigan, June 16 to July 25.

Tennessee—Arrowmont School of Arts and Crafts, Box 567, Gatlinburg 37738. Furniture design, June 9-20, with Bob Kopf; woodworking, beginning to advanced, July 28 to Aug. 8, with John McNaughton.

Vermont—Guitar Research and Development Center, South Strafford 05070. Two courses in guitar design and construction with George Morris, June 2 to July 11, July 28 to Sept 5.

West Virginia—Augusta Heritage Arts Workshop, Box 1725, Elkins 26241. Four courses in woodworking, carving, country woodcraft and dulcimer and banjo making, July 7 to Aug. 9.

England—Avocations (Bristol Crafts) Ltd., 57 Coombe Bridge Ave., Stoke Bishop, Bristol, Avon BS9 2LT. One-week "craft vacations" living and working with craftsman-host. Concentrations include cabinetmaking, carving, turning, musical-instrument making and furniture restoration.


Mike Lane

Planes made by Krenov's students in Mendocino last summer.

by Richard Starr

DAN DUSTIN: SPOONMAKER 'I ask each spoon, what do you want of me?'

"Western man has always thought he is terrific. He knows what a spoon is. He knows what he wants to do. People who think they know can take a pencil and draw a picture and make it. But I'm different. I don't know anything. As I work on this spoon I don't have any opinions. I'm working like the ocean and this spoon is like driftwood." Dan Dustin is talking to me as he uses a hatchet to carve out a wooden spoon. We are standing at his outdoor chopping block amidst a mid-May mosquito swarm. His material is a piece of white oak just split from a bent branch.

"Western man has been hung up on sawn lumber for so long that he just doesn't think about this kind of thing," he says as I watch the spoon shape develop from the natural curve of the wood. "The difference between the white man and the primitive was the sawn board. When the white man made his wooden spoons, he traced the pattern on the sawn board and cut it out with a fretsaw, clamped it on the bench and chiseled it out." Dustin's hatchet rises and falls in a relaxed rhythm. It occurs to him to compare himself to a blacksmith at his anvil. In a short time a bowl and handle emerge from the green wood. "There are no spoon-shaped pieces of wood," he remarks. "There are only wooden spoons. I find my spoons in the living tree."

Dustin, 33, of Contoocook, N.H., is a professional spoonmaker. As a master in a small field, he is prepared to expound at length on all its aspects. Sitting on the handle of the spoon, he begins smoothing the outside of the bowl with an old wooden spokeshave, which he holds like a block plane. The green wood shaves easily and the tool leaves a smooth surface. "I paid $35 for this shave at the flea market. Now that I've cut the handles off, it's probably worth about $6. I don't think I'll be selling it, though." While smoothing the handle he wedges the spoon between his waist and the chopping block. Dustin doesn't like to use vises.

"I see each spoon as a performance," he says as he begins hollowing the bowl. An accomplished flutist, Dustin often draws analogies between craft and music. Watching him coax wood out of the bowl using a sculptor's adze, then a gouge and a hook knife, I am not sure whether he means it's his performance or the tree's. But the spoon is becoming an attractive and useful implement, whoever is responsible for it.

"I'm not responsible," Dustin tells me. We are sitting in his new shop, which is an 8-ft. by 8-ft. dirt-floor room attached to his hand-hewn log cabin. To get to the upstairs bedroom, his wife and three children must scramble over the shop roof. He is explaining that Hamada, the revered Japanese potter, also disclaimed responsibility for the design of his work. "Hamada asked each pot, 'What do you want of me?' and that's exactly how I make a spoon. He had the concept of *mingei*, which is the art of the people, or folk art. He calls *mingei* 'utility, locality and the lack of overemphasized individualism.' That's basically a statement of what I do."

I learn that music led him to woodworking. His flute teacher was also a professional harpsichord-maker. Dustin went to work in his teacher's shop and picked up a basic woodworking education. Later he moved to Maine and set up his own shop, advertising "Useful Objects Handmade of Wood, What May I Make for You?"

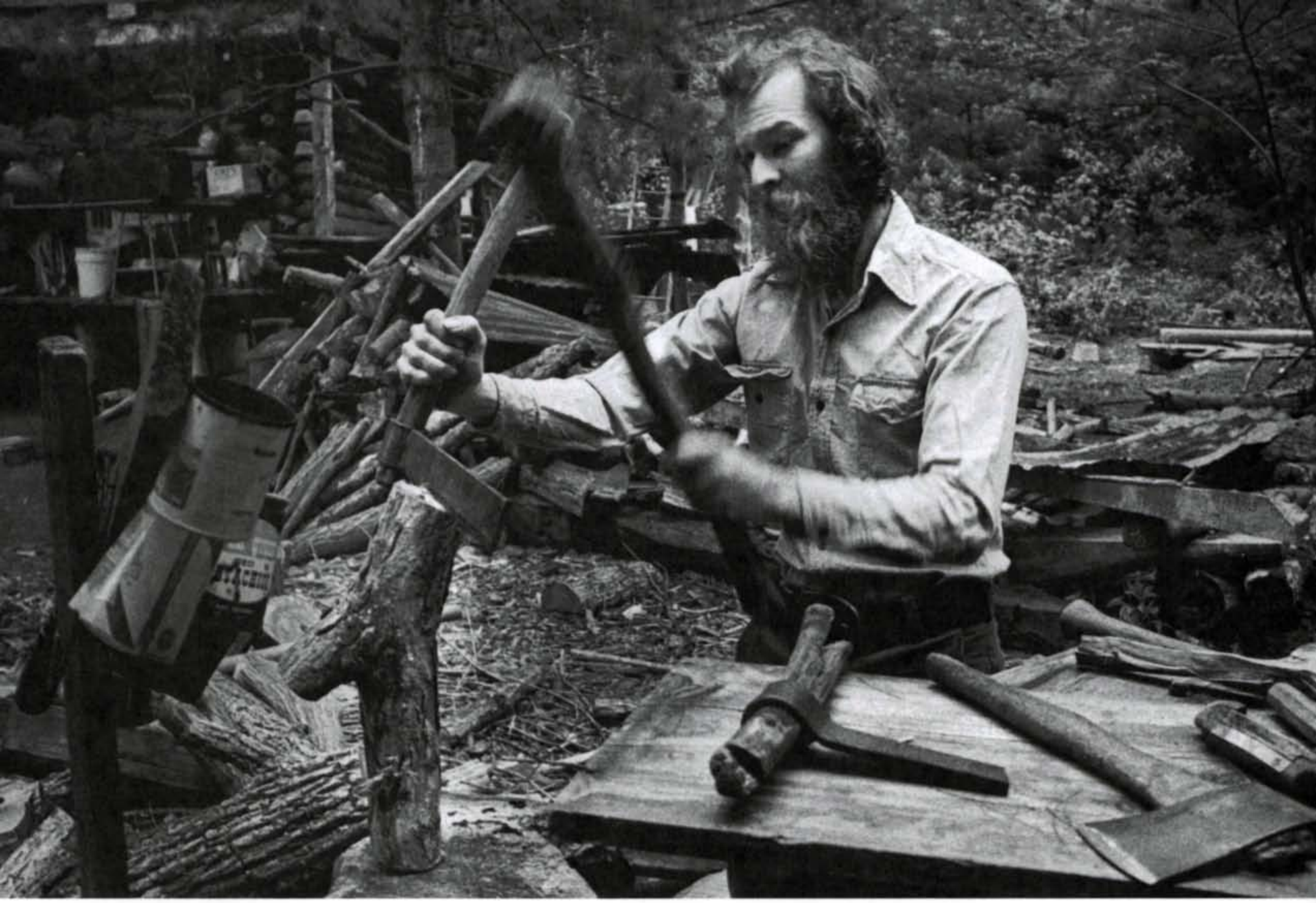
"I got letters from all over the place—people wanting me to do lots of things that machines do better. But I couldn't make good copies by hand, and it was silly to waste my time at it. A few people asked me to make spoons. My first spoons were clubs. They were not good spoons. They were cut out of square boards and there was squareness in them. And they were too much wood; they displaced so much that if you put one in a full plate it would spill the soup. So I dumped all my power tools. It was a simple, obvious technique for improving my work. I didn't know how to make them any better by power so I was going to make them by hand. I moved to New Hampshire with no electricity, just my workbench, vise and stool, and started making spoons by hand. But I was trying to do machine work by hand. You look around in the crafts and you'll see that a lot of young people, fanatical handcraftsmen, are actually copying machine work.

"So my house burned down. I lost my workbench, vise and stool. I borrowed a friend's tepee. I had a wife and child, and I needed a business. One day I was splitting firewood—butternut, which is soft—and this spoon split right out of the log and fell on my toe. I whittled it out and sold it. That's what put me in the spoon business."

While telling this story Dustin is rubbing his finishing material into the spoon he just made. It is a creamy mixture of beeswax and olive oil, and he applies it daily to green spoons as they dry. After a few weeks of this regimen, he'll immerse the spoon overnight in a bath of molten oil and wax, heated in a 300° oven, to drive the remaining water out of the wood, replacing it with beeswax. "Every piece I do is unconditionally guaranteed against cracks forever, no matter what," he says. The finish leaves a pleasant, water-resistant surface.

Dustin was pleased with his first split-out spoons, which were neither straight nor symmetrical. When he displayed his new work at a meeting of the League of New Hampshire Craftsmen, he met workers in other disciplines. "I got very involved with a bunch of potters. Potters know things important to all the arts that the practitioners of the rest of the arts don't know as well. Potters generally know that you have to work honestly by the techniques that occur to your hands. Not everyone does that. From this point on I learned my craft from the potters. Then I discovered the orange peel. . . ." Dustin brings in a box containing objects that at first look like refugees from his compost pile. They are hollow fruit skins, carefully dried in wood ash and treated with his beeswax finish. One would go out on a limb to call them woodworking but in shape, color and texture these things resemble ceramic vessels and turned or carved wooden bowls, with an odd charm all their own.

Surrounded by chickens and children and twisted logs, Dustin describes his lifestyle as "honest and deliberate." He and his family don't need much money to survive, and his craft can supply enough. As a woodworker, musician and raconteur he is concerned with the quality of his performance, which for him includes humor. He compares himself to the Dada artists, whose works were at once beautiful and absurd. He says, "I grew up with *Mad* magazine, and it affected me, I have this kind of attitude toward my art. The orange peel is a wonderful thing. I once sold a honeydew rind for $35. At the same time, I'm serious about it." □

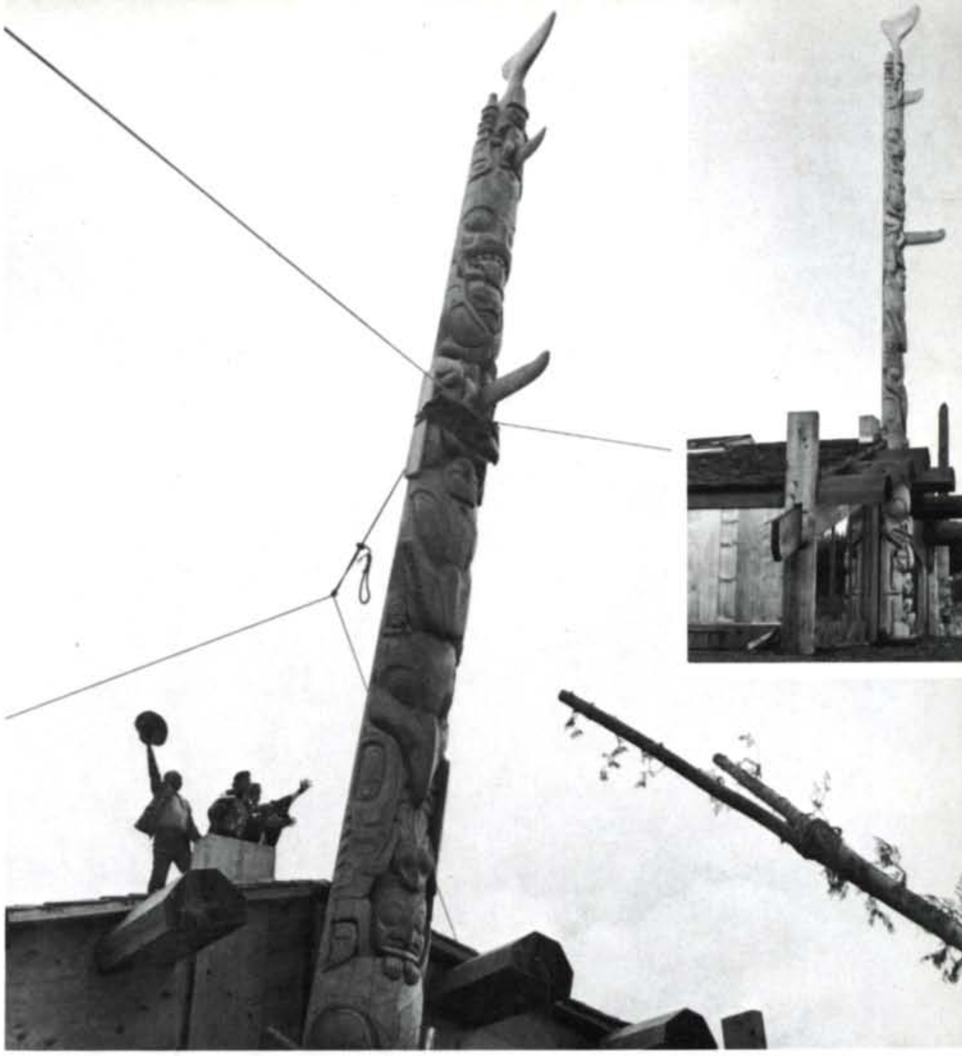


From log to finished utensil. Dustin begins by splitting a white oak crotch with froe and club, top. After rough-shaping with a hatchet, the spoon blank, left, still retains the basic shape of the branch. Next the bowl of the spoon is hollowed with a sculptor's adze, a gouge and a hook knife. Finished spoons, below, are of various woods, including mountain laurel, lilac, apple, butternut, walnut, cherry and cherry dogwood. Right, Dustin's mummified fruit-skin pots, baked in an oven and sealed with oil and beeswax.

Craig Bohannon

Photos: Richard Starr

Raising the pole, June 1978. Men with small trees lashed into props steady the pole while others with long ropes heave it into position.



TOTEM POLE

Haida carver Bill Reid spent two years creating this 57-ft. pole for the band office in Skidegate, Queen Charlotte Islands, British Columbia. The finished pole measures 50 in. wide at the bottom, 30 in. at the top. It is carved from a half log with the heartwood hollowed out to prevent checking. Reid figures the pole should last in recognizable form for about 100 years. Photos: Ulli Steltzer.

Detail: grizzly bear and cub.

The people of Skidegate carry the pole to the raising (center right). Reid carves a detail, summer 1977 (right).